

A Review Paper on Construction Site Layout Design & Planning Techniques

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Abstract--*The effectiveness in site layout and construction planning for large-scale and complicated construction projects not only affects productivity and cost, it also controls whether a project can be handled and completed in a efficient manner. In India site layout planning is mostly a neglected aspect. Most construction sites that run into trouble do so for reasons related to managerial factors rather than because of technical problems. The site-based management can make significant improvements in the cost and time savings during the construction process without involving a mass of additional work. Now-a-days due to site scarcity i.e. limited site space, high cost of purchasing, site selection and site space is considered as important as other resources. The review of literature for various aspects of site layout is presented in this paper.*

KeyWords: Site Layout, Site-Based Management, Construction Planning

I. INTRODUCTION

Site management, in general, involves many tasks, such as site investigation before construction process starts, material delivery and procurement management, keeping better site records, keeping good site communication and high level of information flow, monitoring performance regularly, establishing a well co-ordination system among different parts, and performing a good site layout planning. Among the important tasks of site management is the *site layout planning*. Extensive time loss and cost overruns could result in large projects, where the number of manpower, subcontractors, and equipment involved are high, if there is no effective and systematic approach to site planning. A detailed planning of the site layout and location of temporary facilities can enable the management to make considerable improvement by minimizing travel time, waiting time, and increasing worker morale by showing better and safer work environment. ^[16] (Dr. Emad Elbeltagi)

Construction site layout involves identifying, sizing, and placing temporary facilities within the boundaries of construction site. These temporary facilities range from simple laydown areas to warehouses, fabrication shops, maintenance shops, batch plant, and residence facilities. Required temporary facilities and their areas are depending in many factors including project type, scale, design, location, and organization of construction work. ^[16] (Dr. Emad Elbeltagi)

Site space is a resource that is as important as money, time, material, labor, and equipment. Site space is a limited where all facilities are required to be provided within the boundary of the site. Ideal site layout is one where the cost of the product is kept to minimum, with a large market share, the least risk and the maximum social gain. Generally utilization of site space is based on project managers experience and proper site planning is neglected. Good site layout, however, is important to promote safe and efficient operations, minimize travel time, decrease material handling, and avoid obstructing material and equipment movements (Tommelein et al. 1992b).

There are two general objectives which planners should seek to meet through careful organization of the site for construction. First, the site must be designed to maximize efficiency of operations in order to promote worker productivity, to shorten project time and to reduce cost. Second, the final plan must create a project with a good work environment in order to attract and retain the best personnel and thus contribute to better work quality and productivity. ^[16] (Dr. Emad Elbeltagi)

II. FACTORS AFFECTING SITE LAYOUT PLANNING

A. Nature of Project

Site layout largely depends upon nature & type of project to be done. Requirements of equipments, machinery & materials are different depending upon nature of project.

B. Topography of Site

Site should be selected such that essential requirements such as power, water, canteen facilities etc nearby the site.

C. Construction Methods

Construction methods can be either cast in situ concreting or using precast element. For precast constructions, provision of casting

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yard should be included. For cast in situ concreting, position of mixer, storage of raw material should be predefined to avoid the wastage of material, time, man.

D. Availability of Resources

Separate storage yards for the storage of cement, brick, steel, aggregate, sand etc shall be provided. Location of such storage yards shall be such that lead should be minimum. Materials which are required constant on site shall be placed near the site.

E. Access to Site

Ideally there should be one entrance & one exit from security point of view provided with watchmen's cabin. Proper sign board shall be provided to direct vehicles to delivered material at required place.

F. Internal Roads

Temporary roads shall be constructed within site. These roads shall be properly interconnected to various storage yards.

G. Accommodation

Separate provision for labour camp with adequate water supply & toilet facility. Site lay out included engg offices, toilets, canteen, and parking spaces.

H. Services

Site layout must considered services such as water supply, telephone lines, drainage line, power supply etc.

III. SITE LAYOUT PLANNING TECHNIQUES

Various studies have been done on the site layout planning. Site layout problem has been solved by researchers using different techniques like Genetic algorithm, Ant Colony Optimisation, Simulation techniques and Cad-based site layout planning for irregular facilities^{[13], [14]}

A. Genetic Algorithm

This technique is used to minimize travel time and cost of construction. There are two approaches to genetic algorithm Quantitative method and Qualitative method

B. Simulation Techniques

In simulation model time based factors such as total project time and resource idleness is taken into account during planning. This technique is suitable for site layout planning of projects where repetitive Activities take place and there is limitation on the number of resources.

C. Ant Colony Optimisation

Ant colony optimisation algorithms are higher level procedures for handling combinatorial optimisation objects. The central component of Ant Colony Optimisation is the pheromone model, which is used to probabilistically sample the work space.

D. Cad-Based Site Layout Planning

Cad-based site layout planning is used for unequal and irregular temporary facility using robust search and optimisation capabilities of Ant Colony Optimisation algorithm. The various construction resources such as men, machine, material & money have to be controlled & used in such way that maximum efficiency is obtained.

IV. SITE LAYOUT DESIGN

A site drawing of proposed construction showing the location of entry, exit, temporary services, storage & stacking of materials, location of equipment & site offices is known as site lay out or job lay out. A site lay out is prepared for the smooth exhibition of the project.^[2]

A. Drawings

1) *General Site Layout (Scale 1:500, 1:1000):* Contour of structure to be built.

Directions of access routes.

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Location of main equipments.(e.g. batching plant, tower crane)
Auxiliary workshops, plants, yards (e.g. wood-yard, steel-yard).
Location of stores.
Temporary building, offices.

2) *Detailed Site Layout Design (Scale 1:100, 1:500)*: Exact position of main equipments.
Auxiliary workshops, plants, yards (e.g. wood-yard, steel-yard).
Detailed design of temporary buildings, offices.
Detailed design of access routes.
Power supply equipments, devices and structures.
Design of transmission lines, light towers, spotlight.
Storm water drainage design.
Design of fresh water supply system (pipes, taps, valves)

B. Zoning at the Site

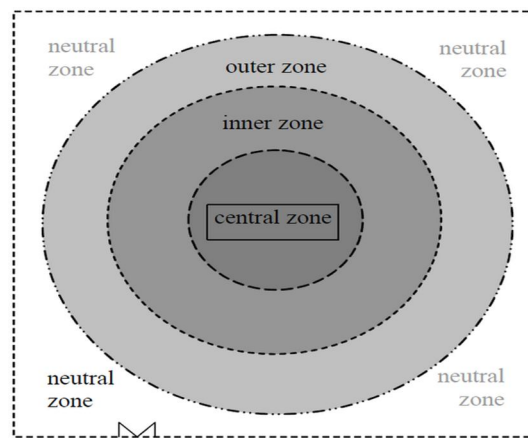


Fig no.1: Zoning At Site ^[2]

- 1) *Central Zone*: Primary area of works/performances, main equipments (tower crane, lift equipments) are located in central zone.
- 2) *Inner Zone*: Close to central zone. Includes loading/unloading areas, active stores and deposits (prefabricated blocks, masonry blocks etc.) main temporary access roads.
- 3) *Outer Zone*: Includes workshops, steel, wood yards, stores.
- 4) *Neutral Zone*: Inside the boundary fences of construction site. Includes site offices, batching plants, water tank, laboratories, parking spaces etc. ^[2]

VI. CONCLUSION

In India, construction site layout planning is very rarely implemented on various construction projects. Research and applications of site layout planning and design is needed. This paper serves only to highlight some of the related factors so that the complication or uncountable variables may be better solved.

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