Localized Low Cost Housing in Jammu and Kashmir

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Abstract
Localized Low Cost Housing in Jammu and Kashmir is a compilation of various techniques, materials and particular architectures in localities of the state which can be successfully implemented in mass constructions so as to reduce the costs considerably to avail housing at a cheap rate and housing for all. It is chosen to be executed throughout the state with particular reference of localities where the techniques find maximum applicability. These techniques have been discussed for foundation, plinth, walls, doors and window specifications, beams, columns, slabs and roofing. The study has been further taken to include materials which are locally available can be used in the construction effectively with no compromise with strength and specifications so as to minimize the cost of construction. In the end some particular, local architectures have been discussed which can be used to further lower the financial burden on construction projects in Jammu and Kashmir.

Keywords: Low Cost Housing, Low expenses, local architecture, building material, low cost techniques, affordable housing.

I. Introduction
One of the major problems which India has to solve in a satisfactory manner is housing for all. With a particular focus on the state of Jammu and Kashmir, we realize that the main reasons for this problem being acute at present is the rapid urbanization. Though industrialization has not seen a booming spring in Jammu and Kashmir but still major population after receiving education look for opportunities in nearby towns and in the cities of Jammu and Srinagar where initially due to lack of savings they find it hard to construct or buy houses. Also the cost of housing, as compared to the limited financial resources of the community remains very high, on account of the high cost of building materials such as steel, cement and timber. The two principal components of housing cost are cost of labor and cost of materials. The cost of materials and services may be affordable to some extent for a few in Jammu and Srinagar but the real problem is faced by people who look to settle in towns like Doda where the material for construction is majorly supplied from Jammu and thus the cost goes sky rocketing. Though there is locally available sand, stone and timber but the transportation
cost makes the material costly. Moreover, as per a general observation, the cost of labor in India is only about 30 to 40 percent of the total cost of construction, the cost of materials being 60 to 70 percent. In some developed countries, the ratio is just the reverse. So it is a matter of utmost importance in India to introduce such housing concepts as would assure minimised consumption of structural materials. Any reduction in the consumption of materials will directly reduce the cost of labour and this can be achieved by introducing better design concepts and new construction techniques.

II. Review of literature
There are several examples of research studies involving low cost housing in various forms and application which has practically been implemented as well. The projects as such or in parts have been articulated along with their pros and cons by various firms, organisations and authors. Some of such glimpses are highlighted in the following review components.

1. Urbanisation and housing shortage: According to Sumit Gothi and Preeti Onkar Singh (2015) Housing Demand Attributes: Perception and Assessment for Prioritization, Research Journal of Engineering Sciences, Vol. 4(12), as per Census of India 2011, the population of the country was 1.21 billion out of which 31.1% live in urban areas. Urban population has increased from 290 million to 377 million and the number of cities and towns has increased from 5,161 to 7,935 in a decade from 2011. This growing population and its concentration in urban area have generated land scarcity, housing deficit and crowded transit.

2. Construction speed and development price: According to Sai Murali Krishna Reddy Raya and S.S Bhanu Prakash (2016), Cost And Time Overruns In Indian Construction Industry, Research Gate Publication, Volume 2, Issue 4, the most important thing is to study, analyze and evaluate certain common factors leading to the cost and time overrun constraints and suggest the most suitable mitigation measures to overcome time and cost overrun constraints. The time and cost are the lifelines of every and any project in the construction industry, the aim of the project managers, and other professionals of the project to control the time and cost and make ensure that the projects finish on time without any time overrun and within their cost (budget), without any cost overruns, with perfect management principles, without the deviation’s in the project.

3. Prefabricated building methodologies: According to B Bakhtyar, A Zaharim, K Sopian, S Moghimi (2013), Housing for Poor People: A Review on Low Cost Housing Process in Malaysia, Volume 9, Issue 2, if we compare the present scenerio with that prevalent 30 years ago, it can be seen that the meanings of house and housing have changed considerably. Standards have eventually improved and satisfaction elements are seen to be different during these periods. It is very much clearlegislation in different countries confirms that the opinion of governments has changed and they are more involved in Low-Income Housing now.

III. Methodology
The methodology of the study and analysis leading to the proper plan establishment consists of proper planning, foundation, plinth, walling, doors and windows, beams and columns and roofing.
1. Proper planning: The construction cost can be reduced to a great extent by proper planning. Planning in general refers to consulting a good structural engineer for designing safe structure with durable and low cost material. Effective design by an engineer can reduce the unnecessary cost and lead to optimum utilization of space. Low Cost housing does not imply construction with cheap quality materials. Rather it implies that scientific methods will be used to reduce the consumption of cement in construction of wall and plastering and likewise other steps will be followed so as to lower the construction expenses. All the rest of works like Flooring, Kitchen platform, Wiring and Plumbing etc will be with good quality materials. But proper planning has to be used to maximum extent for selection/purchasing of material for flooring and construction of wall, and that too from the nearest source directly. Similarly proper planning must be done in making low cost plan model.

2. Foundation: In case of foundation construction, the cost incurred is generally 10 to 15% of the total building. So before discussing particular foundation techniques, let us discuss points which can be kept in mind so as to reduce the foundation cost:

   i) A foundation depth of 2 ft should be adopted for normal soils like gravely soil, red soil. We realise that most parts of Jammu region and plains of Kashmir valley exhibit this type of a condition. Hence this specification can be widely implemented to reduce the foundation cost in small residential houses.

   ii) If instead we have black cotton and other soft soils, in such a case ream pile foundation which saves about 20% to 25% in cost over the conventional method of construction can be used.

   iii) Another way of reducing cost is to use random rubble masonry in mud or cement mortar placed in excavation over thick sand bed. Rubble should be pointing above ground level in stabilised cement mortar.

Let us now discuss some particular type of foundation the use of which has been established after due research. These are discussed one by one in detail.

   i) Inverted arch foundations: These are provided in the places where the bearing capacity of the soil is very poor and the load of the structure is transferred to ground by walls. In such cases it is required to construct inverted arch foundation between the walls. End walls should be made sufficiently thick and strong to withstand the outward horizontal thrust due to arch action. If the outer walls are provided with buttress walls to strengthen them, it is of great use.

   ii) Folded strip footing: Folded footings should be used as an alternative to the conventional rectangular footings. It is because due to slight design change, it takes much more load and distributes it vertically from the vertices into the ground. Hence it can take bigger loads without much heavy foundations.

3. Plinth: The portion of the wall between the ground level and the ground floor level is called plinth. Usually, it is constructed in stone masonry. In case of pile foundation, a plinth beam is cast to support wall above floor level. A damp proof course is usually provided on the top of plinth. It is usually 75 mm thick plain concrete course. The function of the plinth is to keep the ground floor above ground level, while being free of dampness. Its height is not less than 450 mm i.e. 1.47 feet. It is required that
plinth level is at least 150 mm above the road level, so that connections to underground drainage system can be made.

Now what are the ways which can be followed so as to achieve low cost plinth. Here are a few:

i) Usually 1 ft height can be adopted above ground level which generally surpasses the convention but for the purpose of low cost construction the specification is compromised.

ii) A cement mortar of 1:6 may be used for plinth construction.

iii) Furthermore, brick on edge can be used in place of plinth slab for reducing the cost.

By adopting these procedures, the cost of plinth foundation can be reduced by about 35 to 50%.

Furthermore, The height of 1 ft can be applied in only a selected few places in the state of Jammu and Kashmir because of varying weather conditions. It can be implemented only in those areas like Jammu plains and foothills of Jammu where no snow fall takes place. In rest of the state including Kashmir Valley plains, Kashmir Hills, Chenab Valley, Pir Panjal Range and Ladakh, snow fall is enormous and hence the height of plinth is generally adopted at being 2.5 ft.

3. Walls: Following are the various techniques which can be used for low cost walling:

i) Mud Mortar: Soil is mixed with water and used as mortar for various types of masonry construction. This method is however used only when there is dire need to use low cost technique. This method as such can be used throughout the state. In fact in the regions of upper reaches like Kashmir, Pir Panjal and Ladakh, this mortar provide better insulation in comparison to cement mortar.

ii) Rat trap bond: Rat trap bond is a method of wall construction followed in brick masonry, in which bricks are placed in vertical position instead of horizontal position as placed conventionally and thus creating a cavity (hollow space) within the wall. This method was introduced by Architect Laurie Baker introduced in Kerala in the 1970s and used it extensively for its lower construction cost, low material requirement and better thermal efficiency than conventional masonry wall, without compromising strength of the wall. This method of bonding can be used throughout the state successfully in rural as well as urban areas. Furthermore, one more use of this bond is that it creates a uniform cavity from which if air is pumped out, it creates a vaccumm which makes very efficient insulation.

iii) Brick Jaali: In various conditions and situations a brick jaali can be used in place of regular brick wall. A Brick Jaali is a pattern formed by placing bricks next to each other while providing some space in between and not in edge to edge complete contact. The brick jaali can be used in case of parapet and boundary wall, linking corridors, balcony fences, staircases and for replacing window systems.

iv) Hollow concrete blocks: Hollow concrete blocks present a very good combination of durability and affordability. Hollow concrete blocks cover much volume in comparison to the material they require to be made. They are made from concrete with wide spaces in between the supporting frame. In fact the hollow concrete blocks are frame unit in themselves with no filled space. They are perfect for every terrain and topography across the state of Jammu and Kashmir. The fact that they are made of concrete and have very little insulation remains true but doesn’t impede their usage in the higher reaches because of the fact that the hollow space in between provides enough insulation. Hence they can be used in high altitude areas. If temperature remains very low, then further a uniform cavity can
be made in the walls from which the air can be pumped out using a vacuum pump. In this way an utmost insulation can be reached without much expenditure.

v) Interlocking bricks: Interlocking Bricks are made by mixing Soil, Sand and Cement and compressing it in a machine. It is an Earthquake resistant technology. It is fast to build with and on average 25% less cost compared to fired bricks. Interlocking bricks are the most appropriate walling technique that ought to be followed throughout J&K and can very well be implemented throughout. They are suited for both urban and rural areas.

vi) Beams, columns and slabs: Beams and columns are the most important structural units of a framed structure. They provide the basic strength to the structure while the rest of units are just to fill the space and serving functions other than structural loads. Similarly all the slabs in the building are another platform for further constructions which ought to be structurally very conforming to the required standards. Both the beams and columns require concrete and steel and the ratio is already set by the I. S. Standards. Hence to look for low cost construction of beams and columns, something very innovative must be followed. Here is one such adoption which can considerably reduce the dependence on steel reinforcement and can considerably reduce the construction cost.

Use of Bamboo reinforcement

For past some time, Bamboo Reinforced concrete has been around and trending now. As per a study by Future Cities Laboratory, Singapore it has been suggested that an alternative to this manufactured rarity is available i.e., bamboo. Its qualities being various like abundant availability, sustainable, and extremely resilient, bamboo has potential to become an ideal replacement in places where steel cannot easily be produced or afforded.

IV. Local low cost material

1. Earth: Earth is the oldest building material known to mankind. Its use although is hindered due to the limitations like water penetration, erosion of walls at level by splashing of water from ground surfaces, termite attack and pests, high maintenance requirements etc. These limitations can however be tackled by using compressed earth block and non-erodible mud plaster.

i) Compressed Earth block: Compressed Earth Block: The compressed earth block is the developed form of moulded earth block, more commonly known as the adobe block. This technology offers an economic, environment friendly masonry. The stabilized earth blocks are manufactured by putting together and compacting raw material earth in tandem with a stabilizer such as cement or lime using manual soil compaction.

ii) Non erodible mud plaster: A new technique and infact an economical but effective process has been developed by Central Building Research Institute, India to protect mud walls by applying non-erodible mud plaster. Non-erodible mud is prepared by mixing Bitumen & Kerosene oil mixture, which is called bitumen cutback, with a specified mud plaster. These non-erodible mud plastered walls are specifically resistant to water erosion. Centre for Science for Villages, Wardha, India has developed a technique of providing potter made tile lining to mud-walls protecting them from rain and moisture.
2. Gypsum: The Gypsum deposits occur in areas of Ramban and Assar in Distt. Doda of J&K State. It is situated at 30 K.M. from Batote on N.H.-18 and there is another huge gypsum reserves from Parlanka area in Distt. Ramban. Both of these areas are at strategically important locations and can serve the building material to whole state at very low costs. This will bring down the rates of construction throughout the state. It can lower the prices of various further construction materials which require gypsum for production. Following are certain uses of gypsum:

- Making Plaster of Paris;
- Making of cement;
- Manufacture of gypsum boards; and
- Land re-conditioning.

V. Low cost architecture

Architecture being specific to particular places has a wide role to play when it comes to the adaptability owing to a particular place. This includes the affordability of the local architecture. Since most of the forms of architecture are derived from local materials which are most of the times available locally, speculations grow that if the material is available in abundance the cost of construction can be reduced considerably. Let us discuss some of the forms of architecture which are suited to low cost construction.

1. Gujjar Houses in Upper Reaches: Gujjars are an ethnic tribe who are basically nomads in nature. Their residences generally comprise mud houses with logs for roofing. But there is a specific and very unique architecture which certain gujjars follow. There is a place named Bangus Mawer in the district Kupwara of Kashmir. Here the gujjar houses are very unique in architecture as well as construction. Here the houses are made solely of wood with wooden columns and beams. So the frame as well as filling of walls and other spaces including the floor and roof are purely made of wood. But this leads to a concern. Wood is rare now a day and there is strict restriction on the use of wood imposed by the government. Hence if a probable modification is made in this form of architecture wherein the use of wood is minimized and a more easily available and cheap filling material is used in place of wooden planks to line the outer walls and inner boundaries. The load of the structure is completely taken by the beams and columns which are traditionally made from wood. These structures are skillfully made in such a way that these can comfortably withstand all the load of the superstructure. The real issue is that of the filling material. Now if the frame is filled with fly ash blocks, it serves many purposes.

   i) The fly ash blocks are now a days cheaply and widely available and can be procured at low costs so as to reduce the cost of whole of the structure.

   ii) These are light in weight and do not impose any extra load on the frame supporting the structure.

   iii) These have large volume and hence per feet cost of construction is greatly reduced compared to traditional brick.
iv) Because of big size these can be installed with great speed.
v) Because of being porous in nature these align greatly with any adhesive material including concrete glue which binds them to a great perfection.
vi) These can be lined with a wide range of materials including composite plasters other than cement mortar.

vii) This technique is different from conventional fly ash block construction because it doesn’t involve any concrete beams and columns and the use of steel reinforcements which get the construction prices sky rocketing.

Hence this form of architecture can be readily used in almost all cold places where previously wooden planks and logs were used to construct houses which incurred heavy prices.

2. Dhajji Style Housing: Dhajji style architecture was previously very common in some parts of the state. The key to this architecture was again the use of wooden logs of the width of wall at various levels say lintel level, sill level and also overall framing. The rest of the wall was constructed traditionally with raw bricks with mud mortar and the combination lined well with each other to form a structure which involved no cement mortar, steel reinforcements, concrete beams and columns etc.

This was the key to reduced price in constructing the houses. This style of architecture can be subjected to a surge but in rural areas as in urban centres people will seldom turn to this architecture owing to reduced strength in comparison to concrete structures.

VI. Summary and conclusion

Localized Low Cost Housing Techniques in Jammu and Kashmir is an extensive study of various techniques and materials whose implementation results in minimized cost of construction in both rural and urban areas. The study gives an insight into various studies done till now which come handy in understanding the local needs and specifications required in order to implement various low cost techniques in varied terrains of Jammu And Kashmir State. It further discusses the pattern in two broad ways. The first being the various techniques which simply refer to the ways in which the things can go slightly different so as to make a big difference in the aftermath. In other words it refers to procedural changes which are slightly varied from the conventional procedures but make a big difference in turn when it comes to the expenses incurred thereby considerably reducing the cost of construction. These techniques have been discussed in detail and almost all the phases of construction have been discussed. These include foundation, plinth, beams and columns, doors and windows, walling and roofing. Under these headings the techniques have been discussed as to how can the expenditure be minimized at every such step. Further, the materials for construction have been discussed. It includes the conventional as well as non conventional materials which have been arranges as natural and manmade materials which can be used so as to replace the traditional modes of material usage or the material altogether in order to reduce and minimize the cost of construction incurred.
VII. References

