

Construction planning of industrial building — A few important considerations

by
N. C. Bhagat* and
Ajay Singh**

Introduction :

An Industrial Building is much different from a residential or public building for various other activities and so its construction, planning and execution are also much different from other buildings. The construction of an industrial building needs high level of expertise in planning, construction, specifications and various other parameters which need consideration and should work out as most befitting to industry for which the building is to be constructed. It not only requires the input from civil engineering considerations but would also invite participation from mechanical, electrical, chemical and similar other disciplines. The civil engineer normally plans construction and installation activities in coordination with the members of other disciplines involved in the industry. Hence the planner should be skillful in winning the cooperation from other disciplines so as to avoid errors from the planning stage which may lead to delays or hinder progress of the plant at the construction stage. This would be in addition to the detailed scheduling and control on activities planned to achieve early completion and efficient working of the industry. This would require in-depth knowledge regarding the activities involved so as to have possible solutions to the difficulties which may crop up as hindrances in the progress of the work. A few important points which need in-depth considerations have been discussed in the following paragraphs.

Planning Construction Activities/ Some Pre-construction Planning Aspects

Specifications :

Proposed specifications will have an impact on the Cost, Life of structure, Time of construction, and Controls for quality and safety of the building. Specifications work as the backbone of any structure and thus need care in selection. The selection of specifications will depend on factors like, the environmental requirement of the industry, availability of materials, cost of materials, transportation involved, equipments to be installed with specific requirement of each equipment, etc.

Sometimes locally available materials are ignored and other materials from outside needing long-distance transportation are decided to be used. Such a decision should be avoided, if the local material could be treated to fulfill the needed requirements, because it may lead to delays on account of :

- Communication delays or misunderstanding the exact requirement.
- State policies if needed to be transported from outside the state.
- Availability of proper transport facilities.
- Vendor's monopolies.
- Confirmation delays regarding ready availability.

Any delay in supply is likely to hamper the progress leading to delay in completion and financial losses on account of investment which re-

mains unused for the period of delay. This could be avoided by appropriate selection of local materials. In case needed, advice from experts in the field of building industry or research organisation working on building materials could be obtained.

Construction procedure :

Before detailed planning is done to accomplish the end results, and network planning by use of CPM/PERT is resorted to for time saving, it is essential to know the actual procedure of construction which will be made use of, such as :

- Material handling procedure to be adopted.
- Laboratory facilities for tests and analysis of materials if to be created of own or to depend on other agencies.
- Layout of machines to be in conformity with the process line, and every machine structure may require separate treatment.
- Selection of construction agency.
- Creation of storage facilities, their capacity and distance from the place of use.
- Anticipated site problems to have in mind their solutions to avoid interruption.

Post-implementation Analysis or Feed-back :

For planning various activities or for making decision, the post-implementation analysis works as an important tool. But the experience and data of an earlier identical or similar work under identical conditions will be the best guide. The data

* Scientist, CBRI, Roorkee

** Technical Officer, CBRI, Roorkee.

should be in one of the following forms :

- Objectives of the project as initially planned and actually achieved with reasons for shortfall and deviations.
- The reasons of non-achievement and how it could be avoided/taken care of.
- Technical problems faced during the execution and their tackling with results achieved.
- Impact on account of time and cost deviation from the planned.
- Experiences of the organisation (internal) or managerial staff.

These are only a few points, and the information on such points will be very useful for planners in planning various activities based on the earlier experience.

Contingency Planning :

Time now can be measured or expressed in the form of money especially where delays or completion time is involved. There are certain uncertainties which are responsible for delay in completion time and in other form added to the cost of the project. If a considered thought is applied by the experienced construction manager he can apply his mind and guess the likely uncertainties which could crop up during the progress of the project and also plan the remedial measures in advance if any such contingency arises. The various parameters which require contingency planning are :

- Geotechnical structure at the site of construction may not be clear, needing changes in foundation design.
- Prediction of natural events like rain, occurrence and span of monsoon for which proper planning at the beginning will help uninterrupted progress at site.

- Licences of various items could be delayed, needing contingency planning.
- Strike by transporting agencies.
- Insufficient labour turning up during harvesting seasons.
- Fatal accident, fire or theft and like happening at site.
- Government decisions to close some or all quarries supplying raw materials in the neighbourhood.
- Dissatisfaction of manpower leading to labour strike etc.

Similar happenings cannot be ruled out and uncertainties can be avoided if some contingency plan is in mind to overcome such a situation without allowing any set-back to the progress of the project.

Clear Concept of Cost :

For an accurate estimate of time, costs, quantities and resources a clear concept of break-up of time and costs associated with each operation or item is very necessary. Costs for any activity or operation could be based on

- Hiring of equipment.
- Materials consumed including wastages.
- Labour of all types.
- Overtime of staff where needed.
- Lay-off costs if required.
- Undertime costs.
- Movement of materials from one site to another.
- Cost on account of space.
- Cost on account of insurance and risk prevention.
- Indirect cost of delays.
- Labour health costs.
- Changes required in view of operational conditions, etc.

If the above parameters have been considered while working out

production costs there is no reason for cost going above the estimates and competing in the market with success.

Network Programme :

It is a system to plan sequence of activities and arriving at the critical path for economy in time and thereby cost of every activity. It is very sensitive part of any project and needs very careful consideration. As different alternate paths need to be considered to optimise time, it needs an expert, well experienced and qualified person to carry out this exercise and take decision.

Work Award :

All the planning is of no use if the agency awarded the work for execution lacks experience, expertise, finances, machines, equipments and is devoid of skilled workers and trained supervisors. Contract or award may also be labour rate, covering few activities, or in full.

Sub-contracts could also be awarded by the main agency for various items such as

- (a) Labour rate for, earth work, brick laying, plastering, carpentry etc.
- (b) Specialised works like plumbing, electrical fitting, painting & finishing, glazing etc.
- (c) Architect may also recommend his nominee for specialised works of terrazzo, tile work, floor laying etc.

Though a sub contract proves quite helpful in achieving progress, it needs stricter supervision due to involvement of different agencies for different works. Clarity of language of awarded items of work is also important to avoid any sort of confusion and litigations on this account as the litigations always lead to delays. Conditions like safety, compensation and penalty should also form part of the award.

Execution Management :

The execution management apart from aggregate planning includes details like scheduling, supervision, equipment and materials arrangement, testing at site and laboratory, and decision making. The following points may be useful :

- Timely allocation of resources as scheduled.
- After completion of critical activities, next preference should go to jobs with minimum or least slackness.
- If needed priority of non critical jobs should be fixed according to funds/resources available.
- Dissatisfaction amongst labour and working agencies should be avoided by normalising relations.
- Maintain good vendor relations for timely receipt of supplies.
- Make available two sets of drawings, agreements, decisions, network CPM/PERT for use direct at site/site office.
- Immediate and without delay conveyance of management decisions to supervisory staff.
- Confirm verbal decisions at site through letter/written instructions.
- Monitoring should be continuous and thorough.
- Decision should be timely and skillful.
- Site visits of seniors should be advisory and problem solving.
- All administrative and technical difficulties should be provided appropriate solutions.

Safety at Site :

Generally the following points need consideration from safety angle.

- Design and Construction of temporary works.
- Site access and egress.
- Plant and equipment upkeep.
- Temporary power houses.
- Site and approach roads.
- Site services like temporary water/power lines.
- Lighting of site.
- Fire fighting, site security and first-aid etc.
- Appointment of security and safety officers.

The accidents generally occurring could be categorised as :

Falling Hazards :

On account of personnel, materials and tools etc.

Plant and Machinery :

Due to sudden failure on account of insufficient and improper maintenance.

Misc. or General :

Due to site condition, strains and twists, electrical apparatus, scalds & burns etc.

Fire/Chemical :

Due to chemical/general fire or gas release etc.

For prevention of accidents a sound up to date knowledge of regulations related to safety in addition to properly trained persons to look after safety are necessary.

Proper planning of placing the materials and moving operations is also desirable to minimise risks of accidents. The prime responsibility of safety is of management and the points mentioned above need to be seriously considered to carry out accident-free execution of projects and works.

Conclusion :

The suggestions made regarding construction of industrial buildings are only a few and more could be possible. All effort has been made to attract attention to the fact that industrial buildings need a separate treatment even though a few of the suggestions mentioned may be common and useful for other buildings too. A few of the points suggested are not taken care and given due importance in general practice at present, and may work out really useful if considered and put in use for future industrial constructions. The suggestions given if followed, the difference from present methodology and practice will definitely be felt alongwith the various merits and advantages as mentioned in the foregoing paragraphs:

Acknowledgment :

The authors are thankful to the director, Central Building Research Institute, Roorkee, for the kind permission to get the paper published.

References :

- G. Turner and K. Elliott, 'Project Planning and Control in the Construction Industry', CASSEL LONDON — 1964.
- Roy Pilcher, 'Principles of Construction Management', McGRAW-HILL Book Company (UK) Limited, Maidenhead, Berkshire, London — 1975.

BEREAVEMENT

We regret to announce, with profound sense of sorrow, the sad demises of Smt. Papathi Ammal, beloved mother of BAI President, M. Karthikeyan, on 12th September 1993, at Madras, and Dr. (Smt.) Shantabai Gulabchand, beloved mother of our Past President, Ajit Gulabchand, on 1st October 1993, at Bombay.

We pray for the eternal peace of the noble souls.