

## Research Project Report

Program for Asia-Japan Research Development, Asia-Japan Research Institute

April 2017 - March 2020

# Establishment of Asia-based Research Center for Mitigation of Landslide and Flood Disasters by Japan-Vietnam Joint Initiative

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## 1. Background and Significance of this Research

In recent years, as global warming progresses, the tendency for natural disasters to occur more frequently and become more intense is showing a marked increase in East Asia and Southeast Asia as well as in Japan. In developing countries, the risks to economic growth are increasing because social infrastructures are not developed sufficiently.

Against such a background, among researchers of disaster mitigation in our university, the momentum for research interaction mainly between Japan and Vietnam has been gathering. For several years, we have been continuing research collaboration with researchers who received their PhDs from Ritsumeikan and have acquired leading roles in their own countries or abroad. As a part of the achievements, researchers from Ritsumeikan University, Ho Chi Minh City University of Technology, Institute of Mechanics, Hanoi, and Tohoku University have gathered annually to hold a Japan-Vietnam joint seminar from 2011 to 2016. Adopted for Grant-in-Aid (KAKENHI) for Scientific Research (B) (Overseas Scientific Investigation), a research project on the clarification of riverbank erosion of the Saigon River and proposals for countermeasures was conducted for three years from FY2011.

If the goal of this project for Asia-Japan research development is achieved, the outcome would be applicable to flooding and sediment disasters especially in Southeast Asian countries. This is because we can find similar land structures in many of the countries characterized by large scale rivers and steep mountainous areas which are vulnerable to disasters.

The goal of this research project is also especially important for Japan. In Japan, as the amount of public investment continues to decrease, the focus is shifting to how to develop good social infrastructure at a low cost. For example, a number of sites require landslide prevention measures to be taken (there are approximately 330,000 of sites in danger of steep slope failure regulated by the Sediment Disaster Prevention Act, and approximately 180,000 of debris flow hazard areas), and there are a number of areas where economical and effective disaster mitigation measures are required.

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## 2. Objectives

Focusing on sediment disasters caused mainly by debris flow and slope failure, and river disasters typified by flooding, this project aims at social and international contribution through the implementation of disaster mitigation measures, more specifically: (1) conducting surveillance and analysis on the current condition of sediment disasters and river disasters in Asian countries, (2) verifying the effectiveness of disaster mitigation methods by laboratory/outdoor model experiments or numerical simulations, (3) establishing effective watershed management methods and prediction methods for reduction of river disasters, and (4) developing economical and effective disaster mitigation measure methods utilizing local materials. As a result, this project is expected to contribute to development of disaster management measures in Asian countries.

## 3. Actual Activities

This project basically consists of individual research activities in each country. In order to put a high priority on sharing the obtained research outcomes, we planned international joint seminars annually. The joint seminars were held alternately in each of the project's core countries, Japan and Vietnam. Researchers shared their knowledge and exchanged their opinions for the purpose of further development of disaster mitigation research. In addition, project members were invited to Japan to hold international workshops for knowledge sharing. Furthermore, specific joint researches on some topics were conducted, for example, the numerical simulations (mentioned above as Objective 2)) and soft ground improving method (Objective 4)).

For the implementation of the project, we strongly focused on the training of young researchers, by (1) promoting cooperative research in foreign countries by postdoctoral fellows, (2) implementing research support for PhD students, (3) dispatching master's students overseas, and (4) encouraging the writing and presentation of English papers by master's students.

## 4. Result and Perspectives

As the research activities on the topics mentioned above were mainly conducted as individual research in each country, the major research results were introduced and discussed at annual joint seminars to solve the given problems, such as the elucidation of sediment disasters and river disaster phenomena described above as Objective 1) of this project.

### (1) Joint Seminars

An overview of the three joint seminars is as follows:

#### 1. The 1<sup>st</sup> Joint Seminar on Landslides, Flood Disasters, and Environmental Issues

Date: September 21, 2017

Place: Ho Chi Minh City University of Technology

Number of papers: 20 (Special Session: 2, River and coastal disasters: 9, Sediment disasters: 5, Ground improvement:4)

#### 2. The 2<sup>nd</sup> Joint Seminar on Landslides, Flood Disasters, and Environmental Issues

Date: September 7, 2018

Place: Ritsumeikan University, BKC campus

Number of papers: 24 (River and coastal disasters: 13, Sediment disasters: 6, Ground improvement: 5)

### **3. The 3<sup>rd</sup> Joint Seminar on Landslides, Flood Disasters, and Environmental Issues**

Date: September 19, 2019

Place: Vietnamese Academy of Science and Technology, Institute of Mechanics

Number of papers: 21 (River and coastal disasters: 11, Sediment disasters: 5, Ground improvement: 5)

All the papers which were presented at the joint seminars introduced above were published in the proceedings for knowledge sharing.

## **(2) Joint Workshops**

Joint workshops were held twice, and domestic and overseas project members were invited.

### **1. The Joint Workshop on Natural Disasters in Asia**

Date: March 11, 2019

Place: Ritsumeikan University, OIC Campus

Special Lectures:

- i. “Landslides and Earthquakes in Indonesia: Disaster Reconnaissance and Recovery”  
Luky Handoko, Assistant Prof. of Atma Jaya Yogyakarta University, Indonesia
- ii. “Community-Based Disaster Risk Reduction in Indonesia -Focus on: Landslides and Tsunamis-”  
Hatma Suryatmojo, Lecturer of Gadjah Mada University, Indonesia
- iii. “Landslide and Flood disasters in northern Vietnam”  
NGUYEN Tien Cuong, Senior Researcher of Institute of Mechanics, Hanoi, Vietnam
- iv. “Coastal Disasters in Vietnam”  
LUU Xuan Loc, Lecturer of Ho Chi Minh City University of Technology, Vietnam

### **2. The 2<sup>nd</sup> Joint Workshop on Natural Disasters in Asia and their Numerical Simulation**

Date: December 20, 2019

Place: Ritsumeikan University, BKC Campus

Special Lectures

- i. “Establishing a Rainfall-based Warning System for Highway Slope Failure in Southern Taiwan”  
LEE Der-her (李德河), Prof. of National Cheng Kung University, Taiwan
- ii. “How to Connect Four-scales in Geomechanics: Fundamentals & SPH Applications with Hydromechanical Coupling”  
BUI Hong Ha, Senior Lecturer of Monash University, Australia
- iii. “Landslide and Flood Disasters Caused by 2019 Typhoon 19<sup>th</sup>”
  - Outline of Typhoon 19<sup>th</sup>, its Disasters and the Damage Situations in Fukushima Pref.  
FUKAGAWA Ryoichi, Ritsumeikan University, Japan
  - Damage Situations in Miyagi and Gunma Pref.  
ISHIDA Yuko, Ritsumeikan University, Japan
  - Damage Situations in Tokyo Met. and Kanagawa Pref.  
FUJIMOTO Masamitsu, Ritsumeikan University, Japan

### (3) Training Young Researchers

One of the important tasks in this project was the training of young researchers. The achievements of the four set subjects are summarized in the following.

#### 1) Promotion of Cooperative Research in Foreign Countries by Postdoctoral Fellows

Ms. Ishida, a member of this project, conducted a research on the preservation of pagodas in Ayutthaya, Thai with local researchers and officers. This experience contributed to her career development and in fact, she will start working as a lecturer at Osaka Prefecture University College of Technology from FY2020.

#### 2) Implementation of Research Support for Phd Students

Two PhD students were given research support during the project. Ms. Oya, who was studying geotechnical engineering, developed her capability through coaching younger students and participating in international conferences including the joint seminars. She started her career at a consulting firm specializing in analysis as she had wished. Mr. Takayama, who was studying hydrology, joined a joint on-site investigation in Nepal with researchers from a local university. Through this experience, he improved his communication skills and ability to carry out research projects.

#### 3) Overseas Dispatch of Master's Students

In September 2017, two master's students were dispatched to Monash University, Australia. Dr. BUI Hong Ha, a senior lecturer of Monash University is a world-renowned researcher in the field of computational mechanics. He graduated from Ho Chi Minh City University of Technology and received a master's and doctoral degree from Ritsumeikan University. He was deeply involved in this project as a research member. Through the research exchange with his lab students, the two master's students greatly developed their capabilities and later decided to contribute the results of their research to an English journal.

#### 4) Encouragement in the Writing and Presentation of English Papers by Master's Students

We actively encouraged master's and PhD students in the lab of the project members to write papers and give their presentations in English. As a result, for the joint seminars, in the 1st: six students (PhD: 1 and Master: 5), in the 2nd: seven students (PhD: 1 and Master: 6), and in the 3rd: six students (PhD: 1 and Master: 5) wrote papers of about eight pages and made their presentations in English (10 minutes presentation and five minutes Q&As). Moreover, in FY2018, three master's students contributed to an English journal and were accepted.

### Project Members and Roles

	Name	Affiliation	Initial Position	Degree	Specialized Field
Project Leader	SATOFUKA Yoshifumi	C. of Sci. and Eng.	Professor	D. of Eng.	River Engineering River Disaster
Project Member	FUKAGAWA Ryoichi	C. of Sci. and Eng.	Professor	D. of Eng.	Geotechnical Engineering Geo-hazards
Project Member	KOBAYASHI Taizo	C. of Sci. and Eng.	Professor	D. of Eng.	Geotechnical Engineering Terra-mechanics

Project Member	FUJIMOTO Masamitsu	C. of Sci. and Eng.	Assistant Professor	D. of Agri.	Sabo Engineering
Project Member	ISHIDA Yuko	Res. Center for Sci. and Eng.	Post-Doctoral Fellow	D. of Eng.	Cultural Heritage Disaster Mitigation Studies
Project Member	OYA Ayaka	G. C. of Sci. and Eng.	D. C. 2	M. of Eng.	Geotechnical Engineering Numerical Simulation
Project Member	KAJIYAMA Atsushi	G. C. of Sci. and Eng.	D. C. 2	D. of Sci.	River Hydrology
Project Member	TAKAHASHI Hiroshi	G. C. of Tohoku Univ.	Professor	D. of Eng.	Environmental Resources Engineering
Project Member	LUU Xuan Loc	Ho Chi Min City Univ. of Tech.	Deputy Dean of Civil Eng. Dep.	D. of Eng.	River Engineering River Disaster
Project Member	NGUYEN Cuong Tieng	Dep. for Hydro-Informatics, Ins. of Mechanics (IMEch)	Deputy Head	D. of Eng.	Watershed Management Geotechnical Engineering
Project Member	LEE Der-her	Nat. Cheng Kung Univ., Taiwan	Professor	D. of Eng.	Geotechnical Engineering Geo-hazards
Project Member	Ir Djoko Legono	Indonesia, Gadjah Mada Univ.	Professor	D. of Eng.	River Engineering River Disaster
Project Member	Meg B. Bishwakarma	Nepal, Ins. of Eng. Premises	General Manager	D. of Eng.	River Engineering River Disaster
Project Member	BUI Hong Ha	Australia, Monash Univ.	Senior Lecturer	D. of Eng.	Geotechnical Engineering Numerical Simulation
Total:14 members					

### Selected List of Publications (Project members' names are underlined)

1. Nguyen C.T., Nguyen G.D, Das A., Bui H.H. 2017. Constitutive modelling of progressive localized failure in porous sandstones under shearing at high confining pressures, *International Journal of Rock Mechanics and Mining Sciences*, Vol.93, pp. 179-195.
2. Teuku Faisal Fathani, Djoko Legono, and Muhammad Ahnaf Alfath. 2017. Sensitivity analysis of depth-integrated numerical models for estimating landslide movement, *Journal of Disaster Research*, Vol.12 No.3 pp. 607-616.
3. Khiem Quang Tran, Tomoaki Satomi and Hiroshi Takahashi. 2017. Study on strength behavior of cement stabilized sludge reinforced with waste cornsilk fiber, *International Journal of GEOMATE*, Vol.13, Issue 39, pp.140-147.
4. Kana Nakatani and Yoshifumi Satofuka. 2018. Debris flow scale and landform data resolution effect on influence area, *Journal of Japan Society of Civil Engineers. Ser. B1, Hydraulic engineering*, Vol. 74, No. 4, I\_1201- I\_1206.
5. Norio Harada, Shoki Takayama, Kana Nakatani, Yoshifumi Satofuka, and Takahisa Mizuyama. 2018. Proposal for a countermeasure against driftwood using steel stakes on impermeable-type sabo dams, *Journal of Japan Society of Civil Engineers. Ser. B1, Hydraulic engineering*, Vol. 74, No. 4, I\_1219-1224.
6. Atsushi Kajiyama, Akinobu Sato, Naoyuki Kishigami, Go Yanagisaki, and Yoshifumi Satofuka. 2018. A Method of development for representing one-dimensional analysis results by a two-dimensional plane -converting the analysis results to GIS data-, *Journal of Japan Society of Civil Engineers. Ser. B1, Hydraulic engineering*, Vol. 74, No. 4, I\_1447- I\_1452.
7. Yuko Ishida, Ayaka Oya, Weerakaset Suanpaga, Chalemnchai Trakulphudphong, Chaweewan Denpaiboon, Masamitsu Fujimoto and Ryoichi Fukagawa. 2018. Estimation of initial void ratio of consolidated clay based on one-dimensional consolidation theory, *International Journal of GEOMATE*, pp.51-56.
8. Kazunari Sako, Yusuke Yokota, Tomoaki Satomi, Toru Danjo, and Ryoichi Fukagawa. 2018. Long-term measurement system of negative pore-water pressure in slopes using wireless, *Journal of Japan Society of Civil Engineers, Ser. C, Geosphere Engineering*, Vol.74, No.2, pp.144-163, 2018.
9. Nguyen Thong, Luu Xuan Loc, Ho Tuan Duc, Tran Thanh Thao. 2018. Coastal erosion prevention in Go-Cong beach by T-head shape groynes, *Science and Technology Journal of Agriculture and Rural Development*.
10. Kota Kono, Akihisa Nakahashi, Dong Daicho, Nobuo Fukushima and Ryoichi Fukagawa. 2018. Structural

- simulation on an OPEN-WING-TYPE Ground Anchor, *International Journal of GEO MATE*, Vol.14, pp.89-94.
11. Yuko Ishida, Tsuyoshi Kibayashi, Tatsuo Konegawa and Ryoichi Fukagawa. 2018. Analysis of groundwater fluctuation characteristics before-after drainage works: —A case study of the landslide on "Yokogaki-Toge" pass, at the world heritage Kumano pilgrimage route—, *Journal of the Japan Landslide Society*, Vol. 55, No.4, pp.18-23.
  12. Yasuyuki Hirakawa, Kazuyuki Okano, Toshiyasu Ueno, Yoshifumi Satofuka, Daizo Tsutsumi and Shusuke Miyata. 2019. Topographical and geological factors to advance debris flows occurrence on hillslope covered with pyroclastic-flow deposits for 20 years after the eruption in Mt. Unzen-Fugen-dake, *Journal of the Japan Society of Erosion Control Engineering*, Vol. 72, No. 1, pp. 21-31.
  13. Yasuyuki Hirakawa, Kazuyuki Okano, Hisayoshi Takeishi, Toshiyasu Ueno, and Yoshifumi Satofuka. 2019. Rainfall-runoff response to the source area of debris flow at Tansan-dani Stream, Mt. Unzen-Fugen-Dake, *Journal of the Japan Society of Erosion Control Engineering*, Vol. 72, No. 3, pp.19-26, 2019.
  14. Le L.A., Nguyen G.D., Bui H.H., Sheikh A.H. & Kotousov A. 2019. Incorporation of micro-cracking and fibre bridging mechanisms in constitutive modelling of fibre reinforced concrete, *Journal of the Mechanics and Physics of Solids*, Vol.133.
  15. Tran H.T., Wang Y., Nguyen G.D., Kodikara J. & Sanchez M., Bui H.H. 2019. Modelling 3D desiccation cracking in clayey soils using a size-dependent SPH computational approach, *Computers and Geotechnics*, Vol.116.

### **Selected List of Research Funding/Grants**

1. Yoshifumi Satofuka (Principal Investigator): Grant-in-Aid (KAKENHI) for Scientific Research (B) “Development of prediction method for natural dam outbreak breach by combining riverbed change model and slope failure model” (FY2018-2020), Total 16,900,000JPY
2. Yoshifumi Satofuka (Co-Investigator): Science and Technology Research Partnership for Sustainable Development (SATREPS), Disaster Prevention and Mitigation field “Integrated Study on Mitigation of Multimodal disasters caused by Ejection of Volcanic Products” FY2013-2018, (Principal Investigator: Masato Iguchi), Distributed budget total 1,520,000JPY
3. Yoshifumi Satofuka (Co-Investigator): Competitive funds on research and development for River engineering and Sabo engineering, Ministry of Land, Infrastructure, Transport and Tourism “Development of design method for sabo facilities resilient to external force” (FY2017-2018), (Principal Investigator: Yoshiharu Ishikawa), Distributed budget total 1,030,000JPY
4. Ryoichi Fukagawa (Principal Investigator): Grant-in-Aid (KAKENHI) for Scientific Research (C) “Study on wing-spread type anchoring method for reinforcement of large-scale residential area developed with embankment” (FY2018-2020), Total 3,900,000JPY
5. Ryoichi Fukagawa (Principal Investigator): Collaborative Research with NITTO CONSTRUCTION CO., LTD. “Project for preservation of cultural heritage against from sediment disasters” (FY2018-2020), Total 3,000,000JPY
6. Taizo Kobayashi (Principal Investigator): Ministry of Land, Infrastructure, Transport and Tourism, Kinki Regional Development Bureau, Project Research by Research Group for Creation and Integration of New Urban Social Technologies “Research on utilization of 3D data” (FY2016-2017), Total 6,469,000JPY
7. Taizo Kobayashi (Principal Investigator): Grant-in-Aid (KAKENHI) for Scientific Research (C) “Advancement of embankment construction and maintenance management technologies using 3D data, and implementation of earthwork CIM” (FY2019-2021), Total 4,290,000JPY
8. Taizo Kobayashi (Co-Investigator): Grant-in-Aid (KAKENHI) for Scientific Research (A) “Development of Coreless Geotechnical Investigation Method and Challenge to Digital Geotechnical Engineering” (FY2019-2022), (Principal Investigator: Takaaki Mizutani), Distributed budget total 12,290,000JPY
9. Masamitsu Fujimoto (Principal Investigator): Grant-in-Aid (KAKENHI) for Young Scientists (B) “Elucidation of the mechanism of slope surface failure by understanding of slope hydrology process during heavy rain events” (FY2015-2017), Total 4,420,000 JPY
10. Masamitsu Fujimoto (Principal Investigator): Grant-in-Aid (KAKENHI) for Scientific Research (C) “Elucidation of slope failure mechanism due to rainfall after large-scale earthquake focusing on ground strength and rainfall

penetration characteristics” (FY2018-2021), Total 4,290,000JPY