Status of Building Code Implementation in Municipalities of Nepal

A report on the Building Code Implementation Status Survey (BCISS) implemented under the Building Code Implementation program in Municipalities of Nepal (BCIPN)





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FOREWORD

It is my great pleasure to share this report: "Status of Building Code Implementation in Municipalities of Nepal- A report on the Building Code Implementation Status Survey (BCISS)" implemented under the Building Code Implementation program in Municipalities of Nepal (BCIPN). The project was implemented during 2012-2017 by NSET with funding support from the U.S. Office of Foreign Disaster Assistance (USAID/OFDA) under the overall guidance and direction of the Department of Urban Development and Building Construction (DUDBC), Ministry of Urban Development (MOUD), and Ministry of Federal Affairs and Local Development (MOFALD) of the Government of Nepal, in close coordination with DUDBC Division Offices and the municipalities.

The Building Code Implementation Program in Municipalities of Nepal (BCIPN) has been instrumental in developing and piloting methodologies for building code compliance in 30 municipalities and urbanizing settlements of Nepal.

Building Code Implementation Status Survey (BCISS) was designed to measure the change in the municipal systems of building permit and building code implementation. The main objectives were: to know the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in building permit process and building code enforcement system. This report highlights the objective, methodology, results, discussion and conclusions of the Building Code Implementation Status Survey (BCISS) conducted as part of the Monitoring and Evaluation process of BCIPN.

The report will be useful for decision makers, policy-makers, and social leaders. Relevant technical professionals and researchers may also find it a useful resource for better understanding the process of building code implementation in Nepal.

Surya Narayan Shrestha Executive Director NSET

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We are grateful to Dr. Amod Mani Dixit, Dr. Ramesh Guragain and Dr. Rebekah Paci-Green for their thorough review and comments on the document that helped to further enhance the analysis and the recommendations.

We are thankful to NSET management for assigning us this important task and for all the administrative support. We extend our gratitude to the U.S. Office of Foreign Disaster Assistance (USAID/OFDA), for the funding support and for the continued guidance throughout the implementation of the BCIPN program.

ACRONYMS	BCCS	Building Code Compliance Survey
	BCI	Building Code Implementation
	BCIPN	Building Code Implementation Program in Municipalities of Nepal
	BCISS	Building Code Implementation Status Survey
	CBO	Community Based Organization
	GON	Government of Nepal
	MCPM	Minimum Conditions and Performance Measures
	MOFALD	Ministry of Federal Affairs and Local Development
	MOUD	Ministry of Urban Development
	NBC	National Building Code
	NEA	Nepal Engineers Association
	NGO	Non-Governmental Organization
	NSET	National Society for Earthquake Technology-Nepal
	OFDA	Office of Foreign Disaster Assistance
	USAID	United States Agency for International Development
	VDC	Village Development Committee

Executive Summary

National Society for Earthquake Technology-Nepal (NSET) implemented the Building Code Implementation Program in Municipalities of Nepal (BCIPN) in 30 municipalities of Nepal during October 2012 to September 2017 with funding support from the U.S. Office of Foreign Disaster Assistance (USAID/OFDA). BCIPN is a program to support municipalities in their efforts to implement the National Building Code (NBC).

BCIPN aimed to reduce the vulnerability of communities by ensuring that a growing percentage of newly built houses in program municipalities comply with the provisions of Nepal National Building Code.

BCIPN comprised of three main pillars: a) creating demand for safer building construction through awareness raising; b) addressing the demand through capacity enhancement of municipal and private sector engineers and architects, as well as of masons and petty contractors; and c) working in partnership with stakeholders to improve the implementation mechanism and policy environment for ensuring compliance to building code.

During the five years of BCIPN implementation in 30 municipalities, more than 150 numbers of training and awareness activities were conducted, more than 1,100 engineers, 4,600 masons, 100,000 house owners/community members, 6,300 social mobilizers, 630 municipal professionals and political leaders, 103 master instructors have been trained and oriented on earthquake resilient construction.

Four major indicators and targets set to measure the progress of the program activities are as follows:

- More than 60% of new buildings are constructed in compliance with the National Building Code;
- More than 60% of the masons trained under the program continue practicing earthquake-resistant construction in the second and third years of the program implementation;
- More than 50% of the people living in the municipalities have improved perception of risks; and
- More than 75% of the municipalities adopt sustainable and sound building permit processes that are reflected in their periodic plans and budget.

Building Code Implementation Status Survey (BCISS) was designed to measure the change in the municipal systems of building permits and building code implementation. The main objectives were: to know the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement system.

Status of Building Code Implementation is defined by three major elements: 1) Institutional system for building permit process and building code enforcement, 2) Technical capacity within municipal offices and in municipality areas, and 3) Budget allocation for BCI. Under each of these elements, a weighted score of several key indicators was created. The weight of each indicator reflects its level of importance. The selection of indicators and their weighting was based on the experience of working with the municipalities and interactions with the municipal professionals.

Element 1 measures the institutional mechanism, system, and capacity of the municipality in implementing the building code. It also measures the system for overall disaster risk management. There are seven indicators in this element.

The second element measures the technical capacity within the municipality. Here, the strength on human resources who are directly involved in the construction of house (engineers, masons and the house owners) is assessed. Four indicators are used to assess Element 2.

The third and final element measures the proportion of budget the municipality allocates for building code implementation. Municipalities are grouped into three different categories based upon the size of the annual revenue generation from building permit process.

A survey questionnaire was used to collect data from 29 out of 30 BCIPN municipalities. Various modes of communication such as telephonic conversation, emails, in-person interviews and exploratory visits to municipalities etc. were used for the data collection.

The assessment was done in three phases: at the initial phase before the implementation of BCIPN program (2012, Baseline), at the mid-term of the program implementation (2014, Midterm); and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation in the municipalities.

We calculated the overall status of BCI in all 29 municipalities in the different years and evaluated the changes or progress over time. There has been significant improvement in the capacity of municipalities towards implementing building code over the years. Of the three major elements of BCI Status, the Institutional System (S1) had a greater change than the other two components. The value increased from 6% to 68% for Institutional System, 17% to 49% for Technical Capacity and 14% to 43% for Budget Allocation.

Considering all the municipalities, the score for the institutional system has increased from an average score of 0.30 (out of 5) in 2012 to 1.52 in 2014 to 3.4 in 2016, corresponding to an increase from 6% to 30% to 68% during that period.

In regard to the technical capacity within the municipality, the average score rose from 0.84 (17%) out of 5 in the year 2012 to 1.56 (31%) in the year 2014 to 2.47 (49%) in 2016. While municipalities have set up and conducted number of training programs for masons, engineers and other professionals, which has increased the number of trained technical workforce in the municipality, the demand still exceeds the supply.

The increased allotment of a dedicated budget for the BCI process was observed during the survey. The municipalities started allocating some budget for the implementation of building code. Overall, the average score related to budget allocation increased from 0.72 (14%) out of 5 in 2012 to 1.55 (31%) in 2014 to 2.71 (43%) in 2016.

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Based upon the achieved level of success in building code implementation (total score achieved), BCIPN program municipalities have been classified into four different categories. Class A (Building Code Implementation – Level 4: BCI-L4) includes the municipalities that have already started implementation of building code and have achieved higher level of success. These are most successful municipalities in terms of effective building code implementation systems. Class B (Building Code Implementation – Level 3: BCI-L3) are the municipalities that have achieved appreciable level of success in building code implementation. Class C (Building Code Implementation – Level 2: BCI-L2) where the municipalities have shown some improvements towards effective building code implementation systems and Class D (Building Code Implementation – Level 1: BCI-L1) where the municipalities have had little improvements and much needs to be done.

According to the scores obtained for the three components of BCI in the year 2016, out of 29 municipalities, six municipalities were able to achieve the Class A (BCI Status Score=10-15), nine municipalities Class B (Score=8 up to less than 10), six Class C (Score=7 up to less than 8) and eight of the municipalities still fall under Class D (Score=less than 7) category.

Of the 29 municipalities surveyed, substantial progress was seen in most of the municipalities. Overall, the 29 municipalities started in 2012 with an average BCI Status Score of 1.9 (out of 15) and by 2016 they had increased to an average of 8.1.

A similar survey was conducted in three additional municipalities, one from each region where the BCIPN program was not implemented to compare the difference in level of progress in the BCIPN and non-BCIPN municipalities. A remarkable difference was observed in these municipalities compared to the BCIPN municipalities. Even the data of 2016 show that those three municipalities are far behind in terms of Institutional System, Technical Capacities and Budget Allocation for building code implementation.

The BCIPN program implemented during 2012-2017 has thus been instrumental in making remarkable progress and achievements and provides key inputs in paving future course of action.

Municipalities have expressed that the approaches and focus of technical support have been very useful and could motivate municipalities to continuously work toward ensuring safer construction through building code enforcement. The approaches and activities need continuation in the current municipalities and expansion to all other municipalities.

BCIPN has created a platform to bridge the gap between central and local levels – BCIPN worked with both central and local level government authorities which helped to reduce the gap and enhance the understanding at both levels. There has been a trickling down effect to other municipalities as well, the works done at the BCIPN municipalities have contributed to influence the nearby municipalities and villages as well.

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1 INTRODUCTION

1.1 Building Code Implementation Program in Municipalities of Nepal (BCIPN) The Building Code Implementation Program in Municipalities of Nepal (BCIPN), implemented by NSET with funding support from the U.S. Office of Foreign Disaster Assistance (USAID/OFDA), is a program to support municipalities in their efforts to implement the National Building Code (NBC). BCIPN has been implemented in 30 municipalities of Nepal during 2012-2017 under the overall guidance and direction of the Department of Urban Development and Building Construction (DUDBC), Ministry of Urban Development (MOUD), and Ministry of Federal Affairs and Local Development (MOFALD) of the Government of Nepal, in close coordination with DUDBC Division Offices and the municipalities.

BCIPN aims to ensure implementation of the building code through a multi-faceted approach. The program seeks to enhance the knowledge, skill and awareness of stakeholders, which include municipal engineers, municipal staff, masons, consultant engineers, house owners, material suppliers, contractors, etc. related to building construction. The program focuses on assisting municipal governments by enhancing their capabilities to develop and administer the building permits and control system that can ensure improved seismic performance of all buildings. This goal requires helping the municipalities to develop an effective mechanism for building code implementation. It also requires that residents have better earthquake awareness and that municipal officials and technical professionals have enhanced technical knowledge of earthquake-resistant design and construction. These are all expected to contribute to enhancing earthquake resilience of urban settlements in Nepal.

BCIPN is comprised of three main strategic program components, which are implemented from the local to national levels. The **first strategic component** of the program is raising awareness of local community, stakeholders and government representatives on the causes of earthquake risks and possible ways to mitigate these risks. The **second component** consists of building the capacity of the construction workforce local masons and contractors, in earthquake-resistant construction technology and building capacities of engineers and technical professionals in designing and supervising construction of safer buildings. The **third component** is building the institutional capacity of municipalities to effectively enforce building code and to institutionalize a code compliance system.

BCIPN is a comprehensive program that has three pillars: 1) creating demand through awareness raising; 2) addressing the demand through capacity enhancement of municipal and private sector engineers and architects, as well as masons and petty contractors; and 3) working in partnership with stakeholders to improve the implementation mechanism and policy environment.

BCIPN also focuses on consolidating the gains made through improving the building permit systems by developing national standards and manuals that can help replicate the permitting and compliance system in other municipalities.

Nepal is experiencing rapid urbanization as in many other developing countries. More and more buildings are constructed in urban and urbanizing centres in the country. However, a majority of the buildings are constructed without following the provisions of the national building code, and, hence, likely to be extremely vulnerable to earthquakes. Most municipalities are not capable of exercising effective control over the building permit and building inspection processes due to the lack of appropriate mechanisms and lack of capacity. Low public awareness of earthquake-resistant construction and its effectiveness is another hindrance in enforcing building code.

The BCIPN program was conceptualized and designed to support municipalities in the process of building code implementation to address these problems of low capacity, low awareness, and a lack of appropriate mechanisms for permitting and oversight (BCIPN Program Completion Report, 2017). A total of 30 municipalities across the country are part of the BCIPN program. The BCIPN program municipalities are grouped into three regions -- Eastern, Central and Western -- based on their geographical location.

BCIPN aims to reduce the vulnerability of communities by ensuring that a growing percentage of the newly built houses in program municipalities comply with the provisions of Nepal National Building Code.

During the five years of BCIPN implementation in 30 municipalities, **more than 150 numbers of training and awareness activities** were conducted in close coordination with the municipalities who also increasingly allocated budget for the implementation of activities. More details on BCIPN interventions can be referred in the BCIPN Program Completion Report 2017.

More than 1,100 Engineers, 4,600 Masons, 100,000 house owners/community members, 6,300 Social Mobilizers, 630 municipal professionals and political leaders, 103 Master Instructors have been trained and oriented in earthquake resilient construction through BCIPN (Annex 3).

BCIPN has helped to enhance earthquake awareness of the residents and technical knowledge of the municipal officials, technical professionals on aspects of earthquake risk management including earthquake-resistant design and construction.

In addition to the awareness and capacity enhancement programs, BCIPN worked towards assisting the municipalities in building their institutional capacities to effectively enforce building code and institutionalize the code compliance system. Various activities were conducted that contribute towards improving the institutional system and process in the municipalities. Some of the major activities were as follows:

Development and Use of Building Permit System Software: In most of the municipalities of Nepal there is no mechanism of

maintaining digital database of constructed buildings; therefore, in order to help the municipalities to reduce the volume of paper works and also to ease the process of monitoring and inspection of the construction of buildings, a GIS based building permit system software has been developed through BCIPN program. Some of the municipalities have already installed the system and other municipalities are now in the process to fully utilize the software.

Development and Use of Building Code Compliance Checklist: The Building Code Compliance Checklist developed through BCIPN, is the document that assists the building permit professionals to check the structural designs and drawings submitted by house-owners and consultant for building permit process. The compliance checklist was prepared and finalized through series of discussion with municipality professionals based on study of various national and international technical documents and learnings from the experience in the past years.

Demonstration of Retrofitting of Existing Building: In order to demonstrate the retrofitting techniques to the people so that they can understand about the importance and feasibility of retrofitting and hence replicate the technology for improving their buildings, three program municipalities, Bharatpur Metropolitan City, Damak Municipality and Dharan Sub-Metropolitan City have taken the initiation to retrofit their office buildings as demonstration of retrofitting. BCIPN provided technical support to retrofit the buildings.

BCIPN also helped prepare Local Disaster Risk Management Plan (LDRMP) for Vyas Municipality; Urban Regeneration Plan for Dwalkha Bhimeshwor Area, Dolakha; Model Designs of Residential Houses for Bharatpur Metropolitan City and conducted the Building Inventory Database Survey of four municipalities namely Birtamode, Bharatpur, Vyas and Birendranagar.

The Building Code Implementation Program in Municipalities of Nepal (BCIPN) has been instrumental in developing and piloting methodologies for building code compliance in 30 municipalities and urbanizing settlements of Nepal.

The Monitoring and Evaluation (M&E) Plan for BCIPN guides the implementation of the program through monitoring of progress and outputs and through evaluation of the impact of the program. This plan also serves as a guide for any mid-course review and corrections. Additionally, the M&E plan serves as a management tool for continuous learning, feedback and improvement. To ensure the quality of the work, the M&E team has regularly collected and analysed data on program activities.

The four major indicators set to measure the progress of the program activities are as follows:

• More than 60% of new buildings are constructed in compliance with the National Building Code;

1.2 Monitoring and Evaluation (M&E) Plan



- More than 60% of the masons trained under the program continue practicing earthquake-resistant construction in the second and third years of the program implementation;
- More than 50% of the people living in the municipalities have improved perception of risks; and
- More than 75% of the municipalities adopt sustainable and sound building permit processes that are reflected in their periodic plans and budget.

To measure the progress related to the above four indicators, four major types of survey or data collection were carried out: i) Risk Perception Survey to measure the change in awareness of the population; ii) Retention Survey to measure the retention of knowledge and skills after the training courses; iii) Building Code Implementation Status Survey (BCISS) to measure the change in the municipal systems of building permits and building code implementation; and iv) Building Code Compliance Survey (BCCS) to measure the actual changes in construction practices. To measure changes over time, the M&E team carried out Baseline, Midterm and End-line surveys.

The BCISS, one of the four M&E surveys, is the focus of this report.

1.3 Scope of the Report This report highlights the objective, methodology, results, discussion and conclusions of the Building Code Implementation Status Survey (BCISS) conducted as part of the M&E process of BCIPN.

The report will be useful for decision makers, policy-makers, and social leaders. Relevant technical professionals and researchers may also find it a useful resource for better understanding the process of building code implementation in Nepal.

- **1.4 Objectives** The main objectives of the study are:
 - To know the level of capacity of the municipalities for building code implementation
 - To assess the change in elements of building code implementation over the period in BCIPN program municipalities
 - To measure the level of sustainability of building code implementation reflected in building permit process and building code enforcement system.



Participants of a Mason Training course during hands-on exercise Source: BCIPN program

METHODOLOGY 2

2.1 Elements of **Building Code** Implementation **System**

Based on our experiences and interactions with the participating municipalities, we identified three major elements for assessing building code implementation. The three major elements are:

- 1. Institutional system for building permit process and building code enforcement,
- 2. Technical capacity within municipal offices and in municipality areas, and
- 3. Budget allocation for BCI.

Status of building code implementation in each of the municipality can be evaluated in terms of these institutional systems, technical capacities, and budget allocation.

Under each of these elements, a weighted score of several key indicators was created. The weight of each indicator reflects its level of importance. The selection of indicators and their weighting were based on the experience of working with the municipalities and interactions with the municipal professionals.

Further, the indicators and scoring were also guided by the Government of Nepal's Minimum Conditions and Performance Measures (MCPM) and Performance Evaluation System, measurements established to assess the performance of the municipalities. Until recently, the MCPM measured the performance of local bodies; the Government of Nepal (GoN) tied block grants and revenue sharing to the performance results.

2.2 Major indicators, Based on the three major elements -- Institutional System, Technical Capacity and Budget Allocated -- a questionnaire was weightage and designed to measure the status of BCI in each municipality scores for BCI (Annex I). The key indicators contributing to that element, as well status as the scoring and weighting of these indicators are described below.

This element measures the institutional mechanism, system, and capacity of the municipality in implementing the building code. It also measures its system for overall disaster risk management.

The following list and table give the details of the indicators and scores used to assess Element 1. There are seven indicators in this Element. Each indicator is given a score based on the use or availability in the municipality. The seven indicators of Element 1 are:

a. E1.1: Advisory/ Technical Advisory or Technical Committee for BCI are required for Committee for BCI providing oversight to the building code implementation works. Such committees also provide technical guidance and input for approval of building drawings and designs submitted to the municipality office. Having such Technical or Advisory Committee is considered a positive institutional system for improving building code enforcement. Municipalities that had established such committees were given a score of 0.5 and those that had not created such committees were given a 0 score.

i. Element 1: Institutional System for Building **Permit Process**

b. E1.2: Separate Earthquake Safety Unit or Separate BCI Cell or Dedicated Technical Staff

> c. E1.3: Need structural drawing for Building Class "C" and detail designs for Class A and B buildings:

Ram Narayan Mandal, House owner, Janakpur Sub-Metropolitan City

As I decided to build my house, I went to municipality along with the building drawings of my house. In my visit to municipality, I was surprised as the municipality's overseer took me to the courtyard and showed me the model building and explained me about safe construction practices. I have followed all the municipality rules and am very much satisfied with it. I still keep visiting municipality office if I need any information on constructing my house. I found that the municipality has been working to increase awareness of people about the safe construction practices. Building code enforcement and earthquake risk management are very specific technical tasks and require dedicated team for better and coordinated work. If the municipalities work under the leadership of such separate units, they become more organized and effective. Therefore, having a separate dedicated cell or unit for building code implementation was considered as contributing to a positive environment and better institutional system. Hence, a score of 0.75 was given to such municipality and 0 for those without a separate unit.

Even where the municipalities had a building permit system, most required that applicants only submit architectural drawings as part of the building permit process, they did not require structural designs and drawings. Structural design and drawings are those which show the details of structural elements such as wall thickness, size of columns, beams, reinforcement bar details, type and strength of concrete etc. These specifications directly relate to the strength and capacity of the building. From structural designs and drawings, we can evaluate whether the building can withstand anticipated earthquake forces. If the structural design and drawings are submitted to the municipality as part of the building permit process, technical professionals in the municipalities can check the earthquake-resistance of the proposed building and can propose improvements in the building design. This review of structural design drawings is a first basic step towards achieving safer construction.

Nepal National Building Code classified prevailing buildings into four major types: i) Buildings designed following any international code higher than Nepali code – called International state-of-the-art design buildings or **A Class buildings**; ii) buildings designed and constructed following the Nepali seismic provisions – called Professionally engineered buildings or **B Class** buildings; iii) the most common building class in urban and urbanizing centres, which are buildings designed and constructed following standard Mandatory Rules of Thumb and called MRT Buildings or **C Class** buildings; and iv) **D Class** buildings, which are those mostly built in rural areas using local materials such as stone, timber etc. and which can be made earthquake resistant by following the Guidelines for rural construction.

Today, in many of the municipalities that have most thoroughly implemented building codes, the house-owners need to submit structural designs and drawings for class A and class B buildings; they need to submit only structural drawings for class C buildings. Such requirements support building code enforcement. Hence, municipalities with such a system are given higher score of 0.5 and without such system are given a 0 score. d. E1.4: Use of detailed checklists for building code compliance checks (building configuration, building strength, building ductile detailing etc.)

e. E1.5: Provision for field inspection of structural details such as at 1) Foundation, 2) Plinth level, and 3) story structure

f. E1.6: System of registering masons and a roster of trained masons

Municipal engineers or technical professionals within the municipal office check the building designs and drawings submitted to the municipality as part of the building permit process. In many cases, municipal engineers check only the urban by-laws and architectural provisions of the buildings and do not check any structural aspects. Yet, to ensure safer design and construction, structural aspects of the building design need to be checked. Despite its necessity for safer building construction, many municipal professionals do not even have a clear idea about how to assess structural provisions. In light of this difficulty, NSET developed a comprehensive Building Code Compliance Checklist and associated Guidelines based on provisions of NBC and other relevant codes. This checklist and associated guidelines are meant to be used by municipal engineers while checking the building designs and drawings; they provide step-bystep procedures and include required details. Using the checklist to guide review of structural provisions is considered yet another major step towards effective building code implementation. Hence, the municipalities, which have started use of such checklists, receive a score of 1 and those who do not, receive a score of 0. Notably, this indicator is of such great importance to safer building construction that a positive score is higher than a positive score for previous indicators described above.

Field inspection during the construction is also a very critical step for ensuring proper construction of buildings. This process helps ensure buildings are constructed as per the design and drawings and without violating the stipulations of building code provisions. However, in most municipalities a system of inspecting houses during construction does not currently exist; even where there is such system, municipal inspector checks only the urban by-laws related provisions, not the structural aspects. Municipalities where such system of building inspection at various stages of construction have been mandated are considered as achieving better building code implementation; therefore, they get a score of 1 while those without a system of field inspection of structural provisions get a score of 0. Currently, we have considered only whether such inspection system exist or not, we have not considered the various stages of inspection.

Masons are a key for ensuring safer construction. Most residential buildings, even in urban areas, are constructed under the leadership of local masons or local smaller (informal, petty) contractors. They serve also as the main advisors to the house-owners. Therefore, their knowledge, skills and their overall construction management capacities are very important and need to be regulated properly by the municipal offices. Providing proper training for masons and contractor and the registration and regulation of these masons and contractors are major steps towards building code enforcement. Additionally, the maintenance of rosters of trained masons helps house-owners find and employ trained masons. Municipalities where such systems have been started get a score of 0.75; those that do not, get a score of 0.

g. E1.7: Provisions for strengthening of existing buildings / retrofitting In most areas, people construct additional floors on existing buildings, an addition for which they are required to obtain a permit from the municipality. In most cases, the existing buildings are not strong enough or the structural elements are not sufficient to support additional stories. Strengthening or retrofitting of existing building is the solution for ensuring code compliance when adding more stories. Therefore, it is important that municipalities implement an enforcement system for assessment and retrofitting of existing buildings. Where such a system is already in place, the municipality gets a score of 0.5 and where it is not in place, the municipality gets a score of 0.

Table 1: Indicators and Scores assigned to measure the Institutional System on Building Permit Process in the municipality

S.N	Does Municipality Have	Yes/No	Weightage	Score	Remarks
E1.1	Advisory/Technical guide/committee for BCI		0.5		(Yes=1, No=0)
E1.2	Separate EQ Safety Unit or Separate BCI Cell or dedicated technical staff		0.75		(Yes=1, No=0)
E1.3	Need structural drawing for building class "C" and detail designs for class A and B buildings		0.5		(Yes=1, No=0)
E1.4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)		1		(Yes=1, No=0)
E1.5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure		1		(Yes=1, No=0)
E1.6	Has a system of registration of masons and roster of trained masons		0.75		(Yes=1, No=0)
E1.7	Has a provision for strengthening of existing buildings/Retrofitting (such as for construction of addition storey)		0.5		(Yes=1, No=0)
	Individual Score= Value for the (Yes/No) Colum	n * Wei	ghtage		

Total Score Possible = 5 (S1)

ii. Element 2: Technical Capacities/ Human Resources This second element measures the technical capacity within the municipality. Here the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed.

The proportion of human resources trained/oriented with respect to the numbers of new buildings constructed per year is measured and the scores are assigned accordingly.

The four indicators used to assess Element 2 are:

a. E2.1: Municipal Engineers/Sub-engineers Capacity An indicator of engineering capacity is calculated as (E/X) *100, where E is the number of engineers in the municipal office and X is the number of new buildings constructed per year in that municipality. The score calculation is based on the assumption that one municipal engineer is required to inspect 100 building construction works each year. Accordingly, if the calculated indicator is more than or equal to 1%, then the full score of 1 is provided. For example, if there are 4 engineers in a municipality where 400 houses are constructed per year, then the municipality is assigned a full score. Similarly, in a municipality with 1 engineer to 400 houses, the indicator would equal 0.25% and the score would be 0.25.

- b. E2.2: Trained Masons Capacity
 An indicator of trained mason capacity is similarly calculated as (M/X) *100, where M is the number of trained masons and X is the number of new buildings constructed per year in that municipality. One mason is assumed to build two houses a year, one during each of the two building seasons. An indicator of 50% or more is given a full score of 2. For example, in a municipality where there are 200 masons and 400 houses being built, the trained mason capacity indicator would equal 50% and the score given to this indicator would be 2.
 c. E2.3: Trained Engineers
 A similar indicator of trained engineers, (consultant engineers)
- (Consultant) Capacity evaluates whether the municipality has sufficient trained personnel to create design drawing for Class A and B buildings or to follow guidelines for Class C and D buildings and to provide required supervision during construction. the Assuming one engineer/consultant looks after 5 houses per season, with two seasons per year, then each engineer supervises 10 houses per year. (In a municipality with 400 houses being constructed, 40 trained engineers would be required). If the availability of trained engineers is 10% or higher, then the full score of 1 is assigned. Percentages lower than 10% are given partial scores as shown in Table 2.
 - d. E2.4: Percentage of Educated House-owners Finally, every house-owner should be aware of seismic risk and should know how to prepare. If the number of house-owners oriented is more than or equal to 75% of the number of buildings constructed per year in the municipality, then the municipality will get a full score of 1.

Table 2: Indicators and Scores assigned to measure the availability of Technical Capacities within the municipality

S.N	% of human resources trained/oriented building construc	Remarks			
	Human resources	Nos.	Percentage	Score	
E2.1	Municipal Engineer & Sub engineer Capacity	E	(E/X) *100	S=0 to 1	$\geq 1\% = 1$ 0.75% to 1% = 0.75 0.25% to 0.75% = 0.5 0.01% to 0.25% = 0.25 0% = 0
E2.2	Trained Mason Capacity	Μ	(M/X) *100	S=0 to 2	≥ 50% = 2 25% to 50% = 1 12.5% to 25% =0.5 0.1% to 12.5% =0.25 0% = 0
E2.3	Trained Engineer (Consultant + Contractor) Capacity	ET	(ET/X) *100	S=0 to 1	$\geq 10\% = 1$ 5% to 10% = 0.75 2.5% to 5% = 0.5 0.1% to 2.5% = 0.25 0% = 0
E2.4	Percentage of House-owners Oriented	НО	(HO/X) *100	S=0 to 1	≥75% = 1 50% to 75% = 0.75 25% to 50% = 0.5 1% to 25% = 0.25 Less than 1% = 0
	Total Scores out of 5 (S2)			TS	
	Numbers of new building constructed per year=X				

ii. Element 3: Municipality Revenue/ Budget

The third and final element measures the proportion of budget the municipality allocates for building code implementation.

Municipalities collect tax and other revenue from different activities like the building permit process, property taxes, and other revenue sources. Revenue generated from building permitting depends on the number of buildings constructed in the municipality. The greater the number of buildings constructed, the more revenue that the municipality generates. The revenue generated from the building permit process is a source of income for the municipalities, however most municipalities have no system in place to ensure that a portion of the collected revenue is used to support the building code implementation process, such as to support capacity building and awareness programs.

The number of buildings constructed per year is different in different municipalities of Nepal and therefore, the revenue generation is also different and so is the budget allocation for BCI. A survey among a few municipalities was done to know how much revenue is generated through building permit processes in an average size municipality. Also, the approximate cost required to conduct main basic activities for building code enforcement was estimated. Additional information such as physical, demographic and other related information on BCI was also included in the questionnaire.

Based on the annual revenue generation rate from building permit, the municipalities are categorized into three different categories. In each of the three categories, scores are given as per the amount of budget allocation. The allocation is divided into six brackets and a score given to each. The score ranges from 0 to 5. Out of the total revenue generated from building permit process, if more than 15% is allocated for building code implementation, the budget allocation is considered better for creating better institutional systems and will get a full score of 5. If lesser amount is allocated, the score is a portion of the full score.

S.No.	Category	Revenue from Building Permit	Budget Allocation	Code(S3) Score out of 5
			<25000	0
			25,000 (2.5%)	1
			25,000-50,000	2
	1	100,000 - 1,000,000	50,000-100,000	3
			100,000-150,000	4
F 0.4			>150,000 (15%)	5
E3.1		1,000,000 - 5,000,000	<50,000	0
			50,000-100,000	1
			100,000-200,000	2
	2		200,000-300,000	3
			300,000-500,000	4
			>500,000	5
			>500,000	5

Table 3: Scores assigned based on the budget allocated from the revenue generation in the municipality

S.No.	Category	Revenue from Building Permit	Budget Allocation	Code(S3) Score out of 5
3			<50,000	0
		100,000-200,000	1	
	0	5,000,000-10,000,000	200,000-300,000	2
	3		300,000-500,000	3
			500,000-800,000	4
			>8,00,000	5

iii. Total score for BCI Status

The total score obtained under each of the three elements is then calculated as S1, S2 and S3 for each of the three years when the survey was conducted.

Table 4: Total score for BCI Status

S.N	Key variables	2012	2014	2016
1	Institutional system on building permit process (Sum of indicator scores based on (i) Table 1)	S1	S1	S1
2	Technical Capacities Human Resources (Sum of indicator scores based on (ii) Table 2)	S2	S2	S2
3	Municipality Revenue/Budget (Sum of indicator scores based on (iii) Table 3)	S3	S3	S3

The survey questionnaire used for collecting data and information from municipalities can be found in Annex 1

2.3 Data collection from municipalities:	The survey questionnaire (Annex 1) was used to collect data from the 30 BCIPN municipalities. Various modes of communication such as telephonic conversation, emails, in person interviews and exploratory visit to municipalities were used for the data collection.
i. Telephonic/Email conversation	The questionnaires were sent to all municipalities by fax or email. At the same time, briefing on objective of the study and verification of collected data was carried out through telephonic conversation. This was done in three phases; during the start of the project (2012) to collect the baseline information, towards the midterm (2014), and towards the end of the project in the year 2016.
ii. Exploratory Visit to Municipalities	A team of senior professionals of NSET visited 50 municipalities across Nepal for in depth interaction with the relevant municipal professionals and further verification and collection of baseline information. From the visited 50 municipalities, 30 municipalities were selected as BCIPN program municipalities. A number of interactive meetings were conducted in each selected municipality and the survey form was filled during those meetings.
2.4 Data Limitations	There are some limitations of this survey, the major limitations are:
	• Due to lack of proper documentation in the municipalities, some of the data are based solely on the interaction with the municipal professionals.
	• The survey was carried out for three fiscal years 2012, 2014 and 2016 only.
	• The report has been generated based on the available data of the year 2012, 2014 and 2016. There is a possibility of some changes in the systems of the municipalities in the subsequent years.

3 THE BCIPN MUNICIPALITIES

3.1 Selection Process and the Program Municipalities

On the basis of population, annual income and facilities available, Nepal has three categories of municipalities; Municipality, Sub-Metropolitan City and Metropolitan City. In 2012, there were 58 municipalities in Nepal and out of 58 municipalities, 30 municipalities (24 municipalities in 2012 and 6 in 2015) were selected as program municipalities.

The municipalities were selected following a detailed process. Initial data and information on physical, demographic, historical and other relevant aspects of all 58 municipalities were collected through telephone interviews and email communications. Based on the data collected, preliminary selection of municipalities was done using a selection criterion developed for municipality selection (see Annex II). Out of the 58 municipalities, 34 municipalities were preliminarily identified as potential municipalities for BCIPN implementation. Exploratory visits were organized to further understand the municipalities and to finalize the municipalities to be selected for program implementation. The NSET team, comprising of senior professionals, made exploratory visits to the municipalities with greatest potential. Interaction meetings were organized in the municipalities to verify collected information and to collect more data, know the status of BCI and existing capacities, and gauge the level of commitment in the municipalities. The interaction meetings were attended by the municipal officials and technical professionals, contractors and consultant engineers, mason group, chamber of commerce and industries, division officers of DUDBC, district or regional of Engineers' Association chapter Nepal (NEA), media/journalists, local representatives of political parties, social worker, representatives from local NGOs and CBOs. The complete list of visited municipalities is included in Annex II.

Thus, through the preliminary analysis and further verification during the field exploratory visits, 24 program municipalities were finally selected. Continuous consultation with the Department of Urban Development and Building Construction (DUDBC) was done to select the municipalities. Those selected were Bhadrapur, Biratnagar, Inaruwa, Janakpur, Khandbari, Triyuga and Birtamod municipality (then Anarmani VDC) in the Eastern region; Bharatpur, Bhimeshwor, Butwal, Gorkha, Hetauda, Kamalamai, Putalibazar, Siddharthanagar, Gaidakot (then Gaidakot VDC) and Karyabinayak municipality (then Sainbu VDC) in the Central region; and Amargadhi, Bhimdatta, Birendranagar, Dhangadhi, Ghorahi, Gulariya and Nepalgunj municipality in the Western region were selected for program implementation.

Later in 2015 after the Gorkha earthquake, the program was extended to an additional six municipalities (Dharan Sub Metropolitan City, Besisahar, Tansen, Vyas, Tulsipur and Damak municipality), thus increasing the total number of program municipalities to 30 (Figure 1).

3.2 The BCISS Municipalities The Building Code Implementation Status Survey (BCISS) was carried out in all 30 BCIPN municipalities to measure the quality and strength of their permit and enforcement systems. Out of 30 BCIPN program municipalities, the survey was successfully completed in 29 municipalities. Gorkha municipality was excluded from the survey because the program activities could not be implemented in Gorkha municipality.



Figure 1: Map showing the BCIPN program municipalities

Table 5: List of BCISS Municipalities

BCISS Municipalities								
Eastern Region	Central Region	Western Region						
1. Biratnagar	1. Bharatpur	1. Amargadhi						
2. Damak	2. Butwal	2. Bheemdutta						
3. Dharan,	3. Hetauda	3. Birendranagar						
4. Inaruwa,	4. Putalibazar	4. Dhangadi						
5. Janakpur,	5.Sidharthnagar	5. Ghorahi						
6. Kamalamai,	6. Tansen	6. Gulariya						
7. Khandbari	7. Vyas	7. Nepalgunj						
8. Triyuga	8. Gaindakot,	8. Tulsipur						
9. Birtamod	9. Bhimeshwar							
10. Bhadrapur	10. Karyabinayak							
	11. Beshisahar							

3.3 Summary Data/Information of Municipalities

Table 6 below presents the summary of data observed in the BCIPN program municipalities in the three different phases of the assessment.

Table 6: Summary of data observed in the BCIPN program municipalities in the three different phases

		MEAN			MODE		STAND	ARD DEVIA	TION	l	MINIMUM			MAXIMUM	
	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016
Building Constructed per year with permit	423	495	544	400	600	600	396.2	455.6	439.5	30	40	50	1500	1800	1800
Building Constructed per year without permit	128	118	92	100	20	20	138.9	117.1	90.66	0	10	0	550	450	300
Engineer	2	2	3	1	1	1	2.415	2.478	2.339	0	0	1	12	12	12
Sub Engineer	2	3	2	2	2	2	1.966	1.939	2.029	0	0	0	8	8	10
Asst. Sub Engineer	1	1	2	1	1	1	1	1	1	0	0	0	4	4	6
Petty Contractor	108	133	177	100	20	300	105	117	169	0	0	0	400	450	600
Masons Trained	50	99	196	0	95	296				0	0	63	50	700	735
Consulting Firms	9	11	16	5	4	4	9	15	17	0	0	0	40	74	80
Consulting Technical Personnel within Municipality	10	13	16	10	3	4	10	12	14	1	0	1	50	50	50
Total Revenue (in thousands)	93,848	84,564	81,562	5,000	5,000	1,70,000	1,32,179	1,38,326	99,198	0	0	0	6,00,000	6,00,000	3,20,000
Revenue from Building Permits (in thousands)	3,953	5,465	7,559	5,000	2,0000	10,000	4,232	5,819	7,831	0	400	600	16,000	20,000	30,000
Budget Allocation for BCI (In thousands)	71	164	266	0	300	100	106.5	121.7	183.8	0	0	50	300	400	800
RCC Building Constructed per year	74	75	79	80	80	85	19	19	17	10	16	35	99	99	99
Masonry Building constructed per year	25	29	21	20	20	15	19	30	17	1	1	1	90	150	65

4 RESULTS: EVALUATION OF BCI STATUS IN MUNICIPALITIES

4.1 Overall Nepal Situation

The status of building code implementation in the BCIPN program municipalities were assessed in terms of three major elements described in section 3 -- Institutional Systems, Technical Capacity, and Budget Allocation. Under each of the elements, key indicators contributing to that element were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm); and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation in the municipalities over time.

We calculated the overall status of BCI, per the methodology described above, in all 29 municipalities in the different years and evaluated the changes/progress overtime. Table 7 and Figure 2 show the overall score and changes of status over the years.

The figure below shows that there has been significant improvement in the capacity of municipalities towards implementing building code over the years. Of the three major elements of BCI Status, the Institutional System (S1) has had a greater change than the other two components. The value increased from 6% to 68% for Institutional System, 17% to 49% for Technical Capacity and 14% to 43% for Budget Allocation.



Figure 2: Average scores for BCI status in the municipalities in the year 2012, 2014 and 2016

Institutional System Municipality Technical Year (S1) Capacities(S2) revenue/Budget (S3) Proportion Proportion Proportion Value Value Value (%) (%) (%) 0.30 6 % 0.84 17% 0.72 14% 2012 1.52 30% 1.56 31% 31% 1.55 2014 2016 3.41 68% 2.47 2.17 43% 49%

The overall BCI Status in municipalities (Average Score)

Table 7: Average scores and

change of status for BCI in

the municipalities in the

year 2012, 2014 and 2016

i. Results for Element 1: Institutional System

The score for the Institutional System has increased from an absolute score 0.30 out of 5 in 2012 to 3.4 in 2016, corresponding to an increase from 6% to 68% during that period (Table 7). The key indicators contributing to the rise in the institutional system score were: dedicated technical staff /separate earthquake safety unit, requirement of structural drawing for all building classes, use of detail checklist for building code compliance check and provision of field inspection for structural details.





The number of program municipalities having a separate earthquake safety unit, or a dedicated technical staff has increased from 5 in the year 2012 to 22 in the year 2016 (Fig 4). However, there are still several municipalities without any dedicated technical staff for building code implementation.

Figure 4: E 1.2, Number of municipalities having separate Earthquake Safety Unit or Dedicated Technical Staff for BCI



Similarly, by 2016 the municipalities have established a system where structural drawings are required for all building class. Out of the 29 municipalities, 28 municipalities have established the system (Fig 5).



Figure 5: E 1.3, Number of municipalities which require structural drawing for all building classes

> Before the start of the program only one municipality i.e. Dharan Municipality had started the system of use of detail checklist for building code compliance check which included building configuration, building strength and building ductile detailing (Fig 6) and also had initiated the provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure (Fig 7). There was some increase in number in the year 2014 and now almost 75% of the municipalities have initiated the system (Fig 6, 7).





Figure 6: E 1.4, Number of municipalities that use detail checklist for building code compliance check

Figure 7: E 1.5, Number of municipalities that have provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure

Further in the recent years, all of the BCIPN municipalities have started a system of registration of masons and have been maintaining a roster of trained masons. The process has been initiated in all of the 29 municipalities (Fig 8).



The vast majority of municipalities still do not have any provision for strengthening of existing buildings/ retrofitting (for example, during the construction of an additional storey). Only three of the municipalities have begun to do so, and even there a fully functional system has not been established (Fig 9).



Figure 9: E 1.7, Number of municipalities that has provision for strengthening or retrofitting of existing buildings

ii. Results for Element 2: Technical Capacities In regard to the second element measuring technical capacity within the municipality, municipalities still score lower though the score did increase from 2012 to 2016. The number of new buildings constructed per year in the municipalities has been increasing even as the municipalities lack sufficient technical human resources (engineers, masons) to carry out safe construction.

Overall 29 municipalities surveyed, the S2 score rose from 0.84 (17%) in the year 2012 to 1.56 out of 5 (31%) in the year 2014 and 2.47 (49%) in 2016, clearly shows that demand still exceeds capacity in Nepal.



While municipalities have set up and conducted a number of training programs for masons, engineers and other professionals, that increased the number of trained technical workforce in the municipality, the demand still exceeds the supply. There are still not enough trained construction professionals to fulfil the ever-growing rate of construction (Figure 10).



On an average, there are just two to three engineers in municipalities while the average number of buildings constructed is more than 500 per year (Fig 10). It is estimated that for every **100 buildings there has to be at least one engineer in the municipal office for ensuring safer construction**. Therefore, for nearly 600 buildings there has to be at least six (6) engineers in the municipal office, but the available engineer is only two to three. This clearly shows that **the average number of engineers available in the municipality office is not sufficient as per the number of building construction in the municipalities**. In addition, in some of the municipalities there is just one subengineer and in some there is not a single engineer to look after the construction process (Table 8). It was observed that the number of available engineers as per the number of buildings constructed in that municipality is also not sufficient.

Table 8: Number of Engineers in the municipality

Number of Engineers in the municipality								
2012 2014 2016								
Minimum	0	0	1					
Maximum 4 4 4								

Figure 10: Average number of buildings constructed per year with permit in the municipalities along with the average number of engineers within the municipal office

iii. Results for Element 3: Municipality Revenue/ Budget Score

The revenue generated from the building permit process is a source of income for the municipalities and there was no system in most of the municipalities to allocate certain amount from the collected revenue to support for the building code implementation process, such as budget for conducting capacity building and awareness programs. Recently, after the implementation of BCIPN program and through continuous advocacy and interactions with the municipalities, the municipalities have now started allocating some amount from generated revenue for a budget to support the BCI activities in the municipalities.

The increased allotment of a dedicated budget for the BCI process was observed during the survey. The municipalities started allocating some budget for the implementation of building code. Overall, S3 representing budget allocation increased from 0.72 out of 5 (14%) to 2.17 (43%). There was almost no provision or minimal provision of allocating budget for implementing BCI. Less than 2% of the budget generated from revenue was allocated to building code implementation in the year 2012 which has increased up to 4-5% over the years (Fig 11).



Figure 11: Average amount of budget allocated for BCI from the revenue generated from Building Permit

4.2 Test of statistical significance for the difference in BCI scores in 2016 compared to 2012 This section attempts to test whether the differences in two set of scores are statistically significant. Since the samples are dependent, paired samples t-test or its non-parametric alternative (Wilcoxon Signed Rank Test) have been employed to test the statistical significance.

Test of Statistical Significance for the Difference in Institutional System Score (S1)

The statistical significance for the difference in S1 scores between 2012 and 2016 was examined using the Wilcoxon Signed Rank Test as the assumptions for paired samples t-test were not satisfied. However, it is important to note that using Wilcoxon Signed Rank Test, the decision is made for median values of the data sets, and not the mean, by computing ranks of each score.

The assumptions for the test used were examined before running the analysis.

Accordingly, we proceeded with the following hypothesis:

Null Hypothesis, H_0 : The median of the differences between two set of ranks equals zero.

Alternative Hypothesis, H_1 : (Median S1 Ranks) 2016 are statistically significantly higher than (Median S1 Ranks) 2012

Descriptive Statistics									
	Number of Observations	Mean	Std. Deviation	Minimum	Maximum				
S1_2012	29	0.30	0.91	0.00	4.50				
S1_2016	29	3.40	1.12	0.75	5.00				
	Test Statistics b								
	S1_2016 - S1_2012								
	Z -4.73 a								
P-value 0.00									
a. Based on negative ranks									
b. Wilcoxon Signed Rank Test									

Based on the above output of the statistical analysis (Table 9), it can be concluded that the median S1 ranks for 2016 were statistically significantly higher than the median ranks for 2012. Also, since the test was run because the data was skewed, we may conclude that mean S1 scores (3.4 ± 1.1) in 2016 were statistically significantly higher than mean S1 scores (0.3 ± 0.9) in 2012, Z= -4.73, p<0.00; an improvement of 3.1 ± 1.3 .

Test of Statistical Significance for the Difference in Technical Capacity Score (S2)

Since the assumptions for running the paired sample t-test were satisfied, the statistical significance of the difference in S2 scores between 2012 and 2016 was examined using paired sample t-test. The test was conducted with the following hypothesis:

Null Hypothesis, H₀: The mean of the differences between two set of scores equals zero.

Alternative Hypothesis, H₁: (Mean S2 Scores) 2016 are statistically significantly higher than (Mean S2 Scores) 2012.

Table 9: Test of Statistical
Significance for theDifference in Institutional
System Score (S1)

Paired Samples Statistics										
		N	lean	Number of Observations		Std. I	Deviation		ean	
S2_2	016	2	2.51	29)		0.84		0.15	
S2_2	012	(0.84	29)	0.80			0.14	
Paired Samples Test										
Paired Differences					t	Degree of freedom	P- value			
			Mean	Std. Deviation	Std. Error Mean	95% Confide of the Di	ence Interval fference			
						Lower	Upper			
Pair 1	S2_201 S2_201	6 2	1.67	0.71	0.13	1.40	1.94	12.67	28	0.00

Table 10: Test of Statistical Significance for the Difference in Technical Capacity Score (S2)

Based on the above output of the statistical analysis (Table 10), it can be concluded that the mean S2 scores (2.5 ± 0.8) for 2016 were statistically significantly higher than the mean S2 scores (0.8 ± 0.8) for 2012, t (29) = -12.7, p<0.00; an improvement of 1.7 ± 0.7 .

Test of Statistical Significance for the Difference in Budget Allocation Score (S3)

Finally, the statistical significance of the difference in S3 scores between 2012 and 2016 was established using the Wilcoxon Signed Rank Test as the assumptions for paired samples t-test were not satisfied. Following hypotheses were set for running the test:

Null Hypothesis, H₀: The median of the differences between two set of ranks equals zero.

Alternative Hypothesis, H_1 : (Median S3 Ranks) 2016 are statistically significantly higher than (Median S3 Ranks) 2012.



Table 11: Test of StatisticalSignificance for theDifference in BudgetAllocation Score (S3)

4.3 BCI status of the

4.3.1 Status of building

municipalities of Eastern

code implementation in the

municipalities by

Region of Nepal

region

Descriptive Statistics										
	Number of Observations	Mean	Std. Deviation	Minimum	Maximum					
S3_2012	29	0.72	0.99	0.00	3.00					
S3_2016	29	2.17	0.88	1.00	4.00					
	Test Statistics b									
S3_2016 - S3_2012										
Z -4.39a										
P-value 0.00										
a. Based on negative ranks										
b. Wilcoxo	n Signed Rank Te	st								

Based on the output of the statistical analysis (Table 11), it has can be concluded that the median S3 ranks for 2016 were statistically significantly higher than the median ranks for 2012. Also, since the test was run because the data was skewed, the result implies that mean S3 scores (2.2 ± 0.9) for 2016 were statistically significantly higher than mean S3 scores (0.7 ± 0.9) for 2012, Z= -4.39, p<0.00; an improvement of 1.4±0.9.

The BCIPN program municipalities are grouped into three different regions (Eastern, Central and Western) based on their geographical location.

Out of 30 municipalities covered by BCIPN program, ten (10) municipalities are grouped in the Eastern Region municipalities (Table 5).

The assessment of the municipalities of Eastern Region in the three different years indicated that the municipalities have made a significant progress in establishing a system and institutionalizing the process of Building code implementation.

The assessment shows that the municipalities of eastern region are in a better position than the municipalities of western and central region in terms of institutional system. The score has increased from 0.53 (10.5%) in 2012 to 3.65 (73%) in 2016 (Table 12, Table 13).

Gopal Prasad Khatiwada, Consultant sub-engineer, Birtamod Municipality

In Birtamod municipality the consultant engineers are assigned to submit the periodic report of the newly constructed houses. Since the number of engineers is very small and work load is high in the municipality, the consultant engineers are assisting the municipality to monitor the code compliance. We, the consultant engineers, house owners and municipality engineers are working together in full coordination to implement building code in this municipality.

Figure 12: Average score for BCI status in the municipalities of Eastern Region in the year 2012, 2014 and 2016



Table 12: Change in the average score and proportion of BCI status in the municipalities of Eastern Region

Birendra Yadav, Janakpur Sub-Metropolitan City

We didn't have an updated **Building Permit Application Forms** in our municipality, we were referring to the forms of other municipalities. Now, we have revised our permit system and the Application forms considering the local situation and house owner's perception. This revised version of permit application has two sets, one for house owner and another for the municipality. It is very easy and time saving for municipality and even for the house owners. Now, the House owner do not have to worry about where they need to go, who to visit and what to do next while in the process of getting the building permit and during the construction of their house. They can get all the information from the permit application book regarding construction and permit.

Year	Ins Sys	titutional stem (S1)	Te Capa	echnical acities(S2)	Budget for BCI/Revenue (S3)		
	Value	Proportion (%)	Value	Proportion (%)	Value	Proportion (%)	
2012	0.53	10.5%	1.07	21.5%	0.50	10%	
2014	1.40	28%	1.5	31.5%	1.6	32%	
2016	3.65	73%	2.45	49%	2.00	40%	

Institutional system for building code implementation in some of the municipalities of Eastern Region, such as Dharan and Damak, is very good. For instance, in **Dharan and Damak municipality**, **at present there is a system of regular supervision of the construction stages by the municipality officials, they have established a system of reporting of field supervision with photographs for different stages** (Annex 5). Dharan municipality has also formed an Advisory Committee comprising of relevant technical professionals. Most of the municipalities of eastern region have system of having a roster of trained masons.

Municipalities such as Bhadrapur, Birtamod, Biratnagar, and Triyuga have shown very good progress over the years. Their score was very low in the year 2012 compared to their score in 2016. A lot of improvements can be seen in Janakpur and Kamalamai municipalities as well. While in the municipalities such as Khandbari and Inaruwa the building code implementation initiatives are in very preliminary stage. The municipalities still don't have a system of using detail checklist for building code compliance check and also there is no provision set for the field inspection.
Table 13: Summary Table- BCI scores in the municipalities

BCI Score Summary Table

S. N	Key Variables	Bi	ratnag	jar		Damal	¢		Dharai	n	I	naruw	a	J	anakp	ur	Ka	amalan	nai	к	handb	ari		Triyug	a	B	lirtamo	bd	В	hadrap	our		Average	2
	Year	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016
Eastern	S1	0.75	1.5	4.5	0	3.5	4.5	4.5	4.5	5	0	0	2.25	0	0	4	0	0.75	4	0	0	1.25	0	2.25	3	0	0.75	4	0	0.75	4	0.53	1.40	3.65
	S2	0.75	1.5	1.5	1.25	1.5	3	4.5	4.5	4.5	1	1	2	0.5	1.25	1.5	0.5	1	1.5	0.75	0.75	2.25	0.5	1.25	2.5	0	1	2.75	1	2	3	1.08	1.58	2.45
	S3	0	1	3	3	3	3	2	3	3	0	1	1	0	1	1	0	1	1	0	2	2	0	2	2	0	0	1	0	2	3	0.50	1.60	2.00

S. N	Key Variables	В	haratp	ur		Butwa	I	ŀ	letaud	a	Ρι	ıtaliba	zar	Sidd	lharthr	nagar	-	Tanser	۱		Vyas		G	aindak	ot	Bh	imesh	wor	Kar	yabina	iyak	Be	sishal	har	A	lverag	e
	Year	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016
Central	S1	0	3	5	0	2	3	0.75	1.25	2	0	1.25	3.25	0	2	3	0	0	1.25	2	4	4	0	1.25	4	0	0.75	4.5	0	1.5	4	0	0	3.25	0.25	1.55	3.39
	S2	0.5	1.5	1.75	1	2.25	3	0.75	1.25	1.25	0.5	1.5	2.75	1	2.25	2.5	1.75	1	3.25	1	2	2.75	0	1.25	2.25	1	1	1.5	0	0.75	1.25	1	1	3	0.77	1.43	2.30
	S3	2	2	4	2	2	1	2	2	3	2	3	2	1	1	2	0	0	1	2	2	4	0	1	2	0	0	2	0	1	2	0	0	1	1.00	1.27	2.18

S. N	Key Variables	Aı	margao	dhi	Bh	eemdu	utta	Bire	ndran	agar	DI	nanga	dhi	(Ghoral	ni	0	Gulariy	a	N	epalgu	inj		Tulsipu	ır	1	Averag	е
	Year	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016	2012	2014	2016
Western	S1	0	0.75	0.75	0	0.75	4	0	1.5	4	0	3	4	0	3.25	3.25	0	0.75	3	0.75	1.5	2	0	1.5	4	0.09	1.63	3.13
	S2	1	3	3.75	0.75	1.25	3.75	0.5	1	2	0.5	1.25	2.25	0.5	1.25	2	1	3.75	4	0.25	1.25	1.5	0.75	1	2.5	0.66	1.72	2.72
	S3	0	2	2	0	2	3	0	1	2	1	2	3	2	2	3	2	2	2	0	2	2	0	2	2	0.63	1.88	2.38

4.3.2 Status of building code implementation in the municipalities of Central Region of Nepal Central Region covered twelve municipalities, while the survey data covers information for eleven municipalities (Gorkha was excluded from the survey).

The assessment of the municipalities of Central Region indicated that the region covers a very heterogeneous group of municipalities as the average score are lower than the other two regions. However, the results show that there has been a significant progress in the region: the score has increased from 0.25 (5%) in 2012 to 3.39 (68%) in 2016 in terms of institutional system, 0.77 (15%) to 2.3 (46%) in terms of technical capacities and 1 (20%) to 2.1 (44%) in terms of budget allocation.

Surya Prakash Lama, Civil Engineer, Bharatpur Metropolitan City

I improved my work with what I had learned from the trainings provided through BCIPN program. Now I found my work easier and I am able to answer Building Code related questions from construction workers, people in the community and even technicians. After the 2015 Gorkha earthquake, I tried my best to share my knowledge and skills. There was a time when people used to express their dissatisfaction with us at the office, claiming that the municipality was using the Building Code to harass them or to make things difficult. Now the situation has changed, the perception of people is changing. Building Code implementation is progressing, with almost 90% of new houses now constructed according to the Building Code. This level of understanding from the people brings satisfaction to our work.



Table 14: Change in the average score and proportion of BCI status in the municipalitiesof Central Region

Year	Instituti	onal System (S1)	Techn	ical Capacities(S2)	Budget for E	3CI/Revenue (S3)
	Value	Proportion (%)	Value	Proportion (%)	Value	Proportion (%)
2012	0.25	5.0	0.77	15.5	1	20.0
2014	1.55	30.9	1.43	28.6	1.27	25.5
2016	3.39	67.7	2.3	45.9	2.18	43.6

In municipalities such as Besisahar, Gaindakot (then VDC), Putalibazar, "building code implementation" was not declared and building construction practices were very poor before the implementation of the program. In other municipalities, "building code implementation" was declared but it was in a very preliminary stage, with very few technical personnel interested in following provisions of the building code. All the attributes for Santa Bahadur, Mason, Gaindakot Municipality, Nawalparasi

Before I attended the mason training, I didn't realize that masons could receive formal training, become certified, and join the Trained Mason's Union. I was also totally unaware that masons are provided identity documents and registered in their municipality. Even though I was working as a mason, I used to belittle the mason's profession. But after attending the mason training I realized that this profession carries the responsibility of saving thousands of lives. Since then, I worked hard to ensure that houses constructed under my supervision are strong and will not collapse and take lives. Now, I am very proud to be a mason. I want to be in this profession as long as I can contribute.

4.3.3 Status of building code implementation in the municipalities of Western Region of Nepal

Figure 14: Average score for BCI status in the municipalities of Western Region in the year 2012, 2014 and 2016 the three major components of building code implementation scored low in the year 2012.

Over the years, municipalities of Central Region have also made positive changes. Improvements are visible in many areas like size of the pillars increased, configuration of buildings improved, and provision of bands in masonry walls followed: in drawings as well as in field.

Municipalities have established systems for institutionalizing mandatory implementation of building code. For instance, in Bharatpur municipality, at present, there is a regular inspection and monitoring of building construction by municipality officials, they have established a system of reporting of construction completion through photographs. There is system of having roster of trained masons in most of the municipalities of central region.

Municipalities such as Vyas, Bharatpur, Bhimeshwor are doing very well. A progressive change can be seen over the years. Following them are Gaindakot and Putalibazar municipalities. Municipalities such as Tansen and Hetauda are still behind other municipalities in the region. Few training programs have been started in those municipalities while establishing a system at the municipality still remains a challenge.

Out of 30 municipalities covered by BCIPN program, eight (8) municipalities (Table 5) are in Western Region.

The assessment of the municipalities of Western Region in the three different years indicated that the level of progress has also been strong, like the other two regions. The results show that the score has increased from 0.09 (1.8%) in 2012 to 3.13 (62.5%) in 2016 in terms of institutional system, 0.6 (13.1%) to 2.7 (54.8%) in terms of technical capacities and 0.6 (12.5%) to 2.38 (47.5%) in terms of budget allocation.

It was observed that the municipalities of Western Region are in better position than the municipalities of eastern and central region in terms of technical capacity and budget allocation as the average score received by these municipalities was 2.7 (54.8%) in terms of technical capacities and 2.38 (47.5%) in terms of budget allocation.

Status of BCI in the municipalities of Western Region of Nepal



Year	Institution	al System (S1)	Technical	Capacities (S2)	Budget for B	CI/Revenue (S3)
	Value	Proportion (%)	Value	Proportion (%)	Value	Proportion (%)
2012	0.09	1.88%	0.66	13.1%	0.63	12.5%
2014	1.63	32.5%	1.72	34.4%	1.88	37.5%
2016	3.13	62.5%	2.72	54.4%	2.38	47.5%

Table 15: Change in the average score and proportion of BCI status in the municipalities of Western Region over the years

The municipality of Western Region such as Bheemdutta, Dhangadi are doing very well: a progressive change can be seen over the years. Following them are Gulariya, Tulsipur, Ghorahi and Birendranagar municipalities. While municipalities such as Amargadhi and Nepalgunj are still behind other municipalities in the region. Though the technical capacity of Amargadhi municipality was scored well (considering the fact that number of building construction is low in the municipality compared to the number of trained capacity) the municipality lacked proper institutional system to be in place.

Most of the municipalities of western region have already developed a system of provision of field inspection and monitoring by municipal engineers at three different stages of construction and reporting of construction completion with photographs. Municipalities such as Dhangadi, Bheemdutta, and Gulariya have recently started using the revised building permit forms. Ghorahi municipality does not issue building permit for story addition for those building that are not complying to the building code. The municipalities have a system of reward and punishment for masons based upon their work performance to follow the provisions of building code. Realizing the need, most of the municipalities (Ghorahi, Birendranagar Gulariya, and Dhangadi) have increased the number of technical manpower in the municipality.











4.4 Categorization of Municipalities according to BCI Status

Based upon the achieved level of success in building code implementation (total score achieved), BCIPN program municipalities have been classified into four different categories. Class A (Building Code Implementation - Level 4: BCI-L4) includes the municipalities that have already started implementation of building code and have achieved higher level of success. These are most successful municipalities in terms of effective building code implementation systems. Class B (Building Code Implementation - Level 3: BCI-L3) are the municipalities that have achieved appreciable level of success in building code implementation. Class C (Building Code Implementation – Level 2: BCI-L2) where the municipalities have shown some improvements towards effective building code implementation systems and Class D (Building Code Implementation – Level 1: BCI-L1) where the municipalities have had little improvements and much needs to be done.

Table 16: BCI Class Scoring System

BCI Status	Category	Score Obtained
BCI-L4	Class A	10-15
BCI-L3	Class B	8 up to less than 10
BCI-L2	Class C	7 up to less than 8
BCI-L1	Class D	Less than 7

The BCI Class score is the summation of the element scores achieved by the municipalities in three different components of Building Code Implementation i) S1- Institutional System ii) S2-Training Capacity and iii) S3- Financial Resources. The municipalities that scored between 10-15 are categorized as Class A municipalities, 8 up to less than 10 - Class B Municipalities, 7 up to less than 8 – Class C municipalities and less than 7 - Class D Municipalities.



S.No	Region	Municipality	Total (S=15)	Category	Total (S=15)	Category	Total (S=15)	Category
			201	12	201	4	201	6
1	Eastern	Dharan	11	А	12	А	12.5	А
2	Central	Bharatpur	2.5	D	6.5	D	10.75	А
3	Western	Bheemdutta	0.75	D	4	D	10.75	А
4	Central	Vyas	5	D	8	С	10.75	А
5	Eastern	Damak	4.25	D	8	С	10.5	А
6	Eastern	Bhadrapur	1	D	4.75	D	10	А
7	Central	Bhimeshwor	1	D	1.75	D	9.5	В
8	Western	Dhangadi	1.5	D	6.25	D	9.25	В
9	Eastern	Biratnagar	1.5	D	4	D	9	В
10	Western	Gulariya	3	D	6.5	D	9	в
11	Western	Tulsipur	0.75	D	4.5	D	8.5	В
12	Central	Gaindakot	0	D	3.5	D	8.25	В
13	Western	Ghorahi	2.5	D	6.5	D	8.25	В
14	Western	Birendranagar	0.5	D	3.5	D	8	В
15	Central	Putalibazar	2.5	D	5.75	D	8	В
16	Eastern	Birtamod	0	D	1.75	D	7.75	С
17	Central	Siddharthnagar	2	D	5.25	D	7.5	С
18	Eastern	Triyuga	0.5	D	5.5	D	7.5	С
19	Central	Besisahar	1	D	1	D	7.25	С
20	Central	Karyabinayak	0	D	3.25	D	7.25	С
21	Central	Butwal	3	D	6.25	D	7	С
22	Western	Amargadhi	1	D	5.75	D	6.5	D
23	Eastern	Janakpur	0.5	D	2.25	D	6.5	D
24	Eastern	Kamalamai	0.5	D	2.75	D	6.5	D
25	Central	Hetauda	3.5	D	4.5	D	6.25	D
26	Eastern	Khandbari	0.75	D	2.75	D	5.5	D
27	Western	Nepalgunj	1	D	4.75	D	5.5	D
28	Central	Tansen	1.75	D	1	D	5.5	D
29	29 Eastern Inaruwa			D	2	D	5.25	D
	OVERALL A	VERAGE	1.9		4.6		8.1	

Madan Paswan, Chairman of Bharatpur Municipality Worker's Association of Construction Workers.

We have formed an association of construction workers in our municipality and the association is working constantly to ensure safer construction. We have been working in close coordination and supervision of our municipality engineers towards implementing the building code. For this, we are jointly conducting various activities to promote awareness on building code compliance and monitoring. And, if any contractor is found to be constructing houses without following the earthquake safety measures, the association will take action against them.

Laxmi Prasad Soti, Civil engineer, Gaindakot Municipality

Actually, I was totally unaware about the importance of building code compliance until few years back. But 3-4 years' experience during this BCIPN program has helped to broaden my knowledge. Now, I have been conducting trainings to masons, house owners and community members. Neighboring municipalities and V.D.Cs also request me to conduct the engineer's training and mason trainings for them. I feel very proud on my improvement during the last few years in this field.

All the 29 program municipalities, with the exception of Dharan, were ranked as Class D (S<7) in the year 2012 (Table 17). The score was almost 0-1 in most of the municipalities. Activities supporting building code implementation were almost non-existent. The municipalities were not aware of and did not have idea and specific plans about building code implementation.

Of the 29 municipalities surveyed, substantial progress was seen in most of the municipalities over the years. Municipalities such as Bharatpur, Vyas, Bheemdutta, Damak, Bhadrapur and Dharan are now in BCI status Class A and are the highest scorer municipalities. Except for Dharan, all the other four municipalities have transformed from being a Class D municipality to a Class A municipality from 2012 to 2016 time period. Dharan municipality is one of the pioneer municipalities for implementing the building code and NSET has been working with Dharan municipality since the beginning. It is likely that the longer engagement period explains Dharan's higher initial status.

Similarly, much improvement can be observed in the municipalities such as Gaindakot, Bhimeshwar, Dhangadi (Class B municipalities) as compared to year 2012.

Among several other factors, readiness of the municipality to accept changes, role of strong leadership, positive attitude and continuous support to the municipalities through BCIPN program are likely some of the main contributing factors that contributed to this change.

According to the scores obtained for the three components of BCI, out of 29 municipalities, six (6) municipalities were able to achieve the Class A (BCI Status Score=10-15), nine (9) municipalities Class B (Score=8 up to less than 10), six (6) Class C (Score=7 up to less than 8) and eight (8) of the municipalities still fall under Class D (Score <7) category.

Municipalities such as Tansen, Khandbari, Inaruwa, and Nepalgunj scored lowest in all the attributes of building code compliance; however, even in these municipalities some good progress is observable over the assessment time period (Fig 16).

Report on Status of Building Code Implementation in the Municipalities of Nepal Building Code Implementation Program in Municipalities of Nepal (BCIPN)



Figure 16:Map showing the Ranking of the municipalities according to the Average BCI Score achieved in three different years

4.5 Comparison with non-BCIPN Municipalities

The Building Code Implementation Status Survey (BCISS) was carried out in additional three municipalities which were not part of BCIPN program, to have a comparative analysis of the observed change in the program municipalities against the nonprogram municipalities.

The survey was conducted in the year 2016, in the three municipalities: Shuklaphanta, Mithila, and Shuklagandaki municipalities, one each from the three regions as grouped in the BCIPN according to their geographic location. Shuklaphanta Municipality from Western Region, Mithila Municipality from Eastern Region and Shuklagandaki Municipality from the Central Region.



		-	-
Key Variables	Suklaphanta	Mithila	Suklagandaki
Institutional System on Building Permit Process	2016	2016	2016
Advisory/Technical Committee for BCI	No	No	No
Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
Need Structural Drawing for All Building Class	No	Yes	Yes
Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	Yes	No
Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
Has a system of registration of masons and roster of trained masons	No	No	No
Institutional System on Building Permit Process Score (S1)	0.00	1.50	1.25
Technical Capacities			
Building Constructed per Year with Permit	10	10	200
Building Constructed per Year without Permit	140	60	800
Engineer within Municipal Office	1	1	3
Sub Engineer within Municipal Office	0	0	6
Numbers of Mason Trained	0	0	0
Numbers of Engineer Trained (Consultant/Contractor)	0	0	0
Numbers of House Owner Oriented	0	0	0
Technical Capacities Score (S2)	0.50	1.00	0.75
Municipality revenue/ Budget	-		•
Revenue from Building Permits (in thousands)	200	500	1500
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (in thousands)	0	400	0
Budget for BCI/Revenue (S3)	0	5	0

Table 18: BCI Scores in the Non- BCIPN municipalities

It was observed that these non-BCIPN municipalities scored very low in all the attributes of building code implementation. Looking at the three major elements of BCI Status-- Institutional System; Technical Capacity and Budget Allocation, it was observed that the attributes defined to measure the institutional system on building permit process in the municipalities was not in place in all the three municipalities. Shuklaphanta municipality scored 0 out of 5 in the Institutional System (S1), while Mithila and Suklagandaki municipalities had just initiated the process (Table 18).

Similarly, the attributes of second element of BCI i.e. Technical capacities, was also the same. The municipalities had not yet started any form of trainings for engineers, masons and house owners of the municipality. The score for the third element, Budget Allocation was also 0 in the two municipalities except for Mithila municipality which interestingly scored high in this element (Table 18). Based upon the achieved level of success in building code implementation (total score achieved), all the three municipalities fall under Class D (Score <7) category (Building Code Implementation – Level 1: BCI-L1) where the municipalities have had little improvements and much needs to be done.



5 DISCUSSION AND CONCLUSIONS

Suraj Shrestha

Sr. Engineer, Dharan Sub-Metropolitan City, Dharan

Dharan has been actively providing continuous efforts in making municipality earthquake resilient since long back. Building Code was implemented in Dharan in 2007A.D. We have been using the checklist developed by NSET for monitoring the compliance of the constructed buildings. We have been also conducting house owner orientations to those houseowners who submit permit applications for constructing their houses. After the program intervention, the number of aware and responsible citizens have increased. We at Dharan Sub-metropolitan City feel very proud to say that our works is being replicated by other cities."

The Building Code Implementation Program in Municipalities of Nepal (BCIPN), which was implemented in 30 municipalities of Nepal, has been instrumental in providing technical support to municipalities and has helped them increase the effectiveness of their building code implementation systems. The technical support consists of 1) awareness-raising of populations on possibility of safer building construction, 2) building capacities of construction stakeholders i.e. masons, technicians, contractors, municipal engineers through training courses, and 3) improving institutional systems of municipalities to implement the code.

The Building Code Implementation Status Survey was carried out to measure the status level of each municipality in terms of creating an effective building permit and code enforcement system. The BCI Status was defined as a score of 15 (5 each in all 3 elements identified).

Of the 29 municipalities surveyed, substantial progress was seen in most of the municipalities over the assessment time period. Overall, the 29 municipalities started in 2012 with an average BCI Status Score of 1.9 (out of 15) and by 2016 they had increased to an average of 8.1.

Looking at the three major elements of BCI: Institutional System; Technical Capacity and Budget Allocation, score for establishment of Institutional System increased more than the other two elements. Further, in the recent years, all of the BCIPN municipalities have started a system of registration of masons and have been maintaining the roster of trained masons. The process has been initiated in all of the 29 municipalities. While there have been substantial changes in most areas, still much needs to be done. Most municipalities still don't have any provision for strengthening or retrofitting of existing buildings; only three of the municipalities have taken the initiation in this area even they still lack a fully functional system of existing building review.

The number of new buildings constructed per year in the municipalities has been increasing, but the number of human resources (engineers, masons) in the municipalities has not kept pace. While there has been a number of training programs for masons and engineers in the municipalities, conducted by the municipality and other organizations, and while these programs have increased the number of trained technical workforce in the municipality, their numbers are still not enough to fulfil the evergrowing rate of construction. Within the municipal office, there are just 2-3 engineers (average) to look after the construction while the average number of buildings constructed is more than 500 per year.

The revenue generated from the building permit process is one of the major sources of income for most of the municipalities. However, there was no system in most of the municipalities to allocate appropriate budget to support aspects of the building code implementation process, such as budget to conduct capacity building training and awareness programs. Recently, after the implementation of the BCIPN program and through continuous advocacy and interactions, municipalities have now started allocating some budget for supporting BCI activities.

Based upon the achieved level of progress in building code implementation (total score achieved), BCIPN program municipalities have been classified into four different categories:

- Class A (BCI-L1) municipalities which have already started implementation of Building Code and have achieved higher level of success. These are most successful municipalities and have been serving as examples.
- Class B (BCI-L2) municipalities are those who have achieved appreciable level of progress.
- Class C (BCI-L3) municipalities have shown some improvements in Building Code Implementation, and
- Class D (BCI-L4) municipalities with little progress and much need to be done.

It was observed that out of the total 29 municipalities surveyed, significant progress was seen in most of the municipalities over the years. Municipalities such as Bharatpur, Vyas, Bheemdutta, Damak, Bhadrapur and Dharan were the Class A, municipalities with highest progress. Except Dharan, all the other 4 municipalities have transformed from Class D municipality to Class A municipality over the years. Dharan was already in class A in year 2012. Much improvements can be observed in the municipalities such as Gaindakot, Bhimeshwor, Dhangadi (Class B municipalities) as compared to year 2012.

Readiness to accept changes, strong leadership role, and positive attitude of the municipality and continuous support of BCIPN program had made possible to achieve this change.

Out of 29 municipalities, six municipalities achieved Class A by 2016, nine municipalities Class B, six Class C and eight of the municipalities still fall under Class D category.

A similar survey was conducted in three different municipalities, one from each region where the BCIPN program was not implemented to compare the difference in the level of progress in the BCIPN and non-BCIPN municipalities. A remarkable difference was observed in these municipalities compared to the BCIPN municipalities. Even the data of 2016 shows that those three municipalities are far behind in terms of Institutional System, Technical Capacities and Budget Allocation for building code implementation and could be ranked under Class D (Score <7) category (Building Code Implementation – Level 1: BCI-L1). Activities such as training and orientation to the building construction stakeholders (masons, engineers, house owners, and municipal staff) were not there. The municipalities were not aware and did not have much idea on the elements of building

Rabindra Lal Mul,

Engineer, Vyas Municipality, Tanahu

The condition of Vyas municipality before introducing Building Code was in a much-disoriented state, the construction work was not up to the quality and the materials used were of very low quality. For eg. While making a concrete column people used to put only 4 bars where actually it should be at least 6 bars. And people used to put more bars in the visible portion like slab: 8 bars. But there have been tremendous changes in the recent years in Vyas municipality after the intervention of Building Code implementation program. Now, house-owners and masons build pillars, beams and slabs in proper manner. The municipality has been strictly following building codes and standards. code as a result of which the municipality's system for building code implementation was very poor as compared to the municipalities where BCIPN program was implemented.

BCIPN program has contributed to change in the perception of municipalities about building code implementation: Earlier, officials and staff at municipalities used to think that Building Code Implementation is a very difficult task, and they were very much reluctant to initiate the process. However, now most of the municipalities think BCI is possible and very much needed to ensure life safety of the population. BCI is possible with little additional efforts. There is a major change in perception of municipal staff. BCIPN efforts have established a consensus on various small but critical issues and solutions among the various stakeholders in building production process such as:

- Everyone agrees to the huge need of capacity enhancement, and there is a significantly increased demand for more training courses such training for engineers, masons, social mobilizers
 - Maintaining a uniform and standard national curriculum is critically important to improve uniform system of BCI compliance

There have been several policy decisions and practices established during the period, such as the initiation of allocation of budget for BCI, licensing system for local masons and contractors, etc. BCIPN has created a platform to bridge the gap between central and local levels – BCIPN worked with both central and local level government authorities which helped to reduce the gap and enhance the understanding at both levels. There has been a trickling down effect to other municipalities as well, the works done at the BCIPN municipalities have contributed to influence the nearby municipalities and villages as well.

The BCIPN program implemented during 2012-2017 has thus been instrumental in making remarkable progress and achievements and provides key inputs in paving future course of action.

Municipalities have expressed that the approaches and focus of technical support have been very useful and could motivate municipalities to continuously work toward ensuring safer construction through building code enforcement. The approaches and activities need continuation in the current municipalities and expansion to all other municipalities.



ANNEXES

Annex 1: Questionnaire for data collection

Building Code Implementation Program in Municipalities of Nepal (BCIPN)

Survey Checklist for Status of Building Code Implementation (BCI) in Municipality

Dat	te: //
Α.	Information on Municipality Buildings and Human Resources
1.	Population
2.	Numbers of existing buildings
3.	Numbers of new buildings construction per year with permit
4.	Numbers of new buildings construction per year without permit
5.	% of R.C.C new buildings constructed per year.
6.	
7.	Numbers of manpower within the municipal office
	a) Engineers: b) Sub-engineer: c) Sub-overseer:
	d) Total manpower
8.	Within municipal area tentative numbers of
	a) Petty contractors: b) Masons:
	c) Consulting firms d) Consultant engineers:
В.	Information on Building By-Laws
1.	Building by-law exists: Yes No
2.	If yes, when was by-laws built: (Date)
3.	Risk Sensitive Land Use Planning exists; : Yes No
C.	Information on Building Permits
1.	Does building permit application process is required for all wards/settlement of municipality? :
	Yes \square No \square
2.	Does the municipality has Local Disaster Risk Management Plan (LDRMP)?
	Yes No
3.	Current Building permit system of the municipality has
	a) Building Permit Unit/Cell b) Separate BCI Cell c) Separate EQ Safety Unit
	d) Dedicated Technical Staff for BCI e) None
4.	Does the municipality has a separate Advisory Committee/ Technical Guide Committee for BCI?
	Yes No No

5. Does municipality have earthquake damage scenario and action planning? Yes No

Wherever applicable, please tick mark the appropriate option in the given box ($\sqrt{}$) for Yes and (X) for No

	Building	g Class ac	cording to	NBC	
	Class	Class	Class "	C"	Class
	"A"	"B"	RCC	Masonry	"D"
Building permit application process is required for					
Permit fee per square feet					
Current building permit system required					
Architectural plans					
Structural details drawing					
Structural design report					
Building material specifications					
Soil investigation report					
Declaration from designer					
Declaration from house owner					
Designer permit license					
Contractor permit license					
Mason/petty contractor license					
Does Building permit application content					
Checklist of building configuration according NBC					
Checklist of building strength according NBC					
Checklist of building ductile detailing according NBC					
Checklist of architectural design requirement according NBC					
Checklist of city building bylaws					
Field monitoring step					
Layout & bylaws					
Foundation structure					
Plinth level structural					
on every storey structural					
Supervisor by designer and declare compliance according to design					
Foundation Structure					
Plinth level structural					
on every storey structural					
Certification					
issue for layout and foundation digging					
Issue for construction up to Plinth level					
Issue for construction of superstructure					
Completeness of building permit process					
Completeness and compliance with applicable Law					

6. Status c	of BCI
-------------	--------

		Declared and implemented with concrete plans, programs
		Declared and implemented with very little plans, programs
		Declared but not concrete plans, programs
		Planning to initiate, declare
		Very little or no awareness, but interested
		No awareness, no interest
7.	If BCI	is already declared, it was declared on
8.	Does 1	nunicipality have immediate plans/program in terms of BCI?
	Yes	No 🗌
9.	If yes,	what are the plans for BCI on municipality?
		Mason Training
		Engineers Training
		Awareness Program
		Demonstration Program
		Radio/TV Program
		Review of BCI
		Others (Please Specify)
10.	Name	of organization supporting BCI.
11.	No of	training on the past?
		Mason Trainings: No of training No. of Masons Trained
		Earthquake basic and MRT training for Engineers (consultants + contractors): No of training No of engineers trained
		Detail Design training for Engineer: No of training, No of engineers trained
		House Owner Trainings/Orientation: No of training/orientationNo of house owners Oriented
12.	Does (While	the municipality has the provision for strengthening of existing buildings/Retrofitting e addition of storey or in any case)?

Report on Status of Building Code Implementation in the Municipalities	of Nepal
Building Code Implementation Program in Municipalities of Nepal ((BCIPN)

Yes 🗌 No 🗌

13. What is the level of awareness /understanding of other municipal staff towards the importance of Building Code?

Little Aware	No Awareness
	Little Aware

D. Municipality Revenue/Budget

- 1. Total Revenue of municipality
- 2. Revenue from building permits process
- 3. Budget allocation for Building Code Implementation

E. Contact Details

4. Municipality contact person and mobile no:

44

Annex 2: Municipality Details: List of visited municipalities, selection criteria and selected BCIPN municipalities

- a) List of municipalities visited with brief details
- b) Selection criteria
- c) Scores for various criteria used for selection of municipalities
- d) Selected Municipalities
- a. List of municipalities visited with brief details

1. Ilam	8.Dharan	15.Janakpur	22.Butwal	29.Gulariya
2.Mechinagar	9.Inaruwa	16.Birgunj	23.Siddarthanagar	30.Birendranagar
3.Bhadrapur	10.Dhankuta	17.Hetauda	24.Kapilbastu	31.Narayan
4.Damak	11.Khandbari	18.Bharatpur	25.Ghorahi	32.Tikapur
5.Biratnagar	12.Triyuga	19.Ramgram	26.Tulsipur	33.Dhangadhi
6.Itahari	13.Kamalamai	20.Tansen	27.Nepalganj	34.Bhimdutta
7.Dipayal	14.Silgadhi	21.Amargadhi	28.Dasarathchanda	



b. Selection Criteria: Criteria used for the preliminary selection of program municipalities

S. No.	Municipality Selection Criteria	Weightage given for selection
1	Annual Growth Rate	10%
2	Building construction permit per year	10%
3	MCPM Rank	15%
4	BCL Level	15%
5	Level of Interest	20%
6	Engineer	10%
7	Municipality Plan	10%
		100%

c. Scores for various criteria used for selection of municipalities

S.No	Criteria	Score
1	Population	
а	less than 25000	2
b	25000- 50000	6
С	50000-75000	10
d	75000-100000	10
е	100000-150000	6
f	above 150000	2
2	Annual Growth Rate	
а	less than 1	2
b	1 to 1.99	5
С	2 to 3.99	8
d	above 4	10
3	Building construction permit per year	
а	less than 100	2
b	100-200	4
с	200-300	8
d	300-400	10
е	400-500	8
f	500-800	6
g	above 800	2
4	MCPM Rank	
	Rank 1	15
	Rank X	15-(X-1)*0.2586
	Rank 58	0.2586
5	BCL Level	
а	Declared and implemented with concrete plans, programs	10
b	Declared and implemented with very little plans, programs	15
С	Declared but not concrete plans, programs	10
d	Planning to initiate, declare	6
е	Very little or no awareness, but interested	3
f	No awareness, no interest	1
6	Level of Interest	
	High	20
	Medium	10
	Low	5
	None	0
7	Availability of Engineer/Technical Manpower	
	above 6	4
	2 to 3	6
	1	10
	0	4
9	Municipality Plan	т
3	Plan with hudget	10
		ίυ ζ
		0
	No pian no budget	U

d. Selected Municipalities

BCIPN program municipalities

	Eastern Part	Central Part	Western Part	Total
Municipalities	 Bhadrapur Biratnagar Inaruwa Janakpur Khandbari Triyuga 	9. Bharatpur 10. Bhimeshwor 11.Butwal 12.Gorkha 13. Hetauda 14.Kamalamai 15.Putalibazar 16.Siddharthanagar	 22. Amargadhi 23. Bhimdatta 24. Birendranagar 25. Dhangadhi 26. Ghorahi 27. Gulariya 28. Nepalgunj 	21
Town under VDC	7. Anarmani (Now Birtamod municipality)	17. Gaidakot (Now Gaidakot municipality) 18. Sainbu (Now Karyabinayak municipality)		3
Additional municipalities	8. Dharan Sub- Metropolitan City (SMC)	19. Besisahar Municipality 20. Tansen Municipality 21. Vyas Municipality	29.Tulsipur Municipality 30.Damak Municipality	6
Total	8	13	9	30

Annex 3: BCIPN Program Accomplishments (October 2012-September 2017)

S N	Output Indicator	Target	Target	Reached	Reached
0.14	output maleator	Nos	Beneficiary	Nos	Beneficiary
1	Number of engineers and junior engineers trained on earthquake resistant buildings construction	24	720	26	1,171
2	Number of masons trained on earthquake resistant building construction	160	5,000	150	4,926
3	Number of house owners that participated in earthquake safety awareness programs		20,000		>95000
4	Number of Social leader, TLO, social mobilizers trained on earthquake-resistant construction technology and mobilization of communities for safer construction practices	48	1,200	175	6,233
5	Number of master instructors trained on safer construction practices (TFI+TOT)	2+3	48+72	1+3	24+79
6	Number of demonstration projects completed	3		2	
7	Number of sharing and exchanges visits conducted	3	36	3	30

Annex 4: References

- 1. A. Dixit (2004) "Promoting safer building construction in Nepal" 13WCEE Conference, Vancouver, Canada
- 2. JICA (2002). *The Study on Earthquake Disaster Mitigation in the Kathmandu Valley, Kingdom of Nepal*, Tokyo, Japan International Cooperation Agency.
- 3. Kandel.R 1, S. Shrestha.2, A. Dixit (2008) "Bottom- up approach for Building Code Implementation in Nepal". 14WCEE Conference, Beijing, China
- L. Arendt, A. Hortacsu, K. Jaiswal, J. Bevington, S. Shrestha, F. Lanning, G.M-William, G.Naeem, K. Thibert. "Implementing Nepal's National Building Code – A Case Study in Patience and Persistence" EERI, Published in Earthquake Spectra (2017)
- 5. MCPM Report (2017). An Analysis Report of Minimum Conditions and Performance Measures of Local Bodies in Nepal, 2014/2015, Local Bodies Fiscal Commission. Government of Nepal
- 6. Municipality Profile of different municipalities, as published in the respective municipality websites
- 7. NSET (2017). Program Performance Final Report Building Code Implementation Program in the municipalities of Nepal (BCIPN)
- 8. *Nepal National Building Code; NBC 205: (1994).* Ministry of Physical Planning and Works Department of Urban Development and Building Construction, Government of NEpal
- 9. Parajuli, Y., J. Bothara, A. Dixit, J. Pradhan, and R. Sharpe. 2000. "*Nepal Building Code—Need, Development Philosophy and Means of Implementation*." WCEE Conference, Auckland, New Zealand.
- 10. Rana, M. G. B. S. J. B. (1935). *The Great Earthquake in Nepal 1934 A.D.* (K. Lal, Trans.): Ratna Pustak Bhandar. Kathmandu.
- S. Shrestha.2, A. Dixit (2008) "A hierarchical system for training and awareness raising at grass roots level: experiences of NSET from earthquake-resistant housing reconstruction in Pakistan". 14WCEE Conference, Beijing, China
- 12. S. Shrestha.2, A. Dixit (2004) "Earthquake risk management in rapidly urbanizing areas of Nepal" 13WCEE Conference, Vancouver, Canada
- 13. Thapa, N. (1989). *Bhadau Pachiko Bhukampa* (Earthquake of Bhadra 5) 2045. Kathmandu: Central Natural Calamity Response Committee.
- 14. UNCRD (United Nations Centre for Regional Development). 2008. "Handbook: Building Code Implementation— Learning from Experience of Lalitpur Sub-Metropolitan City, Nepal." United Nations Centre for Regional. Development Disaster Risk Management Planning Hyogo Office.
- 15. World Bank Group/GFDRR (2015). Building Regulation for Resilience Managing Risks for Safer Cities



Annex 5: Summary report of each Municipality Status of Building Code Implementation EASTERN REGION

Bhadrapur Municipality

1. Location and Demography

Bhadrapur Municipality is located in Jhapa district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Bhadrapur got municipality status in 1952 A.D (2008 B.S.) It occupies land area of 96.35 sq. km and lies around 300 feet above sea level. It has a sub-tropical climate with maximum and minimum temperatures ranging around 38° C to 10° C during the summer and winter respectively.



i. Population Distribution

The 2011 census counted 18,646 inhabitants with 0.27% annual growth rate and population density 1766 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 18,899 inhabitants with 4,306 households. This population is of the then Bhadrapur municipality before the change in new federal structure. Nepali is spoken as the national language.

ii. Population Demography

The mother tongue for the majority of residents is Nepali. The main inhabitants of the municipality consist of groups like Brahman, Rajbansi, Chhetri, Muslims, Newars, Bangalis, Marwadis and Kewats.

(District and VDC profile, 2010).

iii. Main Economy

Bhadrapur Municipality is located at the border with India. It was also a major center for trade and commerce. However, due to the construction of the East West Highway (north of Bhadrapur), economic activities have also shifted north to the junction of the highway Birtamod. This has left Bhadrapur with a receding population and crippled its once booming economic activity. But now, as Mechi Bridge is being constructed, municipality will again gain its pace.

iv. Service and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 81.31% with male literacy rate 88.04% and female literacy rate 75%. It was found that 89.22% of households have access to electricity, 62.36% use tap/piped water, 75.52% households own mobile phones and 25.21% households use landline telephone.

(National Population and Housing Census, 2011)

2. Hazards and Risk

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Bhadrapur municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Epidemic, Flood, Thunderstorm and Accident. Fire ranked as first major hazard as 74% building out of 331 total buildings were destroyed by it. Similarly, epidemic is ranked as second

major hazard which caused 98% injuries out of 728. Accident ranked as fifth major hazard in terms of occurrence and caused 49% of death out of 94 total death.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Bhadrapur municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

Bhadrapur is a historical town of Nepal. It consists of approximately 2,691 buildings as of 2016 A.D. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 96% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N	Description	2012	2014	2016
	Population	18,696	18,797	18,899
	Area (Sq. Km)			96.35
	Number of existing buildings	2,662	2,677	2,691
	Number of new building constructed per year with permit	30	40	100
	Number of buildings constructed per year without permit	100	100	60
	No. of Trained Masons		60	126
	Numbers of Engineer Trained (Consultant/Contractor)		63	152
	Technical manpower with Municipal Office	2	2	2
	Total Manpower in Municipal Office			54

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2015 A.D. in Bhadrapur Municipality. Groups of masons were formed in 2013, before declaration of BCI. Field supervision through consultants was initiated in 2017 to ensure the building code implementation.

Municipal Milestones on Building Code Implementation

	Milestones			
Year	In etitution of Connecity	Capacity Enhancement		Awareness Beneficiaries
			Engineers	
2013	Formation of mason group	32		
2014		31		
2015	Declare Building Code	28		
2016	Increased technical manpower of municipality	31		57
2017	Field Supervision through consultant	29		

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Bhadrapur municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals, exploratory visit to municipality, etc. were used for the data collection.

The status of building code implementation in the Bhadrapur municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Bhadrapur municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	400	500	1000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	50	100

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	30	40	100
Building Constructed per Year without Permit	100	100	60
Engineer within Municipal Office	1	1	1
Sub Engineer within Municipal Office	1	1	1
Numbers of Mason Trained		63	152
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	0
2014	0.75	2	2
2016	4	3	3

Fig 1: Average scores for BCI status in Bhadrapur Municipality in the year 2012, 2014 and 2016

The figure shows that there has been remarkable improvement in the Institutional System towards implementing building code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional System on building code seems to change better than the other two components.

iv. Institutional System on Building Permit Process of Bhadrapur Municipality

The institutional system on building permit process has seen much improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Bhadrapur Municipality has succeeded to introduce separate Earthquake safety Unit or Separate BCI Cell or Dedicated Technical Staff, need of structural drawing for all building class, use of detail checklist for building code compliance and provision of field inspection for structural details since 2016 A.D. The system of maintenance roster of trained masons started from year 2014.

v. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new buildings constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012, 2 in 2014 and 3 in 2016 out of 5, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Bhadrapur Municipality, there are around 150 buildings constructed per year and are under the supervision of 1 engineer and 1 sub-engineer as shown in the figure below.







Fig 3: No. of Engineer and Sub-Engineer within Bhadrapur Municipal Office

vi. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code.

The score increased from 0 in 2012 to 2 in 2014 to 3 in 2016.

4. Conclusions

• There has been remarkable improvement in Institutional System towards implementing

building code over the years than the other two components-Technical Capacity and Budget Allocation.

- In Bhadrapur Municipality, more than 150 buildings are constructed per year and are looked after by 1 engineer and 1 sub engineer.
- Bhadrapur municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation EASTERN REGION

Birtamod Municipality

1. Location and Demography

Birtamod is known as the heart of Jhapa District which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Birtamod was announced as municipality in May, 2014 merging Anarmani, Charpane and Garamani VDCs. It occupies the land area of km. The coordinates 78.24sq. of this Municipality are 26^0 38' North to 87^0 59' East. The nearest settlements to Birtamod Municipality are Sarnamati Bazar. Kamatoli Bazar. Shivasatakshi Bazar, Chakchaki Bazar and Surunga Bazar.



2. Hazard and Risk

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Birtamod municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Flood, Accident, Thunderstorm and Epidemic. Fire ranked as first major hazard that was responsible for damaging all 721 buildings and caused 97%

i. Population Distribution

The 2011 census counted 60,174 inhabitants with 4.3% annual growth rate and population density 1,674.29 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 74,273 inhabitants with 17,765 households. This population is of the then area occupied by Birtamod before the change in new federal structure. Nepali is spoken as the national language.

ii. Population Demography

The main inhabitants of the Birtamod Municipality are Rajbansi, Brahmins, Chhetri, Newar, Limbu, Rai and various others. Majority of the people follow Kirant and Hinduism with significant numbers of Muslims, Buddhists and Christians in the municipality.

iii. Main Economy

Birtamod Municipality is largest city of Jhapa District. It is commercial, educational and tranportional hub of Jhapa. The main economy of Birtamod is agriculture because of its fertile soil. Some of the seasonal crops are rice, wheat, mustard and tea. Similarly, industrial trends such as various cement factories and IT industry are also growing for outsourcing business.

injuries out of 30 total injuries. Accident, the third major hazard in terms of occurrence caused 27% of deaths out of 15 total deaths.

Nepal is highly earthquake prone and throughout the country, there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Birtamod municipality is not an exception.



Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 11,103 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed building. A study conducted in 2016 under BCIPN program

of NSET evidenced that 94% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as shown in the table.

S.N	Description	2012	2014	2016
	Population	62,761	68,275	74,273
	Area (Sq. Km)			78.24
	Number of existing buildings	9,382	10,207	11,103
	Number of new building constructed per year with permit	100	200	500
	Number of buildings constructed per year without permit	300	300	50
	No. of Trained Masons		95	209
	Numbers of Engineer Trained (Consultant/Contractor)			42
	Technical manpower with Municipal Office		2	3
	Total Manpower in Municipal Office			30

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2015 A.D.in Birtamod Municipality. However, preparatory works such as formation of trained masons' group was done earlier in 2012 A.D. masons/contractors in 2014. Similarly, the municipality also prepared the roster of consultant engineers in 2016. Recently in 2017, Building Permit process had come up with building permit software which incorporated revised building permit form.

The municipality started a system of certification/identity card to trained Municipal Milestones on Bu

	Milestones				
		Capacity Enhancement		Awareness	
Year	Institutional Capacity	Masons	Engineers	Beneficiaries	
2012	Formation of mason groups				
2013	Budget Allocation for BCI				
2014	System of certification/identity card to masons/ contractors	58			
2015	Declare Building Code Implementation	31	16		
2016	Listing of Consultants	64	23	182	
2017	Implement revised building permit form	33			

Municipal Milestones on Building Code Implementation

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Birtamod municipality to measure the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Birtamod municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality were used for the data collection.

The status of building code implementation in the Birtamod municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Birtamod municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	1000	2000	4500
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	0	100

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	100	200	500
Building Constructed per Year without Permit	300	300	50
Engineer within Municipal Office	0	0	1
Sub Engineer within Municipal Office	0	2	2
Numbers of Mason Trained		95	209
Numbers of Engineer Trained (Consultant/Contractor)			42
Numbers of House Owner Oriented			210

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0	0
2014	0.75	1	0
2016	4	2.75	1

Fig 1: Average scores for BCI status in Birtamod Municipality in the year 2012, 2014 and 2016
The figure shows that there has been remarkable improvements in Institutional System towards implementing Building Code over the years. Of the three major components of Building Code Implementation - Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Birtamod Municipality

The institutional system on building permit process has seen much improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as: introduction of separate Earthquake safety Unit or Separate BCI Cell or Dedicated Technical Staff, need of structural drawing for all building class, use of detail checklist for building code compliance and provision of field inspection for structural details were initiated by the year 2016 A.D. The system of certification of masons /maintenance of roster of trained masons was introduced in 2014 AD.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0 in the year 2012, 1 in 2014 and 2.75 in 2016 out of 5, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Birtamod Municipality, more than 500 buildings are constructed per year and are under the supervision of 1 engineer and 2 sub-engineers as shown in the figure below:



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of Building Code since 2016.

The score has increased from 0 in 2012 to 1 in 2016.

7. Conclusions

- There has been significant improvement in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacity and Budget Allocation.
- In Birtamod Municipality more than 500 buildings are constructed per year and are looked after by 1 engineer and 2 sub- engineers.
 - Birtamod municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken NSET.

Status of Building Code Implementation EASTERN REGION

Biratnagar Metropolitan City

1. Location and Demography

Biratnagar Metropolitan City is located in Morang district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Biratnagar was established as town in the year 1915 A.D., after headquarter of Morang district was transferred from Rangeli to Biratnagar. Biratnagar got municipality status in 1951 A.D and Sub-Metropolitan City status in 1995 A.D. Biratnagar was declared as a Metropolitan City on May 22, 2017. It occupies land area of 78.24 sq. km. and the altitude ranges around 72m above sea level. It has a sub-tropical climate with maximum and minimum temperature ranging around 42° C to 10° C during the summer and winter respectively.



iv. Population Distribution

The 2011 census counted 2,04,949 inhabitants with 2.07% annual growth rate and population density 3,504.60 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection of 2016 was counted 2,27,058 inhabitants with 49,999 households. This population is of the then Biratnagar Sub-Metropolitan City before it was merged to form Metropolitan City. The mother tongue for the majority of residents is Nepali and Maithili.

v. Population Demography

The main inhabitants of the metropolitan city consist of groups like Brahman, Kshtriya, Marwari, Madhesis, and Tharus. It has a significantly large Muslim population.

vi. Main Economy

In Nepali "birat" means huge and "nagar" means city. In the past, the region had a king whose name was Birat and the ruins of whose palace can be seen. The name "Biratnagar" for the city comes from the name of King Birat. It is located in the Gangetic plains and the land is very fertile. Hence, Biratnagar has traditionally been an agricultural hub and is home to many industries based on agriculture. It is located at the border with India and is therefore a major center for trade and commerce with India.

Out of total population of Biratnagar Metropolitan City, 32.0% is Usually Active Population Aged 10 and above of which 20.3% were involved in service and sales works, 15.1% were involved in crafts and elementary works, 15.7% in elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

vii. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 80.49% with male literacy rate 86.96% and female literacy rate 73.86%. It was found that 91.77% of households have access to electricity, 36.84% of households use tap/piped water and 78.27% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Biratnagar Metropolitan City. The DesInventar datasets show that the metropolitan City has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Epidemic, Flood, Accident and Thunderstorm. Fire is the first major hazard as 95% buildings out of 651 were destroyed due to it. Similarly, epidemic is second major hazard which caused 87% of injuries out of 843 and 83% of death out of 356 total deaths.

Nepal is highly earthquake prone and throughout the country, there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Biratnagar Metropolitan City is not an exception.



Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

Biratnagar is a historical town of Nepal. It consists of approximately 25,000 buildings as of 2016. Nowadays, most of the newly constructed

buildings are Reinforced Cement Concrete (RCC) framed. A study conducted in 2016 under BCIPN program of NSET evidenced that 86% of the RCC buildings comply with Nepal National

S. N.	Description	2012	2014	2016
1	Population	2,09,191	2,17,942	2,27,058
2	Area (Sq. Km)			78.24
3	Number of existing buildings	23,033	23,996	25,000
4	Number of new building constructed per year with permit	1,500	1,800	1,800
5	Number of buildings constructed per year without permit	500	300	300
6	No. of Trained Masons		95	209
7	Technical manpower with Municipal Office	17	19	16
8	Numbers of Engineer Trained (Consultant/Contractor)		64	64
9	Total Manpower in Municipal Office			336

Building Code. Building information and human metropolitan city are as follows: resources for building construction in the

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestone on Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2013 A.D. in Biratnagar Metropolitan City with the allocation of some budget. However, as preparatory works for BCI, formation of masons group was already done in 2012. In 2016, the Metropolitan city had formed an advisory committee of technical consultants for the smooth implementation of Building Code and roster of consultant engineers were also prepared in the same year. Field supervision through consultants was initiated in the same year to ensure the building code implementation.

	Milestones					
Year	Institutional Constitu	Capacity Enhancement	Awareness			
	Institutional Capacity	Masons	Engineers	Beneficiaries		
2012	Formation of mason group					
2013	Budget allocation for BCI	33		27		
	Declare Building Code					
2014		63	61			
2015		27				
2016	Increased technical manpower of metropolitan city	53				
	Field Supervision through consultant					
	Formation of advisory committee of technical consultant Listing of consultant					
2017		35				

Municipal Milestones on Building Code Implementation

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Biratnagar Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Birtanagar Metropolitan City. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality were used for the data collection.

The status of building code implementation in the Biratnagar Metropolitan City was assessed in

terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each components, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Biratnagar Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	Yes
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	Yes	Yes	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	16000	20000	30000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	200	500

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	1500	1800	1800
Building Constructed per Year without Permit	500	300	300
Engineer within Municipal Office	12	12	12
Sub Engineer within Municipal Office	5	7	4
Numbers of Mason Trained		95	209
Numbers of Engineer Trained (Consultant/Contractor)		64	64
Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0.75	0.75	0
2014	1.5	1.5	1
2016	4.5	1.5	3

Fig 1: Average scores for BCI status in Biratnagar Metropolitan City in the year 2012, 2014 and 2016

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The figure shows that there has been significant improvement in Institutional System towards implementing Building Code over the years. Of the three major components of Building Code Implementation - Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional Mechanisms seems to change better than the other two components.

4. Institutional System on Building Permit Process of Biratnagar Metropolitan City

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0.75 in 2012 to 4.5 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; introduction of Advisory Committee, need of structural drawing for all building class, use of detail checklist for building code compliance and provision of field inspection for structural details were initiated in 2016. The establishment of Earthquake Safety Unit or BCI Cell or Dedicated Technical Staff was introduced in 2012.

Number of Building constructed in municipality with permit and without permit 1800 1800 1800 1500 1600 1400 1200 1000 800 00 600 400 200 0 2012 2014 2016 Building Constructed per Year with Permit Building Constructed per Year without Permit

Fig: No. of Buildings constructed in Biratnagar Metropolitan City

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that Biratnagar metropolitan city

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the metropolitan city. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.75 in the year 2012 and remained 1.5 (out of 5) when surveyed in 2014 and 2016. This shows that the high demand of technical manpower is gradually fulfilled and still a huge gap prevails. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Biratnagar Metropolitan City, at present, more than 2000 buildings are constructed per year and are under the supervision of 12 engineers and 4 sub-engineers as shown in the figure below:



Fig: No. of Engineers and Sub-Engineer within Biratnagar Municipal Office

has started allocating budget for the implementation of building code since year 2014.

The score has increased from 0 in 2012 to 1 in 2014 to 3 in 2016.

7. Conclusions

- There has been significant improvement in Institutional system towards implementing building code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Biratnagar Metropolitan City more than 2,000 buildings are constructed per year and are looked after by 12 engineers and 4 sub-engineers.
- Biratnagar Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the Municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation EASTERN REGION

Damak Municipality

1. Location and Demography

Damak Municipality is located in Jhapa district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Damak was established as a municipality in 2039 B.S. It covers an area of 70.86 sq. km. and lies at an altitude of 71 meters above sea level. It has moderate climate with maximum and minimum temperature ranging around 35° C to 10° C during summer and winter respectively. Damak Municipality is surrounded by the Lakhanpur VDC in the east, Urlabari and Ramghat VDCs in the West, Chulachuli VDC in the north and Kohabara VDC in the south. It lies between 26° 20' to 26° 50' north latitude and 88° 39' to 88° 12' east longitude.



i. Population Density

The 2011 census counted 75,743 inhabitants with 7.72% annual growth rate and population density 1,072.39 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1,09,856 inhabitants with 26,258 households. This

population is of the then Damak Municipality before the change in new federal structure. Nepali is spoken as the national language.

ii. Population Demography

The main inhabitants of the municipality are Brahmin followed by Chhetri, Rai, Dhimal, Newar and Limbu. The mother tongue for the majority of residents is Nepali covering 65% of total population followed by Limbu (6.17%), Dhimal (5.58%) and Rai (4.13%).

(Municipality Profile of Nepal, 2008)

iii. Main Economy

Of the total population of Damak Municipality, 37.2% is usually Active Population Aged 10 and above of which 34.9% are involved in agriculture, forestry and fishery works, 18.1% are involved as service and sales works, 13.1% in crafts and elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 81.99% with male literacy rate 87.81% and female literacy rate 76.87%. It was found that 92.6% of households have an access to electricity, 35.24% of households use tap/piped water and 84.75% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and in Damak municipality. impact The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazard on the basis of frequency of occurrence are Fire, Flood. Epidemic. Thunderstorm and Accident. Fire ranked as first major hazard as 58% buildings out of 329 total buildings were destroyed by it. Although, epidemic ranked as third major hazard, it had significant effect as 46% out of 23 total injuries and 75% out 61 total deaths were due to epidemic.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Damak municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 13,129 buildings as of 2016. Nowadays, most of the newly constructed buildings are in Reinforced Cement Concrete (RCC) framed. A study conducted in 2016 under BCIPN program

of NSET evidenced that 90% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N	Description	2012	2014	2016
	Population	81,590	94,674	1, 09,856
	Area (Sq. Km)			70.86
	Number of existing buildings	9,751	11,314	13,129
	Number of new building constructed per year with permit	400	500	600
	Number of buildings constructed per year without permit	100	100	50
	No. of Trained Masons	100	130	230
	Numbers of Engineer Trained (Consultant/Contractor)		28	57
	Technical manpower with Municipal Office	4	4	4
	Total Manpower in Municipal Office			60

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestone on Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2012 A.D. in Damak Municipality with the allocation of budget. Similarly, the municipality also formed an Advisory Committee of technical consultants for the smooth implementation of Building Code.

The municipality started a system of certification/identity card to trained masons/contractors in 2013. Similarly,

municipality prepared the roster of consultant engineers in the same year.

In 2014, to ensure the Building Code implementation, field supervision through consultants was initiated. The process of reporting with photographs of different stages of construction for the field supervision was introduced in the same year.

	Milestones				
		Capacity En	hancement	Awareness	
Year	Institutional Capacity	Masons	Engineers	Beneficiaries	
2012	Budget allocation for BCI Formation of advisory committee of technical consultant Formation of mason group				
2013	Identity card/certification system of trained masons/ contractors Listing of consultant	32	29	29	
2014	Field Supervision through consultant Reporting of field supervision with photographs after completion of house	35			
2015					
2016		32	30	282	
2017		35		36	

Municipal Milestones on Building Code Implementation

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Damak Municipality to measure the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality etc. were used for the data collection.

The status of building code implementation in the Damak Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each components, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Damak Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	Yes	Yes
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	5000	8000	10000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	300	400	500

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	400	500	600
Building Constructed per Year without Permit	100	100	50
Engineer within Municipal Office	1	3	3
Sub Engineer within Municipal Office	3	1	1
Numbers of Mason Trained	100	130	230
Numbers of Engineer Trained (Consultant/Contractor)		28	57
Numbers of House Owner Oriented			400

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1.25	3
2014	3.5	1.5	3
2016	4.5	3	3

Fig 1: Average scores for BCI status in Damak Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional System towards implementing building code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional System on building code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Damak Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4.5 in 2016 (out of 5). The key factors contributing to the component of institutional system such as: Provision of Advisory Committee, separate Earthquake safety Unit, structural drawing for all building class, use of detail checklist for building code compliance and system of certification of masons and maintaining the roster of trained masons came into existence since 2014 A.D. Moreover, the provision of field inspection for structural details was successfully implemented from year 2016. The municipality is yet to introduce the system of strengthening the existing buildings.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly. The score is 1.25 in the year 2012, 1.5 in 2014 and 3 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Damak Municipality there are around 600 buildings constructed per year and are under the supervision of 3 engineers and 1 sub-engineer as shown in the figure below:



Fig 2: No. of Buildings constructed in Damak Municipality



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has been allocating some budget for the implementation of building code since 2012.

The score has remained constant throughout the survey period.

7. Conclusions

- There has been significant improvement in Institutional System towards implementing building code over the years than the other two components-Technical Capacity and Budget Allocation.
- In Damak Municipality more than 600 buildings are constructed per year and are looked after by 3 engineers and 1 sub-engineer.
- Damak municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation EASTERN REGION

Dharan Sub Metropolitan City

1. Location and Demography

Dharan is located in Sunsari district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1. It was declared as Sub Metropolitan City on 2nd December, 2017 A.D. (2071, Mangsir 16).

The city occupies land area of 192.32 sq. km. and lies at an altitude of range 305 - 600 meter above sea level. The maximum and mean minimum temperatures of the sub-metropolitan city range around 30°C and 14°C in the summer and winter respectively.



i. Population Distribution

The 2011 census counted 1, 19,915 inhabitants with 2.29% annual growth rate and population density 1,159.94 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection of 2016 was counted 1, 34,289 inhabitants with 31,076 households. This population is of the then Dharan Municipality before it was merged to form Sub-Metropolitan City. Nepali is spoken as the national language. The mother tongue for the majority of residents is Nepali, Bantawa, Newar and Tamang.

ii. Population Demography

The word "Dharan" refers to the wooden platforms which are used in sawing logs. Large parts of forest were cleared in 1890s in order to establish the settlement. Also, Dharan remained the Gurkha recruiting area from 1953 till 1990 when it was relocated at Pokhara. This helped in an expansion of this town which was initially started as a small settlement. The main inhabitants of the sub-metropolitan city are Rai followed by Newar, Limbu, Chhetri, Brahmin, Tamang, Kami and Magar. The highest group of population is aged between 15-19 years, covering 11.77% out of the total population of Dharan Sub- Metropolitan City.

iii. Main Economy

Of the total population of Dharan Sub Metropolitan City, 30.38% is usually active population- aged 10 and above of which 19.4% are involved in agriculture, forestry and fishery work, 24.3% service and sales work, 13.6% on the crafts and elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 84.5% with male literacy rate 90.87% and female literacy rate 78.94%. It was found that 96.19% of households have an access to electricity, 94.30% of households use tap/piped water and 83.08% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Dharan Sub-Metropolitan City. The DesInventar datasets show that the sub metropolitan city has faced different hazards in the past. Among them major five hazards based on frequency of occurrence are Fire, Epidemic, Flood, Accident and Thunderstorm.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. While it is not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Dharan Sub-Metropolitan City is not an exception. The 1988, Nepal-Bihar earthquake that occurred in Nepal near the Indian border which affected much of northern Bihar also caused extensive damage in the eastern Nepal including Dharan municipality. The earthquake, with a magnitude of 6.6 in Richter scale, killed about 138 people and left 2117 people injured with more than 2500 damaged buildings in Dharan only. Earthquake though not a major hazard in terms of occurrence, has been the major hazard in terms of the impact caused. 58% of the deaths out of total 238 deaths and 68% of injury were due to earthquake in Dharan municipality. 92% of the buildings damaged were due to earthquake.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The sub-metropolitan city consists of approximately 19,423 buildings as of 2016. Nowadays, most of all newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016

under BCIPN program of NSET evinced that 96 % of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the sub metropolitan city are as follows:

S.N.	Description	2012	2014	2016
1	Population	1, 22,661	1, 28,343	1, 34,289
2	Area (Sq. km)			192.32
3	Number of existing buildings	17,741	18,563	19,423
4	Number of new building constructed per year with permit	600	600	600
5	Number of buildings constructed per year without permit	20	20	20
6	No. of Trained mason	700	700	735
7	Numbers of Engineer Trained (Consultant/Contractor)	240	240	240
8	Technical manpower with Municipal Office	11	9	9
9	Total Manpower in Municipal Office			205

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory Implementation of Building Code was declared in 2007 A.D. in Dharan Sub Metropolitan City with the allocation of budget. Same year, groups of trained masons were formed, and the reward and punishment mechanism were initiated by evaluating their performance.

Dharan municipality is one of the pioneer municipalities for implementing the building code and NSET has been working with Dharan municipality since the beginning. The submetropolitan city has started a system of providing license to trained masons/contractors since 2010 A. D. For smooth implementation of Building Code, the Sub-Metropolitan city also formed an Advisory Committee of technical consultants in 2013. In 2016, field supervision through consultants were initiated to ensure the building code implementation. Retrofitting techniques were also introduced for the strengthening of existing buildings in the same year. The process of reporting with photographs of different stages of construction for the field supervision was introduced in 2017.

Milestones				
Institutional Conscitu	Capacity E	Capacity Enhancement		
Institutional Capacity	Masons	Engineers	Beneficiaries	
Budget allocation for BCI Declare Building Code Implementation Listing of consultants				
Formation of mason group Reward and punishment				
Licensing of trained masons				
Formation of advisory committee of technical consultant				
Implementing retrofitting techniques	30	36	277	
Reporting of field supervision with photographs of different stages	33			
	Milestones Institutional Capacity Budget allocation for BCI Declare Building Code Implementation Listing of consultants Formation of mason group Reward and punishment Licensing of trained masons Formation of advisory committee of technical consultant Implementing retrofitting techniques Field supervision through consultant Reporting of field supervision with photographs of different stages	Milestones Capacity En Institutional Capacity Capacity En Budget allocation for BCI Declare Building Code Implementation Listing of consultants Masons Formation of mason group Reward and punishment - Licensing of trained masons - Formation of advisory committee of technical consultant - Implementing retrofiting techniques 30 Field supervision through consultant - Reporting of field supervision with photographs of different stages 33	MilestonesCapacity EnhancementInstitutional CapacityCapacity EnhancementMasonsEngineersBudget allocation for BCI Declare Building Code Implementation Listing of consultantsImplementationFormation of mason group Reward and punishmentImplementationLicensing of trained masonsImplementing retrofitting techniquesFormation of advisory committee of technical consultant30Implementing retrofitting techniques30Field supervision through consultant33	

Municipal Milestones on Building Code Implementation:

(Source: Sub-metropolitan city and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Dharan Sub Metropolitan City to measure the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Dharan municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component. kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Dharan Sub Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	Yes	Yes	Yes
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	Yes	Yes	Yes
3	Need Structural Drawing for All Building Class	Yes	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	Yes	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	Yes	Yes	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	Yes
7	Has a system of registration of masons and roster of trained masons	Yes	Yes	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	4.5	4.25	2
2014	4.5	4.25	3
2016	5	4.25	3

Fig 1: Average scores for BCI status in Dharan Sub-Metropolitan City in the year 2012, 2014 and 2016

The figure shows that sub metropolitan city had already established a strong institutional system towards implementing building code over the years. Of the three major components of Building Code Implementation - Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System seems to perform better than the other two components.

4. Institutional System on Building Permit Process of Dharan Sub-Metropolitan City

The key factors contributing to the component of institutional system such as: Presence of Advisory Committee, Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check, provision of field inspection for structural details and system of registration of masons and roster of trained masons been introduced in Dharan Sub-Metropolitan City., Dharan already has established a strong institutional system for implementation of Building Code. The score on Institutional System increased from 4.5 in 2012 and 2014 to 5 in 2016 (out of 5).

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the sub-metropolitan city. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score was 4.25 (out of 5) in the year 2012 and the score is still the same when measured in an interval of 2 years. This shows that there is a satisfactory availability of the technical manpower right from the inception of BCIPN program. It is estimated that for every 100 buildings there must be at least one engineer in the municipal office to look after the construction. In Dharan Sub-Metropolitan City, at present, approximately 600 buildings are constructed per year and are under the supervision of 4 engineers and 5 sub-engineers as shown figure below: in the



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that Dharan sub-metropolitan city has been allocating some budget for the implementation of building code. However, the budget is not yet adequate, as per the finding of the BCI Survey.

The score increased from 2 in the year 2012 in 3 in 2016.

7. Conclusions

- There is a strong institutional system and technical capacity towards implementing building code in Dharan Sub-Metropolitan City. While the budget allocated for BCI is still inadequate.
- In Dharan Sub Metropolitan City approximately 600 buildings are constructed per year and are looked after by 4 engineers and 5 sub engineers.
- Dharan Sub Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation EASTERN REGION

Inaruwa Municipality

1. Location and Demography

Inaruwa Municipality is located in Sunsari district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Inaruwa got municipality status in 1991 A.D (2047 B.S.) It covers an area of 77.92 sq. km and lies at an altitude of 1700 meter above sea level. Inaruwa Municipality is surrounded by Madhesa ChandBela VDC in the east, Bhocrah and Marasingh VDC in the West, Dumrah / Madhesa VDC in the north and Babia VDC in the south. It has maximum and minimum temperature ranging between 39° C to 10° C during the summer and winter respectively.



(Municipality Profile Report, 2008)

i. Population Distribution

The 2011 census counted 28,923 inhabitants with 2.2% annual growth rate and population density 1,293 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 32,248 inhabitants with 6,907 Households. This population is of the then Inaruwa Municipality

before the change in new federal structure. The mother tongue for the majority of residents is Maithili and others are Nepali, Tharu and Urdu.

ii. Population Demography

The main inhabitants of the municipality consist of groups like Brahmin-Hill, Koiri, Chettri, Tharu, Newar, Dhanuk, Muslim and Teli. The largest group of population is aged between 10 to 14 years, covering 12.66% of the total population of the municipality.

iii. Main Economy

Of the total population of Inaruwa Municipality, 31.3% is usually active population aged 10 and above of which 23.2% are involved in skilled agriculture, forestry and fishery work, 12.9% are engaged in crafts and related works, 13.6% in elementary work and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity are available in most parts of the city. Majority of the people have access to education and the overall literacy rate of Inaruwa Municipality is 77.46% with male literacy rate 85.46% and female literacy rate 69.6%.

It was found that 88.86% of households have access to electricity, 14.35% of households use tap/piped water and 78.74% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Inaruwa Municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Flood, Accident, Epidemic Cold and Wave/Thunderstorm. Fire is the first major hazard as 69% buildings out of 196 were damaged due to fire. Although, epidemic ranks

as fourth major hazard in terms of occurrence, it had significant effect as 80% (out of 86 injuries) were due to it. Accident, as third major hazard, caused 24% deaths out of 38 total deaths.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Inaruwa Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 5,313 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed. A study conducted in 2016 under BCIPN program of

NSET evidenced that only 51% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows;

S.N	Description	2012	2014	2016
1	Population	29559	30874	32248
2	Area (Sq. Km)			77.92
3	Number of existing buildings	4870	5087	5313
4	Number of new building constructed per year with permit	200	225	250
5	Number of buildings constructed per year without permit	60	50	50
6	No. of Trained Masons		58	103
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	3	2	5
9	Total Manpower in Municipal Office			60

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2014 A.D. in Inaruwa Municipality. The municipality started a system of certification/identity card to trained masons/contractors in 2016 A. D. Similarly, to ensure implementation of building code field supervision through consultants were initiated along with the process of reporting with the photographs of different stages of construction for the field supervision in the same year.

In 2016, with the purpose of strengthening the capacity of municipality towards Building Code Implementation, technical manpower in the municipality office was increased. Same year, groups of trained masons were formed to support BCI efforts.

	Milestones					
Year	Institutional Canacity		nhancement	Awareness		
	institutional Capacity	Masons	Engineers	Beneficiaries		
2013		32		15		
2014	Declare Building Code Implementation Field Supervision through consultant Reporting of photographs from field supervision through consultant,	27				
2015		39				
2016	Formation of mason groups Increased Technical manpower of municipality Certification/ID of trained Masons/ contractors	70				

Municipal Milestones on Building Code Implementation

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

The Building Code Implementation Status Survey (BCISS) was carried out in Inaruwa Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the BCIPN municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality were used for the data collection.

The status of building code implementation in the Inaruwa Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3 for 29 BCIPN program municipalities. Figure 1 shows the overall score and changes of status of BCI in Inaruwa Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Municipality revenue/ Budget	2012	2014	2016	Technical Capacities	2012	2014	2016
	2012	2011	2010	Building Constructed per Year with Permit	200	225	250
Revenue from Building Permits 1800 2500 3000 Building Constructed per Year without Permit in thousands) Engineer within Municipal Office Engineer within Municipal Office		60	50	50			
Budget allocation for BCI for				Engineer within Municipal Office	1	1	3
Awareness, Orientation, Training	0	100	100	Sub Engineer within Municipal Office	2	1	2
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands) 0 100 100 Sub Engineer within Municipal Office Sub Engineer within Municipal Office Numbers of Mason Trained		58	103				
				Numbers of Engineer Trained (Consultant/Contractor)			
				Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	0
2014	0	1	1
2016	2.25	2	1

Fig 1: Average score for BCI status in Inaruwa Municipality in the year 2012, 2014 and 2016

The figure shows that there has been slight improvement in Institutional System towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Inaruwa Municipality

The institutional system on building permit process has seen slight improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 2.25 in 2016 (out of 5). The key factors contributing to the component of institutional system such as: the system of need of structural drawing for all building class, use of detail checklist for building code compliance and maintenance of roster of trained masons has been initiated in the municipality since 2016 A.D.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score 1 in the year 2012 & 2014 and 2 in 2016 (out of 5), shows that there is still high demand of technical manpower in the municipality. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Inaruwa Municipality, there are around 300 buildings constructed per year and are under the supervision of 3 engineers and 2 sub-engineers as shown in the figure below:



Fig 2: No. of Buildings constructed in Inaruwa Municipality

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey,



Fig 3: No. of Engineers and Sub-Engineer within Inaruwa Municipal Office

it was observed that the municipality has started allocating some budget for the implementation of Building Code since 2014.

The score increased from 0 in 2012 to 1 in 2014 and 2016.

7. Conclusions

- There has been slight improvement in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Inaruwa Municipality around 300 buildings are constructed per year and are looked after by 3 engineers and 2 sub-engineers.
- Inaruwa municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation EASTERN REGION

Janakpur Sub Metropolitan City

1. Location and Demography

Janakpur Sub-Metropolitan City is located in Dhanusha district which lies in the then Central Development Region of Nepal and as per the current federal structure it lies in Province No. 2.

Janakpur got municipality status in 1962 A.D (2019 B.S) and was declared as Sub-Metropolitan City on 2^{nd} December, 2014 (2071 Mangshir 16). It is surrounded by the Machuwa VDC in the east, Mahottari District in the west, Beng Piparahi VDC in the north and Debpura Rupaidha VDCs in the south. It covers an area of 85.99 sq. km. The city lies between 26^0 43' north latitude and $85^058'$ east longitudes.



(Municipality Profile 2008)

i. Population Density

The 2011 census counted 98,446 inhabitants with annual population growth rate of 2.83% and population density of 4,000.24 person per sq. km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1,13,187 inhabitants with 22,055 households. This population is of the then Janakpur municipality before it was re-structured to form Sub-Metropolitan City. Nepali is spoken as the national language. The mother tongue for the majority of residents is Maithili, Urdu, etc.

ii. Population Demography

The main inhabitants of the Sub-Metropolitan city are Hill Brahmins followed by Sudhis, Yadhavs, Telis and Muslims, etc. The largest group of population lies in 10-14 age group, covering 13.1% of the total population of Janakpur Sub-Metropolitan City.

iii. Main Economy

Of the total population of Janakpur Sub-Metropolitan City, 24.1% is usually active population aged 10 and above of which 19.4% are involved in agriculture, forestry and fishery work, 24.3% are involved in service and sales work, 13.6% are engaged on the crafts and elementary work and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most parts of the city. Majority of the people have access to education and the overall literacy rate is 74.23% with male literacy rate 81.61% and female literacy rate 65.9%. It was found that 93.44% of households have access to electricity, 13.18% of households use tap/piped water and 76.98% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Janakpur Sub-Metropolitan City. The DesInventar datasets show that the submetropolitan city has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Epidemic, Fire, Flood, Cold Wave and Accident. Epidemic is the first major hazard as 61% injuries out of 280 and 67% deaths out of 176 were due to epidemic. Similarly, flood, as the third major hazard in terms of occurrence, damaged 51% buildings out of 749 damaged buildings.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Janakpur Sub-Metropolitan City is not an exception.



Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

Janakpur is one of the famous religious and historical place of central Nepal. The submetropolitan city consists of approximately 11,028 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that only 12% of the RCC buildings constructed comply with Nepal

National Building Code. Building information and human resources for building construction in the sub- metropolitan city are as follows:

S.N	Description	2012	2014	2016
1	Population	1,01,232	1,07,043	1, 13, 187
2	Area (Sq.km)			85.99
3	Number of existing buildings	9,863	10,429	11,028
4	Number of new building constructed per year with permit	750	750	800
5	Number of buildings constructed per year without permit	150	150	160
6	No. of Trained Masons		32	86
7	Technical manpower in the consulting firms	24	30	30
8	Technical manpower with Municipal Office	6	6	6
9	Total Manpower in Municipal Office			197

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2016 A.D. in Janakpur Sub-Metropolitan City. Same year, the submetropolitan city prepared the roster of consultant engineers and groups of trained masons. The municipality had also initiated the system of reward and punishment for evaluating the performance of masons. Recently in 2017, Janakpur Sub-Metropolitan City started a system of certification/identity card of trained masons/contractors and system of field supervision through the consultant's engineers. Building Permit Process using the building permit software which incorporated revised building permit form was also started the same year.

Municipal Milestones on Building Code Implementation:

Year	Milestones				
	Institutional Capacity		Capacity Enhancement		
			Engineers	Beneficiaries	
2014		29	27		
2015		35			
2016	Reward and Punishment system Listing of consultants Declare Building Code Implementation	26		31	
2017	Implement revised building permit form Field supervision through consultants Certification of Trained Masons/contractors			58	

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Janakpur Sub-Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the BCIPN municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Janakpur Sub-Metropolitan City was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Janakpur Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Municipality revenue/	2012	2014	2016	Technical Capacities	2012	2014	2016
Budget				Building Constructed per Year with Permit	750	750	800
Revenue from Building Permits (in thousands)	6000	6000	8400	Building Constructed per Year without Permit	150	150	160
Budget allocation for BCI				Engineer within Municipal Office	1	1	1
for Awareness, Orientation,	0	100	300	Sub Engineer within Municipal Office	5	5	5
Training and Workshop (In Thousands)				Numbers of Mason Trained		32	86
		Numbers of Engineer Trained (Consultant/Contractor)	24	30	30		
				Numbers of House Owner Oriented			21

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.5	0
2014	0	1.25	1
2016	4	1.5	1

Fig 1: Average score for BCI status in Janakpur Sub-Metropolitan City in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional System of the Sub-Metropolitan City towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on building code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Janakpur sub-Metropolitan City

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as: introduction of separate Earthquake safety Unit/Separate BCI Cell/ Dedicated Technical Staff, need of structural drawing for all building class, use of detail checklist for building code compliance and provision of field inspection for structural details were initiated in 2016 A.D.

5. Technical Capacities



Fig: No. of Buildings constructed in Janakpur Sub-Metropolitan City

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, This component measures the availability and capabilities of technical manpower within the sub- metropolitan city. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.5 in the year 2012, 1.25 in 2014 and 1.5 in 2016 out of 5 score, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Janakpur Sub-Metropolitan City, more than 900 buildings are constructed per year and are under the supervision of 1 engineer and 5 sub-engineers as shown in the figure below:



Fig: No. of Engineers and Sub-Engineer within Janakpur Municipal Office

it was observed that Janakpur sub- metropolitan city has started allocating budget, although inadequate, for the effective implementation of Building Code.

The score has increased from 0 in the year 2012 to 1 in 2014 and 2016.

7. Conclusions

- There has been significant improvement in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Janakpur Sub-Metropolitan City more than 900 buildings are constructed per year

and are looked after by 1 engineer and 5 subengineers.

• Janakpur Sub-Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the sub- metropolitan city and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation EASTERN REGION

Kamalamai Municipality

1. Location and Demography

Kamalamai Municipality is located in the Sindhuli district which lies in the then Central Development Region of Nepal and as per the current federal structure it lies in Province No. 3.

Kamalamai got municipality status in 1996 A.D. Municipality is surrounded by Kamalamai Ranichuri, Ranibas, Bhimsthan and Belghari VDCs in the East, Dadiguranse and Bhadrakali VDCs in the West, Ratanchura and Bhadrakali VDCs in the North and Churiya range of Sarlahi, Mahottari and Dhanusha districts in the South. It covers an area of 482.97 sq. km. It lies between 27°10' north latitude and 85° east longitudes. It is 518 meter high above the sea level. The maximum and minimum temperature of this municipality range between 28°C to 17.2°C during the summer and winter respectively.



i. Population Distribution

The 2011 census counted 41,117 inhabitants with 2.25% annual growth rate and population density 197.73 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 45,956 inhabitants with 10,399 households. This

population is of the then Kamalamai municipality before the change in new federal structure. Different castes are dwelling-in with social harmony, mainly Brahmin, Chhetri, Dalit, Janajati, Madhesi and others.

ii. Population Demography

The main inhabitants of the municipality are 24% Chhetris, 18% Tamangs, 14% Newars, 11% Hill Brahmins, 9% Magars and 4% Kamis. The major spoken languages in Kamalamai Municipality are Nepali, Tamang and Magar languages. The greatest population are aged in between 10-14, covering 14.29% out of the total population of Kamalamai Municipality.

iii. Main Economy

Of the total population of Kamalamai Municipality, 35.2% is usually active population aged 10 and above of which 47.7% are involved in agriculture, forestry and fishery work, 11.6% are involved as service and sales work, 8.3% are engaged on the elementary work and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 73.91% with male literacy rate 82.26% and female literacy rate 66.43%. It was found that 85.28% of households have access to electricity, 65.44% of households use tap/piped water and 69.10% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Kamalamai Municipality. The DesInventar datasets shows that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Flood, Fire, Epidemic, Landslide and Thunderstorm. Flood is the first major hazard as 39% death out of 236 were due to flood. Although Earthquake was not among the five major hazards on the basis of occurrence, the 2015 Gorkha earthquake happened to be the major incident that caused 50% of injuries out of 937 and destroyed almost 97% of buildings out of 20,995 total destroyed buildings.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 7,999 buildings as of 2016. Nowadays, most of the new constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 75% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	42,042	43,955	45,956
2	Area (Sq. Km)			482.97
3	Number of existing buildings	7,318	7,651	7,999
4	Number of new building constructed per year with permit	150	150	250
5	Number of buildings constructed per year without permit	100	100	50
6	No. of Trained Masons		33	136
7	Technical manpower with Municipal Office	1	1	2
8	Numbers of Engineer Trained (Consultant/Contractor)			
9	Total manpower in Municipal Office			80

(Source: Building Code Implementation Baseline Survey, 2013)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared only in 2016 A.D. in Kamalamai Municipality with the allocation of some amount of budget. The municipality had already started maintaining roster of trained masons/contractors and formation of mason groups in 2014 A.D. Similarly, in the same year, municipality had prepared the roster of consultant's engineers. With the purpose of strengthening the capacity of municipality towards Building Code Implementation, technical manpower in the municipality was increased in 2016. The provision of field supervision through consultants, reporting with the photographs of different stages of construction was also initiated in the same year.

Municipal Milestones on Building Code Implementation:

Year	Milestones					
	Institutional Consolty	Capacity E	nhancement	Awareness		
	institutional Capacity	Masons	Engineers	Beneficiaries		
2014	Formation of mason groups Roster of trained Masons/ contractors	33		17		
2016	Field supervision through consultants Reporting of field supervision with Photographs of different stages Increase technical manpower of municipality Budget Allocation for BCI Declare Building Code Implementation	103		21		

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Kamalamai Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the. Kamalamai Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection. The status of building code implementation in the Kamalamai Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Kamalamai Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	1250	1500	1900
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	100	100

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	150	150	250
Building Constructed per Year without Permit	100	100	50
Engineer within Municipal Office	0	0	1
Sub Engineer within Municipal Office	1	1	1
Numbers of Mason Trained		33	136
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented			
Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
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2012	0	0.5	0
2014	0.75	1	1
2016	4	1.5	1

Fig 1: Average score for BCI status in Kamalamai Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional System in building Process towards implementing building code over the years. Of the three major components of Building Code Implementation: Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Kamalamai Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; introduction of separate Earthquake safety Unit/Separate BCI Cell/Dedicated Technical Staff, need of structural drawing for all building class, use of detail checklist for building code compliance and provision of field inspection for structural details was initiated in 2016 A.D. While the maintenance of roster of trained masons was implemented from the year 2014.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.5 in the year 2012, 1 in 2014 and 1.5 in 2016 out of 5, shows that the demand of technical manpower is still not fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Kamalamai Municipality, more than 300 buildings are constructed per year and is under the supervision 1 engineer and 1 sub-engineer as shown in the figure below.



Fig 2: No. of Buildings constructed in Kamalamai Municipality



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started

7. Conclusions

- There has been slight improvement in the Institutional System towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Kamalamai Municipality more than 300 buildings are constructed per year and are

allocating some budget for the implementation of building code since 2014.

The score has increased from 0 in the year 2012 to 1 in 2014 and 2016.

looked after by 1 engineer and 1 subengineer.

• Kamalamai municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation EASTERN REGION

Khandbari Municipality

1. Location and Demography

Khandbari is the district headquarter of Sankhuwasabha district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1. Khandbari was established as a municipality in 1996 A.D. It occupies land area of 122.78 sq.km. Khandbari Municipality is surrounded by the Dhupu VDC in the east, Sitalpati VDC and Arun River Dobhan VDC in the South. It lies at an altitude of 457 meter above from sea level.

(Municipality Profile of Nepal, 2008)



i. Population Distribution

The 2011 census counted 26,658 inhabitants with 2.02% annual growth rate and population density 292.85 person per sq.km. Based on the annual growth rate of 2011 census, the population projection of 2016 was counted 29,461 individuals with 6,679 households. This population is of the then Khandbari municipality before the change in new federal structure.

ii. Population Demography

Khandbari is the home to many different races and ethnic groups. Different castes are dwellingin with social harmony. The main inhabitants of the municipality are Chhetri followed by Rai, Newar, Brahmin Hill, Gurung, Tamang, Kami, Magar, etc. Most of the people speak Nepali. The largest age group of people is 10-14 years, covering 12.63% of the total population.

iii. Main Economy

Of the total population of Khandbari municipality, 57.6% is usually active population aged 10 and above of which 23.2% are involved in agriculture, forestry and fishery work 11.0% are involved in service and sales work, 8.2% are engaged in the crafts and related works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 74.3% with male literacy rate 82.55% and female literacy rate 66.98%. It was found that 84.31% of households have access to electricity, 55.80% of households use tap/piped water and 72.29% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and in Khanbari Municipality. impact The DesInventar datasets shows that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Accident, Landslide, Thunderstorm and Epidemic. Fire is the first major hazard as 69% building (out of 88) were destroyed by fire. Similarly, accident in second major hazard which caused 39% of death out of 23 total deaths. Although epidemic is fifth major hazard in terms of occurrence, it had

significant impact as 57% out of 28 total injuries were due to epidemic.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Khandbari Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 6,951 buildings as of 2016. A study conducted in 2016 under BCIPN program of NSET evidenced that only 77% of the RCC buildings comply with

Nepal National Building Code. The building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	27,196	28,306	29,461
2	Area (Sq. Km)			122.78
3	Number of existing buildings	6,417	6,679	6,951
4	Number of new building constructed per year with permit	60	60	84
5	Number of buildings constructed per year without permit	150	150	100
6	No. of Trained Masons			63
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	2	2	3
9	Total Manpower in Municipal Office			29

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2015 A.D. in Khandbari Municipality.

supervision was introduced in 2016. Field supervision through consultants was initiated in 2017 to ensure building code implementation.

The process of reporting with photographs of different stages of construction for the field

Municipal Milestones on Building Code Implementation:

	Milestones						
Year	Institutional Consolty	Capacity Er	Capacity Enhancement				
	Institutional Capacity	Masons	Engineers	Beneficiaries			
2015	Declare Building Code Formation of mason group	32		26			
2016	Reporting of field supervision with photographs of different stages	31					
2017	Field Supervision through consultant						

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Khandbari Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Khandbari Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Khandbari Municipality was assessed in terms of three major components described in (of the report): Institutional Section 3 Mechanisms, Technical Capacity, and Budget Allocation. Under each component, kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Khandbari Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes
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Municipality revenue/ Budget	2012	2014	2016		Technical Capacities	2012	2014	2016
Revenue from Building Permits (in thousands)	600	600	800		Building Constructed per Year with Permit		60	84
Budget allocation for BCI for	Or Building Constructed per Year without Permit		150	150	100			
Awareness, Orientation, Training and Workshop (In Thousands)	0	50	50		Engineer within Municipal Office	0	0	1
······································				╹	Sub Engineer within Municipal Office		2	2
	Numbers of Mason Trained				63			
			Numbers of Engineer Trained (Consultant/Contractor)					
					Numbers of House Owner Oriented			26

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.75	0
2014	0	0.75	2
2016	1.25	2.25	2

Fig 1: Average score for BCI status in Khandbari Municipality in the year 2012, 2014 and 2016

The figure shows that there has been slight improvement in the three major components of Building Code Implementation- Institutional Mechanism, Technical Capacities and Budget Allocation for BCI. The scores for all three components have risen over the years.

4. Institutional System on Building Permit Process of Khandbari Municipality

The institutional system of Khandbari Municipality has seen some improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 1.25 in 2016 (out of 5). Of the key factors contributing to the component of institutional systems: Khandbari Municipality has succeeded to introduce need of structural drawing for all building class and the system of maintenance of roster of trained masons since 2016 A.D.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.75 in the year 2012 and 2014, and 2.25 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Khandbari Municipality, more than 150 buildings are constructed per year and are under the supervision 1 engineer and 2 sub-engineers as shown in the figure below:



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code since 2014.

The score has increased from 0 in 2012 to 2 in 2014 and 2016.

7. Conclusions

- There has been slight improvement in the three major components of the Building Code implementation- Institutional System, Technical and Budget Allocation.
- In Khandbari Municipality more than 150 buildings are constructed per year and are looked after by 1 engineer and 2 sub-engineers.
- Khandbari municipality has initiated the system of allocating budget for the Building Code implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation EASTERN REGION

Triyuga Municipality

1. Location and Demography

Triyuga Municipality is located in the Udaypur district which lies in the then Eastern Development Region of Nepal and as per the current federal structure it lies in Province No. 1.

Triyuga got municipality status in 1996 A.D (2053 B.S). It occupies land area of 547.83 sq. km. It is surrounded by the Jogidaha and Saune VDCs in the East, Bhalayadaha and Rauta VDCs in the West, Saune and Khabu VDCs in the North and Saptari in the South. It lies between $26^{0}45'0''$ to $26^{0}52'30''$ north latitude and $86^{0}37'30''$ to $86^{0}45'0''$ east longitude. The maximum and minimum temperature lies between 39° C to 4° C during the summer and winter respectively.



i. Population Distribution

The 2011 census counted 71,405 inhabitants with 2.56% annual growth rate and population density 223.22 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 81,025 inhabitants with 18,072 households. This population is of the then Triyuga municipality before the change in the new federal structure.

ii. Population Demography

The main inhabitants of the municipality are Chhetri followed by Tharu, Hill Brahmin, Rai, Danuwar, Magar and Kami. Some religious places of the municipality are Churiyamai temple, Kakani temple, Khat temple, Shivalaya temple and Radha Krishna temple. The largest population group is aged between 10 to 14 years, covering 13.97% of the total population.

iii. Main Economy

Of the total population of Triyuga municipality, 35.1 % people is usually active population aged 10 and above of which 33.3% are involved in agriculture, forestry and fishery work, 19.9% in service and sales work and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 75.31% with male literacy rate 83.34% and female literacy rate as 68.3%. It was found that 91.47% of households have access to electricity, 23.08% of households use tap/piped water and 79.30% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Trivuga Municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Flood, Accident, Epidemic and Thunderstorm. Although earthquake was not among the five major hazards on the basis of frequency of occurrence, it had significant effect on human lives and buildings. Earthquake caused 80% of injuries out of 701 total injuries and destroyed almost 63% of buildings out of 4,276 total destroyed buildings. Epidemic ranked as fourth major hazard in terms of occurrence and caused 29% injuries out of 264 total injuries.



Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 13,901 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete framed (RCC) buildings. A study conducted in 2016 under BCIPN program

of NSET evidenced that 95% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

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S.N	Description	2012	2014	2016
1	Population	73,233	77,030	81,025
2	Area (Sq. Km)			547.83
3	Number of existing buildings	12,564	13,216	13,901
4	Number of new building constructed per year with permit	300	300	300
5	Number of buildings constructed per year without permit	150	150	60
6	No. of Trained Masons		96	159
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	3	3	3
9	Total Manpower in Municipal Office			55

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2014 A.D.in Triyuga Municipality with some allocation of budget. After the declaration of BCI, there were a number of achievements in the same year; the municipality introduced system of preparing roster of consultant's engineers, field supervision through consultants and the process of reporting with photographs of different stages of construction. Moreover, the municipality also started system of certification/identity card to trained masons/contractors in 2014 A. D.

In 2016, separate technical dedicated staff for BCI was provisioned.

Municipal Milestones on Building Code Implementation

	Milestones					
Year	Institutional Conscitu	Capacity E	Enhancement	Awareness		
	Institutional Capacity	Masons	Engineers	Beneficiaries		
2014	Certification of trained Masons/ contractors Listing of Consultants Field supervision through consultants Reporting of field supervision with Photographs of different stages Budget Allocation for BCI Declare Building Code Implementation	93		188		
2016	Separate technical dedicated staff for BCI	31		46		
2017		32				

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Triyuga Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Triyuga Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Triyuga Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. each component, Under kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Triyuga municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	Yes	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Fig 1: Average score for BCI status in Triyuga Municipality in the year 2012, 2014 and 2016

The figure shows that there has been some improvements in the Institutional System towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional system on building code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Triyuga Municipality

The institutional system on building permit process has seen some improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3 in 2016 (out of 5). Of the key factors contributing to the component of institutional system; need of structural drawing for all building class, provision of field inspection for structural details, system of certification of masons and maintenance of roster of trained masons were initiated in 2014. Separate EQ Safety Unit/Separate BCI Cell/Dedicated Technical Staff was introduced in the municipal system in 2016 A.D.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The

Humber of building construction in Municipality with and without Permit

Fig 2: No. of Buildings constructed in Triyuga Municipality

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for Building Code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of Building Code since 2014.

The score increased from 0 in the year 2012 to 2 in 2014 and 2016.

proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.5 in the year 2012, 1.25 in 2014 and 2.5 in 2016 (out of 5), shows that the high demand of technical manpower is gradually being fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Triyuga Municipality, more than 350 buildings are constructed per year and are under the supervision of 1 engineer and 2 subengineers as shown in the figure below:



Fig 3: No. of Engineers and Sub-Engineer within Triyuga Municipal Office

7. Conclusions

- There have been some improvements in Institutional System towards implementing Building Code over the years than the other two components-Technical capacities and Budget Allocation.
- In Triyuga Municipality more than 350 buildings are constructed per year and are looked after by 1 engineer and 2 sub-engineers.
- Triyuga municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 undertaken by NSET.

Status of Building Code Implementation CENTRAL REGION

Besisahar Municipality

1. Location and Demography

Besishahar Municipality is the district headquarters of Lamjung district which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province No. 4.

Besisahar Municipality was formed by merging the then existing Besisahar Gaunshahar, Udipur, Chandisthan VDCs on 2014 May 8 (2071 B.S Baisakh 25). It occupies land area of 127.34 sq. km and has a sub-tropical climate with deciduous forests. Annapurna II, Machhapuchhre, Lamjung Mountain Range can be viewed from north of the municipality.



i. Population Distribution

The 2011 census counted 26,640 inhabitants with 2.8% annual growth rate and population density is 590 person sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 30,584 inhabitants with 8,310 households. This population is of the then Besisahar municipality before the change in new federal structure. Nepali is spoken as the national language.

ii. Main Economy

Besisahar Municipality is rich in water resources, forestry and natural beauty. Besisahar is famous as it is gateway entrance of Manang and Annapurna trekking route which is enhancing local tourism business. homestay. communication facilities. Similarly, the municipality is connected to Prithvi Highway which also connects from Dumre to Besisahar upgrading the agricultural, industrial, hospitals and high fertile agricultural land, green forestry and cultural, historical and cultural areas and commercial sectors.

iii. Hazard and Risk

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Besisahar Municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them five hazards based on frequency of occurrence are Fire, Accident, Thunderstorm Landslide, and Hailstorm. Fire is the first major hazard as 47% buildings of the 66 total destroyed buildings were due to it. Landslide ranked as fourth major hazard which caused 30% of death out of 23 total deaths. Although epidemic was not among the five major hazards based on frequency of occurrence, it had a significant impact as 50% out of 60 total injuries were due to epidemic.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Besisahar municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

2. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 6,392 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed buildings. A study conducted in 2016 under BCIPN program

of NSET evidenced that 68% of the RCC buildings constructed comply to National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N	Description	2012	2014	2016
	Population	27,386	28,941	30,584
	Area (Sq. Km)			127.34
	Number of existing buildings	5,724	6,049	6,392
	Number of new building constructed per year with permit	50	100	150
	Number of buildings constructed per year without permit	50	50	40
	No. of Trained Masons			94
	Numbers of Engineer Trained (Consultant/Contractor)			31
	Technical manpower with Municipal Office	2	2	2
	Total Manpower in Municipal Office			36

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

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ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2014 A.D.in Besisahar Municipality. However, municipality allocated budget only in 2016 A.D. for the effective implementation of BCI. In 2015, first Mason Training on Earthquake Safe Construction Technique was conducted, and roster of trained mason was also prepared by the municipality. In 2016, field supervision through consultants was initiated to ensure the effective BCL.

Requirement of structural drawing was also made mandatory from 2016.

Recently in the year 2017, with the purpose of strengthening the capacity of municipality towards Building Code implementation, technical manpower in the municipality was increased.

	Milestones						
Year	Institutional Conscitu	Capacity E	nhancement	Awareness Beneficiaries			
	Institutional Capacity	Masons	Engineers				
2014	Declare Building Code Implementation						
2015	First Batch of trained masons Listing of trained masons	29					
2016	Allocation of budget for BCI Requirements of structural drawings Field Supervision by municipal engineer on three different stages of construction	64					
2017	Increase technical manpower of municipality		33				

Municipal	Milestones	on	Building	Code	Implementation
					1

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Besisahar Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Besisahar Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Besisahar Municipality was assessed in terms

of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. component, Under each kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Besisahar Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	500	1000	1250
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	0	100

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	50	100	150
Building Constructed per Year without Permit	50	50	40
Engineer within Municipal Office	1	1	1
Sub Engineer within Municipal Office	1	1	1
Numbers of Mason Trained			94
Numbers of Engineer Trained (Consultant/Contractor)			33
Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	0
2014	0	1	0
2016	3.25	3	1

Fig 1: Average score for BCI status in Besisahar Municipality in the year 2012, 2014 and 2016

The figure shows that there has been some improvements in Institutional System towards implementing building code over the years. Of the three major components of Building Code Implementation- Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on building code seems to change better than the other two components.

3. Institutional System on Building Permit Process of Besisahar Municipality

The institutional system on building permit process has significantly improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3.25 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; need of structural drawing for all building class of registration of masons, use of detail checklist for compliance check, provision of field inspection for structural details, system of maintenance roster of trained masons was initiated since 2016.



Fig2: No. of Buildings constructed in Besisahar Municipality

5. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started

4. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012 and 2014 and 3 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Besisahar Municipality, more than 150 buildings are constructed per year and are under the supervision of 1 engineer and 1 sub-engineer as shown in the figure below:



Fig 3: No. of Engineer and Sub-Engineer within Besisahar Municipal Office

allocating some budget for the implementation of Building Code since 2016. The budget score of 1 implies that it is unable to meet the requirements for effective BCI.

The score increased from 0 in the year 2012 and 2014 to 1 in 2016.

6. Conclusions

- There has been some improvements in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacity and Budget Allocation.
- In Besisahar Municipality more than 150 buildings are constructed per year and are looked after by 1 engineer and 1 sub-engineer.
- Besisahar municipality has just initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Bharatpur Metropolitan City

1. Location and Demography

Bharatpur Metropolitan City is located in Chitwan district which lies in the then Central Development Region of Nepal and as per the current federal structure it lies in Province No. 3.

Bharatpur got municipality status in 1979 A.D (2035 B.S). By 2014, Bharatpur was declared as Sub-Metropolitan City merging various VDCs namely Gitanagar, Fulbari, Sibanagar, Mangalpur and Patihani. Later in 2016 A.D, Bharatpur was declared as a Metropolitan City. However, this report covers the situation of the then Bharatpur Sub-Metropolitan City.

The sub-metropolitan city covers an area of 432.95 sq. km. and lies at an altitude of 215 meters above sea level. The maximum and minimum temperatures lie between 40° C to 7° C during the summer and winter respectively.



i. Population Distribution

The 2011 census counted 1,47,777 inhabitants with 5.03% annual growth rate, and population density 911.30 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1, 88,875 inhabitants with 47,212 households. This population is of the then Bharatpur Sub-Metropolitan City before it was merged to form Metropolitan City.

ii. Population Demography

Bharatpur is the city of the migrants. Almost all people, except some indigenous groups like Tharu, Darai, Kumal and Chepang, are immigrated from different parts of the country. The migration had taken its root after the eradication of Malaria. Inception of the Rapti Valley Development Project, in the sixties, promoted another surge of migration by distributing land. As a result of the migration, varieties of castes and ethnic groups are found dwelling in the Metropolitan City. Among them, Brahmin, Chhetri, Newar, Magar, Tamang and Gurung are major ethnic groups. In the downtown of the Metropolitan City, Newar is the dominant caste. Indigenous tribes such as Chepang, Tharu, Darai and Kumal can be found in the fringes of the Metropolitan City. The mother tongue for the majority of residents is Nepali and Maithili.

iii. Main Economy

The economy of Bharatpur was traditionally based on agriculture. The agricultural land is gradually converted into residential area and also in industrial uses. Basic industries of Bharatpur are processing industries of small scale. A large number of poultry industries have been developed in the Metropolitan City. It is believed that it serves more than 60% of the total poultry demand of the country. Moreover, this Metropolitan City has a substantial volume of poultry products for export trade. Chitwan is regarded as food surplus district, which is processed in Bharatpur and sold to major cities of the country including Kathmandu and Pokhara. Besides, multinational companies like Coca-Cola and San Miguel are also situated within the Metropolitan City.

A large number of business and trading houses are based in the city. The major companies have opened their branches in the city. Its central position along with the crossroads of Bharatpur enabled.

2. Services and Facilities

There are 33 government and public educational institutes; 14 primary educational institute, 5 lower secondary educational institute, 9 secondary schools, 5 higher secondary schools and 3 technical colleges. The literacy rate of Bharatpur Metropolitan City is 85.34% with male literacy rate 90.58% and female literacy rate 80.27%.

Bharatpur Metropolitan City is well facilitated with modern mass communication services. All the means of communication such as postal service (public and private), telephone services with STD and ISD facilities, e-mail and internet are easily available here. 26.87% of households are using telephone, 87.18% of households own mobile phones. It was found that 97.94% of the households have access to electricity and 52.08% of households are using tap/pipe water. There are 5 radio stations and 3 local televisions. The city has a stretch of 188 km black topped road, 185 km gravel road and160 km of raw road. There are 21 government/ private hospitals with 2730 total beds. There is a health post and 4 urban health centers within the metropolitan area.

(National Population and Housing Census, 2011)

3. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Bharatpur Metropolitan City. The DesInventar datasets shows that the metropolitan city has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Flood, Fire, Epidemic, Accident and Landslide. Flood is the first major hazard as 47% of the 1967 total destroyed houses were due to it. Similarly, epidemic is ranked as third major hazard causing 95% of injuries out of 5394 and 38% of deaths out of 299 total deaths.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events) earthquake is one of the major hazards faced by all the municipalities of Nepal and Bharatpur Metropolitan City is not an exception.





Source: NSET/DesInventar Report, 2017

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Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

4. Situation of Building Code Implementation

i. Existing Building Scenario

The sub-metropolitan city consists of approximately 23,606 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed. A study conducted in 2016 under BCIPN program of NSET evidenced that 90% of the RCC buildings constructed comply with Nepal National Building Code. Building information and human resources for building construction in the metropolitan city are as follows:

S. N.	Description	2012	2014	2016
1	Population	1,55,210	1,71,217	1,88,875
2	Area (sq. km)			432.95
3	Number of existing buildings	19,399	21,399	23,606
4	Number of new building constructed per year with permit	1500	1800	1800
5	Number of buildings constructed per year without permit	550	450	300
6	No. of Trained Masons		175	296
7	Technical manpower with Municipal Office	10	10	11
8	Numbers of Engineer Trained (Consultant/Contractor)		76	99
9	Total Manpower in Municipal Office	300		

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2013 A.D in Bharatpur Metropolitan City with allocation of some budget. However, as preparatory works for BCI, formation of separate BCI Cell and mason training took place already in 2012 A.D.

In 2014, Bharatpur started providing orientation to house-owners during building permit process. Same year, a roster of trained masons was prepared and the requirements of structural drawing was made mandatory. The detail structural drawings provides clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. By the year 2016, field supervision through consultants was initiated to ensure the Building Code implementation. Building Code Compliance checklist came in practice from the same year.

In 2017, with the purpose of strengthening the capacity towards Building Code implementation, technical manpower in the metropolitan city was increased. Similarly, the process of reporting with photographs of different stages of construction for the field supervision was introduced. Bharatpur also started a system of certification/identity card to the trained masons/contractors from the same year.

	Mile				
Year		Capacity E	Enhancement	Awareness Beneficiaries	
	Institutional Capacity	Masons	Engineers	(Orientation to House owners and Social Mobiliser)	
2012	First batch of trained masons Formation of BCI cell	_	_	_	
2013	Declare Building Code Implementation Allocation of budget for BCI Formation of mason groups Listing of consultants	24	46	78	
2014	Requirements of structural drawings Listing of trained masons Orientation for house owner during Building Permit Process	150	_	96	
2015		33	-	_	
2016	Implementation of building code compliance checklist Field supervision through consultant with photographs	56	24	138	
2017	Certification/ID system for trained masons Reporting of construction completion with photographs Increase technical manpower of Metropolitan City	19	_	40	

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Bharatpur Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality were used for the data collection.

The status of building code implementation in the Bharatpur Metropolitan City was assessed in

terms of three major components described in Section (of the report): Institutional 3 Mechanisms, Technical Capacity, and Budget Allocation. Under each component, kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Bharatpur Metropolitan City.

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	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	Yes
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	Yes
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.5	2
2014	3	1.5	2
2016	5	1.75	4

Fig 1: Average scores for BCI status in Bharatpur Metropolitan City in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional System towards implementing building code over the years. Also, the budget allocation for BCI is also very good. Of the three major components of Building Code Implementation - Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System seems to change better than the other two components.

5. Institutional System on Building Permit Process of Bharatpur Metropolitan City

The institutional system on building permit process has significantly improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 5 in 2016 (out of 5). The key factors contributing to the component of institutional system such as: Presence of Advisory Committee, Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check, provision of field inspection for structural details and system of registration of masons and roster of trained masons have been established in Bharatpur Metropolitan City.

Among the aforementioned components of institutional system, Bharatpur Metropolitan City has succeeded to introduce all the components by 2016 A.D. Therefore, the city receives a full score of 5 for the Institutional System for BCI.

6. Technical Capacities

Compared to other two components of BCI the score of Technical Capacities is the lowest in Bharatpur. This component measures the availability and capabilities of technical manpower within the Metropolitan City. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new buildings constructed per year is measured and the scores are assigned accordingly.

The score increased from 0.5 in 2012 to 1.5 in 2014 and 1.75 in 2016 A.D (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Bharatpur, at present, more than 2,000 buildings are constructed per year and are under the supervision of 7 engineers and 4 sub-engineers from the figure below.



7. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for Building Code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the Metropolitan City has been allocating budget for the implementation of Building Code since 2012.

The score increased from 2 in 2012 and 2014 to 4 in 2016.

8. Conclusions

- There has been significant improvement in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Bharatpur Metropolitan City more than 2000 buildings are constructed per year and

are looked after by 7 engineers and 4 subengineers.

• Bharatpur Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the Metropolitan City and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Bhimeshwor Muicipality

1. Location and Demography

Bhimeshwor Municipality is located in the district of Dolakha which lies in the then Central Development Region of Nepal and as per the current federal structure it lies in Province No. 3.

Bhimeshwor got municipality status in 1997 A.D (2054 B.S). It is surrounded by Tamakoshi River in the east, Charnawati VDC in the west and South, Chemawati VDC in the North. It occupies land area of 132.5 sq. km. and lies at an altitude of 840 meter above the sea level. Charikot, Dolakha, Makaibari and Mati VDCs were amalgamated to form the Bhimeshwor Municipality.



i. Population Distribution

The 2011 census counted 23,337 inhabitants with 0.63% annual growth rate and population density 358.81 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 24,081 inhabitants with 6,270 households. This population is of the then Bhimeshwor municipality before the change in new federal structure.

ii. Population Demography

The mother tongue for the majority of residents is Nepali. The main inhabitants of the

municipality are Chhetri followed by Newar, Hill Brahmin, Tamang, Dalit, Thami and Gurung.

iii. Main Economy

The municipality is developing rapidly and attracting new residents and industries due to relocation of mid-hill migrants. It is also a center for business for adjacent districts. Of the total population of Bhimeshwor municipality, 44.5% is usually active population aged 10 and above of which 60% are involved in agriculture, forestry and fishery work, 9.0% in service and sales work, 6.9% in crafts and related works and the remaining in other occupations.

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 71.86% with male literacy rate 82.87% and female literacy rate 62.41%. It was found that 96.63% of households have access to electricity, 86.36% of households use tap/piped water and 68.84% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Bhimeshwor Municipality. The DesInventar dataset shows that the municipality has faced different hazards in the past. Among them major six hazards on the basis of frequency of occurrence are Thunderstorm, Landslide, Fire, Epidemic, Flood, Accident and Structural Collapse. Landslide is the first major hazard as 38% of death out of 42 total deaths were due to it. Out of 35 total destroyed buildings, 43% were due to fire. Similarly, epidemic ranked as fourth major hazard in terms of occurrence causing 28% of injuries out of 58 total injuries.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazard faced by all the municipalities of Nepal and Bhimeshwor Municipality is not an exception.

The 2015 earthquake, though a one-time event was a major disaster due to which almost 90% of total existing houses were damaged leaving 18 people dead and 139 people injured in Bhimeshwor municipality only. This event is not included in the below analyzed figures.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 6,270 buildings as of 2016 among which most are masonry buildings. However, most of the newly constructed buildings are Reinforced Cement Concrete framed (RCC) buildings. A study conducted in 2016 under BCIPN program

of NSET evinced that 83 % of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
	Population	23,484	23,781	24,081
	Area (Sq. Km)			132.5
	Number of existing buildings	6,114	6,192	6,270
	Number of new building constructed per year with permit	40	40	334
	Number of buildings constructed per year without permit	10	12	0
	No. of Trained Masons			82
	Numbers of Engineer Trained (Consultant/Contractor)			
	Technical manpower with Municipal Office	3	3	3
	Total Manpower in Municipal Office	30		

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

In Bhimeshwor Municipality, building code compliance checklist was introduced in 2015 to check building drawing submitted for building permit process and building permit form was revised and implemented following the same year. By 2016, the municipality allocated budget to support activities for BCI. Same year, field inspection of construction according to codal provision was initiated to ensure the Building Code Implementation. Similarly, municipality prepared the municipal Bye Laws and prepared Dolakha regeneration plan in the same year.

Municipal Milestones on Building Code Implementation:

	Milestones				
Year	Institutional Conscitu	Capacity Enhancement		Awareness	
	institutional Capacity	Masons	Engineers	Beneficiaries	
2015	Implement revised building permit form Used building code compliance checklist to check building drawing submitted for building permit process Conduct detail damage assessment	51		33	
2016	Prepared Dolkha regeneration plan Allocation of budget for BCI Prepared Bhimeshwor municipality Bye laws Used damage assessment report for reconstruction activities Field inspection of constructing building according to codal provision.	31		54	

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Bhimeshwor Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Bhimeshwor Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Bhimeshwor Municipality was assessed in terms of three major components described in (of the report): Institutional Section 3 Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Bhimeshwor Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	Yes
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	0
2014	0.75	1	0
2016	4.5	1.5	2

Fig: Average score for BCI status in Bhimeshwor Municipality in the year 2012, 2014 and 2016

The figure clearly shows that there has been significant improvement in Institutional system towards implementing Building Code over the years. Of the three major components of Building Code implementation- Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Bhimeshwor Municipality

The institutional system on building permit process has significantly improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4.5 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; Presence of Advisory Committee, Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check (building configuration, building strength, building ductility), provision of field inspection for structural details and system of registration of masons and roster of trained masons have improved in Bhimeshwor Municipality.

Among the aforementioned components of institutional system, Bhimeshwor Municipality has succeeded to introduce all the components by the year 2016 except an Advisory Committee for the effective implementation of BCI.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the

Number of building construction in Municipality with permit and without Permit 350 300 250 200 150 100 50 0 2014 2016 2012 Building Constructed per Year with Permit Building Constructed per Year without Permit Fig 2: No. of Buildings constructed in **Bhimeshwor Municipality**

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code since 2016.

The score has increased from 0 in 2012 and 2014 to 2 in 2016.

municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the umbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012 and 2014 and 1.5 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Bhimeshwor Municipality, more than 300 buildings are constructed per year and are under the supervision of 2 engineers and 1 sub-engineer as shown in the figure below:



Fig 3: No. of Engineer and Sub-Engineer within Bhimeshwor Municipal Office

7. Conclusions

- There has been significant improvement in institutional system towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Bhimeshwor Municipality more than 300 buildings are constructed per year and are looked after by 2 engineers and 1 sub-engineer.
- Bhimeshwor municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Butwal Sub-Metropolitan City

1. Location and Demography

Butwal Sub-Metropolitan City is located in Rupandehi district which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5.

Butwal is one of the oldest municipalities of Nepal which was established in 1959 A.D. (2016 B.S). At the beginning, it had only 12 wards which later expanded in 1996 A.D (2053 B.S.) to 15 wards. Recently in 2017 March 10, (2073 B.S. Falgun 27), Butwal municipality was declared as Sub-Metropolitan City comprising of 22 wards. It occupies land area of 101.613 sq.km, has a sub-tropical climate with maximum and minimum temperatures ranging between 35.9°C to 11.5°C during the summer and winter respectively.



i. Population Density

According to the 2011 census, it has 1,20,982 inhabitants with 4.73% annual growth rate and population density 1,746 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1,52,432 inhabitants with 37,373 households. This population is of the then Butwal municipality before it was merged to form Sub-Metropolitan City.

ii. Population Demography

The main inhabitants of the sub-metropolitan city consist of groups like Brahmin, Kshtriya, Magar, Newar, Gurung, Kami and Muslims. The mother tongue for the majority of residents is Nepali and others include Newari, Magar and Hindi.

iii. Main Economy

Of the total population of Butwal Sub -Metropolitan City, 29.4% is usually active population aged 10 and above of which 29.6% are involved in service and sales work, 9.2% on the crafts and elementary work and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 88.98% with male literacy rate 93.62% and female literacy rate 84.48%. It was found that 95.91% of households have access to electricity, 94.57% of households use tap/piped water and 87.52% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Butwal Sub-Metropolitan City. The DesInventar dataset shows that the city has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Fire, Flood, Epidemic, Landslide and Accident. Fire is the first major hazard as 75% of the 738 total destroyed houses were due to it. Similarly, epidemic is ranked as third major hazard which caused 42% deaths out of 145 total deaths and 92% injuries out of 379 total injuries.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Butwal Sub-Metropolitan City is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

Butwal Sub-Metropolitan City consists of approximately 18,686 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed buildings. A study conducted in 2016 under BCIPN program of NSET evidenced

that 40% of the RCC buildings constructed comply with Nepal National Building Code. Building information and human resources for building construction in the sub-metropolitan city are as follows:

S. N.	Description	2012	2014	2016
	Population	1, 26,704	1, 38,974	1, 52,432
	Area (Sq. Km)			101.61
	Number of existing buildings	15,533	17,037	18,686
	Number of new building constructed per year with permit	816	900	1000
	Number of buildings constructed per year without permit	100	90	90
	No. of Trained Masons		140	280
	Technical manpower with Municipal Office	10	12	14
	Number of Engineer Trained (Consultant/Contractor)		28	28
	Total Manpower in Municipal Office			230

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2013 A.D in Butwal Sub-Metropolitan City with the allocation of budget. As a preparatory work for BCI, separate BCI cell was already formed in 2012.

In 2013, mason training on Earthquake Safe Building Construction Technique was organized for the first time and groups of trained masons were formed. In 2014, the sub-metropolitan city started providing orientation to house owner during building permit process. Same year, the requirements of structural drawing was made mandatory. The detail structural drawings provides a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. By the year 2016, with the purpose of strengthening the capacity of submetropolitan city towards Building Code implementation, technical manpower within the sub-metropolitan city was increased.

	Milestones			
Year	Institutional Capacity	Capacity Enhancement		Awareness
		Masons	Engineers	Beneficiaries
2012	Formation of BCI cell Field Supervision by municipal engineer on three different stages of construction			
2013	Declare Building Code Implementation First Batch of trained masons Allocation of budget for BCI Formation of mason groups Listing of trained masons	17		41
2014	Requirements of structural drawings Orientation for house owner during Building Permit Process	125	28	75
2015		37		
2016	Increase technical manpower of sub-metropolitan city			
2017		40		

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Butwal Sub- Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Butwal Sub- Metropolitan City. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality etc. were used for the data collection.

The status of building code implementation in the Butwal Sub- Metropolitan City was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Butwal Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Sub-metropolitan city revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	7000	20000	20000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	250	300	150

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	816	900	1000
Building Constructed per Year without Permit	100	90	90
Engineer within Municipal Office	2	4	4
Sub Engineer within Municipal Office	8	8	10
Numbers of Mason Trained		140	280
Numbers of Engineer Trained (Consultant/Contractor)		28	28
Numbers of House Owner Oriented		45	300

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1.25	2
2014	2	2.25	2
2016	3	3	1

Fig 1: Average score for BCI status in Butwal Sub-Metropolitan City in the year 2012, 2014 and 2016

The figure shows that there has been some improvements in Institutional System and Technical Capacities towards implementing building code over the years.

4. Institutional System on Building Permit Process of Butwal Sub-Metropolitan City

The institutional system on building permit process has improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Butwal Sub-Metropolitan City has succeeded to introduce the system of dedicated technical staff/ separate earthquake safety unit, need of structural drawing for all building class and the maintenance of roster of trained masons since 2014. The provision of field inspection for structural details was integrated in the municipality system since year 2016.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the sub-metropolitan city. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012 to 2.25 in 2014 and 3 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Butwal Sub-Metropolitan City, at present more than 1000 buildings are constructed per year and are under the supervision of 4 engineers and 10 sub-engineers as shown in the figure below.



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the sub-metropolitan city has been allocating some budget for the implementation of building code.

The score has decreased from 2 in the year 2012 and 2014 to 1 in 2016. This indicates that though revenue generation has increased over the years the budget allocation for BCI remains the same.

7. Conclusions

- There has been some improvements in Institutional system towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Butwal Sub Metropolitan City more than 1000 buildings are constructed per year and are looked after by 4 engineers and 10 sub-engineers.
- There is a need to increase budget allocation for BCI as the total score S3 declined over the years

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the sub-metropolitan city and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.
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Status of Building Code Implementation CENTRAL REGION

Gaindakot Municipality

1. Location and Demography

Gaindakot Municipality is located in Nawalparasi District which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province No. 4.

Gaindakot got municipality status recently in May 2014, merging the existing Mukundapur, Amarapuri, and Gaindakot VDCs. It occupies land area of 159.93 km². It lies between 27.73⁰ north latitude and 84.39⁰ east longitude.



i. Population Distribution and Demography

The 2011 census for Gaindakot VDC counted 55,205 inhabitants with 3.5% annual growth rate. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted

65,566 inhabitants with 15,468 households. This population is of the then Gaindakot municipality before the change in new federal structure. Nepali is spoken as the national language.

The main inhabitants of the municipality are Chhetri followed by Brahmin, Magar and Tharu.

(National Population and Housing Census, 2011)

2. Hazard and Risk

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and Gaindakot Municipality. impact in The DesInventar dataset shows that the municipality, (then VDC) has faced different hazards in the past. Among them three major hazards based on frequency of occurrence are Landslide, Fire and Accident Landslide is the first major hazard that caused 40% of total 15 deaths. Strong wind destroyed 80% buildings out of 25 total destroyed.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Gaindakot municipality is not an exception.





Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 11,899 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed. A study conducted in 2016 under BCIPN program of

NSET evidenced that 95% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S. N	Description	2012	2014	2016
	Population	57,137	61,207	65,566
	Area (Sq. Km)			159.93
	Number of existing buildings	10,369	11,108	11,899
	Number of new building constructed per year with permit	300	428	500
	Number of buildings constructed per year without permit	0	22	100
	No. of Trained Masons		91	125
	Numbers of Engineer Trained (Consultant/Contractor)			22
	Technical manpower with Municipal Office		1	3
	Total Manpower in Municipal Office			35

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2014 A.D.in Gaindakot Municipality with allocation of some budget for its effective implementation. In the year 2015, Gaindakot municipality started a system of providing identity card/certificate to trained masons/contractors and also prepared the roster of consultant engineers. In the year 2016, technical manpower in the municipality was increased with the purpose of strengthening the capacity of municipality towards Building Code Implementation. Similarly, requirements of structural drawing were made mandatory. The detail structural drawings provide a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction.

	Milestones					
Year	Institutional Canacity	Capacity E	nhancement	Awareness		
	institutional capacity	Masons	Engineers	Beneficiaries		
2013	Listing of trained Masons	30				
2014	Declare Building Code Implementation Allocation of budget for BCI	61		79		
2015	Listing of consultants Identity Card/Certification system for trained masons	34		68		
2016	Requirements of structural drawings Field Supervision by municipal engineer on three different stages of construction Allocation of budget for BCI Increase technical manpower of municipality		22	321		
2017		45				

Municipal Milestones on Building Code Implementation

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Gaindakot Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Gaindakot Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Gaindakot Municipality was assessed in terms of three major components described in (of the report): Institutional Section 3 Mechanisms, Technical Capacity, and Budget each Allocation. Under component, kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Gaindakot Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
 Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case 		No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes

f

Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	0	1426	2500
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	100	200

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	300	428	500
Building Constructed per Year without Permit	0	22	100
Engineer within Municipal Office	0	0	1
Sub Engineer within Municipal Office	0	1	2
Numbers of Mason Trained		91	125
Numbers of Engineer Trained (Consultant/Contractor)			22
Numbers of House Owner Oriented		225	308

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0	0
2014	1.25	1.25	1
2016	4	2.25	2

Fig 1: Average score for BCI status in Gaindakot Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional system towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Gaindakot Municipality

The institutional system on building permit process has significantly improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; Presence of Advisory Committee, Separate EO Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check (building configuration, building strength, building ductility), provision of field inspection for structural details and system of certification/registration of masons and maintaining roster of trained masons were initiated in Gaindakot Municipality.

Among the aforementioned components of institutional system, Gaindakot Municipality has succeeded to introduce all the components by 2016 except the formation of Advisory Committee for effective BCI and provision of strengthening of existing buildings.

5. Technical Capacities

This component measures the availability capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0 in the year 2012, 1.25 in 2014 and 2.25 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Gaindakot Municipality, more than 500 buildings are constructed per year and are under the supervision of 1 engineer and 2 sub-engineers as shown in the figure below:



Fig 2: No. of Buildings constructed in Gaindakot Municipality



Fig 3: No. of Engineer and Sub-Engineer within Gaindakot Municipal Office

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality have started allocating some budget for the implementation of building code.

The score increased from 0 in the year 2012 to 1 in 2014 to 2 in 2016.

7. Conclusions

- There has been significant improvement in Institutional System towards implementing Building Code over the years than the other two components-Technical Capacity and Budget Allocation.
- In Gaindakot Municipality more than 500 buildings are constructed per year and are looked after by 1 engineer and 2 sub-engineers.
- Gaindakot municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation CENTRAL REGION

Hetauda Sub Metropolitan City

1. Location and Demography

Hetauda Sub-Metropolitan City is located in the Makwanpur district which lies in the then Central Development Region of Nepal and as per the current federal structure it lies in Province No. 3.

Hetauda got municipality status in 1969 A.D. (2026 B.S.) In 2014 A.D., Hetauda was declared as Sub-Metropolitan City. It occupies an area of 261.59 sq.km. and lies at 474 meters from mean sea level. Hetauda Sub-Metropolitan City is surrounded by the Chhatiwan V.D.C in the East, Manahari, Haandikhola and Sarikhet V.D.C in the West. Naamtaar. Bhainse and Makwanpurgadhi V.D.C in the North and Bara and Parsa District in the South. It lies between 27°25' north latitude and 85°03' east longitude. The maximum and minimum temperatures lie between 36°C to 18°C during the summer and winter respectively.



(Municipality Profile Report, 2011)

i. Population Distribution

The 2011 census counted 85,653 inhabitants with 2.24% annual growth rate and population density 1,793 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 95,686 inhabitants with 22,176 Households. This population is of the then Hetauda Municipality

before it was merged to form Sub-Metropolitan City.

ii. Population Demography

The main inhabitants of the Sub-Metropolitan City are Hill Brahmin followed by Chhetri, Newar, Tamang, Magar, etc.

iii. Main Economy

Of the total population of Hetauda Sub-Metropolitan City, 38.0% is usually active population aged 10 and above of which 19.5% are involved in skilled agriculture, forestry and fishery work, 19.8% in service and sales work, 16% on the crafts and related works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phone, electricity and others are available in most parts of the city. Majority of people have access to education and the overall literacy rate is 84.35% with male literacy rate 90.48% and female literacy rate 78.32%. It was found that 96.11% of households has access to electricity, 82.56% of households use tap/piped water and 87.33% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Hetauda Sub-Metropolitan City. The DesInventar datasets show that the submetropolitan city has faced different hazards in the past. Among them major five hazards on the occurrence were Fire. basis of Flood. Thunderstorm, Epidemic and Accident. Fire is the first major hazard as 46% of the 168 total houses destroyed were due to it. Epidemic

ranked as fourth major hazard which caused 54% of death out of 190 and 51% of injuries out of 404 total injuries.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Hetauda Sub-Metropolitan City is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The Sub-Metropolitan City consists of approximately 11,088 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016

under BCIPN program of NSET evidenced that 52% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the Sub-Metropolitan City are as follows:

S.N	Description	2012	2014	2016
1	Population	87,572	91,539	95,686
2	Area (Sq. Km)			261.59
3	Number of existing buildings	10,148	10,608	11,088
4	Number of new building constructed per year with permit	500	600	700
5	Number of buildings constructed per year without permit	250	30	30
6	No. of Trained Masons		30	90
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	6	10	10
9	Total Manpower in Municipal Office			165

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2011 A.D.in Hetauda Sub-Metropolitan City while some amount of budget for Building Code implementation was allocated in 2013 A.D. By 2012, groups of trained masons were formed. Likewise, technical manpower in the Sub-Metropolitan City was increased in 2013 with the purpose of strengthening the capacity of Sub-Metropolitan City towards Building Code Implementation. Same year, roster of trained masons was prepared.

Municipal Milestones on Building Code Implementation

	Milestones					
Year	Institutional Conseitu	Capacity Enhancement Aware		Awareness		
	Institutional Capacity	Masons	Engineers	Beneficiaries		
2011	Declare Building Code Implementation					
2012	Formation of masons group					
2013	Capacity enhancement of technical manpower of Sub-Metropolitan City Allocation of budget for BCI Listing of trained masons	30		16		
2015		30				
2016		30				

(Source: Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Hetauda Sub-Metropolitan City to measure the level of capacity of the municipalities for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality were used for the data collection.

The status of building code implementation in the Hetauda Sub-Metropolitan City was assessed

in terms of three major components described in (of the report): Institutional Section 3 Mechanisms, Technical Capacity, and Budget Allocation. Under each components, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation in the municipality over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Hetauda Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	Yes	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Municipality revenue/ Budget	2012	2014	2016	Technical Capacities	2012	2014	2016
Revenue from Building Permits	Permits 5000 2000 10000 Building Constructed per Year with Permit 50		500	600	700		
(in thousands)	sands) Source and sour		250	30	30		
Budget allocation for BCI for	get allocation for BCI for Engineer within Municipal Office		2	4	4		
and Workshop (In Thousands)	200	300	400	Sub Engineer within Municipal Office	4	6	6
	Numbers of Mason Trained			30	90		
				Numbers of Engineer Trained (Consultant/Contractor)			
				Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0.75	0.75	2
2014	1.25	1.25	2
2016	2	1.25	3

Fig 1: Average scores for BCI status in Hetauda Sub-Metropolitan City in the year 2012, 2014 and 2016

The figure shows that there hasn't been much improvement in all three major components of Building Code Implementation-Institutional Mechanisms; Technical Capacities and Budget

Allocation for BCI. As of the year 2016, score for budget allocation was the greatest among the three scores.

4. Institutional System on Building Permit Process of Hetauda Sub-Metropolitan City

The institutional system on building permit process has slightly improved in the year 2016 compared to that in 2012. The score increased from 0.75 in 2012 to 2 in 2016 (out of 5). Among the key factors contributing to the component of institutional system , Hetauda Sub-Metropolitan City have been successful to introduce the system of Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff, need of structural drawing for all building class, and system of maintenance of roster of trained masons.

5. Technical Capacities

This component measures the availability and capability of technical manpower within the Sub-

Metropolitan City. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.75 in the year 2012 to 1.25 in 2014 and 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Hetauda Sub-Metropolitan City, more than 700 buildings are constructed per year and are under the supervision of 4 engineers and 6 sub-engineers as shown in the figure below.



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that Hetauda Sub-Metropolitan City has been allocating some budget for the implementation of building code.

The score has increased from 2 in the year 2012 and 2014 to 3 in 2016.

7. Conclusions

- There has been slight improvements in the three major components of the Building Code implementation-Institutional System, Technical Capacities and Budget Allocation over the years.
- In Hetauda Sub-Metropolitan City more than 700 buildings are constructed per year and

are looked after by 4 engineers and 6 subengineers.

• Hetauda Sub-Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the Municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation CENTRAL REGION

Karyabinayak Municipality

1. Location and Demography

Karyabinayak Municipality lies in Lalitpur district, Bagmati Zone and lies in the Central Development Region in Nepal and as per the current federal structure it lies in Province No. 3.

Karyabinayak got municipality status in 1957 B.S (2nd December, 2014 A.D). Karyabinayak was merged with Lalitpur Metropolitan City in 2073 B.S (2016 A.D). Now, Karyabinayak covers Sainbu ward no. 18 and 25, Agnisal ward no. 19 and Khokana ward no. 25. It covers an area of 139.33 sq. km. However, this municipality pager covers



the cases of the then Karyabinayak Municipality area covering 25 wards. Merging neighbouring VDC's of Khakana, Bungamati, Chhampi, Dukuchhpa and Sainbu is not included.

i. Population Distribution

The 2011 census counted 38,066 inhabitants with 4.2% annual growth rate and population density 1,761.49 person per sq.km. Based on the annual

growth rate of 2011 census, the population projection for 2016 was counted 46,760 inhabitants with 11,042 households.

ii. Population Demography

Newars are the main inhabitants of the municipality since ancient time. Ethnic communities like Chhetri, Hill Brahmins, Tamang, Magar, Rai, Gurung, Limbu etc. are other major city dwellers. Newari language is the dominant language of the very municipality.

(Municipality Profile, 2008)

iii. Main Economy

Karyabinayak Municipality is mainly known for the production of rich mustard oil since ancient time. The economy of Karyabinayak was traditionally based on agriculture while the agricultural land is now gradually converted into the residential area.

2. Situation of Building Code Implementation (BCI)

i. Existing Buildings Scenario

The municipality consists of approximately 5,521 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 65% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S. N	Description	2012	2014	2016
	Population	39,665	43,067	46,760
	Area (Sq. Km)			139.33
	Existing buildings	4,683	5,085	5,521
	New building construction per year with permit	400	600	600
	Building constructed per year without permit	10	20	30
	No. of Trained Masons		13	134
	Numbers of Engineer Trained (Consultant/Contractor)			
	Technical manpower with Municipal Office		2	6
	Total Manpower in Municipal Office			37

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

Building Code Implementation (BCI) was enforced in 2012 in Karyabinayak Municipality. From 2013, municipality started checking building drawings according to the codal provision along with the support from the DUDBC professionals during the building permit process. In 2015, with the purpose of strengthening the capacity of the municipality towards Building Code Implementation, technical manpower of the municipality was increased.

Municipal Milestones on Building Code Implementation:

	Miles	stones			
Year	Institutional Capacity	Capacity En	hancement	Awareness	
		Masons	Engineers	Beneficiaries	
2012	Started to enforce building code implementation				
2013	Mandatory check building drawings according codal provision by DUDBC professionals during building permit process				
2014				37	
2015	Increase technical manpower of municipality				

(Source: Online Database of BCIPN up to date of 2017-10-30)

ii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Karyabinayak Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Karyabinayak Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Karyabinayak Municipality was assessed in

terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Karyabinayak Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0	0
2014	1.5	0.75	1
2016	4	1.25	2

Fig 1: Average score for BCI status in Karyabinayak Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Institutional system towards implementing building code over the years. Of the three major components of Building Code Implementation: Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional system on building code seems to change better than the other two components.

3. Institutional System on Building Permit Process of Karyabinayak Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; Presence of Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check (building configuration, building strength, building ductility), provision of field inspection for structural details and system of registration of masons and roster of trained masons has been initiated in Karyabinayak Municipality.

By the year 2016, Karyabinayak Municipality succeeded to introduce all the components except formation of advisory committee for BCI and provision of retrofitting for the strengthening of existing buildings.

4. Technical Capacities

This component measures the availability and capabilities of technical manpower within the



Fig 2: No. of Buildings constructed in Karyabinayak Municipality

5. Municipality Revenue/Budget Score

The component assessed the proportion of budget allocated by the municipality for building code implementation. From the survey, it was observed that the municipality have started allocating some budget for the implementation of building code.

The score on municipality/revenue budget has increased from 0 in the year 2012 to 2 in the year 2016.

municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly. The score is 0 in the year 2012, 0.75 in 2014 and 1.25 in 2016 out of 5 score shows that the demand is high. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Karyabinayak Municipality, more than 600 buildings are constructed per year under the supervision of 4 engineers and 2 sub-engineers as shown in the figure below:



Fig 3: No. of Engineer and Sub-Engineer within Karyabinayak Municipality

6. Conclusion

- There has been significant improvement in Institutional System towards implementing building code over the years than the other two components; Technical Capacity and Budget Allocation.
- In Karyabinayak Municipality more than 600 buildings are constructed per year and are looked after by 4 engineers and 2 sub engineers.
- Karyabinayak municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation CENTRAL REGION

Putalibazaar Municipality

1. Location and Demography

Putalibazaar Municipality is located in Syangja district which lies in the Western Region of Nepal and as per the current federal structure it lies in Province No. 4.

Putalibazar got municipality status in 2053 B.S (1996 A.D). Putalibazar municipality is surrounded by the Paubegainde and Thulahide VDCs in the East, Sataudarau and Arjun chupari VDCs in the West, Setidobhan Bhatkhola VDCs in the North and Dahaum darsing, Pelkachaur VDCs in the South. It is the district headquarter of the Syangja district. It lies between 28°02'30" to 28°07'30" north latitude and 83°47'30" to 83°55'00" east longitude.



i. Population Distribution

The 2011 census counted 31,338 inhabitants with 0.55% annual growth rate and population density 446.79 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 32,209 inhabitants with 8,407 households. <u>Nepali</u> is spoken as the national language. The mother tongue for the majority of residents is Nepali.

ii. Population Demography

The main inhabitants of the municipality are Hill Brahmins followed by Chhettri, Magar, Dalit, Gurung, Newar and Gharti/Bhujel.

iii. Main Economy

Of the total population of Putalibazaar Municipality, 36.5% of population are usually active population aged 10 and above of which 56.3% are involved in skilled agriculture, forestry and fishery work, 11.9% in service and sales works, 8.3% in crafts and related works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 79.74% with male literacy rate 88.64% and female literacy rate 72.92%. It was found that 95.67% of households have access to electricity, 95.78% of households use tap/piped water and 83.56% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Putalibazaar Municipality. The DesInventar datasets show that the municipality has faced different hazard in the past. Among them major five hazards on the basis of frequency of occurrence are Landslide, Flood, Fire, Hailstorm and Accident. Landslide is ranked as first major hazard as it caused 69% injuries out of 29 and 59% death out of 51 total deaths. Flood is second major hazard which destroyed 34% buildings out of 65 totals destroyed.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Putalibazaar Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 6,497 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced

Cement Concrete (RCC) buildings. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	31510	31858	32209
2	Area (Sq. Km)			147.21
3	Number of existing buildings	6327	6397	6467
4	Number of new buildings constructed per year with permit	100	130	200
5	Number of new buildings constructed per year without permit	200	180	150
6	No. of trained Masons		122	219
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	2	2	3
9	Total Manpower in Municipal Office			42

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestone of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2014 A.D. in Putalibazaar Municipality. The municipality prepared the roster of consultant engineers and trained masons and conducted mason training on earthquake safe construction in the same year. In 2015, some amount of budget was allocated for the Building Code Implementation (BCI). Further, the requirements of structural drawing were made mandatory. The detail structural drawings provide a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. By the year 2016, field supervision through consultants was initiated to ensure the Building Code implementation. Building Code Compliance checklist was introduced in the same year.

	Milestones				
Year	Institutional Canacity	Capacity E	nhancement	Awareness	
		Masons	Engineers	Beneficiaries	
2014	Listing of consultants Listing of trained masons Declare Building Code Implementation First Batch of trained masons Formation of mason groups	122		91	
2015	Allocation of budget for BCI Requirements of structural drawings	35			
2016	Implementation of building code compliance checklist Field Supervision by municipal engineer on three different stages of construction	65		134	

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN unto date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Putalibazaar Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Putalibazaar Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Putalibazaar Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Putalibazaar Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	800	1000	1300
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	50	100	200

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	100	130	200
Building Constructed per Year without Permit	200	180	150
Engineer within Municipal Office	0	0	1
Sub Engineer within Municipal Office	2	2	2
Numbers of Mason Trained		122	219
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented			

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.25	3
2014	1.25	1.25	3
2016	3.25	2.5	3

Fig: Average score for BCI status in Putalibazaar Municipality in the year 2012, 2014 and 2016

The figure shows that there have been some improvements in the Institutional System towards implementing building code over the years. Of the three major components of Building Code Implementation-Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional system on Building Code seems to change better than the other two components.

4. Institutional System on Building Permit Process of Putalibazaar Municipality

The institutional system on building permit process has improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3.25 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; introduction of the system of the need of structural drawing for all building class, system of certification of masons and maintenance of roster of trained masons were initiated since 2014. Moreover, the use of detail checklist for building code compliance check and provision of field inspection for structural details came into practice since 2016.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.25 in the year 2012, 1.25 in 2014 and 2.5 in 2016 (out of 5), shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Putalibazaar Municipality, more than 300 buildings are constructed per year under the supervision of 1 engineer and 2 sub-engineers as shown in the figure below.



Fig 2: No. of Buildings constructed in Putalibazaar Municipality



Fig 3: No. of Engineers and Sub-Engineer within Putalibazaar Municipal Office

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has been allocating budget for the implementation of building code. However, there is a need of increment in the allocated budget as suggested by the budget score. The score is 3 in the year 2012 and remained constant throughout the survey period.

7. Conclusions

- There has been some improvements in the Institutional System towards implementing Building Code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Putalibazar Municipality more than 300 buildings are constructed per year and are looked after by 1 engineer and 2 sub-engineers.
- Putalibazar municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Siddharthanagar Municipality

1. Location and Demography

Siddharthanagar Municipality is located in Rupandehi district which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province no. 5.

Siddharthanagar was declared as a municipality in 1967 A.D (2024 B.S). It occupies an area of 36.03 sq.km. and lies 110-meter-high from sea level. Siddharthaagar Municipality is surrounded by the Bagaha and Basantpur VDC in the East, Hati Bangai VDC in the West, Padsari and Farsatikar VDC in the North and Sunauli in the South. The maximum and minimum temperatures lie between 45.2°C to 2.4°C during the summer and winter respectively.





i. Population Distribution

The 2011 census counted 64,566 inhabitants with 2.06% annual growth rate and population density 1,792.01 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 71,496 inhabitants with 13,838 households.

ii. Population Demography

The main inhabitants of the municipality consist of group like Brahmin-Hill, Muslim, Chettri, Magar, Gurung, Yadav and Newar. The mother tongue for the majority of residents is Nepali and others are Bhojpuri, Awadhi and Gurung.

iii. Main Economy

Siddharthaagar municipality has cultivable land. Rice, wheat, oils, legumes, potato and vegetables are mainly produced in the municipality.

Of the total population of Siddharthanagar Municipality, 30.4% is usually active populationaged 10 and above of which 20.7% are involved in skilled agriculture forestry and fishery workers, 26.3% are involved in service and sales works, 9.7% on the crafts and related works and the remaining active population in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phone, electricity and others are available in most parts of the city. Majority of people have access to education and the overall literacy rate is 80.26%. There are 6 Pre-Primary Schools, 3 Primary Schools, 6 Secondary schools under community level. Whereas, from Private sector, there are 5 Pre-Primary schools, 2 Primary schools and 16 Secondary schools. There are 2 community High schools and 4 private High schools. Children from Muslim community attend 10 Madarsas established in the municipality area. People have access to different hospitals and health centers: Lumbini Rana-Ambika Shah Eye Hospital, Shree Krishna Netralaya, Lumbini Netralaya, Universal College of Medical Sciences Teaching Hospital and Universal College of Dental Surgery are among the major ones.

The 2011 census found that 82.87% of households own mobile phones and 26.82% households are using telephone facility. Considering the road facility, the length of black topped road is 82 k.m. while gravel road is 54.52 k.m. It was found that 92.34% of the households have access to electricity and 43.43% of households have access to tap/piped water.

> (National Population and Housing Census, 2011 and Municipality Website)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Siddharthanagar Municipality. The DesInventar dataset shows that the municipality has faced different hazards in the past. Among them, major five hazards on the basis of frequency of occurrence are Epidemic, Fire, Flood, Hailstorm and Rain. Epidemic is first major hazard in terms of occurrence and caused 83% of death out of 70 total deaths. Similarly, fire is second major hazard which was only the cause that damaged all 179 houses. Though accident was not among the 5 major hazards, it caused 2 out of 3 injuries.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Siddharthanagar Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Status of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 6,919 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of

NSET evidenced that 89% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	65,896	68,639	71,496
2	Area (Sq. Km)			36.03
3	Number of existing buildings	6,377	6,643	6,919
4	Number of new building construction per year with permit	500	500	500
5	Number of building constructed per year without permit	15	20	10
6	No. of trained Masons		47	78
7	Numbers of Engineer Trained (Consultant/Contractor)			28
8	Technical manpower with Municipal Office	6	6	6
9	Total Manpower in Municipal Office	200		

(Source: Building Code Implementation survey 2012, 2014, 2016)

ii. Milestone of Building Code Implementation (BCI)

In Siddharthanagar Municipality, the mandatory implementation of Building Code was declared in 2004 A.D. However, budget for BCI was allocated only in 2012. With the aim of enhancing the capacity of masons, first training on Earthquake Resistance Building Construction Technique was organized in 2013. Similarly, separate BCI unit was formed in municipality in the same year. The requirements of structural drawing were made mandatory in 2015. The detail structural drawings provide a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction.

	Milestones				
Year	Institutional Conssitu	Capacity Er	Awareness		
	institutional capacity	Masons	Engineers	Beneficiaries	
2004	Declare Building Code Implementation				
2012	Allocation of budget for BCI				
2013	First Batch of trained masons Formation of BCI cell	26		115	
2014	Listing of trained masons	21	28	60	
2015	Requirements of structural drawings			61	
2016		31			

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Siddharthanagar Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Siddharthanagar Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the BCIPN program municipalities were assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Siddharthanagar Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016	Technical Capacities	2012	2014	2016
Revenue from Building Permits	2000	3000	10000	Building Constructed per Year with Permit	500	500	500
(in thousands)				Building Constructed per Year without Permit	15	20	10
Budget allocation for BCI for				Engineer within Municipal Office	4	4	4
Awareness, Orientation,	100	100	300	Sub Engineer within Municipal Office	2	2	2
Training and Workshop (In	100			Numbers of Mason Trained		47	78
I nousands)				Numbers of Engineer Trained (Consultant/Contractor)		28	28
				Numbers of House Owner Oriented		37	37

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	1
2014	2	2.25	1
2016	3	2.5	2

Fig 1: Average score for BCI status in Siddharthanagar Municipality in the year 2012, 2014 and 2016 The figure shows that there has been some improvements in the Institutional System towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional System on Building Code seems to change better than the

4. Institutional System on Building Permit Process of Siddharthanagar Municipality

other two components.

The institutional system on building permit process has improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3 in 2016 (out of 5). Among the key factors contributing to the component of institutional Siddharthanagar systems, Municipality has succeeded to introduce the system of separate EO Safety Unit/Separate BCI Cell/Dedicated Technical Staff. need of structural drawing for all building class and maintenance of roster of trained masons since 2014. Moreover, the provision of field inspection for structural details is in practice since 2016.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new buildings constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012, 2.25 in 2014 and 2.5 in 2016 (out of 5), shows that the demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Siddharthanagar Municipality, more than 500 buildings are constructed per year under the supervision of 4 engineers and 2 sub-engineers as shown in the figure below:



Fig 2: No. of Buildings constructed in Siddharthanagar Municipality



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has been allocating budget for the implementation of building code although the amount is inadequate.

The score has increased from 1 in the year 2012 to 2 in 2016.



7. Conclusions

- There have been some improvements in the Institutional System towards implementing Building Code over the years than the other two components-Technical capacities and Budget Allocation.
- In Siddharthanagar Municipality more than 500 buildings are constructed per year and

are looked after by 4 engineer and 2 sub engineers.

• Siddharthanagar municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Tansen Municipality

1. Location and Demography

Tansen Municipality is located in Palpa district which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5. It was declared as Municipality in 1988 A.D (2045 B.S). The municipality occupies land area of 109.8 sq. km. and lies 1,372 meters above mean sea level. The maximum and minimum temperatures lie between 35°C to 0°C during summer and winter respectively and the average rainfall is 1,600 mm per year. It is located on the highway between Butwal and Pokhara, on the crest of the Mahabharat range or Lesser Himalaya overlooking the valley of the Kaligandaki River to the north.



i. Population Distribution

The 2011 census counted 31,161 inhabitants with 4.22% annual growth rate and population density 1,434.67 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 38,315 inhabitants with 10,342 households.

ii. Population Demography

The main inhabitants of the municipality are Brahmin, and other ethnic groups are Magar, Chhetri, Newar, Kami, Damai, Sarki, and Muslim. <u>Nepali</u> is spoken as the national language. The mother tongue for the majority of residents is Nepali.

iii. Main Economy

Of the total population of Tansen municipality, population of 34.8% are usually active population-aged 10 and above of which 19.2% are involved in skilled agriculture, forestry and fishery works, 18.5% in service and sales works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most parts of the city. Majority of people have access to education and the overall literacy rate of Tansen municipality is 87.81% with male literacy rate 93.22% and female literacy rate 83.09. It was found that 97.25% households have access to electricity, 86.24% are using tap/piped water, 88.87% of households own mobile phone and 19.36% of households are using telephone services.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and of Tansen Municipality. The DesInventar dataset shows that the municipality has faced different hazards in the past. Among them major five hazard on the basis of frequency of occurrence are Fire, Landslide, Flood, Epidemic, and Rain. Fire is the first major hazard on the basis of occurrence which damaged 66% out of 41 total damaged houses. Though structural collapse and thunderstorms are not among the five major hazard, they had significant impact as nearly 30% of deaths out of 20 were due to structural collapse and 71% injuries out of 7 were due to thunderstorm.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Tansen municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 6,414 buildings as of 2016. Nowadays, most of the newly constructed buildings are constructed in Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN

program of NSET evidenced that 71% of buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	32476	35275	38315
2	Area (Sq. Km)			109.8
3	Number of existing Buildings	5479	5951	6464
4	Number of new building constructed per year with permit.	200	200	200
5	Number of buildings constructed per year without permit	20	20	20
6	No. of Trained Masons	100		127
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office.	2	4	4
8	Total Manpower in Municipal Office.			40

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones on Building Code Implementation (BCI)

In Tansen Municipality, mandatory implementation of Building Code was declared in 2015 A.D. In 2016, Tansen Municipality conducted its first Mason Training on earthquake safe building construction technique and prepared a roster of trained masons. Same year, the requirement of structural drawing was made mandatory. The detail structural drawings provides a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. Municipality started allocating budget for BCI since 2016. In 2017, with the purpose of strengthening the capacity of municipality towards Building Code Implementation, technical manpower in the municipality was increased. Similarly, the process of field supervision of the construction by municipal engineer was introduced in the same year.

Milestones on Building Code Implementation

Year	Milestones					
	Institutional Capacity	Capacity Enhancement		Awareness		
		Masons	Engineers	Beneficiaries		
2015	Declare Building Code Implementation					
2016	First Batch of trained masons Requirements of structural drawings Listing of trained masons Allocation of budget for BCI	29		155		
2017	Increase technical manpower of municipality Field Supervision by municipal engineer on three different stages of construction	32	21			

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Tansen Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Tansen Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities were used for the data collection.

The status of building code implementation in the Tansen Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Tansen municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	No	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	1200	1500	2400
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	0	100

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	200	200	200
Building Constructed per Year without Permit	20	20	20
Engineer within Municipal Office	1	1	1
Sub Engineer within Municipal Office	1	3	3
Numbers of Mason Trained	100		127
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented			25

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1.75	0
2014	0	1	0
2016	1.25	3.25	1

Fig 1: Average score for BCI status in Tansen Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in Technical Capacities towards implementing building code over the years. Of the three major components of Building Code Implementation- Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Technical Capacities for BCI seems to change better than the other two components.

4. Institutional System on Building Permit Process of Tansen Municipality

The institutional system on building permit process has slightly improved in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 1.25 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Tansen Municipality have succeeded to introduce the system of need of structural drawing for all building class, system of certification of masons and maintenance of roster of trained masons since 2016.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1.75 in the year 2012, 1 in 2014 and 3.25 in 2016 out of 5 shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Tansen Municipality, more than 200 buildings are constructed per year under the supervision of 1 engineer and 3 sub-engineers as shown in the figure below:



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code since 2016.

The score increased from 0 in 2012 and 2014 to 1 in the year 2016.

7. Conclusions

- There have been improvements in Technical capacities of Tansen municipality towards implementing building code over the years than the other two components; Institutional System and Budget Allocation.
- In Tansen Municipality, more than 200 buildings are constructed per year and are

looked after by 1 engineer and 3 sub engineers.

• Tansen municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation CENTRAL REGION

Vyas Municipality

1. Location and Demography

Vyas Municipality lies in Tanahu district which lies in the then Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5. It was declared as a municipality in 1992 A.D (2048 B.S). The municipality occupies land area of 248 sq.km and lies between 27°40 '45" to 27°43'50" North latitude and 83°23'30 to 83°29'20" East longitude. The maximum and minimum temperatures lie between 37.0°C to 8.4°C during summer and winter respectively. The average rainfall is 1960.6 mm per year. It has its own vision developed as "Self-reliant, clean and beautiful city of Vyas".



(Municipality Profile of Nepal, 2008)

i. Population Distribution

The 2011 census counted 43,615 inhabitants with 4.34% annual growth rate and population density 726.67 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 53,937 inhabitants with 14,000 households.

ii. Population Demography

The main inhabitants of the municipality are Hill Brahmins followed by Magar, Chhetri, Darai, Newar, Dalit and Gurung. <u>Nepali</u> is spoken as the national language. The mother tongue for the majority of residents is Nepali.

iii. Main Economy

Of the total population of Vyas Municipality 31.9% is Usually Active Population Aged 10 and above of which 42.9% are involved in skilled agriculture, forestry and fishery works, 15.5% in service and sales works, 11.2% in the crafts and related works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phone, electricity and others are available in most parts. People have access to education and the literacy rate of Vyas municipality is 83.26% with male literacy rate 89.49% and female literacy rate 78.26%. It was found that 96.476% of households have access to electricity, 79.22% of households use tap/piped water and 12.48% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Vyas Municipality. The DesInventar dataset shows that the municipality has faced different hazard in the past. Among them, major five hazard on the basis of frequency of occurrence Landslide, were Fire, Flood. Epidemic and Landslide. Although earthquake was not among the five major hazards on the basis of occurrence, it had significant impact on buildings. Though one-time event, Earthquake destroyed almost 93% of buildings out of 5,266 total destroyed buildings and caused 11% of the total injuries. Similarly, epidemic ranked as fourth major hazard and caused 31% of deaths out of 159 and 47% of injuries out of 237.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 53,937 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) framed buildings. A study conducted in 2016 under BCIPN program

of NSET evidenced that 98% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the municipality are as follows:

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S.N.	Description	2012	2014	2016
1	Population	45,508	49,544	53,937
2	Area (Sq. km)			248
3	Number of existing buildings	9,086	9,892	10,770
4	Number of new building construction per year with permit	350	350	351
5	Number of building constructed per year without permit	10	10	25
6	Number of Trained Masons		120	170
7	Numbers of Engineers Trained (Consultant/Contractor)			26
8	Technical manpower with Municipal Office	5	5	4
9	Total Manpower in Municipal Office	90		

ii. Milestone of Building Code Implementation (BCI)

In Vyas Municipality, mandatory implementation of Building Code was declared in 2011 A.D. Same year, the requirements of structural drawing were made mandatory. The detail structural drawings provide a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. In 2013 A.D., budget to organize activities for Building Code implementation was allocated by the municipality and the first Mason Training on earthquake safe building construction technique was conducted. The municipality then started a system of certification of trained masons/contractors and formation of the groups of trained masons following the same year.

In 2014, Vyas Municipality started providing orientation to house owner during Building Permit Process. Similarly, municipality also prepared a roster of trained mason and consultant's engineers.

By the year 2016, field supervision through consultants was initiated to ensure the Building Code Implementation. Building Code Compliance checklist was introduced in the same year. In 2017, the process of reporting with photographs of different stages of construction for the field supervision was introduced.

	Milestones				
Year	Institutional Canacity	Capacity E	Capacity Enhancement		
	institutional Capacity	Masons	Engineers	Beneficiaries	
2011	Declare Building Code Implementation Requirements of structural drawings				
2013	First Batch of trained masons Allocation of budget for BCI Formation of mason groups Certification system for trained masons				
2014	Listing of consultants Listing of trained masons Orientation for house owner during Building Permit Process				
2016	Implementation of building code compliance checklist Field supervision through consultant with photographs	50	26	471	
2017	Reporting of construction completion with photographs				

Municipal Milestones on Building Code Implementation

(Source: Municipality Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Vyas Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Vyas Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection. The status of building code implementation in the Vyas Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Vyas municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	Yes	Yes	Yes
3	Need Structural Drawing for All Building Class	Yes	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	Yes	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	Yes	Yes	Yes



B					1																													
Municipality revenue/	2012	2014	014 2016	Technical Capacities	2012	2014	2016																											
Budget	_			Building Constructed per Year with Permit	350	350	351																											
Revenue from Building Permits (in thousands)	3000	3000	3660	Building Constructed per Year without Permit	10	10	25																											
Budget allocation for BCI	3CI nd 150			Engineer within Municipal Office	2	2	1																											
for Awareness,				Sub Engineer within Municipal Office	3	3	3																											
Orientation, Training and Workshop (In		150 150	150	150	150 500	150	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	0 500	Numbers of Mason Trained		120
Thousands)				Numbers of Engineer Trained (Consultant/Contractor)			26																											
				Numbers of House Owner Oriented																														

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	2	2.5	2
2014	4	2.5	2
2016	4	1	4

Fig 1: Average score for BCI status in Vyas Municipality in the year 2012, 2014 and 2016

The figure shows that there has been significant improvement in the Institutional System and Budget Allocation towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Technical Capacities of the municipality seems inadequate.

4. Institutional System on Building Permit Process of Vyas Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 2 in 2012 to 4 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Vyas Municipality have succeeded to introduce almost all the components system by the year 2016 except establishment of Advisory Committee, and provision for strengthening of existing buildings or retrofitting.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 2.5 in the year 2012, 2.5 in 2014 and 1 in 2016 out of 5, shows that the high demand of technical manpower is not yet fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Vyas Municipality, around 400 buildings are constructed per year under the supervision 1 engineer and 3 sub-engineers as shown in the figure below:



6. Municipality Revenue/Budget Score

From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code. The score of the revenue/budget has increased from 2 in the year 2012 to 4 in the year 2014 and remained constant in 2016.

7. Conclusions

- There has been significant improvement in Institutional System and Budget Allocation for implementing building code over the years. The technical capacity, on the other hand, needs to be enhanced.
- In Vyas Municipality around 400 buildings are constructed per year and are looked after by 1 engineer and 3 sub-engineers.
- Vyas municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation WESTERN REGION

Amargadhi Municipality

1. Location and Demography

Amargadhi Municipality is located in Dadeldhura District which lies in the then Far-Western Development Region of Nepal and as per the current federal structure it lies in Province no. 7.

Amargadhi was established as municipality in 2053 B.S. (1996 A.D). Amargadhi Municipality occupies land area of 139.33 sq. km. and is surrounded by Ganeshpur, Ashriram VDC in East, Bagarkot, Ajaymeru VDC in West, Samaiji, Koteli VDC in North and Gankhet VDC in South.



i. Population Distribution

The 2011 census counted 22,241 inhabitants with 1.9% annual growth rate and population density 160 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 24,436 inhabitants with 5,249 households. Nepali is spoken as the national language.

ii. Population Demography

The mother tongue for the majority of residents in Amargadhi is Doteli. The main inhabitants of the municipality are Chhetris followed by Hill Brahmins, Dalits and Terai Brahmins.

(District and VDC profile, 2010)

iii. Main Economy

Of the total population of Amargadhi Municipality, 41.8% of population are usually active population-aged 10 and above of which 57.1% are involved in skilled agriculture, forestry and fishery work, 8.4% in service and sales works, 8.7% on the elementary works and the remaining population in other occupations.

(CBS, 2011)

iv. Services and Facilities

There are 21 government and 2 private schools of primary education in the municipality. Among them, 2 government and 1 private school are as secondary education system; 3 government and 1 private as Madhyamik bidhyalaya and 2 general and 1 private higher secondary school along with 1 general campus and 6 computer institutes. People in the municipality have access to the education and the overall literacy rate of municipality is 70.23% with male literacy rate 84.9% and female literacy rate 57.42%. It was found that only 7.35% of households are using telephone whereas 67.35% of households are using mobile phones. Similarly, 82.61% households have access to electricity in the municipality and 78.63% of households are using tap/pipe water. There is one government hospital with 15 bed, one community hospital with 43 bed, one "herbo" hospital and 4 sub-hospitals. Black topped road has a stretch of 41 km and gravel road of 3.5 km in the municipality area.

(CBS, 2011 & Municipality website)

2. Hazard and Risk

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Amargadhi Municipality. The DesInventar database shows that the municipality has faced different hazards in the past. Among them major three hazards on the basis of occurrence are Fire, Epidemic and Flood. Similarly, cold wave, drought, forest fire and thunderstorm have all occurred once in Amargadhi Municipality during the study period. Fire ranked as first major hazards in terms of occurrence which damaged 73% of buildings out of 26 and remaining 27% of buildings were damaged due to flood which was second major hazard. Epidemic was responsible for causing all reported 50 injuries. Similarly, one death was reported due to thunderstorm in the municipality.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Amargadhi Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 4,038 buildings as per the projected figure for

2016 A.D. Nowadays, most of the newly constructed buildings are in Reinforced Cement

Concrete (RCC) frame. A study conducted in 2016 under BCIPN program of NSET evidenced that 85% of the RCC buildings comply with Nepal National Building Code. Building

information and human resources for building construction in the municipality area are as follows:

S. N	Description	2012	2014	2016
	Population	22664	23533	24436
	Area (Sq. Km)			139.33
	Existing buildings	3745	3889	4038
	New building construction per year with permit	50	50	50
	Building constructed per year without permit	40	40	20
	No. of Trained Masons		60	126
	Numbers of Engineer Trained (Consultant/Contractor)			
	Technical manpower with Municipal Office	1	1	2
	Total Manpower in Municipal Office			23

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones on Building Code Implementation

In Amargadhi Municipality, the mandatory implementation of Building Code was declared in 2014 A.D. along with the allocation of budget to conduct activities supporting Building Code Implementation. Same year, the municipality prepared a list of trained masons to understand their potential for Building Code Implementation. In 2015, with the purpose of strengthening the capacity of municipality towards Building Code implementation, technical manpower in the municipality was increased. Similarly, revised building permit form was brought into implementation and a roster of consultant engineers was prepared in the same year.

	Milestones					
Year	Institutional Consolity	Capacity E	Enhancement	Awareness		
		Masons	Engineers	Beneficiaries		
2014	Declare Building Code Implementation Allocation of budget for BCI Listing of trained Masons	60		66		
2015	Listing of consultants	26		48		
2016	Capacity Enhancement of Masons	40				
2017	Initial work for certification of masons			52		

Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Amargadhi Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Amargadhi

Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Amargadhi Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Amargadhi Municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	No	No
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	0
2014	0.75	3	2
2016	0.75	3.75	2

Fig 1: Average score for BCI status in Amargadhi Municipality in the year 2012, 2014 and 2016.

The figure shows that there has been some improvements in technical capacity of Amargadhi Municipality towards implementing building code over the years while not much improvements in the institutional system and budget allocation.

4. Institutional System on Building Permit Process of Amargadhi Municipality

The institutional system on building permit has seen not much improvement during the 4 years period from 2012 to 2016. The score has just increased from 0 in 2012 to 0.75 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Amargadhi Municipality have succeeded to introduce only the system of maintenance of roster of trained masons since 2014.

5. Technical Capacities

This component measures the availability of technical capacities for building construction within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012, 3 in 2014 and 3.75 in 2016 out of 5, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Amargadhi municipality, there are around 70 buildings constructed per year under the supervision of 2 engineers, as shown in the figure below:





6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey,

Engineer and Sub-Engineer in Amargadhi 2 1.8 1.6 1.4 1.2 1 0.8 0.6 0.4 0.2 0 2012 2014 2016 Engineer within Municipal Office Sub Engineer within Municipal Office



it is observed that the municipality has started allocating some budget for the implementation of building code since 2014. The score has increased from 0 in 2012 to 2 in 2014 and 2016.

7. Conclusion

- There have been some improvements in technical capacity of municipality towards implementing building code over the years than the other two components- Institutional System and Budget Allocation.
- More than 70 buildings are constructed per year and are looked after by 2 engineers.
- Amargadhi municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation WESTERN REGION

Bhimdatta Municipality

1. Location and Demography

Bhimdatta Municipality is located in Kanchanpur District which lies in the then Far Western Region of Nepal and as per the current federal structure it lies in Province No. 7.

Bhimdatta Municipality was established as a municipality in 1977 A.D (2034 B.S). Municipality occupies land area of 171.80 sq. km. It has a sub-tropical climate with maximum and minimum temperature ranging around 43°C to 6.96°C, during the summer and winter respectively. The city was originally established by late Shri Ghadsi Ram Sarawagi, who hailed from Birgunj in Parsa District and named it Mahendranagar in the honor of late king Mahendra of Nepal. After the establishment of federal democratic republic in the country in 2008, the city's name was changed to Bhimdatta.



i. Population Density

The 2011 census counted 1,06,666 inhabitants with 2.77% annual growth rate, and population density 622.90 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1,22,281 inhabitants with 23,712 households. Nepali is spoken as the national language.

ii. Population Demography

The main inhabitants of the municipality are Chhetris followed by Hill Brahmins, Thakuris, Tharus, Dalits, and so on.

iii. Main Economy

Of the total population of Bhimdatta 34.3% Municipality, are Usually Active Population-aged 10 and above of which 59.3% are involved in skilled agriculture, forestry and fishery works, 9.1% in service and sales works, 7.7% on the crafts and elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

People in Bhimdatta municipality have access to education. The literacy rate of Bhimdatta municipality is 77.34% with male literacy rate 87.62% and female literacy rate 67.69%. It is found that 85.75% of households have access to electricity, 21.91% of households use tap/piped water and 67.89% households use mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Bhimdatta Municipality. The DesInventar datasets show that the municipality has faced different hazards in the past. Among them major five hazards on the basis of occurrence are Flood, Fire, Epidemic, Accident and Thunderstorm. Flood ranked as first major hazard in terms of occurrence and damaged 54% building out of 322 total destroyed buildings. Epidemic, though ranked as third major hazard in terms of frequency of occurrence, caused 72% of injuries out of 49 and 56% of death out of 112.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Bhimdatta municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 18,240 building as of year 2016. Nowadays, most of new buildings are constructed on Reinforced Cement Concrete (RCC) frame. A

study conducted in 2016 under BCIPN program of NSET evidenced that 83% of RCC buildings comply with Nepal National Building Code. The city is developing rapidly and attracting new residents and industries due to relocation of midhill migrants. It is also a canter for business for adjacent districts. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
	Population	1,09,621	1,15,778	1,22,281
	Area (Sq. Km)			171.80
	Existing buildings	16,351	17,270	18,240
	New building construction per year with permit	250	400	800
	Buildings constructed per year without permit	250	250	150
	No. of Trained Masons	28	100	180
	Numbers of Engineer Trained (Consultant/Contractor)			30
	Technical manpower with Municipal Office	4	4	4
	Total Manpower in Municipal Office			101

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones on Building Code Implementation

In Bhimdatta Municipality, mandatory implementation of Building Code was declared in 2014 A.D. with the allocation of budget to conduct activities supporting Building Code Implementation. Municipality prepared a roster of consultant engineers in 2015 A.D. From 2016, supervision through consultants field was Building initiated to ensure the Code Implementation. Similarly, the process of reporting with photographs of different stages of construction for the field supervision was introduced. Same year, municipality started providing orientation to house owners during the Building Permit process. With the purpose of strengthening the capacity of municipality towards Building Code implementation, engineers of the municipality were provided capacity enhancement training in 2016 A.D. The Municipality also formed groups of trained masons and prepared the roster of trained mason in the same year. Later, in 2017 A.D., building compliance checklist was introduced in the municipality.

Milestones							
Voor	Institutional Conscitu	Capacity Er	hancement	Awareness			
rear	Institutional Capacity	Masons	Engineers	Beneficiaries			
2014	Declare Building Code Implementation Allocation of budget for BCI	131		122			
2015	Listing of Consultants	67		48			
2016	Formation of Masons group Field supervision through municipal staffs Requirement of structural drawings Listing of trained masons Capacity enhancement of technical manpower of municipality	105	30				
2017	Implementation of Building Code Complaince checklist Capacity enhancement of technical manpower of municipalities and consultants		24	70			

Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN, 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Bhimdatta Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the BCIPN municipalities. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with municipal professionals and exploratory visit to municipalities etc. were used for the data collection. The status of building code implementation in the Bhimdatta Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Bhimdatta Municipality.

2016

800

150

2

2

180

30

139

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.75	0
2014	0.75	1.25	2
2016	4	3.75	3

Figure 1: Average score for BCI status in Bhimdatta Municipality in the year 2012, 2014 and 2016 The figure shows that there has been significant improvement in institutional system towards implementing building code over the years. Of the three major components of Building Code Implementation-Institutional Mechanism, Technical Capacities and Budget Allocation for BCI, Institutional Mechanism seems to change better than the other two components.

4. Institutional System on Building Permit Process of Bhimdatta Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check (building configuration, building strength, building ductility), provision of field inspection for structural details and system of registration of masons and roster of trained masons have been introduced in Bhimdatta Municipality.





Among the aforementioned components of institutional system, Bhimdatta Municipality have succeeded to introduce almost all the components except provision of advisory committee and strengthening of existing buildings/retrofitting (while addition of storey or in any case).

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.75 in the year 2012, 1.25 in 2014 and 3.75 in 2016 out of 5, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Bhimdatta municipality, at present, around 900 buildings are constructed per year under the supervision of 2 engineers and 2 sub-engineers as shown in the figure below:



Fig 3: No. of Engineers and Sub-Engineer within Bhimdatta Municipal Office

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating budget for the implementation of building code since year 2014.

7. Conclusions

• There has been significant improvement in Institutional System towards implementing

Building Code over the years than the other two components-Technical Capacities and Budget Allocation.

- In Bhimdatta Municipality around 900 buildings are constructed per year and are looked after by 2 engineers and 2 sub engineers.
- Bhimdatta municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation WESTERN REGION

Birendranagar Municipality

1. Location and Demography

Birendranagar Municipality is located in Surkhet district which lies in the then Mid-Western Development Region of Nepal and as per the current federal structure it lies in Province No. 6.

Birendranagar Municipality was established as a municipality in 1976 A.D. (2033 B.S.). It occupies land area of 245.06 sq. km. It is 665 meters high from sea level. It has moderate climate with maximum and minimum temperature ranging around 33° C to 10° C respectively.



i. Population Distribution

The 2011 census counted 52,137 inhabitants with 5.08% annual growth rate and population density 1,492 person per sq. km. Based on the annual growth rate of 2011 census, the population projection of 2016 was counted 66,795 inhabitants with 15,411 households. This population is of the then Birendranagar municipality before the change in new federal system.

ii. Population Demography

The mother tongue for the majority of residents is Nepali and others are Maithili and Rajbansi. The main inhabitants of the municipality consist of groups like Brahmin-Hill, Chettri, Magar, Sonar, Thakuri, Kami and Dholi.

iii. Main Economy

Of the total population of Birendranagar Municipality, 33.7% is usually Active Population Aged 10 and above of which 23.5% are involved in skilled agriculture, forestry and fishery works, 23.4% service and sales works, 13.9% on the crafts and elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of city. Majority of people have access to education and the overall literacy rate is 82.53% with male literacy 90.05% and female literacy rate 75.47%. It was found that 93.07% of households have access to electricity, 85.28% of households use tap/piped water and 83.12% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Birendranagar Municipality. The DesInventar dataset shows that the municipality has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence were Fire, Flood, Epidemic, Landslide and Accident. Fire destroyed 4% buildings out of 1,167 total destroyed buildings. Flood, ranked as second major hazard, destroyed 94% of the total destroyed buildings. Epidemic is ranked as third major hazard which caused 55% of death out of 112. Although strong wind is not among the five major hazard it had a serious impact causing 34% of injuries out of 32.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events) earthquake is one of the major hazards faced by all the municipalities of Nepal and Birendranagar Municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

v. Existing Buildings Scenario

The municipality consists of approximately 9,632 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of

NSET evidenced that 86% of the RCC buildings comply with National Building Code (NBC). Building information and human resources for building construction in the metropolitan city area are as follows:

S.N.	Description	2012	2014	2016
	Population	54,786	60,493	66,795
	Area (Sq. Km)			245.06
	Number of existing buildings	7,900	8,723	9,632
	Number of new building constructed per year with permit	600	750	800
	Number of buildings constructed per year without permit	230	300	300
	No. of Trained Masons	32	56	210
	Numbers of Engineer Trained (Consultant/Contractor)		27	258
	Technical manpower with Municipal Office	3	4	5
	Total Manpower in Municipal Office			150

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

vi. Milestones on Building Code Implementation (BCI)

In Birendranagar Municipality, mandatory implementation of Building Code was declared with the allocation of budget in 2014 A.D. In the year 2015 A.D, field supervision through consultants was initiated and roster of consultant engineers were prepared to ensure effective implementation of the Building Code. Later in 2016 A.D, with the purpose of strengthening the capacity of municipality for effective implementation of Building Code technical manpower in the municipality was increased. Similarly, old houses which were built without permit were listed in the municipality.

In the year 2017, requirement of structural analysis for "B" class building was made compulsory in the municipality.

	Milestones									
Year	Institutional Consoity	Capacity Er	Awareness							
	institutional Capacity	Masons	Engineers	Beneficiaries						
2014	Declare Building Code Implementation Budget allocation for BCI	27		57						
2015	Field supervision through consultants Listing of consultants	58		40						
2016	Increase technical manpower in municipality Old houses which are made without consideration of Building Permit Process were listed on municipality data during that period.	140	24	411						
2017	Structural analysis for B class building was made compulsory.	32		105						

Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

vii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Birendranagar Municipality to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Birendranagar Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Birendranagar Municipality was assessed in terms of three major components described in (of the report): Institutional Section 3 Mechanisms, Technical Capacity, and Budget Under each component, Allocation. key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then

towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Birendranagar municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	5000	7000	10000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	0	200	300

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	600	750	800
Building Constructed per Year without Permit	230	300	300
Engineer within Municipal Office	1	2	3
Sub Engineer within Municipal Office	2	2	2
Numbers of Mason Trained		27	258
Numbers of Engineer Trained (Consultant/Contractor)			24
Numbers of House Owner Oriented		60	600

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.5	0
2014	1.5	1	1
2016	4	2	2

Fig 1: Average score for BCI status in Birendranagar Municipality in the year 2012, 2014 and 2016.

The figure shows that there has been improvements in institutional system towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanism. Technical Capacities and Budget Allocation for BCI, Institutional Mechanism seems to change better than the other two components.

Institutional System on Building 4. Permit Process of Birendranagar **Municipality**

The institutional system on building permit process has seen improvements in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). Among the key factors contributing to the component of institutional systems, Birendranagar Municipality have succeeded to introduce the need of structural drawing for all building class, use of detail checklist and provision of field inspection for building code compliance check and system of maintenance of roster of trained masons in the year 2016.

5. **Technical Capacities**

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.5 in the year 2012 to 1 in 2014 and 2 in 2016 out of 5, shows that the demand is high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Birendranagar Municipality, at 1000 present. more than buildings are constructed per year under the supervision of 3 engineers and 2 sub-engineers as shown in the figure below:



This component assesses the budget allocated by municipality building the for code implementation as a proportion of revenue collected from building permit. From the survey, allocating budget for the implementation of building code since year 2014.

The score increased from 0 in 2012 to 1 in 2014 to 2 in 2016.

7. Conclusions

- There have been improvements in the Institutional System towards implementing building code over the years than the other two components-Technical Capacities and Budget Allocation.
- In Birendranagar Municipality more than 1000 buildings are constructed per year and are looked after by 3 engineers and 2 sub engineers.
- Birendranagar municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation WESTERN REGION

Dhangadhi Sub-Metropolitan City

1. Location and Demography

Dhangadi Sub-Metropolitan City is located in Kailali District which lies in the then Far-Western Development Region of Nepal and as per the current federal structure it lies in Province No. 7.



Dhangadi was established as a municipality in 1976 A.D. (2033 B.S). By September 2015 (2072, Ashwin), Dhangadi was declared as Sub-Metropolitan City. It occupies land area of 261.75 sq. km. and located at 170 meters above sea level. It has a sub-tropical climate, maximum and minimum temperatures ranging around 38°C to 7°C respectively.

i. Population Distribution

The 2011 census counted 1,04,047 inhabitants with 4.34% annual growth rate and population density 1,003 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 1,28,672 inhabitants with 26,007 Households. This population is of the then Dhangadi municipality before it was merged to form Sub-Metropolitan City.

ii. Population Demography

The mother tongue for the majority of residents is Nepali. The main inhabitants of the municipality are Tharus followed by Chhetris, Hill Brahmins, Unidentified Dalits, Thakuri's etc.

iii. Main Economy

Of the total population of Dhangadhi Sub-Metropolitan City, 31.6% of population are usually active population Aged 10 and above of which 33.8% are involved in skilled agriculture, forestry and fishery works, 18.2% in service and sales works, 12.8% on craft and related works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most parts of the city. Majority of people are access to education and the literacy rate of Dhangadhi Sub-Metropolitan City is 78.86% with male literacy rate 87.11% and female literacy rate 70.52%. It was found that 90.1% of households have access to electricity, 6.36% of households use tap/piped water and 21.56% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Dhangadhi Sub-Metropolitan City. The Desinventar dataset show that the submetropolitan city has faced different hazard in the past. Among them five major hazards on the basis of frequency of occurrence were Epidemic, Flood, Fire, Thunderstorm and Accident. Epidemic is ranked as first major hazards in terms of occurrence which caused 87% of injuries out of 94 and 69% of death out of 158 total deaths. Similarly, flood is ranked as second major hazard which destroyed 72% buildings out of 407 total destroyed buildings.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Dhangadhi Sub-Metropolitan City is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The sub-metropolitan city consists of approximately 16,254 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete framed (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 75% of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the sub-metropolitan city are as follows:

S.N.	Description	2012	2014	2016
1	Population	1,08,563	1,18,190	1,28,672
2	Area (Sq. km)			261.75
3	Number of existing buildings	13,714	14,930	16,254
4	Number of new building constructed per year with permit	1,000	1,000	1,000
5	Number of buildings constructed per year without permit	100	100	100
6	Number of Trained Masons		64	353
7	Numbers of Engineer Trained (Consultant/Contractor)		27	27
8	Technical manpower with Municipal Office	1	1	1
9	Total Manpower in Municipal Office	160		

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones on Building Code Implementation (BCI)

In Dhangadhi Sub-Metropolitan City, mandatory implementation of Building Code was declared in 2013 A.D. while some amount of budget was already allocated in 2012 to support the efforts for BCI. The municipality conducted first Mason Training on Earthquake Resistance Building Construction in 2013 A.D.

To ensure the implementation of the Building Code, separate BCI Cell was formed in the municipality in the year 2014 A.D. By the year 2015, roster of consultant engineers was prepared, and mason groups were formed. Similarly, the requirements of structural drawing were made mandatory in the same year. The detail structural drawings provides a clear picture of detailing of reinforcement bars such as size of bars, lapping, spacing, anchorage etc. which are helpful during the actual construction. Dhangadhi Sub-Metropolitan City started preparing roster of trained masons along with the system of reward and punishment on the basis of their performance appraisal since 2016. Same year, building code compliance checklist was also brought into implementation.

Recently in 2017 A.D, revised building permit form (consisting of municipality copy and house owner copy) was brought into implementation and a system of certification of trained masons/contractors was established. Similarly, the process of reporting with photographs of different stages of construction with field supervision through consultants was also initiated ensure the Building Code to Implementation. Furthermore, technical manpower was increased with the purpose of strengthening the capacity of the Sub-Metropolitan city.

Year	Institutional Capacity	Capacity E	Inhancement	Awareness Beneficiaries
		Masons	Engineers	
2013	Declare Building Code Implementation First Batch of trained masons	32	47	117
2014	Formation of BCI cell	64	28	379
2015	Formation of mason groups Listing of consultants Requirements of structural drawings	96		
2016	Listing of trained masons Implementation of building code compliance checklist Reward and punishment methods for masons	124		102
2017	Implementation of revised building permit form (municipality copy and house owner copy) Certification of system for trained masons Reporting of construction completion with photographs Increase technical manpower of municipality Field Supervision by municipal engineer on three different stages of construction	69		40

Municipal Milestones on BCI: Dhangadhi Sub-Metropolitan City

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Dhangadhi Sub-Metropolitan City to measure the level of capacity of the municipalitiy for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Dhangadhi Sub-Metropolitan City. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Dhangadhi Sub-Metropolitan City was

assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Dhangadhi Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	Yes	Yes
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016 Technical Capacities		2012	2014	2016	
Revenue from Building					Building Constructed per Year with Permit	1000	1000	1000
Permits (in thousands)	8000	9000	10000		Building Constructed per Year without Permit	100	100	100
Budget allocation for BCI for					Engineer within Municipal Office	3	3	3
Awareness, Orientation,	200	300	500		Sub Engineer within Municipal Office	1	1	1
Thousands)					Numbers of Mason Trained		64	353
,				-	Numbers of Engineer Trained (Consultant/Contractor)		27	27
					Numbers of House Owner Oriented		150	500

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.5	1
2014	3	1.25	2
2016	4	2.25	3

Fig: Average score for BCI status in Dhangadhi Sub-Metropolitan City in the year 2012, 2014 and 2016.

The figure shows that there has been improvements in institutional system towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanisms, Technical Capacities and Budget Allocation for BCI, Institutional System seems to change better than the other two components.

4. Institutional System on Building Permit Process of Dhangadhi Sub-Metropolitan City

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). Among the key factors contributing to the component of institutional system, Dhangadhi Sub-Metropolitan City have succeeded to introduce the system of Separate EQ Safety Unit, need of structural drawing for all building class, use of detail checklist for building code compliance check and system of certification of masons and roster of trained masons since 2014. Also, the provision of field inspection for structural details during foundation, plinth level and storey structure started since 2016.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.5 in the year 2012 to 1.25 in 2014 and 2.25 in 2016 out of 5, shows that the high demand is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Dhangadhi Sub-Metropolitan City, at present, approximately more than 1000 buildings are constructed per year under the supervision of 3 engineers and 1 sub-engineer as shown in the figure below:







Fig 3: No. of Engineers and Sub-Engineer within Dhangadhi Sub-Metropolitan Office

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has been allocating some budget for the implementation of building code since 2012.

7. Conclusions

• There have been improvements in Institutional System towards implementing

Building Code over the years than the other two components-Technical Capacities and Budget Allocation.

- In Dhangadhi Sub-Metropolitan City more than 1000 buildings are constructed per year and are looked after by 3 engineers and 1 sub-engineer.
- Dhangadhi Sub-Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

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Status of Building Code Implementation WESTERN REGION

Ghorahi Sub-Metropolitan City

1. Location and Demography

Ghorahi Sub-Metropolitan City is located in Dang district which lies in the then Mid-Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5.

Ghorahi was established as a municipality in 1978 A.D. (2035 B.S.) It occupies land area of 522.21 sq. km. and ranges between 213m to 2,058m above sea level. The maximum and minimum temperatures range approximately between 38.5°C to 2.5°C respectively.



i. Population Distribution

The 2011 census counted 65,107 inhabitants with 4.12% annual growth rate and population density 874.51 persons per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 79,671 inhabitants with 18,949 households. This population is of the then Ghorahi municipality before it was merged to form Sub-Metropolitan City.

ii. Population Demography

The mother tongue for the majority of residents is Tharu. The main inhabitants of the municipality are Tharu, and other ethnic groups are Chhetri, Brahmin, Magar, Kami, Newar and Sanyasi.

iii. Main economy

Of the total population of Ghorahi Sub-Metropolitan City, 32% are usually active population aged 10 and above of which 31.7% are involved in agriculture, 18.8% in forestry and fishery works, 11.6% in service and sales works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most parts of the city. Majority of people have access to education and the overall literacy rate is 81.25% with male literacy rate 88.43% and female literacy rate 74.75%. It was found that 87.06% of households have access to electricity, 61.26% use tap/piped water and 82.50% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D. was analyzed to have basic idea of the disaster occurrence and impact in Ghorahi Sub-Metropolitan City. The DesInventar datasets show that the submetropolitan city has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Epidemic, Fire, Flood, Thunderstorm and Accident. Epidemic is ranked as first major hazard which caused 80% injuries out of 597 and 70% of death out of 399. Fire ranked as second major hazard and damaged 72% building out of 732.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events) earthquake is one of the major hazards faced by all the municipalities of Nepal and Ghorahi Sub-Metropolitan City is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 16,000 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC) frame. A study conducted in 2016 under BCIPN program of

NSET evidenced that 97 % of the RCC buildings comply with Nepal National Building Code. Building information and human resources for building construction in the metropolitan city area are as follows:

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S.N	Description	2012	2014	2016
1	Population	67,789	73,490	79,671
2	Area (Sq. Km)			522.21
3	Number of existing buildings	12,402	13,445	14,576
4	Number of new building constructed per year with permit	400	600	600
5	Number of buildings constructed per year without permit	30	50	100
6	No. of Trained Masons		132	296
7	Numbers of Engineers Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	3	3	3
9	Total Manpower in Municipal Office			140

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

In Ghorahi Sub-Metropolitan City, mandatory implementation of Building Code was declared in 2012 A.D. along with the allocation of some budget to support activities for BCI. The city conducted first Mason Training on Earthquake Resistance Building Construction and also prepared a roster of consultant engineers in 2013 A. D. The city formed the groups of trained masons, established a system of providing license/identity cards trained to masons/contractors along with reward and punishment system for performance appraisal in 2014 A.D.

From 2015, field supervision through consultants was initiated to ensure effective implementation of building code. Similarly, the process of reporting of construction with photographs of different stages was introduced for the field supervision. Same year, municipality started providing orientation to house owner during the Building Permit process.

Since 2016, buildings not complying with National Building Code were not allowed for the addition of storey.

	Milestones			
Year	Institutional Capacity	Capacity Enhancement		Awareness
		Masons	Engineers	Beneficiaries
2012	Declare Building Code Implementation Budget Allocation for BCI			
2013	Listing of Consultants First Mason Training was conducted.	37		80
2014	Certification/Listing of trained Masons/ contractors Formation of Mason Groups Reward and Punishment system	92		136
2015	Field supervision through consultants Reporting of field supervision with Photographs of different stages Orientation for house owner during Building Permit Process	31		305
2016	Not permitted for story addition for those building that are not constructed under National Building Code.	113		
2017	Addition of technical manpower along with increase of sub- metropolitan area coverage.	35		

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Ghorahi Sub-Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipality etc. were used for the data collection.

The status of building code implementation in the Ghorahi Sub-Metropolitan City was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each components, kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation in the municipality. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Ghorahi Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	No
3	Need Structural Drawing for All Building Class	No	Yes	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	Yes	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	Yes	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014	2016
Revenue from Building Permits (in thousands)	4000	6000	8000
Budget allocation for BCI for Awareness, Orientation, Training and Workshop (In Thousands)	200	300	400

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	400	600	600
Building Constructed per Year without Permit	30	50	100
Engineer within Municipal Office	1	1	1
Sub Engineer within Municipal Office	2	2	2
Numbers of Mason Trained		132	296
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented		75	200

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.5	2
2014	3.25	1.25	2
2016	3.25	2	3

Fig 1: Average scores for BCI status in Ghorahi Sub-Metropolitan City in the year 2012, 2014 and 2016.

The figure shows that there has been improvements in institutional system towards implementing Building Code over the years. Of the three major components of Building Code Implementation - Institutional System, Technical Capacities and Budget Allocation for BCI, Institutional System seems better than the other two components.

4. Institutional System on Building Permit Process of Ghorahi Sub-Metropolitan City

The institutional system on building permit process has seen much improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 3.25 in 2016 (out of 5). Among the key factors contributing to the component of institutional system, Ghorahi Sub-Metropolitan City was successful to introduce since the year 2014, the system of need of structural drawing for all building class, system of registration of masons and maintaining roster of trained masons and the provision of field inspection.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house - owners) are assessed. The proportion of human resources trained/oriented with respect to numbers of new building constructed per year is measured and the scores are assigned accordingly.

The scores 0.5 in the year 2012, 1.25 in 2014 and 2 in 2016 out of 5 score, shows that the demand is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Ghorahi Sub-Metropolitan City, there are around 700 buildings constructed per year under the supervision of 1 engineer and 2 sub-engineers as shown in the figure below:



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has been allocating some budget for the implementation of building code since 2012 A.D.

7. Conclusions

• There have been improvements in Institutional System towards implementing

Building Code over the years than the other two components - Technical Capacities and Budget Allocation.

- In Ghorahi Sub-Metropolitan City more than 700 buildings are constructed per year and are looked after by 1 engineer and 2 sub engineers.
- Ghorahi Sub-Metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation WESTERN REGION

Gulariya Municipality

1. Location and Demography

Gulariya Municipality is located in Bardiya district which lies in the then Mid-Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5.

Gulariya was established as a municipality in 1996 A.D (2053 B.S.). Gulariya Municipality is surrounded by the Babai River in the east, Taratal and Sanoshree VDCs in the west, Babai River in the north and India in the south. It lies between $28^{0}07'54''$ to $28^{0}10'22''$ north latitude and $81^{0}16'48''$ to $81^{0}22'54''$ east longitude. It has maximum and minimum temperature ranging between 42^{0} C to 7.7^{0} C during the summer and winter respectively. It is 145 meters high from sea level.



⁽Municipality Profile of Nepal, 2008)

i. **Population Distribution**

The 2011 census counted 57,232 inhabitants with 2.18% annual growth rate and population density of 602 person per sq.km. Based on the annual growth rate of 2011 census, the population projection of 2016 was counted 63,748 inhabitants with 12,497 households. This population is of the then Gulariya municipality before the change in new federal system.

ii. Population Demography

The mother tongue for the majority of residents is Awadhi and others are Nepali, Tharu and Hindi. The main inhabitants in the municipality consist of groups like Tharu, Chettri, Brahmin-Hill, Yadav, Chidimar, Muslim, Brahman-Terai and Lodha.

iii. Main Economy

Of the total population of Gulariya Municipality, 35.3% is usually Active Population Aged 10 and above of which 54.2% are involved in skilled agriculture, forestry and fishery works, 8.2% on the crafts and elementary works, 16.1% elementary works and the remaining in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 59.96% with male literacy rate 66.92% and female literacy rate as 52.99%. It was found that 58.94% of households have access to electricity, 20.27% use tap/piped water and 55.77% of the households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazards and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May, 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Gulariya municipality. The DesInventar datasets show that the municipality has faced different hazard in the past. Among them major five hazard on the basis of frequency of occurrence were Fire, Accident, Epidemic, Flood and Cold Wave. Fire ranked as first major hazards in terms of occurrence which damaged 92% building out of 490 total destroyed buildings. Similarly, epidemic is ranked as third major hazard which caused 93% injuries out of 275. Flood ranked as fourth major hazard in terms of occurrence and caused 38% of death out of 65 total death. Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Gulariya municipality is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.
3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The municipality consists of approximately 9,613 buildings as of 2016. Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete (RCC). A study conducted in 2016 under BCIPN program of NSET evidenced

that 27% of the RCC buildings comply with Nepal National Building Code (NBC). Building information and human resources for building construction in the municipality are as follows:

S.N	Description	2012	2014	2016
1	Population	58,480	61,057	63,748
2	Area (Sq. Km)			118.21
3	Number of existing buildings	8,819	9,208	9,613
4	Number of new building constructed per year with permit	70	70	100
5	Number of buildings constructed per year without permit	35	35	30
6	No. of trained Masons		97	194
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	3	3	4
9	Total Manpower in Municipal Office			32

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

ii. Milestones of Building Code Implementation (BCI)

Mandatory implementation of Building Code was declared in 2013 A.D. in Gulariya Municipality while budget for conducting activities support Building Code to Implementation was allocated earlier in 2012 A.D. In 2015 A.D., with the purpose of strengthening the capacity of municipality towards Building Code Implementation, technical manpower in the municipality was increased. Municipality also started a system of

providing license to trained masons/contractor, the same year. By the year 2016 A.D., field supervision through consultants was initiated to ensure the Building Code implementation. The process of reporting with photographs of different stages of construction for the field supervision was introduced in the same year. Since 2017 A.D., the municipality started using the revised building permit form.

	Milestones								
Year	Institutional Consolty	Capacity E	Awareness						
	Institutional Capacity	Masons	Engineers	Beneficiaries					
2013	Declare of Building code implementation. Listing of consultants	30		72					
2014		67		60					
2015	Increase technical manpower in municipality Licensing of trained masons	37							
2016	Field supervision through consultants Reporting of filed supervision with photographs of different stages.	60		471					
2017	Implementation of revised building permit form			52					

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Gulariya Municipality to measure the level of capacity of the municipality

for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Gulariya Municipality. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Gulariya Municipality was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component. kev indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in in Gulariya municipality.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	No	No	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue	/	2012 2014	2012 2014	2012 2014	2012 2014	2012 2014	2014	2016	Technical
Budget					Building C				
Revenue from Buildi Permits (in thousand	ng ls)	700	800	900	Building C				
Budget allocation for	BCI				Engineer v				
for Awareness, Orier	rientation,	50	50 50 50	50	50	Sub Engin			
Training and Worksh Thousands)	iop (In				Numbers of				
					Numbers of				

Technical Capacities	2012	2014	2016
Building Constructed per Year with Permit	70	70	100
Building Constructed per Year without Permit	35	35	30
Engineer within Municipal Office	1	1	2
Sub Engineer within Municipal Office	2	2	2
Numbers of Mason Trained		97	194
Numbers of Engineer Trained (Consultant/Contractor)			
Numbers of House Owner Oriented		75	120

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	1	2
2014	0.75	3.75	2
2016	4	4	2

Fig: Average score for BCI status in Gulariya Municipality in the year 2012, 2014 and 2016

The figure clearly shows that there has been significant improvement in Institutional System and Technical Capacities towards implementing building code over the years. Budget allocation for Building Code implementation has remained constant throughout the survey period.

4. Institutional System on Building Permit Process of Gulariya Municipality

The institutional system on building permit process has seen significant improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). The key factors contributing to the component of institutional system such as; Separate EQ Safety Unit or separate BCI Cell or Dedicated Technical staff, need of structural drawing for all building class, use of detail checklist for building code compliance check (building configuration, building strength, building ductility), provision of field inspection for structural details and system of registration of masons and roster of trained masons have been initiated in Gulariya Municipality. Also, system of registration of masons and maintenance of roster of trained masons are in practice since 2014.

5. Technical Capacities

This component measures the availability and capabilities of technical manpower within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 1 in the year 2012 to 3.75 in 2014 and 4 in 2016 out of 5, shows that the high demand is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Gulariya Municipality, there are more than 100 buildings constructed per year under the supervision of 2 engineers and 2 subengineers as shown in the figure below.



Fig: No. of Buildings constructed in Gulariya Municipality



Fig: No. of Engineers and Sub-Engineer within Gulariya Municipal Office

6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it is observed that the municipality has been allocating some budget for the implementation of Building Code.

7. Conclusions

• There has been significant improvement in Institutional System and Technical capacities towards implementing Building Code over the years than the third component i.e. Budget Allocation.

- In Gulariya Municipality more than 100 buildings are constructed per year and are looked after by 2 engineers and 2 sub engineers.
- Gulariya municipality has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.

Status of Building Code Implementation WESTERN REGION

Nepalgunj Sub-Metropolitan City

1. Location and Demography

Nepalgunj sub-metropolitan city is located in Banke district which lies in the then Mid-Western Development Region of Nepal and as per the current federal structure it lies in Province no.5.

Nepalgunj got Municipality status covering 17 wards in 1969 A.D. (2019 B.S.). Before 1967 A.D. (2017 B.S.) it was known as Nepalguni Later in 2nd December 2014 Nagar City. (16th of Mangsir 2071 B.S.), 10 VDCs around the Municipality were merged to form Nepalgunj Sub-Metropolitan City. This Sub-Metropolitan City now has 27 wards. It occupies land of 85.94 sq. km area and lies at 490 ft. above sea level. The city is 10 km away from East-West Mahendra Highway in the north and attached to Nepal-India border in the south. Nepalgunj is around 500 k.m. west of Kathmandu, the capital city. The minimum temperature of the city is around 5° Celsius in the winter, and maximum around 46° Celsius in summer and experiences average rainfall. Nepalgunj is also known to be the hottest city of Nepal.



i. Population Distribution

The 2011 census counted 73,779 inhabitants with 2.49% annual growth rate and population density of 5,897 person per sq.km. Based on the annual growth rate of 2011 census, the population

projection of 2016 was counted 83,433 inhabitants with 17,166 households. This population is of the then Nepalgunj municipality before it was merged to form Sub-Metropolitan City. Nepali is spoken as the national language. The mother tongue for the majority of residents is Awadhi.

ii. Population Demography

Nepal's largest Muslim community lives in Nepalgunj; other ethnic groups are Brahmin, Chhetri, Baniya, Newar, Thakuri and Magar. Usually there is a sizeable international community of foreign-aid workers.

(District and VDC profile, 2010).

iii. Main Economy

Nepalgunj city is one of the major import/export hub in Nepal for the trade between Nepal and India. Trading is the main economy of Nepalgunj. The major market areas in the city are Eklaini, Sadarline, B.P Chowk, Tribhuvan Chowk, Dhamboji Chowk, Gharbari Tole and New Road areas. Rupaidhia, a town in India attached to Nepalgunj city is popular marketing destination for the peoples of Mid-Western Development region. Of the total population of Nepalgunj Sub-Metropolitan City, 29.5% is usually active population-aged 10 and above of which 32.1% are involved in service and sales works, 16.5% on the crafts and related works, 11.5% on elementary works and the remaining active population in other occupations.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of people have access to education and the overall literacy rate is 79.79% with male literacy rate 84.17% and female literacy rate 75.18%. It was found that 94.9% of households have access to electricity, 28.96% of households use tap/piped water and 74.84% households own mobile phones.

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to May 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact in Nepalgunj Sub-Metropolitan City. The DesInventar dataset shows that the municipality has faced different hazard in the past. Among them major five hazards on the basis of frequency of occurrence were Fire, Epidemic, Flood, Accident and Strong Wind. Fire is ranked as first major hazard in terms of occurrence which damaged 82% buildings out of 304. Similarly, epidemic is ranked as second major hazard which caused 83% injuries out of 188 and 88% death out of 253 total deaths.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events) earthquake is one of the major hazards faced by all the municipalities of Nepal and Nepalgunj Sub-Metropolitan City is not an exception.



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Building Scenario

The municipality consists of approximately 8,583 buildings as of 2016 A.D. Nowadays, most of new buildings are reinforced Cement Concrete (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 66% of the RCC building comply with National Building Code (NBC). The city is developing

rapidly and attracting new residents and industries due to relocation of mid-hill migrants. It is also a center for business for adjacent districts. Building information and human resources for building construction in the municipality are as follows:

S.N.	Description	2012	2014	2016
1	Population	75616	79429	83433
2	Area (Sq. Km)			85.94
3	Existing buildings	7779	8171	8583
4	New building construction per year with permit	750	800	800
5	Buildings constructed per year without permit	150	300	250
6	No. of Trained Masons		95	175
7	Numbers of Engineer Trained (Consultant/Contractor)		28	28
8	Technical manpower with Municipal Office	2	2	2
9	Total Manpower in Municipal Office			204

ii. Milestone on Building Code Implementation (BCI)

As an initiation of Building Code Implementation in Nepalgunj municipality, first mason training on Earthquake Resilient Building Construction was conducted in 2013. Mandatory implementation of Building Code was declared in 2014 with allocation of some amount of budget for the implementation. Field supervision through consultants were initiated in 2016 to ensure the building code implementation of building code.

	Milestones								
Year	Institutional Consulty	Capacity E	nhancement	Awareness					
	institutional capacity	Masons	Engineers	Beneficiaries					
2013	First Mason Training was conducted.	27		135					
2014	Declare of Building code implementation.	68	29	105					
	Budget allocation of BCI Listing of consultants								
2015	Increase technical manpower in municipality	28							
2016	Field Supervision through consultants	28							

Municipal Milestones on Building Code Implementation

(Source: Municipality and Online Data base of BCIPN up to date of 2017-10-30)

iii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Nepalgunj Sub-Metropolitan City to measure the level of capacity of the municipaliy for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement. Survey questionnaire (Annex I) was used to collect the data from the Nepalgunj Sub-Metropolitan City. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Nepalgunj Sub-Metropolitan City was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Nepalgunj sub-metropolitan city.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI	No	No	No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff	Yes	Yes	Yes
3	Need Structural Drawing for All Building Class	No	No	Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)	No	No	No
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	No
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case	No	No	No
7	Has a system of registration of masons and roster of trained masons	No	Yes	Yes



Municipality revenue/ Budget	2012	2014 2016		Technical Capacities	2012	2014	2016
Devenue from Duilding Demoite				Building Constructed per Year with Permit	750	800	800
(in thousands)	6000	8000	10000	Building Constructed per Year without Perm	it 150	300	250
Budget allocation for BCI for				Engineer within Municipal Office	2	2	2
Awareness, Orientation, Training	0	300	300	Sub Engineer within Municipal Office	0	0	0
and Workshop (In Thousands)				Numbers of Mason Trained		95	175
				Numbers of Engineer Trained (Consultant/Contractor)		28	28
				Numbers of House Owner Oriented		70	123

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0.75	0	0
2014	1.5	1.25	2
2016	2	1.5	2

Fig1: Average score for BCI status in Nepalgunj Sub-Metropolitan City in the year 2012, 2014 and 2016

The figure shows that there has been slight improvement in the three major components of Building Code Implementation-Institutional Mechanism, Technical Capacities and Budget Allocation for BCI.

4. Institutional System on Building Permit Process of Nepalgunj Sub-Metropolitan City

The institutional system on building permit process has seen little improvement in the year 2016 compared to that in 2012. The score increased from 0.75 in 2012 to 2 in 2016 (out of 5). Among the key factors contributing to the component of institutional system, Nepalgunj Sub-Metropolitan City have succeeded to introduce the system of Separate EQ Safety Unit/Separate BCI Cell/Dedicated Technical Staff since 2012. The system of maintaining roster of trained masons was established since 2014. Also, need of structural drawing for all building class was made mandatory by 2016.

5. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of House (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0 in the year 2012 to 1.25 in 2014 and 1.5 in 2016 out of 5, shows that the demand is high is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Nepalgunj Sub-Metropolitan City, there are more than 1000 buildings constructed per year under the supervision of 2 municipal engineers as shown in the figure below:







Number of Engineers and Sub-Engineers



6. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey,

it was observed that the municipality has started allocating some budget for the implementation of building code since 2014.

7. Conclusions

- There has been just minimal improvements in all three major components of Building Code Implementation-Institutional system, Technical Capacities and Budget. As such the city has a lot to do for the effective implementation of Building Code.
- In Nepalg unj Sub-Metropolitan City, more than 1000 buildings are constructed per year and are looked after by 2 engineers.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Survey (BCISS) 2012, 2014 and 2016.

Status of Building Code Implementation WESTERN REGION

Tulsipur Sub Metropolitan City

1. Location and Demography

Tulsipur Sub-metropolitan City is located in Dang district which lies in the then Mid-Western Development Region of Nepal and as per the current federal structure it lies in Province No. 5.

Tulsipur Municipality was established as a municipality in 1991 A.D (2048 B.S). In September 2015 A.D (2072 B.S, Ashwin), Tulsipur was declared as a Sub-metropolitan City. It occupies land area of 384.63 sq. km. and ranges from 692 meters to 1,666 meters above sea level. The maximum and minimum temperature ranges around 38°C to 2°C during the summer and winter respectively. It is the second largest municipality after Ghorahi, another municipality of the same district. Tulsipur Airport is about two kilometers south from the town center. Paved roads go north to Salyan District, south to the Mahendra Highway in Deukhuri Valley and east to Ghorahi.



i. **Population Distribution**

The 2011 census counted 52,224 inhabitants with 4.33% annual growth rate and population density 566.30 person per sq.km. Based on the annual growth rate of 2011 census, the population projection for 2016 was counted 64,553 inhabitants with 15,097 households. The population is of the then Tulsipur municipality before it was merged to form Sub-Metropolitan City.

ii. Population Demography

The mother tongue for the majority of residents is Nepali. The main inhabitants of the municipality are Chhetri, Brahmin Hill and other ethnic groups are Tharu, Magars, Kami, Damai/Dholi, Sanyasi and Sonar. Age group with the highest population in the municipality is 10 to 14 with 13.90% of the total population.

iii. Main Economy

Of the total population of Tulsipur Submetropolitan City, 31.1% is usually active population aged 10 and above of which 33.3% are involved in skilled agriculture, forestry and fishery workers, 19.9% in service and sales workers and 14.3% in craft and related workers.

(National Population and Housing Census, 2011)

iv. Services and Facilities

Urban services such as tap/piped water, mobile phones, electricity and others are available in most of the parts of the city. Majority of the people have access to education and the overall literacy rate is 80.65% with male literacy rate 87.99% and female literacy rate 74.02%. It was found that 82.50% of households have access to electricity, 68.15% use tap/piped water and 81.23% households own mobile phones.

(National Population and Housing Census, 2011)

2. Hazard and Risks

The information on disaster events available from DesInventar database during the period of 1971 A.D to 2017 A.D was analyzed to have basic idea of the disaster occurrence and impact Tulsipur Sub-metropolitan in City. The DesInventar datasets show that the submetropolitan city has faced different hazards in the past. Among them major five hazards on the basis of frequency of occurrence are Epidemic, Fire, Flood, Accident and Thunderstorm. Epidemic caused 69% deaths out of 158 and 87% injuries out of 94 total injuries. Fire is ranked as second major hazard which destroyed 28% of the total destroyed houses. Flood, although ranked third in terms of number occurrence, destroyed 72% of the buildings out of 566. Epidemic caused the largest number of deaths in the city in the past. which can occur anytime. Therefore, though not indicated as the major hazard by the DesInventar database (as it is based on the occurrence of events), earthquake is one of the major hazards faced by all the municipalities of Nepal and Tulsipur Sub-metropolitan City is not an exception.

Nepal is highly earthquake prone and throughout the country there is high risk of earthquake



Source: NSET/DesInventar Report, 2017

Note: For the DesInventar database, media sources like national daily newspapers and periodicals were considered as the main sources of information. Among others, Gorkhapatra National Daily, has been taken as the most authentic source. All the data were collected from different sources available within Kathmandu Valley only; therefore, the data that might be available in the local newspapers in different districts may be missing from the database.

3. Situation of Building Code Implementation

i. Existing Buildings Scenario

The sub-metropolitan city consists of approximately 11,613 buildings as of 2016.

Nowadays, most of the newly constructed buildings are Reinforced Cement Concrete framed (RCC) buildings. A study conducted in 2016 under BCIPN program of NSET evidenced that 71% of the RCC buildings comply with Nepal National Building Code. Building

information and human resources for building construction in the metropolitan city area are as follows:

S. N	Description	2012	2014	2016
1	Population	54,485	59,306	64,553
2	Area (Sq. Km.)			384.63
3	Existing buildings	9,802	10,669	11,613
4	New building construction per year with permit	300	400	400
5	Building constructed per year without permit	20	20	20
6	No. of Trained Masons		67	199
7	Numbers of Engineer Trained (Consultant/Contractor)			
8	Technical manpower with Municipal Office	3	3	3
9	Total Manpower in Municipal Office			64

(Source: Building Code Implementation Survey, 2012, 2014, 2016)

4. Milestone of Building Code Implementation (BCI)

In Tulsipur Sub-Metropolitan City, mandatory implementation of Building Code was declared in 2014 A.D. Similarly, preparation of a roster of consultant's engineers and formation of mason groups took place the same year. Field supervision through consultants were initiated to ensure the Building Code Implementation since 2015 A.D. By the year 2016, the process of reporting with photographs of different stages of construction was initiated.

Municipal Milestones on Building Code Implementation:

	Milestones							
Year	Institutional Consoity	Capacity	Enhancement	Awareness				
	Institutional Capacity	Masons	Engineers	Beneficiaries				
2013				39				
2014	Declare Building Code Implementation Listing of Consultants Formation of Mason Groups	67						
2015	Field supervision through consultants	32						
2016	Reporting of field supervision with Photographs of different stages	100		435				

(Source: Municipality and Online Database of BCIPN up to date of 2017-10-30)

ii. Status of Building Code Implementation (BCI)

Under the BCIPN program of NSET, Building Code Implementation Status Survey (BCISS) was carried out in Tulsipur Sub-Metropolitan City to measure the level of capacity of the municipality for building code implementation; and to measure the level of sustainability of building code implementation reflected in robust building permit process and building code enforcement.

Survey questionnaire (Annex I) was used to collect the data from the Tulsipur Sub-Metropolitan City. Various modes of communication such as telephonic conversation, emails, in person interviews and interaction with the relevant municipal professionals and exploratory visit to municipalities etc. were used for the data collection.

The status of building code implementation in the Tulsipur Sub-Metropolitan City was assessed in terms of three major components described in Section 3 (of the report): Institutional Mechanisms, Technical Capacity, and Budget Allocation. Under each component, key indicators contributing to a particular component were identified and measured. The assessment was done in three phases: at the initial phase/ before the implementation of BCIPN program (2012, Baseline), at the midterm of the program implementation (2014, Midterm) and then towards the end of the BCIPN program (2016, End line) to measure the change in the status of building code implementation over time. The overall status of BCI was calculated following the methodology described in Section 3. Figure 1 shows the overall score and changes of status of BCI in Tulsipur Sub-Metropolitan City.

	Institutional System on Building Permit Process	2012	2014	2016
1	Advisory/Technical Committee for BCI			No
2	Separate EQ Safety Unit or Separate BCI Cell or Dedicated Technical Staff			Yes
3	Need Structural Drawing for All Building Class			Yes
4	Use of detail checklist for building code compliance check (bld. configuration, bld. strength, bld. Ductile detailing)		No	Yes
5	Has provision of field inspection for structural details: i) foundation, ii) Plinth level, iii) storey structure	No	No	Yes
6	Have a provision for strengthening of existing buildings/Retrofitting (While addition of storey / In any case		No	No
7	7 Has a system of registration of masons and roster of trained masons		Yes	Yes



Municipality revenue/	2012	2014	2016	Technical Capacities	2012	2014	2016
Budget				Building Constructed per Year with Permit	300	400	400
Revenue from Building Permits (in thousands)		4000	4000 4000 Building Constructed per Year without Permit		20	20	20
Budget allocation for BCI	BCI ation, p (In 0		200	Engineer within Municipal Office	1	1	1
for Awareness, Orientation,		200		Sub Engineer within Municipal Office	2	2	2
Training and Workshop (In Thousands)		200		Numbers of Mason Trained		67	199
				Numbers of Engineer Trained (Consultant/Contractor)			
				Numbers of House Owner Oriented			453

Year	Institutional System on Building Permit Process Score (S1)	Technical Capacities Score (S2)	Municipality revenue/ Budget Score (S3)
2012	0	0.75	0
2014	1.5	1	2
2016	4	2.5	2

Fig 1: Average score for BCI status in Tulsipur Sub-metropolitan City in the year 2012, 2014 and 2016

The figure shows that there has been much improvements in Institutional system towards implementing Building Code over the years. Of the three major components of Building Code Implementation-Institutional Mechanism, Technical Capacities and Budget Allocation for BCI, Institutional Mechanism seems to change better than the other two components.

5. Institutional System on Building Permit Process of Tulsipur Submetropolitan City

The institutional system on building permit process has seen much improvement in the year 2016 compared to that in 2012. The score increased from 0 in 2012 to 4 in 2016 (out of 5). Among the key factors contributing to the component of institutional system, Tulsipur Submetropolitan City have succeeded to introduce almost all the component except separate Advisory Committee provision and for strengthening of existing buildings/ retrofitting. The system of Separate EQ Safety Unit/Separate BCI Cell/Dedicated Technical Staff and system of registration of masons and roster of trained masons started in 2014. Moreover, the system of need of structural drawing for all building class, provision of field inspection for structural details, use of detail checklist for building code compliance check were initiated since 2016.

6. Technical Capacities

This component measures the availability of technical capacities within the municipality. Here, the people who are directly involved in the construction of house (engineers, masons and the house owners) are assessed. The proportion of human resources trained/oriented with respect to the numbers of new building constructed per year is measured and the scores are assigned accordingly.

The score is 0.75 in the year 2012 to 1 in 2014 and 2.5 in 2016 out of 5, shows that the high demand of technical manpower is gradually fulfilled. It is estimated that for every 100 buildings there has to be at least one engineer in the municipal office to look after the construction. In Tulsipur Sub-metropolitan City, more than 400 buildings are constructed per year and are under the supervision of 1 engineer and 2 sub-engineers as shown in the figure below:



Fig 2: No. of Buildings constructed in Tulsipur Sub-metropolitan City



Fig 3: No. of Engineers and Sub-Engineer within Tulsipur Sub-metropolitan City

7. Municipality Revenue/Budget Score

This component assesses the budget allocated by the municipality for building code implementation as a proportion of revenue collected from building permit. From the survey, it was observed that the municipality has started allocating some budget for the implementation of building code since 2014.

8. Conclusions

• There has been much improvements in Institutional System towards implementing

building code over the years than the other two components-Technical capacities and Budget Allocation.

- In Tulsipur Sub-metropolitan City more than 400 buildings are constructed per year and are looked after by 1 engineer and 2 sub engineers.
- Tulsipur Sub-metropolitan City has initiated the system of allocating budget for the Building Code Implementation.

Note: This summary description has been developed based upon data/information collected from Census 2011, interaction with the municipality and BCI Status Survey (BCISS) 2012, 2014 and 2016 from NSET.



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