General Floor Problems

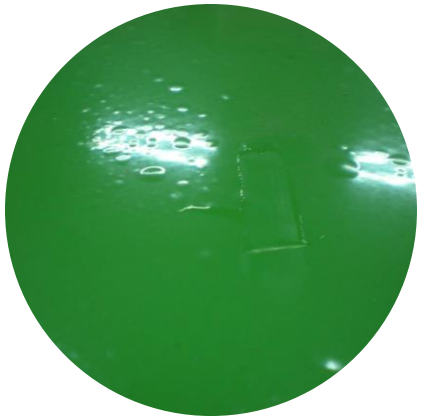
Speaker: Goh Siang Wee
Company: Sto SEA Pte Ltd
Title: Head of Regional Technical Support & Training (SEA) – CRS & Flooring

Most annoying flooring problems that Architects hate

Peeling

Inconsistent colours

Uneven finishing



Bubbling

Peeling

i) 90% of all peeling is associated with poor surface preparation

DIAMOND GRINDING

SHOT BLASTING

Peeling

i) 90% of all peeling is associated with poor surface preparation

ii) Weak substrate

PULL-OUT STRENGTH

Average 1.5 N/mm²

Minimum 1.0 N/mm²

Peeling

i) 90% of all peeling is associated with poor surface preparation
ii) Weak substrate
iii) Wrong primers

USE SUITABLE PRIMER, FOR EXAMPLES

OIL CONTAMINATED SUBSTRATE

Use Oil Blocker Primer

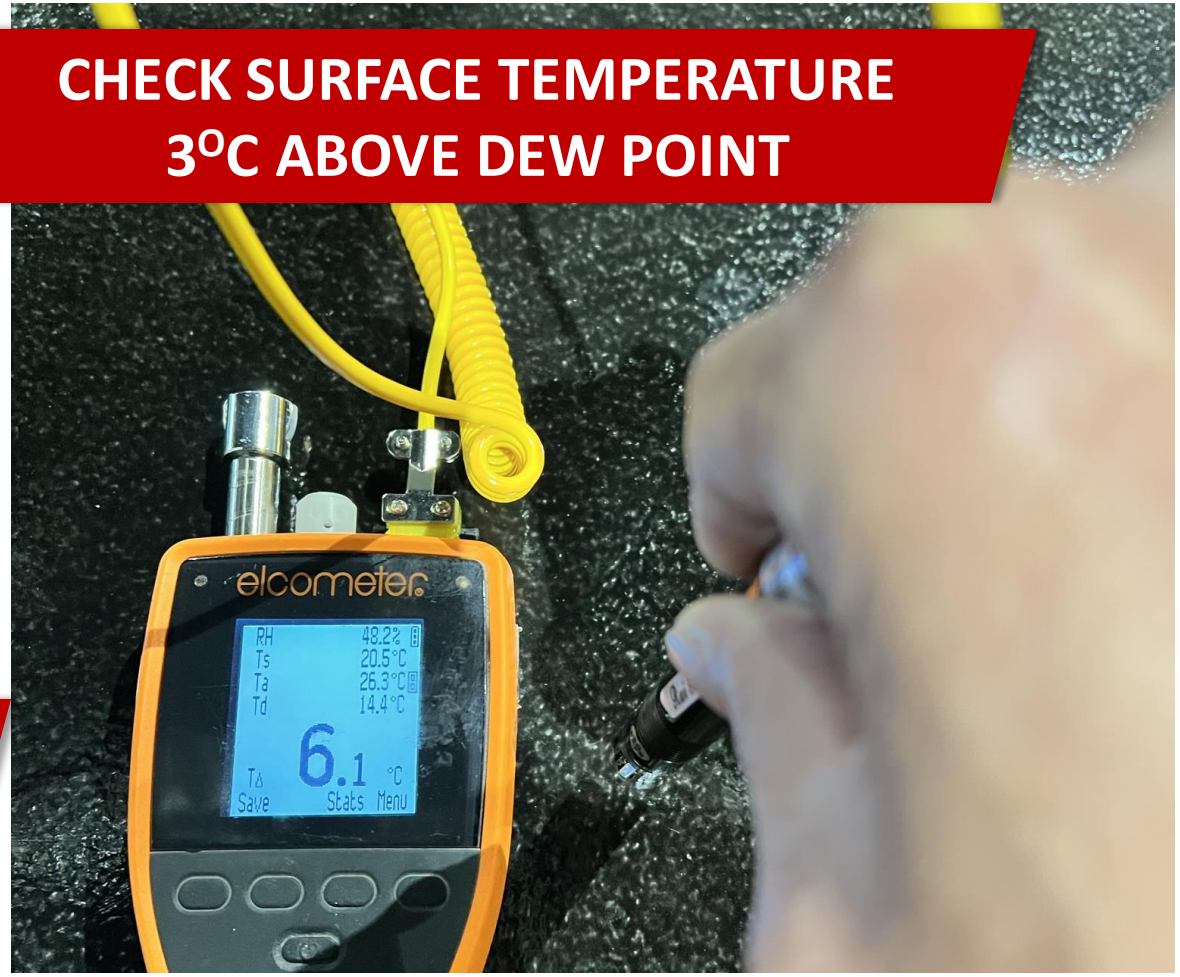
DAMP SUBSTRATE

Use Moisture Tolerant Primer

Inconsistent colours

i) High relative humidity

Provide good ventilation

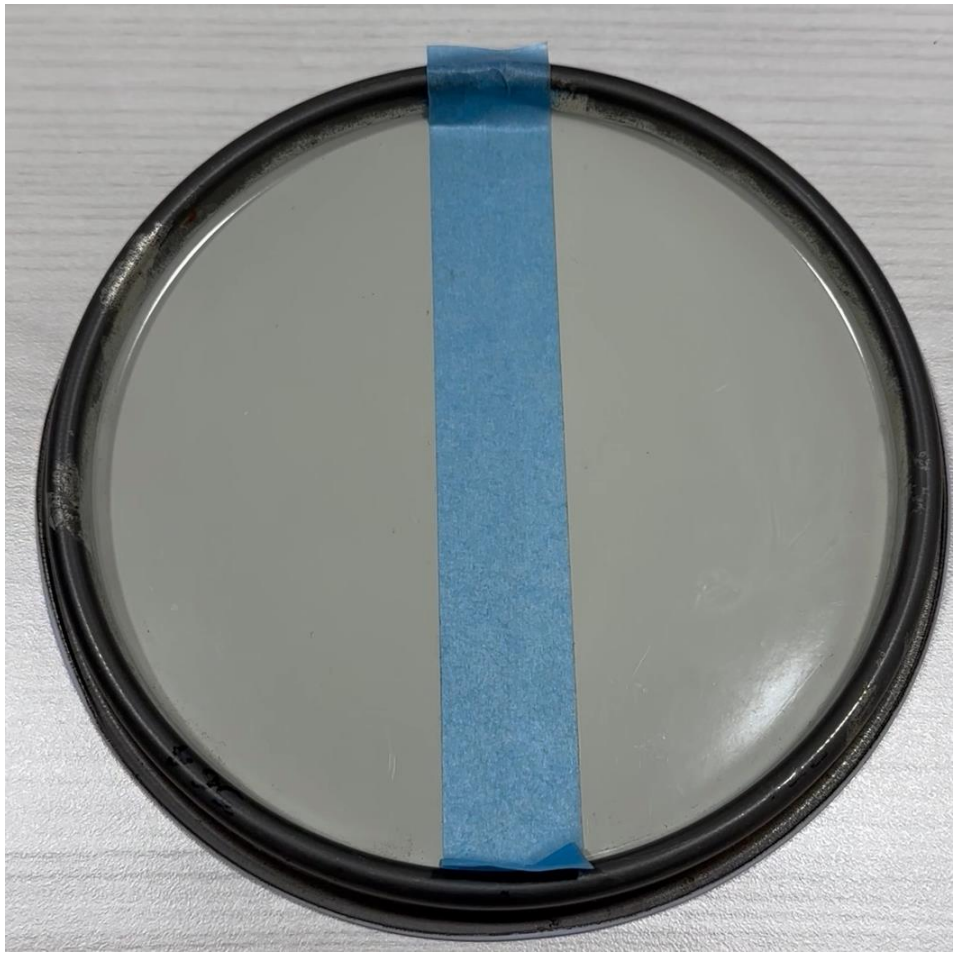


Inconsistent colours

i) High relative humidity

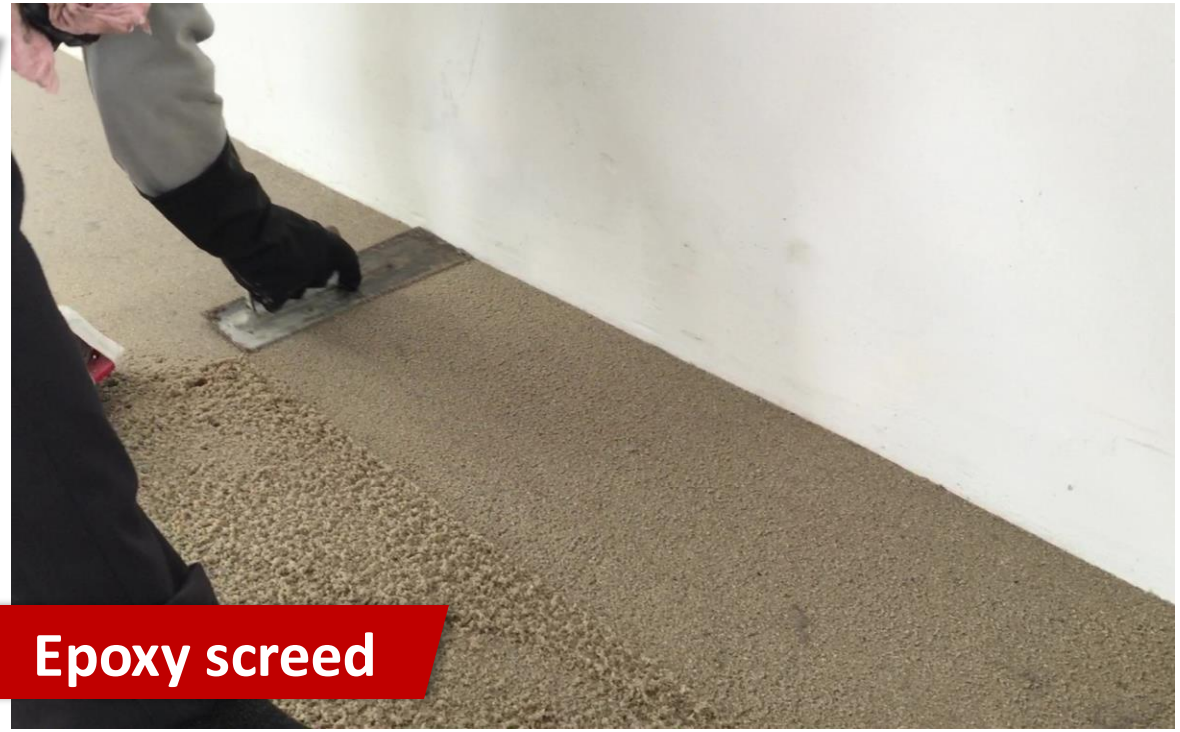
ii) Batch colour tone issue

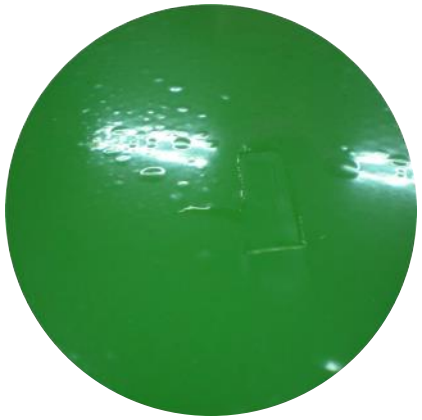
Practise batch number re-ordering



Uneven finishing

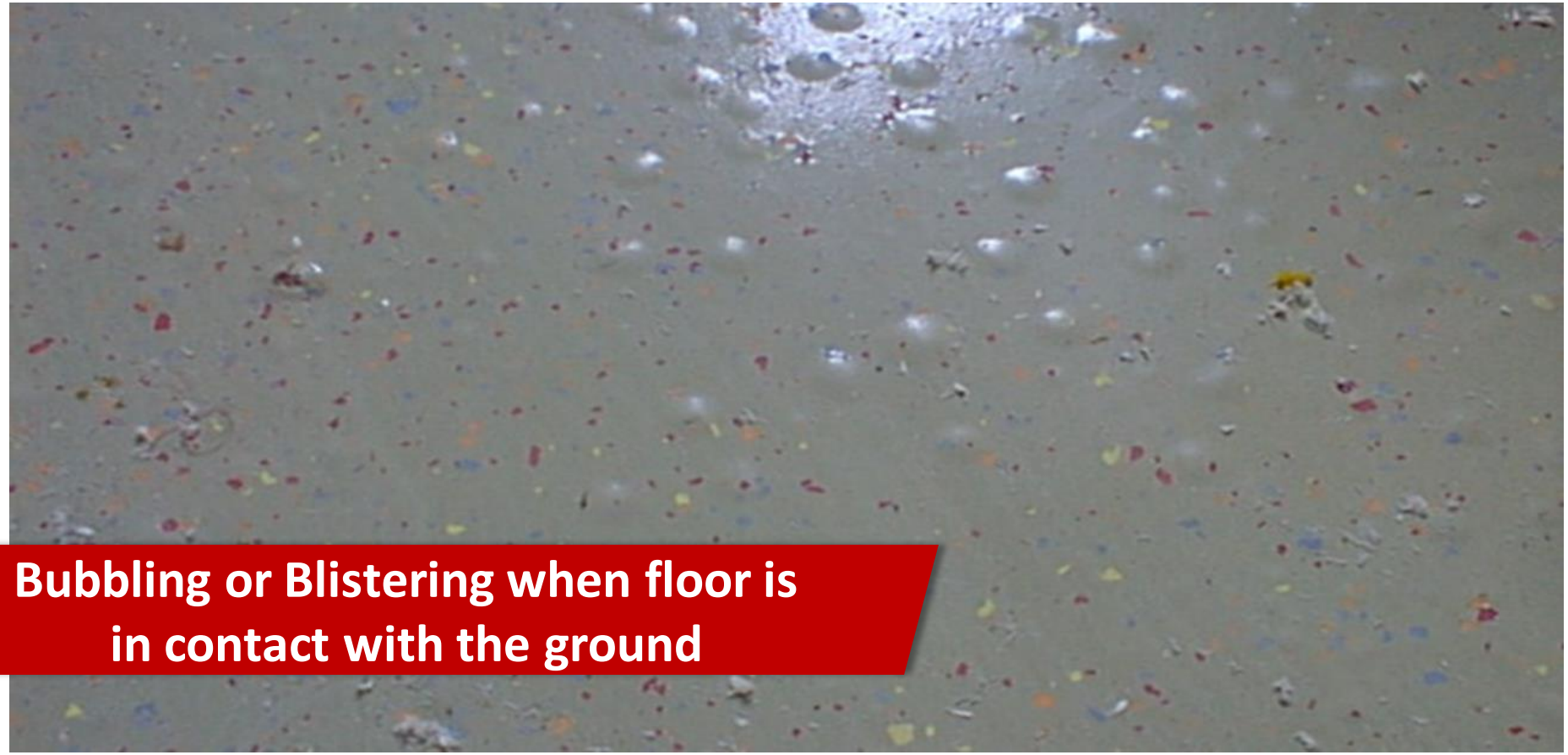
i) Substrate unevenness

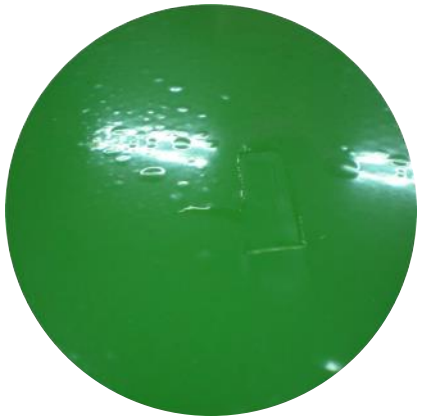




Bubbling

i) Rising dampness

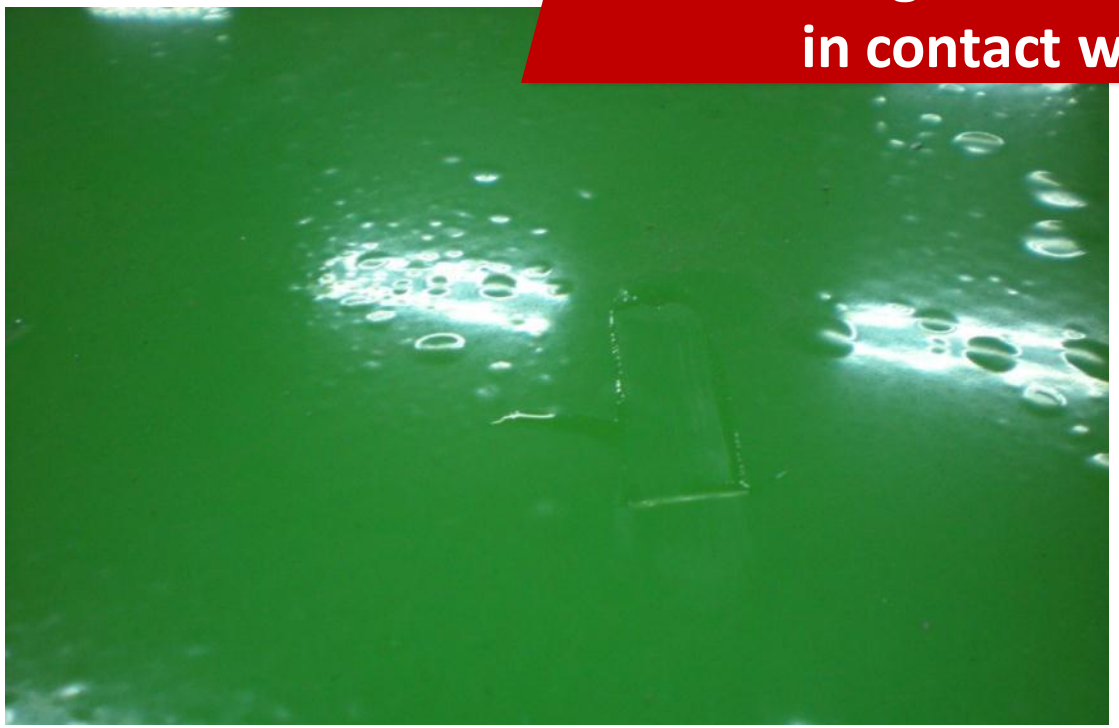


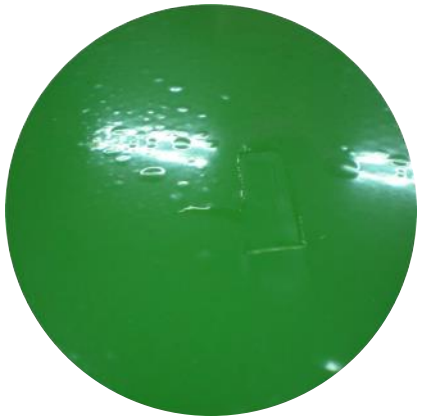


Bubbling

i) Rising dampness

Bubbling or Blistering when floor is in contact with the ground





Bubbling

i) Rising dampness

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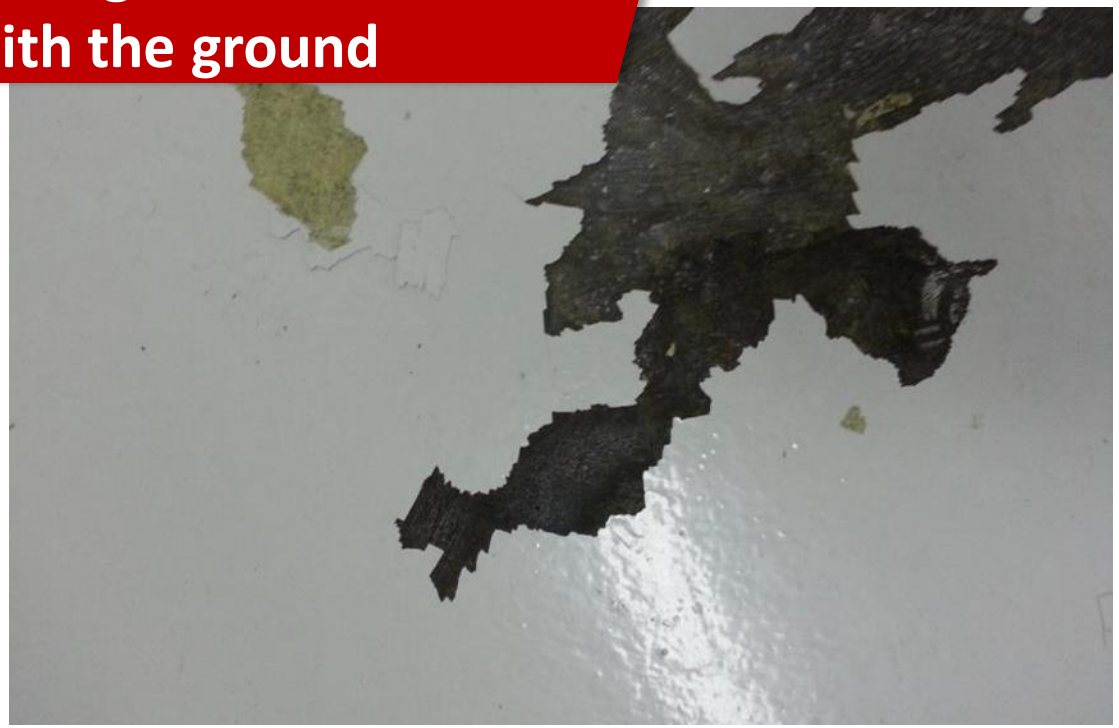
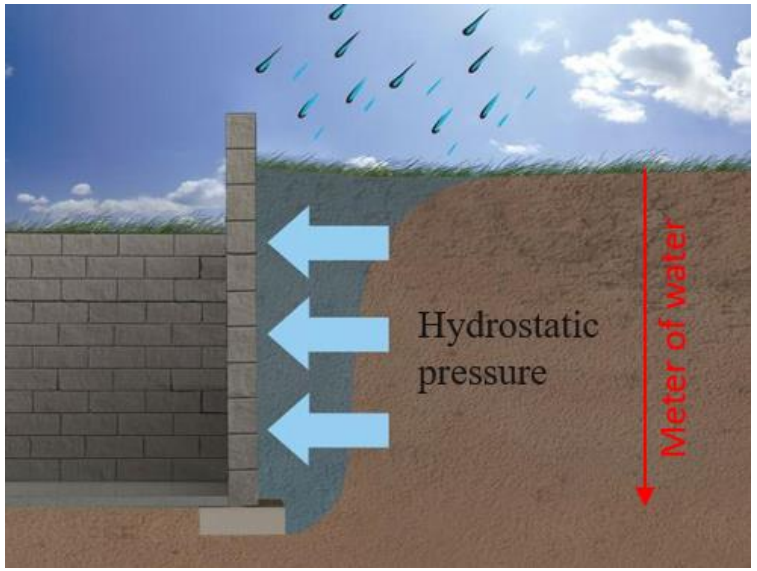


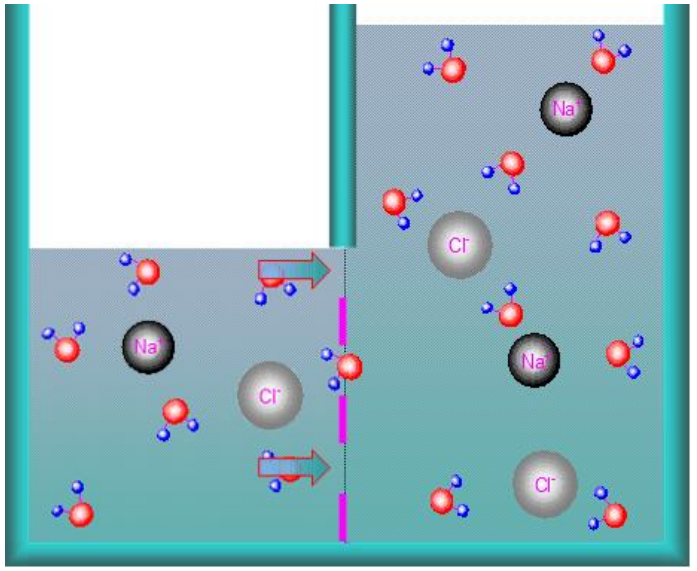
Quiz

- What causes rising dampness in coating?

Vapour pressure



Hydrostatic pressure



Osmotic pressure

Design criteria of floor coating

EN 1504-2:2004 (E)

Table 5 — Performance requirements for coatings

No. of Table 1	Performance Characteristics	Test method	Requirements		
1	2	3	4		
15	Pull-off test Reference substrate: MC (0,40) as specified in EN 1766 curing — 28 days for one component systems, cement containing and PCC-systems — 7 days for reactive resin systems.	EN 1542		Average [N/mm²] Crack-bridging or/ flexible systems	Rigid systems[c]
			without trafficking:	≥0,8 (0,5)[b]	≥1,0 (0,7)[b]
			with trafficking:	≥1,5 (1,0)[b]	≥2,0 (1,5)[b]

Conversion

- 1.5 N/mm^2 =

Metric

hide

clear form | Convert Me

bar	15	tonne per square centimeter	0.0153
kilopascal (kPa)	1,500	kilogram per square meter (kgf/m²)	152,957
hectopascal (hPa)	15,000	tonne per square meter	153
megapascal (MPa)	1.5	newton per square meter (N/m²)	1,500,000
millibar	15,000	kilonewton per square meter (kN/m²)	1,500
pascal (Pa)	1,500,000	meganewton per square meter (MN/m²)	1.5
gram per square centimeter (gf/cm²)	15,296	newton per square centimeter (N/cm²)	150
kilogram per square centimeter (kgf/cm²)	15.3	newton per square millimeter (N/mm²)	1.5

Water (at 39.2°F, 4°C)

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clear form | Convert Me

meter of water	153	millimeter of water	152,957
centimeter of water	15,296	foot of water	501.8
		inch of water	6,022

Source from http://www.convert-me.com/en/convert/pressure/

Rising dampness
What are the causes?

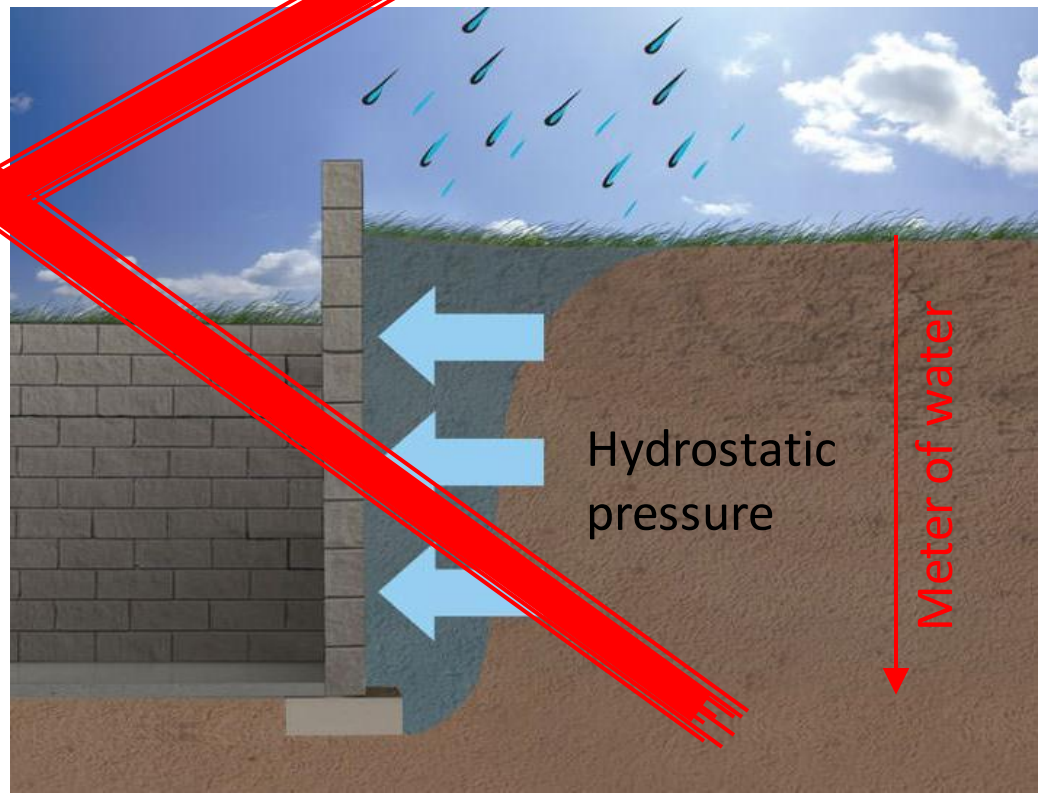
- **Vapour pressure under the coating**
  - Vapour pressure @ 100 °C, i.e. Steam
  - 1,500 kPa = 1.5 N/mm²
  - 101 kPa = 0.1 N/mm²
  - Not high enough to cause blistering

Temperature (°C)	Vapour pressure (kPa)	Vapour pressure (mmHg)
25	3.2	23.8
26	3.4	25.2
27	3.6	26.7
28	3.8	28.4
29	4.0	30.0
30	4.2	31.5
32	4.8	36.0
35	5.6	42.0
40	7.4	55.5
50	12.3	92.3
60	19.9	149.3
70	31.2	234.1
80	47.3	354.9
90	70.1	525.9
100	101.3	760.0

Source from https://en.wikipedia.org/wiki/Vapour_pressure_of_water

Rising dampness
What are the causes?

- **Hydrostatic pressure under the coating**
  - In practice normally not more than 20 m of water head
  - ≈150 m = 1.5 N/mm²
  - 20 m = 0.2 N/mm²
  - Not high enough to cause blistering



Rising dampness
What are the causes?

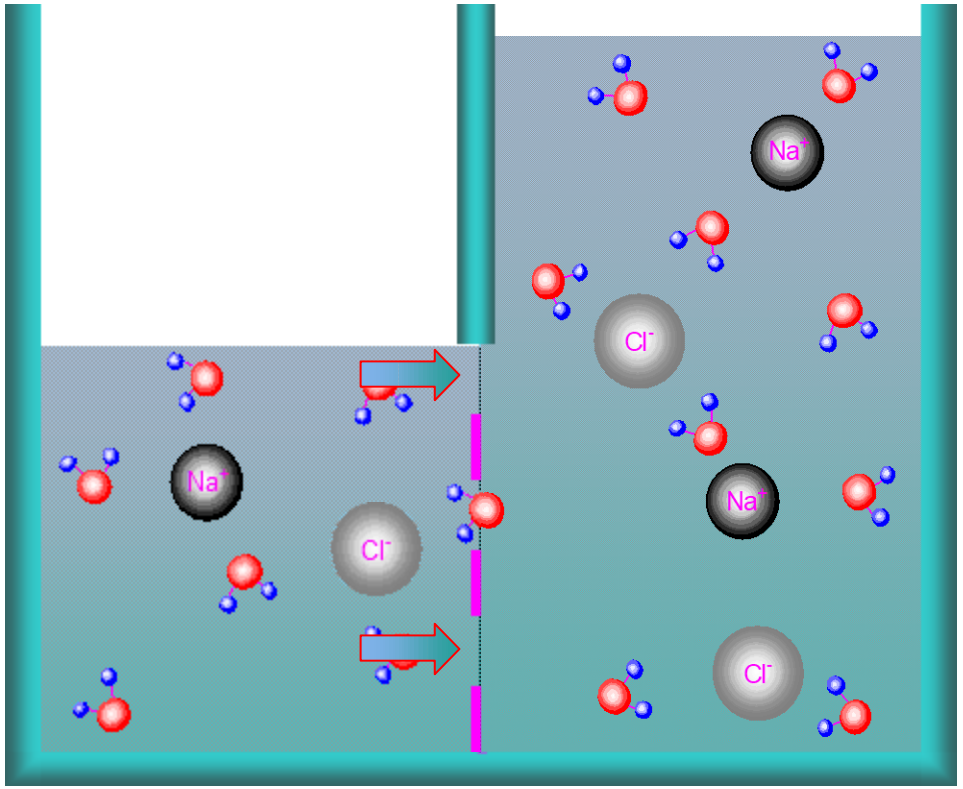
- **Osmotic pressure**
  - Osmosis

Osmosis

Definition:

slow change in concentration: the diffusion of a **solvent (water)** through a **semi-permeable membrane** from a **dilute to a more concentrated solution**

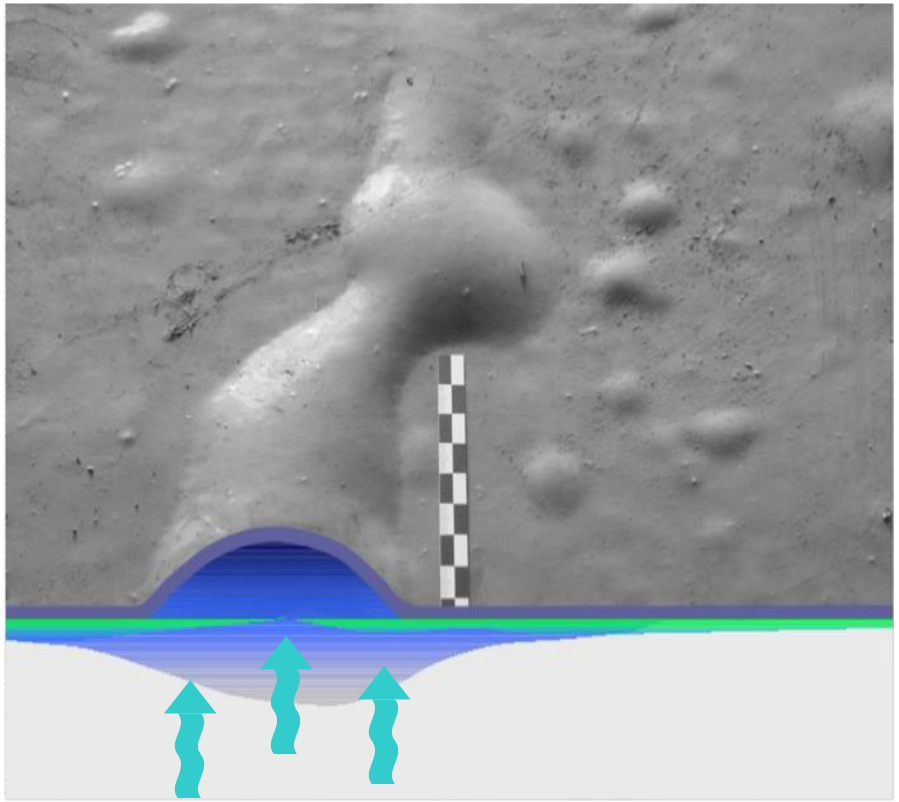
1 2 3



Osmotic pressure

Definition:

The pressure required to prevent the passage of water through a semi-permeable membrane from a region of low concentration of solutes to one of higher concentration, ***by osmosis***



An example of osmotic effect

Osmosis

An example of osmotic effect

Osmosis

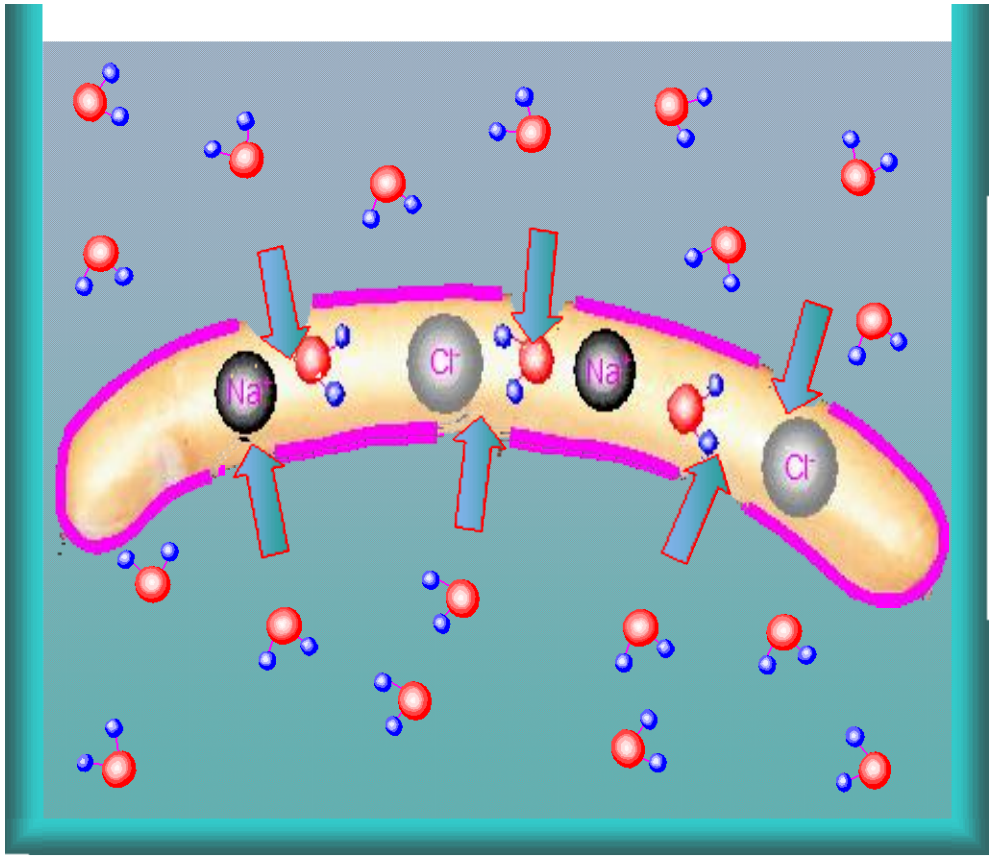
An example of osmotic effect

Osmosis

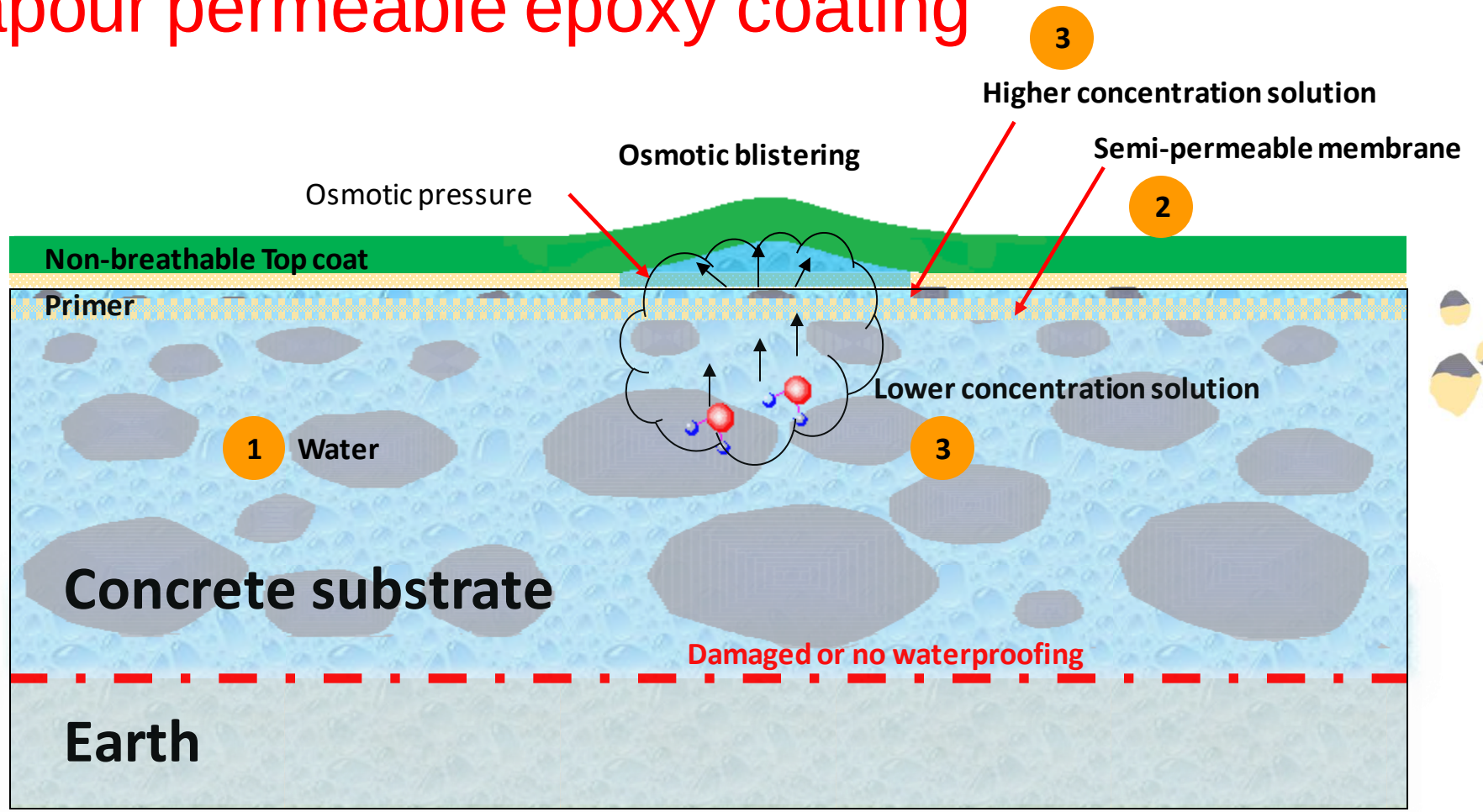
Sodium Chloride Solution (NaCl) : 6.0%

Temperature 10°C :
Osmotic pressure : 5N /mm²

Temperature 100°C :
Osmotic pressure : 6.6N /mm²



Osmotic blistering on non-vapour permeable epoxy coating

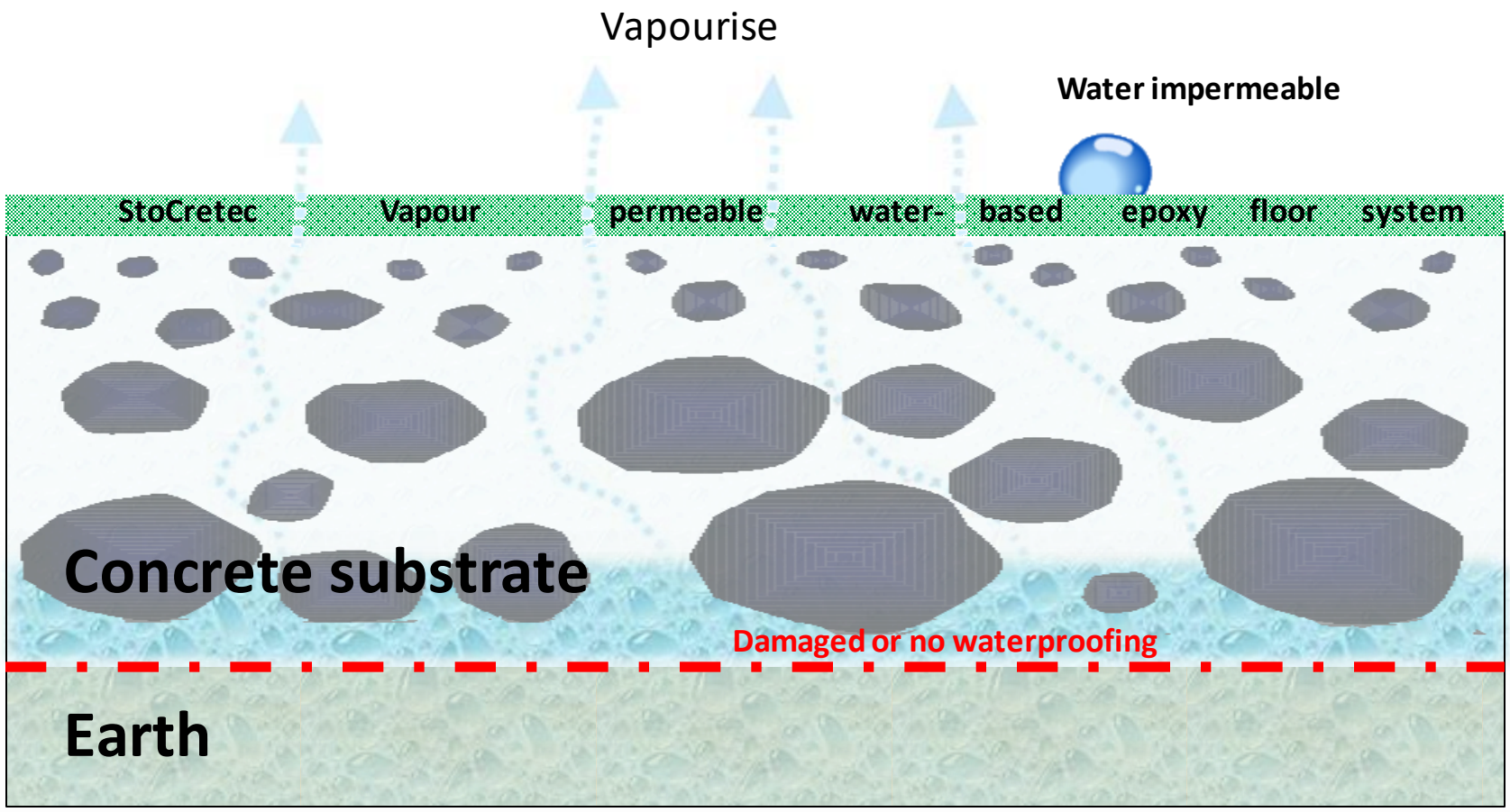


Concrete pores not fully closed

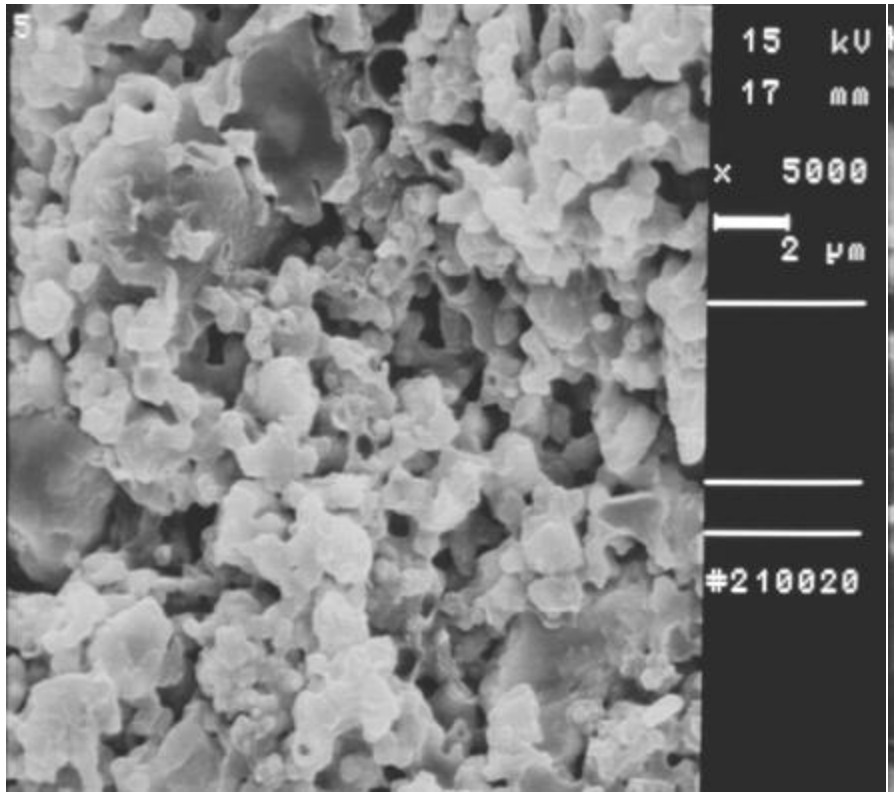
Solution
Vapour diffusion system

Breathable Water-based epoxy system

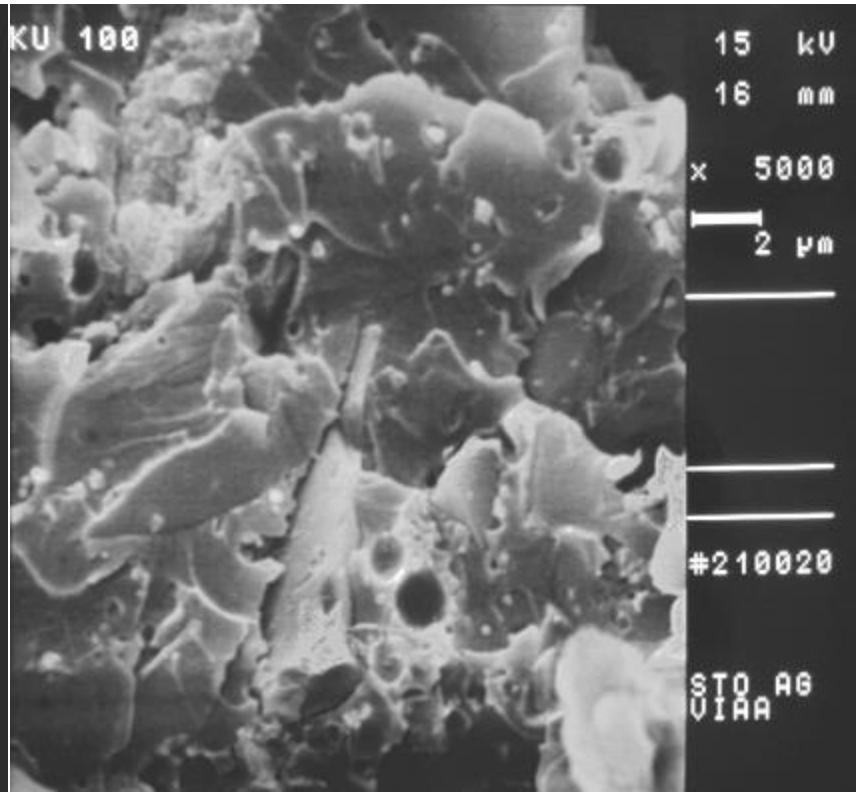
Solution
Vapour diffusion system



Solution
Vapour diffusion system

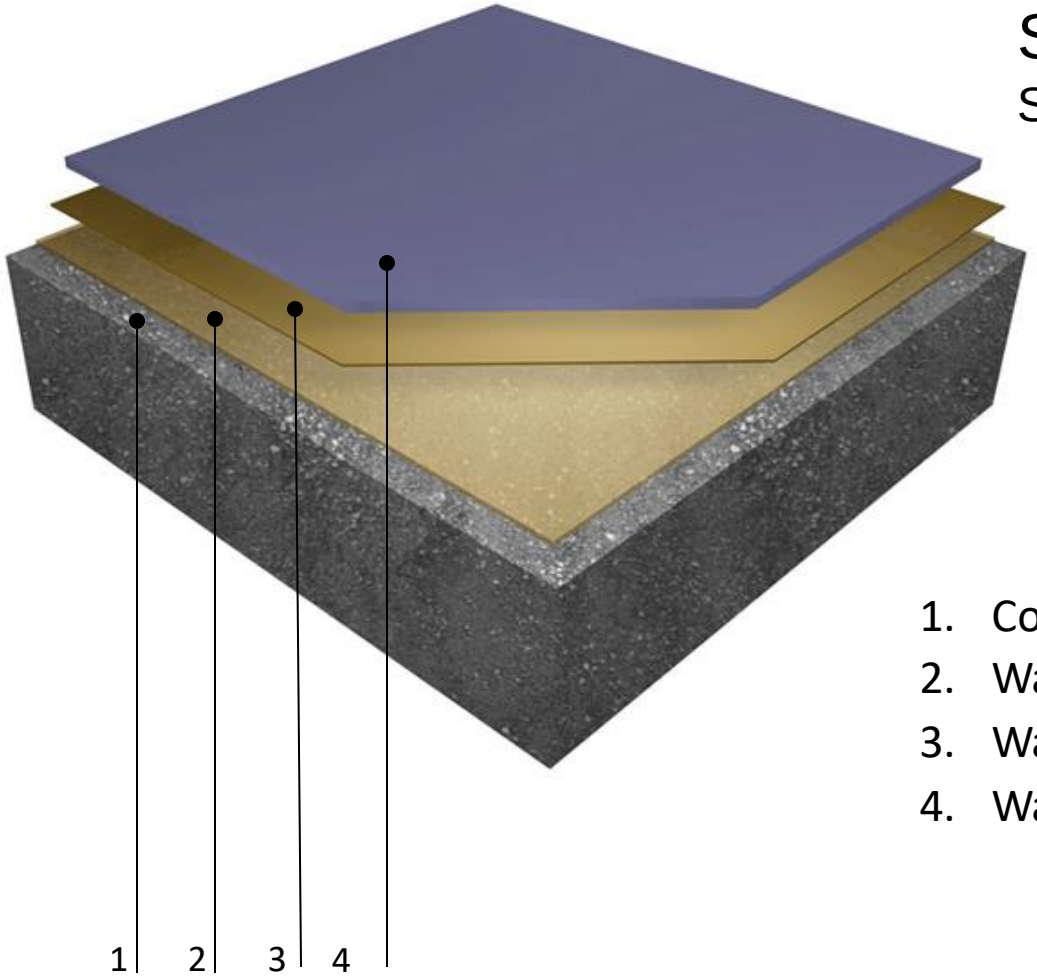


Breathable Water-based Epoxy Coating



Non-breathable Solvent-free Epoxy Coating

Vapour diffusion system
Smooth



Smooth

System components

1. Concrete substrate
2. Water-based Primer
3. Water-based Intermediate coat
4. Water-based topcoat

Vapour diffusion system
Smooth

Master Approach, 2021, Klang, Selangor, Malaysia

Vapour diffusion system
Smooth

Mazda Service Centre, 2012, Singapore

Vapour diffusion system
Smooth

Lamborgini Service Centre, 2011, Singapore

Vapour diffusion system
Smooth

Cleanroom of semi-conductor factory, 2004, Singapore

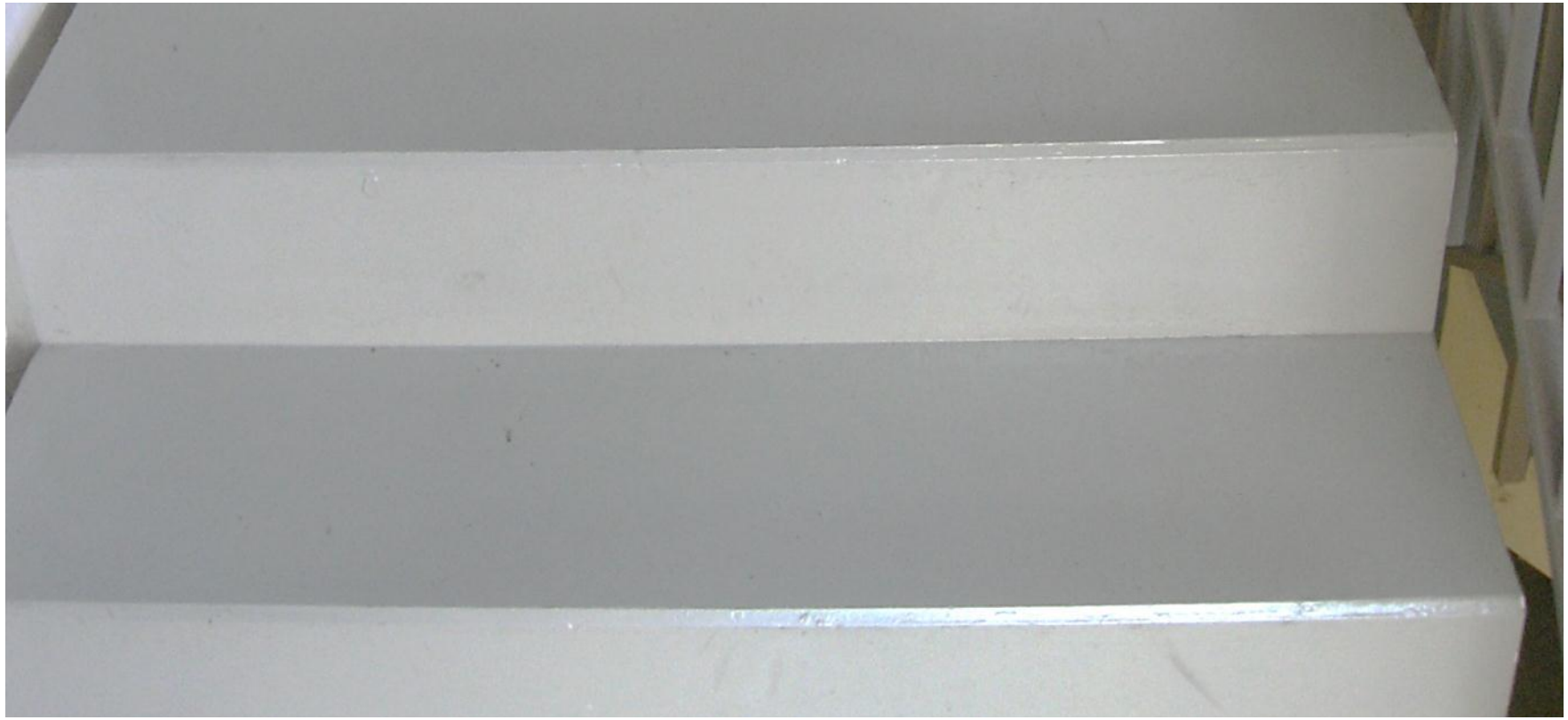
Vapour diffusion system
Smooth

Handicap lots at Devan Nair Institute, 2013, Singapore

Vapour diffusion system
Smooth

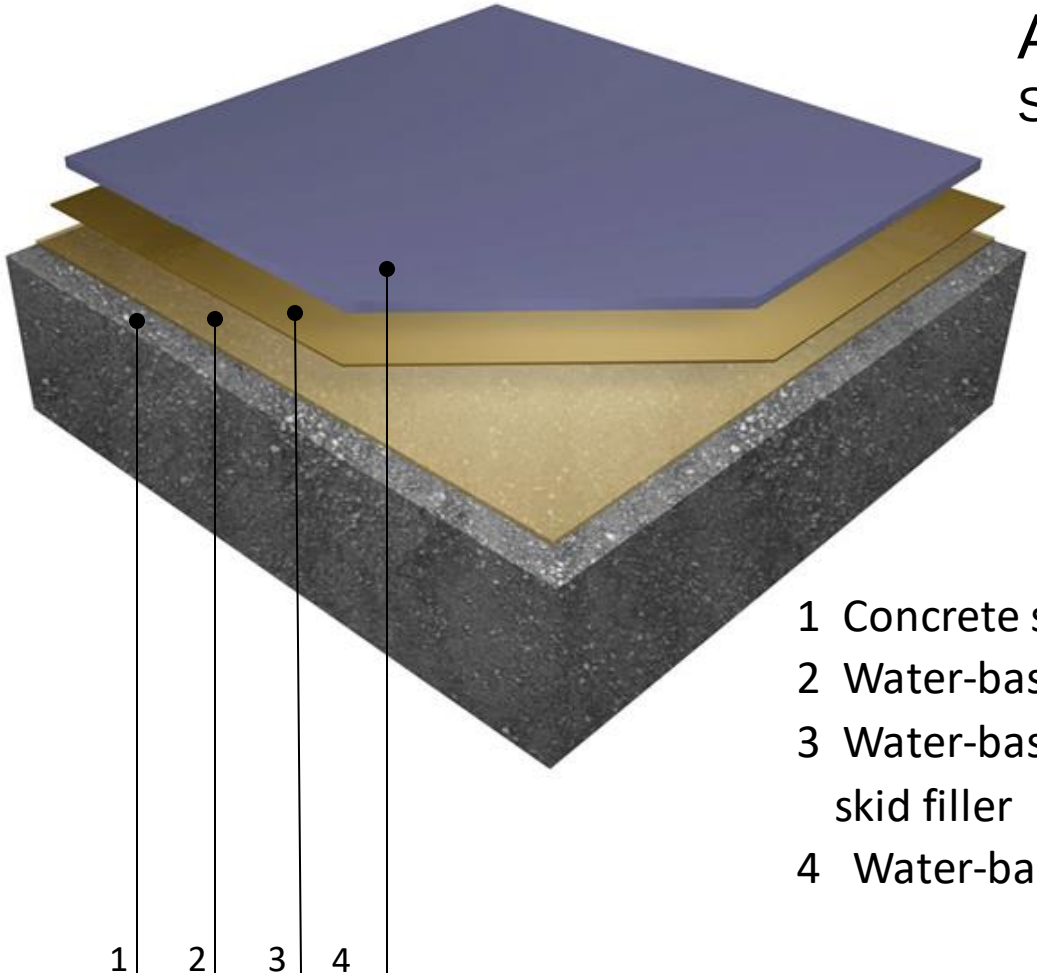
Warehouse at Port of Tanjung Pelepas, 2012, Malaysia

Vapour diffusion system
Smooth



Staircase at PTW Freiburg, Germany

Vapour diffusion system
Integrated with ant-skid filler



Anti-skid – filler integrated

System components

1 Concrete substrate
2 Water-based Primer
3 Water-based Intermediate coat with integrated anti-skid filler
4 Water-based Topcoat with integrated anti-skid filler

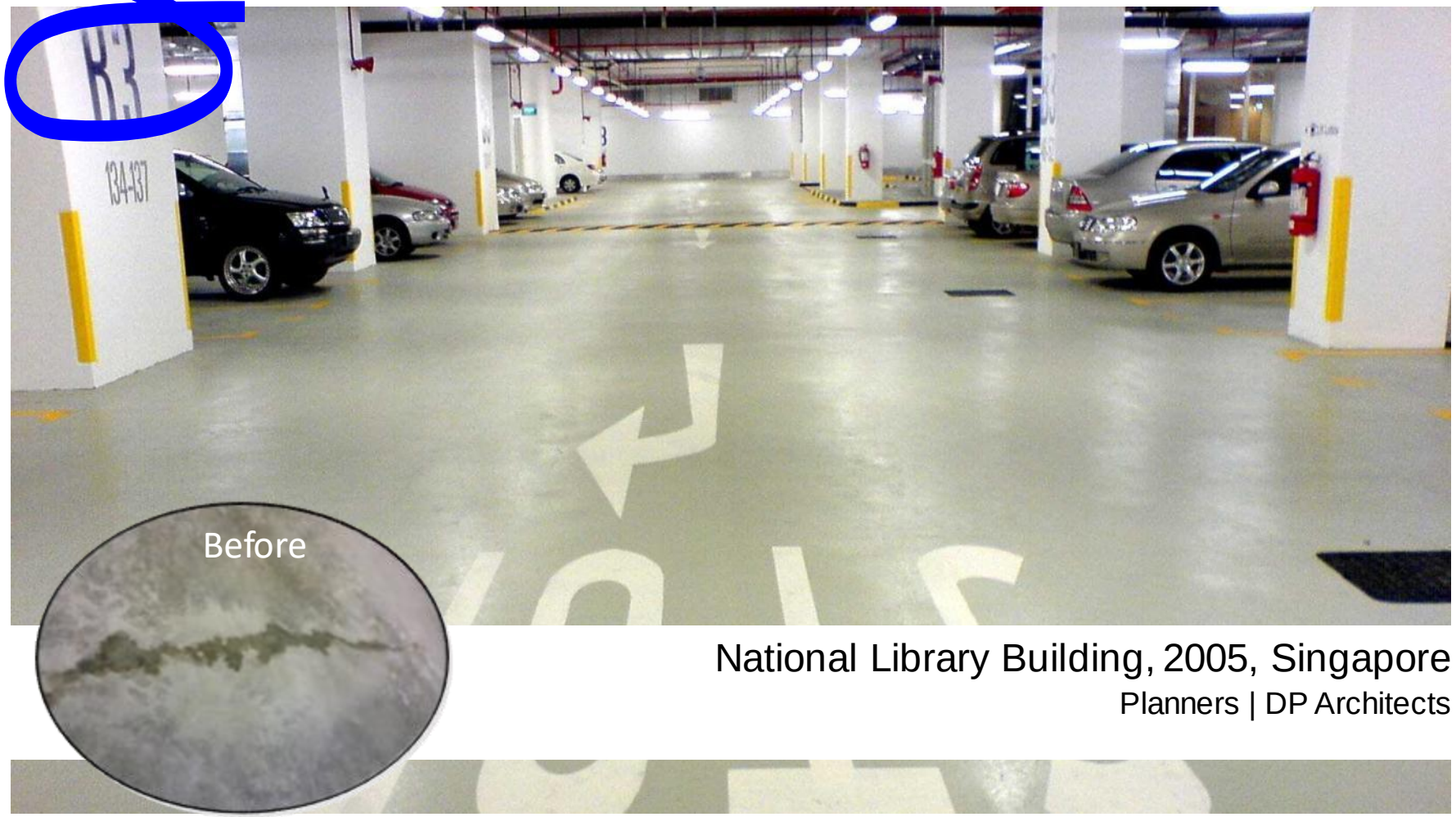
Vapour diffusion system Integrated with ant-skid filler

Anti-skid – filler integrated

System components

- Skid test using British Pendulum Tester (ASTM E 303:93)
- Car park > 55 BPN (Wet)

Vapour diffusion system
Integrated with ant-skid filler

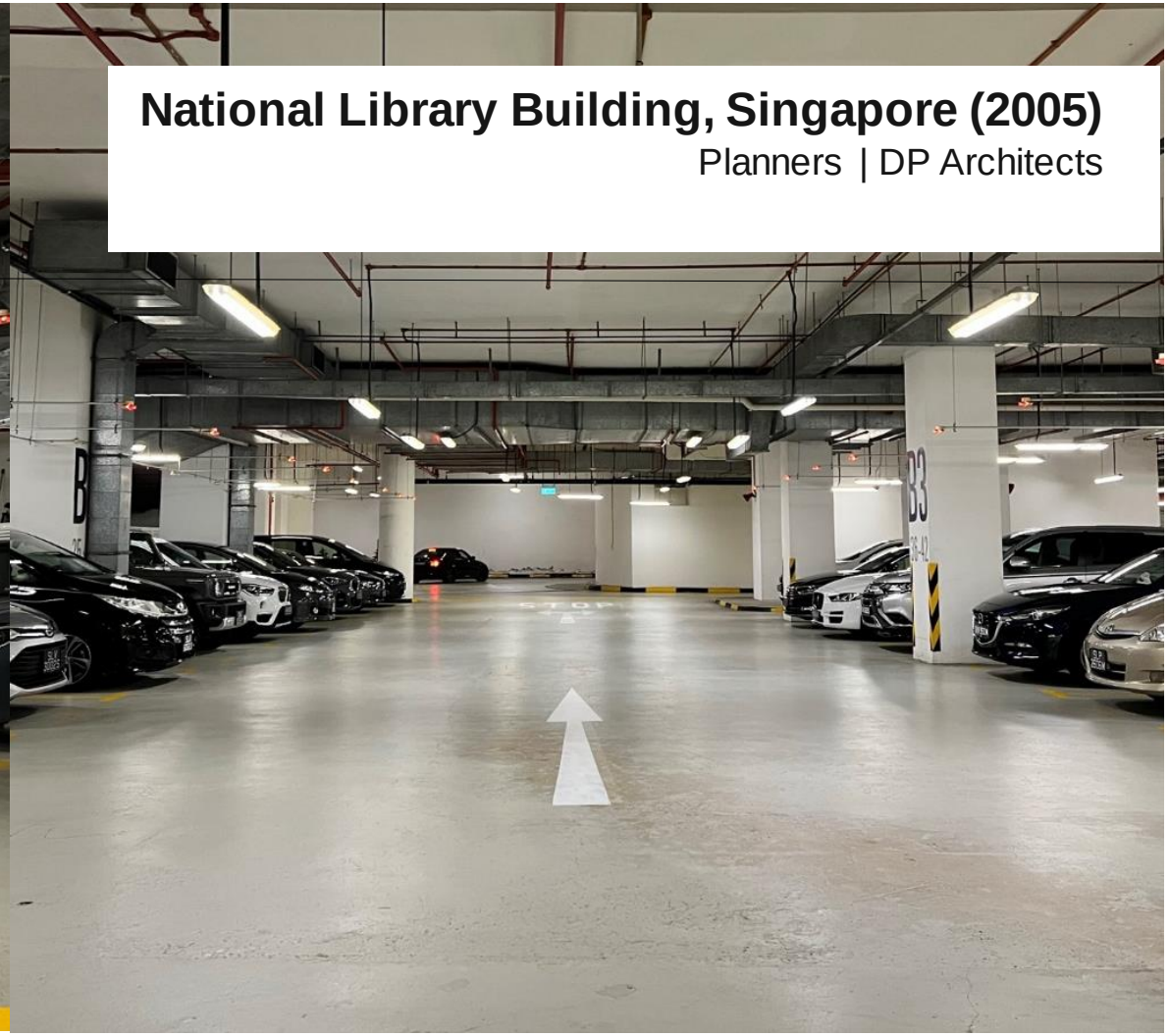


National Library Building, 2005, Singapore

Planners | DP Architects

Water vapour permeable system

Integrated with anti-skid filler : Year 2022 (After 17 Years)



National Library Building, Singapore (2005)

Planners | DP Architects

Water vapour permeable system
Year 2022 (After 17 Years)

National Library Building, Singapore (2022)
Planners | DP Architects

Vapour diffusion system
Integrated with ant-skid filler

Public housing‘s lobby, 2007, Singapore

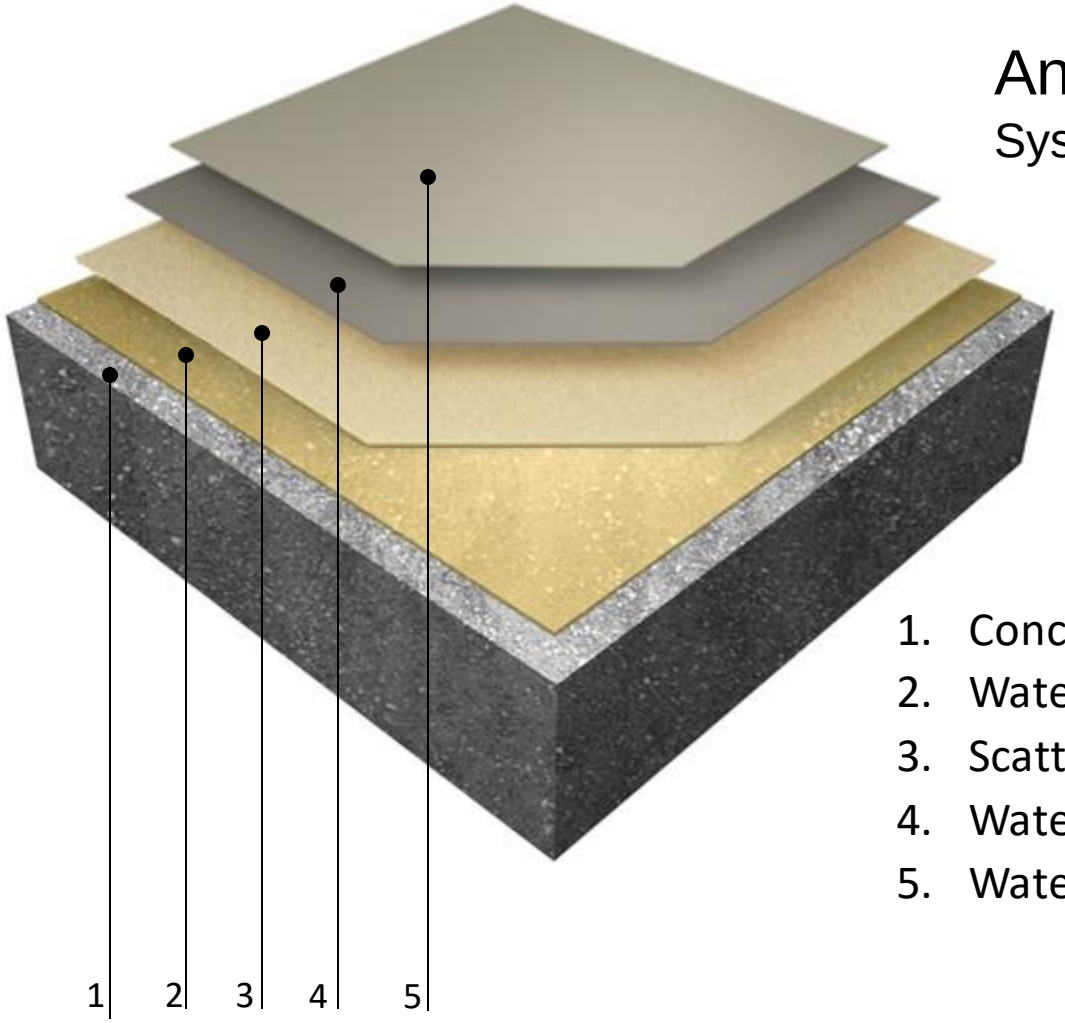
Planners | Town council

Vapour diffusion system
Integrated with anti-skid filler

St Joseph Convent School, Thailand

With UV resistant topcoat

Vapour diffusion system
Anti-skid with sand broadcast

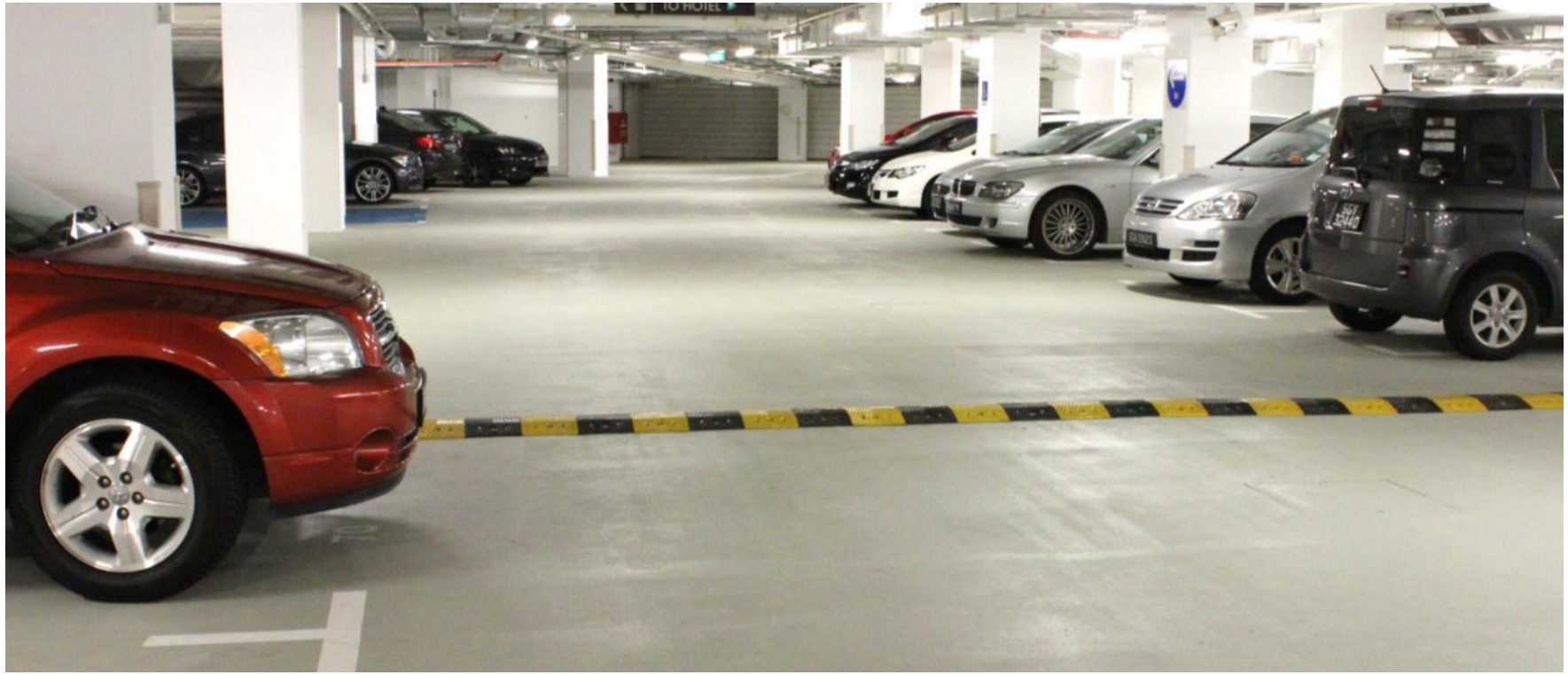


Anti-skid – sand broadcast

System components

1. Concrete substrate
2. Water-based Primer
3. Scattered coat of quartz sand
4. Water-based Intermediate coat
5. Water-based Topcoat

Vapour diffusion system
Anti-skid with sand broadcast



The One North @ Rochester, 2011, Singapore

Planners | CPG Consultants, in partnership with Tange Associates

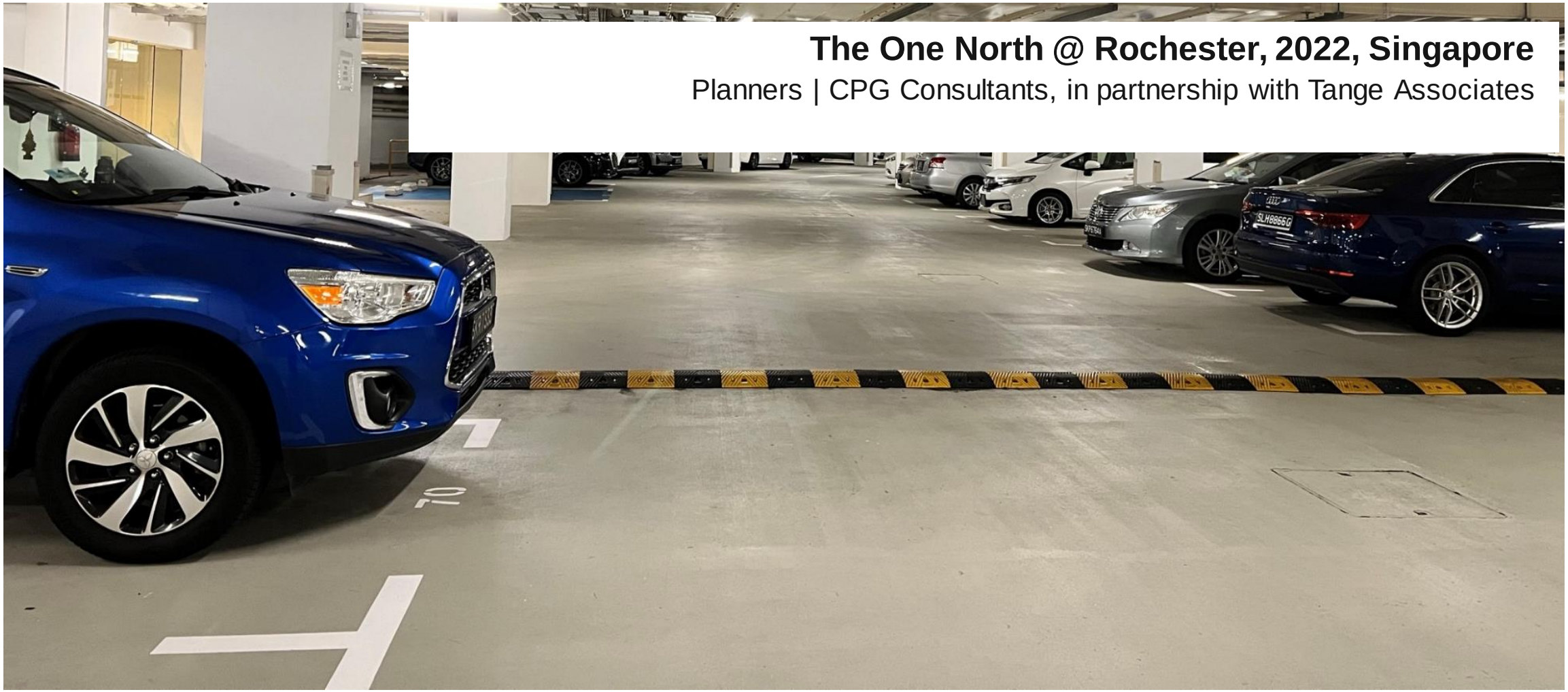
Vapour diffusion system
Anti-skid with sand broadcast

The One North @ Rochester, 2011, Singapore

Planners | CPG Consultants, in partnership with Tange Associates

Water vapour permeable system : Year 2022 (After 11 Years)

Anti-skid with sand broadcast



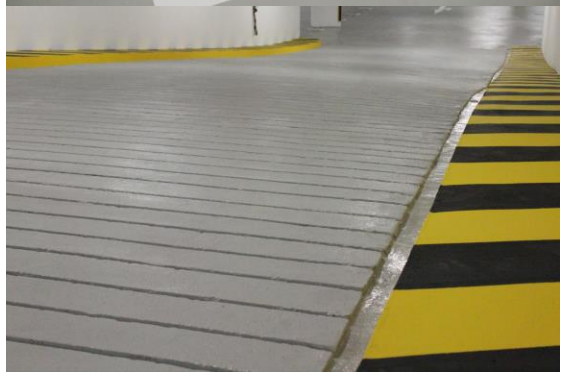
The One North @ Rochester, 2022, Singapore

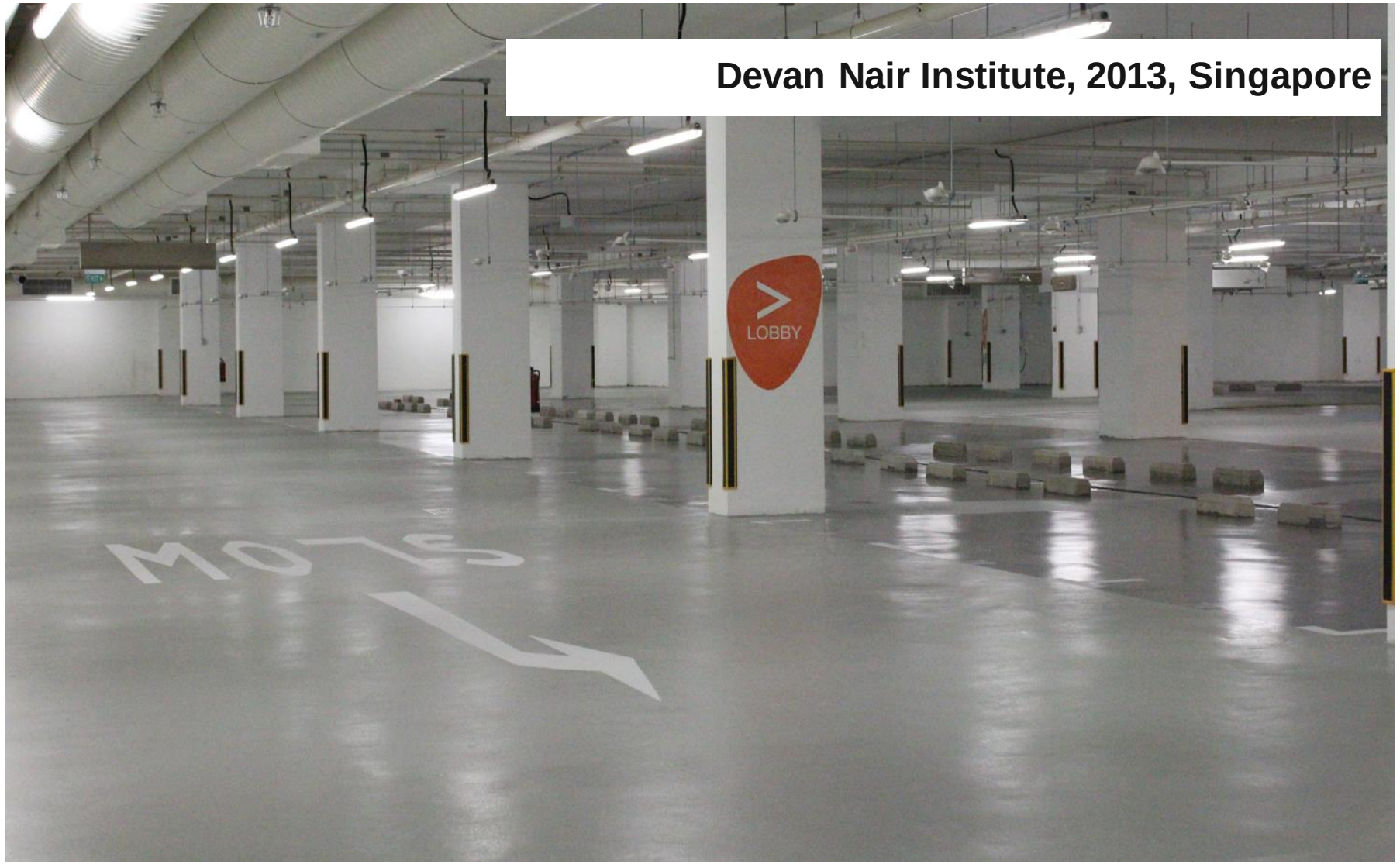
Planners | CPG Consultants, in partnership with Tange Associates

Vapour diffusion system
Anti-skid with sand broadcast

The Wharf Condominum, 2012, Singapore

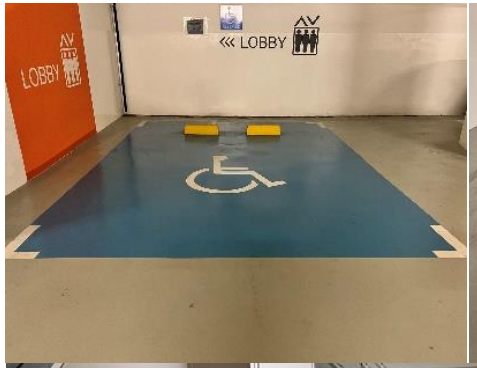
Water vapour permeable system : Year 2013
Anti-skid with sand broadcast

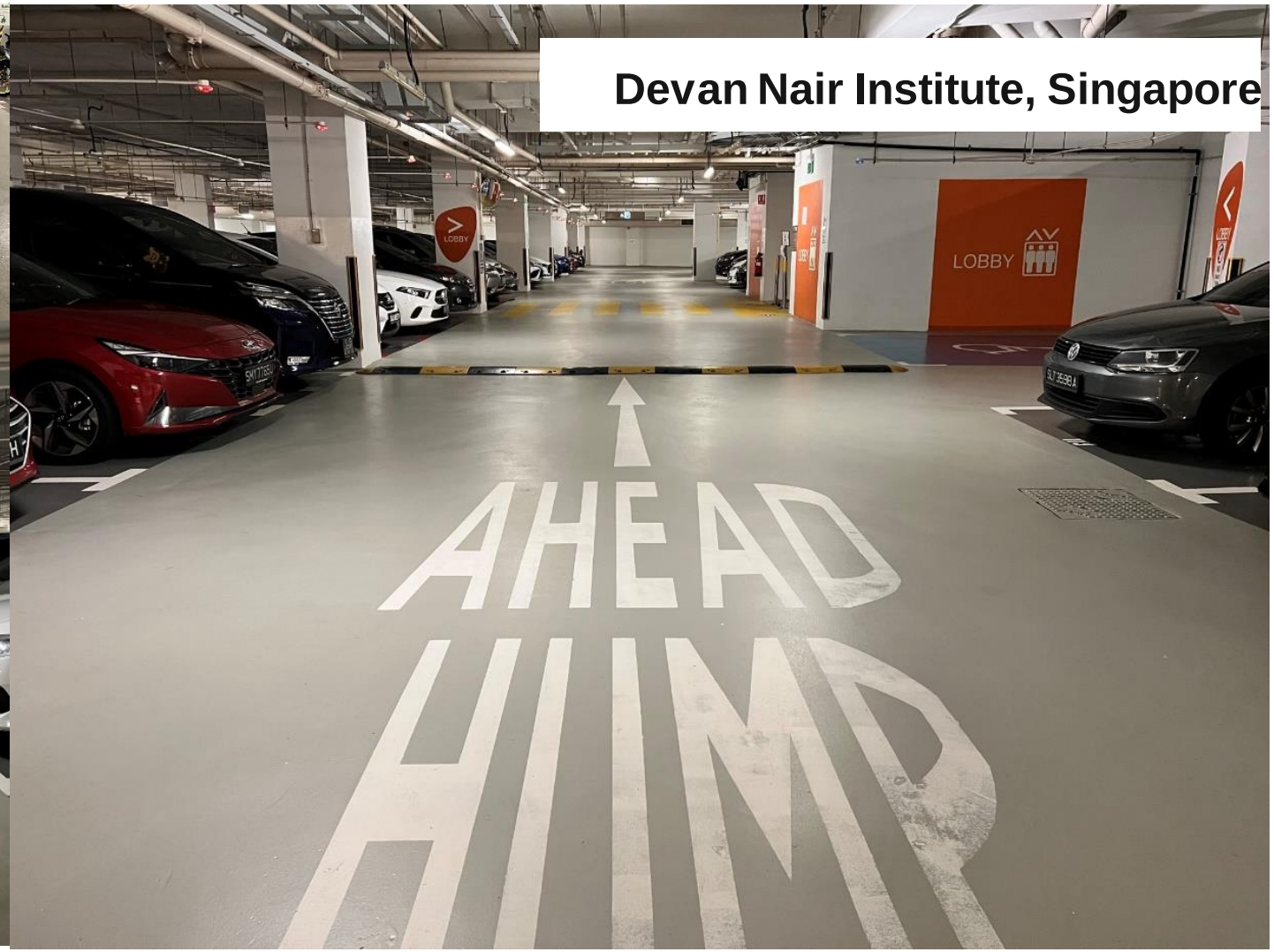




Devan Nair Institute, 2013, Singapore

Water vapour permeable system Year 2022 (After 9 Years)
Anti-skid with sand broadcast





Devan Nair Institute, Singapore

Vapour diffusion system
Anti-skid with sand broadcast

Commercial building at 30 Hill Street, 2012, Singapore

Water vapour permeable system : Year 2022 (10 Years)

Anti-skid with sand broadcast

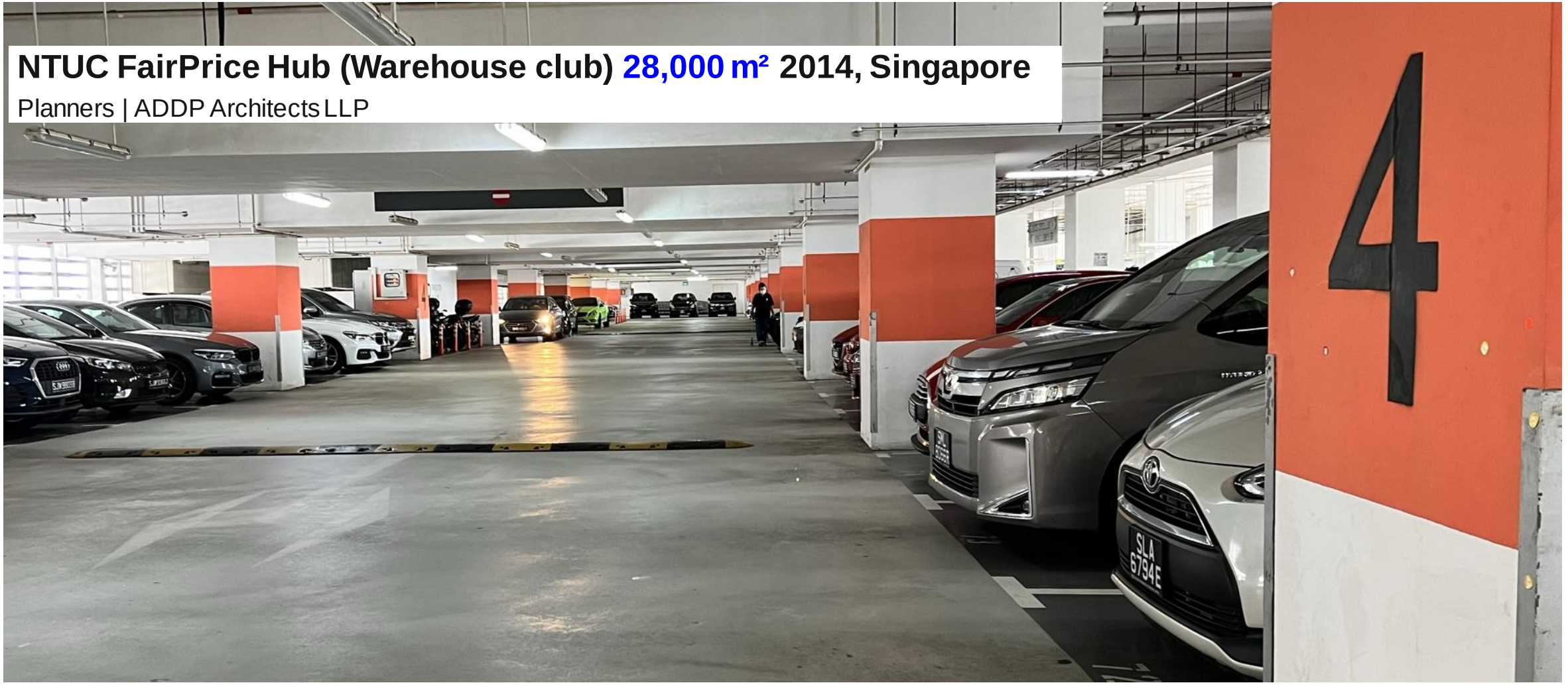
Vapour diffusion system
Anti-skid with sand broadcast

NTUC FairPrice Hub (Warehouse club), 28,000m², 2014, Singapore

Planners | ADDP Architects LLP

Water vapour permeable system : Year 2022 (After 8 Years)

Anti-skid with sand broadcast

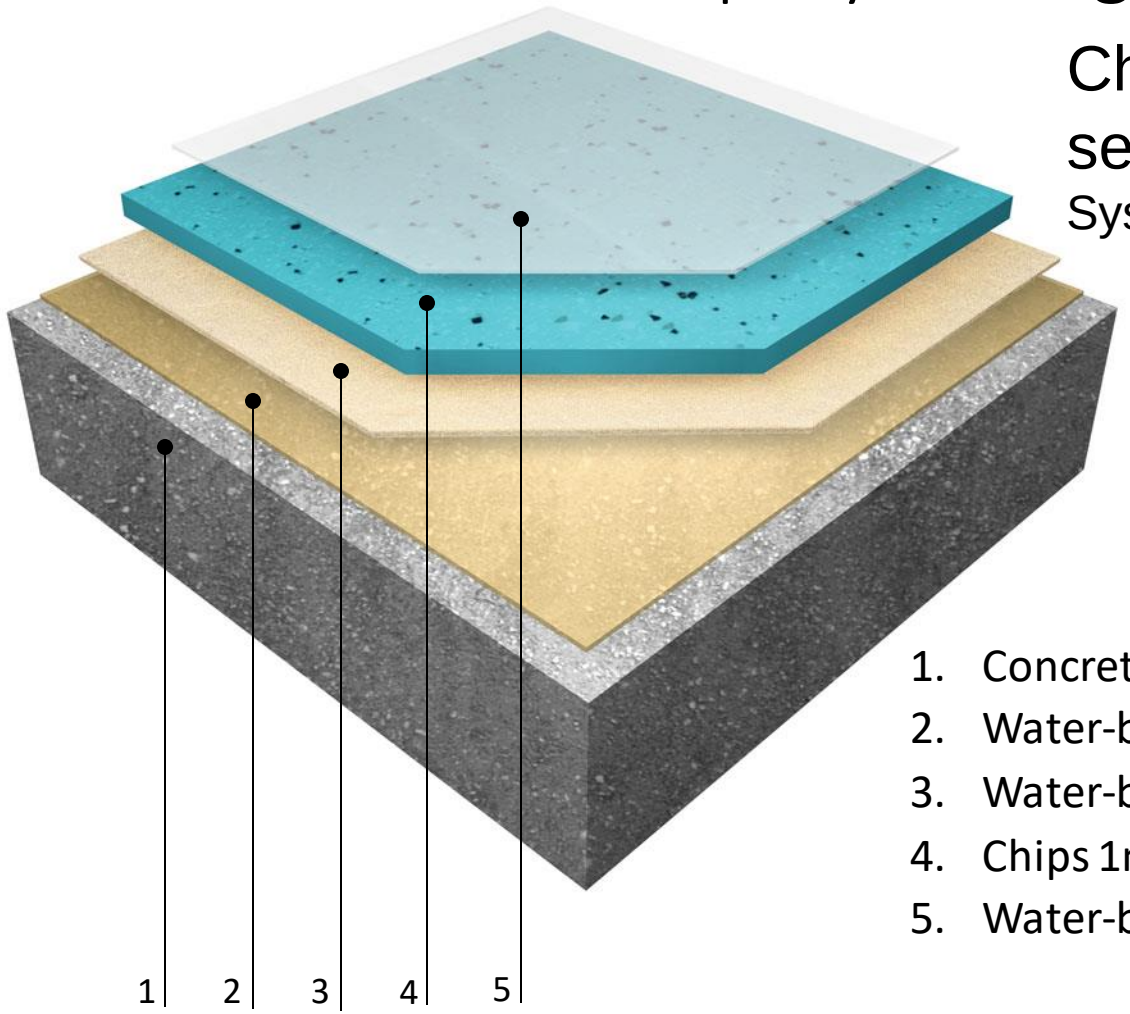


NTUC FairPrice Hub (Warehouse club) 28,000 m² 2014, Singapore

Planners | ADDP Architects LLP

Vapour diffusion system

Transparent water-based epoxy sealing



Chips with transparent sealing

System components

1. Concrete substrate
2. Water-based Primer
3. Water-based Intermediate coat
4. Chips 1mm or 3mm
5. Water-based Topcoat, transparent

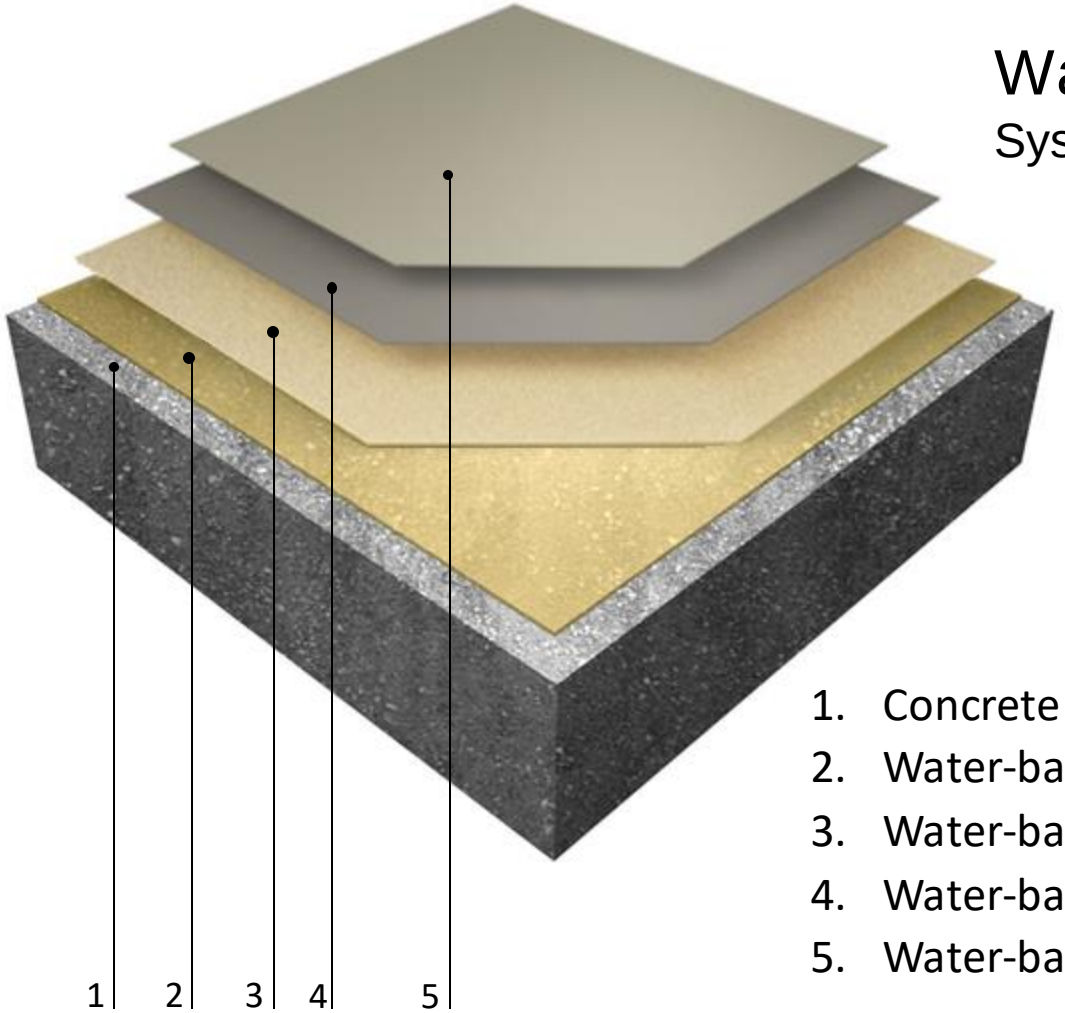
Transparent water-based epoxy sealing

Decorative floor coating
Chips 1mm system

Anderson Primary School, 1,250m², 2015, Singapore

Planners | Inter Consultant Pte Ltd

Vapour diffusion system
Scratch coat to level unevenness



Water-based Scratch coat

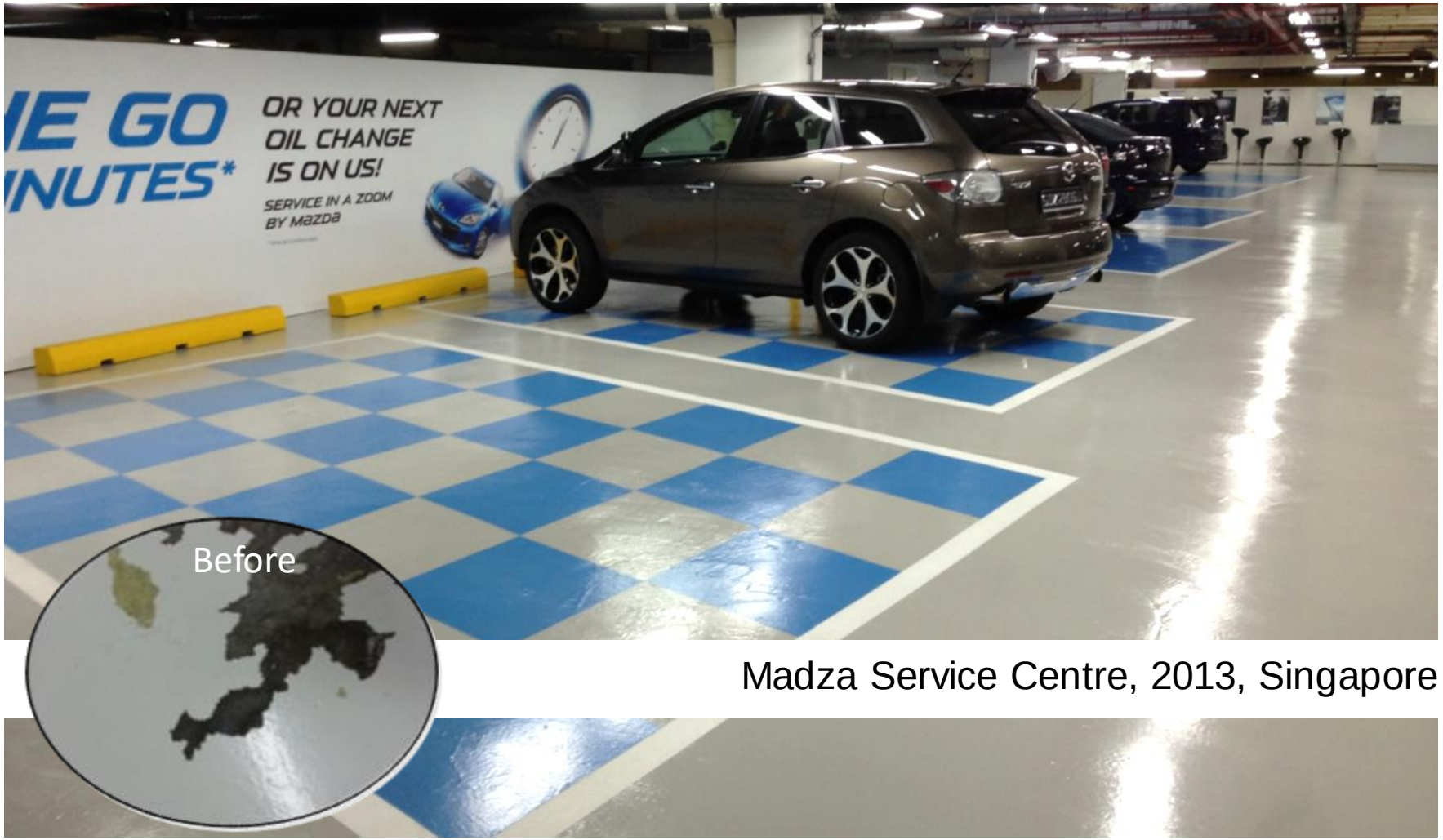
System components

1. Concrete substrate
2. Water-based Primer
3. Water-based Scratch coat
4. Water-based Intermediate coat
5. Water-based Topcoat

Vapour diffusion system
Scratch coat to level unevenness

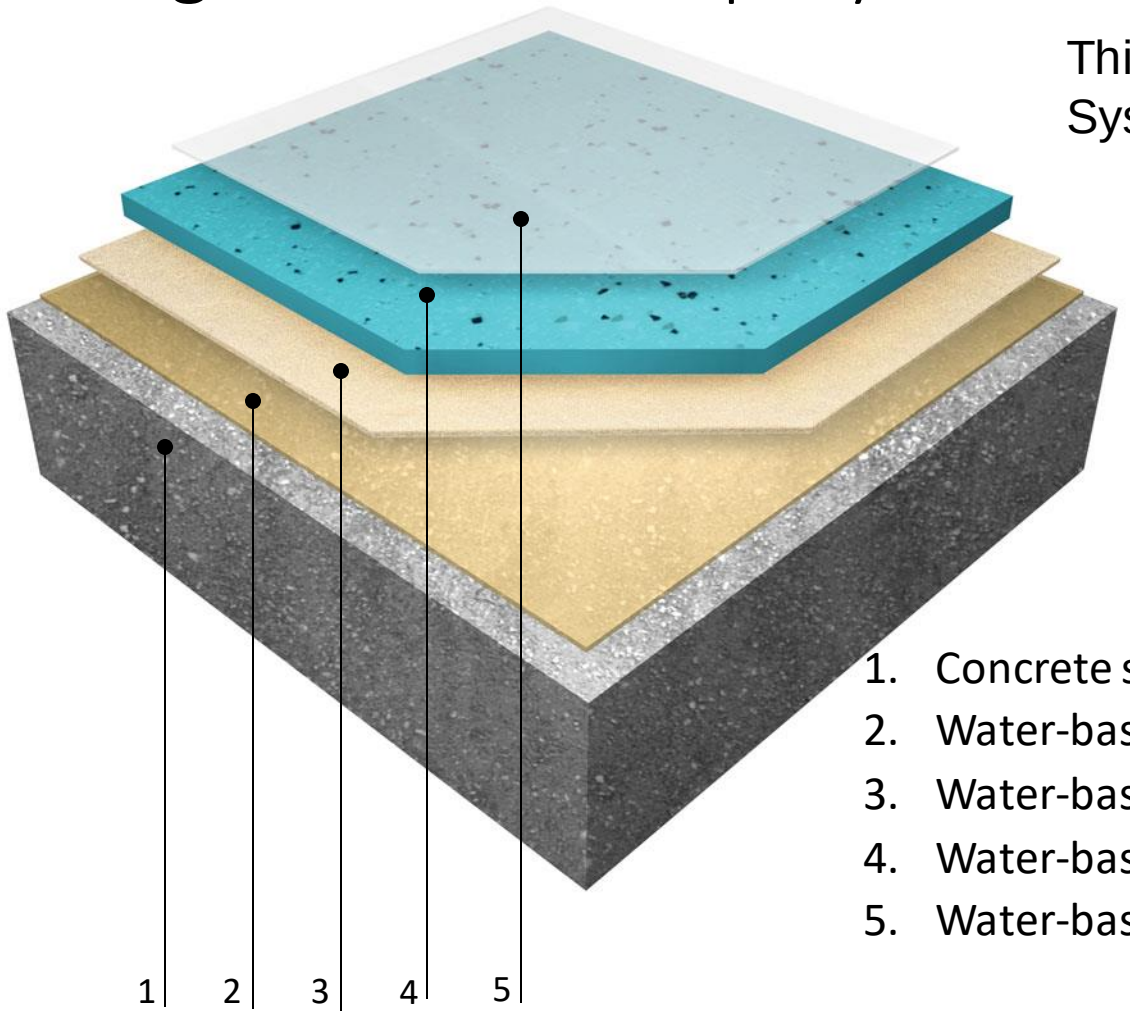
Mazda Service Centre, 2013, Singapore

Vapour diffusion system
Scratch coat to level unevenness



Madza Service Centre, 2013, Singapore

Vapour diffusion system
Self-leveling water-based epoxy floor



Thick coating
System components

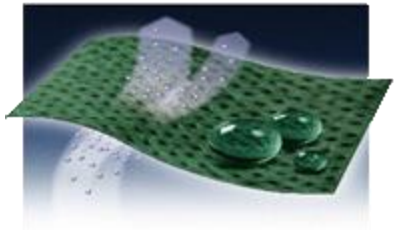
1. Concrete substrate
2. Water-based Primer
3. Water-based Leveling coat
4. Water-based Self-levelling (1.5mm)
5. Water-based Top sealing, epoxy or wax

Vapour diffusion system

Self-levelling water-based epoxy floor

Sto SEA Pte Ltd, 2015, Singapore

Other benefits of vapour diffusible water-based epoxy floor coating



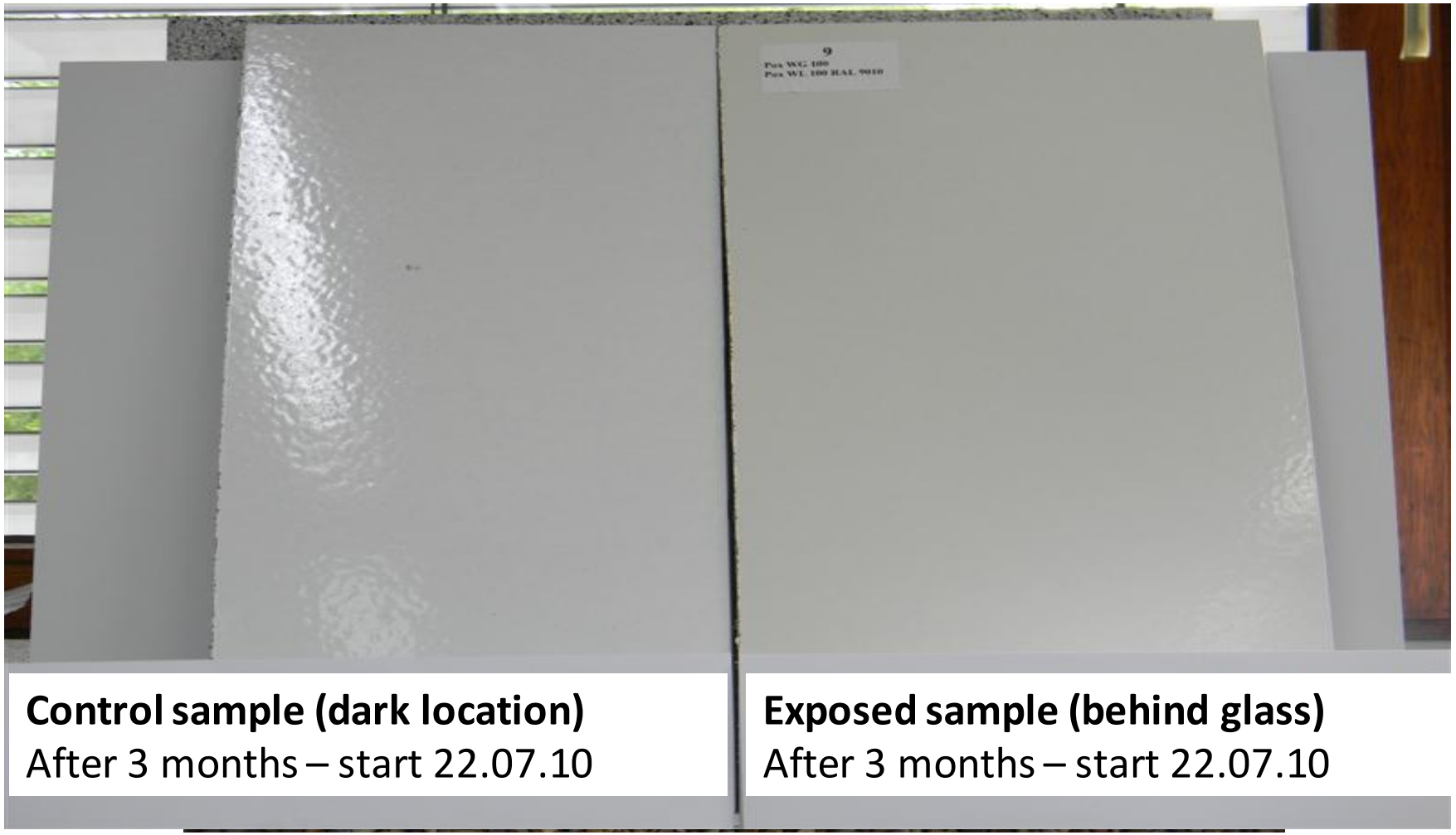
- Water vapour permeable
- Water impermeable
- Solvent-free
- No Benzl alcohol and Nonylphenol (plasticisers)
- Suitable for office and residential
- Low VOC emissions
- Suitable for use in food processing industry
- Suitable for cleanrooms
- Almost no odour during application
- Tools can be cleaned with water
- Many colours available (RAL/StoColorSystem ...)
- Plasticiser resistant (car tyres)
- Less yellowing than standard solvent free epoxy

SINGAPORE GREEN BUILDING PRODUCT SGBC LEADER

Cleanroom® Suitable Materials
StoCretec GmbH Industrial Alliance Membership

Yellowing test

Water-based epoxy



Control sample (dark location)
After 3 months – start 22.07.10

Exposed sample (behind glass)
After 3 months – start 22.07.10

Yellowing test

Standard Solvent-free epoxy

Control sample (dark location)
After 3 months – start 22.07.10

Exposed sample (behind glass)
After 3 months – start 22.07.10

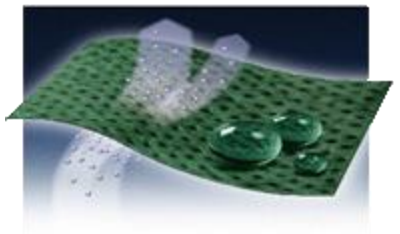
Yellowing test

Water-based self-levelling

Control sample (dark location)
After 3 months – start 22.07.10

Exposed sample (behind glass)
After 3 months – start 22.07.10

Other benefits of water-based epoxy floor coating



- Water vapour permeable
- Water impermeable
- Solvent-free
- No Benzl alcohol and Nonylphenol (plasticisers)
- Suitable for office and residential
- Low VOC emissions
- Suitable for use in food processing industry
- Suitable for cleanrooms
- Almost no odour during application
- Tools can be cleaned with water
- Many colours available (RAL/StoColorSystem ...)
- Plasticiser resistant (car tyres)
- Less yellowing than standard solvent free epoxy

SINGAPORE GREEN BUILDING PRODUCT SGBC LEADER

Conclusion

Preventive measures

Peeling

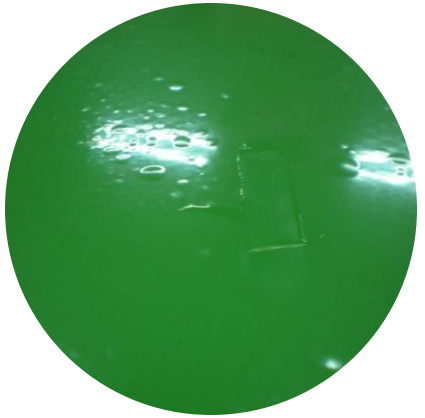
1. Proper surface preparation
2. Sound substrate

Inconsistent colours

1. Avoid high humidity
2. Practise batch re-ordering

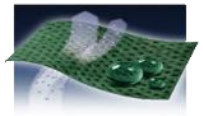
Uneven finishing

Level uneven substrate before topcoat



Bubbling

Use water vapour diffusion coating



THANK YOU!

ขอบคุณ!