



Basic Testing of Construction Materials for Farmers

Sandeep Bhardwaj

Assistant Professor, College of Agricultural Engineering & Technology, CCS HAU, Hisar-125004

Email: bhasandeep@gmail.com

In the process of construction of building for different purposes, we need to select and buy different construction materials such as brick, cement, aggregate etc. Depending upon the quality of these materials, the construction quality is highly going to affect. However various laboratory tests are prescribed for testing the quality of these materials; moreover below are the few field tests which also help in buying the appropriate construction materials from the market. But these are not the only test; interpretation should be done in conjecture with laboratory tests.

1. Bricks

Following points to be remembered while buying brick from any kiln.

- The colour of the brick should be uniform dark red colour.
- All the faces are uniform and smooth. All the edges are sharp and rectangular.
- A broken surface shows a uniform compact texture and no kankar inside.
- Bricks should be free from cracks or flaws.
- Scratch with finger nails leaves no mark.
- Two first class bricks when struck with each other give a sharp metallic ringing sound.
- If you drop the brick from chest height it should not break into two pieces.
- Lighter colour or Pilla bricks should be discarded.
- If the brick has irregular shape with dark patches of colour blue, this should be discarded, but may be used in foundation.
- Bricks should not absorb water more than 20% by weight.
- Modular Brick size without mortar is 19cm x 9 cm x 9 cm.
- Modular Brick weight is 3-4kg.

2. Cement

- The colour of cement should be uniform. In India typical colour of cement is grey colour with a light greenish shade.
- One should feel smooth when this cement is touched or rubbed in between fingers. If it is felt rough, it indicates adulteration with sand.

- If hand is inserted in a bag or heap of cement, it should feel cool and not warm.
- If a small quantity of cement is thrown in a bucket of water, it should sink and should not float on the surface.
- A thin paste of cement with water should feel sticky between the fingers.
- If the cement contain too much of clay and silt as an adulterant, the paste will give an earthy smell.
- The cement should be free from any hard lumps. Such Lumps are formed by the absorption of moisture from the atmosphere.
- Before using any cement Indian Standard should be met by the respective cement which you buy. Compressive strength (grade of cement), Setting Time, Tensile strength, Fineness and soundness are the very important physical properties of the cement, they have to met the Indian Standards (like IS 269, IS 455, IS 1489, IS 6453, IS 6909 etc.)
- Cement loses its strength and various other properties if it is stored for longer duration.

3. **Aggregates**

Coarse Aggregate

- It should be hard, durable, clean and free from adherent coatings and organic matter and shall not contain appreciable amount of clay.
- Shall not contain harmful impurities such as iron pyrites, alkalis, salts, coals, mica, shale or other materials which will effect hardening and attack reinforcement.
- It shall be of quartz, light grey or whitish variety.
- It is used an adulterant to increase the volume of mortar.

Fine Aggregates

- In natural sand or crushed gravel, the amount of clay, fine silt and fine dust should not be more than 4% by weight and in crushed stone it should not be greater than 10%. Generally sea sand should not be used except in making precast piles and heavy stone work for use in harbour works.
- Use of fine aggregates reduces shrinkage and cracking of mortar on setting.
- It helps pure lime to set because it allows the penetration of air which provides carbon di oxide needed for the carbonization and setting of lime.
- Volume of sand fluctuates with the variations in its moisture content. Increase in volume of sand being wet is known as “Bulking of sand”. Bulking increases gradually with the increase in moisture content by weight, the increase in volume is about 25%. It then decreases with increase in moisture till it becomes zero when the water is more than 20%.
- Bulking is more in fine sands than in coarser. In measuring sand by volume its bulking due to moisture content should be taken note of.
- Rub a little sand between the fingers; Stains left on fingers will indicate the presence of clayey (undesirable) impurities.

4. Timber

- Timber should have sufficient weight and sweet smell. A timber with heavy weight is considered to be sound and strong.
- Following Timber should be used Rosewood, Teak, Willow, Shesham, Sal etc. Moreover Medium Density Fiber Board, plywood and Chipboard can also be used appropriately. These woods are also available in Haryana as well.
- Following is the appropriate weight of the one cubic meter wood. While purchasing check appropriately.

Name	Density (Kg/cubic meter)	Name	Density (Kg/cubic meter)
Afromosia	705	Lignum Vitae	1280 - 1370
Apple	660 - 830	Mahogany (Honduras)	545
Ash, black	540	Mahogany (African)	495 - 850
Ash, white	670	Maple	755
Aspen	420	Oak	590 - 930
Balsa	170	Pine (Oregon)	530
Bamboo	300 - 400	Pine (Parana)	560
Birch (British)	670	Pine (Canadian)	350 - 560
Cedar, red	380	Pine (Red)	370 - 660
Cypress	510	Redwood (American)	450
Douglas Fir	530	Redwood (European)	510
Ebony	960 - 1120	Spruce (Canadian)	450
Elm (English)	600	Spruce (Sitka)	450
Elm (Wych)	690	Sycamore	590
Elm (Rock)	815	Teak	630 - 720
Iroko	655	Willow	420
Larch	590	Walnut (European)	570

- The structure of timber should be uniform hard and compact.
- A timber should have sufficient hardness, i.e. resistance against penetration.
- A timber should have dark colour (sign of strength), straight fibers, shining appearance, free from defects, sweet smell, good sound when struck etc.
- It should be free from heart shakes, star shakes, cup shake, ring shake, radial shake, Rind gall, upsets or ruptures, twisted fibers or wandering hearts, wind cracks, knots, end splits, dead wood, druxiness etc.
- It should be well protected against pin hole borer, powder-pest beetles, termites or white ants.
- Proper seasoning of the timber should be done before its use.

- After Construction, Preservation of timber should be done.
- If suitable timber is not available, then veneers, plywood, fiberboards, Laminated Lumber, block boards, Batten board, Lamina Board etc. may be used in place of timber.

5. Steel

- The grades of steel which are available is
 - Low carbon steel or mild steel (carbon percent 0.25).
 - Medium carbon steel or hard steel (carbon percent 0.25 to 0.7).
 - High carbon steel (carbon percent 0.7 to 1.5).

It should be noted that the increase of carbon percentage increases the tenacity and hardness, with a corresponding decreases in ductility and toughness.

- Steel containing carbon 0.3% is required for high strength and structural purposes.
- The ultimate strength of mild steel in compression and tension are 100 MN per sq. m. and 70 MN per sq. m. respectively. The ultimate strengths of high carbon steel or hard steel in compression and tension are 180 and 100 MN per sq. m. respectively.
- For concrete Reinforcing steel, cold drawn steel is better because of its high tensile strength and high yield point.
- **Structural steel:** Take those steel which have addition of alloying elements such as manganese, silicon, nickel, chromium and molybdenum in the specified amounts. Medium carbon (C=0.4% to 0.6%) steels after suitable heat treatment suits this.
- Used and rusted steel should not be used.

6. Quality Control of Concrete

The control on quality of concrete at various stages, i.e. batching and mixing of ingredients, transporting, placing, laying, compacting and curing, must be exercised strictly in accordance with the specified procedure mentioned in Indian Standards to obtain the high quality concrete with desired properties.

- The air bubbles should be eliminated from the body of the concrete.
- The size of cement particles should be as small as possible.
- The concrete would be compacted fully so as to remove the voids to a maximum extent.
- The concrete should be continuously cured for sufficient time (28 days) for achieving full strength.
- The cubical particles of the aggregates should be used so as to gain maximum strength through good interlocking.
- The water cement ratio should be kept low, preferably less than 0.4.
- The quantity of cement should be low and that of aggregates should be high.
- Bleeding and segregation must be controlled during concreting.
- Concrete should be used within one hour after adding the water.
- Centering and shuttering should be removed at least after 10 days in summer and 15 days in winter after concreting. It should be removed in phases.