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TOP 10 BRIDGES OF THE WORLD - THE WORLD FAMOUS BRIDGES

Across the world from the Far East to the far west, there are plenty of rivers and chasms over which humans have to pass, and bridges are invaluable in this matter. We have scanned the world map edge to edge and found some truly amazing bridges. So, here are the top 10 bridges of the world.

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1. London Bridge

Arguably the most famous bridge in the world, the London Bridge was built across the river Thames. Something of a bridge has already existed in that place for as long as history can remember, maybe even before. The modern bridge that we see in that place today is only 50 years old or so. The original bridge was built in the beginnings of the 1800's, and was bought by an American who transported it to Arizona, where it remains on display today.

2. Golden Gate Bridge

The second most famous bridge and until recently the longest bridge ever is the majestic Golden Gate bridge. It sits astride the Golden Gate bay separating San Francisco and Maine County. It is so large that you can fit 40 Boing Jumbo Jets end to end on its span and still have some legroom.

Finished in 1937, the Golden Gate bridge's deck rises 220 feet above the water, and is hung by over 80,000 miles of wires coiled into two gigantic cables. Its massive twin towers are set 4200 feet apart, each leaning six inches away from vertical to create tension on the cables hanging from their shoulders. Just the orange paint of the bridge alone can cover the entire white house 17 times over and still have some leftover.

3. Akashi Kaikyo Bridge

In Kobe, Japan, the beautiful and giant Akashi Kaikyo Bridge spans the Akashi strait, its sheer proportions numbing the mind. Almost as high as the Eiffel tower, the bridge's towers support the massive two and a half miles long span carrying 9 million vehicles every year via its 6 comfortably wide lanes.

Built under severe beatings of typhoons, tsunamis, and heart-dampening rainfall, the bridge is supposed to be as strong as it is big. The 12,828 feet of roadway over the bridge is well-protected from the earth's fury. The area being earthquake prone, the bridge was built with special flexible technology.

4. Sunshine Skyway Bridge

Only about 40 years or so old, the Sunshine Skyway Bridge in St. Petersburg, Florida is truly a piece of beauty! It is as long as the Mount Everest is high (over a kilometer), with sunshine yellow colored steel cables hanging the span, spreading a sense of warmth and joy to the people on and around the bridge. But don't get deceived by the beauty of the bridge, because beneath the beauty slumbers a beast. The Sunshine Skyway is among the toughest bridges in the world. Indeed, it can withstand a direct collision with a fully loaded ship twice the size of Titanic at full speed and that only gets its paint scratched.

5. Tower Bridge

The Tower Bridge of London is among the most famous landmarks in the city. A pride of the British Capital, it was the most expensive bridge at its time (it cost 1 million pounds exactly, in 1894). The bridge is made mostly out of Cornish granite and Portland stone, giving it quite a solid structure that has aged very well.

The Tower Bridge of London was primarily constructed to reduce the traffic on the original London Bridge mentioned above. Iconic in its majestic singular appearance, the bridge is called a combine bascule and suspension bridge due to the duality of its engineering. It now features a glass floor for the tourists.

6. Firth of Forth Bridge

Built back in the 1890's, this oddly named bridge is located in Queensferry of Scotland. It was one of the very first steel bridges to be constructed in the world – with around 54,000 tons of steel. The huge bridge has over 7 million rivets holding it together. All of that made the Firth of Forth bridge among the strongest bridges from that era.

The primary function of the bridge was railroad loading, and it still functions well to this day carrying nearly two hundred trains across the river every day. One of the major arteries connecting Glasgow and Edinburgh, the Firth of Forth is among the highlander's favorite workhorse infrastructure.

7. Brooklyn Bridge

The spot of many romances and mysteries, of many movies and TV shows, of many enjoyments and sorrows, the Brooklyn Bridge in New York has to be one of the top pieces of infrastructure the New Yorkers love most. Opened in 1883, it connected Brooklyn and the island of Manhattan, and was the longest suspension bridge in the world before the Golden Gate Bridge stole that award. Not only were this – at that time, the towers of this bridge the tallest buildings in New York as well.

However, the real significance of the Brooklyn Bridge isn't in its engineering but in the cultural value it represents. It has been a silent actor in many a novels and movies. The bridge very clearly divides two different cultures – that of the New Yorkers and of the Brooklynites.

8. Chesapeake Bay Bridge-Tunnel

This exceptionally long structure is so massive that it is one of the few man-made things that can be seen from a geostationary orbit in space. The unique engineering marvel that is the combination of

bridge and tunnel stretches a whopping 17.6 miles long, and it is supported by more than five thousand concrete pilings.

Over 30 years rolled by till the Chesapeake Bay bridge tunnel hybrid was complete, bleeding off nigh five hundred million dollars. The bridge-tunnel at Virginia Bech has a twofold purpose – first to shorten the

Virginia-Maryland-Delaware commute, and secondly a line of defense for the US Navy in that area to remain functional even if the bridges in the area are taken or destroyed.

9. Sydney Harbor Bridge

Australians lovingly call this great grey structure the “Coat Hanger”. It took them 5 years to complete the Sydney Harbour bridge through the great depression era. Aptly named, the bridge sits 194 feet above the said harbor, consuming 72 thousand gallons of gray paint every year for maintenance.

The 53 thousand ton steel bridge connects the central Sydney business district and the North Shore, carrying huge amounts of vehicles, bicycles, rail, and even pedestrian traffic every day. It is a world heritage site and is probably the longest steel-arch bridges in the world, spanning 1650 feet.

10. Gateshead Millennium Bridge

The funkiest bridge in our top ten bridges list has to be this wicked bridge in Gateshead, England. Also called the “Blinking Eye” bridge, it is the first and only tilting bridge in the world. A result of an incredible innovation of engineering, the Gateshead bridge allows only bicycle and pedestrians, but it can fold up to let boats pass underneath as well.

When the Gateshead bridge folds up to let a boat pass, it looks like an eye is blinking, hence it got the comic nickname. It was opened it 2001, but was officially inaugurated by Queen Elizabeth in 2002. Since then, it has snatched up a lot of awards including the most innovative architecture.

Article

Using SpeedCore Composite Steel Method, Buildings Are Made Much Faster

By the month of August, Seattle's 58-story Rainier Square tower in finished out only 10 months after development began. On the off chance that this high rise had an ordinary strengthened solid center, the undertaking likely would have taken far longer. In any case, this skyscraper had no customary solid center. Instead, it used the SpeedCore composite steel building method using steel and concrete panels.

It rather has a sort of concrete filled composite plate shear divider, with each building block having two hot-moved steel plates associated with a progression of bars that go about as spacers (alongside different functions in the composite plan) as concrete is poured in the middle. It's a frozen yogurt sandwich of structural steel and cement.

SpeedCore building method

Exploration around this development technique started years back at Purdue University and is being supported halfway by the American Institute of Steel Construction (AISC), which has named it SpeedCore. In the event that the structure strategy takes off, it could influence basic creation incredibly.

Drive by a cutting edge high rise being built with a solid center and you'll probably observe the center overshadowing the steel outlining that encompasses it. Building that solid center takes additional time than raising structural steel. Therefore, to adjust the timetable, the temporary workers start with the center first, at that point follows it with the structural steel outlining. In the long run the steel outlining "makes up for lost time" with the center as the structure finishes out—at any rate that is the ideal.

In his NASCC introduction recently, Klemencic clarified that outrigger bracket associations with a solid center can be grave. A composite center with steel plate basically makes these associations steel to steel, and a great deal of it can occur in the shop.

How SpeedCore was used at the Rainier Square

Meanwhile, the core of the Rainier Square is a similar size and measurement as though it were fortified solid, 40 feet wide by 90 feet in length at the base (however the structure tightens at the upper floors). The SpeedCore composite boards involve 0.5-in.- thick plate sandwiching 10,000-PSI concrete. The width of that "sandwich" fluctuates from 21 to 45 in., contingent upon the board area inside the structure.

The board's two steel plates are associated by 1-in.- breadth tie poles separated at 12 in. on focus. With 58 accounts of composite center boards, the employment required in excess of 350,000 bars, and each end must be welded to a plate (making the "sandwich"), for a sum of 700,000 welds.

Every bar fits in openings in each plate, cut on the consume table. View a finished composite board and you'll see the pole closes distend marginally past the external plate surface, and every one requires an external circumferential filet.

Rainier Square actually has floor outlining, gravity sections, and other run of the mill basic creation work. In any case, the undertaking's center was, well, the center—those composite sandwich boards that would make up the structure's center and require the brunt of the welding.

How SpeedCore fabrication is done

Shop manufacture is typically significantly savvier than field creation. All things considered, Seattle is in a seismic zone, which implied every composite board graft would require broad association itemizing between the boards.

To limit the quantity of field welds, the venture accomplices chose to make the composite boards as extensive as could be expected under the circumstances. Preeminent bought another consume table that would permit it to cut gigantic plates into 14-ft.- wide by up to 40-ft. areas—sufficiently large to limit the field welding yet little enough to be controlled in the shop, onto the truck, and got by a crane at the place of work. The heaviest board weighed 36,000 pounds.

When creation started in the shop, sequencing was particularly basic off the consume table. As laborers utilized a scaffold crane to offload each huge plate, they stacked them deliberately, guaranteeing that they had enough stock cushion to keep creation streaming, but additionally guaranteeing they didn't cover a plate that would be required right away.

After the plates were cut and openings were made, the shop set up an assortment of dances that considered the base plate to be leveled and the bars to be introduced with the top plate. Sounds sufficiently direct, but since these plates were so enormous, soundness turned into a test.

Problems in SpeedCore fabrication

The organization thought about mechanical robotization yet ruled against it. The task had so many moving parts—the in excess of 500 center boards, yet additionally the segments, shafts, and deck plate encompassing the center and box segments that made the center's corners. With all that in play, the organization figured it would present huge danger whenever went with a static robotized cell.

The shop required adaptability, including the capacity to take the welding computerization to the work. Consequently, in the end it built up a patent-forthcoming mechanical orbital wire welding framework that an administrator can move starting with one weld then onto the next. The framework has an arm that designs it to the right area, after which the metal-cored curve welding weapon circles around the external perimeter, saving a smooth filet right around.

The normal weld cycle took around 20 seconds. Curiously, this was about the very speed that a human welder could achieve the undertaking, "yet it permits us to dodge those ergonomic issues," Guile stated, "with a welder consistently slouching over to get to the joint, throughout the day, consistently."

Why SpeedCore is good news for subcontractors too

With the SpeedCore framework, the administrator basically fastened the machine to the weld area, started the cycle, at that point eliminated the framework and proceeded onward to the following weld. The organization created seven of these welding frameworks, which implied that the activity could have many weld stations working all the while.

Cleverness added that all these orbital welds didn't make hazardous mutilation. Indeed, the best difficulties came not from bending but rather from redirection, which was comprehended by those inside brackets that additional board inflexibility.

SpeedCore moves more work to the controlled shop climate and away from the place of work. Doing so builds the structural fabricator's cut of the pie. Be that as it may, as sources underscored, in light of the fact that the general development cycle is so a lot more limited, the pie is more modest, which implies proprietors and speculators spare a lot of cash.

In any case, as and industry, struct ural fabricators could remain to pick up from that developing cut of the pie, particularly if SpeedCore takes off as a favored development technique for tall structures. Structural fabricators that success SpeedCore ventures have a lot of creation to perform, and more consume table work specifically may spread to territory fabricators and administration focuses.

All things considered, for SpeedCore to take off, Guile said that joint effort among all partners—the designing firm, the fabricator, the drapery divider contractual worker, MEP (mechanical, electrical, plumbing), the erector, shipping and coordination, and then some — is as outright should. A mistake on a drawing or other little, apparently immaterial detail could snowball crazily in a rush. All things considered, conveying an erroneously created composite board is far costlier than conveying some unacceptable shaft or segment.

Standard Road Structure Cross Section Details

When you are in charge of building roads, it is vitally important that you know all about the proper cross-sectional structure of roads. Otherwise, a roadway with an improperly built structure may result in deformation of the road which could lead the major accidents. Today, we will talk about the standard road structure cross section details in this article.

There are four major elements of a road structure cross section, all of which need to perfect in order to make the road worth the investment. They are:

1. Surface/Wearing Course
2. Base Course
3. Sub Base
4. Sub Grade

Now, let us see each of these elements in detail.

Surface or Wearing Course

This is the very top level of the whole roadway architecture cross section. This is the surface the cars roll on, so it is in direct contact with the vehicles. This also means that the surface/wearing course is continually exposed to the weather.

Also called the pavement, the surface of the road is generally built using bitumen as the binding material. In a bituminous pavement, a combination of mineral aggregate and bituminous binder material is used. The course can be something as inexpensive as a thin (less than 0.25 inch) layer, or it can be asphaltic concrete, and anything in-between, depending upon the needs of the road.

Quality of pavement

The bituminous concrete should have the following qualities if it is to last a long time with good service:

a) It should not get easily cracked or raveled.
b) It should be greatly resistant to weather conditions such as heat, cold, and water.
c) It should not create or absorb internal moisture, worst of all, and water vapors.
d) The surface needs to be as dense or as porous as the need of the underlying road element dictates.
e) It should provide a smooth yet skid resistant surface.

The design of the pavement mix should be done in such a way so that it lasts throughout a considerably long period of time to justify investment. Also, similar care should be taken at the time of the construction of the wearing course as well.

Common pavement construction methods

There are six different ways you can achieve all the above conditions in a pavement. These are as follows:

- **Method 1**: heat up a viscous bituminous binder until it is fluid. Mix it with heated aggregate in a mixing plant. Apply the mix when ready, and immediately begin the compaction process while its hot.
- **Method 2:** Get a liquid bituminous binder first. Mix it with the stone chips at normal temperature (you might need a little bit of heating if working in freezing conditions). You can use a plant or prepare a roadway mix. Apply the pavement mix and compact at normal temperature.
- **Method 3:** Get non-fluid bituminous binder, and add a solvent like naphtha or kerosene to it to make it fluid. Now, quickly before the solvent can evaporate, spread the mix and immediately compact it. This works better at lower temperatures.
- **Method 4:** Same as above, but use water and compact it before the bitumen can react with the H_2O.
- **Method 5:** Clean up the aggregate by washing it first. Then apply the aggregate directly on the road surface in the needed thickness. Then pour emulsified or molten bituminous binder over it. This method is also known as the "*penetration method*" since the fluid binder directly penetrates the open areas between the rocks and binds them together.
- **Method 5:** Also called the "*Inverted Penetration Method*", the liquified bituminous binder is spread on surface first and then the stone chips are applied.

You can use any of the above methods, but each of these methods has their ups and downs useful in certain scenarios. Therefore, you should investigate further before you choose a method. However, note that the first two methods are most common in practical use.

Base Course

The layer immediately under the pavement or the surface layer is known as the base course. It bears all the load on the road, so it should be prepared for that accordingly. That is why the material for the base course is chosen of the top quality and the construction is done very carefully.

There are four main types of base course depending upon material:

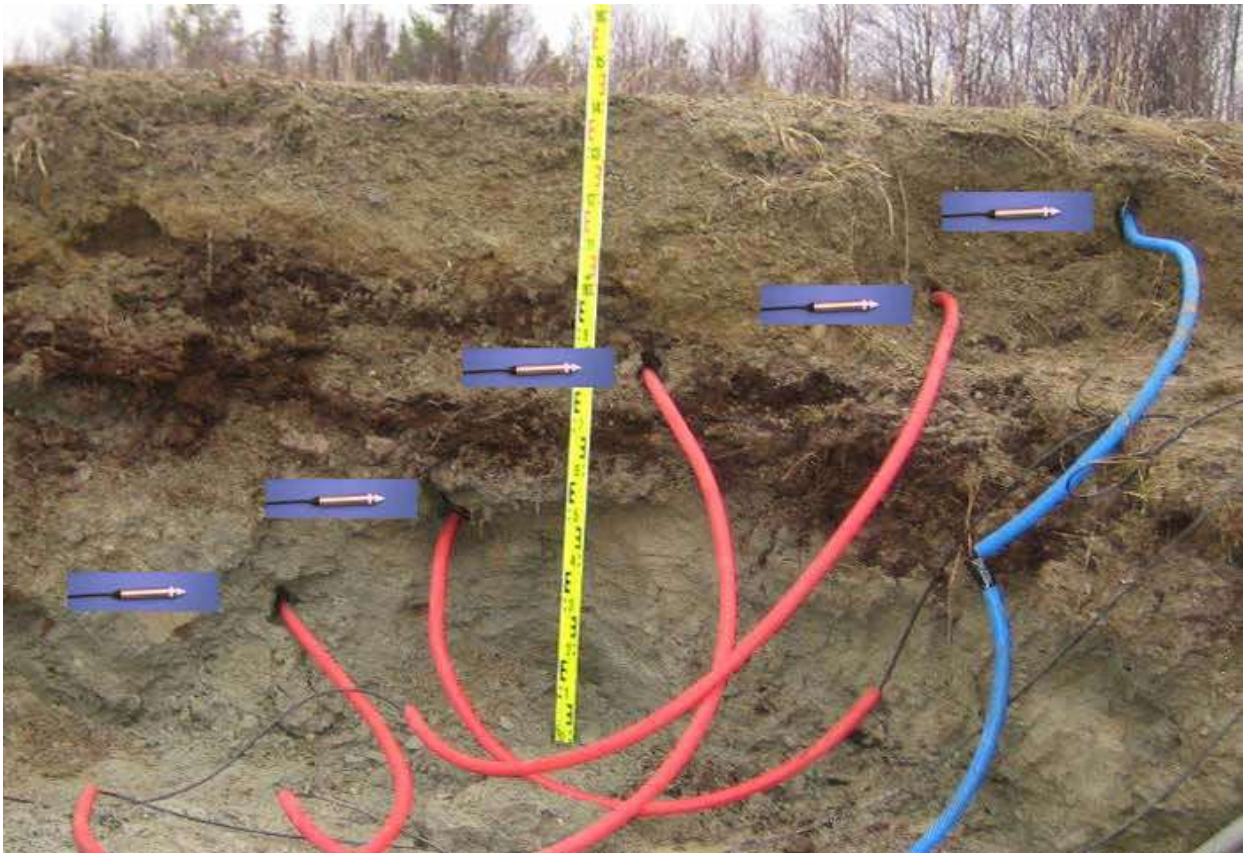
1. Granular Base Course
2. Macadam Base
3. In-water bound Macadam
4. Treated Bases

Sub Base

A granular material layer is provided between the loaded base course and the bottom layer to buffer the loads coming from above. This is called the Sub base in a road structure cross section. It is generally made out of low-quality subgrade.

The main use of the sub base is to reduce the loads coming down from the base course to an acceptable level till they are okay for the bottom layer to take. However, it also acts as a working plate for constructing the layers above, and acts as a drainage layer by preventing movement of water up or down.

Also, the subgrade and the base course need a diaphragm between them or they get mixed up; the sub base works as that separator.



Sub grade

It is the bottom most road structure cross section level, and therefore consists the natural ground material of that location. Or, you can use fill material brought in from an external source as well. This layer acts as the final layer to carry vehicle loads to the earth, and any other stress as well.

As it is the bottom most layer, if the layer is unchanged from the natural ground, the layer is considered of an infinite depth (or at least till the bedrock). The properties of the first 1 foot of the material are considered only, as prepared by compaction or cleaning. In case you are filling in external material that should be of the same height in this level too.

Top 8 Ways to Save Money on House Construction

Are you planning on building your own dream home that you always wanted? Or are you renovating or upgrading your existing house? Either way, construction is an expensive task, made doubly difficult by the present home loan situation. So, here are the top 8 ways to save money on house construction.

Constructing new or upgrades is always costly, and you don't get much say in this. But if you plan about your home building carefully and choose the right options, you can avoid a lot of expenses on design, construction, and maintenance. It is always good to be able to cut back on homebuilding costs. There are three main ways you can do this:

- Reduce basic pre-construction expenses
- Avoid costly mistakes
- Cut back on maintenance

While those are the main three avenues of cutting costs on homebuilding, in practice you will have to give time and efforts a lot of small matters to optimize your house construction costs. The following are the top 8 ways to save money on house construction you can try among those.

1. The Devil is in the Details

Why pay for stuff you don't really need? Most building contractors, or even designers, will try to push on expensive features on you that you won't actually use. Why would you want some exotic vitrified tiles on your floor when you are perfectly ok with a simple mosaic? Don't fall into sales traps.

Sometimes, many unfair contractors won't even mention these stuffs to you, they will just tell you a lump sum amount for the total work. To avoid paying for unnecessary features, you should always dig into the details of their estimate.

Go literally line-by-line over the contract, and see what you need and see what you don't. You will probably be doing this only once in your whole life, so you can spare the time.

2. DIY is the high

You'll probably be surprised to hear this, but some of the expensive stuff they do, you can do yourself too. And what's more, you don't have to be a great handyman for that either – as long as you know which end of the hammer to hold and are careful enough not to hit your thumb – you can do it.

Especially, much of the after-construction work fall in this category. Painting the house is definitely something you can handle, and it brings some great joy to your soul too. If you know woodworking or electrification, even better – why would you pay through your nose to somebody else for those stuff? However, be careful here and know your limits.

3. Supply the fixtures yourself

Often to reduce hassle people choose to let the contractor buy most of the material and fixtures for their home. Don't! Contractors often provide low-quality materials at a high cost. Also, they may not have many choices.

As much as you can, try to source the small materials yourself. You will get wider choices, better deals, and may even find stuff that completely changes the way your house feels without spending an extra penny otherwise.

4. Get a second opinion, and a third, fourth, fifth...

This should be a no-brainer: don't trust the first quote you get. There should be plenty of builders in your town; and if not, you can source out-of-towners as well. Some of them are bound to give you some solid low prices that may even fall as low as half of some other quotes.

It's a good idea to consider at least 3 to 5 options before you settle on one; and mix up their origins and other values. Who knows, maybe you'll find some choices you never knew you had.

However, a word to the wise. Giving the lowest quote doesn't automatically mean it is a good deal – the cheap guy can be skimping on mandatory stuff or compromising heavily on material quality in order to keep up a good profit margin. Research the background!

5. Build green, live green

It is not only the upfront investment that counts towards construction costs, but also the maintenance costs as well. If you choose to go the sustainable way, your house will save a whopping lot on energy, water and other maintenance bills – which translates into a fractional return of your original investment. Who doesn't like to get a cashback, though be it late?

Also, as a citizen of the 21st century, it is your moral obligation towards humanity to reduce carbon emission and use renewable and organic sources for construction. Imagine what your children will think of you when they are bleeding out through energy bills.

If you're building in cold climate with low sunshine, invest in heavy insulation, wind power, and clever architecture that make best use of the heat inside. If you're in a sunny area, invest like crazy in solar-powered systems and batteries, like solar panels and solar water heaters, and opt for more open designs than congested.

6. Prefab is the new fab

Prefabricated buildings are getting more and more popular especially for personal homes since they reduce the cost, time, and hassle of construction. The traditional on-site construction method is messy, wasteful, and expensive to boot. Whereas, prefab buildings are easy to erect since there is very little construction work – you just buy ready-made walls and roofs and screw them together. It's that easy.

The more important point here is the cost cutting – since building parts are made in a factory (as a whole – e.g., the walls come with internal plumbing and electrification, and can even come painted), they save a lot on the standardized manufacturing process.
Another good point for prefab buildings is that they are often very green, sustainable buildings! Many modern prefab buildings are made with eco-friendly, sustainable material, and they have good insulation and are great for installing renewable energy units.

Last but not the least – prefab, modular buildings are flexible as well! Where with traditional system you will have to go through a whole renovation process just to move one wall – with prefab building parts it's just like Lego!

7. Keep track of everything to the last minute detail

While it may be rather a headache, keeping track of every single little detail, and organizing them well can be extremely rewarding, especially with homebuilding projects. When sourcing materials yourself, make sure you got the materials before they start work. It drains your money down the drain when expensive pay-per-hour workers are standing around while you run around shopping doorknobs and bathroom shelves.

If you have ordered some special materials, make sure to check before they start working! Sometimes, dishonest constructors make do with standard material even when you've ordered something special, especially if they can get away with it. This happens often with woodwork. So, check before work start to see if they did bring the special order or not, and if they're actually using it. It is better if you learn a bit about how to test these materials beforehand.

Also, if you're doing a renovation, make sure you have cleaned out the work area thoroughly and took care of any other needs of that area well beforehand. If you have to move out, plan and book all the alternate residence clearly with lots of time in hand to make changes if necessary.

8. Be a little space-conscious

In construction, total expense is directly related to the total square footage, no matter what technology you use or what design. So, deflate your dreams a bit and opt for smaller rooms if you truly want to cut costs. Often, after work, you'll see that small rooms are what you actually need instead of vast halls.

If you have a good architect, you can tell him or her to design cleverly and make small places look big. An open-type house design often brings the illusion and feeling of space, while a congested, tight-packed design can subtract the spacious feeling from large rooms.

How it feels and what you truly need, is more important than square footage. You can save a lot on the total square footage if you measure the furniture you will put in the rooms and plan accordingly. Clever furniture placing plans will make sure your money is not wasted on unnecessary space.

Sometimes, even the way you place the furniture can define the available open space in a room. For example, if you are willing to compromise one side of the bed, place it along a wall rather than in the middle of the room and suddenly you've doubled the left over space in that room.

Editorial

Materials Quantity Estimation by Center Line Method

Quantity estimation is the process of finding out how many materials you need to build a structure, and how much will it cost you. Estimating the quantity of materials about a building project gives you a precise idea about how expensive the project is going to be and how much time will it take, which in turn lets you know if the project is feasible or not. Today, we will talk about the center line method of material quantity estimation.

The center line method is quite popular with small-scale builders because it is easy, quick and quite accurate. The only downside to this method is that it is only applicable for load-bearing buildings (where there are no columns or similar structural members). Hence it is mostly applied to only load-bearing walls, or partially in case of rooms with no columns.

Using this method and some formula, you can quickly find out the number of bricks and the amount of mortar and plaster required for the applicable room.

Mechanisms of the center line method

The center line method of materials quantity estimation is one of the simplest of them available, and so it is very popular as well. If there are columns or other similar structures in the room, then this method cannot be used, but otherwise it's a very good quantity estimation method.

The centerline method works on the principle that given all walls (long or short sides) have the same cross section and the same type of footing, the total volume of the wall will be the total length of the center line of all the walls in the room, multiplied by the cross section of the wall (height and breadth).

Hence, in this method the total center line length of the walls is measured out, with special care at the corners and junctions. When you have the total length of the walls, that is the center line length, you multiply it by the width and breadth of the wall – and that is the entire wall quantity. Now you can find out the materials estimate by using expected formulas or charts.

Advantages of using the center line method

1. It is great for rooms with unusual types of walls, like circular rooms or polygonal shaped rooms, where other methods of quantity estimation will be very difficult indeed.
2. It is a very fast method for quantity estimation if the building has no cross walls.

3. It is a fast-paced method for quantity estimation.
4. It can be performed by field people and doesn't require much expertise.

Sample quantity estimation by center line method

We have,

Total center line length

= 2 x (Length of long wall + Length of short wall) + 3 x (Length of partition wall)

So, Total center line length

= 2 x (5.3 + 5.3) + 3 x 4.3

= **34.1 m**.

Earthwork in excavation

= Total center line length x Breadth x Depth

= 34.1 x 0.9 x (3 x 0.3)

= 34.1 x 0.9 x 0.9

= **27.621 m^3**.

Concrete in foundation

= Total center line length x Breadth x Depth.

= 34.1 x 0.9 x 0.3

= **9.207 m^3**.

Brickwork in foundation for first footing

= Total center line length x Breadth x Depth

= 34.1 x 0.6 x 0.3

= **6.138 m^3**.

Brickwork in foundation for second footing

= Total center line length x Breadth x Depth

= 34.1 x 0.5 x 0.3

= **5.115 m^3**.

Brickwork in plinth

= Total center line length x Breadth x Depth

= 34.1 x 0.3 x 0.6

= **6.138 m^3**.

Brickwork in superstructure

= Total center line length x Breadth x Depth

= 34.1 x 0.3 x 3.5

= **35.805 m^3**.

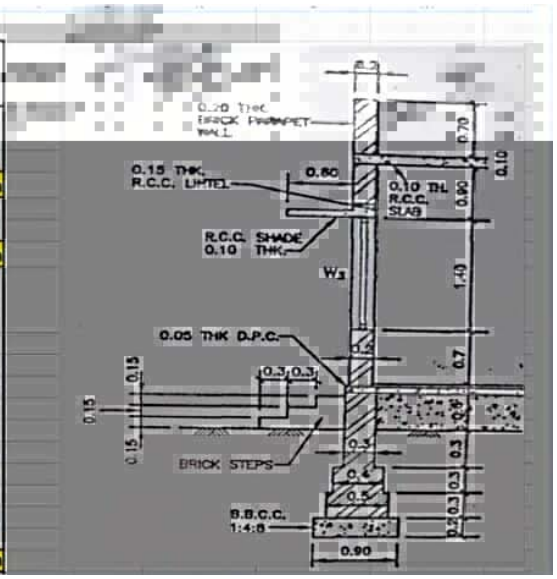
Important considerations in the center line method

- In case of buildings with one partition wall or cross wall having two junctions, for earthwork in foundation trench and foundation concrete, deduction of one breadth of trench or concrete from total center length.
- For each junction half breadth of the respective item is to be deducted from the total center length.

- For footings, deduction of one breadth from the total center length is to be done for two junctions.
- In case of number of footings, the length of first footing is determined by applying half breadth as deduction per junction from the total center line length
- For each subsequent footing, simply offset for every junction to the length of previous footing.
- At every stage deduction of half breadth of the main wall at that particular level shall have to be made per junction. That means the overall one breadth for two junctions from the total center line length.
- This net center length after deduction shall be multiplied by the respective breadth and depth to get total quantities.
- If two walls come from opposite directions and they meet at the same point, there will be two junctions.
- For buildings having different type of walls, each set of walls have to be considered separately.
- All the outer walls or main walls shall be considered first together and then all inter or cross walls must be considered.
- There is no provision of deduction for main walls or outer walls. However, deduction of half breadth of main wall, for each junction must be made for inter or cross walls.

QUANTITY SHEET

Sr. No	Item Description	No.	Length (m)	Width/ Breadth (m)	Height/ Depth (m)	Quantity
1	Earthwork in Excavation in Foundation:					
	48.9 -0.90/2*6	1	46.20	0.90	1.10	45.74 cu m
	46.2					45.74 cu m
2	P. C.C. for Foundation					
	48.9-0.90/2*6	1	46.20	0.90	0.20	8.32 cu m
	46.2					8.32 cu m
3	Brickwork in Cement Mortar in Foundation Plinth:					
	**Foundation:					
	1st Step:					
	48.9-0.5/2*6	1	47.40	0.50	0.30	7.11 cu m
	47.4					
	2nd Step:					
	48.9-0.4/2*6	1	47.70	0.40	0.30	5.72 cu m
	47.7					
	3rd Step:(up to plinth)					
	48.9-0.3/2*6	1	48.00	0.30	0.85	12.24 cu m
	48					
						25.07 cu m



Tips & Tricks

10 Types of Columns Depending on Shape

Arguably, the most important part of any modern architecture are the columns, because they bear all the load of the superstructure. Columns can be of many types, but we prefer to categorize them depending upon their physical shape. So, today we will talk about the 10 types of columns depending on shape.

We can classify columns based on the following characteristics:

- Physical shape
- Reinforcement type
- Loading type
- Slenderness ratio

But in this article, we will only discuss the types of columns depending on shape.

Depending upon physical shape – the shape you see them in, or the shape they are cast in – columns can be of nine main types. These are the following:

1. Rectangular columns
2. Square columns
3. Circular columns
4. L-Type columns
5. T-Type columns
6. V-type columns
7. Y-type columns
8. Y-type columns with arch
9. Hexagonal columns
10. Arched columns

Now, let us go and learn about each type of column based on shape in brief.

Rectangular Columns

The most common type of column found nowadays, these are the simplest to cast and fit in the most scenarios. Where the shape of a room is rectangular, it is a safe bet that you'll find at least a rectangular column in there.

Rectangular columns are so popular because they are so very easy to cast. With simple way of shuttering or formwork, these columns can be cast fast and easy without much complicated calculations. This simple yet effective shuttering prevents the concrete from flowing without much ado.

For all these reasons, the rectangular columns are the cheapest and thus they are used most commonly in residential and commercial construction.

Square Columns

These types are columns are basically rectangular columns with equal length and width. Square columns are most useful when the load on the column is distributed evenly on all sides. So, they are not as common as the rectangular columns.

However, since the casting process and the cost thereof the square columns are similar to the rectangular columns, you are bound to find many in civil construction.

Circular Columns

These specially designed columns are used in elevations and piling of buildings, since they reduce the appearance of edges. So, you wouldn't see the bigger of the circular columns out in daylight – they're often underground, or are covered by other members.

However, a well-finished circular column is, arguably, the prettiest load-bearing member ever. Therefore, you will find some of the rather slender ones, lovingly finished, on the most visible portions of buildings – porches, sit-outs, auditoriums, etc.

Circular columns are also good to place where there will be a lot of traffic – of people, vehicles, or even water. So, you may also find them under bridges and flyovers as well. However, due to the difficulty of casting these, circular columns are not seen often.

L-type Columns

Very rarely found, these columns are suitable in the very isolated cases of being in the corners of tall boundary walls needing extra support. L-type columns have similar properties as rectangular columns, and are just as easy and cheap to cast. However, due to the rare need, it's hard to find them in use.

T-type Columns

Most commonly found holding up bridges, flyovers, and similar heavy elevated paths, they are favored in heavy construction and are made to be very strong, since they have to bear all the load of the section alone. They are also easily cast, like rectangular columns, and are cheap, considering the situational requirements.

V-type Columns

Another rare type, the column is cast in a V shape only if the room is trapezoidal or triangular in shape, which is quite uncommon, indeed. It is not cheap to cast due to the odd shape of formwork needed, and the excess amount of concrete needed – it requires the most amount of concrete per cross sectional area among all types of columns.

Y-type Columns

A deviation of the T-type, the Y-type columns are often found holding up bridges or elevated roads. It is more common when there is not much ground space for the column footprint, but the section above is quite wide (or, there are two lanes to be supported with a gap in-between). These are never found in small sizes – only heavy constructors prefer them.

Y-type Columns with Arch

It is a Y-type column, but the twin arms of the column are curved outwards gradually. These are useful for areas with even more severe space constraints, or just for the sheer aesthetic pleasure of it. Again, they are found in heavy construction only.

Hexagonal Columns

More commonly seen in older constructions, hexagonal columns are often reformed columns, found in buildings from previous eras, or olden-style architecture. They are quite aesthetically pleasing and are as such placed in exposed positions, such as verandahs, movie theaters, front facades of large buildings, etc. Persian architecture has many great examples of hexagonal and circular columns.

Arched Columns

This very rare type of column is used in rooms where there is no scope of constructing rectangular or circular columns. Arched columns are used in rooms where the shape is arched. More often than not a different support solution is found rather than using these columns, since their casting process is ridiculously tricky and costly.

Civil Engineering Thumb Rules – Common Must Know Construction Rules

Any site supervisor, hands-on contractor, or civil engineer must know about some basic engineering laws and formula that are used every day in most building situation. As a civil engineer, you are expected to know and remember these civil engineering thumb rules. Today, we will look into what are the common rules a civil engineer must know.

What are Civil Engineering Thumb Rules

The common rules, or thumb rules are some simple mathematical formula that help you to find out the solution to a given problem. In construction, they are extremely important for intelligent and informed decision making on the go. They are easy to use and much of the calculation using these can be done in your head, or in a pocket calculator or mobile calculator.

While the civil engineering thumb rules are very handy, there is a downside to them as well. These rules and formulas are good for doing approximated work only; to make snap decision on the moment. But they are also inaccurate! When the time comes to do the actual work, you had better use the textbook formulas, official tables, or charts.

If you are working in the field, there are quite a few civil engineering mobile apps that can help you with the fieldwork calculations – consider them a digital upgrade to the civil engineering thumb rules. Anyway, let us move forward to see what are the most common thumb rules for site engineers.

A. Estimating concrete volume in an area

- Volume of concrete per unit area = 0.038 m^3/ft^2

B. Estimating steel quantity for load-bearing members

- For residential buildings: 4.5 to 4.75 kg/ft^2
- For commercial buildings: 5 to 5.5 kg/ft^2

These rules are good for calculating reinforcement amounts in beams, columns, slabs, and footings.

C. Percentage of steel in structural members:

With respect to total volume of concrete in a given structural member,

- Steel required in a slab: 1%
- Steel required in a beam: 2%
- Steel required in a column: 2.5%
- Steel required in a footing: 0.8%

D. Estimation of Shuttering:

1. Total area of shuttering = 6 x concrete volume, or, 2.4 x plinth area
2. Shuttering ply quantity = 0.22 times the shuttering area. Then divide it by the area of each ply sheet to get the number of ply sheets or boards required.
3. Shuttering battens quantity = 19.82 x no. of ply sheets
4. Nails quantity in shuttering = 75 grams/m^2 shuttering area

5. Binding wire quantity in shuttering = 75 grams/m^2 of shuttering
6. Shuttering oil quantity = 0.065 x shuttering area. Or, 1 liter/15 m^2 of shuttering area.

E. Estimation of cement quantity in masonry work:

1. Cement required for 1 m^3 brickwork =
    - 0.876 m3 for 230 mm brickwork
    - 0.218 m3 for 115 mm brickwork
2. Cement required for 1 m^2 masonry =
    - 6.2 kg for 200 mm 1:6 work
    - 4.65 kg for 150 mm 1:6 work
    - 10.3 kg for 200 mm 1:4 work
    - 7.2 kg for 150 mm 1:4 work
    - 5.15 kg for 100 mm 1:4 work
3. Cement required for 1 m^2 plastering:
    - 4.5 kg for rough plastering, internal wall, and ducts
    - 8.75 kg for external walls and stucco plastering
    - 25.5 kg for lath plastering

Note: for the cement quantity estimation, find the mass of cement required in kg first, and then to find out the number of cement bags required, used this thumb rule: *1 bag of cement = 50 kg*.

Wrapping up

The above rules were the common civil engineering thumb rules you must know if you are a civil engineer or site engineer or supervisor. These thumb rules of civil engineering will help you figure out material quantities quickly and that will let you make snap decisions on the field.

We hope this article about common rules that a site engineer should remember has been useful to you. Please let us know what you think using the comments section below. We are eager to hear your thoughts and suggestions!

Concrete Joints - What, Why and How

Often in the longer structures like bridges, you will see that there are thin gaps intentionally placed in the long structural members. These are called concrete joints, and they are very useful in preserving the concrete over long time. Today, we will take on the what, why and how's of concrete joints.

Why are concrete joints needed?

Concrete has immense compressive strength, but not much tensile strength. Which is the primary reason we provide reinforcements inside concrete. However, some structural members, or some parts of them have to be made without reinforcement. What happens when these come under unexpected tensile stress?

One of the reasons of unexpected tensile strength is that concrete undergoes shrinkage over time. This creates tensile stress inside the member automatically which is hard to foresee. Now, if the tensile force being generated over time is gradually rises above the member's tensile strength, then it will, eventually, crack the concrete. Which, as you can expect, may have disastrous effects.

This is exactly why concrete joints are needed. Joints are provided in concrete in order to prohibit, or, at least minimize the possibility of cracks appearing automatically due to shrinkage from time or temperature changes.

One can say, joints in concrete are pre-planned cracks. They are created at portions where there the concrete is expected to undergo tension most, regulating the tensile forces there and pre-empting the formation of cracks.

Types of Concrete Joints

There are four kinds of joints provided in concrete slabs or pavements depending upon the need or the expected scenario. They are as follows:

1. Construction joints
2. Expansion joints
3. Contraction joints
4. Isolation joints

Now let us see about each type of concrete joint in detail.

Construction Joints

When you already have a pre-existing joint network running along the system, placing a construction joint makes the most sense. They are placed in a concrete slab to define the extent of the individual placements.

A construction joint is created in such a way that it will allow displacement between both sides of the slab, but will also transfer flexural stresses on the member coming from outside. It should let displacements happen perpendicular to the surface of the joint. This is the movement caused by heat and shrinkage related tension.

However, they must not allow any movement vertically, or worst of all, they must not allow any rotational displacement. Because that would defeat the whole purpose of the slab being there.

Expansion Joints

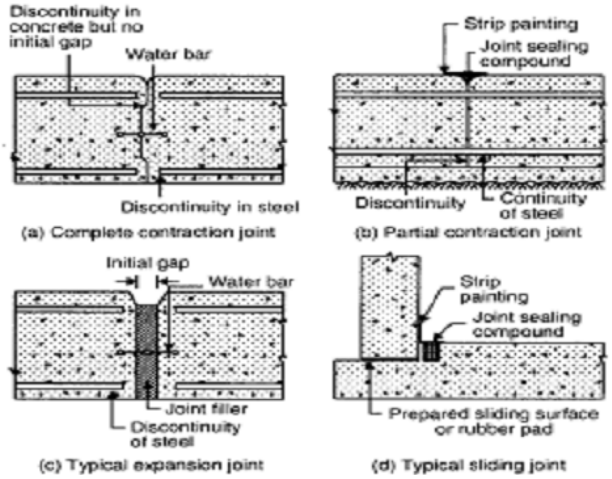
When we have to worry about not only the length of the concrete member but also the volume of it, then we use expansion joints. They are basically a small gap left intentionally by sawing, tooling, or using joint formers, which the concrete can utilize when expanding.

Contraction joints

A contraction joint is the best example of an "intentional, man-made crack". They are basically cut concrete in the place when cracks are expected to appear. It intentionally weakens the concrete and by so it regulates the location of the cracking caused by dimensional changes in the slab.

As you may have realized, contraction joints are the most common type of concrete joints, so "joints" in concrete generally means contraction joints unless otherwise specified explicitly. They are defined by their method of load transfer and the spacing at which they are placed.

In general, we place contraction joints at 25% to 30% depths of the concrete slab, and are spaced out at a distance of 3 to 15 meters.



Isolation Joints

When the concrete itself is not much in danger, but something else attached to the concrete may be (due to the automatic shape change of concrete), then isolation joints are used. They exist to protect some other, softer part of the structure.

Isolation joints are simply a gap given between the untrustworthy concrete and a softer member, like a pipe, a wall, a non-concrete member etc. This is mostly true for walls and columns whose footings go much deeper than the subgrade of the concrete slab. They won't displace the same way as the slab would, so you have to keep them separated.

Sometimes, if the other member beside the concrete slab or pavement is a much stronger thing, then there will be considerable resistance when the concrete tries to displace. This will end up in the slab damaging itself, instead of the other member. So, providing an isolation joint here also is a good idea.

Note that expansion or isolation joints are almost never needed indoors, because there wouldn't be that much temperature difference indoors. Also, make sure you cover up the joint area properly, or external matter – like moisture and small stones – can get into the joints and make things very ugly in the long run. Concrete blow ups are a common example of what might happen with carelessly finished concrete joints.

Types of Bricks used in Construction

Bricks are the most common building block used for millennia. They are so popular and so old because of their durability, ease of manufacture, and ease of use. It is hard to think of a common building without bricks. Around the world, many kinds of bricks were developed throughout history. Today, we will learn about the different types of bricks used in construction.

Formally, the term brick is utilized to mean a structure unit made of molded earth, yet in current occasions it is utilized to allude to any stone-or mud based structure unit that is gotten together with cementitious mortar when utilized in construction.

Commonly, bricks are around four inches wide, eight inches in length, with an assortment of thicknesses. Bigger stone or earth based structure units of the sort utilized in establishments are generally called blocks.

How Bricks are categorized

There are various ways that brick can be classified. For instance, you can partition brick into the sorts utilized for confronting (uncovered and obvious on the outside of a structure) versus backing bricks (which are utilized basically and are escaped in-wall).

Another method for classifying brick is as per how they are fabricated: unfired (brick that is air-restored) and terminated (brick that is heated in broilers so as to solidify it). Bricks can be likewise classified by their run of the mill use: normal bricks or building bricks.

For motivations behind private construction, it is normally regular bricks that are of most enthusiasm, since designing bricks are all the more frequently utilized in structural building ventures, for example, street or scaffold construction, or in sewers construction.

Bricks classified by shapes

Brick veneers

These bricks are meager and utilized for surface cladding.

Airbricks

These bricks contain huge openings to circle air and decrease weight. They are utilized in suspended floors and cavity dividers.

Perforated bricks

These bricks contain numerous barrel shaped openings penetrated all through the brick. They are exceptionally light in weight.

Bullnose brick

These are bricks formed with round edges.

Paving bricks

These bricks contain a decent measure of iron. They are utilized underneath paving applications.

Capping bricks
These bricks are utilized to top the highest points of unattached dividers.

Hollow bricks
About 33% of the heaviness of the typical bricks, these are utilized for the most part in parcel dividers where load-bearing isn't required.

Classifying Bricks by Raw Materials
In present day construction rehearses, regular bricks are classified by their segment materials and strategy for fabricate. Under this arrangement, there are five basic sorts:

1. Burnt Clay bricks
2. Sand lime bricks (calcium silicate bricks)
3. Concrete bricks
4. Fly ash clay bricks
5. Firebrick

Burnt Clay Bricks
Burnt clay bricks are the great type of brick, made by squeezing wet mud into molds, at that point drying and terminating them in ovens. This is an old structure material—the kind of brick found in a significant number of the antiquated structures of the world. In appearance, these bricks are strong blocks of solidified dirt, typically rosy in shading.

Burnt clay bricks are commonly sold in four classes, with five stars offering the best quality and most quality. These high-grade consumed mud bricks have no recognizable defects, but on the other hand they're going to cost more.

At the point when these bricks are utilized in dividers, they require putting or rendering with mortar.

Sand Lime Bricks
Sand lime bricks (otherwise called calcium silicate bricks) are made by blending sand, fly debris and lime. Shades may likewise be included for shading. The blend is then shaped to frame bricks; the materials bond together by a compound response that happens as the wet bricks dry under warmth and weight.

These bricks are not, notwithstanding, terminated in furnaces in a similar way as consumed dirt brick. Sand lime bricks can offer a few favorable circumstances over earth bricks, for example,
Their shading appearance is dark rather than the standard rosy shading. Their shape is uniform and presents a smoother finish that doesn't require putting.

These bricks offer incredible quality for load-bearing structures. At the point when colors are included, the bricks can be utilized for elaborate purposes. Less mortar is required during construction. Their edges are straight and exact, making construction simpler.

Concrete Bricks

Concrete bricks are produced using strong cement and are developing in notoriety among mortgage holders. Solid bricks are typically put in exteriors, fences, and give a magnificent tasteful nearness. These bricks can be fabricated to give various hues if colors are included during creation. Solid bricks ought not be utilized in subterranean applications.

Fly Ash Clay Bricks

Fly Ash Clay Bricks are produced with mud and fly ash — a result of coal consuming — terminated at around 1,000 degrees C. Since fly debris contains a high volume of calcium oxide, this sort of brick is in some cases depicted as self-solidifying, since it grows when presented to dampness.

This propensity to grow, be that as it may, can likewise deliver jump out disappointment. Fly debris earth brick has the upside of being lighter in weight than mud or solid brick.

Fire Bricks

Otherwise called refractory bricks, these are produced from exceptionally defined earth with a high aluminum oxide content. In the wake of consuming, these bricks can withstand high temperatures without their shape, size, or quality being influenced.

They are mostly used in the covering of stacks and heaters, pizza broilers and open air brick grills.

Conclusion

It is now established that even in remotely ancient civilizations bricks were the common material of construction. It is believed that first-time bricks were used, in sun-dried form (unburnt Bricks), in Egypt some 6000 years ago. Excavations of prehistoric sites in the world have revealed that bricks were used abundantly.

Even at present, brick is the most basic and favored material for common construction throughout the world. Brickwork has become a traditional profession, and very experienced skilled bricklayers are available in all villages, towns, and cities.

SERIES

Making Your Walls, Roofs, Concrete Waterproof

Don't you get angry when your wall or roof gets soaked? Moisture penetration through concrete members is no joke since it can severely damage the structure and completely ruin the finishing. Therefore, ae should always try making the walls, roofs, concrete waterproof. Here are the basic methods to waterproof your concrete.

Making a better concrete

To begin with, we must take care to make the concrete, because a badly made concrete cannot be made waterproof. No kind of admixture or coating will prevent moisture penetration if the concrete is not good enough. So, first we will have to create the concrete well.

Normally, all concrete is porous to some degree in nature, and the moisture seeps through these microscopic pores in the concrete. So, our goal is to create the mix in such a way so that the resultant concrete is as little porous as possible.

To do this, we have to achieve a good proportion of non-porous aggregates in the mix to make the final product as dense as possible. Also, it should have a low water to cement ratio, that is, 0.54 or less. This is in order to ensure there are as few air bubbles as possible in the concrete.

How to mix a dense concrete

- Use an excess amount of fine aggregate.
- Adjust the mix ratio in such a way that there is a small increase of cement with less amount of water. This should result the same workability.
- Mix the concrete very well, and when pouring, use the vibrator abundantly to make sure the concrete gets into even the congested areas and that no bubbles are left.

Coating the concrete

When the concrete is already prepared, use this to protect it from water. In this method, the concrete or masonry surface is coated with multiple layers of alum and soap solutions, which makes the surface quite impermeable to moisture. These solutions, when dried out, form water-insoluble fillers in the pores of the concrete and so prevent the influx of further water.

Method of waterproofing concrete surfaces by applying alum and soap coats

- Clean the surface thoroughly.

- Heat as much water as needed.
- Dissolve 10 grams of alum per 1 liter water.
- Dissolve 50 grams of soap per 1 liter water.
- Coat the surface with hot alum solution first. Use a stiff brush.
- Immediately apply the hot soap solution.
- Let the surface coats dry out for 24 hours (at least).
- Repeat above steps as necessary.

To make the surface completely impervious to atmospheric water, you may need to apply the above three times consecutively, at least. Note that the concrete needs not be completely cured to begin applying the coats – in fact, experiments show that this coating method works best when the soap is applied while the concrete has just set and is still green.

However, these coats are ravaged by the flow of time and will slowly erode away in time, making them only reliable in short terms.

Waterproofing concrete by adding hydrated lime

Hydrated lime, also generally known as fully slacked lime occupies twice the volume of dry cement and its very non-porous too. This is why it is good to add small amounts of hydrated lime to the concrete mix to make it waterproof.

The lime itself gets into pores of the concrete and therefore increases the water resistance of the concrete. Also, adding fully slacked lime to concrete increases its workability, so you wouldn't need to add so much water as compared to normal. This in turn will cause less bubbles in the concrete, making it less porous and more water-resistant.

Since this method makes the concrete intrinsically resistive to moisture, this is a very good way of making concrete waterproof. However, a word of caution here. Lime is an adulterant and it will decrease the strength of the concrete – so, where strength is the primary property of that concrete member, you had better stick to other methods.

Building Cost Estimation Excel Sheet 2020 Download

Cost estimation is the process finding out the approximate value or expenses of a project. The process of construction cost estimation starts with many, many variables and ends up presenting a single value. Today we present a best building cost estimation excel sheet 2020. Download this cost estimation spreadsheet for easy calculation of the building cost estimate.

A cost estimate can save you from the very possible danger of cost overrun, that is, running out of funds before the project is done. That is why you should always perform a cost estimation for your project, preferably by a professional cost estimator.

RCC Building Cost Estimation Excel Sheet

To find out the end expenses of a particular building construction project, RCC building cost estimation is performed. To do this, all the data points that impact the exit rate of the project are taken together and considered carefully. This yields a final sum of costs that may be incurred in that project, including overheads.

This process of rate analysis is called a cost estimation of a building project. This is a fairly complicated process, and the bigger the project is, the more difficult it becomes. For this reason, pre-formatted cost estimation sheets are used to quickly figure out cost estimates. Here is one such building cost estimation sheet that you can download and utilize for your own RCC (reinforced concrete cement) construction project.

Factors affecting the cost estimate of an RCC building

There are many factors and variables that shape the output of a cost estimation process, but the major players affecting expenses in an RCC building construction project are the ones as follows:

1. Work specifications
2. Material quantity
3. Material specifications
4. Construction method
5. Material costs
6. Labor cost/wages
7. Site conveyance costs
8. Overhead and contingency
9. Establishment costs (legal and other)
10. Profit margin

To be specific, the costs of materials are taken at the value in total of their initial purchase expenses and their conveyance expenses as they are delivered to the site from the source or storage depot. This will also include any local taxes incurred on the materials and transport.

Purpose of rate analysis for cost estimation

- Calculating the effective cost of each unit item or work at the end of the production or construction pipe line.
- Figuring out the most optimized synergy between materials and their proper usage that is the best in economic terms.
- The afore mentioned are considered in light of the construction process pipe line in completion of one or more particular items or units of work in the whole project or a select part of it.
- Anticipating, planning for, and projecting the approximate costs of the items, methods, or systems that were not mentioned in the initial design based on which you are doing this cost estimation, but which may well be needed in practical sense based on the experience of the constructor.
- Estimating the changes in exit expenses of the project or part project in case if the project specifications or on-site situation changes. This may come through a negative change in the market of the materials or an increase in labor requirements or wages, or if any serious accident occurs in the field.

Cost estimation sheet categories to be covered

The following are the categories that need to be considered in an RCC building cost estimation excel sheet:

- Preparation
- HVAC
- Site Work
- Electrical
- Foundation
- Insulation
- Basement and Garage Floor
- Interior Finish
- Structure
- Kitchen
- Log/Hybrid Home Package
- Bathrooms
- Windows and Doors
- Floor Coverings
- Roofing Material
- Painting and Decoration
- Exterior Finish
- Fireplaces
- Fascia
- Decks, Driveway and Landscaping
- Log/Timber
- Other systems
- Plumbing
- Miscellaneous

Note that all of these may or may not be usen in your project or in the design, so you will have to pick and choose carefully which one do you want and which one you do not want in your cost estimate. Also, a project may undergo changes as specified by the client or needed by situational consideration. At that time, some of the afore mentioned items may get added or extracted from the final cost estimate calculation.

How to use the free building cost estimate excel sheet 2020

The cost estimation process of RCC buildings can be a very complicated matter and a grueling experience, but it need not be. You can use our RCC building cost estimate excel sheet in the following three simple steps:

1. Download the free building cost estimation sheet from here: <link>
2. Open MS Excel, or any similar spreadsheet program compatible with the latest excel document specifications, and open the downloaded file in it.
3. Fill in the values of the fields provided (empty boxes), and that's it! Your final cost estimate projection will be automatically ready at the output box.

Yes, it's that easy!

We hope you have liked our article about the free RCC building cost estimation excel sheet download. Please let us know what you think! You can use the comments form below to let us know about your thoughts and suggestion. Till the next time, bye and happy building!

Cost Estimation RCC Building Excel Sheet

Particular	No.	Measurement L	B	H	Deductions	Contents	Unit	Totoal of Each
Site Cleaning Work	1	70.00	40.00	-		2800.00	SFT	2800.00
Excavation for Foundation								
Post Footings	25	3.50	3.50	4.00		1225.00	CFT	
Retaining Wall Line 1, 3 & 4	3	39.00	2.50	2.00		585.00	CFT	
Retaining Wall Line A, C, E & G	4	19.50	2.50	2.00		390.00	CFT	2200.00
Hardcore Filling Work								
Post Footings	25	3.50	3.50	0.75		229.69	CFT	
Retaining Wall Line 1, 3 & 4	3	39.00	2.50	0.25		73.13	CFT	
Retaining Wall Line A, C, E & G	4	19.50	2.50	0.25		48.75	CFT	351.56
(1:3:6) Lean Concrete								
Post Footings	25	3.50	3.50	0.25		76.56	CFT	
Retaining Wall Line 1, 3 & 4	3	39.00	2.50	0.25		73.13	CFT	
Retaining Wall Line A, C, E & G	4	19.50	2.50	0.25		48.75	CFT	198.44
Brick Work 1st Class in 1:4 Cement Mortor								
Retaining Wall Line 1 & 3								
1st Step	2	55.50	1.50	0.25		41.63	CFT	
2nd Step	2	55.50	1.13	0.25		31.36	CFT	

Builder's Estimate							
Item	Particular	Quantity	Unit	Rate (Ks)	Per	Amount (Ks)	Remark
1	**Site Cleaning Work**	**2800.00**	**SFT**				
	Labour						
	Workers	14.00	No	5,000	No	70,000	
2	**Excavation for Foundation**	**2200.00**	**CFT**				
	Labour						
	Workers	44.00	No	5,000	No	2,20,000	
3	**Hardcore Filling Work**	**351.56**	**CFT**				
	Material & Labour						
	Broken Brick	4.39	Sud	25,000	Sud	1,09,863	
	Sand	0.88	Sud	85,000	Sud	74,707	
	Workers	3.52	No	5,000	No	17,578	
4	**(1:3:6) Lean Concrete**	**198.44**	**CFT**				
	Material & Labour						
	Cement	25.51	Bags	5,700	Bags	1,45,426	
	River Shingle	1.91	Sud	90,000	Sud	1,71,450	
	Sand	0.95	sud	85,000	sud	80,963	
	Mason	1.98	No	6,500	No	12,898	

Various Civil Engineering Sheets Free Download

From design to construction to maintenance, data management and analysis is a very important part of the construction industry. Most of it is done by using MS excel or other spreadsheets. Here is a collection of the most common 10 civil engineering sheets for free downloading.

1. Soil Boring Log Template Excel Sheet

This is a sample spreadsheet you can use as a template for boring logs. The boring logs are very useful for geotechnical engineers to display the results of gas and oil mining. It is also very useful for other mining, geotechnical and environmental drilling and soil sampling.
Download link: https://civilengineeringbible.com/files.php?i=35

2. Retaining Wall Calculator spreadsheet

This Excel sheet can be used to design and construct the most perfect retaining walls. You can also use this sheet to verify the feasibility of the retaining wall in that situation of overturning and sliding forces at that point.
Download link: https://civilengineeringbible.com/files.php?i=23

3. Beam Analysis Excel Sheet Download

This excellent spreadsheet is capable of analyzing both single span or continuous span beams. The members can be either a singly supported span, or a 2, 3, or even 4 span continuous over middle support. You will find the results of the analysis in a nicely tabular form.
Download link: https://civilengineeringbible.com/files.php?i=65

4. Concrete Design Spreadsheet (HOT!)

You don't have to buy expensive software for your structural design solution if you have this superb excel sheet in your hand. This spreadsheet is very useful for civil engineers involved in concrete design. You will find the concrete design results very quickly and easily using this spreadsheet.
Download link: https://civilengineeringbible.com/files.php?i=17

5. Bar Bending Schedule Excel Sheet (HOT!)

Here is the bar bending schedule sheet for civil engineers working with the Indian standards. Using this BBS spreadsheet, you will be able to find any reinforcement mark, shape, size, location, length, and bending details. The data is represented in an easy tabular form that you will find very handy indeed.
Download link: https://civilengineeringbible.com/files.php?i=18

6. Concrete Mix Design Excel Sheet

This spreadsheet will be extremely useful when you are going to design the concrete mix. You can find the right quantities of the right materials for your particular concrete grade quickly and efficiently using this sheet. You will be able to achieve the right compressive strength at the right workability if you are using this sheet!
Download link: https://civilengineeringbible.com/files.php?i=20

7. Rectangular Steel Duct Design Spreadsheet Excel

If you're working with the American building codes, then this spreadsheet will come in very handy to you when designing rectangular steel ducts for HVAC and other purposes. This sheet is a comprehensive collection of procedures and formulas to determine the properties for any steel section of the duct for any given quality and specifications.
Download link: https://civilengineeringbible.com/files.php?i=119

8. Construction Daily Report Spreadsheet

This daily reporting template can be used to provide information about the daily or even hourly work status on the site. Very, very useful for site supervisors and engineering officers both, this excel sheet is an excellent way to keep track of what is going on at the building site and the work progress.
Download link: https://civilengineeringbible.com/files.php?i=99

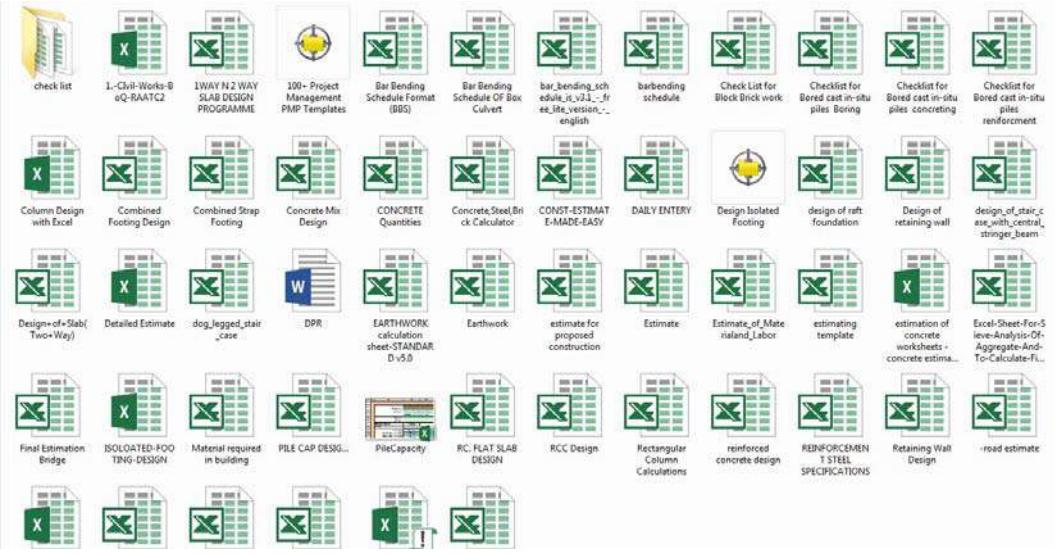
9. Road Construction Estimating Excel Sheet

Any type of construction requires estimation, and road construction is no exception. Using this excellent spreadsheet, you can easily figure out the quantity of materials, and the final cost of materials, labor, overhead and establishment expenses quickly and efficiently. You will get the results either per unit road length, or per section – just as you wish.
Download link: https://civilengineeringbible.com/files.php?i=69

10. RCC Staircase Design Spreadsheet

The design of a dog-legged staircase is complicated and therefore you need much help in figuring out the design metrics and quantities for constructing each staircase. That gets very easy when you are using this brilliant RCC staircase design excel sheet. The best thing is, it is also totally free!
Download link: https://civilengineeringbible.com/files.php?i=16

We hope the above civil engineering spreadsheets for free download have served you well. You can ask us for more of the same, using the comments forms below. We would love to hear from you! Please let us know of your thoughts and suggestions.



RESOURCES

Free Excel Sheet Download for Brick, Concrete Mix, Mortar, Tile, Plaster Conversion

Hi there, folks! Today we are here with another free spreadsheet for you to download. This all-in-one excel sheet is very useful in converting Brick Masonry Work, Concrete Work, Plaster Work, Tile Work, Unit Conversion.

Brickwork or Brick Masonry

The most basic building unit known to humankind is a brick, which has been in use since the dawn of history. It is available in a very particular rectangular block shape, whose length must be twice its width. The height of the brick may differ from place to place, though.

Commonly, the normal bricks found in most countries around the world are 9 inches by 4.5 inches by 3 inches. This is called the nominal size of a brick, however, other shapes and sizes of bricks are also used in some places.

The above is true for standard bricks, but there are other kinds of building blocks that serve the same purpose with better functions, which can be of different shapes.

The trade of laying bricks in mortar systematically and homogenously is called brick masonry. Properly done, brick masonry can last hundreds of years, withstanding lots of structural loads without taking damage.

Size of bricks

Brickwork or masonry can be defined by two kinds of final per unit measurements, called nominal dimensions and architectural dimensions. The nominal dimensions of a brick are 225 mm by 112.5 mm by 75 mm, but the architectural or working dimensions of a brick are 215 mm by 102.5 mm by 65 mm.

The difference between the sizes comes from the amount of mortar that must be placed with the brick to stabilize it. The nominal or coordinating dimension of a brick is the actual brick and the mortar surrounding it. That is, mortar on three faces – bed, header and stretcher.

However, we have to remind ourselves that it is very hard to make a brick of a perfect size. During manufacturing, many factors affect the size of a brick; shrinkage, distortion when drying out, firing etc. These factors combine to make each batch of brick slightly different from another batch. However, this difference is made up for when mortar is applied to the bricks and pressed on. Some approximation at the edges of the wall is always expected.

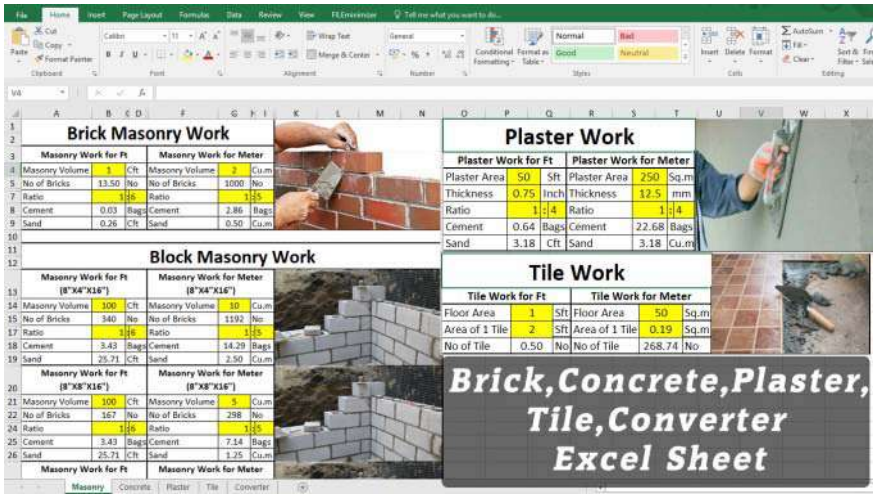
Mortar joints in brick masonry

There are two ways a couple of bricks can be joined together – vertically or horizontally. A bed is the mortar placed horizontally below bricks to join them (or the beam/slab) vertically. And the mortar placed in-between bricks laying on the same bed side-by-side is called prepend, that joins them horizontally. Therefore, one brick has at least four mortar joints going with it.

Requirements of a masonry wall

To be considered a properly built masonry wall worth the investment, it has to stand up to the following factors:

1. It should have enough support strength to uphold the loads imposed on it.
2. It should be waterproof enough to protect the people or goods inside the room.
3. It should be able to give adequate visual and aural privacy.
4. It should be impervious to common domestic fire and explosions.
5. It should be thick enough to accommodate various utility lines through it, like heating/cooling, electricity, plumbing etc.
6. It should be built with proper plans and supports to allow openings in the wall where needed, for example for doors and windows.



Mix design objectives

Why should you worry about concrete mix design? Because it makes the structural support members that hold the whole building together without a properly planned concrete mix design, the structural supports may collapse under load, and thereby bring down the whole building.

- The concrete mix design should be able to provide enough strength to support the loads the member is about to receive.
- The structural requirements should be fulfilled by the mix proportion and composition.
- While the concrete mix is still soft, it should have the desired workability for the application.
- When set, or hardened, it should be able to provide the amount of strength it was expected to give.
- The mix should yield a concrete that is durable for the given environmental conditions on site.
- The mix should be economical as well, because the materials of concrete, especially cement, are not cheap.

Download link: https://drive.google.com/file/d/1LJ7Bj0lLR-IJTBrlrKiAkaZ39USZUOOP/view

Civil Work Quantities Excel Sheet Free Download

When you are a civil engineer, site engineer, or similarly engaged in construction work directly, you have to know exactly how much material you need for the work or you cannot do your job. For this, a quantity calculation sheet comes very handy. So, here we are with the civil work quantities excel sheet for free download.

Civil Work Quantity Calculation

The work of constructing a building is divided into many parts such as concreting, masonry, plastering, tiles etc. Each of this work requires a certain number of materials to construct. For example, for concrete work you need to know exactly how much cement, fine aggregates, and coarse aggregates do you need. Also, you need to know the mass of the steel you need for reinforcing.

This is what we know as the civil work quantity calculation. It is possible to do this work by hand, but it would be a huge task. To make it easier, we present a very useful excel workbook for civil work quantity. This workbook has sections to calculate the material quantity for each type of work.

But not only that, there is another sheet inside the workbook that is a converter sheet. Using this sheet, you can convert any quantity from one unit to another unit. For example, you can convert how many cubic feet of concrete you need to cubic meters.

Advantages

You can do the following kinds of work using this civil work quantities excel sheet.

Brick Masonry Work:

The following quantities of brick masonry work you can find out using this sheet.

1. Masonry Volume
2. No of Bricks
3. Ratio
4. Cement
5. Sand

Concrete Work:

1. Concrete Work for Feet
2. Concrete Work for Meter
3. Steel in RCC per Meter
4. Steel in RCC per Foot

Plaster Work:

1. Plaster Work per Foot
2. Plaster Work per Meter

Tiling work:

1. Tile Work per Foot
2. Tile Work per Meter

Unit conversion:

This sheet is great for converting all types of units from one type to another. All the units supported for conversion in this sheet are:

- Meter to feet
- Feet to Meter
- Area
- Sft to Sq.m
- Sq.m to Sft
- Feet to Centimeter
- Inch to Centimeter
- Inch to Millimeter
- Sooter to Millimeter
- Mile to Km
- Km to Mile
- Mile to Meter
- Mile to Feet
- Km to Meter
- Km to Feet
- Sq.in to Sq.mm
- Ton to Kg
- Kg to Ton
- Kg to Lbs.

Civil Work Quantities Excel Sheet Free Download

Download link: https://drive.google.com/open?id=1fSpQSVSGGfTYvZ7E4R2Wh5h0nVE5Z77e

How to calculate brickwork per square meter including mortar

Assuming

- Grade of mortar = 1:6 (cement to sand)
- Class A brick (19 cm x 9 cm x 9 cm)
- Volume of brickwork = 1.0 m3
- Thickness of mortar = 10 mm

Step 1. Calculation of bricks

No. of bricks = (volume of brick work / volume of one brick with mortar)
Volume of one brick (without mortar) = 0.19 x 0.09 x 0.09 = 0.001539 m3
Since thickness of mortar = 10 mm (0.01 m)
Volume of brick with mortar = (0.19+0.01) x (0.09+0.1) x (0.09+0.1) = 0.2×0.1×0.1 = 0.002 m3
Therefore,
No. of bricks = 1.0/ (0.002) = 500
consider the percentage of waste as 10 % or 15 %
Total no. of bricks = 500 + (10 x 500)/100=550

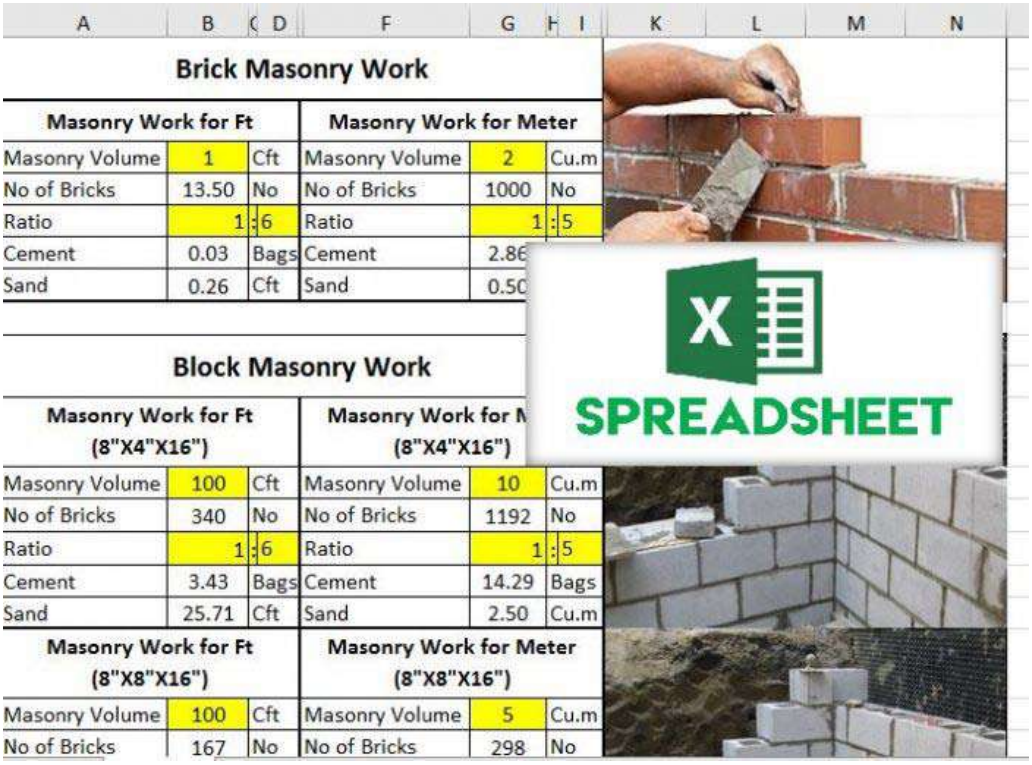
Step 2. Calculation for quantity of mortar

Since we need 500 no of bricks
Volume occupied by bricks = No of bricks x volume of one brick
Volume of bricks = 500 x 0.001539 = 0.7695 m3
Volume of mortar = Volume of BRICK WORK – Volume of BRICKS
Therefore,

Volume of Mortar = 1.0 – 0.7695 = 0.2305 m^3

Step 3. Calculation for Quantity of Cement

Cement = (dry volume of mortar x Cement ratio)/ sum of the ratios proportion)
Dry volume of Mortar = 1.33 x 0.2305 = 0.3065 m3 (33% increment due to volume shrink after water)
Cement= (0.3065 x 1) / (1+6) = 0.3065/7= 0.043795 m^3
Cement (kg) = 0.043795 x 1440 = 63.0648 kg
No. of bags = 63.0648 / 50 = 1.26 bags approximately 2 bags



Brick Masonry Work

Masonry Work for Ft			Masonry Work for Meter		
Masonry Volume	1	Cft	Masonry Volume	2	Cu.m
No of Bricks	13.50	No	No of Bricks	1000	No
Ratio	1	:6	Ratio	1	:5
Cement	0.03	Bags	Cement	2.86	
Sand	0.26	Cft	Sand	0.50	

Block Masonry Work

Masonry Work for Ft (8"X4"X16")			Masonry Work for M (8"X4"X16")		
Masonry Volume	100	Cft	Masonry Volume	10	Cu.m
No of Bricks	340	No	No of Bricks	1192	No
Ratio	1	:6	Ratio	1	:5
Cement	3.43	Bags	Cement	14.29	Bags
Sand	25.71	Cft	Sand	2.50	Cu.m

Masonry Work for Ft (8"X8"X16")			Masonry Work for Meter (8"X8"X16")		
Masonry Volume	100	Cft	Masonry Volume	5	Cu.m
No of Bricks	167	No	No of Bricks	298	No

Step 4. Calculation for Quantity of Sand

Sand = (dry volume of mortar x Sand ratio)/ sum of the ratio proportion)
or
Sand = cement volume x 6 (since 1:6 grade of mortar)
Therefore,
Sand = 0.043795 = 0.26277 m3, or
Sand = 0.26277 x 1920 = 504.5184 kg /1000 = 0.5045 tons or
Sand = 0.26277 x 35.3147 = 9.279 cft or
Sand = 0.26277 x 0.354 = 0.0930 brass

Results

So, For
Grade of mortar = 1:6 (cement to sand)
Class A brick (19 cm x 9 cm x 9 cm)
Volume of brickwork = 1.0 m3
Thickness of mortar = 10 mm
Number of Bricks = 500
Cement = 1.26 bags of 50 Kg
Sand = 0.26277 m3

Hope this is useful!

VIDEOS

Design of an RCC Column for House

Columns are probably the most important load-bearing member of any structure, since they carry all the vertical loads of the building and transport it to the bottom of the structure, the foundation. For this reason, you have to design columns very carefully, with zero margin of error. Today, we will see the cost estimation design of an RCC column for house, taking an example.

Columns are defined as the main compression member of the structure, having more length than width or breadth. That is to say, a column will be bearing most of the loads coming down from above, and it will have an effective length much greater than its least lateral dimension.

We need to estimate the steel and concrete before we start making the column, because we have to be very precise in our work. The following is an example scenario where we calculate the steel design on an RCC column for houses, particularly for a given design.

Example Scenario

Let us say,

We are supposed to design a column for a house. The column is square in cross section, and it is short in comparison. There will be various forces acting on this column, but the major of this will be the axial load. The axial services compressive load acting on the column in question will be 600 KN.

Furthermore, when constructing the column, we will need to use M20 grade concrete (read more about the grades of concrete) for the compressive strength. However, to generate shearing strength and tensile strength, we need use reinforcement in the column, obviously. That steel quality in the reinforcements will be Fe-500. There will be 1% steel in the column by volume.

And to be on the safer side, we will have to maintain a safety margin of 1.5 in our calculation.

Solution

Now that we have the data, we can go ahead and figure out the quantity of materials in the column in question.

We have given

- Fck = 20 N/mm2
- Fy = 500 N/mm2
- Ag = Gross area of Column

Area of Steel in concrete(Asc) = (1/100) x Ag

Area of Concrete (Ac)

= Gross area of column (Ag) – Area of steel(Asc) Ac

= Ag – 0.01 Ag
Ac = 0.99 Ag
Pu = Axial load on Column (600 x 1.5)
= **900 KN**
Pu = 0.4 fck x Ac + 0.67 x Fy x Asc (IS: 456 – 2000 P – 71)
= 900 x 103
= 0.4 x 20 x (0.99 Ag) + 0.67 x 500 x 0.01 Ag
Ag = **79858 mm2**
As because it is a square Column, the size of Column = √ (79858)
= **282.59 mm**
Provide square column size = 285 mm x 285 mm
Ag as provided = (285 mm x 285 mm) = 81225 mm2
Asc = Area of steel in concrete
= 0.01 Ag
= 0.01 x 81225
= **812.25 mm2**
Provide 8 nos. Of reinforcement bars with 12 mm Dia., and the steel bar having Ast (Area of steel) = 905 mm2

RCC Column Design

Dia of lateral ties: (as per IS 456 - 2000 P - 49)
1/4 x Dia. of larger bar
= 1/4 x 12
= **3 mm**
At 8 mm, provide larger of 2 values (Provide 8 mm dia. lateral ties)
Pitch of Lateral Ties: (as per IS - 456 -2000 P - 49)
Least lateral dimension = 285 mm
And therefore 16 x Dia of smaller bar = 16 x 12
= **192 mm**
As for the 300 mm provide smaller of 3 values (Provide Pitch = 190 mm)
Provide 8 mm Dia. lateral ties at 190 mm c/c.

There you go, now you have the working solution of the design of an RCC column for house. We hope this article was useful to you. Please let us know what you think! We would love to know about your thoughts and suggestions. Please use the comment box below to let us know.

To get more details, go through the following video tutorial.
https://www.youtube.com/embed/bbIGPnQV2R4

Calculating Steel Quantity in Beam in 3 Easy Steps

Beams are extremely important parts of a building. They are one of the major load-bearing members of the structure, transferring loads from slabs to columns. When you construct a beam, you have to put steel reinforcements in it in order to combat the tensile forces generated at the bottom side. Today, we will see how should we go about calculating steel quantity in beams.

They say learning on the work is the best way to learn anything. This is true about construction as well. So, we will learn about calculating steel quantity in beams using a live example.

The problem

Let us say, we have a simply supported beam. Let the cross section of the beam be 300 mm by 500 mm (width x height). Also, let's suppose this beam is 4 meters long.

Moving onto the available reinforcements. We have 20 mm bars to be used the main reinforcement, and the support bar dia is 16 mm. Furthermore, we will use 12 mm stirrups at 100 mm gaps. The midsection will have an increased stirrup spacing of 150 mm.

Now, given this design, we will have to calculate the steel quantity in this beam.

Three steps to calculate the steel quantity in beam

It is quite simple to find out the steel quantity in beams if you take a step-by-step approach. You will need only the following three steps to find out the solution:

1. Calculate the volume of steel in the beam.
2. Calculate cutting length of the stirrups.
3. Finally, calculate the weight of the steel required for the beam.

Now we will compute the amounts in each step one by one.

Given data:

- Length = 4 m
- Height = 500 mm
- Width = 300 mm

Steel volume calculation for beam

Calculating for the main bars (20 mm)

Actual length = length of beam + development length – bend

Where,

- bend 45 deg = 1d
- 90 deg = 2d
- 135 deg = 3d

Knowing that development length is the grip between steel and concrete.

Therefore,

Length:

Main = 4000 + (50d×2) – (2d×2)
= 4000 + (50×20×2) – (2×20×2)
= 4000 + 2000 – 80
= 5920 mm
= 5.92 meter.

For 2 bars it will be total:
= 5.92×2
= **11.84 meters.**

Weight:

The weight of steel = d2/162 × length
=20 × 20/162 × 11.84
= 29.2 kg

Calculating for support bars (16 mm)

Length = length of beam + Ld – bend

Where,

- for 90 deg bend = 2d

Therefore,

Support = 4000 + (50d×2) – (2d×2)
= 4000 + (50×16×2) – (2×16×2)
= 4000 +1600 – 64
= 5536 mm
= 5.536 meter.

For 2 support bars, total length
= 5.536 × 2
=**11.072 meter**.

Weight of support steel:

Weight = d2/162 × length
= 16 × 16/162 × 11.072
= **16.47 kg**

Calculating for stirrups

Length is divided into 2 way 1st is at support and 2nd is at mid support.

For end supports: (spacing 100 mm)

Length / 3:
= 4000/3
= 1333.3 m

No of stirrups
= Length/spacing + 1
= 1333.3/100+1
= 14.33

So, we have to use 15 pieces, in real life work.

Total no of stirrups for end supports
= 15×2
= **30 pieces**

For mid supports: (spacing 150 mm)

Length = 1333.3 m

No of stirrups
= length /spacing + 1
= 133.3/150+1
= 7.88

Therefore, we have to use **8 pieces** in real life.

Cutting length of stirrups:

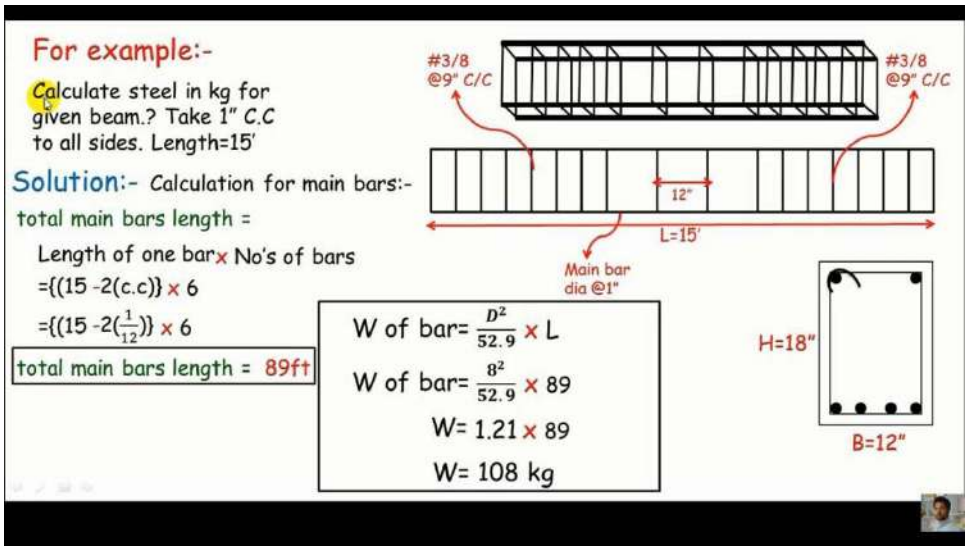
Cross section of stirrups is

- Width = 300 mm
- Height = 500 mm

A is horizontal length of stirrup

= 300 – (2 x clear cover) – (2 x half of bar dia)
= 300 – (2 x 30) – (2 x 6)
= 228 mm

B is vertical length of stirrup
= 500 – (2 x clear cover) – (2 x half of bar dia)
= 500 – (2 x 30) – (2 x 6)
= 428 mm



Cutting length of one stirrup is
Cutting length:
= (2 x A)+(2 x B)+(2 x 10D)-(3d x 2)-(2d x 3)
Where, 10d is hook and 3d is bend 135 for deg and 2d is bend for 90 deg, and in one stirrups 5 bends are required.
Therefore, cutting Length:
= (2 x 228)+(2 x 428)+(2 x 10 x 12)-(3 x 12 x 2)-(2 x 12 x 3)
= 456 + 856 + 240 – 72 – 72
= 1408 mm or **1.408 m**

For total 38 stirrups
= 1.408 x 38
= **53.50 m**

Weight of stirrups is
= d2/162 x length
= 122/162 x 53.50
= **47.55 kg**

Therefore, total weight of steel
= Main bars + Supports bars + Stirrups
= 29.2 + 16.47 + 47.55
= **93.22 kg**

That's it, we got the answer! You will need a total of **94 kilo** steel for reinforcing the given beam. Make sure you add some error or environmental adjustment margin.

To get more details, go through the following video tutorial.
https://www.youtube.com/embed/Sz8XHE2HE7s

Bent Up Bar in Slab Cutting Length Calculation

If you are a civil engineer or a site engineer, it is essential for you to be able to calculate the cutting lengths of the reinforcement bars inside every load-bearing member. The same applies for the bent up bar in slab cutting length calculation. Today, we will try to explain it using a live example.

A bent up bar in slab is also called a crank. It is extremely important since it is used as the main reinforcement in the floor slab. It is provided in the bottom side of the slab, in the shorter side of the span. The main purpose of providing this bent up bar or crank is to transfer both the dead and live load of the slab to the beam. This load is then carried from the beam to the columns, from the column to the footing, and from the footing to the ground soil.

Why do you need to calculate bent up bar in slab

When you don't have to deal with a much large construction area, the detailing of reinforcements in slabs can be done by bar bending schedules, by the person in charge of it. Those in charge of BBS or the bar benders can take care of the reinforcement detailing.

However, this method may not be perfect because the bar benders may not be vigilant in taking account of the cranks and bends, though they will give out some amount of cutting length. They might give some extra cutting length, but that will almost certainly not be enough for your bending requirement.

To remedy this problem, all site engineers responsible for considerable floor areas need to be capable of calculating the cutting length of bent bars in slabs on their own, independent of bar benders. This article will try to explain this in detail, to help you in working out the nuts and bolts of the bar cranking process. Please pay attention because it can be complicated.

Calculation of the bent bar in slab

Let us say that the scenario has the following dimensions of things:

- Diameter of the bar = 12 mm
- Clear Cover = 25 mm
- Clear Span (L) = 8000
- Slab Thickness = 200 mm
- Development Length(Ld) = 40d
-

Now that we have the given data, we can figure out the cutting length of the bent bar in the given slab.

Process of computing the cutting length of bent bar in slab

Formula:

Cutting Length = Clear Span of Slab + (2 x Development Length) + (2 x inclined length) – (45° bend x 4) – (90° bend x 2)

In this scenario,

Inclined length

= D/(sin 45°) – dD/ (tan 45°)

= (D/0.7071) – (D/1)

= (1D – 0.7071D)/0.7071

= **0.42 D**

Now, in this scenario, there are four 45° bends at the inner side and two 90° bends in the system.
We take 45 ° = 1d and 90 ° = 2d
So, Cutting Length = Clear Span of Slab + (2 X Ld) + (2 x 0.42D) – (1d x 4) – (2d x 2)
Where,

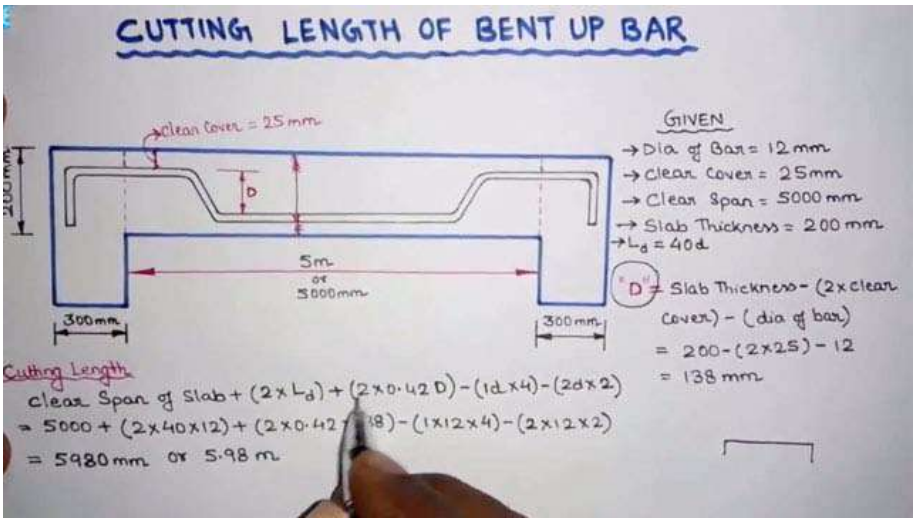
- d denotes Diameter of the bar.
- Ld denotes Development length of the bar.
- D denotes Height of the bending bar.

With the above formula, all values are established exclusive of D.

Therefore, now we just need to find out the value of D.

Here, D = Slab Thickness – (2 x clear cover) – (diameter of bar)
= 200 – (2 × 25) – 12
= **138 mm**

Using the values found out in the computations above in the formula, we get,



Cutting Length = Clear Span of Slab + (2 x Ld) + (2 x 0.42D) – (1d x 4) – (2d x 2)
= 8000 + (2 x 40 x 12) + (2 x 0.42 x 138) – (1 x 12 x 4) – (2 x 12 x 2)
This calculates out to:
Cutting Length = 8980 mm or **8.98 m**.

We hope this was useful for your civil engineering work! Please let us know what you think using the comment section below. We would love to know your thoughts and suggestions. Till next time, happy building!

To get more details, go through the following video tutorial.
https://www.youtube.com/embed/tYVFPr2eG2Y

NEWS

The US Pavillion at Expo 2020 Dubai is Inaugurated

The concrete was poured first on-site for the US Pavilion in the Expo 2020 Dubai at March 2020. Since then, the construction work has progressed securely throughout the pandemic phase and has finished in majority now.

Located within the Mobility District, the US Pavilion takes up about 4.32 square kilometers of area, and looks positively beautiful. The splendid construction underlines the USA's commitment to participate in the World Expo 2021, which is expected to start next year on the first day of October.

The elegant and modern structure was inaugurated by the Commissioner General of the Pavilion, and more prominently, the US Ambassador to the UAE, John Rakolta Jr. Counselor of the US Department of State T Ulrich Brechbühl also presided over the program.

The construction of the US Pavillion at Dubai Expo 2020 was taken up by a public private joint venture between the US Department of State and a partnership of major private sector construction and architecture firms from the USA – the Thinkwell group being a highlight in it. This consortium altogether is responsible for the funding, design, construction, operations, support, maintenance, and when needed, decommissioning of US Pavilion at Dubai Expo 2020.

About the funding part, the Arabians have also contributed substantially in the project. The UAE contribution for the funding of the US Pavilion at Dubai Expo 2020 is as high as $60 million USD – or about 220.39 AED. Ther rest of the money required to erect and run the project was raised by the other US entities involved in the aforementioned consortium.

The Commissioner General of the Pavillion and the US Ambassador John Rakolta Jr. has said in the ceremony that the UAE is one of the best partners of the USA, and this partnership is highlighted by the versatility and the comprehensiveness of the bond. He says this is because it includes "various fields from security and defense to culture, business, investment and trade," as mentioned to the Emirates News Agency.

The US Pavilion at the Dubai Expo 2020 is an artful, modern piece of architecture, featuring slants giving the onlookers a feeling of motion, inspiring an illusion as if the whole building is in movement. The Pavillion will also feature a full scale model of the SpaceX Falcon 9 rocket.

The rocket itself is expected to be the biggest attraction at the Expo, as it is the tallest item on the Expo 2020 grounds. At 14 stories high, the replica rocket is sure to attract the most visitors at the grounds.

The SpaceX Falcon 9 is the rocket most used in the history of spacefaring in the US so far, and for good reason. The Falcon 9 is the first orbital class rocket also capable of re-flight (that is, re-using it after it lands). This ability virtually ends the era of expensive, expendable rockets the US previously used.

The US Mission says, “our state-of-the-art exhibition will recognize how US leadership in the space sector is charging forward to make space accessible to all.” And therefore, the completion of the pavilion is a major milestone for the US as one of the big boys at the 2021 World Expo.

The statement further reads, "As the first World’s Fair to be hosted in the Middle East, Expo 2020 Dubai will draw visitors from around the region to take part in six months of extraordinary programming and business engagement opportunities. Through our nonprofit partner Global Ties US, the US Pavilion is actively recruiting cultural performers and speakers to appear at the pavilion, along with bilingual Americans to serve as youth ambassadors and pavilion guides."

The US Pavilion at the Expo 2020 Dubai is targeted to impose a unique experience on the visitors to the pavilion. The guests will get to celebrate the American values and theme of “Life, Liberty, and the Pursuit of the Future.” The message that you will get to learn that for America, sky is no longer the limit!

As you move through the comfort of a moving walkway which snakes though the major exhibits, you will get to experience how innovation and creativity thrive in an environment powered by American freedoms. You can also sit down and relax for the 8-minute looping show on the ceiling of the pavilion. If you’re a bit tired, you can go to the courtyard of the structure and enjoy authentic Americal food and culture while enjoying live performance throughout the day.

Windover Construction Launches the IDEA Platform

It is a form for much rejoice when Windover Construction, a global leader in construction innovation and management announced the green light on their IDEA (Innovations for Design, Engineering & Automation) consultancy platform. This platform is especially optimized to work in the construction projects utilizing modern day technologies like BIM, drones, robots or automated construction machines, and much more.

The clients of IDEA will get to enjoy unique real time solution for their scenarios through a technology first gateway. Windover Construction's award-winning expertise at streamlining decision making and their history at transforming the design, engineering and construction process is going to be the key reliance factor for this consultancy platform.

A great example what and how much you can slingshot your work above the mainstream level is the work of Windover Construction's venture at the Fuller Mixed-Use Venture. According to a Windover spokesperson, "the driving force behind IDEA: combining today's technology with tomorrow's vision."

The IDEA platform is targeted to existing clients as well as new partners from the nation and the world, and it is a considerably robust framework over existing construction consultancy available in the market. The IDEA platform will combine cutting edge construction related innovations, for example, 4D planning, digital prefabrication, virtual construction, VR and AR, laser scanning, automated construction, drone surveys, highly optimized MEP-BIM, 3D printing, point cloud mapping, interactive 3D design – with a wide spectrum of adaptable strategic counsel on your project.

A global leader in using bleeding edge technologies, Windover exists to serve and support the planning, design and construction phases in many awe-inspiring projects around the world. Their presence is found across the spectrum of public and private sector construction, from academic to residential, life science, healthcare and mixed-use buildings.

Not surprisingly, Windover Construction has won the Autodesk AEC Excellence Award in the Construction: Small Projects ($100 million or less) last year. This was for the firm's contribution to various projects with their cutting-edge combination of modular construction techniques and Virtual Design and Construction (VDC).

Not only that, Amr Raafat, Windover's Vice President of VDC, was awarded Autodesk's 2019 AEC Innovator of the Year, an international award recognizing an individual leading, changing, and transforming the design and construction phases for the definitive better. Consequently, Amr is the person in charge of the IDEA spark.
According to Stuart Meurer, President of Windover Construction, Windover is dedicated to achieving a construction speed parallel to the speed of technological innovations in the industry. Further, "Rather than focusing on one solution, we've perfected the art of collaboration among existing and emerging technologies. IDEA redefines the possibilities to advance the Architectural, Engineering and Construction industry while providing our clients and partners with the opportunity to mitigate risk, increase efficiencies and bring their forward-thinking visions to life."

Dedicated to building great things with great people, Windover Construction aims to move as fast as the construction innovations do. With their IDEA (Innovations for Design, Engineering & Automation) consultancy platform, clients can experience the same heady rush of combining multiple bleeding edge technologies. IDEA will bring together surfacing innovations like drone mapping, robotics, automation, BIM-MEP coordination, laser scanning, 4D planning and mixed reality assembly in an industry-first, unprecedented manner to improve onsite productivity and mitigate risk.

As an example, let's look at the Fuller site again. The Windover VDC team in that project was able to employ a mixtape of leading construction, design and survey technologies to offer real-time solutions to the client that truly made a substantial difference. The result was a much more streamlined construction process the company ever experienced. Furthermore, the Windover process cleared up wastages and reduced the bills by as much as 70 percent. Now, the same power consultancy is brought to the world neatly packed and upgraded as the IDEA movement.

Market Analysis of Roofing Tiles from Allied Market Research

According to a recent study conducted by Allied Market Research, the global roofing tiles market closed at 2019 with the value of $30.4 billions. The market analysts at the said research firm have predicted that this value will increase up to $41.3 billions by the time we reach 2027. Meaning, the market analysis of roofing tiles shows a projected growth of CAGR of 5.2% now.

Mostly used in residential construction, roof tiles are laid on top of the roof, on a detailed framework to support them. They are an attractive, baroque looking, environment friendly option for your roofing needs. Many homeowners prefer to have their nests covered by roofing tiles, owing to their style, longevity, fire and wind resistance, and other such valuable properties.

Factors concerning roofing tiles market growth

There are many factors affecting the research data. For one, there is the rapid urbanization growth in the third-world countries, such as India, Bangladesh, Brazil, Indonesia, Egypt, etc. which in combination with the fast industrialization of productions, which fuels the residential construction market very well. Even China is included in that list while it isn't a third-world country. This, of course, is greatly beneficial to the roofing tiles market.

On the other hand, regions such as Europe, Russia and America are seeing a negative effect on the roofing tiles market since they have economic uncertainty in a country-wide scale. Add to that the high installation costs for roofing tiles in these regions. Altogether they affect the roofing tiles market growth negatively.

Another factor is the advancement in technology which is quite complicated to calculate on the roofing tiles market. There are innovative new roofing tiles such as solar panels which are being favored by many homeowners now. And again, there are technological breakthroughs in the roofing tile manufacturing process, such as using polymers and recycled materials, which may lower the costs and attract more market traffic.

Research segments on the roofing tiles market

By material

The concrete roofing tiles are projected to see the most amount of growth. Boasting a solid 5.9% predicted CAGR during the forecast period, the concrete segment is expected to grow much better than other types of roofing tiles, terracotta, for example. There is good reason for this, since the concrete roofing tiles are highly durable, resist heat and fire very well, quite cheap in comparison with other types of roofing tiles, and are also quite well energy efficient.

By construction type

The market is divided between new construction and re-roofing work, and here the new construction segment leaves the other side sagging. The new construction of buildings is growing rapidly and a lot of these new buildings they require roofing tiles for the roofs, window tops and other places. Thusly, the

forecast period expects to see surges in population and urban or suburban density. The rise of the mega construction projects factor in this as well, and housing-for-all initiatives taken by many governments.

By region

The roofing tiles market was segmented region-wise into the following:

- North America
- Europe
- Asia-Pacific
- LAMEA

As mentioned above, the major growths in urbanization and population density affect the roofing tiles market growth a lot, and therefore the Asia-Pacific won outright in this category. The region is expected to show the highest CAGR in the projection period of 2020 to 2027, and the rapid economic growth and recovery is injecting adrenaline into the roofing tiles market in these countries.

Soleil Energy Starts Construction on California Rooftop Virtual Power Plant

The Wasatch Group's new engineering, procurement and construction arm, Soleil Energy, is beginning construction on the world's biggest Virtual Power Plants (VPP) this month. This effort from Soleil Energy is going to be constructed on top of the apartment rooftops in the suburbs of California.

This project is the first among the seven projects that Soleil Energy has lined up one after other. According to Blake Richetta, the CEO, these projects are there in part to show what can be done. The key point of breaking ground on the California rooftop VPP project is to take advantage of the abundant renewable natural resources in the state and thusly reduce the energy shortage.

What is a VPP

A virtual power plant, or VPP, is a network of small to medium power generators working together to output power levels comparable to a traditional power plant. It is a cloud-based energy architecture, a distributed energy resource, targeted to enhance the existing power grid, storing power, or even selling it on the electricity market.

VPP's generally are made up of small energy generators, often driven by natural resources. For example, solar panels, wind turbines, combined heat and power units – or even power consumers letting go of the electricity when they aren't using it. Combining these small units together, a veritable "power cloud" is established, the total output of which can rival even big traditional power plants.

This particular VPP we are talking about, the Soleil Energy's California Rooftop based VPP, uses solar panels on the rooftops of apartments.

Why California

California as a region has many features welcoming a solar power solution to its grid. First of all, the state experiences abundant sunshine and regular wind currents most of the year, so the opportunities of developing renewable energy solutions here are great. Secondly, the Californian power grid is highly unstable and to some extent unpredictable. The power costs are high, there are frequent load shadings, and safety-related power cuts due to wildfires are pretty common over the state are quite common.

All of the above makes California a prime logical target for a solar or wind powered VPP solution, and that is exactly what the Wasatch Group and Sonnen have been developing for the past few years. According to Ryan Peterson from the Group, this VPP on Californian rooftops is a proof of concept project that may change the whole energy generation trend in the whole USA.

The plan so far

The Wasatch Group, Sonnen, and Rocky Mountain Power have jointly completed the 600-unit Soleil Lofts VPP solar power generation and storage facility on a Herriman apartment complex in Utah. The power grid there has immensely benefited from this extra juice and decongested the system. Heady with success, the group has moved to California now.

The design of the power network infrastructure in the Soleil Energy California rooftop VPP dictates that each unit in this system will be able act as community oriented peaker plants. This system is utterly flexible and can be used as-needed for load shaping purposes.

Not only will the solar plants produce clean, reliable energy for the residents of the huge apartment complex, it will also be able to send some of the power back to the grid. This will take of a major load in the power system in the region now, and in turn will also shore up on local demands generated by power cuts as directed by the grid.

Most important to mention, the Soleil rooftop VPP in California apartments will give the residents of these apartment communities “resiliency at a discounted electricity rate”, according to Richetta.

The battery systems to be used as power storage solution in this VPP fleet are going to be provided by Sonnen, which is already famous for such solutions. The primary role of the battery system is, of course, to store power for night time when there is no solar power generation.

But furthermore, the Sonnen battery system with all its intricate modules will be able to optimize each community’s solar production, grid usage and individual apartment loads. One of the most astonishing features of the Sonnen battery grid that these computerized battery unit systems are imbued with the ability to ‘talk to’ each other, thereby working as a team to skew the load balance as necessary. The system is, in effect, one giant truly smart battery.

The numbers

The construction of first part of the seven-part project has started this month at the Heron Pointe apartment complex in Fresno with 417 units being retrofitted. That part-project alone has cost the Wasatch Group $19.7 millions already, however, the cost of rest of the parts shall be borne by other contributors.

The completion of the Soleil Energy California rooftop VPP fleet shall be completed in 2021, barring any unforeseen issues. As completed project, the seven parts altogether will be able to produce over 60 MWh of energy, and will be able to store 24 MWh of electricity for low-time use.

California is really powering up, thanks to Soleil Energy!

Tesla Begins Construction of the World's First 1 GWh Battery Pack

With the advent of solar and wind energy, and sustainability being the heaviest buzzword in the energy development sector, big battery stations are getting more and more common. There are multiple energy storage projects going on worldwide, but none are bigger than Tesla's new 1 GHz battery energy storage station in the US.

Being developed jointly by Pacific Gas & Energy (PG&E) and Tesla, the massive battery storage project is located in the Moss Landing, Monterey County, California. The massive batteries will be installed on the grounds at the existing PG&E electric substation in Moss Landing, enjoying the fame of being the largest energy storage system (for now).

The project is initially clocked to store 182.5 megawatts of power capable of injecting 730 MWh into the grid for 4 hours, the project has expansion capabilities which will soon push it delivering over 1.1 GWh for 6 hours. The mega energy storage project will utilize 256 of Tesla Megapack battery units, which will be standing on top of 33 large concrete slabs.

While the project has just only began pouring concrete on July of 2020, it's expected to finish full construction completion within early 2021. The power storing process, or energization, will start at once after inauguration, but to achieve full capacity energy grid assistance they will take a few months more, rolling into the second quarter of 2021. Only then they will be usable to their full extent.

As with most other ongoing construction projects in the USA, it could have been done sooner if the pandemic didn't hit. Either way, there is hope that the next phase or expansion of the Moss Landing battery project would start next year as soon as the existing phase has proven its stability.

However, it seems the glory of this massive battery project will be short lived. PG&G has already signed the contract of a new project in the same location with up to 300 MW battery storage levels, which is expected to output 1.2 GWh to the grid. This project will be developed by Vistra Energy, and it also has an expansion option to add another 100 MW of power storage capability to the batt-packs, topping up the already strong output by another 400 MWh.

Actually, PG&E has a lot of similar contracts on hand right now. For example, other than these giant projects, they are also staring on a 75 MW transmission connected power project at Morgan Hill, and a relatively tiny 2 MW project at Salinas Valley. As for up and running battery packs, they have a 20 MW energy storage system located the Llagas substation in Gilroy, California.

However enthusiastic PG&G may be about power storage, Tesla is even more so. Under Tesla's belt, there is already the award of the world's existing biggest battery station in Hornsdale, Australia. Also known as the 'Tesla Big Battery', this project can store 150 MW of power and deliver 193.5 MWh energy to the grid for 1.2 hours. Note that it is also an expanded system, which was initially clocked at 100 MW and 129 MWh at the end of its first phase construction.

Tesla has a lot of battery energy storage projects all over the world, but none are as big as these. Some of the other notable Tesla battery energy storage projects around the world are:

- Stocking Pelham, UK – 50 MW
- Jardelund, Germany – 48 MW
- Minamisoma, Japan – 40 MW
- Nishi-Sendai, Japan – 40 MW
- Laurel AES, USA – 32 MW
- Escondido, USA – 30 MW
- Pomona, USA – 20 MW

Though these battery packs are supplying good power to the grid for now, the landscape is set to change absolutely in a short while. This is because there are quite a few of around 100 MW power storage stations are under construction or will be in near future. This includes many projects in the United States as well as outside the states.

One of the most important among them is the 409 MW behemoth (that's about a 100 million iPhone batteries, or 300 million AA batteries!) in Florida Power & Light Manatee Project. It will cover 40 acres of land, the equivalent of 30 football fields laid together. The huge project, when complete in late 2021, will be able to deliver 900 MWh of energy without considering any expansion, powering 3,29,000 homes in the region for two hours without breaking a sweat.

There are also large projects oncoming from Clean Power Alliance Lancaster, AES Alamitos Arizona, Strata Oxnard, the Minety project and so on. Together, they are sure to completely change our conception of how a power grid works.

Watch Out for These Top Construction Industry Trends in 2021

The Covin-19 pandemic and technology have already defined 2020, in all respects as well as in the construction industry. But what about 2021? According to trends spotted in social media and in various market surveys, you should watch out for these top construction industry trends in 2021.

Changing the reality for virtual construction

Using AR and VR in construction is fast becoming the new craze, and for good reason. Augmented reality, virtual reality, and mixed reality – these three facets have already affected most of the mainstream industries, and the construction industry is no exception.

Using AR, VR, and MR is especially useful in pre-construction design phases. These technologies assist the architects and engineers in virtual construction, and it gets incredibly easy and quick as you continue using these tech. You can also let you client take a virtual walk through your creation before you start building, which give them a much better idea of the actual building that's going to be, than a simple 3D model, or, heaven forbid, a 2D paper drawing ever could!

For the above reasons, usage of AR, VR, and MR is going viral all over the world, and 2021 will see a massive usage of this yet.

3D Printing parts or whole construction

Believe it or not, you can 3D print an entire house within 24 hours these days. The AEC consortium is well aware of the capabilities and implication of this fact, and they are leaping off to grab the trend while it is still fresh!

The ability to make portions of the building off-site and just assemble it on-site has already become incredibly popular. 3D printing ups the tempo by several notch by attaching the prefabrication system to a design computer.

With good reasons such as those, the concrete 3D printing market has already broken quite a few growth records, and is expected to touch $57 million in value by next year. Innovative ideas are being put together to make the construction process faster, cheaper, and more efficient. 3D printing, of course, stands right inside the inner circle of such ideas, which will be sure to show us a totally new way in 2021.

Automating construction workflow with robots

Robotics is being used worldwide in many factories, from electronics to cars to medicines. But their advent in construction industry is somewhat stunted compared to other fields. Where entire factories and delivery rooms run by only robots exist, a fully robotic construction workflow has yet to be developed.

However, that wind is about to turn. Today, robotics is steadily and surely making headways into the construction field. From robotic bricklayers to giant road-making vehicles, we have already seen how

robotics can be extremely useful for the industry, and 2021 is sure to have many more surprises in this field than other.

Constructing sustainable buildings

Green building is probably the most used construction industry buzzword in 2020, and it looks like it will only increase in volume, not lower. As environmental treaties are signed around the world, more and more countries are placing more and more building regulations to make them more energy efficient and reduce their environmental impact – both during and after construction.

For several years in the new millennium (and even before that that) architecture has been steadily influenced by green tech solutions to reduce energy consumption of new buildings and optimize towards zero carbon emissions for both new and existing buildings. This drive has populated new industries to develop new building construction and insulation material that can reduce building maintenance and running costs to mere fractions of the traditional.

Recycling of old materials and using natural materials to construct buildings are also two very important facets in the green building criteria. In 2021, these trends will surely grow more and more important, turning into more necessities than quirks.

Prefabricating buildings by blocks

Modular construction using prefabricated

building blocks has been around for quite a while now, but it has been always a specialty area till recent. People are understanding how incredibly useful prefabrication really is. It reduces construction cost, time, manpower need, and wastage. It is quite cleaner than the traditional on-site method, and makes oh so little pollution byproducts. Not only that – prefcated buildings are often quite sustainable and reusable or reconfigurable too!

For all those reasons and some more, prefabrication is steadily beginning to look like it is here to stay for good. And anyone not jumping on board will be looking dejectedly as the 2021 train whishes by.

Using exoskeletons to go beyond human limits

This isn't very well explored yet because robotics is competing with it – or you can say, this is also robotics, in a manner of speaking. Humans are fragile and weak in comparison to machines, and so, these machines are being used to augment a normal human's abilities. This will greatly reduce the need to use complicated heavy machinery, half of whose entire presence is required just because the puny humans can't use them in person.

Well, no more. 2021 is about to see real advancement in the exoskeleton sector – modern technology is slowly but surely making that certain. And the market growth for them speaks for itself – a whopping billion dollar growth prediction (by 2021) is nothing to joke about!