Specifiers Guide to Polished Concrete in Greater Kansas City

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www.concretepromotion.com

Provision:

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About Polished Concrete

Polished Concrete is mechanically treated concrete, treated with diamond grinding tools. Typically polished concrete is defined as treated with 800 grit up to 3,000 grit levels. (Anything ground below 400 grit levels is not technically considered polishing.) Grinding tools are progressive pads building to the desired polish level. Polishing often includes using liquid hardeners and/or densifiers to add durability and serviceability to the surface. Colors and dyes can be used in conjunction with the polished system to further enhance the aesthetics. There are other methods to meet client desires for a "polished concrete look"; these other methods depend on the existing concrete profile, the contractors experience and expertise, the equipment and the supplies used.

Polished concrete is not to be confused with "stained" concrete, "epoxy" concrete, "terrazzo" concrete or "sealed" concrete. Sealers or epoxies are applied over plain concrete or stained concrete. These sealers/epoxies can produce a flat finish or a high gloss finish. Polished concrete is actually changing the surface of the concrete physically by using pads, grits and buffing materials to achieve the finish mechanically.

Polishing Benefits

- A sustainable design flooring option.
- Uses materials already present.
- Eliminates the energy and additional materials to apply other flooring options such as carpet, wood, tile, etc.
- Low maintenance.
- More durable and easier to clean than many other flooring options.
- Increased slip resistance (vinyl composite tile (VCT) standards typically are a minimum of .5 SCOF, polished concrete is typically .7 to .9 SCOF).
- Reduces the opportunity for dust and dust mites for asthma and allergy suffers.
- Improves natural lighting with the reflective surface bouncing light around the room.
- Potentially reduces the need for additional interior lighting.
- Hard wearing surface has less opportunity for chipping, denting and wear and tear.
- Cleaner, healthier atmosphere for restaurants, hospitals and medical clinics, etc.

Types

- New (construction of a new floor can have a huge effect on the final polished product).
- Retrofit (either with an overlay that is polished or by "cutting" and sanding the existing floor).

Sustainability & Green Building

Many current green building certification programs and construction guidelines for achieving green points or credits can be attained by using polished concrete. The reasons are listed above in the benefits section, i.e., less energy use, more natural light, less construction materials needed, low maintenance, etc. Some examples of the programs are:

- LEED® by the U.S. Green Building System, USGBC
- Green Building Standards, National Association of Home Builders, NAHB
- National Green Building Standard, International Code Council, ICC
- Green Globes, ECD Energy and Environment Canada

Polished concrete can achieve LEED®NC credits:

- Materials & Resources (MR) Credit 1.1- Building Reuse, Maintain 75% of Existing Walls, Floors and Roof.
  The intent is to extend the lifecycle of materials to prevent waste and reduce the environmental impact that is caused by harvesting and manufacturing new material. Reusing the concrete slab as part of the building helps to achieve this point if the total amount of reused materials in the project meets or exceeds 75% as calculated by square footage.
- Materials & Resources (MR) Credit 1.2- Building Reuse, Maintain 95% of Existing Walls, Floors and Roof.
  The intent is the same as above in MR Credit 1.1 except it must meet the criteria of 95% reuse of building materials on the project.
- Materials & Resources (MR) Credit 3.1- Materials Reuse, 5% reused items.
  Polishing the slab instead of harvesting additional materials to cover the slab prevents waste and reduces the impact on the earth's finite resources. Reusing the slab as a finished floor, instead of covering it up with carpet, tile or other materials helps to meet this objective.
- Material & Resources (MR) Credit 3.2- Material Reuse, 10% of reused items.
  If the amount of materials reused exceeds 5% and meets or exceeds 10% then this point can be attained in addition to MR 3.1.
- Indoor Environmental Air Quality 4.2- Low Emitting Materials, Paints and Coatings.
  Indoor air quality effects the quality of life and well being of the occupants of a building considering the amount of time spent indoors at work, home or school. Materials that emit odors or VOCs (volatile organic compounds) should be eliminated. By using a low VOC or no VOC sealer on the polished floor or by eliminating the sealer altogether, polished concrete can meet this requirement.
- Energy & Atmosphere (EA) P2 – Minimum Energy Performance (Mandatory Prerequisite).
  All buildings must comply to a minimum energy efficiency level overall as established by the local building codes, the Dept. of Energy Standards or by complying with ASHRAE/IESNA 90.1-2004 regulations. The reflective nature of polished concrete reduces the amount of artificial light needed. This helps to maximize the natural and artificial lighting already in use, improving energy efficiency of the lighting system as a whole. The insulation gained from the thermal

mass of constructing with concrete, including walls and exposed slabs, used with passive solar design principals, helps retain the internal temperature of the building. Using thermal mass as a design element will moderate the daily temperature fluctuations and reduce the HVAC load.

- Energy & Atmosphere (EA) 1- Optimize Energy Performance 1-10 points.
  If the energy efficiency exceeds the energy savings required in the baseline in prerequisite EA P2, an additional ten points can be achieved through EA1. Polished concrete can assist through increased ambient lighting and thermal mass for these items.

Glossary of Polished Concrete Terms

(As established by the Concrete Polishing Association of America, Spring 2013 to create a common language between designers, constructors and the industry.)

- **Polished concrete** - The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss using one of the listed classifications; Bonded Abrasive Polished Concrete, Burnished Polished Concrete, or Hybrid Polished Concrete.

- **Bonded abrasive polished concrete** - The multi-step operation of mechanically grinding, honing, and polishing a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPAA. This yields the most durable finish and requires the least maintenance.

- **Burnished polished concrete** - The multi-step operation of mechanical friction-rubbing a concrete floor surface with or without waxes or resins to achieve a specified level of finished gloss as defined by the CPAA. This operation yields a less durable finish and requires more maintenance than bonded abrasive polished concrete.

- **Hybrid polished concrete** - A multi-step operation, using either standard grinding / polishing equipment, lightweight equipment, high speed burnishing equipment, or a combination of, to combine the mechanical grinding, honing, and polishing process with the friction rubbing process by utilizing bonded abrasives, abrasive pads, or a combination of, to achieve the specified level of finished gloss as defined by the CPAA.

- **Surface coated concrete** - Surface coated concrete ***does not*** conform to the definition of polished concrete per the CPAA. It is the operation of applying a film forming coating to a concrete floor surface to achieve a specified level of finished gloss. Durability depends on the quality of the chemical coating used, the amount of traffic across the floor, and floor maintenance.

- **Polishing Process** - The steps required by a polishing technician to transform the concrete substrate into a specified finished gloss. These steps may include a sequence of grits of bonded abrasives spanning the grinding, honing and polishing stages (i.e. 70 grit metal bond, 120 grit metal bond, 50 grit hybrid bond, 100 grit hybrid bond, 200 grit resin bond, 400 grit resin bond, 800 grit resin bond, 1500 grit resin bond, 3000 grit resin bond).

- **Grinding Stage** - The steps of the polishing process that refines the concrete in preparation for the honing stage. This stage is typically the beginning for Class C and D specified floors and may meet the requirements for a level 1 specified gloss. This stage consists of any bonded abrasive that is 100 grit or lower.

- **Honing Stage** - The steps of the polishing process that refines the concrete in preparation for the polishing stage. This stage can sometimes be the beginning steps for Class B specified floors and may meet the requirements for a level 2 specified gloss. This stage consists of diamond tooling within the 100-400 grit range.

- **Polishing Stage** - The final stages of the polishing process that refines the concrete to the specified finished gloss levels 3 or 4. This stage consists of diamond tooling that is 800 grit or higher.

- **Burnishing** - The act of using a high speed burnisher affixed with an abrasive pad to further enhance the microscopic abrasion of the concrete surface to increase the finished gloss.

- **Grouting** - The act of using a grout that is forced into the pore structure of the concrete substrate to fill surface imperfections.

- **Grout** - a thin mortar used for filling spaces; also: any of various other materials (as a mixture of cement and water or chemicals that solidify) used for a similar purpose.

- **Bonded abrasive** - abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.

- **Diamond tooling** - Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.

- **Metal bond tooling** - Diamond tooling that contains industrial grade diamonds within a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates. (ie hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.

- **Resin bond tooling** - Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.

- **Hybrid tooling** - Diamond tooling that combines metal and resinous bonding that has the characteristics of both types of tooling. These type of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.

- **Transition tooling** - Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.

- **Abrasive pad** - An abrasive pad, resembling a typical floor maintenance burnishing pad that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

- **Grinder** - A multiple head, counter-rotating, walk behind or ride on machine, of various sizes and weights, with diamond tooling affixed to the heads for the purpose of grinding concrete. Excludes janitorial maintenance equipment.

- **Burnisher** - A variable speed, single or multiple rotating head walk behind or ride on machine that spins an abrasive pad, with or without bonded abrasives, at 1200 rpm or higher.

- **Edge polishing** - The steps required by a polishing technician to process the concrete substrate along the perimeter of the room(s) to a finished gloss equal to that installed within the open areas of the room. These steps typically involve the same sequence of grits used by the polishing technician within the polishing process and typically are performed within sequence of the grinder.

- **Edge detailing** - The act of blending or installing a contrasting border along the perimeter of the room(s) using a liquid coating.

- **Maximum refinement** - The point in time when the diamond tool has refined the surface to the degree to which it no longer cuts or cuts very little under its current weight and variables as defined by the CPAA.

- **Pass / Cut** - The forward and backward motion with a grinder or burnisher along a grid pattern of the concrete floor required to process the concrete into a specified finished gloss. One pass is typically forward and back within the same pathway, however this may be adjusted by the polishing technician due to the many variables as defined by the CPAA.

- **Cross Hatch** - a multi-directional pass / cut.

- **Variables** - An unlimited number of influential changes or pressures imposed upon the polishing technician during the polishing process. (i.e. weight of the machine, linear speed of the grinder, diamond tooling head pressure, hardness of the concrete substrate, etc)

- **Aggregate exposure** - Grinding a concrete floor surface with bonded abrasives to achieve a specified class of exposed aggregate. These are classified as A, B, C and D with varying levels of exposed aggregate (see Aggregate Exposure Chart)

Aggregate Exposure Chart

CLASS	NAME	APPROXIMATE SURFACE CUT DEPTH*	APPEARANCE
A	Cream	Very little	Little aggregate exposure
B	Fine Aggregate (Salt and Pepper)	1/16 inch	Fine aggregate exposure with little or no medium aggregate exposure at random locations
C	Medium Aggregate	1/8 inch	Medium aggregate exposure with little or no large aggregate exposure at random locations
D	Large Aggregate	1/4 inch	Large aggregate exposure with little or no fine aggregate exposure at random locations

*substrate mix design, finish and flatness will affect the appearance.

- **Finished Gloss** - Processing a concrete floor surface to achieve a specified level of finished gloss prior to application of any protective treatment; Flat [ground], satin [honed], semi polished, and highly polished are measured in reflective clarity (DOI), and reflective sheen (specular gloss). Finished Gloss is classified as levels 1, 2, 3 and 4 with varying degrees of reflective clarity, and sheen. (see Finished Gloss Chart)

Finished Gloss Chart

LEVEL	NAME	REFLECTIVE CLARITY		REFLECTIVE SHEEN		SUGGESTED GRIT RANGE	SUGGESTED MINIMUM NUMBER OF ABRASIVE PASSES
1	Flat [Ground]	Flat appearance with no to very slight diffused reflection	10 to 100	None to very low	15 to 80	Below 100	4
2	Satin [Honed]	Matte appearance with or without slight diffused reflection		Low to medium		100 to 400	5
3	Semi-Polished	Objects being reflected are not quite sharp and crisp but can be easily identified		Medium to high		800 and higher	6
4	Highly-Polished	Objects being reflected are sharp and crisp as would be seen in a mirror-like reflection		High to highest			7

- **Specular Gloss** - A single measurement of gloss by shining a known amount of light at a surface within a specified angle of illumination and quantifying the reflectance. Specified angles of illumination are 20 degrees for gloss ranges higher than 70 GU, 60 degrees for gloss ranges between 10-70 GU, and 85 Degrees for gloss ranges below 10 GU.

- **Distinction of Image (DOI)** - A measure of how clearly a reflective image will appear in a reflective surface.

- **Haze** - An optical effect caused by microscopic textures or residue on a surface.
- **Rspec** - The peak gloss value over a very narrow angle.
- **Gloss meter** - A device that is capable of measuring specular gloss at 20, 60, or 80 degrees.
- **Gloss Measurement** - A determination of specular gloss that incorporates distinction of image, haze and Rspec.
- **Reflective Clarity** - The DOI (distinction of image) value of the degree of sharpness and crispness of the reflection of overhead objects when measured by a device in accordance to ASTM D5767.
- **Reflective Sheen** - The specular gloss value of the degree of gloss reflected from a surface, at specified angles of illumination, when measured by a device in accordance to ASTM D523-08.
- **Surface profile** - The advanced measurement of surface topography on a microscopic level of a concrete floor surface with metrology devices.
- **Polished Concrete Auditor** - A technician that has been trained to test and evaluate a polished concrete surface to ensure that it is within the specified ranges of reflective clarity, reflective sheen, slip coefficient and overall quality.
- **Dynamic Coefficient of Friction (DCOF)** - The ratio of the horizontal component of force applied to a body required to overcome resistance to movement when the body is already in motion divided by the vertical component of the weight of the body or force applied to the surface where movement occurs.
- **Static Coefficient of Friction (SCOF)** - The ratio of the horizontal component of force applied to a body that just overcomes the resistance to slipping to the vertical component of the weight of the object or force applied.
- **Tribometer** - An instrument or device specifically designed to measure the available level of traction upon a floor or walkway surface.
- **Mock up** - A sample of products and procedures performed at the job site to establish a standard for visual appearance, skill and knowledge level of the craftsman, and overall procedures required to overcome imposed variables and install a polished concrete floor for a particular project.
- **Liquid Densifiers** - an Aqueous solution of SiO_2 dissolved in the respective Hydroxide (see below) that penetrates into the concrete surface and reacts with the Calcium Hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete.
    - Sodium Silicate
    - Potassium Silicate
    - Lithium Silicate
    - Alkalis solution of Colloidal Silicates or Silica

    All the above is the same chemistry varying only by the alkali used for solubility of the SiO_2.
    NOTE: The following products do not harden or densify concrete

        a. Siliconate is a synonym for Sodium Silicate that is a solid without any water and therefore non-reactive in the reactions described above.

        b. Colloidal Silica SiO_2 that is suspended only in H_2O is non reactive as a densifier.

        c. Siliconates are sometimes a truncated descriptions for a Alkyl (organic) Alkali Metal Silicate which are water repellents and react in the acid form of CO_2 (Carbon Dioxide) and H_2O (Carbonic Acid). These might be used as an additive in Silicate Solutions for early water repelling of the densifiers

Stain - a pronounced colored spot in the concrete caused by a material which is a soilant, discolorant or a reactant which changes the concrete surface resulting in an undesired appearance.

Stain - Decorative Application Treatment; The deliberate action of applying a material to the concrete to change the color resulting in a transparent appearance by a chemical reaction, penetrating dye or pigment.

Stain Resistant - as defined in ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

Dye - Non film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration and appearance of a concrete floor surface without a chemical reaction. Definition of Sealer from ASTM D16 - a liquid composition to prevent excessive absorption of finishing coats into porous surfaces; also a composition to prevent bleeding.

Sealer-Semi Impregnating Stain Protection – a film forming material which will penetrate into the polished and densified concrete leaving a protective surface film of less than 0.5 mils which meets the OSHA requirements for slip resistance as tested by ASTM D 20471 and stain resistance of ASTM D 13082.

Sealer-Impregnating Stain Protection - Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete. Material must meet the requirements of OSHA for slip resistance as tested by ASTM D20471, and Stain resistance of ASTM D13082.

Notes:
ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

Film Forming Coating - a film forming material which is designed to be a surface coating on concrete with a minimal film thickness of greater than 0.05 mils. which meets the OSHA requirements for slip resistance as tested by ASTM D2047 and stain resistance of ASTM D1308.

- Typical Film Formers
- Wax
- Acrylics
- Epoxy
- Urethane
- Polyaspartic
- Methyl Methacrylates
- or other film formers compatible with concrete

Pigmented Microstains - Fine pigment particles (<3.9 x 10- -4 inches) suspended in water-based silicate solution that penetrates concrete and reacts with calcium hydroxide to lock in color particles.

Edge Treatment - A liquid clear or pigmented coating that is applied to any concrete-to a vertical surface to define the edges.

Joint Filler - Compressible material used to fill a joint to prevent the infiltration of debris and provide support for sealants applied to the exposed surface.

Repair Material - A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.

Processing - The act of changing a concrete floor surface by means of a multi-step mechanical operation that involves cutting and/or refining the surface to the maximum potential with a bonded abrasive where each step cuts progressively finer microscopic peaks and valleys. Each step must be refined to its maximum potential in which the abrasive no longer cuts or cuts very little under its current weight and set variables.

The CPAA is a non profit trade association for the national concrete polishing industry Their website is found at http://www.concretepolishingassociation.com.

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Note: This guide does not contain any proprietary brand names or systems as part of the recommendations. This is a generic concrete industry suggestion for best practice use. Please recognize that manufacturers have their own proprietary training and certifications for good reasons. While we do not recommend one over the other, they are recognized as good educational opportunities and contractors are encouraged to participate in them. There is also industry training and certification that are not proprietary and are outstanding programs. The Concrete Polishing Association of American is a national trade association for the polishing industry that offers such programs.

1. References

AASHTO M 194	Chemical Admixtures
ACI 301	Specification for Structural Concrete for Buildings
ACI 302	Practice for Concrete Floor Construction
ACI302.1R	Guide for Concrete Floor and Slab Construction
ACI 303	Specification for Cast in Place Architectural Concrete
ACI 304	Practice for Measuring, Mixing, Transporting and Placing of Concrete
ACI 305	Hot Weather Concrete
ACI 306	Cold Weather Concrete
ACI 360R-10	Guide to Design of Slabs-on-Ground
ANSI B101.1	Standard for Walkways (benchmark for wet tile and concrete floors)
ASTM 1028	Co-Efficient of Friction
ASTM C 33	Aggregate Conformity
ASTM C 150	Type I, II Portland Cement Conformity
ASTM C309	Liquid Membrane Curing Compounds
ASTM C1315	Liquid Membrane Curing Compounds
ASTM C494	Chemical Admixtures for Concrete
ASTM C1028	Static Coefficient of Friction Values (SCOF)
ASTM C779	Test Method for Abrasion of Horizontal Concrete Surfaces.
ASTM C805	Impact Strength
ASTM C979	Pigments for Colored Concrete
ASTM E1155	Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers
CPAA 03 3543	Concrete Polishing Assoc. of America Specification Diamond Polishing
CPAA	Recommendations for the Design, Specification and Placement of Concrete Floor Slabs for Polished Concrete
ICRI	Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, G03732P
PCA PA/124	Finishing Slabs with Color and Texture
PCA SP/021	Color and Texture in Architectural Concrete

2. Floor Contactor
    a. Submittals
        i. Materials
            1. Provide data sheets for integral color.
            2. Provide data sheets for curing compounds used.
            3. Provide data sheets for sealing compounds used.
            4. Provide data joint and crack fillers and the certification for using this product.

5. Provide a concrete mix design for the concrete mix to be used (the mix design should be created by someone with experience in polished floors).
6. Provide mock up sample of slab.
7. Review flatwork contractor qualifications, certifications (ACI Flatwork Finisher Technician) and experience.

ii. Concrete Mix

1. Submit concrete mix design with appropriate testing data, and data sheets for all the materials in the mix including: sand, large aggregates, cement, and all admixtures, etc.
2. It is highly recommended that an experienced mix designer very familiar with polished concrete create the desired mix design. There are some schools of thought that are extremely wary of using supplementary cementitious materials in the mix.

iii. Mock-ups

1. Mock-ups shall be submitted for color, aggregates, etc. prior to construction and accepted/rejected by owner/architect/representative
2. When planning the schedule to do mock-ups and the approval process, realize the mock-up must cure for a minimum of 28 days prior to the polished contractor conducting his/her finish on the test panel.
3. Mock-up approval process can be just for the flatwork contractor or for both flatwork contractor and polished contractor, depending on the specifics for the job.

iv. Quality Assurance

1. Flatwork contractors shall have ACI Certification for Concrete Flatwork Technician. Go to www.concrete.org to find out if the contractor has a valid certification.
2. Review flatwork contractor qualifications, length of time and experience placing slabs.
3. 3 local references.
4. **The polishing contractor and the concrete flatwork contractor IF they are not one in the same MUST have a pre-placement meeting. As the flatwork contractor placing the concrete has a heavy hand in the success of the polished finished product.**

b. Construction:

i. Materials

1. Materials should be consistent from the same lot and batch for the entire project.
2. Light weight aggregates should not be used when exposed aggregates are the desired look.
3. Concrete must be delivered from the same batch plant throughout the entire job.
4. Calcium chloride additives should not be used with colored concrete or polished concrete.

ii. Project Conditions
    1. Concrete placement should be done:
        a. Without intense hot sun.
        b. Without high winds.
        c. Never on frozen surfaces.

iii. Weather
    1. Follow Hot and Cold Weather Concrete in ACI 305 and 306.

iv. Storage (On and Off Site)
    1. Powdered color additives should be delivered in un-opened containers and stored in dry conditions.
    2. Liquid color additives should be protected from freezing and need to be remixed prior to use.
    3. Chemical admixtures should be properly stored and protected from elements that could affect their use.

v. Subgrade
    1. Subgrade for all concrete pavements must be uniform. Uneven locations or soft spots will cause cracks and/or deflections in the surface that will affect the finished polished product.

vi. Concrete Mix Designs
    1. Minimum 3500 psi (Typical strengths are 3500 psi to 5000 psi).
    2. Water/cement ratio $\leq$ 45.
    3. Interior polished slabs should not be air entrained.
    4. < 15% total supplementary cementitious materials (SCM's - include fly ash & slag).
    5. Optimized aggregate gradations are beneficial in reducing bleed water and for other benefits. Seek advice from experienced ready mix producers and/or mix design engineers for help designing a concrete mix. Optimized mixes can often reduce the need for more joints.

6. Admixtures in moderation are very useful, especially in controlling the water/cement ratios.
7. If an integral color is used, the minimum batch size should be 3 cubic yards.
8. Target slump is 4 inches ±1 inch.

vii. Jointing and Repairs

1. Joints are always at right angles if possible.
2. Saw cutting should be done as soon as possible after the slab has been placed without causing raveling at the joint or premature micro-cracking.
3. Typical joints on interior slabs for polished floors:

Slab thickness in inches	Max. Joint spacing in feet
4	10
6	12
8	15

4. Jointing concrete always creates curling slabs (often not visible to the eye). Curling creates highs and lows within each panel. Any "uneven" slab will polish differently in the high spots and the low spots.
5. Not jointing can be a problem because the slab is going to crack. At least with joints the "cracks" are aesthetically pleasing and usually acceptable to all. Random cracks are perceived as not acceptable most of the time.
6. Seek help from an experienced mix design engineer to optimize concrete mixes to reduce the need for as many joints or in some cases, no joints at all (with highly engineered designs with low shrink concrete, optimized gradations, etc.).
7. Know that jointing affects FF and FL numbers.
8. Repairs need to be completed before the polish. There are a multitude of products on the market to repair slab defects.

viii. Curing

1. Cure for a minimum of 28 days before starting polishing procedures.
2. Follow ACI 308R-01 Guide to Curing Concrete for evaporation control and wet curing.
3. **The Flatwork Contractor and the Polishing Contractor need to agree on the curing agent to be used on the actual slab pour, as it has a huge effect on the Polishing Contractors job.**

4. If using densifiers and hardeners, do not apply them at this time. The polishing contractor should handle this during his scope of work.
5. Flatwork Contractor signs off slab to Polishing Contractor.

ix. Flatness/Levelness Tolerances
1. Floors should be poured in accordance with ACI 301.
2. F_F numbers of at least 50. (See F_F and F_L section below.)
3. F_L numbers of at least 30. (See F_F and F_L section below.)
4. The F_F and F_L numbers specifications will vary greatly from polished concrete countertops to highly technical floor slabs with pneumatic tired computerized systems for filing and retrieval in many warehouse environments.
5. The FF and FL numbers herein refer to the not so technical jobs. For the very technical situations contact an experienced structural engineering firm/consultant.
6. F_F and F_L Tolerance Chart:

	Specified Overall Value	Minimum Local Value
F_F Floor Flatness	50	35
F_L Floor Levelness	30	20

7. Floor flatness and levelness should be tested within 8 hours after completion of the final troweling operation according to ASTM E1155-96(2008) by an independent testing agency.
8. In the pre-construction meeting a remedy should be set for out-of-tolerance work.

x. Finish
1. During the pre-construction meeting a goal should be agreed upon as to the desired finish appearance of the slab, set by measuring the gloss reflectivity from a gloss meter.

3. General Contractor or Owner
a. The responsible party for the slab during the transition from the flatwork contractor until the polishing contractor commences work.
i. Keep other trades off the slab if possible.
ii. Cover the slab with a non-chemical laden cover to protect it from oil spills, gouges, contact with metals, protected from mastics/glues, etc.
iii. Keep chewing tobacco juice from contaminating the floor, especially if it is to be an architectural featured floor, as the tobacco will inhibit color, stains, hardeners, etc. from working properly.
iv. Keep vehicle traffic completely off the floor.

4. Polishing Contractor

    a. Submittals
        i. Materials
            1. Provide data sheets for hardeners and densifiers.
            2. Submit data sheets for joint and crack fillers and the certification for using this product.
            3. Submit data sheets for any materials used in the coloring and polishing process.

        ii. Equipment
            1. Submit product data sheets for the polishing equipment:
                a. Grinding machine
                b. Metal bonded diamond tools
                c. Resin bonded diamond tools
                d. Burnishing pads
            2. Submit data sheets on dust control and run-off for both dry and wet polishing systems.
            3. If using a wet polishing system, submit a slurry disposal plan.
            4. If using a dry polishing system, submit cfm's for vacuum.

        iii. Mock-Ups
            1. Provide mock-ups for all projects.
            2. Provide color mock-ups for color approval.
            3. Square footage or size of the mock up is between the architect/owner and the polishing contractor. Some estimates are: between 10 and 20 sq. ft. for small projects, 100-200 sq. ft. for larger warehouse or big box type floors. (Depends on job size)
            4. Use the same personnel that will be doing the job, including the supervisor.
            5. Install the mock-up in accordance with the specification using the same materials, staff and equipment.
            6. Finish various levels to show the maximum final finish and a couple of options.
            7. Approvals should be based on:
                a. Complies with pre-submitted examples.
                b. Uniformity of exposed aggregates.
                c. Uniformity in sheen.
                d. Desired color enhancement.
                e. **Do not destroy or alter field mock-ups until after the entire project is completed** so they will always be around to make a

comparison. Sometimes mock-ups are needed to practice a "fix" later in the project for approval.

f. Approval from the Architect/Owner is necessary BEFORE the job can be started.

iv. Quality Assurance

1. Review contractor qualifications, certifications and length of time and experience with polishing.
2. Certification from the Equipment Manufacturer being used on the job.
3. Check for certifications from Joint Filler Manufacturer and Densifiers/Hardener Manufacturer.
4. 3 local references for polished concrete.
5. The same personnel shall complete the entire job.
6. **The polishing contractor and the concrete flatwork contractor IF they are not one in the same MUST have a pre-construction and pre-polish meeting. As the flatwork contractor placing the concrete has a heavy hand in the success of the polished finished product.**
7. Testing Goals
    a. Gloss Meter (60° angle meter)
    b. SCOF (Static Coefficient of Friction Values) ≥.5
    c. Free of scratches
    d. No cloudy/haziness
    e. Consistent look or sheen

b. Equipment

i. Polishing and Grinding Equipment:

1. Provide hook ups or generators with proper outlets.
2. Have the proper polishing machine with a proper amount of lbs per down pressure for the job.
3. Dust system for either dry or wet procedures (vacuum or squeegee).

ii. Metal Bonded Pads:

1. Use metal bonded pads - grit sizes vary with manufacturers. Metal bonded pad example: 16, 25, 40, 60, 150 and 300. **NOTE: Not all pads need to be used in sequential order on all concrete.**
2. Resin Bonded Pads-use resin diamond pads - grit sizes vary with manufacturers. Resin diamond pad example: 100, 200, 400, 800, 1500, and 3000. **NOTE: Not all pads need to be used in sequential order on all concrete. Note: the 1500 to 3000 range doesn't usually meet slip coefficient. If used for a floor with traffic, slip & fall options need to be discussed.**

c. Polishing Process
    i. Clean the slab thoroughly.
        1. Remove paint, mastics, oil spots (as best as possible), dirt, etc.
        2. Scrub slab with soft brush or pads.
        3. Use neutral pH detergent and rinse well.
        4. Protect adjacent areas to prevent damage by polishing machines and/or materials.
    ii. Repair and fill any surface cracks.
        1. Allow the crack repairs to cure thoroughly
    iii. Follow the recommendations of the equipment manufacturer in increments of various heads or pads for grinding, honing, and polishing to the desired level.
    iv. Apply the densifiers and hardeners as necessary for maximum performance
    v. Surface color application is debatable as whether to apply before or after the honing and/or polishing steps. This needs to be worked out in the mock-up stage for approval.
    vi. Cleanup the site.
    vii. General Contractor or Owner provides protection from construction trades until the project is turned over to the owner. This needs to be discussed in the pre-construction conference.
    viii. Edges are harder to polish because they are perpendicular to the wall. The corners are challenging to get into with large polishing equipment. As a result they rarely are polished to the same degree as the main part of the floor. Many contractors offer edging detail as an alternative to polish in the 45° corner. Discuss this ahead of time in the pre-construction conference and agree on an edge "solution" that satisfies all involved.

d. Maintenance
    i. Leave a Maintenance Protocol for the Owner
        1. Do not use high ph cleaners like "Mean Green", use neutral ph cleaners
        2. Suggest cleaning pads/brushes (white or red pads).
        3. Clean with the same Brand as the "Guard" and/or densifier used in the polishing process, as they are made to be used together for a reason.

5. Pre-Construction Conference
    a. Attendees:
        i. Concrete Sub-Contractor
        ii. Polishing Sub-Contractor
        iii. General Contractor
        iv. Architect/Owner
        v. Ready Mix Producer

vi. Testing Company Representative

b. Agenda Items:
   i. Review approved mock-ups (may include site visit).
   ii. Review contract documents.
   iii. Review substrate conditions.
   iv. Review surface preparations.
   v. Review sequence of procedures.
   vi. Set expectations for the surface appearance, as determined by a gloss meter.
   vii. Ensure proper ventilation when applying some liquid products for hardening and densifying.
   viii. Set protection for concrete floor after placement until polishing time.
   ix. Discuss and set edge treatment as mentioned in the Polishing Process above.
   x. Make it clear who is responsible for protection of the polished concrete until it is time to turn it over to the owner (damage from other trades during construction).
   xi. Set protection from damage or stains by:
      1. Parked vehicles over slab.
      2. Pipe cutting over slab.
      3. Storage of anything on slab for 28 days after placement.
      4. Petroleum products, oils, hydraulic liquids, acids, dyes, soaps, detergents, and paints all prior to polishing.
   xii. Provide a written maintenance care sheet to pass on to the owner, explaining the simple maintenance needed to keep the polished floor/slab.
   xiii. Set a remedy for out-of-tolerance work if, F_F and F_L numbers do not meet specification/tolerances.

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- Husqvarna Polishing System
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- Lavina SPS Polished Concrete
- Murray Decorative Concrete Supply's Guidelines for Polished Concrete Floors
- PROSOCO, Inc.
- Structural Services, Inc.