

Construction Materials Term Project

Topic: Portland Cement Concrete

By:

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split tension)**

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/ penetration resistance test)**

Introduction

As far as man-made building material use goes, only Portland cement concrete can compete with its widespread use. One cannot stress the relevance of concrete to our everyday life. Buildings, bridges, tunnels and dams are among examples of constructions where it is employed. Many admixtures may be added to the combination of portland cement and aggregates to make it more durable. While portland cement is most often employed in the production of portland cement concrete, additional applications include soil stabilization as well as aggregate bases for roadway building. Different cements have resulted in a wide variety of concrete kinds. However, since portland cement concrete is so widely used, it is presumed to always refer to portland cement concrete when the word concrete is used. The limestone cliffs of England's Isle of Portland inspired Joseph Aspdin to patent Portland cement in 1824.

In order to manufacture concrete using Portland cement, all you need to do is mix it with water. Portland cement's physical and chemical qualities and manufacture should be familiar to those in the field of materials engineering who are involved in the selection, specification, or quality control of such projects. The quality assurance of Portland cement concrete as well as the quantities of the components used in it are directly handled by civil and construction engineers. The chemical composition of Portland cement, hydration as well as formation of the nanostructures, admixtures, and aggregate qualities all have a role in the final concrete's quality and strength. In addition to the placing, consolidation, and curing, the quality is greatly influenced. The processes used to mix; transport, place, and cure concrete in the open have a significant impact on the long-term performance of a concrete construction. An "excellent" concrete may in reality have the same elements as a "poor" concrete.

Engineers and professionals who handle concrete during construction may make a big impact, though. Concrete is now more widely applicable than it was even a few decades ago, thanks to technological advancements in the concrete industry. In addition to ordinary concrete, civil as well as construction professionals should be aware of lightweight concrete, high-strength concrete, polymeric concrete, fibre-reinforced concrete, roller-compacted concrete, and other alternatives to conventional concrete. Engineers need to thoroughly research these alternatives to traditional concrete before deciding whether or not to use them. Among the topics covered in this chapter are the fundamentals of ordinary Portland cement concrete and its mixing and handling, as well as curing and testing. Alternatives to standard

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concrete have also been created, increasing the number of uses and enhancing the performance of the material.

The American Society of Testing & Materials, sometimes known simply as ASTM, is recognized as one of the most influential organizations in the realm of product development and certification. The American Society for Testing and Materials (ASTM) is a reputable organization that is based in the United States and enjoys international recognition. Its standards include best practices for determining whether one material grade as well as product are deserving of investment and can be utilized in typical applications. The American Society for Testing and Materials (ASTM) has earned the reputation of being a world leader in the delivery and creation of optional consensus standards. More than 12 thousand of the standards that have been issued by ASTM are now being used all over the globe to increase product quality, boost market commerce and access, improve health and safety, and let

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bigger, it indicates that the concrete surface is harder, which in turn indicates that the strength is stronger. Graphs that were generated by the manufacturer to link rebound to strength are often included in the package that the device arrives in. In addition to that, the test may be used to examine the degree to which the concrete surface is uniform.

The ASTM C805 standard ensures that the test may be carried out quickly and easily. In order to carry out the test, the hammer has to be positioned such that it is perpendicular to a smooth and spotless concrete surface. In certain circumstances, it could be difficult to fulfil the requirements of this criterion.



Figure 4: Rebound hammer test

Penetration Resistance Test

ASTM C803 is the standard that governs the penetration resistance testing, which is also often referred to as the Windsor Probe test. The tool resembles a pistol and fires probes into the surface of the concrete so that the strength of the concrete may be determined. The degree to which the probe is able to penetrate into the concrete has a relationship that is inversely

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proportional to the concrete's strength. Due to the fact that it punches holes into the concrete surface, the test is considered to be practically non-

Maturity Test

The amount of cement hydration is what determines the maturity of a cementitious material, and this degree varies with both the passing of time and the rising or falling of temperature. Because of this, it is generally accepted that the level of a concrete mixture's strength is directly proportional to its degree of aging. In order to offer a rough estimate of the strength of concrete, maturity monitors have been created. These meters do this by tracking the temperature of the concrete over time. This testing (ASTM C1074) is carried out on newly placed concrete, and it is maintained over the course of many days. Each every batch of concrete requires that the maturity meter be recalibrated.



Figure 6: Concrete maturity monitor

Significance of ASTM Testing

The major purposes of the American Society for Testing and Materials are also the promotion of research on the effect that the physical and chemical properties of materials have on the end uses of those materials, the establishment of processes by which substantial characteristics can be evaluated with adequate precision and accuracy, and the setting of restricting criteria that define the appropriateness of materials for specific uses. Even while these goals are straightforward to understand in theory, it is almost never feasible to put them into practice exactly as intended due to the numerous different factors involved. For instance, there is often neither the data nor the theory necessary to establish a general link between the performance of a property and that of the substance in its final application. In most cases, proper testing procedures have not been created, or the expense of personnel or facilities, or the amount of time necessary for testing, may make it impossible to apply such procedures to the process of selecting and controlling the materials. As a consequence of this, the majority of the methods of testing that are used for the evaluation and control of materials are compromises.

This is due to the fact that these methods might not measure accurately and uniquely the properties that are essential to the adequate properties of the material. In most cases, the practical tests only provide a general reflection of the properties of the material. In addition, the test may only be applicable at all under a specific set of conditions or to only a specific type of material from among the components that can be regarded to be alternatives when choosing materials for specific uses. In addition, the specified limits are typically made on the basis of testing data which may not be broadly applicable or on the basis of past experience

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permission for ASTM certification. These tests must ensure that the product is dependable when subjected to high pressure as well as stress calculation-tested scenarios. Customers are provided with the sense of pleasure that comes from being aware that their goods perform admirably in comparison to the benchmarks that are set by their industry.

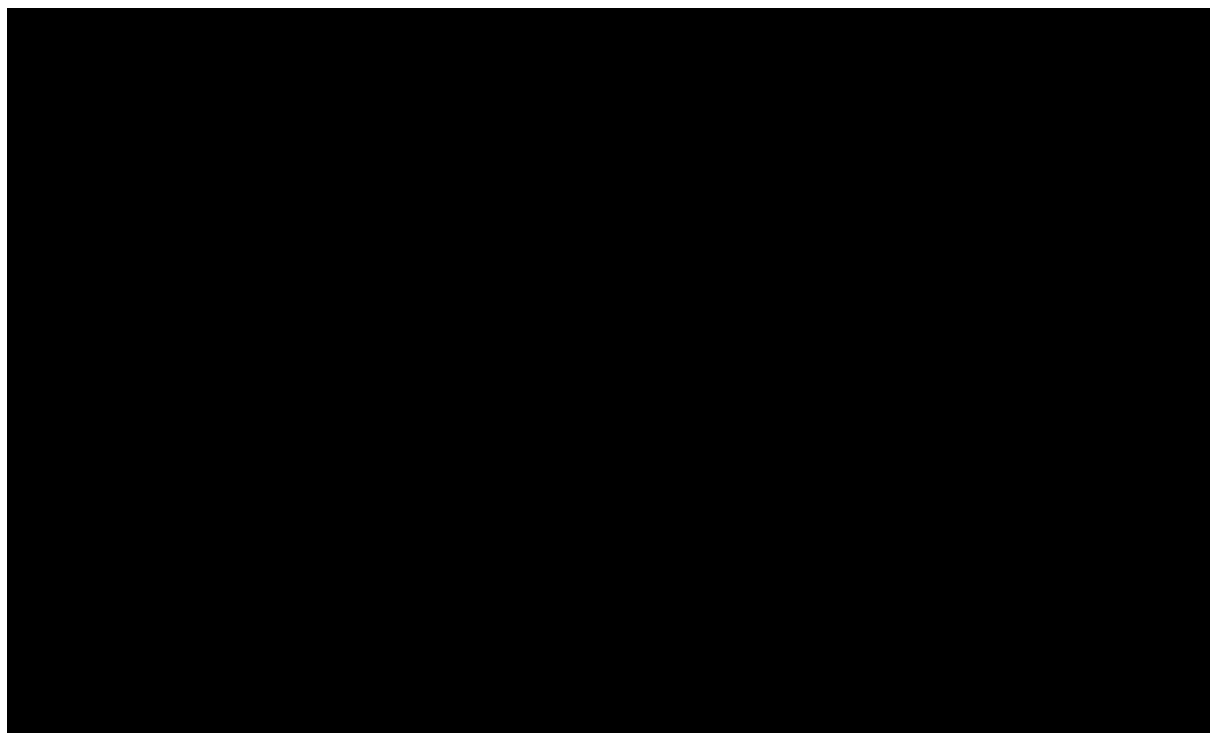
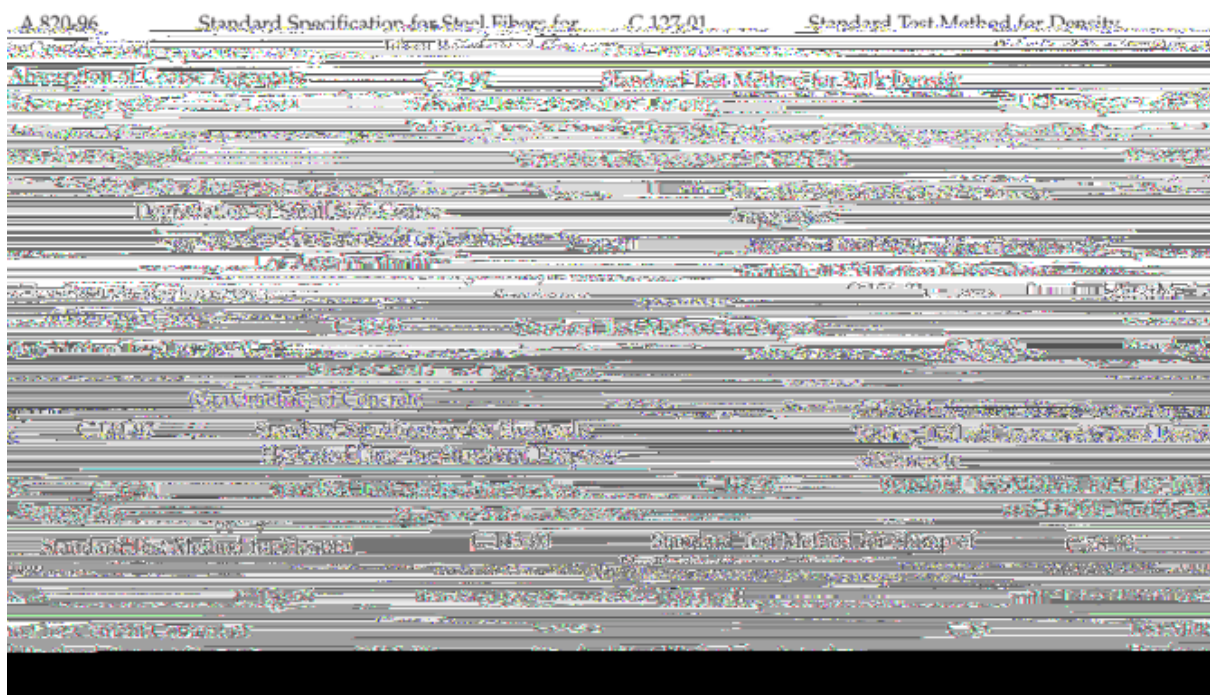


Figure 7: List of ASTM Standards for Concrete

Conclusion

Civil engineers are directly responsible for the design and development of long-lasting materials that are comprised of Portland cement concrete. The quality of the concrete that is used in structural applications is determined by selecting the appropriate amounts of Portland cement, water, aggregates, & admixtures, in addition to following sound building procedures. Concrete that has the necessary strength and durability may be produced by using the proportional mix design approach that is detailed in this body of work. The right selection of Portland cement concrete, on the other hand, is completely pointless if the required building processes are not followed. These procedures include the correct mixing, transporting, putting, & curing of the concrete. Numerous quality control tests, including as slump tests, air content experiments, and strength-gain-with-time tests, are carried out by civil engineers in order to guarantee that the concrete that is produced via these methods has the characteristics that are wanted.

Although the great majority of infrastructure projects are built using traditional materials, there are a range of alternative concrete formulas that are vital and are available for use in speciality applications. This chapter provides an introduction to these other options; nevertheless, the technology connected with these alternate options is rather complicated, and more research is necessary in order to completely grasp the behaviour of these materials.

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