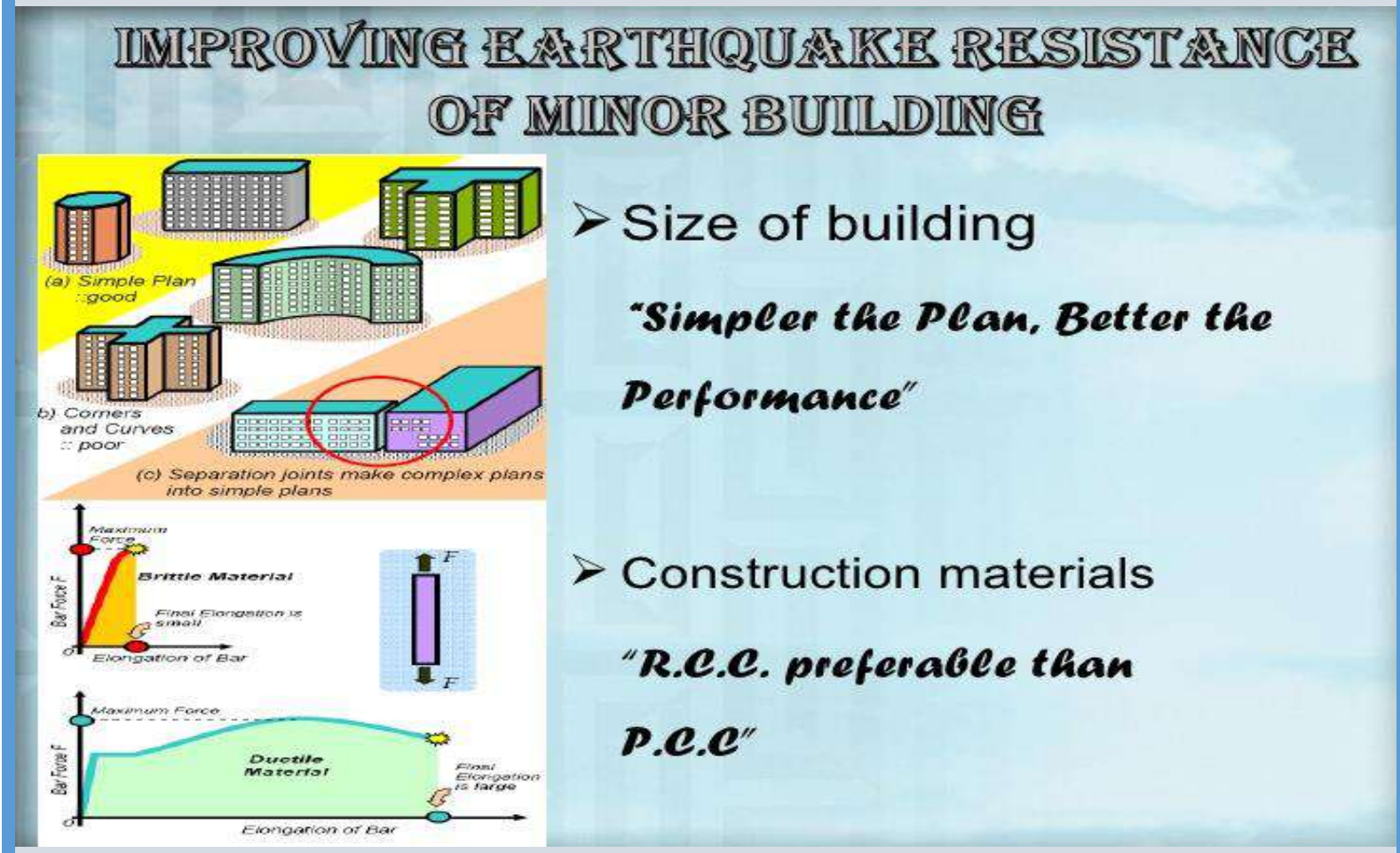
# TRAINING OF MASONS ON HAZARD-RESISTANT CONSTRUCTION

**AT**

**DEHAR PANCHAYAT, SUNDERNAGAR BLOCK, DISTT MANDI HP**




*Organised by*

**Himachal Pradesh Council for Science, Technology and Environment, Shimla**

*In collaboration with*

**State Disaster Management Authority (SDMA), H.P. Secretariat, Shimla**

## FIRST MODULE (18-20 FEBRUARY 2020)

## EXECUTIVE SUMMARY

**WORK SCHEDULE FOR TRAINING ON "EARTHQUAKE RESISTANT CONSTRUCTIONS" FOR RURAL MASONS"**

**VENUE: O/o Junior Engineer, Irrigation and Public Health Department, *Dehar.***

**PROGRAMME: 18-20 February, 2020. PARTICIPANTS : 29No.**
**Organised by : HP Council for Science, Technology and Environment (HIMCOSTE).**
**Sponsored by: State Disaster Management Authority, Shimla.**

| Day/Sessions | Topic | Resource Person |
|---|---|---|
| **Day 1- 18.02.2020 (Thursday)** | | |
| **09:00- 09:30** | Registration and Inaugural session and video film. | **Inauguration** |
| **09.30 to 10.00**<br>**C 1** | Purpose of training and Introduction of Participants. | **Sh. Gopal Jain, Scientific Officer,** HIMCOSTE, Shimla |
| **10.00 to 11.00**<br>**C 2** | Housing Typologies of the<br>Region: Contribution and Role of Artisans | **Ar. PremLal Thakur, Asstt. Architect,** HIMCOSTE, Shimla |
| **11.00 to 12.30**<br>**C 3** | Hazard : Severity, Zonation and Impact on Buildings | **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar |
| Lunch Break | | |
| **13:30 to 18.00**<br>**P 4** | Examining Quality of Materials importance of construction Tools for Good Quality Construction | **Gopal Jain,** Scientific Officer, **Er. Kalit Bhardwaj,** Sr. Tech Asstt**, Ar. PremLal,** Asstt. Architect.<br>**Er. KanchanRana,** Jr. Research Fellow |
| **Day 2- 19.02.2020 (Wednesday)** | | |
| **09:00 to 09:30** | Recapitulating the previous<br>Day's Learning. | **Sh. Gopal Jain**, Scientific Officer, HIMCOSTE, Shimla<br>**Er. KanchanRana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| **09.30 to 10.30**<br>**C 5** | Principles of Hazard Resistant of Construction. | **Ar. PremLal Thakur, Asstt. Architect,** HIMCOSTE, Shimla |
| **10.30 to 11.30**<br>**C 6** | Hazard Resistant Features for House Size and Configuration. | **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar |

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|---|---|---|
| **11.30 to 12.30**<br>**C 7** | Importance of Site and Soil Conditions. | **Er. KanchanRana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| Lunch Break | | |
| **13.30 to 14.30**<br>**C 8** | Hazard Resistant Features:<br>Foundation and Plinth. | **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar |
| **14:30 to 18:00**<br>**P 9** | Constructing Sample foundation and Plinth. | **Gopal Jain,** Scientific Officer, **Er. Kalit Bhardwaj,** Sr. Tech Asstt**, Ar. PremLal,** Asstt. Architect.<br>**Er. KanchanRana,** Jr. Research Fellow |
| **DAY 3 - 20.02.2020 (Thursday)** | | |
| **9:00 to 09:30** | Recapitulating the previous Day's Learning. | **Sh. Gopal Jain**, Scientific Officer, HIMCOSTE, Shimla<br>**Er. KanchanRana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| **09.30 to 12.30**<br>**C 10** | Hazard Resistant Features:<br>Walls and Openings. | **Ar. PremLal Thakur, Asstt. Architect,** HIMCOSTE, Shimla |
| Lunch Break | | |
| **13:30 to 18:00**<br>**P 11** | Constructing Hazard Resistant Walls. | **Gopal Jain,** Scientific Officer, **Er. Kalit Bhardwaj,** Sr. Tech Asstt**, Ar. PremLal,** Asstt. Architect.<br>**Er. KanchanRana,** Jr. Research Fellow |

| **HIMCOSTE, Team Members** | | |
|---|---|---|
| **S. NO.** | **Name** | **Designation** |
| 1. | Sh. Gopal Jain | Scientific Officer |
| 2. | Ar. PremLal | Asstt. Architect. |
| 3. | Er. Kalit Bhardwaj | Sr. Tech Asstt., |
| 4. | Er. KanchanRana | Jr. Research Fellow |

## Introduction

This training made them aware not only of the critical principles of hazards resistant construction but also provide some practical skills in appropriate and relevant details of Rural Housing Technologies that people use in different regions of India. The objective of this training curriculum is to strengthen the practicing Masons on Hazard Resistant Construction Techniques and features through theoretical and practical sessions.

**This training is meant to guide Masons on construction of engineered houses up to two stories and does not cover construction of engineered buildings with reinforced concrete frame for multi storey buildings.**

### Training methods

This training module is envisaged to be for 3 days. Each training day is designed such that there is ample time for hands-on training of Masons. The classroom sessions are plant using participatory methods with discussions, audio visual presentations models etc. Sessions provide enough time and scope for the trainees to discuss their concerns, questions and issues. The practical construction sessions were to get hands-on experience of hazard resistant features and details used in construction work.


A maximum of 3 dozen Masons were trained at one time with three resource persons training them.

**Masons trained at DeharPanchayat, Sundernagar block, Distt. Mandi. H.P. from 18-20 February, 2020. The total number of masons were 29.**

| Sr. No. | Name | Father Name | Panchayat | Address | Phone |
|---|---|---|---|---|---|
| 1 | Sh. Manoj Kumar | Sh. Balwant | Salwana | Vill. Guddidhar,P.O. Salwana, Tehsil Sundernagar Distt. Mandi | 98050 16473 |
| 2 | Sh. Sita Ram | Sh. Ram Chand | Kangu | Vill. Jakhol,P.O. Kangu, Tehsil Sundernagar Distt. Mandi | 86289 13589 |
| 3 | Sh. Sant Ram | Sh. Budhu Ram | Jarol | Vill. Bhawana,P.O. Jarol, Tehsil Sundernagar Distt. Mandi | 78762 46614 |
| 4 | Sh. Rattan Lal | Sh. Dyalu Ram | Chanol | Vill. Chanol,P.O. Taleli, Tehsil Sundernagar Distt. Mandi | 78071 47244 |
| 5 | Sh. Desh Raj | Sh. Ranjeet Singh | Chanol | Vill. Barl,P.O. Taleli, Tehsil Sundernagar Distt. Mandi | 98168 92832 |
| 6 | Sh. Ram Lal | Sh. Dandu Ram | Baroti | Village Thana ,P.O. Baroti ,Tehsil Sundernagar , Mandi | 85447 09010 |
| 7 | Sh. Sher Singh | Sh. Sarnu | Tihari | Vill. Chouri ,P.O. Ghanganoo, Tehsil Sundernagar Distt. Mandi | 78072 09031 |
| 8 | Sh. Indru Ram | Sh. Mansu Ram | Baroti | Vill. Sohar ,P.O. Baroti , Tehsil Sundernagar Distt. Mandi | 98166 94729 |
| 9 | Sh. Roop Lal | Sh. Nathu Ram | Tihari | VPO. Ghanganoo, Tehsil Sundernagar , Distt. Mandi | 98571 98109 |

| | | | | | |
|---|---|---|---|---|---|
| 10 | Sh. Sukh Ram | Sh. Gokul | Dehar | VPO Dehar , Up Tehsil Dehar , Distt. Mandi | 75800 61406 |
| 11 | Sh. Leharu Ram | Sh. Tota Ram | Dehar | VPO Dehar , Up Tehsil Dehar , Distt. Mandi | 98170 33956 |
| 12 | Sh. Khem Raj | Sh. Achhru Ram | Dehar | Vill. Alsu , P.O. Dehar , Tehsil Sundernagar Distt. Mandi | 98177 11003 |
| 13 | Sh. Krishan Lal | Sh. Sant Ram | Dehar | Vill. Drehda, P.O. Dehar , Up Tehsil Dehar , Distt. Mandi | 98051 20345 |
| 14 | Sh. Roshan Lal | Sh. Devnu Ram | Smoun | Vill. Manjhayar , P.O. Salwana , Up Tehsil Dehar, Distt. Mandi | 98051 63162 |
| 15 | Sh. Hans Raj | Sh. Minku Ram | Dehar | Vill. Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 98828 44322 |
| 16 | Sh. Vikash Kumar | Sh. Roop Lal | Jambla | Vill. Upper Kotalu, P.O. Jambla ,Up Theisl dehar , Distt. Mandi | 98164 50650 |
| 17 | Sh. Gopal | Sh. Mani Ram | Dehar | Vill. Lower Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 78072 54427 |
| 18 | Sh. Tota Ram | Sh. Shankar Ram | Dehar | Vill. Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 98162 16435 |
| 19 | Sh. Roshan Lal | Sh. Longu Ram | Kangu | Vill. Jakhol , P.O. Kangu , Up Tehsil Dehar , Distt. Mandi. | 98054 63665 |
| 20 | Sh. Prabhu Ram | Sh. Munshi Ram | Nalag | Vill. Nalag , P.O. Nalag , Up Tehsil Dehar , Distt. Mandi. | 98164 21938 |
| 21 | Sh. Roshan Lal | Sh. Narayanu Ram | Nalag | Vill. Nalag , P.O. Nalag , Up Tehsil Dehar , Distt. Mandi. | 98161 60601 |
| 22 | Sh. Balak Ram | Sh. Kansi Ram | Jambla | Vill. Chamrada , P.O. Jambla , Up Tehsil Dehar , Distt. Mandi. | 98165 26825 |
| 23 | Sh. Tota Ram | Sh. Narayanu | Jambla | Vill. Sai, P.O. Dehar ,Up Tehail Dehar , DIStt. Mandi | 98166 50328 |
| 24 | Sh. Ram Prasad | Sh. Paras Ram | Jarol | VPO Jarol , Up Tehsil Dehar , Distt. Mandi | 86797 38794 |
| 25 | Sh. Chandu Ram | Sh. Jaind Ram | Dehar | VIll. Kot, P.O. Dehar , Up Tehsil Dehar , Distt. Mandi | 89889 96879 |
| 26 | Sh. Ram Krishan | Sh. Guju Ram | Salwana | VPO Salwana Tehsil Sundernagar , Distt. Mandi | 98169 34584 |
| 27 | Sh. Kamal Dev | Sh. Hiru | Salwana | VIll. Guddidhar ,P.O. Salwana , Up Tehsil Dehar , Distt. Mandi | 82787 82417 |
| 28 | Sh. Sunil Kumar | Sh. Om Prakesh | Salwana | Vill. Fagla , P.O. Salwana, Up Tehsil Dehar , Distt. Mandi | 88945 52549 |
| 29 | Sh. Amar Nath | Sh. Bansi Ram | Dehar | Vill. Alsu, P.O. Dehar , Up Tehsil Dehar, Distt. Mandi | 80912 01409 |

# Training Sessions

## Inaugural Session

The opening speech is given **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar. The esteemed dignitaries present were,**Sh. Gopal Jain** Scientific Officer HIMCOSTE, Ar. Prem Lal Thakur Asstt. Architect HIMCOSTE, **Er. KanchanRana,**Jr. Research FellowHIMCOSTE **and** the audience. While inaugurating the training lauded that such trainings may help in adoption of suitable Earthquake Resistant Technologies and serve the larger interest of the Himalayan State, which falls in Zone IV & V by the norms of the earthquake definitions.

## Welcome Address

At the outset of the Programme, **Sh. Gopal Jain, Scientific Officer,** HIMCOSTE, Shimla of esteemed dignitaries and the entire audience. Setting the Programme's premise. She highlighted the growing concern around hazard resistant techniques. He appreciated the effort of HIMCOSTE for taking up an interesting societal programme. She advised the trainee participants to learn appropriate techniques with full dedication and a commitment in order to take and transfer them further for field implementations in all future construction activities. He also suggested for inclusion of a discussion on suitable retrofitting techniques in the training curriculum so as to help and get them implemented in the improvement of the existing houses and making them earthquake resistant.

The training comprises of theory and practical sessions, The sessions are named in sequence of 1 to 13 and the prefix letter indicates the nature of session i.e. "C' for classroom session and "P" for practical exercises.

**Session C1** was introductory classroom session where **Sh. Gopal Jain, Scientific Officer,** HIMCOSTE, Shimladiscussed about the coarse objective. The participants interacted with each other and with the trainers. Their expectations from this training program were defined in this session.

The participants were encouraged to discuss the role the artisan play in influencing the choices of the house owners and promoting hazard resistant specifically in context of self build of self build houses.

**Session C2**In this session,**Ar. Prem Lal Thakur,**Asstt. Architect, HIMCOSTEintroduced the participants to good construction practices in the country. He focused on regional context of the trainees. This establish linkages between the building typologies and materials available as well as construction skills in the region. This session led discussion on important roleartisans have played in evolving these typologies.


**Session C3**In this session, **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar, discussed about how to examine quality of materials and importance of construction tools for good quality of construction. He also discussed different natural hazards and focused on the locally experienced hazards, their severity, frequency and their impact on buildings.

**Er. KanchanRana, Jr. Research Fellow** HIMCOSTE, Shimla The natural hazards covered under different topics are earthquake, flood, cyclone, tsunami and landslides. There is flexibility to include other local hazards that may affect the particular region. The session gives conceptual understanding of different hazard zones that the country is divided into and the impact a particular region would have certain hazards. A specific discussion was initiated

in the session on multiple hazards striking a particular region. Further impact of the above hazards on buildings is discussed.

**Session P4** was a practical session which is meant to instil the importance of good quality materials and workmanship in construction. In this session, masonsvisited the Demonstration Centre with **HIMCOSTE Team.**Layout and Construction of Sample Foundation was done.Simple steps, rules and techniques were expected to be performed by participants to know their understanding of basics of construction. The session helped the trainers to know the skill levels of the participants so as to customise future instructions.

**Session C5**was a classroom session given by **Ar. PremLal Thakur, Asstt. Architect,** HIMCOSTE, Shimla. This session was focusedon Recapitulation of previous Day's Learning on the principles of hazard resistant construction. While discussing various hazards that induced damage, this session identified the characteristics that help buildings survive earthquake forces. Basic structural principles were discussed in this session with simple and often day to day life examples.

**Session C6, Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar discussed about the Hazard Resistant Features for House Size and Configuration.

**Session C7, Er. KanchanRana, Jr. Research Fellow** HIMCOSTE, Shimla, discussed about the Importance of Site and Soil Conditions.

**Session C8, Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar told the masons about the Hazard Resistant Features for House Size and Configuration.

**Session P9,** was a practical session which was meant to construct the Hazard Resistant Foundations with corner vertical bars. This sessions was led by **HIMCOSTE Team**. The plinth is constructed on site.

The bar are provided at the corners of walls to make the building earthquake resistant.

**Session C10** was a classroom session in whichHouse size and shape and damage due to hazards was discussed. **Ar. PremLal Thakur, Asstt. Architect,** HIMCOSTE, Shimla made all masons aware about size, shape, scale and proportions of building and its elements that play important role in determining whether or not the building is prone to damage during hazards.

**Session P11** was a practical session in **Gopal Jain,** Scientific Officer, **Er. Kalit Bhardwaj,** Sr. Tech Asstt**, Ar. PremLal,** Asstt. Architect and **Er. KanchanRana,** Jr. Research Fellow Team talked about Hazard Resistant Features and construction of Foundation and Plinth. The masons are made familiar with the good construction practices, directions of windows, slab thickness, steps to be followed in stone masonry and brick masonry, techniques of shuttering, positions of windows and doors, construction of staircases.

Participants understands how to construct foundations incorporating hazard resistant features. The foundations chosen in these exercises were selected from the locally practiced typologies. Also, participants were exposed to the basics of reinforced concrete footings and details of horizontal bands.

**In** a practical session in which construction of earthquake resistant plinth band was done. **Ar. Prem Lal Thakur and HIMCOSTE TEAM also** discuss facts of building site, different soil types and hazard resistant features of the house.

Specific soil conditions like house on black cotton or Sandy soils as well as special incidents like liquefaction are discussed in this section.

Specifications of foundation for hilly Terrain and landslide prone regions are discussed in this session. Junction of vertical reinforcement and horizontal bands.

**The Major Things learned from this workshop:-**

1. Construct CL stubs and mark CL and level. Protect stubs from damage. Protect stubs from damage.

2. Always check dimensions and corners by 3-4-5 method or equal diagonal method.

3. Check the level of construction at different levels.

4. Check that the course are in level.

5. After checking the level plumb the bob.

6. Apply mortar to brick face before putting it in the course and fill all the mortar joints.

7. Consume mortar within 30-60 minutes of adding water.

8. Ensure perfect bond.

9. Provide RC band and corner steel as per design and detail.

The final structure made is shown in the following picture.

# Feedbacks

1. They like the Training programme because they learned new techniques for hazard resistant construction.

2. They don’t use the horizontal and vertical bands in the construction of buildings, now they said they will use.

3. They commit that they will use centre line method and will use stubs in construction.

4. They said that they will teach other masons these techniques.

5. In village they don’t use bands in load bearing structures, but now will use.

6. They said that they have learned 50% new techniques.

# SECOND MODULE OF MASON TRAINING

## (27-29 February, 2020)

### EXECUTIVE SUMMARY

**WORK SCHEDULE FOR TRAINING ON "EARTHQUAKE RESISTANT CONSTRUCTIONS" FOR RURAL MASONS"**
**VENUE: O/o Junior Engineer, Irrigation and Public Health Department, *Dehar***

**PROGRAMME: 27-29 February, 2020. PARTICIPANTS : 29No.**
**Organised by : HP Council for Science, Technology and Environment (HIMCOSTE).**
**Sponsored by: State Disaster Management Authority, Shimla.**

| Day/Sessions | Topic | Resource Person |
|---|---|---|
| **Day 4- 27.02.2020 (Thursday)** | | |
| **09:00- 09:30** | Registration and Inaugural session Recapitulating the previous Day's Learning. | **Inauguration** |
| **09.30 to 12.30**<br>**C 12** | Hazard Resistant Features | **Sh. Gopal Jain,** Scientific Officer, HIMCOSTE, Shimla |
| Lunch Break | | |
| **13:30 to 18.00**<br>**P 13** | Constructing Hazard Resistant | **Gopal Jain**, Scientific Officer, **Er. Kalit Bhardwaj**, Sr. Tech Asstt, **Ar. Prem Lal**, Asstt. Architect.<br>**Er. Kanchan Rana**, Jr. Research Fellow |
| **Day 5- 28.02.2020 (Friday)** | | |
| **09:00 to 09:30** | Recapitulating the previous Day's Learning. | **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar<br>**Er. Kanchan Rana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| **09.30 to 12.30**<br>**P 14** | Field Visit: Rural House Construction and Materials Available. | **Gopal Jain**, Scientific Officer, **Er. Kalit Bhardwaj**, Sr. Tech Asstt, **Ar. Prem Lal**, Asstt. Architect.<br>**Er. Kanchan Rana**, Jr. Research Fellow |
| Lunch Break | | |
| **13.30 to 18.00**<br>**P 14** | Field Visit (Continued). | **Gopal Jain**, Scientific Officer, **Er. Kalit Bhardwaj**, Sr. Tech Asstt, **Ar. Prem Lal**, Asstt. Architect. |

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|---|---|---|
| | | **Er. Kanchan Rana**, Jr. Research Fellow |
| **Day 6- 29.02.2020 (Saturday)** | | |
| **9:00 to 09:30** | Recapitulating the previous Day's Learning. | **Ar. Prem Lal Thakur,** Asstt. Architect, HIMCOSTE, Shimla<br>**Er. Kanchan Rana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| **09.30 to 11.30**<br>**C 15** | Hazard Resistant Features for Other Construction Elements. | **Er. Kanchan Rana, Jr. Research Fellow**<br>HIMCOSTE, Shimla. |
| **11.30to 12.30**<br>**C 16** | Estimation of Quantities and Costs. | **Er. Kalit Bhardwaj,** Sr. Tech Asstt, Appropriate Technology Centre, Govt. Polytechnic College Sundernagar |
| Lunch Break | | |
| **13:30 to 15:30** | Tests | |
| **15:30 – 16:30**<br>**C 17** | Clarification of Questions | **HIMCOSTE Team** |
| **16:30 – 18:00**<br>**C 18** | Concluding Session | **Certificates distribution.** |

*Tea will be served at 11:30 and 15:30.

| **HIMCOSTE, Team Members** | | |
|---|---|---|
| **S. NO.** | **Name** | **Designation** |
| 1. | Sh. Gopal Jain | Scientific Officer |
| 2. | Ar. Prem Lal | Asstt. Architect. |
| 3. | Er. Kalit Bhardwaj | Sr. Tech Asstt., |
| 4. | Er. Kanchan Rana | Jr. Research Fellow |
| 5. | Sh. Tajender Kumar | Master Trainer |

**REGISTRATION OF MASONS OF THREE DAYS TRAINING PROGRAMME ON "EARTHQUAKE RESISTANT CONSTRUCTION " AT GRAM PANCHAYAT DEHAR , TEHSIL SUNDERNAGAR DISTT. MANDI. H.P FROM 27TH TO 29TH , FEBRUARY, 2020.**

| Sr. No. | Name | Father Name | Panchayat | Address | Phone |
|---|---|---|---|---|---|
| 1 | Sh. Manoj Kumar | Sh. Balwant | Salwana | Vill. Guddidhar,P.O. Salwana, Tehsil Sundernagar Distt. Mandi | 98050 16473 |
| 2 | Sh. Sita Ram | Sh. Ram Chand | Kangu | Vill. Jakhol,P.O. Kangu, Tehsil Sundernagar Distt. Mandi | 86289 13589 |
| 3 | Sh. Sant Ram | Sh. Budhu Ram | Jarol | Vill. Bhawana,P.O. Jarol, Tehsil Sundernagar Distt. Mandi | 78762 46614 |
| 4 | Sh. Rattan Lal | Sh. Dyalu Ram | Chanol | Vill. Chanol,P.O. Taleli, Tehsil Sundernagar Distt. Mandi | 78071 47244 |
| 5 | Sh. Desh Raj | Sh. Ranjeet Singh | Chanol | Vill. Barl,P.O. Taleli, Tehsil Sundernagar Distt. Mandi | 98168 92832 |
| 6 | Sh. Ram Lal | Sh. Dandu Ram | Baroti | Village Thana ,P.O. Baroti ,Tehsil Sundernagar , Mandi | 85447 09010 |
| 7 | Sh. Sher Singh | Sh. Sarnu | Tihari | Vill. Chouri ,P.O. Ghanganoo, Tehsil Sundernagar Distt. Mandi | 78072 09031 |
| 8 | Sh. Indru Ram | Sh. Mansu Ram | Baroti | Vill. Sohar ,P.O. Baroti , Tehsil Sundernagar Distt. Mandi | 98166 94729 |
| 9 | Sh. Roop Lal | Sh. Nathu Ram | Tihari | VPO. Ghanganoo, Tehsil Sundernagar , Distt. Mandi | 98571 98109 |
| 10 | Sh. Sukh Ram | Sh. Gokul | Dehar | VPO Dehar , Up Tehsil Dehar , Distt. Mandi | 75800 61406 |
| 11 | Sh. Leharu Ram | Sh. Tota Ram | Dehar | VPO Dehar , Up Tehsil Dehar , Distt. Mandi | 98170 33956 |
| 12 | Sh. Khem Raj | Sh. Achhru Ram | Dehar | Vill. Alsu , P.O. Dehar , Tehsil Sundernagar Distt. Mandi | 98177 11003 |
| 13 | Sh. Krishan Lal | Sh. Sant Ram | Dehar | Vill. Drehda, P.O. Dehar , Up Tehsil Dehar , Distt. Mandi | 98051 20345 |
| 14 | Sh. Roshan Lal | Sh. Devnu Ram | Smoun | Vill. Manjhayar , P.O. Salwana , Up Tehsil Dehar, Distt. Mandi | 98051 63162 |
| 15 | Sh. Hans Raj | Sh. Minku Ram | Dehar | Vill. Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 98828 44322 |
| 16 | Sh. Vikash Kumar | Sh. Roop Lal | Jambla | Vill. Upper Kotalu, P.O. Jambla ,Up Theisl dehar , Distt. Mandi | 98164 50650 |

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|---|---|---|---|---|---|
| 17 | Sh. Gopal | Sh. Mani Ram | Dehar | Vill. Lower Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 78072 54427 |
| 18 | Sh. Tota Ram | Sh. Shankar Ram | Dehar | Vill. Alsu , P.O. Dehar , Up Tehsil Dehar Distt. Mandi | 98162 16435 |
| 19 | Sh. Roshan Lal | Sh. Longu Ram | Kangu | Vill. Jakhol , P.O. Kangu , Up Tehsil Dehar , Distt. Mandi. | 98054 63665 |
| 20 | Sh. Prabhu Ram | Sh. Munshi Ram | Nalag | Vill. Nalag , P.O. Nalag , Up Tehsil Dehar , Distt. Mandi. | 98164 21938 |
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| 27 | Sh. Kamal Dev | Sh. Hiru | Salwana | VIll. Guddidhar ,P.O. Salwana , Up Tehsil Dehar , Distt. Mandi | 82787 82417 |
| 28 | Sh. Sunil Kumar | Sh. Om Prakesh | Salwana | Vill. Fagla , P.O. Salwana, Up Tehsil Dehar , Distt. Mandi | 88945 52549 |
| 29 | Sh. Amar Nath | Sh. Bansi Ram | Dehar | Vill. Alsu, P.O. Dehar , Up Tehsil Dehar, Distt. Mandi | 80912 01409 |

The training through its various learning sessions covers housing typologies hazard occurrence and impacts principles of hazard resistant construction importance of site and soil conditions specific safety features for foundation and plinth walls and roof.

P13 is a session which is meant to introduce participants to Constructing Hazard Resistant and various other house elements where hazard resistant features need to be incorporated these elements are staircases, parapets, balconies, chajjas, verandas extra. Vulnerability due to furniture and service installations is also discussed and necessary steps are evolved by a participatory method.

P14 this session introduces participants to Field Visit: Rural House Construction and Materials Available and understanding the implications of hazard resistant features on cost of construction through comparative cost estimation. Here, it is stressed that safety is a choice that the owner and Mason make along with aesthetic choices. In case of budget constraints often safety is compromised over specific choice of elements and materials. Such questioning it is hoped will help and guide the participants to make correct choices when restraint bi limited budget or other such limitation.

C15 This session includes Hazard Resistant Features for Other Construction Elements and listing various elements of construction based on the house designs provided by the trainers with brick and stone walls using appropriate foundation. Based on local construction practices more material options may be taken up.

C16 This session also includes Estimation of Quantities and Costs and quantities of materials required for each of the building elements like foundation walls bands roofs roofing materials vertical reinforcements and openings.

Rates of materials collected from local market and participants and trainers knowledge. Cost estimation for each elements of the house and overall cost of the house in absolute and per square metre terms.

C17 is session which includes Clarification of Questions and Cost comparison with or without be hazard resistant materials in absolute and per square metre terms. In this session the method included was finding and identifying various house elements material requirements quantities of those materials rates based on question answers and consensus building through participative discussion.

C18 it is meant for Concluding Session and clarifying any new questions for an answer questions on hazard resistant construction that participants may have. This gives opportunity to discuss the test questions and understand correct answers.

In this session the trainer ask again about the situations which they face in regards to building hazard resistant homes which has not been dealt with in the training program. Other participants encouraged to answer these questions and the trainers clarify the unanswered questions. Questions by trainees was first attempted by other trainees. The training culminates with concluding session in which feedback of trainees is sought on the training and trainers. Trainer's feedback on the entire group of participants is sought in this session. Further any unanswered questions for ROM participants are be clarified in this session. To conclude the training missions handbook and participation certificate are distributed.

The participants understand relevant variety of housing typology in the region traditional and conventional. They also know different materials, construction systems and template on the relevance of the choice of materials to make his are resistant houses. Participants understand role play by using available materials and help evolve the typologies in the region and its importance in adding hazard resistance to houses. Participants understand different hazards their currencies and frequency in the region. They also know about celebrity of disasters and methods of measuring there intensity.

Participants discuss different zones of hazards and locate their own region to relay with the intensity of possible hazards. Trainers evaluate the existing knowledge of the participants in using different tools.

**Contextualizing the vulnerability in local construction**:

Anchoring: to ensure the entire house is well and curd the joinery between plinths and was between adjoining walls falls and roof and between different roof elements must be secured safely to ensure that they do not get damaged during an earthquake or a cyclone. Plasticity this is the property of a material to be able to come back to its original position.


For practical purposes these cannot be the only materials used in the building and therefore it becomes important to design buildings well to ensure that elastic materials are at the right place and in the right quantity.

A house should be able to come back to its original position after a hazard. The final structure is shown as follows.

Also materials that are elastic but which break suddenly when their limit of elasticity is crossed need to be used carefully in the construction.

Materials like Timber bamboo and steel are more elastic than materials like concrete blocks and earthen materials. Homes made of plastic materials may be able to come back to original positions more easily.

**Earthquake-resistant construction**, the fabrication of a building or structure that is able to withstand the sudden ground shaking that is characteristic of earthquakes, thereby minimizing

structural damage and human deaths and injuries. Suitable construction methods are required to ensure that proper design objectives for earthquake-resistance are met.

Construction methods can vary dramatically throughout the world, so one must be aware of local construction methods and resource availability before concluding whether a particular earthquake-resistant design will be practical and realistic for the region. The Earthquake resistant opening (window) should be like this.

**Training feedback:** Looking back from the first day in up cards and assessing if the objectives and expectations of each person have been met.

**Trainer feedback:** The trainers ask the trainees to share their experience weather their expectations we met and also elaborate on the parts of the training that will help them in their future engagement in construction.

**Trainee feedback:** Trainers talk about the response of the trainees. The part of the training the trainer responded well and part where the trainers expectations were not met well and where the trainees can further improve through training hand out.

**Distribution of hand-out:** explanation of how Masons main use it in their daily work. Distribution of trainees hand out booklet and presentation by trainers explaining how to use it.

**Certificate distribution:** Certificate distribution was done in the End Session.