

# Implementation of Nepal National Building Code Through Automated Building Permit System



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## **Background**

Electronic - Building Permit System (E-BPS), the automation of a building permit system, is a project initiated by UNDP's Comprehensive Disaster Risk Management Program (CDRMP). CDRMP aims, inter alia, to provide support in the effective implementation of Nepal National Building Code (NBC) in the building permit process of municipalities in Nepal. E - BPS is an automated system by which provisions of code and by-laws are integrated into the process. It also provides basic database of the total building stock of the municipalities and analyzes the seismic vulnerabilities of the built area. In addition, it enhances the municipal governance system by facilitating the accountability and transparency factors during service delivery.

## **Context**

Nepal's National Building Code (NBC) was formulated in 1994. After almost 20 years of its existence, the actual implementation still remains a critical issue. In Nepal, municipalities are the

responsible agencies to issue building permits. The current municipal building permit process does not ensure the compliance of NBC. Only 3 out of 58 municipalities in Nepal have tried to incorporate NBC into their building permit process; but these attempts have been too limited and lack the necessary verification to ensure compliance.

These three municipalities are Kathmandu and Lalitpur in the capital region and Dharan which is in the far eastern region of Nepal. However, Dharan Municipality has limited enforcement of NBC compliance to the pre-engineered design category such as Mandatory Rules of Thumb (MRT).

The de facto building permits process in Kathmandu and Lalitpur is very superficial and subjective even though both municipalities enforce NBC compliance in theory. Few generalized checklists have been developed and the questionnaires in checklists are overlooked and easily manipulated. There is no effective mechanism for field verification of approved



drawings. Even the concerned authorities of Kathmandu Metropolitan City (KMC) and Lalitpur Sub-Metropolitan City (LSMC) realize that they have ineffective code compliance tools in their building permit system. Such a haphazard implementation of NBC in Kathmandu is dampening any effort and/or enthusiasm of the rest of the municipalities to emulate the Capital City's building permit system.

After many intensive discussions with municipal officials, it was reported that compliance enforcement is ineffective mainly because of the high workload and limited number of trained professionals. The tracking system of building permit processing is also inefficient. Often permit application documents under certification process are lost and manipulated. The documents are found to be replaced with new ones which have been manipulated to conform to the NBC code compliance rules. In order to overcome this malpractice, an effective governance system which can ensure transparency and accountability of the system in each stage of process is required.

The database management of building stock inventory in KMC and LSMC is weak. There is no exposure data of existing buildings within KMC and LSMC regions. Hence, it is very difficult to calculate the underlying risk factors in more than 200,000 existing buildings within these cities. In addition, vulnerability in the Kathmandu valley is rising each day with every new building permit being issued which is not NBC compliant. Hence, it is imperative to establish a system which can not only assess the resilience of new buildings but also handle the archival of old building permit folders. This will eventually assist in identifying the underlying vulnerability factors.

All these factors necessitated to design an automated system - Electronic Building Permit System - which can systematically handle the complexities of building code compliance and building permit system for both new buildings as well as old building stocks. The sole aim of the automated system is to effectively

implement the NBC and Building By-Laws (BBL) to promote safe building construction practices and planned urban development in the national capital of Nepal - mainly Kathmandu and Lalitpur municipalities.

### **General Objective**

The main objective of this project is to implement NBC through an automated building plan approval and monitoring system in the Kathmandu Metropolitan City and Lalitpur Sub-Metropolitan City.

Specific objectives:

The specific objectives of the activities are in the line of the following;

1. Develop a customized software system for managing a building permit system based on the NBC and Municipal BBL.
2. Digitize and archive the existing 15,000 building plans and drawings in both Kathmandu Metropolitan City (KMC) as well as Lalitpur Sub Metropolitan City (LSMC) areas.
3. Train KMC and LSMC staff members to implement NBC and their respective Municipal BBL through E-BPS, which will allow them to manage and process building permits and ensure their compliance within the NBC framework.
4. Identify and recommend suitable ICT systems and logistic requirements to KMC and LSMC to ensure business continuity.
5. Provide software implementation support to ensure a successful installation and a hassle free operational environment.

### **Current status**

As of now (end of September 2013) the development of the E-BPS system is completed. The system is being tested in KMC and LSMC by archiving the old building permit files. Further, LSMC has initiated testing

the system by processing the new building permit process simultaneously using both manual and automated process. While testing the system, the errors in the system were rectified and upgraded. At this stage, the system is being widely disseminated and suggestions from the stakeholders are processed and integrated. KMC and LSMC have planned to fully utilize the system from November 2013 onwards. Meanwhile, a series of capacity development activities about the system operation is being conducted in both the cities.

### **Methodology**

It is a daunting task to design a streamlined corresponding software architecture which will map an arbitrary and haphazard manual process and develop a simplified and rational flowchart.

An automated permit system has been developed through the efforts of a group of highly qualified professionals in their respective subject areas who have been in regular consultations with staff members in KMC, LSMC, Government officials and other private stakeholders.

The application architects have been able to develop crucial design data points like application processing events, building code compliance checking and a sense of building permit process management. They have mapped the random manual process to a systematic modular work desk based system.

Each module and work desk has been suggested by the respective working committee of each municipality. This has been further supported by a high level steering committee represented by the mayors and concerned high level authorities from concerned line ministries.

Since E-BPS is a unique, highly customized system, there are very few similar case studies. Literatures from similar building permit systems from Bangalore, India and Nairobi, Kenya have been reviewed. However, Nepal's

requirements are more specific to building code compliance and more suitable in local context for simplicity and sustainability.

### **Concept of E-BPS**

E-BPS is an application software system which has been developed to assist municipalities to improve their current building permit process. It does this by ensuring the effective compliance of the NBC and BBL in urban regions, thus promoting safe building practices and planned urban development for the entire nation. UNDP has currently planned to implement E-BPS at Kathmandu Metropolitan City (KMC) and Lalitpur Sub Metropolitan City (LSMC). E-BPS is a web-based application through which building permit applications are processed and current building records are maintained. This is an effective and efficient system to monitor and evaluate the current state of building constructions in a municipal area. E-BPS is a distributed system and will be implemented at both the municipal offices as well as their respective ward offices. The system allows citizens to submit as well as track their application(s) and its status respectively over the internet.

E-BPS enables municipalities to manage a building permit system by integrating the NBC and municipal BBL. It supports municipal staff members to maintain a building permit database and ensure NBC and BBL compliance for individual buildings through an intuitive web interface. Municipal staff members with different responsibilities, such as application registration, technical data verification, compliance checking, field verification, certificate printing, handling of legal issues, house address generation, GIS data maintenance, collection of permit fees, assessment of disaster vulnerability, building permit data archiving, executive permit approval, etc. will be able to access the E-BPS through any of the following mediums: LAN, Internet or Intranet.

### ***Key features:***

The key features of the developed system are as follows;

- Compliance Checking: Compliance checking for BBL and NBC is one of the most complex and time consuming tasks in E-BPS but also one of the most important features. The system verifies the data and information provided by the building designer against the system standards defined by the Municipality. This feature helps Municipalities to speed up the permit process and also helps to identify buildings that do not comply with its current standard. This feature can eventually also be integrated as a key component of any future Disaster Risk Management system.

- Online Registration: An applicant can register and submit a building permit application through the KMC's web portal. Submitting a permit application online is the fastest and easiest method which helps to eliminate many manual hours the municipal staff has to devote in entering the same information for the permit process. The required information to apply for a building permit, i.e. information about BBL and NBC, checklist to apply for building permit, information about Municipality's registered designers and trained masons, etc are available online.

- Tracking Permit Status: The system updates the permit status of each application. Applicants may track their building permit status online by logging onto their Municipality's website through their Municipality's web portal. This reduces (almost eliminates) the number of calls or visits an applicant has to make to their municipality office to query about their permit application status.

- Management of Building Permit Application: The system manages building permit applications which includes (but not limited to) the following documents: House and Land Ownership, Construction Site, Neighboring Land Parcels (plots), Building Plan and Drawings, Design Data required for BBL and NBC compliance, Citizenship certificate, Land ownership certificate, etc. and any other specific municipality requirements.

- Archiving Building Permit Data: This system enables municipalities to archive existing building drawings/plans and related documents. It has the capability of storing, retrieving and managing electronic AutoCAD and/or other image/PDF file formats of building drawings. E-BPS also has a capability to scan and store maps and documents with its built-in hardware support.

- Checklists for Vulnerability Assessment: The archived building database includes acquisition of exposure data of each building through visual inspection. This allows for conducting qualitative vulnerability assessment of each building structure following the developed guidelines of Department of Urban Development and Building Construction (DUDBC). The provision also recommends the requirement of retrofitting options of the vulnerable structures as per the approved retrofitting guidelines.

- GIS/Addressing Support: E-BPS enables Municipalities to integrate building data with a GIS based building database and thus enables them in assigning a House Address for new buildings.

- Revenue Generation: E-BPS has the system of archiving of the old building stock database. By doing so, it can, in fact, regularize many building structure within the framework of NBC and BBL. As a result, it can impart resiliency of building stocks as well as generate the revenue for the municipality. Further, E-BPS has checklists for current fees paid status. Any discrepancy in the collection of land and/or property tax stalls the permit application thereby leading to revenue collection.

### ***System Process and Work Desks***

E-BPS has been implemented with the concept of Work Desks for the processing of building permit applications and maintaining a current and archived permit database. The description of each work

desk is as follows:

Registration Desk for username creation, general data entry and data verification: Any building permit application starts at the Registration Desk. It is the main customer facing section of E-BPS. It is also the last stage of the permit process where approved building certificates are printed and handed over to the customer.

Technical Desk 1 for design data entry and verification. Once all the required paperwork and accompanying documents are collected, these are sent to Technical Desk 1, where data is entered into the system and verified.

Technical Desk 2 for compliance checking: The main NBC compliance is enforced here. The application is either approved or returned for further processing.

Field Desk for maintaining field reports about field verification and monitoring of construction work. This desk handles the actual visits to the building site.

Ward Desk for maintaining field report and neighborhood information. Ward offices represent satellite offices where local information is handled. Thus we follow an overall trend of authority devolution.

Revenue Desk for processing permit fee and property evaluation. Various permit applications have differing fees associated with them which are processed here.

Legal Desk for processing and maintaining litigation data. Any citizen grievances have an avenue for correction and hearing here.

GIS/Addressing Desk: for maintaining house address data and integration data for Municipal GIS.

Vulnerability Assessment Desk for maintaining exposure data for Seismic Risk Assessment.

Archival Desk for managing archives of permit documents.

Executive Desk for approval of building permit & certification and standard settings.

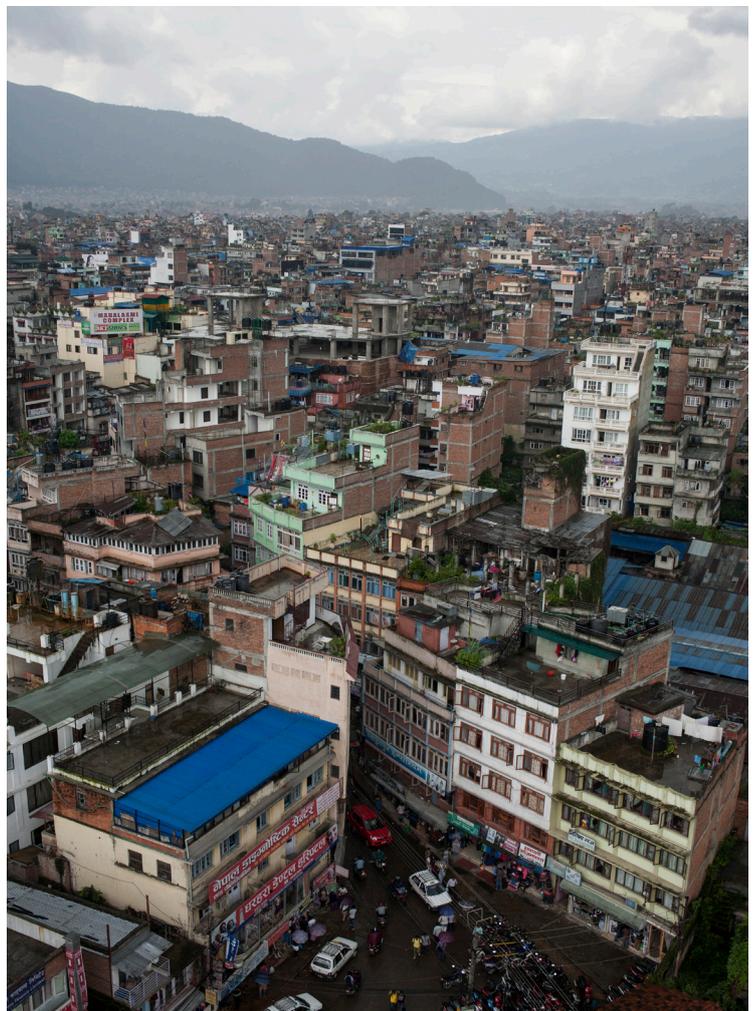
### **Key challenges**

While conducting the activity, the team has encountered many pertinent issues and challenges. The key challenges are as follows;

### ***System Sustainability:***

A considerable number of the electronic tools and Information Technology (IT) based systems were involved in the E-BPS system design. To achieve long term sustainability of the system, due diligence has been done in terms of making it economically feasible and technically viable.

A sizable number of municipal staff members are being trained to operate the system.



Hence, capacity development of staff and stakeholders is one of the major focus areas to achieve sustainability. Similarly, when the system is fully functional, the service providers and consultants will be deployed in the respective municipalities at least for 6 months to ensure business continuity and knowledge transfer.

Routine and periodic maintenance of the system is to be ensured by the institution. A dedicated maintenance fund is to be introduced in the annual budget of the municipalities.

### ***Change Management:***

E-BPS is an evolving piece of application software. There are multiple complex moving parts with intricate dependencies. New features will eventually be added to the software to reflect evolving end user requirements. There also may be changes to the underlying driving force, i.e. NBC and/or BBL. There may be multiple deployments across the remaining municipalities in Nepal with their own unique BBL.

All these possible changes need to be addressed by effectively architecting a Change Management Strategy.

Even the most modular software code has interdependencies and thus Change Management handles new modifications, deployments, and future upgrades. The driving force behind a Change Management Strategy is to ensure Business Continuity. Thus any process modification, code upgrade, or bug resolution should not have an adverse impact on the Business Model, i.e. no customer impact.

### ***Institutional Framework:***

E- BPS is just a part to a whole system of municipal governance; this is an entry point to the development of entire E- Municipal governance system in Nepal. Hence, to maintain the system effectively, an ICT strat-

egy of KMC has to be developed with lucid and coherent duties and responsibilities of each section involved. Similarly, the strategy needs to be supported by legal framework such as Local Self Governance Act (1999). Further, KMC needs to facilitate the process of endorsement of the system through Ministry of Urban Development to ensure its validity as the system elaborates the NBC and BBL. MoUD is the custodian of these legal provisions

### **Impact of the activity**

It has been a positive sign that the municipality has taken ownership and been eager in maintaining the E-BPS. There is widespread message dissemination in related sectors associated with this area. There are few key development partners who now have activities in the pipeline in follow up of this activity.

Asian Development Bank (ADB) has proposed an entire E-municipal governance package to KMC ensuring commitment to the sustainability of the present E- BPS system. Along the line of present E – BPS module, they are trying to address the entire service delivery package of the municipality.

Similarly, the World Bank (WB) is trying to link E-BPS system of KMC with the proposed system to automate building permit process of high rise buildings conducted by Department of Urban Development and Building Construction (DUDBC). They are also proposing to integrate the building inventory generated by this system to carry out urban risk assessment of entire the Kathmandu valley. They are using open street mapping for conducting the inventory of buildings in Kathmandu valley.

### **Future Initiatives**

Once we go-live with the E-BPS all the new building permit process in KMC and LSMC will be effectively code compliant. However much remains to be done for the existing buildings.

Within the current project scope, it has been proposed to have the database of 15,000 existing buildings from both the municipalities. Currently there are more than 200,000 buildings that need to be in the E-BPS database for risk assessment and mitigation purposes. Hence, the archival process of existing building data needs to be prioritized in the annual plan of each municipality.

Another near future initiative is to compile the GPS coordinates of 600 existing buildings from both municipalities including their exposure data and later keep them in the GIS interface of their respective city maps. To maintain an updated Geo-referenced database of new and existing buildings, the municipalities must take an initiative to accomplish this task through their own efforts.

The archived database once translated into geo-referenced format could serve as an effective input for monitoring of implementation of the Risk Sensitive Land Use Planning (RSLUP) and corresponding by-laws. The RSLUP documents are being developed at the valley level by Kathmandu Valley Development Authority (KVDA) with the support from UNDP / CDRMP.