TERMS OF REFERENCE

CONSULTING SERVICE FOR SEISMIC VULNERABILITY ASSESSMENT AND PREPARATION OF SEISMIC RETROFITTING DPRS OF HEALTH CENTERS FOR THE STATE OF UTTARAKHAND

1. Background

As per the Seismic Zoning Map of India (IS 1893, Part II) Uttarakhand lies in Zone IV and Zone V and is likely to experience damaging earthquakes. Four districts of Uttarakhand (Pithoragarh, Bageshwar, Chamoli and Rudraprayag) fall completely and other five (Almora, Champawat, Tehri, Uttarkashi and Pauri) fall partially in Zone V. Earthquake is however not the sole disaster related concern for Uttarakhand that is frequented by a number of other natural disasters that are attributed to geological insatiability, high seasonal precipitation and the related geomorphic characteristics. Apart from earthquake the state is often affected by landslides, flash floods, cloudbursts, forest fires and avalanches. Landslides in the state are particularly common along two salient tectonic discontinuities; Main Boundary Thrust (MBT) and Main Central Thrust (MCT). Due to increasing anthropogenic pressure and extreme weather incidences both frequency and magnitude of disasters are on the rise and these pose a serious threat to human lives and property.

Every year the state faces significant losses, particularly during the monsoon season, due to heavy rains, landslides and flash floods. These cause serious disruption of transport, electricity, water supply, communication and other private and public infrastructure. Crop yields of small and marginal farmers in the rain fed areas of the hills are seriously affected by fluctuations in the precipitation regime and their agricultural and other lands are often lost permanently, particularly in landslide and flash flood incidences. Repeated disaster incidences adversely affect the pace of economic growth and development and these impose recurring and ever increasing pressure upon the public exchequer. This seriously warrants efforts from every quarter to reduce human miseries as also economic losses due to disasters in Uttarakhand.

Despite being prone to multiple disasters Earthquake is a major concern for Uttarakhand. In the previous 20 years this region has experienced two earthquakes of magnitude more than 6 on Richter scale (Uttarkashi, 1991 and Chamoli, 1999). These earthquakes, though of moderate magnitude caused immense loss of life and property (Table 1) which highlights the vulnerability of the built environment. The State is however located in seismic gap of 1905 Kangara Earthquake and 1935 Bihar – Nepal Earthquake and is identified as the potential location of a future devastating earthquake.

Table1. Summary of losses incurred in 1991 Uttarkashi and 1999 Chamoli earthquakes.

	1991 Uttarkashi Earthquake	1999 Chamoli Earthquake
Human lives	768	106
Injured humans	5,066	395
Cattle lost	3,096	327
Houses damaged (full)	20,242	14,724
Houses damaged (partial)	74,714	72,126

Despite immense scientific progress there still exists high degree of uncertainty in earthquake prediction, in space and time. Thus for reducing earthquake induced losses one is left with the only option of ensuring adequate performance by the built environment during an earthquake event. Changes in the techno-legal regime and ensuring compliance of the same together with

strengthening the existing infrastructure to improve its seismic performance are thus rendered high priority.

To assess the existing Government infrastructure in the State of Uttarakhand (India), Government of Uttarakhand has launched a program of Rapid visual Screening (RVS) of all Government buildings funded by the World Bank. The rapid visual screening (RVS) method is designed to be implemented without performing any structural calculations. The procedure utilizes a scoring system that requires the evaluator to (1) identify the primary structural lateral load-resisting system, and (2) identify building attributes that modify the seismic performance expected for this lateral load resisting system. The inspection, data collection and decision-making process typically occurs at the building site, and is expected to take around 30 minutes for each building. The screening is based on numerical seismic hazard and vulnerability score. The scores are based on the expected ground shaking levels in the region as well as the seismic design and construction practices for the city or region. The scores use probability concepts and are consistent with the advanced assessment methods. The RVS procedure can be integrated with GIS-based city planning database and can also be used with advanced risk analysis software. The methodology also permits easy and rapid reassessment of risk of buildings already surveyed based on availability of new knowledge that may become available in future due to scientific or technological advancements.

Presently RVS of 1464 Health building is completed, and the proposed 154 Health buildings for the seismic vulnerability assessment are chosen according to the importance of the building and vulnerability condition .The RVS survey which we have done give a full detail of the structural vulnerability of the Health building ,but in the Health building non- structural elements also play an vital role in the vulnerability, therefore it is important to consider the non- structural vulnerability in seismic vulnerability assessment.

2. Seismic Retrofitting: The principles

Earthquakes are known not to damage the entire built environment of the affected area in a similar fashion. Damages incurred by the structures are a function of the performance of the buildings during an earthquake event and is it universally recognized that the losses can be significantly reduced by conscious efforts to improve the seismic performance of the buildings.

Seismic retrofitting is a technique of improving building performance during an earthquake event by introducing suitable modification in the existing structures so as to make these more resistant to seismically induced ground motions and / or soil failure events. Better understanding of seismic demand on structures through recent seismic experiences has led to universal acknowledgement of the need of seismic retrofitting. Prior to the introduction of modern seismic codes, in the late 1960s in developed countries and in late 1970s in many other parts of the world, most structures were designed without adequate detailing and reinforcement for seismic protection.

Seismic retrofitting is therefore a technique of providing more resistance to seismic activity in the existing structures. In the buildings this process typically includes strengthening of weak connections that are generally found in roof to wall connections, continuity ties, shear walls and the roof diaphragm. Retrofitting is thus a combination of technical interventions in structural system of a building which involve actions for upgrading the seismic resistance of an existing building so that it

becomes safer under the effect of probable future earthquakes. Retrofitting is thus intended to improve the resistance to earthquake activity by optimizing the strength, ductility and earthquake loads. It is worth noting that the strength of the buildings is generated from their structural dimensions, materials, shape, and number of associated structural elements and retrofitting attempts at improving the building strength through well planned structural interventions in these features of the building.

The required ductility in a building is primarily achieved through good detailing together with quality and type of materials used while the earthquake load is a function of the site response, mass of the structure, and the degree of seismic resistance in the building. In the light of these facts retrofitting involves introduction of appropriate interventions in the building so as to enable it to perform better during earthquakes.

3. Retrofitting Need

Retrofitting is needed where the assessment of structural capacity of the building indicates insufficient capacity to resist the forces of expected earthquake intensity and the ensuing damage is likely to exceed the acceptable limits. It is important to note that poor quality of materials and damage to structural elements are not the sole reasons for retrofitting a building. Changes in the building's function, environmental conditions and building codes could also give rise to retrofitting need.

Building codes are sets of regulations governing the design, construction, alteration, and maintenance of structures. They specify the minimum requirements to adequately safeguard the health, safety, and welfare of building occupants. The main purpose of building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures. Adoption and enforcement of up-to-date building codes is critical to reduce the community's risk to earthquakes. Evaluating older buildings and retrofitting structural and non-structural components also are critical steps. Residential and commercial building codes provide a comprehensive set of minimum health, safety and energy standards for the design, construction and maintenance of new houses and buildings, and major renovations. They set an understandable and reliable floor for construction practices that reduce our vulnerability to a wide range of hazards.

4. Objective

With an overall goal of increasing the State Disaster Resilience capacity in Uttarakhand, the consulting services ("the Services") shall have main objective to assess the seismic performance of ninety existing government hospital and health care centers of the state, and design retrofitting solutions to prevent structural damage to these buildings due to earthquakes. The work would provide sustainable and cost effective measures to ensure lesser impact of earthquakes to health centers of the state.

5. Scope of Work

Retrofitting is a technical exercise and has to be undertaken under the supervision of trained and experienced personnel. In most retrofitting works structural engineer has a major role to play. Structural capacity of the building has to be first assessed and analyzed based on which appropriate retrofitting technique has to be designed so as to eliminate the structural deficiencies. Before given

retrofitting solution of any building the consultant should consider the factors like technical aspects, cost implications, importance of building, availability of adequate technology, duration of works etc. The consultant shall constitute a team of experts, consisting of personnel having requisite qualification, and experience to perform the following works under these Services.

Analyze existing information of ninety (Total 154 in combining all units) health centers in the State;

1. Conduct a seismic vulnerability assessment of ninety (154 all blocks) health centers, in order to evaluate the current seismic performance of the buildings;
2. Select cost-effective and sustainable technical solutions and state of art techniques for seismic retrofitting of the vulnerable buildings;
3. Conduct a seismic analysis of the vulnerable buildings for evaluation of the improved structural performance and definition of the retrofitting strategy; and
4. Prepare detailed project reports (DPR) for all buildings that require seismic retrofitting.

Specifically, the consultant shall conduct the following tasks:

1. Collate and analyze relevant information of ninety (154 all blocks) health centers in the State
   - Collate and verify existing information from the Rapid Visual Screening (RVS), Census and State data for the given health centers.

   From the RVS various parameters which are responsible for the vulnerability of Health Buildings are available. And from the census data the population getting affected can be determined.

Health facility	**Population Norm**	
	Plain area	Hilly/Tribal area
Sub-health center	5,000	3,000
Primary health center	30,000	20,000
Secondary health center	120,000	80,000

   - Collect any additional data needed to conduct all the following tasks while taking into account the construction quality, deterioration state and functional conditions of the buildings. This task might require the performance of non-destructive tests (NDT) and any other actions needed to refine the numerical models used in the seismic analyses and retrofitting design.

2. Conduct a seismic vulnerability assessment of ninety (154 all blocks) health centers, in order to evaluate the current seismic performance of the buildings:

   - Liaise with the Government to identify the performance level expected for the health care centers;
   - Build a model of each and all buildings of the 90 health centers (154 all blocks) and conduct structural analyses considering the non-linear response and the actual condition (construction quality and deterioration) of the structures. The aim is to

evaluate the seismic performance of the buildings under appropriately selected ground motions. Relevant building codes and standards must be followed in this task;
- Take into account the performance of non-structural elements (such as equipment) in your analyses;
- Identify the buildings that are vulnerable and require reconstruction or seismic retrofitting.

3. Select cost-effective and sustainable technical solutions and state of art techniques for seismic retrofitting of the vulnerable buildings:

    - Identify cost-effective and sustainable technical solutions for seismic retrofitting of the vulnerable buildings;
    - Select retrofitting techniques based upon: technical aspects (benefits in terms of structural performance), use of the building after a disaster as a critical facility, costs, availability of technology and technical capacity, implementation (duration of works, service disruption), among others.

4. Conduct a seismic analysis of the vulnerable buildings for evaluation of the improved structural performance and definition of the retrofitting strategy:

    - Conduct structural analyses considering the non-linear response and the retrofitted condition of the structures. The aim is to evaluate the benefit of the retrofitting interventions in terms of seismic performance under appropriately selected ground motions. Relevant building codes and standards must be followed in this task;
    - Take into account the performance of non-structural elements (such as equipment) in your analyses;
    - Conduct cost-benefit analyses to identify the buildings that require reconstruction instead of retrofitting, and to identify the type and level of retrofitting to be designed for the expected performance levels;
    - Based on the results of the cost-benefit analyses, discuss and define with the Government the most efficient retrofitting strategy. Consider in the analyses the possibility of incremental retrofitting.

5. Prepare detailed project reports (DPR) for all buildings that require seismic retrofitting.

    - Prepare DPR for each and all buildings that require reconstruction or retrofitting;
    - Take into account the functionality of the buildings, fire safety and emergency evacuation in the design of interventions.

The consultancy is proposed for the following ninety (154 all blocks) selected health centers in the State. Most of the buildings to be assessed and retrofitted are either load bearing masonry wall or confined masonry buildings.

ALMORA DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**Units**	**Covered Area (m^2)**	**No of stories**	**Type of Structure**	**Construction Year**	**Location**
1	Mahila Chikitsalya	Almora	Hawal Bagh	A	713.65	2	Masonry	1899	29.59754333, 79.65908667
				B	290.71	2	Masonry	1920	
				C	675.52	1	Masonry	1919	
				D	174.85	2	Masonry	1980	
2	Samudayik swasthiya kendra Dwarahat	Almora	Dwarahat	A	101.65	2	Masonry	1965	29.75453500, 79.42417333
				B	334.00	1	Masonry	1965	
				C	1084.94	1	Masonry	1992	
3	Community Health Center Lamgarha	Almora	Lamgarha	A	721.44	2	Masonry	1983	29.54057167, 79.75065167
4	PHC Tarikhet	Almora	Tarikhet	A	470.25	1	Masonry	1960	29.61792000, 79.40857833
5	Primary Health Centre Daulaghat	Almora	Hawal Bagh	A	288.51	1	Masonry	1999	29.67183833, 79.57808333
6	Rajkiya Allopathic Chikitsalaya Machkhaali	Almora	Dwarahat	A	287.92	1	Masonry	2000	29.67575333, 79.51032500
7	Primary Health Centre Dhamas	Almora	Hawal Bagh	A	282.76	1	Masonry	2004	29.60034333, 79.58096667

BAGESHWAR DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No. of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Ayurvedic Hospital Chora	Bageshwar	Bageshwar	A	63.887.275	1	Masonry	2006	29.87507000, 79.85618000
				B	43.56	1	Masonry	2006	
				C	93.60	1	Masonry	2006	
2	Govt Homeopathic Hospital Sirkot	Bageshwar	Garud	A	374.4	2	RC	2006	29.96179667, 79.57374333

3	Primary Hospital shama	Bageshwar	Kapkot	A	270.333	1	RC	2004	30.04169667, 80.06309167
4	Primary Health Center Beda	Bageshwar	Kapkot	A	239.7	1	RC	2003	29.90113833, 79.88997000

CHAMOLI DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Ati Prathmik Swasthya Kendra chopta	Chamoli	Narain Bagar	A	51.12	1	Masonry	1985	30.18082477, 79.37234633
				B	120.40	2	Masonry	1995	
2	Samudayik swasthiya kendra Gairsain	Chamoli	Gairsain	A	123.284	1	Masonry	1992	30.05322000, 79.29047667
				B	419.66	2	RC	2004	
				C	190.64	1	Masonry	1998	
				D	464.34	1	RC	2008	
				E	872.46	2	RC	2008	
3	Samudayik Swasthya Kendra, Karnprayag	Chamoli	Karnaprayag	A	239.99	2	Masonry	1970	30.25878930, 79.21924300
				B	508.26	2	Masonry	1988	
4	Prathmik Swasthya Kendra, Ghat	Chamoli	Ghat	A	107.088	1	Masonry	1985	30.25726667, 79.44821833
				B	229.475	1	Masonry	1974	
5	Rajkiya Alopathy Chiktsalaya, Badrinath	Chamoli	Joshimath	A	409.5	1	Masonry	1980	30.74067333, 79.49339000
6	Rajkiya Alopathy Chiktsalaya, Bampa/Maithana	Chamoli	Joshimath	A	367.61	1	Masonry	1980	30.74463500, 79.82916833
7	Prathmik Chikitsalaya Narain Bagar	Chamoli	Narain Bagar	A	239.976	1	Masonry	1970	30.14659073, 79.37447585
8	Rajkiya Allopaethic Hospital Devalkot Gairsain	Chamoli	Gairsain	A	172.032	1	RC	2009	30.16729500, 79.17843333
9	Govt Allopethic Hospital Boragad	Chamoli	Dewal	A	159.36	1	Masonry	2011	30.02935167, 79.65235667

CHAMPAWAT DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Community Health Center Lohaghat	Champawat	Lohaghat	A	15 58.32	2	Masonry	1998	29.40404500, 80.09295500
2	Community Health Center Manch	Champawat	Lohaghat	A	94.16	1	RC	1992	29.34049333, 80.11774167
				B	116.25	1	RC	2004	
				C	85.49	1	Masonry	1998	
				D	235.98	1	RC	2008	
3	District Homeopathy Hospital Champawat	Champawat	Champawat	A	209.55	2	RC	2014	29.33282167, 80.09269667
4	Primary Health Center Chaudamehta	Champawat	Pati	A	419.12	1	Masonry	1996	29.33852500, 80.09166167

DEHRADUN DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	CHC Doiwala	Dehradun	Doiwala	A	1672	2	Masonry	1989	30.17976647, 78.12309794
				B	431.27	1	Masonry	1970	
				C	124.645	1	Masonry	1970	
				D	142.16	1	Masonry	2001	
				E	49.43	1	Masonry	2001	
2	PHC Bhagwantpur	Dehradun	Sahaspur	A	238.08	1	Masonry	2006	30.40509333, 78.06975667
				B	35.65	1	Masonry	2006	
3	Govt Hospital Kaalsi	Dehradun	Kalsi	A	373.91	1	Masonry	1944	30.51907000, 77.84389833
4	PHC Gumaniwala	Dehradun	Doiwala	A	356.7	1	Masonry	2000	30.17660841, 78.15939144

5	PHC Tyuni	Dehradun	Chakrata	A	507	2	RC	2011	30.94247833 77.84857500
				B	210.945	1	Masonry	2007	
				C	57.55	1	Masonry	2008	
				D	70.07	1	Masonry	2008	
				E	180.50	1	Masonry	1998	
6	PHC Sabhawala	Dehradun	Vikasnagar	A	63.72	1	Masonry	2008	30.36734764 77.79259305
				B	27.30	1	Masonry	2012	
7	PHC Raiwala	Dehradun	Doiwala	A	152.44	1	Masonry	2000	30.03305643 78.20719887
8	PHC Nehru Gram	Dehradun	Raipur	A	141.94	1	Masonry	1988	30.29272775 78.08007657

HARIDWAR DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	PHC Imlikheda	Haridwar	Roorkee	A	936.85	1	Masonry	1975	29.93589060, 77.90866140
2	PHC Landhora	Haridwar	Narsan	A	224.4	1	Masonry	1980	29.79510250, 77.95125200
				B	29.14	1	Masonry	2011	
3	PHC Kota Muradnagar	Haridwar	Bahadrabad	A	2407	1	Masonry	2003	29.95833160, 77.95682490
4	PHC Dhanori	Haridwar	Roorkee	A	135.85	1	Masonry	2004	29.94370000, 77.96145500
5	PHC/ANM center alawpur	Haridwar	Bahadrabad	A	130.98	1	Masonry	1995	29.84351030, 78.00361490
6	PHC Manglore	Haridwar	Narsan	A	129.8	1	Masonry	2001	29.79151360, 77.86997160
7	PHC Latherdeva Hund/Parivar kalyan kendr	Haridwar	Narsan	A	90.95	1	Masonry	1983	29.79394000, 77.80580030

PAURI DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Primary Health Center Persundakhal	Pauri	Pauri	A	56.525	1	Masonry	2010	30.07868667, 78.77926333
				B	70.7	1	Masonry	2010	
				C	127.6	1	Masonry	1995	
				D	51	1	Masonry	2006	
				E	156.75	1	Masonry	1990	
2	District Hospital Pauri	Pauri	Pauri	A	2315.4	2	Masonry	1960	30.15071667, 78.77356833
				B	660	1	Masonry	1999	
3	CHC Kaljikhal	Pauri	Kaljikhal	A	929.88	2	Masonry	1987	30.02441500, 78.69399667
4	PHC Dogadda	Pauri	Dogadda	A	174.8	1	Masonry	1980	29.80719333, 78.61262000
				B	104.39	1	Masonry	1990	
5	PHC Jhandichaur	Pauri	Dogadda	A	310.34	1	Masonry	1991	29.77594000, 78.40908833
6	PHC Dumakot	Pauri	Naunidanda	A	224.28	1	Masonry	1985	29.74741667, 79.01369333
7	PHC Kalaalghati	Pauri	Dogadda	A	192.279	1	Masonry	1959	29.78065667, 78.44107833
8	PHC Dadamandi	Pauri	Dwarikhal	A	183.06	1	Masonry	1970	29.86377427, 78.61072936
9	Govt Allopathic Hospital Bhrigukhal	Pauri	Yamkeshwar	A	180	2	Masonry	1964	29.92415167, 78.46075500
10	Govt Homeopathic Hospital Thalisain	Pauri	Thalisain	A	178.18	1	Masonry	1995	30.02249905, 79.04758164
11	Govt Allopathic Hospital	Pauri	Dogadda	A	174.89	1	Masonry	2000	29.75475667,

	Motadhak								78.46019000
12	Govt Primary Health Center Zahrikhal	Pauri	Zahrikhal	A	174.25	1	Masonry	1984	29.86740104, 78.68103069

PITHORAGARH DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Primary health centre Barbe	Pithoragarh	Munakot	A	276.13	1	Masonry	1965	29.50572167, 80.22958333
				B	70.49	1	Masonry	1965	
				C	133.87	1	Masonry	1965	
				D	28.98	1	Masonry	1965	
				E	37.95	1	RC	1965	
				F	81.4	1	Masonry	1965	
2	Hare Govind Pant Mahila Hospital	Pithoragarh	Pithoragarh(BIN)	A	609.56	2	Masonry	1982	29.57892600, 80.20784850
				B	521.24	1	Masonry	1980	
				C	276.96	1	Masonry	1985	
				D	303.6	2	RC	1983	
				E	46.62	1	Masonry	1984	
3	CHC Didihat	Pithoragarh	Didihat	A	1632	3	RC	2000	29.80551106, 80.24549720
4	CHC Tejam	Pithoragarh	Munsyari	A	247	1	Masonry	1998	29.95224667, 80.13056167
				B	114.13	1	Masonry	2009	
5	CHC Berinag	Pithoragarh	Berinag	A	336	1	Masonry	1965	29.77991113, 80.05440038
6	PHC ASKOT	Pithoragarh	Kanali Chhina	A	288	1	Masonry	1955	29.76240414, 80.33661851
				B	76	1	Masonry	2002	
7	PHC Bhagichaura	Pithoragarh	Kanali Chhina	A	192	1	Masonry	2003	29.72139914, 80.33703283

RUDRAPRAYAG DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Govt Allopethic Hospital Gholteer	Rudraprayag	August Muni	A	619.92	2	Masonry	1998	30.29931833, 79.10510667
2	Govt Allopethic Hospital Tilwara	Rudraprayag	August Muni	A	505.09	2	Masonry	2000	30.33963833, 78.96825000
3	Govt Allopethic Hospital Guptkashi	Rudraprayag	Ukhimath	A	298.06	1	Masonry	1964	30.52842167, 79.08226833
4	Ati Prathamic Swashtya Kendra Chopda	Rudraprayag	August Muni	A	228.85	1	Masonry	2015	30.32122667, 79.05519833
5	Govt Allopethic Hospital Saurakhaal	Rudraprayag	Jakholi	A	200.52	1	Masonry	1985	30.30246167, 78.89733000
6	Govt Allopethic Hospital Gwad	Rudraprayag	Unknown	A	165.85	1	Masonry	2005	30.25553333, 78.97788167

TEHRI DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	PHC Pilkhi	Tehri	Bhilangana	A	428.33	2	Masonry	1982	30.41539000, 78.63177500
				B	429.50	1	Masonry	1995	
2	Primary Health Center Fakot	Tehri	Narendra Nagar	A	434.02	2	Masonry	1974	30.22825833, 78.35175667
				B	16.5	1	Masonry	1995	
3	CHC Devprayag	Tehri	Devaprayag	A	636.24	1	RC	2011	30.15800667, 78.59883833
4	Community Health Center Kirtinagar	Tehri	Kirtinagar	A	408.25	1	RC	2002	30.21625500, 78.74652333
				B	120.96	1	Masonry	2005	
5	CHC Hindolakhal	Tehri	Devaprayag	A	546	1	Masonry	1991	30.22616000, 78.59616833

6	Govt Ayurvedic Hospital Jaajal	Tehri	Narendra Nagar	A	94.15	1	Masonry	2005	30.26969833, 78.36682000
				B	17.36	1	Masonry	2005	
7	Additional PHC,Nainbagh	Tehri	Jaunpur	A	181.65	1	Masonry	1997	30.57111333, 78.00496333
				B	135.72	1	Masonry	2011	
8	Additional PHC Anjanisen.	Tehri	Jakhanidhar	A	178.19	1	Masonry	1956	30.31317833, 78.58940333
				B	134.32	1	Masonry	2000	
9	Govt Ayurvedic Hospital Narendranagar	Tehri	Narendra Nagar	A	311.61	2	Masonry	1987	30.16086667, 78.28701500
				B	142.27	2	RC	2010	
10	Ati prathmic Swashtya kendra New Tehri	Tehri	Chamba	A	109.69	1	Masonry	1988	30.37577167, 78.43292000
				B	37.5	1	Masonry	1988	
				C	135.75	1	Masonry	1988	

UDHAM SINGH NAGAR DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Govt. Allopatheic Hospital Haldi	Udham Singh Nagar	Rudrapur	A	180	1	Masonry	2004	29.03599000, 79.44877167
2	Primary Health Centre Gularbhoj	Udham Singh Nagar	Gadarpur	A	280	1	Masonry	1990	29.11378667, 79.30266333
3	Primary Health Centre Sakeniya	Udham Singh Nagar	Gadarpur	A	286	1	Masonry	1994	29.03660500, 79.17612500
4	Primary Health Centre Mohanpur	Udham Singh Nagar	Gadarpur	A	170	1	Masonry	1995	29.01040333, 79.29379667
				B	144.38	1	Masonry	1995	
5	Primary Health Centre Dineshpur	Udham Singh Nagar	Gadarpur	A	116	1	Masonry	1995	29.04628333, 79.32093667
				B	80	1	Masonry	2000	
				C	117	1	Masonry	2000	
				D	34.88	1	Masonry	2012	
6	Govt. Allopatheic Hospital Raipur Gadarpur	Udham Singh Nagar	Gadarpur	A	150.75	1	Masonry	2011	29.02241000, 79.33837333

UTTARKASHI DISTRICT									
S.No.	**Building Name**	**District**	**Block**	**No of Units**	**Covered Area (m^2)**	**No of Stories**	**Type of Structure**	**Construction Year**	**Location**
1	Govt Ayurvedic Hospital Maneri	Uttarkashi	Bhatwari	A	28.5	1	Masonry	2000	30.74014000, 78.53510000
				B	24.42	1	Masonry	2000	
2	Govt Primary health centre bhatwari	Uttarkashi	Bhatwari	A	283.1	1	Masonry	1993	30.80585262, 78.62054017
				B	107.06	1	Masonry	1989	
				C	506.3	2	RC	2007	
3	Govt Alopathic hospital Kalyani	Uttarkashi	Dunda	A	306.8	1	Masonry	1990	30.64975667, 78.30485667
				B	37.4	1	Masonry	2013	
4	Govt Primary hospital Kharadi	Uttarkashi	Naugaon	A	390	1	Masonry	1955	30.84426833, 78.27097667
				B	210	1	RC	2005	
5	Govt Allopathic hospital Maneri	Uttarkashi	Bhatwari	A	402.9	1	Masonry	1987	30.74108739, 78.52971800
6	Govt Primary hospital mori	Uttarkashi	Mori	A	335.48	1	Masonry	1985	31.02003667, 78.04481000
7	Allopathic Hospital Harsil Bhatwari	Uttarkashi	Bhatwari	A	163.06	1	Masonry	1955	31.03620333, 78.75201333
				B	141.71.	1	Masonry	1992	
8	Ayurvedic Hospital khand	Uttarkashi	Chinyalisaur	A	129.56	1	RC	2005	30.58944333, 78.35715500
				B	26.1	1	RC	2014	
9	Govt Allopathic Hospital Raithal	Uttarkashi	Bhatwari	A	255.36	1	Masonry	2006	30.82068667, 78.60353167
10	Primary hospital banchura	Uttarkashi	Chinyalisaur	A	228	1	RC	2010	30.64945833, 78.21684500

6. Performance Levels

The consultant will liaise with the Government to select the expected performance level for health care centers in the State. Seismic retrofitting is undertaken to achieve the following performance levels, characterized by various levels of structural and material survivability determined by human and economic considerations:

a) ***Public safety only*****:** The goal is to protect human life, ensuring that the structure does not collapse upon its occupants or passerby, and that the occupants get enough time to make a safe exit. Under severe seismic shaking conditions the structure might be rendered useless, requiring tear down and replacement.

b) ***Structure survivability*****:** The goal is to ensure that the structure remains safe for exit and can be put to use after extensive repair. The option of reconstruction is thus ruled out. This is typically the lowest level of retrofit applied to bridges.

c) ***Structure usability*****:** The goal here is to ensure that the functional aspects of the building are not disrupted by seismic event. The structure may however require extensive repair or replacement of components so as to ensure that it performs satisfactorily during the next major seismic event. This is typically the lowest level of retrofit recommended for lifeline structures. It is often the most economical level of retrofit option for transportation infrastructure such as rail and highways, bridges and tunnels. This level of retrofit is also required for the water supply and fire fighting infrastructure that are required to function after an earthquake.
A high level of retrofit is required for ensuring that the primary structure is undamaged and its functionality is maintained after an earthquake. This level of retrofit ensures that the repair related requirements after an earthquake are of cosmetic nature; for example minor cracks in the walls. This is the minimum acceptable level of retrofit for hospitals.

d) **Structure unaffected:** This level of retrofit is preferred for historic structures of high cultural significance.

7. Methods of retrofitting

There exist a number of methods for undertaking seismic retrofitting of structures. Depending of the retrofitting objectives that include increase in the load, deformation, and/or energy dissipation capacity of the structure (FEMA, 2000) together with availability of resources and technical expertise a suitable retrofitting methodology can be chosen but these are not limited.

8 Approval of Drawing

The client reserves the right to approve the drawing in full or in part depending upon the information available.

The client shall, however, have full power and authority to modify from time to time, during the progress of works, the drawings approved previously, as shall be necessary for the purpose of proper and adequate execution / completion of works.

On completion of review, the client will return the submission with one of the following comments:
"Approved" to allow work to proceed.
"Approved (with held)" to allow work to proceed subject to amendments and Conditions.
"Not approved" resubmission required incorporating comments given.

The client may withdraw or modify his approval of approved drawings as result of subsequent submissions, in case they contradict the provisions based on which the approval is given. The Consultant shall review of such designs/drawings without any extra cost.
Approval of drawings by the client shall mean checking in principle only and not verifying every dimension and detailed manner. To enable the Client to appreciate/ understand the observations/ comments of Consultant, the Consultant shall submit all the required documents such as drawings, Design calculations, explanatory note containing adopted design criteria, and loads etc., brief description of methodology used as well as the results etc.

Review of Computerized Analysis and Design

Following shall be compiled by the consultant in his submittals for review:

- Consultant shall use accredited / validated software and the same shall be indicated.
- Details of figures of Models, wherever applicable.
- All information as called for in clause of design calculations.
- In case Client asks for validation sample examples calculations of the engineering software used, Consultant shall furnish the same without extra cost to client.
- Consultant shall submit printout and softcopies of all pages as appeared in output of the computer Programme without disturbing the output as generated by the program. Consultant shall also submit all the software used for the designs and drawings.

Comments of the Client shall be delivered to the consultant's office in Dehradun. The date of dispatch of comments to the consultant from the Client's office shall be considered as the date of delivery. The consultant will submit the comments in duplicate hard copies and soft copy to the Engineer-in-Charge and will also be required to give a presentation on the same as & when required. Weekly progress report shall be discussed with the Engineer-in-Charge for further improvement in the future activity schedule. On completion of works, the as- built drawings submitted by Contractors will be reviewed by the consultant.

In order to perform the above activities efficiently, the consultant at his own cost is required to establish a well-equipped office having sufficient number of professional experts at Dehradun (Uttarakhand) for carrying out various design/design review activities and assist the Client in approval of different reports/ design documents and drawings during contract period and attend the meeting with Client and Contractors.

9 Expected Inputs

The composition and duration for services expected for the Retrofitting Consultant is as per the suggestions given in Table below. This table is given only for guidance and the Retrofitting Consultant shall make his own assessment of the extent of involvement of various professionals.

S.No.	KEY PROFESSIONAL / EXPERT/SUPPORT STAFF	Man month	Scope	Input	Numbers
KEY PROFESSIONAL / EXPERT					
1	Team leader cum Specialist	9	Analysis, Design &DPR	Full time	1
2	Sr. Structural Engineer / Earthquake Engineer	9	Analysis, Design &DPR	full time	1
3	Structural Engineer / Earthquake Engineer	54	Analysis, Design &DPR	full time	6
4	Surveyor	24	Analysis, Design &DPR	intermittent input	4
5	DPR and procurement expert	5	Design &DPR	intermittent input	1
SUPPORT STAFF					
6	CAD Draftsman	10	Design &DPR	intermittent input	2
7	Assistant Surveyor	10	Design &DPR	intermittent input	2

10 Additional Services

The retrofitting consultant shall, if so required by the Client, provide any additional service at rates or on man-month rates as per the contract, or as mutually agreed upon, as a variation order.

Deliverables

The retrofitting Consultant will prepare and submit the following reports to the Client on the format prepared by the retrofitting Consultants and as approved by the Client.

Sl. No.	Report	Frequency	Due Date	No. of Copies	No. of CDs
1.	Inception Report	One Time	Within 30 days after commencement of services.	5	1
2.	Results of seismic analyses of all given hospital buildings (current condition)	One time	Within 90 days after commencement of service	5 for every building	1
3.	Results of seismic analyses of vulnerable hospital buildings after retrofitting	One time	Within 150 days after commencement of service	5 for every building	1
4	Good for construction drawings/Design and final DPR of the proposed retrofitting work of the buildings	Periodically	First 40 buildings' drawings and DPRs shall be submitted within 30 days after deliverable 3 and then after every 30 days submit 40 buildings' drawings and DPRs	5 for every building	1
5	Progress Report (Monthly & Quarterly)	Every month	10th of following month and 10th of the 1st month of next quarter beginning.	5	1
5	Occasional updated report& Presentations	As and when asked by the PIU	Immediately	3	1

Time Period of Consultancy: The expected time for consultancy is 9 months.

Qualification and Experience Requirement of Key Personnel

TEAM LEADER CUM SPECIALIST

i)	Educational Qualification	
	Essential	Post Graduate in Structural Engineering or Earthquake Engineering
ii)	Essential Experience	
	a) Total Professional Experience	15 years
	b) Experience in building structural design	5 years as Team Leader and in contract administration and min 15 years in design of building & quality assurance, with sufficient experience in retrofitting design
	c) Experience in similar capacity	At least experience of 1 similar project

SR. STRUCTURAL ENGINEER / EARTHQUAKE ENGINEER

i)	Educational Qualification	
	Essential	Post Graduate in Structural Engineering or Earthquake Engineering
ii)	Essential Experience	
	a) Total Professional Experience	10 years
	b) Experience in building structural design	07 years in Analysis & design of building with sufficient experience in retrofitting design
	c) Experience in similar capacity	Independently handled the design work of at least 15buildings in similar topographic conditions

STRUCTURAL ENGINEER / EARTHQUAKE ENGINEER

i)	Educational Qualification	
	Essential	Post Graduate in Structural Engineering or Earthquake Engineering
ii)	Essential Experience	
	a) Total Professional Experience	8 years
	b) Experience in bridge design and engineering	Minimum 5 years in design buildings
	c) Experience in similar capacity	Involved in the design work of at least 5buildings in similar topographic conditions

DPR AND PROCUREMENT EXPERT

i)	Educational Qualification	
	Essential	Graduate in Civil Engineering
ii)	Essential Experience	
	a) Total Professional Experience	3 years

	b) Experience in Preparation of DPRs in bridge projects	2 years in preparation of DPRs of bridge construction projects for the Govt. of India projects or State Govt. projects. Experience in handling Procurement in respect of World Bank / ADB financed projects for 2 years is necessary.

SURVEYOR

i)	Educational Qualification	
	Essential	Bachelors in Civil Engineering.
ii)	Essential Experience	
	a) Total Professional Experience	5 years
	b) Experience in bridge sector	Min. 03 years as buildings survey, with sufficient experience in building survey assessment.
	c) Experience in similar capacity	Supervision of building construction related projects in similar topographic conditions

CAD DRAFTSMAN

i)	Educational Qualification	
	Essential	Diploma in Civil Engineering
ii)	Essential Experience	
	a) Total Professional Experience	5 years of experience in drawing, layout and sectional plan of typical buildings

ASSISTANT SURVEYOR

i)	Educational Qualification	
	Essential	Diploma in Civil Engineering
ii)	Essential Experience	
	a) Total Professional Experience	2 years of experience in building survey

Note: (i) Fitness certificate including ID proof with Photograph of the candidates need to be furnished

(ii) For non-key technical support professionals, CVs will not be included in the evaluation but must be submitted prior to deployment in the project, during the contract negotiations, to determine the adequacy of qualifications and experience.