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Study on Comparison of Precast and Cast In-Situ Construction of the Structure based on Social Category

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Abstract –*Performance criteria in this cluster concern health and community such as workers' health and safety, health of occupants, labour availability, traffic congestion, and community disturbance. Therefore, this factor is named "impact on health and community". It is essential that a selected construction method has minimal negative impact on workers, potential occupants, and surroundings. As stated earlier, prefabrication can improve workers' health and safety due to cleaner and safer working environments. It also contributes to the health of future occupants during the building use phase. Prefabricated elements are completed in a factory-controlled setting using dry materials, and the low levels of moisture in new buildings correlate to lower risks of chronic health issues of occupants. But for the new on-site buildings, the potential of high levels of moisture trapped in the site-built elements leads to many indoor air quality issues. Social category-*

1. Environmental impact.
2. Safety and security)

Key Words: Prefab, cast in-situ construction, Safety and security…

1.INTRODUCTION

Prefabrication plays an important role in the modern world construction of every building today, it refers to the making of parts in an offsite workshop or factory prior to the installation at the site. "The primary purpose of prefabrication is to produce building components in an efficient work environment with accesses to specialized skills and equipment in order to reduce overall cost and time expenditures on the site while enhancing quality and consistency". Most new construction will have to use more and more prefabrication. From primary structures to small architectural ornaments, prefabrication has become a major part of building construction.

Although prefabrication is a common method of construction in the U.S. and in many European countries, several countries in Asia are still not familiar with this method. Because those Asian countries have different social and economic systems from the U.S., they tend to use more actual manpower for constructions rather than prefabrication methods. Construction methods that require a lot of physical labour such as masonry, hand paint or cast-in-place concrete are common in India. Because India is an agricultural society, the labour wage for agricultural work in India is much lower than the labour wage for industrial work in the United States. Furthermore, unlike the United States, a lot of countries in Asia including India may have fewer concerns in many important aspects of building construction, such as preciseness, on-site safety, energy saving and waste management during a construction. All these issues can be resolved by prefabrication methods.

1.1 NEED OF STUDY

Performance criteria in this cluster concern health and community such as workers' health and safety, health of occupants, labour availability, traffic congestion, and community disturbance. Therefore, this factor is named "impact on health and community". It is essential that a selected construction method has minimal negative impact on workers, potential occupants, and surroundings. As stated earlier, prefabrication can improve workers' health and safety due to cleaner and safer working environments. It also contributes to the health of future occupants during the building use phase. Prefabricated elements are completed in a factory-controlled setting using dry materials, and the low levels of moisture in new buildings correlate to lower risks of chronic health issues of occupants. But for the new on-site buildings, the potential of high levels of moisture trapped in the site-built elements leads to many indoor air quality issues.

A building using substantial prefabrication contributes to reductions of on-site construction activities and construction duration, thus definitely reducing the nuisance factor such as construction noise, dust, light pollution and other pollutants faced by the nearby community. The construction method is particularly beneficial in urban areas where minimal traffic disruption is critical. Precast concrete units are normally large components, so it takes only a limited number of trips to the construction site through the congested city traffic, creating less disruption overall. However, for an on-site construction, intense cast-in-place activities result in untidiness, dust, noise, and air pollution.

2 SOCIAL CATEGORY-

2.1 ENVIRONMENTAL IMPACT-

The final factor is related to environmental effects, from site disruption, material and energy consumption to waste, pollution, and recyclability. With the increased awareness of greenhouse gases, global warming and scarcity of natural resources, environmental impact has become an important performance improvement agenda in construction.

Prefabrication has many environmental benefits during construction as well as the life cycle phase of buildings. Waste reduction was thought to be one of the most significant environmental benefits when adopting prefabrication in many previous studies. Most of the work is conducted at the manufacturing plant, where tight control of quantities of constituent materials is achieved and waste materials are more readily reused/recycled, resulting in effective waste reduction. Tam et al. revealed that the use of prefabrication reduces waste arising from plastering, timber formwork and concrete works by about 100%, 74%–87% and 51%–60%, respectively. Although the magnitude of waste reduction depends on the level of prefabrication, waste levels have an average reduction of 65% and up to 70% when compared with on-site construction method

Although precast concrete manufacturers use the same basic components as onsite, the manufacturing methods allow the production of the precast elements to happen at a safe height and under optimal conditions. Therefore, precast concrete methods represent a substantial advantage in terms of the following items required for the equivalent construction site work:

- Elimination of needs for supports / scaffolding
- Elimination of temporary structures
- Reduced health and safety risks
- Reduction in lorry traffic and traffic management
- Easier management of steel procurement
- Elimination for long and continuous pouring operations
- Significant reduction/elimination of temporary shuttering
- Controlled curing of concrete
- Improved quality controls performed at the factory
- Process not subjected to weather conditions

Precast concrete solutions can help the construction industry to reduce the waste generated on site by up to 50% compared to more traditionally managed construction sites. Used for over 150years, precast concrete has gained an impressive market share that, in terms of annual turnover, equals the sum of the cement and ready-mix markets.

2.2 SAFETY AND SECURITY

2.2.1 Fire Resistance- Precast concrete provides non-combustible construction that can help contain a fire within minimal boundaries. As a separation wall, precast concrete helps to prevent a fire from spreading throughout a building or jumping between structures. During wildfires, precast concrete walls help provide protection to human life and the occupant's possessions. As an exterior wall, concrete that endures a fire can often be reused when the building is retrofitted.

Figure 1 precast concrete fire resistance

2.2.2 Earthquake Resistance- Precast concrete can be designed to resist seismic events, and recent advancements in connection approaches provide additional design options. Earthquakes in Guam, the United States (Richter scale 8.1); Manila, the Philippines (Richter scale 7.2); and Kobe, Japan (Richter scale 6.9), have subjected precast concrete buildings, using both architectural cladding and structural components, to some of nature's deadliest forces. During the 1994 Northridge, Calif., earthquake (Richter scale 6.8), in which damage was estimated at $20 billion, most engineered structures within the affected region performed well, including structures with precast concrete components.

In particular, significant damage was not observed in precast concrete cladding due to either inadequacies of those components or inadequacies of their connections to the building's structural systems, nor was damage observed in the precast concrete components used for the first floor or first-floor support of residential housing.

Figure 2 Earthquake test

Earthquakes generate horizontal and vertical ground movement. When the seismic waves pass beneath a structure, the foundation tends to move with the ground, while the superstructure remains in position. The lag between foundation and superstructure movement causes distortions and develops forces in the structure. As the ground moves, distortions and forces are produced throughout the height of the structure, varying with the ground acceleration and the resonance of the building.

2.2.3 Wind Resistance-

In most areas of the United States using IBC 2003, the earthquake loading will be more critical than wind. But wind loads should be checked, and more emphasis today is being put on designing structures to withstand tornado and hurricane impacts, certainly in coastal areas where they are being addressed through supplemental codes and other local precast concrete structural systems and architectural panels provide significant benefits in meeting wind-resistance needs. A calculation for determining proper wind loads for precast concrete structures can be found in MNL-120-04: PCI Design Handbook, Sixth Edition.

2.2.4Tornados- Single-family homes provide the greatest danger of destruction during a tornado. In regions of the country where tornados can wreak havoc on single-family homes, precast concrete designs can provide a durable, wind-resistant structure. Several key elements are desired in designing a home to resist tornado damage. These include:

- Connections that securely tie the house together from roof to foundation, providing protection for winds up to 130 mph.
- Impact-resistant roof materials that better withstand high winds and fire.
- Windows and doors with higher wind- and water-design pressure ratings and a garage door capable of withstanding impact from large objects.
- Construction materials and siting work that eliminate the threat of flood or wildfire.

Precast concrete homes provide significantly more protection from wind-borne debris than other building materials, according to tests conducted by the Portland Cement Association. The group tested various walls with the impact of a 2x4 wood stud traveling at 100 mph, the equivalent of wind-borne debris during a tornado with 250-mph winds. About 90% of tornados have wind speeds of less 150 mph, the group says. Of all materials tested, only the concrete design stopped the debris from penetrating the wall.

Figure 3 testing of wall against tornado

Test three smashed a 2 x 4 through a brick home with steel framing. This damage is still rather significant, but in this test the projectile did not travel through the wall. Looking at the back side shows it would take only slightly more force to push all the way through. Now for the real test: hurl a 2 x 4 at a precast wall panel at 112 mph. The result: no damage visible, not even a chip.

Figure 5 shows damage of wall against tornado

3. CONCLUSIONS

We have study and analyzed the both methods cast in-situ construction and precast construction. Precast concrete solutions can help the construction industry to reduce the waste generated on site by up to 50% compared to more traditionally managed construction sites. Used for over 150years, precast concrete has gained an impressive market share that, in terms of annual turnover, equals the sum of the cement and ready-mix markets.

The final factor is related to environmental effects, from site disruption, material and energy consumption to waste, pollution, and recyclability. With the increased awareness of greenhouse gases, global warming and scarcity of natural

resources, environmental impact has become an important performance improvement agenda in construction.

More significant advantages, such as improved quality control, reduction of construction time, construction waste, dust and noise on-site, and less labour requirement on-site

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BIOGRAPHIES

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