KINGKRETE® We Create Future ACADEMY

CPD SEMINAR CPD-FL-CH-01

Concrete Floors: Dry-Shake Hardeners, Densifiers and Sealers

How finishing, curing and surface treatments decide whether a concrete floor dusts or lasts

0.75 LEU | AIA LU | 45 MIN | FOUNDATION

RIBA core curriculum · Design, construction and technology



BEFORE WE START

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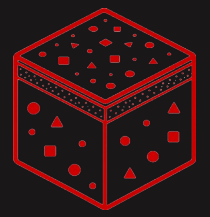
Questions about specific products or services are answered after the course, outside the time that earns credit.

Why this matters

A concrete floor is judged by its top few millimetres. Dusting, wear and staining usually start there, long before the slab itself is in any trouble.

This seminar explains why concrete floor surfaces fail, compares dry-shake hardeners, silicate densifiers and sealers, sets out the correct timing and method for applying each, and shows how to specify abrasion resistance, flatness and appearance with the tests that verify them.

FOR Architects, specifiers, flooring contractors and warehouse owners



CREDIT

0.75 LEU · AIA LU

RIBA TOPIC

Design, construction and technology

LEVEL

Foundation

FORMAT

Live, in-office or self-paced

ASSESSMENT

10 questions, 80% to pass

LEARNING OBJECTIVES

By the end of this course you will be able to

01

Explain

why concrete floor surfaces dust, wear and stain, and how finishing and curing set surface quality

02

Compare

dry-shake hardeners, silicate densifiers and sealers by how they work and what they improve

03

Apply

the correct timing and method for broadcasting dry-shake hardeners and for applying densifiers and sealers

04

Specify

abrasion resistance, flatness and appearance requirements and the tests that verify them

HSW

AGENDA

How the next 45 minutes run

01	Why floor surfaces fail	LO1	8 min
02	Hardeners, densifiers, sealers	LO2	8 min
03	Applying dry-shake hardeners	LO3	8 min
04	Densifiers, sealers and joints	LO3, LO2	8 min
05	Specifying and verifying	LO4	8 min
Q	Knowledge check and summary	LO1–LO4	5 min

01

MODULE 01 · 8 MIN · LO1

Why floor surfaces fail

Bleed water, finishing, curing and site conditions set surface quality

SURFACE QUALITY

The top few millimetres decide the floor

Forklifts, pallets and cleaning machines never meet the structural slab. They meet a thin surface zone, and its strength is set on the day of the pour by finishing and curing.



What makes a concrete surface weak

Most dusting and early wear can be traced to one or more of these causes on the day of the pour.

01

Bleed water

Water rising to the surface raises the local water-cement ratio, leaving a weak, porous skin.

02

Early trowelling

Closing the surface while bleed water is still rising traps water beneath it, causing a soft layer or blisters.

03

Over-finishing

Excessive working brings fines and water up, creating a thin paste layer prone to dusting and crazing.

04

Inadequate curing

Early drying stops hydration near the surface, so the top zone never gains its intended strength.

05

Heater carbonation

Unvented combustion heaters release carbon dioxide that carbonates fresh concrete, leaving a soft, dusty surface.

How finishing builds, or spoils, the surface

01	**Strike off and bull float**	Level the concrete and embed coarse aggregate, then leave the surface alone while bleeding takes place.
02	**Wait for bleed water to go**	Floating starts only when the sheen has gone and the surface takes a shallow footprint.
03	**Power float**	Pan or float blades open and compact the surface, bringing up just enough paste to work.
04	**Power trowel**	Successive passes at steeper blade angles densify and close the surface as it stiffens.
05	**Stop at the right finish**	Further trowelling past the specified finish adds burnish marks and risk, not durability.

Curing is what lets the surface gain strength

7 days

Typical minimum moist curing for slabs using ordinary Portland cement

≈3 mm

Typical depth of the near-surface zone that carries wear and stains

---

The surface dries first and fastest. Without curing, the zone that takes all the wear is the zone with the least hydrated cement.

SYMPTOMS

Reading the defects: dusting, wear and staining

01

Dusting

Fine powder rubs off under foot or wheel traffic, a sign of a weak, under-cured or carbonated surface paste.

02

Abrasion wear

Paste wears away to expose fine and then coarse aggregate, usually in traffic lanes and turning areas.

03

Staining

Oils, drinks and tyre marks soak into an open, porous surface and become impossible to clean.

04

Crazing and scaling

Fine map cracking or flaking from a paste-rich skin, often from over-finishing or rapid drying.

A finisher closes the surface with a power trowel while bleed water is still rising. What is the most likely result?

A A denser, more abrasion-resistant surface

B A weak layer or blisters from trapped bleed water

C Faster strength gain in the structural slab

D Reduced need for curing after finishing

QUICK CHECK · LO1 · ANSWER

A finisher closes the surface with a power trowel while bleed water is still rising. What is the most likely result?

A — A denser, more abrasion-resistant surface

B — A weak layer or blisters from trapped bleed water

C — Faster strength gain in the structural slab

D — Reduced need for curing after finishing

WHY Sealing the surface before bleeding ends traps water just below it, raising the local water-cement ratio and causing a weak layer, blisters or delamination.

02

MODULE 02 · 8 MIN · LO2

Hardeners, densifiers, sealers

Three different ways to improve a concrete surface, and what each one does

THREE APPROACHES

Three ways to improve a concrete surface

01

Dry-shake hardener

Hard aggregate and cement broadcast onto fresh concrete and trowelled in to form a dense, wear-resistant top.

02

Silicate densifier

A liquid that penetrates hardened concrete and reacts chemically to fill pores and harden the paste.

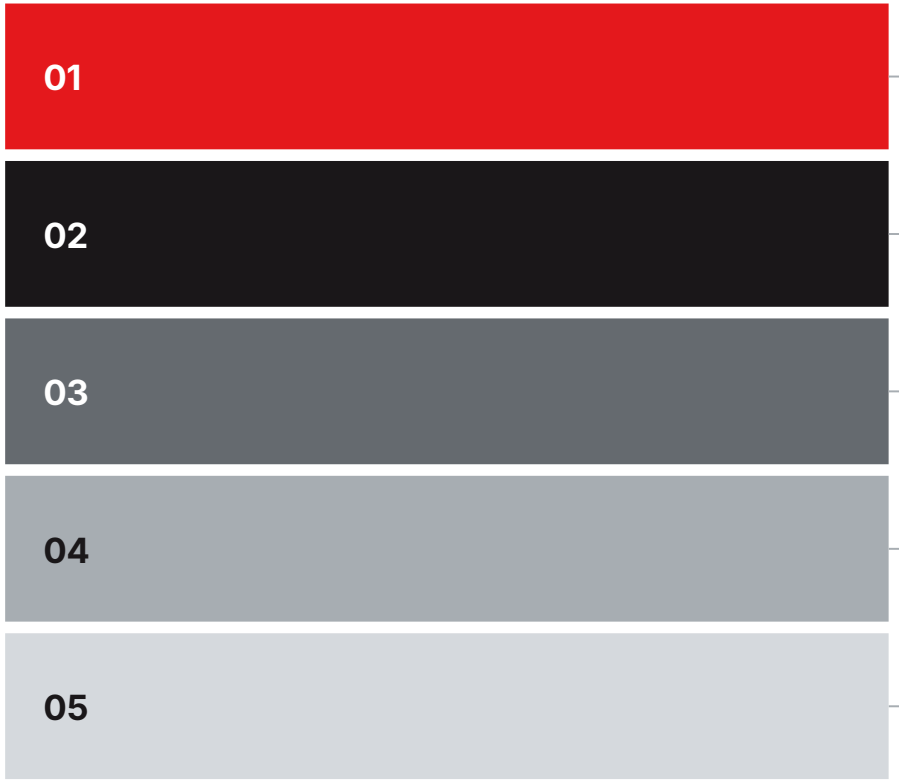
03

Sealer

A penetrating or film-forming liquid that reduces absorption, improves stain resistance and eases cleaning.

BUILD-UP

A dry-shake hardened floor, layer by layer



Optional densifier or sealer
Applied later to the hardened surface to cut dusting and improve stain resistance

Dry-shake wearing surface
Hard aggregate and cement trowelled in, typically a few millimetres thick

Monolithic bond zone
Shake material merges with the slab's own paste; there is no separate bond line

Structural concrete slab
Non-air-entrained concrete with a consistent mix and setting time

Sub-base and membrane
Compacted sub-base; membrane position affects bleeding and curling

Because the shake becomes part of the slab, it cannot debond, but it depends entirely on the slab and finishing beneath it.

Types of dry-shake hardener

01 **Mineral (quartz)**

Hard natural aggregate with cement; the general-purpose choice for light to medium traffic.

02 **Emery or corundum**

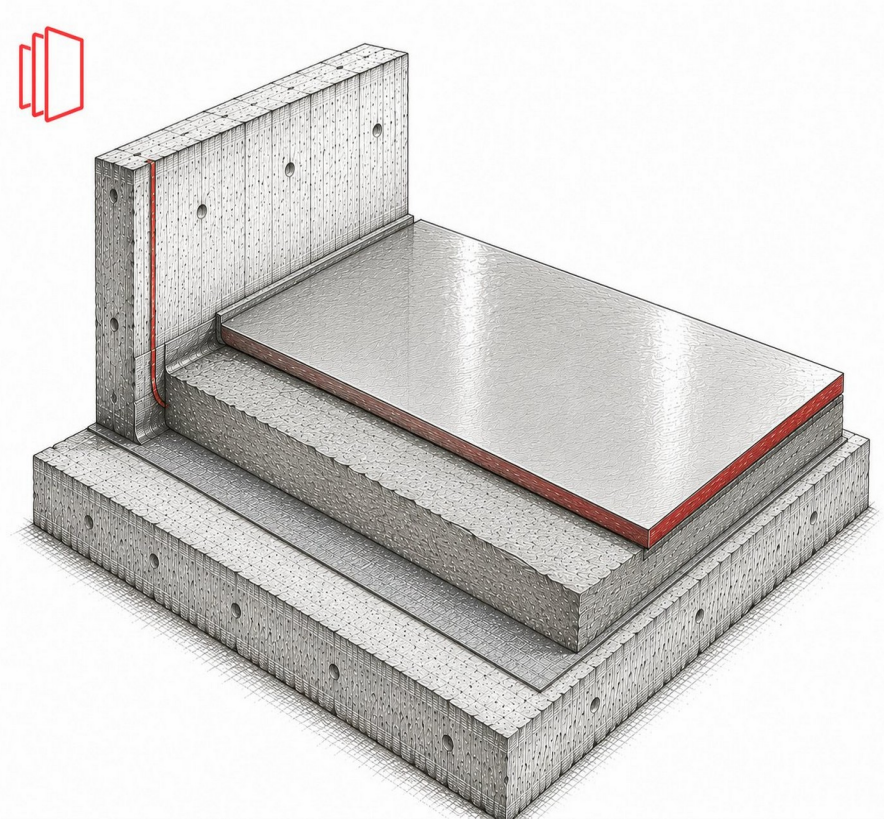
Very hard aggregates for heavy-duty floors with steel-wheeled or high-intensity traffic.

03 **Metallic**

Graded iron aggregate for very heavy impact and abrasion; avoid wet exposure and chloride admixtures.

04 **Coloured shakes**

Pigmented versions for zoning or appearance; colour shade varies with finishing and curing.



How silicate densifiers harden the surface

Silicates react with calcium hydroxide in the cement paste to form extra calcium silicate hydrate (C-S-H) in the pores.

01

Sodium silicate

Long-established and economical; larger amounts of reaction residue usually need scrubbing and rinsing off.

02

Potassium silicate

Similar reaction to sodium; often chosen where polishing follows, with residue control still needed.

03

Lithium silicate

Lower risk of white efflorescence and fewer surface residues; widely used on polished floors.

04

Colloidal silica

Very fine silica particles that react with calcium hydroxide; typically low residue and fast to apply.

SIDE BY SIDE

Hardener, densifier or sealer: what each improves

Dry-shake hardener	Silicate densifier	Sealer
Applied to fresh concrete during finishing	Applied to hardened, cured concrete	Applied to hardened concrete or over densifier
Adds a hard aggregate wearing surface	Reacts with paste to fill pores	Penetrates or forms a thin film
Largest gain in abrasion resistance	Reduces dusting; modest wear benefit	Improves stain resistance and cleaning
Cannot be added after the slab has set	Enables polishing; little stain protection	Films wear and need periodic renewal

Treatments are complementary: a shake-hardened floor is often densified and sealed later.

Sealer types and their trade-offs

01

Acrylic

Thin film, easy to apply and recoat; limited resistance to hot tyres, solvents and heavy wear.

02

Polyurethane

Tougher, more chemical and abrasion resistant film; good stain resistance in light traffic.

03

Epoxy

Hard, chemical-resistant film; may yellow in sunlight and becomes a coating at higher builds.

04

Penetrating

Silane, siloxane or similar treatments that line pores; little change in look or slip.

05

Slip resistance

Glossy films can be slippery when wet or dusty; add grit or choose a matt finish where needed.

An existing warehouse floor dusts badly but needs no extra wear layer. Which treatment targets the dusting most directly?

A A dry-shake hardener broadcast onto the surface

B A thin acrylic film sealer only

C A silicate densifier applied to the hardened slab

D Additional moist curing for seven days

QUICK CHECK · LO2 · ANSWER

An existing warehouse floor dusts badly but needs no extra wear layer. Which treatment targets the dusting most directly?

A — A dry-shake hardener broadcast onto the surface

B — A thin acrylic film sealer only

C — A silicate densifier applied to the hardened slab

D — Additional moist curing for seven days

WHY Densifiers react with calcium hydroxide in hardened concrete to form C-S-H, hardening the paste and reducing dusting. Dry-shakes need fresh concrete.

03

MODULE 03 · 8 MIN · LO3

Applying dry-shake hardeners

Slab requirements, timing, broadcasting, finishing and curing

Slab and site requirements for dry-shake work

01

No air entrainment

Entrained air delays bleeding and traps water under a closed surface, risking blisters and delamination.

02

Consistent concrete

Steady slump and setting time across loads so finishing and shake timing stay predictable.

03

Roof and walls on

Shelter from sun, wind and rain avoids uneven drying and early crusting of the surface.

04

Chloride-free mixes

Avoid calcium chloride accelerators, especially with metallic shakes, to prevent corrosion and staining.

05

Crew and equipment

Enough finishers, power floats and trowels for the bay size, plus a spreader for even broadcasting.

METHOD

Broadcasting a dry-shake hardener

01

Wait for bleed water

Start when the sheen has gone and a footprint leaves an indent of only a few mm.

02

First broadcast

Spread typically about two-thirds of the total quantity evenly, ideally with a spreader.

03

Float it in

Let the shake darken as it absorbs moisture, then power float it into the surface.

04

Second broadcast

Spread the remaining third at right angles to the first and float it in again.

05

Power trowel

Trowel in successive passes as the surface stiffens, to the specified finish.

06

Cure at once

Begin curing as soon as finishing ends, using a method compatible with later treatments.

Rates and timing vary by product and duty; follow the shake supplier's data and the agreed method statement.

Judging when the slab is ready for the shake

01	**Sheen has gone**	No free water on the surface; adding shake into bleed water weakens it and causes dusting.
02	**Footprint test**	Typically an indent of a few millimetres; deep prints mean too early, none means too late.
03	**Even setting**	Check edges, shaded areas and the middle of the bay; they rarely set at the same rate.
04	**Not too late**	If the surface is too stiff, the shake cannot absorb moisture or bond and will dust off.

Mistakes that spoil a shake-hardened floor

01

Adding water

Sprinkling water to help finishing weakens the surface paste and leads directly to dusting.

02

Uneven spreading

Thin and thick patches give variable wear, colour and flatness across the bay.

03

Dry shake left on top

Material that never darkened or got floated in stays unbonded and wears away quickly.

04

Over-trowelling

Excessive passes create dark burnish marks and can increase crazing without adding strength.

05

Delayed curing

A dense shake surface still needs early curing, or it dries and cracks at the surface.

Curing options and later treatments

Curing method	Advantages	Watch-outs for later treatments
Water curing or ponding	Very effective; leaves no residue on the surface	Hard to manage in large bays; can mark coloured shakes
Curing sheets	Simple, no residue; good moisture retention	Can cause mottling on coloured or shake surfaces
Curing compound	Fast on large areas; to ASTM C309 or equivalent	Film may block densifiers, sealers or coatings unless removed
Cure-and-seal compound	Cures then acts as a sealer; to ASTM C1315	Check compatibility with any later sealer or coating

Agree curing and any later treatment together, so the curing method does not stop the next product working.

The specification calls for a dry-shake hardener, but the ready-mix supplier proposes an air-entrained mix. Why is this a concern?

A Entrained air makes the shake too hard to trowel

B Entrained air reduces the colour of the shake

C Entrained air can trap bleed water, risking blisters or delamination

D Entrained air prevents the use of curing compounds

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D Entrained air prevents the use of curing compounds

WHY Air entrainment slows bleeding, so the surface can be closed while water is still rising. Trapped water causes blisters or delamination of the top layer.

04

MODULE 04 · 8 MIN · LO3, LO2

Densifiers, sealers and joints

Applying liquid treatments to hardened concrete and timing saw cuts

Applying a silicate densifier

01	**Clean and open surface**	Remove dust, oil and any curing film that would stop the liquid penetrating.
02	**Check age and condition**	Typically apply once the slab is cured; follow the product data for minimum age.
03	**Apply evenly**	Spray or flood at the stated rate and keep the surface wet for the stated dwell time.
04	**Scrub and remove excess**	Work it in with a broom or scrubber; remove surplus before it dries to a white residue.
05	**Allow reaction time**	Hardening continues for days to weeks; test only after the stated reaction period.

Getting sealers to perform

01

Dry, clean substrate

Film-formers need a dry, dust-free, sound surface; trapped moisture can whiten or lift the film.

02

Thin, even coats

Two thin coats outperform one heavy coat, which can bubble, blush or stay soft.

03

Mind the conditions

Observe air and surface temperature, humidity and dew point limits on the product data.

04

Slip and texture

Add a fine grit to film-formers in walkways and wet areas to maintain slip resistance.

05

Plan maintenance

Film sealers wear in traffic lanes; plan cleaning and periodic recoating from day one.

CASE BRIEF

Treating a dusting distribution warehouse floor

THE BRIEF

Floor

Five-year-old power-trowelled slab with no surface treatment

Problem

Dust on stock and in racking aisles; tyre marks and oil stains

Traffic

Pneumatic and polyurethane-tyred forklifts, pallet trucks

Constraint

Operation must continue; work in zones over weekends

01 Diagnose the surface

Check for curing film, soft areas and stains; trial a small area to confirm penetration.

02 Clean and prepare

Scrub and degrease; lightly grind badly stained or weak areas to open the surface.

03 Densify

Apply a lithium silicate at the stated rate, scrub in and remove surplus to avoid residue.

04 Seal for stains

Apply a penetrating or thin film sealer chosen for tyre and oil resistance.

05 Hand over

Agree a cleaning regime and recoat interval, and record the products and rates used.

Joints and saw-cutting timing

01

Cut early enough

Saw before shrinkage stresses crack the slab at random, often within hours of finishing.

02

Not so early it ravels

Cutting too soon tears aggregate out of the joint edges; test cut first.

03

Depth of cut

Typically a quarter to a third of slab depth, or as the joint design requires.

04

Protect the arrises

Shake-hardened edges can still chip; fill joints in traffic areas once shrinkage allows.

KEY PRINCIPLE

Every treatment depends on the one before it

A curing compound can block a densifier, a densifier residue can stop a sealer bonding, and a sealer can make a floor slippery. Plan finishing, curing and treatments as one sequence.

A densifier is sprayed on a slab cured with a membrane-forming curing compound, and it sits on the surface. What should have happened first?

A The curing film should have been removed to open the surface

B The densifier should have been diluted with extra water

C A film-forming sealer should have been applied first

D A second coat of curing compound should have been applied

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WHY Densifiers must penetrate to react with the paste. A curing film blocks penetration, so it must be removed, or a compatible curing method chosen.

05

MODULE 05 · 8 MIN · LO4

Specifying and verifying

Abrasion resistance, flatness and appearance, and the tests that prove them

How abrasion resistance is measured

01

EN 13892-4 (BCA)

Rolling-wheel test measuring wear depth in micrometres; results give AR classes under EN 13813.

02

ASTM C779 Procedure A

Revolving disks with abrasive grit; measures depth of wear over set time intervals.

03

ASTM C779 Procedure B

Dressing wheels rotate across the surface; a more aggressive grinding action.

04

ASTM C779 Procedure C

Rotating ball bearings under load; suited to harder, high-performance surfaces.

05

Compare like with like

Results from different methods are not interchangeable; state the method in the specification.

AR classes under EN 13813 (BCA method)

Class	Maximum wear depth	Typical use
AR0.5	50 µm	Very heavy abrasion, steel wheels, severe industrial duty
AR1	100 µm	Heavy industrial traffic and busy warehouse aisles
AR2	200 µm	Medium industrial and commercial traffic
AR4	400 µm	Light industrial and pedestrian traffic
AR6	600 µm	Light pedestrian use only

Typical uses are indicative; set the class from the actual traffic, wheel type and loading.

What abrasion classes mean in practice

50 µm

Maximum BCA wear depth for class AR0.5, the most demanding class

200 µm

Maximum BCA wear depth for class AR2, a common medium-duty target

≤ 3%

Typical limit on total air content for hard-trowelled shake floors

A tighter class needs the right aggregate, rate, finishing and curing together; the test only confirms what the site process produced.

Specifying flatness: random and defined traffic

Free movement (FM)

- Vehicles travel in any direction across the floor
- Surface regularity checked across the whole area
- F-numbers to ASTM E1155 or TR34 FM classes
- Typical of open warehouses and production

Defined movement (DM)

- Trucks run in fixed paths, e.g. narrow aisles
- Measured along the wheel tracks of each aisle
- Tight limits on cross-aisle level differences
- Essential for tall, very narrow aisle racking

TR34, the Concrete Society guide to industrial ground floors, is widely used for warehouse floor design and flatness.

Setting realistic appearance expectations

01	**Colour variation is normal**	Shade varies with cement, finishing time, curing and drying; coloured shakes vary most.
02	**Burnish marks**	Darker trowel marks are typical of hard-trowelled floors and are not a defect in themselves.
03	**Agree a reference panel**	Use a sample area or earlier project as the agreed standard for colour and texture.
04	**Specify the tests too**	State abrasion class and method, flatness classes, curing and treatment sequence.

A specifier wants a heavy-duty floor to lose no more than 100 µm in the BCA test. Which requirement should be written?

A Class AR6 to EN 13813, tested to ASTM C779

B Class AR4 to EN 13813, tested to EN 13892-4

C Class AR0.5 to EN 13813, tested to ASTM E1155

D Class AR1 to EN 13813, tested to EN 13892-4

KNOWLEDGE CHECK · LO4 · ANSWER

A specifier wants a heavy-duty floor to lose no more than 100 µm in the BCA test. Which requirement should be written?

A Class AR6 to EN 13813, tested to ASTM C779

B Class AR4 to EN 13813, tested to EN 13892-4

C Class AR0.5 to EN 13813, tested to ASTM E1155

D **Class AR1 to EN 13813, tested to EN 13892-4**

WHY AR1 sets a maximum BCA wear depth of 100 µm, and the BCA method is described in EN 13892-4. ASTM E1155 measures flatness, not wear.

SUMMARY

Four things to take away

LO1 Dusting and wear start in the top few mm: bleed water, finishing timing, curing and heaters set its quality

LO2 Hardeners add wear resistance at the pour; densifiers cut dusting; sealers improve stain resistance

LO3 Broadcast shake after bleed water has gone, in two passes, float in, trowel and cure; never add water

LO4 Specify AR class with its test method, flatness to ASTM E1155 or TR34, and an agreed appearance panel

EARN YOUR CREDIT

Complete the online assessment

10

questions drawn at random from the four objectives

80%

to pass; two attempts, reshuffled each time

0.75

LEU and AIA LU on your certificate

Sign in to SpecWorld, open the course and take the assessment. Your certificate is issued on passing and kept in your Workdesk under CPD & Certificates.

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Knowledge › CPD-FL-CH-01

Standards and references

ACI 302.1R

Guide to concrete floor and slab construction

ACI 308R

Guide to external curing of concrete

EN 13813

Screed material and floor screeds. Screed material. Properties and requirements

EN 13892-4

Methods of test for screed materials. Determination of wear resistance (BCA)

ASTM C779/C779M

Standard test method for abrasion resistance of horizontal concrete surfaces

ASTM E1155

Standard test method for determining FF floor flatness and FL floor levelness numbers

ASTM C309 / ASTM C1315

Liquid membrane-forming compounds for curing concrete, and for curing and sealing concrete

Concrete Society TR34

Concrete industrial ground floors: a guide to design and construction

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THANK YOU FOR ATTENDING

Questions?

Kashif Aijaz
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This concludes The American Institute of Architects Continuing Education Systems course.

