IDENTIFICATION, PLAN AND DEVELOPMENT OF POST- EARTHQUAKE SAFE SHELTER FOR SHIMLA CITY

FINAL REPORT

SUBMITTED TO:

COMMISSIONER,
MUNICIPAL CORPORATION SHIMLA,
HIMACHAL PRADESH

SUBMITTED BY:

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PRINCIPAL INVESTIGATOR'S DECLARATION

I hereby certify that the work being presented in the Research Project entitled **"Identification, Plan and Development of Post Earthquake for Shimla City"** is carried out during the period from August 2017 to March 2018. The project was sponsored by Municipal Corporation Shimla, Himachal Pradesh.

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We are grateful to Mrs. Komal Kantariya, Shimla City Project Co-coordinator, UNDP India, for her efficient coordination between Project Investigators and Municipal Corporation Shimla during the initial phase of the project. Further, we are thankful to Sh. Manas Dwivedi, State Project Officer-Department of Revenue (Disaster Management Cell) - Himachal Pradesh for his extended support. We also appreciate the administrative assistance provided by Sh. Devender Kumar, PA to Commissioner MC Shimla.

We appreciate the efforts of Abhinandan, Project Assistant for conducting the survey of required sites for the development of Safe Shelter, compiling the collected data, preparing drawings and report.

We are thankful to National Institute of Technology Hamirpur for giving us the approval to work withMunicipal Corporation Shimla for this project.

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1.0 INTRODUCTION

Himachal Pradesh is vulnerable to various natural hazards such as earthquake, flash flood, cold wave, wildfire, landslide etc. The importance of vulnerability of the capital is increased in view of its strategic importance. Thus, Shimla among the various other cities of Himachal Pradesh is important being the capital. With the possibility of experiencing an earthquake, it becomes necessary to adopt an integrated disaster management approach for proper functioning of administration after an earthquake. The integrated approach could include one of the many features such as setting up of Safe Shelters covering various parts of Shimla City. The definition of safe shelter comprises the development of a particular site which could be selected after preliminary study and which can cater to the range of affected people say 500-2500 who have been either rescued or who need a shelter that would be able to provide medical facility, shelter, food and sanitation. So that, the dependency on only one or two organization can be reduced and a decentralized system can be developed which itself be able to provide the above mentioned important services to the affected people. The Safe Shelters would assist the administration to manage after earthquake situation and to provide basic medical and other facility to the local people for the first 24 hours and beyond which is the most crucial time for the people as well the local government.

Maintenance of such local level disaster management policies can set paradigm for sustainable and efficient approach after earthquake. For that, state level departments need to be supportive in adopting and incorporating after earthquake risk reduction strategy. This can be done by setting up Safe Shelters in Shimla City.

2.0 PROJECT PROPOSAL OBJECTIVES

The main objective of this project work will be to identify appropriate Safe Shelter for the event of an earthquake leading to a disastrous situation in Shimla city through.

a. Geotechnical judgment investigation of the building identified. The existing building selection will be based on acceptance of the site geotechnical suitable. Such location will be selected leading to non-requirement of geotechnical intervention.

b. The building will be selected based on the structural judgmental investigation. The building will be selected in appropriateness to the distribution across the city through

ward demarcation, the safe shelter capacity to be such that an appropriate population of the respective wards can accommodated.

c. The procedure shall be defined for the supply of drinking water from the nearest water source to the selected building.

d. The methodology for handling sanitation issue shall be formulated.

e. The project shall develop a model safe shelter with the required items to be replicated for other selected safe shelter location or can be modified as per requirement.

3.0 SCOPE OF WORK AND THE PROGRESSIVE CHANGES

This Research and Development Project was conceived with an objective that, various existing car parkings shall be selected for rapid visual survey which are spread in the various parts in the Shimla City. The Safe Shelter shall be judged for their structural suitability along with the possibility of slope failure of the land on which these structures exist. These slope failure criteria would be judged by the soil samples taken from the respective sites. As the project progressed the open ground and ground car parking were also considered for the rapid visual survey for the consideration of the site for safe shelter. Among these car parkings, one parking shall be taken up for the development as safe shelter. For the development of safe shelter, procurement of components shall be carried out as inventory sample to check the suitability and accordingly provide suggestion for their storage in safe shelters.

The Rapid Visual Survey (RVS) of the sites under the category of Open grounds, Parkings on Ground and Multi Level Parkings will be conducted with the developed RVS form. Along with the same the study of water bodies (Bawari) shall be conducted to check the suitability of the supply of water from these water bodies to the safe shelter. Procurement of Inventory samples shall be done simultaneously.

3.1 RAPID VISUAL SURVEYOF SITES SELECTED FOR SAFE SHELTER

The Rapid Visual Survey for sites as given by Road and Bridge Department, Municipal Corporation Shimla has been categorized as:

a) Open Ground
b) Parking on Ground
c) Multi Level Parking

Various parameters were observed while framing the format for RVS for the above mentioned categories of sites. Before starting the RVS, various parameters have been observed which would provide needful information about the site, nearby area and about nearest water source (bawari). The numbers of parameters are optimized so that complications in analysis of data can be eliminated. Parameters observed and considered for Open Ground and Parking on Ground are given in Section 3.1.1 and 3.1.2 respectively.

3.1.1 - PARAMETERS CONSIDRED FOR RVS OF OPEN GROUND AND PARKING ON GROUND

i) Area

Area of site is observed as an important parameter as the number of people that can be accommodated in the Safe Shelter will be based on the area available to be developed as Safe Shelter. The area of the ground is calculated in terms of approximate outer dimensions of the ground neglecting some obstructions and temporary structure.

ii) Vehicular approachability

Vehicular approachability to the Safe Shelter site is a necessity as the approach will provide convenience in supply of required material in the safe shelter. Sites counted under Vehicular approachable site category will be the site that has a distance ranging 10m to 50m from the nearby road.

iii) Distance from Near Water Source (Bawari)

Sites having water source nearby would be given preference. A distance of up to 500m would be considered for the Bawaris water source. Bawari's having distance more than 500m would be difficult to manage and taking water from those bawari's to the Safe Shelter site would be a tough situation to handle.

iv) Ground Condition

To get information of the present condition of the Ground, two options were considered which are: 1. Flat and 2. Undulated. Flatter ground will provide more convenience in fixing tentage and rescue operations. Also, a flatter ground will cater more number of rescued people.

v) Latitude and Longitude

The GPS details will assist in generating the map of the safe shelters in Shimla city.

3.1.2 - PARAMETERS FOR RVS OF BAWARI

i) Availability of water

This parameter will help in knowing the availability of water in a particular season.

Options which are considered for this particular parameter are mentioned below:

Option A – Throughout the year

Option B – Half year

Option C – Other (specify)

ii) Turbidity of water

Turbidity in water has huge physiology effect on the people who are drinking water. To know the level of turbidity of water available in the bawaris of the Shimla, this parameter is exclusively added in the RVS format. The options are mentioned below:

Option A – Clean

Option B – Few particles

Option C – Turbid

Option D – Very Turbid

iii) Discharge

After getting the information about the availability and drinkability level of water, the next important parameter with respect to water is the discharge of water. This parameter would assist in the usefulness of the nearest water body (Bawari). Discharge is recorded at the time of survey which was being conducted in the Month of October/ November and December. The discharge is approximated in Litre/minute.

iv) Latitude and Longitude

GPS location of Bawari has also been recorded to generate the GIS map of bawari and their distances from safe shelter

RVS FORMAT OF OPEN GROUNDS FOR POST-EARTHQUAKE SAFE SHELTER IN SHIMLA

Name of the Ground: _____	
Location: _____	**Date of inspection:** _____
Nearest Landmark: _____	**Year of construction:** _____

1.0 PARAMETERS FOR GROUND

S.NO.	PARAMETER	OPTION	UNIT	
i.	Area of Ground	-	Sq.m	
ii.	Distance of Ground from Nearest Road	-	m	
iii.	Distance from Near Water Source (Bawari)	-	m	
iv.	Ground Type	a. Flat b. Undulated	-	
v.	Approach road existing	a. Yes b. No	-	
vi.	Shelter Existing	a. Yes b. No	-	
viii.	Size of Shelter	-	L x B	
ix.	Latitude & Longitude	-	-	

2.0 PARAMETERS FOR BAWARI

S.NO.	PARAMETER	OPTION	UNIT	
i.	Name of Bawari	-	-	
ii.	Availability of water	a. Throughout the year b. half year c. Other (specify)	-	
iii.	Turbidity of water	a. Clean b. Few particles c. Turbid d. Very Turbid	-	
iv.	Discharge	-	Litre/minute	
v.	Latitude & Longitude	-	-	

RVS FORMAT OF PARKING ON GROUND FOR POST-EARTHQUAKE SAFE SHELTER FOR SHIMLA

Name of the Parking: _____	
Location: _____	**Date of inspection:** _____
Nearest Landmark: _____	**Year of construction:** _____

1.0PARAMETERS FOR PARKING

S.NO.	PARAMETER	OPTION	UNIT	
i.	Area of Parking	-	Sq.m	
ii.	Distance of parking from Nearest Road	-	m	
iii.	Distance from Near Water Source (Bawari)	-	m	
iv.	Shelter Existing	a. Yes b. No	-	
v.	Size of Shelter	-	L x B	
vi.	Latitude & Longitude	-	-	

2.0 PARAMETERS FOR BAWARI

S.NO.	PARAMETER	OPTION	UNIT	
i.	Name of Bawari	-	-	
ii.	Availability of water	a. Throughout the year b. half year c. Other (specify)	-	
iii.	Turbidity of water	a. Clean b. Few particles c. Turbid d. Very Turbid	-	
iv.	Discharge	-	Litre/minute	
v.	Latitude & Longitude	-	-	

3.2 PARAMETERS CONSIDERED FOR RVS OF MULTILEVEL PARKING

Following are the parameters which have been observed in the RVS of the Multi Level Parkings in Shimla City.

a) Year of Construction

The particular parameter will reveal about the codal provisions that have been taken into account while designing the structure. Accordingly, the Information about Earthquake resistance and ductile design of structure could be judged.

b) Structural Components

Various non-structural components like fire safety provision at the parking site, staircase connectivity of different level with each other, past history of landslides in that particular area are observed and were considered in the RVS format for the Multi Level Parking.

c) Structural Irregularities:

Irregularities like Re-entrant corners, Non-parallel system, in the structure could be ascertained and accordingly it's perform could be judged.

d) Structure Deterioration

Existence of any cracks in the structure, corrosion of reinforcement is the parameters that would help in judging the integrity of the structure

e) Non-Structural Building Components

i) Brick parapets
ii) Water tanks made up of RC, masonry or PVC material
iii) Sign boards or display boards which are hanged or attached to the structure
iv) Fire extinguisher if provided in sufficient numbers in the parkings.

RVS FORMAT OF MULTILEVEL PARKINGS FOR SHIMLA CITY

Name of the Parking: _____

Location: _____ **Date of inspection:** _____

Nearest Landmark: _____ **No. of floors and height (m):** _____

Year of construction: _____

1.0 STRUCTURAL FRAME TYPES

S.NO.	WHETHER MOMENT RESISTANT FRAME – (RCF/SF) WITH	YES	NO	N/A
i	Ordinary design without Earthquake Resistant Design (ERD)			
ii	Ordinary ERD and with ordinary infill walls			
iii	ERD ductile detailing provision			
iv	ERD Ductile detailing provision, infill wall, shear walls and braces			

2. 0 DESCRIPTION

S.NO.	WHETHER THE BUILDING HAS	YES	NO	N/A
i	Soft storey			
ii	Fire safety devices as per NBC-2005 in place			
iii	Parking located in landslide prone area			
iv	Any heavy mass anchored to the structural system of Building			
v	Infill masonry wall made with half brick walls or brick on edge walls (4 ½" or 3")			
vi	Staircases and elevators un-symmetrically placed in plan			
vii	Plan aspect ratio of the building more than 3.0			
viii	Situations to develop short column effect			
ix	Floating columns or floating structural walls			
x	Main load bearing columns are along the length of the building plan			
xi	Beam-column supports / junctions centrally positioned in all floors			
xii	Separation between the adjacent buildings is less than 2% height of building			

3.0 IRREGULARITIES IN STRUCTURE

S.NO.	TYPE OF IRREGULARITY	YES	NO	N/A
i	Re-entrant corners			
ii	Diaphragm discontinuity			
iii	Out of plane offsets			
iv	Non-parallel system			
v	Vertical (Stiffness) irregularity			
vi	Staircase connectivity			
vii	Dampness			

4.0 PRESENT STATUS OF BUILDING (NO. OF CRACKS TO BE ENTERED)

S.NO.	DESCRIPTION	GF			FF			SF		
i	Reinforcement									
ii	RCC Column F/M/S									
iii	RCC Beam F/M/S									
iv	RCC Slab F/M/S									

5.0. NON-STRUCTURAL BUILDING COMPONENTS

S.N	ITEM IF PROVIDED AND STABILIZED AGAINST	YES	NO	N/A
i	Partition (brick wall / wooden partitions)			
ii	Facade-elements (cladding / decorative elements)			
iii	False Ceilings			
iv	Brick parapets / pillars / planters etc.			
v	RC / Masonry / PVC Water Tank on Roof			
vi	Signs / display boards etc.			
vii	Almirah / Racks			
viii	Fire extinguisher			

4.0 RAPID VISUAL SURVEY SITES

The sites selected for the RVS are divided into three broad categories as mentioned in section 3.1 and list of sites in each category is given in Table 4.1 to Table 4.3. There are some sites which require special permission from concerned departments and ministries before carrying out RVS hence, such sites have not been surveyed. The list of the same has been given in Table 4.4.

Table 4.1 SITES SELECTED UNDER THE CATEGORY OF OPEN GROUND

SR. NO.	OPEN GROUND	LOCATION
1.	Police Line Ground	Bharari
2.	Ground with Govt. Middle School	Ruldubhatta
3.	Waqf Board Idgah Ground	Ruldubhatta
4.	Loreto Convent School	Kaithu
5.	Gol Pahari Park	Annandale
6.	HPU Sports Ground	Summer Hill
7.	Govt. Sr. Sec. School Ground	Totu
8.	Waqf Board Ground	Boileauganj
9.	Jangli Ground	Tutikandi
10.	Govt. Sr. Sec. School Ground	Phagli
11.	Govt. High School Ground	Krishna Nagar
12.	HPCA Ground	Krishna Nagar
13.	Rothney Castle (Sishe wali kothi) Ground	Jakhu
14.	Woods Ville Palace Ground	Benmore
15.	Radha Swami Satsang Bhawan Ground	Benmore
16.	Ground in Engine Ghar	Sanjauli
17.	Water Reservoir Ground	Sanjauli
18.	Hotel Club Mahindra Ground (Hotel Gable)	Mashobra
19.	Govt. Sr. Sec School Ground	Bhattakufar
20.	Govt. High School Nav-Bahar Ground	Malyana/ Nav-Bahar
21.	Govt. Sr. Sec. School Ground	Kasumpti
22.	Central school for Tibetans Ground	Chhota Shimla
23.	Sarswati Vidhya Mandir School Ground	Vikas Nagar
24.	D.A.V Public School Ground	New Shimla
25.	S.D Sr. Sec. School Ground	Ram Bazar

Table 4.2 SITES SELECTED UNDER THE CATEGORY OF PARKING ON GROUND

SR. NO.	PARKING ON GROUND	LOCATION
1.	Municipal Corporation Car Parking	Khalini
2.	Municipal Corporation Car Parking	Kasumpti
3.	Municipal Corporation Car Parking	New Shimla
4.	Parking Near Forest office	Khalini

Table 4.3 SITES SELECTED UNDER THE CATEGORY OF MULTI LEVEL PARKING

SR. NO.	PARKING	LOCATION
1.	Car Parking Cum-Shopping Complex	Sanjauli
2.	Car Parking Cum-Shopping Complex	Chhota Shimla
3.	Car Parking Cum-Shopping Complex	Lift

Table 4.4 SITES REQUIRED SPECIAL PERMISSION BEFORE RVS

SR. NO.	OPEN GROUND	LOCATION	REMARKS
1.	Annandale Ground	Annandale	High Security Zone
2.	CPWD Ground	Bhadai	Land under CPWD
3.	Ridge Maidan	Lower Bazar	High Security Zone
4.	Raj Bhawan Ground	Benmore	High Security Zone
5.	Subzi Mandi Ground	Dhalli	Permission Denied
6.	Marketing Board Ground	Khalini	Permission Denied
7.	Railway Station Ground	Majath	Land under Railway Ministry

4.1 DETAIL OF OPEN GROUND SITES

1. **Ground Name** - Police Line Ground

   Location - Bharari

   Nearest landmark - Police Line

   Approximate Area - 7032 m^2

   Vehicular Approach - Yes

   Latitude & Longitude of Ground - 31° 07’ 19.0”N 77° 10’ 38.2”E

   Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.1

Figure 4.2

Figure 4.3

Figure 4.4

2.	**Ground Name**	-	Ground with Govt. Middle School
	Location	-	RulduBhatta
	Nearest landmark	-	Mata temple
	Approximate Area	-	98 m^2
	Vehicular Approach	-	No
	Latitude & Longitude of Ground	-	31° 06’ 24.3”N 77° 10’ 32.4”E
	Name of Bawari	-	N.A
	Location	-	RulduBhatta
	Distance from Ground	-	30 m
	Water Availability	-	Throughout the year
	Turbidity of water	-	Few Particles
	Discharge	-	10 Litres / Minute
	Latitude & Longitude of Bawari	-	31° 06’ 24.3”N 77° 10’ 32.4”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.5

Figure 4.6

Figure 4.7

Figure 4.8

PHOTOGRAPHS OF BAWARI

Figure 4.9

Figure 4.10

3.	**Ground Name**	-	Waqf Board Idgah Ground
	Location	-	Ruldubhatta
	Nearest landmark	-	Idgah
	Approximate Area	-	795m^2
	Vehicular Approach	-	No
	Latitude & Longitude of Ground	-	31° 06’ 23.5”N 77° 10’ 28.1”E
	Name of Bawari	-	Not Available
	Location	-	Ruldubhatta
	Distance from Ground	-	30 m
	Water Availability	-	Throughout the year
	Turbidity of water	-	Few Particles
	Discharge	-	10 Litres / Minute
	Latitude & Longitude of Bawari	-	31° 06’ 24.3”N 77° 10’ 32.4”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.11

Figure 4.12

Figure 4.13

Figure 4.14

PHOTOGRAPHS OF BAWARI

Figure 4.15

Figure 4.16

4.	**Ground Name**	-	Loreto Convent School
	Location	-	Tarahall, Kaithu
	Nearest landmark	-	Shiv Shakti Mata Temple
	Approximate Area	-	1560 m^2
	Vehicular Approach	-	Yes
	Latitude & Longitude of Ground	-	31° 06’ 33.3”N 77° 09’ 55.6”E
	Name of Bawari	-	Not Available
	Location	-	Police Line, Kaithu
	Distance from Ground	-	650 m
	Water Availability	-	Throughout the year
	Turbidity of water	-	Clean
	Discharge	-	1 Litre / Minute
	Latitude & Longitude of Bawari	-	31° 06’ 31.9”N 77° 09’ 44.8”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.17

Figure 4.18

Figure 4.19

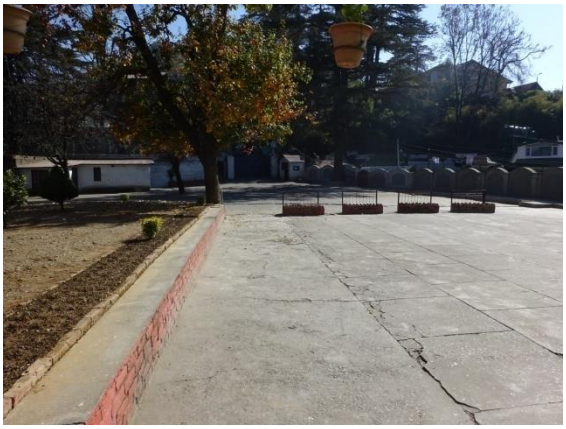


Figure 4.20

PHOTOGRAPHS OF BAWARI

Figure 4.21

Figure 4.22

5. **Ground Name** - Gol Pahari Park

Location - Annadale

Nearest landmark - Not Available

Approximate Area - 649 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 07’ 02.4”N 77° 09’ 44.9”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.23

Figure 4.24

Figure 4.25

Figure 4.26

6. **Ground Name** - HPU Sports Ground

Location - Summer Hill

Nearest landmark - Summer Hill Railway Station

Approximate Area - 5400 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 06’ 31.1”N 77° 08’ 17.7”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.27

Figure 4.28

Figure 4.29

Figure 4.30

7.	**Ground Name**	-	Govt. Sr. Sec. School Ground I and II
	Location	-	Totu
	Nearest landmark	-	Shiv Shakti Mata Temple
	Approximate Area	-	673 m^2 (both grounds)
	Vehicular Approach	-	No
	Latitude & Longitude of Ground	-	31° 05’ 54.7”N 77° 07’ 19.6”E
	Details of Nearest Bawari:		Not Available

PHOTOGRAPHS OF OPEN GROUND - I

Figure 4.31

Figure 4.32

PHOTOGRAPHS OF OPEN GROUND - II

Figure 4.33

Figure 4.34

8. **Ground Name** - Waqf Board Ground

Location - Boileauganj

Nearest landmark - Shri Gopal Mandir

Approximate Area - 1187m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 05’ 57.9”N 77° 08’ 27.2”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.35

Figure 4.36

Figure 4.37

Figure 4.38

9. **Ground Name** - Jangli Ground

Location - Tutikandi

Nearest landmark - New ISBT Shimla

Approximate Area - 1974m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 05’ 49.6”N 77° 09’ 06.1”E

Details of Nearest Bawari Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.39

Figure 4.40

Figure 4.41

Figure 4.42

10. **Ground Name** - Govt. Sr. Sec. School Ground

Location - Phagli

Nearest landmark - CPWD Phagli Club

Approximate Area - 1138m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 06’ 01.6”N 77° 09’ 33.5”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.43

Figure 4.44

Figure 4.45

Figure 4.46

11. **Ground Name** - Govt. High School Ground

Location - Krishna Nagar

Nearest landmark - Valmiki temple

Approximate Area - 327 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 06’ 08.2”N 77° 10’ 24.7”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.37

Figure 4.38

Figure 4.39

Figure 4.40

12. **Ground Name** - HPCA Ground

Location - Krishna Nagar

Nearest landmark - Office of Directorate of Elementary Education

Approximate Area - 1157.6m^2

Vehicular Approach - No

Latitude & Longitude of Ground - 31° 06’ 10.9”N 77° 10’ 02.7”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.41

Figure 4.42

Figure 4.43

Figure 4.44

13. **Ground Name** - Rothney Castle (Sishe wali kothi) Ground

Location - Jakhu

Nearest landmark - Jakhu Temple

Approximate Area - 780 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 06’ 17.4”N 77° 10’ 47.9”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.45

Figure 4.46

Figure 4.47

Figure 4.48

14.	**Ground Name**	-	Woods Ville Palace Ground I to V
	Location	-	Benmore
	Nearest landmark	-	Raj Bhawan
	Approximate Area	-	2355m^2(All Grounds)
	Vehicular Approach	-	Yes
	Latitude & Longitude of Ground	-	31° 05’ 29.8”N 77° 10’ 39.6”E
	Details of Nearest Bawari:		Not Available

PHOTOGRAPHS OF OPEN GROUND - I

Figure 4.49

Figure 4.50

PHOTOGRAPHS OF OPEN GROUND - II

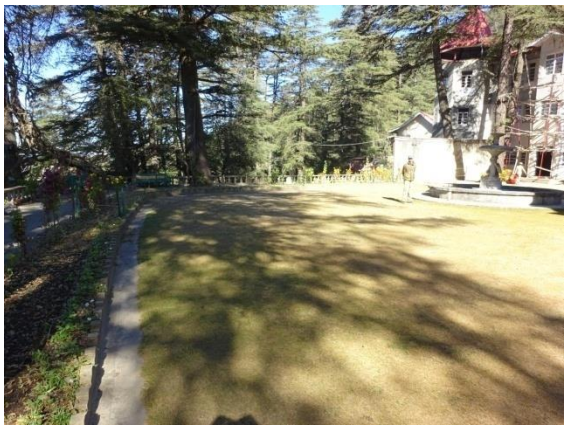


Figure 4.51

Figure 4.52

PHOTOGRAPHS OF OPEN GROUND - III

Figure 4.53

Figure 4.54

PHOTOGRAPHS OF OPEN GROUND - IV

Figure 4.55

Figure 4.56

PHOTOGRAPHS OF OPEN GROUND - V

Figure 4.57

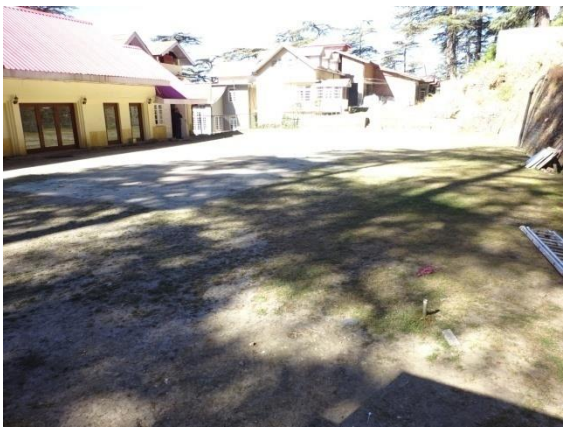


Figure 4.58

15. **Ground Name** - Radha Swami Satsang Bhawan Ground

Location - Benmore

Nearest landmark - SP Residence

Approximate Area - 1339 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 05’ 29.7”N 77° 10’ 44.3”E

Details of Nearest Bawari: Not Available

Note: Photography was prohibited on the site

16. **Ground Name** - Ground in Engine Ghar

Location - Sanjauli

Nearest landmark - S.P.M Model School

Approximate Area - 1500 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 06’ 05.6”N 77° 11’ 24.5”E

Name of Bawari - Below labour building

Location - Ward no. 24, Sangti, Sanjauli

Distance from Ground - Throughout the year

Turbidity of water - Few particles

Discharge - 2.7Litres / minute

Latitude & Longitude of Bawari - 31° 6’ 0.06”N 77° 11’ 22.50”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.59

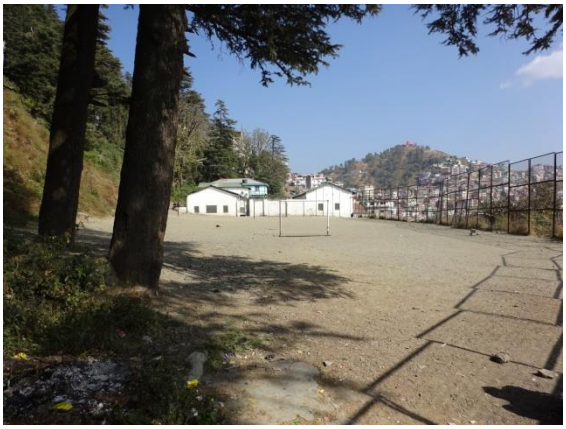


Figure 4.60

Figure 4.61

Figure 4.62

PHOTOGRAPHS OF BAWARI

Figure 4.63

Figure 4.64

17.	**Ground Name**	-	Water Reservoir Ground
	Location	-	Sanjauli
	Nearest landmark	-	Sanjauli Chowk
	Approximate Area	-	2356 m^2
	Vehicular Approach	-	Yes
	Latitude & Longitude of Ground	-	31° 06’ 05.6”N 77° 11’ 24.5”E
	Name of Bawari	-	Below labour building
	Location	-	Ward no. 24, Sangti, Sanjauli
	Distance from Ground	-	Throughout the year
	Turbidity of water	-	Few particles
	Discharge	-	2.7Litres / minute
	Latitude & Longitude of Bawari	-	31° 6’ 0.06”N 77° 11’ 22.50”E

Note: Photography was prohibited on the site

18. **Ground Name** - Hotel Club Mahindra Ground (Hotel Gable)

Location - Mashobra

Nearest landmark - Mashobra 1 bus stop

Approximate Area - 806 m^2

Vehicular Approach - No

Latitude & Longitude of Ground - 31° 07’ 44.7”N 77° 13’ 40.8”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.65

Figure 4.66

Figure 4.67

Figure 4.68

19. **Ground Name** - Govt. Sr. Sec School Ground

Location - Bhattakufar

Nearest landmark - Office of Food and Civil supplies

Approximate Area - 1289 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31° 05’30.3”N 77° 12’ 26.5”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.69

Figure 4.70

Figure 4.71

Figure 4.72

20.	**Ground Name**	-	Govt. High School Nav-Bahar Ground
	Location	-	Shanon, Village Bhakrayi, Nav-Bahar
	Nearest landmark	-	Ghat wali mata temple
	Area	-	1840m^2
	Vehicular Approach	-	Yes
	Latitude & Longitude of Ground	-	31°05’ 14.3”N 77° 11’ 33.1”E
	Name of Bawari	-	Not Available
	Location	-	Nu-balai
	Distance from Ground	-	450 m
	Water Availability	-	Throughout the year
	Turbidity of water	-	Few Particles
	Discharge	-	Not Available
	Latitude & Longitude of Bawari	-	31°05’ 22.3”N 77° 11’ 35.4”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.73

Figure 4.74

Figure 4.75

Figure 4.76

PHOTOGRAPHS OF BAWARI

Figure 4.77

Figure 4.78

21. **Ground Name** - Govt. Sr. Sec. School Ground

Location - Kasumpti / Chhota Shimla

Nearest landmark - Kasumpti market

Approximate Area - 385 m^2 (approx.)

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31°04’ 44.5”N 77° 10’ 55.6”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.79

Figure 4.80

Figure 4.81

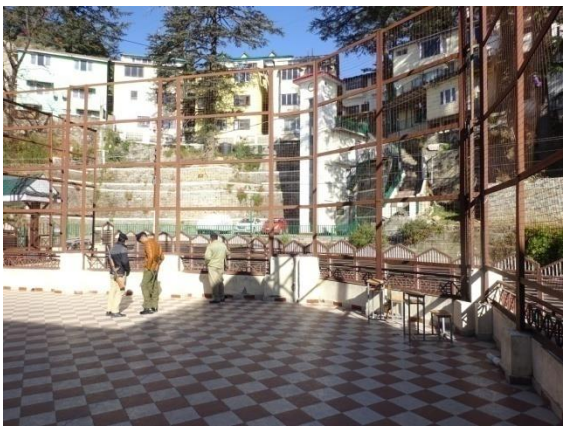


Figure 4.82

22. **Ground Name** - Central school for Tibetans ground

Location - Chhota Shimla

Nearest landmark - B.S.N.L exchange

Approximate Area - 1854 m^2

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31°05’ 09.9”N 77° 10’ 48.1”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.83

Figure 4.84

Figure 4.85

Figure 4.86

23.	**Ground Name**	-	Sarswati Vidhya Mandir School Ground
	Location	-	Vikas Nagar
	Nearest landmark	-	Vikas Nagar Bus stop
	Approximate Area	-	1422 m^2
	Vehicular Approach	-	Yes
	Latitude & Longitude of Ground	-	31° 4’ 41.5”N 77° 10’ 40.0”E
	Name of Bawari	-	Not Available
	Location	-	Vikas Nagar
	Distance	-	0 m
	Water Availability	-	August to January
	Turbidity of water	-	Few particles
	Discharge	-	Not Available
	Latitude & Longitude of Bawari	-	31° 4’ 41.5”N 77° 10’ 40.0”E

PHOTOGRAPHS OF OPEN GROUND

Figure 4.87

Figure 4.88

Figure 4.89

Figure 4.90

PHOTOGRAPHS OF BAWARI

Figure 4.91

Figure 4.92

24. **Ground Name** - D.A.V Public School Ground – I to VI

Location - Sector 4, New Shimla

Nearest landmark - Office of Agriculture Insurance Co.

Approximate Area - 4089m^2(All Grounds)

Vehicular Approach - Yes

Latitude & Longitude of Ground - 31°04’ 54.2”N 77° 10’ 05.9”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND - I

Figure 4.93

Figure 4.94

PHOTOGRAPHS OF OPEN GROUND – II

Figure 4.95

Figure 4.96

PHOTOGRAPHS OF OPEN GROUND - III

Figure 4.97

Figure 4.98

PHOTOGRAPHS OF OPEN GROUND - IV

Figure 4.99

Figure 4.100

PHOTOGRAPHS OF OPEN GROUND - V

Figure 4.101

Figure 4.102

PHOTOGRAPHS OF OPEN GROUND - VI

Figure 4.103

Figure 4.104

25. **Ground Name** - S.D Sr. Sec. School Ground

Location - Anaj Mandi

Nearest landmark - SBI Bank

Approximate Area - 243 m^2

Vehicular Approach - Yes

Latitude & Longitude - 31° 06’ 15.7”N 77° 10’ 18.2”E

Details of Nearest Bawari: Not Available

PHOTOGRAPHS OF OPEN GROUND

Figure 4.105

Figure 4.106

Figure 4.107

Figure 4.108

4.2 DETAILS OF PARKING ON GROUND SITES

1.	**Parking Name**	**-**	Municipal Corporation Car Parking
	Location	**-**	Khalini
	Nearest landmark	**-**	ACC area office / HPSEB office
	Approximate Area	**-**	204m^2
	Latitude & Longitude of Ground	**-**	31° 5’ 23.4”N 77° 10’ 13.9”E
	Name of Bawari	**-**	Dyton by Pass
	Location	**-**	Khalini
	Distance from Parking	**-**	550 m
	Water Availability	**-**	Throughout the year
	Turbidity of water	**-**	Clean
	Discharge	**-**	1.6 Litre / minute
	Latitude & Longitude of Bawari	**-**	31° 5’ 32.22”N 77° 10’ 29.889”E

PHOTOGRAPHS OF PARKING SITE

Figure 4.109

Figure 4.110

Figure 4.111

Figure 4.112

PHOTOGRAPHS OF BAWARI

Figure 4.113

Figure 4.114

2.	**Parking Name**	**-**	Municipal Corporation Car Parking
	Location	**-**	SDA Complex, Kasumpti
	Nearest landmark	**-**	HIMURJA Office
	Approximate Area	**-**	246m^2
	Latitude & Longitude of Ground	**-**	31° 04’ 43.6”N 77° 10’ 50.2”E
	Name of Bawari	**-**	Bawari near Kanongo Building
	Location	**-**	Vikas Nagar
	Distance from Parking	**-**	1100 m
	Water Availability	**-**	Throughout the year
	Turbidity of water	**-**	Clean
	Discharge	**-**	20 Litre / minute
	Latitude & Longitude of Bawari	**-**	31° 4’ 50.45”N 77° 10’ 40.838”E

PHOTOGRAPHS OF PARKING SITE

Figure 4.115

Figure 4.116

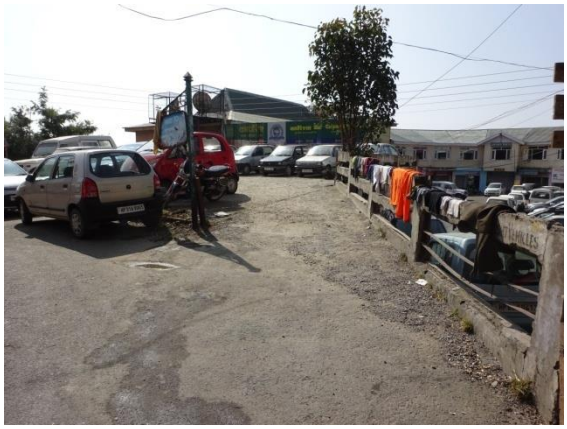


Figure 4.117

Figure 4.118

PHOTOGRAPHS OF BAWARI

Figure 4.119

Figure 4.120

3.	**Parking Name**	**-**	Municipal Corporation Car Parking
	Location	**-**	Sector 3, Block No. 31, New Shimla
	Nearest landmark	**-**	JCB School
	Approximate Area	**-**	105m^2
	Latitude & Longitude of Ground	**-**	31° 04’ 56.1”N 77° 09’ 55.8”E
	Name of Bawari	**-**	Not Available
	Location	**-**	Near Block No. 25, Sector 3, New Shimla
	Distance from Parking	**-**	550 m
	Water Availability	**-**	Throughout the year
	Turbidity of water	**-**	Few Particles
	Discharge	**-**	25 Litre / minutes
	Latitude & Longitude of Bawari	**-**	31° 4’ 54.35”N 77° 10’ 1.28”E

PHOTOGRAPHS OF PARKING SITE

Figure 4.121

Figure 4.122

Figure 4.123

Figure 4.124

PHOTOGRAPHS OF BAWARI

Figure 4.125

Figure 4.126

4.	**Ground Name**	**-**	Parking Near Forest office
	Location	**-**	Khalini
	Nearest landmark	**-**	Forest Construction Range Office
	Area	**-**	440m^2
	Latitude & Longitude of Ground	**-**	31° 05’ 20.4”N 77° 10’ 08.8”
	Name of Bawari	**-**	Panchiyaati
	Location	**-**	Khalini
	Distance from Parking	**-**	950 m
	Water Availability	**-**	Throughout the year
	Turbidity of water	**-**	Few particles
	Discharge	**-**	2 Litre / minute
	Latitude & Longitude of Bawari	**-**	31° 5’ 18.097”N 77° 10’ 15.71”E

PHOTOGRAPHS OF OPEN GROUND / PARKING

Figure 4.127

Figure 4.128

Figure 4.129

Figure 4.130

PHOTOGRAPHS OF BAWARI

Figure 4.131

Figure 4.132

4.3 DETAIL OF MULTI LEVEL PARKING SITES

1.	**Parking Name**	**-**	Car Parking Cum-Shopping Complex
	Location	**-**	Sanjauli
	Nearest landmark	**-**	Near Sr. Sec. School
	Year of construction	**-**	2011
	Area	**-**	Not Available
	Latitude & Longitude of Ground	**-**	31° 06’ 08.3”N 77° 10’ 26.5”E
	Name of Bawari	**-**	Ward no. 24**,** Sangti
	Location	**-**	Sanjauli
	Distance from Parking	**-**	550 m
	Water Availability	**-**	Throughout the year
	Turbidity of water	**-**	Clean
	Discharge	**-**	1.60 Litre / minute
	Latitude & Longitude of Bawari	**-**	31° 6’ 0.06”N 77° 11’ 22.50”E

PHOTOGRAPHS OF PARKING

Figure 4.133

Figure 4.134

Figure 4.135

Figure 4.136

PHOTOGRAPHS OF BAWARI

Figure 4.137

Figure 4.138

2.	**Parking Name**	-	Car Parking Cum-Shopping Complex
	Location	-	Chhota Shimla
	Nearest landmark	-	Police Station Chhota Shimla
	Year of construction	-	2016
	Area	-	Not Available
	Latitude & Longitude of Ground	-	31° 5’ 19.9”N 77° 10’ 44.6”E
	Details of Nearest Bawari:		Not Available

PHOTOGRAPHS OF PARKING

Figure 4.139

Figure 4.140

Figure 4.141

Figure 4.142

3.	**Parking Name**	-	Car Parking Cum-Shopping Complex
	Location	-	Lift, Central Shimla
	Nearest landmark	-	HPDTC Lift
	Year of construction	-	2015
	Area	-	Not Available
	Latitude & Longitude of Ground	-	31° 06’ 05.0”N 77° 10’ 31.7”E
	Details of Nearest Bawari:		Not Available

PHOTOGRAPHS OF PARKING

Figure 4.143

Figure 4.144

Figure 4.145

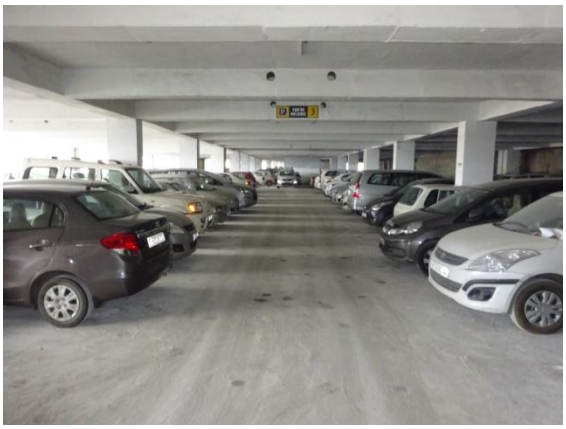


Figure 4.146

5.0 COLLECTION OF SOIL SAMPLE OF MULTI LEVEL PARKINGS SITES

The Geotechnical investigation of sites would assist in determining the possibility of slope failure. Sample in sufficient amount are taken for the study of soil. Various test such as sieve analysis; specific gravity and plastic limits of the soil are being carried out. Study of these samples will reveal whether the parking structure is on the stable soil. Three Sites from where soil samples have been taken for geo-technical investigation are mentioned in the Figure 5.1, Figure 5.2 and Figure 5.3 respectively.

Figure 5.1 Car parking cum-shopping complex at Sanjauli

(a)

(b)

Figure 5.2 Car parking cum-shopping complex at Chhota Shimla

(a) (b)

Figure 5.3 Car parking cum-shopping complex at Lift

5.1 SLOPE STABILITY INVESTIGATION OF THE MULTILEVEL PARKING SITES

Before selecting any site for developing Safe Shelter model, detailed geotechnical investigation should carried out. In the case of Shimla city, since, the development of Safe shelter is proposed to be carried out either in the open ground or in the different levels of existing parkings. The stability of the safe shelter in the open ground shall be depended upon only on the stability of the structure itself. However, in the case of safe shelter in the parkings, this stability will also depend upon the stability of the structure. The stability of the structure on slope is further depended the strength and stiffness of the structure and the stability of the slope in itself. In the present case, since, out of 16 parkings, only the drawings of three parkings were available. Hence, accordingly, it was decided that the slope stability investigation of the following three parkings shall be carried out:

1. Parking complex near SSS, Circular road, Sanjauli
2. Car Parking complex at Chhota Shimla, Shimla
3. Car Parking complex at the Lift, Shimla

The soil properties of the car parkings at Sanjauli, Chhota Shimla and Lift have been tabulated in the Table 5.1 to Table 5.3 respectively. For each parking Shear stress versus shear strain, Sieve Analysis, Compaction curves and Normal stress versus Shear stress have determined. The results of experimentation over the collected soil samples and the corresponding analytical work are shown in the Figure 5.4 to Figure 5.9.

Table 5.1 – Soil properties of car parking at Sanjauli

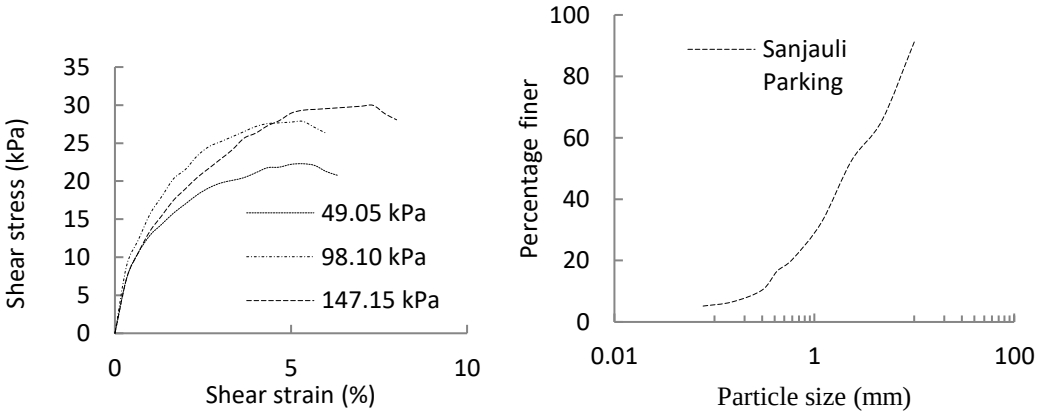
Sr. No.	Property	Values
1.	Specific gravity	2.44
2.	Natural moisture content (%)	18.72
3.	Maximum dry unit weight (kN/m3)	15.45
4.	Optimum moisture content (%)	6.00
5.	D60 (mm)	3.10
6.	D30 (mm)	1.00
7.	D10 (mm)	0.28
8.	Cu	11.67
9.	Cc	1.15
10.	Cohesion (kPa)	19.02
11.	Friction angle (Deg.)	4.47

Table 5.2 – Soil properties of car parking at Chhota Shimla

Sr. No.	Property	Values
1.	Specific gravity	2.60
2.	Natural moisture content (%)	10.72
3.	Maximum dry unit weight (kN/m3)	13.40
4.	Optimum moisture content (%)	6.30
5.	D60 (mm)	2.00
6.	D30 (mm)	0.45
7.	D10 (mm)	0.07
8.	Cu	28.57
9.	Cc	1.45
10.	Cohesion (kPa)	15.86
11.	Friction angle (Deg.)	7.82

Table 5.3 – Soil properties of car parking at Lift

Sr. No.	Property	Values
1.	Specific gravity	2.53
2.	Natural moisture content (%)	6.32
3.	Maximum dry unit weight (kN/m3)	16.80
4.	Optimum moisture content (%)	9.20
5.	D_{60} (mm)	1.80
6.	D_{30} (mm)	0.35
7.	D_{10} (mm)	0.05
8.	C_u	36.00
9.	C_c	1.36
10.	Cohesion (kPa)	16.64
11.	Friction angle (Deg.)	7.19



(a) (b)

Figure 5.4 Sanjauli parking (a) Shear stress versus shear strain (b) Sieve Analysis

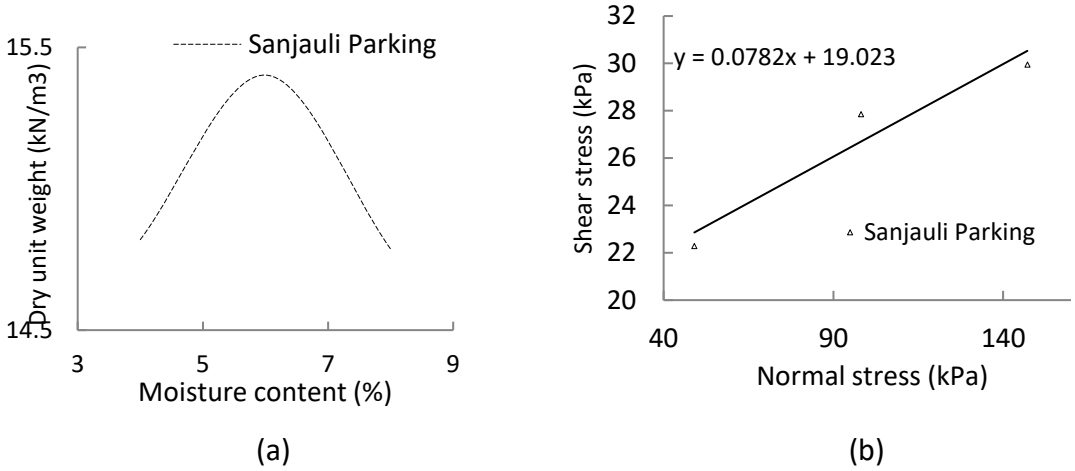


Figure 5.5 Sanjauli parking (a) Compaction curves (b) Normal stress versus Shear stress

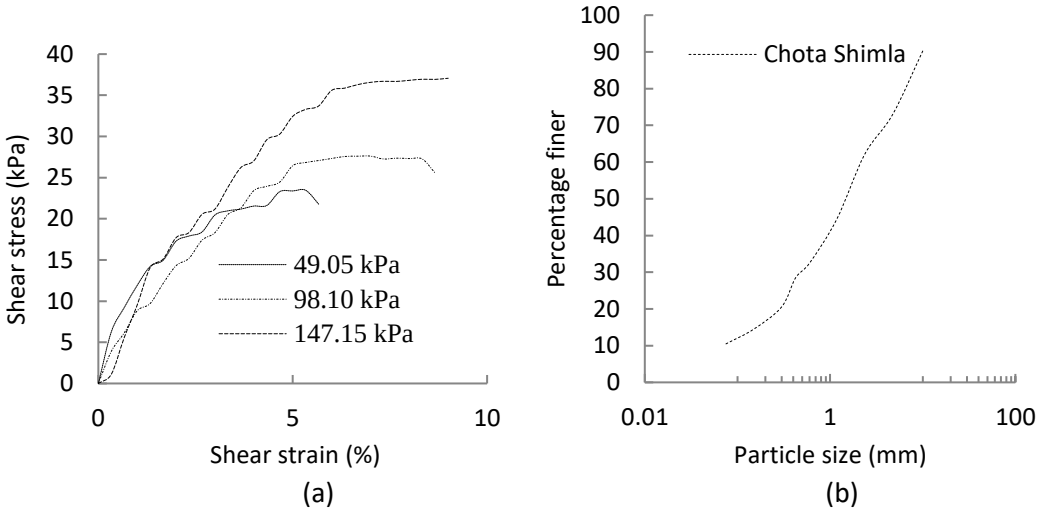


Figure 5.6 Chhota Shimla (a) Shear stress versus shear strain (b) Sieve analysis

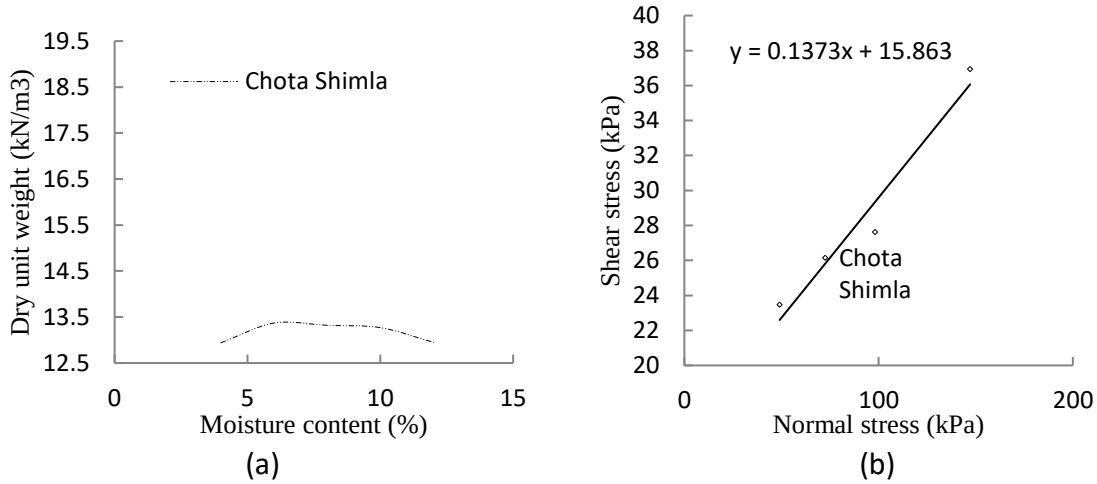
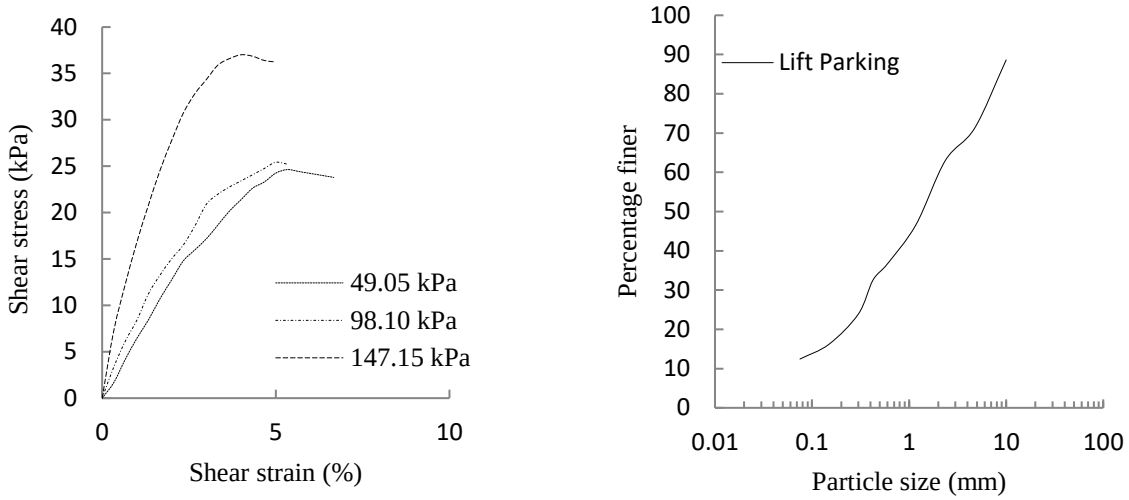
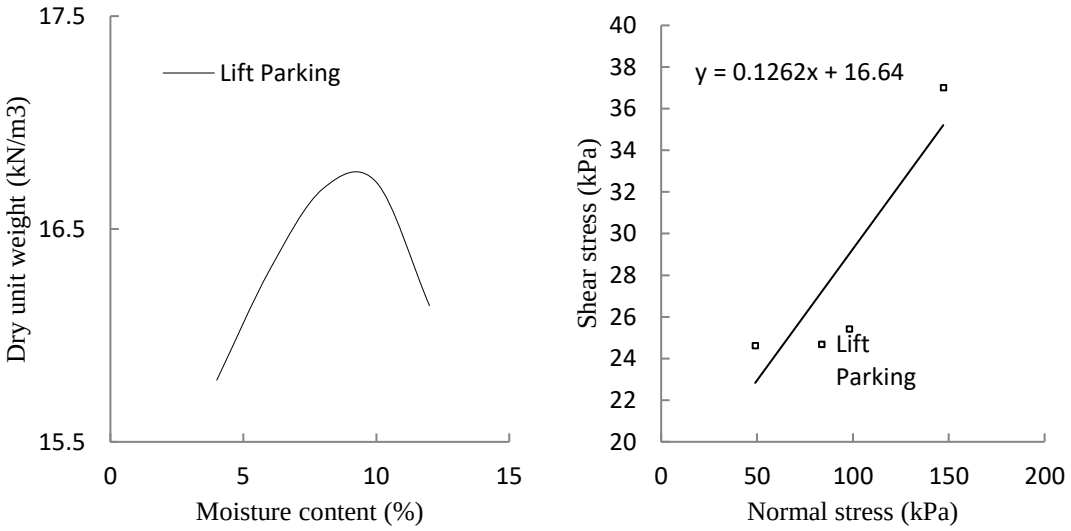


Figure 5.7 Chhota Shimla (a) Compaction curves (b) Normal stress versus Shear stress



(a) (b)

Figure 5.8 Lift (a) Shear stress versus shear strain (b) Sieve analysis



(a) (b)

Figure 5.9 Lift (a) Compaction curves (b) Normal stress versus Shear stress

5.2 RECOMMENDATIONS:

Based upon the geotechnical investigation as tabulated in the tables 5.1 to 5.3, it has been determined that the friction angle are in the range of 4.47 to 7.82 which is much less than the desired values of a good cohesive soil which is normally expected to be above 30. Also, the cohesion values are in the range of 15.86 to 19.02 which should again be more than 50. Hence, in case of these three multilevel parkings the soil condition is not suitable for the setup of Safe Shelter as during an earthquake there are chances that the soil may not provide appropriate fixity to the foundation of the parking as would be required. Hence, the safe shelter construction in these parkings should not be considered.

6.0 SAFE SHELTER COMPONENTS

To provide treatment to the injured and rescued people, there must be a proper arrangement of providing some of the basic items / services so that the rescue operations do not get delayed because of non-availability of the basic items. Thus, various components are being considered after studying the basic requirements of a Disaster Management aspect. The components are being discussed in the section 6.1.

6.1 BASIC REQUIREMENT OF SERVICES

a) **First aid kits –** This is one the most important and primary item required after an earthquake. It will be beneficial for the authorities, if the First Aid Kits are stored in Safe Shelters in advance so that in event of an earthquake, people who would be rescued can get basic treatment without being taken to the hospital. Sufficient number of First Aid Kits could be stored in Safe Shelter Model.

b) **Water –**Water plays a crucial role in Disaster Management operations. Its availability will ensure the proper and efficient working of Safe Shelter. The availability has to be ensured from the nearest bawari as studied.

c) **Food –** Providing food to rescued people would be a big challenge for the concerned authority after an earthquake. To handle this, provision of raw cooking material could be the component of the safe shelter. However, replacement of cooking material will have to be ensured. Cooking items such as Rice, Wheat, Edible Oil, Pulses and Dry Milk can be stored in the Safe Shelter. This will help in managing the disaster in an efficient manner.

d) **Electricity –** Provision of power supply has to be ensured / by the concerned department at the earliest to ensure overall working Safe Shelter efficiently. However, it is taken for granted that electricity supply could only be restored after few hours to few days. Hence, an alternative arrangement should be part of safe shelter.

e) **Shelter –**A shelter will be needed to safeguard people from weather, any anti-social activity and animals. Thus, foldable tents will play an important role. Provision of tent shall be made for at least 20% people of the estimated population of that particular area.

f) **Sanitation –** In the event of any disaster, sanitation for people has always been a great challenge for the governments and disaster management agencies. To cater this problem effectively, temporary toilet tents shall be a part of the initial inventory of Safe

Shelter. Pit latrine system can be adopted as it requires fewer technicalities when compared to other sanitation systems. Provision of Digging tools, Odor control agents and human waste composting agents could be ensured.

6.2 SAMPLE ITEM PROCUREMENT

Samples from varies companies and of various type are being procured for the purpose of study. The study would assist in finding out the suitability of samples which will serve the desired purpose in the best way. Most of the samples have been procured and procurement is still in progress. Details of samples have been covered in this report which has been purchased till 10th March 2018.

Table 6.2 - Sample items procured

Sr. No.	Sample name	Category	Tentative cost (Per unit) (Rs.)
i.	St Johns First Aid Kit – SJF P4	Medical facility	810
ii.	St Johns First Aid Kit – SJF V3	Medical facility	450
iii.	St Johns First Aid Kit – SJF M2	Medical facility	4,370
iv.	Jilichem First Aid Kit – SCK05	Medical facility	790
v.	Life Straw Water Purifier Bottle	Water Purification	1,690
vi.	Aqua guard Water Purifier Bottle	Water Purification	590
vii.	Tata Swachh Water Purifier Bottle	Water Purification	449
viii.	Bugota Water Purifier Bottle	Water Purification	400
ix.	Life Straw Family water Purifier 2.0	Water Purification	5,090
x.	Ef-Chlor Overhead Tank Chlorine	Water Purification	430
xi.	Saral Compressed Tissue	Sanitation	300
xii.	Ginni Compressed Tissue	Sanitation	410
xiii.	Suncool Foldable PVC Water Tank	Sanitation	7,000
xiv.	Lifestyle-You Foldable PVC Water Tank	Sanitation	499
xv.	Ginni Bed Bath Towel	Sanitation	474
xvi.	Exel Bioculum, Biological Inoculum	Sanitation	690
xvii.	Sanitreat, Odour Control Agent	Sanitation	600
xviii.	Generic Solar Emergency Light Bulb	Electricity	289
xix.	Smart fish Pull Light	Electricity	449
xx.	HansTm Power Pack 150	Electricity	9,990
xxi.	GFT Fibre Blanket	Fire Safety	636
xxii.	Homestrap Fabric Storage Bag	Storage	699
xxiii.	Yatra Portable Stove	Cooking Stove	75
xxiv.	Flem-o Hexamine Tablet	Fuel	30
xxv.	Inditradition Toilet Camouflage Tent	Tentage	1,313

6.3 DETAIL OF SAMPLE OF INVENTORY PROCURED

A thorough analysis has been done to find the suitability of the samples. The purpose of the analysis is to reveal the better inventory which fulfill its suitability on the parameters of its usability and economical.

i) SAMPLE NAME – ST JOHN'S FIRST AID KIT – SJF P4

The kit has 81 medical items in it and it is suitable for treating 10 persons. This kit is suitable for treating small and medium wounds. It also has medical items for general medical purpose like Hydrogen Peroxide, Dusting Powder, Glucose tablet and Electrolyte Powder. The limitation of this first aid kit is the size of the box. It may be not suitable for storing as it will require more space. Also, separate section for each category of medicine is not provided. Cost of treatment with this kit is Rs. 81/person.

ii) SAMPLE NAME – ST JOHN'S FIRST AID KIT – SJF V3

The kit has 60 medical items in it and it is suitable for treating 5 persons. This kit is suitable for dressing wounds and has general medical items like adhesive plaster, antiseptic wipes, glucose tablet and antiseptic cream. The limitation of this kit is the limited no. of medicine items and that too are not suitable in treating wounds. The Kit is cardboard with plastic wrap which is likely to get damage if accidently drop or handled roughly. Cost of treatment with this kit is Rs. 90/person.

iii) SAMPLE NAME – JILICHEM FIRST AID KIT – SCK 05

The kit has 24 medical items and it is suitable for treating 10 persons. It comes in plastic box which has a separate section for each type of medical item. This kit is suitable for treating small wounds and has general medical items like Pain ointment, Skin Burnt ointment, Microbicidal

water souable ointment, headache medicine, body ache tablet. Items which are additional in this particular kit are eye wash cup, cold rub, vomiting and wooden splinter. The kit contains medicine for every possible medical need. The limitation of this kit is the size and cost which if compared with others, comes out to be on higher side. Cost of treatment with this kit is Rs. 79/person.

iv) SAMPLE NAME – ST JOHN'S FIRST AID KIT – SJF M2

The kit has 173 medical items and it comes in metal box. The box has 7 compartments for every type of medical item. The kit is ISO 9001:2008, ISO 13485:2003 certified and made as per industrial standards. The kit is suitable for treating small as well major wounds and injuries has general medical items like Wound Cleaning Swabs, Burn Dressing, Absorbent cotton, Triangular bandage, Hydrogen peroxide solution, Micropores tape, Wooden splint, Examination gloves, Paracetamol tablet, Pain ointment, Skin Burnt ointment, Microbicidal water souable ointment, headache medicine, body ache tablet. The only limitation of this kit is that because of its size, the initial procurement cost is high. This is the most suitable kit for treating large number of people. Cost of treatment with this kit is Rs. 87/person.

v) SAMPLE NAME – LIFESTRAW GO WATER PURIFIER WATER BOTTLE

This particular water purifier bottle has many advantages over others. First of all, it has great filtration capacity of 1000 Litres which makes the purification life very long. The bottle has been made with food grade plastic. The technology used for water purification is Microbiological water filtration. The bottle claims to purify any type of raw water which adds to it usability. The limitations of this bottle are the storage capacity of only 650ml and high cost which may not be economically feasible to be used in Safe Shelter or on a large scale in the event of Earthquake. Cost of filtering water is Rs. 1.69/litre.

vi) SAMPLE NAME – EUREKA FORBES AQUAGUARD PURIFIER BOTTLE

The bottle has simple water filtration mechanism in the form of a cartridge which can be easily replaced when needed and the filtration technology is known as space nano technology. The filtration process works when the bottle is gently squeezed. The storage capacity of this bottle is 700ml. This bottle has a very compact size when compared to others and easy to hold because of it ergonomics. The limitations of this bottle are the squeezing mechanism which may sometime not be easy to be used. The filtration rate of this bottle is less when compared to others. It has filtration capacity of only 420 Litres which is the least in the category. Cost is also on the costlier side. Cost of filtering water is Rs. 1.40/litre.

vii) SAMPLE NAME – TATA SWACH INSTASIP INSTANT PURIFIER BOTTLE

The storage capacity of this bottle is 740ml which is more than the previous bottles in this category. The filtration capacity of this bottle is also on the higher side with 1036 Litres. This bottle is also based on the squeezing mechanism but due to its soft and flexible material, it is convenient to use. The filtration rate is quite high when compared with other bottles in this category. The limitation of this bottle is the softness in material which may be the reason of breakage if the bottle is accidently dropped from 5 to 6 feet. Cost of filtering water is Rs. 0.43/litre.

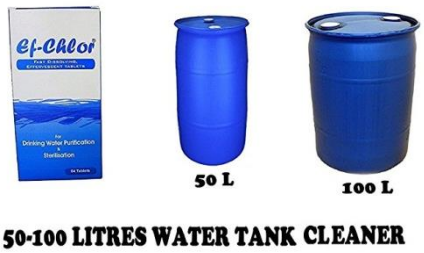
viii) SAMPLE NAME – BUGOTA PURIFIER BOTTLE

The storage capacity of this bottle is 750ml which is highest in the category. The filtration capacity of this bottle is only 200 Litres which is the least in the category. This bottle is based on NanoSilver Activated Carbon Filter technology which itself a reliable technology. The filtration rate is less when compared with other bottles in this category. The limitation of this bottle is as same as the previous bottle (Tata Swach). Cost of filtering water is Rs. 2.00/litre.

ix) SAMPLE NAME – LIFESTRAW FAMILY WATER PURIFIER 2.0

This water purifier is basically for household use. Based on Microbiological water purification technology, this water purifier filters water in 20-30 minutes. The storage capacity of this water purifier is 6 Litres. One of the most attractive features of this product is the filtration capacity which is 30,000 litres. Despite meeting the world's most rigorous standards for microbiological in water treatment, it has its limitation too. The size of the filter is bigger than others and due to this it is difficult to carry or store this filter, the product itself very delicate and sensitive. It cannot be used roughly as others. Cost of this filter is very high. All these limitations make this filter not appropriate to be used in Safe Shelter. Cost of filtering water is Rs. 0.17/litre.

x) SAMPLE NAME – EF-CHLOR OVERHEAD TANK TABLETS



To purify raw water which would be carried from nearest water source, chlorination process would be necessary. Standard chlorine may be difficult to handle and use. Also, technical knowledge of its dosage is required but that is not in the case of Chlorine tablets. These tablets come with fixed disinfection limit. The tablet requires only 30 minutes disinfecting water from 100 litres up to 1000 litres. This has the capability to remove 99.99% bacteria, viruses, fungi and protozoa from water. The tablets are very easy to carry and store. Cost of one tablet is less than Rs. 5.

xi) SAMPLE NAME – SARAL COMPRESSED TISSUE

To cater the sanitation problem, we tried to introduce this compressed tissue to Municipal Corporation Shimla. It has many advantages over conventional cloth or fabric towels or handkerchief. It is made up of pulp

rayon which is a result of natural process. The tissue is completely bio-degradable. So, it will not do any harm to the environment even if thrown in open spaces which may be the case in Safe Shelter. The size of this tissue is equal to a coin with thickness equal to 3 coins. It expands when comes in contact with water. Also, it can be used again and again. Lastly, this product is very affordable; almost Rs. 5/tissue which is very cheap when compared to conventional cotton or fabric towel/tissues. The limitation of this particular product is that it does not have any longevity.

xii) SAMPLE NAME – GINNI COMPRESSED TISSUE

This product is more affordable than the previously mentioned as the cost of one tissue is Rs. 2/tissue since it does not have any fragrance as the previously mentioned tissue. The limitation of this particular product is that it does not have any longevity.

xiii) SAMPLE NAME – FOLDABLE PVC WATER TANK PILLOW TYPE

The conventional PVC storage tanks which are placed on the terrace of the buildings can get damaged when an earthquake hits Shimla. To come out from this situation, PVC foldable water tank can be handy. This is basically a pillow type water storage tank which is laid on the ground. The inner part of the tank is made of food grade plastic so that water does not get any kind of contamination. Available in capacity from 200 Litres to 2000 Litres, this can be used in Safe Shelters as it requires less space and it can protect water from harmful UV rays. With a shelf life of 5 years, it is surely an alternate to the standard PVC water tank. But it has some limitations too. The tank requires a wide area to lay which may not be possible in the area where rescue operations are going on. The price of this foldable tank is very high which may be not economical to be used in Safe Shelter.

xiv) SAMPLE NAME – PORTABLE PVC WATER CARRIER BAG

This is the smaller version of the above mentioned product. It is foldable and has transparent material which helps in knowing the water level in the bag. The build quality of the bag is very good and it can handle rough usage easily. The inlet and Outlet of the bag is same. It also has a handle attached to it to carry the bag easily. Its storage capacity is 10 litres which is suitable for single tent unit in the Safe Shelter model.

xv) SAMPLE NAME – GINNI BED BATH TOWEL

To cater / provide medical treatment to bed ridden patients, this biodegradable bed bath towel will help. The properties and details are almost identical to the compressed tissue which has been mentioned in the previous pages. The size of the towel is more than a handkerchief which may not be as a standard towel but in the event of earthquake, it certainly will be a better option for the people.

xvi) SAMPLE NAME – EXEL BIOLOGICAL INOCULUM

The product is basically for home composting but it can be used for composting human waste as human waste too falls in the category of organic waste. The product is free from pathogens, foul smell and weed seeds. Also, the product is bio-stabilized so there is no harm to the environment/earth. The major attraction of this Bioculum is that it can compose 1000kg of organic waste by just using 1kg of its quantity. There is no such limitation of this product.

xvii) SAMPLE NAME – SANITREAT ODOUR CONTROL AGENT

The purpose of adding this product into the list of sample testing for inventory of Safe Shelter was to get rid from foul smell which comes from toilet area. The main advantage of this product is removing/eliminating foul smell completely from the toilet area and provides a pleasant fragrance. The major attraction of this odour control agent is that it can eliminate foul smell coming from 1000kg of waste by just using 1kg of its quantity. There is no such limitation of this product.

xviii) SAMPLE NAME – LED SOLAR EMERGENCY LIGHT BULB

Power or electricity is one of the basic needs in Safe Shelter. Solar power is the best alternate to the conventional power system. LED solar light can be handy when the standard system is not working or en emergency power source is required. It has USB port to charge mobiles in emergency situations. But is particular product has some limitations. The bulb is too delicate and easily gets damaged if accidently dropped on floor. Leakage in the storage battery used in the bulb is major issues with these bulbs.

xix) SAMPLE NAME – SMARTFISH PULL LIGHT LED BULB

This bulb is based on the pull mechanism which is very convenient to use in dark areas. The reason behind procuring this bulb is that it can be easily used in the storage room of the Safe Shelter and at the time of an earthquake when the standard power may be not available to be used in the Safe Shelter. The overall build quality of the bulb is good and can survive few drops of water and rough usage. The only limitation is the high price of this bulb which reduces the affordability.

xx) SAMPLE NAME – HANS^{TM} Power Pack 150

This is basically a solar power battery backup which has a solar panel attached with it. When solar panel comes in direct contact with the sunlight, the power charges up the battery. It has a USB port to charge mobile phones and other electronic devices. Also, the product comes with 12Volts port through which small fans and radios can be powered. It has built in lights for emergency purpose which has a huge backup of 150 hours. The power pack only weighs 3kg which makes it very easy to carry and store. The material used is very strong and rugged. The only limitation of this power pack is its price but as it comes with 12 Years warranty so the price is justified.

xxi) SAMPLE NAME – GFT FIBRE BLANKET

Just in case, if a fire is occurred in the Safe Shelter area, there must be a proper arrangement to handle the fire effectively and quickly. To cater this problem, blanket made of glass and fiber will be suitable as it do not catch fire and damage even after extensive use. Despite meeting the American standards of fire safety, it has a limitation which is the price and that takes out this product from the affordability.

xxii) SAMPLE NAME – INDITRADITION TOILET CAMOUFLAGE TENT

Foldable tents are easy to carry and store. To cater the issue of sanitation, toilet tents can be used to privacy and hygienic toilet area / toilet. This toilet tent approximate 6'-0" high and 3'-0" wide which is sufficient for one person. The tent is made up of nylon taffeta which is water proof. The tent is very economical and easy to assemble and re-assemble. There is no such limitation of this tent.

xxiii) INVENTORY SAMPLE NAME – UNDERBED STORAGE BAG/ STORAGE ORGANIZER

To organize inventory items in the storage room, this bag can play a crucial role. It is made up of Non Woven Fabric which has strength up to some extent. The weight carrying capacity of the bag is up to 6kg. The volume of the bag is $1m^3$ which is capable of accommodating many inventory items in it. The limitation of this is the fabric thickness which is very thin and may tend to get damaged when used roughly.

xxiv) SAMPLE NAME – PORTABLE STOVE

The stove comes handy in emergency situations and also finds its suitability as an alternative cooking / heating tool. The cost of the product is very less which adds to its usability. It is made of iron and coating with paint. The stove is compact and one carry can it in pocket. Thus, it will be very easy and convenient to store in Safe Shelter as it requires very less space. The legs / supports of the stove are foldable which results in increasing its compactness. As such this product does not have any limitation.

xxv) SAMPLE NAME – HEXAMINE FUEL TABLET

To complete the overall concept and working of portable cooking, hexamine tablet is very useful. This product has six tablets which together will last up to 3 hours of cooking.

6.4 SUITABLITY OF SAMPLES FOR INVENTORY

In this particular study of development of safe shelter for post-earthquake scenario, various products under different category with different specification were procured. Each product has its own pros. and cons. in relation to its cost. Hence, it would not be justified to out rightly reject all the samples except one for different category. The procurement of these items with in different quantities can be worked out based on the availably of the budget. For the particular designated budget, the items can be procured in varying quantities with the justification of their appropriateness.

To summarize, the samples of various categories that would be at least required are:

- First Aid Kit- St Johns First Aid Kit – SJF M2
- Power Supply- Solar-cum-battery Power backup
- Water storage- Foldable PVC water tank
- Water Disinfection- Overhead tank tablets
- Sanitation- Compressed tissue, Inoculum, Odour control agent, Toilet tent

7.0 DEVELOPMENT OF SAFE SHELTER

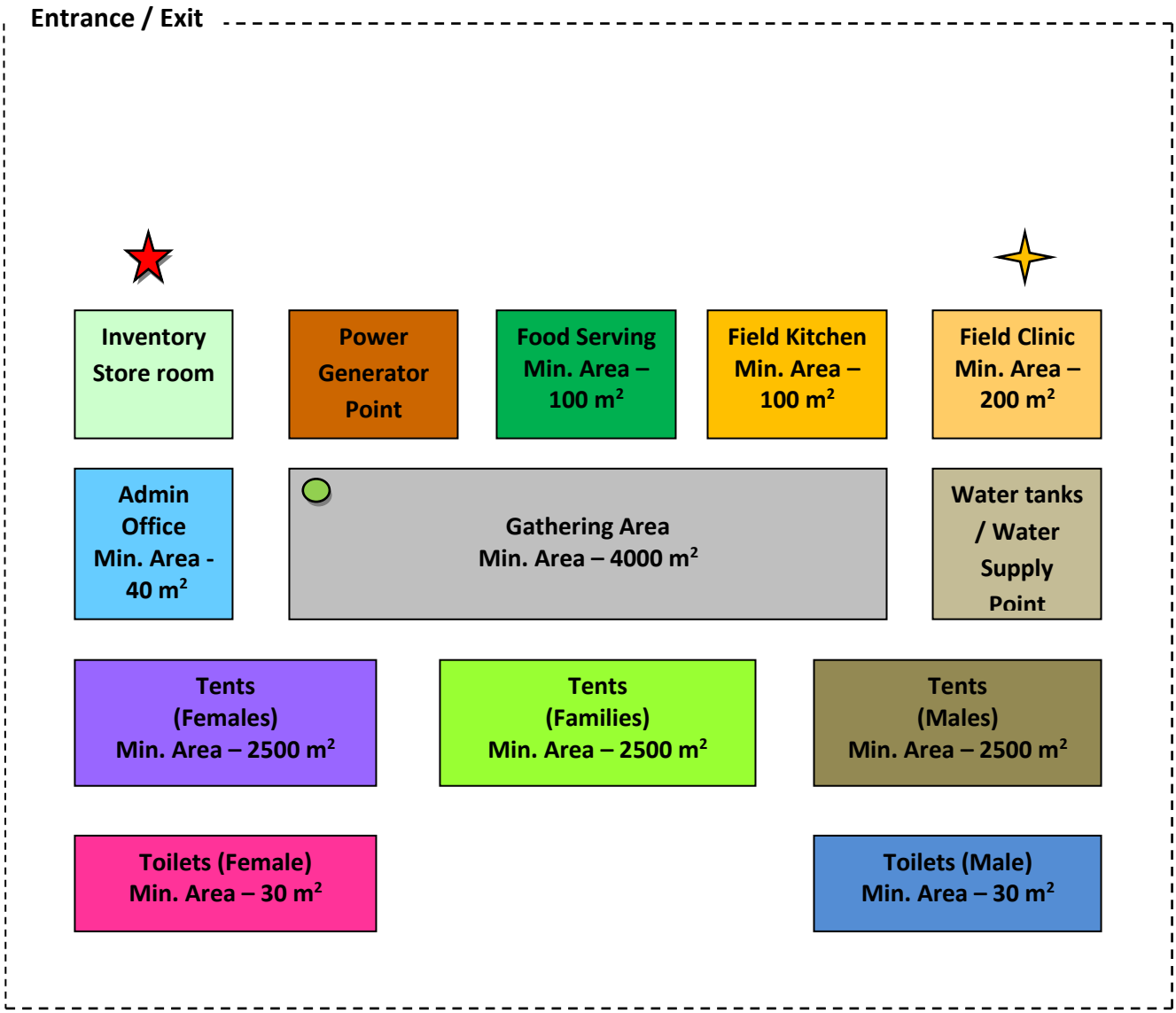
Although, the sample inventory items were procured/are being procured for the study, however, based on the past experience and requirements, suggestion of the inventory items along with its quantity was given by Municipal Corporation Shimla. Details of inventory to be stored in storage room of Safe Shelter, Quantity, Shelf life, replacement period and department concerned replacing the inventory stock on regular intervals is given in Annexure I.

Since, it is not possible to procure these many numbers of items in the budget provided in this project and logistically placed the items in the safe shelter. Also, earlier the development of safe was thought to taken up at much smaller scale However, this many number of items would require a larger infrastructure. Hence, the same may procured by the Municipal Corporation Shimla and development of the safe shelter can be carried out. However, the technical aspect on the development of safe shelter shall be monitored by Principal Investigator of the project, NIT Hamirpur.

7.1 LAYOUT OF SAFE SHELTER TO BE DEVELOPED AT OPEN GROUND

Layout of Safe Shelter to be developed in Open ground space in Shimla City is represented as follows:

IDEAL LAYOUT OF SAFE SHELTER IN OPEN GROUND



Note 1: The proposed layout will vary as per actual site conditions in each case.

LEGENDS:

Inventory Downloading Uploading Point

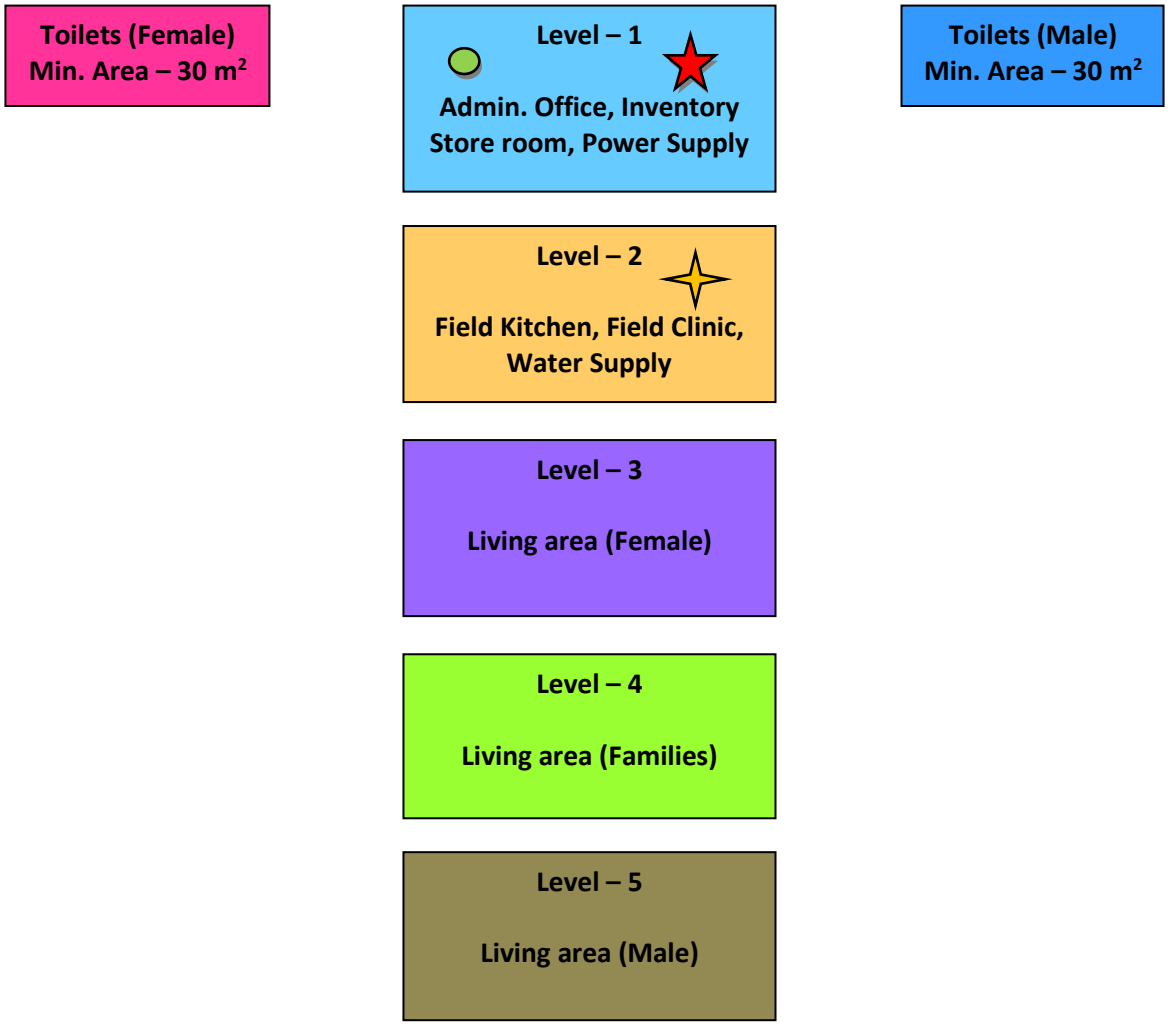
Ambulance Arriving Point

Notice board / Announcement Point

7.2 LAYOUT OF SAFE SHELTER TO BE DEVELOPED AT MULTILEVEL PARKING

Layout of Safe Shelter to be developed in Multi Level Parkings in Shimla City is represented as follows:

IDEAL LAYOUT OF SAFE SHELTER IN MULTILEVEL PARKINGS



Note 1: Level 1 will be that parking floor which is connected to the road level.

Note 2: The proposed layout will vary as per actual site conditions in each case.

LEGENDS:

Inventory Downloading Uploading Point

Ambulance Arriving Point

Notice board / Announcement Point

7.3 LAYOUT AND SPECIFICATION OF STORAGE ROOM

Two different layouts and specification of Storage room for inventory have immerged during the study.

1. Based on the basic items requirement for immediate post-earthquake disaster management.
2. Based on the items requirement for a period of 72 hours of post-earthquake scenario

1. *Based on the basic items requirement for immediate post-earthquake disaster management.*

   The storage room for the basic items for immediate post-earthquake could be built of size 2.4m x 2.4m (5.76 Sq.m). This safe shelter model will cater to first aid medical requirement, drinking water, power supply and sanitation.

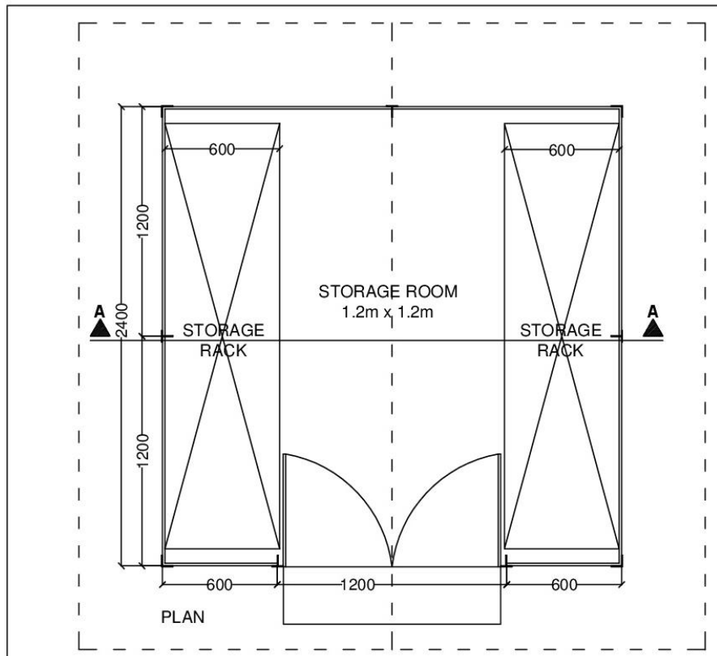
   Material - The storage room shall be built as a M.S frame structure.

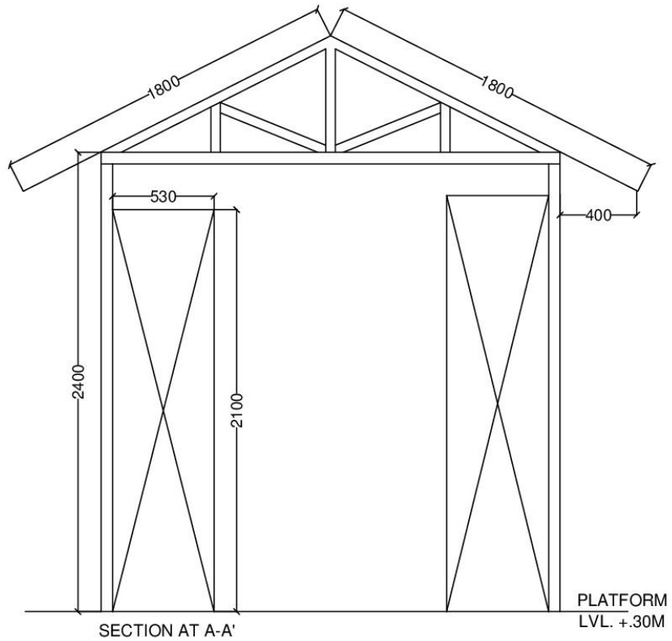
   Drawings for the same has been shown in Figure 7.1

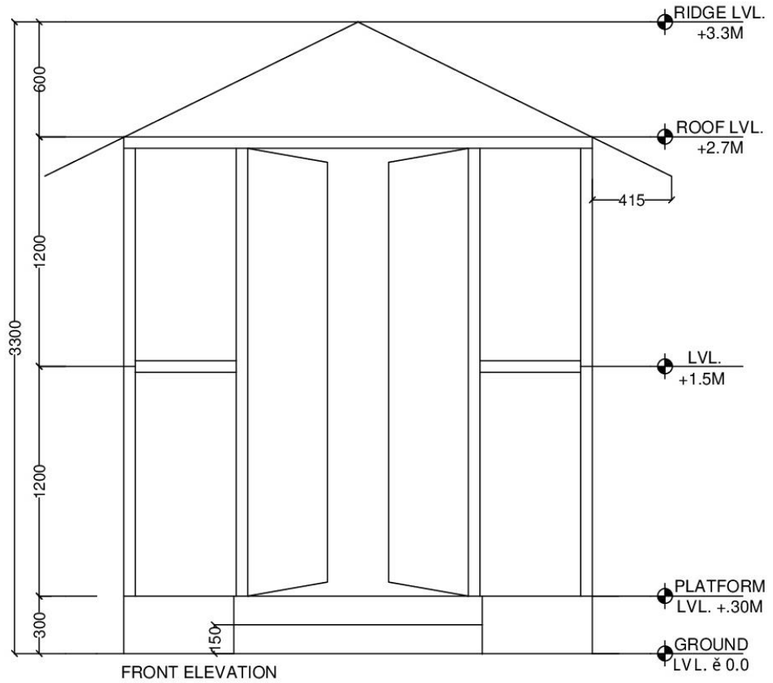
2. *Based on the items requirement for a period of 72 hours of post-earthquake scenario*

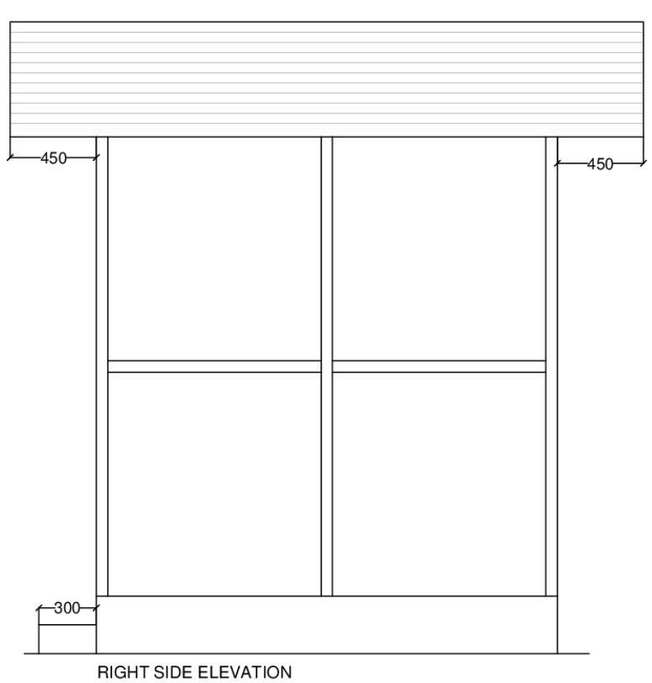
   The storage room for the items requirement for a period of 72 hours of post-earthquake scenario could be of size 10.80m x 3.60m (38.88 Sq.m). This safe shelter model will cater to first aid medical requirement, drinking water, power supply, sanitation, tentage, food supply. This modified storage room size and layout has been done with consecutive meeting between NIT and Municipal Corporation Shimla which were held on 12th, 14th, 18th and 22nd December 2017.

   Material - The storage room shall be built as a M.S frame structure. Drawings for the same has been shown in Figure 7.2









NOTES:

1. PANEL SHEETS USED FOR DOOR AND WALLS SHALL BE OF FIBRE CEMENT BOARD / CEMENT BONDED PARTICLE BOARD.
2. BRICKS USED IN CONSTRUCTION SHALL BE OF SECOND CLASS.
3. STORAGE RACKS SHALL BE MADE OF M.S ANGLES (ISA 45x45x6) AND M.S WIRE MESH 25mm x 25mm
4. ROOF G.ISHALL BE OF GALVALUME SHEETS
5. ALL THE MATERIAL USED IN CONSTRUCTION SHALL BE OF APPROVED MAKE.

PROJECT TITLE: IDENTIFICATION, PLAN AND DEVELOPMENT OF POST-EARTHQUAKE SAFE SHELTER FOR SHIMLA CITY	
DRAWING TITLE: ARCHITECTURAL DRAWING OF 2.4M x 2.4M STORAGE ROOM	
DRAWING NO: NITH/MCS/SSS/ARCH/01	
SHEET NO: 01	**SCALE:** Not To Scale

Figure 7.1 Storage Room Layout 2.4m x 2.4m in Safe Shelter

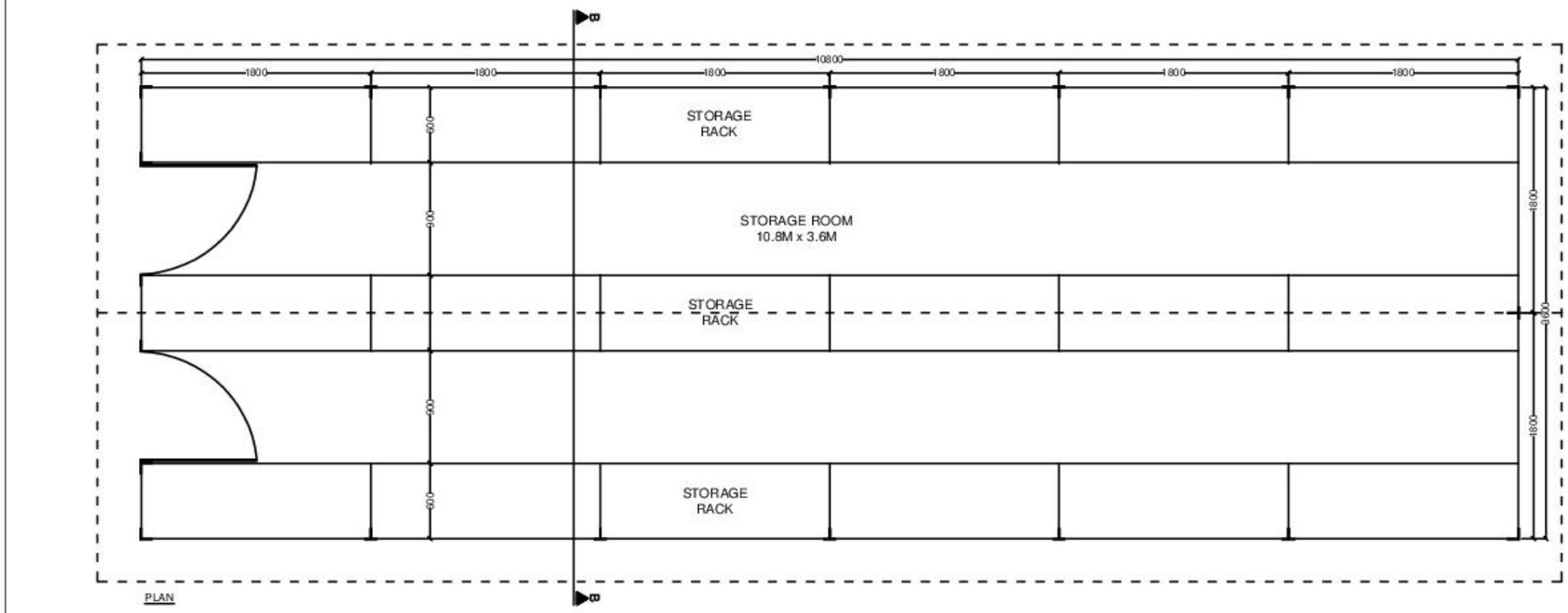


Figure 7.2 Storage Room Layout 10.8m x 3.6m in Safe Shelter

8.0 GPS LOCATION MAP OF SAFE SHELTER SITES SURVEYED AND BAWARIS

Each site and bawari which has been surveyed has its GPS location which has been mentioned in section 4.1. Here, GPS location maps have been made to have a brief idea about the location of sites and bawaris in Shimla City. The GPS location maps for Safe Shelter Sites and Bawaris surveyed for Safe Shelter setup has been given in Fig. 8.1 and Fig. 8.2 Respectively.

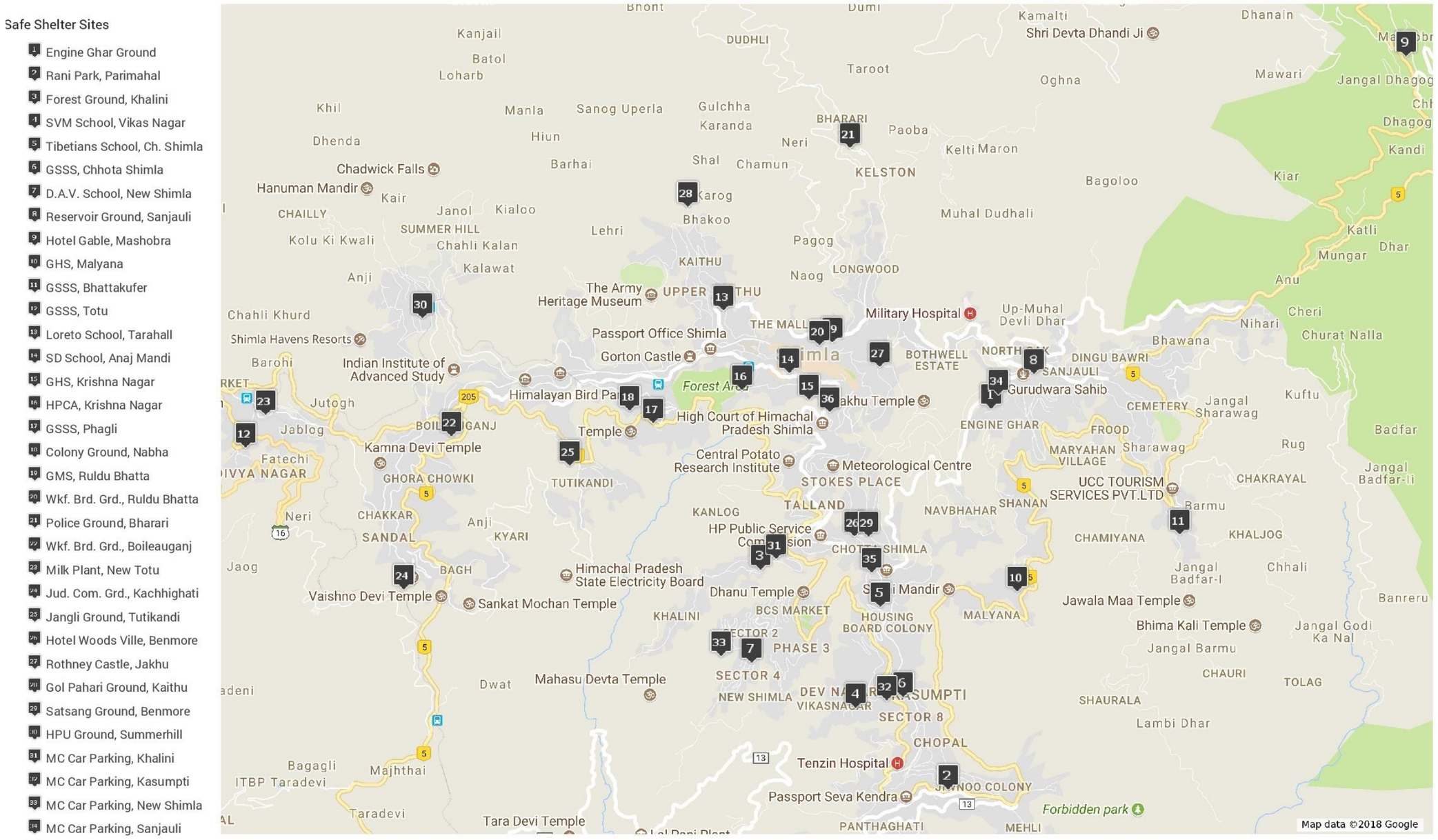


Figure 8.1 GPS Location map for Safe Shelter Sites

Bawaris Near Safe Shelter Sites

- Ward No. 24 Sangti
- Housing Board Colony
- Panchi Hatta
- Saraswati Vidya Mandir
- Nav-Bahar Vill. Bhakrayi
- Kaithu
- Ruldu Bhatta
- Dyton By Pass
- Vikas Nagar
- New Shimla

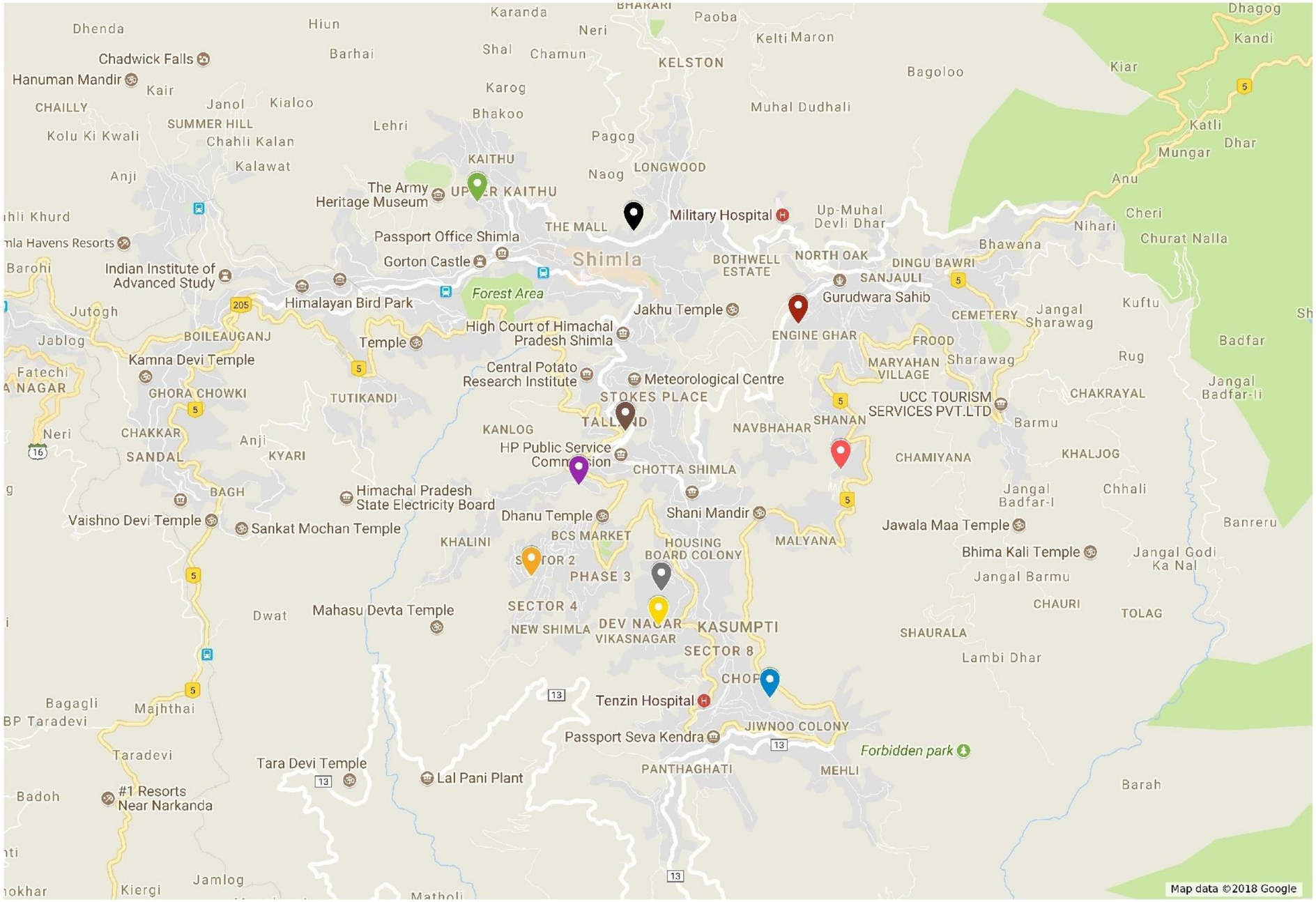


Figure 8.2 GPS Location map for Bawari

ANNEXURE – I

INITIAL INVENTORY CATRING FOR 500 PEOPLE AND TENTATIVE COST OF ONE SAFE SHELTER IN OPEN GROUND FOR SHIMLA CITY

SR. NO.	INVENTORY ITEMS	QUANTITY	COST (ONE UNIT)	AMOUNT (RS.)	REMARKS	SHELF LIFE
A	**WATER**	**Water Purification Tablet**				
1.	Chlorine Tablets (1000L)	5	430	2,150	Disinfects water in 30 minutes	36 Months
		Water Storage Tank				
2.	Plastic Water Tank 5000L	4	50,000	2,00,000	Desired water level will be maintained by Water supply dept.	-
3.	PVC foldable tank (10 Litre)	50	450	22,500	For individual/tent use	-
B	**SANITATION**	**Bio-degradable tissue paper/towel**				
4.	Coin Tissue (Set of 200 tissues)	25	350	8,750	For individual use	36 Months
5.	Bed bath towel (Set of 10)	10	1,500	15,000	For bed ridden patients	18 Months
6.	Cotton Towel	100	100	10,000	For individual use	-
7.	Soap for bathing and toilet	100	25	2,500	75g Antiseptic soap	36 Months
		Pit Toilet/Bio Toilet				
8.	Toilet Tent/Separators	20	1,500	30,000	Vertical camouflage tent.10 for male and 10 for female.	-
9.	Shovel (Digging tool)	10	1,000	10,000	-	-
10.	Crow Bar/Auger/Post hole digger	5	1,500	7,500	Bore hole digging	-
11.	Inoculum for toilet waste (5kg)	3	750	2,250	For composting human waste	12 Months
12.	Odor control agent (5kg)	2	750	1,500	-	18 Months
C	**MEDICAL TREATMENT**	**First Aid Kit**				
13.	First Aid Kit	10	4100	41,000	Suitable for 50 Persons	
14.	Antiseptic Liquid (1 Litre)	5	300	1,500	-	24 Months
15.	Surgical Cotton (1kg)	10	200	2,000	-	-
16.	Surgical Dressing	150	20	3,000	-	-
17.	Surgical Paper Tape (Set of 12)	10	350	3,500	-	24 Months
D	**LIGHTING**	**Solar/Battery/Self/Generator powered light**				
18.	Power Generator (5KV)	1	2,50,000	2,50,000	Petrol start Kerosene operated with 20L tank capacity	-
19.	Light for tent	50	300	15,000	Wired Light	-
20.	Light for Field Clinic	4	1,000	4,000	Solar Light	24 Months for battery

21.	Light for Cooking Area	4	1,000	4,000	Solar Light	24 Months for battery
22.	Light for Water Supply Area	2	1,000	2,000	Solar Light	24 Months for battery
23.	Lights for storage room	6	500	3,000	Wired Light	-
24.	Lights for toilets	20	500	10,000	Wired Light	-
25.	Holder for Light/Bulb	76	50	3,800	For Tent, Storage room and Toilets	-
26.	Portable Torch	10	800	8,000	Self/Hand Powered	-
E	**CONSTRUCTION**	**Construction/assembling**				
27.	Storage room	1	5,00,000	5,00,000	Autoclave Block/ Steel Framed/ Masonry Construction with provision for mice/ insects/moisture protection and inbuilt racks for stocking inventory	-
F	**COOKING**	**Utensils**				
28.	Disposable Plates (Set of 100)	45	200	9,000	Plastic made	-
29.	Disposable Spoons (Set of 100)	45	70	3,150	Plastic made	-
30.	Disposable glass (Set of 100)	20	100	2,000	Plastic made	-
31.	Utensil for Cooking (type I)	4	4,000	16,000	Aluminum Pot with lid	-
32.	Utensil for Cooking (type II)	4	500	2,000	Stainless Steel Palta	-
33.	Utensil for Cooking (type III)	8	200	1,600	For serving meals	-
34.	Utensil for boiling Water	2	3,000	6,000	Aluminum Pot with lid	-
		Ration/Cooking Material				
35.	Rice (50 kg bag)	12	-	-	350g for each person per day (as per WHO guidelines) To be supplied by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
36.	Pulse (50 kg Bag)	4	-	-	100g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
37.	Edible oil (10 litre)	5	-	-	25g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
39.	Salt (1 kg)	8	-	-	5g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
40.	Sugar (50kg)	2	-	-	20g for each person per day To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	6 Months
		Gas stove/Essentials				
42.	Stainless Steel Gas Burner	4	2500	10,000	Bhatti Type	-
43.	LPG hose pipe	4	650	2,600	3 Metre long	-

44.	LPG cylinder	4	1500	6,000	Commercial	-
		Utensils Washing				
45.	Detergent for washing utensils	10	220	2,200	(1 Litre)	-
G	**TENTS**	**Living area**				
46.	Tent for 10 person	50	35,000	17,50,000	Water Proof made of Tarpaulin	-
47.	Tarpaulin for tent flooring	50	1600	80,000	For making the bedding	-
48.	Bedding for tent	350	525	1,83,750	32mm Thick foam sheet to provide protection from ground moisture and thermal insulation	-
49.	Blankets for bedding	350	120	42,000	-	-
50.	Blankets for People	500	180	90,000	-	-
		Clinic/Field Clinic area				
51.	Tent for Clinic	1	80,000	80,000	Water Proof made of Tarpaulin	-
52.	Tarpaulin for flooring	2	1600	3,200	Below bedding	-
53.	Bedding	15	525	7,875	32mm Thick foam sheets	-
54.	Blankets for bedding	15	120	1,800	-	-
55.	Blankets for patients	20	180	3,600	-	-
		Kitchen area				
56.	Tent for Kitchen	1	60,000	60,000	Water Proof made of Tarpaulin	-
H	**MISCELLANEOUS ITEMS**					
57.	Easy climber	5	2300	11,500	To move inventory	
58.	Tarpaulin for storage room	10	1600	16,000		
59.	CCTV Camera	1	5,000	5,000	Recording activities near Storage room	-
60.	Storage for CCTV recording	1	6,000	6,000	1 TB storage and backup	-

61.	Kerosene (50 Litre)	1	-	-	To be stored in dark place preferably in masonry pit. To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	24 Months
		Total Cost		**35,64,225**		
Total cost in words – **Thirty Five Lacs Sixty Four Thousands Two Hundred Twenty Five Only**						
TENTATIVE COST OF 10 SAFE SHELTERS FOR SHIMLA CITY						
Cost of One Safe Shelter				**35,64,225**		
Total no. of Safe Shelter				10		
Total Cost of 10 nos. of Safe Shelter				**3,56,42,250**		
Miscellaneous 10%				**35,64,225**		
GRAND TOTAL				**3,92,06,475**		
Grand Total in words – **Three Crore Ninety Two Lacs Six Thousand Four Hundred Seventy Five Only**						

ANNEXURE – II

INITIAL INVENTORY CATRING FOR 500 PEOPLE AND TENTATIVE COST OF ONE SAFE SHELTER IN BUILT UP TYPE FOR SHIMLA CITY

SR. NO.	INVENTORY ITEMS	QUANTITY	COST (ONE UNIT)	AMOUNT (RS.)	REMARKS	SHELF LIFE
A	**WATER**	**Water Purification Tablet**				
1.	Chlorine Tablets (1000L)	5	430	2,150	Disinfect water in 30 minutes	36 Months
		Water Storage Tank				
2.	Plastic Water Tank 5000L	4	50,000	2,00,000	A desired water level will be maintained by Water supply dept.	-
3.	PVC foldable tank (10 Litre)	50	450	22,500	For individual/tent use	-
B	**SANITATION**	**Bio-degradable tissue paper/towel**				
4.	Coin Tissue (Set of 200 tissues)	25	350	8,750	For individual use	36 Months
5.	Bed bath towel (Set of 10)	10	1,500	15,000	For bed ridden patients	18 Months
6.	Cotton Towel	100	100	10,000	For individual use	-
7.	Soap for bathing and toilet	100	25	2,500	75g Antiseptic soap	36 Months
		Pit Toilet/Bio Toilet				
8.	Toilet Tent/Separators	20	1,500	30,000	Vertical camouflage tent.10 for male and 10 for female.	-
9.	Shovel (Digging tool)	10	1,000	10,000	-	-
10.	Crow Bar/Auger/Post hole digger	5	1,500	7,500	Bore hole digging	-
11.	Inoculum for toilet waste (5kg)	3	750	2,250	For composting human waste	12 Months
12.	Odor control agent (5kg)	2	750	1,500	-	18 Months
C	**MEDICAL TREATMENT**	**First Aid Kit**				
13.	First Aid Kit	10	4100	41,000	Suitable for 50 Persons	
14.	Antiseptic Liquid (1 Litre)	5	300	1,500	-	24 Months
15.	Surgical Cotton (1kg)	10	200	2,000	-	-
16.	Surgical Dressing	150	20	3,000	-	-
17.	Surgical Paper Tape (Set of 12)	10	350	3,500	-	24 Months
D	**LIGHTING**	**Solar/Battery/Self/Generator powered light**				
18.	Power Generator (5KV)	1	2,50,000	2,50,000	Petrol start Kerosene operated with 20L tank capacity	-
19.	Light for Field Clinic	4	1,000	4,000	Solar Powered Light	24 Months for battery

20.	Light for Cooking Area	4	1,000	4,000	Solar Powered Light	24 Months for battery
21.	Light for Water Supply Area	2	1,000	2,000	Solar Powered Light	24 Months for battery
22.	Lights for storage room	6	500	3,000	Wired Light	-
23.	Lights for toilets	20	500	10,000	Wired Light	-
24.	Holder for Light/Bulb	30	50	1,500	For Tent, Storage room and Toilets	-
25.	Portable Torch	10	800	8,000	Self/Hand Powered	-
E	**CONSTRUCTION**	**Construction/assembling**				
26.	Storage room	1	5,00,000	5,00,000	Autoclave Block/ Steel Framed/ Masonry Construction with provision for mice/ insects/moisture protection and inbuilt racks for stocking inventory	-
F	**COOKING**	**Utensils**				
27.	Disposable Plates (Set of 100)	45	200	9,000	Plastic made	-
28.	Disposable Spoons (Set of 100)	45	70	3,150	Plastic made	-
29.	Disposable glass (Set of 100)	20	100	2,000	Plastic made	-
30.	Utensil for Cooking (type I)	4	4,000	16,000	Aluminum Pot with lid	-
31.	Utensil for Cooking (type II)	4	500	2,000	Stainless Steel Palta	-
32.	Utensil for Cooking (type III)	8	200	1,600	For serving meals	-
32.	Utensil for boiling Water/Tea/Milk	2	3,000	6,000	Aluminum Pot with lid	-
		Ration/Cooking Material				
34.	Rice (50 kg bag)	12	-	-	350g for each person per day (as per WHO guidelines) To be supplied by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
35.	Pulse (50 kg Bag)	4	-	-	100g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
36.	Edible oil (10 litre)	5	-	-	25g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
37.	Salt (1 kg)	8	-	-	5g for each person per day (as per WHO guidelines) To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	12 Months
38.	Sugar (50kg)	2	-	-	20g for each person per day To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	6 Months
		Gas stove/Essentials				

39.	Stainless Steel Gas Burner	4	2500	10,000	Bhatti Type	-
40.	LPG hose pipe	4	650	2,600	3 Metre long	-
41.	LPG cylinder	4	1500	6,000	Commercial	-
		Utensils Washing				
42.	Detergent for washing utensils (1 Litre)	10	220	2,200	-	-
G	**TENTS**	**Living area**				
43.	Separators	50	2500	1,25,000	Made of Tarpaulin	-
44.	Tarpaulin flooring	50	2500	1,25,000	For making the bedding	-
45.	Bedding for tent (32mm thick foam sheet)	350	525	1,83,750	32mm Thick foam sheet to provide protection from ground moisture and thermal insulation	-
46.	Blankets for bedding	350	120	42,000	-	-
47.	Blankets for People	500	180	90,000	-	-
		Clinic/Field Clinic area				
48.	Separator	10	2,500	25,000	Made of Tarpaulin	-
49.	Tarpaulin for flooring	10	2,500	25,000	Below bedding	-
50.	Bedding	20	525	10,500	32mm Thick foam sheets	-
51.	Blankets for bedding	20	120	2,400	-	-
52.	Blankets for patients	20	180	3,600	-	-
		Kitchen area				
53.	Separator	10	2,500	25,000	Made of Tarpaulin	-
H	**MISCELLANEOUS ITEMS**					
54.	Easy climber	5	2300	11,500	To move inventory	
55.	Tarpaulin for storage room	10	1600	16,000		

56.	CCTV Camera	1	5,000	5,000	Recording activities near Storage room	-
57.	Storage for CCTV recording	1	6,000	6,000	1 TB storage and backup	-
58.	Kerosene (50 Litre)	1	-	-	To be stored in dark place preferably in masonry pit. To be supplied and replaced by Food and Civil Supplies Dept. on circulation/ life cycle basis	24 Months
		Total Cost		**19,01,950**		
Total cost in words – **Nineteen Lacs One Thousand Nine Hundred Fifty Only**						
TENTATIVE COST OF 10 SAFE SHELTERS FOR SHIMLA CITY						
Cost of One Safe Shelter				**19,01,950**		
Total no. of Safe Shelter				5		
				19,01,950 x 10		
Total Cost of 10 nos. of Safe Shelter				**95,09,750**		
Miscellaneous 10%				**9,50,975**		
GRAND TOTAL				**1,04,60,725**		
Grand Total in words – **One Crore Four Lacs Sixty Thousand Seven Hundred Twenty Five Only**						