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A PAPER ON DESIGN OF FORMWORK

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ABSTRACT

Construction is one of the important parts of Indian budget and is an essential part of the development. Today India's urban population is the second major in the world and its upcoming development leads to increased demand for housing to cope with this problem India should very much need to plan for acquisition of land and rapid creation of dwelling units. Construction is a complex process involving basically the areas of Architectural planning, Engineering & Construction.

Formwork is an open container, like open box into which concrete is poured and compacted. When the concrete is set, then the formwork is removed and a solid mass is produced in shape of inner part of formwork. Formwork systems are among the key factors determining the success of a construction project in terms of quality, quantity, labor, time and cost. The purpose of this paper is to identify the various factors that influence formwork efficiency.

Formwork is one of the extreme significant factors in determining the achievement of a construction project in terms of speed, quality cost and security of work as it accounts about 35% of the total project cost of the structure. To minimize the costs the contractor needs to complete the project as soon as possible and the consumer wants the building to use the building as early as possible for the intended purpose. In high rise building construction the most effective way to speed up the work is by achieving a very tiny floor cycle. That directly depends on the selected form work type for the construction. With the advancement of the science man used plywood in its place of timber planks and pipe supports with various kinds of jacks instead of timber supports. Then the man invented small units of formworks when the same structure is restating such as slab forms, flying forms for the walls etc. lastly the utmost invention came for the complete system. At the beginning the system was made out of steel and which was very heavy. Then the man paid his care towards reducing the weight of the formwork system.

Now the materials for formwork have extended to aluminum, plastic, fiber glass etc. The interaction of structure and compressible shoring, rime-dependent concrete properties of strength, creep and shrinkage of concrete and the change in construction load during construction cycles are considered in the shoring system analysis. For wall formwork analysis, the time- dependent concrete properties of strength and the properties of wall-element parts are considered.

Keywords*: Formwork, design*..

I. INTRODUCTION

The progress made by the construction industry of any country could be considered as the index of progress of that country. Further, the number of pucca houses built in any country could be another index. While there has been a progressive rise in stock of housing in India since independence, the speed there of has not kept pace with the rapid growth of population and urbanization. As a result, the shortage of accommodation is increasing constantly and the situation has become acute in urban areas.

In construction industry, the freshly cast-in-place concrete elements like slabs, walls, etc. are usually supported temporary by a system of formwork until the imposed loads can be carried by the concrete structure itself. Formwork is an expensive component in most concrete structures. Its cost generality ranges from 40% to 70% of the cost of the concrete structure. Savings depend on the originality and knowledge of all those involved in design and construction of concrete structures. Good assumption in the selection of materials and equipment, in planning fabrication and manufacture procedures, and in scheduling reuse of forms, can accelerate the job and cut costs.

Service loads may be smaller than construction loads, imposed by the shoring system for which the slabs were designed, even if they were at full design strength. Removal of shore may also be conducted before the slab attained their required strength. "For undertaking mass housing works, it is necessary to have innovative technologies which

are able of fast construction rate, also which are able to carry good quality and durable structure in cost effective method." Therefore, rigorous analysis, based on the performance and conduct of the early age concrete, must be performed during the design and construction stages of concrete structures. Over or under estimating the maximum lateral burdens of fresh concrete in contradiction of the vertical forms may not help to achieve the main objectives in design formwork, such as: safety, economy and quality,. The degree of accuracy of finding the magnitude and the nature of loads and pressures, by studying al1 factors is the only way to achieve safe and economical vertical formwork.

II. LITERATURE REVIEW

Dr. M.N. BAJAD, "Comparative Study of formwork in Building Construction" - When the concrete is set, the formwork is removed and a solid mass is produced in the shape of the inner face of the formwork. Formwork systems are among the key factors determining the success of a construction project in terms of quality, quantity,

labor, time and cost. The purpose of this paper is to identify the various factors that influence formwork output. When considering a construction project the contractor wants to finish the work rapidly with greater profit and the client wants to use the building as soon as possible.

Miss. Patil Dhanashri Suryakant, "Emerging Trends in Formwork - Cost Analysis & Effectiveness of Mivan Formwork over the Conventional Formwork", -Construction is one of the significant sectors of Indian economy

and is an basic part of the development. Today India's urban population is the second largest in the world and its future development leads to increased demand for housing to cope with this problem India should desperately need to plan for acquisition of land and rapid creation of dwelling units. Construction is a complex process involving ultimately the areas of Architectural planning, Engineering & Construction. There is growing insight today that speed of construction needs to be given greater significance especially for large housing projects. This is not only essential for the faster income of equipment and investment – leading possible to the reduction in the housing cost but also for achieving the national objective of creating a large stock to overcome shortest possible time. Fortunately, some of the advanced technologies providing to faster speed of construction are already available in the country. For e.g. Prefabrication, autoclaved blocks, tunnel formwork, aluminum formwork (Mivan Technology) of construction etc. This paper describes the comparative analysis of conventional formwork and tailor made formwork on the basis of cost and time parameter.

Basher Aiami, "Analysis of Construction Loads on Concrete Formwork"- This study presents analytical procedures for determining the loads on the shoring system and supporting slabs during the construction of multistory concrete buildings and for determining the lateral pressures imposed by fresh concrete against the wall forms. The interaction of structure and compressible shoring, rime-dependent concrete properties of strength, creep and shrinkage of concrete and the change in construction load during construction cycles are considered in the shoring system analysis. For wall formwork analysis, the time- dependent concrete properties of strength and the properties of wall-element parts are considered.

III. FORMWORK MATERIALS

Formwork materials can be classified as:

1. Timber
2. Metals
3. Plastics

1. Timber

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A. ***Lumber:*** Lumber is commonly available substantial and has brilliant strength, weight and cost factor. Lumber is classified as:

- Sheets: 1 to 1.5 inches thick, 2 or more inches width
- Sizes: 2 to 4 inch thick, any width.
- Planks: 5 or more inches thickness, 5 or more inches width

Fig no.1 Timber Formwork

B. ***Plywood:*** The use of plywood in concrete forming for form in front of has improved the quality of finished concrete. The relatively large sheets of plywood have cheap the cost of building and at the same time have provided smooth surfaces that reduces cost of finishing of concrete surfaces. Plywood is a manufactured wood product consisting a number of veneer sheets, or pile. Type of plywood can be grouped as exterior and interior. For formwork the exterior plywood is used. Bonding agent used to bond the piles in manufacturing of exterior plywood is watertight and gives maximum number of reuses.

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2. Metal Formwork

Fig no.2 Metal Formwork

The initial cost of metal formwork is more than timber formwork but the number of reuses of metal formwork is higher than that of timber. In long run metal formwork can be economical. In heavy construction works metal formwork may require a lifting mechanism to handle the formwork panels or props. Steel sheet formwork has the problem of rusting also. To avoid rusting, in every use the surfaces should be oiled with an appropriate releasing agent. Metal formwork usage, the metal sheets are prepared as panels of standard sizes. This brings the difficulties of erecting irregular dimensions of formwork. Steel or aluminum or magnesium is the most widely used metals.

3. Plastics

They have impermeable surfaces that usually create a smooth finish to the concrete. Plastic formwork could be reinforced or unreinforced. Plastic is reinforced by glass fibers. Reinforced plastics are specially produced for a specific formwork type. Un-reinforced plastics are produced in sheet form with smooth or textured surfaces. Plastic formwork is lighter but less durable than metal formwork.

Fig no.3 Plastic Formwork

IV. FORMWORK TYPES (BY SHAPE)

Considering shapes, formwork types can be classified as:

1. Column formwork
2. Beam formwork
3. Slab formwork
4. Wall formwork

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1. Column Formwork

Column formwork is made usually with either timber or metal panels. The principle is to create an enclosed box with frames at the exact size of the column and fix it tightly on the kicker left from base or at the last stage of column concreting. The box is held in position by steel column clamps or bolted yokes and supported by timber studs or props.

Fig no.4 Column Formwork

2. Beam Formwork

Beam formwork consists of open through section and because it is not closed at the top requires more supporting frame work to restrain the sides. The supports need to be maintained to the soffit and also provide lateral support to the sides. In timber this is done by the use of a head tree across the top of a vertical member. Metal panels are used with corner pieces, but timber head trees are needed for vertical support.

Fig no.5 Beam Formwork

3. Slab Formwork

Floors require a large area of formwork to be provided usually front beam to beam. Timber floor formwork consists of timber boards or plywood sheets supported on a framework and resting on a series of timber joists. Again timber and metal props can be used for vertical provisions. Metal panels can be used and bolted or clipped together and held in place by a system of metal beams or a tabular scaffold system. Adjustable props need for levelling purposes.

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Fig no.6 Slab Formwork

4. Wall Formwork

Wall formwork is a simpler than for other concrete units as the actual forces against it are less, most of the load being carried vertically downwards. The panels at both sides are held in position by ties. Ties are also used as spacer, arranging wall thickness. Wall support systems are usually sloping props at satisfactory intervals.

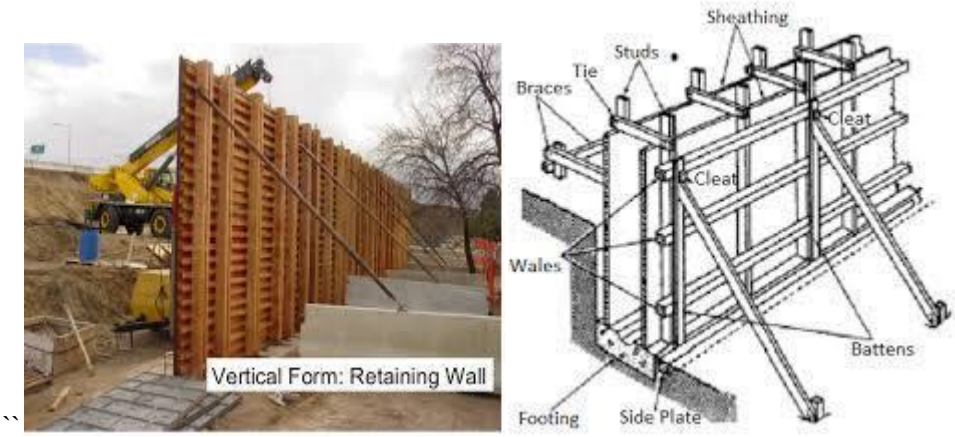

Fig no.7 Wall Formwork

V. FORMWORK STRIKING TIMES

The time to be allowed before formwork can be removed naturally depends on many factors, such as:

1. The type of concrete mix used (type of cement): Rapid hardening cement mix requires less time whereas high water cement ratio needs longer time for striking the formwork.

2.The type of structural member being cast*:* Soffit of beams and slabs or sides of beams or columns require different time.

3. Temperature: High temperature can cause rapid curing of concrete and formwork can be struck in shorter time than low true weather.

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Standards Formwork Striking Times Tables

Table no.1 Indian Standards Formwork Striking Times

Sr no.	Elements and supporting condition	Stripping time days
1.	Walls, columns, vertical sides of beams	1 to 2
2.	Slab with props left in position	3
3.	Beam soffits with props left in position	7
4.	Slab : removal of props a) Span up to 4.5m b) Span over 4.5m.	 7 14
5.	Beam and arches : a) Span up to 6m b) Span over 4.5.	 14 21

VI. CONCLUSION

We can conclude that the conventional methods of formwork system are economical for small scale projects. While the modern-day methods are economical for high growth mass constructions. The modern techniques save cost for construction work and period of construction work. The use of current construction techniques and equipment's on its entire project is maximize our goal. Aluminum formwork construction technique is cost actual for the mass construction tedious projects. It is rapid construction technique in which construction take place at high speed. Likewise it is offering high quality of construction and low maintenance at the minimum cost. The understanding of formwork behavior during the construction of concrete structures and the developing of useful computer-based models to determine the construction load distribution between shoring system and interconnected slabs of multistory concrete buildings, the lateral pressures exerted by fresh concrete on wall formwork.. Thus it can be decided that quality and speed must be given due consideration with regards to economy. The construction work should be of good quality as it will never deter to project speed. Also it will be economical.

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