Architectural Flatwork Finishes

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Concrete Floor Contractors Association

High quality is never an accident, but the result of high intentions and sincere efforts.

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Attitude is as important as the materials and methods of construction.

The CFCA

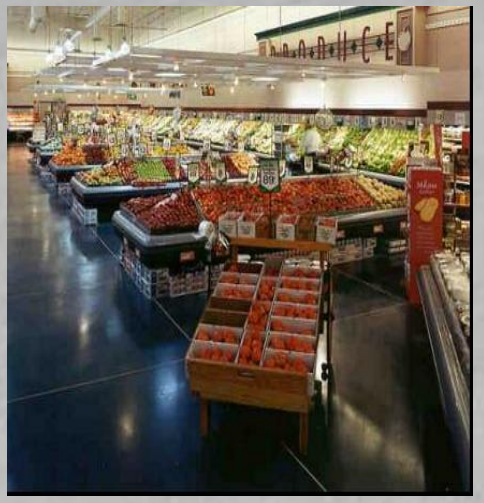
- Founded in 1972.
- Represent major concrete floor contractors and materials suppliers across Ontario.
- Provide technical assistance to specifiers and contractors.
- *Our goal is to assist you with obtaining high quality results (and avoid problems !).*

The Best Floors Start with Our Finish ! ™

Apollo • Belmont • Bravo • Centis • Diplock • Duron (Toronto) • Duron (Ottawa) • Marrik • Metro • Structural • Tri-Con • United Arcelor Mittal • Bartell Morrison • BASF • Bekaert • Duracon • Euclid • Maccaferri • WR Meadows • Optimet • Pontarolo • ProPex • Sika

Agenda

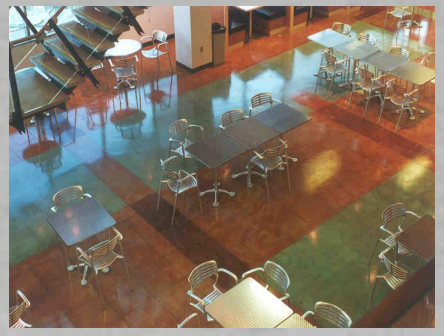
- The high quality process.
- Types of Finishes.
- Problem Areas.
- Resources.



“Architectural” Concrete

- Falls into a different category than regular concrete flatwork because the focus is on quality and not speed.
- It is essential to carefully select:
  - The right trade contractor (hint: CFCA members)
  - The right materials.
- Site conditions vary widely and require careful management too.



Materials Selection

- Materials selection based upon a variety of factors including workability and durability.
- A list of the materials should be submitted by the trade contractor (which can be used by inspectors).
- Beware material substitutions (which are common but not always of equal quality).

Specifications

- Need to be clear and precise.
- Should include a full scope of work (including concrete supply).
- Should pre-qualify trades when possible.
- Named contractors on the tender form.
- Should stipulate the acceptability of alternates and any performance requirements that need to be met.
- Should specify a pre-construction meeting.

Pre-Construction Meetings

= Avoid Problems !

Are required to ensure:

- The Owner's/specifiers expectations are understood.
- Held on-site.
- Review the condition of the building envelope and ambient conditions.
- Review the specified methods & materials.
- Review the associated work of other trades.
- Review the mock-up.
- Review the joint details and layout.
- Review the QA inspection procedures.

Must invite: The Owners rep, GC, concrete producer, finisher, testing firm, and any major or unique suppliers.

Minimum 4 weeks prior to pouring !!!

Key Issues

- Safety including ventilation.
- Ambient Conditions.
- Temporary services including water, lights, and vented heat.
- Specifications & tolerances.
- Drawings and details.
- Materials to be used.
- Methods of construction.
- Position Statements.
- Joint shop drawings.
- Mock-ups.
- Contract scope of work.
- Concrete mixes.
- Granular base elevations.
- Schedule of placements and joint filling.
- Site walk-through.
- Any perceived problems or concerns by anyone.

Inspection Items

- INSPECTION IS CRITICAL TO SUCCESS !!!
- Full time inspection on pour days is an investment in quality.
- Inspect and record the quantity and source of all materials being used (fibres, sealers, plasticizer, hardeners, concrete etc.).
- Site inspection letters can be requested from major materials suppliers.
- *Inspection stops mistakes (& cheaters), last minute substitutions and ensures value !*

Mandatory Standards

- *CSA A23.1-04 Concrete Materials & Methods of Concrete Construction*
- A23.3-04 Design of Concrete Structures
- S269.3-92 Concrete Formwork
- *S413-07 Parking Structures*
- S448.1-93 Repair of Reinforced Concrete in Buildings
- A3000-08 Cementitious Materials

Note: CSA Standards are mandatory in Canada through inclusion in national and provincial building codes. American Standards & Guides may be mandatory if denoted in project specifications.

CSA A23.1-*2004*

Our mandatory national standard for Canada on Concrete Materials and Methods of Concrete Construction which includes reference information on:

- Granular base elevation tolerances.
- Slab thickness tolerances.
- Concrete Mix designs.
- Concrete batching, handling and testing information.
- Floor surface tolerances.

New version every 5 years (2009) !

Concrete Mixes

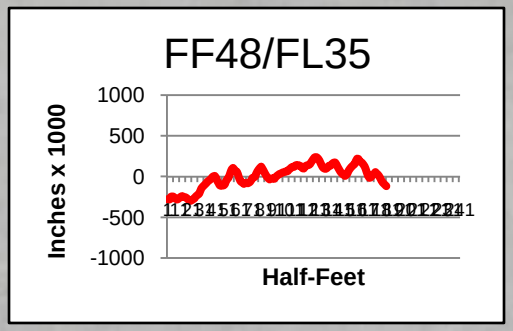
- Concrete mix constituents and proportions vary widely and are changing rapidly around the World.
- Cement manufacturing contributes 0.9kgs of $C0_2$ per kg of cement manufactured (an average truckload of concrete = 2,400 kgs of $C0_2$).
- Cement is being partially replaced with “slag” and “flyash” by-products creating new protection, finishing and durability concerns.
  - Slag = steel manufacturing by-product (up to 25% for floors).
  - Flyash = coal burning by-product (up to 15% for floors).
  - GUL = limestone dust cement (up to 15% for everything).
- Cement contents are being minimized causing longer drying periods for applied finishes and lower wear resistance.

Reinforcing

- Unreinforced concrete is NOT a good solution.
- Micro-synthetic fibres provide plastic shrinkage protection only.
- Dowels may be used to reinforce joints only.
- Wire mesh must not be permitted to settle to the base.
- Steel and macro-synthetic fibres are generally not a good solution for architectural pavements.
- Rebar reinforcing may not be a good solution for exterior applications due to long term corrosion.

ALL joints MUST be physically connected !

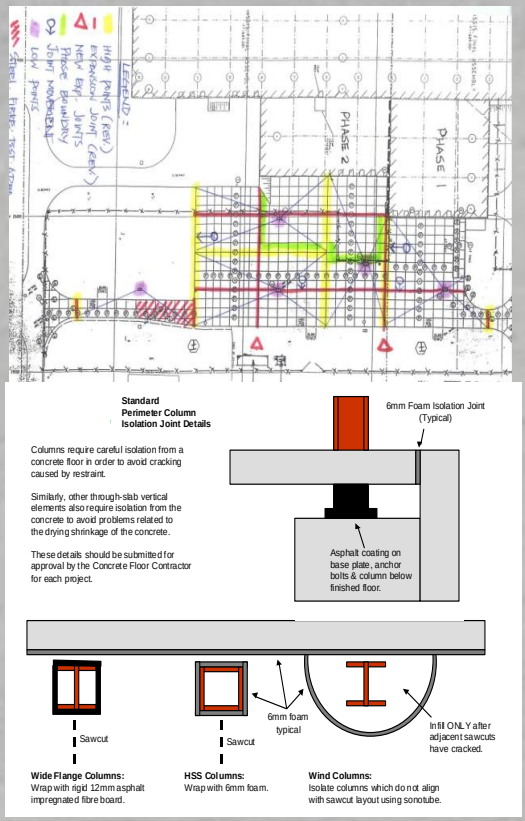
Floor Flatness



- Floor tolerance MUST be listed in Division 3 and should carefully be reviewed in the preconstruction meeting.
- FF20 is a conventional flatness tolerance specification.
- FF30 is a “flat” floor tolerance specification for exposed surfaces or thin applied finishes.
- Tolerances MUST be measured in 72 hours for acceptance/rejection purposes.

Joint Shop Drawings

- Joint layout is critical to minimize cracking.
- Discuss at preconstruction meeting.
- 4 types:
  - Isolation
  - Construction
  - Contraction
  - Expansion (exterior only)

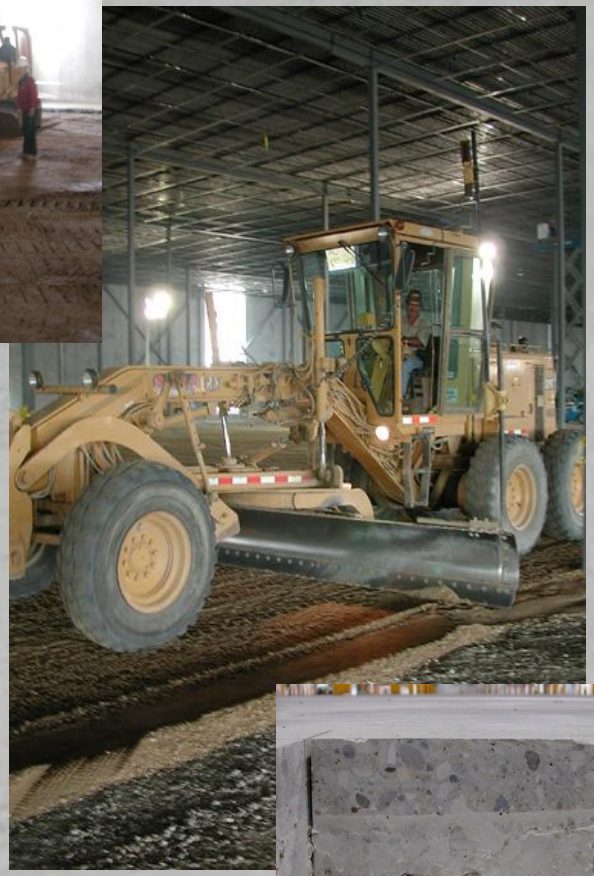


Mock-ups

- Must be representative of the final product (not too small).
- *MUST BE SPECIFIED (because they cost $$).*
- Samples are generally to required to ensure that the finished work will match the expectations of the Owner/specifier.
- No architectural work should proceed until this critical step is completed.

Granular Bases

- Compaction must be uniform.
- Elevations vary and are not being thoroughly checked on many projects.
- Base elevations “shall” be within ±10 mm (CSA A23.1).
- Thickness control is essential for good slab performance.
- NEEDS more inspection.



Curing

- Curing is the process of providing sufficient water for the cement to harden properly.
- Lack of curing creates weak/dusty surfaces.
- Curing affects the top 6mm (the wear surface).
- Curing is not optional.

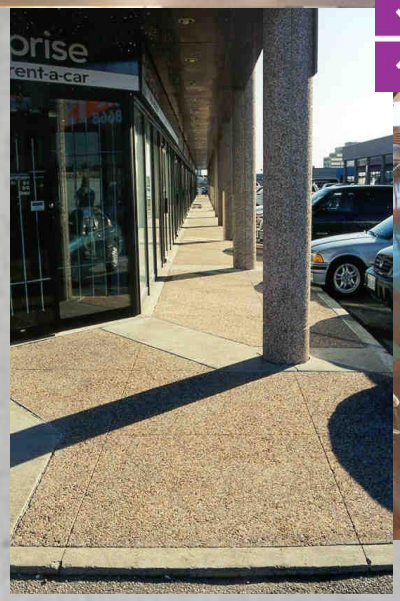
- Wet curing is ideal.
- Liquid hardeners are not curing agents.
- Avoid multiple coats of sealers which can create slippery conditions.

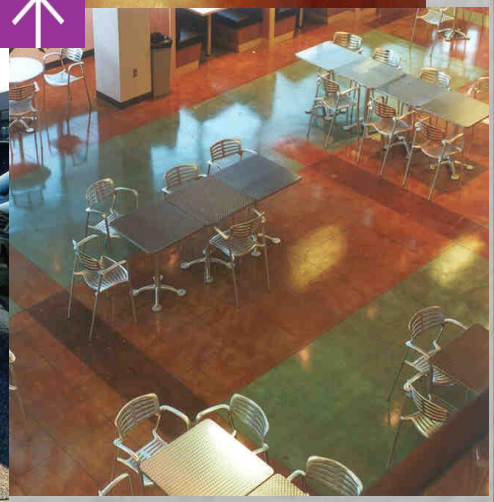
Concrete Floor Finishes

Colouring:
- Surface Applied
- Integral Coloured
- Stained / Dyed Concrete

Textures:
- Traditional
- Exposed Aggregate
- Impressed (Stamped) Concrete
- Polished Concrete

Sealers:
- Liquid Densifiers
- Surface Sealers



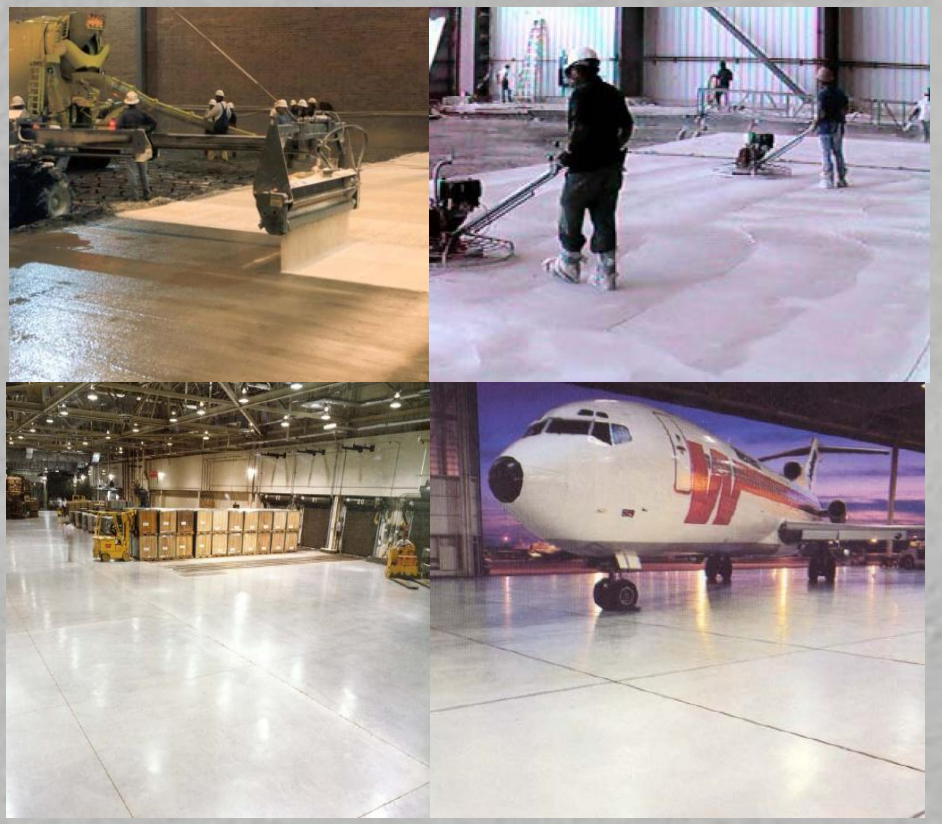


Surface Colouring

- Dry surface application of aggregates with or without pigment.
- Increased wear resistance (2-4 x).
- 6 kgs/m² is the ideal coverage rate.
- Ideal for interior applications.
- Can produce light reflectivity.

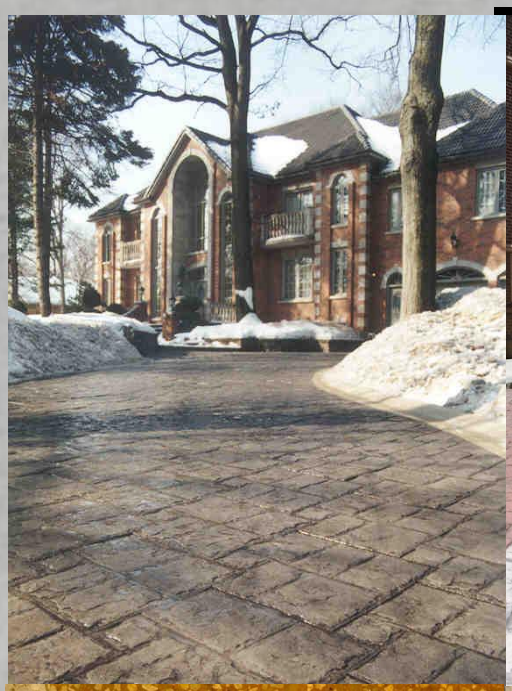
Light Reflective Hardeners

- Originally developed for aircraft hangers.
- Light reflective pigments can improve light levels.
- Reduce fixture investment, maintenance and energy costs.
- Increased surface wear resistance (bonus).



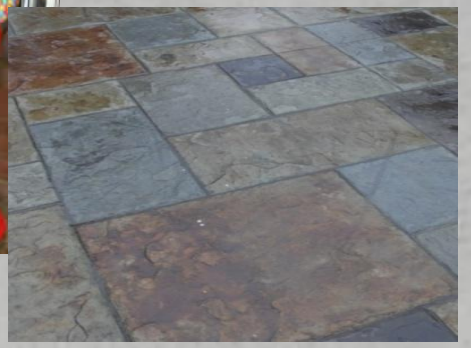
Integral Colouring

- Coloured throughout the entire slab thickness (may also be applied as a coloured topping).
- No improvement in wear resistance.
- No effect on freeze thaw durability.
- Ideal for exterior applications.



Stained Concrete

- Permanent.
- Non-uniform in colour.
- Chemically etched.
- Can be combined with a polished concrete finish or acrylic sealer.
- Multiple colours.

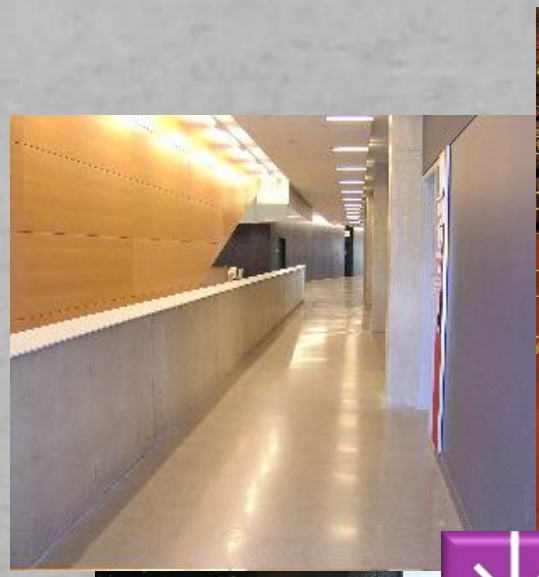


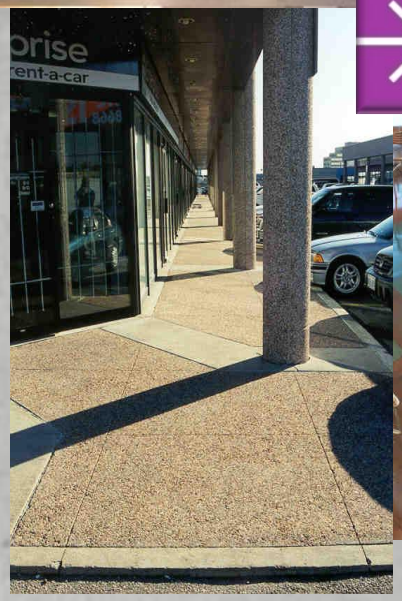
Dyed Concrete

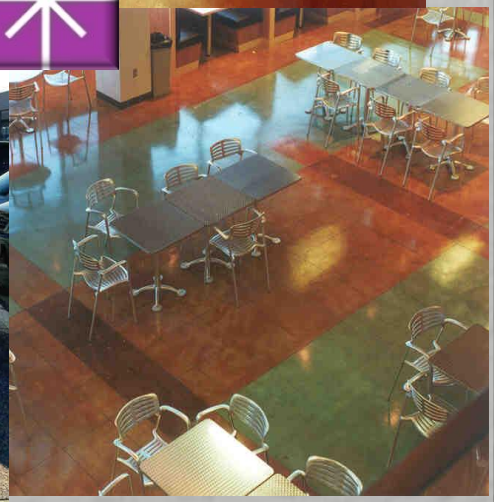
- Permanent.
- Uniform in colour.
- Can be combined with a polished concrete finish or acrylic sealer.
- Multiple colours.

Types of Finishes

- Traditional Finishes
- Exposed Aggregate
- Impressed Concrete
- Coloured Concrete
- Stained Concrete
- Polished Concrete
- Liquid hardeners / sealers

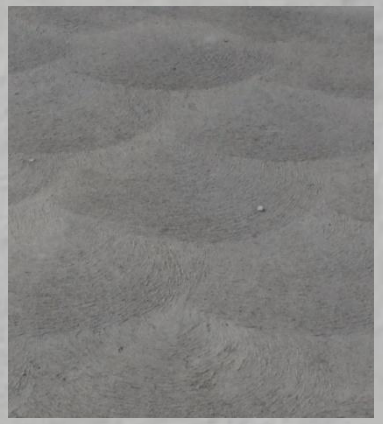






Traditional Finishes

- Broom finish (sidewalks &non-slip areas)
- Hand swirl float finish (walks & decorative pavements)
- Machine float finish (pavements)



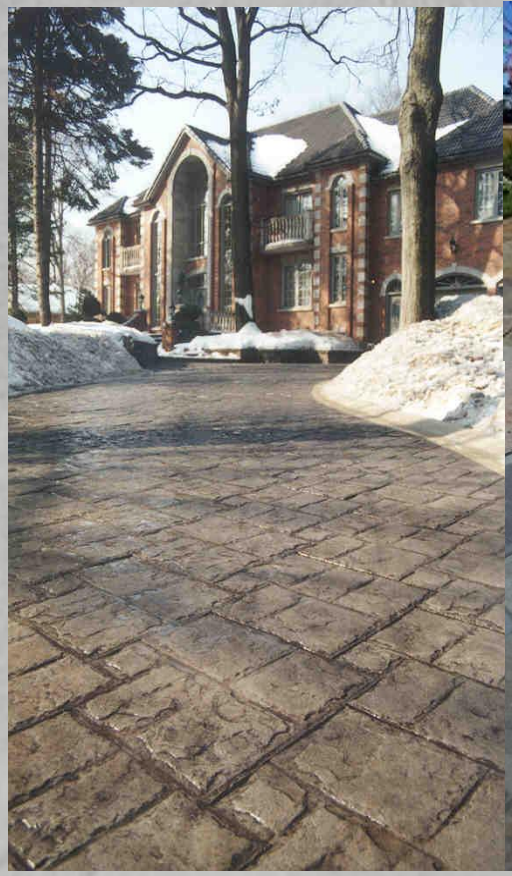
Exposed Aggregate

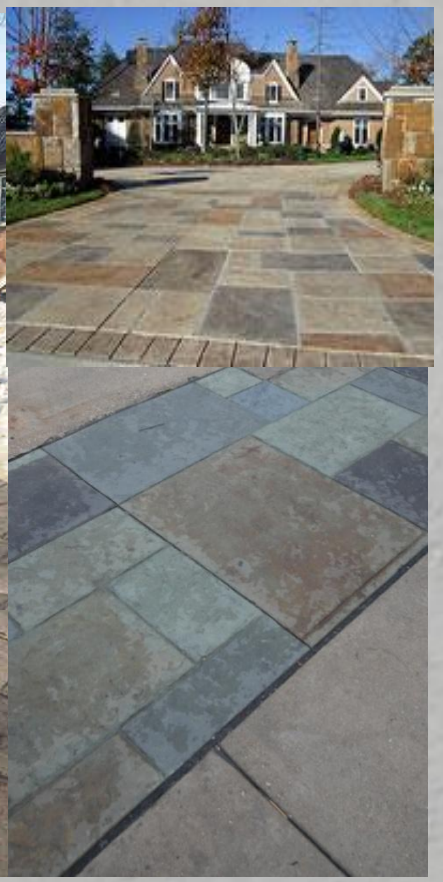
- Can be either seeded or integrally mixed.
- Many colours of aggregates.
- Concrete can also be integrally coloured.
- Non slip.

Impressed Concrete

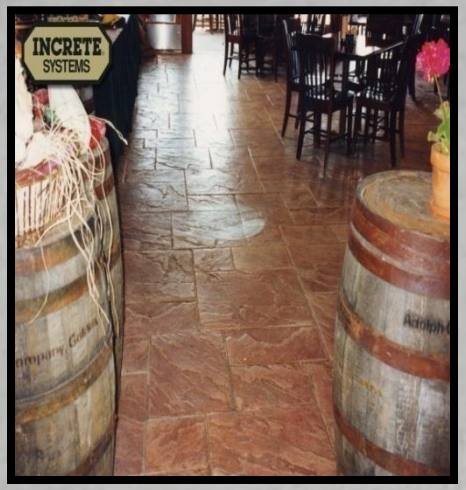
Imprinted, “INCRETE” ™, “Patterned” ™, “Bomanite” ™

- Various surface patterns and colours.
- Various accent colours.
- Looks very much like real stone, but it is concrete.
- A rigid pavement vs. asphalt & interlock.





Impressed Concrete



Skin Texturing

- No predefined patterns.
- Sawcuts are used for control of drying shrinkage and to create patterns.
- Can be natural coloured or pigmented.

Polished Concrete

- High shine, low maintenance finish.
- Concrete can be plain, stained/dyed or pigmented.
- Eliminates an applied finish and associated future maintenance costs.
- No waxing - scrub only.
- Water based.
- Does not scrape off like a coating.

Polished Concrete Floors

Before:

After:

Polish Levels

- Various systems in the marketplace with different definitions.
- 3 distinct levels of final polish:
  1. matte
  2. Semi-gloss
  3. high gloss

Aggregate Exposure

- Polished concrete is a surface treatment.
- Aggregate exposure needs to be CLEARLY defined in project specifications for exposed aggregate “terrazzo” type applications.

Liquid Hardeners

- Chemically react with the cement to densify the surface.
- Does not scrape off like a coating.
- Will develop a sheen with power scrubbing.
- Inexpensive compared to traditional coatings.
- Not a curing agent.

Sealers

- Acrylic: inexpensive, clear, relatively soft, easy to re-seal.
- Epoxy: clear, pigmented, wear and chemical resistant, more complicated to re-apply.
- Wax: as used on tile finishes (cost and labour intensive).

Endless Combinations

- The only limitation is your creativity.
- Various textures, colours, sealers, borders & form-liners.
- Manufacturers will also assist you.

BASF The Chemical Company

ASHFORD FORMULA RETRO PLATE

The Euclid Chemical Company

W. R. MEADOWS SEALTIGHT

Sika

GREEN Concrete Floors

How ?

- Better decisions on labour & materials.
- Redistributing concrete cementing materials.
- Reducing energy needs.
- Eliminating solvents.
- Improving durability, performance & lifespan.
- Reducing repairs & maintenance.

Options:

- Full responsibility “Single Source” Specifications.
- Complete slab design.
- Concrete mixes.
- Light reflective floors.
- Exposed concrete finishes.
- Built better = longer lasting.

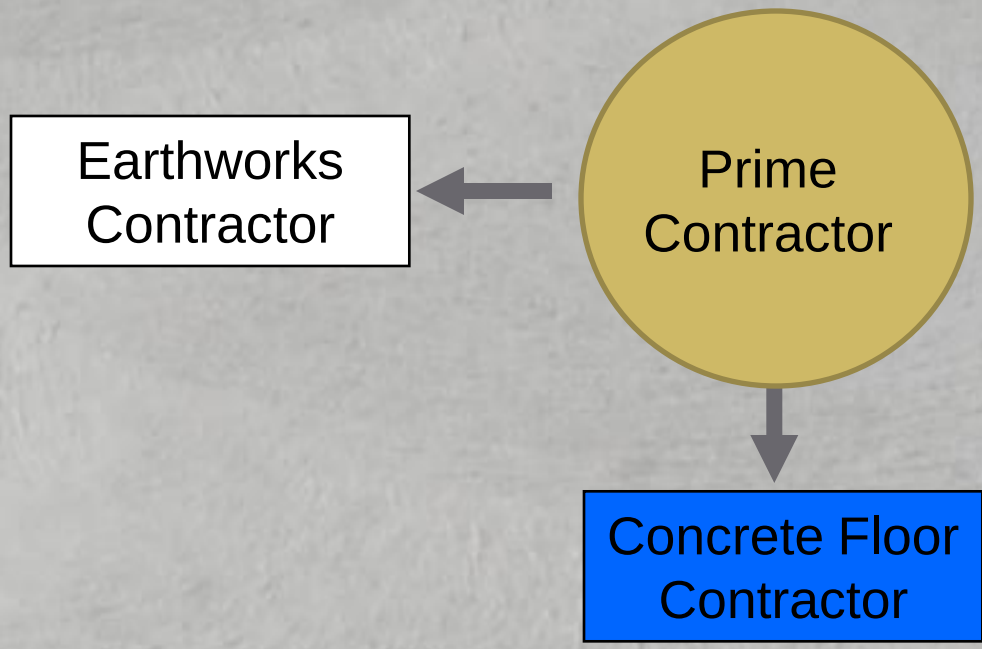
Major ~~Problem~~ Improvement Areas

1. Divisions of accountability.
   - Coordination
   - Scope of work
   - Prequalification
2. Lack of reinforcing.

Coordination

- Schedules are shorter than ever.
- Site conditions are generally poor.
- Coordination between trades is often minimal.
- Planning time is almost non existent.
- Division of responsibilities are creating problems.

“Single Source”
(Undivided Scope)



For all critical surfaces:
- Architectural finishes
- Super Flat floors
- Rick slabs

- Undivided responsibility
- Single warrantee
- No conflicts

Earthworks Inspection	Forming Operation	Place & Finish Operations	Concrete Mix Supply
Materials Selection	Reinforcing Design	Sawcutting Operation	Caulking Operation

Prequalification

- Management of workmanship is often the weakest link.
- Too little prequalification is done in specifications beyond the general contractor.
- *“Members of the Concrete Floor Contractors Association” !*

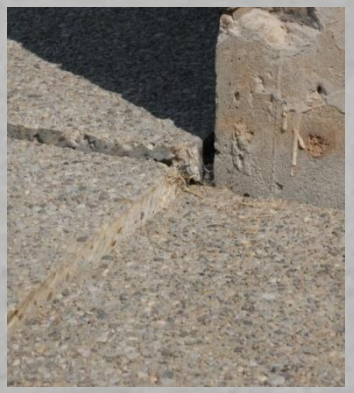
Slab Design

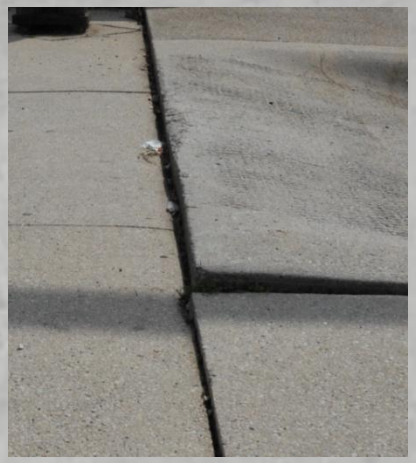
- Unreinforced concrete cracks easily and often moves differentially at joints (repairs ≠ green).
- It is generally not possible to repair architectural concrete seamlessly.

Performance MUST also be considered !

Lack of Reinforcing

Uneven joints are a common & major failure

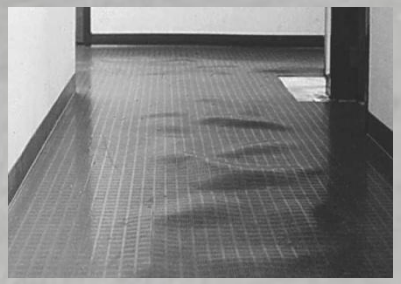




Dowel across all joints and between pours !

Vapour Retarders ~~Barriers~~

- To reduce future delaminations of non-breathing finishes due to vapour movement.
- Located directly under the concrete slab.
- Will aggravate curling and cracking.
- Should be reinforced and use low slump (plasticized) concrete.
- Review schedule of applied finishes at the preconstruction meeting.



Drying Time for Applied Finishes

- Unused concrete mix water equals 0.5 litre/sf.
- Do not use a curing membrane (wet cure for 3 days).
- Protect the slab from environmental re-wetting.
- Minimize slab thickness.
- Decrease the water:cement ratio of the concrete to between 0.40 and 0.45 (less water + plasticize & increase cement content).
- Avoid lightweight concrete aggregates (if possible).

On the Web

Product Information

- CFNEWSletter
- Coloured Floors
- CSA A23.1
- Definitions
- Help Centre
- Maintenance
- Members
- Metric Conversions
- Polished Concrete
- Position Statements
- Presentation Centre
- Product Library
- Request for Information
- Request For Quotation
- Residential Pavements
- Seminar Reservations
- Standard Specification
- Technical Information
- Weather & Traffic
- Workplace Safety
- WWW Concrete Links

Association Information

- CF NEWS
- CFCA Canada
- Complaint Reporting
- Board of Directors
- Ethics Code
- Geoff Kinney Sr. Industry Award
- Join Us !
- Labour Relations
- Mailing List
- Member Websites
- Press Releases
- Training

- Contact Us

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Technical Library

CFCA

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Technical Library

Many factors effect the quality of a new floor slab. The following is a list of reference areas recommended for consideration when designing or building a new concrete floor (product information is also available from our Product Library as well).

If you require other information, please refer to our Help Desk or submit your questions through out request for information page or send us an e-mail.

The purpose of these documents is to provide information and promote high quality concrete floors. It does not contain a full analysis of the law nor does it constitute a legal opinion. CFCAO is not liable for any damages resulting from the use of this information.

Technical Bulletins:

- Dipstick Calibration
- Sawcut Constraction Joints
- Sloping Floors
- "T" Sawcut Intersections

- Presentations

Materials:

- Air in Concrete
- Coloured Finishes
- Concrete Best Practices Guide
- Crazing
- CSA A23.1
- Liquid Densifiers
- Polished Concrete

- Product Library

Methods:

- Cold Weather
- Environmental Issues
- Exhaust Fumes
- Inspection Issues
- Maintenance Instructions
- Protection

Design:

- Concrete Mixes
- Curling of Joints
- Dock Pit Angle Detail
- Dock Pit Sawcut Layout
- Drying Time for Applied Finishes
- Dry Shake Aggregate Hardeners
- F Number Tolerances
- Joint Sealants & Fillers
- Steel Fibre Reinforcing
- Super Flat Floors
- Thickness
- Unreinforced Floors

Summary

- Specify full “single source” scopes of work.
- Specify mock-ups.
- Prequalify your trades.
- *Hold pre-construction meetings !*
- Inspect everything to ensure value.
- E-mail or call us if you need help !

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Geoff's Advice

- Listen carefully and ask lots of questions.
- Employ experts.
- You are part of "the team".
- Document everything.
- Plan for breakdowns – be proactive.
- Promote continuous improvement.
- *Be safe (each day is a gift) !*

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- Shouldn't Yours ?