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The formula to calculate the 28-Day Compressive Strength is: $fc = S7 + (30 \times \sqrt{S7})$ Where: fc = 28 Day Compressive Strength of Concrete (MPa) $S7$ = 7 Day Compressive Strength (MPa) The 28 Day Compressive Strength of Concrete is defined as the strength of the concrete after 28 days of curing. The 7 Day Compressive Strength achieved by concrete at 7 days is about 65% of the target strength. Lets assume the following values: 7 Day Compressive Strength ($S7$) = 4.5 MPa Using the formula: $fc = 4.5 + (30 \times \sqrt{4.5}) \approx 68.14$ MPa The 28 Day Compressive Strength is approximately 68.14 MPa. 28 Day Compressive Strength is the maximum compressive load concrete can bear per unit area after 28 days of curing. 2. Why is 28 days standard for testing concrete strength? Concrete gains most of its strength in 28 days, though it continues to harden for years. 3. What if my 7-day strength is zero or negative? The calculator will return "Invalid" as the square root of zero or negative numbers is not real. 4. How accurate is this formula? This is an empirical formula that provides approximate results. Actual strength may vary based on mix design and curing conditions. 5. Can I use this for high-strength concrete? This formula works best for normal strength concrete (20-40 MPa). For high-strength concrete, consult specific empirical relationships. Calculator - All Rights Reserved 2025 Home General Civil Engineering Compressive Strength of Concrete at 7 Days, 14 Days, 28 Days By -Civil Engicon Team December 03, 2023 Update: April 18, 2025 The strength of concrete refers to its ability to withstand loads without failing. It is a key property that determines the performance and durability of concrete in construction. The strength of concrete is typically measured in terms of compressive strength, which is the capacity of the concrete to resist compression forces. This is usually determined by testing concrete specimens in a laboratory after they have been cured for a specific period, typically 28 days. The strength of concrete is influenced by several factors, including the mix proportions of cement, water, aggregates, the quality of the materials used, the curing conditions, and the age of the concrete. Higher strength concrete is often used in structural applications where greater load-bearing capacity is required. At 7 days, concrete typically achieves about 65% of its

Concrete strength is influenced by several factors, including the mix proportions of cement, water, aggregates, the quality of the materials used, the curing conditions, and the age of the concrete. Higher strength concrete is often used in structural applications where greater load-bearing capacity is required. At 7 days, concrete typically achieves about 60-70% of its ultimate 28-day strength. This early-stage strength is crucial for assessing the curing progress and ensuring that the concrete is hardening at the expected rate. However, the exact strength at 7 days can vary based on factors like the mix design, environmental conditions, and curing practices. By 14 days, concrete usually reaches about 80-85% of its 28-day strength. This is a good indicator that the concrete is continuing to gain strength at an appropriate rate, though it is still expected to reach its full design strength by 28 days. At 28 days, concrete is considered to have attained its full design strength, which is the standard timeframe used in construction to define the required compressive strength. For instance, if the specified compressive strength is 30 MPa, the concrete should reach 30 MPa at 28 days under standard curing conditions. The compressive strength of concrete is the most important factor in determining the load-bearing capacity of a concrete structure. It is typically measured after 28 days of curing, but it can also be measured at earlier ages. The compressive strength of concrete can range from as low as 1,000 psi to as high as 10,000 psi. The range of compressive strength of concrete is given below based on concrete type and its strength.

- Low-Strength Concrete:** Below 20 MPa (about 2,900 psi)
- Normal Strength Concrete:** 20 MPa to 40 MPa (about 2,900 psi to 5,800 psi)
- High-Strength Concrete:** More than 40 MPa (about 5,800 psi)

1. Concrete Cube Test: In this method, specimens of concrete cubes are subjected to a compression load in CTM or UTM. The specimens, typically 6 inches in diameter and 12 inches tall, are prepared from fresh concrete and cured under controlled conditions. After the specified curing period, usually 28 days, the cubes are placed between the platens of a compression testing machine and subjected to increasing compressive load until they fail. The compressive strength is calculated by dividing the maximum load by the cross-sectional area of the cube.

2. Concrete Core Test: In this method, specimens of concrete cores are cut from the structures and they are subjected to a compression load in CTM or UTM to find the breaking load, and the value is used to determine strength.

3. Ultrasonic Pulse Velocity (UPV) Test: This non-destructive method measures the time it takes for an ultrasonic pulse to travel through a concrete specimen. A higher UPV indicates a denser and stronger concrete. Correlations are established between UPV and compressive strength based on concrete type, age, and moisture content.

4. Rebound Hammer Test (Schmidt Hammer Test): This non-destructive method utilizes a rebound hammer to assess the in-situ compressive strength of concrete. The hammer is swung against the concrete surface, and the rebound distance is measured. A higher rebound distance indicates a stronger concrete. Correlations are established between rebound distance and compressive strength based on concrete type, age, and surface conditions.

5. Penetration Resistance Test: This non-destructive method measures the resistance of concrete to the penetration of a steel probe. The probe is driven into the concrete surface using a calibrated hammer, and the depth of penetration is recorded. A shallower penetration depth indicates a stronger concrete.

6. Maturity Method: This method estimates the compressive strength of concrete based on its maturity, which is a function of time and temperature. The maturity is calculated using a maturity function that takes into account the concrete mix design and curing conditions. Correlations are established between maturity and compressive strength based on concrete type, age, and temperature data.

The compressive strength of concrete depends on factors such as the concrete mix design (proportion of ingredients), age of specimen, quality of materials, curing conditions, and testing procedures. Tensile strength of concrete is the ability to resist tensile or pulling forces. The tensile strength of concrete is about 10% of its compressive strength. This means that concrete is much stronger in compression than in tension. The tensile strength of concrete is important for resisting cracking and

conditions, and testing procedures. Tensile strength or flexural strength of concrete is the ability to resist tensile or pulling forces. The tensile strength of concrete is about 10% of its compressive strength. This means that concrete is much stronger in compression than in tension. The tensile strength of concrete is important for resisting cracking and spalling. So that, concrete is often reinforced with materials like steel to enhance its tensile strength. Tensile strength of concrete is measured in pounds per square inch (psi) or megapascals (MPa). The tensile strength of concrete can be measured using following methods: 1. Splitting Test: In this method, cylindrical specimen of concrete is subjected to a compressive load while it is resting on two supports. The tensile strength is calculated from the load at which the specimen splits in half. 2. Beam Test: In this method, beam-shaped specimen of concrete is subjected to a load at its center through a designed rod in UTM. The tensile strength is calculated from the deflection of the beam. The shear strength of concrete is the resistance to forces that tend to cause two opposite sides of a material to slide past each other. The shear strength of concrete is about 70% of its compressive strength. Strength of concrete test is the process to know the ability of the hardened concrete to resist the compression load, tensile load and shear stress. These test results are obtained from various test procedures like compression test on concrete cube or concrete core, tensile strength or flexural strength test on concrete beam and split strength test on the concrete cylinder. Strength of concrete cube is determined by the compression test, in this the cube is placed under compression machine and load is provided. The maximum load at which cube breaks is noted down and the load is divided by the surface area of concrete cube. The result value is called as compressive strength of concrete. For flexural strength and split strength different procedures are used to determine the strength. As we can observe, the strength of concrete increases fast and then the strength of concrete increases slowly till its maximum strength. The strength of concrete over long time starts decreasing because the bond of cement starts becoming weak. The strength of concrete can increase with several factors. Some of the factors are given below.

1. Water-to-Cement Ratio (W/C Ratio): The water-to-cement ratio is a

critical factor affecting the strength of concrete. Generally, lower water-to-cement ratios result in higher compressive strength. Too much water can weaken the concrete, while a lower water content leads to better strength. 2. Curing Conditions: Proper curing is essential for concrete strength development. Adequate curing involves maintaining a favorable temperature and moisture level during the early stages of concrete setting and hardening. Well-cured concrete tends to achieve higher strength. 3. Quality of Materials: The quality of constituent materials, including cement, aggregates, and water, significantly influences concrete strength. Using high-quality materials ensures better overall performance. 4. Type and Quality of Cement: Different types of cement, such as Portland cement or blended cements, can impact concrete strength. Additionally, using cement with higher strength characteristics can contribute to stronger concrete. 5. Aggregate Properties: The type, size, shape, and gradation of aggregates affect the concrete's strength. Well-graded aggregates with good bonding properties can enhance the overall strength. 6. Concrete Mix Design: The proportions of cement, aggregates, and water in the concrete mix, known as the mix design, play a crucial role in determining its strength. A well-designed mix, considering the specific requirements of the project, contributes to better strength performance. 7. Admixtures: Admixtures are chemicals that can be added to concrete to modify its properties. Certain chemical admixtures, such as superplasticizers or accelerators, can be used to modify the properties of fresh or hardened concrete. Proper use of admixtures can enhance workability, durability, and, in some cases, strength. 8. Age of Concrete: Concrete continues to gain strength over time. While the early curing period is critical, the concrete's strength will continue to develop over weeks and months. 9. Temperature: The temperature during curing and early stages of concrete hardening can influence its strength. Generally, higher curing temperatures contribute to faster strength development, but extreme conditions should be avoided. 10. Mixing and Placing Practices: Proper mixing and placing of concrete ensure uniform distribution of materials, reducing the likelihood of weak zones. Adequate consolidation during placement helps eliminate air voids that could weaken the concrete. The strength

of different grade of concrete concrete at 7 days, 14 days and 28days of curing and compressive strength test of concrete cube.Compressive strength of concrete cube test procedure & result at 7 days & 28 days of curingWhat is Compressive strength? Compressive strength is the capacity of material or structure to resist a load under compressive load. The Compressive strength is determined by the ability of the concrete material to resist failure in the form cracks and fissure. The maximum load at which the specimen breaks is taken as a compressive load.The compressive strength of M30 grade concrete varies between 27 and 33 N/mm²(i.e. between 270 kg/cm² and 330 kg/cm²) after 28 days curing. This means that the concrete can withstand a compressive load of 270 to 330 kg/cm before it fails.The compressive strength of M25 grade concrete varies between 22 and 28 N/mm² (i.e. between 220 kg/cm² and 280 kg/cm²) after 28 days curing. This means that the concrete can withstand a compressive load of 220 to 280 kg/cm before it fails.The compressive strength of M15 grade concrete varies between 12 and 18 N/mm² (i.e. between 120 kg/cm² and 180 kg/cm²) after 28 days curing. This means that the concrete can withstand a compressive load of 120 to 180 kg/cm before it fails.The compressive strength of M20 grade concrete varies between 17 and 23 N/mm² (i.e. between 170 kg/cm² and 230 kg/cm²) after 28 days curing. This means that the concrete can withstand a compressive load of 170 to 230 kg/cm before it fails.In compressive strength test of concrete cube the push force applied on the both faces of concrete specimen and the maximum compression that concrete bears without failure is noted.What is Compressive strength?Compressive Force acting on concrete testing specimen helps us to majorly focus on the Compressive strength of concrete because it helps us to quantify the ability of concrete to resists Compressive stresses among structures where-as other stresses such as axial stresses and tensile stresses are caused by reinforcement and other means ALSO READ: COMPRESSIVE STRENGTH OF CEMENTAs we know compressive strength is measured by compressive strength test machine (CTM). Compressive strength is defined as ratio of compressive load applied by CTM machine on concrete cube or cylinder to cross sectional surface area of concrete cube.

Compressive strength is represented by $F = P/A$, where F = compressive strength, P = total load applied by CTM machine & A = cross sectional surface area. Compressive strength of concrete at 3, 7, 14 & 28 days is measured in psi (pound force per square inch in USA) & MPa (mega pascal) in India and other countries. MPa in another terms represented as N/mm². And 1 MPa = 145.038 psi. As per IS code the cube strength achieved by the concrete in 7 days is about 65%, in 1 day is about 16%, in 3 days is about 40%, in 14 days is about 90%, in 21 days is about 94% and in 28 days is approximately 99%. As per IS code the cube strength achieved by the M25 concrete in 7 days is about 16.24 MPa, in 1 day is about 4 MPa, in 3 days is about 10 MPa, in 14 days is about 22.5 MPa, in 21 days is about 23.5 MPa and in 28 days is approximately 25 MPa. As per IS code the cube strength achieved by the M15 concrete in 7 days is about 9.75 MPa, in 1 day is about 2.4 MPa, in 3 days is about 4 MPa, in 14 days is about 13.5 MPa, in 21 days is about 14.1 MPa and in 28 days is approximately 15 MPa. As per IS code the cube strength achieved by the M20 concrete in 7 days is about 13 MPa, in 1 day is about 3.2 MPa, in 3 days is about 8 MPa, in 14 days is about 18.8 MPa and in 28 days is approximately 20 MPa. As per IS code the cube strength achieved by the M30 concrete in 7 days is about 19.5 MPa, in 1 day is about 4.8 MPa, in 3 days is about 12 MPa, in 14 days is about 27 MPa, in 21 days is about 28.2 MPa and in 28 days is approximately 30 MPa. The compressive strength achieved by the concrete is about 16% of the target strength at 1 day, about 40% at 3 days, about 65% at 7 days, about 90% at 14 days, about 94% at 21 days and about 99% of the target strength at 28 days. Generally compressive strength of concrete can vary from 2175 psi (15 MPa) to 4350 psi (30 MPa) for construction of residential and commercial structures and may exceed higher up to 10000 psi (70 MPa) for specific structures. When concrete is subjected to high compressive stress, it undergoes plastic deformation and eventually fails. The failure load is known as the compressive strength of concrete.

compressive load acting on both face of concrete cube, it resist or withstand under compressive load and causes compression. Due to compression diameter of concrete cube structure is increased and their length is decrease and developing stress known as compressive stress. ALSO READ: COMPRESSIVE STRENGTH OF CEMENT. Compressive stress is represented by s , which is equal to ratio of compressive load to cross sectional area of concrete cube structure, such that $s = P/A$, where P = compressive load and A = cross sectional area of concrete cube specimen. Now understand with given diagram. Compressive strength is the maximum load at which the specimen breaks is taken as a compressive load represented by F or S , which is equal to ratio of compressive load to cross sectional area of specimen, such as $F = P/A$, where F = compressive strength, P = compressive load and A = area of cross section of specimen. Compressive strength of concrete at 3, 7, 14 & 28 days. This strength is measured by CTM testing Standard 15cm larger & 10cm smaller cubes in India and standard cylinder specimens dia 15cm & height 30cm in USA and a few other countries. Compressive strength of concrete at 3, 7, 14 & 28 days. The grade of M25 concrete is denoted by the letter M or C (Europe) stand for mix & followed by numerical figure is compressive strength. Thus compressive strength of M25 concrete is 25N/mm² (25MPa) or 3626Psi. Compressive strength of different grade concrete at 3 days. Making of at least 3 concrete cube size each 150mm x 150mm x 150mm in mould by cement sand and aggregate different ratio for different grade of concrete, use tamping rod for levelling the surface of mould, it is kept for 24 hours setting after water mix in concrete, after 24 hours it is kept in water for curing for 3 days. And taken out just 30 minute prior to start of test. Compressive strength of different grade concrete at 3 days. Calculation: Now concrete cube test by CTM machine, assuming 14N/mm²/minute load is applied on concrete cube specimen of different grade till the cube collapse. The maximum load at which the specimen breaks is taken as a compressive load. Now following results are obtained for compressive strength of different grade of concrete at 3 days measured in MPa (N/mm²) or psi. Concrete Grade M10 - 4 MPa or 580 psi, M15 - 6 MPa or 870 psi, M20 - 8 MPa or 1160 psi, M25 - 10 MPa or 1430 psi, M30 - 12 MPa or 1710 psi, M35 - 14 MPa or 1960 psi, M40 - 16 MPa or 2240 psi, M45 - 18 MPa or 2560 psi, M50 - 20 MPa or 2870 psi.

maximum load at which the specimen breaks is taken as a compressive load. Now following results are obtained for compressive strength of different grade of concrete at 3 days measured in Table 1. Compressive strength of concrete at 3 days measured in MPa (N/mm²) or psi. Conc. Grade MPa psi M10 - 4.5 MPa or 300 psi M15 - 5 MPa or 870 psi M20 - 8 MPa or 1160 psi M25 - 10 MPa or 1450 psi M30 - 12 MPa or 1740 psi M35 - 14 MPa or 2030 psi M40 - 16 MPa or 2320 psi M45 - 18 MPa or 2610 psi M50 - 20 MPa or 2900 psi. Compressive strength of different grade concrete at 7 days Making of at least 3 concrete cube size each 150mm x 150mm x 150mm in mould by cement sand and aggregate different ratio for different grade of concrete, use tamping rod for levelling the surface of mould, it is kept for 24 hours setting after water mix in concrete, after 24 hours it is kept in water for curing for 7 days. And taken out just 30 minute prior to start of test. Calculation: Now concrete cube test by CTM machine, assuming 14N/mm²/minute load is applied on concrete cube specimen of different grade till the cube collapse. The maximum load at which the specimen breaks is taken as a compressive load. Now following results are obtained for compressive strength of different grade of concrete at 7 days of curing given in Table 2. Compressive strength of different grade concrete at 7 days Table 2: compressive strength of concrete at 7 days measured in MPa (N/mm²) or psi. Conc. Grade MPa psi M10 - 6.5 MPa or 940 psi M15 - 9.75 MPa or 1410 psi M20 - 13 MPa or 1890 psi M25 - 16.25 MPa or 2360 psi M30 - 19.25 MPa or 2790 psi M35 - 22.75 MPa or 3300 psi M40 - 26 MPa or 3770 psi M45 - 29.25 MPa or 4240 psi M50 - 32.5 MPa or 4710 psi. Compressive strength of different grade concrete at 14 days Now following results are obtained for compressive strength of different grade concrete at 14 days of curing given in Table 3: compressive strength of concrete at 14 days measured in MPa (N/mm²) or psi. Conc. Grade MPa psi M10 - 9 MPa or 1305 psi M15 - 13.5 MPa or 1960 psi M20 - 18 MPa or 2610 psi M25 - 22.5 MPa or 3260 psi M30 - 27 MPa or 3920 psi M35 - 31.5 MPa or 4570 psi M40 - 36 MPa or 5220 psi M45 - 40.5 MPa or 5874 psi M50 - 45 MPa or 6530 psi. Compressive strength of different grade concrete at 28 days Now following results are obtained for compressive strength of concrete at 28 days of curing given in Table 4: compressive strength of concrete at 28 days measured in MPa (N/mm²) or psi. Conc. Grade MPa psi M10 - 11.5 MPa or 15.5 MPa or 2175 psi M15 - 16.5 MPa or 2325 psi M20 - 20 MPa or 2850 psi M25 - 25 MPa or 3575 psi M30 - 30 MPa or 4300 psi M35 - 35 MPa or 5025 psi M40 - 40 MPa or 5750 psi M45 - 45 MPa or 6475 psi M50 - 50 MPa or 7200 psi.

following results are obtained for compressive strength of different grade of concrete at 28 days of curing given in tableCompressive strength of different grade concrete at 28 days measured in MPa (N/mm²) or psi.Conc. Grade MPa psi M10 - 10 MPa or 1450 psi M15 - 15 MPa or 2175 psi M20 - 20 MPa or 2900 psi M25 - 25 MPa or 3625 psi M30 - 30 MPa or 4350 psi M35 - 35 MPa or 5080 psi M40 - 40 MPa or 5800 psi M45 - 45 MPa or 6530 psi M50 - 50 MPa or 7250 psi% of concrete compressive strength over timeRelationship between concrete strength according to time is not linear, it means increasing strength is not increases according to applied load as time increases, it will increase in nonlinear.Concrete is a macro content with Sand, Cement, & Coarse aggregate as its micro-ingredient (Mix Ratio) and gains its 100% strength over time at the hardened state.Concrete gains 16 % of its initial strength within 24 hrs, whereas concrete gains 65% of the target strength by the time of 7 days of its casting and curing.Till 14 days concrete shows 90% of the target strength and there after the gain in strength slows down and it takes 28 days to achieve 99% of its strength.We cant judge the strength of concrete until it becomes stable. And we also wont wait for 28 days to judge the concrete whether it suitable for construction or not to keep it balanced, concrete is tested at various intervals.Table 5:- % of concrete compressive strength over timeDays % of Strength 1 Days 16% 3 Days - 40% 7 Days 65% 14 Days 90% 21 Days 94% 28 Days 99%The maximum strength gain spike is observed till 14 days, so we test concrete at an intervals of 7 days, 10 days & 14 days and If concrete fails to show results of 90% of its overall strength 14 days then that batching is rejected.Compressive strength of M20 concrete at 7 days, 14 days and 28 daysThe compressive strength of M20 concrete is approximately 8 MPa (1160 psi, or 80 kg/cm²) at 3 days, approximately 13 MPa (1900 psi, or 130 kg/cm²) at 7 days, approximately 18 MPa (2600 psi, or 180 kg/cm²) at 14 days, and approximately 20 MPa (2900 psi, 200 kg/cm²) at 28 days.Compressive strength of M10 concrete at 7 days, 14 days and 28 daysThe compressive strength of M10 concrete is approximately 4 MPa (580 psi, or 40 kg/cm²) at 3 days, approximately 6.5 MPa (940 psi, or 65 kg/cm²) at 7 days, approximately 9 MPa

Properties of coarse aggregates and cement matrix, which leads to failure of concrete. Concrete technologists came up with theoretical concepts regarding size of aggregates, which as the size of aggregate is increased, the strength is increased. This theory was later discarded, as experiments proved that greater size of aggregates showed increased strength in initial phases but reduced exponentially. The sole reason for this strength drop was due to the reduced surface area for bond strength between cement matrix and aggregates and water transition zone. Air entrainment:- Air entrainment in concrete was one of the concepts developed by cold countries in order to prevent damages due to freezing and thawing. Later on, as experimentations proved multidimensional benefits of air entrainment along with improved the workability of concrete at lower water/cement ratio. As the achievement of the desired workability at lower water content helped one to achieve concrete with the greater compressive strength which in turn, leads to light concrete with greater compressive strength. Water/Cement ratio:- We are all very aware of how excess water can be harmful to the strength of concrete. Cement being the major binding material in concrete needs water for hydration process, but that is only limited to about (0.20 to 0.25) % of cement content. The excess water turns out to be beneficial in contributing to workability and finishing of concrete. The very aspect where excess water is considered harmful because as the water in the concrete matrix dries, it leaves large interstitial spaces among aggregate and cement grains. This interstitial space becomes primary cracks during compressive strength testing of concrete. Why do we test concrete for 7 days, 14 days & 28 days? Concrete gains maximum strength at 28 days. Since in construction sector great amount of capital is at stake, so instead of checking strength at 28 days we can check strength in terms of concrete strength psi at 7 and 14 days to predict the target strength of construction work. From the below table it is clear that, Concrete gains 16 % of its strength within 24 hrs, whereas concrete gains 65% of the target strength by the time of 7 days of its casting. Till 14 days concrete shows 90% of the target strength and thereafter it gains in

After the below table it is clear that, Concrete gains 10% of its strength within 24 hrs, whereas concrete gains 35% of the target strength by the time of 7 days of its casting. After 14 days concrete shows 90% of the target strength till 7th & 14th Days upto 90% after curing, then gradually increases from there. So we cant predict the strength until the concrete comes to that stable state. Once it attains certain strength at 7 days, then we know (according to the table) only 9% of strength going to increase. So at sites, we do not only test concrete at this interval. If the concrete fails at 14 days, then we will reject that batching. Compressive strength of concrete cube test Procedure & result Concrete cube test Apparatus for procedure and result completed in following steps: 1) IS code:- this concrete cube test it is completed according to IS code 516 2) Required Equipment & Apparatus: a) Tamping rod: tamping rods is used for levelling the surface of concrete cube mould, it is 16mm Dia and 60cm in length. b) CTM machine : CTM machine is required for load applying on concrete cube mould, it should be apply minimum load of 14N/mm²/minute. CTM machine c) THREE type of mould: there is two size of concrete cube mould is used for test, first is large size of 150mm or 15cm have specific dimension (lbh) is 150mm150mm150mm with aggregate size is 38 mm and second smaller size concrete cube mould size is 100mm100mm100mm with aggregate size 19mm used in India. In USA and other country cylindrical concrete mould is also used have dia 150mm, height 300mm & aggregate size is 38mm. concrete cube mould d) Other Apparatus is G.I Sheet (For Making Concrete), Vibrating Needle, tray & other tools. 3) Environmental factors:- for standard calculation of compressive strength of concrete environmental factors should be optimum, minimum number of test specimen should be 3, temperature should be 27^o C and humidity is 96% Compressive strength of concrete cube procedure: Measure the dry proportion of ingredients (Cement, Sand & Coarse Aggregate) in ratio as per the design of concrete. The Ingredients should be sufficient enough to cast test cubes b) first mix cement and sand till it get uniform colour, then add aggregate in it, thorough mix with hand or mechanical mixer to get uniform colour of concrete.

cube procedurea) Measure the dry proportion of ingredients (Cement, Sand & Coarse Aggregate) in ratio as per the desine of concrete. The Ingredients should be sufficient enough to cast test cubes.b) first mix cement and sand till it got uniform colour then added aggregate in it, thoroughly mix the dry ingredients to obtain the uniform colour of mixture and Add design quantity of water to the dry proportion (water-cement ratio) and mix well to obtain uniform texturec) Fill the concrete to the mould with the help of vibrator and used tamping rod for thorough compaction and levelling the surface of concrete cube mould,Finish the top of the concrete by trowel & tamped well till the cement slurry comes to the top of the cubes.d) After some time the mould should be covered with red gunny bag and put undisturbed for 24 hours at a temperature of 27 2,After 24 hours remove the specimen from the mould.e) Keep the specimen submerged under fresh water at 27 2 for curing, the specimen shulde kept for 7,4 or 28 days. Every 7 days the water should be renewed. The specimen should be removed from the water 30 minutes prior to the testing and the specimen should be in dry condition before conducting the testing.Concrete cube specimen 15cm 5) Testing of concrete cube: Now place the concrete cubes into the (CTM) testing machine at centre. The cubes shulbe placed correctly on the machine plate (check the circle marks on the machine). Carefully align the specimen with the spherically seated plate. The load will be applied to the specimen axially. Now slowly apply the load at the rate of 14N/mm²/minute till the cube collapse. The maximum load at which the specimen breaks is taken as a compressive load.6) Calculation: Compressive Strength of concrete = Maximum compressive load / Cross Sectional Area, cross sectional Area = 150mm X 150mm = 22500mm² or 225 cm², assume the compression load is 563 KN, then Compressive Strength of M25 concrete after 28 days = (563N/22500mm²)=25 N/mm²(20MPa) or 3626Psi. You can follow me on Facebook and Subscribe our Youtube Channel You should also visit:-1) what is concrete and its types and properties2) concrete quantity calculation for staircase and its formulaConclusions:- The compressive strength achieved by the concrete is about 65% of the target strength at 7 days, about 90% at 14 days and about 99% of the target strength at 28 days.

So, The compressive strength of M20 concrete is approximately 13 MPa (1900 psi) at 7 days, approximately 18 MPa (2600 psi) at 14 days, and approximately 20 MPa (2900 psi) at 28 days. Throughout the construction industry, the common belief is that concrete takes 28 days to cure and reach 100% of its strength. This is a misconception of what curing actually means. Some regulators characterize concrete as green if it has not cured for a certain time frame, not realizing this leads to unnecessary delays and higher project costs. An evaluation of the concepts of measured compressive strength and curing is in order to shed light on the mystery that surrounds the 28-day myth. Specifying concrete strength is normally done with a minimum compressive strength (psi) at a certain age (days). Specified concrete compressive strength is the minimum compressive strength at which the concrete should fail in standard tests of 28-day-old concrete cylinders. A typical concrete compressive strength specification requires 4,000 to 5,000 psi at 28 days. Some go a step further and mandate that concrete products cannot be installed or used until 28 days after the date of manufacture. This, mistakenly, has given concrete a reputation among some specifiers as being weak or inferior if it has not cured for the full 28 days. An arbitrary time frame of 28 days is an arbitrary specimen age though chosen for many good reasons for testing the compressive strength of concrete. Specification writing authorities chose 28 days as the standard specimen age to establish consistency for testing procedures throughout the industry (1). Such an arbitrary time frame, however, is not relevant to all mix designs. It is estimated that concrete reaches 75% of this 28-day compressive strength in seven days, and its strength will remain stable or even increase over time (2). A specific ratio can be determined for each specific mix design and curing process to fine-tune this arbitrary age so that the mix design dictates the 28-day compressive strength. Some mix designs can reach 5,000 psi of compressive strength in seven days or even in 24 hours. However, the faster concrete reaches the minimum design compressive strength, the cost of the concrete is achieved by taking a sample of concrete at the time of placement.

reach 5,000 psi of compressive strength in seven days or even in 24 hours. However, the faster concrete reaches the minimum design compressive strength, the greater the cost of the concrete. Strength measurement protocolMeasuring the compressive strength of concrete is achieved by taking a sample of concrete at the time of placement. Cylinders, measuring 12 in. high by 6 in. in diameter, or 8 in. by 4 in., are compressed by a break machine that exerts increasing force upon the cylinder until it structurally fractures. When a failure occurs (commonly referred to as a break), the compressive strength is measured by dividing the force (lb) measured at the time the cylinder fails by the load-bearing surface area (sq in.) of the concrete sample. At the time of the break, the samples age is generally noted for quality assurance purposes. Therefore, to meet the typical concrete compressive strength specification as previously noted, the break results should calculate to at least 5,000 psi at 28 days. When a specification has performance criteria of 5,000 psi at 28 days, for example, governing authorities will want a test record (two individual cylinder breaks at 28 days) to ensure conformance with the specification. Fortunately, more than two cylinders are typically collected for testing. Through research and empirical data collection, projection of a 28-day strength from a three- or seven-day test break is easy to perform and results in an estimated strength very close to that measured at 28 days. With the accuracy of this early estimation, if a problem arises, it can be reviewed much sooner than 28 days. Why curing is misunderstoodCuring is the process of controlling the rate and extent of moisture loss from concrete during cement hydration (3). This would refer to a great many processes that are used to cure concrete, including steam curing, moist curing, air curing and more. It is immediately apparent that the phrase curing can have different meanings to different people. Strength and age associations behind the word curing are very haphazardly misunderstood. Digging deeper into the curing process, hydration is the chemical process that allows concrete to go from a plastic state to a hardened state while gaining strength over time. Hydration occurs at a faster rate in the early stages after concrete placement and slows down after a month or so goes by. Many cement pastes will cease

hydration before one year, and some may continue to hydrate over the course of several years (4). Because of the variable length of the hydration process, the phrase green concrete is a purely subjective characterization. With so much variation in hydration time, waiting for completion of the hydration process before testing the compressive strength of concrete would be impractical. In determining a more practical age for testing concrete strength, the 28-day myth began. So, while curing does help the hydration process, 28 days is not an inclusive rule dictating a specific time to produce minimum compressive strengths. Simply stated, as the concrete cures and hydration takes place, the concrete gets stronger and hydration may continue long after the minimum required compressive strength is reached. Curing is a process, not a measure of strength. A specified compressive strength may be for any strength at any age of concrete. There is nothing wrong with specifying 5,000-psi compressive strength at one, seven, 11, 14 or 56 days. It all depends on the mix design, circumstances and project requirements. The American Concrete Institute recognizes 28 days or the test age designated for determination of the specified compressive strength. 5 Therefore, when a specifier calls for 5,000 psi concrete at 28 days, this tells the concrete producer to select a mix design that will attain a minimum of 5,000 psi 28 days after manufacture. In precast concrete manufacturing, however, very early attainment of specified strengths reaching the minimum required compressive strength much sooner than 28 days is the norm. It is extremely rare for a specifier to require a specific cure time. Rather, specifications might state that installation prior to 28 days is acceptable, provided that two cylinder breaks prove the minimum required compressive strength has already been reached. With a select mix design, concrete could easily reach its minimum required compressive strength one day after it is manufactured and therefore be specification-compliant for installation. The main thing to remember is that curing is a process and not a measure of concrete strength. The 28-day stipulation provides a consistent industry-wide basis for comparing the compressive strength of concrete products. The 28-day time frame is not directly related to whether or not a specific product meets strength requirements for a particular application. As long as the concrete has attained the specified strength at the required age, it is specification-compliant.

remember is that curing is a process and not a measure of concrete strength. The 28-day stipulation provides a consistent industry-wide basis for comparing the compressive strength of concrete products. The 28-day time frame is not directly related to whether or not a specific product meets strength requirements for a particular application. As long as the minimum compressive strength is met before the product is put in service, the time frame to reach the minimum compressive strength should not be relevant. Eric Barger is vice president of C.R. Barger & Sons Inc., Lenoir City, Tenn., a family-owned business spanning five generations. Eric is a civil engineer but admits that he learned a lot by growing up in a precast plant and listening to his father's motivational speeches. Contact him at: eric@bargerandsons.com. [separator_dots]Notes: Cement & Concrete FAQs, Portland Cement Association (PCA); www.cement.org/basics/concretebasics_faqs.asp; Kosmatka, S.H., Panarese, W.C., Alle, G.E. and Cummings, S. Design and Control of Concrete Mixtures, PCA, Skokie, Ill. 2002. Curing of Concrete, April 2006; www.concrete.net.au/publications/pdf/Curing06.pdf; Overview of the Concrete Hydration Process, Section 5.1; www.iti.northwestern.edu/cement/monograph/Monograph5_1.html; Building Code Requirements for Structural Concrete and Commentary (ACI 318-11), ACI, Farmington Hills, Mich. Join TheConstructor to ask questions, answer questions, write articles, and connect with other people. When you join you get additional benefits. Have an account? Sign In Share copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt, remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of

the material in the public domain or where your use is permitted by an applicable exception or limitation. No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Compressive strength of concrete can be defined as: capacity of concrete to withstand loads before failure. Among the numerous tests that can be applied to the concrete, the compressive strength test is the most important, as it gives an idea about the characteristics of the concrete. All standards will include a methodology for testing the compressive strength of concrete such as ASTM C39. In all standards, the characteristic strength of concrete is determined at 28 days. In this article, we discuss why standards chose 28 days after casting as the reference day for testing compressive strength. Concrete is an artificial conglomerate stone made essentially of Portland cement, water, and aggregates. When first mixed the water and cement constitute a paste which surrounds all the individual pieces of aggregate to make a plastic mixture. A chemical reaction called hydration takes place between the water and cement, and concrete normally changes from a plastic to a solid state in about 2 hours. Yet, in order for the hydration reaction to continue and concrete to continue to gain strength, there has to be a source of moisture. In addition, there is another thing that needs to exist in order for hydration to continue, which is unhydrated cement grains. If all cement grains are hydrated, nothing will remain to hydrate. Theoretically, if a source of moisture exists for concrete, it will continue to gain strength forever. However, this does not actually happen in reality. To understand the reason why standards chose 28 days for testing compressive strength, let us look at the development of concrete strength: compressive strength of concrete. As you can, concrete starts to gain strength at a high rate and then at later age (beyond 28 days), the rate of strength gain becomes very slow. The following table shows the value of strength gain assuming the maximum value of strength is 100% at various ages. Age (days) Strength (%) 33.7% 76.2% 148.3% 289.9% Therefore, concrete will gain above 90% of its strength in the first 28 days. There is no need to wait beyond 28 days for the remaining strength gain. This is impractical. Due to

Therefore, concrete will gain above 90% of its strength in the first 28 days. There is no need to wait beyond 28 days for the remaining strength gain. This is impractical. Due to this, the industry embraced the 28-day strength as a standard, and specifications frequently include reference to compression tests of concrete cylinders or cubes that are crushed 28 days after being made. It is evident that concrete strengthens quickly in the first few days following casting. Strength gain is only 14 percent in the first 3 days. Concrete continues to grow strength even after it reaches a strength of above 90 percent in 28 days, but the rate of increase in compressive strength is much slower than it was in the first 28 days. Since the concrete strength at 28 days is 99 percent, it is nearly at its maximum strength. As a consequence, we depend on the results of the compressive strength test at 28 days and utilize this strength as the foundation for our design and evaluation. Read Also: [How to Prepare Cube Samples from Fresh Concrete](#) | [Effect of Age on Concrete Strength](#) | [How Concrete is Made](#)

The results of the test provide valuable information for structural design and allow engineers to accurately calculate the load-bearing capacity of a concrete structure. Moreover, the compressive strength test also assists in quality control during the production of concrete, ensuring that the mix proportions and curing processes are optimized for achieving the desired strength. Overall, the importance of the compressive strength test cannot be overstated, as it ensures the safety and reliability of concrete structures. Concrete cube and concrete cylinder The following is the compressive strength of concrete formula, Compressive Strength = Load at failure / Cross-sectional Area of Element IS Code For Concrete Cube Test: Cube Test of Concrete as per IS Code IS 516 (1959): Method of Tests for Strength of Concrete and IS 456 2000: Concrete Strength Acceptance Criteria Compressive Strength of Concrete For the cube test of concrete two types of specimens either cubes of 15cm X 15cm X 15cm or 10cm X 10cm X 10cm. It depends upon the size of the aggregate used for concrete making. For most concrete works cubical molds of size, 15cm x 15cm x 15cm are commonly used. Concrete Cube Mould This concrete is filled in the mould and tempered properly so as to minimize any air voids available in concrete. After 24 hours these moulds are opened and test specimens are soaked in water for curing. The upper surface of these specimens should be made even and smooth. This is done by spreading cement paste on the whole area of the specimen. These cubes are tested by a compression testing machine after 7 days of curing or 28 days of curing. The Load on the cube should be applied gradually at the rate of 140kg/cm² per minute till the specimen fails. Load at the failure of a cube divided by the area of the specimen gives the compressive strength of concrete. Apparatus for Concrete Cube Test Standard Compression testing machine Cube mould of standard size 15 cm x 15 cm x 15 cm Standard compression Testing Machine The proportion and material for making these test specimens should be taken from the same concrete used in the field. Minimum 9 cubes of 15 cm size Max. M15 or above Mix the concrete can be done by hand or in a laboratory batch mixer Mix the coarse aggregate, cement, and fine aggregate on a water platform until the mixture is thoroughly blended and is of uniform color. After that

Curing of Concrete Cube The cube test specimens are stored in a moist air atmosphere for 24 hours and after this period the specimens are given marking and removed from the molds and kept submerged in freshwater until time of testing. The water used for curing should be at 27+20 C. Concrete Cube Test Procedure Remove the concrete cube from the water after the specified curing time and clear out excess water from the surface. Measure the dimension of the specimen to the nearest 2mm. Clean the test surface of the testing machine. Place the cube sample in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast. Place the specimen centrally on the base plate of the machine. Rotate the machines movable portion gently by hand so that it touches the top surface of the specimen. Apply the load gradually to the cube without shock and continuously at the rate of 140 kg/cm²/minute till the specimen fails. Record the breaking load and note any unusual features in the type of failure. Calculations of Compressive Strength Check the Compressive Strength of Concrete Size of the concrete cube = 15 cm x 15 cm x 15 cm Area of the cube sample = 225 cm² (22500 mm²) The same calculation should be done for 28 days of compressive strength The maximum load applied or load at failure of cube = 400 KN (4001000 N) Compressive strength = (Load in N/ Area in mm²) = 4001000/22500 N/mm² = 17.77 N/mm² The following table shows the percentage gain of compressive strength of concrete at 7 days, 14 days, and 28 days Strength Day 1 6.3% Day 30