

# Evolution of Construction Technique: A Literature Review

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**Abstract:** Due to globalization in 21st Century nation require more infrastructure facility for economic development such as roads, ports, thermal and hydro electrical plant, dams, irrigation project, shopping malls, hospitals, education institutes, air ports etc. for supporting and increasing the GDP rates. It leads the pressure on construction industry and industry transforms their conventional methodology into modern construction methodology. The overall aim of this paper is to identify the effect of world trend on construction technique and discuss the evolution of building construction with respective of time scale.

**Keywords:** globalization, GDP, modern construction methodology and conventional methodology

## I. INTRODUCTION

When all over the world due to increase of population and availability of home loans from bank, it demands of dwelling is raise then boosting the supply of home is highest priorities of construction industry. This reduces the construction time and this is only possible when new construction methodology is adopted by industry.

The rate of housing supply in the world, such as in Asia where considerable growth is forecast, is lower than Government would prefer. High demand for housing in this era is pushing up prices, making it more difficult for key workers and those on low incomes to find suitable accommodation. The development of affordable private sector dwellings is outside the control of Government so the focus has been on stimulating the innovative and new construction techniques to increasing the rate of housing supply.

Modern methods of construction are a collective term used to describe a number of construction methods. The methods being introduced into real estate sector differ significantly from so-called conventional construction methods such as brick and block.

Literature review, interviews and site visits were carried out for understanding the evolution of construction technique and methods. Advantage of new construction method is discuss which investigates the use of new construction method in construction project, is appropriate for meeting the aim of this paper. It forms theoretical foundation of this paper and reveal the necessity and originality of study.

A research proposition that has emerged from literature review on use of new construction methodology for increase the productivity is:

1. Traditional construction practices applied for construction is not efficient and effective or traditional construction method need to improve according to world trend.
2. New construction methodology can lead to more efficient production process and client satisfaction on the other hand; Innovation in new construction technique conduce to a more efficient, economical production process and assist to deliver high quality work.

The above two propositions lead to the formulation of the main research hypothesis: The adoption of new and innovative construction methodology could improve the efficiency and effectiveness of construction projects which is indispensable according to new world trend.

In line with the research proposition and research hypothesis, the main research objectives are:

- 1) To theoretically study of evolution of construction technique according to world trend.

In order to achieve the research objective the following tasks need to be completed:

- 1) To assemble a records of old construction technique.
- 2) To argue a new construction methodology and its benefit to construction project.

## II. EVOLUTION OF CONSTRUCTION METHODS

### House Construction over the Last 100 Years

In this paper will be looking at the different ways in which houses have been constructed since the latter part of the last century. Compare a large semi-detached house with a deck access flat built in the 1960s. The house is much bigger, is constructed of solid brickwork or mud work, with a large garden space. The deck access flat will be smaller, may be built of concrete panels and has no individual garden area. A timber framed house built on a new-build housing association scheme is significantly different in terms of construction to a "Unity" house, built after the Second World War, as a quick fix for the Europe housing shortage.

Housing stock can generally be categorized and identified as Old Traditional, Prefabricated, Traditional, Rationalized Traditional, or Industrialized. In the following discussion, an attempt has been made to date the various categories, but these are approximate, as each category was slowly superseded by another, the acceptance of which, particularly Industrialized, was largely dependent upon the attitude of individual Local Authorities.

## III. OLD TRADITIONAL 1900-1930 (LOAD BEARING STRUCTURES)

These had solid external walls of locally produced bricks, on brick foundations, no damp courses, segmented or flat arches to door and window openings, with much use of brick string courses and cills and large areas of cement rendering etc. Roofs were pitched, of timber, many with no under felt, and covered with slates or clay tiles, with mainly cast iron gutters and fall pipes. Ground floors were often solid to kitchen and storage areas, and of suspended timber construction to other rooms and upper floors. Kitchen and store walls were frequently un plastered, and ceilings were lath and plaster. Wind owe were generally timber, vertical-sliding sash, and external and internal doors either panelled or boarded. Kitchens had very few cupboards, if any, and the free-standing sink often had no drainer. The food storage consisted of a cold slab and shelving in a separate larder. Internal plumbing was in lead.

## IV. 1930-1940(PARTIALLY RCC STRUCTURE)

Cavity external walls (still of local bricks) were gradually introduced around the 1930s on concrete strip foundations and damp courses were in common use. The external appearance was slightly less ornate and timber or steel casement windows were introduced. Roofs now had under felt, but were still uninsulated, and cast iron or wooden gutters were provided. There was some improvement in the provision of kitchen fittings, and all walls were now plastered, but many bathrooms were still positioned on the ground floor, usually directly off the kitchen. Open fires were still provided to the main rooms, and lead internal plumbing was gradually replaced by iron or galvanized steel.

## V. PREFABRICATED 1945-1950

After the Second World War there was an urgent need to replace the thousands of houses destroyed, particularly in the cities, and many more were required to provide first homes for the vast numbers of service personnel returning to civilian life. Practical considerations controlled the rate of demobilization and there was insufficient time to provide either the materials or suitable labor, to meet the requirements by traditional building methods. However, there were many factories which had been geared to the war effort, which were suitable for redirection towards the mass production of both new materials and those not previously in common use e.g. fiber boards and aluminum and these were utilized. As far as possible the resultant designs were prefabricated in the factories, using non-traditional materials, in order to reduce the time and skilled labor required on site. They were of frame construction, (generally with trussed roofs of very low pitch), and clad with a variety of materials, including asbestos, steel, aluminum, and concrete, although some were provided with an external skin of traditional brickwork. Metal casement windows of widely different design were in common use and internally maximum use was made of fibre and plasterboards, for

wall, ceiling and partition linings. The provision of kitchen facilities was greatly improved with the introduction of mass-produced cupboard units (some of metal construction) and the inclusion of free-standing cookers and refrigerators. Heating was often provided by an open fire in the living room, and closed stove in the kitchen, with some attempt to provide background heat elsewhere. There was a greater provision of electric power points than previously and whilst subsequent improvements in standards evoked criticism of the performance of some of these dwellings, the better ones are still regarded with some affection by both past and present tenants.

## VI. TRADITIONAL 1945-1960

There had been some traditional building during the prefab era, and this was gradually increased as more skilled labor and materials became available. Of necessity, most Authorities simply resumed building to the same designs as had been used just prior to the outbreak of war and whilst pitch roofs had always been predominant, some flat-roofed dwellings had been introduced and these also continued. Flat roofs were of timber or concrete, felt or asphalt-covered, with parapet walls to the edges. Apart from the roof, the rest of the construction and fittings was identical to that of the pitched roof dwellings built in this period but many maintenance problems were to occur, simply because of the roof construction. Initial improvements to the road network, greater availability and use of motor transport, permitted less reliance on the use of local materials and made available a wider selection of facing bricks of many colors and textures. Concrete roofing tiles of different colors and profiles were introduced. Coke breeze building blocks of various thicknesses were readily available for internal walls, partitions and inner leaves of cavity walls. Pitched roofs returned to a more traditional (steeper) pitch than the prefab type, with much use of asbestos gutters and pipes. Windows were wood or metal casements, doors flush. Some form of background heating was very occasionally included. Copper pipe work and wastes were used and also either separate cookers or combined heating-cooking appliances. Solid floors were either thermoplastic tiled or asphalt-covered.

Towards the end of the 1950s, plastic gutters and pipes were introduced, together with pivot windows, and more use was made of glass panelled external doors. Separate cookers and heating appliances had now superseded the combination range but provision of background heating was still limited and individual electric wall fires often used to supplement the main heat source. More variety was introduced into the external appearance by the use of small panels of cement rendering or timber boarding and reinforced concrete boot lintels (sometimes with projecting concrete window surrounds) were introduced.

## VII. RATIONALIZED TRADITIONAL

In the late '50s and early '60s, fresh efforts were made to improve efficiency and speed in the traditional building process, by the combination of modular-controlled, factory produced components, and traditional practices on site, i.e. by rationalizing the traditional approach. Probably the best known of these is the cross wall construction, involving brick or block gables and separating or 'party' walls, set out to receive infill panels to front and rear elevations. These panels were produced off-site and often only required the addition of window glass and external door hanging after installation. Such panels were generally timber framed, covered with a variety of materials, e.g. boarded or plywood/asbestos panelled. By the early '60s some Authorities were already introducing some form of central heating, if only to the ground floor rooms. However, by the late '60s all authorities were doing so following the introduction of mandatory heating and space standards, as recommended.

## VIII. INDUSTRIALIZED

The rate of house building had not kept pace with housing needs. Accelerating slum clearance programmes and the anticipated post-war population boom were creating a huge housing deficit and drastic measures were required. A vast number of modular building systems were developed using new techniques, materials and maximum use of factory produced and assembled components, which could be so arranged on site as to provide some variation in the external appearance of the dwellings, or internally, to permit the use of a standardized bathroom layout within houses of varying plan arrangements. They generally consisted of a structural frame of timber, steel or concrete, usually with infill panels, or sometimes with an outer skin of brickwork to create a more traditional appearance. In many cases, concrete was the basic material for both the structure and external shell of the dwelling with the emphasis on prefabrication off-site, or cast in-situ using the 'no fines' principle. Most building systems were also designed to allow greater flexibility in the choice of heating installation and waste disposal was by the single stack

system. Such provisions should have improved the living conditions of the occupants. Unfortunately, some building systems relied too heavily on the use of joint sealants, whilst others may have been too enthusiastic in their acceptance of some continental building techniques, which were designed for different climatic conditions to those prevailing in this country. At least one system was designed to such critical structural limits, either through ignorance or economic pressure, that it became unstable in extreme weather conditions, and would have required a degree of quality control during fabrication and construction that was virtually impossible to achieve, given all the vagaries of our weather, and the building industry.

At the peak of the industrialized period there were over two hundred systems on offer, some of which were promoted by companies who had previously only supplied an individual building component, and simply attempted to provide a complete system around it, with insufficient experience or knowledge of the overall problems of housing design and construction. It was, therefore, obvious that many of the systems could not possibly survive the intense competition, and some Local Authorities took this into account, together with the implications for future maintenance, when making their selections. Furthermore, industrialized systems were seen as a threat by traditional building contractors, many of whom reacted by offering their own 'design and build package deals' as an alternative. Of the failures during the Industrialized Period, some were predictable and should have been avoided. Others were not so obvious, and whilst, with hindsight, some criticism of the designers, builders and Local Authorities is warranted, they were subject to the policies, pressures and financial or design constraints of successive central governments and their agencies. The financial and social legacy of such policies has already compelled some Local Authorities to demolish various industrialized dwellings built within the last twenty years, which were intended to last for a minimum of sixty years, rather than attempt to maintain or improve them to a satisfactory habitable standard. Whilst routine maintenance and repair of minor defects occurring in the successful systems is often similar to that required for more traditional housing, detailed knowledge of the particular building system is essential when more serious faults are being examined.

#### IX. HOUSING TODAY

Since the end of the 70s, Authorities have turned away from the industrialized approach and yet there has been an increasing use of the types of framed structures. The standards achieved will vary, as they do with any other form of construction, including traditional. It is, therefore, perhaps unfortunate but inevitable, that even the better ones will be subject to the antipathy originally created by the industrialized approach. Most Authorities have reverted to a more sophisticated rationalized, traditional approach, based upon the mandatory modular 300mm square plan grid, with mandatory heating and insulation standards for walls and roofs. To achieve these standards, much use is being made of thermal building blocks, high performance windows, some form of cavity insulation, and more efficient roof insulation. Externally, many designs are simple, clean in appearance, utilizing high quality brickwork and roofing tiles (usually on trussed rafters) with plastic rainwater goods. Internal, single-stack drainage systems are in almost universal use, with ample provision of both kitchen units and internal storage areas, and wider selection of better quality flush doors. More attention is being paid to detailing, in order to reduce maintenance costs and to improve the internal living conditions of the occupants. There is also a greater emphasis on providing a much more humane and varied environment, which is certainly preferable to the soulless, drab monotony of much of the past.

#### X. CONCLUSION

In conventional approach the inspiration for construction had been an evolutionary process. If one looks at conventional approach there is a main difference in that the human mind had played a major role than the consideration of utility or economy or even safety. It slowly evolved from one of building a shelter against nature's fury to that for social and cultural meetings of the society through road and community halls and then onto structures that satisfy the spiritual needs, like temples, even though they are "assumed to house God". The new high-rise residential buildings, cable-stayed bridges, towers, aircraft hangers and pavilions are the examples demonstrating why, what and how of construction technology. Similarly materials like concrete, composites, high-strength steel, aluminum, stainless steel and metal alloys have all become part of construction technology with choice being optimized for economy and performance. Modern construction mostly caters to function or utility, economy, safety and distinction as a landmark structure in the order of priority. It is interesting to look at the origin of construction technology.

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