KASHMIRI ARCHITECTURE AND NEW CHALLENGES

Mohd Akeeb Dar, Rameez Raja Malik

Abstract— **Kashmir is a seismically active area, and earthquakes big and small will continue to occur. It is not possible to predict when and where an earthquake will strike, nor its intensity. It is therefore hoped that this research will be useful to engineers, architects, contractors, masons and people who may be planning to retrofit existing houses and public buildings to reduce their vulnerability to future earthquakes. Furthermore, at this stage of housing rehabilitation in the areas affected by the 2005 earthquake, newly built houses which do not conform to the code requirements for earthquake safety could be made less vulnerable to future earthquakes by applying IS CODES and retrofitting measures. As has been observed in other earthquakes, people are unable to assess the root causes of earthquake destruction. The 2005 earthquake shook the confidence of many Kashmiris in local building materials, and even in the techniques they had been using to build houses for centuries. The immediate reaction has been a strong desire to abandon traditional architecture and building systems and adopt cement- and steel based construction, without understanding the long-term consequences as well as the viability of such introduced systems in the local context. Until very recently, non-local materials did not represent a valid option for local constructions. They were expensive, and their use added logistical complications to the construction process. However, in recent times new materials have made their way into the valleys of Kashmir on account of their favorable economics as well as people's aspiration to modernity. This paper lays general guide lines that would help us in overcoming the new challenges that are posed by new construction materials.**

***Index Terms*— Constructions, Rural Kashmir, building materials, architects.**

I. INTRODUCTION

A. Constructions in Rural Kashmir

Rural buildings constructed in a traditional way by the people often referred to as vernacular buildings become an integral part of the local cultural heritage. These buildings often reflect the strength of the community to house itself independent of any outside intervention. They are a manifestation of architectural systems optimized over time for a particular context with regard to climate, soil or the threat of natural disasters. Constructed from local materials with local skills and a deep understanding of local social and economic constraints, traditional architecture is in many aspects sustainable architecture**. Rural buildings in Kashmir are generally made by the people for their own use without the help of architects. The various forms of construction have evolved over time with the input of each generation of artisans. Traditional rural buildings use locally available materials and skills.** Traditional architecture in many places continues to evolve ,and Kashmiri rural architecture is no exception. A number of building systems in various parts of Kashmir have developed over time to accommodate local natural and cultural factors, including the impact of earthquakes. These systems are not only part of the cultural heritage of Kashmir but also add to its beautiful landscape. Historically, the buildings have depended completely upon stone, mud, bricks and wood for roofing as well as walling. The valley has soil that is most suitable to make bricks, baked or unbaked. The mountains, on the other hand, offer very little soil but have lots of stone and rock. When people in the hills consider switching from stone to brick, these economic factors become very relevant. Wintercold is the most common natural factor governing most of Kashmir. Thick walls of brick and stone with mud plaster provide excellent protection against this, as does a thick mud-timber roof .Historically,the flat roof has been the most popular on account of low snowfall. Even today, this type of roof is visible in plenty along the Jammu-Srinagar route as well as in many parts of Poonch area. However, the escalating cost of timber along with the easy availability of CGI sheeting has made the latter the most popular roof. The lighter, pitched roof made of timber and CGI sheets in combination with the attic floor also ensures livable conditions inside the house in winter and summer. The steep pitch of the light roof permits little accumulation of snow and prevents any water leakages

II. CONSTRUCTIONS IN URBAN KASHMIR

The urban areas of the Valley have architecture that is distinct from all other areas. The main factor determining this architecture is the high density of development. This calls for vertical growth, resulting into three to four-storey structures. The two most common walling systems observed are (i) Dhajji type,with timber frame and infill consisting of baked or unbaked bricks, and (ii) Taaq type ("Taaq" means window), consisting of brick masonry interlaced with heavy timber bands supported on large masonry piers made of baked bricks. The timber frames in the Dhajji walls are generally well laid out with a system of diagonal bracings that provide a distinct path to the ground for the stresses caused by lateral seismic forces. Inaddition, the walls are lightweight and hence have less mass and less lateral seismic loads. Thus this type of wall is able to withstand ground settlement and major earthquakes without suffering much damage.The Taaq type of construction has a large number of windows one in each gap between the piers. Structures with Dhajji walls, as well as those with the Taaq system of construction, are known to resist earthquake forces effectively. Hence, old structures that have withstood many quakes are still standing.The wood

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Mohd Akeeb Dar is a civil engineering student of Islamic University of Science and Technology Awantipora Kashmir.

Rameez Raja Malik is a civil engineering Student of Islamic University of Science and Technology

shingle roofing that was once used in most structures has been replaced by the CGI sheeting on account of economics and availability.

Fig. 1. Dhajji wall with baked bricks

Fig. 2 Taaq type construction

III. New Challenges and How to Overcome Them

Until very recently, non-local materials did not represent a valid option for local constructions. They were expensive, and their use added logistical complications to the construction process. However, in recent times new materials have made their way into the valleys of Kashmir on account of their favorable economics as well as people's aspiration to modernity. Until the 1970s the most common building systems in Kashmir were brick or stone walls. Some of them timber framed, with timber and mud roofs. But as durable wood like Deodar became very expensive, corrugated galvanized iron (CGI) sheets came to replace wood planks and shingles. In areas where it is easy to transport these sheets, the change has been so far-reaching that CGI sheeting now constitutes the most common form of roofing in the region. Even in areas where just twenty years ago houses were mainly built with flat mud roofs, CGI sheets have become the predominant roofing material. Apart from this, the reinforced concrete (RC) slab is gradually replacing the timber floor and load bearing masonry walls are replacing the timber framing. Again, changing economic forces as well as people's aspirations to a more contemporary lifestyle are encouraging such changes. Architecture constantly adapts to suit the changing context so that it can best meet the common person's needs. There is, however, a risk that new materials and construction methods imported from outside may be introduced at a speed that does not allow for the traditional way of testing novelties over time and adapting them to the local situation. Furthermore, the social, climatic, economic and technical impacts of new interventions are often not fully understood, and this may have negative effects on people's lives. These impacts include the reaction of buildings to earthquakes and other natural disasters. RCC, for example, is a material that requires a high level of engineering, but the people who use this material often know little about this. This is why, in many cases, new materials and techniques applied in an unprofessional way will threaten the safety of buildings and the people who live in them. Some general guide lines that would help us in overcoming the new challenges that are posed by new construction materials are :

1. As far as reinforced cement concrete is concerned it should not be used without the guidance of Civil engineers and concrete technologists because they are fully aware with the codes like IS:456-2000 that prescribe how to use it economically and scientifically.

2. Steel construction should also not be allowed without making use of steel code of practice IS:800-200

3. For unreinforced masonry structures Code IS:1905-1987 should be adopted. This code gives recommendations for structural design aspect of unreinforced load bearing and non load bearing walls , constructed with solid or perforated burnt clay bricks ,sand lime bricks ,stone concrete blocks .

4. It has been endeavoured to ensure that by making use of IS 1893-2002, structures should be able to respond ,without structural damage to moderate intensity earthquakes and without total collapse to shocks of high intensity earthquakes .

5. There are simple ways to reduce the vulnerability of surviving buildings through a process known as retrofitting. This technique can be applied to buildings that appear to be severely damaged on account of delamination or collapse of their masonry walls, but whose roofs are completely intact and in place. In the absence of an awareness of the retrofitting option, most house owners will dismantle these houses at great cost and try to rebuild, usually at an even higher cost. This entails a huge and irrecoverable economic loss for the area, while people may end up with houses that are smaller and quite possibly unsafe.

Fig. 3 One of the structures in Kashmir where Retrofitting work was in progress by making use of IS 1893-2002

6. Unsymmetrical buildings are more prone to damage during earthquakes. Any type of discontinuity or unsymmetry obstracts the load transfer and hence should be avoided.

Incase of such existing buildings,following techniques may be used for making them symmetrical

- By separating the parts of the building so that separated parts are symmetrical
- Inserting new walls, may be of masonry or RCC and connecting it properly to the old walls.

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Mohd Akeeb Dar is a civil engineering student of Islamic University of Science and Technology Awantipora Kashmir. Achievements : was declared winner in the civil engineering exhibition for modeling Cable and Suspension Bridge ,Has been the author of paper Fly Ash Concrete – A comparative Study

Rameez Raja Malik is a civil engineering Student of Islamic University of Science and Technology . Achievements : Indepth knowledge of civil engineering software like AutoCadd, Stadd etc, Has been the co-author of the paper Fly Ash Concrete –A comparative Study