

## **Minutes of the meeting between GSI and DTRL regarding collaboration on landslides, held on 10<sup>th</sup> April, 2019 at CHQ, GSI, Kolkata**

In the 6<sup>th</sup> TAC on Landslide Mitigation and management in India, the Defence Terrain Research Laboratory (DTRL), DRDO proposed Agenda for discussion on Landslide Control measures and Geotechnical Investigation for the following sites: 14<sup>th</sup> Mile Landslide Site (Darjeeling), Dharmund Landslide Site (J&K) North & NE Himalayas including Sikkim. Enhanced Capacity building activities at 14<sup>th</sup> Mile and Narendra Nagar Landslide sites by developing community based evacuation plan and mobile apps especially based on Satphones and HAM radios. In the minutes of the 6<sup>th</sup> TAC meeting under Para 6.5.11, the Committee advised GSI and DTRL to discuss on the matter bilaterally.

Following the recommendation of the 6<sup>th</sup> TAC, a joint meeting between GSI and DTRL was held at the Chamber of DDG, MIVA, CHQ, Kolkata at 1100 hrs on 10<sup>th</sup> April, 2019 to discuss on the possible collaboration on landslide perception studies, capacity building and geotechnical investigation. The meeting was attended by the following officers:

1. Dr. S. Raju, ADG and NMH IV, GSI
2. Dr. K. Jayabalan, DDG MIVA, GSI
3. Dr. Sunil Dhar, Additional Director, DTRL
4. Dr. Sujata Dash, Scientist-F, DTRL
5. Shri N.K. Sarkar, Director TC, M IV, GSI
6. Dr. Pankaj Jaiswal, Director, LnSd, GHRM, GSI
7. Shri A.K. Mishra, Director, LnSD, GHRM, GSI
8. Shri Mrinmoy Kumar Das, Geologist, LnSD, GHRM, GSI
9. Shri Sumit Kumar, Geologist, LnSD, GHRM, GSI

Dr. S. Raju, ADG and NMH IV welcomed the scientists from DTRL and assured GSI's commitment towards collaborative research in Landslide Studies for risk reduction. Dr. Sunil Dhar, Addl. Director DTRL gave a brief description of the purpose of the meeting in light on their ongoing project entitled 'Development of Early Warning System for Landslide Investigation and Terrain Intelligence and its forecasting Mechanism (DEWSLIT-FM)'. He also appraised ADG and NMH-IV on the progress made in the Narendranagar landslide project where GSI and DTRL are jointly working for instrument based monitoring of the landslide and development of an early warning. DTRL has placed 180 pillars in the Narendranagar landslide site for surface deformation monitoring and every 15 days data is being generated using Total Station. He also informed that based on GSI recommendations, deep boreholes are planned at four locations down to 50 m depth. The site will be monitored based on creep meter, inclinometer, piezometer, tilt meter and automatic rain gauges. DTRL is also looking into the possibility of deploying acoustic sensors for ground deformation studies.

Dr. Sujata Dash, Scientist-F, DTRL briefed the house about the expectation from GSI on the future collaboration on landslide capacity building, forecasting models and Decision Support System for landslide mitigation. She has proposed two study areas for future collaboration: 14<sup>th</sup> Mile landslide in Darjeeling district, West Bengal and Dharmund landslide in J&K. Dr. K. Jayabalan, DDG MIVA, GSI informed that the ongoing MoU between GSI and DTRL, which is valid till April 2020, is for geotechnical investigation and instrumentation for landslides in Uttarakhand and Sikkim only. For J&K and West Bengal we need to have a separate MoU is needed on geotechnical investigation, instrumentation and capacity building.

The proposal of DTRL was duly deliberated and after the detailed deliberations, the following decisions were arrived at:

1. GSI and DTRL will collaborate on Landslide Studies at Giddapahar (14 mile), Darjeeling district, West Bengal area where both organization will jointly (i) prepare questionnaire for landslide risk perception survey, (ii) carry out Survey in field, (iii) interpret the data for perception analysis, and (iv) carry out landslide awareness programmes for capacity building. DTRL will develop education modules for community knowledge programs.
2. DTRL will install Piezometer and ARG (Automatic Rain gauge Stations) at the Giddapahar (14 mile) landslide site for landslide forecasting. The data will be shared with GSI.
3. DTRL has developed a Decision Support System for suggesting landslide control measures. For validation of the system, GSI has agreed to provide inventory attributes of a few landslides to DTRL.
4. The landslide site at Dharmund (J&K) will be taken up in collaboration for detailed geotechnical study wherein GSI will carry out the detailed mapping of the landslide and DTRL will carry out instrumentation such as Piezometer & ARG for correlation of movement with pore water pressure. Software based Slope stability analysis will be performed jointly.
5. For implementation of the above mentioned work components GSI and DTRL will sign a separate MoU. The modalities of collaboration can be specified in the draft MoU.

