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At Metromont Materials, our goal is to provide a high quality product with years of experience to back it up. With our various locations in North and South Carolina and a fleet of over 300 trucks, we can meet your concrete needs in regards to location and delivery.

In a continuous commitment to providing a product of high quality and integrity, our Quality Control Department is always working to improve our ready-mix product to meet the highest of standards.

In the following pages, please review the additional information about ready mix concrete. We look forward to working with you and your company on any of your projects. With Metromont Materials, no project is too small or too large for us to be of service to you, our customer. Whether that customer is a new company to the area or one of our valued long time accounts.



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Ready mixed concrete, by far the most common form of concrete, accounts for nearly three-fourths of all concrete. Ready mixed refers to concrete that is batched for delivery from a central plant instead of being mixed on the job site. Each batch of ready mixed concrete is tailor-made according to the specifics of the contractor and is delivered to the contractor in a plastic condition, usually in the cylindrical trucks often known as "cement mixers."

As early as 1909, concrete was delivered by a horse-drawn mixer that used paddles turned by the cart's wheels to mix concrete en route to the jobsite. In 1916, Stephen Stepanian of Columbus, Ohio, developed a self-discharging motorized transit mixer that was the predecessor of the modern ready-mixed concrete truck. Development of improved ready mixed trucks was hindered by the poor quality of motor trucks in the 1920s. During the 1940s, the availability of heavier trucks and better engines allowed mixing drum capacities to increase, which in turn allowed ready mixed concrete producers to meet the high demand for concrete that developed as a result of World War II.

IDEAL FOR MANY JOBS

Ready mixed concrete is particularly advantageous when small quantities of concrete or intermittent placing of concrete are required. Ready mixed concrete is also ideal for large jobs where space is limited and there is little room for a mixing plant and aggregate stockpiles. There are three principal categories of ready mixed concrete:

- Central-mixed concrete is completely mixed at the plant then transported in a truck-mixer or agitator truck. Freshly mixed concrete may be transported in an open dump truck if the jobsite is near the plant. Slight agitation of the concrete during transit prevents segregation of the materials and reduces the amount of slump loss.
- Transit-mixed (also known as truck-mixed) concrete, materials are batched at a central plant and are completely mixed in the truck in transit. Frequently, the concrete is partially mixed in transit and mixing is completed at the jobsite. Transit-mixing keeps the water separate from the cement and aggregates and allows the concrete to be mixed immediately before placement at the construction site. This method avoids the problems of premature hardening and slump loss that result from potential delays in transportation or placement of central-mixed concrete. Additionally, transit-mixing allows concrete to be hauled to construction sites further away from the plant. A disadvantage to transit-mixed concrete, however, is that the truck capacity is smaller than that of the same truck containing central-mixed concrete.
- Shrink-mixed concrete is used to increase the truck's load capacity and retain the advantages of transit-mixed concrete. In shrink-mixed concrete, concrete is partially mixed at the plant to reduce or shrink the volume of the mixture and mixing is completed in transit or at the jobsite.

Ready mixed concrete is often remixed once it arrives at the jobsite to ensure that the proper slump is obtained. However, concrete that has been remixed tends to set more rapidly than concrete mixed only once. Materials, such as water and some varieties of admixtures, are often added to the concrete at the jobsite after it has been batched to ensure that the specified properties are attained before placement.

Information obtained from the Portland Cement Association.

AIR-ENTRAINED CONCRETE

One of the greatest advances in concrete technology was the development of air-entrained concrete in the late 1930s. Today, air entrainment is recommended for nearly all concretes, principally to improve resistance to freezing when exposed to water and deicing chemicals. However, there are other important benefits of entrained air in both freshly mixed and hardened concrete. Air-entrained concrete contains billions of microscopic air cells. These relieve internal pressure on the concrete by providing tiny

chambers for the expansion of water when it freezes. Air-entrained concrete is produced through the use of air-entraining portland cement, or by introducing air-entraining admixtures under careful engineering supervision as the concrete is mixed on the job. The amount of entrained air is usually between 5 percent and 8 percent of the volume of the concrete, but may be varied as required by special conditions. The use of air-entraining agents results in concrete that is highly resistant to severe frost action and cycles of wetting and drying or freezing and thawing and has a high degree of workability and durability.

Information obtained from the Portland Cement Association

PLACING AND FINISHING CONCRETE

Mixing, transporting, and handling of concrete should be carefully coordinated with placing and finishing operations. Concrete should not be deposited more rapidly than it can be spread, struck off, consolidated, and bull floated. Concrete should be deposited continuously as near as possible to its final position. In slab construction, placing should be started along the perimeter at one end of the work with each batch placed against previously dispatched concrete. Concrete should not be dumped in separate piles and then leveled and worked together; nor should the concrete be deposited in large piles and moved horizontally into final position.

CONSOLIDATION

In some types of construction, the concrete is placed in forms, then consolidated. Consolidation compacts fresh concrete to mold it within the forms and around embedded items and reinforcement and to eliminate stone pockets, honeycomb, and entrapped air. It should not remove significant amounts of intentionally entrained air. Vibration, either internal or external, is the most widely used method for consolidating concrete. When concrete is vibrated, the internal friction between the aggregate particles is temporarily destroyed and the concrete behaves like a liquid; it settles in the forms under the action of gravity and the large entrapped air voids rise more easily to the surface. Internal friction is reestablished as soon as vibration stops.

FINISHING

Concrete that will be visible, such as slabs like driveways, highways, or patios, often needs finishing. Concrete slabs can be finished in many ways, depending on the intended service use. Options include various colors and textures, such as exposed aggregate or a patterned-stamped surface. Some surfaces may require only strikeoff and screeding to proper contour and elevation, while for other surfaces a broomed, floated, or troweled finish may be specified. In slab construction, screeding or strikeoff is the process of cutting off excess concrete to bring the top surface of the slab to proper grade. A straight edge is moved across the concrete with a sawing motion and advanced forward a short distance with each movement.

Bullfloating eliminates high and low spots and embeds large aggregate particles immediately after strikeoff. This looks like a long-handled straight edge pulled across the concrete. Jointing is required to eliminate unsightly random cracks. Contraction joints are made with a hand groover or by inserting strips of plastic, wood, metal, or preformed joint material into the unhardened concrete. Sawcut joints can be made after the concrete is sufficiently hard or strong enough to prevent raveling. After the concrete has been jointed, it should be floated with a wood or metal hand float or with a finishing machine using float blades. This embeds aggregate particles just beneath the surface; removes slight imperfections, humps, and voids; and compacts the mortar at the surface in preparation for additional finishing operations. Where a smooth, hard, dense surface is desired, floating should be followed by steel troweling. Troweling should not be done on a surface that has not been floated; troweling after only bullfloating is not an adequate finish procedure. A slip-resistant surface can be produced by brooming before the concrete has thoroughly hardened, but it should be sufficiently hard to retain the scoring impression.

Information obtained from the Portland Cement Association.

CURING CONCRETE

After concrete is placed, a satisfactory moisture content and temperature (between 50°F and 75°F) must be maintained, a process called curing. Adequate curing is vital to quality concrete. Curing has a strong influence on the properties of hardened concrete such as durability, strength, watertightness, abrasion resistance, volume stability, and resistance to freezing and thawing and deicer salts. Exposed slab surfaces are especially sensitive to curing. Surface strength development can be reduced significantly when curing is defective. Curing the concrete aids the chemical reaction called hydration. Most freshly mixed concrete contains considerably more water than is required for complete hydration of the cement; however, any appreciable loss of water by evaporation or otherwise will delay or prevent hydration. If temperatures are favorable, hydration is relatively rapid the first few days after concrete is placed; retaining water during this period is important. Good curing means evaporation should be prevented or reduced.

Information obtained from the Portland Cement Association.

CONCRETE BASICS

In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of portland cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock-like mass known as concrete. Within this process lies the key to a remarkable trait of concrete: it's plastic and malleable when newly mixed, strong and durable when hardened. These qualities explain why one material, concrete, can build skyscrapers, bridges, sidewalks and superhighways, houses and dams. The key to achieving a strong, durable concrete rests in the careful proportioning and mixing of the ingredients. A concrete mixture that does not have enough paste to fill all the voids between the aggregates will be difficult to place and will produce rough, honeycombed surfaces and porous concrete. A mixture with an excess of cement paste will be easy to place and will produce a smooth surface; however, the resulting concrete is likely to shrink more and be uneconomical. A properly designed concrete mixture will possess the desired workability for the fresh concrete and the required durability and strength for the hardened concrete. Typically, a mix is about 10 to 15 percent cement, 60 to 75 percent aggregate and 15 to 20 percent water. Entrained air in many concrete mixes may also take up another 5 to 8 percent. Portland cement's chemistry comes to life in the presence of water. Cement and water form a paste that coats each particle of stone and sand. Through a chemical reaction called hydration, the cement paste hardens and gains strength. The character of the concrete is determined by quality of the paste. The strength of the paste, in turn, depends on the ratio of water to cement. The water-cement ratio is the weight of the mixing water divided by the weight of the cement. High-quality concrete is produced by lowering the water-cement ratio as much as possible without sacrificing the workability of fresh concrete. Generally, using less water produces a higher quality concrete provided the concrete is properly placed, consolidated, and cured.

OTHER INGREDIENTS

Although most drinking water is suitable for use in concrete, aggregates are chosen carefully. Aggregates comprise 60 to 75 percent of the total volume of concrete. The type and size of the aggregate mixture depends on the thickness and purpose of the final concrete product. Almost any natural water that is drinkable and has no pronounced taste or odor may be used as mixing water for concrete. However, some waters that are not fit for drinking may be suitable for concrete. Excessive impurities in mixing water not only may affect setting time and concrete strength, but also may cause efflorescence, staining, corrosion of reinforcement, volume instability, and reduced durability. Specifications usually set limits on chlorides, sulfates, alkalis, and solids in mixing water unless tests can be performed to determine the effect the impurity has on various properties. Relatively thin building sections call for small coarse aggregate, though aggregates up to six inches (150 mm) in diameter have been used in large dams. A continuous gradation of particle sizes is desirable for efficient use of the paste. In addition, aggregates should be clean and free from any matter that might affect the quality of the concrete.

HYDRATION BEGINS

Soon after the aggregates, water, and the cement are combined, the mixture starts to harden. All portland cements are hydraulic cements that set and harden through a chemical reaction with water. During this reaction, called hydration, a node forms on the surface of each cement particle. The node grows and expands until it links up with nodes from other cement particles or adheres to adjacent aggregates. The building up process results in progressive stiffening, hardening, and strength development. Once the concrete is thoroughly mixed and workable it should be placed in forms before the mixture becomes too stiff. During placement, the concrete is consolidated to compact it within the forms and to eliminate potential flaws, such as honeycombs and air pockets. For slabs, concrete is left to stand until the surface moisture film disappears. After the film disappears from the surface, a wood or metal handfloat is used to smooth off the concrete. Floating produces a relatively even, but slightly rough, texture that has good slip resistance and is frequently used as a final finish for exterior slabs. If a smooth, hard, dense surface is required, floating is followed by steel troweling. Curing begins after the exposed surfaces of the concrete have hardened sufficiently to resist marring. Curing ensures the continued hydration of the cement and the strength gain of the concrete. Concrete surfaces are cured by sprinkling with water fog, or by using moisture-retaining fabrics such as burlap or cotton mats. Other curing methods prevent evaporation of the water by sealing the surface with plastic or special sprays (curing compounds). Special techniques are used for curing concrete during extremely cold or hot weather to protect the concrete. The longer the concrete is kept moist, the stronger and more durable it will become. The rate of hardening depends upon the composition and fineness of the cement, the mix proportions, and the moisture and temperature conditions. Most of the hydration and strength gain take place within the first month of concrete's life cycle, but hydration continues at a slower rate for many years. Concrete continues to get stronger as it gets older.

THE FORMS OF CONCRETE

Concrete is produced in four basic forms, each with unique applications and properties. Ready mixed concrete, by far the most common form, accounts for nearly three-fourths of all concrete. It's batched at local plants for delivery in the familiar trucks with revolving drums. Precast concrete products are cast in a factory setting. These products benefit from tight quality control achievable at a production plant. Precast products range from concrete bricks and paving stones to bridge girders, structural components, and panels for cladding. Concrete masonry, another type of manufactured concrete, may be best known for its conventional 8 x 8 x 16-inch block. Today's masonry units can be molded into a wealth of shapes, configurations, colors, and textures to serve an infinite spectrum of building applications and architectural needs. Cement-based materials represent products that defy the label of "concrete," yet share many of its qualities. Conventional materials in this category include mortar, grout, and terrazzo. Soil-cement and roller-compacted concrete-"cousins" of concrete-are used for pavements and dams. Other products in this category include flowable fill and cement-treated bases. A new generation of advanced products incorporates fibers and special aggregate to create roofing tiles, shake shingles, lap siding, and countertops. And an emerging market is the use of cement to treat and stabilize waste.

Information obtained from the Portland Cement Association.