CHAPTER 5

Post-Earthquake Urban Reconstruction

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The devastating earthquake of April 25 2015 destroyed World Heritage sites in Kathmandu, Bhaktapur and Lalitpur, including the iconic Dharahara and historic Kasthamandap. It flattened traditional Newari settlements in Bungamati, Sankhu and Khokana and partially damaged others. Many neighborhoods of Kathmandu, Lalitpur and Bhaktapur were severely affected forcing people to take shelter in open spaces and streets. The Valley lost most in cultural heritage, traditional settlements and government buildings. Many villages were abandoned and the villagers were relocated to nearby spaces. People from some of the villages in Rasuwa, Nuwakot and Sindhupalchowk even shifted to Kathmandu and stayed in temporary camps for several months.

The earthquake and the hundreds of aftershocks created panic among the people living in densely populated areas of Kathmandu Valley. It was then that they felt the dire need for public spaces—for emergency shelter. They also realized how vulnerable they were to such acts of nature even if they were living in strong buildings. Fortunately, damages to hospitals, government buildings (except the historic Singha Durbar) and supermarkets were not significant. Similarly, basic services like electricity, water supply and telephone remained uninterrupted. The early recovery process started quicker than anticipated and life mostly resumed normally after a week.

Nepal Engineers' Association mobilized more than 3,000 engineers to conduct Rapid Visual Assessment of private houses, while Department of Urban Development and Building Construction (DUDBC) conducted a similar exercise for government and public buildings. Engineers, architects, geologists and environmentalists from many countries gathered in Nepal to observe and analyse the causes, effects and extent of the damage. A series of workshops, seminars and interactions were held by government agencies, universities and communities on the subject. The nature of damage and its probable causes were discussed, and temporary shelter and rehabilitation plans were formulated.

The government ordered concerned agencies to review the building code and propose safer building designs to suit different climatic conditions. Information on fully and partially damaged buildings was collected through Central Bureau of Statistics (CBS). Exhibitions of innovative designs of temporary shelters were organized to motivate people to construct temporary shelters that could last up to two years.

National Reconstruction Authority (NRA)—the government's coordinating agency for reconstruction—developed and approved designs of safer houses and formulated policies for resettlement of villages from vulnerable locations.

The government also formulated building construction and settlement development guidelines for reconstruction of earthquake affected areas. This guideline was meant to be implemented by village and municipal councils. Trainings were organized for engineers/architects, masons and craftsmen to orient them to the guideline. Further, the process of verification of earthquake victims in Kathmandu Valley started one year after it was completed in 11 districts outside Kathmandu Valley.

As per the Post Disaster Need Assessment (PDNA) document, published by the National Planning Commission, the earthquake completely destroyed 446 health facilities including five hospitals. Similarly, 19,000 classrooms of 7,923 schools were completely destroyed and 11,000 damaged. Altogether 2,656 government buildings were destroyed and 3,622 damaged.

When reconstruction began, the delays in taking up the heritage sites became conspicuous. However, there were multiple reasons for that—such as uncertainties of funds committed by donors, overlapping roles and responsibilities of government agencies and grievances of local communities.

Resilient urban community

One of the objectives of post-earthquake reconstruction is to build resilient communities. To achieve that, the following steps were considered important by Nepali authorities:

Institutional arrangement

Different government entities have been handed with responsibilities to overlook reconstruction works. DUDBC is entrusted with the design and construction of hospital buildings, whereas the hospital management is responsible for the maintenance works. DUDBC designs comply with the National Building Codes and the Guidelines for Hospital Construction formulated by the Ministry of Health. Nepal Army is also constructing its own hospitals damaged during the earthquake. DUDBC is not involved in the design and construction of army and police hospitals.

Ministry of Education through its Central Level Project Implementation Unit (CLPIU) is responsible for the reconstruction of schools, district education offices and other educational buildings. Multilateral donors have provided financial and technical assistance. CLPIU has delegated authority to District Level Project Implementation Units (DLPIU), based in district education offices, to supervise the reconstruction works of community schools.

NRA's CLPIU based in Ministry of Urban Development is responsible for the reconstruction of private houses and government buildings including public heritage buildings, such as, President's Residence, Nepal Rastra Bank's offices, Singha Durbar etc. There are several issues related to reconstruction of private houses, but the reconstruction of government buildings is proceeding according to approved plans and programmes. The issue related to their construction of the Singha Durbar façade took almost two years to get resolved. Experts and authorities were divided over whether to reconstruct it after demolition or just retrofit it, finally they decided to retrofit the façade.

The CLPIU based at the Department of Archaeology, under Ministry of Culture, Tourism and Civil Aviation, is responsible for the reconstruction of heritage sites and settlements. It also coordinates the reconstruction of temples, shrines and religious sites undertaken by municipalities, donor agencies and local communities.

Box 5.1

Enactment of basic bylaws to guide post-earthquake reconstruction

The government approved "Settlement Development, Urban Development and Building Construction Basic Bylaws, 2015 on 30 September 2015 to assist local bodies like village development committees and municipalities in the rehabilitation and reconstruction of affected settlements. It had directed Ministry of Urban Development (MOUD) and Ministry of Federal Affairs and Local Development (MoFALD) to draft the bylaws. They include the following provisions:

- Provision of Central Monitoring Committee chaired by Secretary of MOUD
- Requirement of human resources at the local government level
- Provision for building design and construction supervision
- Demolition of illegal structures within the Right of Way (ROW) of roads
- Provision of open spaces
- Regulating existing structures which have not received completion certificates
- Provision of land-use planning
- Prohibition of reduction of ROW and public land while updating cadastral maps
- Planning and building construction basic bylaws
- Necessary norms and standards for development of safer settlement.

The new bylaw has separate sections on urban planning and construction of buildings. In the urban planning section, there are provisions determining the minimum width of the access road and ownership of common spaces. For example, out of the total land use, a minimum of 15 per cent land has to be allocated for roads and five per cent for open spaces. Conversion of residential buildings into commercial ones has been restricted. Any commercial activities in a residential building render it commercial.

Seventy per cent of plots up to 250 sq m can be covered by buildings. For plots above 250 sq m the coverage is limited to 60 per cent. For government and public buildings, the ground coverage has been limited to 50 per cent. Encroachment of existing access roads, irrigation canals and public lands has been restricted.

For safer settlements, a geological survey is required for preparing Engineering and Geological Maps of settlement areas. Where there are no such maps, the norms and standards prepared by Department of Mines and Geology shall be followed. Normally, areas with less than 30-degree slope are seen to be fit for settlement development. If the gradient is more than 30 degrees, experts shall be consulted for any settlement development to proceed.

There is a provision for conservation of local architecture, traditions, livelihood and basic services. Similarly, the bylaws have envisioned capacity building of the community for disaster risk reduction. It has also empowered the local governments to formulate planning and building bylaws to suit their local context.

In the building construction section, there is a provision of minimum set back of 1.5 m for building up to 10 m height whereas minimum set back of 3 m is fixed for buildings with height above 10 m and below 17 m. For buildings with more than 17m height the minimum set back is fixed as 5 m.

The height of the boundary wall should not exceed 1.2 m masonry and 0.6 m high wire mesh.

Since FY 2016/17, only trained masons are allowed to take up building construction works. The government will facilitate training for masons at appropriate locations.

Restrictions have been placed on the erection of hoarding boards on roadside buildings. Similarly, there are restrictions on incomplete buildings as well as buildings without plaster and paints.

Some new provisions in the bylaws are:

1. Provision of a central monitoring committee.
2. Restriction on building design for municipal engineers.
3. Third-party verification of public buildings.

4. Restrictions on the use of public land.
5. Regulation of illegal properties/structures.
6. Restriction on updating cadastral maps.
7. Restriction on the use of public buildings without a building completion certificate.
8. Land-use control by municipality.
9. 'Soil Investigation Guidelines' for all public and Class A buildings.
10. Provision of ROW for distinct categories of roads.
11. Employment of trained craftsmen in reconstruction works.
12. Aesthetic beauty of roadside buildings.
13. Emergency response plan for apartment buildings.

Issues and challenges in implementation of bylaws

There are two challenges for the effective implementation of regulations. The first is the perception of the public that regulations are imposed by the government arbitrarily, merely to create inconvenience for the people. The growing impunity in the society has encouraged violation of laws and regulations. People failed to understand the rationale behind the bylaws and its impact on public health and safety. They have not understood the importance of public spaces for normal life and for emergencies. The earthquake has shown that building safer houses is not adequate and open spaces are a must. Unless the community is safe, the residents are always vulnerable.

The second challenge is meeting the human resource crunch which has resulted in the low capacity of institutions. They suffer from inadequate/low budgetary and legal mandate. The municipalities are not in a position to cope with the growing urban challenges, particularly land fragmentation and haphazard constructions. The newly formed municipalities do not have the expertise to monitor urban development activities, nor can they prepare plans for future development on their own. Frequent changes in

staff and policies add to confusion among the staff as well as the people. However, after the local election, the elected representatives have shown commitment to post earthquake reconstruction.

There are several overlapping roles and responsibilities of local and central governments in Kathmandu Valley. The weak coordination among utility agencies–water, electricity, telephone and roads–is visible in ongoing urban infrastructure development projects. Different agencies have their own work schedules, obligations, guidelines and regulations determining their performance. As a result of this, there is frequent digging of roads for various purposes leaving the Valley dusty and muddy for extraordinarily long periods.

Culture of safety

One of the objectives of reconstruction and rehabilitation of damaged buildings and infrastructure is to develop the culture of safety. The principle of 'build back better' must be injected in the construction techniques and mind-set of construction workers, entrepreneurs and the common people. People should be informed about the possible mistakes in construction, remedial measures and new techniques.

Food Security, sanitation and hygiene

Food security is essential for creating a resilient urban community. For this, adequate stock of food has to be kept in government warehouses and private ones. Urban agriculture including terrace farming helps to fulfil part of the demand of food in urban areas besides reducing carbon emission.

Additionally, urban areas need reliable and adequate supply of safe drinking water and a working sanitation system with septic tanks and sewerage. Contingency water supply measures are necessary to tide over supply disruptions. In order to avoid epidemics, a separate contingency plan has to be prepared for drinking water and sanitation provisions.

Open spaces

Open spaces is an indispensable part of urban planning. The importance of open spaces became more pronounced in the aftermath of the earthquake and during the multiple aftershocks.

Traditional open spaces
Traditional Newari settlements of Kathmandu Valley were planned according to Vedic concepts. Residential buildings are laid out around courtyards which follow a hierarchy. Based on their size, they are named *nani, bahi, baha.* Similarly, in the Tarai plains, certain open spaces are allocated for cultural and religious activities. Such open spaces may include ponds and lakes too, for example, Bara Bigha Maidan and the system of ponds in Janakpurdham. In the Himalayas, the compact settlements of Mustang, Humla and Jumla are laid out around public open spaces linked by roads and alleys.

Open spaces in modern planning
In modern urban planning, land plotting is done by government agencies, like town development committees or municipalities, and private real estate entrepreneurs. Private land developers, who merely plot the land and sell them to buyers, hardly allocate plots as open spaces. Residents are reluctant to keep open spaces near their homes because of concerns of misuse by criminals or as garbage dumps. Today, there is a growing trend of encroachment vacant public spaces by communities to use them as playgrounds, police stations, local clubs, ward offices or religious constructions.

Marginal open spaces provided by housing developers
Of late, private housing development is being promoted by the government, especially in Kathmandu. In such development, housing plots are laid as per the road network. The mandatory four per cent open space requirement is generally fulfilled by allocating marginal and left-over land which cannot be sold as housing plots.

Such open spaces are usually not suitable to be properly used by women, children, the elderly and even for emergency shelter.

Perception of local clubs on the use of community open spaces
Existing open spaces in cities and towns are usually captured by local clubs to be used as playgrounds, vegetable markets or even as commercial spaces. Such clubs or individuals permit access to such land only for a certain class of people. The local clubs or their office bearers are known to benefit from the practice, while the community is deprived of its free use.

Government perception of vacant public land
Government agencies also encroach public land in the pretext of constructing office buildings, schools, temples, health posts etc. In the last two decades, a trend to capture public land has been growing, whether to construct trusts *(Pratisthan)*, parks *(Sahid Uddhyan)* or even renting out to businessmen.

Temporary encroachment of public land
Certain open spaces left by the community for ponds, temples and religious functions are being temporarily occupied by community organizations, clubs and individuals to store construction materials or organize fairs and vegetable markets, or use them as garbage processing areas and vehicle parking lots. Such spaces are always occupied and cannot be readily used for social and cultural gatherings.

There is also a trend of planting trees in all kinds of open spaces making them inaccessible to children, women and the elderly. The dense forest created in the neighbourhood attracts criminals and anti-social activities. Also, there is no distinction between public open space and public forest.

Heritage site protection

Kathmandu's heritage sites which suffered damage and destruction during the earthquake can be divided into three categories: world

Box 5.2

Community park at Nandikeshar Garden, Kathmandu

A chunk of land, about one hectare (19 ropani 3 ana precisely), was vacant for many years at the Nandikeshar Garden in Naxal, Kathmandu. It is believed to have been donated by late queen Subarna Prabha in 1856 to grow flowers for the temple there. The land belonged to Guthi Sansthan and remained abandoned. The place was used for parking vehicles and as a play area. Some wanted to construct a modern temple there. Guthi Sansthan had tried to lease the land to the private sector, but to no avail.

A local community-based organization called Community Service Centre, established 17 years ago and headed by Mr. Narendra Bahadur Shrestha, took the initiative to convert the space into a park. The centre approached the locals, banks, Nepal Police Headquarters, Kathmandu Valley Development Authority (KVDA) and Kathmandu Metropolitan City. It mobilized funds needed to clear the land and evacuate the encroachers. Later on, KVDA provided some funds for the construction of the park.

Today, the park has become a beautiful breathing space for everyone. It is being maintained by the local community. During the earthquake, it was used as an emergency shelter for many days. This is a brilliant example of how an encroached and poorly maintained space can be developed into a beautiful urban public space.

heritage, national heritage and local heritage. The world heritage sites include Bhaktapur, Patan and Kathmandu Durbar Squares, Pashupatinath, Changu Narayan, Swayambhunath and Baudhanath. Dharahara, Durbar High School, Trichandra College, Singha Durbar and the Rana palaces located in various parts of Kathmandu can be categorized as national heritage sites. Local heritage sites

include shrines, temples, monasteries and *gumbas* built by people and maintained by the community.

Since the international media focused more on the destruction of world renowned heritage sites, this gave a wrong impression to foreigners that all the world heritage sites of Kathmandu were destroyed. The media reports forced tourists to cancel their visits. The government quickly made a commendable decision to open the world heritage sites for tourists after undertaking some safety measures. The international community has shown concerns over delays in the reconstruction of heritage sites, but the government priority was on housing the earthquake victims.

Issues in heritage reconstruction

Despite being one of the prioritized areas, heritage reconstruction is marred by delays. The causes ranges from insufficient budget allocation to conflict between community and the authorities.

Conflicting role and responsibilities

There is ambiguity in the roles and responsibility of different agencies in the reconstruction works. In reconstruction of world heritage sites, donor countries like India and China have extended grant and loan support. The donors want to do everything on their own while the local government wants to be involved in the process. Citing their cultural rights, the local community, which comprises local *Guthi*–user committees, is also demanding their active participation. There is conflict between Kathmandu Metropolitan City (KMC) and the local community in the reconstruction of Kasthamandap. Similar conflict exists between KMC and Department of Archaeology in the reconstruction of historic Ranipokhari.

Funding

PDNA puts the total funding requirement for reconstruction of heritage sites at NPR 19.22 billion. Development partners, including neighbouring countries like India, China, and Sri

Lanka, have pledged support for reconstruction since the Government of Nepal alone cannot cover the costs. However, fund management and procedural hassles have delayed the start of the reconstruction works. Department of Archaeology has also reported inadequate allocation to cover all the projects under its jurisdiction.

Technology and technical guidelines

There is ongoing debate among experts, academicians, archaeologist and bureaucrats on whether the damaged structures should be retrofitted or completely reconstructed. The United Nations Educational, Scientific and Cultural Organization (UNESCO) guidelines have to be followed in the reconstruction works at World Heritage sites, whereas NRA's own guidelines have to be followed at all other sites, not to mention the Ancient Monument Act and Regulations.

Community participation

Since many temples and shrines belong to local communities, they feel that it is their right and responsibility to reconstruct it as per the traditional architectural norms. They are ready to raise funds and undertake the works themselves, but the local municipality and the Department of Archaeology have reservation in transferring the responsibility to them. They want to get involved as supervisors in government-led projects too. However, not all the community groups are organized nor all of them have the capacity to undertake such responsibility.

Supply of construction materials

Supply of construction materials like seasoned timber, special bricks and stones is a major issue in heritage reconstruction projects. Although there are some suppliers in Kathmandu Valley, the available stock is not adequate. There is a need for increasing the production of such materials to accelerate the speed of construction. For this, the government should facilitate industrialists and businessmen through fiscal incentives.

Box 5.3

Park at Bagmati-Manohara confluence in Sankhamul, Kathmandu

The local people had encroached on a piece of public land for their private use–cultivation, dairy farming and even housing in Sankhamul. Since the land was on the bank of Bagmati, it needed to be secured by separating it from private land. This was done by building a road to separate the narrow strip of public land and widening the strip by building a retaining wall as an embankment on the river. A sizeable plot was thus created. This work was undertaken by High Powered Committee on Integrated Development of Bagmati Civilization (HPCIDBC). It laid interceptor sewers, constructed the retaining walls and the two lane road as part of Bagmati Area Improvement Programme. HPCIDBC, with support from Bagmati Cleaning Campaign, solicited proposals from the local community to build and maintain a park there. A local NGO named Art of Living offered to take up the responsibility. Art of Living mobilized a business group to provide technical and financial support for the purpose.

Today, the park is open for the public and has been a good place for children and the elderly. It has enhanced the aesthetic beauty of the place and changed the local environment completely.

Rehabilitation of traditional settlements

The NRA has given high priority in the reconstruction and rehabilitation of traditional settlements like Sankhu, Khokana, Bungamati, Dolakha and Nuwakot. In addition to conserving local art and architecture, these historic settlements have a potential to attract tourists. The restored Newari settlement of Bandipur is a good example of conservation and development of old settlements, which could be replicated elsewhere during reconstruction. Since traditional construction methods are costly, house

owners are forced to go for modern reenforced cement and concrete construction methods. The local residents need to be educated on the importance of tradition and they need technical support as well as be provided with soft loans and subsidy for rebuilding.

Reviving core area of Kathmandu

Kathmandu's core area was severely damaged at a time when the trend of demolishing traditional houses and constructing concrete buildings was speeding up. Existing open spaces, courtyards and alleys are gradually diminishing and the whole Newari civilization is under threat. The threat is visible not only in the tangible heritage but also intangible ones like festivals, *Jatras*, dance and music. The skyline of the core area of Kathmandu is changing due to violation of the height restriction on buildings. Intervention is needed at this stage to encourage reconstruction using traditional architecture, improvement of public spaces and courtyards and rehabilitation of water spouts and temples. This could boost local businesses and promote tourism and recreational activities. In a way, the earthquake has given this historic opportunity to revitalize the core area of Kathmandu. If the present generation fails to seize this opportunity, the culture, art and architecture will be gradually lost. The Newar community will be displaced and the place will lose its cultural and tourism value.

Complex land tenancy

Land tenure system is very complex in Kathmandu Valley, particularly in traditional Newari settlements. There is dual ownership of land with both landlords and tenants enjoying the benefits. Some land belongs to *Guthi* (trusts). The trusts may be public or private. The occupants of *Guthi* land pay their land revenue to Guthi Sansthan whereas those residing on private land pay the tax to their municipality. In dense areas, multiple families stay in the same building sharing the land, the stair-

case and the lobby. Meanwhile, the authorities provide separate house ownership certificates to each household. In many cases, there is controversy over the ownership of public spaces such as courtyards, playgrounds and marginal land. In Kathmandu Valley, conflicting tenancy issues among central government, local government and local community have led to delays in development works.

Framework for urban planning for disaster preparedness

Disaster preparedness and management has to be made an integral part of urban planning if casualties and destructions are to be minimized in the cases of disasters.

Efficient road network

Road networks play a critical role when disaster strikes. The network should be usable for mass evacuation and relief operations. Any road network consists of a hierarchy of alleys, single lanes, double lanes, four lanes, six lanes etc. Dead-end streets and single lane streets, without alternative parallel roads, are dangerous during disasters. Intersections need proper planning to avoid congestion during disasters. Many streets in Kathmandu Valley and elsewhere have dead-ends, which get blocked if a building along the street collapses, thus turning into traps for those on the other side of the blockade. An efficient road network allows smooth flow of passenger vehicles, ensures quick delivery of essential commodities, reduces cost of utilities like water, sewerage and garbage systems and guarantees uninterrupted access by emergency vehicles. In planned cities, roads generally occupy 20-25 per cent of land-use.

Earthquake resistant housing and buildings

It is the weak buildings that kill people, not the earthquake. Hence, reconstruction should result in earthquake resistant buildings.

The National Building Code categorizes buildings into four types- State of the Art Buildings, Professionally Engineered Buildings, Buildings Constructed with Mandatory Rule of Thumb and Low Strength Masonry buildings for rural areas. Whereas the design and construction of new buildings should comply with the code, partially damaged buildings can be merely repaired or retrofitted. Public buildings—whether privately-owned or owned by government—have to be constructed without compromising on the requirements of the building code. Community buildings such as schools, hospitals have to be retrofitted for them to withstand disasters. School buildings could even function as emergency shelters during disasters.

Emergency shelters and open spaces

To cater to the enormous number of people leaving their homes for safer shelter during disasters, the existing schools and community buildings may not be adequate to accommodate all. During the last earthquake, there was a high demand for temporary shelters. Emergency shelters should be constructed in each neighbourhood. Under normal circumstances, such shelters can function as party venues, indoor sports halls or community halls. Each neighbourhood or *tole* requires at least one community hall.

Open spaces are an essential part of urban planning. Open spaces also have a certain hierarchy-cluster or block level, neighbourhood level, sector level and city level spaces. Open spaces not only provide shelter during disasters but also a breathing space for residents and work as venues for social, cultural and political events. In a planned city four to five per cent of the total land use is allocated for open spaces. Open spaces must be accessible to all and cannot be occupied by any organization or group of people.

Firefighting system

Fire brigade is necessary not only during natural disasters but also during manmade disasters as fire risks are high at such moments.

Box 5.4

Reconstruction of Pilachhen, Lalitpur

Pilachhen is a Jyapu neighbourhood at Ward 7 of Lalitpur Metropolitan City. It has rich culture and architecture and is full of heritage sites. During the earthquake, 82 houses were destroyed. The Jyapu community got itself organized and launched Pilachhen Reconstruction and Tourism Project. Maya Foundation headed by Mr. Ramesh Maharjan, a well-known diamond businessman, raised funds from local philanthropists for the reconstruction of the damaged buildings. CE Construction, a reputed construction company, provided technical support by preparing the designs and supervising the construction.

The buildings are designed in such a way as to use the ground floor for shops, first floor for home stay tourism and the second and third floors for private residence. Lalitpur Metropolitan City has approved the drawings and has waived the building permit fee. A financing scheme was developed with the consent of the house owners. The total cost of the project is NPR 460 million. Maya Foundation has provided two and a half million rupees, renowned eye specialist Dr. Sanduk Ruit has given NPR 40 million and the community has agreed to donate labour and kind equivalent to 25 percent of the cost. Similarly, 25 percent shall be borne by the households themselves and the remaining 25 percent covered through a soft loan (teo per cent interest) from commercial banks. The local community will volunteer for the construction of their own houses. If the manpower is not sufficient, extra craftsmen and labourers will also be engaged.

The expected outputs of the project are: reconstruction of houses on the existing footprint with vernacular architecture and rehabilitation of existing courtyards, alleys and temples. Pilachhen Project can be a model for post-earthquake reconstruction of the heritage settlements.

In dense urban areas, fire can wipe out an entire community within hours. The deployment of fire engines at convenient locations should be given utmost priority. Fire hydrants must be installed at water mains at convenient locations.

Hospitals

Hospitals play a critical role in treating the injured and managing dead bodies. They are under tremendous pressure, regarding space, manpower and logistics, during events leading to mass casualties. All hospitals, both private and government, should prepare their disaster management plan and train their staff accordingly. Regular fire and earthquake drills keep the management on their toes to cope with such eventualities.

Policy recommendations

Building resilient community requires concerted efforts from all sides. Disasters, although painful, do provide and opportunity to implement necessary measures by building-back-better.

Identification of open spaces

Existing open spaces in cities should be identified and recorded in the inventory. Such spaces may be:

- Privately owned: such as agriculture land, backyards, parking lots
- Owned by private organizations: such as driving courses, golf courses, play grounds
- Owned by government organizations: office premises, agriculture farms, stadiums, school and campus premises.
- Owned by security agencies: Tundikhel, parade grounds,
- Owned by clubs: football and basketball grounds
- Owned by community: *bahal, bahi,* squares (*chowk*)

In order to meet the minimum standards of open spaces, local government should acquire private land/buildings. KVDA

has prepared an atlas of open spaces in Kathmandu and Lalitpur. However, such spaces are occupied by government and private organizations. A lot of public land in Nepal has been encroached by individuals, groups or clubs for renting out or building private structures. Such illegally occupied spaces must be cleared before going for acquisition or purchase of new land. Acquisition of land is a cumbersome process in Nepal and local governments alone cannot do it by themselves. The district administration should support the local government in the land acquisition process including fixing of compensation amounts. They are also responsible for providing security during demolition of illegal structures and site clearance. The design of the open space should be made inclusive so that children, women and senior citizens can enjoy it.

Demonstration model of reconstruction of heritage settlements

The historic settlements of Bungamati, Khokana, Sankhu, Dolakha and Nuwakot should be rebuilt to their original architecture and planning, but with improved construction technology. Those settlements need to be reconstructed to accommodate existing households as well as new room for tourists, shopkeepers and businessmen. The ground floor of the buildings should be allocated for shops and upper floors for residential purposes. Roads, alleys, courtyards and temples should be renovated and improved to create a better living environment. The reconstruction of such settlements should lead to tourism development and improve the livelihood of the residents. Public pressure to use modern concrete technology in the reconstruction of traditional buildings should be tackled by politicians and experts by convincing people on the value that aesthetic beauty provides. Old structures were continuously repaired, maintained and even reconstructed by past generations, allowing the transfer of skill and technology to newer generations. This is how any tradition is preserved. However, if the current generation decides to break with the tradition and adopt the concrete technology (which lasts only for 50-60 years), the transfer of the

unique traditional technology will come to a halt with unforeseen socio-economic consequences.

House pooling for core area of Kathmandu

The concept of house pooling has been developed in many countries where traditional houses are dilapidated and unfit for living. The core areas of Kathmandu, Lalitpur and Bhaktapur are culturally very rich but threatened due to commercial activities. The vertical fragmentation of houses leads to narrow buildings with separate lobby and staircases but very narrow rooms. Most of the original house owners have already left such places after renting them out to outsiders. This has resulted in the encroachment of adjacent courtyards and destruction of cultural heritage–both tangible and intangible. The challenge, now, is to:

- build earthquake resistant, modern houses for residential and commercial activities but retaining traditional façade and elements
- integrate the narrow vertical houses into horizontal flats with more space than before
- improve courtyards and public spaces
- renovate temples, wells, stone spouts
- promote sustainable tourism and business activities such as restaurants, cafes, handicraft shops etc.

The existing building code and legal framework allow house pooling in designated areas. However, since this is a new concept for us (similar to land pooling 30 years ago), social acceptance is an issue. The community will accept it if they see tangible benefits.

Water supply, sanitation and hygiene (WASH)

Safe drinking water and sanitation are essential for public health and it holds the key to avoiding epidemics during disaster. Contingency plans should be prepared to deal with emergencies, e.g. tube wells, rapid water treatment facilities, mobile toilets and excreta treatment technology.

Build back better

The main principle of post disaster reconstruction is building better. It means rehabilitating and reconstructing the damaged structure so that it is stronger than before. In rural areas, where houses are constructed with stone, timber and mud, the salvaged materials can be used, but the construction technology should be improved to make it more disaster resilient. This may include provision of horizontal ties on the masonry wall, vertical reinforcement and better anchorage between wall and roof. Innovative building materials and techniques can also be used and this can be replicated in other parts of the country.

While choosing technology for reconstruction in the rural areas, one should not forget that industrial materials are not sustainable in the long run. Indigenous materials and technology gets handed over from one generation to another and keeps the community well aware of the issues involved. Moreover, it ensures preservation of local architecture and culture.

Resettlement of disaster affected communities

Preliminary investigation has identified 475 settlements vulnerable to earthquakes. NRA has studied 116 of them out of which 56 need to be relocated. Relocation consists of land acquisition, provision of basic services, land subdivision, allocation of housing plots and construction of community buildings like health centres, schools and private houses. The relocated community must be disaster resilient and prosperous. Political meddling and social conflicts are posing a serious challenge for smooth implementation of the relocation projects.

Individual versus community

The overarching objective of the reconstruction and rehabilitation policy is building safer, sustainable, resilient and inclusive community. For this, the whole planning process should revolve around

community development rather than earthquake resistant building construction. The earthquake of 2015 has taught everyone a strong lesson that the community is more important than individual property. While planning for a resilient community, there should be a balance between private space and public space. A new culture of thinking, planning and development at the community level should be put in place so that individuals start thinking about how to make the community safer rather than just making their individual houses safer.

Revitalizing Kathmandu, Lalitpur and Bhaktapur

For the core areas of Kathmandu Valley, reconstruction is an opportunity to build safer houses while maintaining the traditional architecture, improving public courtyards, roads and alleys, and carrying out repair and maintenance of temples, shrines and public utilities. To exploit the opportunity, the community, municipality and NRA must come together to prepare workable manuals and guidelines. Before building the entire city core, piloting should be done first involving one of the smaller courtyards. The pilot project would contribute to developing guidelines, manuals and procedures.

Apt opportunity for review

Post-earthquake reconstruction and rehabilitation is an opportunity to build safer communities rather than safer houses or buildings. In physical terms, a typical community in Nepal consists of private houses, public buildings, government buildings, roads, parking lots, open spaces and public spaces. The community needs schools, playgrounds, places of worship, safe water supply, streetlights and police stations. Reconstruction is an opportunity to create new resilient urban communities and to improve existing communities. It is an opportunity not only to recover from the earthquake but also to be prepared for the next disaster. Since the first response to disaster takes place at the community level, it should have a workable disaster management plan to be implemented by a responsible di-

saster response team. Better planning and preparation at the community level results in less damage, quick recovery and early rehabilitation. Existing urban development plans should be reviewed to ensure adequate public spaces at different levels- block, ward and city. Public spaces should be adequate, easily accessible and safe. ■

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