



1992 – 2014 Genova Aquarium case history

Eurocorr 2014
Pisa – Italy



MORE THAN 20 YEARS OF PROVEN DURABILITY OF FLUORINATED ARCHITECTURAL COATINGS

1992 – 2014 Genova Aquarium case history

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Genova Port

1992 Ship

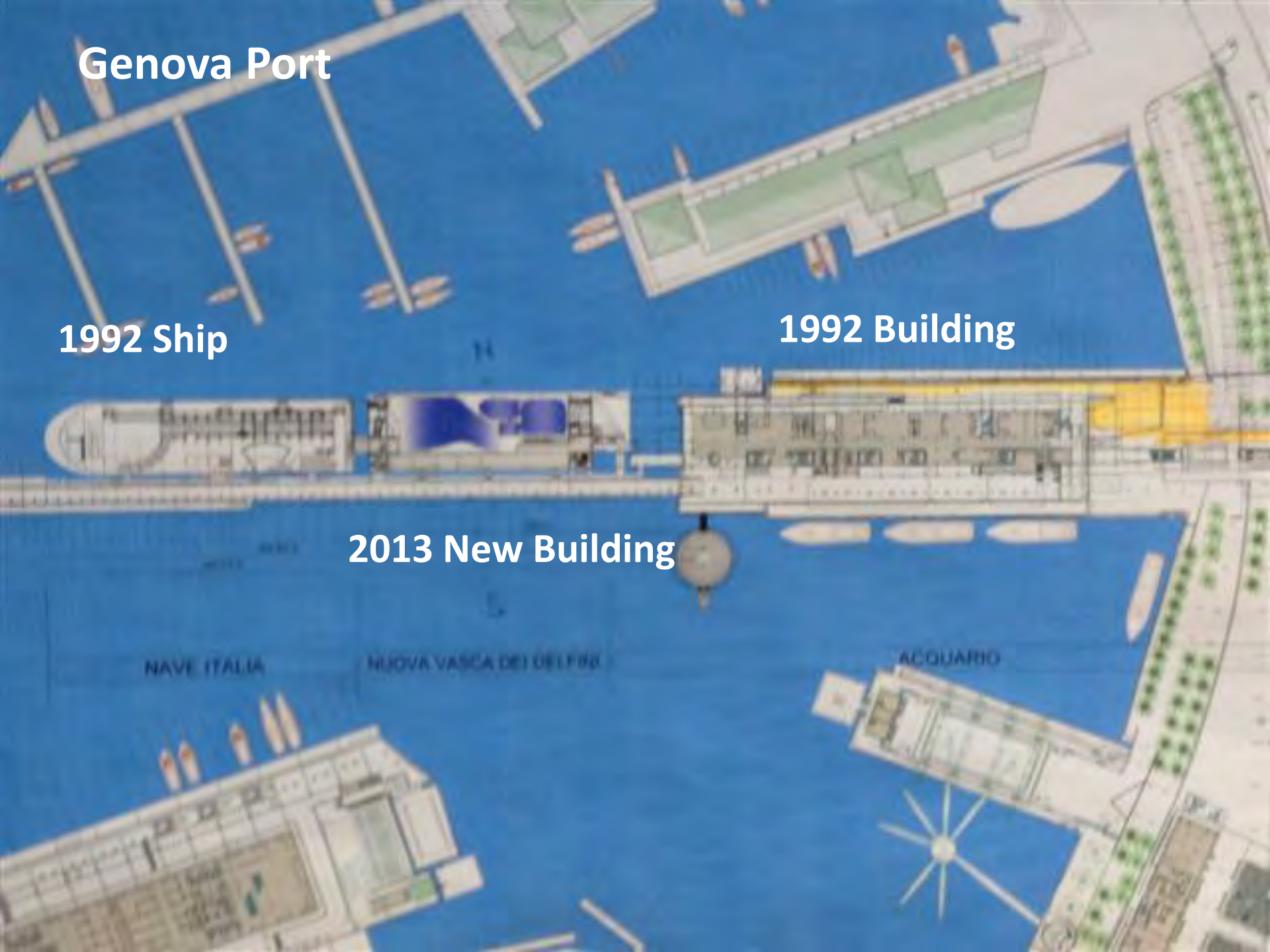
1992 Building

2013 New Building

NAVE ITALIA

NUOVA VASCA DEI DELFINI

ACQUARIO





1992 CONSTRUCTION



Innoventions



AFTER 21 YEARS — 2013 ASPECT

The aspect of the not maintained facade is the same of the original blue color, maintained twice in 21 years was dramatically changed





NO COLOR DIFFERENCE – END OF 2013

2013 fluorocoating onto
new building facade

Old fluorocoating applied onto
1992 building facade and never
repainted







Background of fluorinated coatings

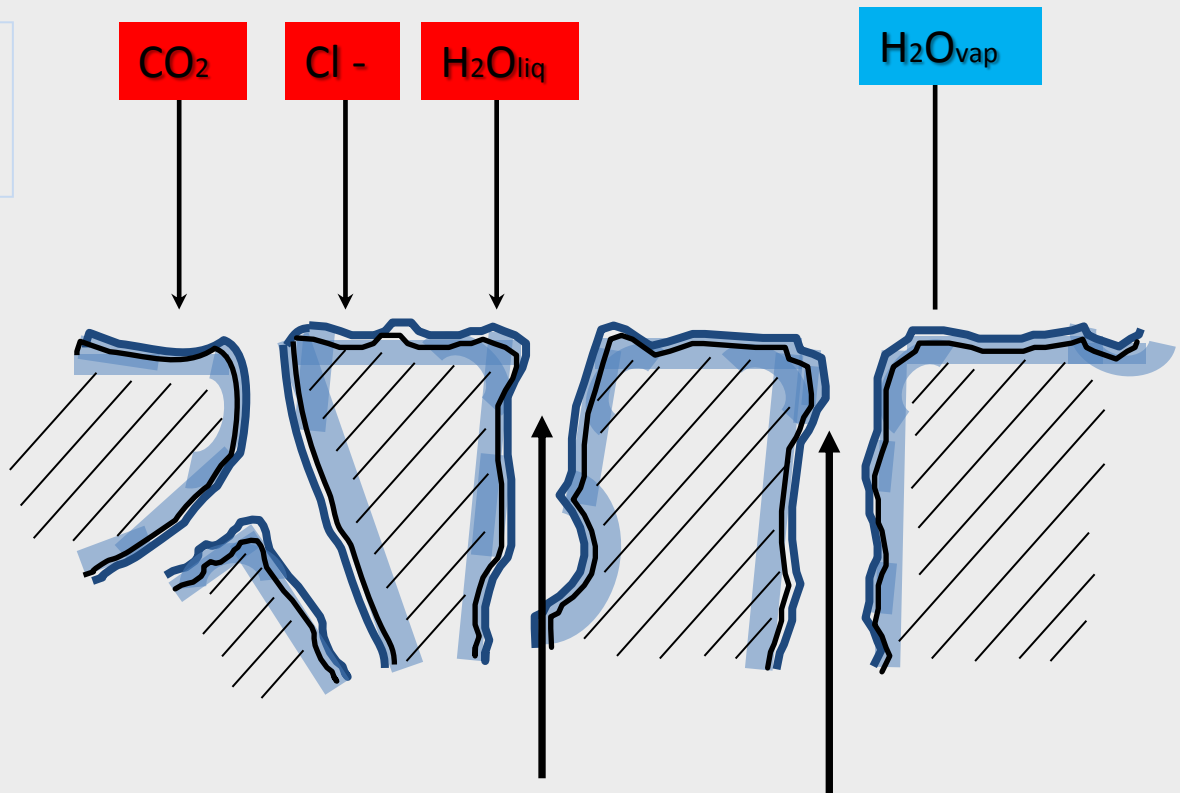
- Fluoropolymers for coatings curable at room temperature were patented in Japan on 1982
 - Main features: coating are UV transparent/unaffected
 - ✓ no outdoor degradation, no performance variation vs. time
 - ✓ no color and low gloss change, no chalking
 - ✓ constant and high barrier properties
 - Easy and fast to apply
 - Innovative coating system for concrete protection
-



Concrete degradation causes

Degradations caused from external sources

Degradation caused from internal sources:
composition and soil may generate byproducts which destroy protective coatings or generate disbondings



Soluble salts & alkali from concrete curing or water uptake from ground



Main Features of protective system for concrete

Key parameters are fixed by ISO EN 1504-2

3 strategies or options

- | | |
|----------------------------|-------------------|
| ➤ Hydrophobic impregnation | 1 micron |
| ➤ Impregnation | 10 – 90 micron |
| ➤ Protective coating | 100 – 5000 micron |

3 key parameters to fit

- | | |
|--------------------------------|--|
| ✓ water vapour transmission | $0,01 < S_d < 5 \text{ meter}$ |
| ✓ water liquid uptake | $< 0,1 \text{ kg/m}^2 \text{ h}^{0,5}$ |
| ✓ CO ₂ transmission | $S_d > 50 \text{ meter}$ |

When focus on coating design is limited on these parameters
there is no evidence to get a durable protective system



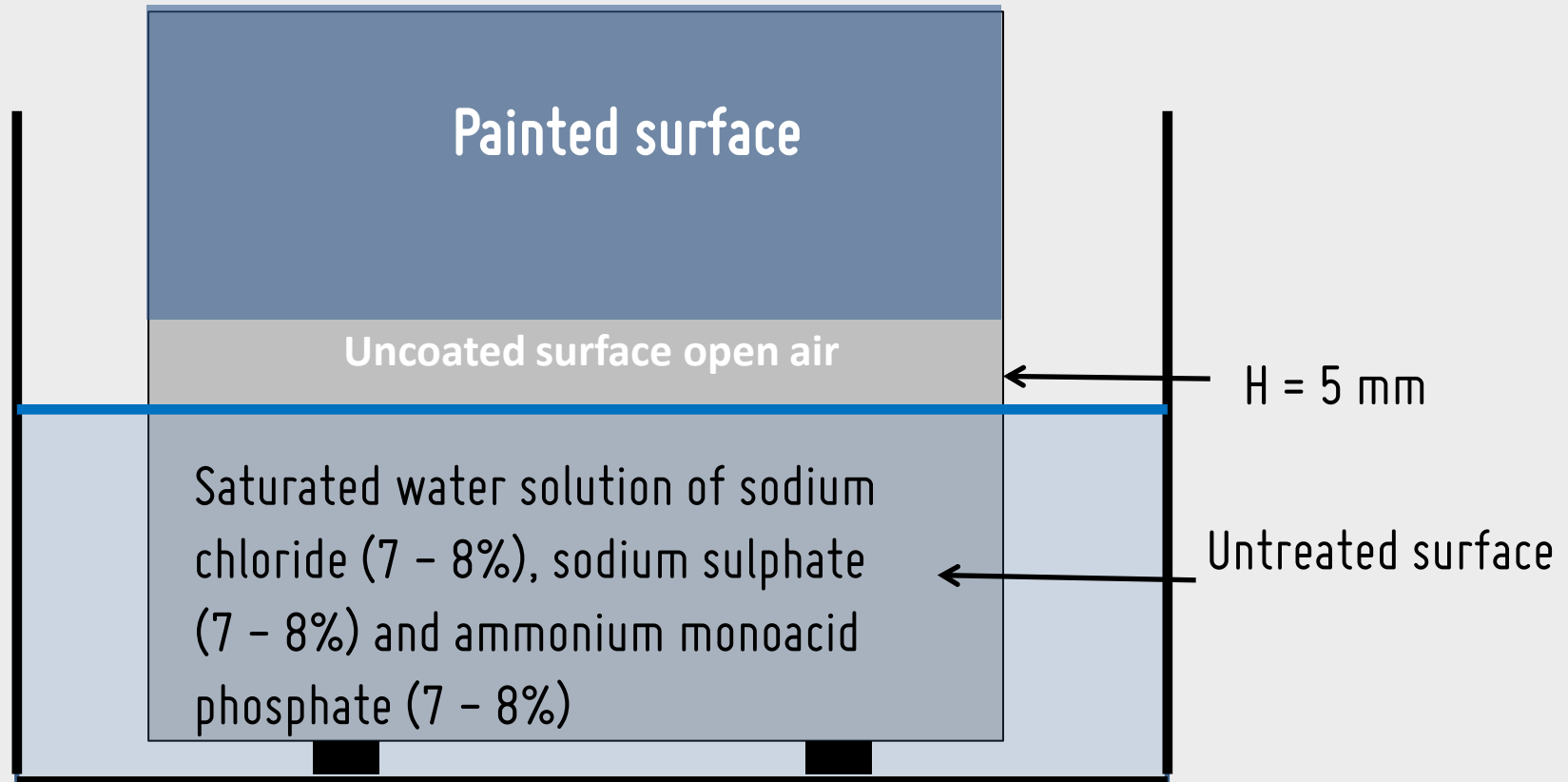
Other parameters to get durability

- ✓ Efflorescence control
 - ✓ Abrasion resistance
 - ✓ UV stability (no colour and gloss change)
 - ✓ Surface properties: water and oil repellency
 - Low dirt pick up
 - Easy to clean from rain
 - Antigraffiti
 - ✓ Chemical crack bridging
-



Efflorescence control

Dipping cycle: 5 days of partial dipping, 7 days drying in open air to speed up efflorescence formation



Efflorescence control reduce risk of coating disbonding



Efflorescence onto untreated sample

Untreated concrete sample

Sample after 4 cycles — 48 days



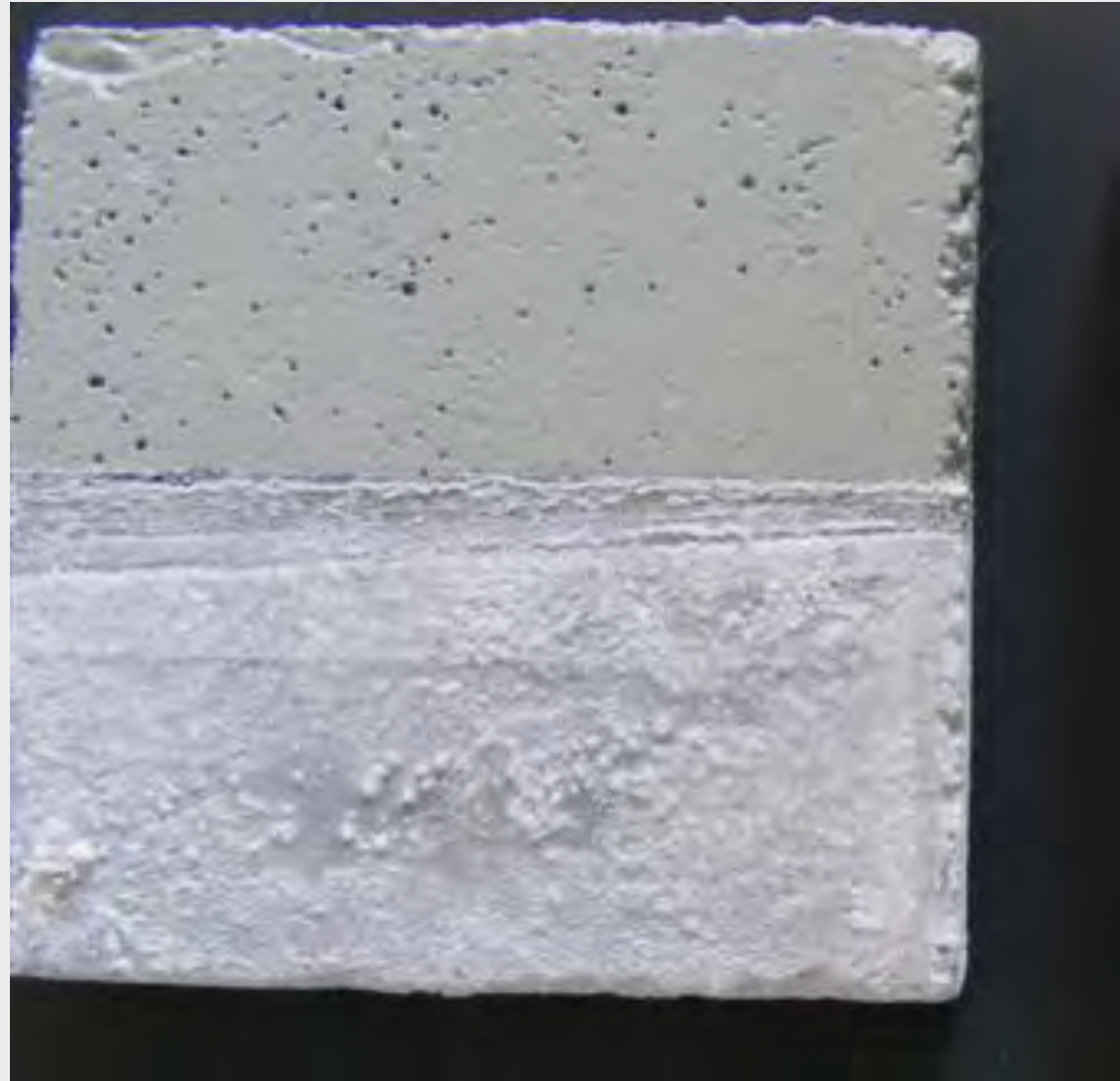


Efflorescence does not affect adhesion

Sample coated with
Fluorcoat after 8 cycles
(i.e. 96 days = 2300 hours
of dipping and drying

Minimum requirement
> 5 cycles

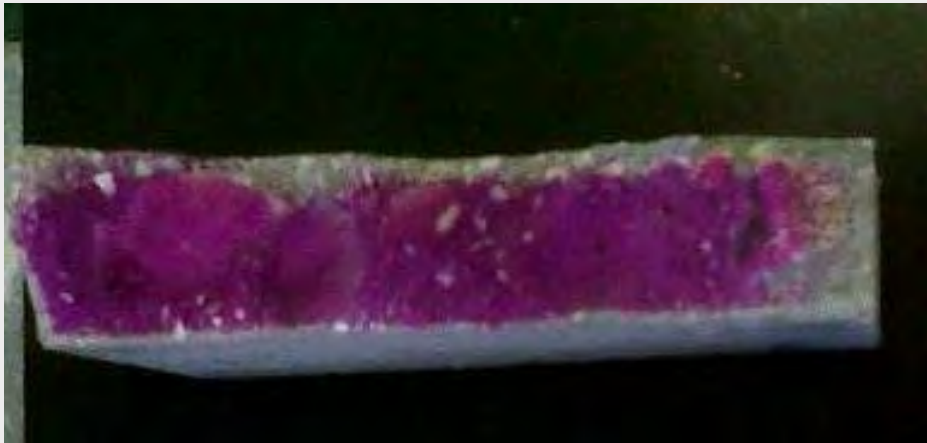
Efflorescence control
reduce risk of disbonding
by inner causes





Carbonation vs. coating thickness

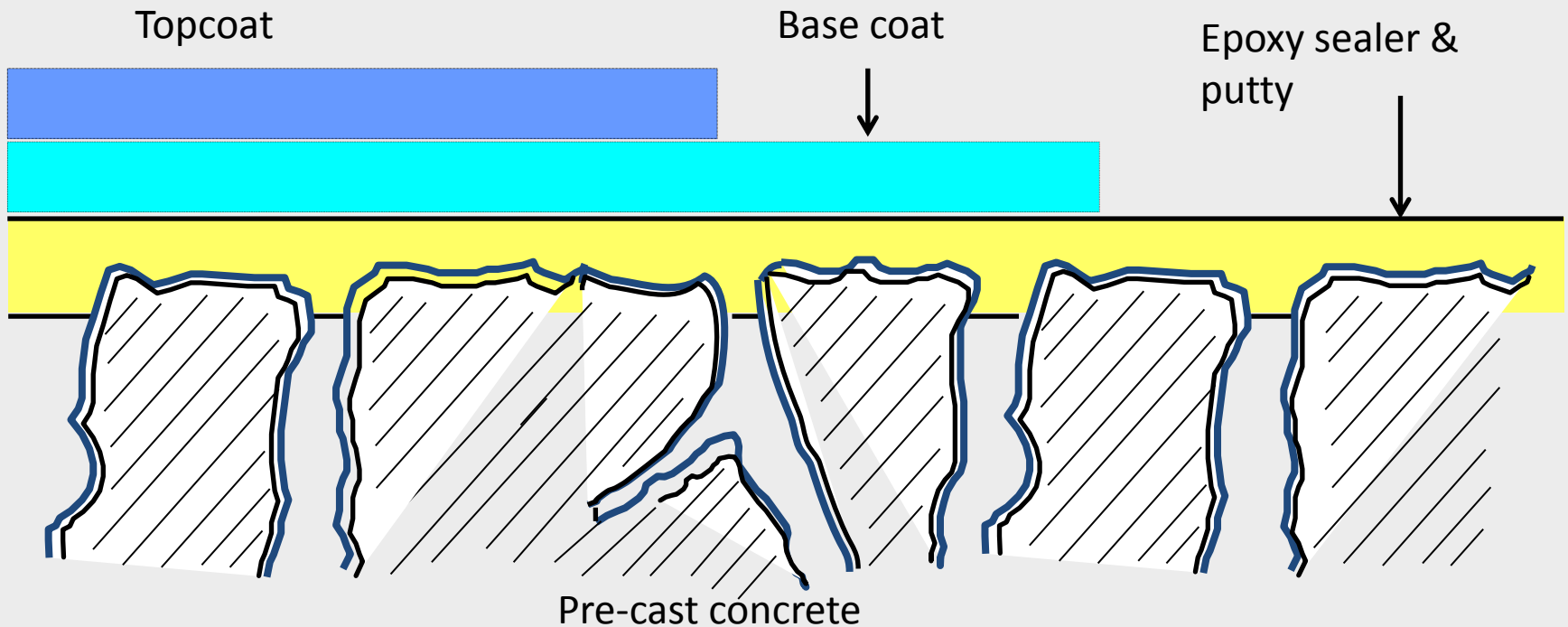
HIGH carbonation depth in uncoated face



NO carbonation depth in coated face



1992 coating system applied



Top coat: fluorinated coating, RAL 7035, 5 -10 gloss

40 micron

Base coat: acryl-urethane, RAL 7035

40 micron

Epoxy putty applied by knife

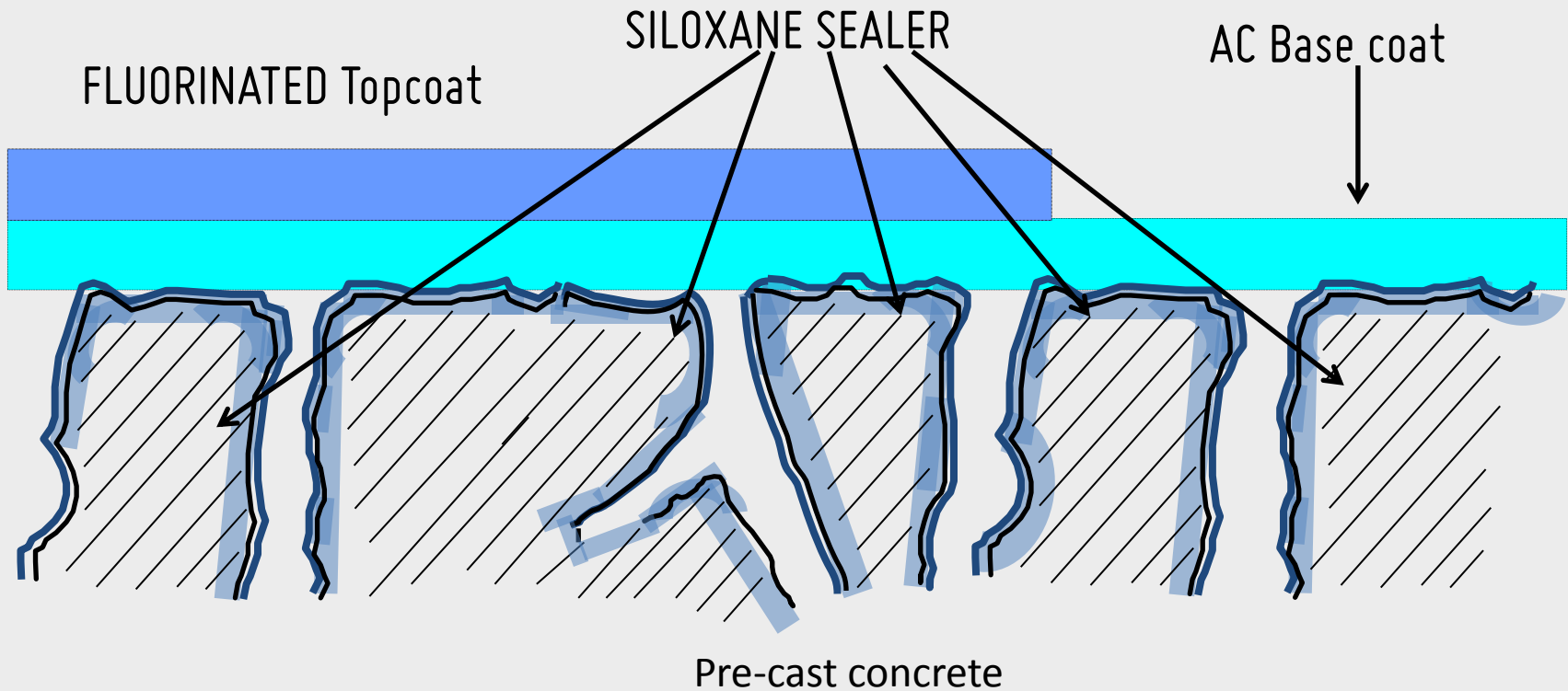
500 — 1500 micron

TOTAL

600 — 1600 micron



2013 coating system applied



Top coat: fluorinated coating, RAL 7035, 5 gloss

Base coat: acryl-urethane, white off

Water borne Siloxane Sealer

TOTAL

40 micron

40 micron

0,5 — 1 micron

80 micron



Protective coatings for concrete: key data

$$SdH_2O = 2,0 - 3,5 \text{ m}$$

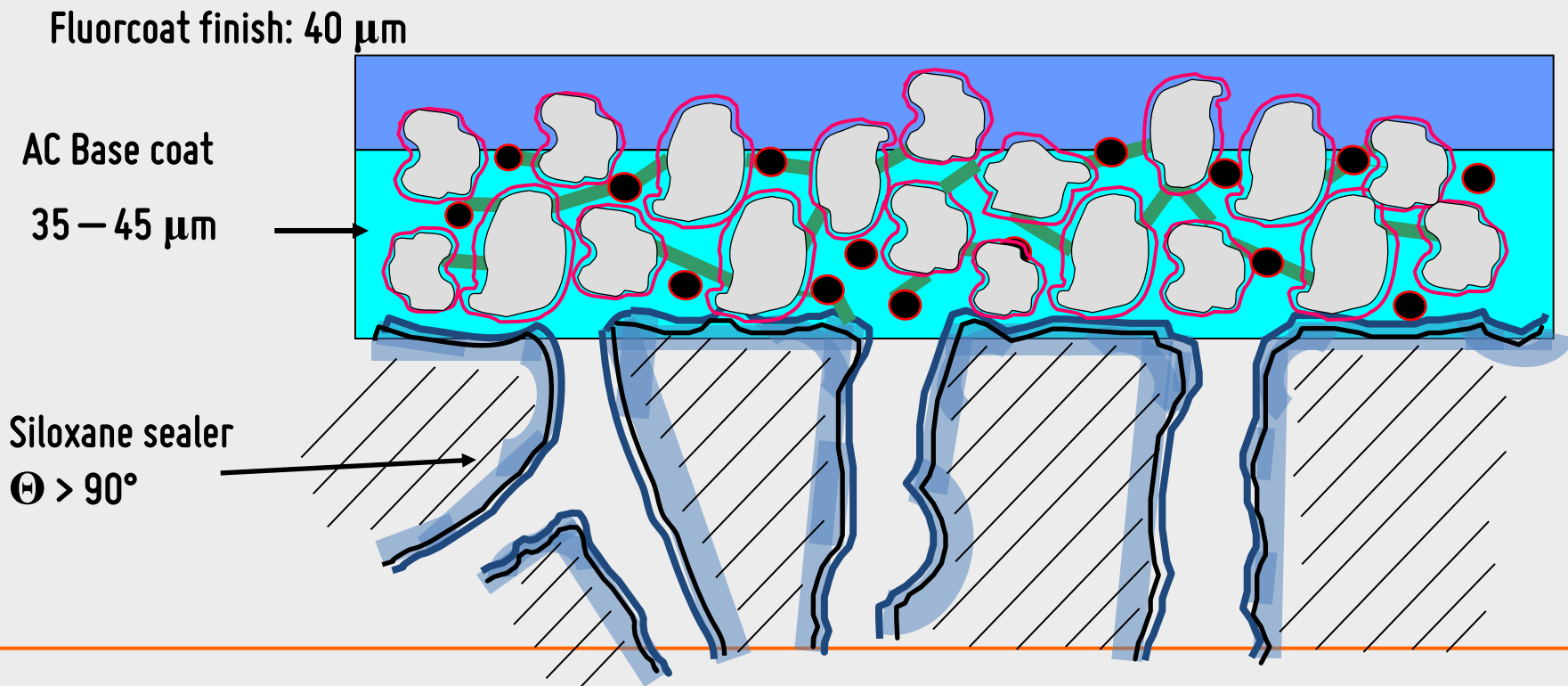
$$SdCO_2 = 450 - 650 \text{ m}$$

$$W < 0,01 \text{ kg/m}^2 \text{ h}^{0,5}$$

$$\mu = 1.9 - 4.2 * 10^4$$

$$\mu = 6.5 - 8.5 * 10^6$$

Static contact angle with water $> 90^\circ$





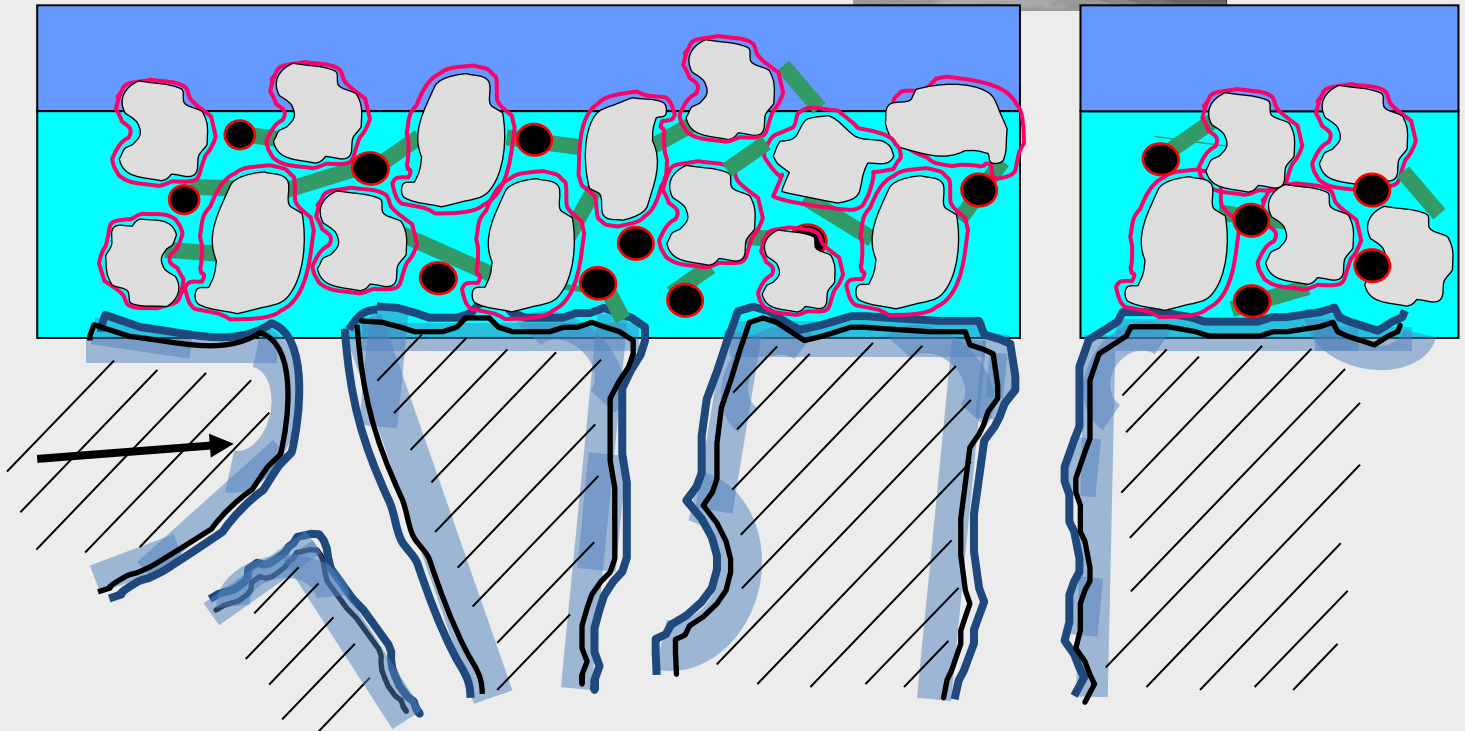
Chemical crack bridging: physical phenomenon

Fluorcoat finish: 40 μm



AC Base coat
35 – 45 μm

Siloxane sealer
 $\Theta > 90^\circ$





No water uptake even on cracked surface

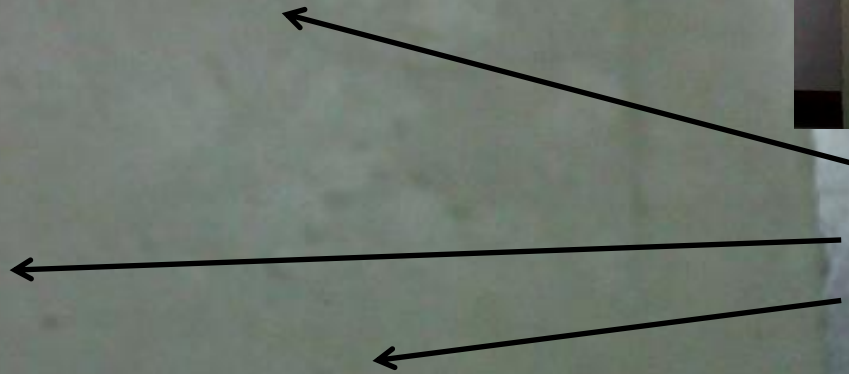
Water repellency,
constant vs. time
due to UV stability,
does not allow
water uptake
from rain





Salt spray test (ASTM B117)

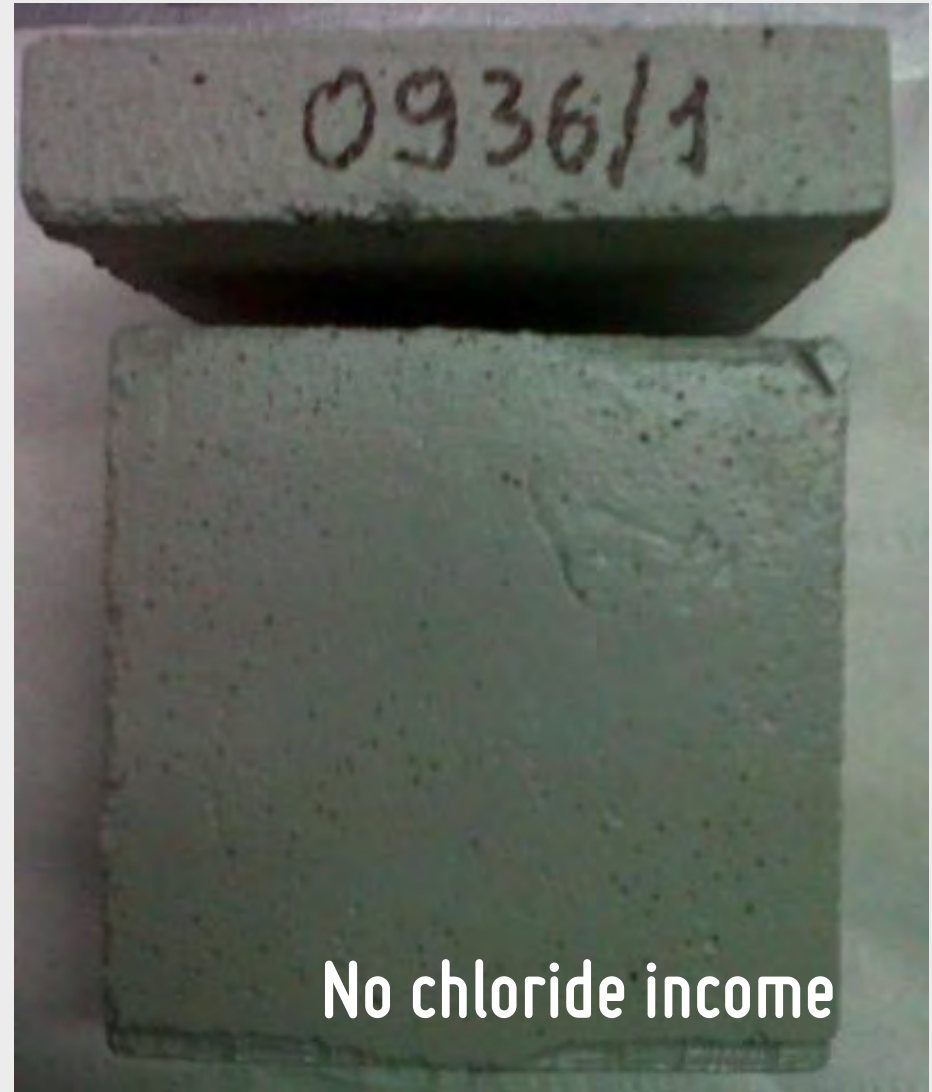
Elastomeric Polyurethane — 250 micron
350 hours of test



**Spread and
diffused
blistering**



Salt spray test on Fluorcoat coating system





Examples of cleanability

Lingotto Torino:
Fluorocoating
applied on 1991





Cleaning test carried on 23.09.2008 in Turin

Hand washing



Low pressure hydrowashing





Brescia incinerator chimney- A2A

Substrate: concrete
Colour project: Jorrit Tornquist
Colour sequence: 30 shades of blue
12 years of warranty

Mistake
2005- 2008



Final effect after restoration
In 2008





Aglio's Viaduct

A1 Motorway

Concrete

July — August 2012





Antegnate: Auchan Trade Centre

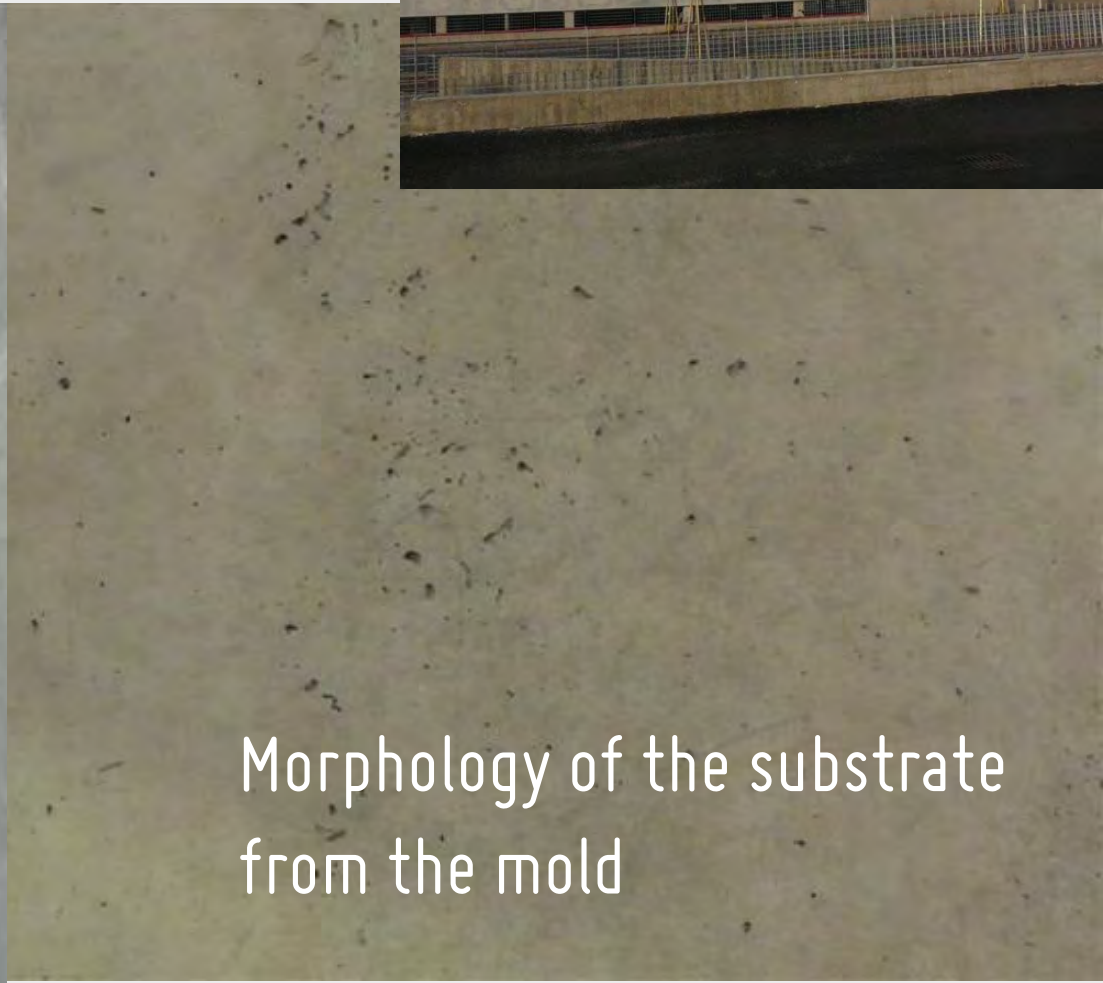
Substrate: pre cast concrete

Colour project: Jorrit Tornquist

Colour sequence: 18 shades of blue



Original surface



Morphology of the substrate
from the mold



Antegnate: Auchan Trade Centre

Substrate: pre cast concrete

Colour project: Jorrit Tornquist

18 shades of blue

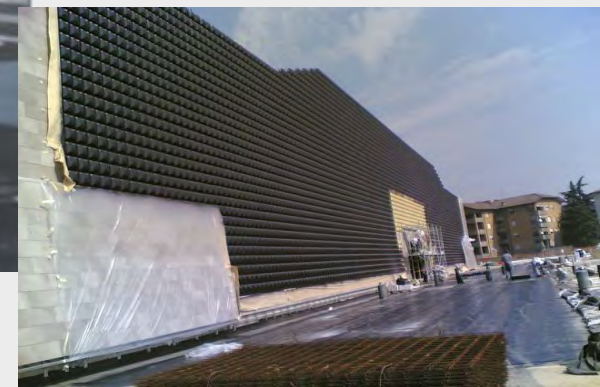




Milano – Esselunga Supermarket

Substrate: GRC — violet glossy finish

Project: Caccia Dominioni





THANK YOU FOR YOUR ATTENTION



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