Progress Report of SEA - ICL Networks

1st January 2016 to 31st December 2017

1. **Project Title of Network:** South-East Asian Network for Landslide Risk Management (SEA-ICL)
2. **List of member organizations**
   1) Gadjah Mada University – Center for Disaster Mitigation and Technological Innovation (GAMA-InaTEK)
   2) Parahyangan Catholic University
   3) Research Center for Geotechnology, Indonesian Institute of Sciences
   4) Slope Engineering Branch, Public Works Department of Malaysia
   5) National Taiwan University, Department of Civil Engineering
   6) Landslide group in National Central University from Graduate Institute of Applied Geology, Department of Civil Engineering, Center for Environmental Studies
   7) Ministry of Agriculture and Cooperatives, Land Development Department
   8) Asian Disaster Preparedness Center(ADPC)
   9) Institute of Transport Science and Technology
   10) Vietnam Institute of Geosciences and Mineral Resources (VIGMR)
   11) Agency for Meteorology, Climatology, and Geophysics of the Republic of Indonesia (BMKG Indonesia)

3. Progress report of activities up to December 2017

3.1. Progress Report of Landslide group in National Central University from Graduate Institute of Applied Geology, Department of Civil Engineering, Center for Environmental Studies

3.1.1. Activities:

A. 2016/6/28-7/5 Site investigation in Chengdu, Sichuan, China.

Daguanbao landslide was triggered by by the 2008 Wenchuan earthquake is one of the largest earthquake-triggered landslides in the world over the past century. Therefore, it is important to well document this landslide, such as the geometry of the sliding mass, the dominating structures, and the failure mechanisms. In this study, remote sensing images analysis, field investigation, laboratory experiment and slope stability analysis were adopted to characterize this Daguangbao landslide.

B. 2017/5/12-14 Engineering Geology Conference between China, Hong Kong and Taiwan.

This Conference, hold by Engineering Geology Commission, China Geology Society, IAEG China National Group, aims the characterization of the special problem in engineering geology using innovative theory and techniques. Site visiting in Wenchuan earthquake area was proceeded at 5/15~5/16

C. 2017/5/29-6/2 WLF4 (The 4th World Landslide Forum) in Ljubljana, Slovenia.

WLF4 is aimed to landslide research and risk reduction for advancing culture of living with natural hazards. 6/2~6/5 Three post-forum study tours were organized for living with slope mass movements in Slovenia and its surroundings.

D. 2017/10/14-18 The 4th Slope Tectonics Conference in Kyoto, Japan.

The main aim of the conference is to deal with slope movements from different approaches in order to improve the general understanding of slope processes. The post-conference field trip at Kyi Peninsula provided the perfect setting to view sites related to one of the main topics: rock slope deformation and catastrophic failure in accretionary complexes and granitic rocks

E. 2017/11/28-30 The 11th Asian Regional Conference of IAEG in Nepal

The 2017 Asian Regional Conference of IAEG hold by Nepal. At this time, Chinese Taipei intended to join the IAEG Council meeting by a team led by Prof. Lee, NCU. He proposed an announcement and, finally, Chinese Taipei received the admission of IAEG Council meeting. Prof. Lee also had the session and presentation regarding the landslide susceptibility analysis during the conference. The group had post visited Tribhuvan University and had promise of further collaboration between Tribhuvan University and NCU via MOU in the near future.

3.1.2. Research Topics:

A. To assess the mechanism and have alert of rainfall-triggered shallow landslides, the study aims to propose field monitoring with sacrificed sensing system accounting for rainfall events in practice. Global Positioning System (GPS) chip is implemented and examined for the enough resolution to record displacements of landslides. Time Domain Reflectometry (TDR) device, which combined with Low Power Wide Area Network, such as LoRaWAN, will be used to obtain multi-node soil water content profiling for slope stability analysis.

B. Tsaoling landslide is the largest and best documented landslide among several large landslides induced by the 1999 Taiwan Chi-Chi earthquake. This landslide mass gives an apparent friction coefficient of 0.21 and the release of the potential energy of 1.6× 10 15 J. This study utilize rotary-shear high-velocity friction experiments to measure the strength of fault gouge from bedding-parallel faults under 3 MPa normal stress. A velocity–displacement dependent friction law was proposed which can describe most experimental data. Newmark analysis of landslide motion for different landslide materials and conditions, assuming a simple rigid block sliding and using measured frictional parameters, revealed that the landslide did not occur with dry frictional properties, and that the landslide occurred at 38–39 s with accumulated displacements of 0.62 m–1.09 m and reached at the river bank at 82–87 s after the generation of Chi-Chi earthquake at its epicenter. Those timings are consistent with high-frequency signals at 32–40 s and at 76 s recorded at a nearby seismic station and with a survivor's witness that the landslide initiated 10 s after he felt strong ground motion, possible S wave arrival at 25.2 s. The landslide was caused by a few peaks of northeast-oriented strong accelerations of the ground motion.

3.2. Progress Report of carried out by ADPC during 2016-17

3.2.1. Regional Meeting on "Application of Drone technology for landslide risk management" – 21-24 November 2016, Bangkok, Thailand

The Asian Disaster Preparedness Center (ADPC) with technical assistance from the Norwegian Geotechnical Institute (NGI) implements an umbrella program namely Asian Program for Regional Capacity Enhancement for Landslide Impact Mitigation (RECLAIM). The program

RECLAIM, executed during the period 2006 -2016, had 05 phases already focusing on different subjects such as landslide hazard mapping, investigations, instrumentation, landslide early warning etc. Good progress has been made with respect to creating interest and understanding of different subjects of landslide risk management, but in the opinion of ADPC and NGI, there is a clear need do much more to support the countries that are still lacking a practical knowledge in technological advancements so that they will be able to apply such latest technology in implementation of landslide studies and services in their respective countries.

Focus of the Regional workshop held in November 2016 was, "Application of Drone technology for landslide risk management". The purpose of the workshop was sharing the experience of application of this sort of latest technology in landslide risk management. The workshop participants could get acquainted with related advanced technology developments such as development of high resolution images using drone mapping technology, application of 3D models for mapping & monitoring landslides, designing remedial measures, use the same in landslide EW etc.

Several Asian countries have problems in getting necessary field data, difficulties in conducting field investigations for landslides. This technology is new to the region and only few countries use this technology. The theoretical and practical experience gained from this workshop expected to help in studying the landslides in the prone areas effectively and efficiently. The workshop was attended by landslide risk management mandated agencies from Bangladesh, India, Sri Lanka, Thailand, Myanmar, and Vietnam. The respective agencies have been selected for this meeting as these countries facing huge landslide risk and number of deaths show the risk faced by communities.

The workshop highlighted good practices on application of advance technology to let the countries that are lacking behind could learn from the most advanced countries. Since there exists no platform for sharing the knowledge gained from this sort of technology applications for landslide studies between the professionals from various countries, ADPC felt that it is useful to continue with this healthy practice for having annual workshops among the networking partners attached to RECLAIM network.

3.2.2. Regional Meeting on "Landslide Risk Management Practice and Appropriate Technology Applications" - 6 - 10 November 2017, Chiang Rai, Thailand

ADPC in partnership with the implementing partners of two regional programs, namely RECLAIM (Asian Program for Regional Capacity Enhancement for Landslide Impact Mitigation) and SERVIR-Mekong, has organized a Regional meeting on the theme of "Appropriate Technology & its applications for Landslide Risk Management" during 6-10 November in Chiang Rai Thailand. The U.S. The National Aeronautics and Space Administration (NASA) and Norwegian Geotechnical Institute (NGI) have extended resource inputs for the conduct of the meeting. The Regional meeting has been attended by 8 countries namely Bangladesh, Myanmar, India, Nepal, Lao PDR, Sri Lanka, Thailand, and Vietnam. The meeting attendees are country representatives of selected agencies in South and Southeast Asia involved in landslide risk management as well as the institutions involved in geospatial

information services. The meeting has been organized through the funding support of Ministry of Foreign Affairs, Norway and USAID. Department of Mineral Resources (DMR) of Thailand was the host institution to provide local support in organizing the event.

ADPC has organized the meeting with the belief that the participating institutions will get benefited through the knowledge and capacity building on wide range of geospatial information tools, services, products, methodologies and applications that can be effectively utilized in landslide risk management such as (i) Space technology applications for generating Geospatial data products (ii) Geospatial services to provide information related to weather regimes and probabilistic near real time weather forecasts (iii) improved methodologies for delineating landslide hazard and risk , (iv) methodology for reporting landslides and communicating landslide loss information, (v) technology applications for monitoring the hazard and risk prone areas (v) data management tools for managing complex spatial data products including landslide inventories.

The meeting participants highlighted the need for ensuring effective production of much needed high resolution geospatial information, delivering of other associated products and tools for landslide risk management, which are fit for the purpose, of appropriate scale, language, format and content. The geospatial products developed have to be easily understandable and useable, and match with concerns and priorities of diverse set of stakeholders involved in landslide risk management in respective countries.

Both communities of practice, namely : Geospatial information and service providers and landslide risk management professionals, have expressed views on the availability of products, application areas and future needs so that they can get mutually benefited. That was one of the positive outcomes of this Regional meeting.

Other important outcome of the meeting is the enhancement of landslide risk management knowledge, in particular available technology advancements at present and in future, which is not being applied effectively yet by RECLAIM partner countries. Undoubtedly if such advancements could be applied, it will certainly help in reduction in landslide related losses, and the resulting improvement in quality of life, health and well-being of communities affected by landslides within a multi-hazard environment.

3.2.3. Myanmar National Workshops on "Landslide Early warning" and "Landslide Disaster Risk Management"- 18 – 19 December 2017, Nay Pyi Taw, Myanmar

It is observed that continued trends in natural disaster occurrences can seriously set back overall development goals and meeting poverty reduction priorities of rapidly developing countries such as Myanmar. In recent years, there have been frequent occurrences of landslides in Myanmar, which are being triggered by the heavy precipitation events. This may be influenced by the changing global climate scenario. Extreme weather events, such as cloud bursts and heavy concentrated rainfall, especially observed in some parts, have been responsible for occurrence of landslides creating devastations in terms of loss of life, property in several

parts in Myanmar. There might be some influence for escalation of landslide events also due to certain structural changes in sub-surface formations as a result of recent seismic events. It has been observed that several hundred millimetres of rain per day for several days have been recorded in several parts and landslides have been triggered during these events causing a disruption in the normal life of the people residing in the affected areas.

Considering the importance of the subject of landslide risk reduction, since 2004, the Asian Disaster Preparedness Center (ADPC) in collaboration with Norwegian Geo-technical Institute (NGI), is implementing the Asian Program for Regional Capacity Enhancement for Landslide Impact Mitigation (RECLAIM) targeting many landslide prone countries and many of the focal agencies responsible for landslide disaster risk management in South Asia and South East Asia are getting benefitted through the activities of the program.

Under the current phase of the RECLAIM program, ADPC in partnership with NGI has organized two National Training workshops on "Landslide Early warning" and "Landslide Disaster Risk Management", during 18th and 19th December 2017 respectively. Both workshops have been organized in partnership with the Department of Meteorology and Hydrology (DMH) and the Department of Disaster Management (DDM) of Myanmar.

The subject areas presented during the two National Workshops have provided basic understanding of the issues that need to take in to consideration in improving the landslide preparedness and ensure safer development in hilly country areas prone to landslides. The workshops helped to provide an opportunity for the government officials, technocrats, professionals, practitioners and all other stakeholders in Myanmar to identify gaps in the present institutional set up and the challenges ahead as well as to discuss measures that can be taken in preparing the communities better. The participants also discussed the strategic actions to minimize the impact of landslides through proactive mitigation measures including the measures to regulate the land use and land development in landslide prone areas. Above two National Workshops also intended in educating the officials of concerned agencies about the good practices on proactive actions undertaken by other countries for reducing the impacts of devastating events of landsides.

3.2.4. Progress of Sri Lanka Community Landslide Risk Mitigation Project (February 2017 to date)

Sri Lanka Community Landslide Risk Mitigation Project has been implemented since February 2017, by the National Building Research Organization (NBRO) with the technical assistance from the Asian Disaster Preparedness Center (ADPC), Thailand in partnership with Norwegian Geotechnical Institute (NGI). This project receives financial assistance from the World Bank and aimed at helping the Government of Sri Lanka (GOSL) in undertaking a systematic approach to reduce the impacts of landslides, which considered to be one of the major hazard events

responsible for disturbing the plans for the economic stability of hill country districts of the country.

Objectives of the Project

- Carry out a Landslide Vulnerability Assessment
- Identify the policy, legal and institutional constraints in resettlement of vulnerable people and recommend improvements
- Develop operational procedures and manuals for efficient planning and execution of a national program for landslide risk mitigation including resettlement of people living in high risk areas.
- Based on the above outcomes, develop a time bound, implementable "Community Landslides Risk Mitigation Action Plan."

It is expected that the findings of the project will allow donor agencies, development partners, etc. and decision makers to prioritize risk mitigation investments and measures to strengthen the risk mitigation, emergency preparedness and response mechanisms for reducing the future losses and damages due to landslide disasters and to extend assistance to the Government of Sri Lanka (GOSL) for adoption of a long-term landslide disaster risk reduction strategy for Sri Lanka.

3.2.5. Landslide Risk Management for Refugee Camp Site in Cox's Bazar, Bangladesh (December 2017 to date)

Asian Disaster Preparedness Center (ADPC) has been conducting landslide hazard and risk assessment for a refugee camp located in Cox's Bazar, Bangladesh, where more than one million Rohingya people have taken refuge. The 12-square-kilometer camp areas are located on a hilly location which is state-owned reserve forest. This study is the part of disaster preparedness initiatives by UNHCR which was divided into two stages, namely rapid landslide hazard assessment and detailed assessment of potential risk to the refugees residing in the area. The rapid hazard assessment was conducted based solely on the slope angle while the detailed hazard assessment takes into account historical landslide events as well as controlling factors such as the slope gradient, vegetation, land use, geology, weak layer thickness and ground water. The rapid assessment result indicated that about 23,000 refugees living on steep slopes within the camp site could be at risk of landslides. The detailed risk assessment is underway and expected to guide future preparedness initiatives.

3.3. Progress Report of Vietnam Institute of Geosciences and Mineral Resources (VIMGR)

3.3.1. Name of board members (Affiliation and emails):

a. Board Member: Tran Tan Van

Affiliation: Director, Vietnam Institute of Geosciences and Mineral Resources (VIMGR), Vietnam

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b. Deputy Board:

* Up to September 2017:

Name: Le Quoc Hung

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* From October 2017:

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3.3.2. Progress report of activities from 1st January 2016 to 31st December 2017

a. Continuing to implement the State-Funded Landslide Project (SFLP)

The SFLP is a national program on landslides in Vietnam, which was planned to implement in ten years (2012-2020). As the coordinating organization of the SFLP, from January 2016 to December 2017, VIGMR successfully conducted the two main tasks of the SFLP: (1) Landslide inventory mapping for three provinces of Lang Son, Ha Tinh, Quang Binh; (2) Landslides susceptibility mapping for three provinces of Ha Giang, Cao Bang and Bac Kan. Thus, among 37 mountainous provinces, the SFLP has completed activities of inventory mapping for 17 provinces (Lai Chau, Dien Bien, Son La, Lao Cai, Yen Bai, Ha Giang, Tuyen Quang, Cao Bang, Bac Kan, Bac Giang, Quang Ninh, Hoa Binh, Thanh Hoa, Nghe An, Lang Son, Ha Tinh and Quang Binh) and susceptibility mapping for 10 provinces (Lai Chau, Dien Bien, Son La, Lao Cai, Yen Bai, Thanh Hoa, Nghe An, Ha Giang, Cao Bang and Bac Kan). The output maps are mainly at scale of 1:50,000 for those provinces, and only at larger scales for some hot-spot areas.

b. Developing a SATREPS proposal

In cooperation with ICL experts from Japan, VIGMR and some other MONRE organizations jointly developed a SATREPS proposal on “Research and implementation of combined early warning and landuse change in vulnerable human settlements exposed to hazardous motion of debris”. Although the scientific research and education aspect were highly evaluated, this joint application was rejected due to some limitations.

c. Participating an international workshop on SATREPS and Sendai Partnerships meeting in Tokyo on 23-24 November 2016.

VIGMR representative presented the status of landslide studies in Vietnam, and the needs of Vietnamese researchers in promoting the SATREPS program and the Sendai Partnerships.

d. Participating the 4th World Landslide Forum in Slovenia from 29 May to 2 June 2017.

In this meeting, VIGMR representative summarized the main contents of the State-Funded Landslide Project (SFLP) as well as presented some achievements and difficulties of the landslide inventory mapping in the fourteen provinces during the first phase of SFLP (2012-2014).

e. Developing the two Landslide Teaching Tools

In 2016, the key SFLP staffs developed two text teaching tools that have been accepted to be published by Springer International Publishing:

* TXT-tool 1.084-3.1: Landslide susceptibility mapping at regional scale in Vietnam

* TXT-tool 2.084-3.1: Rainfall Thresholds for Triggering Geohazards in Bac Kan Province (Vietnam)

3.3.3. Plan of future activities

a. Considerations for future planning and implementation for the SFLP:

* Hand-over all the outputs of the project to the end-users; and guide them how to effectively employ the outputs for promoting the activities of landslide hazard mitigation and prevention in Vietnam;

* Continuing to complete the activities of landslide inventory and susceptibility mapping at scale of 1:50,000 for the remain provinces, and at larger scales for hot-spot areas;

* Cooperation with international experts for technical assistance and advisory services in landslide hazard and risk mapping at medium and large scales.

b. Participating in the ICL-IPL Conference to be held in Kyoto, Japan on 2-4 December 2018

c. Preparing for the contributions to thea 5th World Landslide Forum to be held from 2-6 November 2020 in Kyoto, Japan.

d. Updating the Landslide Teaching Tools in cooperation with other regional and thematic networks.

3.3.4. Publications

a. Main outputs of the SFLP are published in website: http://canhbaotruotlo.vn/

b. Paper for the 4th World Landslide Forum and for the Landslide Teaching Tools are published by Springer International Publishing.