

**“Enhancing the Performance of Concrete Floors through
the Use of Concrete Densifiers” (CDI02)
Presentation Notes**

Slide 1: Title Page

Slide 2: Course Objectives

Slide 3: Common Problems on Concrete Floors

Concrete floors, even those with excellent surface integrity and a tight finish, are subject to long-term problems. Concrete is inherently porous, and is therefore difficult to clean and maintain. It is also susceptible to wear and surface erosion, especially in conditions of heavy traffic. Concrete is also a dusty material. It contains salts that migrate to the surface, creating additional maintenance problems. The finish on concrete is also not naturally glossy or attractive. Uneven coloring can also contribute to the problem.

Slide 4: Common Phenomena that Worsens Problems on Concrete Floors

There are many phenomena that make the known problems with concrete even more pronounced. The most common of these are carbonation, poor water-to-cement ratio, and poor mix design. If these conditions exist, primarily at the wearing surface of the concrete, it is very difficult for any product, coating or chemical densifier to perform as it should, especially at standard coverage rates. It may be possible to remediate such surfaces with *additional* chemical densifier, over and above the first standard application, but even this may not help in severe cases. Chemical densifiers perform best on concrete that is structurally sound.

Slide 5: Carbonation

Carbonation occurs when carbon dioxide from unvented heaters or even trucks is allowed to concentrate in the building while the concrete is still curing. Carbonation basically stops the process by which the water hydrates the cement. The result is a soft, chalky surface that is susceptible to erosion. Severe cases can go deep into the surface. Carbonation is normally detected by applying phenolphthalein to a freshly broken core sample. The good concrete turns pink. Carbonated concrete remains the same color.

Slide 6: Poor Water-to-Cement Ratio Which Results from Adding Water

Another common problem is the presence of excessive water on the surface during the finishing operation. Often, the water is added by finishers who want to make the concrete more workable. Sometimes there is excessive bleed water which is troweled into the surface. This happens when troweling begins too early. Regardless of the source of the water, the effect is the same: the concrete cannot gain strength because the grains of hydrated cement cannot interlock. The cement grains crystallize, but the excess water creates voids between them.

Slide 7: Poor Mix Design

Proper mix design is also critical to performance of a floor slab's wearing surface. The mix must be designed to bear the loads for the intended use of the floor. Excessive water, as already discussed, will create voids between the cement grains that would otherwise interlock. Some admixtures can affect surface performance. Excessive fly ash or air entrainment can cause the surface paste to become too sticky to achieve a tight, compact finish. Chloride-based accelerators can cause unsightly discoloration. High content of fines can create crazing, and dusting.

Slide 8: Membranes: The Traditional Approach to Sealing and Protecting Concrete Floors

Concrete can provide a very durable and functional working surface. Even good concrete, however, has its limitations. We have also seen that those limitations can be made even worse if the right conditions prevail. Over the years, the traditional approach to preserving and protecting concrete surfaces has been coatings, primarily acrylics, urethanes, and epoxies. All three of these classes of coatings come in a variety of curing and application methods, prices, and performance. They all leave a film or membrane on the surface that coats the concrete that is intended to buffer it from the effects of traffic or chemical attack. As a rule, acrylics are the cheapest and least durable. The urethanes and epoxies are the most expensive and most durable.

Slide 9: Advantages of Membranes

Membranes have several advantages. One class of membranes, the acrylics, is typically very inexpensive. Membranes also provide an immediate sheen upon drying. There is also an option to use sand or other aggregates as part of a broadcast system with coatings to create a non-slip surface. A wide variety of colors are also available with coatings. Certain areas of the floor, such as battery charging rooms, may also be regularly or frequently exposed to acids. There are several different versions of urethanes and epoxies formulated specifically for these applications. Many operations and processes are sensitive to static electricity. Some coatings are formulated to conduct static charges into the floor, where they are dissipated. Finally, a major advantage of coatings is that they can cover up unsightly pits, ruts, or other blemishes in the floor surface.

Slide 10: Disadvantages of Membranes

There are also many disadvantages of membranes. Although they produce a relatively pristine appearance initially, they are prone to scratching, peeling, and chipping when the floor is subjected to traffic. They are also very susceptible to delamination from vapor that migrates from beneath the floor slab. Tire marking is also a common problem. Fork lift tires not only lay down rubber, but they actually burn the surface of the coating. This can create a general blackening of the floor. Coatings must also be reapplied many times over the life of the floor. Even if they don't scratch or peel, they eventually wear out. Each time this happens, the material must be installed again. This involves down time, material cost, and labor cost each time it happens. Coatings also require fairly extensive surface preparation to ensure they bond properly to the concrete. Since labor is the most expensive element of an applied price, this adds significantly to the cost. Coatings typically contain VOCs that create safety and

environmental concerns. Finally, coatings, especially acrylics, are known to yellow or discolor over time.

Slide 11: Conceptual Differences Between Chemical Densifiers and Coatings

Coatings leave an organic film or membrane on top of the concrete. They do not react chemically, nor do they become an integral part of the floor. Thinking about chemical densifiers requires a conceptual shift in thinking from a coatings mentality. Chemical densifiers work internally within the surface of the concrete. They are inorganic, and they grow new crystals, densify the floor, lock up the dust, and produce added hardness. All of this is done internally by means of chemical reactions. Coatings are like the frosting on a cake. By analogy, chemical densifiers become part of the cake by chemically altering it to the depth of penetration. Concrete treated with chemical densifiers is still concrete, but it is harder, denser, and free of dust. Coatings are not permanent because they wear out. A high-quality chemical densifier will last the life of the floor. Coatings are not highly sustainable because they are temporary and need to be re-installed many times over the life of the floor. Since chemical densifiers achieve their results inorganically, and because they become part of the concrete surface, their effects are permanent, and they do not need to be re-installed.

Slide 12: Problems with Coatings Have Led to Chemical Densification as an Alternative

Because of the problems associated with coatings, chief among them the lack of permanence, chemical densifiers has become widely accepted as an alternative. These products take a different approach. Rather than coating the surface of the concrete with a film or membrane, they chemically densify the surface itself through increased crystallization. The results are permanent. The more these floors are used and subjected to traffic, the better the look, although not all chemical densifiers are the same. They also generally eliminate concrete dust, and significantly improve the wear resistance of the surface. Because the surface of the concrete is harder, the floor actually begins to self polish over time. Tire marking is minimized. There is no need for re-application, and there is no film or coating to wear out.

Slide 13: How Chemical Densifiers Work

One of the by-products of cement hydration is calcium hydroxide. This material does not contribute to the binding properties of the cement. It is relatively soft compared with the calcium silicate hydrates that account for the strength of the concrete. To the depth of penetration, chemical densifiers generally react with the calcium hydroxide, and turn it into calcium silicate hydrates. This process creates a harder wearing surface because a relatively soft by-product of cement hydration is chemically transformed into a stronger, more durable material. The same process causes the propagation of crystals which fill in the natural pores and voids in the floor surface. The reaction also prevents the efflorescence of salts to the surface, eliminating the floor as a source dust.

Slide 14: Limitations of Densifiers

Chemical densifiers also have their limitations. Although concrete treated with these products is harder and denser, it is chemically still concrete. That means it can still be damaged by acids, especially if the concentration of the acid is high, and if the exposure is frequent and regular.

Salt resistance can also be a concern. The effects of salt on concrete are well-documented. Since chemical densifiers do nothing to buffer the concrete from these effects, salt-related problems can still arise. However, experience has shown chemical densifiers can lengthen the amount of time it takes for salt to have any noticeable effect. Steel wheels with high point load can also eventually cause concrete treated with a densifier to erode. Since steel is harder than concrete, this is a problem with almost any product used to protect floors. Chemical densifiers are also less effective on floors that lack structural integrity. If the surface is carbonated or if it has a high-water to cement ratio, then chemical densifiers cannot perform optimally, at least at standard coverage rates. Another limitation is that chemical densifiers do not seal right away. It typically takes many months before they produce a surface that permits easy removal of stains. Chemical densifiers will also not span cracks, which can create problems on elevated decks.

Slide 15: Typical Facilities in which Chemical Densifiers are Used

Chemical densifiers are typically used in facilities with exposed concrete floors that are subjected to high volumes of forklift or foot traffic. Warehouses, distribution centers, and manufacturing facilities have become the most common types of facilities. These products are also used, however, in exhibit halls, stadiums, aviation hangars, retail space, and in food processing facilities.

Slide 16: Application of Chemical Densifiers

Chemical densifiers are applied by spraying the product on a clean concrete surface at about 200 square feet per gallon. An initial brooming is required to aid penetration into the concrete. The material is then typically allowed dwell on the floor surface for a minimum of 30 minutes. Any areas that dry out must be broomed over or re-treated so that the entire surface is kept uniformly wet. During the entire soak-in period, the material should remain in an active, liquid, penetrating state. This condition may be hard to achieve in a very hot environment. It may be necessary to mist the material with water to keep it from gelling or turning slippery prematurely. When the material turns slippery after the 30 minute minimum, it may be flushed thoroughly with water. This step removes any residue on the surface that could turn white. Allow to dry.

Slide 17: Application of Chemical Densifiers, Continued

One application is normally sufficient to achieve the desired results. The keys to proper performance, at least from an application point of view, are to make sure enough material is used, and to leave it on the floor surface long enough. The residue that is flushed from the surface can in most cases be removed to the grade or disposed down a drain. Floor may be used as quickly as three hours after application, provided the concrete is fully cured. These products can be use on new or existing concrete, but the floor surface must be clean in either case, allowing full penetration of the material into the surface.

Slide 18: Specification of Chemical Densifiers

Chemical densifiers are architecturally specified products. They are most commonly called out in Division 3, Concrete, but can also be found in Division 9, Finishes. Since these products do not immediately seal the floor, some provision should be made in the specification to protect the

concrete from spills and leaks during construction. They are most often specified on interior slabs on grade with a tight, steel-troweled finish. Provision is often made in the specification for the material to be applied only by trained and certified applicators. In order to obtain an early sheen on the floor, mechanical burnishing is often specified after the final cleaning. This may or may not include a light application of additional material.

Slide 19: Timing of Chemical Densifier Properties

Chemical densifiers do not achieve all results immediately. As was mentioned earlier, the sealing benefit is delayed. It occurs as the result of an ongoing chemical reaction. Normally, it takes several months for a full seal to occur. The seal can also be accelerated by the water from frequent and regular cleaning. The hardening and dustproofing of the floor occur within hours or days. The sheen on the floor develops within four to six months, unless an early sheen is developed through scrubbing, burnishing, or buffing. The sheen develops strictly as a result of traffic and cleaning.

Slide 20: Basic Mix Design Guidelines for Optimum Performance of Chemical Densifiers

Shown here are some basic recommendations or guidelines for the concrete mix design, if a chemical densifier will later be used on a finished floor. The water to cement ratio is very important, as discussed earlier. For industrial floors, the recommended ratio is .45 to .50. This is calculated by dividing the water, by weight, by the portland cement in the mix, also by weight. The slump of the mix should not be too runny, but it should also not be too stiff. It needs to have a high enough water content to be workable, but not so much water that the strength of the mix is compromised, or that cracks form when the moisture is gone. This generally falls in the range of a 4-inch to 6-inch slump. The recommended compressive strength should be 4000 psi at 28 days. A proper mix design will typically exceed 4000 psi. Pozzolanic additives like fly ash should not exceed 20% of total cementitious value. This figure is calculated by dividing the amount of fly ash, by weight, by the total amount of fly ash + Portland cement, also by weight. The use of chloride accelerators in cold weather is discouraged. This type of accelerator causes too many salts to migrate to the surface, causing unsightly white stains. Non-chloride accelerators are recommended as an alternative.

Slide 21: Basic Placement and Finishing Guidelines for Optimum Performance of Chemical Densifiers

To achieve a strong and productive working surface, these guidelines are provided for placement and finishing. If possible, especially on large industrial floors, laser screeds should be used to strike off the concrete. These machines offer the best method for achieving levelness because they follow a straight beam of light. All bleed water should be gone before troweling begins. This will ensure that there is no void between the finished paste and the underlying substrate. When there is a void, the finished surface can delaminate in sheets, a phenomenon known as hollow floor. Riding troweling machines are also recommended. Because of their weight and down pressure, they can produce surfaces that are dense, compact, and smooth. Trowel for as long as possible without driving moisture from the surface. The concrete placement contractor should know when there is a danger of over-troweling. For highly flat and level floors, pan trowels should be used instead of steel troweling blades. Do not add water during finishing, as this undermines the strength of the wearing surface, as previously discussed.

Slide 22: Use of Chemical Densifiers with Other Concrete Technologies

Chemical densifiers can be used with a variety of other concrete technologies, including tilt-up construction, dry-shake floor hardeners, admixtures, steel fiber and fiber reinforcement, and pozzolans.

Slide 23: Tilt-Up Construction and Chemical Densifiers

Tilt-up construction is a growing method of erecting many different kinds of facilities. This technology allows the floors of the building to be used as the casting beds for the walls. To keep the walls from bonding to the floor, chemical bond breakers are used. The question often arises as to how chemical densifiers can be used in conjunction with bond breakers. This can actually be done in one of two ways. The chemical densifier may go down as a cure as soon as the troweling operation is complete. Forms are later placed, the bond breaker applied, and the wall panels lifted. The other option is to cure the slab with the bond breaker, place forms, and lift the wall panels. In this scenario, the bond breaker must be stripped off the floor surface before the chemical densifier is applied.

Slide 24: Dry Shake Floor Hardeners and Chemical Densifiers

Often, concrete floors are enhanced with a mixture of additional Portland cement, along with a pulverized aggregate such as trap rock, metallic filings, or quartz. Together, the Portland cement and the aggregate are referred to as a dry shake hardener. Typically, these products are floated and troweled into the surface of the concrete floor at about a pound and half per square foot, where they are activated by the mix water. This produces a hard, dense surface. This surface can be enhanced by treating it with a chemical densifier, which in effect, hardens the hardener. The chemical densifier also provides dustproofing, sealing, and a sheen. Floors treated with dry shake hardeners are normally harder than floors treated only with a chemical densifier. However, chemical densifiers certainly produce a surface that is hard enough for most applications. The use of the two products together has become popular in manufacturing facilities, especially in the automotive industry.

Slide 25: Concrete Admixtures and Chemical Densifiers

In general, chemical densifiers work well with concrete admixtures, whether they be accelerators, retarders, plasticizers, water reducers, or air entrainment. A possible exception is some water reducers which are hydrophobic, and can prevent the chemical densifier from penetrating. Compatibility assumes that all admixtures are added in the correct doses and as directed by the manufacturer.

Slide 26: Densifiers Used with Fiber and Steel Fiber Reinforcement

Chemical densifiers can also be used with polypropylene, nylon, or steel fiber reinforcement. These products are now often used to reinforce slabs on grade as an alternative to welded wire reinforcement. The main advantage is that these products, when added to the concrete during mixing, will provide reinforcement in three planes rather than just one. Chemical densifiers obviously do not react with these products, but with the cement paste that surrounds them near the surface.

Slide 27: Densifiers Used with Pozzolans

Chemical densifiers are also frequently used with pozzolans. These materials are used as cement substitutes in many concrete mix designs. They normally consist of fly ash from coal combustion, silica fume from electric furnaces used to produce silicon metal, or ground and granulated slag from blast furnaces. In general, their benefit is to increase the long-term strength of the concrete, but they also reduce the heat of hydration, improve impermeability, and decrease water demand. Most manufacturers of chemical densifiers recommend that their products be used only with concrete mixes in which the pozzolan content does not exceed 20% of total cementitious materials by weight. The total cementitious value is calculated by adding the weight of the cement to the weight of the pozzolan. That total is then divided into the weight of the pozzolan only.

Slide 28: Maintenance of Concrete Floors Treated with Chemical Densifiers

In order to perform optimally, concrete floors treated with a chemical densifier requires a program of good maintenance and regular housekeeping. All floors treated floors should receive a rigorous final cleaning before the facility opens. All residue from other trades should be thoroughly removed. Plaster should be scraped off the floor. Paint and oil should be removed with appropriate strippers or degreasers. The floor should be vigorously scrubbed with lots of down pressure, aggressive brushes or pads, a good high pH detergent, and plenty of water. Ongoing maintenance is much the same. Avoid acidic detergents, or cleaning agents that contain sulfates or hydroxides. Cleaning should be frequent, as it accelerates the sheen and speeds up the sealing process.

Slide 29: Types of Chemical Densifiers on the Market Today

Not all chemical densifiers are the same. There are basically three different tiers in this market sector, and there are performance differences even between products in the same tier. These divisions are made primarily because these three categories fall into three natural price points. At the low-end and inexpensive tier are the inexpensive silicate curing products. The mid-range products are the magnesium-zinc fluorosilicates. At the high end are enhanced silicates and siliconates.

Slide 30: Basic Facts About Inexpensive Silicate Curing Products

The silicate-based curing products are the least expensive and the poorest performing. They consist only of silicate and water, and contain no accelerators, catalysts, or wetting agents. Most manufacturers have one, in response to the market need for a quick interim cure that does not have to be stripped off later. They are lightly applied, usually at 300 to 400 square feet per gallon, and they are not flushed off. They require no labor other than spraying. If a slab is cured with an inexpensive silicate, a high-end sealer/densifier can be applied later, provided the floor surface is clean. These products do not provide permanent, long-term results, and they have no warranty.

Slide 31: Basic Facts About Magnesium or Zinc Fluorosilicates

The second tier is made up of products that are magnesium or zinc fluorosilicates or silicoflourides. These products require mixing at the job site. Each application requires a different

rate of dilution. They are not known to seal the concrete surface, but they do provide good hardening and dustproofing. They have a limited warranty, usually one year. Directions for these products contain safety and environmental precautions because of acid and heavy metal content.

Slide 32: Basic Facts About Enhanced Silicate or Siliconate Products

The third, or high-end market tier consists of enhanced silicate or siliconates. Their applied price is higher, ranging from 11 to 20 cents per square foot, depending on the size of the facility. These products quickly provide hardening and dustproofing benefits. Over time, the more they are used, the better the floors look. The sealing result, though delayed, is permanent. These products generally offer better warranties and superior performance. They do require regular cleaning to maintain their appearance.

Slide 33: Basic Facts About Enhanced Silicate or Siliconate Products

Some of the products in the high-end category are siliconates as opposed to silicates. At the molecular level there are significant differences between the two. Silicate molecules consist of four oxygen atoms bonded to a silicon atom. The four oxygen sites allow for the formation of three-dimensional crystals within the concrete. These crystals, which take on a pyramid, or tetrahedral configuration, are very stable and strong, based on a strictly inorganic reaction. Siliconates on the other hand have one carbon atom, and three oxygens bonded to a silicon atom. The carbon site, being organic, does not react. This allows siliconates to form only two-dimensional or sheet crystals within the concrete. The long-term results are therefore not the same.

Slide 34: Project Highlight: Chewy.com Fulfillment Center

In this distribution center in Phoenix, AZ, you can see the results that are typical of a high-end densifier. The floor has developed the characteristic sheen as discussed earlier from traffic and cleaning. Keep in mind that the same level and sheen cannot be achieved on floor finishes that are open and porous, like a float finish or a broom finish. This floor is also much harder than untreated concrete would be. It is resistant to abrasion, and has therefore, self-polished, rather than eroded with traffic. You can also observe that the floor is free from annoying concrete dust. The dusty material in concrete is calcium hydroxide, which on this floor, has been locked-up and converted to calcium silicate hydrates. This is a highly desirable property of chemical densifiers, especially in an industrial facility like this because it prevents dust from settling on racks and finished goods. This floor is also highly reflective which creates a more pleasing work environment and can also reduce lighting requirements.

Slide 35: Project Highlight: Menards Home Improvement Store

Here is another example of a floor treated with a chemical densifier. This is in a retail facility so overall presentation is important to the owner. As you can see, the floor is hard, dense, glossy and free of dust. All of which contribute to a pleasant shopping experience for the patrons of the store. In a facility like this, regular maintenance is very important. If dirt is allowed to accumulate it can begin to dull out the finish.

Slide 36: Project Highlight: Baltimore Law School

Hardened and chemically densified concrete has many other applications, like at this corridor inside the Baltimore Law School in Maryland. Designers of this facility were looking for a warm, inviting, and brightly lit interior space. The use of exposed concrete was part of this concept. They used a chemical densifier to ensure that the concrete would bear up under heavy foot traffic, reflect the lighting, and not dust. This illustrates the versatility of chemical densifiers, and illustrates that they are not limited to warehouses, manufacturing plants, or other industrial facilities.

Slide 37: Project Highlight: Coors

This is another example of how a hardened, densified, dust-free concrete floor allows for maximum productivity and lower maintenance costs. It is a beer distribution in the western United States, treated with a leading chemical densifier in 1978. In this particular warehouse, the owners used a system of slip-sheet palletization, meaning that the forklift blades slipped directly under a sheet of hard plastic that held the cases of beer. This meant that the blades had to scrape against the floor surface in order to lift and move the merchandise. The manager of the warehouse reported that before application of the chemical hardener, the blades used to cause the floor to wear. After treatment, he reported that the floor had actually begun to wear out the blades. The manager also reported that the floor dust-free and easy to clean.

Slide 38: Project Highlight: Fairfax County Maintenance Facility

In this county maintenance facility in Virginia, the floors have to withstand heavy loads. The surface of the concrete was treated with a chemical hardener and densifier during construction. As you can see, the floors have developed the characteristic sheen that comes from chemical hardening. Trucks and other vehicles bring in a lot of dirt and grit from outside, so this floor is regularly cleaned and scrubbed. This maintenance preserves the gloss on the floor. If this were not done, dirt would accumulate and eventually dull out the finish. Notice the yellow safety lines on the floor. Paint can still adhere to densified concrete. It is necessary, however, to follow the installation guidelines of the paint manufacturer.

Slide 39: Project Highlight: Boeing

Chemical densifiers have a history of performance in large manufacturing facilities. Boeing has very little tolerance for dust and for high maintenance costs. These exposed concrete floors were treated with a chemical densifier when this hangar was built. Even after years of use, the floor is meeting the customer's expectations. Is it free of dust, easy to clean, and resistant to abrasion.

Slide 40: Project Highlight: Parking Structure

Chemical densifiers can also be used with good effect on parking structures, like this one in Monterrey, Mexico. Parking structures are often not maintained as they should be, yet this floor is still performing very well under heavy traffic after many years. It is permanently free of dust and resistant to abrasion. If it had not been treated, erosion and dusting would be visible in the high-traffic areas. Since it was treated, those same high-traffic areas have self-polished

because they are much harder.

Slide 41: Project Highlight: Phoenix Convention Center

This convention center in Phoenix, Arizona was treated many years ago with a liquid hardener. Despite heavy foot and forklift traffic, the floor is still a hard, dense working surface. This is yet another example of the kind of facilities where chemical densifiers can be used. Exhibit halls, convention centers, and even sports stadiums are all large markets for this type of treatment. Any exposed concrete floor is an excellent candidate for these products.

Slide 42: Project Highlight: North Point Toyota

In this Toyota dealership in Little Rock Arkansas, the floors were treated with a liquid hardener at time of placement. The floor has since developed a marble-like sheen from frequent cleaning and heavy foot traffic. The surface is hard, dense, and free of dust. Many areas of car dealerships have been treated, including repair bays, pull-through lanes, and even showrooms where high-end models are displayed. Car dealers like floor that contribute to a clean and neat appearance for their customers.

Slide 43: Project Highlight: DHL Hangar

Chemical densifiers have also come into their in markets outside the United States. This DHL facility in Leipzig Germany is a good example. DHL is a large international air transport company with headquarters in Bonn, Germany. They operate 250 aircraft servicing 120,000 destinations worldwide. The aircraft need to be maintained in maintenance hangars like this one, which was treated with a chemical densifier. In this busy environment, they don't have a lot of time to worry about the performance of their floors. A chemical densifier was a good option, better than coatings that scratch, delaminate, or peel.

Slide 44: Project Highlight: Metro Store

One other international example is this Metro store in Vietnam. It was treated during floor placement. The aisles have developed an attractive and permanent sheen from cleaning and traffic. Metro is a large international retailer that sees heavy foot traffic in their stores. They have a good maintenance program that keeps the floors free of accumulated dirt that could dull the finish. Another challenge in a store like this shopping carts with hard rubber wheels. This floor shows no visible signs of erosion from shopping cart traffic in the aisles. Chemically densified concrete is still concrete, so in a facility like this it is a good idea to clean up spills from things like wine or vinegar that contain food-grade acids. They can still etch the surface if they are not neutralized right away. Some manufacturers of densifiers offer supplemental products that can buffer the concrete from the effects of acid.

Slide 45: Questions to Ask When Considering a Chemical Densifier

When considering the densification approach to sealing and protecting concrete floors, it is a good idea to ask the right questions about which product will deliver the best results. These questions are probably the most basic ones. What kind of track record and reputation does the product have? Are there reliable and trustworthy customers who use it regularly? What kind of warranty is offered by the manufacturer? Is the warranty in writing, and it is performance-

based? Many times the warranty says nothing more than the material in the drum is good. There is no mention of performance. Is the performance of the product quantified by independent testing? What kind of field support is offered by the manufacturer? Does the manufacturer specialize in chemical densification, or is it just a sideline? How long has the manufacturer been in business? How long has the product been around? Can the manufacturer provide project references? Does the product chemically densify the surface, or does it just plug the pores with solids. The best results are achieved through chemical densification. The issue is not how many solids are in a product, but how well that product can chemically densify the surface, creating permanent results. How old are the floors still in service? Are there floors in service that validate the duration of the warranty?

Slide 46: Summary and Conclusion

In summary, the results of chemical densifiers, particularly those at the high end of the market, can provide significant enhancements to concrete floors. The inorganic chemical densification produces permanent results. There is no coating or membrane to scratch, chip, or peel. If there is a problem with the concrete such as carbonation or poor water to cement ratio, chemical densifiers can often help, but not at standard coverage rates. In such cases, more material needs to be used. The chemical densifiers have proven themselves to be a viable alternative to coatings, and they have gained momentum among architects and other specifiers. They are spray applied, then allowed to soak in. The residue is then flushed off with water, leaving only the material that has penetrated. Hardening and dustproofing are fairly immediate. Seal develops with time, and can be accelerated by the water used to clean the floor. Sheen develops over time as well, but is the result of the polishing action of traffic and cleaning. Chemical densifiers can be used successfully with other concrete technologies. Not all densifiers are the same. Care should be taken to evaluate the products based on their track record, warranty, chemistry, field support, and reputation.