

Selection of Appropriate Technologies in Building Constructions

Prof. Ajay Singh¹, Ayush Sangal²

Abstract: *Technology is a problem solving process, however sometimes; it provides solution to one problem but creates side by side others. Automation in building industry on the one side helps in fast working procedures, but on the other hand, use of fossil fuel or thermal electricity rises the level of CO₂ in the atmosphere. Technology however has no ultimate end and always undergo in the process of improving. It is helpful in changing the quality of life. Adoption of innovative technology depends on various factors, however technology selected should be appropriate and feasible under the given set of conditions. Now a days, technologies are changing very fast, so selection of technology to be adopted should be done carefully considering all possible futuristic aspects. In this article we will discuss some important aspects related to building construction technologies.*

Selection of Technologies :

A technical evaluation of merits and demerits of available technologies is essential, in order to select the appropriate technology for meetings specific requirements. Few points to consider are given below:

(a) Risk Evaluation of Technologies

- Life threatening and safety aspects.
- Risk of low laying areas, high seismic zone and harsh weather.
- Cost of risk management.
- Technological hazards (ban on technologies).
- Human Resource (easily availability of trained manpower locally or required trainings. Dependency on some hiring systems).
- Political decisions (change of high priority area to normal or low priority).
- Breakeven point (profitability in terms of cash or services).
- Market orientation (scope of stability of trends, fashion and demands).
- Feedback of past cases.
- Environment of the organisation (management problems).
- Associated problems (noise, vibration frequencies, maintenance cost, availability of spares).
- Probability of obsolescence duration.

(b) Evaluation of Specifications

- High quality and finish.
- Cost effectiveness.
- Safety requirements.
- Indigenous or imported technology

- Efficiency of production
- Location requirements
- Acceptability in society
- Reliability
- Suitable working temperature range
- Size and housing space requirements

(c) Types of Technologies

- Labour intensive.
- Capital intensive (useful for rich countries).
- Intermediate or semi-automatic technology such as concreting with mixer machine at site.
- Soft energy technologies which consume very low energy.
- Hard energy technologies which consumes high energy such as air conditioners. and fully automatic machines.
- Modern which caters latest fashion, trend and needs.
- Appropriate technology (best suited to problems)
- Alternate technologies, which can be used in replacement of existing technologies.

Advantages of Technology

- Science and technology creates resources and high production.
- New technology allows people to do new things.
- Modern technology provides people more choice in execution.
- Redundancy can be replaced with reliability.
- Technological diffusion changes life style
- Superior technology supersedes anearlier technology but not all.
- Technology is an interactive, evolutionary and accelerative process.
- It affects environment (protection or destruction)

Limitations in use of Technologies

- Financial resources (how much, when and how to be managed).
- Human Resource (to be hired, available or required training.
- Raw materials availability (how much, from where and at what cost.
- Social acceptance (nobody would like a paper industry near to his locality due to release of foul smelling gases).
- Law restrictions (ban on production of materials made from hazardous materials like asbestos or ban on import or export of items).

- Toxic waste and waste disposal problem.
- Non-availability of sufficient energy.
- Location at which to be used
- Political stability
- Administrative, technical and legal constraints (gelatine tubes and detonators for explosion in soil are not freely available).
- Infrastructure facilities.

Building Technologies

(a) Precast Building Components

Today precast technology is replacing cast-in-situ systems-with fast pace, as it is easy and fast in construction. It's finishing, strength and uniformity is more reliable. It is mostly suitable for modular building schemes, where same size of walling or roofing components may be used easily. Now a days variety of precast concrete components like joists, roofing panels, beam and column frames, lintels, lintel-cum-sunshades are available. The foremost requirements of precast construction are; availability of casting and storage space, efficient transportation system to transport precast components from casting yards to site of works, efficient lifting and placing in position device and appropriately trained manpower. Though, it is easy to place the components in their proper position by mechanical means but problematic thing are, their proper jointing system and details for attaching them with each other. In case the jointing is not done properly, the integrity and rigidity of structures is badly affected. On the other hand chances of Ingress of water, leakage and seepage in the building are enhanced. So, method of construction and required specifications should be strictly followed.

(b) Soil Strengthening

Now a days many innovative and efficient technologies are available such as pile grouting, chemical grouting, compaction grouting, soil mixing, vibro compaction, stone columns, preloading and surcharging, soil reinforcing with geo-synthetics, cement/lime stabilisation etc.. Some other innovative technologies like dewatering and electro kinetics, dynamic compaction, rapid impact compaction, blast compaction, jet grouting, cavity filling, squeeze and compensation grouting etc are available to use. But their use depends on type of soils, topography of land, level of ground water table and saturation zones and locations of site. As per requirements the technologies may be selected considering all aspects. Inappropriate technologies may lead to problems. For example service life of geo-synthetics used should be longer than building structures made over it.

(c) Safe Zone Mapping

Ground surface is made of heterogeneous materials. Properties of underneath soil with spacial variation vary

a lot. These properties may be find out by soil explorations and testing at site and samples at laboratories. It requires lot of time and money in mobilisation of equipments and conducting field tests with permeative methods. But now many electronic equipment are available, which can scan the entire site in a very short duration. Geo-radar can map the underneath soils and water bearing strata with quite accuracy. Piezometer or down hole water level data loggers can give idea of seasonal variations in ground water table.

So, after knowing all possible details about ground structures, the vulnerable areas may be separated out from safe areas those are suitable for construction of structures. Now it is easily possible to detect the safe zone for building construction especially for high rise buildings or design of new city. It is possible only due to advancement in the new technologies.

(d) Slopes Stability

Stability of slope is essential, for protection of sites from landslides and safety of buildings on slope. Land slide depends on many factors like; steep slope of fractured rock or soil, orientation of bed rocks and their fault zones, weathering of rocks, Ingress of water in rocks, seepage through soil, cracks in rocks etc. Today many technologies are available for control and manage landslides. A few of them are listed below:

- Inserting layers of geo-grids or geo-synthetics up to passive zone of slope including necessary anchorage beyond slip circle.
- Laying on slope erosion control mats, which helps in growing vegetation cover also to reduce water and wind erosion.
- Securing loose, unstable or overhanging rocks by using spider net.
- Applying dust and erosion control spray on the surface of soils of slope.
- Controlling erosion by bio- engineering approach
- Filling cement and admixture grout in cracks of fragile rocks to join the rocks and stop Ingress of water in it.
- Reducing runoff over slope by providing catchment drains and diverting water to other areas.
- Construction of retaining structures, drop structures.
- Slope roughening and developing terraces.
- Converting slope in stepping

In addition to these there are many other technologies but appropriate technology of slope stability should be selected as per requirements of site. The selected technology should serve the desired purpose with advantages in terms of their life, application, cost, time of application, cost of transactions etc.

(e) Fire Extinguishment and Fire Detection Technologies

In all important buildings, particularly in high rise buildings establishing fire extinguishment, detection and warning system are of paramount importance. Many technologies are available, but most suitable should be selected considering all possible long term and short term aspects. A few technologies are mentioned here:

- Multi-sensors smoke detectors
- Sensor based linear heat detectors
- Fire alarm.
- Flame detectors.
- Fire extinguishers.
- Fire hose.
- Sensor based ceiling and wall sprinklers.
- Photo- electronic smoke automatic detectors.
- Wall mounted or ceiling mounted sensor based warning speakers.
- Fire stops to stop spreading of fires from one room to another through cables.
- Fire proofing of cloths for curtains and cushions
- Fireproof paints for application on wooden or plastic items.
- Fire retarders for delay of fire.

After having detailed knowledge about relevant technologies, one can select suitable technology to adopt.

(f) Seismic Damage Control and Safety Techniques

Seismic damage control measures are very important for the health of buildings. These may be mostly preventive in nature. If proper provisions are not made in the building structures, to resist earthquake forces a huge devastation may take place. Buildings damage may be fatal. To save the buildings from earthquake damages many technologies are available, few of them are listed below for appropriate selection:

- Avoiding unsafe areas for building construction by getting micro-zonation mapping of earthquake prone areas.
- Providing bends at plinth, window sills, lintel, roof/ slab and gable end levels as per location of site in earthquake zones.
- Avoiding unsymmetrical plans horizontally or vertically.
- Reducing projected lengths of cantilever structures.
- Reducing load of structures by using light weight materials.
- Making building plans convex instead of concave at all floors.
- Providing expansion joints to separate out the Z shape, L shape or T shape buildings to make them convex in plans, which are more resistant to earthquake forces.

- Use of pile foundations with beams, slabs and columns instead of load bearing foundations in order to avoid settlement in loose soils.
- Provisions of the early warning systems, including alarms, automatic audio warning messages.
- Automatic shutting off the lifts,
- Providing escape gates and staircases.

Conclusions

A large range of technologies in building materials and construction are available. Basic problem is to know about the innovative technologies and assess them properly. It requires good knowledge, experience, expertise and willingness to adopt latest technologies. Changes in technologies through R&D process are never ending process. We should grab appropriate and feasible technologies and obtain necessary trainings required. Selection and use of appropriate technology will certainly help us in every field of building industry, including time saving, money saving, human resources saving, ease in construction, safety of human life and structures, living comfort and aesthetic views. Only need is to be intelligent in selecting technologies.

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BIOGRAPHIES



Prof Ajay Singh is working as Head Of Department in Civil Engineering in Roorkee Institute of Technology, Roorkee. He has vast experience of R & D and landslide control measures, construction sites, cost economics of buildings during his services in CBRI Roorkee.



Mr. Ayush Sangal is studying in M.tech branch (Structure and Construction Engineering) in Civil Engineering dept in Roorkee Institute of Technology, Roorkee