# Innovation in Building Technology: A Need to Review Traditional Practices

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*ABSTRACT*

*With the changing scenario and fast rate of development in the demands on construction the need is to switch over to new building technologies and processes. This paper attempts to list out a few important innovative techniques and equipments which may be useful in planning and execution of building projects. Technologies for rural development programmes, helpful in energy conservation and new development in the building materials are also being dealt with briefly.*

In India construction constitutes a diverse set of activities and is rather diffused, not having the characteristics of an industry. Construction industry is in a state of very active growth and is fast moving from traditional labour orientation to mechanisation. There is, therefore, a need to review the traditional practices and introduce innovations in the field of building construction to meet the needs of the changing scenario. A number of new materials, equipment and processes for use of the building industry have been developed with proven benefits and advantages over traditional ones. A few instruments for site observations and investigations which have come in the market are very precise and accurate, capable of carrying out work in hours which earlier took days.

In addition to the above developments there is also much change in our living pattern. This is due to the introduction of new appliances and gadgets like kitchen processors, electric driers, ovens and blowers which have become a part of our daily life. The space planning for these additions also needs re-consideration and to draw norms for minimum space requirements with the new added facilities.

## CONSTRUCTION TECHNOLOGIES

Construction plays a very significant role in both economic growth as well as employment generation/creation. There is hardly any sector which does not have a construction component. Thus, it assumes importance both from the economic and employment scenario and to achieve speed in construction.. A few construction technologies are mentioned below:

### Precast Roofing

Roofing is a major component of a building and costs nearly 20 percent of the civil works involved. Traditional methods of in-situ casting are time consuming and slow. Prefabrication has its advantages on these counts.

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| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Precast R.C. plank flooring/roofing scheme | RCC/RB flat roof | No shuttering required |
| Channel Unit for floor/roofing | RCC/RB flat roof | Quality assurance |
| Prefab Brick Panel flooring/roofing | RCC/RB flat roof | Speedy construction<br>Economical |
| Waffle Unit for floors/roofs | RCC slab with heavy beams for large spans or grid slab | Being precast units saves in shuttering cost<br>No beams are visible<br>Good aesthetically<br>Useful for large span halls<br>Economy in cost and materials where large spans are involved |
| L-pan roofing for pitched roofing | CGI or AC sheet with angles or steel/ wooden frames | Long lasting for pitched roofing<br>Reusability of units like sheets |
| In-situ R.C. Ribbed slab | Flat RCC/RBC/RB slab | About 20 percent economical than RCC/RB/RBC slabs<br>Saving in materials |

## Walling

Nearly 20 to 30 percent of plinth area is covered by the walls. Reduction in wall area percentage is possible with use of materials of appropriate strength for walling, specially in areas where good clay bricks are not available or in areas where bricks need to be transported from distant places. The first break point in the progress of walling happens to be at lintel level. Use of precast lintel can help in over-coming this break point and provide continuity in the progress of work. A few non-traditional walling techniques are :

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Thin precast RC lintel | Cast-in-situ RC lintel | Fast construction and economical |
| Precast stone masonry block walling | RR stone masonry | Comparetively less wall area and lower wall thickness. |
| | Walling with bricks transported from outside | Less cement consumption in mortars<br>Regular shape and size of blocks.<br>Lesser thickness of finishing layer. |
| Autoclaved calcium silicate (Sand-Lime) bricks<br>Fly ash sand lime bricks | Low strength bricks where good quality of bricks are not available | Machine moulded under pressure |
| Fly ash clay bricks | | Very regular shape & size, good strength.<br>Can be used in high quality face work<br>Can be produced in different colours<br>Saving in finishing items.<br>Better aesthetically. |

## Water Supply and Sanitary Installation

Any building cannot be put to use till it is connected by services. The cost of internal services is nearly 20 percent of the total cost of the building and any saving in the services will be a substantial amount, which can be achieved through proper planning and use of innovative techniques. A few innovative techniques suitable for urban and rural areas are :

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Single stack system of building drainage | Dual stack drainage system | Suitable for multi-storeyed construction<br>Economy of material and cost<br>One WC, one bath and one kitchen each floor clubbed in one stack<br>Fittings available in market |
| Dual flushing cystern | Ordinary flushing cystern | Conservation of water variable discharge possible |
| PVC/Polymer and Ferrocement water tanks | RCC or brick tanks | Less maintenance<br>Economical<br>Easy in handling and fixing |
| Low cost sanitation for rural and urban houses | Use of septic tank and soakpit | Economical in construction and operation<br>Easy to construct. |

## Water Proofing of Roofs

Traditional RCC/RBC roofs by themselves are not water-proof and normally an additional water-proofing treatment is given. It is necessary to avoid damage due to dampness and any health hazards due to dampness.

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Ferro-cement roof treatment | Lime concrete terracing or mudphuska with brick tiles | Cost effective<br>Reduction in superimposed load<br>Improvement in surface runoff |

## Foundations

The foundation is the basic requirement of any building. It's selection will depend upon the soil strata and the superimposed loads. But care is necessary that proper and adequate foundation is provided as the stability of structure will depend upon foundation stability.

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Under-reamed pile foundation | Heavy spread footing or raft foundation | Useful for black cotton soil areas<br>Economical for bldgs. with heavy super-imposed loads or multi-storeyed<br>Easy in construction |
| Bored compaction piles | Heavy spread footing or raft foundation | Increased load bearing capacity in comparison to under-reamed piles |
| Skirted granular piles | Compaction mechanically or ground improvement chemically | Suitable for ground improvement and structure foundations |
| Pedestal piles | Spread footing or raft footing | Suitable for black cotton soil areas.<br>Economical for single storyed building in black cotton soil areas. |

## Doors and Windows

For ecological balance and restrictions on felling of trees, timber has not only become scarce but also very costly. There is, thus, a need for wood substitute which are free from defects like swelling and warping. A few substitutes are :

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Ferrocement/PVC/Aluminum shutters<br>Pressed steel frames<br>Standard steel sections for windows | Wooden door and window frames and shutters. | Substitute of wood from ecological point of view<br>Economical than timber frames |

## Flooring

Flooring is that part of the building which is directly used by the dweller for movement, storage etc. Different types of flooring systems and materials are available now-a-days to make the floor according to need.

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Clay tile flooring | C. C. flooring | Suitable for low cost buildings<br>About 30 percent economical. |
| Rubber<br>PVC tiles/linoleum | C.C. or terrazo/stone flooring | Useful in high class constructions and dustproof floors. |

## Energy saving process

Conservation of energy is the need of the hour, the supply is progressively falling short of demand. Any saving in energy will help in more production otherwise restricted for non-availability of energy needed for production. Saving of energy will also save the cost of production.

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| High draught kiln for burning of bricks | Ordinary bulls trench kilns | About 15 per cent fuel saving and uniform burning of bricks resulting in more bricks of superior quality. |
| Roof-surface evaporative cooling of buildings by water soaked gunny bags | Air-conditioners | Saves electrical energy used in running A.C.<br>Occupy no space inside the buildings.<br>Most effective for industrial buildings. |
| Low cost pipe type solar water heater | Geysers | Saving in electrical energy. |
| Room heating by solar energy | Room heaters, blowers etc. | No need of electrical energy. |

## Equipment and Instruments

A number of new equipment and instruments are now available, which help to reduce time and cost and are also very accurate. They suit the present day need for speed and diagnosis and a few are :

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Foundation pile diagnostic system (FPDS) | Load test on pile and all piles cannot be tested | Easy assessment of structural integrity of piles |
| Ground penetrating radar (Geo-Radar) | Making bore hole for knowing strata | Sub-surface strata can be found with out making any bore hole |
| Computer controlled consolidation testing system. | Mechanical process | Quick results |
| Universal testing machine (fitted with data processing unit, built-in-modules, XY recorder and printer for tensile, flexural and compressive strength testing). | Universal testing machine (without processing system) | Quick and accurate results |
| Path finder. | | Helpful for monitoring of corrosion of reinforcement in concrete |
| Automatic sprinklers. | | Can be used for automatic detection, extinction and limitation of fires in buildings |
| Ultrasonic concrete tester. | Destructive testing by crushing the sample or measurement of deflection after applying load | Conrete quality can be ensured by non-destructive testing |
| Electronic distance meter (EDM). | Plane table, levels, ghat tracer and measuring tapes etc. | Contouring and monitoring of surface movement can be done easily at a rapid rate |
| Earth pressure cell. | | Helpful in the measurement of active or passive earth pressure in retaining structures |

| Innovative/Proposed system | Traditional System | Advantages over traditional systemw |
|---|---|---|
| Inclinometer | | To measure the ground movement above bed rock and making profiles. |

## Materials

Development of new building materials is essential to make-up for the current and future requirement, for economy and utilisation of wastes which otherwise need disposal. A few such materials are:

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Geo-synthetics and geo-grids for retaining structures | Gabions using wire crates<br>Rigid masonry walls. | Geosynthetic is embedded in passive earth pressure zone, it helps in increasing the shear and tensile strength of soils<br>Local quarried material can be used as filler in the wall<br>Problematic slopes can be easily controlled<br>Cost economic |
| Clay flyash bricks | Poor quality bricks due to lack of technology | Good strength bricks may be obtained from clay by adding flyash content |
| Clay flooring tiles | C.C. flooring | Cheap in cost and can be manufactured locally |
| Coir roofing sheets | A.C. sheets | Sustitute of A.C. sheet<br>Economical |
| Wood wool board. | Hard board<br>A.C. sheet<br>Perforated panels of gypsum etc. | For false ceiling and acoustic treatment in buildings. |

## TECHNOLOGY FOR RURAL APPLICATION

Technologies being used in rural India are generally of semi-permanent nature based on local materials which can be produced with ease. There is also a need of environmental protection in villages. A few technologies which may help in this direction are:

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Non-erodable mud plaster on mud walls | Ordinary mud plaster | Life of the plaster is more (about 7 to 10 yrs) |
| Fire retardant and water resistant thatch | Ordinary thatch | Longer life<br>Less consumption |

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| Waste water disposal system | Open drains with poor drainage | Waste water can be disposed by ground absorption at a nominal cost |
| Plinth protection of mud walls | | Protects the foundations against moisture and erosion |
| Low cost latrine | Traditional W.C. with septic tank and soak pit provisions | Economical<br>Can be easily constructed. |

## MISCELLANEOUS

Apart from specific items there are many miscellaneous items which can be used with specific advantage as alternative materials :

| Innovative/Proposed system | Traditional System | Advantages over traditional system |
|---|---|---|
| PVC, Fibre reinforced plastic, Fibre reinforced glass fittings for water supply and sanitary installation etc. | Brass, steel and iron fittings | An alternate material of steel and brass<br>Can be used as a low cost material |
| Mini climbing cranes | Heavy cranes | Can be fixed at any floor<br>Easy dismantling and assembling. |
| Computers and software | Manual system | Calculations, storage of data, analysis, network diagrams etc. can be processed very fast. |
| Multiple use furniture | | Can be used in different ways for example : an almirah can be used as a study table, dining table and single bed etc. |

The items covered above are only a few just to indicate the need to review the traditional processes in building practice. There may be many other processes, which are useful in the present day scenario, and one has to be aware of the latest developments and their feasibility and economy for their adoption.

### Revision of Space Planning Norms

Besides construction practice, there is a need to review the space norm in planning of buildings due to addition of new technological facilities like refrigerator, oven, mixy, kitchen processor, hot plate, milk boiler, toaster, washing machine, geyser, T.V., VCR, telephone, hand drier, stereo-deck, sun blower, air conditioners and coolers etc. For using all these facilities a proper layout planning is needed. The traditional norms and sizes need to be revised. In this way the minimum size indicating position of kitchen, bath room, bed, drawing room, guest room etc. should be fixed keeping in view the present requirement of the user of a residential unit.

In public buildings the space provision and layout design should be based on the actual requirements and future scope of using different apparatus and appliances may be kept in view. For example, a class room may be equipped with TV, Projection TV, projector, personal computer as such its size and orientation should be planned according to the above requirements. While planning a complex of school, college, university or a public building a futuristic view should be taken.

## CONCLUSION

Technological updating by careful selection of appropriate technology is an essential part for the construction industry. An effort to explore new resources, use of local material and labour will certainly help in cost reduction of construction works and saving in foreign currency. Use of sophisticated equipments will improve quality and will save time on the project. Sometimes we go for traditional items, even though we know the advantages of the new systems developed, due to lack of confidence in performing the desired operation. In such cases either the concerned staff should be trained at places where training facilities are available or a small experiment should be carried out before mass-scale adoption. Government should also encourage people who want to switch over to new technology. We hope that the theme of this article will persuade builders, manufacturers of building materials, users, building organisations, planners etc. to understand the need for review of building practices in the interest of economic use of resources.

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