

Causes of Catastrophe in Multi Storied Building Construction

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Abstract

India is on the threshold of making industrial revolution. From the traditional agrarian economy, the country is galloping towards industrial economy. Multi National Companies vie with each other in having Joint Venture with Indian Corporates. India is considered to be a safe platform for investment by the whole world.

The Nation is seeing, like never before, a remarkable development in the overall economy. Construction Industry is considered to be one of the important ones in receiving overwhelming attention of the Government of India.

The "Home For All" is the motto of the Government. Various schemes are being popularised to ensure that all in the country have their own dwelling units.

Construction Industry is the major contributor for national economy and is the largest provider of employment opportunities to people of all walks of life, next only to agriculture.

The large scale movement of people from rural areas to urban areas for employment purposes necessitates more number of 'living space' in the city. The rental costs are prohibitive in the city.

The first one leads to construction of more number of apartments in the city and the outskirts of same. The second one urges people to own an apartment instead of indefinitely paying rent. It is true that the payment of EMI is cheaper, compared to rental costs, for youngsters who have the benefit of availing long term institutional finance.

The overall wage structure is also reasonable enabling people to have a good disposable income.

All these contribute to construction of multi storied buildings in a large measure.

Key Words - Weak Foundation, Modifications, Site Workers, Excavation around nearby Projects.

I. RESEARCH METHODOLOGY

Personal visits to sites. Observation Method. Discussion with people. Perusal of records.

Contours	Details
No. of sites visited	2
No. of floors	4 and 6
Competent Approvals (including RERA)	Obtained in both
Covered Car Park, Round the Clock Security and Power Backup	In Both
Children Play Area, Gym, ATM	In the second site only
Migrated Labour	Present in both sites
Female Workers	Noticeable in the first and negligible in the second
Use of Construction Machineries	Remarkable in second site
Proximity to Important Locations	Both enjoy locational advantage

II. WHY EXTRA CARE IS NEEDED FOR MULTI STORIED BUILDING CONSTRUCTION?

Construction, per se, is a matter of great importance and attention to be paid at each and every stage. In building an independent house, it is easy to do so as the work involved is not much.

In the case of multi storied building construction, (generally a building with three and more floors is defined to be a multi storied building) right from basement till the roof top, passing through every stage is identified with great task and risk.

A small slip in one stage will lead to huge crack or further consequential damages to the whole structure. There are instances where problems erupt immediately and these are perhaps, better and easily manageable. There are far worse cases where the damages will occur after some length of time only.

Of course, the building would have been completed satisfactorily but within a short span of time, some catastrophe will burst in. This is more dangerous and will result in fatalities.

Chances of collapse of the whole edifice are also there.

In this regard, it is not out of place to mention that in Singapore, a six storied hotel called "Hotel New World" collapsed like cards on 15/03/1986, within 20 years of its construction.

A team of experts were probing in to the cause of the disaster. Initially, they suspected of a bomb blast. They were also probing whether the MRT System (Singapore was busy making the tunnelling) was the cause for the collapse. It was found that they were digging hundreds of yards away from the hotel and this was also ruled out.

The probe was made deeper and deeper and finally to the shock and dismay of every one, it was found out that the structural engineer who drew the plans for the hotel, took into account all the possible moving loads in all the six floors, but, alas, did not account for the dead weight of the building as such. It was a startling discovery.

In other words, the building had the inherent danger of collapse, ever since the construction started.

This is only a just a small example. A case of structural blunder.

Here, it is worthwhile noting that "the load associated with the weight of the structure and its permanent components (floors, ceiling, ducts and so forth) is called Dead Load. Since the dead load must be used in the computations to size members but is not known precisely, until the members are sized, its magnitude must be estimated initially. if a large difference exists between the estimated and the computed values of dead load, the designer should revise the computations using the improved value of dead weight". [1]

Construction of multi storied building is a tedious and time consuming process. While some portion of activities can be expedited by working day and night (such as plumbing, electrical work etc.), minimum amount of time gap must be given without fail for some activities – such as concrete curing. Any rush up on this will only invite calamity.

III. CATASTROPHIC FACTORS IN CONSTRUCTION

Taller the height and more the apartments (the breath – number of apartments in each floor and also the height - total number of floors), greater should be the attention even on the infinitesimal detail.

A casual approach at one stage will result in casualties throughout. From the origination of idea stage itself, planning must be ensured. Origination, Formation and Implementation - All these three phases require concerted attention and closer observation, monitoring and co-ordination with everyone in the loop for successful completion of the project.

It is a fact that even established builders slip in one way or the other resulting in inordinate delays in completion of the project or complaint from the occupiers, of quality deficiency in the apartments or maintenance problem. The list, if stretched, will be too long.

The catastrophe befalls during construction itself or immediately after construction – sooner or later but sure to take place.

The important factors that cause such dreadful catastrophe are discussed below.

IV. WEAK FOUNDATION

Foundation is the basic thing that takes care of the whole structure. It is true that majority of the construction costs is consumed by foundation. Any imprudent action in this whether in terms of inadequate depth disproportionate to the height of the building or poorly laid foundation will result in total collapse of the structure, soon enough.

The key activity in construction is ensuring solid foundation.

What should be essentially borne in mind is the solidity of the soil. Soil test should be conducted thoroughly and no compromise, whatsoever be in nature, should be made. When the soil is not solid enough to withstand the structure, it is only worthwhile to abandon the project there, instead of trying to strengthen the same by various means of action.

Structural Engineers say that such man made action will, perhaps, work out for some time and it is only the question of time. Any efforts in trying to strengthen the basically weak soil are not only waste but also are dangerous either during the construction

itself or later. The in bread risk element can never be eliminated at all.

There are also cases where such constructions on “weak soil subsequently strengthened” have developed cracks in the structure necessitating frequent patch up works, though the danger of shaky foundation could never be overcome.

Even on the solid soil, it is to be adequately ensured that foundation is laid strongly enough to take care of moving weights in the structure and also the wind effect. Calculation of present weight and also the possible add on weights over a period of time should be carefully taken into account while fixing the foundation work.

Most important of all is the dead weight of the building, ie, the weight of the building itself. Any dilution in this will weaken the structure during construction itself. It is not uncommon that many structural engineers pay overwhelming attention on the moving weights and pay scant attention on the dead weight.

In fact, as per Structural Engineers, the predominant thing is to ensure ‘absolute foundation’ to take care of the dead weight of the building in the present mode and also ensuring cushion for a couple of floors more, whether later on built or not. This additional foundation strength is an inbuilt cushion to comfortably bear the moving weights in the building, even if they are unmindfully added. The structure would remain fit enough with additionally added weights.

In this context, it is quite relevant to note that “foundation system should be adequate to sustain some later changes in site or construction geometry and be easily modified should changes in the super structure and loading become necessary”

[2]

Any attempt to add even one floor extra over what is specified and fixed by the structural engineers is suicidal. The additional foundation strength for possible additional floors is only a buffer strength for unmindful add on of weights after physical possession, by the occupiers.

It is normally a fact that no builder, nowadays, attempts to add even a floor extra.

Now, the enforcement of rules is also so strict that any violation would be sternly dealt with by the authorities and chances are there that the builder would even be blacklisted. The promulgation of Real Estate Regulations Act (RERA) is considered a boon

to the buyers. The RERA does the police function on the builders.

V. NEVER ATTEMPT FOR MODIFICATIONS

It is a normal practice with the builders (this was, of course, followed in the past and has been very rare or virtually nil now, after the RERA, in India) to make alterations, after foundation and during the course of construction, in order to conclude the sale fast, by mending to the requirements of buyers. All these generous modifications were done inside only.

The foundation, having been accounted, after meticulous calculation of weights both dead and moving and with possible cushion, taking the length and breath of the structure precisely as per the plan, in all floors, any ‘adjustments’ during the course of construction will only produce shock waves to the structure.

Repetitive action of this will also cause destabilisation of the very structure. Right from wild cracks to even collapse. Anything is possible.

In fact, one of the reasons attributed for the collapse of a 11 storied building in Chennai, Tamil Nadu, during June 2014 was that in order to enhance the space of car parking, unmindful additions and deletions took place which totally shook the structural system as such. Unwarranted modifications in order to gain some space in ground and basement pulled down the whole structure like tumbling of cards. It has cost the lives of more than 60 people.

It is a pity that some small builders still follow this as a technique to clinch the deal fast. The risk is only for the occupants.

The eminent and established builders make it very clear that no modifications, even of small nature, would be entertained by them and the apartments would be sold as prescribed by the structural engineers and built by them only. This rigidity, in a way, brings them further name that they are perfect in profession and so are the occupants, after possession.

Some unscrupulous builders who tactfully saved on foundation have lost their business forever. The curse of occupants drove them out of business. It is a pity that the dwellers of such apartments would always be harbouring a fear of collapse in their mind.

VI. ALWAYS USE GRADED MATERIALS AND SAME MATERIALS

This requires a specific mention for the small builders and one time builders. It has been now fully

systematized that only experienced and eminent builders can venture into multi storied building construction – thanks to RERA.

One of the conditions of RERA for according approval is that the builder should produce documentary evidence for the projects successfully completed in the past. The term “successfully” means that any litigation or issues would bring a blemish on the builder. Until and unless he is cleared by the Court, he cannot get any permission to proceed his business.

A welcoming thing after RERA is that too many unprofessional people wound up their business and only genuine and professionals are pursuing the construction business, now. It was a matter of surprise that even Milk Vendors, Tailors and Transport employees were doing construction business by hook or crook. They are simply eliminated from the field.

Normally, some builders use any brand of cement, though sticking on to the grade, as available in the market. They would also say that as long as the grade is stuck to, any brand is permissible, the quality and attributes being same.

The Project Manager of the second site, upon asked about this, gave a clear and thorough reply. Though of same grade, using different brands, as are available in the market during the process of construction, is not right and should be desisted forthwith.

Every brand has its own uniqueness and only the same brand of cement should be used throughout the construction. Mix of brands is mess of things, he warned.

Goes without saying that this not only applies to Cement, but also to steel and other things as well.

The Project Manager further said that for this purpose only, they have Rate Contract with their Suppliers and they have excellent Supply Chain Management System. He went on to add that based on technology improvement, their suppliers are also prepared to do product up gradation in their supplies. They treat their suppliers as Partners and there is no secrecy in the dealings and they fully share technical transfer of details, to get best supplies from them.

It is a sad fact that in order to vie with each other, some suppliers make compromise on quality, to be on par with the price of the Leader or their Competitor. The price advantage of the Leader or the Competitor could be due to mass production or exceeding demand or of both. The new supplier having neither

of this just wants to be in business and is prepared to go down in business practice.

Small builders normally fall a pretty to them.

The established builders always use top class products and their price and services are forever justified. The secret of their roaring success is this. Hence, use only the Tested and Trusted Products.

VII. SITE WORKERS COULD CAUSE HAVOC

It is not a statement – translation of incidents.

The site workers, most commonly, make mistakes, in brick laying (either of negligence or wilful scant attention), concrete mixing and curing and in routine maintenance during construction. A very few important things are only expressed here, though it is a long list.

If swift action is not taken while laying the concrete, it would produce different effect. Concrete curing of 21 + days is only a number. Watering the concrete is pretty important. In the second site, it was observed that they pour water on concrete, cover it with gunny bags and pour water again on it so that the concrete is, something like, in a water bed.

The Project Manager said that this meticulous application gives the concrete, the rock effect. Definitely, the Project Manager or the Site Engineer cannot do this job themselves and this has to be executed only by the site workers.

If the workers at the site are doing proper job, the construction would be pretty strong. If they are negligent or unscrupulous in behaviour, the risk is only passed on to the poor occupants. The effect of their work will affect only after years.

The builder would be in trouble, the occupants would be in peril and the real devil are the bad workers at the site. They will be shifting from site to site but the bad job they did will cause the havoc only after years.

The Project Manager made a private remark that the workers are like tamed animals. They will show brute strength in work. If their work should turn out into performance, they should be used harsh words (to guide and correct them) and if their performance should become ‘splendid result’, they should be used sweet words (motivate and encourage them).

From the above it can be seen that workers could cause havoc but if they are constantly monitored, guided and corrected, they would become workhorse and show wonderful performance.

The responsibility of making the workers give right performance lies with the Site Engineer and Project Manager only.

VIII. TRUSTED LABOUR CONTRACT

It is noticed that almost, all the big builders have only a very minimum people in their permanent payroll. These people comprise Project Manager, Site Engineer, Finance Manager, Administration Manager etc., assisted by group of youngsters.

Apart from the above core personnel, others are just contracted from outside. Like in materials, outsourcing is practised in labour as well.

A Prudent Builder would always have a trusted and experienced Labour Contractor. Freezing a labour contract involves tremendous expertise. It is not just the requirement of number of people to be supplied to the site. What is the fun in having basket full of rotten tomatoes?

Chalking out the requirement of site personnel is a careful exercise.

Young and Sturdy personnel are required to do the arduous construction job. The Site In Charge, who is also, normally hired from the Labour Contractor, should be a young guy, possessing HR skills (this is necessary as he has to interact daily with the group of youngsters, mostly uneducated). An elderly Site In Charge is, generally, despised by the site personnel, as he is misconstrued to be a Fault Finder. Amongst youngsters, it is matter of fun].

It was observed in the second site that while the Site Engineer is a fairly young person, the Project Manager is an elderly person with a rich project experience. Goes without saying that the Project Manager must be an Icon of Experience and Education and age is the plus point for him.

IX. TEACH, TRAIN AND MOTIVATE THE PERSONNEL

Construction activities are laborious and time taking one. Impatience in performance will mar the very work being done.

It was observed in the first site that a group of workers were indulging in altercation with the Site In Charge. Upon investigation, it was found that language was an issue to them, as they are basically migrated workers.

The Site In Charge was issuing instructions to them in local vernacular (Tamil) and with a selected few words in Hindi. The workers, basically being Hindi

people, were doing the job as much as they understood from the instructions passed on to them.

Since their understanding was not full enough, they performed the job based on their own experience and style. This infuriated the Site In Charge which resulted in the quarrel.

It is true that for construction activities, not much of education is needed for the site personnel, as the job is simple and repetitive. What is important here is that the result that is expected by the Site Engineer, passed on via Site In Charge did not take place due to language barrier.

The Site Engineer, who is well versed in Hindi as well, passed on himself the instructions to them in the manner easily understandable to them. That did the wonder. The Site Engineer was all praise of the workers.

More than mere telling, teaching is of importance in construction sites. There is no use in passing on instructions like a loudspeaker which will never be heeded (or understood, for that matter) by the workmen.

It is the duty of the Site In Charge (or in their own interest, the Site Engineer), to get feedback from the workers as to what they have understood of his instructions. If he is satisfied of their perception, he can rest assured of their performance.

In the second site which was using more of construction machineries, an interesting scene was observed. The Project Manager called all the site personnel, including Supervisor and Site In Charge and conducted a sort of parade, in training them on how to handle the Construction Equipments which were kept in a row before them.

Individual training was given to all the people. He got feedback from every one on their understanding of the application.

The Project Manager exhibited his smartness in that – perhaps, that could be out of his sheer experience. He asked questions individually on how to protect themselves in the event of a mishandling of the equipments. He was satisfied with their reply.

The Project Manager proved his worth. Yes. He has ensured the handling of the equipments to all the site personnel. He has also made them avert accidents in the usage of such machines and also taught them on how to protect themselves in the event of a mishandling.

Workers safety is pretty important at the site. In the event of an untoward incident, the builder only will have to hugely suffer. It is also possible that a wrong electrical connection by an ignorant worker may set ablaze the building.

Proper training will induce a sort of involvement in the work and proper Motivation will turn out the workers to be an asset to the builder/contractor.

Anything lacking in this may cause tremor at the work site - HR Tremor.

X. EXCAVATION AROUND NEARBY PROJECTS

This is an inevitable one. It is true that decades ago, there was ample space between one property and another. Tall structures were blessed with enough open space, all around.

This is fast decreasing now. Space has become a major constraint. This is more acute in the city. Only the most minimum space, as per statutory regulations, is left and the balance is converted into tall structures. No doubt, excellent foundation is ensured after a thorough soil test.

As far as the present project is concerned, it has passed through all the tests and it stands like a solid rock.

The problem would emerge only when the next vacant space is also excavated for identical multi storied building.

The Structural Engineers generally opine that while the existing structure is well anchored on solidity of the soil which could withstand any abuse by even nature (such as tremors, earthquake etc.), the impact of excavation at the next site cannot be ruled out.

This does mean that the existing structure will definitely receive (and, of course, pass down the earth) the impact of the next site undergoing similar operations. The foundation and the construction efficacy will keep the structure intact.

They, off the record, opine that the threat factor cannot be ignored. Probably, the strongest will only stand tall].

The Planning Authorities may control this by ensuring sufficient 'safe distance' between two multi storied buildings. The practicability of this in the City, is only a question.

The Structural Engineers say that it is not an issue of debate or worry at all. So many tall structures stand, side by side, intact, in the city as landmark. Perhaps,

these buildings are the cynosure of structural stability.

Here, it is relevant to note this. "The term foundation includes the Soil or Rock upon which a structure rests, as well as the structural system designed to transmit building loads to the supporting soil or rock". [3]

What must be ensured for the safety is the Solid Foundation and Proper Construction Techniques while executing the project. This has to be tested and confirmed by time and nature only.

XI. NEVER CHANGE THE INTENDED USE

This is pretty important. When a multi storied building is constructed for residential use, it has to be ensured throughout the life of the building, as residential apartment only. Changing the use midway, or even immediately after construction, to a godown or as a multi storied library will surely cause the collapse of the building, however strong the foundation be.

The reason is very simple. The structural system was so planned for residential use only. Apart from the dead weight of the building, the moving weights were computed on number of dwellers in each floor with reasonable furniture, fixtures and other weights.

When it is converted in to a warehouse, the moving weight will become multi fold. This will tear the whole structure by causing wild cracks in the beams which are unable to withstand the weight and ultimately passing down the same. The entire weight will settle down on the foundation and just shatter the same.

The solidity of the soil and the efficacy of foundation will all get blown up in the air pulling down the structure in no time causing instant collapse.

XII. CONCLUSION

The second site was a master piece as it had professionalism in everything.

Apart from commendable use of construction machineries, the site personnel also exhibited decorum in work. The builder was blessed with a wonderful Project Manager – a man of wisdom and experience.

The first site, for its size and operations, was ok. But, what was noticeably missing was co-ordination, at all levels. Constant bickering of site personnel will have telling impact on the construction and project completion. In a fit of rage, some persons could cause

wilful damage to the site that may lead to catastrophe.

XIII. RECOMMENDATION

Foundation consumes the major chunk of the construction cost. It has to be consciously endured. Reputed builders take this aspect in their pricing pattern. Some unscrupulous builders, in their avarice to amass money, compromise on foundation expenses. This is dangerous. This bad practice should never be followed.

Same grade and same brand of items should be only used throughout the construction – whether it is cement or steel or any other thing.

Site personnel are the people who do the actual construction, brick by brick. Hence, they should be trained and developed. Motivation is a must for them to pour out their best.

Constant supervision is absolutely essential. An error, albeit, small it be, may prove costly.

More use of machineries will contribute to more of labour productivity.

At any cost, never change the use for which the multi storied building was constructed.

Periodic Maintenance is a Must for the safety of the building.

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