

Research on effective of construction as apply the light weight concrete structure in order to shorten the working time in civil construction

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ABSTRACT: At present, the construction needs to ensure the technical requirement and schedule in place. Beside that, the effective control of the investment should be considered. Currently in Vietnam are still using traditional materials in the construction such as brick, this will affect the environment and ecological balance. Need to change perception for design and construction is difficult in current conditions. Applied light weight reinforced concrete structure is a modern solution to help investors, contractors and state regulators have a new look in its current condition. In the article, the author refers to the efficient investment light weight reinforced concrete structural applications in construction. From that, the author give some specific suggestions for improvement works when needed, repair in cramped space conditions and rapid construction progress

KEY WORDS: Light weight concrete structure, civil construction, environmental, ecological balance

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I. INTRODUCTION

Nowadays, with the development of modern industry helped to build the project becomes more convenient and easier. The construction work is encouraged the application of new technologies in the construction process. Currently the application works designed using lightweight structure makes the building becomes faster, lighter and more technical assurance. As we know, the structure of the larger mass makes vertical load exerted on the footing with larger foundations. Thus, while reducing the vertical load on the foundation will make the footing lighter, the depth shall be lower. As usual, the ratio of investment costs for the foundation in Vietnam, accounting for 20-40% of the total value of the entire project. If we reduce the investment costs for the foundation then the time for construction is also decreased. On the other hand when the mass of the building is reduced then earthquake load effects on buildings is lower correspondingly. To complete the light weight structure solution we should adopt the following approach: using the steel structural for main bearing parts of the building and use light weight reinforced concrete walls and slabs accordingly. When using the steel structure then it will maximum effect of it is plastic deformation ability, high strength then it leads to get higher energy dissipation capability. On the other hand, the use of steel structural for the main frame then we take the advantage of its positive aspects and its advantages such as faster producing schedule, ensuring quality control because it is produced inside the factory. The erection time will be reduced by the use of modern machinery led to the number of workers present on the site will be limited. Now that both the owner and the contractor will reduce costs of human management as well as easy to control safety issues on construction sites. Another aspect, the case of risk at the job site will be reduced significantly. When using lightweight concrete part it will make the possibility of mechanization in the construction process more. The structural walls and floor panels can be produced in the factory. Just like steel structural, light weight reinforced concrete structure will be cast into light panels in the factory. From that we can control better the quality of concrete slabs. We can control the grading during the manufacturing process, curing conditions to be considered carefully. After producing lightweight concrete slabs finished we just transport them to the construction and install it. Due to the part to be manufactured in the factory then it tend to be shaped and controlled desired shape without affecting from the construction conditions at the job site. Eventhough when it comes to the complex shape, we can pre-designed modules for each floor so that we can finish assembly to the required design. As we know, when poured in place concrete to the floor we need to use many type of formwork to the shape of the desired

architecture. Then we need to have a large number formwork to form the shape of the architecture on demand. However, if the floor panels that are manufactured inside factory then we do not need to make the bottom formwork but only side one to create a shape for that slab. To shape the bottom we can take advantage of the ground floor of the factory to create a flat bottom. Such a large amount of formworks and pillars are reduced in the construction process as well as reduce the execution time of formwork, shoring for construction. Beside that, when it is synonymous with the use of formwork materials are a significant wage reduction in order to minimize the environmental pollution and the overexploitation of natural resources scarce today. A chain reaction for this is that after logging, plastic or steel formwork, we need to processing, manufacturing and transportation to the site. If we do not use this amount of formwork, we do not need to transport them as well as we will not need workers to assemble it - the formwork. That is a large amount of direct labor will be reduced and it is coupled with the management of labor on site will reduce to the maximum extent. And it is accompanied by the risk of labor accidents will go down. As we now know accidents happen in the process of removing, mounting the supporting, scaffolding is at high levels due to construction work on the narrow condition. Due to the distance between the supporting column close lead to the movement of the the workers is very hard incramped conditions. As we know, this is the consequences of the limited conditions in construction. When workers move, it will face many difficulties and when negligence the collision possibility of workers and their widgets with outrigger scaffolds that can happen. The supporting of scaffolds are capable of falling, the accidents can happen and lives are threatened workers that are difficult for us to control. When using lightweight concrete slabs, along with the steel frame erection we install light weight concrete panels together. Obviously taking the advantage of the crane to install the steel structures we can use for lightweight concrete panels one then we can reduces the frequency of movement of the crane to the other job sites. This mean that we maximize use of crane on the construction from start to finish. Thus, efficient use of cranes reach a maximum.

Taking account of the factor for using traditional brick materials we encounter many things to be discussed. First, we must mention that the exploitation of natural resources of the land surface area fields. To get them, they need to dig up the clay and a large volume of crops soil. After exhaustion of soil surface usually leaves the artificial lakes on the unwanted fields or residential areas. In the mining area land resources we can not farm or farming out of fishing or aquaculture. However, the formation of scattered ponds, artificial lakes is not as systematic then it should result in deficit to have a good development planning to ensure aquaculture as desired. So after a while exploiting the land as to the consequences of bricks as ponds, artificial lakes only have the ability to exploit a number of limitations.

Besides, the land after mining is finished we need to spend a large amount of coal or firewood for burning bricks. Currently, fossil energy sources are being depleted worldwide, and Vietnam is not an exception. We all know that the present world war is only intended annexation gas fields, coal, and natural resources. Then the extraction of fossil resources or forest resources is also a factor to be considered. Also, when we know that when burning coal or wood for burning bricks, a large amount of waste gas emissions also pollute the environment. Thus using traditional bricks will deplete natural resources on many aspects (soil removed, creating artificial lakes, unwanted exploitation of fossil resources excessive discharge of waste cause the greenhouse effect to the environment, create more dust causes lead to environmental pollution, ...). In addition, when using traditional brick masonry creates structures heavy volume and resulting vertical pressure on the larger foundations. That also means that the construction costs will be higher for larger foundations. When it works construction takes more time, labor consuming to build more. Add to that the mass of concrete will be higher, or excavation pile will increase significantly. This led to the construction schedule will be longer. Risk will increase due to: increase the number of workers, many materials for construction, longer construction time, excavation time for foudation is longer, the amount of rock excavation to pour away will be heavier. Then direct management and indirect construction also increased. And when prolonged schedule then the risk by not having foreseen the extreme weather mode current is not anyone want. We know the current regime under the weather became more extreme tendencies. People try to forcast the weather to an approximate but can not foresee the impact of climate change all around the world. When the schedule of project is extended lead to the project cost is increasing proportionally. Consequently, the time put to use and exploit shall be slowed down. If the public is not commissioned in time it will lead to slower social welfare decreases. As for commercial buildings, if the buildings slowly put into operation, it will resulting in economic losses for the investors. Then the capital recovery time is slow down and the probability of business risk will be increased accordingly. If investors soon put to exploit the project then the rest of the time they will conduct research and implementation of subsequent projects. Opportunity to operate the new project will change if the work put into operation is late. In addition, financial risks for investors as evident when the project was delayed. Shown in picture 1.



Picture 1: Traditional brick wall

Most of today's construction projects tend to develop in height. Thus for construction in the city is another matter of concern. With this format works, we must think of the remaining area for construction. Due to the current use of land for construction is shrinking, investors try to use the maximum area for construction to maximize investment efficiency. From the fact that shortens construction time, modern methods of construction should be applied to work as a higher priority. For the development of current works in large cities require multifaceted needs are met. These include: construction time, construction cost, completion time and put into use, safety on construction sites, risks during construction and operation, performance and use of funds ability to recover capital, time to work on mining communities, ...

II. MATERIAL AND METHODS

Circular 13/2017 / TT-BXD [8] of the Ministry of Construction regulates the prohibition of using fired brick materials for projects in Hanoi and Ho Chi Minh City. Accordingly, other cities can only use up to 30% of fired bricks in construction works. This regulation applies to projects funded by the state budget. On the other hand, with construction on 9 floors, the number of fired bricks can only be used up to 20%.

III. RESULTS AND DISCUSSIONS

When applying the new technology in terms of construction in Vietnam need to pay attention to the actual conditions. Steel structural frames for buildings have many advantages as mentioned above, there are also some disadvantages that we need to keep in mind. First, using the steel structural frame, this is a material that has high thermal conductivity. When a fire occurs, steel structural frame is not likely to catch fire but the plastic limit reached quickly if no preventive measures. To ensure the ability to prevent fires, steel structural need fireproofing or to be used for fire-fighting materials to cover specific surface. However, import prices for fireproofing for structural steel remains high today in Vietnam. In addition, the material cost for steel is relatively high compared to reinforced concrete structures. But in the future, the cost of concrete materials will increase over the time. But steel material is a material capable of re-use after a period of use. A steel structure project after an extraction time, when we do not want to use any more, we also can be removed and reused at another location. Buildings can move to a new location that works reinforced concrete (RC) can not afford it, or if it want to move then it will need a huge cost. Thus, the steel structure is capable of re-use and cause less environmental pollution after serving time all that works. So if the use of reinforced concrete structures after work no longer use, or it only the way we smash it and waste materials out of landfills or used for the filling only. Also, when we smash the concrete it will create a lot of dust.

We compare the progress between the two schemes using conventional reinforced concrete structures and steel structures used in combination with lightweight concrete in construction as table 1:

Table 1. Comparison of investment funds and progress of construction works between traditional plans and schemes lightweight concrete combined with steel structure.

No	Comparision index	Type for comparision	Using RC and traditional brick for construction	Using light weight concrete and steel structure	Using RC and traditional brick for construction	Using light weight concrete and steel structure
1			Expense (Base on 1000 money units of work)		Schedule (Base on 1000 time unit of work)	
2	Design of project (3%)	Fix cost (direct cost)	30	20	30	20
3	Design approval (0,2%)		2	1	2	1
4	Foundation execution work (24%)		240	200	240	200
5	Body execution work (65%)		650	750	650	500
6	Finishing work (1,8%)		18	10	18	10
7	Project management of the contractor (1.5%)	Flexural cost (indirect cost)	15	10	15	10
8	Site supervision consultant (3%)		30	20	30	20
9	Project management of the owner (1.5%)		15	10	15	10
10	Natural resource exploitation (100%)	Govement management and environmental issue	1000	800	1000	800
11	Govement management of the authority related (100%)		1000	800	1000	800
12	Risk that govement facing (100%)		1000	700	1000	700
13	Safety , health and environmental (100%)		1000	600	1000	600
14	Social security (100%)		1000	800	1000	800
15	Total		6000	4721	6000	4461
16	Ratio % Increase(+) Decrease (-)		+27.1	-21.3	+34.5	-25.7

Over the table 1, we can see if our calculations comparing the problem of expense between new alternatives (steel structure combined with lightweight concrete) and former plan (RC structures and traditional bricks), the investment performance will significantly increase. In addition, the overall construction schedule will reduce 25% of the time. This is a figure that should be considered and applied widely in the industrialization and modernization of the country.

The building using traditional methods will gradually be replaced by design and methods of modern construction. When sanctions prohibiting the use of bricks gradually take effect, the lightweight material, unburnt material will be replaced. Meanwhile, the bricks will be totally banned to protect natural resources and compromised soil emissions causing the greenhouse effect. The unburnt bricks such as brick molding, foam concrete, light weight concrete, ... will be a new trend for the inevitable development of construction technology today.

Structural steel design will help give people more choice and also the approach to technology and modern construction. The combination of structural steel and lightweight materials has become a new trend in the way of thinking and engineers today. The fact that some of the steel design has been applied this technology is that the building of Hotel at Phu quoc Island of Vietnam (picture 3). With 7 stories steel structure, it has a lesson for design consultants and construction contractors have more experience in choosing the best solution for the investor. Especially with this new technology will limit pollution, reduce overall construction schedule and work so soon put to operation and utilization.

The effect of structural steel used in combination with structural lightweight concrete has proven to be very large and thus shorten the construction time of civil works for the high-rise buildings. According to the statistics, the construction cost was reduced to 21% and reduce the execution time up to 25% when the application main frame structural steel and light weight reinforced concrete walls and floors (refer to Picture 2 and 3).



Picture2: Two floor of restaurant in Central of Vietnam



Picture3: Hotel at Phu quoc Island of Vietnam

- The change of routine use of new materials as well as change management practices in developing country conditions need to be considered at present.

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