



# Learning from the Field: Concrete Repair and Rehabilitation in Practice Friday 12 December 2025

# THE RESTORATION AND RENOVATION OF THE VELASCA TOWER STRUCTURES AND FAÇADES

**Presented by:** 

Bruno Finzi & Maxine Finzi Company: CEAS srl



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## PROJECT INFO



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Building Info		
Building Name	TORRE VELASCA	
Location	Piazza Velasca 3/5, Milan	
Original Architect & Engineer	BBPR studio & Engineer Arturo Danusso	
Original Contractor	Sogene	
Date	1956-1958	
Current Use	Office, residential	

Project Info		
Client	Hines	
Team	CEAS: Structural and Façade project design and construction supervision	
Project Type	Restoration and renovation	
Project Budget	Total: ~ 57 Million € Structures: 3 M € Opaque Façade: 3 M €	
Project Start and End Date	2021 - 2024	





## OBJECTIVES



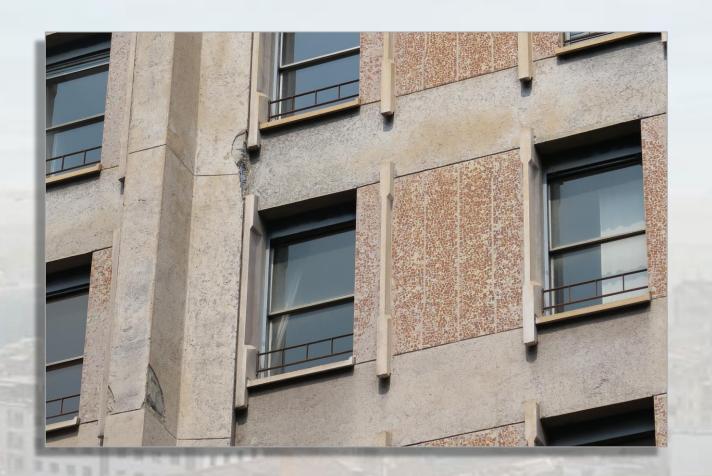
Complete retrofit and development of the Velasca Tower to guarantee a new service life



Static structural reinforcement



Garage basement



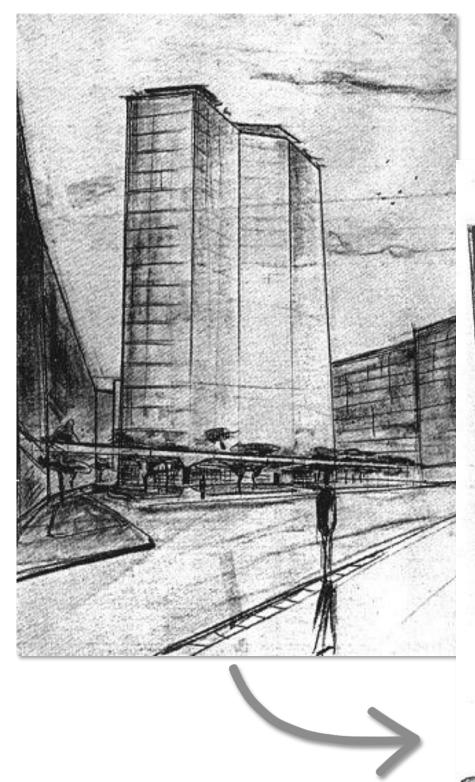
Façade



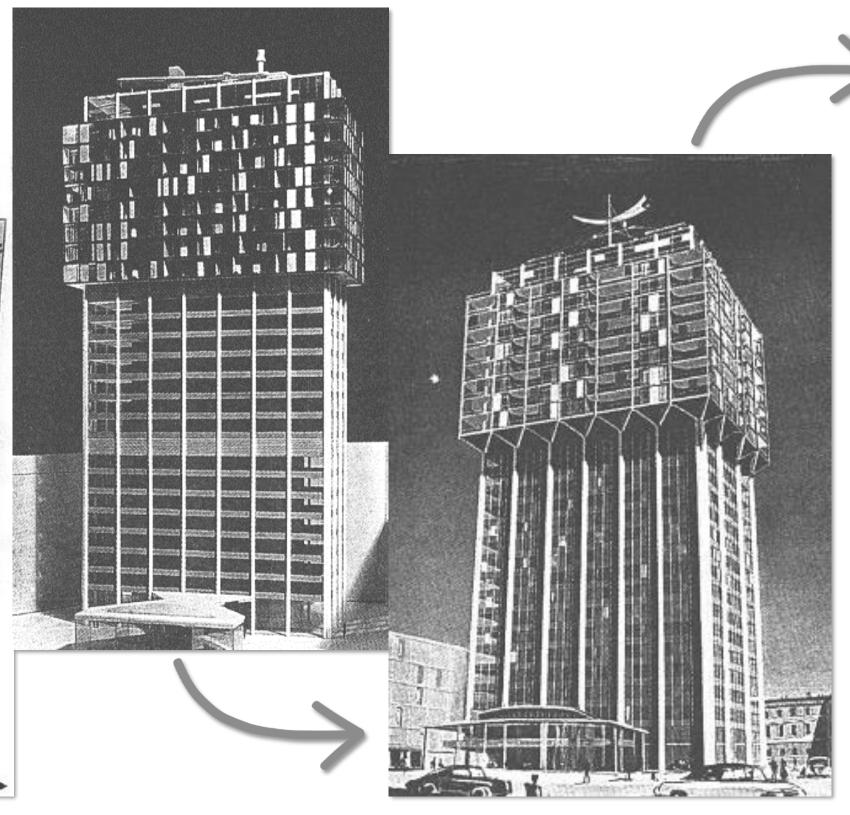


#### Shape evolution

#### Screen solution



Steel solution n.1



Trapezoid solution Steel solution n.2

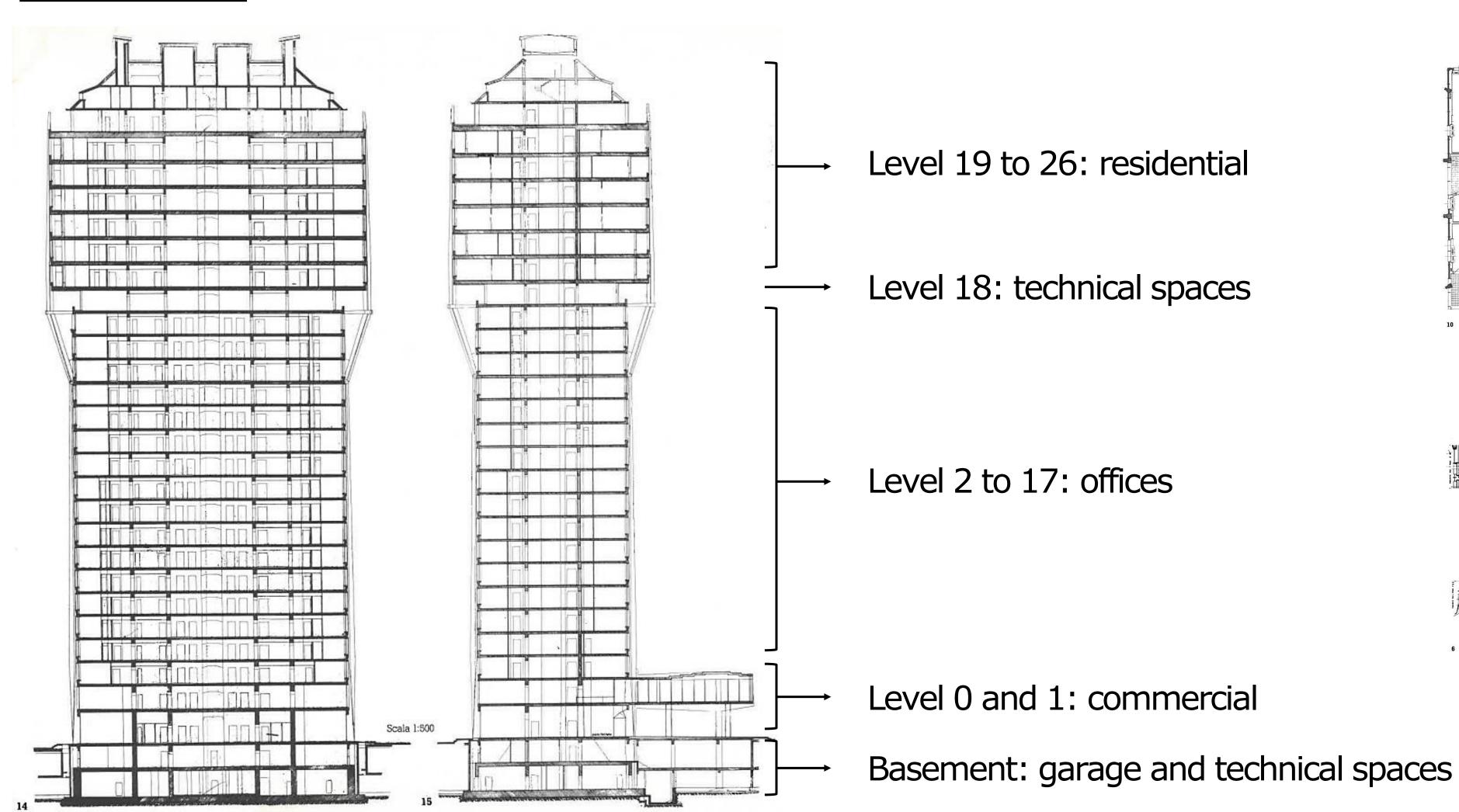


RC final solution

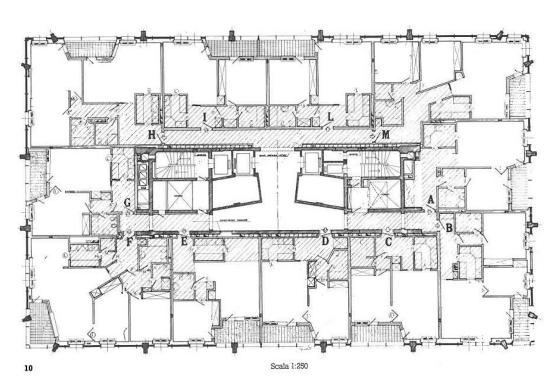




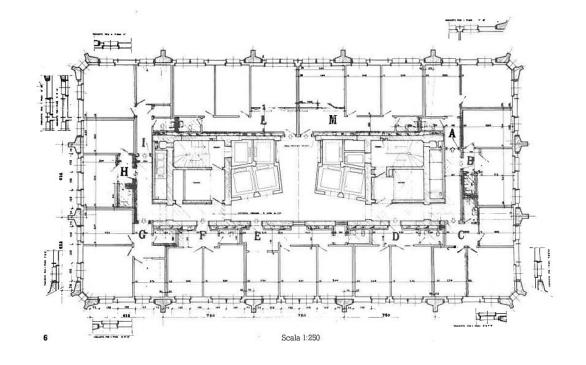
#### **Architecture**



Vertical sections



Residential floor plan



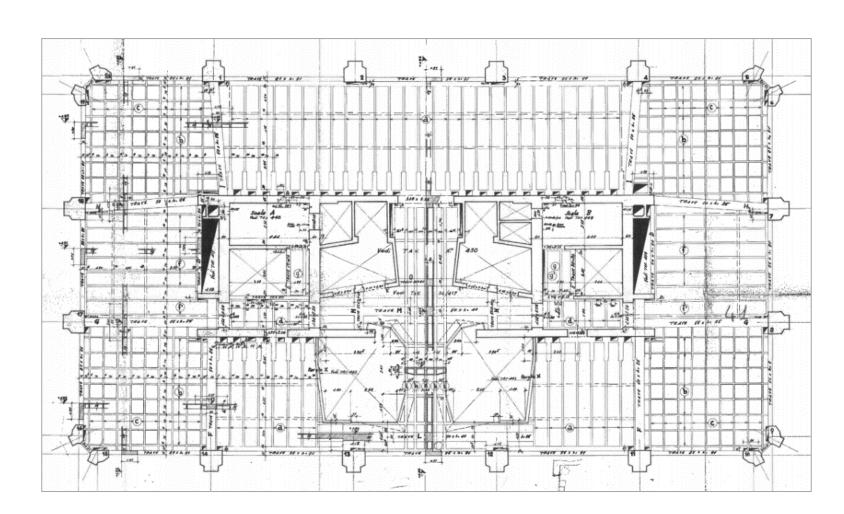
Office floor plan



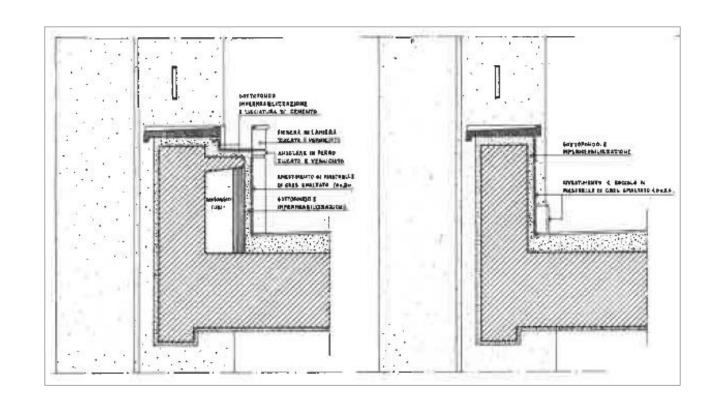


#### **Structure**

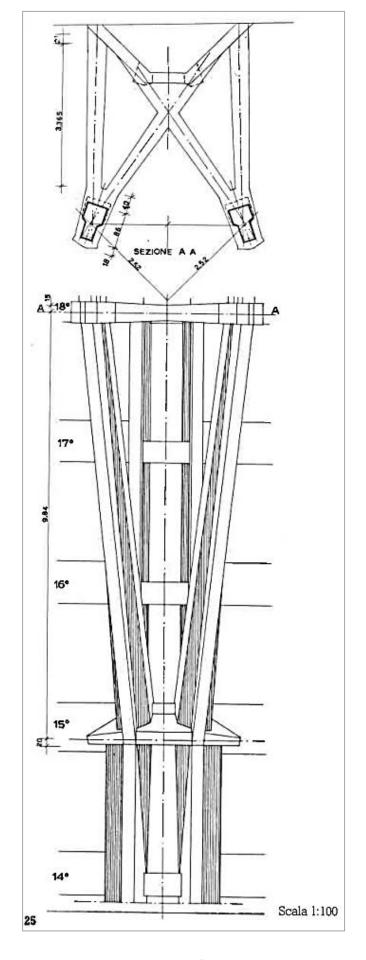
- → R.c. foundation slab
- → Basement:
  - r.c. walls
  - r.c. slab
- → Bracing: central r.c. core
- → Above ground elevation:
  - T-shaped r.c. tapered columns
  - r.c. parapet beams
  - Hollow clay floor slabs
  - r.c. struts and tie beams



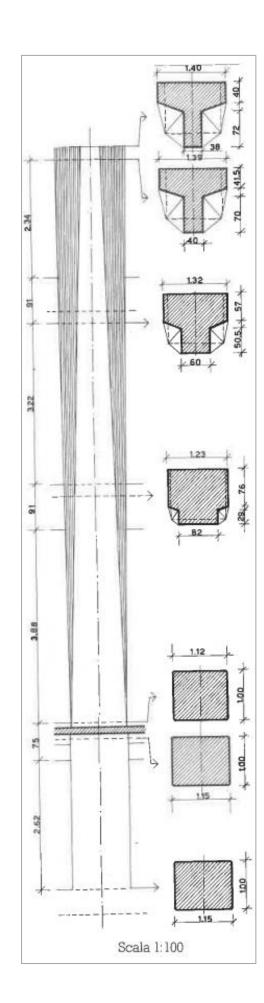
Structural floor plan



Parapet beam



Strut and tie



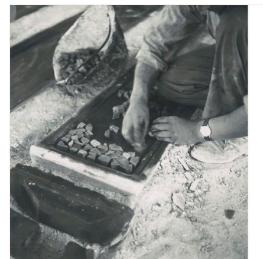
Tapered columns





#### <u>Façades</u>

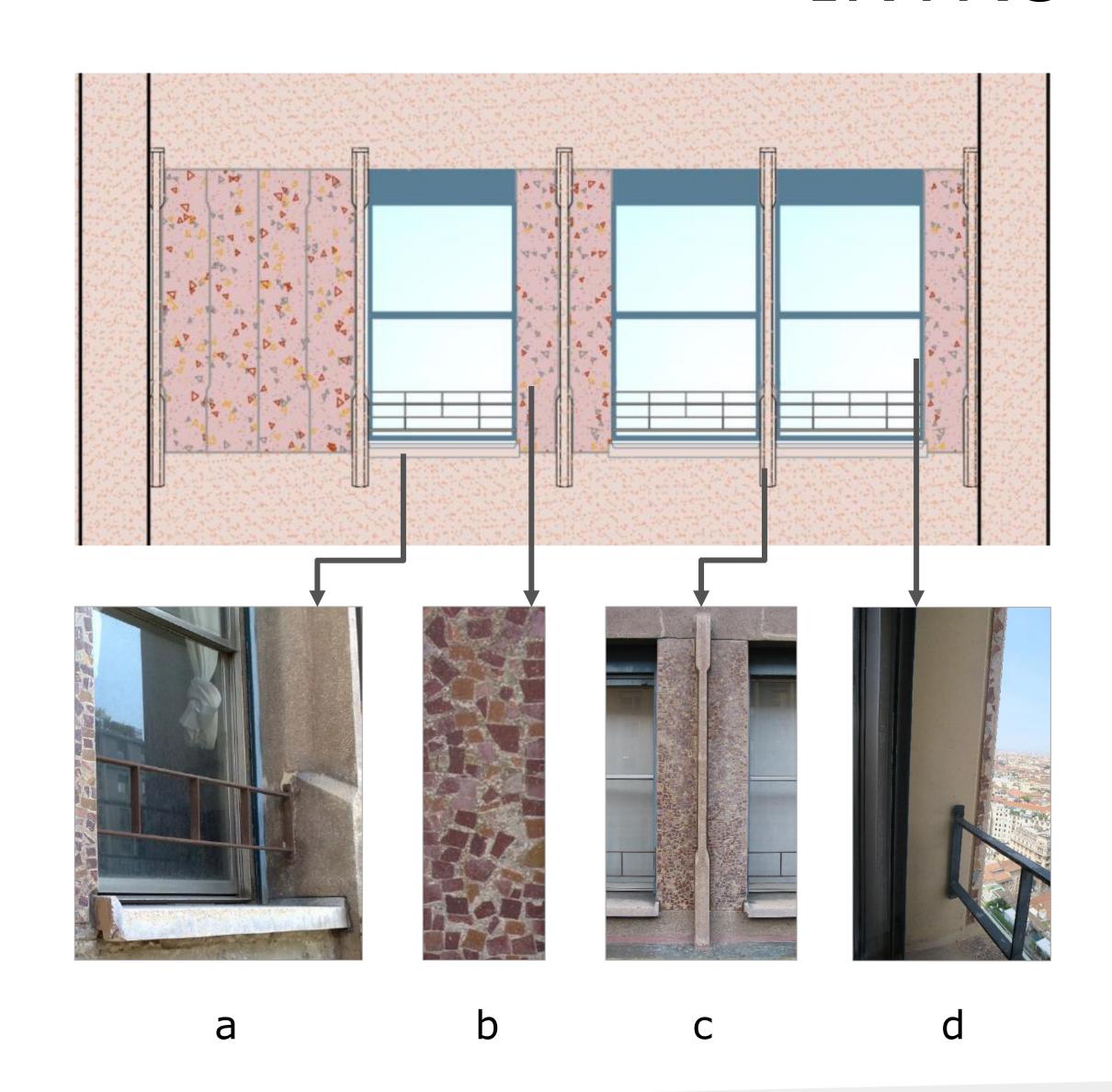
- → Cast in situ structural elements:
  - Tapered "T" section columns
  - Parapet beams
  - Struts and tie beams
- → Prefabricated elements:
  - Prefabricated window ledges (a)
  - Prefabricated panels (b)
  - Monolithic prefabricated pillars (c)
  - Prefabricated window jambs (d)







Prefabricated panels production in the fifties







## METHODOLOGY

#### **Phases**



→ Archival research and available documentation



→ Preliminary investigations:

- On-site visual inspections
- Non-destructive
- Semi-destructive

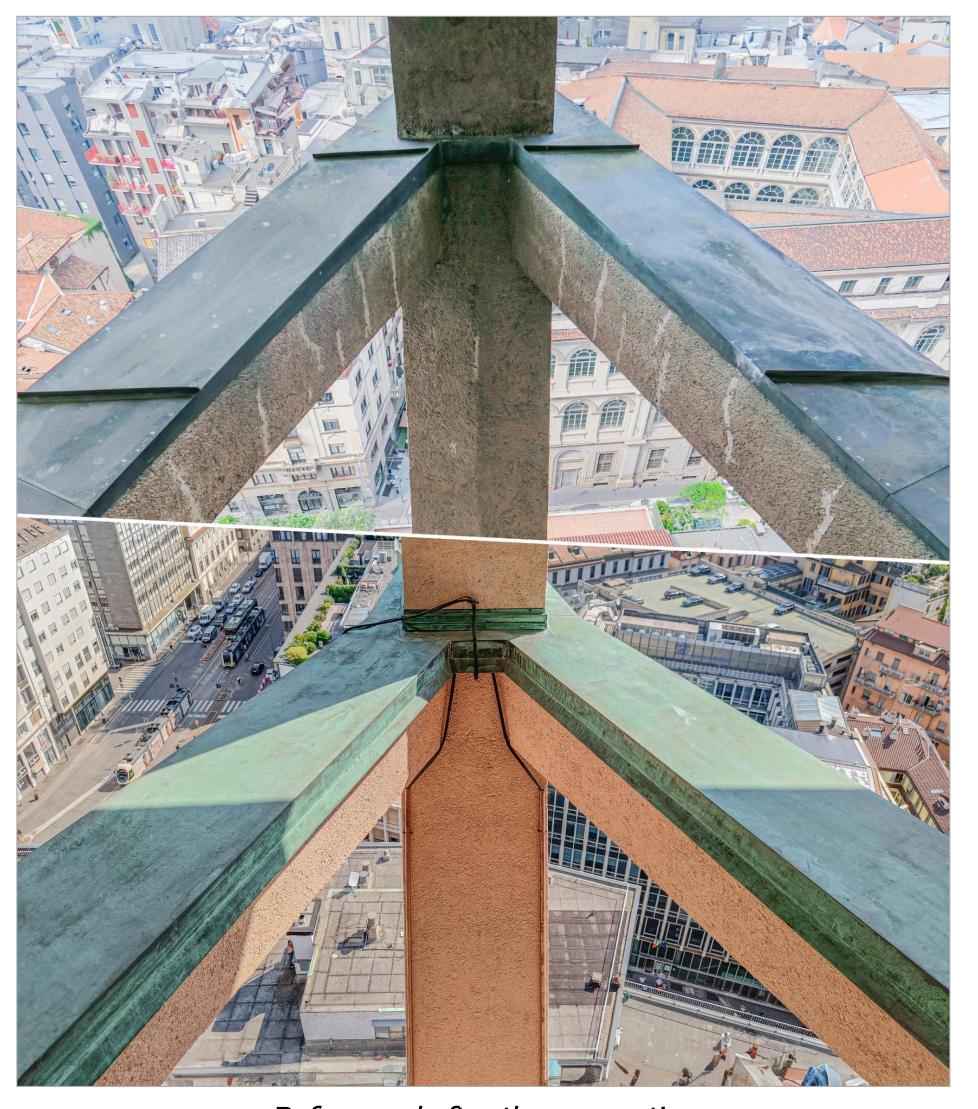


→ Structural and façade design



→ Durability guarantee:

- Laboratory tests
- Quality control
- On-site tests



Before and after the renovation





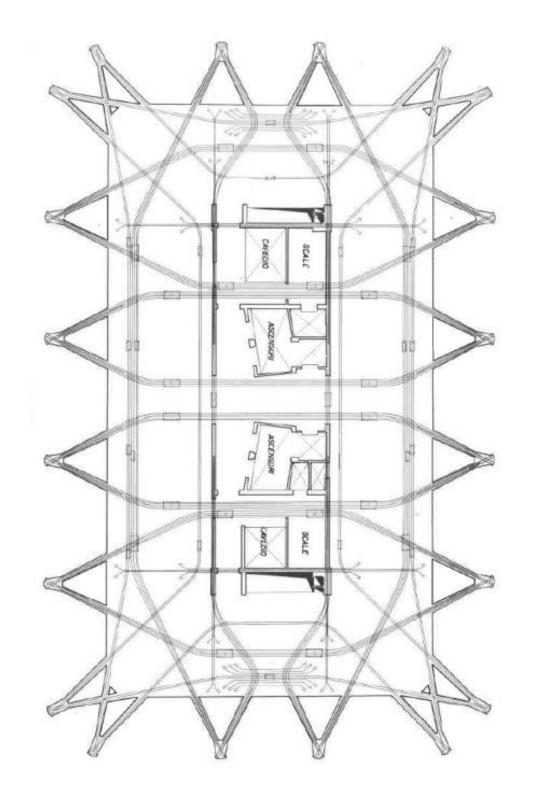




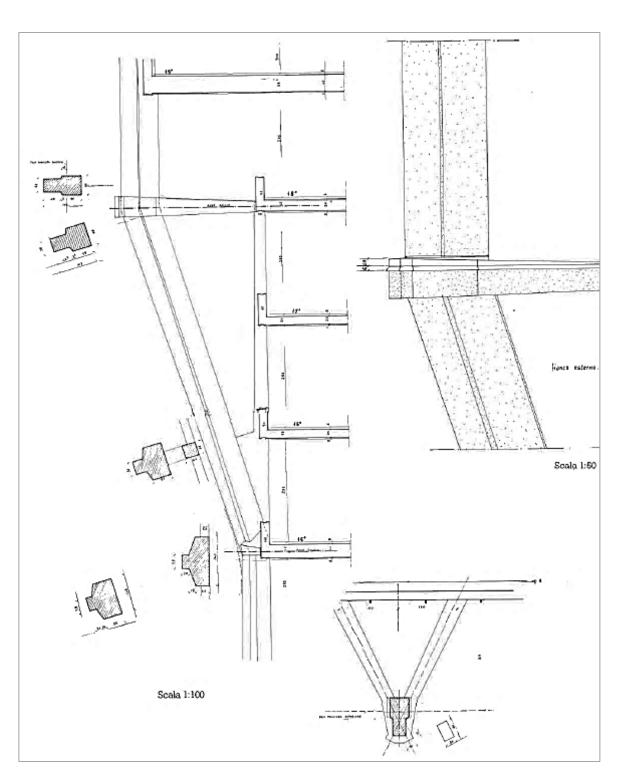


#### Level 18

#### → Structural drawings



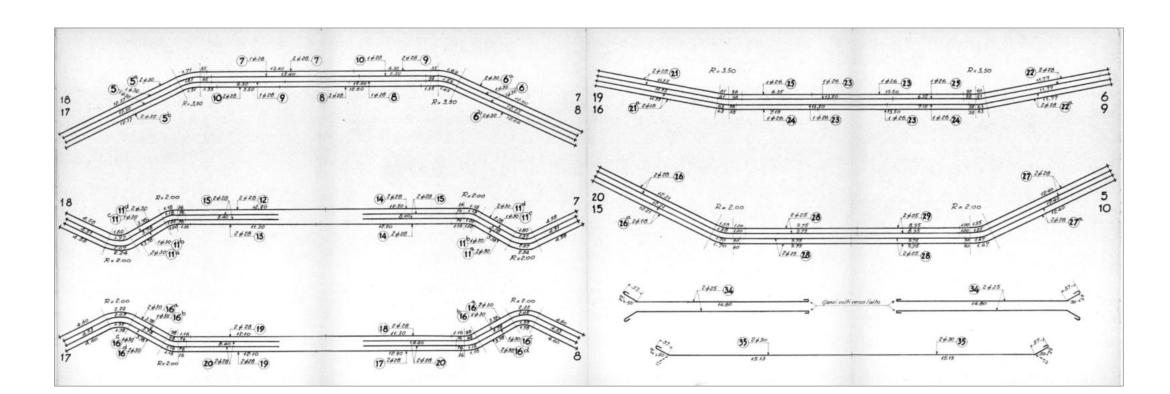
Rebars layout – 18th floor slab



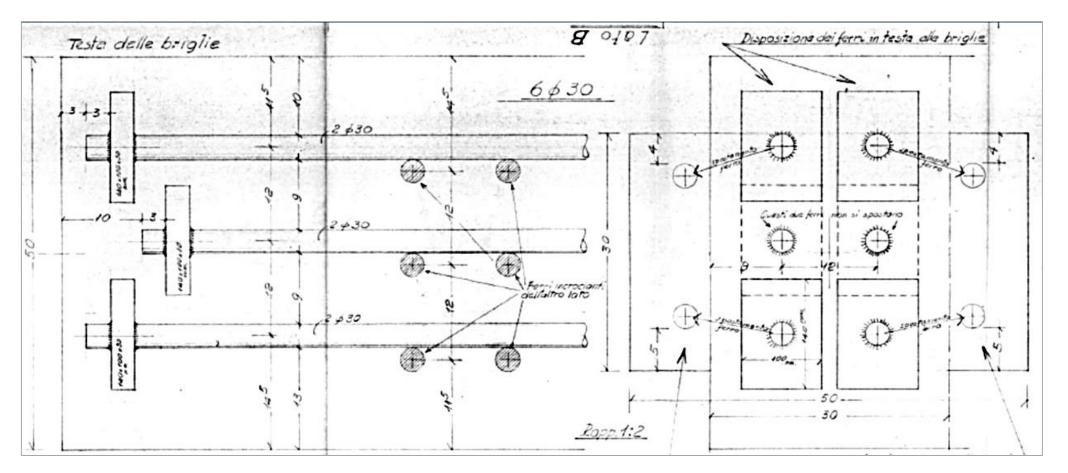
Strut & tie beams

#### PROJECT PHASE

#### 1.0 Archival Research & Documentation



Rebar details



Anchor plate detail pillar, strut and tie-beam junction

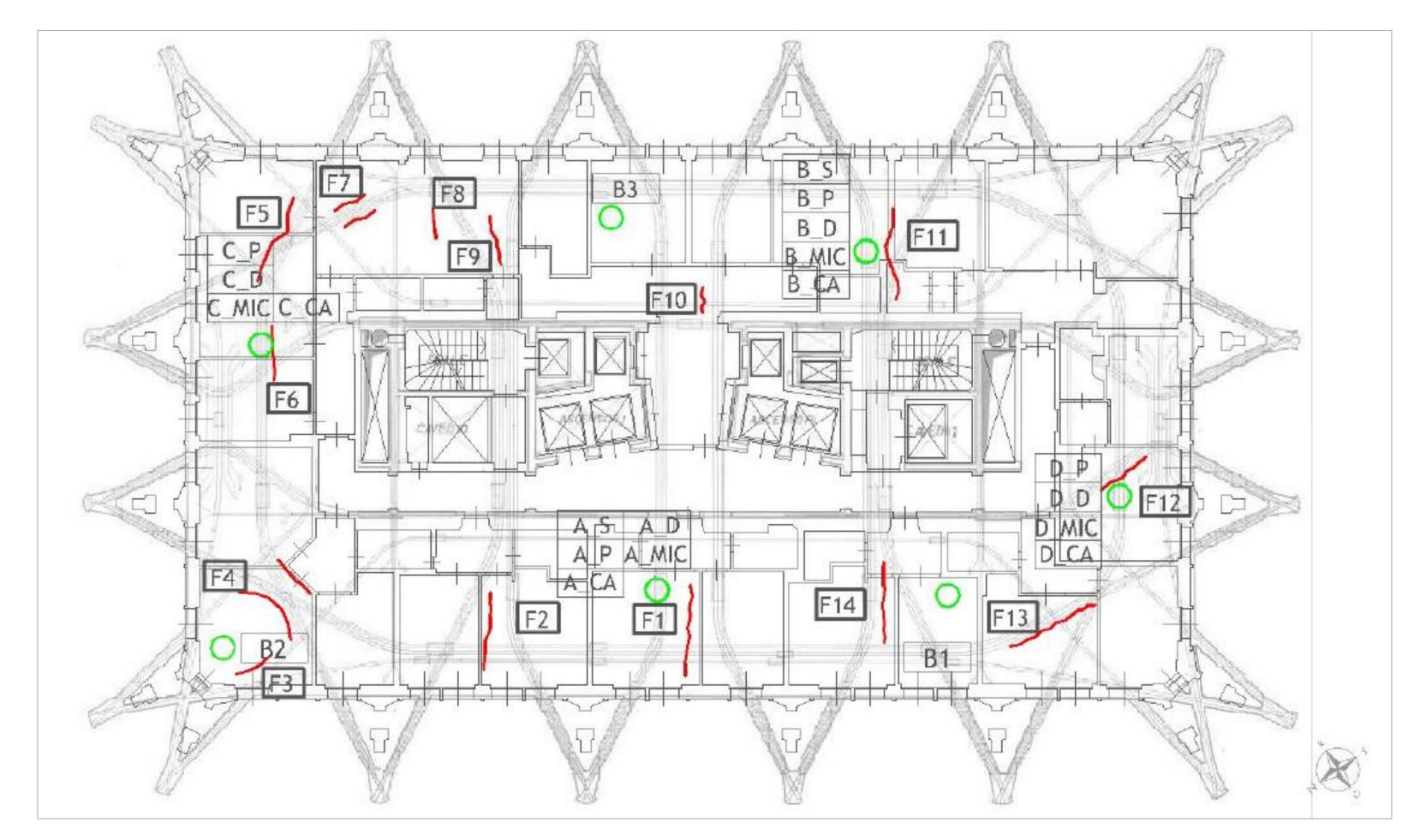




#### 2.0 Inspection and condition survey



- → Visual inspections
- → Existing crack pattern survey
  - Graphic transcription of the most significant cracks



18th floor crack pattern plan





#### 2.0 Inspection and condition survey

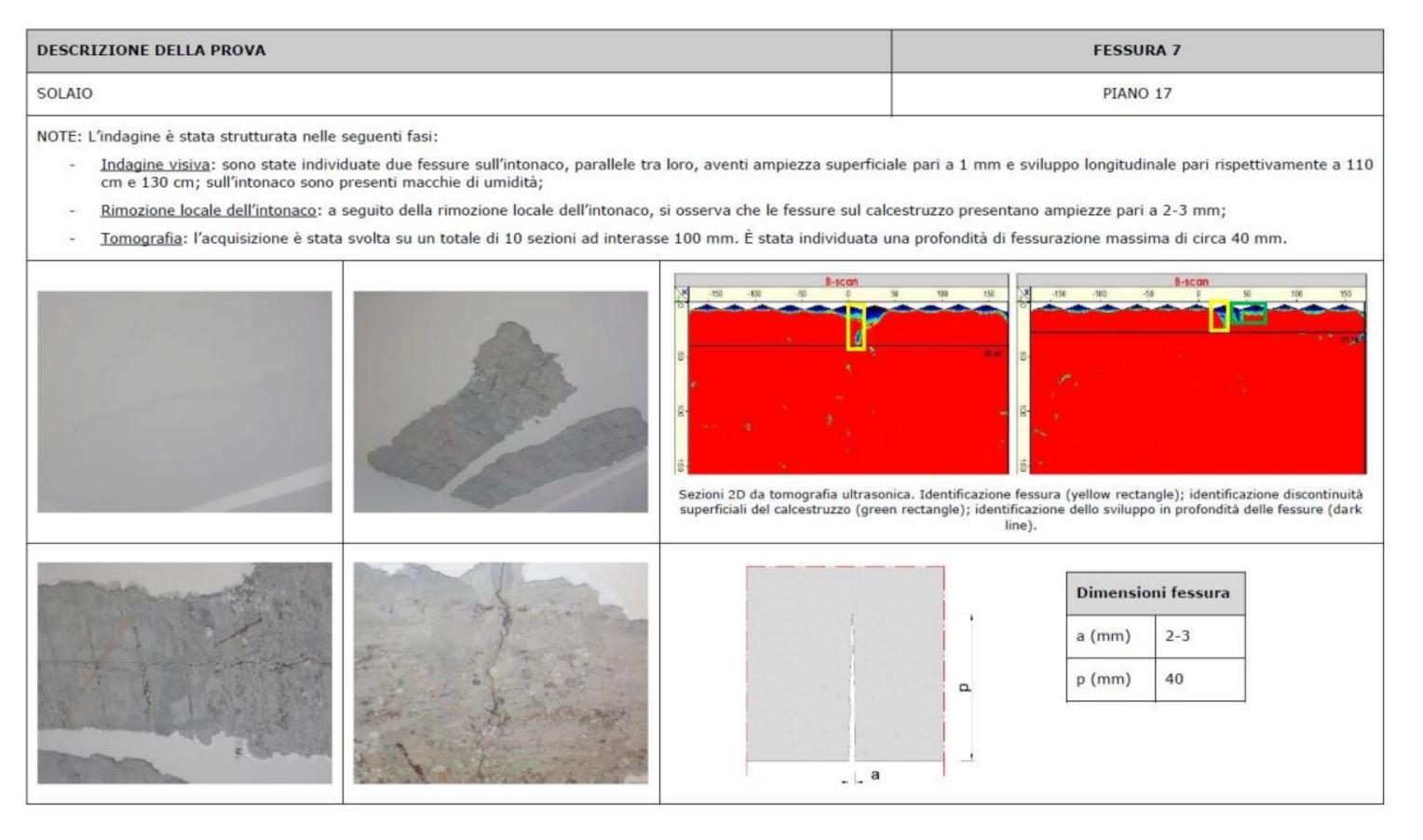


#### Level 18 – r.c. slab

- → Non-destructive testing methods:
  - Tomography (evaluate the crack pattern and crack depth)

#### → Results:

- Numerous cracks at the slab intrados
- Maximum crack depth = 40 mm



Tomograph survey





#### 2.0 Inspection and condition survey



#### <u>Level 18 – tie beams</u>

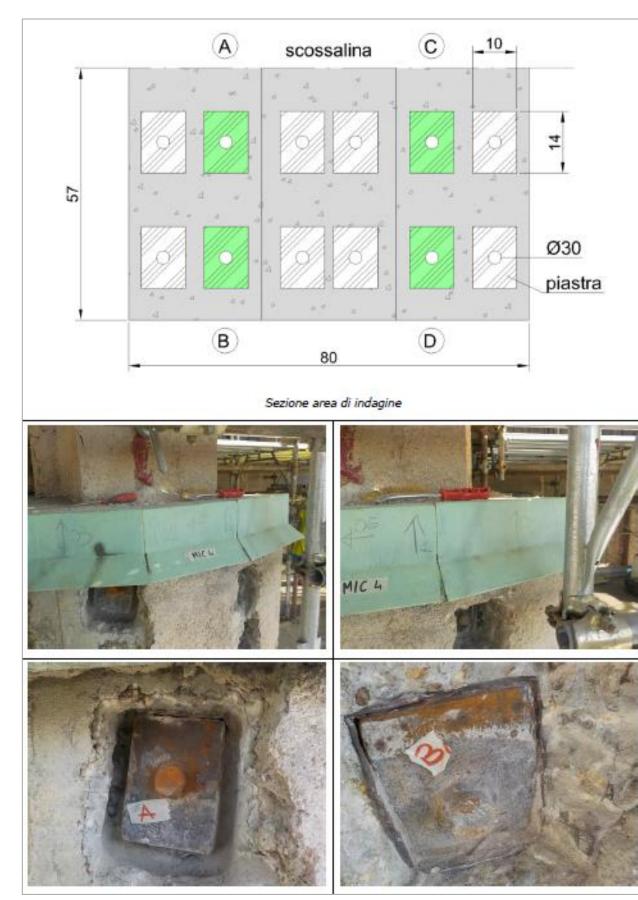
#### → Testing methods:

- Carbonation
- Durometer
- Georadar
- Corrosion potential assessment

#### → Results:

- Concrete cover thickness
- Plate dimension
- Plates and the top of the rebar present superficial oxidation

DESCRIZIONE DELLA PROVA	MIC 4
TESTATA IN C.A.	PIANO 18
NOTE: E' stato rilevato: zona di ancoraggio in testata composta da Copriferro minimo testa barra pari a 3,5 cm, copriferro piastra pari a 6, Con l'indagine georadar sono state individuate le armature e le piastre d microscassi in corrispondenza delle piastre A, B, C, D (riferimento all'imi e la testa delle barre presentano ossidazione superficiale.	,5 cm. Dimensioni piastra 10x14x5 cm. i ancoraggio; sono stati eseguiti quattro
Ø30	intonaco armato



Geometric survey



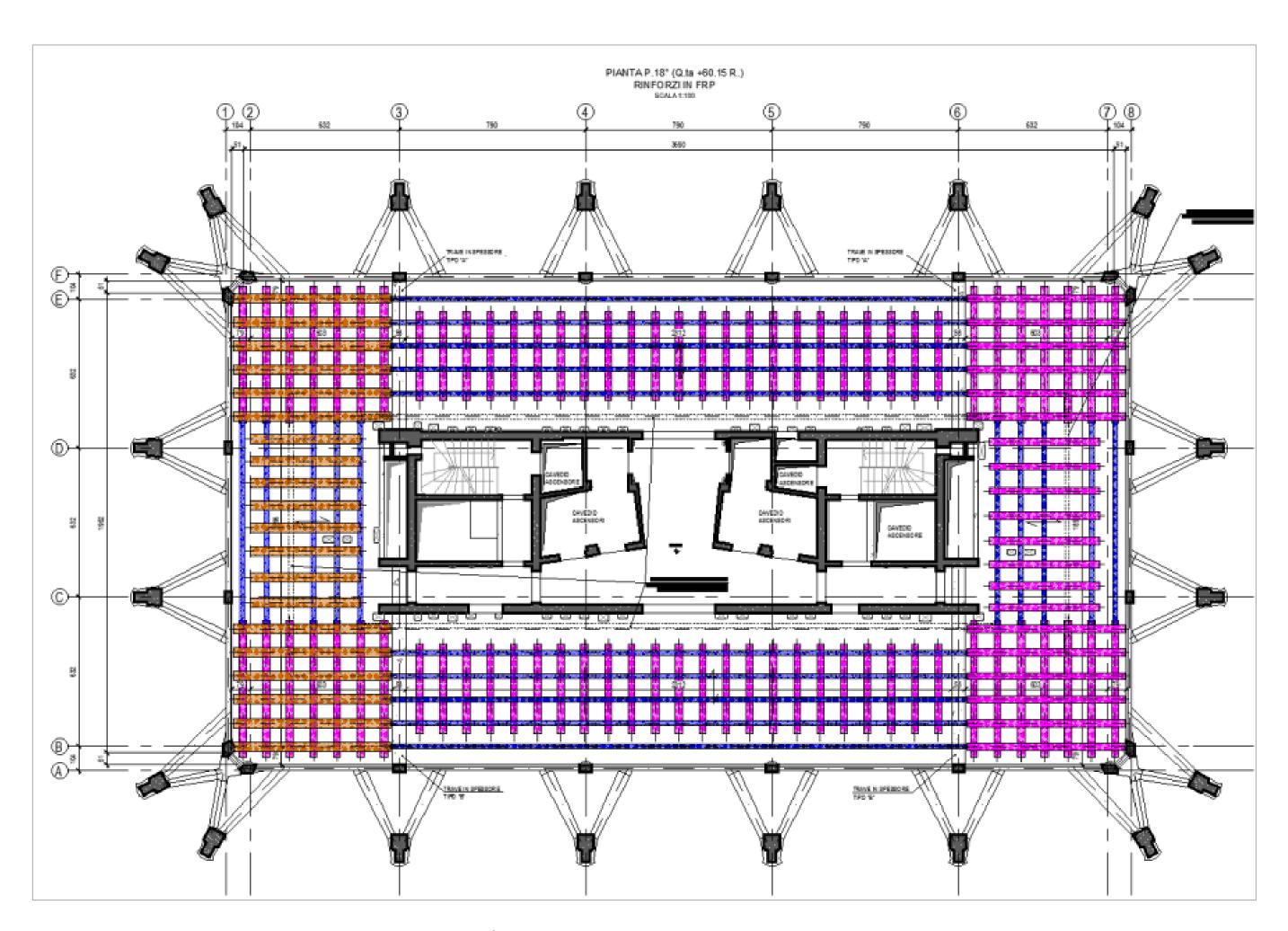


#### 3.0 Repair & Intervention

# Level 18 – slab

→ The building is subjected to restrictions and protected by the Superintendence of Cultural Heritage of Milan

- → Reinforcement structural design:
  - Structural strengthening using carbon fibre fabric (FRP) and epoxy resins to impregnate and bond the fibre
  - Product: Mapei Mapewrap C



18th floor FRP slab configuration







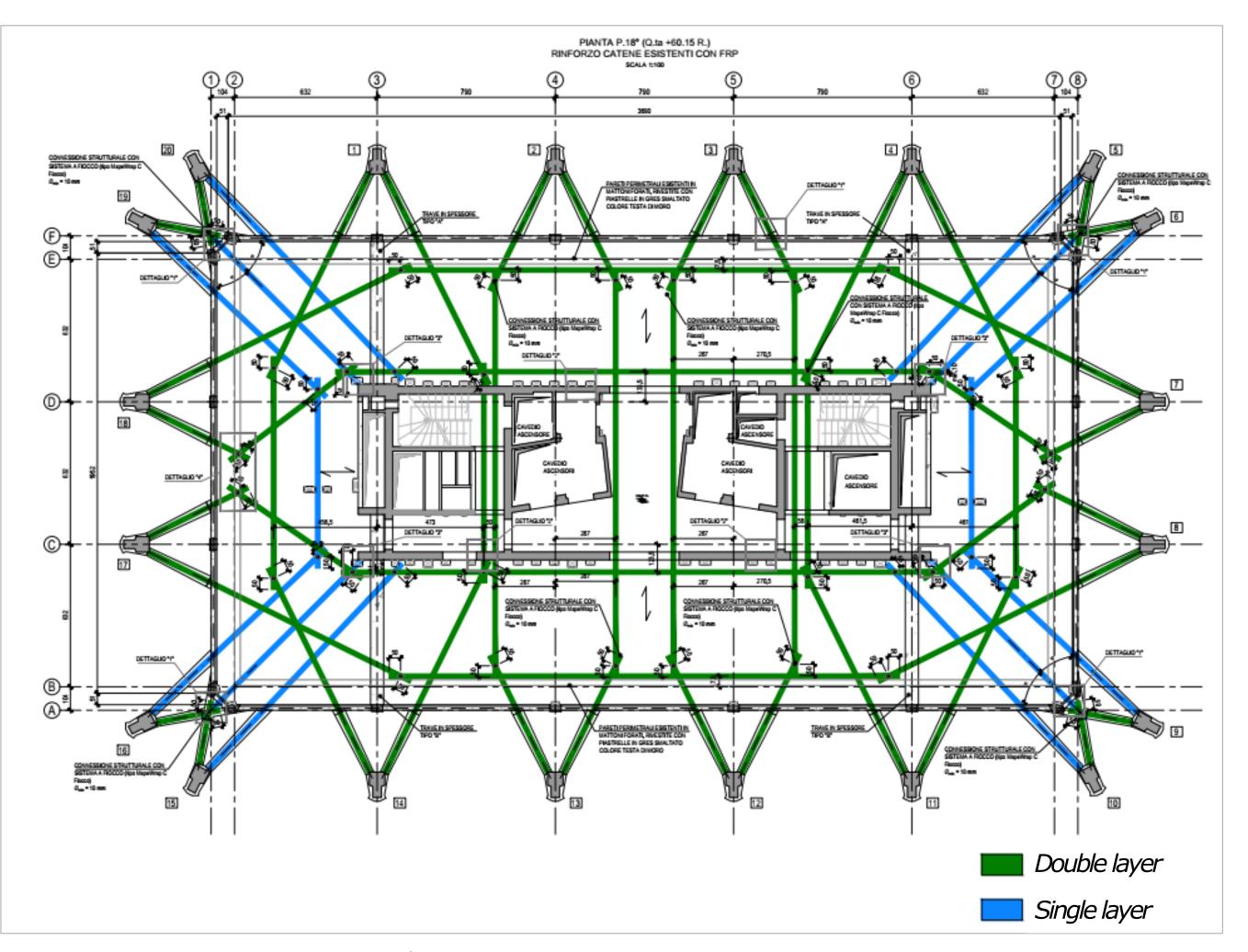
#### Level 18 – tie beams

→ The building is subjected to restrictions and protected by the Superintendence of Cultural Heritage of Milan

- → Reinforcement structural design:
  - Structural strengthening using carbon fibre fabric (FRP) and epoxy resins to impregnate and bond the fibre
  - Product: Mapei Mapewrap C

#### PROJECT PHASE

#### 3.0 Repair & Intervention



18th floor FRP tie-beam configuration





#### 3.0 Repair & Intervention

#### <u>Level 18 – FRP on-site execution</u>



Reinforcement external tie beams



Reinforcement external tie beams



Reinforcement intrados slab



Reinforcement intrados slab and tie beams



Reinforcement extrados slab



FRP tracing on ceiling plasterboard







#### Level 18

#### → Quality control

- On-site adhesion tests to validate the structural design assumptions
- On-site application temperature
   T ≥ 10°C
- 30 tests to establish the tensile rupture and the Young modulus
- 3 tests to determine the glass transition temperature

# 3



Temperature control

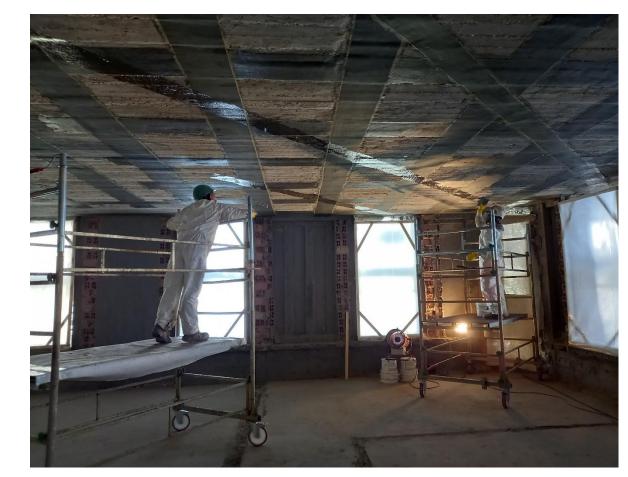






Sample draw

# PROJECT PHASE 3.0 Repair & Intervention



FRP application







#### 2.0 Inspection and condition survey



#### Garage basement

→ On-site visual inspections



Hollow clay slab degradation



Hollow clay slab degradation



Advanced stage of corrosion of beam rebars



Rebars external from the resistant section



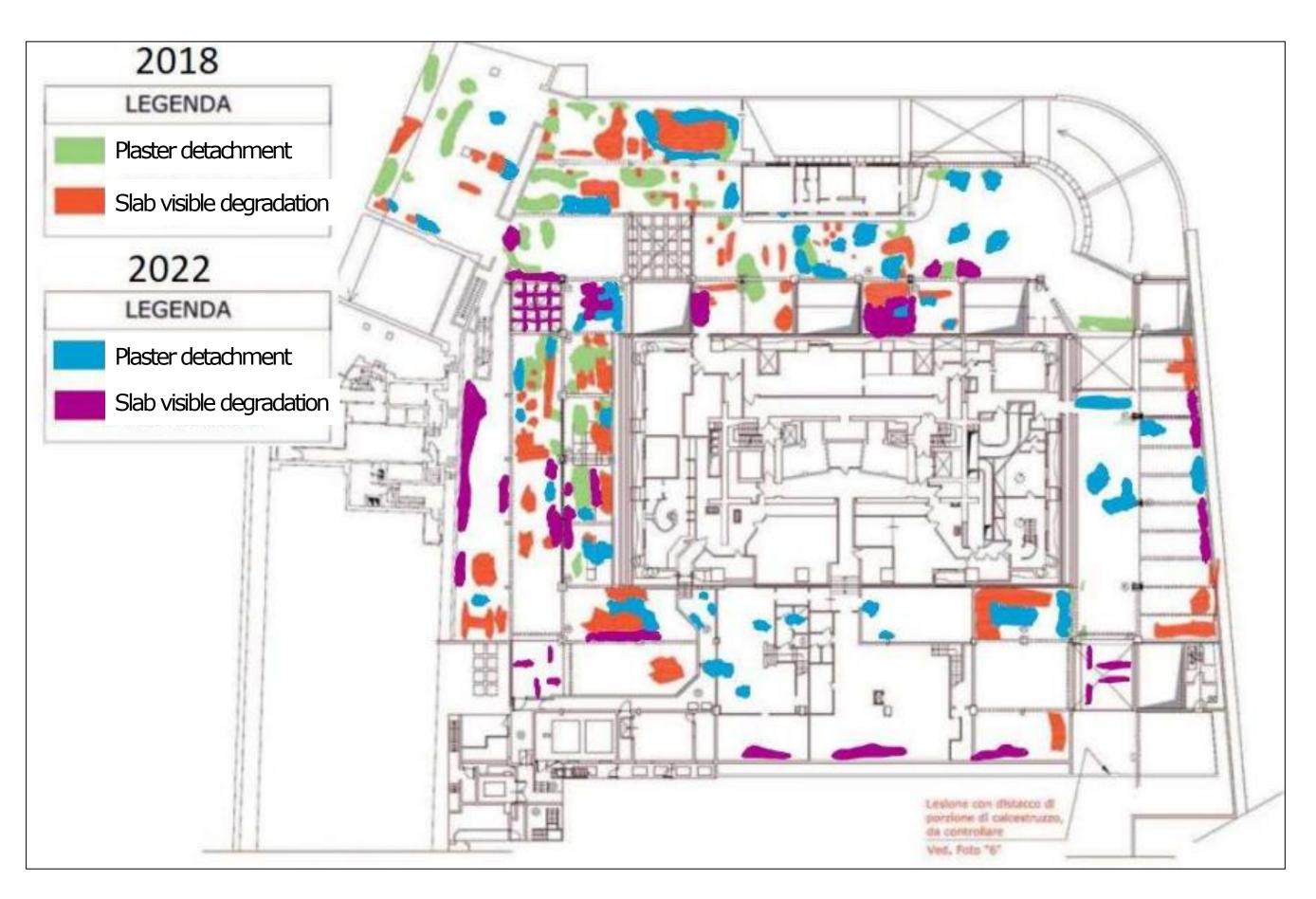


#### 2.0 Inspection and condition survey



#### Garage basement

- → On-site surveys and sampling to define the mechanical characteristics of materials
- → Slab state of degradation mapping and analyses over time
- → Existing structural static verification according to the current Standards
- → Demolition of critical slab portions with structural collapse risk



Garage degradation map plan

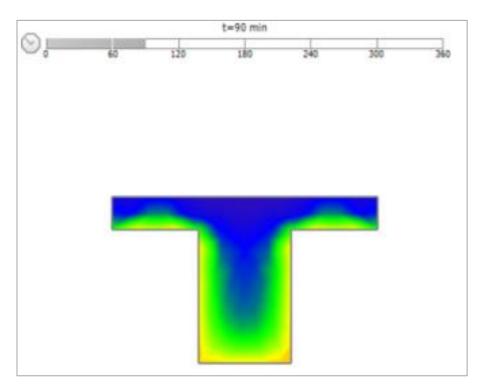




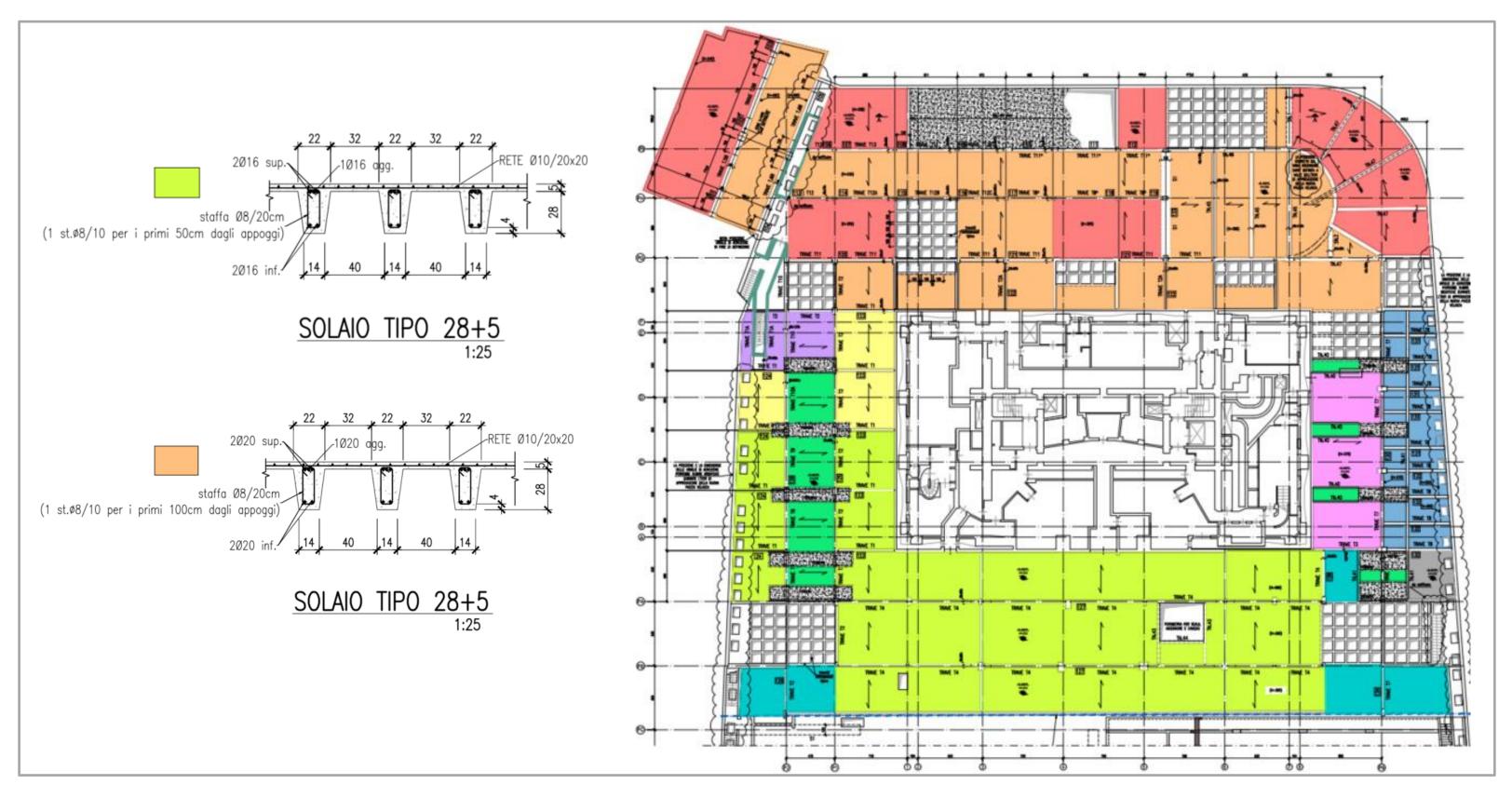
#### 3.0 Repair & Intervention

# Garage basement

- → Reinforcement structural design:
  - Total demolition and reconstruction
  - Ribbed r.c. slab cast in situ
  - Guarantee fire resistance according to the standards



Fire resistance section verification

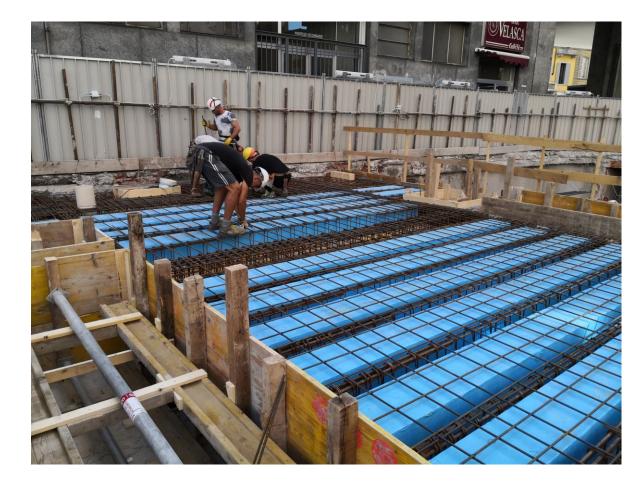


Ribbed r.c. slab structural plan





#### Garage basement slab execution



Reinforcement extrados slab



Intrados slab



Reinforcement extrados slab



Intrados slab

#### PROJECT PHASE

#### 3.0 Repair & Intervention



Reinforcement extrados slab



Intrados slab





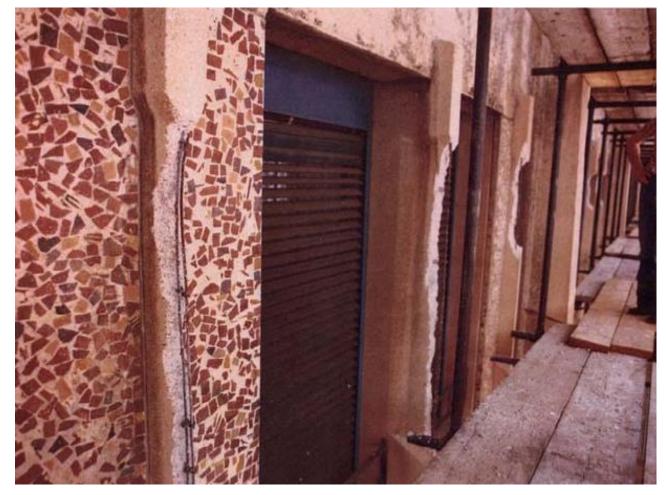




#### 1.0 Archival Research & Documentation



- → Past remediation works:
  - 1977-1979: mortar detachments that were repaired
  - 1995-1998: activities to repair the detachment of plaster and concrete cover at the connection between strut, tie beam and columns of the 18<sup>th</sup> floor
- → Study conducted by the University Politecnico of Milan (2006-2008):
  - Geometric and material survey
  - Carbonation tests
- → Since 2011 the building is subjected to restrictions and protected by the Superintendence of Cultural Heritage of Milan



Mortar detachments prefabricated pillars ('70s)



Concrete cover and plaster detachment ('90s)



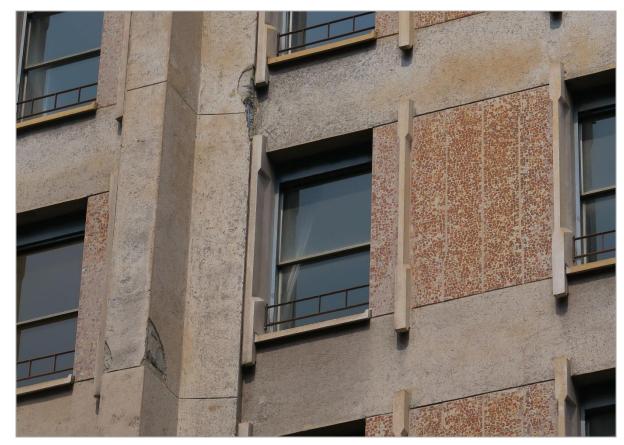


#### 2.0 Inspection and condition survey

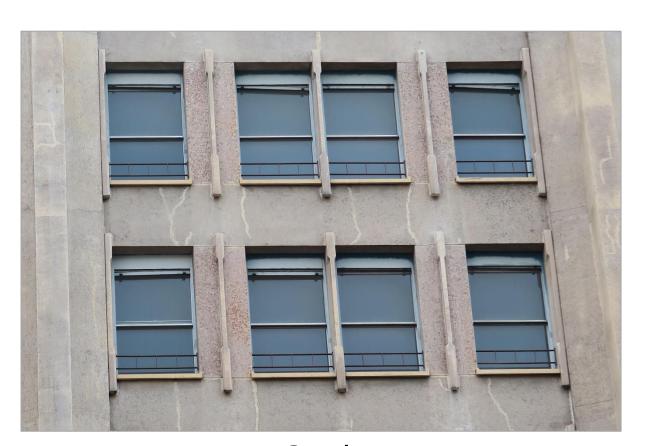


Overview on the current situation (2020):

- → r.c. cast in situ elements
  - Plaster detachments
  - Extensive crack patterns
- → prefabricated elements:
  - Cracks
  - Mortar detachment
  - Exposed reinforcement bars



Plaster and concrete cover detachments



Cracks



Exposed rebars



Exposed rebars





#### 2.0 Inspection and condition survey

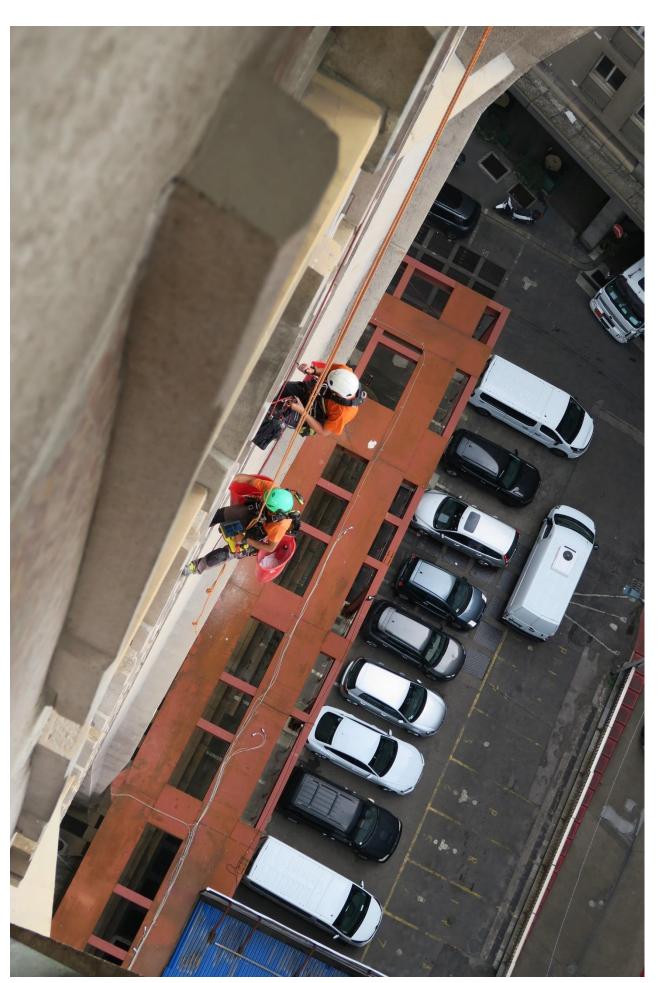


#### *Façade*

- → New survey campaign (2020) in the same areas investigated in 2008:
  - Micro core drilling of cast in situ and prefabricated elements
  - Carbonation depth
  - Water absorption, chloride content and electrical resistivity

#### → Results:

- The carbonation process involves 100% of the core samples
- In 40% of the samples the carbonation depth reached the concrete cover
- Possible depassivation of the reinforcing bars



Rope climbing access technicians survey



Carbonation tests





# PROJECT PHASE 3.0 Repair & Intervention

## Façade

#### → Reinforced concrete structural elements design (parapet beams and columns)



1) Plaster thickness survey



5) Reconstruction concrete cover



2) Removal of existing plaster



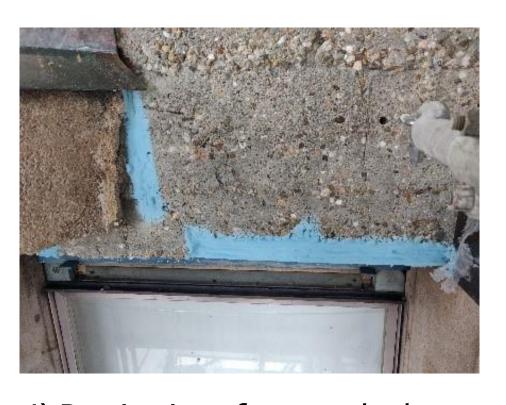
6) Bonding layer



3) Hydro-scarification



7) New plaster finishing



4) Passivation of exposed rebars



8) Air-abrasion + water-repellent

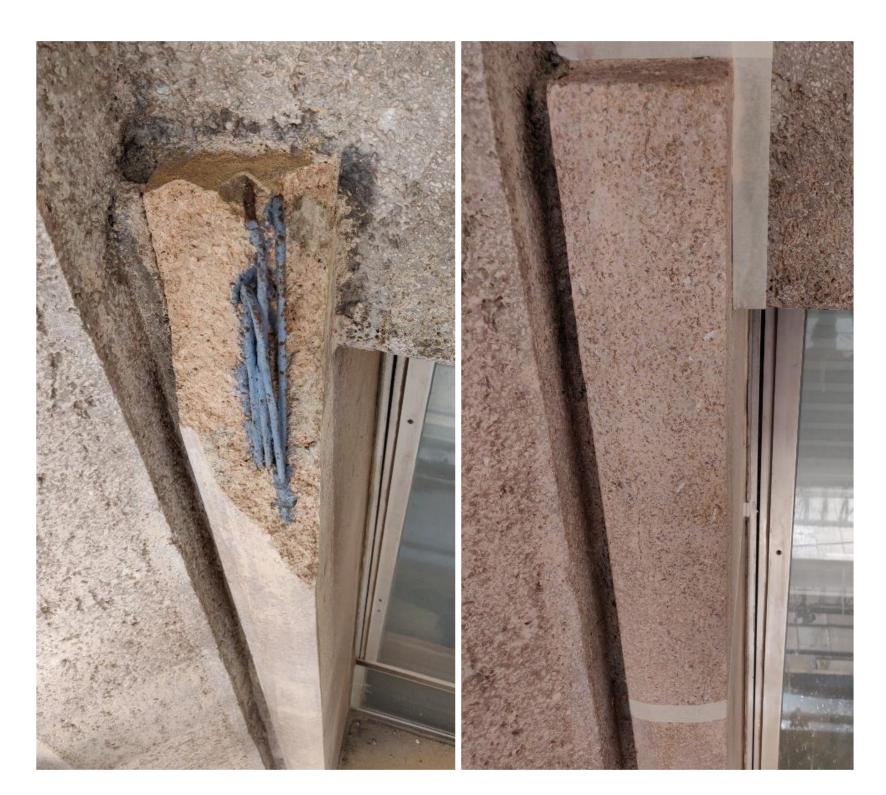




#### 3.0 Repair & Intervention

## Façade

→ Prefabricated elements design (monolithic pillars and panels)



Sandblasting, manual demolition, rebars passivation, reconstruction, water-repellent treatment



Sandblasting, manual demolition, rebars passivation, reconstruction, pictorial integration, water-repellent treatment







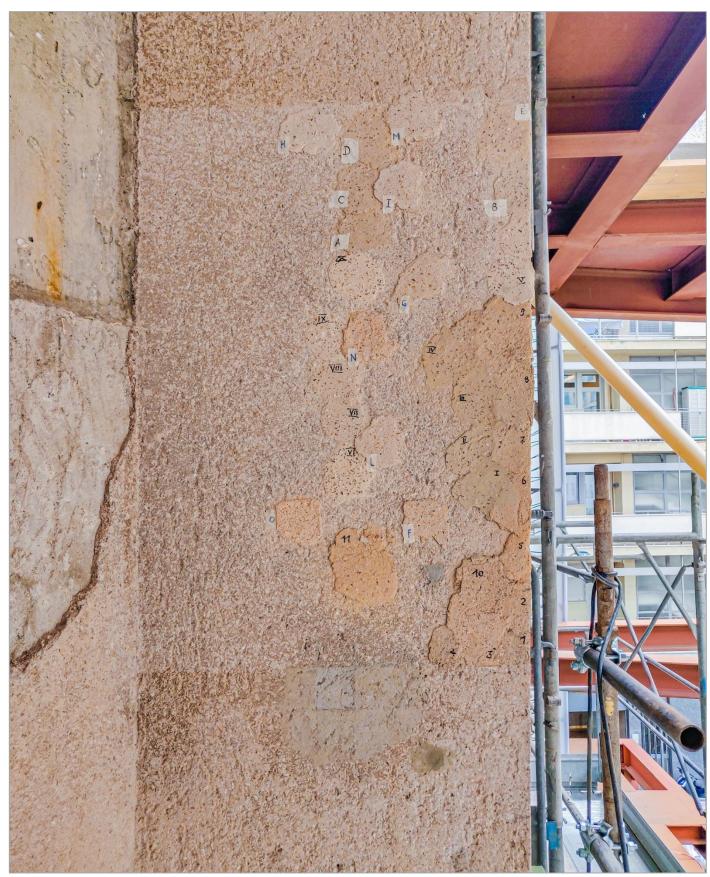
#### → Respect the original colour

- → Creation of a new plaster binder
- → On-site samples forSuperintendence approval
  - Plaster finishing "G"
  - Panel "F"



Plaster finishing samples and prefabricated panel samples





Plaster finishing color samples





#### 3.0 Repair & Intervention



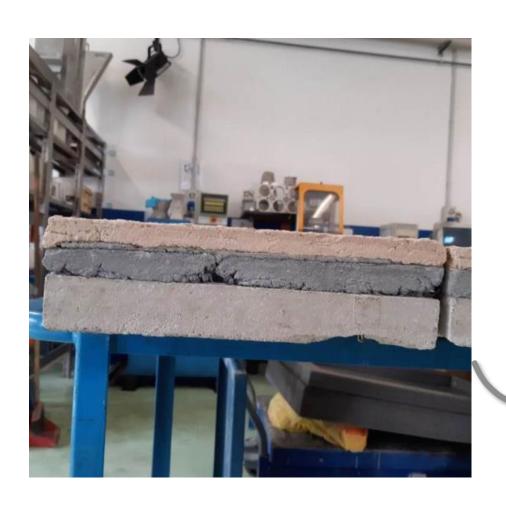
#### *Façade*

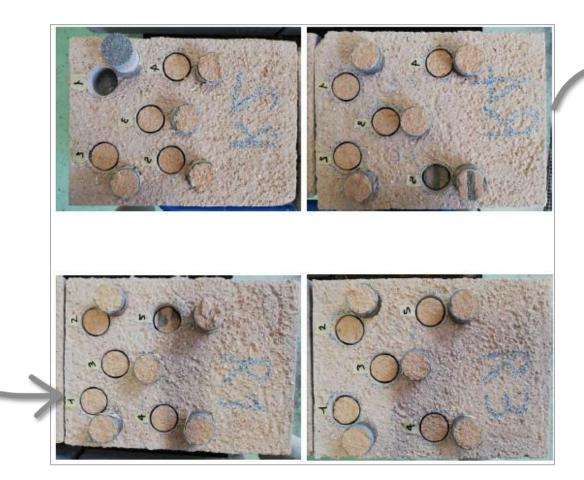
Quality control & Durability Guarantee

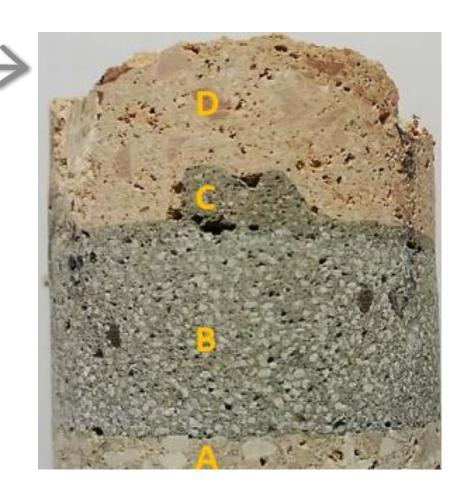
- → Laboratory tests:
  - Adhesion tests at the end of curing
  - Adhesion test after thermal/hygrometric cycles



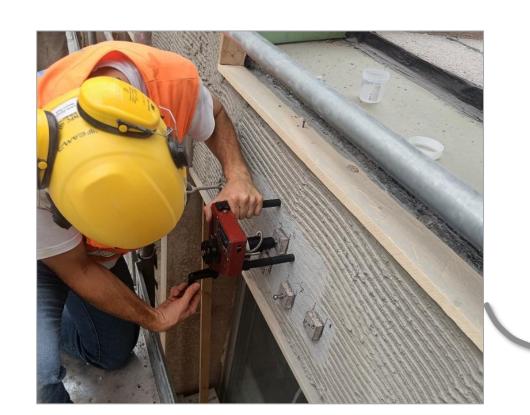
- Pull-off tests
- Karsten tests







Laboratory tests







Pull-off tests





# CONCLUSIONS Future & Maintenance

#### Maintenance plan

#### → Structures:

- Visual inspections
- Ordinary maintenance work
- Extraordinary maintenance work

#### → Façade:

- Ordinary and extraordinary maintenance works performed by access rope technicians
- Pull-out tests on the r.c. elements every 10 years
- Karsten tests to check the waterrepellent treatment every 2 years



Before After





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# THANK YOU

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