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Concrewall - A Structural infill Substitute

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ABSTRACT

Prefabrication has been widely regarded as a sustainable construction method in terms of its impact on environmental protection. One important aspect of this perspective is the influence of prefabrication on construction waste reduction and the subsequent waste handling activities, including waste sorting, reuse, recycle, and disposal. Nevertheless, it would appear that existing research with regard to this topic has failed to take into account its innate dynamic character of the process of construction waste minimization; integrating all essential waste handling activities has never been achieved thus far. This Topic proposes a dynamic model for quantitatively evaluating the possible impacts arising from the application of prefabrication technology on construction waste reduction and the subsequent waste handling activities. The object of this project is to identify new technologies or methodologies in the Construction Industry that could require new training or up-skilling of the trades and semi-skilled workforce.

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I. INTRODUCTION

Prefabrication has brought a substantial change in the development of construction industry worldwide over the last few decades. It ensures the strength, economy and environmental performance of the structures and hence is preferred over the onsite construction. Pre-assembly, prefabrication, modularization, system buildings and industrialized buildings are the various terms used to describe the processes of manufacturing of modular units on-site or off-site. Prefabrication usage large panel technology was initially developed in the mid 1960s. This is quick construction of huge numbers of building units at a minimal cost. It is referred as off-site construction and fabricating of some or all elements of structure in industrial units, and transporting and assembling them to the construction site where the building is to be made. It is learnt that this construction technique exists from prehistoric times and has not been evolved recently. "The Stonehenge" is a prominent example as it was also completed in different stages.

Prefabrication is the Practice of assembling components of a structure in a factory or other Manufacturing site and transporting complete assemblies to the construction site where the structure is to be located. The role of prefabrication in architecture has been lauded for its potential to increase productivity and efficiency while not sacrificing quality. The values of better, faster and cheaper are applicable to developed countries such as the U.S., Japan, and Europe, whose middle class continues to demand this equation in buildings that range from the remarkable to the prosaic. Developing countries, including China, India, Africa and many parts of South America, that are beginning to rely on prefabrication have the potential advantages of realizing housing quickly and affordably; however, greater reliance on manufactured production has possibly more disadvantages than advantages for these cultures. With prefabrication, improved working conditions would seem to be agreeable to everyone: instead of building in the weather, international fabricators supply controlled environments with ergonomically considered equipment and yet in many fabrication environments, reliance on minimal skills, and a disconnect with the community in which workers live, leaves little room for continued fostering of personal and collaborative skills, culture, tradition and community building.

II. CONCREWALL PANEL SYSTEM

Description of System

Name of the System– Concrewall System

Brand Name – Concrewall

Brief Description

The Concrewall System is an industrial system for the construction of structural walls of reinforced concrete for building in single panel up to G+3.

The system is composed of a factory produced panel of undulated (wave shape) polystyrene covered on both sides by an electro-welded zinc coated square mesh of galvanized steel and linked by 40 connectors per sq m made of high-elastic-limit 3mm dia wires realizing a 3 dimensional hyper-static reinforced steel.

The panels are assembled on site and in-situ concrete (double panels, floors, stairs) and concreted concrete poured (single panel) to realize the following different elements of the system: Vertical structural walls Horizontal structural elements Cladding element, internal walls.

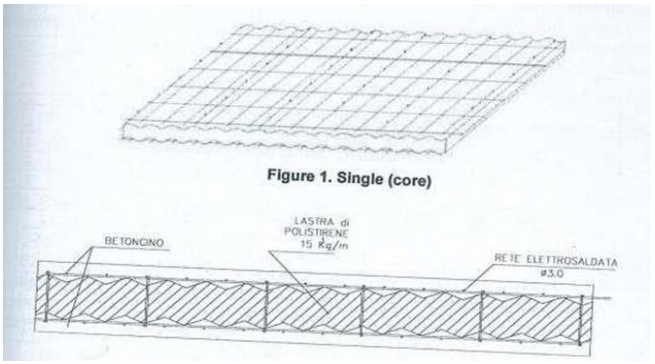


Figure 1. Single (core)

III. DESIGN CONSIDERATION

The Concrewall panels may be designed using the appropriate design software. The buildings constructed with these panels shall be studied and designed reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. In the calculation model, the building shall be designed as a structure composed of load bearing walls with a box- like structure.

The system is intended for use where Architectural drawings are available and satisfy the various requirements. The Architect and Engineer designer team of the concerned developer (client) is responsible for the drawings and overall building design to comply with the various regulatory requirements applicable to the area.

The design engineer shall liase with the engineer of the developer and provide the necessary loading information for the design of the foundation.

The system shall be designed to provide the required performance against the loads to be taken into account in accordance with IS 875 (Parts 1-5):1987 and the data given by manufacturer for various panels. It shall also provide the required bearing resistance for earthquake and wind forces as per IS 875 (Part 3):1987 and IS 1893 (Part 1):2002, wherever applicable.

Foundation shall be specifically designed in accordance with provision given in IS 1904:1986. Both single and double panels should have starter bars from either foundation or ground floor slab. Experienced engineer with appropriate reference should design all foundations.

The design assumptions, detailed calculations, references to necessary and detailed design drawings shall be made available on demand, if required. The structural design calculations should clearly demonstrate structural integrity and stability including connection details.

In addition, any other requirement regarding safety against earthquake need to be ensured by the designer as per prevailing codal requirements.

Structure

The Concrewall System receives its outer plane strength by its own geometrical configuration.

Every longitudinal wire is in correspondence of the wave, so once the plaster is applied, the

wire is well covered and the panel acts as a series of micro-column.

Wind Uplift

The design of roof to wall connections shall be to a specific design to ensure that the roof structure is properly restrained against uplift.

In-fill Wall

When used as in-fill wall in framed RCC structure, the structure shall be designed in accordance with IS 456:2000. The fixing of the panels shall be done in accordance with the details provided by the manufacturer.

IV. CASE STUDY

Introduction to Schnell houses in Jindal Steel power plant

Jindal Steel and Power Limited (JSPL) is one of India's primary & integrated steel producers with a significant presence in sector like Mining, Power Generation and Infrastructure. National wide it had two branches in Odisha and Chhattisgarh. During the site visit to Angul, Odisha the following information is collected:

Schnell is a manufacturer of machinery for the production of innovative building elements

Schnell machinery manufacturing EPS panels was installed within JSPL Company, Angul. Polystyrene balls get imported from New Delhi for making EPS sheets.

- JSPL Township consists of G+3 storey residential houses with Single panel structures constructed for employees working with in industry shown in figure.
- There are other structures made of Schnell EPS panels integrated other building systems :
- RCC + EPS Partition Wall Buildings
- EPS Wall Panel Buildings
- Combination of Hot Rolled

RCC Moment frame wall panel building d) Hot rolled steel and with panel erection

Figure Schnell EPS panel buildings integrated with other construction systems, JSPL, Angul.

V. CONCLUSION

Cost: On comparison from Table 1and 2, the material cost when using the expanded polystyrene panels (Rs.4,

32,088.00)is about 16% less than cost of the same when using the conventional method of construction using RCC frame with brick infill (Rs.5,83,859.00) for a single–storey residential dwelling. An overall reduction of about 35.7% in the total cost of materials, labor and equipment using cast in-situ concrete panels with EPS core and shear connectors was estimated for the project.

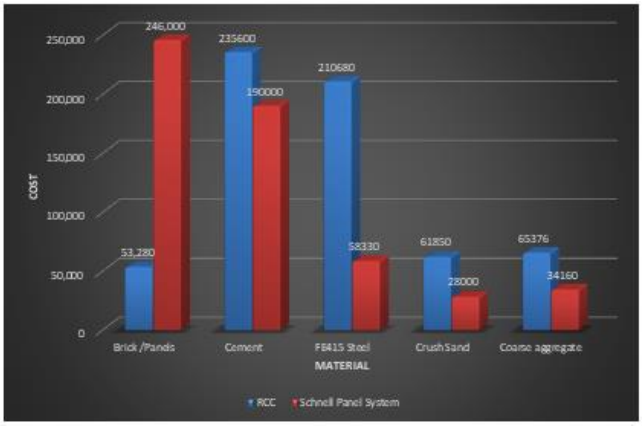
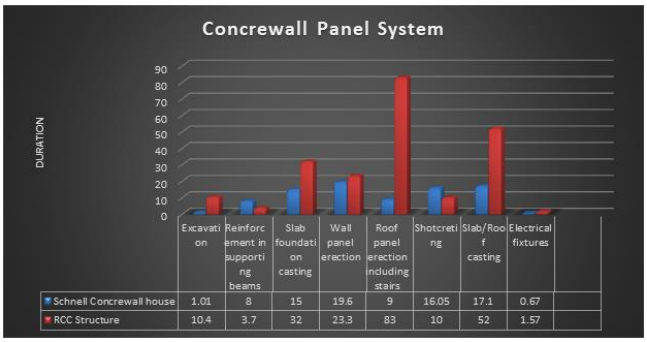


Figure. Material cost comparison bar chart between Schnell and RCC Building

Duration: The time taken by each activity in Schnell Concrewall construction technology is much less than RCC which has been analyzed through simulation using EZ-Strobe.

	Schnell Concrewall house		RCC Structure	
S.No	Activity	Duration(hours)	Activity	Duration(Hours)
A1	Excavation	1.01	Excavation	10.4
A2	Reinforcement in supporting beams	8	Reinforcement up toplinth level	3.7
A3	Slab foundation casting	15	Concrete casting up to plinth level	32
A4	Wall panel erection	19.6	Plinth beam	23.3
A5	Roof panelerection including stairs	9	column raising to Slab reinforcement	83
A6	Shotcreting	16.05	Slab casting	10
A7	Slab/Roof casting	17.1	Brick wall	52
A8	Electrical fixtures	0.67	Electrical fixtures	1.57



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