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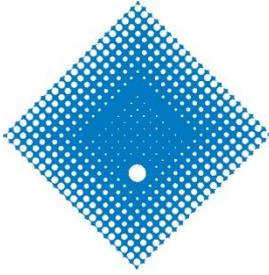
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**VICTORIA
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Construction of Tall Buildings in Southeast Asia

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Executive summary

The construction of tall buildings is one of the most dominating structures in most parts of South East Asia. This is due to the advancement in technology which has resulted in building more stable tall buildings using the available strong materials such as concrete and steel. The construction of a tall building requires the development of a construction process which acts as the guideline for the completion of the project. This also involves the legal formalities which are involved in the constructions of high rise structure. The advancement in construction methods such as in-situ concrete and precast, as well as steel structure methods has made it possible to build tall buildings within a short period. Moreover, the best construction materials depend on the purpose of the building and regulatory requirements as well as the nature of the soil which determines the foundation and construction methods of the basement. The construction methods in South East Asia are more similar to those in Australia. However, Australian engineers have started using wood panels in building high rise buildings. This paper has discussed the construction methods in south East Asia and the materials involved in order to achieve best structures.

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1.0 Introduction

The field of construction has over the years grown tremendously in South East Asia when compared to construction in past years. This is evident by the type of buildings that are being constructed which show significant changes to the previous buildings. One significant change that is witnessed in the present day buildings is how high such buildings are constructed. In previous years, it was almost impossible to construct tall buildings as evident in South East Asia. The most dominating symbols in terms of buildings in South East Asia are mega structures including tall buildings. Most of the tall buildings in South East Asia were constructed in order to serve as commercial buildings (Ali & Al-Kodmany, 2012, p. 384). The earliest tall buildings were constructed in the United States of America. Moreover, with the increases of investment, most of the buildings are now common in Asia. This means that there has been an increase in construction of a tall building in Asia than in any other part of the world. Most of the tall buildings in South East Asia are serving as commercial buildings, residential and hotels. The construction of tall buildings involves the consideration of many complex factors which include economic, technological, government or municipal regulations and political stability of the country (Cuthbert, 2006, p. 45). The most influential factors in the construction of tall buildings include economics and technology. Additionally, the extraordinary nature of the buildings requires the engineers to consider certain factors in materials and methods of constructions in order to make the buildings stronger and prevent them from falling (Ghafoori, 2011, p. 95).

The revolution in the structure of buildings from the timber based, and concrete based to the steel based materials have also encouraged the building of tall structures in various parts of the world. This can be attributed to the advancements witnessed in civil engineering and the various inventions such as the use of steel. The ability of steel reinforced with concrete to withstand a lot of pressure has made it easier for the construction of building (Ali & Moon 2007, p. 215). The revolution has also changed to incorporate steel and glass materials for the walls have led to the development of the skyscraper. A tall building requires sophisticated foundations, structural system, and electrical engineering equipment, which is able to support the other building materials (Ali & Al-Kodmany, 2012, p. 385). Moreover, the construction requires a large basement and core area which is able to accommodate the elevator systems services. Tall buildings are also affected by environmental factors such as wind and gravity which is dependent on the material type. In line with this statement, tall buildings also have significant effects on the environment around them especially on people surrounding. However, with construction of tall buildings there is always the possibility of a hazard occurring on such buildings. Therefore, this has led to various regulation and standard being formulated by the various governments concerning buildings that pass a particular threshold. These standards and regulations are there to ensure that care is taken in construction of tall buildings since if not regulated it could lead to massive losses of both property and human lives (Al-Kodmany & Ali 2013, p.140).

2.0 Effects of Tall Buildings on People Surrounding

Tall buildings have an immense effect on the surrounding area, which may at times go unnoticed to the public in general. However, recent studies have shown that the presence of numerous tall buildings within the same area have a significant effect especially when it comes to the climate of the environment. Tall buildings affect the wind pattern of the surrounding area thereby changing the climate of the area. This is attributed to the fact that the presence of numerous tall buildings creates a block. This is in turn preventing winds reaching the public below thus altering the climate pattern of the area. In addition to these, tall buildings are known to because shading effect on the surrounding area. This is because too many tall buildings block the sun, thus preventing sun rays reaching the ground below them. This has effect on the vegetation growing below them since sunlight is one of the requirements. Additionally, prevention of the sun rays from reaching the ground also has a cooling effect since less heat is transmitted to the ground. This is evident in areas around Singapore which is characterized by numerous tall buildings. Other studies have shown that tall buildings contribute to climate change. This is attributed to the amount of emissions witnessed in such building due to high consumption of energy in the running of their daily activities (United Nations Environmental Programme 2009, p. 8).

3.0 The Construction Process

The construction of the tallest building in South East Asia involves construction managers who monitor the whole construction process. The tall building construction is headed by a construction and project management committee which is responsible for overseeing the design and construction process of the tall buildings. The construction process can be summarised in a construction cycle, which involves organizing of the project, schematic design, design development, construction documents, bidding, construction, and occupancy of the building.

3.1 Initial Planning

The committee responsible for the development of the project and responsible for making the necessary decisions on behalf of the stakeholders of the project. This committee makes decisions that regard to the stakeholder's requirements in the building. During organizing, the committee develops a program of requirements, which contains the objectives, spaces, the equipment, furniture and all spatial relationships. In addition, the committee develops the documents in the requirements projects which are then approved by the relevant authorities prior to the construction process. The estimated time for programming is estimated to be between two months and six months depending on the nature and number of stories the building should have (Anatomy of a Construction Project (n.d)).

3.2 Design Professionals

This is the selection of the company that will be responsible for designing the architecture of the building. There are various firms in south East Asia which offered architecture designs in engineering of tall buildings. In practice, the design professionals are incorporated to the project team in order to work as one team. In most cases, the design professional team is selected through vigorous interviews in the projects in order to select the best team which will offer the best design and services. The firms that win the designing of the building is then provided with the program of requirements, the standard for constructions of building, the schedule in constructing the high rise building, the budget in constructing the building, and all the necessary basics involved in the construction of the building. This process is estimated to take not more than two months (Cuthbert, 2006, 25).

3.3 Schematic Design

In this step, the construction design team considers a variety of factors which include the number of individuals who should be allowed to occupy the building. The design team develops a schematic diagram which shows all sizes of the rooms and systems in the building. This schematic diagram should clearly indicate the water systems, electrical systems and other systems that are crucial in facilitating the use of the building. This schematic diagram will also show the external and interior of the building and their relationship. This schematic diagram is then presented to the relevant committee and authority for approval. Since it involves evaluation and approval at various stages and by different authorities, this step may take 2-4 months.

3.4 Design Development

The design team then splits the schematic design into various plans and elevations. The building committee reviews the colour, materials, and building equipment that will be required in the construction. In this stage, the complete plan of the building is revealed and discussed for approval (Anatomy of a Construction Project (n.d).

3.5 Construction Documents

The approved design and requirements documents are then used by the project manager in securing a building permit. The designs are used to design the comprehensive drawing of the construction and the specifications which are vital in obtaining the construction permit from the relevant authorities. There are various parts, which are followed in obtaining a construction permit in most parts of South East Asia. In an application for the construction permit, the municipal authorities inspect the construction site in order to approve its suitability for the tall building. In this step, the necessary documents for approval are submitted. Before the plan can be approved, the relevant building authorities inspect the building plan and the construction site in order to see whether the plan is suitable with the site of construction. After the approval, the construction manager is given a construction permit. The construction team then requests for a building controller who will be responsible for controlling the construction of the building. This controller is the supervisor of the project. In

most cases, the supervisor is the owner of the construction company and is assumed to meet all the necessary requirements. In addition, the company requests for telephone and water connection from the relevant authorities. The company then embarks on the building process of the company. On completion, the inspection authority inspects the building before it is occupied by the president and commercial business owners (Anatomy of a Construction Project (n.d)).

4.0 Construction Materials and Methods

The engineers use various construction methods in the construction of tall buildings. Since the buildings in most cities are situated in capital cities, the construction occupies the whole construction site (Short, 2012, p. 26). The methods they used in the construction of tall buildings considered the environmental impacts of the tall building. In their methods, the engineers used a designated off site location in storing the materials used in the constructions of the building. The construction methods are considered facts such as costs, times, environmental impact, logistics and flexibility of the construction method.

4.1 In-Situ Constructions

This is a construction method in which the construction materials are made at the construction site. This is because the construction of tall buildings requires more materials which means they will have to be transported from the factory to the construction site. In situ construction methods consider labour costs in the construction of tall buildings. Since the materials are manufactured at the site of construction, they reduce the cost of transportation. In addition, this technique uses cheaper raw materials in constructing the building. In this method, the engineers use a mixture of builder's mix which then blended with cement and water. This mixture is freed from oil and acids. The cement in the manufacturing g site is made of lime and gypsum which is readily available in most parts of China, Thailand and other parts of South East Asia. This insitu concrete is stronger and durable, stable, and easy to maintain. This is mostly used in constructions where accessing the construction site is difficult. Since most of the tall buildings require meeting certain condition in order to comply with wind and other environmental constraints such as gravity, the materials require being shaped inn certain shapes. In-situ concrete can be shaped in various ways to accommodate desired shapes. However, the use of in situ construction method is not possible in countries that have changing weather conditions (Bennett, 2002, p. 318).

4.2 Precast Constructions

This is a construction method in which the concrete is manufactured away from the construction site. With the growing technology and the need to reduce cost of construction as well as construct more strong buildings, the use of modern construction methods such as precast is becoming common. In this method of construction, the precast concrete is done by moulding the concrete in a different place in a reusable form and then lifted to the construction sites where it is placed in the desired manner. Tall buildings take a long time to complete hence the need to establish a construction method which is quicker and cost effective (Taranath, 2011, p. 189). The precast construction method offers the engineers with

a quicker reaction time, there is a reduced need for a plant in the construction site, good management of the construction site, and can be beneficial especially for tall complex buildings. This method is preferred compared to the in situ constructions since it produces more durable construction materials and can be used for quicker projects with more complex designs. This method offers a lot of advantages include the use of fewer resources on the site of constructions hence cannot be affected by weather conditions. Additionally, the quality of the material is sophisticated since the materials are manufactured at optimized conditions in the manufacturing firms away from the construction sites (Lin, 2009, p. 284).

4.3 Structural Steel Constructions

In south East Asia countries including china, steel structure construction has been used for many decades. Examples of the mega structure that used steel structure construction methods include the Shanghai bank corporations well as the old bank of china building in Hong king china. In the recent years, buildings that have used the steel construction methods include the park lane hotel, convention and exhibition centre and Manulife tower in china. Most of the old structure used steel with broad bases (Lin, 2009, p. 295). However, with the increased demand for high rise structure, the steel structure construction method has been modified in order to suit the tall buildings. The tall buildings using steel structure are built in order to sustain typhoon and high winds. In tall buildings, the steel used is highly tensile, withy improved connection and fireproofing materials. The use of steel structure construction is preferred compared to all other methods because of the following benefits (Taranath, 2011, p. 45).

- a) Structural performance: The materials made of steel are able to withstand high compression, has a high yield of stress which is able to take any form of tension. This is better as compared to insitu concrete or precast concrete constructions. Tall buildings require the use of light materials in order to reduce the weight of the building during construction. This is to minimize the risk of collapse. Steel is a light material which is stronger. This makes it possible for the engineers to use less building materials. This also reduces the size of the foundations and the size of the column while achieving a large span. Moreover, the fabrication of the steel is done in the factory hence producing high quality building materials. In case of amendments or expansion of the structure is required, the steel materials offer an easy member connection which makes it faster and reliable.
- b) Construction: The construction speed in steel structure construction is faster. This is because most of the materials made of steel are fabricated away from the construction site. This gives room for other construction works to continue. This means that foundation and erection of the building are faster when using steel structure construction as compared to in situ construction method.
- c) Maintenance: the cost of maintaining steel structure is less and affordable.

However, the use of steel structure has certain limitations. Since the materials are fabricated away from the construction site, there is an increase in labour and transportation costs. In case of fire, the strength of steel is weakened hence may lead to collapse of the building. Moreover, deflection may occur especially when the steel is exposed to varying weights at very extremely high temperature. In addition, the demand for fire and safety securities require the steel to be protected from fire since it loses its strength when exposed to fire. This makes

it less common in building of the tall structure especially when there are no enough resources and funds. This means that the performance of steel in tall buildings requires reinforcement with concrete materials in order to make it useable and comply with health and safety regulations as well as fire safety regulations (Takumi et al., 2009).

5.0 Basement Methods Construction

The basement is the most important structure of the tall buildings. It is constructed using steel structure methods which are combined with concrete in order to make it more firms. A steel structure is erected in the form of a pile to make steel columns. These steel columns are used to support the basement slab which is made of concrete in a top down construction sequence. The first slab of the basement is usually cast after the core wall in order to allow the structural frame and core walls to proceed upwards. Therefore, the construction of the tall building basement involves the excavation of the site, building the concrete, construction of the raft foundation, reinforcing the foundation with steel structures, and covering the structure with a concrete floor. Therefore, the construction methods are top downs and open cut construction methods (Lin, 2009, p. 145).

6.0 Foundation Construction Methods

The foundation of tall buildings determines the stability of the building. There are different types of foundation which include pile foundations, raft foundation and pad foundations which are used in tall buildings. The selection of the type foundation depends on the nature of the soil. Hence, a strong building material is required in order to ensure stability of the high rise structure. The foundation construction methods include in situ constructions, which are used to assess the engineering appropriateness of the strata. The in situ method is preferred since the construction of the building is in its initial stages hence there is not much work at the construction site (Lin, 2009, p. 61).

7.0 Standards and Regulations

Despite the various benefits associated with the construction of tall buildings in Southeast Asia there are various standards and regulations that have been set out. The main reason for these is preventing the construction of poor structure and designed buildings. This is because with such buildings it then becomes exceedingly likely to experience catastrophes. Therefore, these standards and regulations are there to benefit the people around the buildings. One and probably one of the main standard and regulation concern the fire safety of tall buildings. Most South East Asian countries have made it a priority that tall buildings should have an elaborate fire system. This is meant to prevent excessive fatalities as it would be extremely difficult to carry out rescue operation on the top most floors. Therefore, each building should have a fire system that can be used to extinguish the fire on their top most floors. In addition to these, such buildings should be constructed in a manner which does not encourage the spread of fire such as use of fire resisting walls (Chow 2011, p. 58). Additionally, materials used for the construction of such buildings should be of high quality. This ensures that buildings are strong and stable to accommodate the pressure and weight of the building upon

completion. Design of the buildings also plays a large role in ensuring stability of the building. This has led to most of the South East Asia countries to regulate the designs by approving or disapproving them. This is as a result of the seismic activities experienced in most parts of South East Asia. Therefore, tall buildings in such areas should be able to withstand seismic activities such as earthquakes as is evident with the Taipei Tower (Shafii et al 2006 c30-c44)

The construction of tall buildings involves the consideration of many complex factors which include economic, technological, government or municipal regulations and political stability of the country. The most influential factors in the construction of tall buildings include economics and technology. The construction of tall building requires the development of a construction process which acts as the guideline for the completion of the project. This also involves the legal formalities which are involved in the constructions of high rise structure. The advancement in construction methods such as in situ concrete and precast as well as steel structure methods have made it possible to build tall buildings within a short period of time. Therefore, in constructing tall buildings, engineers in south East Asia utilize a variety of construction methods and materials which were discussed in the report. The other notable aspect is the contribution made by such buildings in relation to climate and the environment. Also, all of this will not have been possible if were not for the standards and regulations that have been set out. These standards ensure not only the safety of those using such buildings but also the public at large.

8.0 Discussion

The construction of tall buildings in South East Asia has incorporated the use of various construction methods. Most of these high rise mega structures are built in order to withstand environmental impacts such as strong wind currents and gravity. There are various construction methods which are used in building tall buildings. The nature of the materials used in the construction of tall buildings determines the type of concrete construction methods (Taranath, 2011, p. 129). The most commonly used construction methods in South East Asia especially in Japan includes in situ construction methods, precast concrete construction methods and steel structure construction methods. The use of in situ method is best when the project manager wants to reduce the construction costs and ensure quicker erection. However, this method is not preferred especially when the structure is several hundreds of meters high. The in situ is best for foundations. The use of steel is the most preferred method due to its strengths and ability to resist fire. However, when exposed to high temperatures, steel loses its tensile strengths and may collapse. Therefore, steel reinforces with concrete in order to abide by fire regulations. In the construction of tall buildings, the construction process involves a variety of steps (Lin, 2009, p. 296). The best steps involved in the construction of tall building include the setup of the project management committee which is headed by a project manager. The project manager chairs the programming team which is responsible for developing the requirements of the construction. The next step is choosing a design professional firm which design the schematic design and develop the construction design, upon approval of the development design, the supervisor of the project seeks the necessary construction permit from the relevant authority which allows the construction firm to start the construction of the building.

The construction process in South East Asia countries is more or less similar to that of Australia. Most of the Australian tall buildings are constructed using steel and concrete materials. In the construction of foundations, the engineers in Australia use concrete and steel reinforcements. However, the engineers in Australia also use wooden materials in building tall houses. The woods are used in making the panels of the high rise buildings (Harris, 2012).

9.0 Conclusion

The construction of tall buildings involves the consideration of many complex factors which include economic, technological, government or municipal regulations and political stability of the country. The most influential factors in the construction of tall buildings include economics and technology. The construction of tall building g requires the development of a construction process which acts as the guideline for the completion of the project. This also involves the legal formalities which are involved in the constructions of high rise structure. The advancement in construction methods such as in situ concrete and precast as well as steel structure methods have made it possible to build tall buildings within a short period of time. Therefore, in constructing tall buildings, engineers in south East Asia utilize a variety of construction methods and materials which were discussed in the report.

10.0 References

- Anatomy of a Construction Project (n.d). The Design and Construction Process. (Online). Available at :< http://www.cod.edu/facilities_plan/DESIGN1.pdf> accessed on 13-05-2013
- Ali, M., & Al-Kodmany, K., 2012. Tall Buildings and Urban Habitat of the 21st Century: A Global Perspective. *Buildings*, 2: pp. 384-423.
- Ali, M., & Moon, K., 2007. Structural Developments in Tall Buildings: Current Trends and Future Prospects. *Architectural Science Review*, 50 (3): pp. 205-223.
- Bennett, D., 2002. *Innovations in Concrete*. Hong Kong: Thomas Telford.
- Cuthbert, A., 2006. *The Form of Cities: Political Economy and Urban Design*. Malden: Blackwell Publishing.
- Ghafoori, N., 2011. *Challenges, Opportunities and Solutions in Structural Engineering and Construction*. Boca Raton: CRC Press
- Harris, M., 2012. Wooden high-rise buildings. (Online). Available at: < <http://eandt.theiet.org/magazine/2012/09/wood-goes-high-rise.cfm>> Accessed on 13-05-2013.
- Lin, M., 2009. *Construction Technology for Tall Buildings*. New Jersey: World Scientific
- Short, M., 2012. *Planning for Tall Buildings SHORT*. London: Routledge
- Takumi, I., Seiji, F., & Akio, O., 2009. Overview and Application of Steel Materials for High-Rise Buildings. *JFE Technical Report*.
- Taranath, B., 2011. *Structural Analysis and Design of Tall Buildings: Steel and Composite Construction*. Boca Raton: Tailor & Francis

9.0 Appendices