



## WEBINAR REPORT

# LANDSLIDE RISK MITIGATION IN MIZORAM

(June 15, 2021)

Jointly Organized by

**National Institute of Disaster Management**

(Ministry of Home Affairs, Govt. of India)

&

**Department of Disaster Management and Rehabilitation**  
Government of Mizoram

# POSTER



WEBINAR ON

PM 10 POINT AGENDA NO. 5, 8 AND 9

## LANDSLIDE RISK MITIGATION IN MIZORAM



**15 JUNE 2021**  
**11.30 AM - 01.00 PM**

Registration Link: [training.nidm.gov.in](https://training.nidm.gov.in)

### PATRONS



**Maj Gen M K Bindal**  
Executive Director,  
NIDM



**Shri John L T Sanga**  
Director, DM & R  
Government of Mizoram



**Dr. Amir Ali Khan**  
Faculty,  
NIDM

### GUEST SPEAKERS



**Dr. Lalrokima Chenkual**  
Asst Director (Training),  
DM & R, Mizoram



**Dr. Kishor Kumar**  
Chief Scientist (Retd.),  
CSIR-CRRI



**Prof Chandan Ghosh**  
Resilient Infrastructure  
Division, NIDM



**Dr. Laldinpula**  
Associate Prof, Centre for  
DM, Mizoram University

Jointly organized by :

**National Institute of Disaster Management**  
Ministry of Home Affairs, Govt. of India  
and  
**Dept of Disaster Management & Rehabilitation**  
Government of Mizoram



**COORDINATOR**  
**Ms Yogita Garbhal**  
YP, NIDM

Joining details

Platform: **CISCO WEBEX**

Event number: **184 069 7027** Event password: **2021** Link: <https://bit.ly/3zku67q>

/nidmmhindia /nidmindia

Website: [www.nidm.gov.in](http://www.nidm.gov.in)



**Stay Protected  
from Corona**



Wear your Mask  
Properly



Wash your Hands  
Regularly



Maintain Social  
Distancing

## Programme Schedule

*Webinar on*

### **Landslide Risk Mitigation in Mizoram**

(1130-1300 hrs, June 15, 2021)

**Jointly Organized by**

**National Institute of Disaster Management**

(Ministry of Home Affairs, Govt. of India)

&

**Department of Disaster Management and Rehabilitation, Govt. of Mizoram**

| <b>Hrs</b> | <b>Topic</b>  | <b>Speaker</b>  |
|------------|---|---|
| 1130-1135  | Introduction and Welcome address  | Dr. Amir Ali Khan, NIDM                                   |
| 1135-1140  | Opening Remarks   | Shri John L T Sanga,<br>Director DM&R                     |
| 1140-1145  | Inaugural Address   | Maj. Gen. Manoj Kumar Bindal,<br>Executive Director, NIDM |
| 1140-1200  | Landslide Risk in NE India and its mitigation and management using green techniques | Prof. Chandan Ghosh                                       |
| 1200-1215  | Landslide risk Mitigation activities of the State Government of Mizoram             | Dr. Lalrokima Chenkual                                    |
| 1215-1230  | Instrumentation for LS risk mitigation in NE India                                  | Dr. Laldinpuia, Centre for DM,<br>Mizoram University      |
| 1230-1245  | Building Resilient Infrastructure in Landslide Prone Areas                          | Dr. Kishor Kumar, CRRI (Rtd.)                             |
| 1245-1300  | Discussion on landslide safety issues in NE   | Ms Yogita Garbyal, NIDM                                   |

## **Introduction**

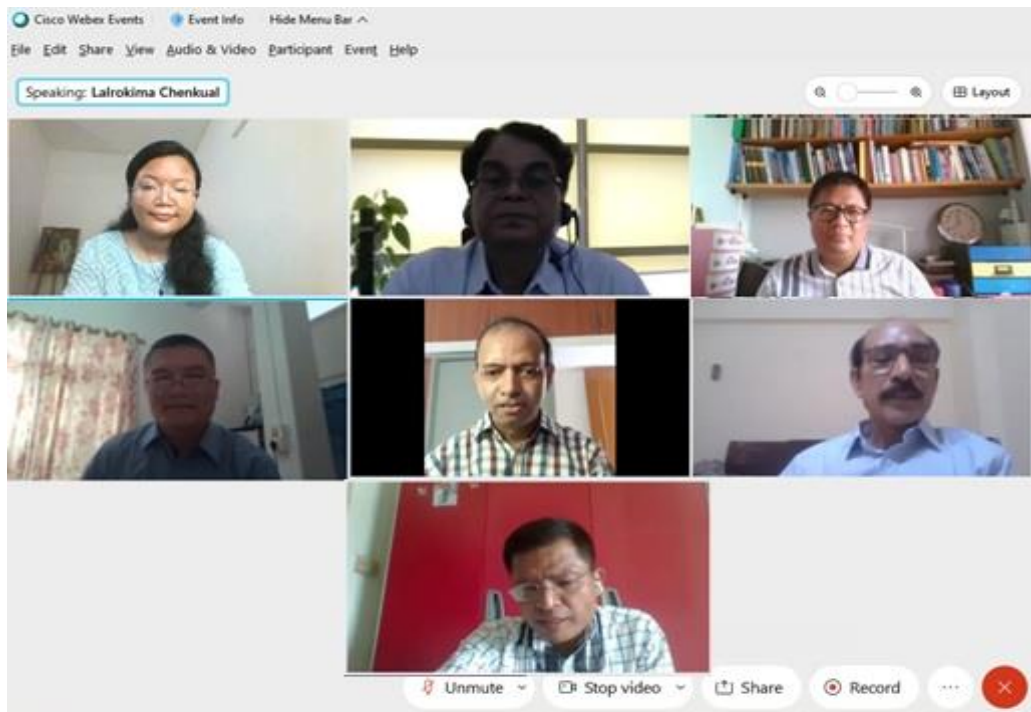
Webinar on Landslide Risk Mitigation in Mizoram, jointly organized by National Institute of Disaster Management, Ministry of Home Affairs, Govt. of India, and Department of Disaster Management and Rehabilitation Govt. of Mizoram was held on June 15, 2021. This webinar topic was also in compliance with PM 10 point agenda no. 5, 8 and 9 of DRR which highlights the importance of using technology for DRR, learning from past lessons and building our local capacities. Webinar topic revolved around the Landslide hazards mitigation measures so that they does not become a disaster, landslides are quite common and natural phenomena in hilly regions throughout the NE hilly regions and Himalayan belt especially with this monsoon period where they become quite active. Unprecedented population growth, unauthorized colonies, their expansion and other manmade disturbances with change in climate phenomena is what making them far more dangerous and unpredictable behavior. Through this webinar the lectures were focused specifically for mitigation measures of landslides for Mizoram however, certain do's an don'ts and awareness will be similar for other hilly region for the country as well.

## **Objective**

- To talk about the landslide hazard issues in the Mizoram state and their impacts
- To understand the geological and tectonic structures, lithology, geomorphology, changing climate and housing patterns found in Mizoram state,important to understand the cause of landslides.
- To check the type of landslides occurring, slope stability challenges and their mitigation measures based on past research studies, evidences and observations.
- Promoting bioengineering solutions, green houses and resilient infrastructures in the hilly regions.
- Role of instrumentation and early warning system for frequent landslide affected zones.

## Summary of the Programme

Ms Yogita Garbyal, Young Professional NIDM moderated the webinar and welcomed all dignitaries and participants. She gave the introduction of the topic and highlighted the webinar objectives, introduced the speakers and programme context as per the agenda.



### **Welcome address:**

**Dr Amir Ali Khan, Faculty NIDM** in his welcome address said the entire Himalayan belt including NE hills are highly prone to landslides and only way out is to implement the mitigation measures effectively. He said these physical issue is changing into social issues as well such as, we have to go for larger scale landslide hazard mapping and strengthen the early warning for landslide like we have now for cyclones. He concluded by saying we need to use every opportunity for creating awareness for mitigation and early warning both.



## Opening Remarks:

### Shri John L T Sanga, Director DM&R, Govt. of Mizoram

He stated the institutional framework at state level and said landslide hazards are highly studied in NW Himalayan states but North east also faces the landslide frequently even being at foothills of Himalaya due to fragile lithology. He shared the recent case studies of landslide in Mizoram due to heavy rainfall and mitigation SDMRF scheme – mitigation fund are used by making proposal for



mitigation projects. Shri Sanga also pointed out the frequent earthquake in Mizoram. He spoke of Champai earthquake of 2021 which also triggers landslides and loosens the soil. He talked about the resource mobilization helps given by DM &R department and State disaster management control room working 24\*7 for reporting any incident.

## Technical Sessions

### Lecture: Landslide Risk in NE India and its mitigation and management using green techniques.

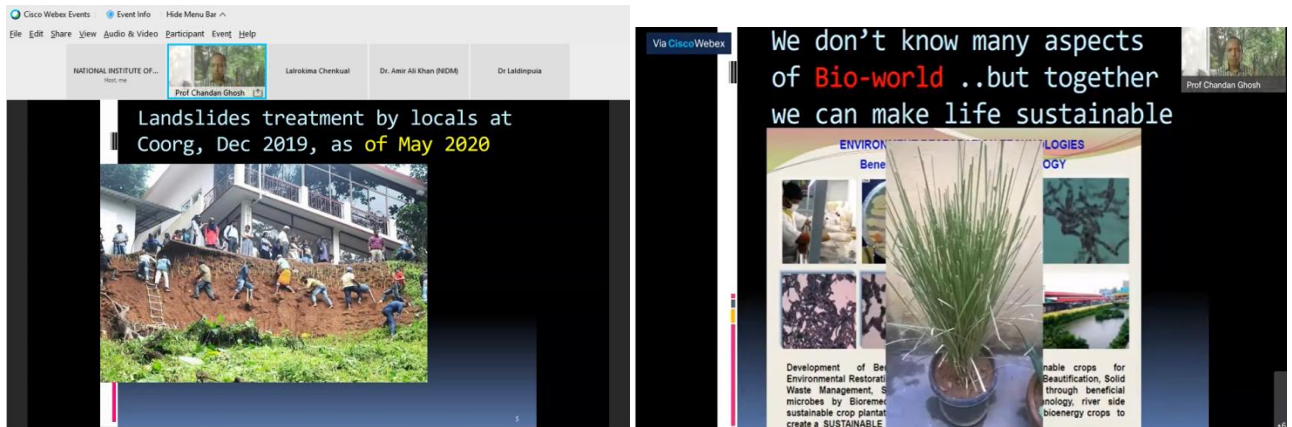
#### Speaker: Prof. Chandan Ghosh, Head Resilient Infrastructure Division, NIDM

Prof Ghosh talked about the simple nature based solutions for the challenges faces by slope failures. He said we need to start with grassroots level and then incorporate the technical scientific aspects in our works. Prof Ghosh also talked about the need of large scale mapping at 1cm scale using drones



which can survey the whole state in few days of time. He showed the case studies of using Vetiver grass both nationally and internationally in stabilising the unstable slopes. He described various use and benefits of Vetiver grass even as other by products. He also described the use of geo-membrane, restoration of slopes by coir geo-textiles, biomass substrate, beneficial

microbes etc. he concluded by stating that we are unaware of many aspects of Bio-world and learning and incorporating green solutions can help make life more sustainable.



**Lecture: Landslide risk Mitigation activities of the State Government of Mizoram.**

**Speaker: Dr. Lalrokima Chenkual, Asst Director (Training), DM & R, Mizoram**

Dr Chenkual in his lecture started by highlighting various hazards includes landslide in Mizoram. He told landslides are happening since long back and community had organised response and management at their own capacity in the past. He highlighted the different conditions governing landslides like geology and precipitation. He said in Mizoram slope failure has been increased over the time period due to developmental work like road construction, slope modification, improper drainage system and absence of rain gutter, improper dumping of soil and deforestation. Dr Chenkual pointed the anthropogenic factors in



He said in Mizoram slope failure has been increased over the time period due to developmental work like road construction, slope modification, improper drainage system and absence of rain gutter, improper dumping of soil and deforestation. Dr Chenkual pointed the anthropogenic factors in

details which has increased our vulnerability from landslide. He showed the mitigation plan/fund section under DM Act 2005 which was used by state for mitigation measures for landslide case studies as well such as in Ramhlun and Laipuitlang slide areas. He also showed the case study of Hunthar sinking area and the present progress, and other restoration of damaged roads within Aizawl city. Dr Chenkual also talked about the FLIM Mobile app developed by NRSC/ISRO aimed to be used by SDMA/DDMA/Govt organizations etc. to collect data of landslides from field and develop a warning system for the region using the collected data.

**2. NDMA, MHA, GoI Project Landslide Risk Mitigation Scheme**

- 'Restoration of NH-54 and Mitigation of Land Sinking Area at Hunthar Veng, Aizawl.'
- Rs. 20, 86, 45, 800.00 : Rs. 10.998 Crore
- SPWD - SPAR GEO INFRA PVT.LTD, Pitampura, New Delhi vide No. T-11031/14/20/NHD-III/38 dt. 12.03.2020

|               | Rs in Cr | 1 <sup>st</sup> inst | 2 <sup>nd</sup> inst | 3 <sup>rd</sup> inst | 4 <sup>th</sup> inst |
|---------------|----------|----------------------|----------------------|----------------------|----------------------|
| Central Share | 10.998   | 3.2994               | 3.299                | 3.299                | 1.0998               |
| SMS           | 9.8670   | 2.9601               | 2.960                | 2.960                | 0.9867               |

**Probable causes of landslides**

- Town/City Master Plan are not properly followed
- Absence of proper regulation in land use
- No proper Building Regulation and Bye laws for a long time.
- Building Regulation and Bye laws.
  - Proper execution by the builders
  - Monitoring from the authority
- Hazards zonation are not properly followed
- Continuation of Issuing of LSC/House pass even at high degree of slopes and unstable sites.
- Construction of House at Vulnerable Sites.
- Irregular Building Configuration
- Lack of good quality Construction materials/Uses of Inferior Building materials.
- Lack of Construction machineries
- Lack of trained Masonry/skilled workers.
- Awareness level/moral and attitudes

**FIELD LANDSLIDE INVENTORY MAPPING (FLIM) MOBILE APP**

- MoU was signed with NESAC for implementation of Field Landslide Inventory Mapping (FLIM). The FLIM mobile app is developed by NRSC/ISRO. It aimed to be used by SDMA/DDMA/Govt.organizations/ researchers with reasonable knowledge on landslides.
- The main purposes of this app are :
  - To collect data of landslides from the field.
  - To develop a landslide warning system for the region using the collected field landslide data.
- The data collected and sent from the field using this app will be uploaded in the BHUVAN and NDEM servers for analysis and visualization. Hence, the app will help the state agencies as incident reporting system for landslide disasters.
- The 'date of landslide' and 'rainfall amount during the landslide and other attributes are vital information which is required for development of a landslide early warning system.
- Data's for the calendar year 2019 and 2020 was collected, collaged and shared.

**Mapping and Zonation. Atlas of Landslide Hazard Zonation of Mizoram (DM system Project)**

Prepared by MIRSAC sponsored by NEC 2011

| Zone Code | Hazard Class | Area (Sq. Km) | %      |
|-----------|--------------|---------------|--------|
| 1         | Very High    | 162           | 8.95   |
| 2         | High         | 428           | 23.2   |
| 3         | Medium       | 892           | 47.25  |
| 4         | Low          | 523           | 28.57  |
| 5         | Very Low     | 115           | 6.19   |
| 6         | Water Body   | 115           | 6.19   |
| Total     |              | 1835          | 100.00 |

Further 1 : 500,000 = District and 1 : 125,000

**3. REBUILDING TOTALLY WASHED AWAY/DAMAGED INFRASTRUCTURE DURING FLOODS IN 2017**

- Rs. 16.36 Crores from DONER on 2<sup>nd</sup> June, 2018

- DC
- SPWD = 10 sectors (62 works)
- I & WR = 20 sectors

| Sl.No        | District  | Works under PWD      | Works under I & WR | DM & R |
|--------------|-----------|----------------------|--------------------|--------|
| 1            | Aizawl    | 5 (8 works)          | 1                  | 1      |
| 2            | Lunglei   | 2 (14+9 works)       | 4                  | 1      |
| 3            | Serchhip  | 2 (13+9 works)       | 5                  | 1      |
| 4            | Kolasib   | -                    | 4                  | -      |
| 5            | Lawngtlai | 1 (9 works)          | 1                  | -      |
| 6            | Champhai  | -                    | 5                  | -      |
| <b>Total</b> |           | <b>10 (62 works)</b> | <b>20</b>          |        |

## Lecture: Instrumentation for LS Risk Mitigation in NE India.

**Speaker: Dr. Laldinpuia, Associate professor, Centre for DM, Mizoram University**

Dr Laldinpuia went through different landslide case studies in Mizorma and how the mitigation measures were implemented on ground using various field instrumentations. He showed the most landslide prone areas of Mizoram like Rulchawm, Zemabawk, Thuampui, Ngaize



etc which affected from recent landslides. He showed how to carry preliminary and detailed investigation for landslides including studies of surface deformation, geophysical investigation, geotechnical investigation and hydrological investigation. He showed the landslide hazard zonation of Hnahthial town and how they carried the investigation step by step for landslide mitigation using movement monitoring instruments, stability analysis etc. He concluded by showing the do's and don'ts for stability of slopes.

**Stability analysis for rock: FEM, UDEC, 3DEC, Kinematic analysis, etc.**

Class of Rock strength

Sliding surface along discontinuity?

- Yes: Joints parallel to face, Pair of intersecting joints, Use discontinuity shear strength
- No: Closely fractured rock, Weak, massive rock, Use rock mass shear strength

**Bad practice: Australian Geomechanics Society**

Viewing Dr Laldinpuia's app... Unstabilised rock topples and travels downslope

Discharges of roofwater soak away rather than conducted offsite or to secure storage for re-use

Structure unable to tolerate settlement and cracks

Poorly compacted fill settles unevenly and cracks pool

Inadequately supported out falls

Saturated slope fails

Mud flow occurs

Roofwater introduced into slope

Vegetation removed

Roofwater introduced into slope

Qualling not founded in bedrock

Absence of subsol drainage within fill

Loose, saturated fill slides and possibly flows downslope

Ponded water enters slope and activates landslide

Possible travel downslope which impacts other development downhill

**Mitigation: System**

**Increase the resisting force**

- Buttressing
- Retaining structures
- Reinforced soil slopes and walls
- Reinforcement: Nails, Anchors, Micropiles
- Surface slope protection, e.g. Shotcrete, stone pitching, gabion, masonry wall, RCC wall, bioengineering measures

**Reduce the driving force**

- Unloading: Excavation (e.g. Benching), Light weight fill materials
- Drainage system: Surface drainage (E.g. catch water drain, chute, toe drain, etc.), Sub-surface drainage (E.g. Horizontal drains, cut off drains, drainage trenches, etc.)

**Rockfall mitigations:** Berms, ditches, rock sheds, drapery, barrier, etc.

**Investigations: Case study**

Viewing Dr Laldinpuia's app...

Investigation photos showing field work, instrumentation, and slope analysis.

## Lecture: Building Resilient Infrastructure in Landslide Prone Areas.

**Speaker: Dr. Kishor Kumar, Retd. Chief Scientist, Advisor Landslide Management, CSIR-CRRI.**

Dr Kishor Kumar gave an overview of why these Hilly regions are favourable to certain hazards and how the active tectonics, geology become the causative factor for natural landslide phenomenon as well. However, the manmade landslides on the modified slopes especially along



the hill roads are critical and increase the vulnerability to landslides. He emphasised that if we know and take care of these peculiarities at planning to monitoring stage, the impact and challenges will be reduced. He showed the case study of Huthar and Dawn landslide/sinking areas and said once problem started of erosion it is difficult to stop and hence preplanning in maintaining the slopes is to be addressed. He emphasised on the major concern which will also impact Mizoram such as climate change effects causing intense rainfall, flash flood, temperature will increase and with dynamic geological setup will pose more challenges. He concluded by addressing the slope management system of making slopes and highways resilient during planning stage before any designing and construction.

**Weak Geology** – Layered form, highly friable/weathered rocks  
Alteration – Weak and Strong  
Water – further weakening  
Failure of strong, if overlaying  
Failure of weak, if overlaying disturbed

**Drainage:** Seepage/springs/dameness etc- always troublesome  
Disturbed- failure

**Morphology:** good to dense- Not always helpful

**Vegetation:** Intense

**Weathering:** Intense

**Erosion:** Intense

**Climate:** Weathering friendly

**Rainfall:** High

**Temperature:** Fluctuating – Failure friendly

**Moisture:** Mainly failure friendly

**Slope cuts:** Steep- sensitive to fail

**Slope cuts:** High- Sensitive to fail

**Vibrations:** Make slope prepare to fail later

**Cracks:** Troublesome

**Toe cutting:** Troublesome

**Road at bottom of valley**  
High water table  
High stresses  
Well developed drainage  
Toe cutting  
Loss overburden  
Dense vegetation  
High weathering and erosion

**MULTIMODAL ROADS, MIZORAM**

A project on construction of a two-lane highway of about 100 kms, near Lawngtlai (Mizoram) to the Myanmar border to provide road linkage to Sittwe port in Myanmar being developed as part of the Kalandan Multi Modal Project.

**Down Landslide/Sinking Area**

started: The sign of sinking of the area was first notice in the year 1978. Since then sinking occurred almost every year. Major sinking occurred during the year 1987 where several houses were dislocated and dismantled.

**NER - A hot spot for landslide activities WHY ???**

- ✓ unique Geo-environmental/Geotectonic setting of the region
- ✓ poor cohesive foundation grade material
- ✓ lack of proper drainage leading to piping action
- ✓ natural drainage congestion and blocking due to unsystematic constructions of poor quality and constant toe erosion.
- ✓ The region fall under high rainfall zone with subtropical type of climate.
- ✓ Seismic vibration and active tectonic (Thrust/Faults)
- ✓ Planning/Construction/Maintenance issues

*Landslides in Assam, Mizoram, Nagaland and Tripura are located on relatively soft sediments, whereas landslides in Arunachal Pradesh and Meghalaya are located in Metamorphic and Igneous Rocks*

**Unmissable and unescapable Future**

- Highway design should consider the susceptibility of terrain to multihazard.
- The terrain vulnerability assessment must be made part of the highway development
- After any major event/hazard/disaster the terrain must be revisited/ mapped for the imprints left on the terrain
- A multidisciplinary team should be part of highway development at least until the selection of alignment or before widening of highway
- *Slope management should be made inseparable part of highway development*

**Change the Approach**

Highway slopes ----- Part of Road Infrastructure? Yes or No?  
 Highway slopes ----- Just a Natural Asset ?, part of Infrastructure asset? HAM - HS  
 Can we maintain highways or any other infrastructure without maintaining Highway slopes ?  
 Is there any Highway slope management system in the country sofar?

Highway slope management system

| Slope Information system   | Slope Maintenance and Upgrading   |
|--|---|
| Inventory of slopes  | Slope maintenance plan/ Maintenance manual                                |
| Slope location plan  | System for appraising of substandard slopes                               |
| Slope catalogue  | Slope maintenance inspection and work records                             |
| At least records of slope  | A long term strategy for selecting substandard slopes for upgrading       |
| Parameters that could affect or be affected by slope                       | Computerized system to manage the maintenance inspection and work records |
| Hierarchy of peak landslide  | Landslide hazard information system                                       |
| Computerized slope inventory & database for managing the slope information | Highway slope management and forecasting                                  |

Range of options for highway slope management system

## Closing Session:

All the panellists in panel discussion gave answers to the queries of the participants regarding the correct instrumentation, reoccurrence of landslides and illegal constructions at risk prone areas. Dr Kishor Kumar in closing remark said these sensitization programmes are equally important for raising awareness and hence NIDM is doing a great task in the field of capacity building Dr Khan also thanked all the panellists for their valuable suggestions and Ms Yogita Garbyal gave the formal vote of thanks for the closing of webinar.

The screenshot shows a Cisco Webex meeting interface with a grid of participants. The participants visible are Prof Chandan Ghosh, Kishor Kumar, Dr. Amir Ali Khan (NIDM), and Kishor Kumar. The interface includes a top menu bar with options like 'File', 'Edit', 'Share', 'View', 'Audio & Video', 'Participant', 'Event', and 'Help'. A 'Speaking' indicator is shown above the participants' video feeds.

## **Key takeaway points of the webinar**

1. Strong community participation and targeting local engineers and geologist should be promoted to carry out mitigation measures.
2. Bioengineering solution like using Vetiver grass can be used as cost effective and sustainable solution for unstable eroded slopes.
3. Modern technology and real time remote sensing data can help in developing resilient highway slope management system.
4. Field investigations and instrumentation needed for carrying good landslide vulnerability investigation, landslide vulnerability mapping at larger scale and early warning PLIM App for landslide can also be used.
5. Sustainability of infrastructure and safety of people has to be maintained by incorporating slope vulnerability analysis at initial planning stage apart from construction and maintenance phases.
6. Infrastructure development should be mandatorily integrated with DRR and sustainable goals.
7. Make sure DPR has the option for vulnerability assessment of slopes/terrain- at large scale.
8. No landslide should be left unattended at the initial stage of erosion.
9. Critical and frequent landslide zones should be studied at pace setter examples from scratch to finish for implementing mitigation strategies.
10. State DM &R Govt officials using state mitigation funds through many projects helped in various landslide mitigation measures for stabilizing the affected slope.
11. Community participation and their awareness is also critical in case of landslides.

## **Target Audience**

Webinar was designed for every responsible citizen of country living in hilly areas where landslides are major issue. Webinar was also designed for state govt departments, DM officials from SDMA, DDMA. Scientific research community from students to trainers, NGOs and Community Leaders etc. working in field of disaster and environment protection can help raise awareness and capacity building.

## **Participation Details**

213 participants attended the webinar session, which was held using NIDM Cisco Webex. Programme and was also live at YouTube: <https://youtu.be/6-CQQI9vgos> on 15 June 2021.

## List of Participants

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# FEEDBACK

11/18/21, 4:59 PM

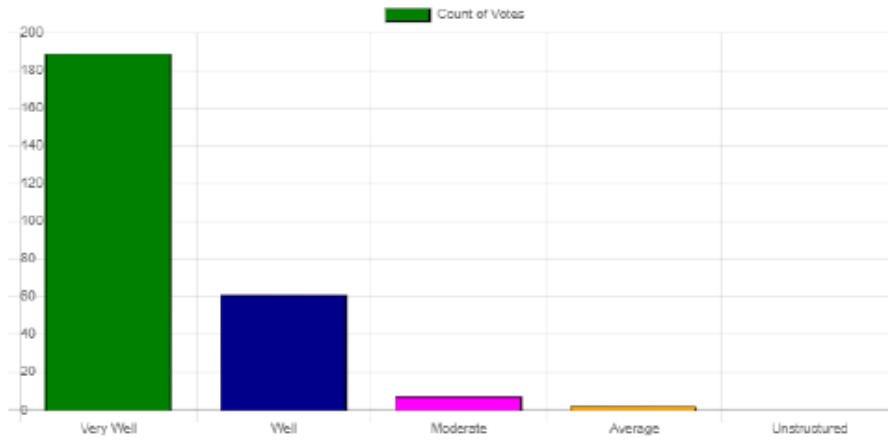
NDM Training Portal

## Enrolled Participants

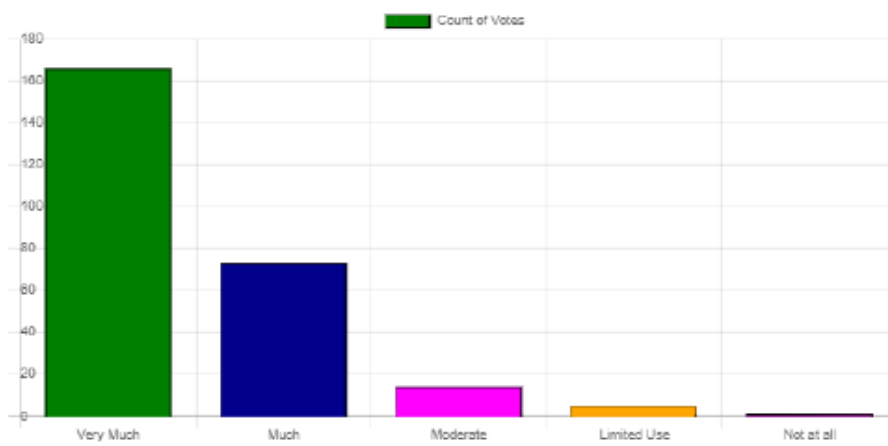
Profile | **Feedback** | Participants

### Feedback Result

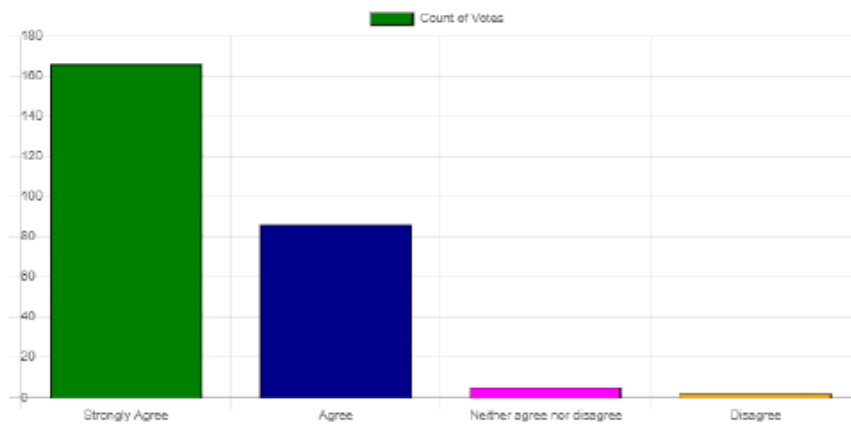
I think the structure and organization of the course fulfilled the objectives of the Training programme.



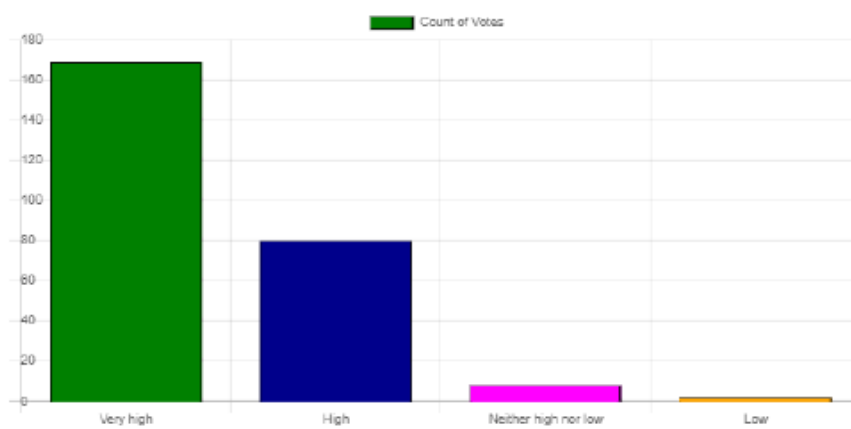
I feel this programme would be useful to me immediately in my job.



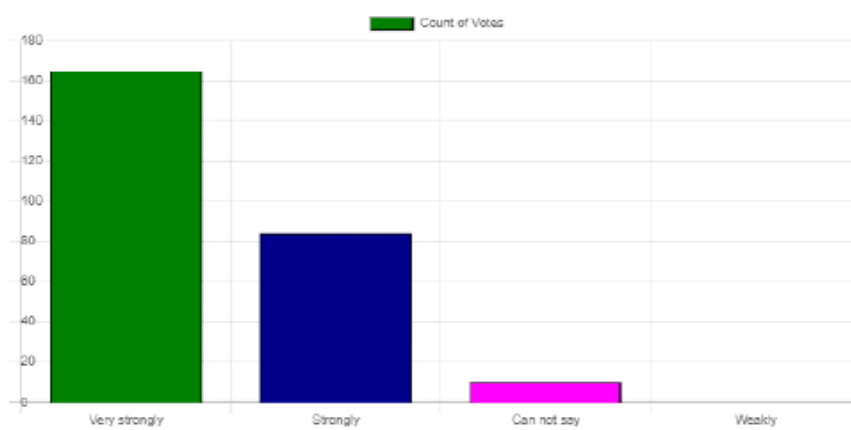
I believe this will help me in my future job related to Disaster management.



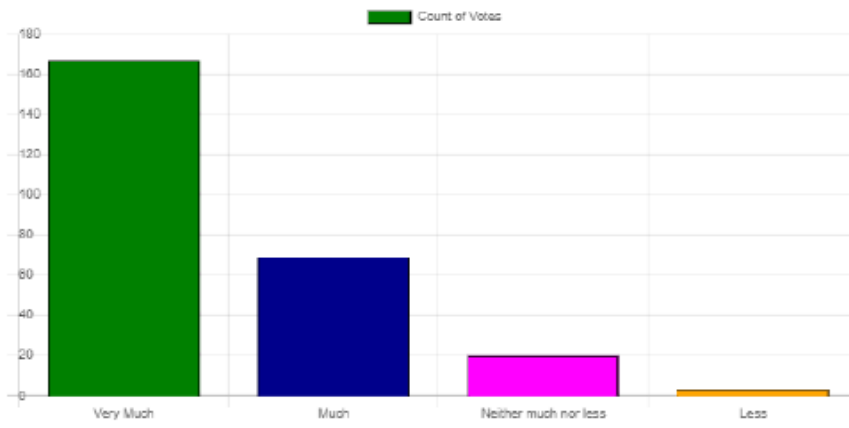
Practical orientation of the Training programme.



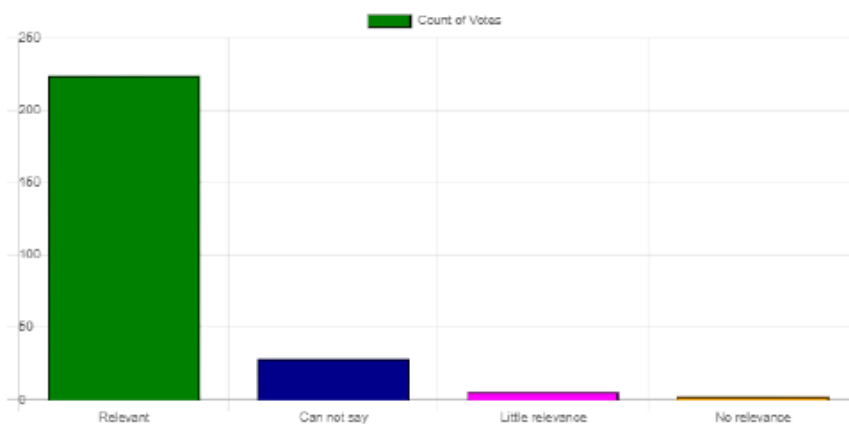
I feel this inspires me to take up assignments related to Disaster Management.



I have benefited from interaction with fellow participants in the course.



I found the course materials supplied to us to be



Your overall impression of the training programme.

