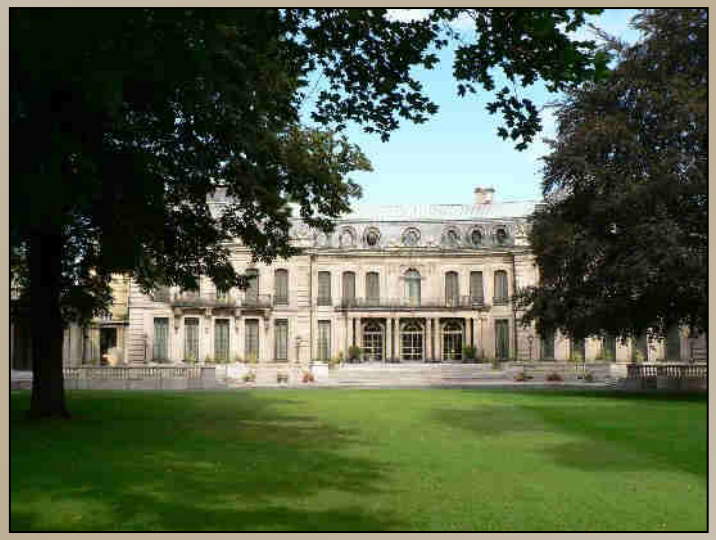
Concealing or Expressing the Past?
Issues in Restoring an Early 20th Century Stucco

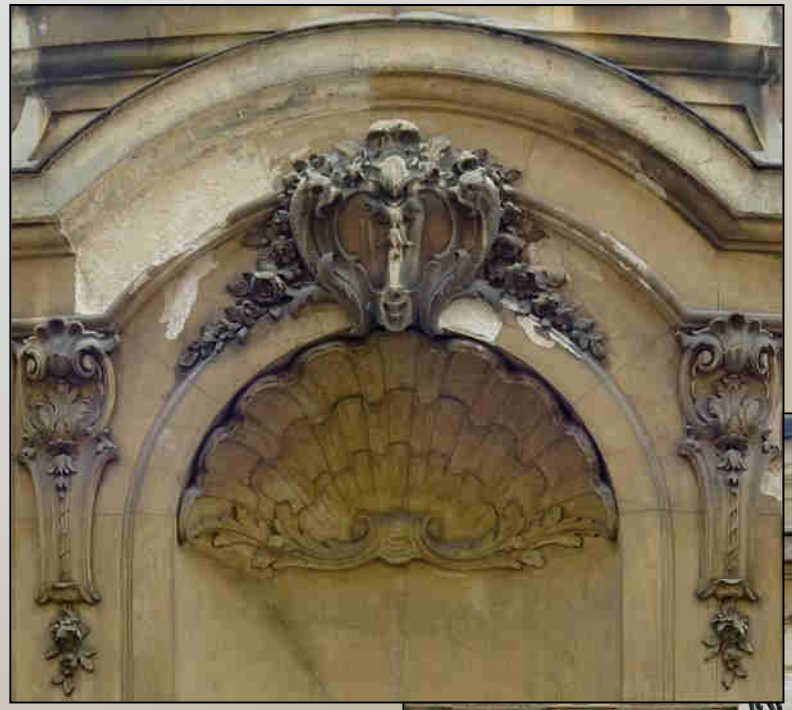
Part II –case study



Christopher Tavener, Einhorn Yaffee Prescott, A & E, P.C., Albany, NY, USA

Petr Justa, Gema Art Group, Prague, Czech Republic

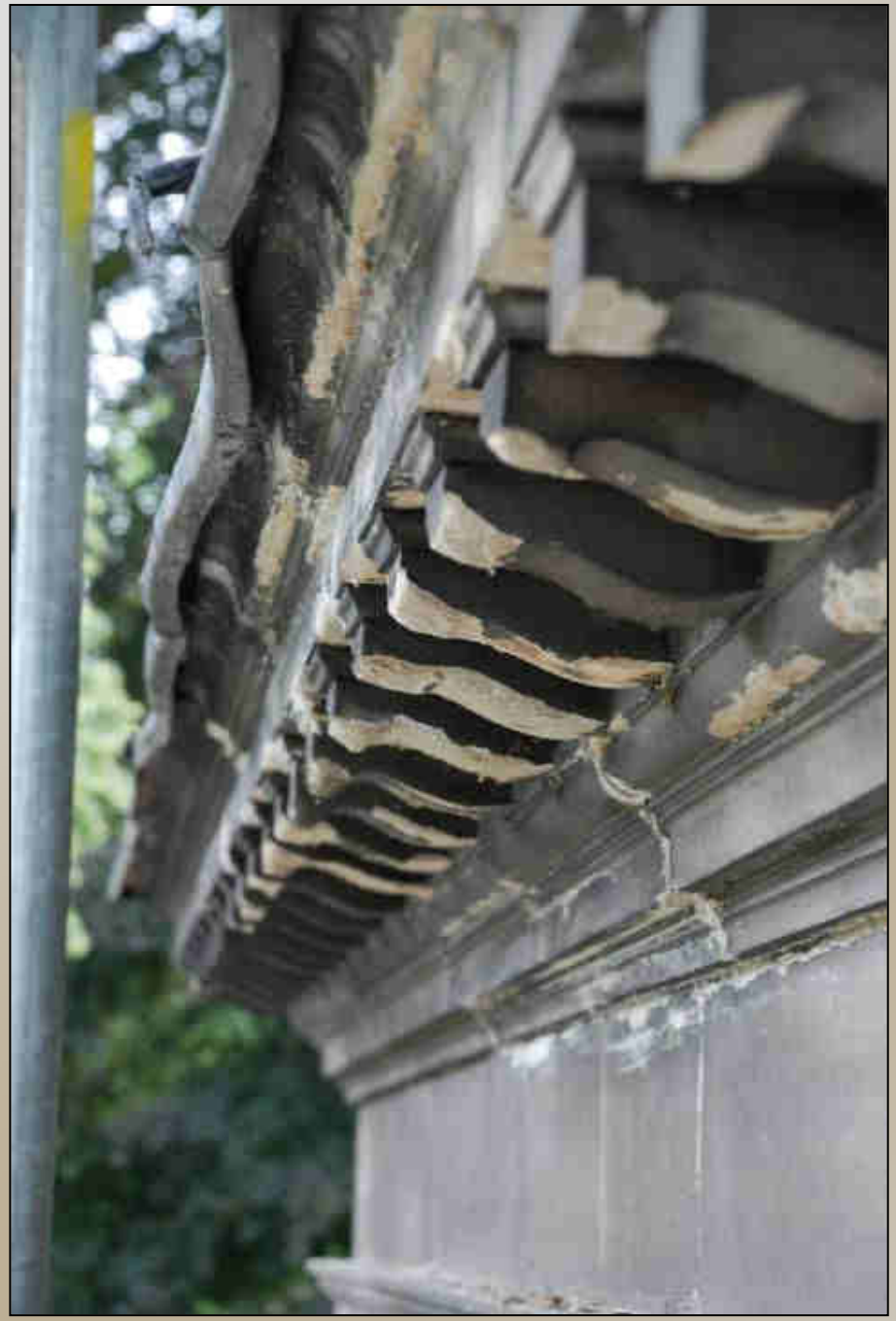
Cast stucco decoration at enclosed terrace – after removal of unattached parts



Stucco decoration at enclosed terrace - after removal of unattached parts

Detail of fissures in stucco

Salt efflorescence at stucco



Detail of the cornice below eastern balcony

Intensive salt efflorescence under Loggia cornice

Salt analysis of stone cornice under Northern portico

Results

v1 stone surface

v2 efflorescence

Cation content in percentage by weight

samples	**Ca**	**K**	**Mg**	**Na**	**NH_4**
v1	0,25	0,18	0,01	0,04	0,01
v2	3,55	3,57	0,28	9,69	0,11

Anion content in percentage by weight

samples	**Cl**	**F**	**NO_2**	**NO_3**	**PO_4**	**SO_4**
v1	0,005	0	0,001	0,07	0	0,94
v2	0,17	0	0,06	0,82	0	38,0

Construction of original stucco

Separation according to the construction of layers

List of stuccoes needed to be used at CMR

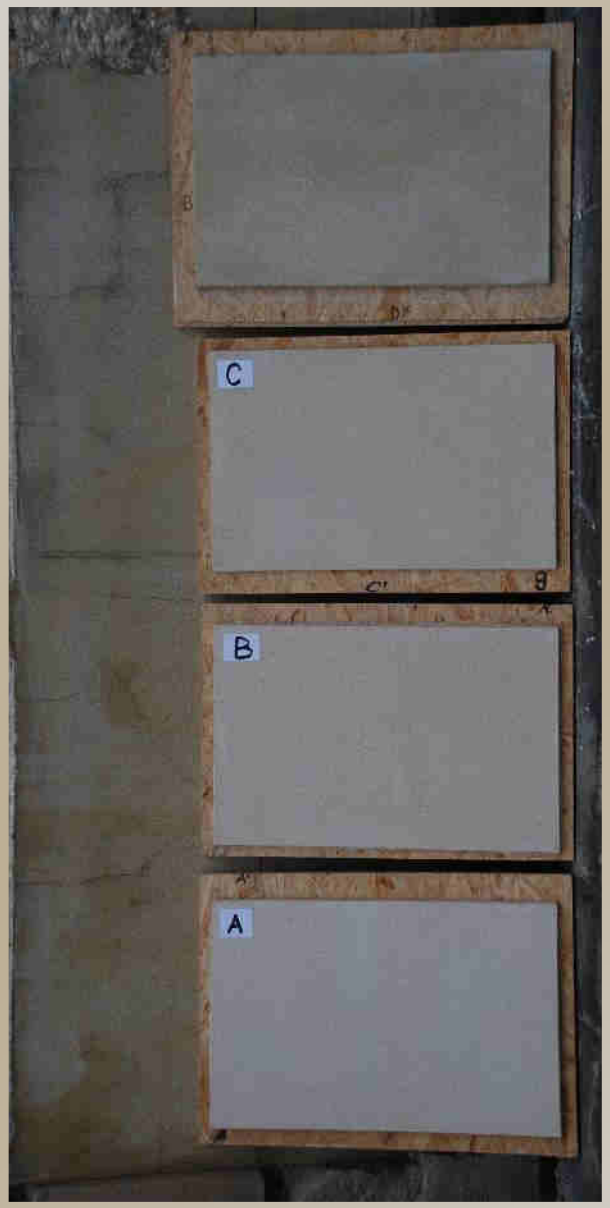
- for plane facades
- for cast elements
- sacrificial mortar for wet areas
- thin layer stucco for main cornice
- cemented stucco for attic balustrade and statues

Requirements for new stucco

- to be suitable both for casting and large scale application (high level of workability
- to be suitable for drawn architectural elements e.g. cornices
- to create minimal shrinkage between drawn and troweled stucco
- to be able to withstand cutting false joints (high endurance)
- to be hard enough to be ground or polished
- to be still permeable to water vapor (optimal porosity)

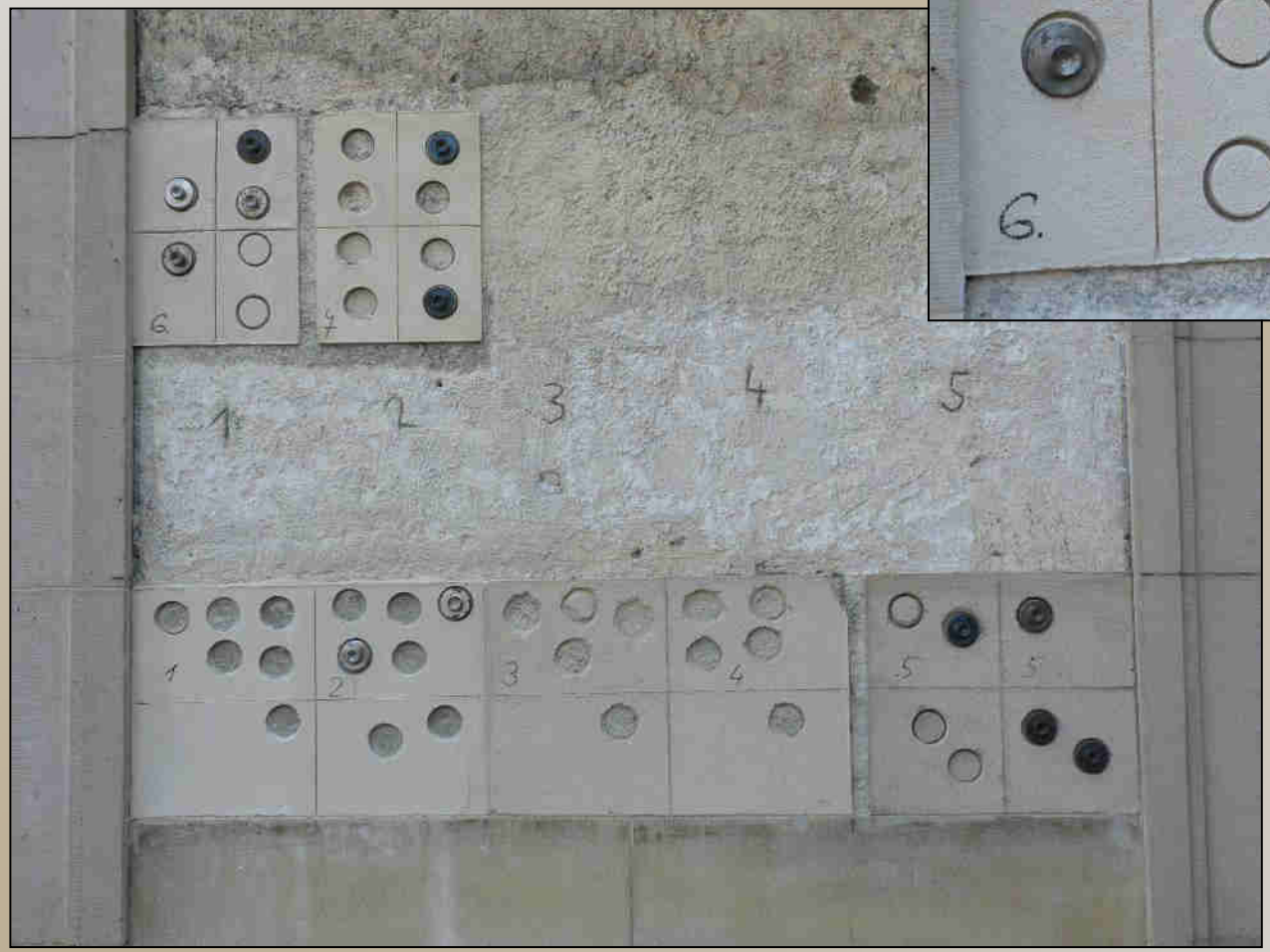
Initial tests for stucco: Keim, Schwenk, Alva, Terzit

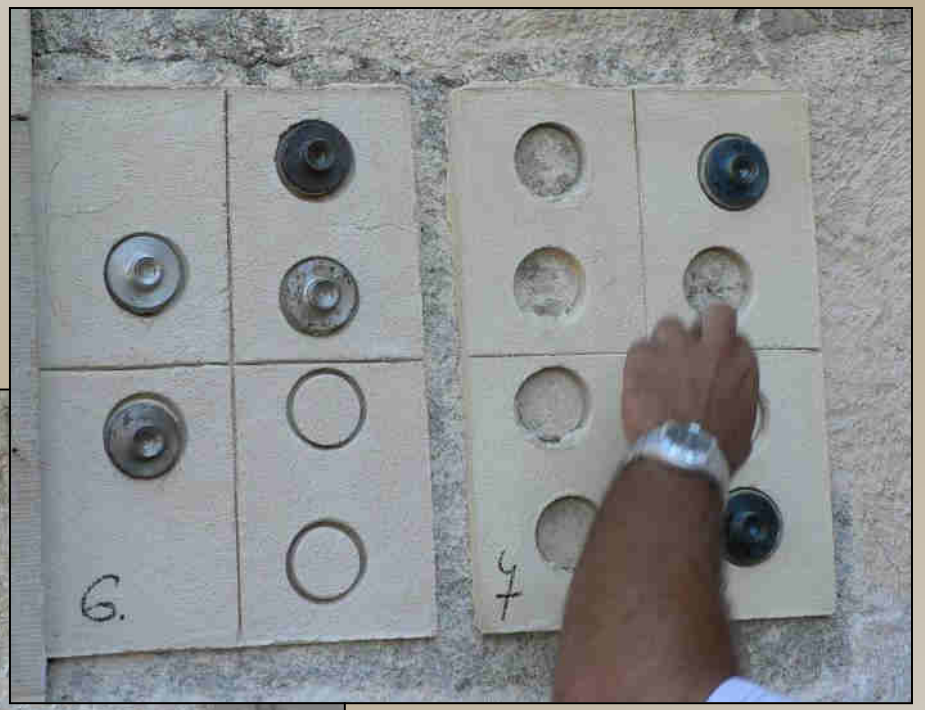
Weber.pral by Terranova (top left)
A, B, C samples based on white cement (left below) and Keim system prepared for winter weathering test (right)



Adhesion tests of portland layer to brick wall

Stucco adhesion tests





Tests for grinding resistance of commercial stuccoes Schwenk and Keim

Stucco for the plane facade

Based on the weber.pral
by Terranova

weber.pral MF – technical information

Uses:

- **Through-coloured external render**
- **For applications where a fine finish is required**
- **For application to most brick, block and concrete substrates**
- **Provides scope to produce distinct architectural features.**
- **weber.pral MF can be used for the following finishes: Fine scraped - Spray textured - Ashlar features**

About this product:

weber.pral MF is a fine finished, one-coat, cementitious, weatherresistant,external decorative, through-coloured render, suitable for most types of brick or blockwork. Factory produced from carefully selected raw materials for consistency of product, it only requires the addition of water on site.

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weber.pral

mineral combed stucco

for mechanical treatment

CE

Weber Servon ZI,

chemin de Charreau, 45390 Puisseaux

05

EN 998 - 1

coloured mortar for exterior plaster (CR)

Fire reaction:	A1
Water absorption:	W2
Water vapour permeability:	µ15
Adhesion:	0,2 N/mm²
FP:	B
Conductance:	0,5 W/m.k (tab. value)
Durability:	25 cycles
	(according to CSN 72 2452 standard)
Volume density in dry state:	1410kg/m²
Compressive strenght:	7,5 MPa
Application life:	90 hours

Gypsum interlayer removal

Stucco area after removal

Repairs of deep cracks in the Portland support

Method of application of 1st layer of stucco

Detail of 1st layer of stucco when applied

Construction of the 1st layers of stucco on plain facades

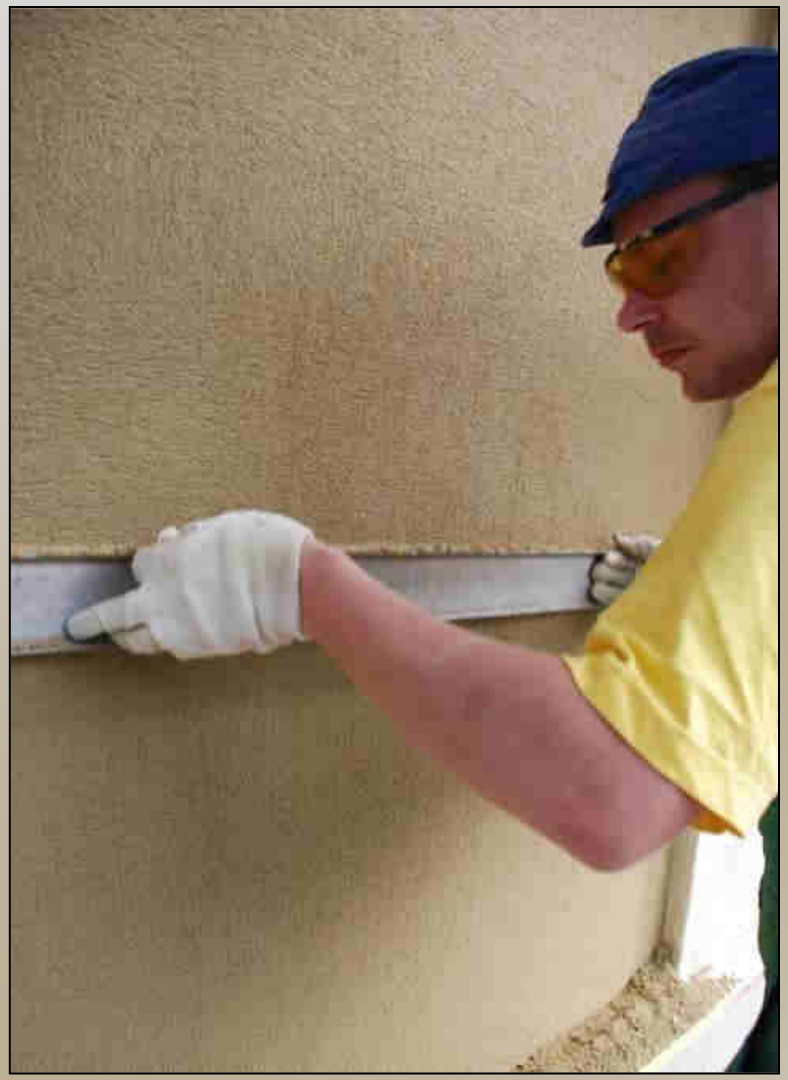
Terranova mortar application machinery

Machine application of the 2nd layer of stucco

Stucco planing after application of the 2nd layer

The treatment of the 2nd stucco layer before application of the 3rd layer

Final smoothing of 2nd layer and application of the 3rd layer

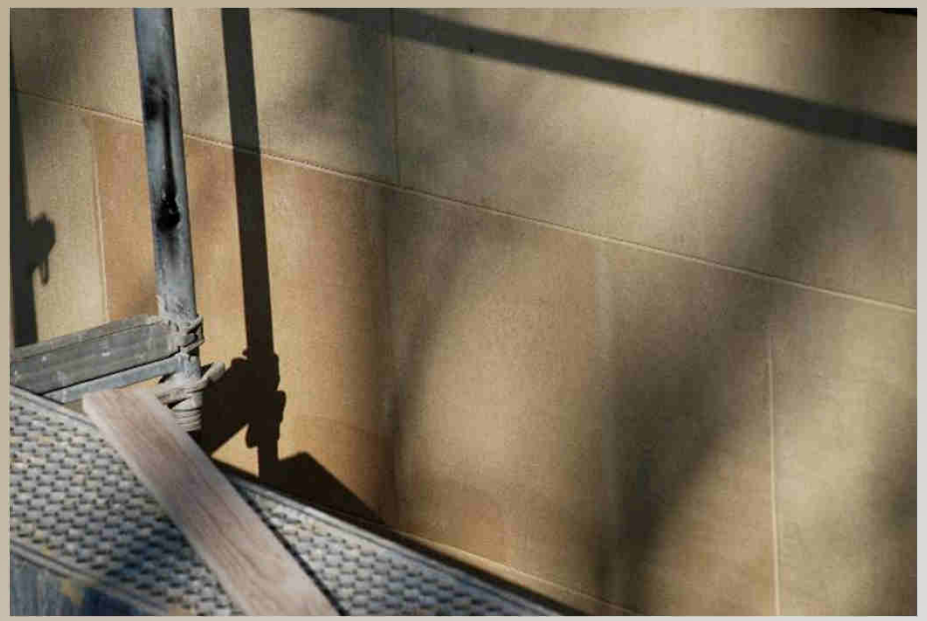


Final appearance of stucco before setting

„Planing“ of stucco by Vertika hydraulic grinding machine

Detail of ground stucco before final treatment

Samples of final treatment of stucco



Appearance of stucco after cutting joints and final treatment

Drilling holes for pressure impregnation and details of the ventilation system

High pressure grouting of retaining wall

Part of grouted wall before and after application of stucco

Retaining wall before and after renovation

Stucco for cast and drawn elements

General view on cast stucco workshop

Preparation of architectural elements for moulding

Wedge mould for casting stucco ornament

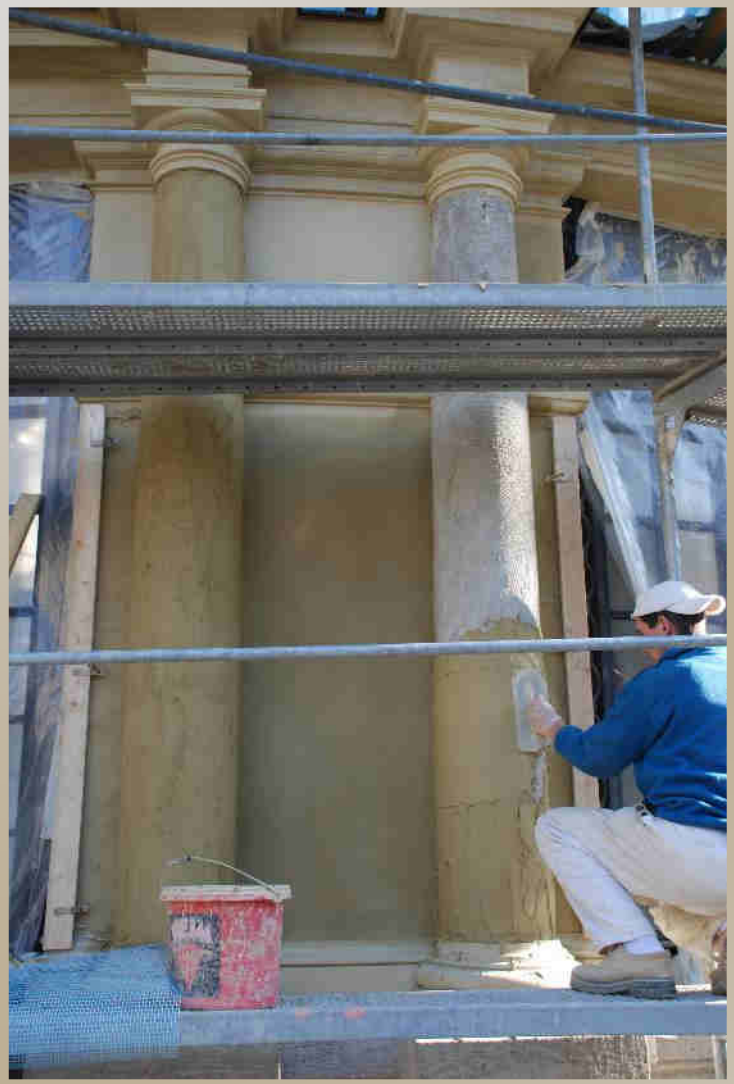
Detail of one of wedges and general view of the silicon rubber mould with gypsum support

cast stucco and after-treatment of the surface

cast elements with
stainless steel hooks
to be hang up at the facade

Building up the architectural elements at breezeway of Loggia

Completing drawn stucco elements by hand

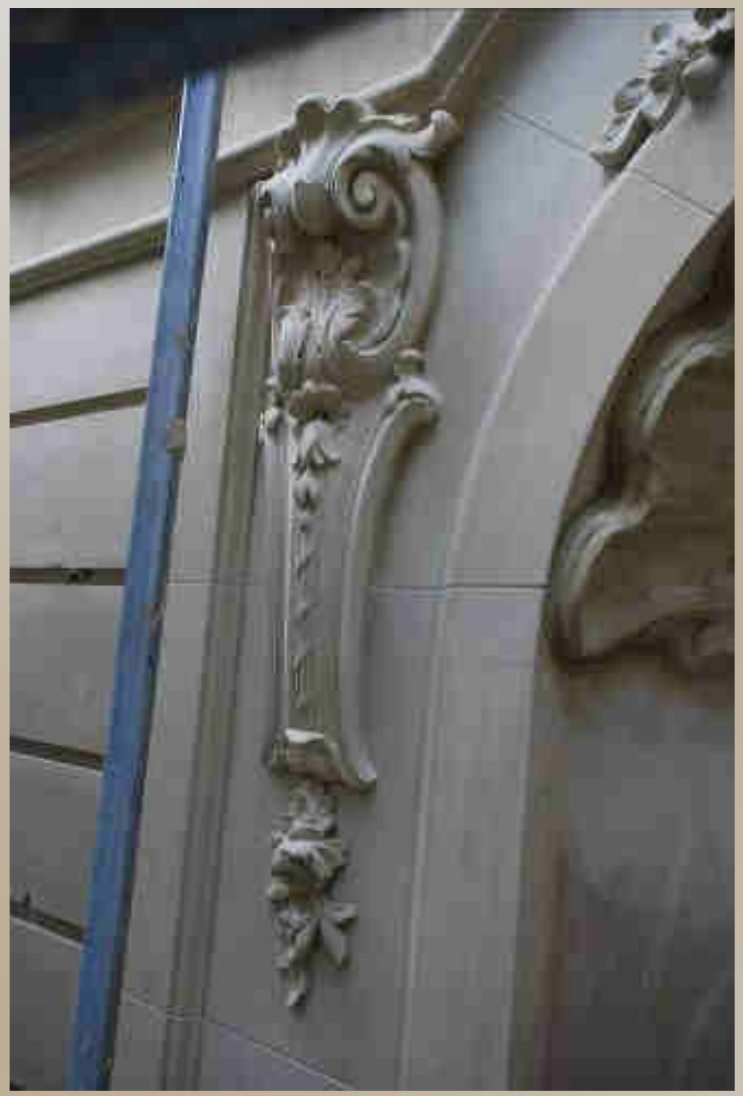


Assembling heads of columns

Assembling feet of columns

Assembling cast elements on facade

Cast stucco elements after assembling



Cast stucco elements after assembling

Cast stucco elements after assembling

Stucco for wet walls

Sacrificial mortar

Tests for sacrificial mortars

Application of sacrificial mortar

Thin layer stucco for the main cornice

Based on Acrystal Optima system

Acrystal – technical information

Acrystal Optima is a solvent free composite material which is very easy to work.
It is available as
•Liquid based on aqueous acrylic resins
and
•A powder based on mineral crystal structures; Basic Crystal

Technical data (indicative figures)

Fresh wet density (unfilled)	1860 kg / m^3
Air dry density (unfilled)	1750 kg / m^3
Pot life	8 – 10 mn
Final set	20 – 100 mn
Compressive strength oven dry	25 – 30 Mpa
Impact strength	1kJ / m^2
Maximal bending strength	15 Mpa
Expansion at setting	< 0,1 %
Shore D hardness	84 - 86
U.V. resistance	excellent

Akrystal AR tests

1. Accelerated Weathering. ASTM G-23 (ultraviolet light/ultraviolet light+rain). Possibly 2.000 hours

2. Acid Rain Resistance ASTM B-117 (wetting with a salt spray followed by spray with dilute sulfuric and nitric acids.) Possibly 2.000 hours, with chemical sprays for thirty seconds every 100 hours

3. Humidity resistance ASTM D-2249 (95-100% relative humidity at 110F)

4. Water Absorption ASTM C-67

5. Rapid freezing and thawing ASTM C-666 (modified cycling, 2 hours well below freezing and 2 hours well above 100F, 100 cycles

6. Compressive and flexural strength

7 Adhesion test

8. Specific density

Results of measurements / tests and evaluation of material

Measurement / test	Protocol no.	Measurement procedure	Result	Required/ declared rate	Evaluation
Specific density[kg/m^3]	010-021267	see ČSN EN 998-1	1 760	D: 1 600-1 800	pass
Compressive strength [N/mm^2]	010-021257		31	P: CS IV ≥ 6,0	pass
Adhesion test after treatment cycles [N/mm^2]	A 020-018988		Porous concrete: 10 mm – 0,75 20 mm – 0,65 Concrete 10 mm – 0,85 20 mm – 0,85	D: ≥ 0,5	pass
Capillary water-absorption coefficient [kg/(m^2.min^{0,5})]	010-021267		0,1	P: W 2 c ≤ 0,20	pass
Water permeability [ml/cm^2]	A 020-018988		0	P: ≤ 1 after 48 hours	pass
Conductance[1)] [W/(m.K)]	---		P = 50% 0,67 P = 90% 0,76	P: Volume density 1 600-1 800 kg/m^3	pass
Water vapour permeability[μ]	010-021267		9,8	D: ≤ 15	pass
Adhesion to support [N/mm^2]	010-021257		3,4	D: ≥ 0,5	pass
Flexural strenght [N/mm^2]	010-021257		9,2	D: ≥ 2,0	pass

[1)]Request of standard no CSN EN 998-1 - method of testing CSN EN 1745, Tab. - declared tab. value. These tab. values are applicable on materials with volume density test provided due its production, but without real testing of λ value. These values rates are 50% and 90% of quantile probability dividing of existing range of λ values for specific material with specified volume density.

Adhesion to support after freeze-thaw test (100 cycles)

Akrystal AR

Sample	Adhesion [N/mm^2]	Way of Failure
1	1,55	100 % B
2	1,3	100 % B
3	1,3	100 % B
4	1,45	100 % B
5	1,3	100 % B
Arithmetic average [N/mm^2]	1,4	

Types of failures

A ….. Adhesion failure – Failure of connection between mortar and base

B ….. Cohesion failure – Failure in mortar layer

C ….. Cohesion failure – Failure in base material

Preparation of main cornice for the Akrystal application

Main cornice in detail before and after grinding

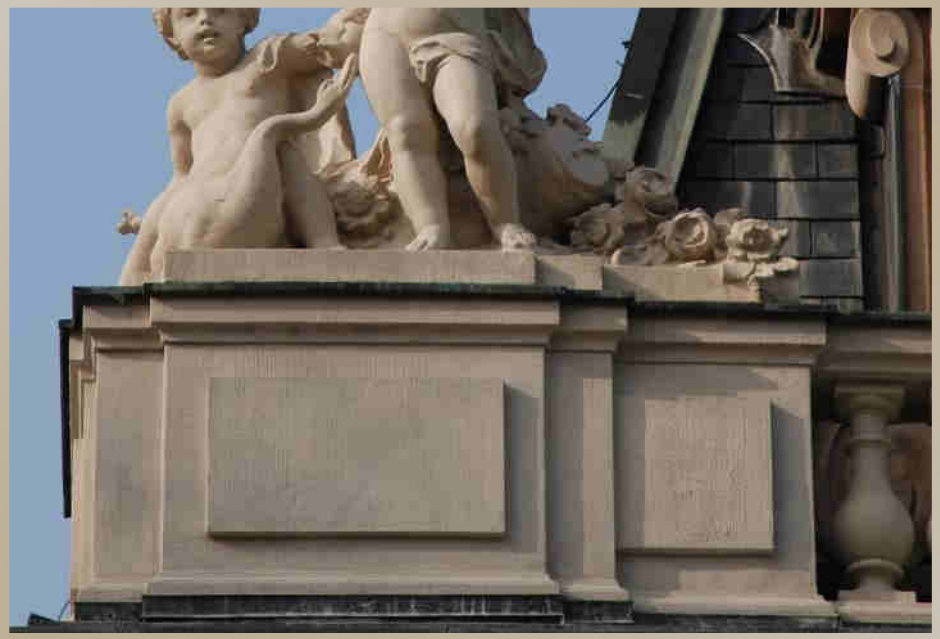
Application of Akrystal AR
on the main cornice
Before and after application

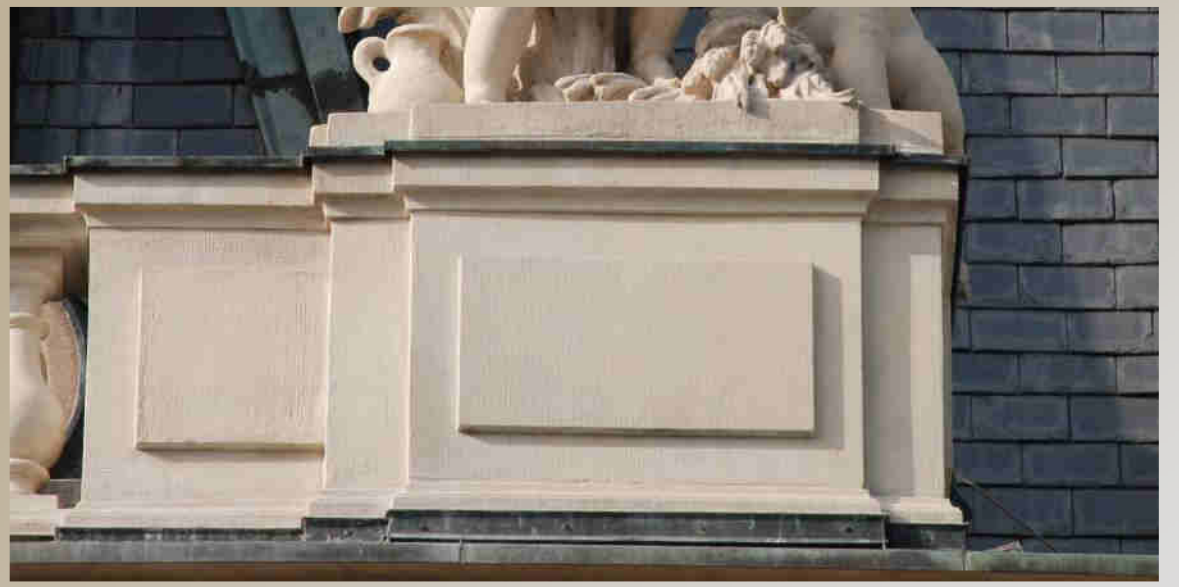
Cemented stucco for attic line balustrade and statues

„artificial limestone“

Deteriorated cast cement stucco at plinths on attic balustrade

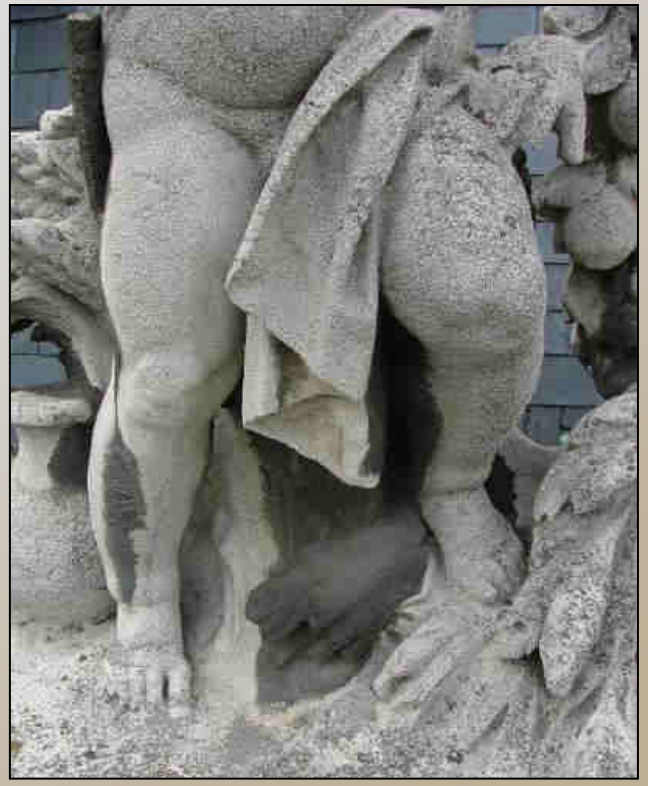
Same plinths after restoration

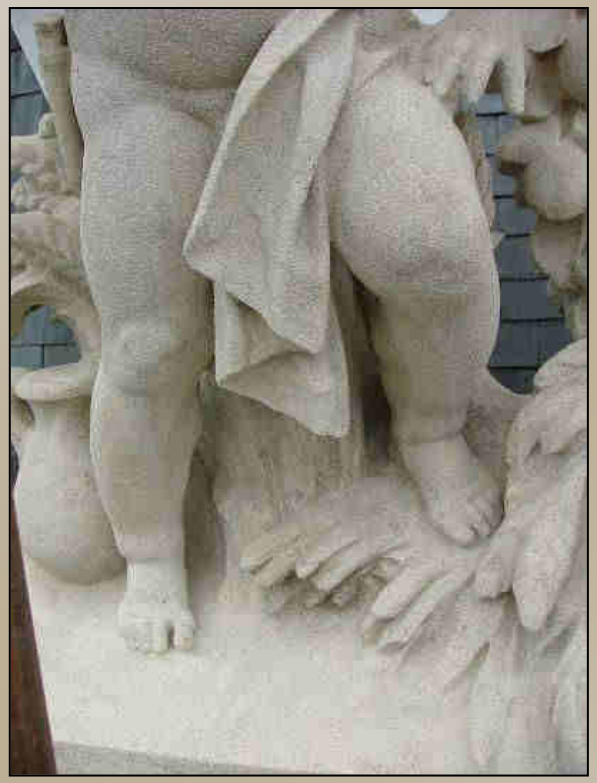


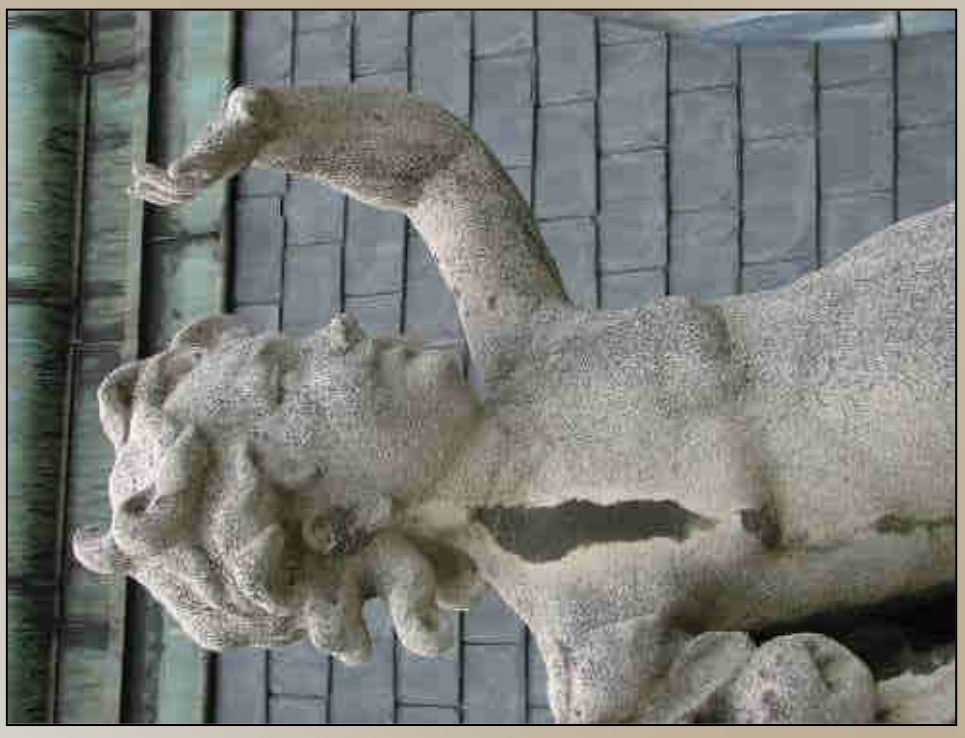


Statues before and after restoration

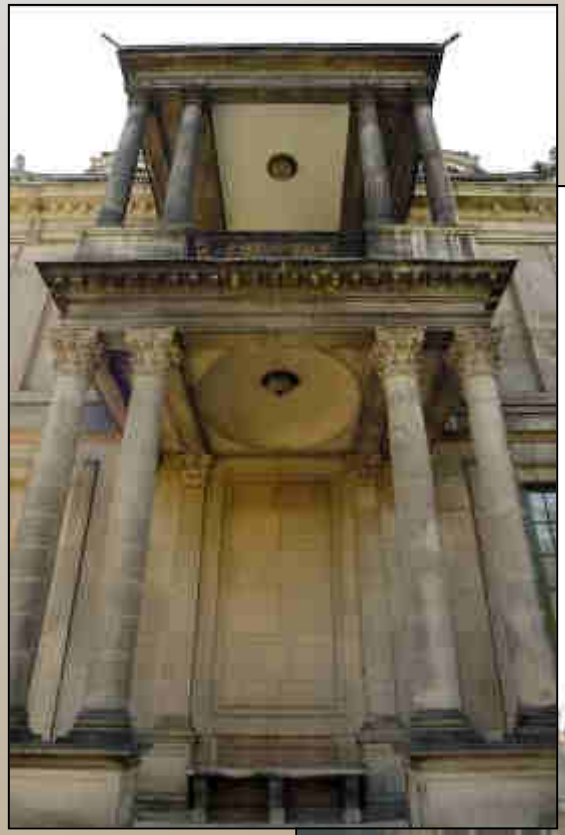
Statues before and after restoration

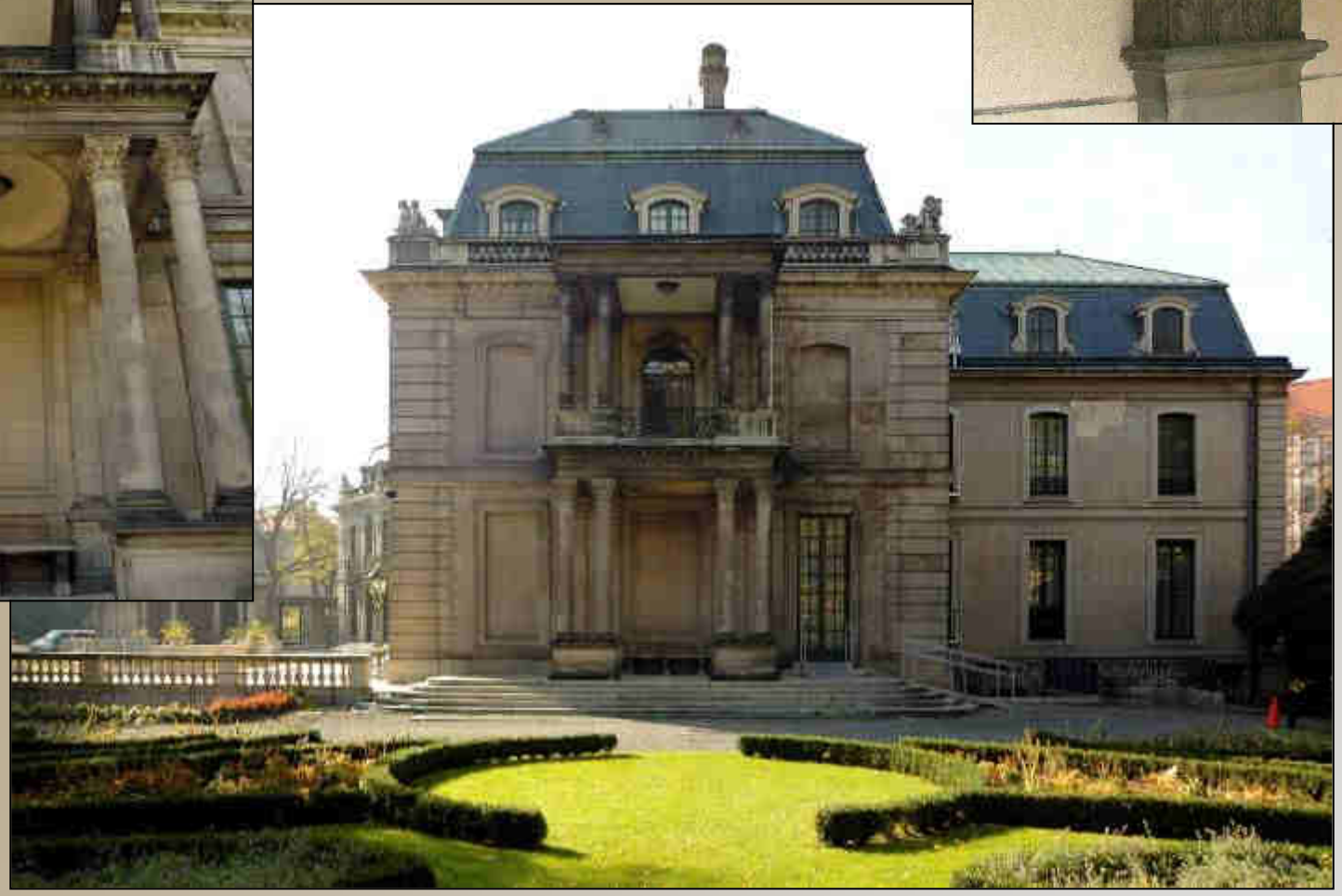






Eastern elevation before renovation

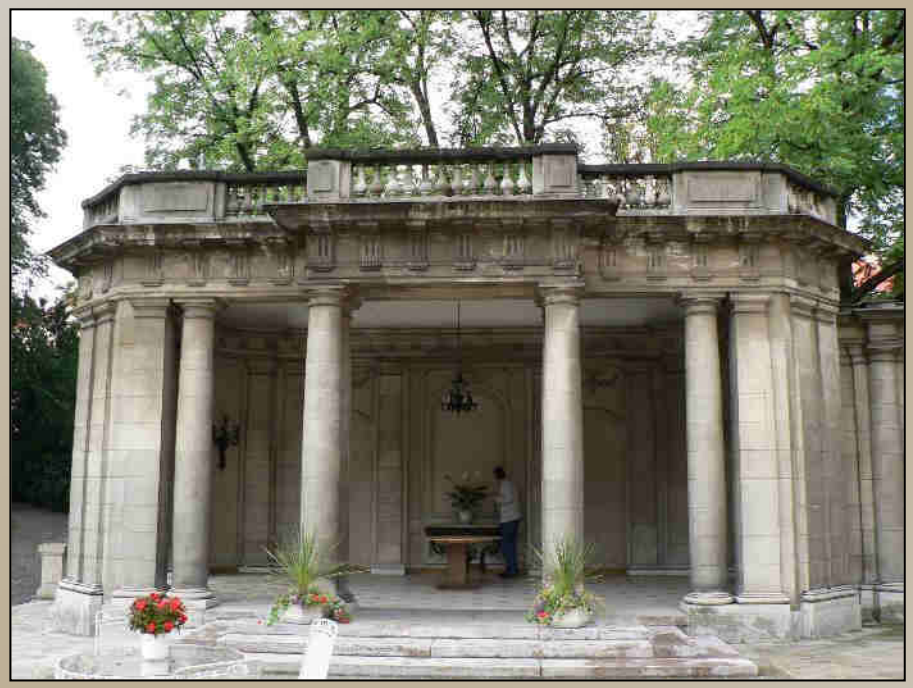




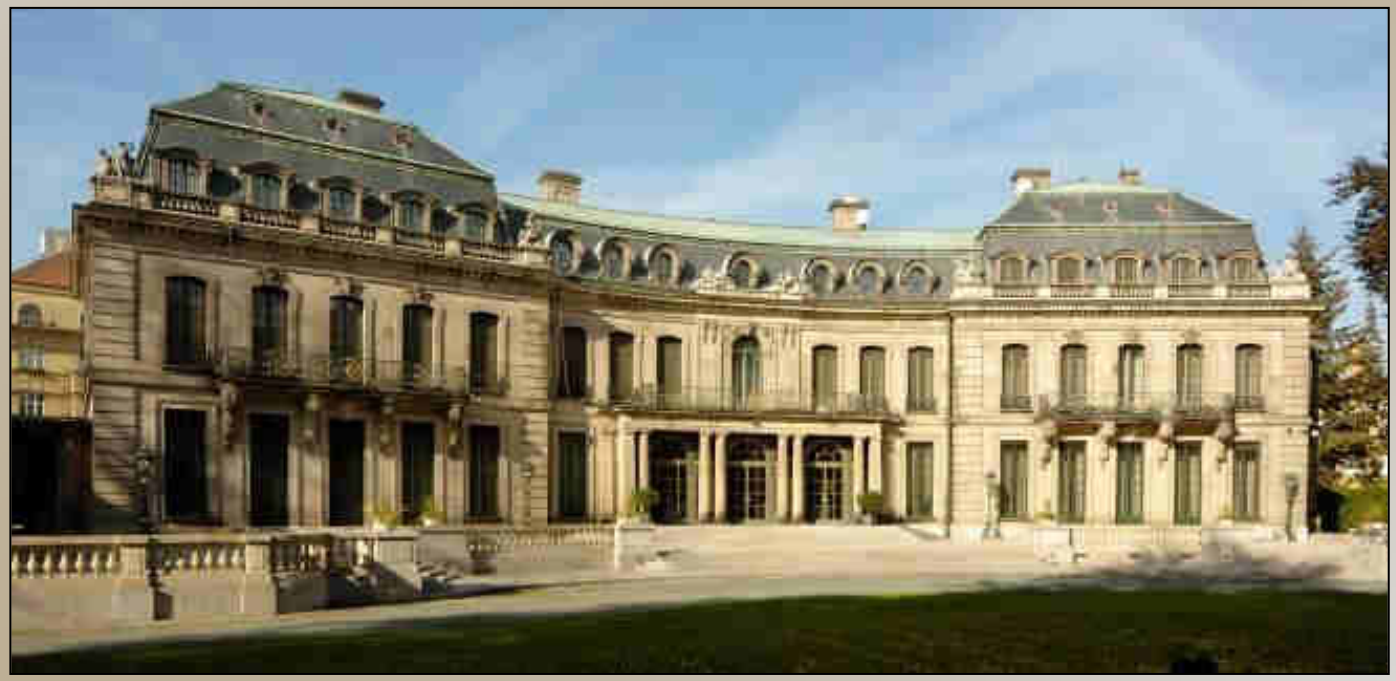
Eastern elevation after renovation

Head of pilaster before and after restoration

Loggia before and after restoration



General view of Petchek villa before renovation



General view of Petchek villa after renovation