

## ***Frequently Asked Questions (FAQ's) about Concrete Driveways***

### **What type of concrete mix should be used?**

Your local ready-mix producer and your contractor will assist you in ensuring the proper concrete mix is pre-ordered. The American Concrete Institute (ACI) code 318 recommends a minimum 4500 psi mix with maximum 0.45 water to cementitious ratio (w/cm) that is air-entrained to resist the effects of freezing and thawing and exposure to de-icing chemicals. If a higher slump than normally produced is required, it may be obtained with the use of a water reducer, superplasticizer, and/or mineral admixture and this should be communicated with the ready-mix supplier before ordering

### **What does portland cement mean?**

Portland cement is not a brand name, but the generic term for one type of cement used in virtually all concrete and is defined by American Society for Testing and Materials (ASTM) C 150. There are cementitious materials other than portland cement that are used within concrete that the American Concrete Institute (ACI) and Wisconsin Department of Transportation recognize.

### **What does cementitious mean?**

The term cementitious describes the materials used to bond the aggregates in concrete together. This includes portland cement (ASTM C150), blended cement (ASTM C595), hydraulic cement (ASTM C1157), fly ash (ASTM C618), slag cement (ASTM C989), silica fume (ASTM C1240) and other supplementary cementitious materials recognized by ASTM. The sum of all of the cements and supplementary cementitious materials in a mix is commonly referred to as cementitious material.

### **What are supplementary cementitious materials?**

Supplementary cementitious materials (sometimes called mineral admixtures) positively contribute to the properties of hardened concrete through hydraulic or pozzolanic activity. Commonly, this includes materials such as fly ash or ground granulated blast furnace slag.

### **What is a six-bag mix?**

ASTM C94 refers to a bag of portland cement weighing 94 lbs. Portland cement is defined under ASTM C 150. Therefore, a six-bag mix refers to (6 x 94) 564 lbs of portland cement meeting the requirements of ASTM C 150. Over the years the cement and concrete industry have made several advancements in the area of supplementary cementitious material that replace a portion of portland cement in the mix to improve both the plastic and hardened properties of concrete. Mixes that use supplementary cementitious materials are typically performance-based mixes and should not be referred to as bag or sack mixes. It is very important for the producer and purchaser to communicate that the intended use of the concrete is for a driveway and discuss the desired properties of the concrete both plastic and hardened to ensure the proper mix is supplied. It is important to understand that a "6 bag"

mix may not meet the 4500 psi and 0.45 w/c (w/cm) ratio requirement without the use of a water reducer, superplasticizer, and/or mineral admixture.

### **What is water/cementitious (w/cm) ratio?**

Water/cementitious ratio is expressed by the pounds of free water (that not absorbed by the aggregate) in the mix divided into the pounds of cementitious materials, as described above, in the mix. This is commonly used as an indicator of concrete durability and strength. It is recommended that a maximum 0.45 w/cm be use for exterior concrete exposed to wet freeze/thaw conditions.

### **What is air-entrainment?**

Air-entrainment is typically a chemical admixture added to all exterior concrete subjected to a freeze/thaw environment and/or deicer chemicals. Air entrainment creates small, evenly spaced bubbles in the concrete which serve as relief vessels to resist the internal tension forces due to the freezing action of water. It is recommended that exterior concrete in Wisconsin, which is regularly exposed to wet freeze/thaw conditions, deicers, or other aggressive agents, have a target air content of 6% +/- 1.5% by volume.

### **What is pounds per square inch (psi)?**

Pounds per square inch is a unit measuring a force per unit area. The compressive strength of concrete is typically measured by psi. It is recommended that exterior concrete in Wisconsin have a minimum compressive strength of 4500 psi.

### **Should I use "Low Chert" stone?**

Chert is a light porous stone found in many aggregates and can cause the occurrence of some aesthetic, superficial issues. Aggregate used for concrete should meet ASTM C33, which specifies that aggregate for concrete should have no more than 5% deleterious materials (including chert) within the aggregate. The use of "Low Chert" stone is not required for driveway construction. However, if you want to minimize the potential of chert pop outs in your concrete, you should explore what aggregates are available in your market. In addition, cleaning and resealing your concrete every few years reduces the risk of moisture penetration into soft porous aggregates such as chert thereby minimizing pop outs. Membrane forming sealers will typically have a life of 2-3 years. Penetrating sealers with typically have a life of 8-10 years. It should be noted that popouts are generally aesthetic issues and do not affect the structural capability of the driveway.

### **How thick should a concrete driveway be?**

A minimum of 4 inches is recommended. Keep in mind that the 2 x 4's often used to form driveways are only 3 ½ inches wide, so the ground inside the 2 x 4 forming needs to be removed at least ½ inch below the bottom of the form. Thickness is the major factor (even more than the strength of the concrete) in determining the driveway's structural capacity. In other words, thickening your concrete slab carries more load. Increasing your driveway's thickness from 4 inches to 5 inches will add 20% to your concrete cost, but the additional inch of concrete will add almost 50% to the load-carrying capacity of your driveway. If the driveway

will be used by both cars and light trucks or SUVs, then a 4" thickness should be adequate. If garbage trucks or other heavy vehicles will be traveling on the slab 5 or more inches may be necessary.

### **What kind of base and sub grade preparation needs to be done?**

Base is the material directly underneath the concrete. This material should be compacted gravel or crushed stone that allows drainage. 6-12" of compacted gravel or crushed stone will not only provide better drainage but provide more load-carrying capacity for your driveway. The sub grade is the material below your base. Make sure all the organic material and soft pockets of sub grade are removed before placing base materials. Clay or expansive soils are not recommended and may need to be removed and replaced with fill material to prevent driveway movement. Any fill material used on the subgrade should be uniformly compacted and should not exceed 8" for earth or 24" for sand. The base and sub grade should be uniform in firmness, grade, and dampness. The driveway should be sloped away from the home for proper drainage, with a minimum slope of ¼" per foot.

### **Should there be reinforcement in my driveway?**

Steel reinforcement is optional but is often used to contain cracks. Types of reinforcement are steel deformed bars or wire mesh, and these should be supported to ensure that it is installed in the upper 1/3 of the slab. Fiber reinforcement may also be used as an alternate system. There are many types of fibers offering a range of benefits from plastic shrinkage cracking control to crack containment. Make sure you discuss this with your contractor or ready-mix supplier to understand what fiber reinforcement will do for your project.

### **What should the surface texture be on the driveway?**

A broom finish for exterior concrete is ideal because it provides a slip resistant surface. Finishing techniques to provide a smooth finish on exterior concrete can greatly decrease surface durability. The surface may also have an exposed aggregate look or be colored and stamped - [www.wrmca.com](http://www.wrmca.com) has additional information on colored and stamped concrete.

### **What provision can be made to avoid cracks?**

There are many reasons why concrete cracks, some of which are inherent and unavoidable, and this rarely affect structural integrity. The majority of random concrete cracking usually occur due to improper design and construction practices, such as: omission of isolation & control joints, improper jointing practices, improper sub grade preparation, the use of high slump (very wet) concrete or addition of water on the job, improper finishing and inadequate or no curing. Concrete ""shrinks"" slightly as it dries, therefore, proper spacing of joints is most important.

### **Should there be joints in a concrete driveway?**

Install control joints at a spacing of no more than 10' x 10' and to a depth of no less than ¼ depth of the driveway. Spacing joints at wider intervals invites random cracking. While such cracks are generally not a structural problem and will not reduce the service life of the driveway, they are unsightly. Also avoid joint patterns that produce rectangular or triangular sections. Lay out your joints to form square sections. If in doubt, make the sections smaller, not

larger. Ask your contractor to provide a jointing plan as part of his written proposal. Timing of tooling the joints or sawing the joints is very critical and should be as soon as possible to prevent un-wanted cracks from developing.

### **Why must concrete driveways be cured?**

Curing of concrete is a required step of the construction process and should begin as soon as the concrete is finished and continue for at least 7 days. Curing is essential to allow the concrete to obtain its full strength and durability potential. Unfortunately, it is also one of the most neglected steps. In extreme cases, failure to cure concrete can result in reductions of “surface” strength (and durability) by 50% or more. Curing or keeping the surface moist to assure greatest hydration of cement and highest potential strength is easily done by applying a membrane forming curing compound, or other readily available products and procedures. Curing compounds should be applied after the final finishing operation to increase the concrete’s resistance to the effects of weather, and to decrease the occurrence of surface defects. If the owner wants the driveway to be sealed with a membrane forming sealer, he should request that a compatible membrane forming curing compound is applied in accordance with ASTM C1315, which typically requires an additional application some time after the curing process is complete.

### **Is it necessary to seal a concrete driveway?**

Periodically sealing a concrete driveway will protect it from water or chemical absorption. This will make it much easier to clean accidental spills and will also help prevent the occurrence of surface defects. The material compatibility of the curing compound and sealer is imperative. Surface preparation prior to application of the sealer must follow the manufacturers’ recommendations for sealing concrete. The differences between penetrating vs. membrane forming sealers must be taken into account by the owner. Some sealers, primarily designed for industrial applications, darken or yellow the concrete. Ask if your sealer discolors the concrete and follow the manufacturer’s directions. Your local ready-mixed producer is an outstanding resource for sealers and further information.

### **How should I care for the concrete in the winter? Can I salt my driveway?**

Prevent snow and ice from accumulating on the concrete especially during the first winter. There many de-icing materials referred to as “salt” that are used to melt ice during freezing temperatures. Freezing and thawing with moisture and de-icing material present on your concrete produces one of the harshest conditions for concrete surfaces. Therefore, it is highly recommended that you minimize the amount of any de-icing material used, especially the first winter. Sand may be used anytime for skid resistance during the first winter and longer. NEVER use de-icers containing fertilizer ingredients such as ammonium sulfate or ammonium nitrate and avoid the use of calcium chloride and magnesium chloride products. Sodium chloride (NaCl), though not recommended, is the least aggressive de-icing material to use. The chemical constituents of the de-icer material are commonly found on the bag or container. NEVER use de-icing material that is described by the manufacturer to cause potential damage to concrete. Read the bag carefully!

**How important is the role of the concrete contractor?**

The concrete contractor has a major role in the outcome of the project. The contractor is the installer of the concrete and is responsible for the placing, finishing, curing, and sealing of the driveway, all of which affect the final project quality. However, if it is not installed properly, the result may be unnecessary surface defects or lessened durability.

**How should one select a concrete driveway contractor?**

A good place to start is to call your local WRMCA ready mixed producer or go to [www.wrmca.com](http://www.wrmca.com) for a list of members in your area. Once you come up with a list of contractors, be sure to ask them some important questions.

Find out how long they have been in business and ask for references or ACI Certifications. The American Concrete Institute & the WRMCA offers educational programs and certifications that contractors should attend. These programs educate contractors on the installation of concrete with regard to ACI codes and recommendations. If a contractor has the correct knowledge this will help assure you that your concrete project will be professionally installed. Ask for the location of work they have recently completed, as well as additional projects completed 3-5 years ago. Check out these projects and determine whether or not the workmanship exhibited in these projects is what you expect. Note whether or not the quality has endured in the older projects. Ask if the contractors offer any type of warranty on their work. When obtaining bids on the project remember that the lowest price is often not the best quality.

Make sure that the contractor that you chose to work with understands your expectations and that your expectations are reasonable. You will then be better served by the entire construction team.