



INDUSTRIES
— ISO 9001: 2015 COMPANY —

CONCRETE: THE BACKBONE OF MODERN CONSTRUCTION

COMPOSITION, PROPERTIES & IMPORTANCE AT A GLANCE



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WHAT IS CONCRETE – COMPOSITION & KEY FEATURES

Concrete is the most widely used construction material in the world, serving as the foundation of modern infrastructure. It is a composite material made from a carefully balanced mix of key components—cement as the binding agent, fine aggregates such as sand, coarse aggregates like gravel or crushed stone, water for hydration, and specialized admixtures including plasticizers, retarders, accelerators, shrinkage reducers, and fibers tailored for specific applications. The strength and durability of concrete are achieved through the hydration process, in which cement chemically reacts with water to form a hardened matrix that binds the aggregates together. This transformation turns a plastic mixture into a solid, resilient material capable of bearing immense compressive loads.



1. Composite Nature of Concrete

Concrete is not a single material but a composite formed by combining cement, aggregates, water, and admixtures. Each ingredient contributes to the overall performance—for example, cement acts as the binder, aggregates provide strength and stability, and admixtures enhance workability or durability.

2. Hydration Process for Strength

The strength of concrete comes from the hydration process, where cement reacts chemically with water. This reaction creates a hardened matrix that binds the aggregates together, transforming the fluid mixture into a strong, durable material capable of withstanding heavy compressive loads.

3. Importance of Mix Design and Quality

The performance of concrete depends heavily on the right proportions and quality of materials used. Proper mix design ensures durability, strength, and suitability for different applications, while poor material control can lead to structural weaknesses and reduced lifespan.

The quality, proportion, and selection of each ingredient play a decisive role in the final performance of concrete, underscoring the importance of precise mix design and material control in construction practices.

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THE IMPORTANCE OF CONCRETE ADMIXTURES—WHY SNF-BASED SUPERPLASTICIZERS MATTER

Concrete can be classified based on strength, density, function, and special properties. By strength, it ranges from normal grades like M10–M20 for simple foundations to high-strength grades (M60–M100+) used in high-rises and bridges. Based on density, normal weight concrete ($\sim 2400 \text{ kg/m}^3$) is common, lightweight concrete ($< 1800 \text{ kg/m}^3$) reduces structural load, while heavyweight concrete ($> 3000 \text{ kg/m}^3$) is used in radiation shielding. Functionally, it includes plain cement concrete (PCC), reinforced concrete (RCC), prestressed concrete, shotcrete, self-compacting concrete, and fiber-reinforced concrete. Under special properties, modern innovations such as high-performance concrete, ready-mix concrete, and eco-friendly geopolymers address durability, efficiency, and sustainability needs in construction.

1. Strength-Based Classification:

- **Normal Strength Concrete (M10, M15, M20):** Used for non-structural works like leveling courses, foundations, and pathways.
- **Standard Strength Concrete (M25–M55):** Most common for beams, slabs, columns, and RCC structural elements.

2. Density-Based Classification:

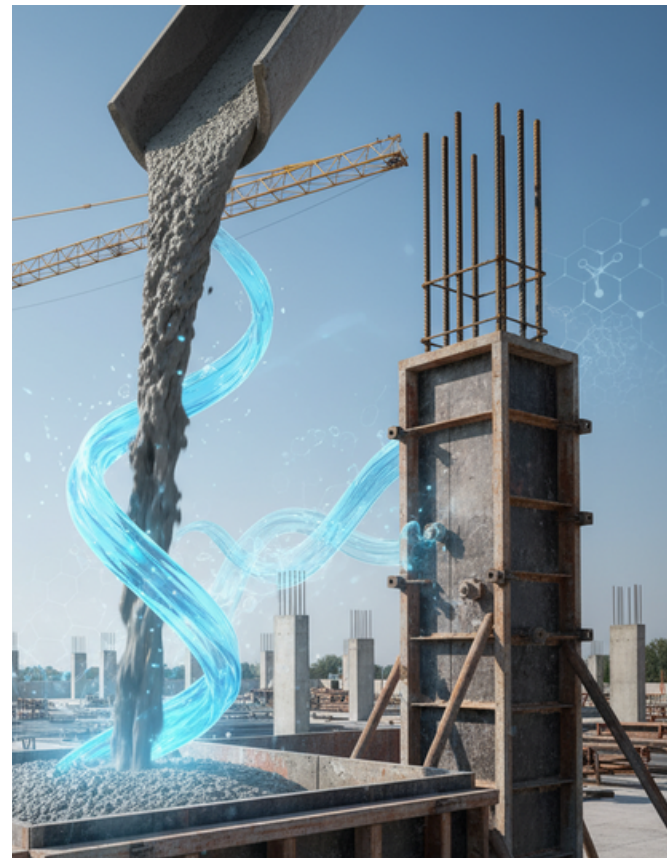
- **Normal Weight Concrete ($\sim 2400 \text{ kg/m}^3$):** Standard concrete used in most construction projects for balanced strength and cost.
- **Lightweight Concrete ($< 1800 \text{ kg/m}^3$):** Made with lightweight aggregates (e.g., expanded clay, cinder); used for partition walls and reducing dead load.

3. Functional Classification

- **Plain Cement Concrete (PCC):** No reinforcement, used for foundations, flooring, and leveling.
- **Reinforced Cement Concrete (RCC):** Steel reinforcement to handle tensile stresses; widely used in structural elements.

4. Specialized Types (Special Properties)

- **High-Performance Concrete (HPC):** With silica fume, fly ash, GGBS; provides superior strength, durability, and low permeability—used in marine and high-rise structures.
- **Ready-Mix Concrete (RMC):** Produced in batching plants and delivered in transit mixers; ensures consistency and time-saving.



CURING COMPOUNDS – APPLICATION, ADVANTAGES & BEST PRACTICES

Application:

Curing compounds are membrane-forming chemicals (water-based, resin-based, or wax-based) applied immediately after surface finishing. They form a thin film that retains moisture in fresh concrete, ensuring proper hydration. Typically, coverage rates are 4–5 m² per liter. White pigmented compounds are often used to reflect sunlight and reduce thermal stress.

Advantages:

- Eliminates the need for continuous water curing.
- Ensures effective hydration and strength gain.
- Reduces shrinkage cracks and surface deterioration.
- Convenient for large construction sites where water curing is difficult.
- Eliminates the need for continuous water curing.
- Ensures proper hydration and strength development.
- Minimizes shrinkage cracks and surface damage.
- Saves time and is practical for large-scale construction projects.

Best Practices:

- Apply uniformly right after finishing to prevent early moisture loss.
- Ensure compliance with standards like ASTM C309 or ASTM C1315 for performance.
- Use biodegradable or removable formulations if future surface finishes (e.g., plaster, paint) are planned.
- Protect the surface from direct sunlight and wind during early curing to maximize effectiveness.
- Apply uniformly after finishing to avoid early moisture loss.
- Follow standards like ASTM C309 / ASTM C1315 for quality.
- Use removable or eco-friendly compounds if surface finishing is planned.
- Protect fresh concrete from direct sunlight and wind.
- Ensure correct coverage rate (about 4–5 m² per liter).



WHY CRACKS OCCUR MORE IN SLABS THAN WALLS – TECHNICAL REASONS & SITE MEASURES

Concrete slabs are more prone to cracking than walls because of their horizontal orientation and exposure to environmental factors. Slabs have large exposed surface areas that directly face sun, wind, and low humidity, causing faster moisture loss and higher evaporation rates than vertical walls. This leads to plastic shrinkage cracking when the surface dries out before the concrete sets. Horizontal slabs also experience greater bleeding—water rises and evaporates from the top surface—creating differential moisture conditions that encourage cracks. Moreover, slabs are usually restrained by reinforcement, formwork edges, or adjoining structural elements; when they shrink, this restraint generates internal tensile stresses that initiate cracking.

Thermal gradients—Such as heating of the top surface by sunlight—further amplify these stresses by creating temperature differences between the top and bottom of the slab.



Preventive measures on-site include: Using properly designed mixes with low water-cement ratios and shrinkage-reducing admixtures; immediate and continuous curing (like ponding, wet burlap, or curing compounds); controlling placement temperature (by using chilled water, shading aggregates, or pouring during cooler hours); and reducing restraint by planning joints at appropriate intervals (4–6 m spacing). Fiber reinforcement, especially polypropylene microfibers, also helps by distributing shrinkage stresses and limiting early-age cracking. Proper compaction and finishing methods, combined with prompt surface protection like plastic sheets or fogging, significantly reduce the risk of cracks in slabs.

By contrast, walls benefit from formwork remaining in place longer, which retains moisture and shields them from direct sun and wind. Vertical orientation reduces bleeding and thermal gradient effects, resulting in fewer cracks.

SHUTTERING OIL (FORM RELEASE AGENT) – PURPOSE, TYPES & BEST PRACTICES

Shuttering oil—also called form release agent—is a specially formulated liquid applied to formwork (shuttering) before concrete placement to ensure easy and clean removal of the formwork once the concrete has set. Its primary purpose is to create a thin, non-staining film between the concrete surface and the formwork, preventing adhesion and reducing the risk of surface damage, honeycombing, or sticking during stripping. This not only improves the appearance of the finished concrete but also extends the life of the formwork by minimizing mechanical wear and tear.

Types of Shuttering Oil:

Form release agents come in various types. (1) Chemical release agents react with cement paste to form a thin soap-like film, ideal for steel and plywood formwork. (2) Barrier-type oils (pure mineral oils or diesel mixes) create a physical layer between concrete and formwork but can sometimes stain or affect finishes. (3) Water-based emulsions combine oil and water to produce eco-friendly, low-odor options suitable for precast yards and interior work. (4) Specialized high-temperature release agents are used where steam curing or high ambient temperatures are involved. The choice depends on the formwork material, the desired surface finish, and environmental considerations.

Best Practices on Site:

For optimal performance, shuttering oil should be applied as a thin, uniform film using a spray or roller after the formwork is clean and dry. Excess oil should be wiped off to avoid surface blemishes or soft spots in concrete. Only approved, non-staining agents should be used where exposed architectural finishes are required. Reapplication before each pour ensures consistent release. Storage and handling must be done carefully—oils should be kept away from dust and moisture to preserve effectiveness. Finally, always comply with manufacturer's instructions and local environmental standards when selecting and applying release agents.

Shuttering oil—also known as form release agent—is a specialized chemical applied to the inner faces of formwork before pouring concrete. Its primary purpose is to create a thin, non-stick film between the formwork (timber, steel, aluminum, or plastic) and the fresh concrete. This prevents the concrete from bonding to the formwork surface, allowing for smooth and easy stripping of the formwork once the concrete has set. Proper use of shuttering oil protects both the formwork and the concrete: it extends the life of expensive formwork panels, reduces surface damage to the concrete, and minimizes patching or finishing work by ensuring a cleaner, blemish-free surface.

When chosen and applied correctly, it saves time, improves finish quality, and extends the life of formwork systems, contributing to cost-effective and durable construction.

SOP – CONCRETE PROCESS (ADT STANDARD) – STAGE-WISE CHECKLIST FOR SITE ENGINEERS

1. Pre-Construction Stage

- **Material Verification:** Check and approve cement (type & batch), fine and coarse aggregates (grading, cleanliness), water source (potability) and admixtures (type & dosage as per mix design).
- **Mix Design Confirmation:** Ensure approved mix design as per IS 10262:2019 and IS 456:2000 is available for the grade required (M20–M60).
- **Equipment Readiness:** Confirm calibration of batching plants, weigh-batching, mixers, and vibrators.



2. Concrete Production & Transport Stage

- **Batching:** Weigh all constituents accurately. Maintain water–cement ratio as per mix design.
- **Admixture Use:** Add plasticizers, shrinkage reducers or retarders as specified.
- **Transit:** For ready-mix concrete, ensure transit mixers arrive within stipulated time; maintain continuous agitation to avoid segregation.



3. Placement & Compaction Stage

- **Continuous Pouring:** Place concrete within initial setting time, avoiding cold joints.
- **Layer Thickness:** Maintain layers not more than 300 mm for vibration effectiveness.
- **Vibration:** Use appropriate vibrators—needle for vertical elements, screed for slabs—to avoid honeycombing.

4. Final Handover & Records Stage

- **Compliance:** Ensure all procedures, test results and approvals meet specifications.
- **Performance Check:** Verify surface finish, dimensional accuracy and durability provisions (cover, joints, curing).
- **Sustainability:** Where applicable, record use of green/geopolymer or high-performance concrete for reporting.

QUALITY CONTROL & VERIFICATION PROTOCOLS

1. Pre-Construction Verification

- **Material Approval:** Verify cement grade and source, aggregate grading, water quality and admixtures. Collect supplier test certificates.
- **Equipment Preparation:** Calibrate batching plants, weigh-batching machines, mixers and vibrators before use.
- **Formwork Check:** Inspect alignment, dimensions, release agent application (shuttering oil), and load-bearing capacity

2. In-Process Quality Control

- **Batching Accuracy:** Weigh all materials precisely. Maintain water-cement ratio per mix design.
- **Admixture Dosage:** Verify correct type and quantity of chemical admixtures.
- **Workability Test:** Conduct on-site slump test for every truckload/batch before placement.

3. Verification During Placement & Compaction

- **Layer Control:** Maintain layer thickness for effective vibration (≤ 300 mm).
- **Vibration Monitoring:** Use correct vibrators (needle for vertical, screed for horizontal) to eliminate honeycombing.
- **Surface Protection:** Apply fogging, shading or plastic sheeting to minimize evaporation during hot/windy weather.

4. Post-Placement Quality Control

- **Cube Sampling:** Take test specimens at required intervals for 7-day and 28-day compressive strength tests. Record results.
- **Early Crack Inspection:** Inspect within 2–3 hours after placement; address plastic cracks immediately with fog spraying or surface protection.
- **Curing Documentation:** Maintain daily logs of curing type (water, hessian, curing compound), start time, and duration.



TECHNICAL REASONS & SITE MEASURES

Issue	Potential Cause	Solution
Low Workability / Stiff Mix	Inadequate water content, insufficient admixture	Adjust water/admixture dosage, ensure proper mix design
Excessive Workability / Flow	High water-cement ratio, excess water	Reduce water content, use proper admixture system
Segregation	Excessive water, poor grading of aggregates	Reduce water, improve aggregate grading, confirm mix design
Surface Bleeding	Excess water or improper fine/coarse ratio	Adjust mix proportions, optimize fines, proper compaction

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- **Low Workability / Stiff Mix (Inadequate water content, insufficient admixture)**
 - **Potential Cause:** Inadequate water content, insufficient admixture.
 - **Solution:** Adjust water/admixture dosage and ensure proper mix design.

 - **Excessive Workability / Flow (High water-cement ratio, excess water)**
 - **Potential Cause:** Overdosing (too much admixture added).
 - **Solution:** Reduce water content and use a proper admixture system.

 - **Segregation (Excessive water, poor grading of aggregates)**
 - **Potential Cause:** Excessive water, poor grading of aggregates.
 - **Solution:** Reduce water, improve aggregate grading, and confirm mix design.

 - **Surface Bleeding (Excess water or improper fine/coarse ratio)**
 - **Potential Cause:** Excess water or improper fine/coarse aggregate ratio.
 - **Solution:** Adjust mix proportions, optimize fine content, and ensure proper compaction.

SAFETY PROTOCOLS & ENVIRONMENTAL COMPLIANCE

Safety is a critical aspect of every concrete project, requiring workers to follow established personal protective equipment (PPE) guidelines such as helmets, gloves, safety boots, and dust masks. These measures protect against injuries from handling heavy materials and exposure to cement dust. Site safety also depends on proper handling of equipment, secure scaffolding, and fall protection measures during casting, compaction, and curing activities. Regular safety drills, signage, and close supervision help create a culture of responsibility and awareness, reducing the likelihood of accidents on site.

Concrete operations generate dust, noise, and slurry that can impact surrounding areas if not managed properly. Batching and mixing should be performed with dust control systems like sprinklers, enclosed conveyors, or misting units. Proper waste management is essential to ensure cement slurry, wash water, and unused material are not discharged into natural water bodies. Recycling aggregates and reusing wash water are effective practices to conserve resources, reduce pollution, and improve operational efficiency.

Concrete production has a significant carbon footprint due to cement manufacturing. Projects can mitigate this impact by adopting supplementary cementitious materials such as fly ash, slag, or silica fume, and by using ready-mix concrete plants to optimize batching. These measures reduce greenhouse gas emissions and energy use while maintaining structural performance. Compliance with local environmental regulations and sustainability certifications ensures the project meets modern standards of eco-friendly construction.

Ultimately, safety protocols and environmental compliance go beyond legal obligations—they represent a long-term commitment to sustainable construction. By combining proper worker training, advanced technologies, and eco-friendly materials, construction teams can deliver durable structures while protecting worker health and minimizing environmental damage. This integrated approach aligns with global best practices and enhances both the quality and sustainability of concrete construction.



Wear PPE

Handle Carefully



Store Safely

Eco-Friendly

CONCLUSION : THE BACKBONE OF MODERN CONSTRUCTION

Concrete truly stands as the backbone of modern construction, shaping everything from simple foundations to advanced infrastructure projects. Its unique combination of strength, durability, and adaptability makes it the most widely used building material across the globe. By bringing together cement, aggregates, water, and chemical admixtures, concrete delivers not only structural stability but also versatility to meet the diverse needs of residential, commercial, and industrial applications.

The continuous advancement of concrete technology has further strengthened its role in the industry. High-performance, self-compacting, and green concretes demonstrate how innovation can improve workability, extend service life, and reduce environmental impact. By integrating supplementary cementitious materials and advanced admixtures, modern concrete can withstand aggressive environments, achieve faster construction timelines, and align with sustainability goals.

Moreover, proper mix design, quality control, and construction practices ensure that concrete structures achieve their intended strength and durability. From highways and bridges to high-rise buildings and marine works, concrete remains unmatched in balancing cost-effectiveness, performance, and longevity. Its ability to adapt to new technologies and environmental standards ensures its relevance well into the future.

In conclusion, concrete is more than just a construction material—it is the foundation upon which modern civilization is built. Its enduring strength, combined with innovations in design and sustainability, secures its position as an essential material for building resilient, efficient, and future-ready infrastructure.



ABOUT ADT INDUSTRIES & CONTACT INFORMATION

ADT Industries is a reputable leader in the construction chemicals sector, committed to delivering innovative and reliable solutions that enhance concrete performance and durability. Known for its focus on advanced technology and sustainable practices, ADT Industries supports contractors, engineers, and builders by providing high-quality admixtures tailored to modern construction needs.

Our flagship offering, CONCRETE High-Performance Concrete, is designed to meet diverse application needs ranging from residential and commercial structures to high-rise buildings, bridges, pavements, and industrial floors. Produced in accordance with IS 456:2000 and IS 10262:2019 mix design standards, our concrete ensures optimal workability, strength, and durability. The use of advanced admixtures, including superplasticizers and shrinkage reducers, allows us to deliver mixes with superior performance characteristics such as high early strength, low permeability, and enhanced crack resistance.

**FOR MORE INFORMATION OR TO PLACE AN ORDER,
REACH OUT TO ADT INDUSTRIES**



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