

# Project – “Conducting structural safety audit and workshop in Vizag, Shimla and Cuttack city”

## Baseline Assessment Report - Shimla

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Ministry of Home Affairs  
Government of India



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## 1. Introduction:

India is vulnerable to numerous natural as well climate-induced hazards such as cyclones, droughts, earthquakes, floods, cold waves, heat waves, landslides and tsunamis due to its unique geo-climatic location. The effects of climate change are adding a new and more intractable dimension to the existing risk profile of vulnerable areas. It is believed that climate change will alter the number, severity, frequency and complexity of climate-induced hazards. With this uncertainty, and more importantly, with new areas experiencing extreme events, it becomes critical to adopt an integrated climate risk management approach. Vulnerability to climate change is determined, in large part, by people's inability to adapt to the impact of the changes. Integration of disaster risk reduction into national and local development policies and plans is considered one of the key processes to promote a sustainable and climate resilient development paradigm. Resilient building infrastructure is one of the important themes on which GOI-UNDP-USAID has been working in various hazard prone cities of the country. It is important to ensure that the government continues to invest in climate change adaptation, capacity building, exposure reduction, and disaster risk reduction in a planned manner. The building infrastructure of India has been hit by various disastrous events in the past. It becomes imperative that the new building stock should be protected through appropriate safety and resilience aspects.

Considering this important aspect, the GoI-UNDP has kick-started a program "Developing Resilient Cities through Risk Reduction to Disaster and Climate Change", which is being implemented in 6 cities viz Cuttack (Odisha), Navi Mumbai (Maharashtra), Shillong (Meghalaya), Shimla (Himachal Pradesh), Vishakhapatnam and Vijayawada (Andhra Pradesh) with support of USAID for the period of four years (from 2016 to 2020). The key outcomes of the project is to enhance the institutional resilience and help reduce disaster risks in urban areas to integrate climate risk reduction measures in development programs as well as undertake mitigation activities based on scientific analysis.

One of the important components of this program is to build the capacity and resilience of stakeholders from various key concerned departments in the domain of structural safety across the partner cities. GeoHazards Society (GHS) has provided technical support to UDNP in carrying out this aspect of the program in the partner cities namely Shimla, Vizag and Cuttack. The GHS team developed a basic qualitative survey instrument for carrying out interviews and consultations with key stakeholders from key departments. The main departments such as City Municipal Corporation / Board, Public Works Department, Town and Country Planning Department, and the Department of Urban Affairs were interviewed. Due to the short duration of the project, the GHS team synthesized the findings from the interviews qualitatively.

This report includes critical reviews and gap analyses of the city building bye-laws, building rules and regulations in context of natural and climate-related-hazards, disaster resilience, provisions and plans dealing with buildings and local enforcement and implementation. The report also summarizes key findings and recommendations.

The interviews and consultations were carried out online (i.e. video-conference / Google Meet) with the key departments that has helped understand the following aspects.

- Understand the techno-legal regime of the structural safety regulations in the cities.
- Determine institutional capacity gap and the actual practices; adequacy of staffing level; level of awareness; current procedures for ensuring the structural safety of buildings
- Understand the role of city administration in the enforcement of structural safety audits

The GHS team members who have been deeply involved in regulatory development at the national and state level led the review of city level administrative structures, the safety provisions in the building regulations, its development and maintenance component as well as enforcement of the regulations.

## 2. Review of the Building Bye-Laws

Unlike other places in Himachal Pradesh (HP), Shimla Municipal Corporation (MC) has its own bye-laws, known as MC Shimla Building Bye-Laws 1998. This was brought out under the HP MC Act 1994. The bye-laws were published in 1998, the Shimla MC is still following this version of the bye-laws. The Himachal Pradesh Town and Country Planning Rules (TCP) 2014, are also applicable to Shimla.

### 2.1 Structural Safety Design, Standards

As per **rule 3**, the applicability of the bye-laws are confined to the following,

- a) Where a building is erect, the bye-laws apply to the design and construction of the building.
- b) Where the whole or any part of the building is removed, the bye-laws apply to all parts of the building whether removed or not.
- c) Where the whole or any part of the building is demolished, the bye-laws apply to any remaining part and the work involved in demolition.
- d) Where a building altered the bye-laws apply to the whole building whether existing or new except that the bye-law applied only to part if that part is completely self-contained with respect to facilities and safety measures required by the bye-law
- e) Where the occupancy of a building is changed, the bye-law applies to all parts of the building affected by the change.

The Shimla Bye-laws is applicable for cases from (a) through (e), it has not covered the buildings which have withstood a disaster. This provision should be incorporated to make sure of their safety.

**Rule 3** also says that “nothing in this bye-laws require the removal, alteration or abandonment nor prevent the continuance of the use or occupancy of an existing approved building unless, in the opinion of the Commissioner, such building constitutes a hazard to the safety of the adjacent property or the occupants of the building itself”. As per this rule alteration works of the existing approved buildings are not required to follow the bye-laws, which itself might leads to the creation of structurally unsafe buildings. It also says that it follows the opinion of the Commissioner, but no procedure is given about how to identify such buildings. This part of the rule also contradicting the earlier part of the rule, as per the earlier part, the bye-laws are confined “Where a building altered the bye-laws apply to the whole building whether existing or new”.

Although the procedure for obtaining building sanction includes the requirement of a signature from the structural engineer as per **sub-rule 1 of rule 7**, later **Sub-rule 10 of rule 7** mandates that all the plans should be signed by a registered engineer. This needs more clarification.

According to **rule 7**, the registered engineer needs to provide the details about the type and grade of material, but it has not specified the requirement of different test results to ensure the quality. The rule should suggest some of the tests that have to be conducted for different materials to make sure of its quality. This rule also mentioned the requirement of a certificate from the state geologist for the sinking zone mentioned, since a geotechnical engineer is being more expert in this subject the rule should also incorporate the requirement of a certificate from a geotechnical person.

**Sub-rule 1 of rule 8** listed the alteration works which doesn't require the building sanction, it also added that the alteration works should not violate structural safety and fire safety as per the bye-laws, however, it has not mentioned anything from the MC side to ensure that the alteration works are confined to the bye-laws. The bye-laws should include provisions for that.

**Rule 14** listed out the qualification of engineer and plumber, it has not listed the qualification of a structural engineer, geotechnical engineer, and architect. The qualification of the above personnel should be incorporated. Also, as per this rule, an engineer can carry out structural details and calculations for all the buildings, but the structural details should be handled by a qualified structural engineer.

As per **sub-rule of 3 of rule 15**, the documents need to be kept at the site are approved drawings and specification, it has not mentioned about the requirement of keeping the test data of the materials.

**Rule 16** has mentioned the details about the site inspection after the completion stage, but no information about the inspections at any other stage of construction is mentioned, and this might lead to the missing of some of the construction deviations. Though rule 20 requires to submit the notice on completion of plinth level work, it has not given anything about the site inspection. The details about the site inspection at different stages of construction needs to be included in the bye-laws.

The bye-laws are lacking the rules for post-occupancy inspections and the after-effects of which are already happened in the city such as encroachment by business establishments, construction of extra floors by shopkeepers, the opening of shops in basements by hotels, the collapse of buildings, lack of maintenance of the buildings, etc. The provisions for post-occupancy inspections should be brought in.

**Rule 17** deals with the deviations during construction. As per this rule, for getting sanction the owner can submit the revised plan, however, the rule doesn't mandate the requirement of a certificate from a structural engineer. In such cases, the requirement of a structural safety certificate should be included to ensure that the altered/deviated structures are structurally safe.

**Sub-rule 2 of rule 26** has given the maximum height of the buildings permitted as 14 metres, therefore the entire bye-laws apply to buildings having a height less than 14 metres. Buildings having height greater than 14 metres and also which are non-residential requires to refer to NBC.

**Sub-rule 3 of rule 30** has given some relaxation for the size of the private garage in the open plot for topographical constraints. This gives more flexibility to this rule.

**Rule 33** has dealt with lift, here no provision is given for the periodic checking of the lifts to ensure their safety. This provision for periodic checking needs to be made mandatory.

None of the rules in the bye-laws are dealing with the mixed-use buildings directly, other than **sub-rule 6 of rule 41**, which has asked to follow zoning regulations in case of use change. To reduce building construction, the bye-laws can incorporate provisions for mixed-use development.

As per **sub-rule 7 of rule 41** “every building is required to be renovated viz painted, distempered, whitewashed roof painted at least once in three years by the owner/tenant”. However, details regarding the inspections to ensure it are not provided in any part of the rule.

As per **sub-rule 11 of rule 41** “where trees are involved no building application shall be considered where the distance between an outer edge of the tree is less than 2 metres”. However, this rule has no further provisions to ensure this.

**Rule 44** has dealt with the construction of temporary structures. However, no provision is given to ensure its safety, which needs to be addressed for such structures.

**Rule 43** is dealing with the regularization of unauthorized constructions, other than levying a fine it has not mentioned the requirement of a structural stability certificate from a structural engineer. It should include the requirement of a structural safety certificate to ensure that the deviated structures are structurally safe.

None of the rules in the bye-law are dealing with the disposal of the construction waste, structural stability of the existing buildings in the sinking zone area. It has also not incorporated the relevant Indian Standards (IS) prescribed by the Bureau of Indian Standards (BIS). The bye-laws should address these issues.

As per CDMP Shimla, the open spaces are very limited within the city limits. For a better response to any emergency, open spaces are required for organizing community shelters, health and rationing camps, etc. This issue needs to be addressed while preparing the master plan/development plan/through zoning regulation, provisions for which already exists in Building Bye-Laws 1998.

## 2.2 Earthquake

According to the Town & Country Planning Department, only 1.52 percent of the buildings of Shimla are safe and not prone to earthquakes. A large number of buildings in Shimla are liable to damage in a high-intensity quake. Despite all these facts, the bye-laws did not have provisions to incorporate the earthquake resistant design as a part of building design till recently. None of the relevant Indian Standards (IS) prescribed by the Bureau of Indian Standards (BIS) for earthquake design are incorporated in the bye-laws. The provisions for the seismic retrofitting of the older buildings are also not given. Though seismic hazard map is available in CDMP of Shimla, the bye-laws must include provisions to follow it. It would be useful to incorporate vulnerability mapping for Earthquakes of appropriate scale (preferably in 1:5,000 to 1:10,000 scale).

The existing rules related to disaster aspects are identified and explained below with their gaps.

As per **rule 7**, the building plan requires the details like contour plan of the site and level of each floor with respect to road/paths/street but nowhere in the bye-laws has explained its application/usage. The bye-laws should incorporate some restrictions in construction based on the contour plan of that area.

As per **sub-rule 1 of rule 26**, the plinth of buildings, “the plinth or any part of a building or outhouse shall be located with respect to surrounding ground level so that adequate drainage of the site is assured but not at a height less than 45 cm. In the case of the sloping site, the maximum height of the plinth level should however not be more than 2.00 metres, including the plinth from the lowermost level of the original ground profile”. This is the rule which has a direct relation with disaster mitigation, however, this rule applies uniformly to the entire Shimla MC, the condition of soil might change from place to place, and hence a certification by the geotechnical engineer is necessary. This rule has excluded the basement, which may be included.

**Sub-rule 1 of rule 41** is an approach to curb the congestion of a place, since congestion is one of the important problems in Shimla this rule has greater importance. According to this rule, the height of the buildings is reduced by keeping a limit for the building angle and it is applicable only for the congested areas listed by the MC. The bye-law should refer to this list which also needs to be updated from time to time.

As per **sub-rule 2 of rule 42**, “when it is essential to develop a plot by cutting it shall be the responsibility of the plot owner to provide, according to the Engineering specifications, retaining and breast walls so that such cutting of natural profile of the land may not harm the adjoining uphill side properties. However, cutting off natural profile shall not exceed more than one storey (3 meters, in any case, having a provision of diaphragm wall for step housing)”, this particular rule is also intended for disaster mitigation, however, this rule lacks detailing and does not mention any inspection by a geotechnical engineer. The certificate from the geotechnical engineer should be made mandatory.

Rule 42 is dealing with site development, as per **sub-rule 1 of rule 42**, the site development should least disturb the land, this rule lacks detailing also there is no provision in the bye-laws for the inspection of the site at this stage. Site inspection at development stage needs to be incorporated in the bye-laws.

### 2.3 Landslide

Landslide is the most common hazard in Himachal Pradesh, which causes an immense risk to life and property. Almost every year the state is affected by one or more major landslides affecting society in many ways. Loss of life, damage to houses, roads, means of communication, agricultural land, are some of the major consequences of landslides. Like an earthquake, provisions related to landslides are also not incorporated in the bye-laws, the relevant IS codes prescribed by BIS are also not included, but it should be. Though landslide hazard map is available in CDMP of Shimla, The bye-laws have no provisions to follow it. There should be some provisions to follow it. It would be useful to incorporate vulnerability mapping for landslides of appropriate scale (not larger than 1:5,000 to 1:10,000).

As per Himachal Pradesh Town and Country Planning Rules (TCPDR) 2014 a uniform limit for slope cutting is allowed. Since Shimla got an undulating terrain area wise maximum limit of the slope can be introduced.

### 2.4 Fire Protection and Fire Safety Requirements

Every year, fire creates a huge loss to the economy & heritage value of Shimla City. The vulnerability lies in the fact that Shimla has a wooden construction and having congested paths which increase the incidents of fire cases and also impact the response time. The existing rules in bye-laws which have gaps are identified and explained below,

According to HP TCPR 2014, firefighting provisions and specifications are given as per the National Building Code of India, 2005. It should be updated to follow NBC 2016.

The inspection team after the completion of the building provided in **rule 16** lacks the presence of a fire officer. The fire officer should be part of the inspection team.

**Rule 36** has given minimum specifications for the staircases, but no provisions are given for fire staircases. **Rule 37** has mandated spiral stairs for commercial buildings having three or more storeys, however, it has not mentioned anything about the requirements of fire stairs for other category of building.

**Sub-rule 3 of rule 43** has provided the minimum access width required for a group of plots exceeding 10, however, there are no provisions given to ensure the entry of fire engines. The access roads should be designed to cater to the fire engines.

### 2.5 Flash Floods / Cloud Bursts

Though there is no reported occurrence of flash floods/cloud bursts in Shimla with the increasing phenomenon of hydro metrological events and climate change the vulnerabilities towards flash floods and cloud burst are increasing every day. None of the rules are directly dealing with flood mitigation measures. The city is lacking proper stormwater drainage, to curb flood, a proper drainage network is mandatory. Some of the existing rules for drainage and their gaps are detailed below.

Although in many places the term drainage is being used, the bye-laws have not given a proper definition for it. According to the bye-laws, drainage means the removal of any liquid by a system constructed for the purpose, it has not specified whether the liquid will be sewage or stormwater.

**Rule 28** is dealing with basements, it has only asked to provide a 6-inch cavity drain towards the hilly side of the basement, and this has not asked to check with the flood map /other hazards of that area before building basements. Vulnerability mapping for flooding of appropriate scale (not larger than 1:5,000 to 1:10,000) should be done to ensure the disaster-resilient constructions.

As per **rule 7**, the site plan requires the details of the disposal of wastewater/rainwater. This rule has a lack of clarification because the disposal of sewage and rainwater are not the same. Under the site plan, it also asked for the details about drain to be connected with MC nallah/drain, however, nowhere in the bye-laws has defined drain. The clear definition of drain is required for a better understanding.

Rule 43 is dealing with the carving of plots. As per **sub-rule 1 of rule 43** "orientation of the plots shall be provided in such a manner to conform with the integration of existing plots/infrastructure, wind direction, the natural flow of surface drainage to allow unobstructed rainwater discharge". This rule also intends for disaster mitigation especially for flood mitigation, however, there is no provision in the bye-laws to ensure it through inspection. It has also not been asked to refer to a disaster management plan for Shimla.

As per CDMP, Shimla is facing a water crisis and the possible reasons are the rising population, unchecked constructions, and depleting forests. The bye-laws have no provisions to stop the unauthorized waterfront developments, hence the building rules may consider its inclusion.



Although HP TCPR 2014 has provisions to obtain NOC under the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981 and Environment Protection Act, 1986, these are applicable only to Colonies/Apartments.

## 2.6 Heavy Snowfalls

Shimla is located at a high altitude and naturally, it is blessed with snowfalls. But gradually the intensity of snowfall is decreasing which is causing a sort of vulnerability for the city. The vulnerability is a dual facet- in one case if the snowfall remains decreasing and the other is if there will be a sudden increase in snowfall. The bye-law has not incorporated the relevant Indian Standards (IS) prescribed by the Bureau of Indian Standards (BIS) to design the buildings accounting for the snowfall, which should be incorporated.

## 3. Review of the CDMP

The Disaster Management (DM) Act, 2005 is related to entry 23 (Social Security and Social Insurance) under the 7th Schedule of the Constitution of India. Thus, state governments have an equal obligation as the Government of India for implementing the provisions of the Disaster Management Act, 2005 to ensure disaster risk reduction in the respective jurisdictions. The DM Act, 2005 makes it mandatory for every state / district to have a Disaster Management Plan (DMP).

The Shimla City Disaster Management Plan (CDMP) was prepared by- Municipal Corporation Shimla under GoI-UNDP, USAID funded Project on 'Urban Climate Risk Management through disaster preparedness and mitigation'. Disaster Management Plan is a cross cutting tool. The Shimla CDMP has many references to vulnerability of buildings and their regulations, enforcement and capacity building of the construction fraternity that has been reviewed.

The CDMP covers both natural as well human induced hazards that can affect the city. The natural hazards that the plan contains include earthquakes, landslides, land sinking, hailstorms, and severe storms, including lightning and high winds (Thunderstorms), flash flood/cloud bursts, and heavy snow falls. The human induced list in the plan includes accidents- train, road, air, and monkey menace, traffic jams, tree falling, Fires (household and forest), lift disorder, stampede and utilities failure including energy, telecommunication, water and sewerage system.

As per the CDMP, the Shimla City has a potential risk of earthquake as it falls in the seismic zone IV as per the seismic zone map of India. The CDMP envisages that the city can expect a maximum Peak Ground Acceleration (PGA) of 4.0 meters per Second Square. It indicates that seismic intensity of VIII on the Modified Mercalli (MM) Intensity Scale van strike. The plan mentions that if such intensity of earthquake hits the city, there can be slight damage in specially designed structures; considerable in ordinary substantial buildings; and great damage in poorly built structures. Panel Walls can be thrown out of frame structures. Chimneys, factory stacks, columns, walls and monuments can collapse. Heavy furniture can get overturned. Sand and mud can get ejected in small amounts. Changes can be caused in water levels.

As per the CDMP, the land distribution of Shimla city shows that major land use is residential that is 75% of the total built-up area. The 7% of the residential buildings accommodate street level commercial activities. Areas such as Mall Road, Lower Bazar, Krishna Nagar, Summer Hill and Totu are highly commercialized where upto 50% of the total buildings are used for commercial purposes. There is only 4% of total building stock that is used by institutions and facilities such as schools, offices, hospitals, post offices, power stations, water works, and places for worship which could be utilized as community shelters. The built-up areas have very few and small open spaces in most of the municipal wards.

The plan states that the 90% structures in the city are 'poorly built' that can collapse during moderate to high earthquake shakings. The most damages could be experienced in the areas such as Lakkar Bazaar, New Shimla, Vikas Nagar and Ruldu Bhatha, which are the part of northern slopes of the ridge. The underlying factors that caused haphazard construction in the city include the huge demand of urbanization triggered by migration and tourism. As a result of these factors, a lot of construction of buildings have started on steep and unstable slopes with improper construction practices.

The plan exhibits that the bad building conditions in the wards of Mall Road, Krishna Nagar, Ruldu Bhata, Ram Bazar, Phagli Nabha and Khalini. Buildings classified under 'very poor' condition in these wards reach upto 72.70% of the total, which is much higher than the city's average of thirty six percent. One reason that has been cited is the lack of maintenance. The plan refers to the Town & Country Planning Department only that cites that the 1.52 percent of the buildings of Shimla are safe and not prone to earthquakes. The plan also cites that the old buildings (around 15%) that were constructed before 1925 are not properly maintained and highly prone to collapse even due to heavy rainfall.

The plan refers to a study carried out by SEEDS in 2006 that mentions that the vulnerability atlas for the country based on a building census for the year 1991 for Shimla and as per the census, only 1.52 per cent buildings are safe. It further highlights that the 50% of the buildings in Shimla are more than two storeys high. 24% of the buildings in Shimla are more than two storeys high. 24% of the buildings have 3-4 storeys. These stocks of buildings violate the local building bye-laws. The plan also mentions that 40% of these buildings are on loose land-fill soil without compaction, post a grave threat.

The plan has references to sinking zone hazard as one of the other potential hazards and roughly estimates 25% of the old city falls under the sinking zone. Slopes have become overloaded, and buildings in several heavily crowded localities in the central part of the town have become unsafe as they fall in the sinking zone. The plan underscores that many of the areas in the city have a large number of construction of buildings on slopes with no compliance to seismic building codes and disaster resistant constructions. The areas such as Sanjauli, Lower Bazaar, Fingask and Ram Bazaar have this common problem. A large number of houses in the city are old and poorly designed.

The plan has references to mitigation strategies that highlight both structural and non-structural measures. The plan cites retrofitting measures for hospitals, lifeline buildings, shelters, and heritage structures, but it does not stipulate strategy, timeframe, budget etc. It states that there should be a city wide phase wise plan for doing the retrofitting of buildings based on priority. For non-structural

measures, the plan highlights the need of Seismic Micro-zonation that will help provide a technical and scientific insight into seismic vulnerability of the city in detail. For this purpose it is required to hire any technical agency which could perform the seismic micro-zonation. However, it does not assign this responsibility to any departments. On the awareness generation training programs for construction fraternity, the plan mentions Central Building Research Institute (CBRI), Roorkee, National Institute of Technology (NIT), Hamirpur, School of Planning and Architecture (SPA) for carrying out training and capacity building programs. The mitigation strategies lack timeframes, budgets, and do not assign responsibility to any departments.

The plan highlights the urgent need of revising local building rules and the Town and Country Planning Act. It states to incorporate the latest National Building Codes and IS codes for new constructions. The plan also focuses on the need of Risk sensitive land use planning and development control regulations that should be enforced. The City Development should be re-visited and re-drafted on the basis of Hazard, Risk, and Vulnerability Assessment (HRVA) of the city. All the stakeholders should be involved in this process.

Poor enforcement of the local building bye-laws, and lack of human resource, and limited training and capacity building programs among the construction fraternity have been articulated by the plan. There are no proper mechanisms for carrying out structural safety audits for any types of buildings. A Rapid Visual Screening (RVS) study has been conducted by UNDP that contains information on many of the buildings that have been listed out as critically unsafe. The draft RVS report is available on MC's website that has a list of buildings / structures that were assessed.

The plan highlights that about 27% were constructed pre 1971, the year when seismic codes were first introduced by the Public Works Department. The local building bye-laws came into being in 1988. Even after the enforcement of the codes, most engineers, planners, architects and other personnel are neither aware nor fully adhere to the provisions. The gross lack of staff members and human resources in the offices / departments restrict the site inspection visits that are mandatorily to be made at different stages.

The plan states that use of GIS has begun in the city, but it is in the initial stage and use of satellite images are almost negligible. The plan mentions that the many important buildings (government) do not comply with the National Building Codes. The other critical buildings such as Secretariat, High Court, Municipal Corporation etc. are not fully equipped to fire safety norms. The plan also adds that there is no post disaster damages assessment carried out after a fire incident.

The CDMP has references to the other hazards such as Severe Storms, including Lightening and High Winds (Thunderstorms) that could affect buildings in the city. The fire that is also a common hazard in Shimla city is often associated with human activities as per the plan. The most common reason for fire in the city includes old wooden structures, congested construction, poor and old wiring and resultant short circuit, rising temperature and extended dry spells. The old historical buildings that are made up of wood and also in present buildings as well the flooring etc. is made up of wood are prone to fire hazard.

Many of the residential and commercial buildings are coming up in the city. It has a congested built-up area now, and many haphazard development is taking place in the city. The plan states that Municipal Corporation (MC) Shimla is checking unauthorized constructions and encroachments. There are also strict restrictions imposed by MC Shimla that prohibits any construction on slopes steeper than 45 degrees.

Among the key gaps that are identified relate to micro hazard zonation, local risk assessment, and unsafe and unauthorized buildings. The plan highlights the needs in this area, but the lack of scientific study, inadequate standards for assessment and retrofit, and limited provisions to deal with them are lacking. The plan emphasizes the importance of reconstruction and rehabilitation, but preventive retrofitting and building maintenance, particularly of lifeline buildings, are missing in the plan. There is no actionable planning to address this area of concern.

The plan stipulates reconstruction plans and designing of houses through a participatory process (using owner driven construction approach) involving government, community, civil society and corporate sectors, but it does not have any roadmap for owner driven construction. It also does not clearly delegate responsibilities to the concerned agencies.

To conclude the review of the city DM plan, it has been observed that the plan extensively highlights the problems associated with the unsafe and unauthorized building constructions, potential of various hazards and their effects on building constructions. However, the plan does not articulate clearly the roadmap for various risk and mitigation measures. The city lacks micro level detailed hazard maps, the human resource capacity is limited compounded with poor enforcement of the local building rules and regulations.

#### 4. Findings based on interview with the stakeholders

Shimla's building regulations adhere to the Building Byelaws 1998, Notifications later issued in 2002, 2011, 2015 and 2016. All ULBs come under Himachal Pradesh follow regulations framed by the TCP department while Shimla MC has their own set of Building regulations.

##### 4.1. Sufficiency of building regulations

The existing building rules address the structural safety against natural and climate-related-hazards to a certain extent. Earthquake and landslides are the most common disasters Shimla is prone to.

Earthquake resilient design were not in force prior to 2018. Although NBC was followed, building design was based on static analysis and the earthquake factors were not taken in account. But after 2018, seismic analysis is being done for designing public buildings. Hands on training were given in structural design and drawings. The design engineering department design public buildings like schools, Technical Institutes, Hospitals, PHC and government housing.

National Hospital Safety Guidelines for Hospitals of NDMA needs to be made use of while designing critical lifeline structure like hospital buildings. The NDMA need to go beyond the code. Importance factors of public buildings depends on its function and varies for schools, and hospitals. Constructing hospitals adhering to or going beyond the NBC as stipulated in the NDMA guideline will have budget implications, which the State may need to source.

For landslide safety, the basic factor checked prior to construction of roads and buildings is the stability of the slope which is critical in Shimla terrain. The design is also reviewed to match with the slope stability. There are no geotechnical engineers, and it is the design engineer who checks the stability of the slope. In case of critical big projects, support is taken from government technical institutes like IIT.

Executive Engineer Roads and Buildings carry out site specific inspection for landslide resilience. It is The Building regulations have provisions for slope cutting and construction one of which is stating that slope cannot be cut more than 3.5 m. In case of violation of this provision a joint inspection is carried out by a Committee led by the Executive Engineer to stop such illegal construction into a dangerous slope, or restrict the slope cutting within permissible limits.

Hill side constructions are not allowed above 45degree angle, making it illegal. Landslide hazard maps are available in Shimla MC but the scale is not clear. IRDP has prepared area maps by the geological departments, geologists have marked boundaries with varying degrees of risks. Development plans with a 20 year perspective upto 2040 are being made for Shimla.

Differential Floor Area Ratio (FAR) has been adopted. Presently, this is 1.75 for residential. It is different for commercial buildings depending on the area and site location. Even though the floating population of Shimla is higher owing to tourism, construction in Shimla MC is limited to two storeys.

#### 4.2. Capacity and enforcement

It has been noted that though building regulations are strong enough but is lack of capacity and enforcement among the stakeholders.

The TCP department informed that during building approval, producing a structural stability certificate is the responsibility of the owner. There are no geotechnical engineers in the planning team. Structural engineers who are registered with the MC carry out the certification of the structural safety components in the building plans and drawings.

The permit application submission is online and site inspection is carried out to verify the building plan. NoCs are required from fire safety department for the high-rise buildings (above 15m height) and the owner can approach the Fire safety department to obtain NoC and submit to the ULB.

Though major construction works are not done directly by the ULBs, there is shortage of staff from Jr. Engineers, Assistant Engineers, and dedicated design engineers to check the construction who lack expertise in structural safety components. There is not enough staff to carry out the site inspections as required at various stages of construction – plinth level, roof level and completion. 61 ULBs have 1 junior engineer each and 5 Assistant Engineers altogether (Besides the MCs of Shimla and Dharamshala).

Engineers in the design department and the ULBs should be given formal training in earthquake resistant construction at an early stage so that it becomes a practice. The educational curricula, at

present does not have any module on the zone factors, resonance factors, required for structural stability, earthquake resistant buildings, and construction.

The Urban Development Directorate which controls all the ULBs and MCs, has no dedicated town planners with good knowledge of the buildings regulations, or any AE or JE. The department itself is not organising any trainings for the ULB engineers, but their engineers nominated for the trainings organised by the SDMA depending on the type and content of the trainings. Need is felt to organise a week-long in-depth training on structural safety components for which ULBs are willing to nominate their engineers in batches.

No structural safety audit has been conducted for buildings in Municipal Corporation of Shimla.

## 5. Key Recommendations

- The DM plan should be made more robust by spelling out clear roles and responsibilities of the stakeholders / concerned departments. The plan needs to include a roadmap for various preventive measures for reducing risk on buildings.
- The plan does not have micro level hazard assessment. It should have city hazard map – Georeferenced Cadastral and topographical maps (1:10,000 or more) for earthquakes, landslides are needed to be developed for micro scale level planning.
- Large-scale training and capacity building programs for key departments (PWD, MC, TCP etc.) and the construction community on structural safety aspects need to be carried out. The plan should also mention about hands-on training involving all stakeholders concerned including provisions for incentive mechanisms to be well articulated.
- The MC Shimla stipulates that line departments may formulate a repair and restoration policy, which should neither be treated as compensation for damage nor as an automatic entitlement and is only relief assistance within the limits of prevalent funding norms. It highlights the need for a comprehensive policy.
- The plan should stipulate a robust retrofitting strategies at least for critical lifeline buildings such as hospitals, schools, fire stations, Emergency Operation Centers (EOCs). It is important that adequate guidance for prioritization and assessment to be worked out.
- The bye-laws should incorporate provisions to ensure the safety of buildings that has withstood a disaster.
- HP TCPR 2014 in general and with respect to Firefighting provisions and specification are referred to NBC 2005, it should change to follow NBC 2016.
- As per bye-laws for constructions in sinking zone, a certificate from a state geologist is only required, since a geotechnical engineer is being more expert in this subject the rule should also incorporate the requirement of a certificate from a geotechnical person. It also needs to incorporate his qualification in the bye-laws.
- For regularization of unauthorized constructions, the bye-laws should incorporate provisions to ensure the structural safety of such structures.

- The bye-laws may incorporate provisions for mixed-use development.
- The structural safety inspections and certification should be handled by a qualified structural engineer.
- There should be some provisions to ensure the structural stability of the existing buildings in the sinking zone area.
- Periodic site inspection and its details needs to be included in the bye-laws. Provisions are also needed for post-occupancy inspections, for Mechanical, electrical, plumbing and firefighting components.
- There should be some provisions to ensure the disposal of construction waste.
- The bye-laws have not incorporated the relevant Indian Standards (IS) prescribed by the Bureau of Indian Standards (BIS) for Earthquake/Landslide/Snowfall. This should be brought in.
- The issue of limited open spaces needs to be addressed in the master plan/development plan/through zoning regulations.
- The provisions for the seismic retrofitting of the older buildings should be brought in.
- There should be some provisions to follow the CDMP of Shimla. It may be incorporated by adding provision to obtain clearance from the Disaster Management Authority for constructing in hazard-prone areas.
- It would be useful to incorporate vulnerability mapping for different disasters of appropriate scale (1:10,000 or better).
- The bye-laws could incorporate some of the restrictions in construction based on the contour plan.
- Since Shimla is very prone to earthquakes and landslides, there should be a site inspection at the site development stage. The condition of soil might change from place to place, and hence a certification by the geotechnical engineer is necessary.
- The bye-laws should contain provisions to stop unauthorized waterfront constructions. It can mandate to obtain NOC under the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981 and Environment Protection Act, 1986 for such sensitive areas.

## Annexure 1: Questionnaire for interaction with department officials

Given below are the set of thematic questions which were used to guide the interactions with the various stakeholder departments.

### **Theme 1: Understanding Building Regulations and Rules**

- Please describe the existing building rules in terms of the following aspects
  - Year of formulation
  - How often the rules have been revised?
  - Subsequent amendments
  
- How effective the existing building rules are in terms of local implementation and enforcement?
- Do the existing building rules sufficiently address the structural safety against natural and climate-related-hazards?
- Do you have the hazard maps that help determine if the site of the buildings are in hazard prone areas? If so, what scale of hazard maps are available?
- Are your building rules in alignment with the national building regulatory frameworks such as National Building Codes and IS codes?
- Does the building permit sanctioning process involve submission of structural drawings with calculation?
- Are all structural calculations checked by your department?
- What is the minimum qualification of the officials checking the calculations?
- Are there provisions for engineers from the department / office to visit site during the construction?
- At what stages of the construction are the visits (e.g. foundation level, lintel level, roof level etc.)?
- How does the official issuing the occupancy certificate ensure the structural safety of the building?
- Is a structural stability certificate mandated from the builders before giving occupancy certificate?
- Is there a practice for assessing the structural vulnerability of the buildings post disaster solutions?

### **Theme 2: Training and Capacity Building**

- How many engineers / architects / technical experts does your department / office have?
- How many officials / staff members in place till today have received any kind of training in assessing structural safety?
- Has your department / office conducted mason training? Was it hands-on? Is there certification for trained masons?
- Is there awareness among all stakeholders about disaster resilient buildings?



- Are there specialized professionals engaged in checking whether the building design is resistant to natural and climate-induced-hazards?
- Do the engineers, overseers, architects, and planners comfortably interpret existing building rules?
- Have they ever been trained on existing building rules?

### **Theme 3: Understand the plans of the city administration**

- How often do you carry out structural safety audits, and for what types of buildings?
- Does your department / office have comprehensive list of critical / lifeline structures that may need to be assessed for structural safety?
- Does your department / office have in-house capacity to conduct the structural safety assessment in the city?
- Does your department undertake retrofitting measures for unsafe public buildings?
- Are there any incentives associated with buildings for performing structural safety audits?
- Is fitness certificate mandated for any category of buildings in specific intervals?

### **Theme 4: Role of the Private Sector in enhancing Structural safety audit**

- Does your department / office collaborate with private sector in building design or safety assessment?
- Does the private sector need capacity building programs for structural safety assessment?
- How can the private sector engage with your department in ensuring disaster resilient construction?
- Are there initiatives undertaken at the city / state level to disseminate hazard resistant construction awareness among private stakeholders and house owners?

### [Annexure 2: List of departments interacted](#)

As part of preparing this baseline assessment report, the project team interacted with officials of the following key stakeholder departments.

1. Himachal Pradesh Public Works Department
2. Directorate of Urban Development
3. Bharat Sanchar Nigam Limited (BSNL)
4. Town and Country Planning (TCP)
5. Architect Planning – Shimla Municipal Corporation
6. Road and Building – Shimla Municipal Corporation
7. Himachal Pradesh Housing and Urban Development Authority