One Health One World

JRNUS

The 1st INTERNATIONAL JOINT STUDENT ONLINE SEMINAR on ONE HEALTH, ONE WORLD (OHOW)
December 9-10, 2021

1st International Joint Student Online Seminar on One Health, One World, 9-10 Dec. 2021

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9-10 December 2021

Co-Organized by

One Health One World (OHOW),
Institute of Industrial Science, The University of Tokyo, Japan

&

Regional Network Office for Urban Safety (RNUS),
School of Engineering and Technology,
Asian Institute of Technology (AIT), Thailand

Supported by Takeuchi laboratory

Organizing Members

Prof. Pennung Warnitchai (AIT, Thailand)
Prof. Toru Okabe (Director General, IIS, UTokyo, Japan)
Prof. Wataru Takeuchi (IIS, UTokyo, Japan)
Prof. Mehedi Ahmed Ansary (BUET, Bangladesh)

1st International Joint Student Online Seminar on One Health, One world

December 9-10, 2021

ONLINE (ZOOM) 17:00-20:00(JST), 15:00-18:00(BST)

Organized by

One World One Health (OHOW), IIS, The University of Tokyo, Japan

&

RNUS, SET, Asian Institute of Technology, Thailand

OneHealth
OneWorld

RNUS

Introduction

ICUS and RNUS have jointly organized the past nine International Joint Student Seminar on civil infrastructures from 2008 to 2020 with more than 1,000 participants from 20 countries. The 1st Joint Student Seminar topic will be extended to one health and one world which is a comprehensive science of human and animal health, and the global environment in addition to civil engineering and infrastructure related research.

Objective

Sharing research information and friendships to improve presentation skills and among major Asian universities.

Seminar Themes

The seminar will include poster presentations by students from each country in different fields, such as disaster and infectious disease, transportation and human mobility, structural and geotechnical engineering for human safety, ecology and environment impact of human public health, climate change and green recovery, remote sensing and GIS etc...

Important Dates

November 15, 2021:
Deadline for abstract submission
November 29, 2021:
Deadline for poster and video presentation submission

Organizing Members

Prof. Pennung Warnitchai (SET, AIT, Thailand)
Prof. Toru Okabe (Director General, IIS, UTokyo, Japan)
Prof. Wataru Takeuchi (IIS, UTokyo, Japan)
Prof. Mehedi Ahmed Ansary (BUET, Bangladesh)

Registration

Please visit to OHOW H.P.
Online registration
https://ohow.iis.u-tokyo.ac.jp/

Contact us

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PREFACE

IIS has established a Regional Network Office for Urban Safety (RNUS) at SET, AIT since 2002 and dispatched young faculty members from Japan to Thailand to work for education and research including urban safety, remote sensing and GIS, infrastructure health assessment, flood risk monitoring. RNUS also serves to organize seminars and arrange IIS/U-Tokyo alumni parties every year. We recognize RNUS as one of the core international liaison research offices leaded by One Health and One World initiative (OHOW) of The University of Tokyo since July 1, 2021.

Recent outbreak of COVID-19, phenomena such as species loss, habitat degradation, pollution, invasive alien species, and global climate change are recognized as fundamentally altering life on our planet from terrestrial wilderness to the most densely populated cities. The concept " One Health, One World" addressed as Manhattan principles in 2004 has been well recognized which is a comprehensive science of human and animal health, and the global environment along with urban safety and urban environmental management.

This is the second event in the last 13 years which is fully organized via online conference style. I was concerned about the connection from countries with unstable internet environments, but the moderator from AIT was able to share the questions on chat and the discussion among the students progressed more than expected. There were 44 student presenters from 11 countries, including Japan, Thailand, Bangladesh, China, Sri Lanka, Philippines, Indonesia, Lao PDR, Kenya, Bhutan, Nepal, for a total of 140 participants over the two days, including the audience.

On the first day, Professor Wataru Takeuchi of IIS presented "Introduction to one health, one world", Professor A. S. M. Maksud Kamal of Dhaka University presented "Public health hazard and economic perspective", and Professor Ahmed Ansary of BUET Mehedi presented "Bangladesh's preparedness to manage earthquake disaster". Prof. Ahmed Ansary of BUET spoke on "Bangladesh's preparedness to manage earthquake disaster". On the second day, Professor Reiko Kuwano of IIS gave a lecture titled "Hidden cavities in the urban ground.

May I ask each of you here today to lend your strength and support to AIT and IIS/UTokyo as it strives to enhance and expand ever-growing friendship and scientific exchange activities for excellent scientific researchers.

Thank you very much, Kopun-krap, Arigato-gozaimasu.

Institute of Industrial Science
The University of Tokyo, Japan
Professor Wataru TAKEUCHI

CONTENTS

PROGRAM

Venue: Online
Date: 9-10 December 2021
D=Disaster, **E**=Environment Field, **I**=Infrastructure, **O**=Others
AIT: Asian Institute of Technology (Thailand), **BUET**: Bangladesh University of Engineering Technology (Bangladesh),
Dhaka: University of Dhaka (Bangladesh), **NUT**: Nagaoka University of Technology (Japan),
SIT: Shibaura Institute of Technology (Japan), **Tsinghua**: Tsinghua University (China),
NIT: National Institute of Technology, Gunma College (Japan), **Utokyo**: The University of Tokyo (Japan)

DAY1: 9th Dec. 2021

Date	Time (Japan)	ID	Name	field	affiliation	Title
Opening ceremony	16:30-16:45 15:30-(Beijing) 14:30-(Thai) 13:30-(Bangladesh)		**Prof. Wataru Takeuchi**		Utokyo	**Introduction to one health, one world**
Special Lecture	16:45-17:05		**Prof. Dr. ASM Maksud Kamal**		Dhaka	**Public Health Hazard and Economic Perspective**
A1	17:05-17:11	2	Mr. Abhishek Regmi	I	AIT	An Experimental Study on Seismic Response Estimation Using Measured Acceleration Data
A2	17:11-17:17	6	Mr. Abu Zahir Abir	D	Dhaka	PM2.5 Concentration Variation Modelling based on Satellite Retrieved Aerosol Optical Depth and In Situ Recordings
A3	17:17-17:23	12	Mr. Chhabi Lal Paudel	I	SIT	Review of issues leading to the delay of mega road projects in Nepal
A4	17:23-17:29	13	Mr. Yoshinobu Watanabe	D	NUT	Evaluation of Stability of Wide-area Slopes Affected by Combined Effects of Earthquakes and Rainfall
A5	17:29-17:35	17	Ms Sayma Ahamed	O	BUET	Impact of Covid-19 Pandemic Immediately after the First Wave on Readymade Garment (RMG) Sector in Bangladesh
A6	17:35-17:41	18	Ms Mahima Yusuf Tarana	O	Dhaka	Assessment of Flood Induced Health Risks and Resulting Disruptions in Health Care Facilities in Louhajang Upazila of Munshiganj District
A7	17:41-17:47	25	Mr. Kyoichiro Hirata	O	Utokyo	Shooting Condition of Urban Landscape Photography with Focusing on the Composition of Skyscrapers
A8	17:47-17:53	31	Mr. Muhammad Rafiul Mahdi	I	BUET	An Experimental Investigation of Welded Wire Reinforced RC Slab Panels for Evaluation of their Flexural Capacity and Serviceability
A9	17:53-17:59	33	Ms Sabah Hossain Iqra	O	BUET	Application of Arima Model to Estimate the Influence of Official Lockdown Period on Road Accident Patterns in Dhaka City
Break	17:59-18:15					
Special Lecture	18:15-18:35 17:15-(Beijing) 16:15-(Thai) 15:15-(Bangladesh)		**Prof. Mehedi Ahmed Ansary**		BUET	**Bangladesh's Preparedness to Manage Earthquake Disaster**
B1	18:35-18:41	3	Mr. Sivaram	O	AIT	Seismic Response of Asymmetric Rectangular Blocks in High-Rise Building
B2	18:41-18:47	5	Mr. Kenneth Edward Torrella Fernando	I	SIT	Understanding stakeholder perspectives on a suspended road widening project in the Philippines using Q methodology
B3	18:47-18:53	8	Ms Fahmida Alam Bintu	D	Dhaka	Development of a Simplified Analytical Model to Evaluate Hospital Preparedness for Earthquake Emergency Response
B4	18:53-18:59	15	Mr. Dhan Raj Chhetri	I	SIT	Characteristics of Road Geohazards in Bhutan
B5	18:59-19:05	20	Ms Tasnim Jabin Jui	D	Dhaka	Assessment of Community 窶凅 Willingness to Pay for Improved Public Healthcare Facilities in the Coastal Hazard-prone Areas of Bangladesh

B6	19:05-19:11	22	Mr. Ren Hori	D	NIT	Study on Geotechnical Behavior of Long-Distance Ground-Flow During the 2018 Sulawesi Earthquake, Indonesia
B7	19:11-19:17	27	Ms Anika Tasmiah	D	BUET	Development of Empirical Correlations between Shear Wave Velocity and In-Situ Penetration Test Results for All Types of Soils in DMDP Area, Bangladesh
B8	19:17-19:23	34	Mr. Zamzam Multazam	I	Utokyo	Shaking table tests on one-quarter scale model of concrete hollow blocks masonry houses retrofitted with fiber-reinforced paint
B9	19:23-19:29	35	Mr. Zarif Ikram	I	BUET	Elaborating Various Vehicles Features on Traffic Safety
B10	19:29-19:35	39	Mr. Ashkar Rahman Aquib	D	BUET	How about the Strict Enforcement laws to Mitigate Traffic Crashes in Bangladesh?
B11	19:35-19:41	43	Ms Ira San Jose	E	Utokyo	Semi-Automated Delineation of Landslides Triggered by the 2018 Typhoon Prapiroon in Eastern Hiroshima, Japan
Comments	19:41- 18:41-(Beijing) 17:41-(Thai) 16:41-(Bangladesh)		From Professors and so on			

DAY2: 10th Dec. 2021

Date	Time (Japan)	ID	name	field	affiliation	title
Special Lecture	16:30-16:45 15:30-(Beijing) 14:30-(Thai) 13:30-(Bangladesh)		**Prof. Reiko Kuwano**		Utokyo	**Hidden cavities in the urban ground**
C1	16:45-16:51	41	Mr. Shuai Shao	E	Utokyo	Biophysical Suitability Assessment for Chinese Cabbage of East Asia from 2001 to 2020
C2	16:51-16:57	38	Ms Sarah Sultana	D	BUET	Exploring Critical Accident Factors of National Highways in Rural Areas of Bangladesh
C3	16:57-17:03	4	Ms Srikulnath Nilnoree	I	AIT	An Integrated Internet of Things Sensor based System for Structural Health Monitoring
C4	17:03-17:09	9	Ms Samiha Saleha	E	Dhaka	Time Series Analysis of the Seasonality of Air Pollution and Its Impact on COPD Cases in Dhaka City
C5	17:09-17:15	10	Ms Eng. Grace Njeri Muna	I	SIT	Effect of Reclaimed Asphalt Pavement on the sustainability characteristics of Asphalt Concrete
C6	17:15-17:21	19	Mr. Shi Zhengyi	I	Tsinghua	Analytical research on city infrastructure interdependencies: A case study based on network method
C7	17:21-17:27	24	Mr. Tonmay Kumar Barman	D	Dhaka	Identifying Dynamics of 2020 Flood Event & It 簒沤 Effect on Health of the Community in Kurigram District by Using Earth Observation Technology.
C8	17:27-17:33	28	Mr. Mir Md. Tousif	I	BUET	Geotechnical Characterization of Riverine and Coastal Embankment Soil of Bangladesh Based on Standard Penetration Testing and Cone Penetration Testing
C9	17:33-17:39	32	Mr. Silimanotham Hatthaphone	D	SIT	The relationship between bridge characteristics and condition rating for road bridges in Lao PDR
C10	17:39-17:45	36	Mr. Aninda Kumar Chowdhury	O	BUET	Hotspot Analysis of COVID-19 Effects on Inland Waterway Accidents in Bangladesh
C11	17:45-17:51	40	Mr. Bo Mahai	D	Utokyo	Dynamic structure-soil-structure interaction of pile groups among structures: a parametric study
break	**17:51-18:10**					
D1	18:10-18:16	44	Mr. Shoki Shimada	E	Utokyo	Detection and disaster risk evaluation of solar photovoltaic cells by satellite remote sensing data and a machine learning method
D2	18:16-18:22	45	Ms Tahsin Ishrak Oishee	E	BUET	Modeling the Spatio-Temporal Correlation of Hydrological Variations with Accident Frequency in the Ganges-Padma River Route

D3	18:22-18:28	7	Ms Teng Limin	O	NUT	Damage Characteristics of the 2019 Yamagata Prefecture Earthquake and Damage Classification in Koiwagawa
D4	18:28-18:34	11	Mr. Nitesh Acharya	I	SIT	Review of the existing road safety issues and improvement practices in Nepal
D5	18:34-18:40	14	Mr. Binay Karna	O	AIT	Modified Andreason & Andersen Particle Packing Optimization method to develop low cement high performance concrete with partial cement replacement by fly ash and silica fume
D6	18:40-18:46	16	Mr. Abul Kashem Faruki Fahim	E	Dhaka	Liquefaction resistance evaluation of soils using artificial neural network for Dhaka City, Bangladesh
D7	18:46-18:52	23	Ms Ji Xinyu	I	Tsinghua	Impacts of climate change on urban drainage systems
D8	18:52-18:58	26	Ms Noshin Nower	E	Dhaka	NO2 concentration trend in Dhaka city during the lockdown and subsequent impact on aerosol index and daily maximum temperature
D9	18:58-19:04	29	Mr. Subashish Kundu Sunny	D	BUET	Mitigating Landslide Hazard Through Bamboo Slope Protection
D10	19:04-19:10	37	Ms Maisha Ghani	O	BUET	A Comprehensive Factor Analysis of Unauthorized Vehicle Accidents in Bangladesh
D11	19:10-19:16	42	Mr. Huang Yiwei	E	Utokyo	Prediction of potential nighttime fishing area using nighttime light and species distribution model in exclusive economic zone of Japan
D12	19:16-19:22	46	Mr. Joydip Paul		BUET	Finite Element Analysis to Evaluate Impact of Head Injury of Commercial Ride-Sharing Service Helmets
D13	19:22-19:28	47	Mr. Yutaro Hara	I	Utokyo	Fine-coarse interlayered soil structure adopted in the construction of ancient tomb mounds
Comments /closing	19:28- 18:28-(Beijing) 17:28-(Thai) 16:28-(Bangladesh)					

SPECIAL LECTURE

・ Prof. Wataru Takeuchi, The University of Tokyo
「Introduction to one health, one world」

・ Prof. Dr. ASM Maksud Kamal
「Public health hazard and economic perspective」

・ Prof. Mehedi Ahmed Ansary
「Bangladesh's preparedness to manage earthquake disaster」

・ Prof. Reiko Kuwano
「Hidden cavities in the urban ground」

STUDENT POSTER

An Experimental Study On Seismic Response Estimation Using Measured Acceleration Data

Abhishek Regmi*, Pennung Warnitchai**

*Graduated Student, Structural Engineering, Asian Institute of Technology (AIT), Nepal

**Professor, Structural Engineering, Asian Institute of Technology (AIT), Thailand

*1st International Joint Student Online Seminar on One Health, One World*

ABSTRACT

This poster presents an experimental study on testing a method of estimating the seismic responses of a structural system using measured acceleration data. The time histories of the acceleration responses are measured only from a limited number of nodes. A modal decomposition approach based on the orthogonal filter, modified for the limited number of acceleration data, has been used to extract the modal accelerations from the measured acceleration data. Then the modal coordinates were obtained by double integrating the modal accelerations. The proposed method utilizes the modal concept to combine the modal coordinates and the dynamic characteristics of the structural system for the estimation of different seismic responses. In this study, a multi-degree freedom steel cantilever system was tested on a shaking table simulating the real earthquake motions. The acceleration transducers were installed for monitoring the acceleration during the vibration. An ambient vibration test was conducted for the determination of the dynamic properties of the physical specimen. The seismic responses, especially the bending and shear, were then estimated using the proposed method. Finally, the seismic response estimation method was validated by comparing the estimated strain responses with those obtained directly from the strain gauges attached to the test model.
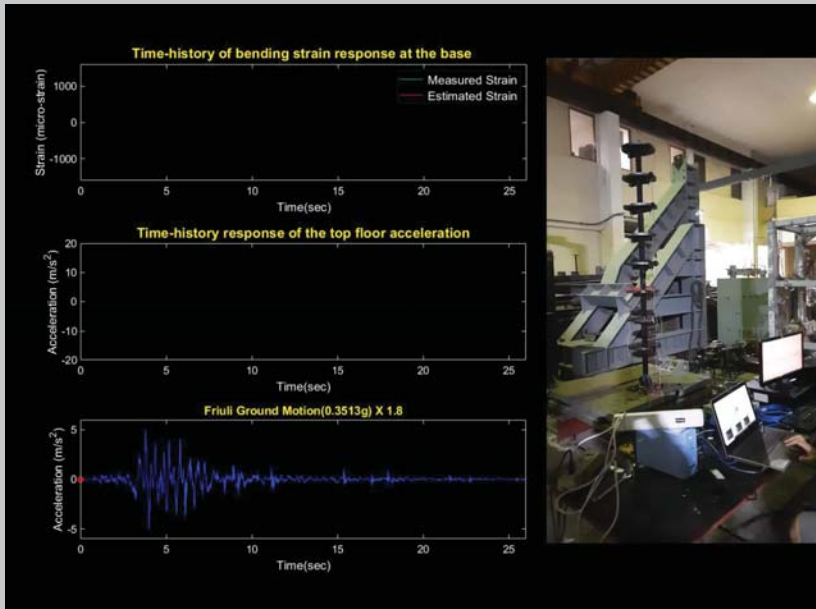
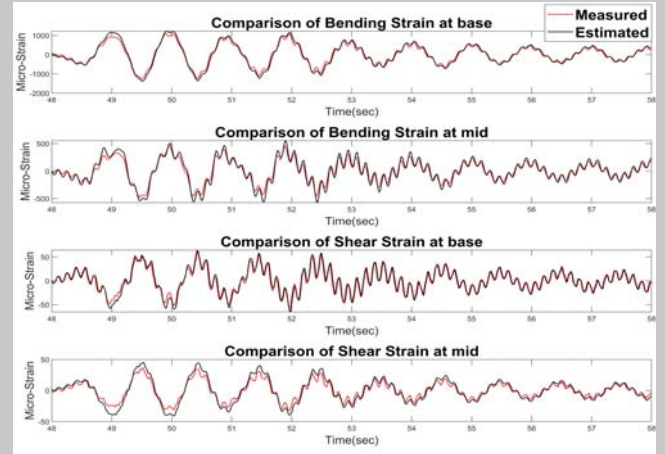## Seismic Response Estimation Method
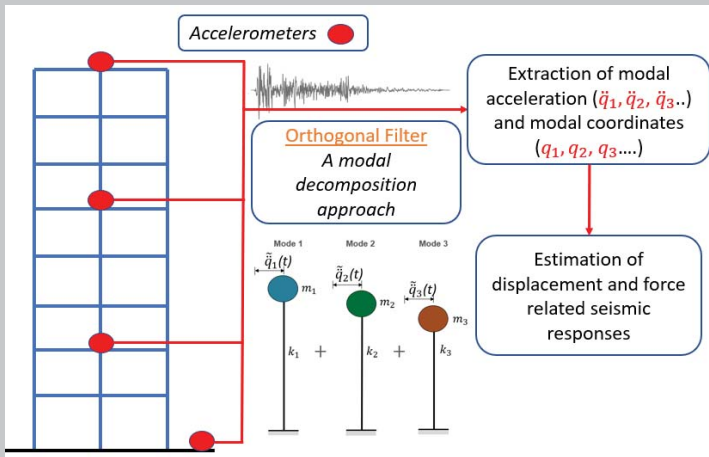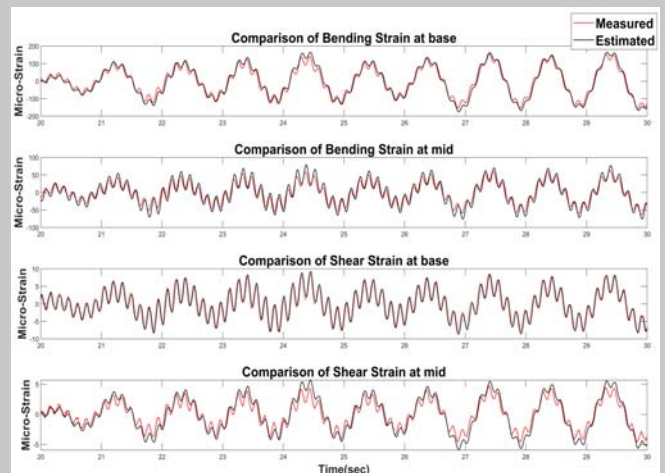

Shaking Table Experiment of a Cantilever Beam Structure
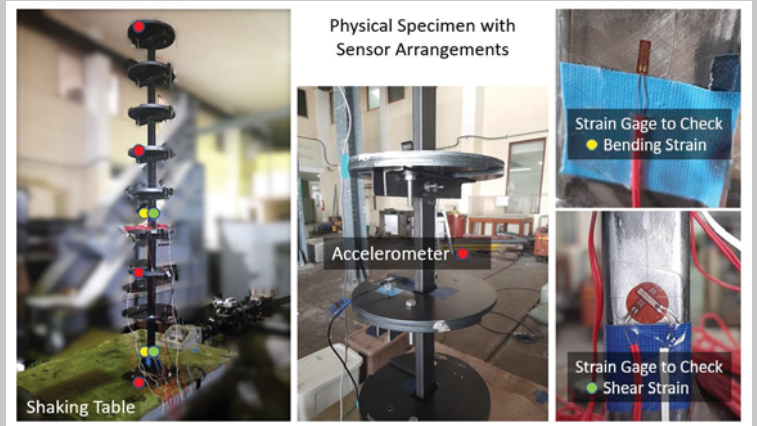
Simulating Real Ground Motions (Friuli X 1.8, **PGA=0.63g**)

Strain Comparison (Friuli X 1.8, **PGA=0.63g**)

Strain Comparison (Kobe X 0.1, **PGA=0.034g**)

Conclusions and Recommendations

- The time history of bending and shear strain responses can be predicted well using the proposed method

- Other seismic responses can also be estimated using this approach

- The experimentally tested method for seismic response estimation was found to be accurate enough for the application

- Further tests need to be done for the application of this method beyond the linear range

For further information, contact below.

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PM2.5 Concentration Variation Modeling Based on Satellite Retrieved Aerosol Optical Depth and In Situ Recordings

Abu Zahir Abir [a], Dewan Mohammad Enamul Haque [b], Dr. Mohammad Moniruzzaman [c]

a Department of Disaster science and Management, University of Dhaka.
b Associate Professor, Department of Disaster Science and Management, University of Dhaka.
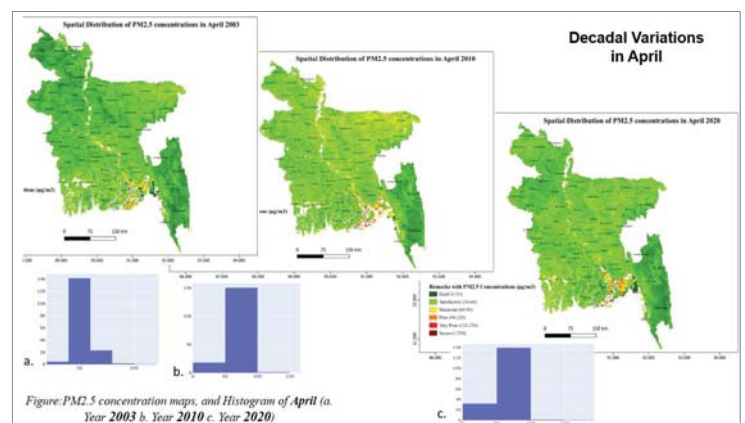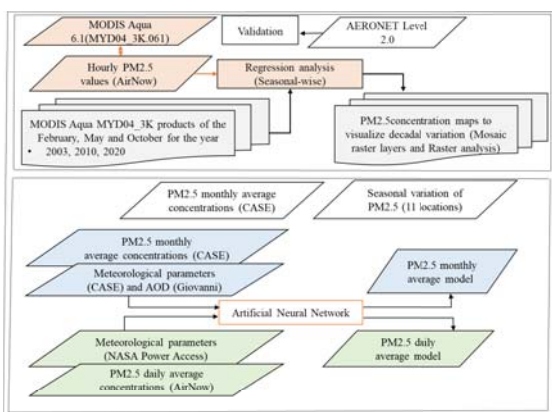c Principal Scientific Officer, Bangladesh Council for Scientific and Industrial Research (BCSIR)

Fine particulate matter with aerodynamic diameters smaller than 2.5μm is known as PM2.5, and it is problematic for our health as it can enter into the alveoli, causing severe cardiovascular diseases, respiratory diseases and even lung cancer. There are few continuous air monitoring stations functioning in Bangladesh but it is not possible to get the whole pollution nature only by these limited number of stations. Considering these limitations, satellite retrieved aerosol optical depth (AOD) is getting familiar worldwide to map PM2.5 concentrations. We have operated season-wise regression analysis between AOD and in situ PM2.5 concentrations, and the R² value of the linear regression functions are 0.4874, 0.42, and 0.7682 for winter, spring, and monsoon respectively. We have used this relationship to map PM2.5 concentrations in February, April, and October for the year 2003, 2010, and 2020. We have found an increasing trend of PM2.5 concentrations in February. During April, the concentration gets higher in the 2010 map compared to the 2003. But we have seen this trend is not followed for 2010, and 2020 because of the COVID19 lock-down protocol. In October, we have found a lower concentration of PM2.5 compared to the February, and April, and there is no significant trend seen in the decadal maps because of the precipitation. In addition, we have proposed two models to calculate monthly average PM2.5 and daily average PM2.5 from the meteorological parameters that are easily accessible.
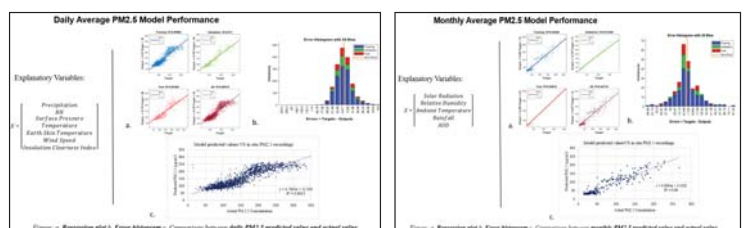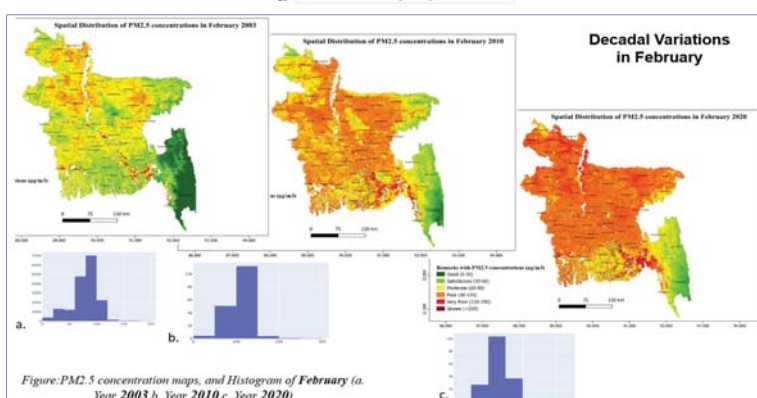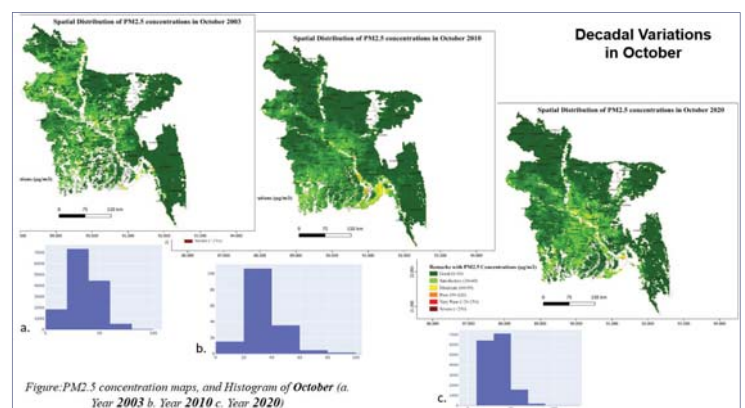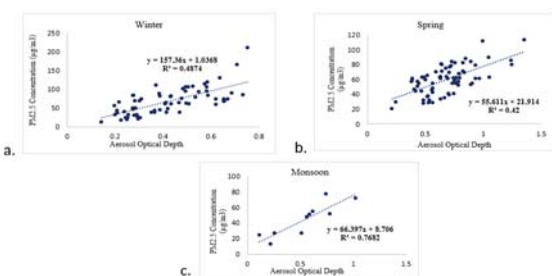
Introduction:

There is a strong relationship between PM2.5 and adverse health effects such as mortality, ischemic heart disease and lung cancer, PM2.5 concentrations should be monitored intensively. But monitoring the air quality instrumentally is so much costly which leads to a limited number of air quality monitoring stations especially in underdeveloped and developing countries. This study aims to understand the PM2.5 concentrations over decades utilizing the satellite retrieved AOD. We have worked with the month of February, April and October to represent the three distinguished seasons of Bangladesh, and selected the year 2003, 2010 and 2020 to understand the decadal variation of PM2.5 concentrations. To map the PM2.5 concentrations of each month, we have used MODIS Aqua 3k AOD products that are freely accessible via Earthdata portal of NASA (LAADS DAAC NASA, 2021) and applied season-wise regional intercept and slope values which have been obtained by the regression analysis between AOD and in situ recordings. In situ PM2.5 recordings are taken from the AirNow website (AirNow, 2021) which is a partnership of the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration (NOAA), National Park Service, NASA, Centers for Disease Control, and tribal, state, and local air quality agencies. Furthermore, we have developed monthly and daily PM2.5 models to calculate approximate PM2.5 concentrations. To develop monthly PM2.5 model, we have used CASE monthly average value of PM2.5, solar radiation (1hr), relative humidity (1hr), ambient temperature (1hr) and rainfall (1hr). In addition, mean of daily mean values of 'Average Combined Dark Target and Deep Blue AOD at 0.55 micron for land and ocean' are included in the model to make the model more accurate. To develop daily model, we have used PM2.5 daily average from March 2016 to February 2021. The in situ recordings are taken from the World Air Quality Index Project which starts working from 2007 (World Air Quality Index, 2021). We have used seven meteorological parameters namely precipitation, relative humidity, surface pressure, temperature, earth skin temperature, wind speed and Insolation Clearness Index in the daily PM2.5 model. The data are taken from the NASA Power Data Access Viewer. Artificial Neural Network is applied to model both the monthly and daily PM2.5 model, and these two models can be used to derive PM2.5 from the model parameters.

Methodological Framework:

Relationship between PM2.5 concentrations and AOD:

Figure: PM2.5 concentration maps, and Histogram of **February** (a. Year **2003** b. Year **2010** c. Year **2020**)

Figure: PM2.5 concentration maps, and Histogram of **April** (a. Year **2003** b. Year **2010** c. Year **2020**)

Figure: PM2.5 concentration maps, and Histogram of **October** (a. Year **2003** b. Year **2010** c. Year **2020**)

Significance:

- Map PM2.5 using satellite retrieved Aerosol products
- Calculate the PM2.5 daily or monthly concentrations from meteorological variables using artificial neural network

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Review of issues leading to the delay of mega road projects in Nepal

Chhabi Lal Paudel[1], Michael Henry[2]

[1]Shibaura Institute of Technology, [2]Associate Professor,

Department of Civil Engineering, Shibaura Institute of Technology

Abstract

The projects of most prominent transport mode have seriously affected by time and cost overrun during their performance. Ultimately, socio-economic development is affected due to resource constraint and poor output performance. The main objective of this research is to examine the most critical delay factors in mega road projects based on past research & available project specific database. It will overview the relevant policies for further improvement. From the literatures & project data, the most critical mega road project delay factors as capacity constraint, land acquisition, relocation of utilities, decision process, environmental clearances, coordination, political instability, force majeure and resource planning. As the delay is inevitable, proper analysis helps to sensitize decision/policy maker & to adopt delay minimization measures.

Background

Government of Nepal under the institutional responsibility of Department of Roads (DoR) has been implementing national highway development projects. As in the other countries, it has the problem of timely accomplishment of projects in stipulated time and cost. This research mainly focus on the mega road projects and their implementation issues.
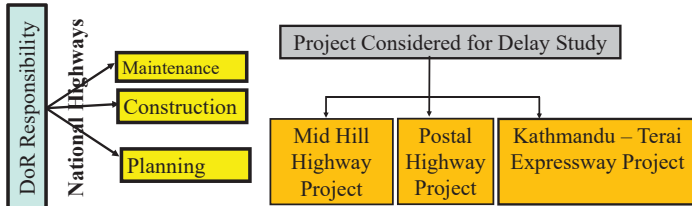
Three projects having high cost, wider area coverage with geographical complexity are defined as mega road projects. At present, the time and cost scenario of these projects are as follows in graphical form:
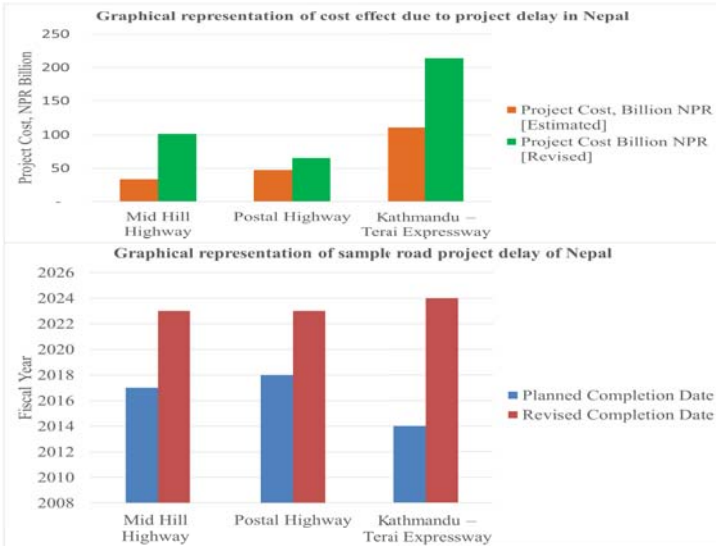
Source: National Planning Commission & Department of Roads Project status reports, 2019

Research Objective

The main objective of this research is to examine the most critical delay factors in mega road projects based on past research & available project specific database.

Methodology and Analysis Results

The data presented in the following table are the findings of past researches in the area of infrastructure project delay analysis. Most important factors from the literatures are considered. In case of Nepal, the findings from the project progress evaluation reports from the government organizations. These are the few among the long list of issues affecting time and cost overrun:

Country	Reasons for Delay (from Literature)	Delay reasons for Nepal
Australia, Malaysia, Ghana	Capacity constraint, planning, financing, resource availability and coordination	Capacity constraint, coordination, resource planning and design deficiencies, Land Acquisition, geographical complexity, relocation, environmental approval, force majeure, political instability and financing.
Ethiopia	Corruption, resource constraint, inflation, quality and decision process	
Turkey	Delayed decision, changes in law, financing, resource and capacity constraint	
Saudi Arabia	Procurement, capacity constraint, motivation, variation and coordination	
Jordan	Payment, slow decision, inaccurate design, variation and financing	

Source: Literature review on delay analysis & project reports of Government of Nepal

Analysis Results

Delay is inevitable in any situation due to the complex nature of mega projects. Extent of effect of delay factors is found country specific and project specific. Schedule and Cost performance indicates the effect of delay factors in overall project performance.

Schedule and Cost performance indices of three mega road projects are calculated as follows:

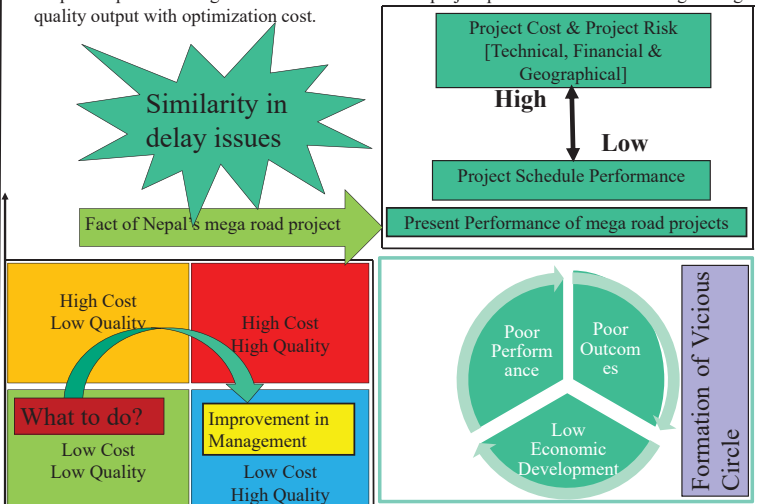| Project Name	Scheduled Performance Index (SPI = Planned Duration/ Actual Duration)	Cost Performance Index (CPI = Estimated Cost/Actual Cost)
Mid Hill Project	0.63	0.33
Postal Highway Project	0.67	0.72
Kathmandu - Terai Expressway Project	0.44	0.52

The overall road sector's yearly expenditure efficiency and the same with the mega road projects indicates that economic growth and timely execution of projects are interrelated. Following graphical representation of data illustrate the relationship.
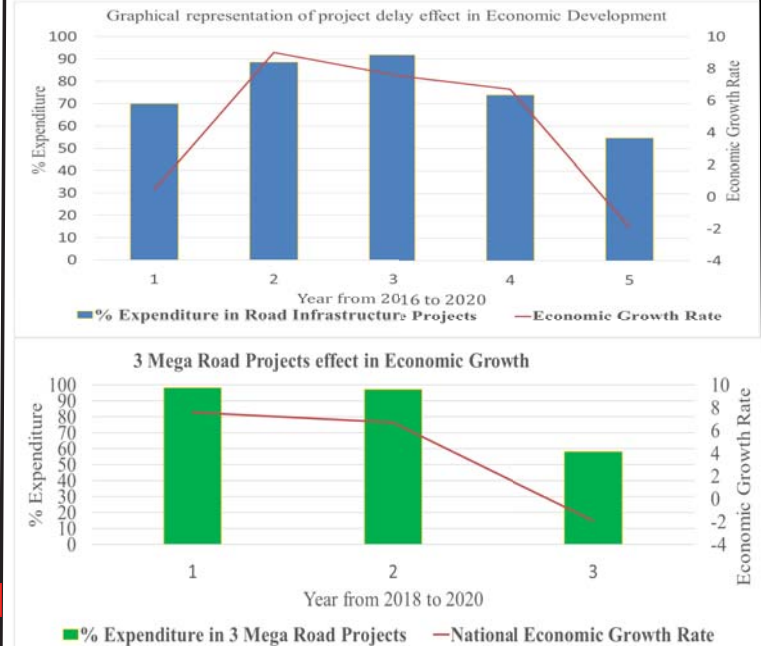
Source: International Monitory Fund, April 2021 & Department of Roads, Progress Report, 2019-20

Findings & Result Interpretation

➤ No project is idle as planned. During the performance, many issues related to planning and contract related arise which are the causes of project delay.

➤ Timely addressing those delay issues, project performance can be improved significantly.

➤ Proper adoption of mitigation measures enhance the project performance for achieving the high quality output with optimization cost.

Similarity in delay issues

Project Cost & Project Risk [Technical, Financial & Geographical]

High / Low

Project Schedule Performance

Fact of Nepal's mega road project

Present Performance of mega road projects

High Cost Low Quality

High Cost High Quality

What to do? Low Cost Low Quality

Improvement in Management — Low Cost High Quality

Poor Performance

Poor Outcomes

Low Economic Development

Formation of Vicious Circle

Evaluation of Stability of Wide-area Slopes Affected by Combined Effects of Earthquakes and Rainfall

Yoshinobu WATANABE, Nagaoka University of Technology , Japan, D1

abstract : This study evaluates the stability of wide-area slopes affected by the combined action of earthquake and rainfall using GIS. The target area is Atsuma Town, which was severely damaged by the 2018 Hokkaido Eastern Iburi Earthquake. The mesh spacing of the digital elevation model is set to 10 m. In order to evaluate the stability of wide area slopes, the safety factor is calculated for each mesh using GIS. Among the parameters of the modified Ferrenius's method, the internal friction angle, cohesion, and horizontal seismic coefficient are determined from the general design values. The angle of slope of the slip surface is determined from the digital elevation model. As a result, unstable parts are extracted in a wider area than the actual failure area. Subsequently, the degree of influence of each parameter on safety factor is confirmed. Although it depends on the range of each parameter, it is found that the thickness of the collapsed soil mass and the angle of slope of the slip surface have a relatively large influence on the safety factor. It is necessary to refine each parameter in consideration of these influences.

Background & Objective

Characteristics of Japan
✓ About 70% of Japanese islands is mountainous terrain and the geology is fragile.
✓ The average annual rainfall in Japan is about 1700 mm, which is about twice the world average.
✓ The number of earthquakes is extremely high

The risk of sediment disasters is extremely high

Preparedness for complex disaster

During the 2018 Hokkaido Eastern Iburi Earthquake and the 2019 Typhoon No.19, rainfall and earthquake occurred almost at the same time. In order to prepare for disasters more carefully, it is necessary to evaluate these compound disasters.

This study attempts to reproduce the slope failures of the 2018 Hokkaido Eastern Iburi Earthquake, which had rainfall just before the earthquake.

※Report on the Damage Surveys and Investigations Following the 2018 Hokkaido Iburi Tobu & Northern Osaka Earthquake,Japan Society of Civil Engineers
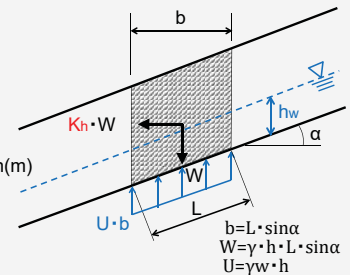
Methodlogy

To evaluate the stability of wide area slopes, the safety factor is calculated by the modified Ferrenius's method for each mesh using GIS.

The mesh spacing of the digital elevation model is set to 10 m.

30km
30km
10m
10m
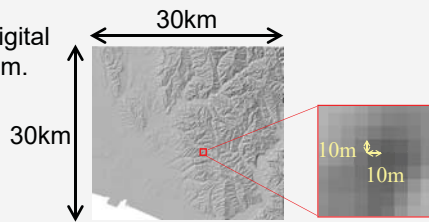
Symbol	Value	Unit	Remarks
C	15	kN/m²	The general design value of loam soil
φ	5	°	The general design value of loam soil
γ	14	kN/m³	The general design value of loam soil
h	4	m	Nearby boring exploration
α	-	°	Digital elevation model of Atsuma town
γw	10	kN/m³	The general design value
hw	1	m	Nearby boring exploration
Kh	0.17	-	The general design value

Modified Ferrenius's method

$$Fs = \frac{C \cdot L + (W \cdot \cos\alpha - U \cdot b \cdot \cos\alpha - Kh \cdot W \cdot \sin\alpha)\tan\varphi}{W \cdot \sin\alpha + Kh \cdot W \cos\alpha}$$

$$= \frac{C + (\gamma \cdot h \cdot \cos^2\alpha - \gamma_w \cdot h_w \cdot \cos^2\alpha - Kh \cdot \gamma \cdot h \cdot \cos\alpha \cdot \sin\alpha)\tan\varphi}{\gamma \cdot h \cdot \cos\alpha \cdot \sin\alpha + Kh \cdot \gamma \cdot h \cdot \cos^2\alpha}$$

Fs : Safety factor
C : Cohesion (kN/m²)
L : Length of slip surface (m)
W : Weight of (kN)
A : Angle of slip surface (°)
U : Pore water pressure (kN/m²)
b : Width of pore water pressure action(m)
Kh : Horizontal seismic coefficient
Φ : Angle of shear resistance (°)
γw : Unit weight of water(kN/m³)
hw : Height of groundwater level(m)

b=L·sinα
W=γ·h·L·sinα
U=γw·h

Result

✓ Unstable parts are extracted in a wider area than the actual failure area.

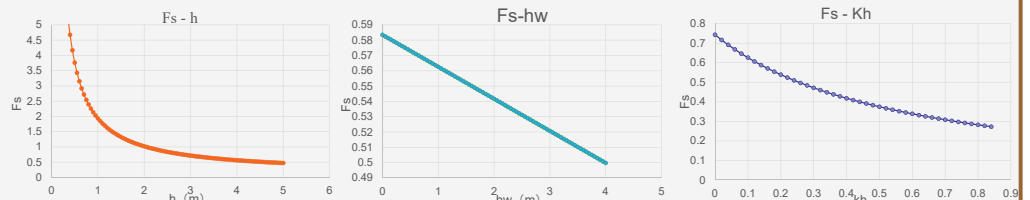### Degree of influence of each parameter

Although it depends on the range of each parameter, it is found that the thickness of the collapsed soil mass have a relatively large influence on the safety factor.

It is necessary to refine each parameter in consideration of these influences.

Unstable
: 0.7≤Fs<0.8
: 0.8≤Fs<1.0

Stable
: 1.0≤Fs<1.2
: 1.2≤Fs<1.5
: 1.5≤Fs
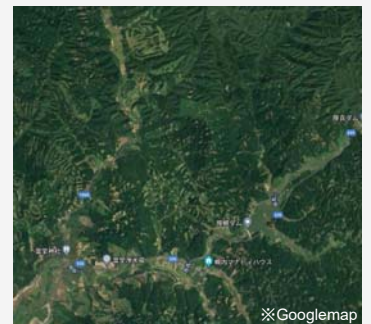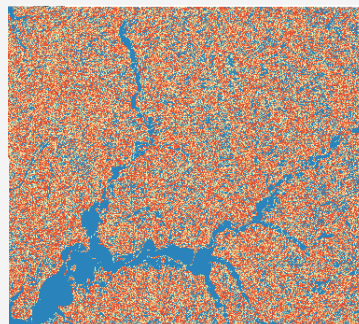
※Googlemap

Fs - h
Fs-hw
Fs - Kh

Impact of Covid-19 pandemic immediate after the first wave on Readymade Garment(RMG) sector in Bangladesh

Sayma Ahamed, Researcher, Bangladesh Network Office for Urban Safety (BNUS), BUET

Introduction: Bangladesh is a fast-growing economy powered by the readymade garments (RMG) industry, which has promoted the country in the world through the slogan 'Made in Bangladesh'.
The journey of this sector is not very long in Bangladesh. Despite this fact, the RMG sector has brought a radical change in the economy of Bangladesh short period (Barua and Ansary, 2017)

Objectives: This study aims to understand and interpret the impact of Covid-19 on RMG sector in Bangladesh.

Methodology

Table 1: Number of surveyed factories

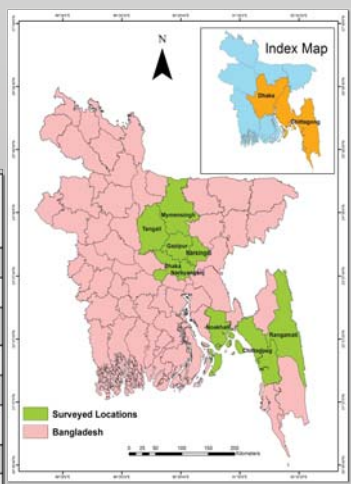| Division	District	Total number of factories	No. of factories surveyed	% of factories surveyed
Dhaka	Gazipur	371	125	33.09
	Dhaka	648	92	14.20
	Narayanganj	301	62	20.59
	Tangail	6	2	33.33
	Narsingdi	11	1	09.09
Chattogram	Chattogram	192	46	23.95
	Rangamati	1	1	100
	Noakhali	1	1	100
Total		1531	330	

Figure 1: Study Area

After data collection, the data processed and analyzed in Microsoft Excel 2016

Table 2: Variables considered for data collection in this research

Variables	
Status of factories	During assessment
	During lockdown
Effect of lockdown on the factories	Availability of buyers
	Occurrence of layoff
	Availability of raw-materials
	Overall effects
	Negative effects
Status of receiving government assistance	

Analysis and findings
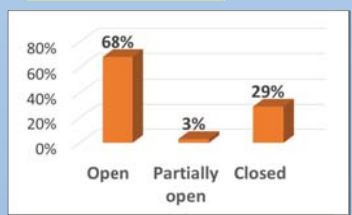
Status of factories

Figure 2: Status of factories during assessment
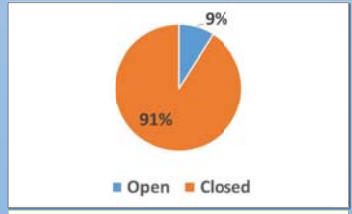
Figure 3: Status of factories during lockdown

Logistics of factories
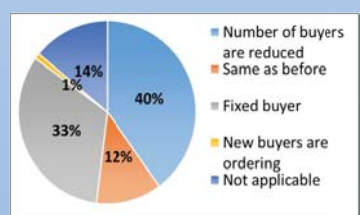
Figure 4: Availability of buyers
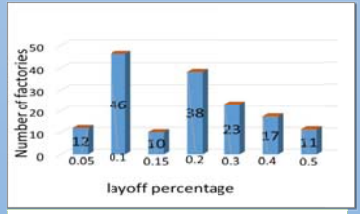
Figure 5: Percentage of layoff Occurrences
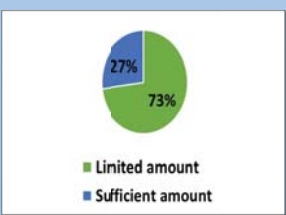
Figure 6: Raw materials availability

Figure 8: Negative impacts of Covid-19

Effects on factories

Figure 7: Overall impacts on factories
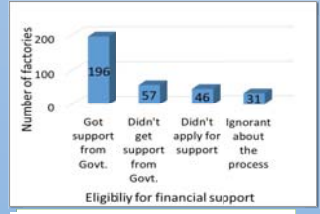
Figure 9: Eligibility for Govt. assistance

Conclusion: Some of the main vulnerable factory located all around the main economic zone of Bangladesh.
91% factories were closed during lockdown and 28% factories were closed after three months had passed since prohibition was lifted.
Even after lockdown was lifted the logistics and production elements were limited in supply. The overall effect of Covid-19 was analyzed considering the major-most problems as shipment problems, production hamper, financial effect, work order problems and other miscellaneous effects.

Assessment of Flood Induced Health Risks and Resulting Disruptions in Health Care Facilities in Louhajang Upazila of Munshiganj District

Mahima Yusuf Tarana, Department of Disaster Science and Management

University of Dhaka, Bangladesh

Abstract: A large portion of the poor rural people of our country is dependent on rivers for their livelihood options and every year they not only suffer economically but also from various diseases due to flood-induced uncertainty and unavailability of adequate health care. The study aimed to find all the resulting health impacts of flood events that occurred during the monsoon of 2020 and associated disruptions in health care facilities in the Louhajang upazila of Munshiganj district. In the study, Sentinel-1 image was used for delineating flood extent to identify the flood-affected and non-affected areas, followed by the collection of health data from hospitals for the time period of April to October 2020. Analysis has been carried out for pre-flood (April to June), during the flood (July, August) and post-flood (September, October) period. Combining all the hospital's data it has been found that during flood cold patients had increased. However, the percentage raised alarmingly after the flood. Furthermore, patients of Covid-19 were highest in June 2020. It had been found that the total monsoo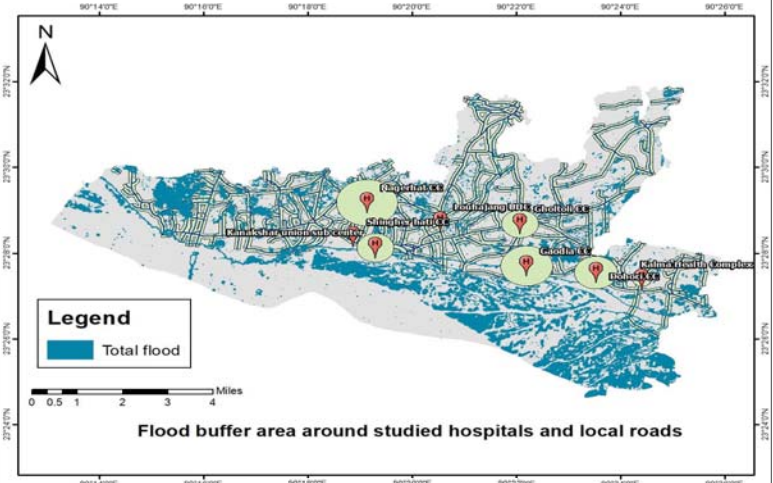n period of July and August hindered the accessibility to health care. Thus, the research shows the high health risks associated with floods and highlights the need for attention to ensure better access to health services to protect the human right of sound health during floods in highly flooded areas through the formulation of appropriate policy strategies.

Background

The heavy monsoon rain and strong current of Padma river cause erosion and flooding every year in the low lying lands adjacent to the river. Louhajang Upazila of Munshiganj district is one of them which increases the frequency of flood and thus the associated health risks. From the period of July to August 189 villages in 29 unions of Munshiganj district were flooded during 2020. July 2020 report said, at least 4,024 people were affected by waterborne diseases during three weeks of flooding. Covid-19 outbreak in 2020 was an additional risk to the health.

Methodological framework

Figure 1: Methodology of the study

Flood extent

Change of water and land area clearly shows the gradual increase in water and decrease in land during flood.
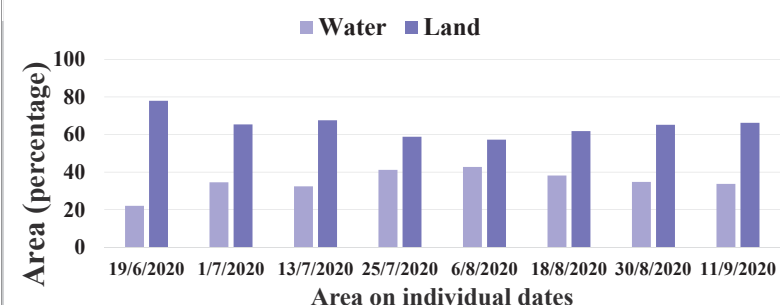
Figure 2: Change in area during flood

Proximity analysis

Flood buffer area around hospitals and roads signifies that the exess water impeded the transportation to hospitals during flood.

Flood buffer area around studied hospitals and local roads
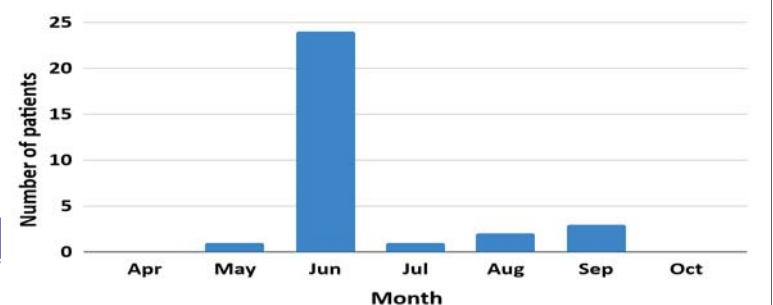
Disease incidence

Figure 3: Monthwise Covid-19 Incidence in Louhajang U...
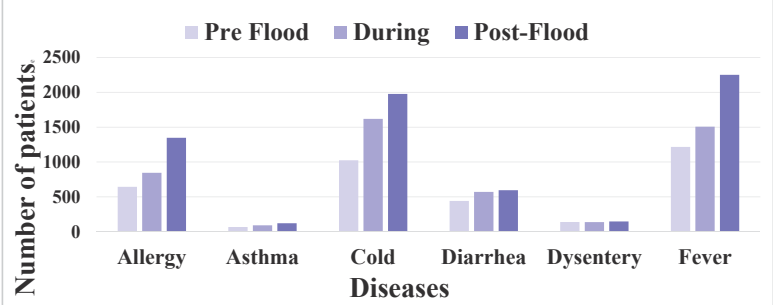
Figure 4: Total Health Statistics

Conclusion

Most prominent diseases were cold, fever, allergy and diarrhea. More patients were recorded in hospitals (Nagerhat, Gaodia and Dohori Community Clinic) covering more buffer areas. Differences between services occured due to the lower number of health service providers than needed. Difference in health facilities and during-post flood statistics occured due to the transportation problem during flood.

Shooting Condition of Urban Landscape Photography with Focusing on the Composition of Skyscrapers

Kyoichiro HIRATA, The University of Tokyo, Japan, M2

Abstract: In this study, in order to investigate rare urban landscape photographs from the viewpoint of arrangement of visual elements, we estimated the shooting conditions based on the correspondence between the two-dimensional positions of visual elements on the image and the geographic three-dimensional positions of those elements in urban landscape photographs. Urban landscape photographs can be arranged in various ways depending on how they are taken, for example, two towers that are actually far apart can be placed next to each other on the image. In such a way, the coordinates are transformed in order to take into account the 2D and 3D positions simultaneously. A point in 3D space and a point in 2D plane can be mutually transformed by three coordinate systems: world coordinate system, camera coordinate system, and image coordinate system, using the principle of a simple pinhole camera. In this study, we mainly focus on the New York City skyscrapers, and estimate the shooting conditions by solving an optimization problem that simultaneously satisfies the two-dimensional position on the image and the geographical three-dimensional position of multiple visual elements of the urban landscape photograph. First, we propose a model that estimates the shooting conditions such as camera position, orientation, and focal length by mapping the 2D and 3D positions of visual elements in urban landscape photography and optimizing them to maximize the feasibility of shooting. Next, the validity of the model is verified by comparing the camera conditions obtained using the model with information at the time of shooting called EXIF data and detailed descriptions of the photos. Finally, we use our model to estimate the shooting conditions for urban landscape photographs, for which it is intuitively difficult to infer the shooting conditions from the photographs. The results of this study are useful for suggesting shooting conditions for capturing the subject in the target arrangement.

1. Background / Objective

- It is becoming more and more important to capture the architecture and urban landscape through photography.
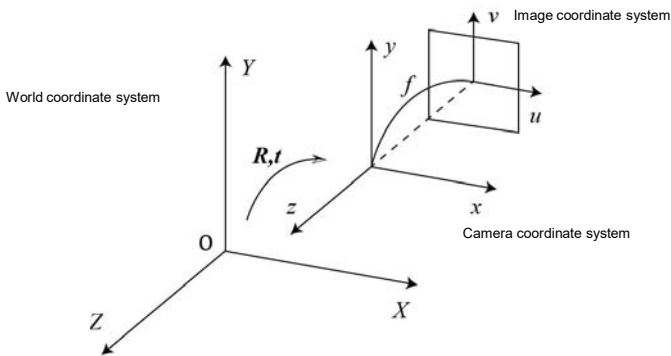- ➤ Investigate rare urban landscape photographs from the viewpoint of arrangement of visual elements.

Seems easy to shoot

Seems difficult to shoot

2. Model

- The principle of a simple pinhole camera

World coordinate system

Image coordinate system

Camera coordinate system

- Relational equations for coordinate systems

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = R \begin{bmatrix} X - t_x \\ Y - t_y \\ Z - t_z \end{bmatrix}$$

$$\begin{bmatrix} u \\ v \end{bmatrix} = -\frac{f}{z} \begin{bmatrix} x \\ y \end{bmatrix}$$

- ➤ Parametrization of camera coordinates

$$\begin{bmatrix} t_x \\ t_y \\ t_z \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} + \frac{z}{f} R^{-1} \begin{bmatrix} u \\ v \\ -f \end{bmatrix}$$

(X, Y, Z)	Position of the object in World coordinate system
(x, y, z)	Position of the object in Camera coordinate system ($z < 0$)
(t_x, t_y, t_z)	Camera position in World coordinate system
(u, v)	The projected position of the object on the image in Image coordinate system
R	Rotation matrix of Camera coordinate system relative to World coordinate system ($R = R_\gamma R_\beta R_\alpha$)
f	Focal length of the camera

- Problem to be solved: Given the image coordinates and world coordinates of N points, find the camera condition that is most likely to have taken the picture.
- Optimization

$$\begin{aligned} \text{minimize} \quad & \max_{i \neq j \, \forall i, j \in N} \| t_i^* - t_j^* \|^2 \\ \text{subject to} \quad & -\frac{\pi}{2} \leq \alpha \leq \frac{\pi}{2} \\ & -\pi \leq \beta \leq \pi \\ & \gamma = 0 \\ & z_i < 0 \ \forall i \in N \end{aligned}$$

3. Verification

- Consider the case where N=3.

One World Trade Center

8 Spruce Street Tower

Brooklyn Bridge

One World Trade Center

8 Spruce Street Tower

Brooklyn Bridge

Target points on the photo

Target points on the map

- Apply the model to find the optimal solution.

top view

up

East

South

South view

World coordinate system and orientation
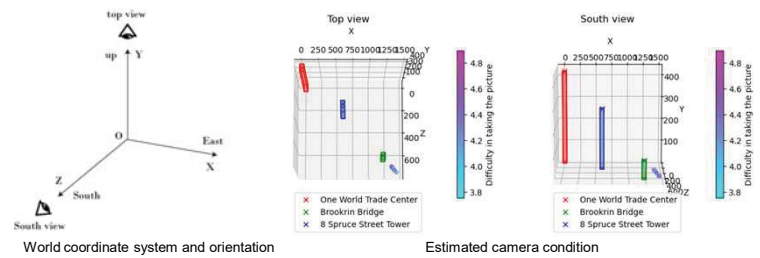
Estimated camera condition
(Origin: 0m above sea level of One World Trade Center)

- ➤ Assume the photo was taken from a boat on East river ($t_y^* = 26[m]$).
- ➤ By checking against the GIS data, we confirmed that we could take the target photo.

Estimated camera position on the map

4. Application

- Picture the tip of Empire State building in a wing of the Brooklyn Bridge.
- It seems more difficult to capture the top of the Empire State Building (blue point) in the pink area than in the light blue area.

easy

difficult

Difficulty of where to place the blue point
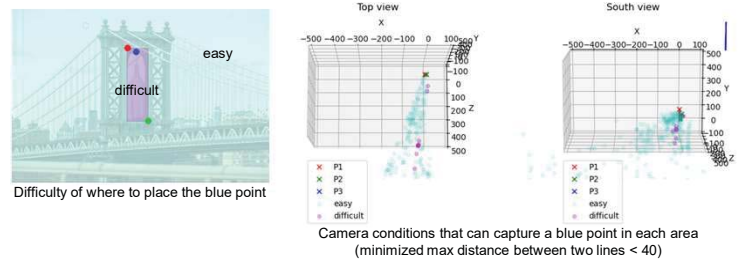
Camera conditions that can capture a blue point in each area
(minimized max distance between two lines < 40)

- ➤ The number of camera conditions that can capture the top of the Empire State Building in the pink area is far fewer than in the light blue area.

5. Summery

- Built a model for estimating the shooting position.
  - Principle of a simple pinhole camera
  - Minimize the maximum distance between any two half-lines
- Validated the validity of the model.
  - Verify that the best solution matches the description in the photo.
- Assessed the difficulty of realizing the target placement.
  - Quantify the difficulty of placing the object in the target position on the photo.

For further information, contact below.

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An Experimental Investigation of Welded Wire Reinforced RC Slab Panels for Evaluation of their Flexural Capacity and Serviceability

Foysal Ahmed & Muhammad Rafiul Mahdi
Supervised By- Dr. Ishtiaque Ahmed & Dr. Nazrul Islam
Bangladesh University of Engineering and Technology (BUET), Bangladesh.

Abstract: Welded Wire Reinforcement (WWR) is a highly effective alternative to traditional mild steel rebars. Due to higher yield strength, better quality control standards and cheaper labor costs, WWR is widely used internationally as per ACI-318-14 code. Use of WWR in concrete slab ensures labor safety as well as reduces cost significantly since there is no cutting of bars, no marking and spacing them out and above all no laborious tying of binding wires. However, many professional designers of Bangladesh are reluctant to use WWR as an alternative to mild steel reinforcing bars due to the unavailability of design guidance in BNBC 2020. Hence, in this study, an experimental investigation has been made to compare the flexure capacity and serviceability performance of slabs reinforced with WWR and the slab panels with traditionally used rebars. Two-point flexure test of one-way slab panels and two-way slab panels are experimentally evaluated, where the local strain, deflection and ductility factor are measured and compared for serviceability limit. The influence of WWR lapping under pure bending was also evaluated. This study aims to formulate a design chart to encourage the usage of WWR in the construction of regular slab panels in Bangladesh.

BACKGROUND

Welded wire reinforcement (WWR) was first used in 1908 in road pavement construction. After World War II, WWR was extensively used in building construction in Europe because it required less labor and time to place compared to conventional reinforcing bars. Currently, WWR is being widely used in various types of structures such as commercial and residential buildings, parking structures, highways, bridges, airports, walls and barriers, and tunnels due to its cost effectiveness and short placement time.

There are numerous benefits of using welded wire reinforcement (WWR) instead of traditional mild steel reinforcing bars. The yield strength of WWR is usually higher than that of conventional bars (usable up to 80 ksi (550 MPa)), which reduces the required amount of steel by approximately 30%. WWR offers a better yield strength and quality control, resulting in significantly lower construction labor costs.

METHODOLOGY

Experimental Test Setup has been constructed as per the given illustration. The strain and deflection of the slab sample will be determined using the strain and dial gauge. Along with manual measurements, HD video cameras mounted on tripods will be used to monitor. External strain will be measured by performing DIC analysis using video recording data.

TEST MATRIX

Specimen name	Aggregate Type	Slab Size	f'c (psi)	fy (ksi)	Load Type	Lapping	No. of Sample
OW6	SC	7.5'X2.5'	6000	72.5	Two Point (Flexure)	Yes	3
OW6	SC	7.5'X2.5'	6000	72.5	Two Point (Flexure)	No	3
OR10	SC	7.5'X2.5'	6000	72.5	Two Point (Flexure)	Yes	1
OR10	SC	7.5'X2.5'	6000	72.5	Two Point (Flexure)	No	1

EXPERIMENTAL SETUP

Figure: Cross-Section of the Specimen

TEST RESULTS OF WWR

Bar Dia Mm	Actual bar dia. mm	Unit Weight kg/m	Average Unit Weight kg/m	Yield or Proof Load kN	Yield or Proof Strength MPa	Average Yield or Proof Strength (YS) MPa	Tensile Load kN	Tensile Strength MPa	Average Tensile Strength (TS) MPa	Elongation (%)	Average Elongation (%)	Bend Test (Separate samples)	Ultimate Load for Weld Shear kN	Weld Shear Failure TypE
6	5.9	0.217		15.8	575		16.9	610		4		Satisfactory	11.03	Shear Failure at Weld
6	5.9	0.218	0.219	16.4	590	585 (85000 psi)	17.5	630	620 (90000 psi)	4	4	Satisfactory	11.55	Shear Failure at Weld
6	6.0	0.222		16.7	590		17.7	625		4		Satisfactory	10.47	Shear Failure at Weld
6	5.9	0.218		13.8	496		16.4	590		3.5		Satisfactory	13.40	Shear Failure at Weld
6	5.9	0.217	0.219	14.6	530	510 (73500 psi)	17.4	630	605 (87500 psi)	3.5	3.5	Satisfactory	10.64	Shear Failure at Weld
6	6.0	0.223		14.2	500		16.7	590		3.5		Satisfactory	6.64	Shear Failure at Weld

Figure- Numerical Model of Deflection Contour Map for Two Point Loading of One Way Slab

CONCLUSION

The main goal of this study is to examine the flexural capacity, ductility factor and serviceability of slabs of concrete members reinforced with WWR using strain gauge, crack gauge, DIC analysis via full-scale specimens and considering various parameters. The advantages of WWR are higher yield strength, flexibility of handling and placing, better and economic crack resistance, better bonding behavior and finally savings of labor, time and binding wire. However, many professional designers of Bangladesh are reluctant to use WWR as an alternative to mild steel reinforcing bars due to the unavailability of design guidance in BNBC-2020. Additionally, this study will aid in the understanding of the effect of several critical parameters on the flexural capacity and serviceability of full-scale slab panels, such as span length and bar diameter.

Figure- Casting of One Way Slab with WWR

Figure- WWR One Way Slab Test Samples

For further information, contact at the following email address. E-mail: foysalahmedkh@gmail.com, rafiulmahdi02@gmail.com

COVID-19 Impact on Changes in Traffic Crash Patterns in Dhaka City During Official Lockdown Period

Presented by- Sabah Hossain Iqra

Department of Civil Engineering, Bangladesh University of Engineering and Technology

Abstract.

When the lockdown was declared owing to a higher number of COVID-19 cases being reported in the nation, Dhaka, the country's capital and mega-city, was the center of attention. The influence of the implemented restrictive measures during the lockdown on Dhaka's accident data was evaluated using time series models in this study. According to the research, lockdown reduced mobility, which resulted in fewer road accidents. As soon as lockdowns started, the number of injuries and deaths grew, and there were peaks. After a few weeks, the peaks leveled down, sometimes disclosing nulls. The study used auto-arima function in R and the best fit models for accidents, injuries, and deaths were found to be (0,1,0), (5,1,0), and (0,1,0). In all circumstances, all three time series models were seen to function reasonably.

Methodology

A. Data Collection and Preparation

The time frame for research was chosen to January 16th to August 6th, 2020, since this study was primarily focused on Dhaka's officially declared lockdown period (March 26th to May 30th, 2020). The days are converted into 30 weeks. The time series analysis was carried out using the Auto-Regressive Integrated Moving Average (ARIMA) model. The Accident Research Institute (ARI), BUET, provided accident data that had previously been reported in national newspapers.

B. Modeling Tools

ARIMA (Autoregressive Integrated Moving Average) Model

The Autoregressive Integrated Moving Average (ARIMA) consists of an autoregressive (AR) model, moving average (MA) model, and seasonal autoregressive integrated moving average (SARIMA) model. To determine the stationarity of the time series obtained from the dataset, the Augmented Dickey-Fuller (ADF) unit-root test is conducted.

Data Analysis

Table 1. Descriptive Statistics

Values	Accident	Injuries	Fatalities
Min.	0.0	0.0	0.0
1st Quartile	1.0	0.0	1.0
Median	2.0	1.0	2.5
Mean	3.3	7.3	3.6
3rd Quartile	5.0	6.3	5.0
Max.	11	67	13

Table 2. Check for Stationarity

Variables	P-value*	Stationarity	Remarks
Accident Data	0.591	Non-stationary	Differencing required
Injury Data	0.01	Stationary	Differencing not required
Fatality Data	0.591	Non-stationary	Differencing required

Table 3. Model Fitting Criteria

	AIC	AICc	BIC
Accidents	146.88		
		147.03	148.25
Injuries	250.42		
Fatalities	152.44	255.52	260.23
		152.59	153.81

Table 4. Model Errors

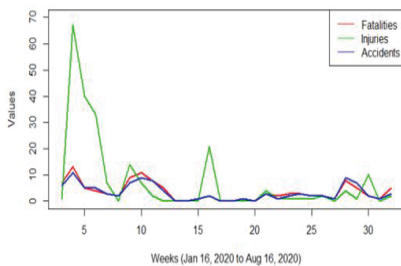|	ME	RMSE	MAE	MASE
Accidents	-0.10	2.90	2.1002	0.97
Injuries	-0.51	12.14	7.28	0.88
Fatalities	-0.07	3.18	2.27	0.97

Fig. 1- Basic time plot of weekly accidents, injuries and fatalities.
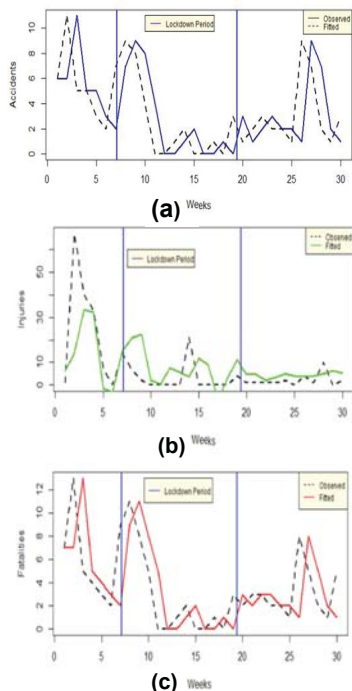
Fig. 2- Presentation of observed and fitted values by ARIMA for a) Accidents, b) Injuries and c) Fatalities.
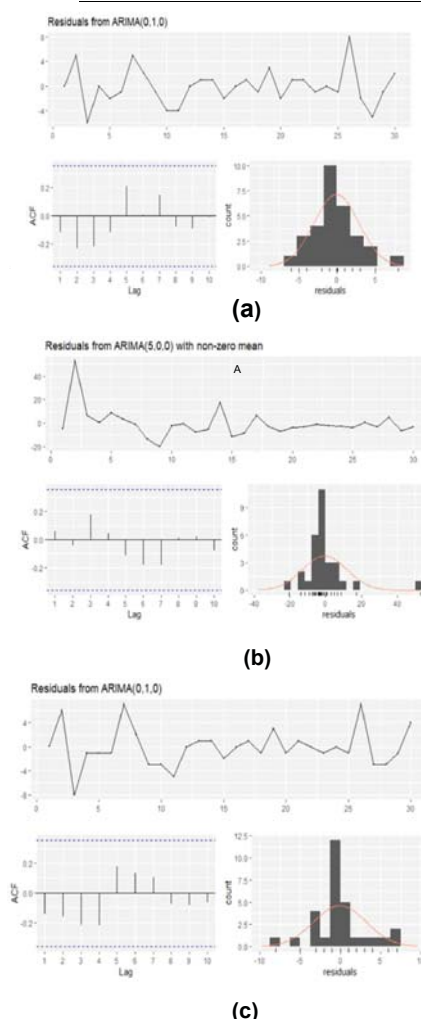
Fig. 3- Model Residuals a) Accidents, b) Injuries and c) Fatalities.

Result Discussions and Conclusions

1. The auto.arima function in R was used to find the best fit model in this study. The best fit models for accidents, injuries, and deaths have been discovered to be (0,1,0), (5,1,0), and (0,1,0) respectively.
2. The value of the Akaike information criterion (AIC), Akaike's information corrected criterion (AICc), Bayesian information criterion (BIC) has been evaluated in this work to examine if the developed models are acceptable enough.
3. The time series for injury has clearly demonstrated maximum values in RMSE and MAE. There is, however, no anomalous mistake.
4. As soon as lockdown incidents started, the number of injuries and deaths grew, and peaks were seen. This tendency is supported by the fact that many people who work in Dhaka or are not permanent residents opted to return to their hometown when the lockdown started. As a consequence of the increased mobility, there was a rise in the number of accidents.
5. After a few weeks, the peaks leveled out, showing nulls on occasion.
6. The model residuals of all the three Time Series are found to be within the upper and lower ranges in all situations, indicating that all models performed fairly.
7. The results of this research, which focused only on the lockdown time of the pandemic outbreak, are likely to vary from those of previous studies, and they should be compared to those of other recent studies.

Acknowledgements

16

Seismic Response of Asymmetric Rectangular Blocks in High-rise Buildings

Sivapalan Sivaram [1], Prof. Pennung Warnitchai [2]

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[2]**Department Head CIE, Structural Engineering, Asian Institute of Technology (AIT), Thailand**

Introduction

In tall building, Designers majorly focus on Structural parts

While, **Non-Structural components**,
[1] **damaged at lower seismic intensity than structural parts**
[2] **cost 70-80%**

Large scale shake table test [Japanese Research team]

Two primary modes of response

Sliding

$\ddot{u}_g$

Only little damage

Rocking

Could be Overturned, cause fatal accidents
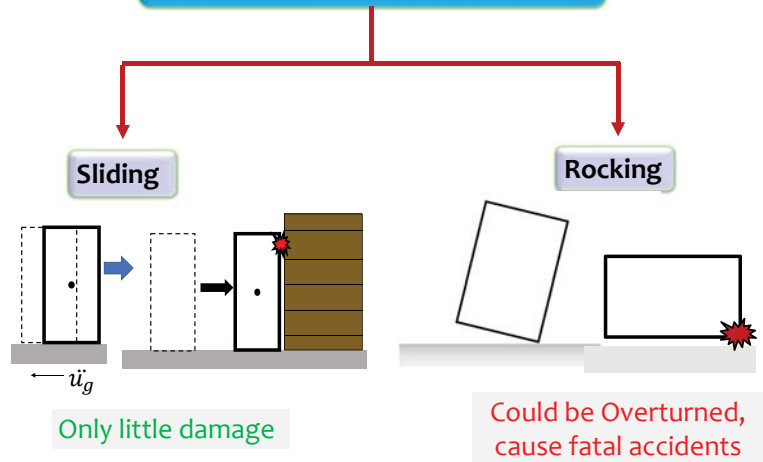
Our Study ➔ Experimental (Shake Table) and Analytical (Matlab) for Asymmetric Bookshelves | Contents inside Bookshelves | Floor Acceleration

1.8 m   2.02 m

| CASE 1 Symmetric | CASE 2 Asymmetric | CASE 3 Packed books | CASE 4 Loosen books Inside | CASE 5 Loosen books Outside |
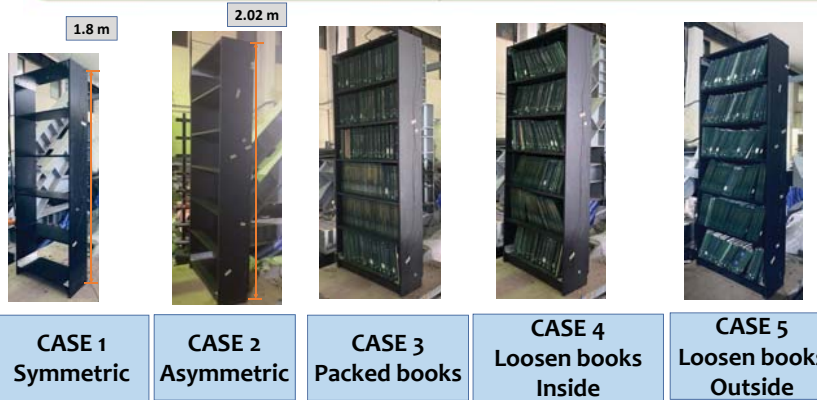
Analytical Model, *Governing Equation:*
$$\ddot{\theta}(t) = -p^2 \left\{ sgn[\theta(t)] \sin(\alpha - |\theta(t)|) + \frac{\ddot{u}_g{}^x}{g} \cos(\alpha - |\theta(t)|) \right\}$$

Using **MATLAB SIMULINK** *,*
fourth − order, Runge − Kutta Integration
Scheme with $\Delta t = 1\ ms$

8 Selected Ground Motions *For Moderate to High Seismic Hazard Zone*
Floor Acceleration - Selected **4 types of high-rise buildings**

Results

Comparison of **Angular acceleration** between Analytical and Experimental Results for Chalfant Valley earthquake
[Scale   +1.0 | Applied peak acceleration 0.25g]

Experimental

Our Analytical Results adopted from Housner (0.982*e1, 0.982*e2)
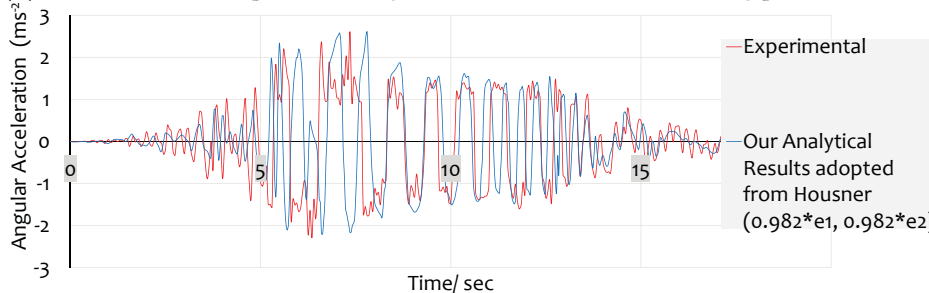
Comparison between Experimental and Analytical results [64 cases]

- Symmetric Bookshelf
- Asymmetric Bookshelf
- Asymmetric Block with Packed books Inside
- Asymmetric Block with Loosen books Outside
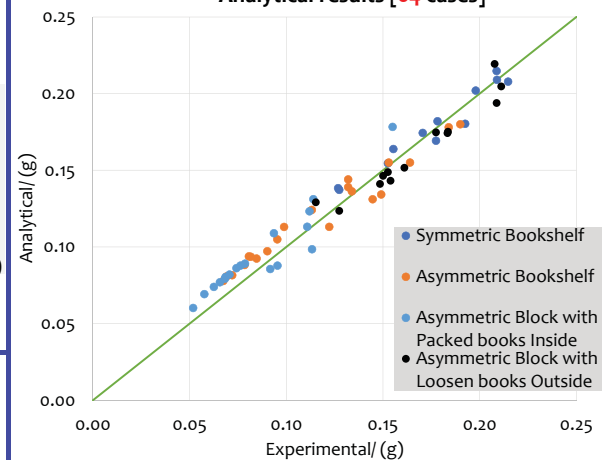
Comparison between **Fragility curve** for both Symmetric Asymmetric blocks in All types of building **(Overturning)] 3456 cases | 501,766 simulations**

— All_Floors [θ=1.52, β=0.26]
— Ground [θ=1.75, β=0.35]

$IM_1 = PFA/(g \tan\alpha)$
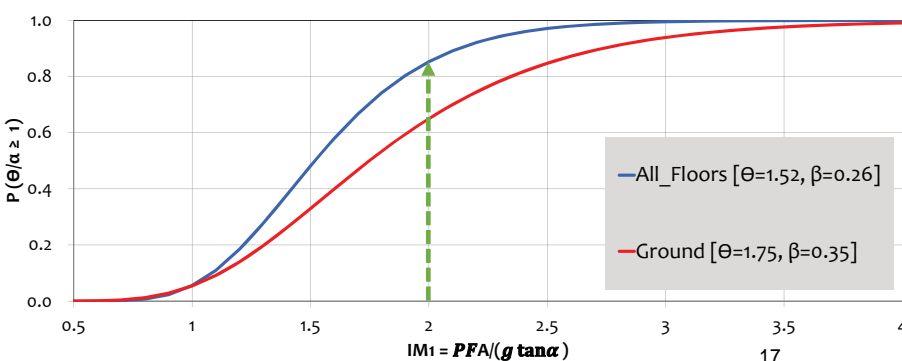
Conclusion

Our Analytical model adapted from Housner (1963), can **well predict our experimental results** in **both Symmetric and Asymmetric cases.**

The building blocks are more vulnerable to floor acceleration in high-rise buildings (narrow band excitation) **than ground acceleration** (wide-band excitation).

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Understanding stakeholder perspectives on a suspended road widening project in the Philippines using Q methodology

Kenneth Edward Torrella Fernando[1], Michael Henry[2]

[1]Student, Filipino, Master 2nd yr., Graduate School of Engineering and Science, Shibaura Institute of Technology,
[2]Associate professor, Department of Civil Engineering, Shibaura Institute of Technology

Abstract – The Philippines, as a fast-growing country, has had the highest road infrastructure investment to date for the past five years compared to the previous years. The infrastructure programs of the country as a solution to decongest Metro Manila and develop the countryside for economic growth are promising yet result in various socio-environmental issues. One of those infrastructures is a suspended road widening project in San Fernando, Pampanga, Philippines, representing numerous issues in public involvement, local impact, road safety, multi-purpose use, environmental preservation, project planning, public policy, and construction time. The project has been suspended due to obstruction of trees along with the road widening backed up by several stakeholder groups protested against the cutting of trees for road widening activities. Similarly, road infrastructure projects across the country explicate similar issues encountered in the project that leads to suspension or even termination of contracts that may have been determined if consideration to stakeholders is evaluated in the first place. This research centers on the said suspended road widening project to analyze stakeholders' perspectives using Q methodology, a tool to examine the subjectivity on the difficulties encountered through the implementation of the project. The investigation identified four distinct perspectives on the suspended project. Perspective 1 advances road widening projects at all costs, prioritizing solving traffic congestion and safety. Perspective 2 prioritizes the environment, not accepting ecological compromises for socioeconomic development. Perspective 3 is practical and straightforward in the implementation of road widening. Perspective 4 is ideal for advancing road development by clearing all obstructions in the road. Understanding different perspectives on the widening project provide a reasonable basis for the project's continuity by combining different socio-environment points for future road planners.
Keywords - Q methodology, Philippines, road widening, road infrastructure, sustainability, socio-environment, perspective

INTRODUCTION

The Build, Build, Build (BBB) program (2017 - 2022) – "Golden Age of Infrastructure" in the Philippines aims to provide countryside development, decongest the traffic in Metro Manila and major cities, and disperse the economic activities and providing jobs especially this pandemic situation. According to NEDA last 2018, there are 5,586 infrastructure programs, activities, and projects with a total investment targets amount to PHP 3.12 Trillion.

PUBLIC INFRASTRUCTURE SPENDING 2010-2022
(AMOUNT IN BILLION PESOS, AS % TO GDP)

Note: Actual spending in 2010 to 2020; programmed infrastructure spending in 2021 and 2022.
Source: Department of Budget and Management (DBM)

Various stakeholders affected by the road infrastructure projects have social and environmental issues. Due to qualitative aspect of these concerns, the subjectivities are hardly quantified or understood by technical people. Thus, sustainability in all aspects were affected socially, environmentally, and economically.
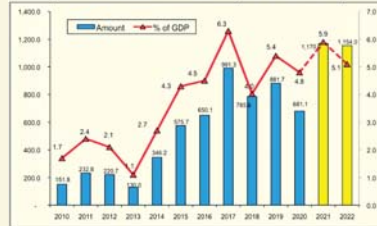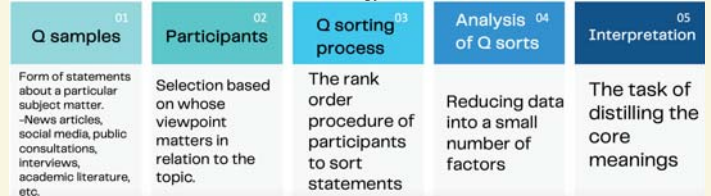
Aim of the study

To understand the different perspectives of stakeholders through investigation of a suspended widening project in San Fernando, Pampanga, the Philippines, that was suspended for more than ten years due to obstruction of trees, utilities, and structures. Various groups protested against the project and reflected different kinds of socio-environment issues.

SUSPENDED ROAD WIDENING PROJECT]
Located in San Fernando, Pampanga, Philippines

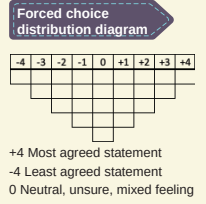## METHODOLOGY

What is Q Methodology?

A set of connected techniques designed to enable the study of subjectivity (views, opinions, beliefs, values, tastes etc.) the perspectives of what people think and feel about with respect to the questions" (Brown 1996)

Five Phases of Q Methodology (McKeown and Thomas)

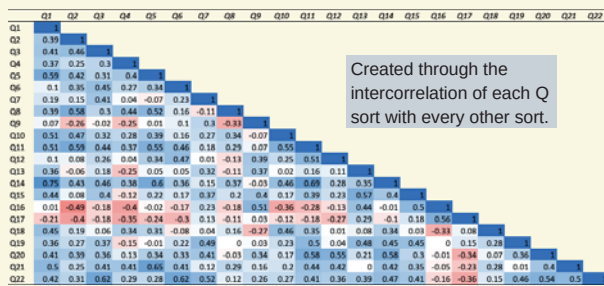| 01 Q samples	02 Participants	03 Q sorting process	04 Analysis of Q sorts	05 Interpretation
Form of statements about a particular subject matter. –News articles, social media, public consultations, interviews, academic literature, etc.	Selection based on whose viewpoint matters in relation to the topic.	The rank order procedure of participants to sort statements	Reducing data into a small number of factors	The task of distilling the core meanings

In this research, the following were used

25 Q Samples
- Public involvement
- Local impact
- Road safety
- Multi-purpose use
- Environmental preservation
- Project planning
- Public policy
- Construction time

22 Participants
- Academe - 2
- Business sector - 2
- NGOs - 3
- LGOs - 2
- Environmentalists - 2
- Non-profit Organization - 1
- Private vehicle drivers - 4
- Local residents - 2
- Contractor - 2
- Bicyclists - 2

Number of participants should be less than the number of items in the Q set (Watts and Stenner, 2012 p.73)

Forced choice distribution diagram

-4	-3	-2	-1	0	+1	+2	+3	+4

+4 Most agreed statement
-4 Least agreed statement
0 Neutral, unsure, mixed feeling

ANALYSIS

FACTOR EXTRACTION
A statistical process

Created through the intercorrelation of each Q sort with every other sort.

Correlation matrix of Q sorts

The end product of the factor extraction process is a table of factor loadings indicating the initial association, or correlation, each Q sort with each factor

Factor Rotation:
The process involves the physical movement or rotation of the factors, and their viewpoints, about a central axis point.

Factor Array:
A single Q sort configured to represent the viewpoint of a particular factor.

Factor 1: 1, 14, 11, 5, 10, 2, 8, 4, 3, 21, 18
Factor 2: 13, 15, 16, 17, 19
Factor 3: 12, 20, 6, 9
Factor 4: 22
Confounded: none
Non-significant: 7

FINDINGS/RESULTS

ARCHETYPES
a very typical example of a certain person or thing.

1 Road Infrastructure Drivers

2 Uncompromising Environmentalists

3 Rationalists

4 Technical Savvy

The study showed four different perspectives or archetypes. Perspective 1, the road infrastructure drivers, advance road widening projects at all costs, prioritizing solving traffic congestion and safety. Perspective 2, the uncompromising environmentalists prioritizes the environment, not accepting ecological compromises for socioeconomic development. Perspective 3, rationalists, is practical and straightforward in the implementation of road widening. Perspective 4, technical savvy is ideal for advancing road development by clearing all obstructions in the road. Understanding different perspectives on the widening project provide a reasonable basis for the project's continuity by combining different socio-environment points for future road planners.

FUTURE STUDY

General study on perspectives of stakeholders
The results of the initial study is helpful for the next larger investigation considering the road development in general through actual results, experience, questionnaires and interviews.

Integration of the views
On each perspective of stakeholders will be reviewed based on the stages of implementation of Road Infrastructure and current standards, guidelines and methods and formulate a solution for improvement in the process.

- Additional archetypes are expected
- Experience, questionnaires and post interviews will be used for wider samples
- Creation of policies for road infrastructure implementation.
- Understanding stakeholders' perspective to give future planners idea on solutions for unending socio-environmental problems.
- Micro application of the study in various projects.

If you are interested in learning more, please contact:
Kenneth Edward Torrella Fernando, Master 2nd year, Shibaura Institute of Technology
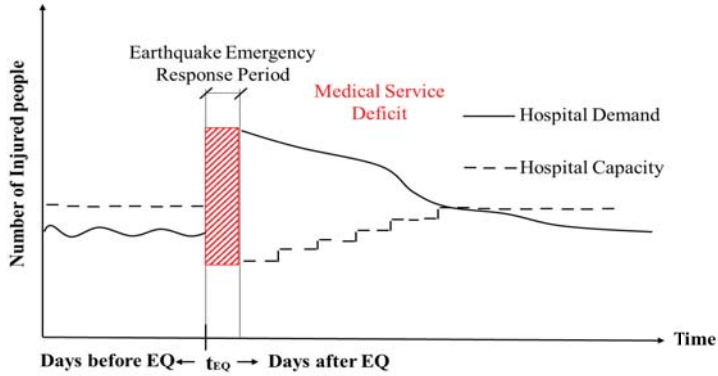
ME20504@shibaura-it.ac.jp

Development of a Simplified Analytical Model to Evaluate the Hospital Preparedness for Earthquake Emergency Response

Fahmida Alam Bintu, Md Shakhawat Hossain
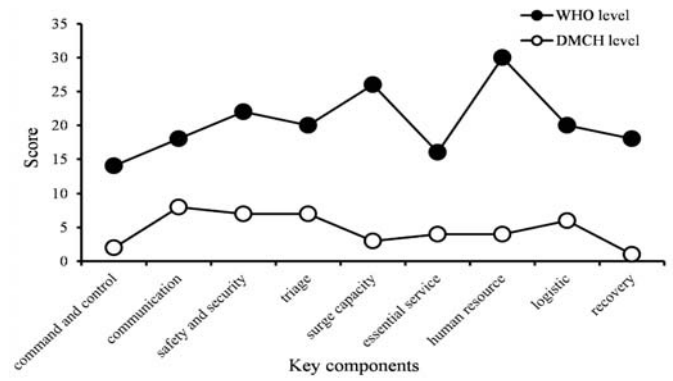Department of Disaster Science and Management, University of Dhaka

Background

➢ Mismatch between hospital demand and capacity
➢ Waiting time increased & survival probability decreased with time
➢ Number of death increased

Simplified Analytical Model

Input

| Scenario Input: Number of casualties, damage function | **+** | System input: Hospital resources, Operational OT, Required times |

System

Estimate number of casualties arrived at hospitals within the emergency time

Segregate casualties according to their triage score
● Triage score < 10; Priority 1 (Glasgow Coma)
● Triage score ≥ 11; Priority 2

1. no of functional OT=n_{OT}
2. no of surgeon = n_s
3. no of anesthetist= n_a
4. no of assistant doctor= n_{ad}
5. no of ward boy=n_w
6. no of nurse=n_n
Therefore, unit no, u= minimum of
of
$n_{OT}, \dfrac{n_s}{2}, \dfrac{n_a}{2}, \dfrac{n_{ad}}{2}$

No of treated people (TP)= t (in hour) *u/2.5(hour)

No of Untreated people=total severely injured people-no of TP

No of treated people (TP)= t (in hours) *u/.5 hours

No of Untreated people=total moderately injured people-TP

1. no of doctor=n_d
2. no of ward boy or nurse=n_w or n_n
Therefore, unit no, u= no of doctor, n_d

Survival probability S_p

Output

No of saved lives

Output of the model

No of saved lives = TP* S_p

Where, TP =No of treated people , S_p= Survival probability

Here, Composition ratio by level of injury and Life-span-characteristics-function for the Kobe earthquake 1995 as survival probability

Comparison and case study

According to WHO checklist DMCH's preparedness

Result of Dhaka Medical college and Hospital

Score	Level of Preparedness
42	Unacceptable preparedness

According to simplified analytical model preparedness of DMCH
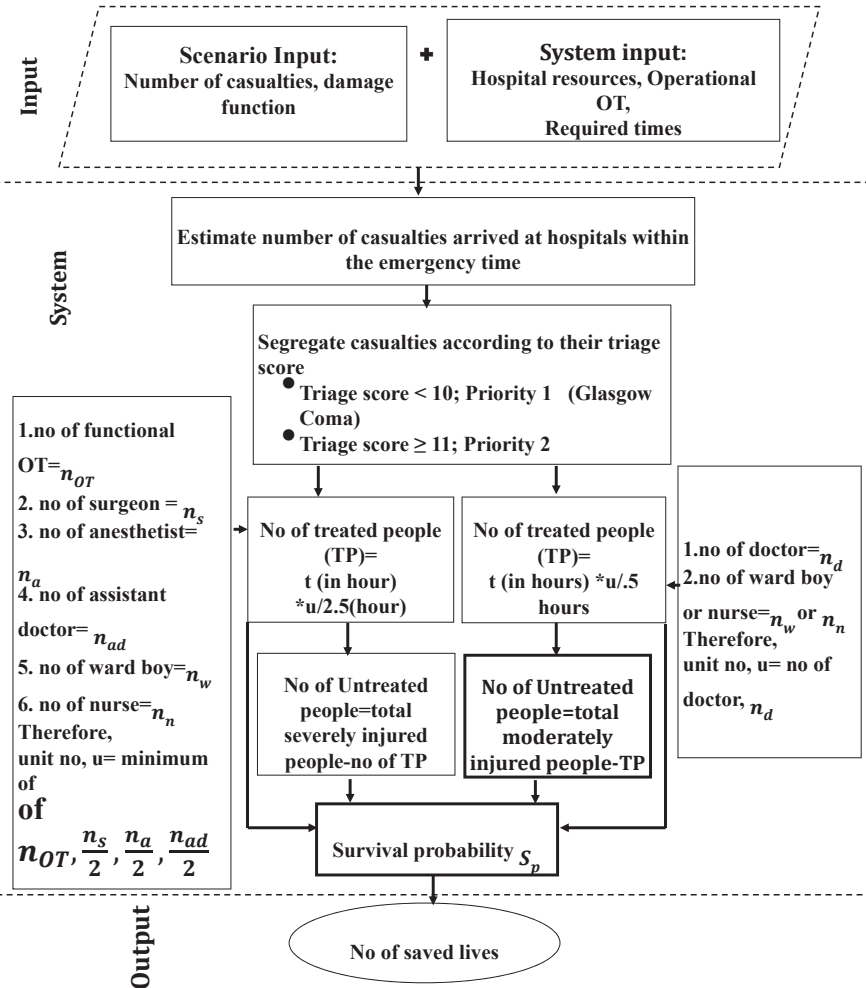
Prioritization of types of casualties for giving treatment after an earthquake (DMCH)
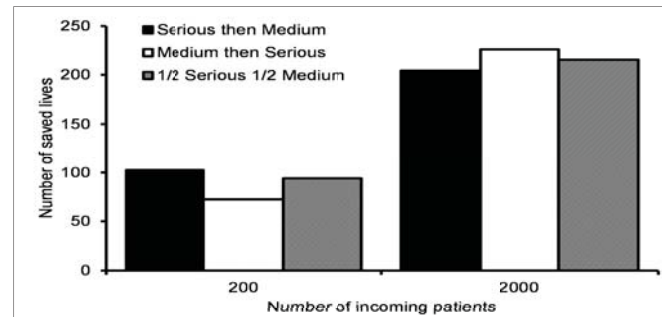
References

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- Ceferino, L., Kiremidjian, A., & Deierlein, G. (2018). Probabilistic Model for Regional Multiseverity Casualty Estimation due to Building Damage Following an Earthquake. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, 4*(3), 04018023. https://doi.org/10.1061/ajrua6.0000972
- Ohta, Y., Murakami, H., Watoh, Y., & Koyama, M. (2004). 13 th World Conference on Earthquake Engineering A MODEL FOR EVALUATING LIFE SPAN CHARACTERISTICS. *A MODEL FOR EVALUATING LIFE SPAN CHARACTERISTICS OF ENTRAPPED OCCUPANTS BY AN EARTHQUAKE Yutaka, 232.*

Characteristics of Road Geohazard in Bhutan

Dhan Raj Chhetri [1], Michael Henry[2]

[1]Division of Architecture and Civil Engineering, Graduate School of Engineering and Science, Shibaura Institute of Technology,
[2] Department of Civil Engineering, Shibaura Institute of Technology,

Abstract: *Road connectivity in Bhutan plays a major role in social and economic development as it being the only mode of surface transport for both goods and people. Disruption to its normal functioning due to roadblocks at any specific location due to unprecedented road geohazard such as landslides, rockfall, debris flow, etc., can have a significant ripple effect at diverse and extreme ends, causing tremendous impact on a country's population and economy. Thus, the purpose of this research was to investigate the overall characteristics of road geohazard recorded in Bhutan. The roadblock inventory data for the year 2020 was obtained and several cross tabulation, comparative and statistical analysis were performed. Overall, from a total of 888 unique block points with 7 different types of roads geohazard, landslides were the most predominate, causing majority of the roadblocks, accounting for 60.92% of the total, followed by roadblocks caused by debris flow (23.54%) and rockfall (7.66%) etc. Conversely, least numbers of roadblocks were recorded from events such as snowfall (0.23%) and scouring (1.58%). In locations where two or more types of failure events occurred simultaneously, the likelihood of a landslide occurring concurrently with debris flow was 62.9%, while the likelihood of rockfall occurring concurrently with subsidence was as low as 0.7%, which were the highest and lowest of any other combination of failure types, respectively. On a regional scale, roads in the southern part of the country were more vulnerable to debris flow (80.9%), subsidence (83.3%), flooding (60%) and scouring (100%) whereas they are vulnerable to rockfalls (54.4%) and snowfall (100%) in the norther region. Such results can assist the Bhutanese government to better understand the severity of each road geohazard and identify the hotspots thus enabling them to plan proper risk reduction and mitigation response to such hazards. (**KEYWORDS:** Roadblocks, Road Geohazard, Risk Reduction)*

BACKGROUND AND CHALLENGES

- Bhutan is a landlocked country in the Himalayas where Road Transport is only the mode of land transportation for both goods people thus, road infrastructure plays a major role in ensuring mobility, social equity and economic development of the country.
- Most Sections of the roads passes through deep river valleys along geologically unstable high mountains making it susceptible to road geo hazards.
- Due to the absence of mitigation and reduction response setup, significant amount of resources are spent every year to restore the damage.


Objective: "To study the characteristics of road geohazard for the development of future risk reduction and mitigation response by timely interventions such as allocation of resources and installation of countermeasure"

MATERIALS AND METHOD

Study Area: Entire National Highway in Bhutan (2983.83).

Data Utilized: Roadblock records for the year 2020, Geospatial data for road inventory and 9 Regional Office under Department of Roads.
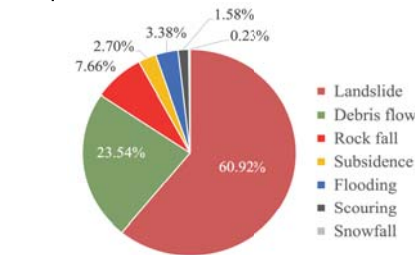
Methodology:
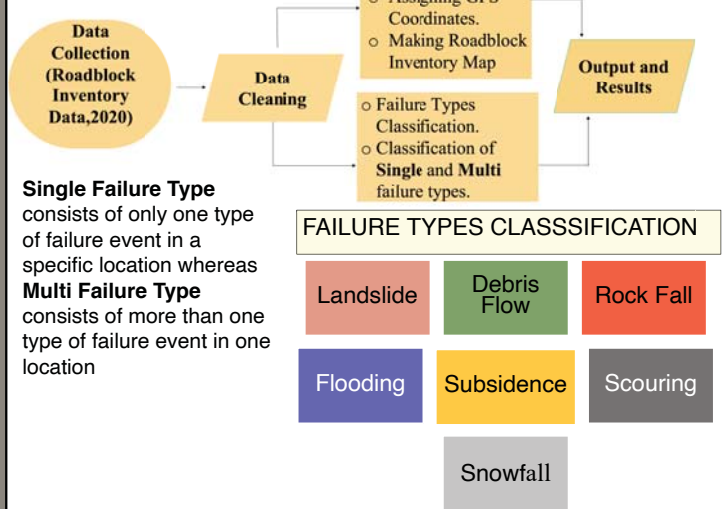
Single Failure Type consists of only one type of failure event in a specific location whereas **Multi Failure Type** consists of more than one type of failure event in one location

FAILURE TYPES CLASSSIFICATION

Landslide	Debris Flow	Rock Fall
Flooding	Subsidence	Scouring
	Snowfall	

RESULTS AND DISCUSSION

Statistical Results

Frequencies of failure occurrence

Landslide and debris flow were the most predominant failure events with snowfall and scouring having relatively lesser records in 2020. Thus, this allows us to understand the hierarchy of each failure types in relation to its frequencies.
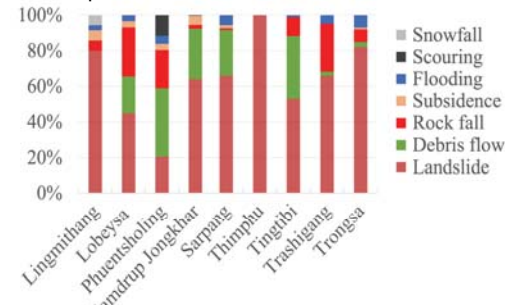

Thimphu, Lingmithang and Trongsa region are highly venerable to landslide events whereas significant numbers of blocks due to debris flow occurred in Phuentsholing, Tingtibi and Sarpang region etc. Thus, such distribution of failure types in different region can helps us to understand relation of each type with its location which is beneficial during planning and budget allocation.

Multi-Faillure	Frequency	Percentage
Landslide/Debris flow	90	62.94%
Landslide/Rock fall	17	11.89%
Debris flow/Rock fall	15	10.49%
Landslide/Scouring	7	4.90%
Landslide/Debris flow/Subsidence	3	2.10%
Landslide/Subsidence	3	2.10%
Landslide/Debris flow/Rock fall/Flooding/Scouring	2	1.40%
Landslide/Debris flow/Scouring	2	1.40%
Landslide/Subsidence/Scouring	1	0.70%
Rock fall/Debris flow	1	0.70%
Rock fall/Debris flow/Scouring	1	0.70%
Rock fall/Subsidence	1	0.70%
Grand Total	**143**	**100.00%**

In the locations which experienced multi failure events, the probability of debris flow to occur concurrently with landslide at some locations is 63% whereas at some locations where rock fall occurred the chances of subsidence occurring at the same location is just .7% Thus such results are useful for the development mitigation plan and risk reduction response at site.

Geospatial Results
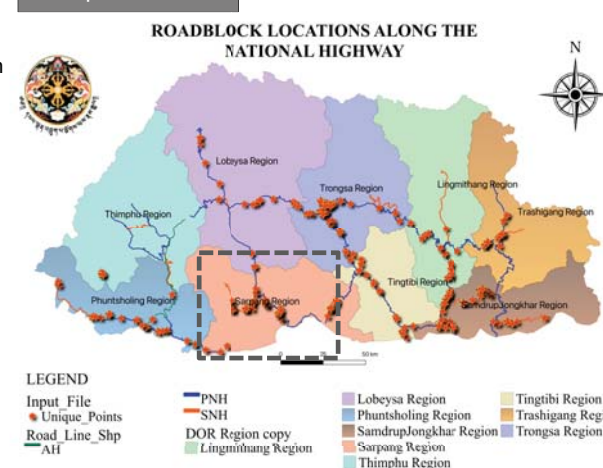
The map shows the locations of roadblocks in Bhutan for the year 2020 (RIM). This allows us to conduct geospatial analysis on each block's points with various parameters and in different region. Overall, Sarpang Regional Office was the most critical and affected region with 31.15% roadblocks from the total.

CONCLUSION

Knowing the characteristics of roadblocks is critical for understanding the nature and frequency of each failure type on a national and regional scale in order to prioritize and plan necessary interventions based on the criticality and vulnerability to which each region is exposed, resulting in a better mitigation and risk reduction response to minimize the impact of such geohazards.

WAY-FORWARD

- Incorporating influencing factors such as geological slope, aspect vegetation cover etc. to develop a relationship pattern with each failure types.
- Develop a susceptible map and future prediction model to further enhance the risk reduction and mitigation response.

For further information, contact :E-mail: me20502@shibaura-it.ac.jp

Study on Geotechnical Behavior of Long-Distance Ground-Flow During the 2018 Sulawesi Earthquake, Indonesia

Ren Hori, National Institute of Technology, Gunma College
**Gunma, Japan, Advanced Course 2nd**

Abstract

During the 2018 Sulawesi earthquake, Indonesia, which caused long-distance ground-flow in several areas in Palu city. The common feature of the long-distance ground-flow area is that the slope of the ground surface is small. In this study, we aim to clarify the mechanism of the large-scale ground flow by using seismic response analysis. Three sites with different damage conditions will be targeted. Then, a 1D soil column model is created from the boring diagram, and the response characteristics are analyzed by seismic response analysis. Also, geological survey of the site assumed that pressurized groundwater exists.

Introduction

Earthquake : 2018 Sulawesi Earthquake, M_w 7.5
Date and time : September 28, 2018 10:02 (UTC)
Epicenter : About 80 km north of Palu City (0.256 S and 119.846 E)
Catastrophic disaster : Four major long-distance ground-flow on very gentle slopes (approximately 1-5%)
Maximum flow area : About 3.5 km × 1.5 km

Balaroa, Palu
Before the earthquake

Flow
After the earthquake
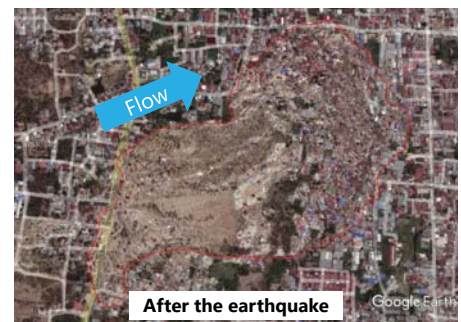
Objectives

☑ Clarifying the mechanism of the long-distance ground-flow
☑ Analyzing at three sites with different damage conditions
☑ Confirming the ground seismic response characteristic of damage site by comparing the results of seismic response analysis at the large-damage point, the small-damage point and the non-damage point

Methods and Results

Nonlinear ground seismic response analysis

1D soil column

Simplified procedure for assessing liquefaction
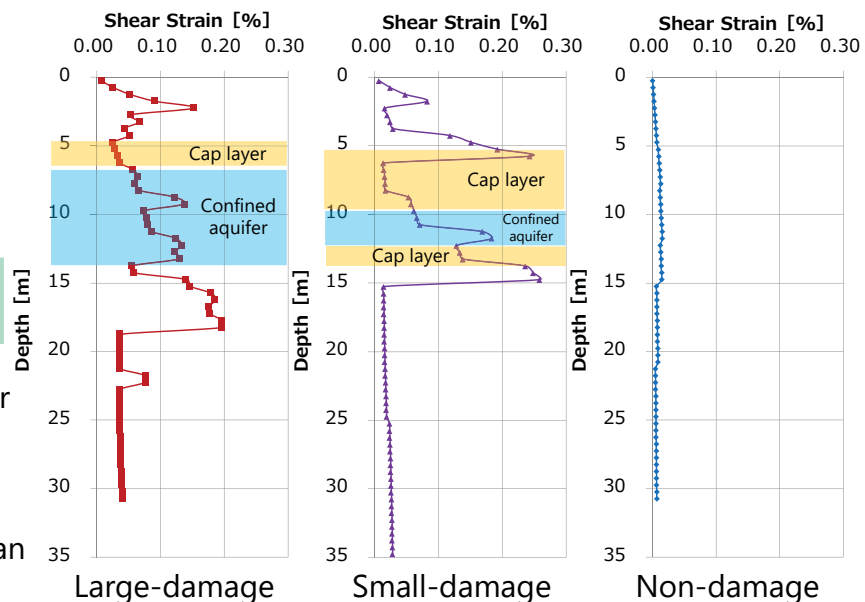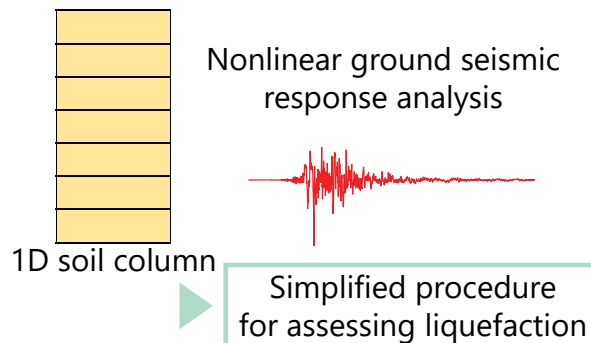
Large-damage point
☑ Under the cap layer is a confined aquifer
☑ Shear strain near the cap layer are small
☑ Possibly liquefied near the cap layer

Small-damage point
☑ The pressure is expected to be lower than that of the large-damage point
☑ Large shear strain at the boundary with the cap layer (Smaller in the cap layer)

Non-damage point
☑ Near the earthquake observation point
☑ Overall, permeable layer and hard ground
☑ No pressure was being applied
☑ Overall, small shear strain

Shear Strain [%]
0.00 0.10 0.20 0.30
Cap layer
Confined aquifer
Depth [m]
Large-damage

Shear Strain [%]
0.00 0.10 0.20 0.30
Cap layer
Confined aquifer
Cap layer
Depth [m]
Small-damage

Shear Strain [%]
0.00 0.10 0.20 0.30
Depth [m]
Non-damage

Summary and Future Works

☑ Magnitude of pressure and level of liquefaction may affect the scale of ground flow
☑ Conducting liquefaction assessment by considering pressure and analyzing the results in detail in the future

For further information, contact below.
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Developing Empirical Correlation Between V_s and SPT-N For All Soils in DMDP Area, Bangladesh

## Anika Tasmiah, M.A. Al-Noman & M. A. Ansary Bangladesh University of Engineering & Technology (BUET)

In the study of seismic microzonation and seismic site response analysis, shear wave velocity V_s is an important parameter for approximating the dynamic response of the soil. But direct determination of shear wave velocity is expensive and necessitates sophisticated technology and an environment free of industrial and traffic noise. This crisis necessitates an empirical correlation with a readily available soil parameter, such as SPT-N, which can be performed in a variety of soil types. Our study attempts to establish an empirical correlation between V_s and SPT-N in the Dhaka Metropolitan Development Plan (DMDP) Area, Bangladesh, which covers an area of 1530 square kilometers. This was achieved using 3000 data pairs for all soils where PS logging was used to determine soil P-wave and S-wave velocities. The test followed ASTM D 7400 – 08 for the downhole seismic test method. The correlation was established using the uncorrected SPT-N value from 200 boreholes. Work of this magnitude has never been done in the DMDP area before, and the empirical correlation between these two parameters is geographically specific, rendering it invalid for other sites. We used simple regression analysis to establish the empirical correlation model. This model equation was evaluated using RMS (root mean square) and graphical approaches such as comparing measured and predicted V_s and residual plot analysis against observed SPT-N values. We compared the newly formed equation to previously established equations in different research around the world and found excellent concordance. Our work can help to identify Geotechnical Hazards of the DMDP area since the data can be used for site response analysis. The paper helps determine V_s easily around the DMDP area which aids in the identification of amplification at a site. This is then useful for assessing damage during an earthquake and determining the extent of ground improvement required.

Introduction

- The Purpose of the study is establishing an empirical equation correlating the shear wave velocity V_s and penetration resistance from SPT test for Dhaka Metropolitan Development Plan (DMDP) area Bangladesh
- SPT-N is an easily accessible parameter but determining V_s calls for sophisticated technique and is expensive so a correlation will make determining V_s in DMDP easier
- The equation is specified for a particular geological location

Methodology

- In present study SPT is used for in-situ geotechnical test
- The SPT process is described in ASTM D 1586 (ASTM, 2002) and it is applied to define soil condition and collect samples of "disturbed" soils.
- Number of blows required to effect every single 6 in. (0.15m) of penetration fraction into the soil is noted. The first 6 in. is considered seating drive and the "N-value" or in other words the "standard penetration resistance" is defined as the average of the 2nd and 3rd 6 inches of penetration.

Regression Equation

3000 data pairs (downhole)
$V_s = 83.863N^{0.3553}$
$r^2 = 0.4878$
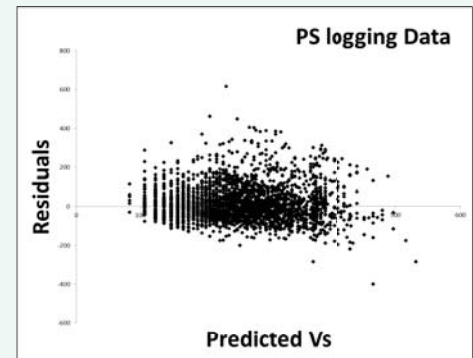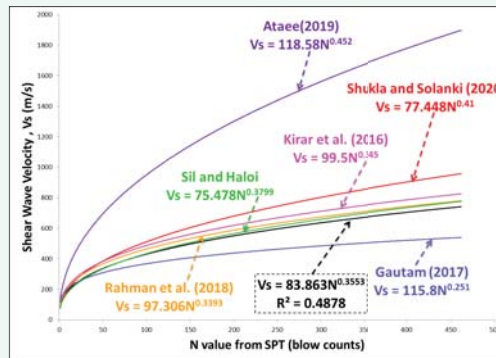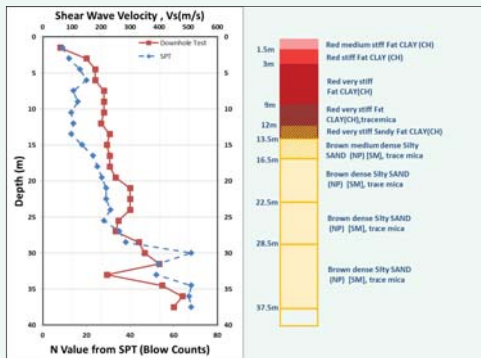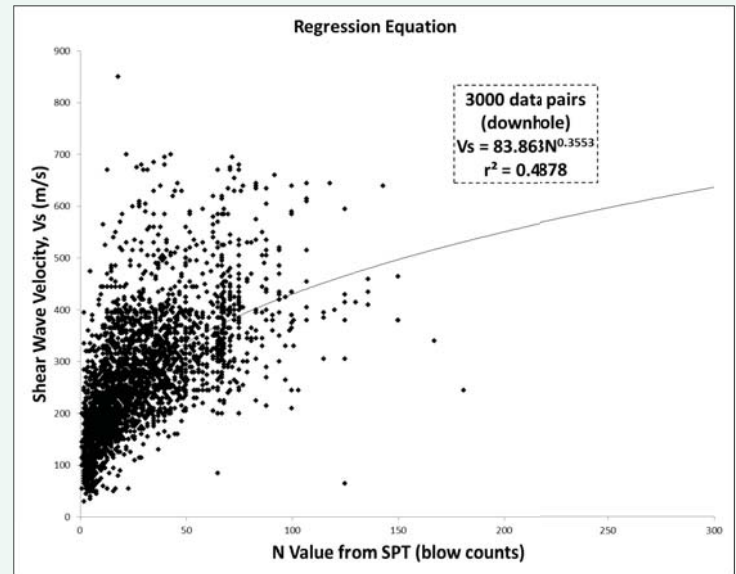
- In this study seismic downhole test is done to determine the shear-wave-velocity of soil. This test procedure is described in ASTM D 7400 – 08 (ASTM 2008).
- The Downhole Seismic Test measures the velocity of compression (P-) or shear (S-) waves in a borehole. A seismic source is used to create a seismic wave train at the earth's surface. The response is captured & the wave train transit time from source to receivers is measured, P and S wave velocities estimated, and stratigraphic profile described.

Use of Study in Seismic Analysis

Because the data may be used for site response analysis, our work can assist in identifying Geotechnical Hazards in the DMDP area. The study facilitates in the identification of amplification at a site by making it easier to determine Vs around the DMDP area. This information is therefore valuable for calculating the extent of damage caused by an earthquake and the amount of ground improvement that is required.

Data Analysis

- 200 Boreholes around DMDP area
- 3000 data pair used
- Nonlinear regression of power law models were formed using regression analysis of the database to derive the correlation equation between V_s and uncorrected value of SPT-N

Validation

- Justification is done by root mean square value
- Previously established equations are in great agreement
- The residuals seem consistent with random error as they are randomly scattered around zero for the whole range of fitted values.

Conclusion

- A correlation equation between two crucial soil parameters SPT-N and Vs was developed for Dhaka Metropolitan Development Plan (DMDP) area of Bangladesh.
- The newly developed equations carried great significance graphically and statistically. These equations can be further used in future to predict soil shear wave velocity from N values obtained from SPT tests in DMDP areas and comparable soil strata but also to study one-dimensional-site response and microzonation of the DMDP area based on the seismicity.

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Shaking table tests on one-quarter scale model of concrete hollow blocks masonry houses retrofitted with fiber-reinforced paint

Zamzam Multazam, The University of Tokyo, Indonesia, Graduate Student

Abstract: Building collapse is responsible for over 75% of human casualties in earthquakes. Masonry is a popular construction technique worldwide due to its advantages, including affordability, availability, and durability. Concrete Hollow Block (CHB), as a masonry unit, has recently become a popular material for residential buildings in Philippines. Most of the buildings are constructed without engineers' involvement, which is commonly called the "Non-Engineered Building." Unreinforced Masonry (URM) building is highly vulnerable during the earthquake. Moreover, most of the CHBs manufactured and used there have low compressive strength. Therefore, this study will focus on improving the strength of masonry buildings to reduce the potential life loss. We developed a new retrofitting method, named fiber-reinforced paint, by using fiber as the primary reinforcing material. Three ¼-scale house models were built; unreinforced house model, 2) reinforced by steel bars (rebar), and 3) fiber-reinforced paint. The result shows that the fiber-reinforced paint house model can handle large deformations and more repeatable shaking than other models. Moreover, the energy dissipation of the fiber-reinforced paint house model is larger than other models. This method exhibits very robust performance even in the high input motion at seismic intensity JMA 7 (Japan Meteorological Agency). It proves that this retrofitting method has a high earthquake-resistant performance.

Background

Cause of death by earthquake in the 20th century (Coburn and Spence 2003)

Low compressive strength of CHB

Objective: This study aims to improve the strength of CHB masonry houses to reduce potential life loss.

Specimen

North | East
South | West

Model dimension

Shake table test will be conducted to obtain an understanding of the dynamic response of CHB masonry house. Three identical ¼-scale house models were constructed using CHB (with compressive strength is 0.28 MPa) as masonry and mortar with cement-sand ratio is 1:6. The mixture is specially designed to obtain mechanical properties similar to CHB houses in developing countries.

Experimental Program

CHB production (3D-Printing)

To obtain the required compressive strength, the mix proportion of CHB is 0.7 water-cement ratio and 12 aggregate-cement ratio.

House model construction

Unreinforced Masonry (URM): Typical house

Reinforced by steel bar (Engineering): Recommendation from government

Fiber-reinforced paint (Paint): proposed retrofitting method

Retrofitting procedure

All openings (door and windows) were painted.

the roof part (wood) and masonry were connected by using fiber-reinforced paint

Testing procedure

In this study, simple and easy-to-use sinusoidal motions were applied with frequencies ranging from 2 to 35 Hz and amplitudes 0.05 to 1.4 g. 20-Accelerations and 5-Lasers will be used in this experiment

Result and Discussion

	D0: no damage	D1: light structural damage	D2: moderate structural damage
	D3: heavy structural damage	D4: partially collapse	D5: collapse

Paint house model (non-engineered + coating) had great performance

Run	Unreinforced Masonry (URM)	Reinforced by steel bar (Engineering)	Fiber-reinforced paint (Paint)
25	Gable wall was collapsed	No damage observed	No damage observed
37	Cracks become more extensive; some blocks fell.	Cracks were developing in gable and openings	No cracks were observed, but bubbles appeared
41	Openings almost separated from the wall	Gable wall was collapsed	The cracks occurred; it becomes bubbles
43	Collapsed	Damages were developing from the gable wall	Bubbles were expanding on both sides from the top to bottom wall
49	Collapsed	Collapsed	The bottom-most layer detached from the base
53	Collapsed	Collapsed	South wall was collpased
56	Collapsed	Collapsed	Collapsed

URM: Run-25

Engineering: Run-43

Paint: Run-53

For further information, contact below.

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Elaborating Various Vehicles Features on Traffic Safety

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Abstract. *Road accidents have been one of the major social and national concerns in Bangladesh over the past few decades. According to MAAP, at least 1,725 people were killed and 1,244 others were injured in 1,692 road traffic accidents across Bangladesh in the year 2015. The government and other regulatory authorities have been struggling over a long period of time to ensure overall road safety throughout the country. As global research and innovation introduce new technologies from time to time intending to tackle the occurrence and fatality of traffic collisions, it's high time we incorporate these modern technologies into our regular public and private transports. In this regard, we aim to explore the effectiveness of some state-of-the-art safety features available globally and suggest some of the useful features based on the necessity, availability, and feasibility in terms of our country. Various types of vehicle safety features including Electronic Stability Control (ESC), Adaptive Cruise Control (ACC), Lane Departure Warning (LDW), Traction Control System (TCS), Anti-locking Braking System (ABS) have been proposed and proved to be well-performing [2] to mitigate the losses due to hazardous traffic collisions in many parts of the world. Again, collisions are found to be of many categories, as we analyze existing accident data collected from Accident Research Institute (ARI). In our article, we illustrate the relationship between two major varieties of vehicle collisions- Head-on collision and Rear-end collision with existing Speed, Traction, and Stability Control vehicle safety features such as ACC, ESC, and ABS by analyzing our gathered dataset. As a part of our study, we design and perform a questionnaire survey among different categories of vehicle users ranging from drivers to buyers and manufacturers to understand the knowledge and perception of Bangladeshi people regarding the availability and feasibility of these safety measures. Finally, based on our findings, we recommend necessary steps to be taken to mitigate traffic collisions as much as possible by incorporating the already proven vehicle safety features into our poorly organized traffic infrastructure.*

Introduction

Nowadays, cars come with many safety features such as **ABS, ESC, ACC**. Such safety features greatly help vehicles to prevent many types of accidents including Head-On collision and Read-End collision. However, in Bangladesh, there is a significant amount of accidents that could be potentially avoided if those safety features were properly utilized. Therefore, the perception and understanding of the safety features of general people needs to be understood.
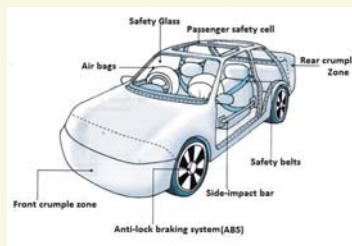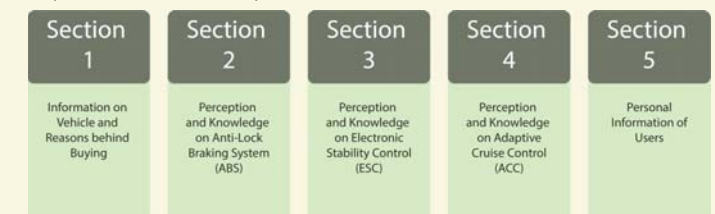
Aim of the study

To understand Bangladeshi people's perception, knowledge, awareness, and experience of safety features in cars. Three most popular safety features in Bangladesh such as ABS, ESC, ACC is evaluated and general people's knowledge about them is recorded.
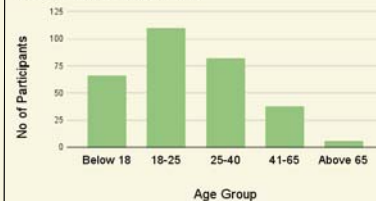
Methodology

Questionnaire

A set of questionnaire was designed according to Bangladeshi road condition and weather. The questionnaire contains five parts :
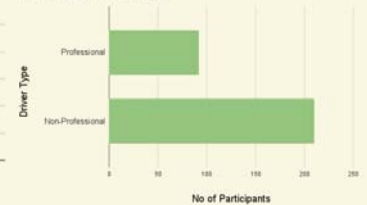
Section 1	Section 2	Section 3	Section 4	Section 5
Information on Vehicle and Reasons behind Buying	Perception and Knowledge on Anti-Lock Braking System (ABS)	Perception and Knowledge on Electronic Stability Control (ESC)	Perception and Knowledge on Adaptive Cruise Control (ACC)	Personal Information of Users

302 Participants

No of Participants vs. Age Group

No of Participants vs. Driver Type

Analysis

How to activate ABS?
- Automatic Detection When Skidding — 38 (11.3%)
- No Idea — 111 (33.0%)
- Regular Braking — 113 (33.6%)
- Automatic Detection — 40 (11.9%)
- Certain Level of Braking — 32 (9.5%)
- Hard Braking
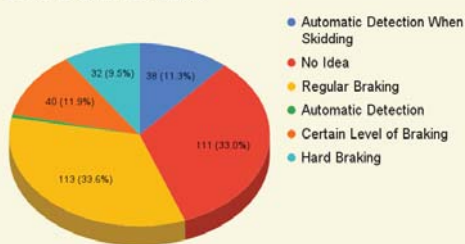
A car with ESC can accelerate more than a can
- Completely disagree — 21.9%
- Disagree — 6.3%
- Neutral — 43.4%
- Agree — 20.5%
- Completely agree — 7.9%

A car with ACC can accelerate faster than a car without it.
- Completely disagree — 19.9%
- Neutral — 44.7%
- Disagree — 6.3%
- Agree — 20.5%
- Completely agree — 8.6%
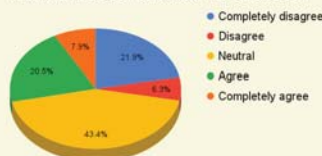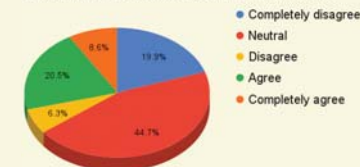
| Perception on ESC	Mean	Median
ESC helps to maneuver at regular speed.	2.90	3
There's a lower risk of skidding with a car equipped with ESC than a car without ESC.	2.88	3
There's a better chance to correct a slide with a car equipped with ESC than a car without ESC.	2.89	3
A car with ESC can accelerate faster than a car without it.	2.86	3
A car with ESC can be driven faster on slippery roads than a car without it.	2.87	3
A car with ESC can be steered and braked simultaneously better than a car without it.	2.89	3

Perception on ACC	Mean	Median
ACC helps to maneuver at regular speed.	2.93	3
There's a lower risk of skidding with a car equipped with ACC than a car without ACC.	2.91	3
There's a better chance to correct a slide with a car equipped with ACC than a car without ACC.	2.79	3
A car with ACC can accelerate faster than a car without it.	2.91	3
A car with ACC can be driven faster on slippery roads than a car without it.	2.93	3
A car with ACC can be steered and braked simultaneously better than a car without it.	2.86	3

Findings

The study showed that a big percentage (33%) of Bangladeshi people does not possess any idea of ABS with almost 34% people having wrong perception of ABS. Besides, more than 43% people of the sample answering neutral to the question of both ESC and ACC indicates that they do not have any experience of the aforementioned safety features. Furthermore, all questions had a mean score of less than, but very close to, 3. This indicates that albeit the participants were confused about the question, they had a negative perception of ability of the safety features.

No Idea and Wrong Conception Among Participants
- No Idea(% of Participants)
- Wrong Conception(% of Participants)

ESC (79%)
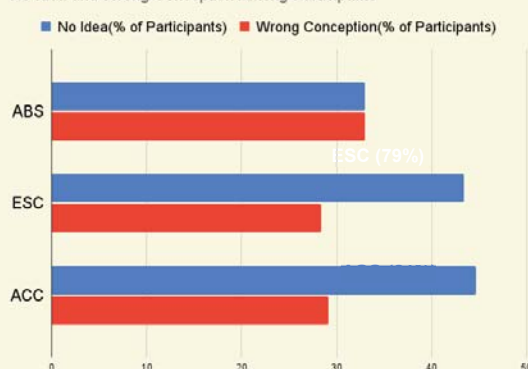
Future Study

- Dependency of perception on sex/age-group/driving experience
- Dependency of accident types on safety feature perceptions
- Model on experience and accident types
- Weather dependency on safety features use case
- Understanding of safety features use frequency in Bangladesh
- Designing cost effective solution of safety features for Bangladesh
- Improving road scenarios to better adapt safety features in Bangladesh

Acknowledgement

If you are interested in learning more, please contact: Mr. Zarif Ikram; Email: zarifikram003@gmail.com; Phone: +8801847304369

How About The Strict Enforcement Laws To Mitigate Traffic Crashes In Bangladesh!

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A Abstract.

Road accident being one of the major social and national concerns in Bangladesh over the past few decades, not only causes deaths and injuries but also causes a huge economic loss. A recent study shows that in 2019 about 5,227 people were killed and 6,953 people were injured in 4,702 road traffic accidents across Bangladesh. In order to reduce road accidents and to find an effective solution a thorough questionnaire survey has been developed for conducting this research project. This study reveals that there is a significant impact of enforcement on traffic safety improvement in Bangladesh. The study mainly focuses on driver's driving attitudes, vehicle fitness, pedestrian activities, roadway conditions, role of law enforcement agencies, existing traffic laws and their functionalities

Feasibility Analysis
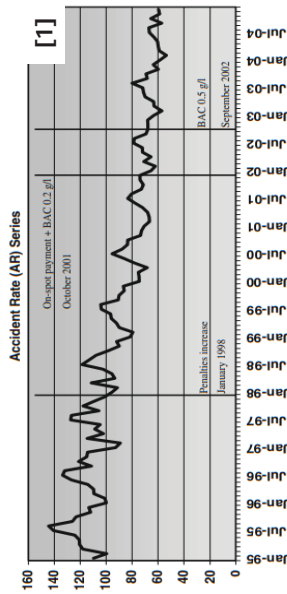
Fig. 1 Monthly traffic accidents per 100,000 vehicles in Portugal, 1995–2004

In 2007, Vietnam's Prime Minister Nguyen Tan Dung introduce a new compulsory helmet law, "Resolution 32" which made helmet law use mandatory in Vietnam for all motorcycle drivers and passengers. As a result,

Number of deaths caused by traffic accidents in Vietnam from 2012 to 2018 [2]

9.92 9.84 9.85 9.1 8.73

■ 2011 ■ 2012 ■ 2013 ■ 2014 ■ 2015
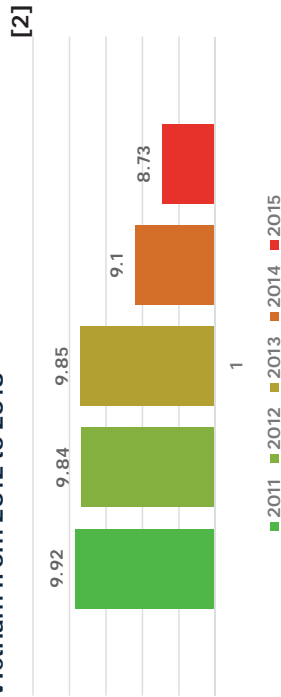
Number of Road Fatalities in Bangladesh from 2011 to 2015 [3]

2072 1953 1782 1629 1725

■ 2011 ■ 2012 ■ 2013 ■ 2014 ■ 2015
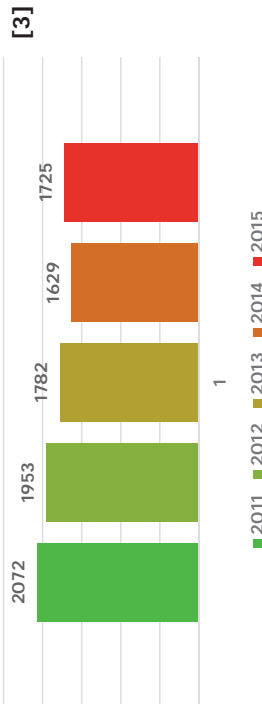
So, we can say if enforcement is done properly then it is very much feasible for our country. As we have seen the example of Vietnam and Portugal. Our country has also achieved success regarding Covid-19 by strong enforcement. So, it's very much possible.

Necessary Traffic Rules → Education → Strong Enforcement → Penalty for breaking traffic rules → Expected Road traffic safety

▷ Methodology

General People — Questionnaire Survey from the perspective of — Drivers

Transportation Experts

BRTA /Authorities

Law enforcing agencies/Police
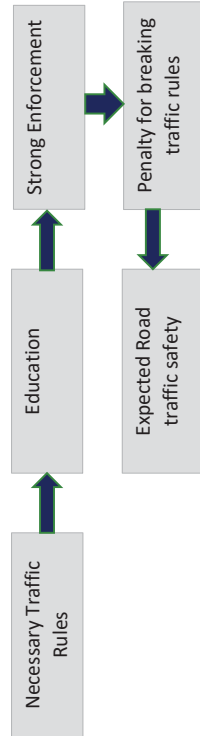
Result & Discussion

From our Questionnaire Survey we got

- Enforcement plays the most important role regarding traffic safety.
- Strong enforcement is needed to overcome critical road traffic situation.
- By creating appropriate traffic rules & implementing them properly we can achieve expected road traffic safety.

Conclusion

We want to bring a change in policy level and by learning from example of Vietnam, Portugal etc. countries we tried to provide a sustainable solution and the solution is appropriate traffic rules and strong enforcement.

References

1.Tavares, A., Mendes, S. and Costa, C., 2008. The Impact of Deterrence Policies on Reckless Driving: The Case of Portugal. *European Journal on Criminal Policy and Research*, 14(4), pp.417-429.
2.Phu, P., Viet, N., Ngoc, N., Hung, V. and Trinh, C., 2012. Simulation and optimization of a silicon-polymer bimorph microgripper. *Vietnam Journal of Mechanics*, 34(4), pp.247-259.
3.Police reported First Information Report (FIR), Bangladesh Police & Micro Computer Crash Analysis Package (MAAP) data base

Acknowledgement

Semi-automated delineation of landslides triggered by the 2018 Typhoon Prapiroon in Eastern Hiroshima, Japan

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Abstract

In mapping the susceptibility of slope failure, the initial stage is to generate a comprehensive database of historical and present landslides in a form of a landslide inventory map. The landslide inventory demonstrates the location, abundance, and type of landslides which serve as input in producing landslide susceptibility and hazard models. The conventional method of preparing a landslide inventory is through manual interpretation of stereoscopic aerial photographs supported by field investigation. However, to reduce the cost and production time while covering a larger area, several studies presented the use of readily available satellite imagery for semi-automated landslide detection.

In this study, multiple change detection techniques (CDT) such as spectral index differencing and image transformation were integrated to generate a landslide inventory map using Sentinel-2 images. For the index differencing, vegetation and soil indices were utilized to map out changes after Typhoon Prapiroon hit Eastern Hiroshima, Japan in 2018. To further highlight the variation, a geometric transformation, principal component analysis (PCA), was also performed. The change detection images for each technique were then merged to form a semi-automated landslide inventory. To validate the results, the produced inventory was compared to an existing landslide inventory published by the Geospatial Information Authority of Japan (GSI) through visual inspection of aerial photographs.

Introduction

Typhoon Prapiroon (Typhoon No. 7)
- Date: July 3-8, 2018
- Affected regions: Hiroshima, Okayama, and Ehime Prefectures
- Disasters: landslides, river flooding, burst levees, etc.
- Casualties: 108 dead, 6 missing in Hiroshima Prefecture

Fig. 1 Aftermath of Typhoon Prapiroon in Western Japan *(source: Japan-forward.com)*

Study Area
- Location: Eastern Hiroshima, Japan
- Land area: ~650 sq. kilometers
- Cities: Fuchu, Fukuyama, Onomichi, Mihara
- Topography: rugged with steep slopes (average 23°)
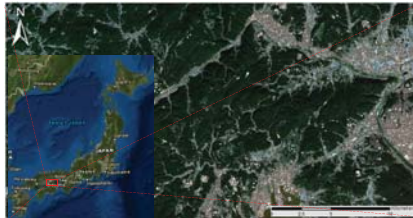
Fig. 2 Location Map of the Study Area

Objective

- To develop a semi-automated landslide inventory map documenting the landslides triggered by Typhoon Prapiroon in Eastern Hiroshima using multiple change detection techniques (CDT)
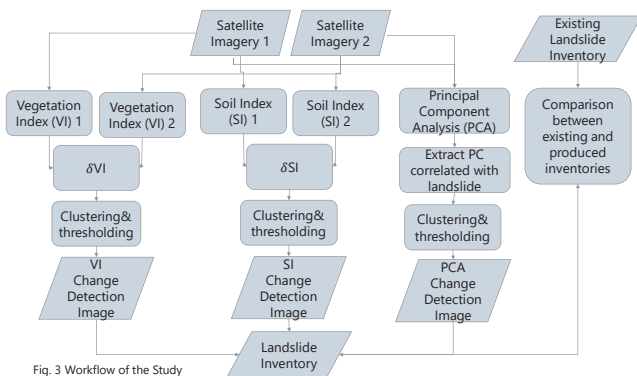
Methodology

Fig. 3 Workflow of the Study

Normalized Difference Vegetation Index (NDVI)
- Determines the health of vegetation
- Large difference in NDVI values = loss of vegetation possibly due to mass movement

$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$

Soil Adjusted Vegetation Index (SAVI)
- Minimizes the soil influence on vegetation quantification

$$SAVI = \frac{(NIR - RED)}{(NIR + RED + L)} * (1 + L)$$

Bare Soil Index (BSI)
- Highlights the difference between agricultural and non-agricultural land

$$BSI = \frac{(RED + SWIR1) - (NIR + BLUE)}{(RED + SWIR1) + (NIR + BLUE)}$$

Principal Component Analysis (PCA)
- feature extraction technique where in superimposed features can be separated and features which have undergone changes can be easily identified
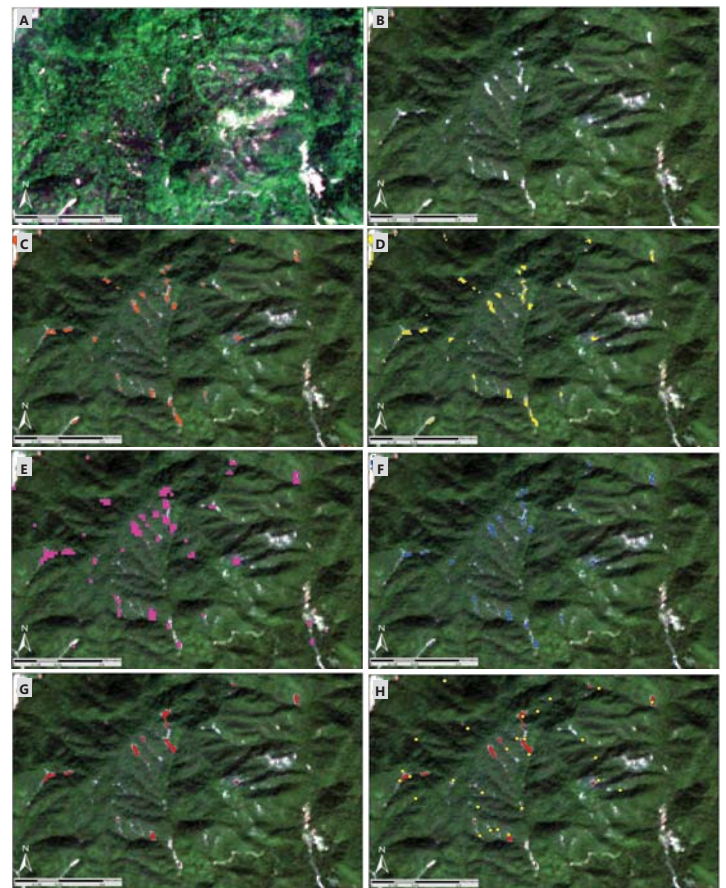
Results

Fig. 4 Results of the multiple change detection. A) Pre-typhoon Sentinel-2 image captured in May 2018, B) Post-typhoon Sentinel-2 image captured in October 2018, C) NDVI differencing, D) SAVI differencing, E) BSI differencing, F) PCA, G) Intersection of the results of the four CDTs, H) Landslide points (yellow circles) extracted from GSI inventory (source: Geospatial Information Authority of Japan)

Figures 4A and 4B show the pre- and post-typhoon event Sentinel-2 satellite datasets. Figures 4C to 4F illustrate the results of the individual change detection technique (CDT). Overlaying these results, Figure 4G extracts the intersection of the polygons generated from varying CDTs. Doing so refines the delineation of landslides by considering only the polygons detected by every CDT. Finally, the landslide inventory points delineated by GSI are represented in Figure 4H showing the close agreement of the semi-automated output with the conducted field survey.

The proposed methodology delineated 634 potential landslide polygons constituting a total area of around 362,545m². Comparing with the landslide inventory map of GSI derived from visual interpretation of aerial photographs, 278 of the 445 landslide points were measured to be at least 100 meters from the generated landslide polygons. Discrepancies in size, distance, and location between the maps may be attributed to certain limitations such as spatial resolution and temporal availability of data among others.

Conclusion

Through the execution of multiple change detection techniques, a semi-automated landslide inventory map of Eastern Hiroshima was generated using pre- and post-event Sentinel-2 satellite images. The application of spectral indices and PCA allows change detection in landslide-prone areas affected by heavy precipitation. The results of this study can be used for preliminary landslide detection caused by a single event such as typhoon especially in cases when aerial photos are unavailable, and accessibility is limited The comparison with higher spatial resolution landslide inventory gives fair results considering the limitations of the model. By extracting landslide conditioning factors (i.e., slope, curvature, lithology, geologic structures, etc.) from relevant datasets, the inventory may be further utilized in landslide susceptibility and risk mapping.

BIOPHYSICAL SUITABILITY ASSESMENT FOR CHINESE CABBAGE OF EAST ASIA FROM 2001 TO 2020

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Institute of Industrial Science, The University of Tokyo, Japan

Abstract: Chinese Cabbage has been an essential daily vegetable supply both for human or livestock's meals especially for Asian Countries. However, as global climate and land use cover keep changing, the ecological niches for Chinese Cabbage also varies because of meteorological changes or different soil conditions, in this case the productivity of Chinese Cabbage are potentially threatened. Intending to eliminate the mismatch between crops and cultivating lands, the bio-geophysical assessment of suitability mapping can be of great significance for sustainable agriculture as it can indicate the levels of suitability across large areas for specific crops. In this study, meteorological suitability consisting of temperature and precipitation, and soil condition suitability which includes soil pH and soil nitrogen would be integrated to comprehensive suitability mapping for Chinese Cabbage across all over East Asia (Japan, North/South Korea, Northeast China) through a GIS-based Analytic Hierarchy Process-Multiple Criteria Decision Making (AHP-MCDM) system carried out by Google Earth Engine. MODIS Land Surface Temperature and Emissivity (MOD11) and Global Satellite Mapping of Precipitation (GSMaP), soil nitrogen and soil pH from Soil Grids were all utilized for two decades' suitability mapping analysis in Spring, Summer and Autumn seasons from 2001 to 2020. As the suitability classification range is parsed into five levels, individually as optimal, suitable, marginal, unsuitable, and pessimal, the Biophysical suitability mapping results showed that summer and autumn could be ideal seasons to grow Chinese Cabbage within such four countries, while the analysis of case studies (Kawakami village in Japan, ACheng district in China) also revealed the suitable farmlands to cultivate Chinese Cabbage.
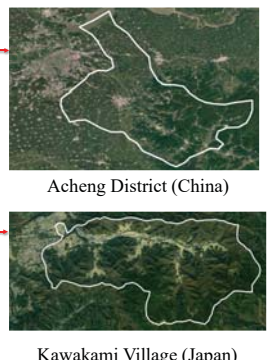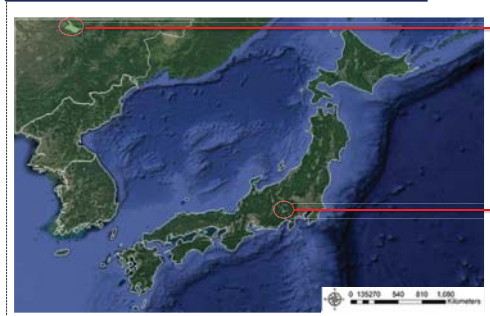
1.BACKGROUND

Spring
- March
- April
- May

Summer
- June
- July
- August

Autumn
- September
- October
- November

2.MATERIALS & METHODOLOGY

Acheng District (China)

Kawakami Village (Japan)

Fig1. Map of the study area

Fig2. FlowChart of this study
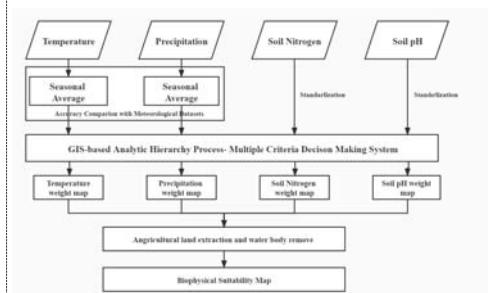
Table1. Details about the input datasets

Data	Precipitation	Temperature	Soil Nitrogen (0-15m)	Soil Ph (0-15m)
Source	JAXA	NASA MODIS	WoSIS	WoSIS
Product	Near Real Time	MOD11A2 v006	Soil Grids 250m 2.0	Soil Grids 250m 2.0
Temporal Range	2000-01-01 to present	2000-02-18 to present		
Temporal Resolution	1 hour	8-day		
Spatial Resolution	0.1-degree	1-km	250m	250m

Table2. Details about the agricultural land extraction datasets

Products	MCD12Q1	GlobCover	GFSAD1000	Hansen Global Forest Change v1.8
Source	NASA	ESA	GFSAD30	Hansen
Temporal Range	2000-01-01 to 2000-01-01	2000-01-01 to 2010-01-01	2010-01-01 to 2020-01-01	2000-01-01 to 2020-01-01
Spatial Resolution	500m	300m	1000m	30.92m

Table3. Criterion of categorization

Criterion	Temperature (℃)	Precipitation (mm)	Soil Nitrogen (cg/kg)	Soil pH
Optimal	15-20	≥180	180-260	6.5-7
Suitable	10-15 and 20-25	80-100	160-180 and 260-280	6.0-6.5 and 7-7.5
Marginal	5-10 and 25-30	70-80	140-160 and 280-300	5.5-6.0 and 7.5-8.0
Unsuitable	0-5 and 30-35	60-70	120-140 and 300-320	5.0-5.5 and 8.0-8.5
Pessimal	<0 and >35	<60	<120 and >320	<5.0 and >8.5

- Set the pairwise comparison Matrix as A= $[a_{ij}]_{n \times n}$ as :

$$A = \begin{bmatrix} a_{11} & \cdots & a_{12} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix}$$

- Set the vector of weights as :
$w = [w_1, w_2, w_3 \cdots, w_n]$

- The elements of the normalized eigenvector are weighted with respect to the criteria or sub-criteria and rated with respect to the alternatives the vector of weights as :

$$a_{ij} = \frac{a_{ij}}{\sum_{j=1}^{n} a_{ij}}$$

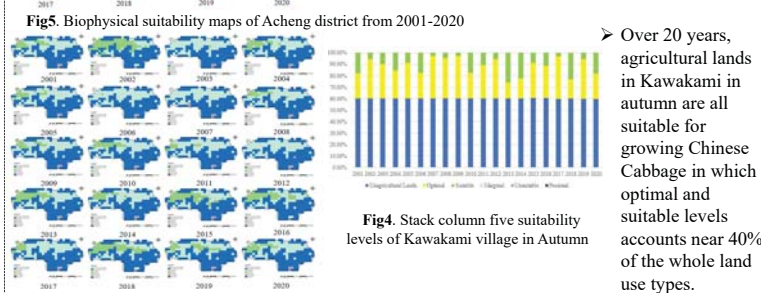$$w_{ij} = \frac{\sum_{j=1}^{n} a_{ij}}{n}$$

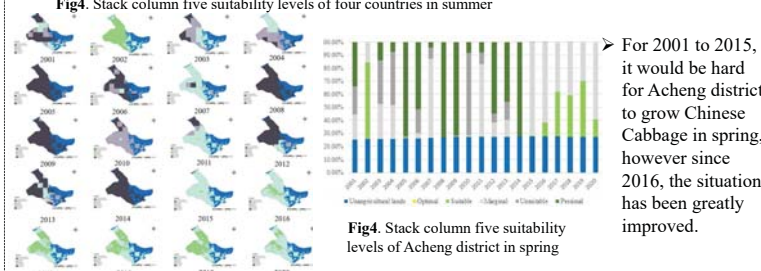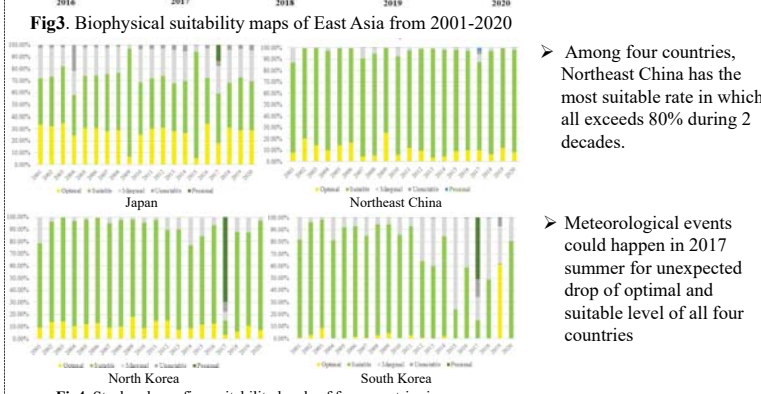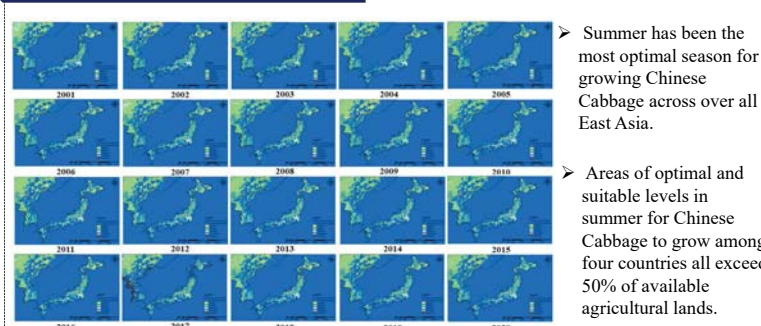Where $i, j = 1,2,3\ldots\ldots,n$

- A consistency ratio (CR) can be calculated as a mathematical measures to determine the consistency of judgement matrix.

$$CI = \frac{\varphi_{max} - n}{n-1}$$

n is the number of elements being compared in the matrix ,φ_{max} is the largest or principal eigenvalue of the matrix

3.RESULTS & DISCUSSIONS

Fig3. Biophysical suitability maps of East Asia from 2001-2020

- Summer has been the most optimal season for growing Chinese Cabbage across over all East Asia.

- Areas of optimal and suitable levels in summer for Chinese Cabbage to grow among four countries all exceed 50% of available agricultural lands.

Japan　　Northeast China

North Korea　　South Korea

Fig4. Stack column five suitability levels of four countries in summer

- Among four countries, Northeast China has the most suitable rate in which all exceeds 80% during 2 decades.

- Meteorological events could happen in 2017 summer for unexpected drop of optimal and suitable level of all four countries

Fig5. Biophysical suitability maps of Acheng district from 2001-2020

Fig4. Stack column five suitability levels of Acheng district in spring

- For 2001 to 2015, it would be hard for Acheng district to grow Chinese Cabbage in spring, however since 2016, the situation has been greatly improved.

Fig4. Stack column five suitability levels of Kawakami village in Autumn

Fig6. Biophysical suitability maps of Kawakami village from 2001-2020

- Over 20 years, agricultural lands in Kawakami in autumn are all suitable for growing Chinese Cabbage in which optimal and suitable levels accounts near 40% of the whole land use types.

4.CONCLUSIONS AND FUTURE WORKS

- The biophysical suitability mapping results of whole East Asia over 3 seasons from 2001 to 2020 shows the ideal seasons to grow Chinese Cabbage can be ranked as: Summer > Autumn > Spring.

- Future works should include more available factors and other famous case place for growing Chinse Cabbage. Yield validation would also be carried out.

Exploring Critical Accident Factors of National Highways in Rural Areas of Bangladesh

[1]Sarah Sultana and [1]Syeda Aniqa Anjum
[1]Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

Abstract: *Despite being paramount in a road network system, highways are the most vulnerable locations for accidents in developing countries as well as developed countries. According to the Road Maintenance Management System (RMMS) of the Roads and Highways Department, Bangladesh has an estimated length of 3,980 km of national highways which consist almost 18% of total roads connecting the country. According to CIPRB, the fatality rate in rural areas is 70% of the total road accidents. On account of high mortality rates on rural highways and lack of dedicated research, this study primarily focuses on accident trend analysis of national highways in rural areas of Bangladesh. MAAP5 (Microcomputer Accident Analysis Package) data from Accident Research Institute (ARI) of Bangladesh over the period of 2006-2015 is utilized for this purpose. This analysis is categorized based on road characteristics and design, driver's behaviour, vehicle performance, pedestrian actions and external factors like weather and availability of light. This research work focuses on identifying and investigating prime causes behind rural national highway accidents in Bangladesh in an elaborate manner using the parameters of MAAP5 data. Accident records disclose that 65.4% of total highway accidents occurred on rural national highways and hit pedestrian (39%) was the most common type of collision in these accidents. The majority of accidents also happened in fair weather (93%) conditions and broad daylight (68.6%). In 98.3% of vehicles, it is observed that drivers involved in casualties did not wear seat belts. Hence, this paper synthesizes a complete idea about the factors that mostly influence these accidents and also discusses the promising recommendations for highway accident prevention. It is believed that this paper will motivate policymakers and road engineers to take apt initiatives in mitigating the percentages of accidents on rural national highways of Bangladesh.*

Introduction:

Every year approximately 1.3 million lives are cut short as a result of traffic accidents and about **93%** of mishaps occur in low and middle income countries (WHO). Bangladesh is a highly populated middle income country with a high fatality rate caused by road accidents. Road casualties is a serious problem in the national highways, especially in the rural areas. Nearly **47%** of the total accidents took place in national highways and **65%** of those were in rural highways. Here we explore some of the critical accident factors of rural national highways of Bangladesh.

Categorization:

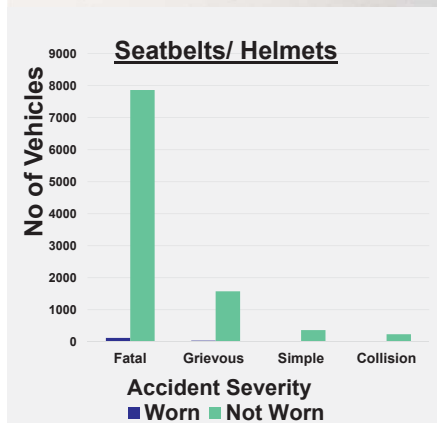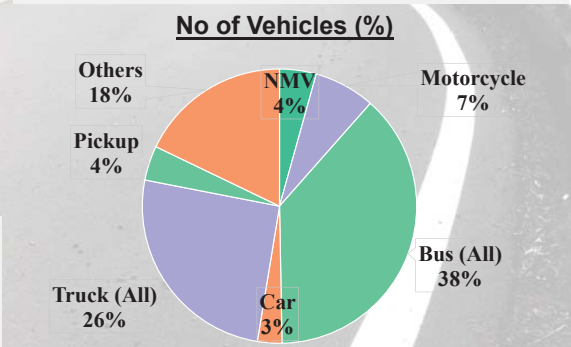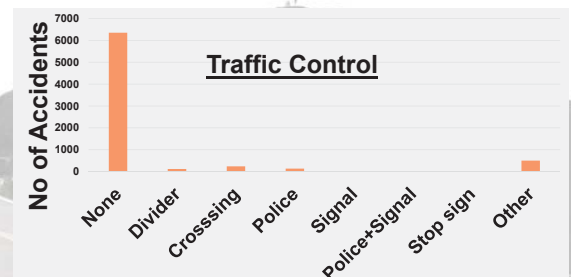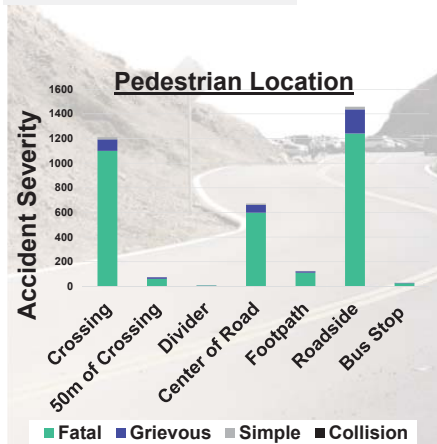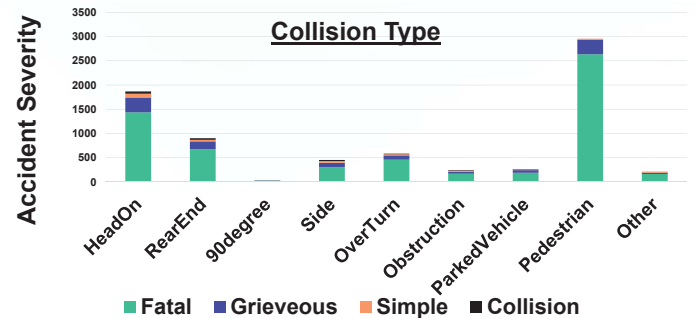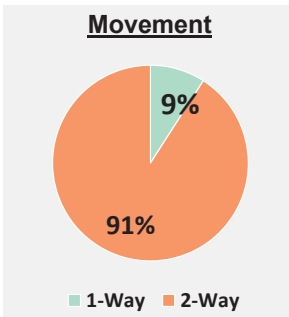*Road Characteristics, Driver Vehicle, Pedestrian, External*

Key points:

- From 2006-2015 year, total 7,529 accidents had been recorded with **80.5%** fatality.
- 2,957 accidents were pedestrian collisions, and **89%** of those were fatal.
- Two significant accident locations for pedestrians are roadside (**40.7%**) and crossings (**33.8%**)
- **91%** of the total accidents happened on 2-way roads
- No traffic control system was present in **85.5%** of accidents.
- The highest rate of vehicles involved in accidents is buses (**38%** combined).
- In **98.3%** of vehicles, drivers did not wear seatbelts or helmets.
- Weather has no significant impact

Recommendations:

- SDG 2030 Target 11.2
- Placing physical islands for lanes
- Creating roundabout and staggered junction
- Increasing pedestrian crossing facilities
- Launching Awareness Programmes
- Proper license and up-to-date vehicle fitness certificate
- Mandatory use of seatbelts and helmets
- Skid resistance- gap graded asphalt mix
- Setting up surveillance camera

Background:

According to Road Maintenance Management System (RMMS) of Roads and Highways Department of Bangladesh, the country has an estimated length of 3,979.80 km of national highways which consist almost **18%** of total roads connecting the country. A significant portion of the national highways pass through rural areas. From 2006-2015 years, 11,856 accidents occurred in national highways, whereas 7,529 of them occurred in rural highways with **66.3%** fatality. Despite this high rate in fatality, lack of dedicated research on this topic has been observed. For this study, Microcomputer Accident Analysis Package (MAAP5) was used as data source and 2006-2015 was chosen as the study period.

Results and Analysis:
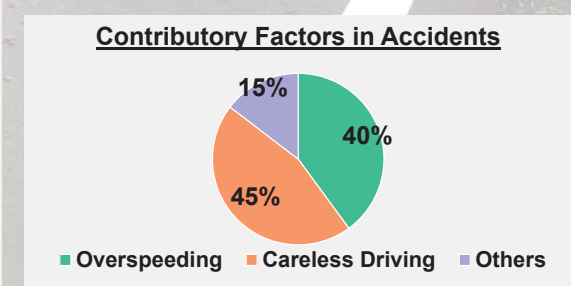
Movement

Collision Type

Pedestrian Location

Traffic Control

No of Vehicles (%)

Seatbelts/ Helmets

Contributory Factors in Accidents

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28

An Integrated Internet of Things Sensor based System for Structural Health Monitoring

Srikulnath Nilnoree* , Attaphongse Taparugssanagorn **

* Doctoral student in Structural Engineering, Asian Institute of Technology (AIT)
** Associate Professor in Telecommunications; Information and Communications Technologies;
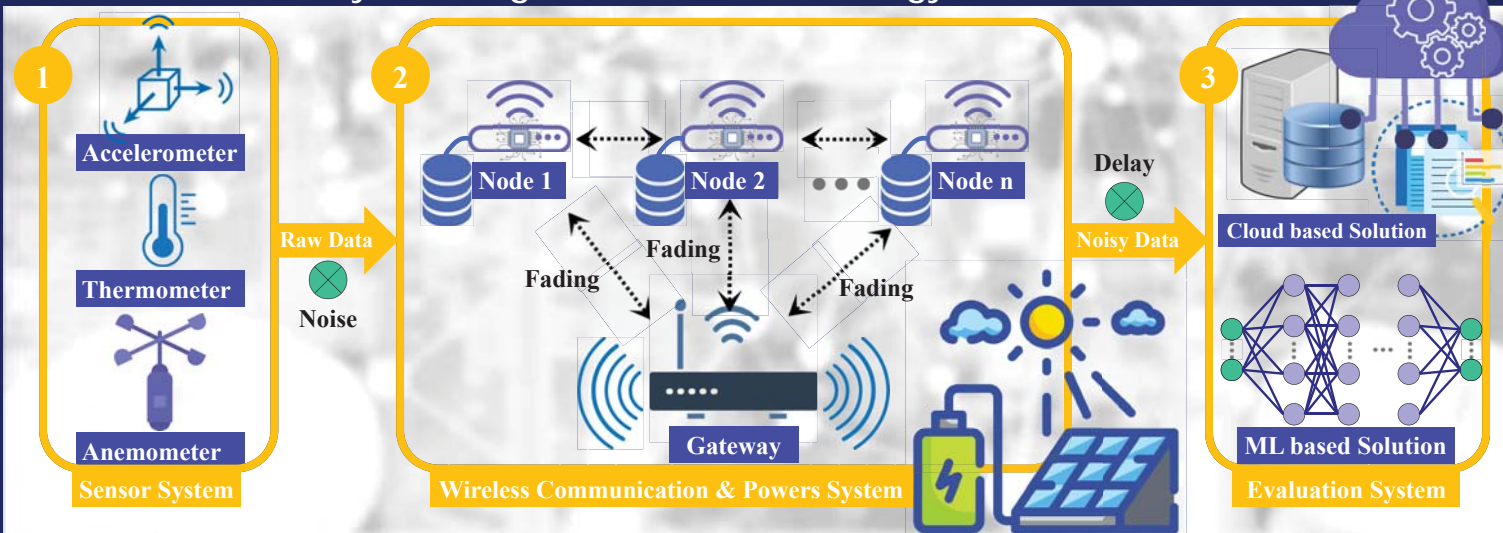IoT Systems Engineering Academic Programs, Asian Institute of Technology (AIT)

Abstract

An Internet of things (IoT) has been a buzz word in the last few decades. IoT is a network which connects physical objects — "things"— via the internet protocol. Monitoring systems based on IoT technology is a key solution for collecting, exchanging, and communicating the data between sensors and users. There are several modules available in the market providing helpful solutions for smart cities. This poster introduces a study on low-cost reliability IoT based system for Structural Health Monitoring (SHM). The architecture of SHM system using IoT and the examples of node system are presented. Following with the key challenges of IoT based SHM. In recent years, the structural dynamic response has been studying to investigate the performance of the structures. The health of in-service structures is a crucial part that can be identified by system identification of the natural frequencies and damping ratios, a part of SHM method. In contrast, the conventional instruments i.e., accelerometer, strain gauge and transducer are expensive and cannot be used to monitor the structures continuously. Thanks to the IoT and wireless sensor network technology that have been rapidly developed, IoT system based SHM can be a key solution of reducing implementing cost of the whole system. Moreover, IoT system is also suitable for dynamic and continuous monitoring application.

Background: Structural Health Monitoring System

Structural Health Monitoring System		IoT Technology
Components	**Disciplinary**	
Data Acquisition	Sensing Technology	IoT End Devices 1
Data Transmitting	Communication Tech.	Wireless Technology 2
Data Storage & Mining	Storage Technology	Cloud Technology 3
Data Processing	Signal Processing	Signal Processing 3
Data Interpretation	Evaluation Method	ML based Identification 3
Power Supply	Battery & Charging Tech	Ultra Low Power Tech 2

Architecture of SHM system using wireless sensor technology for IoT

1 Accelerometer / Thermometer / Anemometer — Sensor System
Raw Data → Noise
2 Node 1, Node 2, ... Node n — Fading — Gateway — Wireless Communication & Powers System
Noisy Data → Delay
3 Cloud based Solution / ML based Solution — Evaluation System

The key challenges of IoT based SHM

- **Sampling Rate Limitation**
- **Time Synchronization**
- **Data Rate and Throughput**
- **Fault Tolerance**
- **Parallel Data Processing**
- **Network Scalability**
- **Power Efficiency**
- **Programmable Interface**
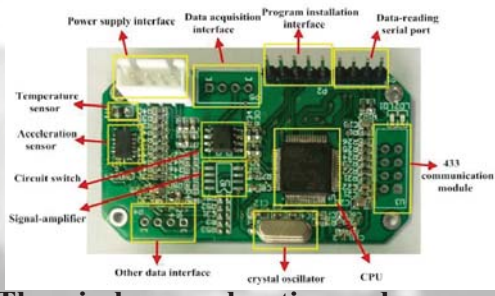
The wireless acceleration node sensor

References:

[1] Dhakal, D. R., Neupane, K. E. S. H. A. B., Thapa, C. H. I. R. A. Y. U., & Ramanjaneyulu, G. V. (2013). Different techniques of structural health monitoring. Research and Development (IJCSEIERD), 3(2), 55-66.

[2] Abdulkarem, M., Samsudin, K., Rokhani, F. Z., & A Rasid, M. F. (2020). Wireless sensor network for structural health monitoring: A contemporary review of technologies, challenges, and future direction. Structural Health Monitoring, 19(3), 693-735.

[3] Tong, X., Yang, H., Wang, L., & Miao, Y. (2019). The development and field evaluation of an IoT system of low-power vibration for bridge health monitoring. Sensors, 19(5), 1222.

[4] Zhou, G. D., & Yi, T. H. (2013). Recent developments on wireless sensor networks technology for bridge health monitoring. Mathematical Problems in Engineering, 2013.

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Time Series Analysis of the Seasonality of Air Pollution and Its Impact on COPD Cases in Dhaka City

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University of Dhaka, Bangladesh

Abstract: Dhaka is a rapidly expanding metropolis that contributes greatly to air pollution due to rapid unplanned urbanization, industrialization, the motorization of vehicles resulting in the burning of fossil fuels and emission of chemical pollutants. This results in an adverse impact on human health and the development of respiratory diseases like chronic obstructive pulmonary disease (COPD). Therefore, this study aims to investigate the impacts of temperature and humidity on air pollution, the seasonality of air pollution, forecasting the concentration of air pollutants for two years and the degree of its effect as one of the main causal factors of COPD, in order to provide plausible suggestions based on the findings. Time-series analysis is carried out to analyze the trend and seasonality of air pollution correlating with temperature and humidity of the years 2016-2020. Forecasting of the pollutants' concentration was done using ARIMA model followed by Multiple linear regression model to explore the chances of the relationship between air pollution and reported COPD cases for the years 2018-2020. The results show that temperature and humidity have strong negative significance (p<0.05) on some specific air pollutants. On the other hand, year-wise regression analysis among pollutants and reported COPD cases identified that pollutants such as SO_2, NO, $PM_{2.5}$, and PM_{10} have a low positive significance on causing this respiratory disease. As results indicate that there is highly significant association among environment temperature, humidity, presence of pollutants (SO_2, NO, NO_2, $PM_{2.5}$, PM_{10}) in the air, and weak positive significance of air pollutants on health hazards, it is recommended to initiate and reinforce some policy actions to minimize the effects. This study will thereby help the policymakers to take necessary actions and plan mitigation strategies to reduce the pollution level of the city and minimize the impacts on health.

Background

Primary and secondary pollutants are the major contributors to air pollution. Weather factors such as temperature, humidity, rainfall, wind direction, and speed may cause fluctuations in air pollutants' concentration Bangladesh had the worst air quality for the last couple of years consecutively and this issue is assumed as one of the major influences for causing respiratory diseases such as Asthma, Chronic Obstructive Pulmonary Disease (COPD).

Methodological Framework
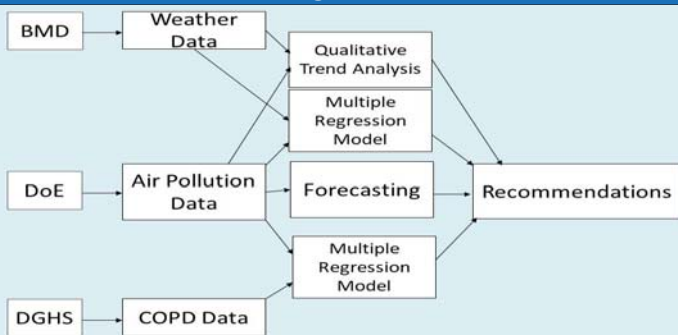
Fig 1: Methodological Framework

Statistical Analysis

Then Multiple Linear regression model has been used to find how temperature and humidity correlate with air pollutants. The equation for this simple regression model will be:

$$Y = a + b_1 X_{(Temperature)} + b_2 X_{(Humidity)} + \gamma$$

Where, X= Predictor variable (Temperature/ Humidity); Y= Dependent variable (Concentration for SO_2/ NO/ NO_2/ $PM_{2.5}$/ PM_{10}); a= Y-intercept (constant term); b= Slope coefficient for X; γ = Model's error term or residuals.

Several forecasting methods were tried out to forecast the pollutants trend with time and the Auto-Regressive Integrated Moving Average Model showed significant results. Using ARIMA Model, pollutants' trends have been forecasted for two years (2021-2022).

The formula and calculation of the Multiple Regression Model that will be used:

$$y = \beta_0 + + \beta_1 x_{(SO2)} + \beta_2 x_{(NO)} + \beta_3 x_{(NO2)} + \beta_4 x_{(PM2.5)} + \beta_5 x_{(PM10)} + \epsilon$$

where, y = Dependent variable (Number of reported cases); $x_{(SO2)}$ = Explanatory variable for SO_2 concentration; $x_{(NO)}$ = Explanatory variable for NO Concentration; $x_{(NO2)}$ = Explanatory variable for NO_2 Concentration; $x_{(PM2.5)}$ = Explanatory variable for $PM_{2.5}$ Concentration; $x_{(PM10)}$ = Explanatory variable for PM_{10} Concentration; β_0= Y-intercept (constant term); β_1/ β_2/ β_3/ β_4/ β_5 = Slope coefficients for each explanatory variable; ϵ= The model's error term
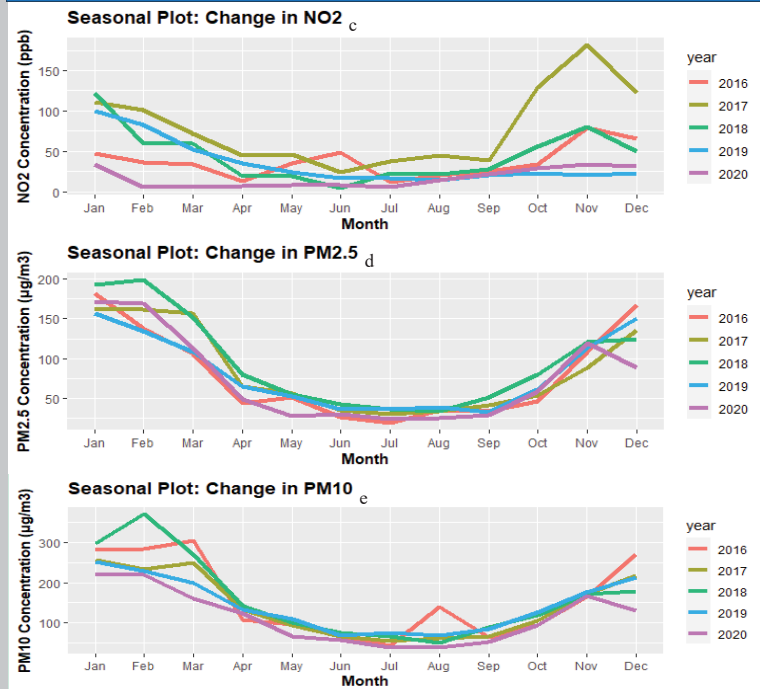
Results
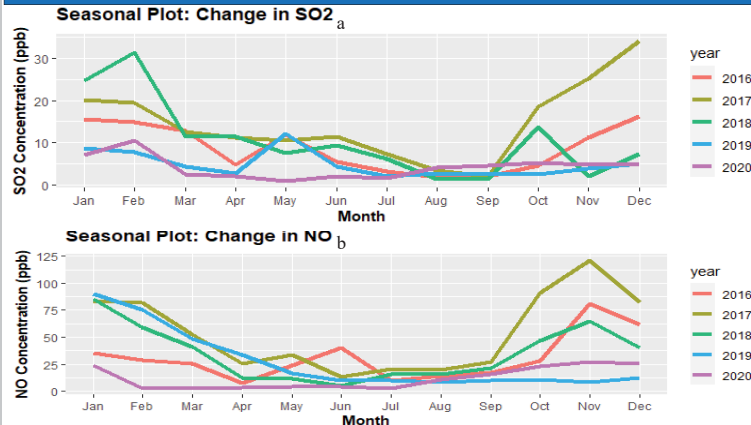
Results

Fig 2: Seasonality Graph of (a) SO_2, (b) NO, (c) NO_2, (d) $PM_{2.5}$, (e) PM_{10}

Table 1: Regression Analysis of Air Pollutants with Temperature and Humidity

	Temperature		Humidity	
	Coefficients	**Pr(>|t|)**	**Coefficients**	**Pr(>|t|)**
SO2	**-1.0691**	**0.00246 ****	**-0.2350**	**0.06894 .**
NO	**-4.1010**	**0.00159 ****	**-1.0914**	**0.02234 ***
NO2	**-5.4451**	**0.00165 ****	**-0.9925**	**0.11459**
PM2.5	**-10.9871**	**< 2e-16 *****	**-3.8965**	**1.71e-15 *****
PM10	**-11.857**	**9.65e-08 *****	**-7.294**	**3.88e-14 *****

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 2: Regression Analysis of COPD Cases and Air Pollution

	(I)		(II)		(III)	
	Pollutants' data: 2017 Cases Data: 2018		Pollutants' data: 2018 Cases Data: 2019		Pollutants' data: 2019 Cases Data: 2020	
	Coefficients:		Coefficients:		Coefficients	
	Estimate	**Pr(>|t|)**	**Estimate**	**Pr(>|t|)**	**Estimate**	**Pr(>|t|)**
SO2	8.222e-01	0.0623 (.)	1.827e-02	0.9544	7.505e-02	0.785
NO	1.700e+00	0.3801	2.755e+00	0.0191 *	1.807e+00	0.416
NO2	1.741e+00	0.3756	1.381e+00	0.1452	1.517e+00	0.515
PM2.5	4.230e+00	0.0470(*)	2.414e+00	0.2105	1.503e+00	0.314
PM10	5.169e+00	0.0206(*)	5.437e-01	0.7309	1.983e+00	0.253
Residual standard error: 0.6164 on 6 degrees of freedom Multiple R-squared: 0.7927, Adjusted R-squared:0.62	p-value: 0.04538	Residual standard error: 0.5305 on 6 degrees of freedom Multiple R-squared: 0.8465, Adjusted R-squared: 0.72	p-value: 0.01978	Residual standard error: 0.7464 on 6 degrees of freedom Multiple R-squared: 0.6961, Adjusted R-squared: 0.4429	p-value: 0.1252

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Conclusions

This study identified that if temperature and humidity increase, there is a high possibility of decreasing air pollution. But the warmer and humid environment is not a perfect situation for human lives. Hence, controlling air pollution and climate change should be one of the top priorities for authorities. Moreover, an increase in air pollution can act as a cause of rising COPD cases. Policymakers can use the research findings for improvising the existing laws and initiating new ones.

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E-mail: samihasaleha.03@gamil.com

The Effects of Reclaimed Asphalt Pavement on the sustainability characteristics of Asphalt Concrete

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[2] Department of Civil Engineering, Shibaura Institute of Technology, Japan.

Abstract

This research will concentrate on improving sustainability through road material modification. Reclaimed Asphalt Pavement (RAP) is a mix that has a portion of recycled coated aggregates included into a new mix and is currently widely associated with improved sustainability due to its improved effects on virgin material consumption, cost effectiveness and proper disposal practices. The use of various sustainability indicators as evaluated in Life Cycle Analysis (LCA) at different stages, from various literatures was used to comparatively assess the effects of using RAP to a conventional mix through relationship graphs. The results show that using 10-100% of RAP in a mix greatly improves the sustainability characteristics of the asphalt concrete, noting that current practices have managed to re-use about 51% of RAP in a new mix to attain standard material performance.

Introduction

The use of recycled road construction and demolition waste RAP, could assist engineers to contribute more towards the achievement of SDG goals.

Sustainability

Transportation (Roads) — *Responsible resource Consumption* — *Sustainable Development*
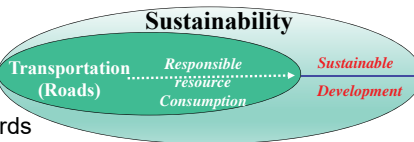
Reclaimed asphalt pavement (RAP) is the term **given to removed and/or reprocessed pavement materials containing asphalt and aggregates** and is often associated with Road pavement sustainability due to its recyclability.

Source: https://www.pwri.go.jp/eng/about/pr/webmag/wm017/seika.html

Possible Challenge:

Assessing the sustainability benefits of recycled road materials.

Objective

Establish the effect of using RAP on various indicators associated with Asphalt concrete to determine improved Sustainability.

Methodology

Secondary data is used to establish a comparison of various indicators for RAP mixes vis-à-vis a conventional mix (baseline) using different scenarios from various LCA studies through relationship graphs.

Recycle

Energy / Resources → Material → Processed → Construction → Use → Disposal — Emissions

(Road Life Cycle)

Indicator Selection → Data Collection → Data Analysis

Production Phase	Whole Life Cycle
Energy Requirements	General Energy Requirements (GER)
Carbon Dioxide (CO$_2$) production	Global warming Potential (GWP)
Sulphur Dioxide (SO$_2$) production	Acidification Potential (AP)
Nitrogen Oxide (NOx) production	Human Toxicity (HT)
Carbon Monoxide (CO) production	Fossil Fuel Depletion (FFD)
Volatile Organic Compounds (VOC)	Whole Life Cost
Production Cost	

- Over **144** papers and **4** books reviewed, and data collected for different scenarios using varying percentages of RAP in various countries.

- Data is then normalized using Distance to a reference (reference is individual case studies baseline conventional Asphalt Concrete mix)
- Relationship graphs plotted for each indicator selected against percentage replaced virgin material in original mix

Results

Reduced Virgin materials in Mix due to use of Secondary Material consumption (%)

Indicators: Production Cost, Energy Requirements, CO2 production, SO2 production, NOx production, CO production, VOC production

Reduced Virgin materials in Mix due to use of Secondary Material consumption (%)

Indicators: General Energy Requirement, Global Warming Potential, Acidification Potential, Fossil Fuel Depletion, Human Toxicity, Whole life Cost

Figure 1 : Relationship graphs for various Indicators vs reduced virgin material in mix in Production phase and Life Cycle Analysis scenarios .

Discussion

❖ Most studies found that most of the indicators assessed reduce in value from those seen when using a normal Mix. It is also observed that the more the amount of RAP used in the mix, the more reduction in indicator values as well.

❖ Experimental research has tested mixes made of 100% RAP mixtures, however with the current technologies, Japan has achieved the highest percentage at more than 51% (NAPA 2015) of RAP in a new mix.

Source: NAPA, 2015

❖ One common shortcoming of RAP is old oxidated binder. It is necessary use rejuvenators to attain high RAP mixes. This, however, seldom negates the positive effects on sustainability in the mix over the whole life cycle.
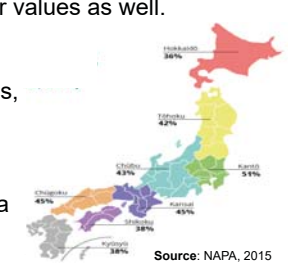
Conclusion

The use of RAP has positive effects on sustainability through the lowering of Green House gas emissions , energy requirements, cost and natural resources consumption as compared to conventional mixes throughout the life cycle of a road.

High RAP content also contributes more towards the sustainability of the mix. It should however be noted that the new mixes require proper engineering such as inclusion of rejuvenators and production practices to achieve standard mix performance.

References

- NAPA, "*High RAP Asphalt Pavements- Japan practice Lessons learnt*", Technical Report IS 139, USA, December 2015.

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Topology-based Analytical Research on City Infrastructure Interdependencies: A Case Study

Shi Zhengyi, Tsinghua University, Peking, China, D1

Research Background and Method

- ☐ infrastructure is the framework of interdependent networks and systems
- ☐ infrastructure malfunction can cause secondary failure due to interdependencies
- ☐ failures may spread among infrastructure networks in a cascading way

modelling and simulation methods	
empirical	infrastructure failure interdependencies (IFI)
economic	agent-based, input-output theory, CGE
system dynamics	critical infrastructure protection/decision support system
topology-based	☐ based on graph theory ☐ suitable for network-like infrastructure systems
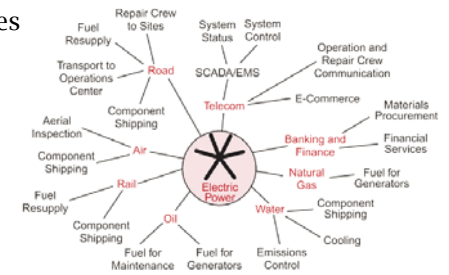
(Rinaldi S M et al. Identifying, understanding, and analyzing critical infrastructure interdependencies. IEEE Control Systems Magazine, 2001.)

water distribution system (WDS) ⟷ quantitatively interdependencies ⟷ electricity distribution system (EDS)
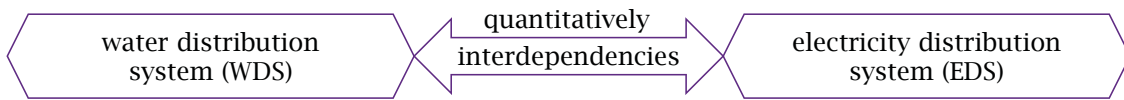
Build a Graph

graph for WDS
$n = 4675, m = 4730$
n the number of nodes
m the number of edges
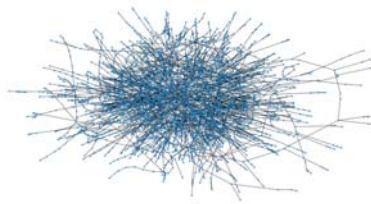
graph for EDS
$n = 4490, m = 4557$

Fragmentation Analysis

- ☐ we study the changes when a small fraction f of the nodes is removed

cluster B   cluster A
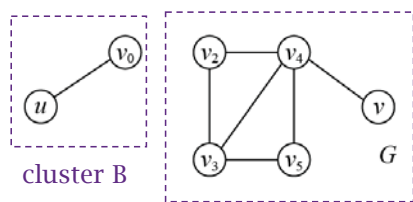
nodes removed

- ☐ with the increase of f, points are moving like

- ☐ fitting those points in exponential form

$$y = a \exp(-b \log x)$$

histograms with x axis denoting frequency

$f = 0.01$ — $y = 0.3551 \exp -0.3108 \log x$

$f = 0.02$ — $y = 0.24977 \exp -0.4408 \log x$

$f = 0.05$ — $y = 0.077194 \exp -0.90714 \log x$

$f = 0.10$ — $y = 0.045974 \exp -0.64908 \log x$

relative cluster size
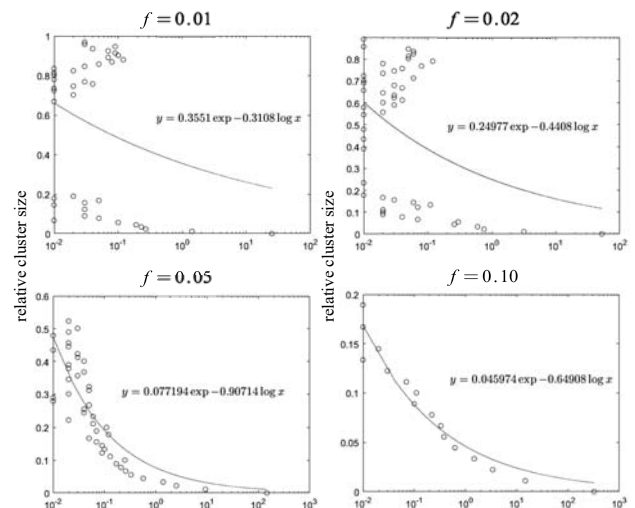
Geographical Interdependency Analysis
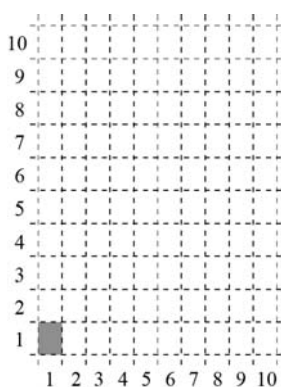
- ☐ remove all nodes of a certain grid
- ☐ remove nodes of EDS and simulate changes of WDS

$$f_{\text{grid}} = c \cdot \frac{n}{\log s_q}$$

c the number of clusters
n the number of nodes
s size of cluster q
q

8×12 grid   10×15 grid   15×20 grid
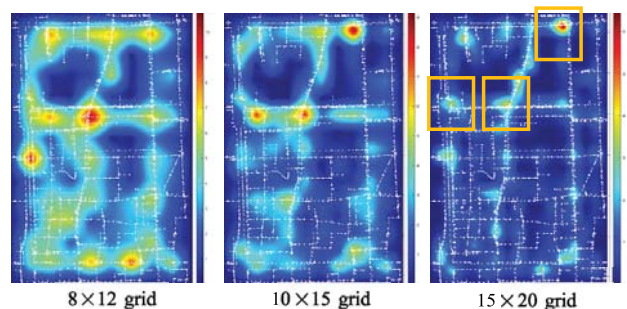
Identifying Dynamics of 2020 Flood Event & Its Effect on the Health of the Community in Kurigram District by Using Earth Observation Technology.

Tonmay Kumar Barman, Dept. of Disaster Science and Management
University Of Dhaka, Bangladesh.

Abstract

Floods are a frequent phenomenon in Bangladesh and Kurigram district is no exception. The rivers Brahmaputra-Jamuna, Dharla, Dudhkumar, and Teesta, are responsible for the majority of the flooding in this Bangladeshi region. The objective of this research is to identify the areas of Kurigram district that were flooded during the 2020 monsoon season including the extent of floodwaters and analyze the impact it remained on the health of the local population. The flood extent was mapped using Sentinel-1 SAR data from June 19 to August 18, 2020. Field surveys were performed to assist with data analysis and to ensure the accuracy of the result. According to the result, the area of floodwater has increased 23% continuously from 19th June to 13th July and decreased 15% from 25th July to 18th August. From 13th July to 25th July, it remained almost the same. Since the onset of the monsoon, the number of people suffering from water-borne diseases in flood-prone areas has increased dramatically. Women and children have suffered more than men in this crisis. COVID-19 also adds post-traumatic psychological impact on the health of people. Due to the flood, the health centers were also unable to provide their basic services and treatments. This research will help authorities in concern to identify the flood-affected areas and improve their health center facilities.

Background

Bangladesh is a tropical country prone to flooding due to the Gangetic delta and its numerous rivers. It's because it's in a basin that's less than 5 meters above sea level. During and after a flood, it is critical to capture the greatest flood extent, which can only be done through flood extent mapping techniques. The research aims to show the size of the flood, its influence on local residents' health, and how the storm affected healthcare facilities' service quality. It will also look at Covid-19's impact on the issue.

Methodological Framework
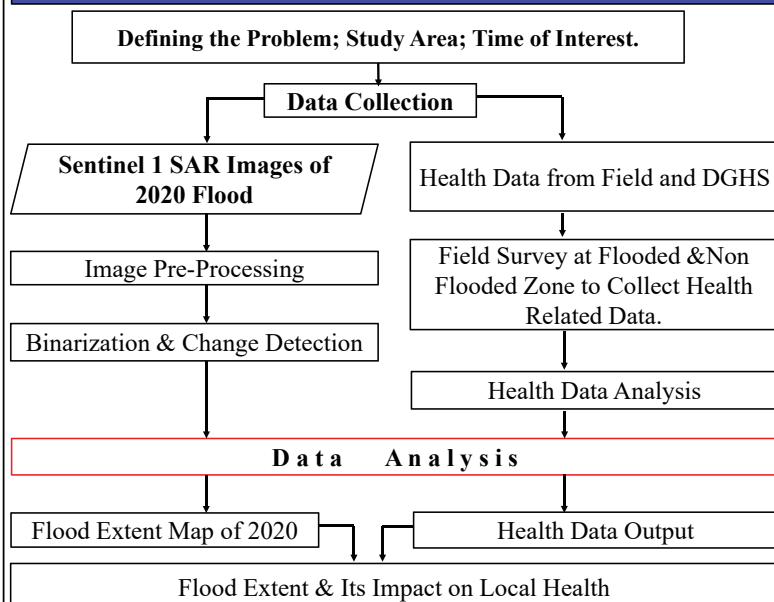
Result
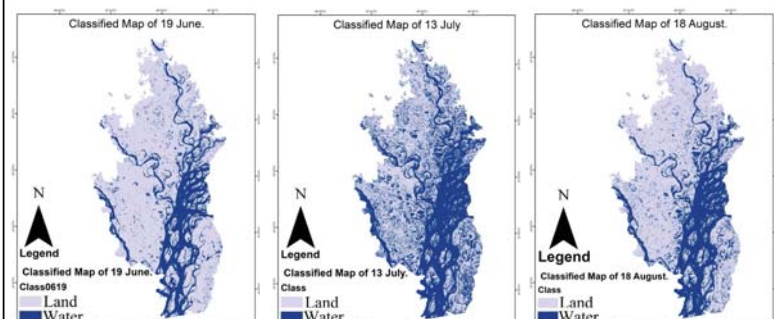
Figure: Classified Map of 19 June, 13 July, 18 August(a)

Table shows that the area of floodwater increased continuously from June 19 to July 13 and decreased from July 25 to August 18.

Class	Area in 06.19	Area in 07.01	Area in 07.13	Area in 07.25	Area in 08.06	Area in 08.18
Land	74%	59%	51%	52%	65%	67%
Water	26%	41%	49%	48%	35%	33%

Table: Area Changes in Percentage.

From 13 July to 25 July, it remained almost the same. From 19 June to 01 July floodwater area increased 15% and 8% from July 01 to July 13. 2% decreased from July 13 to July 25. Then 13% & 2% decreased respectively from July 25 to August 06, August 06 to August 18.
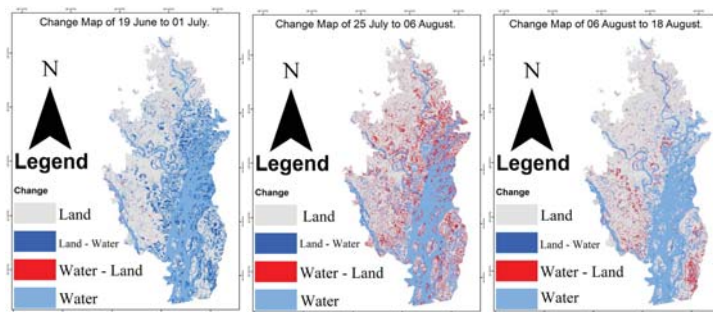
Figure: Post Classification Change Detection(b)
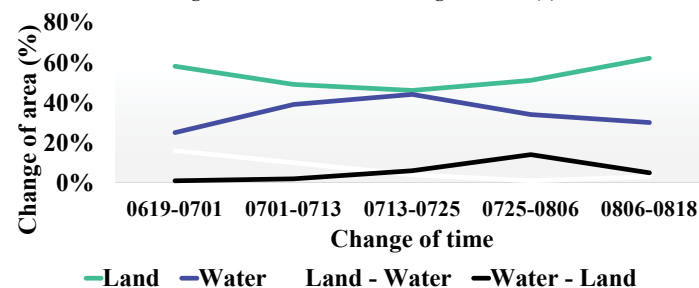
Figure: Changing trend from 06 July to 18 August.(c)

From 19th June to 25th July, flood waters increased, then subsided until 18th August. According to that analysis it can be said that the flood in Kurigram was highest on 25th July and it decreased by 6th August.
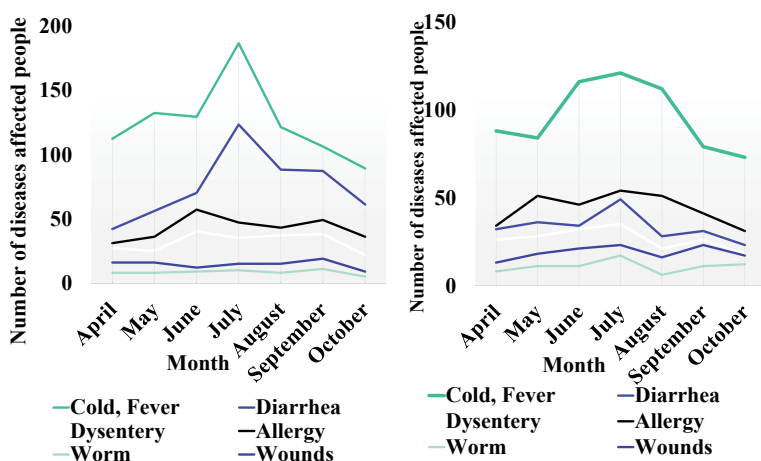

Figure: Relation between Flood and Human Health (a)

Conclusion

The area of floodwater increased from mid-June to mid-July, then decreased from late July to mid-August, according to SAR data. Between July 13th and 25th, there was more flooding. The frequency of water-borne diseases increased in flood-affected areas in July, according to data from the several. Simultaneously, more mothers and children were affected than men. The flood also entirely destroyed one union (Narayanpur) health center. As a result, patients had to seek care at a nearby union.

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GEOTECHNICAL CHARACTERISTCS ANALYSIS OF RIVERINE AND COASTAL EMBANKMENT SOILS OF BANGLADESH BASED FROM STANDARD PENETRATION TEST AND CONE PENETRATION TEST CORRELATION

Mir Md. Tousif , Abhishek Kundu & M. A. Ansary
Bangladesh University of Engineering & Technology (BUET)

Abstract

As a developing hazard prone country Bangladesh needs to predict geological characteristics to minimize natural hazard impact and ensure infrastructural development. To ensure that relationships between different geological parameters assist engineers in using empirical methods to evaluate and analyze soil performance by converting the available database of one of the two Cone Penetration Tests and Standard Penetration Tests into the parameters of the other test (s). A substantial amount of published literature suggests linear statistical correlations between the two test variables: N blow count of the SPT and cone tip resistance (qc) of the CPT. However, soil properties vary greatly from place to place due to formation history, weathering effect, soil-water interaction, and a variety of other geological factors. As a result, it emphasizes the importance of developing new correlations or examining the applicability of previously available correlations for local soil prior to practical application of those correlations for design or research purposes. This research is targeted to create a reliable correlation of geological characterization based on SPT-N value and cone bearing resistance value (qc) of CPT test of riverine soil of south area and coastal embankment soil of north area of Bangladesh. This work consists of a total of 38 data pairs of SPT-CPT tests with a significant number of field and laboratory tests following standard protocols. This research demonstrates that through CPT we can obtain continuous and reliable information about soil strata. The results of the analyses indicate that there is a good enough agreement between previously established and newly developed correlations for the studied soil type. Additionally, this study demonstrates how in-situ soil characterization enables easier and conservative structural design in Bangladesh

Introduction

- The purpose of this work is to develop an empirical equation that correlates SPT-N blow from standard penetration test and cone resistance qc from cone penetration test for soils collected from various places ranging from the northernmost riverine embankment to the southernmost coastal embankment.
- The Cone Penetration Test (CPT) is gaining popularity due to its unmatched ability to outline soil strata and continually measure soil parameters. Although the CPT is gaining popularity, earlier in-situ gear such as the SPT are still employed during sampling boring in practically all geotechnical studies. Correlations between SPT and CPT are thus of practical importance, given the large amount of existing data gathered through SPT.
- Numerous correlations must be established before CPT results can be directly applied. Prior to establishing these relationships, it is critical to connect the cone tip resistance, qc, to the SPT N-value, N60 and other parameters, in order to efficiently utilize the available data base of field performances and property correlations with

Geological Summary

- Cone penetration testing (CPT) and standard penetration testing were used extensively in field studies (SPT). Thirty-eight (38) pairs of CPT and SPT were conducted to a depth of 30m or until maximum resistance was encountered, whichever occurred first.
- The research area consisted of 11 districts (38 locations), of which four districts (15 locations) covered riverine areas, six districts (21 locations) covered coastal regions, and the other two places covered both. Each pair of CPT and SPT has been performed as closely as possible, with a maximum horizontal distance of 1m.

Methodology

- SPT were performed in accordance with ASTM D1586. Wash boring was used to advance the boreholes for the SPT. To gather soil samples from boreholes, the split spoon sampling method was utilized, and disturbed representative samples were collected. Borehole samples were stored in polypropylene bags. Shelby Tube samples were acquired undisturbed using percussion drilling. Consideration has been given to potential sources of uncertainty that could affect the SPT N-value. Throughout the test program, an experienced geologist witnessed borehole drilling, soil sampling, and SPT N-value recording techniques, and this expert supplied visual descriptions of the gathered samples. The SPT N-value was determined and samples were obtained at 1.5 m intervals.
- The CPT soundings were performed using a 10 cm2 Hogentogler type piezocone penetrometer that measures pore water pressure (u2), cone tip resistance (qc), and sleeve friction (fs). The cone was pushed into the ground at a consistent velocity of 2cm/sec. During advancement, dynamic pore water pressure, tip resistance, and sleeve friction were constantly measured in 10 mm depth increments. Most sites in this investigation had a penetration depth of around 30 m below the surface. Each borehole had a CPTu dissipation test.
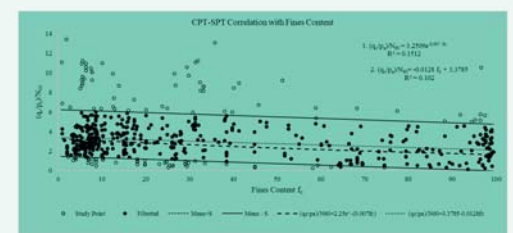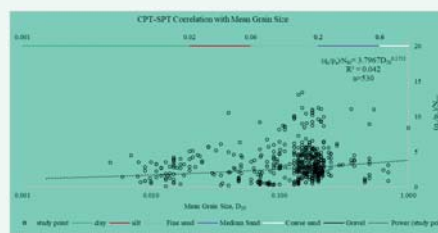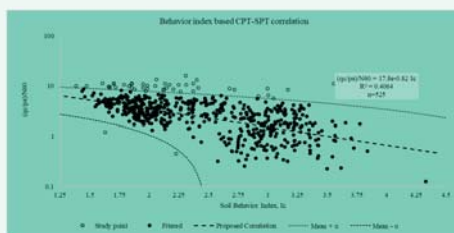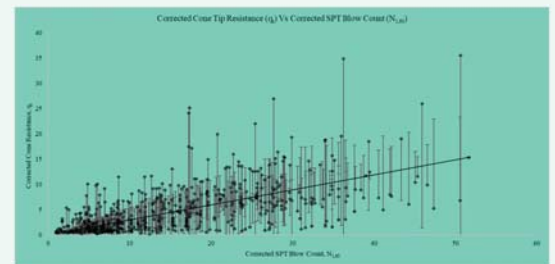
Data Summary

- CPT-based soil classification has been compared to SPT-based classification, and CPT-based classification is generally faster, more consistent, and consistent with conventional categorization. The qt/N60 ratio was found for a variety of soil types using an R2 value ranging from 0.1 to 0.35. Additionally, it has been shown that when the behavior index value and fines content increase, the qt/N ratio drops, whereas it increases as the mean grain size increases. With increased SPT blow count and cone tip resistance, the strength parameters grow in value. With rising cone tip resistance and qt/N ratio, the compression index drops. With increasing cone tip resistance, plastic limits appear to grow. The proposed correlation are described in the graphs above.

Conclusion

The research's primary purpose is to characterize soil using in-situ test parameters. To accomplish this, soil categorization was performed directly utilizing CPT test results; correlations for index parameters, strength parameters, compressibility characteristics, and plasticity qualities were proposed. Additionally, correlations between CPT and SPT have been established for various soil types, indicating that any of these two tests may be used to characterize soil. The primary barrier is the scarcity of laboratory testing. To ensure the correctness of the results, strength parameters and compressibility characteristics were measured using undisturbed samples, althongh there were only a limited number of undisturbed samples for a relatively narrow depth range. While modern technology and recent advancements in sampling enable the gathering of undisturbed sandy samples, no undisturbed sandy sample was acquired for this investigation. Another constraint is the reliance on manual machinery rather than automated ones.

The relationship between bridge characteristics and condition rating for road bridges in Lao PDR

1. Silimanotham Hatthaphone, Doctoral 1st yr on Regional Environment System, Course Graduate School of Engineering and Science, Shibaura Institute of Technology.
2. Associate Professor Michael Henry, Department of Civil Engineering, Shibaura Institute of Technology.

Abstract - This paper presents a situation of bridge infrastructure in Lao PDR to indicate the bridge database including the bridge characteristics and bridge condition rate. Approximately 80 percent of the bridge in Lao PDR was constructed before the 1990s and became the reinforcement to concrete bridge. Almost all bridge span are short and medium-length, smaller than 30 meters and the carriageway of bridge would be the narrow type. This study focuses on analyzing the relationship between bridge characteristics and bridge condition ratings for the purpose of understanding the current state condition of bridges. The analysis process start form the observation of bridge characteristics on the database to clarify the details of bridge such as the span length, carriageway width, structure types, constructed year etc. Next process focus on the bridge condition ratings to find the relationship factors between the bridge characteristics and the rate of bridge condition by statistical analysis. Furthermore, statistical analysis can also be the verification of hypothesis on this relationship factors. In conclusion, the results illustrate the value of relationship factors between the bridge characteristics and the bridge condition ratings.

Keywords: Bridge characteristics, bridge condition rating, Lao PDR, statistical analysis.

Introduction

Bridge database is necessary for bridge management work including bridge characteristics and bridge condition rating. Most bridges in Lao PDR was constructed before the 1990s and became the reinforcement concrete bridge. However, this study is interested on the bridges that are located and belong to the national road.

Road Classification

1. National	2. Provincial
3. District	4. Urban
5. Rural	6. Special

Objective

- To understand the current state condition of bridge.
- To identify the relationship factors between bridge characteristics and bridge condition ratings.

Methodology

❖ Bridge database from the government agency.
❖ Bridge database details:
- Geometric data: span length/member lengths, support condition, truss spacing, roadway widths etc.
- Bridge Element and condition data: element types and actual element sizes, material grade and material losses due to deterioration or corrosion.

Next Process

Summary → Identify → Analysis

Results and Discussions

- Belong to the national road, are 840 bridges with 6 bridge types as concrete girder, concrete slab, steel girder, steel truss, wooden and other.
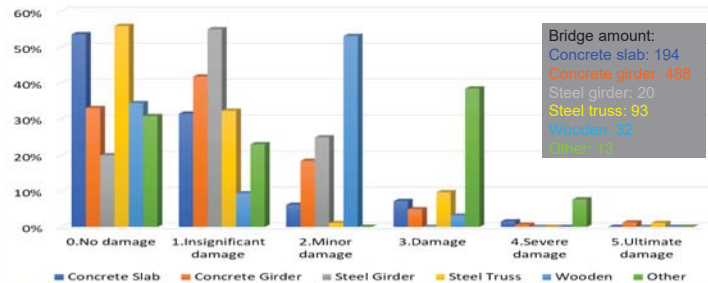- 4 variables of construction year: before 1990s, 1991 to 2000, 2001 to 2010 and after 2011.
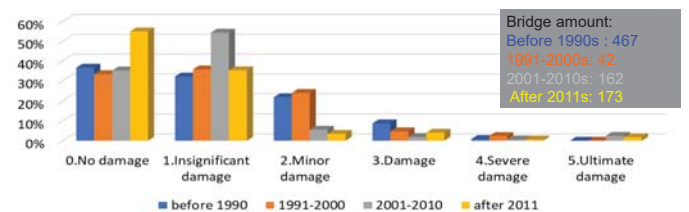- Analysis method:
  This research analyze database on statistical analysis in Microsoft Excel program by using correlation test at 95% of confidence level
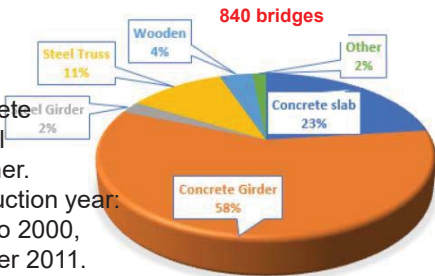
840 bridges

Pie chart: Wooden 4%, Other 2%, Steel Truss 11%, Steel Girder 2%, Concrete slab 23%, Concrete Girder 58%

Relationship between bridge types and condition ratings

Bridge amount:
Concrete slab: 194
Concrete girder: 488
Steel girder: 20
Steel truss: 93
Wooden: 32
Other: 13

(x-axis: 0.No damage, 1.Insignificant damage, 2.Minor damage, 3.Damage, 4.Severe damage, 5.Ultimate damage; legend: Concrete Slab, Concrete Girder, Steel Girder, Steel Truss, Wooden, Other)

Relationship between construction year and condition ratings

Bridge amount:
Before 1990s : 467
1991-2000s: 42
2001-2010s: 162
After 2011s: 173

(x-axis: 0.No damage, 1.Insignificant damage, 2.Minor damage, 3.Damage, 4.Severe damage, 5.Ultimate damage; legend: before 1990, 1991-2000, 2001-2010, after 2011)

> Correlation between condition ratings and each bridge type

Bridge types	Correlation value	P_value
Concrete slab	-0.8911	0.0171
Concrete girder	-0.9025	0.0137
Steel girder	-0.7099	0.1139
Steel truss	-0.8500	0.0320
Wooden	-0.6055	0.2026
Other	-0.5252	0.2845

After correlation test in Excel: the results indicate 3 bridge types as the significant correlation values and 3 bridge types have not got the significant correlation values.

Attention:
- Significant: p_value < 0.05
- Not significant: p_value >0.05

> Correlation between condition ratings and each construction year group

Construction year	Correlation value	P_value
Before 1990	-0.9789	0.0006
1991-2000	-0.9416	0.0050
2001-2010	-0.7753	0.0700
After 2011	-0.8618	0.0273

After correlation test in Excel: the results indicate 3 construction year as the significant correlation values and 1 construction year have not got the significant correlation values.

Attention:
- Significant: p_value < 0.05
- Not significant: p_value >0.05

Summary

The results indicate the characteristics of bridges that belong to the national road in Lao PDR and the relationship between bridge characteristics and state condition rating by correlation coefficient on 95% of confidence level. However, some results did not show significant on the relationship factors because the number of p_value are bigger than 0.05.

Future Works

In the future, the researcher would like to predict the remaining of bridge structure life by using the deterioration model, to study the optimization of maintenance cost and to manage the life cycle of bridge management plan for short term, medium term and long term.

For further information, contact below.
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Hotspot Analysis of COVID-19 Effects on Inland Waterway Accidents in Bangladesh

Aninda Kumar Chowdhury

Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh

Abstract. The Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) is the cause of the corona virus disease. This disease has caused the COVID-19 pandemic all over the world. Bangladesh imposed lockdowns and restricted local transportation after the World Health Organization declared this pandemic in March 2020. Bangladesh is a riverine country and so a large portion of the nation's business depends on waterway transportation. The restricted waterway transportation, as a result of the pandemic, has affected the rate of waterway accidents in the country. This deviation in the rate of accidents is the matter of study in this research. The study was based on newspaper reports of 2019 and 2020. The descriptive statistics demonstrate that the waterway accidents reduced by 10% after the pandemic. Number of deaths, injuries and lost people decreased by 34% altogether. 6% of the total accidents occurred in the post-pandemic period and these accidents took 9% of the lives. The study also comprises a hotspot analysis based on ArcGIS. This analysis graphically shows the regions of Bangladesh where there were the most number of accidents during the COVID-19 pandemic lockdown.

Keywords. COVID-19 Pandemic, Waterway Accidents, Maritime Safety

Introduction

Bangladesh being a riverine country, depends vastly on its waterways for transportation. According to Bangladesh Inland Water Transport Authority (BIWTA), Bangladesh has about 24,000 km of waterways. Of this, the navigable length is 5,968 km in the rainy season and 3,865 km during dry seasons. Despite being such a crucial mode of transport, this sector still sees many accidents. This poster contains the hotspot analysis of the accidents occurring during the COVID-19 lockdown period.

Objectives

1. Identifying the district with the maximum frequency of accidents during the COVID-19 pandemic
2. Identifying the factors behind the change in the frequency of accidents during the pandemic

Collection of Data

Two years (2019-2020) of daily newspaper-based data.

Methodology
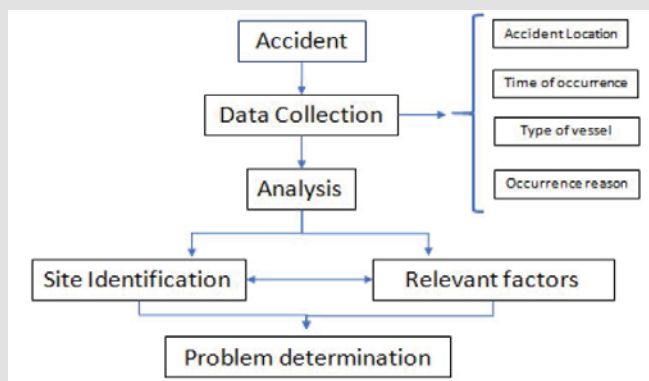
Accident hotspot analysis using ArcGIS

Before the pandemic

After the pandemic

Graduated color range
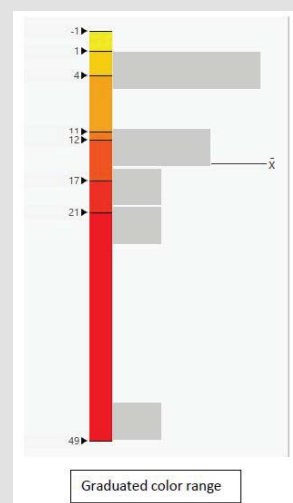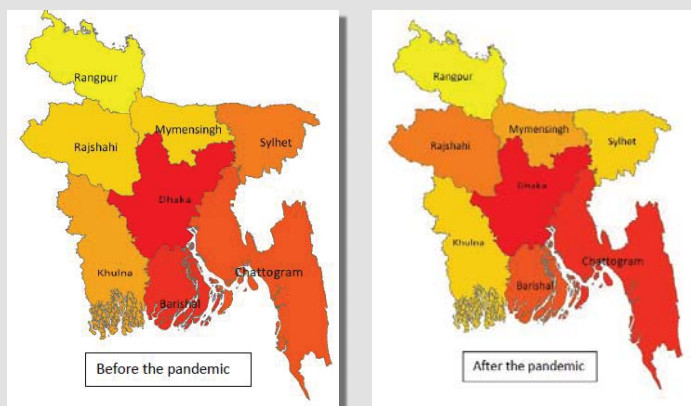
Summary of the Analysis

Summary	Before	After
No. of Accident	120	108
No. of Fatality	129	201
No. of Injury	101	26
No. of Missing	289	118
Total No. of Casualty	519	345

Conclusion

Comprehensive study on effects of COVID-19 on waterway accident factors verifies some very important observations, such as decreased number of accidents (10%) instigated abnormal increased number of fatalities (55.81%) which can highlight the fact people did not travel much in the pandemic period. When they did, they did in bulk volume which resulted in overcrowding and hence accidents occurred. The database which is used to build this analysis is based on daily newspapers. It is worth noting that a large number of accidents are often unreported.

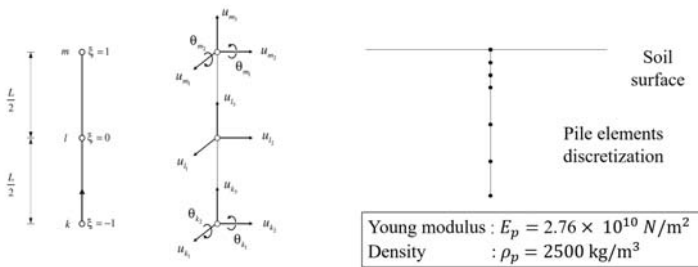# Dynamic structure-soil-structure interaction of pile groups among structures: a parametric study

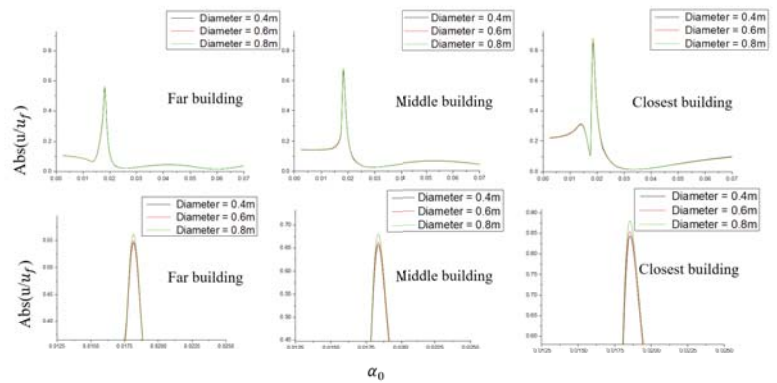## Bo Mahai, The University of Tokyo, China, doctor 1st year

The dynamic behavior between structure and soil under seismic load has been widely studied in the recent years. As a branch of structure-soil-interaction (SSI), the structure-soil-structure interaction has been studied for some problems in the past. However, as a popular foundation form of structures, the parametric study for pile-supported structures towards the parameter of piles is remaining as blank. This thesis aims at carrying a parameter study on the pile group foundations by using a coupled BEM-FEM model on a viscoelastic semi-infinite soil medium under harmonically varied near-field ground motion.

In this work, the parametric studies of pile lengths, pile diameters, and pile arrangement will be studied considering three pile-supported structures lying on the soil surface. The piles and superstructures are modeled by FEM, and the half-space soil is modeled by BEM. Frequency domain numerical analysis has been used in this work. Through the numerical simulation, how the SSSI affects the behavior of pile group foundation will be studied.

Pile finite element elements

Young modulus : $E_p = 2.76 \times 10^{10}$ N/m^2
Density : $\rho_p = 2500$ kg/m^3

Superstructures and material properties

$H = 18$ m

Floor slabs:
$m = 6 \times 10^5$ kg

Cap slabs:
$m_0 = 1.5 \times 10^5$ kg

0.4×0.4 m
6m

damping ratio of piers : $\zeta = 0.05$
mass moment of inertia : $I_x = I_y = 0.05mh^2$
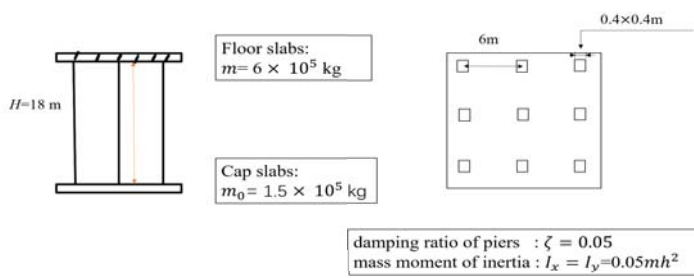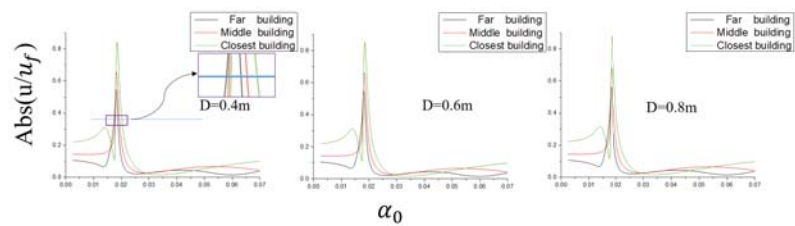
Soil boundary element mesh and properties

Soil Properties

Young modulus: $E_s = 2.76 \times 10^7$ N/m^2
Density : $\rho_s = 1750$ kg/m^3
Soil damping : $\beta_s = 0.05$
Poisson ratio : $v_s = 0.4$
Ratio of Young modulus: $E_p / E_s = 1000$
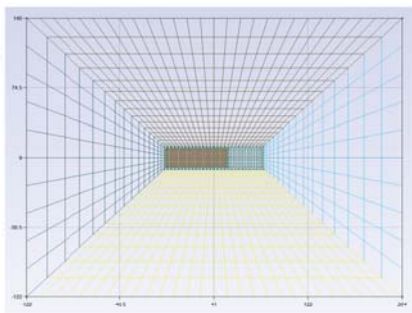
Boundary element meshes:
9,413 nodes
2,466 elements

Input motion and structures arrangement

18m   25m

Far   Middle   Closest

Input motions:
$u_f = e^{i\omega t}$
on the y direction

Semi infinite half-space soil

Pile diameter study

α_0

Pile diameter study

α_0

D=0.4m   D=0.6m   D=0.8m

Summary table

Length	Far building			Middle building			Closest building		
	6m	8m	10m	6m	8m	10m	6m	8m	10m
Max Abs(u/u_f)	0.531	1.02	0.576	0.629	1.57	0.700	0.786	3.57	0.905
Percentage varies	0.0	+92.1%	+8.47%	0.0	+146.6%	11.3%	0.0	+354.2%	+15.1%

Diameter	Far building			Middle building			Closest building		
	0.4m	0.6m	0.8m	0.4m	0.6m	0.8m	0.4m	0.6m	0.8m
Max Abs(u/u_f)	0.547	0.550	0.563	0.656	0.662	0.681	0.843	0.853	0.881
Percentage varies	0.0	+0.58%	+2.88%	0.0	+0.84%	+3.77%	0.0	+1.20%	+4.50%

Arrangement	Far building			Middle building			Closest building		
	2×2	3×3	4×4	2×2	3×3	4×4	2×2	3×3	4×4
Max Abs(u/u_f)	0.549	0.562	0.577	0.667	0.681	0.702	0.873	0.881	0.911
Percentage varies	0.0	+2.49%	+5.25%	0.0	+2.10%	+5.21%	0.0	+1.0%	+4.40%

Conclusions

1. Within a certain range, pile length, diameter, and arrangement barely change the configuration of response curve and natural frequency.
2. The frequency dependent dynamic stiffness of structure-soil-structure system is dominant factor for the maximum response.
3. Shielding effect can make structures less likely to generate large displacement.
4. The more maximum response, the greater the Shielding effect can be observed.

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HP: http://risk-mg.iis.u-tokyo.ac.jp/index.html

Detection and disaster risk evaluation of solar photovoltaic cells by satellite remote sensing data and a machine learning method

Shoki Shimada, University of Tokyo, Japan, M2

The strong demand for renewable energy has contributed to the dramatic increase in the number of solar photovoltaic cells. However, those solar PV cells located in lowlands or steep slopes are vulnerable to natural disasters such as flooding and landslides. Therefore, a simple and cost-effective method of monitoring the locations of those structures is needed. In this study, a combination of Sentinel-1 data and Sentinel-2 data was used to detect solar PV cells by using a machine learning method. Subsequently, the detected locations of solar PV cells were compared to flood and landslide hazard maps to find the high-risk groups. Since this method requires no commercial satellite data, it can be expanded into larger areas and arbitrary timing without budgetary problems.

1. Introduction

•It is important for the authorities and companies to take appropriate actions based on the types of risks on the increasing number of solar PVs around Japan.

•A latest record and the potential risks of the solar PVs will be helpful for disaster mitigation activities on the facilities.

•In this study, a simple and cost-effective method of solar PV structure detection with freely available satellite data was proposed, and the result was compared to the public hazard maps.

https://www.meti.go.jp/shingikai/sankoshin/hoan_shohi/denryoku_anzen/newenergy_hatsuden_wg/pdf/014_01_00.pdf

Fig.1 Damaged solar PV cells

2. Method

Input data

•Sentinel-1 SLC (Coherence)

•Sentinel-2 level-2A

•Temporal average coherence

Classification method

•Random Forest classification

Refinment of the results

•Number that a pixel classified as a solar PV>4 out of 9 classification
=> Final solar PV cell
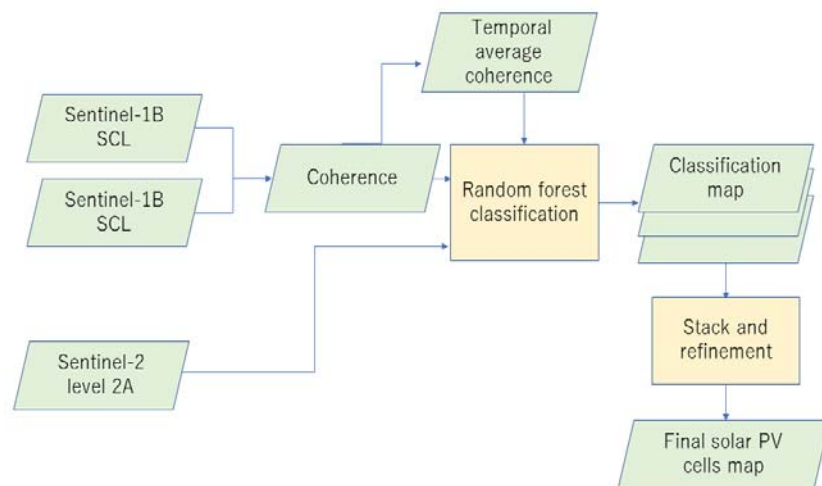
Fig.2 Flow chart of the study

3. Results & Future works

•A good result in terms of the user's accuracy and the overall accuracy was achieved by the proposed approach.

•By comparing the detected solar PV locations to exiting hazard maps, it was observed that the number of facilities facing the high flood risk is high in the region.

•The producer's accuracy was lower than that of the exiting high-resolution LULC map of Japan (ver. 21.03).

•Use of the different orbit data and the advanced classification method such as an object-based machine learning are the possible way of improving the detection accuracy in the future works.

Overall accuracy	User accuracy	Producer accuracy
97.1%	100.0%	81.8%

κ coefficient=0.897

Fig.3 Accuracy assessment result
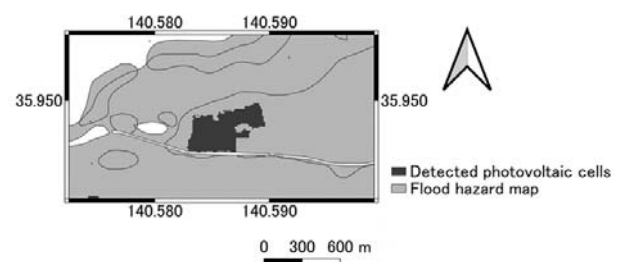
Fig.4 An example of the detected solar PV cells within a flood hazard map

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Modeling the Spatio-Temporal Correlation of Hydrological Variations with Accident Frequency in the Ganges-Padma River Route

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Abstract. Waterway navigation safety in Bangladesh has been a persistent concern as numerous accidents take place every year taking passengers' lives and distressing socio-economic conditions of the affected. Therefore, this study delineated the waterway accident hotspot zones of Bangladesh with two statistical methods, Cluster and Outlier Analysis (Anselin Local Moran's I) and Getis Ord Gi* using ArcGIS. The result exhibited that the accident-prone areas were inside or vicinal to the Bengal delta or Padma-Meghna estuary part of the Bengal delta for the years of 2018-2020. The Ganges-Padma is one of the main channels of the Bengal delta in Bangladesh. Two hydrological parameters- monthly average discharge and monthly average Water level of the Ganges-Padma were evaluated against the accident data in the river for the same three years. Changes in these two parameters were observed in this study by analyzing the data acquired from BWDB (Bangladesh Water Development Board) for three stations situated in the Ganges-Padma route - Hardinge Bridge station in Kushtia in the upstream, Hariampur Station in Manikganj, and Mawa station in Munshiganj district in the downstream. The data showed higher monthly average discharge and water levels in the three aforementioned stations from June to October. This period was identified as the wet season and the period November to May was identified as the dry season for this research. The correlation study carried out in Excel with the accident data that occurred in the Ganges-Padma River for three consecutive years (2018-2020) showed that the accident frequency is affected with hydrological changes of the River. Hence, it could instigate further investigation of the extent of the impact of hydrological characteristics of the river routes in the research domain regarding the improvement of safety measures in waterway navigation in Bangladesh.

Methodology Framework
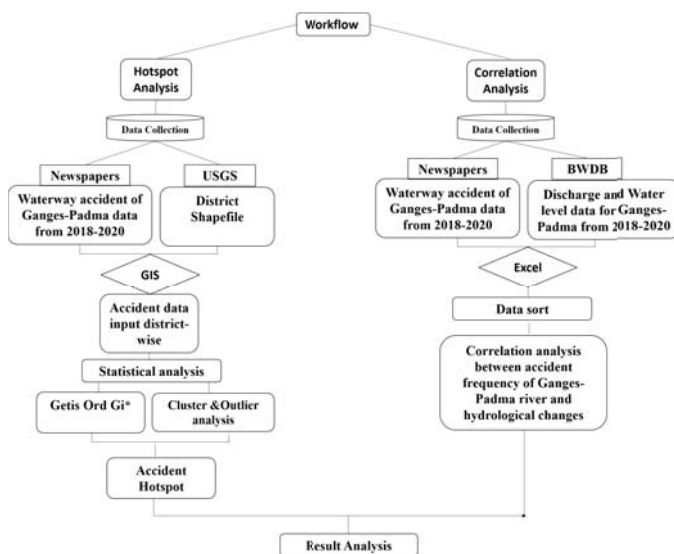
Hotspot Analysis

Figure: Study Methodology
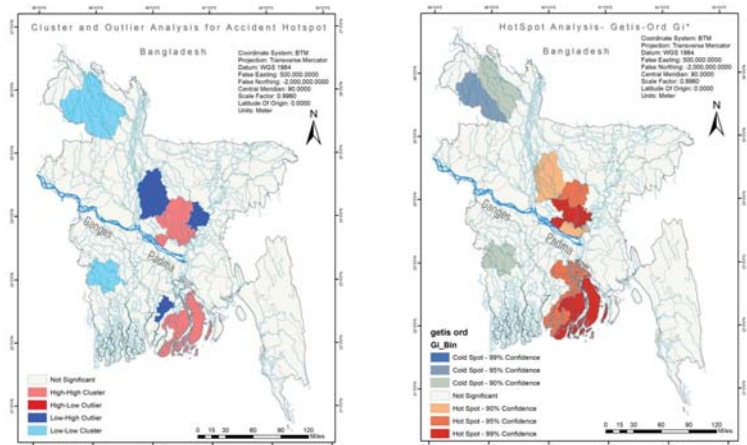
The statistical report of cluster and outlier analysis showed Jhalkathi, Barisal, Tangail, Norsingdi districts were in the zone of a high outlier and the districts Gazipur, Dhaka, Narayanganj, Bhola, Patuakhali, Noakhali were in the zone of the high cluster with a 95% confidence level. The statistical report of Getis Ord Gi* showed Patuakhali, Bhola, Noakhali, Dhaka as hotspots with 99% confidence level and Barisal, Barguna, Munshiganj, Gazipur, Tangail district with 95% confidence level.

Correlation Analysis For Ganges-Padma River Route of Bengal Delta
Hydrological Parameters- Monthly Average Discharge And Monthly Average Water Level
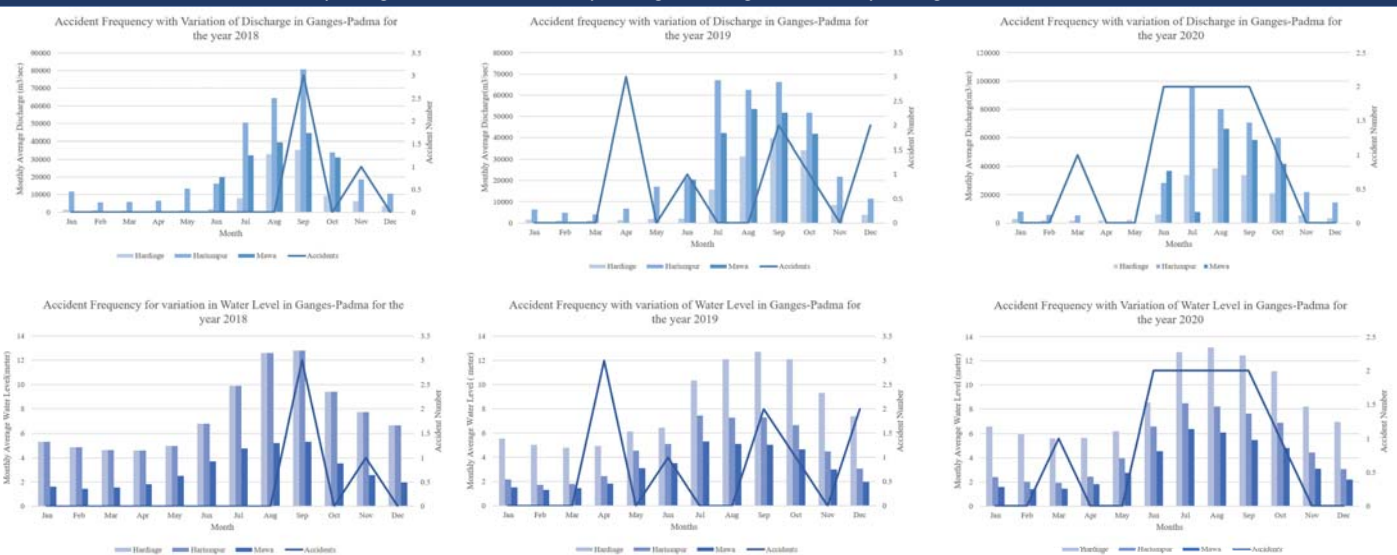
The analysis observed that 75% of accidents in 2018, 67% of accidents in 2019, and 80% of accidents in 2020 had occurred in the wet season out of all the waterway accidents in their respective years. On average, for all the waterway accident events recorded for three consecutive years (2018-2020) in the Ganges-Padma River route, 74% of them had occurred during the wet season when the monthly average discharge and water level were also observed to be higher than the dry season from the BWDB data.

DAMAGE CHARACTERISTICS OF THE 2019 YAMAGATA PREFECTURE EARTHQUAKE AND DAMAGE CLASSIFICATION IN KOIWAGAWA

Teng Limin

Nagaoka University of Technology, Nagaoka, Japan

Abstract

On June 18th 2019 ,the earthquake occurred in the offshore of the Yamagata Prefecture, Japan. We conducted a quick survey in the affected area on June 20th,. There were two purposes for this survey:(1) to grasp a whole damage and situation,(2) to confirm relation between damage and geotechnical condition. Most of the earthquake damage was to tile roofs. A lot of roof tile damage occurred in Koiwagawa which is located in near source area. Damage situation was different even within a narrow area by aerial photography survey and site investigation ,it was assumed that the distribution of ground motion was different by place.

Introduction
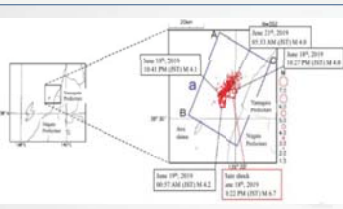
Location of epicenter

Earthquake：2019 Yamagata Prefecture Earthquake
Date and time：June 18, 2019 22:22
Scale：Mw6.2
Epicenter：Offshore Yamagata Prefecture（38°36.4′N 139°28.7′E）
Depth：About 15km
Maximum seismic intensity：6＋Fuya, Murakami City, Niigata Prefecture

Objective

W H Y

(1)A lot of roof tile damage occurred in Koiwagawa.
(2)Damage situation was different even within a narrow area.

Observation results

◆Ground motions

1.The hypocentral distance is about 10 km.

2.Maximum horizontal acceleration reached 633.4 cm/s^2.

The acceleration response spectra have a large amplitude at a short period range, and it exceeded 2,000 cm/s^2 at a period range of 0.1s to 0.2s.
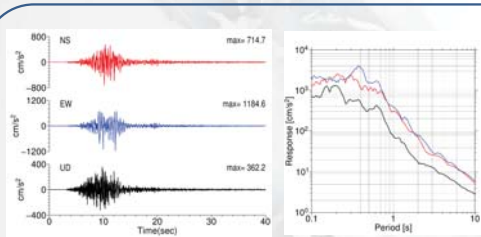
Observed acceleration wave-forms and acceleration response spectra (h=0.05) of Fuya station

Observed acceleration wave-forms and acceleration response spectra (h=0.05) of YMT004

◆Damage situations

Persons
Houses

9 serious injuries
34 minor injuries

36 partially destroyed
1,245 partially damaged
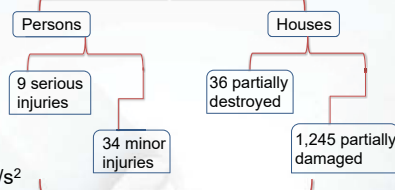
1)Housing damage is concentrated in Yamagata and Niigata Prefectures.
2)No major damage such as a house collapse.
3)The damage of Fuya area, where seismic intensity 6+ was observed, was minor.

◆Damage classification in Koiwagawa

Blue sheets =roof damage houses
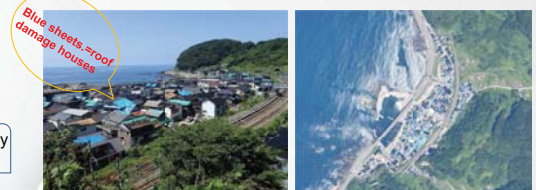
Damage situation of roof tile in Koiwagawa on June 20th,2019

Aerial photograph in Koiwagawa area on June 26th,2019

Category A the highest damage ；
Category C mostly no damaged ；
Category B medium damage rate.

Houses Category	Total number	Blue sheet	Damage ratio
A	47	22	46.81%
B	34	13	38.24%
C	10	0	0
Total	91	35	38.46%

The **site amplification characteristics** of Koiwagawa area is different by location.

Summary

1) Seismic intensity of 6+ was observed at Fuya station, but the damage was minor.

2) The main damage was tiled roof damage of wooden house.

3) Damage ratio of tile roofs were different by place in Koiwagawa area.

We assumed that the ground motions were different.

Review of the existing road safety issues and improvement practices in Nepal

Nitesh Acharya, PhD Candidate, Department of Civil Engineering, Shibaura Institute of Technology, Tokyo
Michael Henry, Associate Professor, Department of Civil Engineering, Shibaura Institute of Technology, Tokyo

Abstract

Road crash is a major concern for least developed country like Nepal because it is responsible for huge loss of human life and economy. In the year 2020, approximately there was 2500 fatalities and 6500 people were seriously injured. A study in the year 2017 shows that the crash cost was around USD 123 million which is equivalent to 1.52% of the nation's Gross National Product. Every year road crash fatalities and injuries are rising because of the unsafe roads and this demonstrates the urgency to reduce road crashes.

After reviewing various reports from government and donor agencies, we can conclude that there is multiple reason for steady increase in yearly crash numbers in Nepal. One of the major reasons for the crashes, is poor road condition in the remote areas of the nation. Due to the geographical terrain, roads in hilly regions have multiple blind curves and the edges of the roads do not have safety barriers. The urban cities and plain land have heterogenous traffic and vulnerable road users like pedestrian, bicyclist and motorcyclist are prone to crashes because of inadequate infrastructures to isolate them from main traffic. Road users lack proper safety education and the nation's prevailing rules and regulations are not properly executed. Besides, only a small amount of fund is being allocated by the government to improve road safety features and in addition to that, there is no clear plan or methodology to rationally spend that budget.

Through this study we can explore the predominant reasons for road crashes and the effective mitigation measures which can be easily implemented in case of Nepal. It is believed that the outcomes will give guidance for further study and contribute in reducing road crashes.

Introduction

Figure 1: Strategic Road Network of Nepal, (Source: DoR)

Figure 2: Road crash trend in Nepal (Source: Nepal Police)
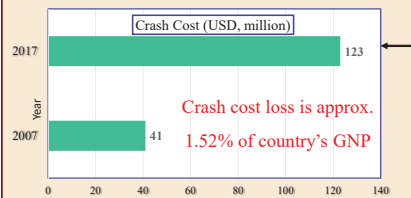
Figure 3: Crash cost in Nepal (Source: Banstola et al,2017)

❖ Huge reliance on Land/Road Transport
❖ 14220 Kms of strategic road network vital for the socio-economic growth
❖ Only 43% road's pavement condition is in good state (Based on IRI)
❖ Government has plan to construct 1000Km roads/ year for next 4 years
❖ Focus mainly on new construction rather than maintaining existing ones
❖ Every year 0.1 million new vehicle are registered (including two-wheelers)

Increased road length and vehicles have significantly increased road traffic crashes and causalities

Source: www.nepalitimes.com

"High-fatality crash" is very common in mountainous roads

Objectives

❖ To understand the road traffic safety situation in Nepal.
❖ To review the existing road safety practices that are being adopted by the government and private agencies, along with the gaps in those practices.
❖ To explore effective crash mitigation measures and practices which can be easily adopted in low income country like Nepal.

Methodology

Almost all information and data used are secondary data, collected through papers and reports published by government and donor agencies. Crash data was retrieved from Nepal Police records. Information regarding crash cost, current budgetary allocation and safety initiatives was collected from Department of Road's (DoR) publications. The World Bank's country report- "Delivering Road Safety in Nepal" was thoroughly reviewed for additional information. All the finding and conclusions are made after reviewing these documents.

Results and Findings

1) Crash Data Management

❖ All vehicular crash data are maintained by Nepal police
❖ Standard format are available, but are not used and thus provides inconsistent data
❖ Many crashes in rural areas not reported at all, particularly minor crashes
❖ Recently the Road Accident Information Management System (RA-MIS), the first web-based crash database management system and is being piloted in few traffic police stations
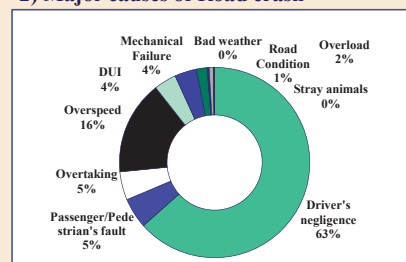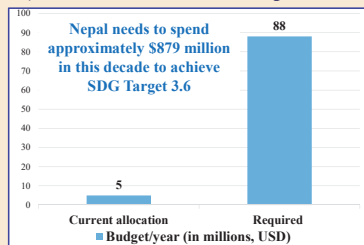
2) Major causes of Road crash

Figure 4: Causes of Road Crashes,(Source: Nepal Police)

\# Based on Traffic police data from the year 2008 to 2019

Major reasons for most of the crashes is inadequate "Safe driving culture"

Actions: 3Es

Task 1: Education & awareness campaign for Road user
Task 2: Engineering road infrastructures so that human error can be forgiven and there is minimal loss
Task 3: Enforcement of laws

3) Current efforts of stakeholders

Government

Agency/ Institutions	Acts/ Regulations	Publications
• Nepal Police • Department of Roads • Department of Traffic Mgmt. • National Road Safety Council • Ministry of Health	• Road Safety Act (Draft) • Public Road Act • Motor Vehicle and Transport Management Act • Nepal's Transport Policy	• Nepal Road Safety Action Plan (2013-2020) • Road Safety Notes • Traffic Sign Manuals • Nepal Road Standard

Private Institutions
• Road safety awareness campaign: Traffic safety week, school campaigns
• Corporate Social Responsibility: Donating Traffic Sign posts, Maintaining trees and shrubs of road median

Donor Agencies
• Grants/ Loans: to execute road safety programs
• Technical support: research works, assistance in drafting related policies & guidelines
• Conduction of trainings, seminar, conference and safety campaign

4) SDG Goals and Scaled-up investment

Figure 5: Road Safety Investment Status (Source: World Bank, 2020 & DoR)

Nepal needs to spend approximately $879 million in this decade to achieve SDG Target 3.6

TARGET 3·6
REDUCE ROAD INJURIES AND DEATHS

By 2030, halve the number of global death and injuries from road traffic accidents

Scaled-up road safety investment in Nepal will also contribute in achieving other sustainable mobility goals like improved transport mobility, universal accessibility, climate change mitigation and reduced air & noise pollution (SUM4All, 2017)

Summary

Through this study we can conclude that, the situation of road traffic safety in Nepal is not in very good shape. Although some efforts and measures have been taken by government, private institutions and donor agencies to mitigate the problem, there is still a great challenge ahead. The national government is the most responsible stakeholder and hence should prioritize and act aggressively, because road safety is vital to national health, well-being of citizen and economic growth of the country. Some of the mitigation measures that can be brought straight into action are:

❖ Road Safety Act bill should be immediately passed by the parliament
❖ Crash data management system has to be made more robust
❖ Training and awareness campaigns to develop & promote Safe Road Safety Culture
❖ Imminent scaled-up investment for short-term to long-term interventions

❖ National Road Safety Council should be legally backed up and provided with necessary resources for effective operation and enforcement
❖ Adopting Safer Road Investment Plan: scientific prioritization of road safety improvement on high risk roads
❖ Existing manual, concept notes and guidelines for implementing safety projects needs to be updated along with National Road Safety Action Plan

Future Work

This research helped a lot in identifying potential road safety issues and probable areas to work with in future. In the upcoming days, the researchers would like to develop a methodology to prioritize future road safety projects and interventions using Multi Criteria Analysis (MCA) techniques.

Modified Andreasen & Anderson Particle Packing Method to Develop Low Cement High Performance Concrete with Partial Replacement by Fly Ash and Silica Fume

Binay Karna[1], Thanakorn Pheeraphan[2]

[1]Research Assistant, Structural Engineering Department, Asian Institute of Technology
[2]Professor, Department of Civil engineering, Royal Thai Force Academy, Thailand

Abstract - With the groom in construction industry with rapid urbanization, need for high-performance concrete is increasing exponentially because of its high mechanical and durability properties. CO_2 emissions related to production of cement is proving to be a big threat for environment because of which sustainability is a big challenge for concrete industry. High-Performance concrete with minimization of cement is must. So, for address this particle packing approach with partial replacement of cement with SCMs is major objective of this work. Mix designs have been developed using Design of Experiment (DOE) for Modified Andreason & Andersen Particle packing model and results were compared to ACI control mixes. Five-factor two level central composite design DOE was with the maximum and minimum Silica Fume and Fly Ash replacements being 15 kg/m³ & 66 kg/m³ and 0 kg/m³ & 83 kg/m³ respectively. The comparison for strength and durability was done by five tests i.e., Slump, compressive strength, rapid chloride penetration, abrasion resistance and absorption. The concrete mixes were also analyzed for sustainability in terms of cement consumption and CO_2 emissions per MPa of concrete. Testing for the 28-day and 56-day properties the mix with 73% Portland cement, 13% silica fume and 14% fly ash was most efficient one. For the mixes, the average reduction in CO_2 emissions per MPa was about 30-40%. In addition to this the concrete developed had good workability with average slump of 189.56mm and very high durability (average RCPT & abrasion resistance value being 898.596 Columb & 0.285%). The conclusion drawn can be used to develop efficient and ecological high-performance concrete. This will contribute to significant reduction of CO_2 emissions.
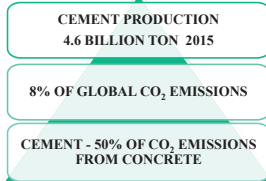
Introduction

With the giant leaps in the construction industry these days; High Performance Concrete is widely used because of its-
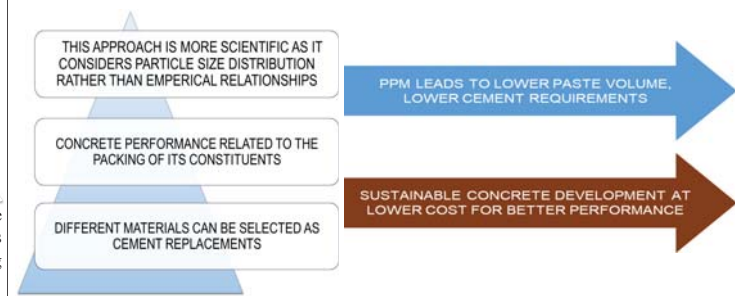- High strength
- High workability
- High dimensional stability & durability
- High density (high modulus of elasticity)

Even tough HPC has longer service life, it requires high use of binder (generally cement is 600-800kg/m³)

This accounts into high amount of CO_2 emissions. Sustainability is a major issue of concrete industry due to CO_2 emissions attached to cement production. High performance concrete with minimum use of cement is required. Partial Replacement of cement with different SCMs is done for this but in most cases, it decreases the desired performance of concrete. So, particle packing approach along with the partial cement replacement can be a solution.

CEMENT PRODUCTION 4.6 BILLION TON 2015

8% OF GLOBAL CO_2 EMISSIONS

CEMENT - 50% OF CO_2 EMISSIONS FROM CONCRETE

WHY PARTICLE PACKING APPROACH ????

THIS APPROACH IS MORE SCIENTIFIC AS IT CONSIDERS PARTICLE SIZE DISTRIBUTION RATHER THAN EMPERICAL RELATIONSHIPS

CONCRETE PERFORMANCE RELATED TO THE PACKING OF ITS CONSTITUENTS

DIFFERENT MATERIALS CAN BE SELECTED AS CEMENT REPLACEMENTS

PPM LEADS TO LOWER PASTE VOLUME, LOWER CEMENT REQUIREMENTS

SUSTAINABLE CONCRETE DEVELOPMENT AT LOWER COST FOR BETTER PERFORMANCE

Objective

- Development of mix for HPC with low cement based on Modified Andreasen & Andersen Particle Packing Approach.
- Present the sustainability analysis of concrete mixes based on CO_2 emissions per MPa.

Six Control Mixes were developed using ACI 211.1 for comparing the outputs with thirty-three mixes from PPM. Fresh property, hardened property and durability studies were done for 28-day and 56-day testing to develop conclusion.

Analysis of Results

- Fresh property for most of the PPM mixes were better than ACI control mixes.
- For same design parameters the strength for PPM mixes were 10-13% higher compared to ACI.
- Durability properties i.e. RCPT, abrasion & Absorption were also better for PPM mixes.

Sustainability Analysis

CO_2 emissions per MPa
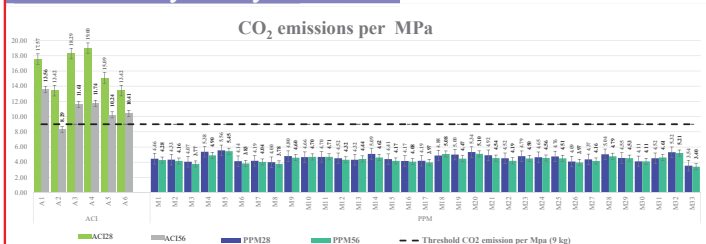
The per MPa CO2 emissions for normal mixes which is minimum of 9 kg/m³/MPa decreased to 5.56 to 3.54 kg/m³/MPa with PPM mixes.

Conclusion

- PPM can be used to produce high performance concrete with binder content as low as 195 kg/m³.
- For similar properties of mixes, PPM showed 33-48% decrease in CO_2 emissions compared to conventional ACI mixes.
- Low cement HPC concrete with partial replacement of cement by silica fume and fly ash can be achieved by PPM approach.

Results and Findings

SLUMP TEST RESULTS

Compresive Strength

Rapid Chloride Penetration Test(RCPT)

Abrassion Test

Absorption Test

For further information, contact below.

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LinkedIn : **https://www.linkedin.com/in/binay-karna-727764b1/**

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Liquefaction Resistance Evaluation of Soils using Artificial Neural Network for Dhaka City, Bangladesh
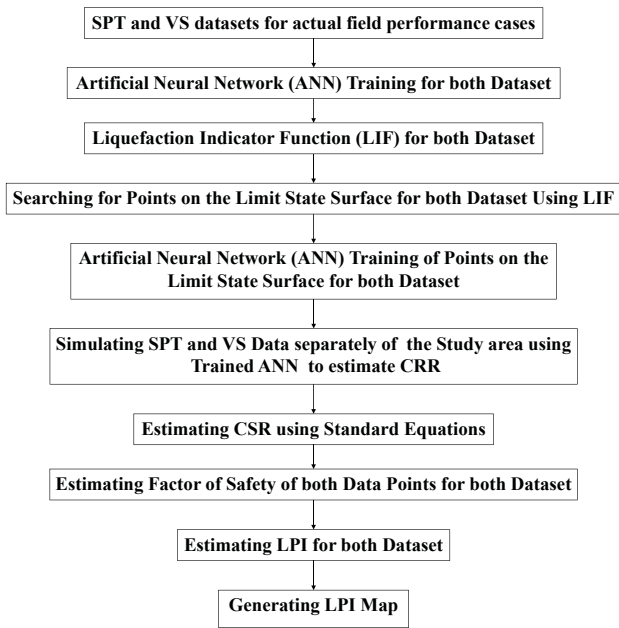
Abul Kashem Faruki Fahim, Department of Disaster Science and Management

University of Dhaka, Bangladesh

Abstract: Soil liquefaction resistance evaluation is an important site investigation for seismically active areas. To minimize the loss of life and property, liquefaction hazard analysis is a prerequisite for seismic risk management and development of an area. Liquefaction potential index (LPI) is widely used to determine the severity of liquefaction quantitatively and spatially. LPI is estimated from the factor of safety (FS) of liquefaction that is the ratio of cyclic resistance ratio (CRR) to cyclic stress ratio (CSR) calculated applying simplified procedure. Artificial neural network (ANN) algorithm has been used in the present study to predict CRR directly from the normalized standard penetration test blow count (SPT-N) and near-surface shear wave velocity (Vs) data of Dhaka City. It is observed that ANN models have generated accurate CRR data. Three liquefaction hazard zones are identified in Dhaka City on the basis of the cumulative frequency (CF) distribution of the LPI of each geological unit. The liquefaction hazard maps have been prepared for the city using the liquefaction potential index (LPI) and its cumulative frequency (CF) distribution of each liquefaction hazard zone. The CF distribution of the SPT-N based LPI indicates that 15%, 53%, and 69% of areas, whereas the CF distribution of the Vs based LPI indicates that 11%, 48%, and 62% of areas of Zone 1, 2, and 3, respectively, show surface manifestation of liquefaction for a scenario earthquake of moment magnitude, Mw 7.5 with a peak horizontal ground acceleration (PGA) of 0.15 g.

❑ Background

Liquefaction occurs when granular, loosely compacted or cohesionless, saturated or partially saturated sediments lose their shear strength and transform from solid to liquid state at or near the ground surface resulting from cyclic loading or other abrupt alteration of stress conditions. In Bangladesh, most of the subsurface lithology is characterized by unconsolidated, sandy and clayey floodplain sediments. Dhaka City, the capital of Bangladesh, is sitting close to the tectonically active Himalayan orogenic belt and Arakan megathrust where there are at least five major active fault zones, which have shown evidence of large magnitude earthquakes, is now one of the world's mega cities.

❑ Methodology

SPT and VS datasets for actual field performance cases
↓
Artificial Neural Network (ANN) Training for both Dataset
↓
Liquefaction Indicator Function (LIF) for both Dataset
↓
Searching for Points on the Limit State Surface for both Dataset Using LIF
↓
Artificial Neural Network (ANN) Training of Points on the Limit State Surface for both Dataset
↓
Simulating SPT and VS Data separately of the Study area using Trained ANN to estimate CRR
↓
Estimating CSR using Standard Equations
↓
Estimating Factor of Safety of both Data Points for both Dataset
↓
Estimating LPI for both Dataset
↓
Generating LPI Map

The Methodological Framework

❑ **Evaluation of CSR**

$$\text{CSR} = \frac{\tau_{av}}{\sigma'_v} = 0.65\left(\frac{a_{max}}{g}\right)\left(\frac{\sigma_v}{\sigma'_v}\right)r_d = 0.65\left(\frac{a_{max}}{g}\right) r_d / \text{MSF} = 0.65\, r_d\, R_p \text{SL}$$

❑ **Evaluation of CRR using artificial neural network**

$$\text{LI/CRR} = f_T\left[B_0 + \sum_{k=1}^{n}\{W_k f_T(B_{Hk} + \sum_{i=0}^{m} W_{ik} P_i)\}\right]$$

$$\text{LI}_{SPT} = f((N_1)_{60}, FCI, \ , Rp, SL)$$
$$\text{LI}_{V_s} = f(V_{s1}, FCI, CSR_{7.5})$$

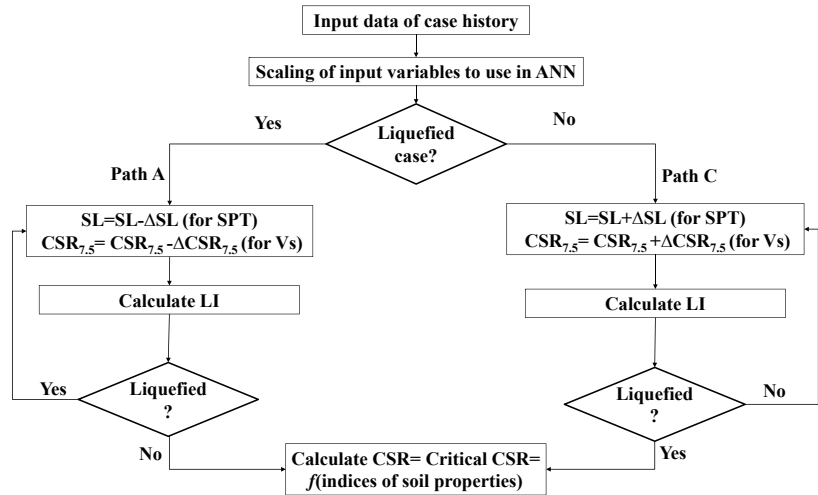$$\text{CRR}_{SPT} = f((N_1)_{60}, FCI, \ , Rp)$$
$$\text{CRR}_{V_s} = f(Vs_1, FCI)$$

❑ **Estimation of Factor of safety**

$$\text{FS} = \left(\frac{CRR_{7.5}}{CSR}\right) MSF$$

❑ **Liquefaction Potential Index (LPI)**

$$\text{LPI} = \int_0^{20} F(z)W(z)\, dz$$

Input data of case history
↓
Scaling of input variables to use in ANN
↓
Liquefied case? — Yes → Path A ; No → Path C

Path A:
SL=SL−ΔSL (for SPT)
CSR$_{7.5}$= CSR$_{7.5}$ −ΔCSR$_{7.5}$ (for Vs)
↓
Calculate LI
↓
Liquefied ? — Yes / No

Path C:
SL=SL+ΔSL (for SPT)
CSR$_{7.5}$= CSR$_{7.5}$ +ΔCSR$_{7.5}$ (for Vs)
↓
Calculate LI
↓
Liquefied ? — No / Yes

Calculate CSR= Critical CSR= f(indices of soil properties)

Conceptual model for searching points on limit state boundary

❑ Results

❑ **Artificial Neural Network Training Accuracy**

R value for Target and Output of ANN models of LI Function

Data Type	Training R	Validation R	Test R	Overall R
SPT	0.86	0.84	0.98	**0.87**
V$_S$	0.88	0.86	0.83	**0.88**

R value for Target and Output of ANN models of Limit state Function

Data Type	Training R	Validation R	Test R	Overall R
SPT	0.93	0.93	0.94	**0.93**
V$_S$	0.99	0.96	0.99	**0.99**

❑ **LPI Maps**
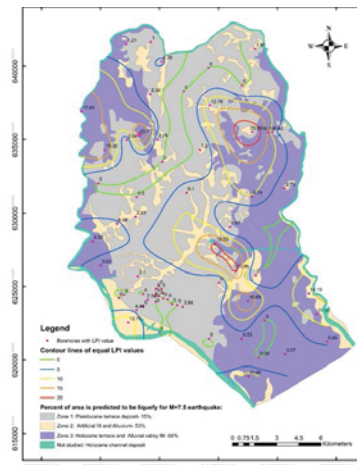
Dhaka City's liquefaction hazard map based on SPT data

- **Zone 1**: Pleistocene terrace deposit- **15%**
- **Zone 2**: Holocene Alluvial valley fill deposit and Holocene terrace deposit- **53%**
- **Zone 3**: Holocene Alluvium and artificial fill- **69%**
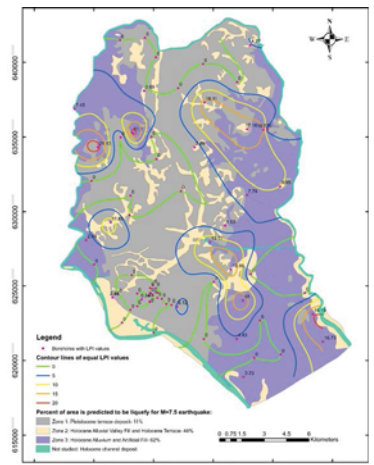
Dhaka City's liquefaction hazard map based on V$_S$ data

- **Zone 1**: Pleistocene terrace deposit- **11%**
- **Zone 2**: Holocene Alluvial valley fill deposit and Holocene terrace deposit- **48%**
- **Zone 3**: Holocene Alluvium and artificial fill- **62%**

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Impact of climate change to urban drainage system in Beijing

Ji Xinyu, Dong Wenxuan, Huang Hong

Tsinghua University, Beijing, China

1. Background

• Impact of Climate Change

➤ The increase of daily temperature extremes at the global scale.
➤ Global mean sea level increased by 0.20 [0.15 to 0.25] m between 1901 and 2018.
➤ The increase of intensity and frequency of precipitation.

• Urban Drainage System

➤ The irregular change in precipitation will likely pose huge challenge to the existing drainage networks.
➤ In combination of urbanization change, could magnify the chance of urban flooding.

2. Study Area and Method

• Study Area

➤ The average annual precipitation of Beijing is 644 mm, with relative large level of seasonal and interannual fluctuations.
➤ The drainage system is independent of other basins or hydrological systems.

• Method

➤ The drainage system is simulated by SWMM.
➤ A 4-hour rainfall time series at 5-minute intervals is generated for each return period according to the SIF relationship.

3. Result

➤ As the increase of the return period, the number of flooding nodes increases significantly, which means the performance of the drainage system decreases.
➤ When facing 50-year return period, 30.18% of the nodes will be flooding for more than two hours.
➤ Climate change has not been taken into account in the present design standards.
  • Damage induced by the 50-year return period rainfall at the present time will likely be caused by more less than 50 future return period rainfall.
  • There is an urgent need for special attention while improving system performance to tackle the threat of climate change.

RCP 2.6   RCP 8.5

Projected changes in annual average surface temperature of 2080-2100 compared with 1986-2005 (IPCC,2014)

RCP 2.6   RCP 8.5

Projected changes in annual average precipitation of 2080-2100 compared with 1986-2005 (IPCC,2014)

$$q = \frac{2719(1 + 0.96\log P)}{(t + 11.591)^{0.902}}$$
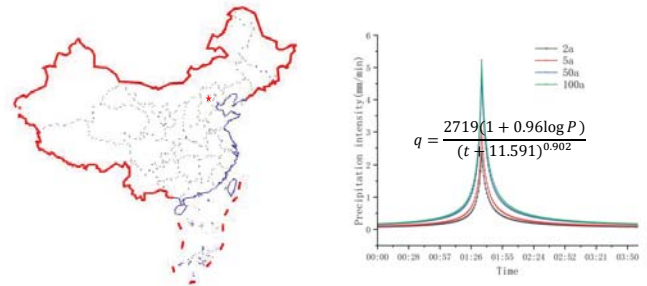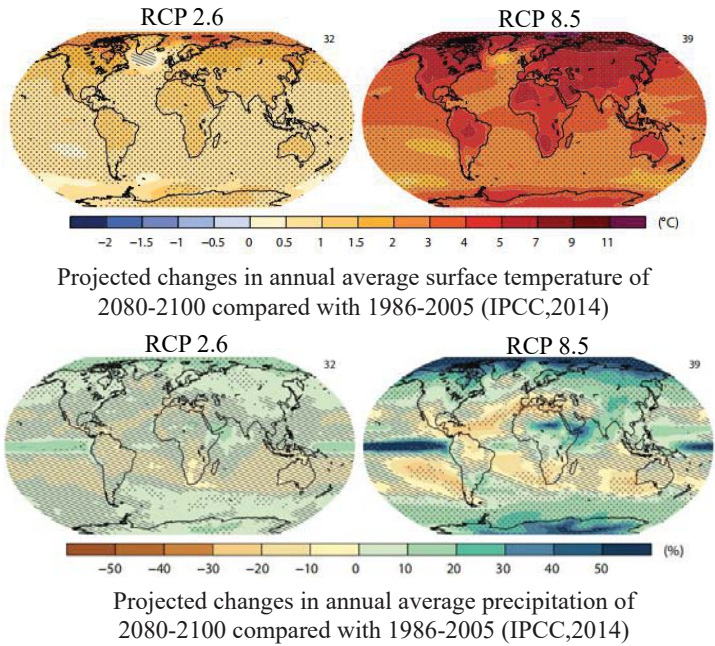
	N-imperv	N-perv	Des-imperv (mm)	Des-perv (mm)	Max.infil. rate (mm/h)	Min.infil. rate (mm/h)	Decay constant
Discreet Value	0.08	0.9	1.8	3.8	50.5	2.5	4
Calibration Value	0.015	0.3	4.5	8.5	75.5	3.5	4
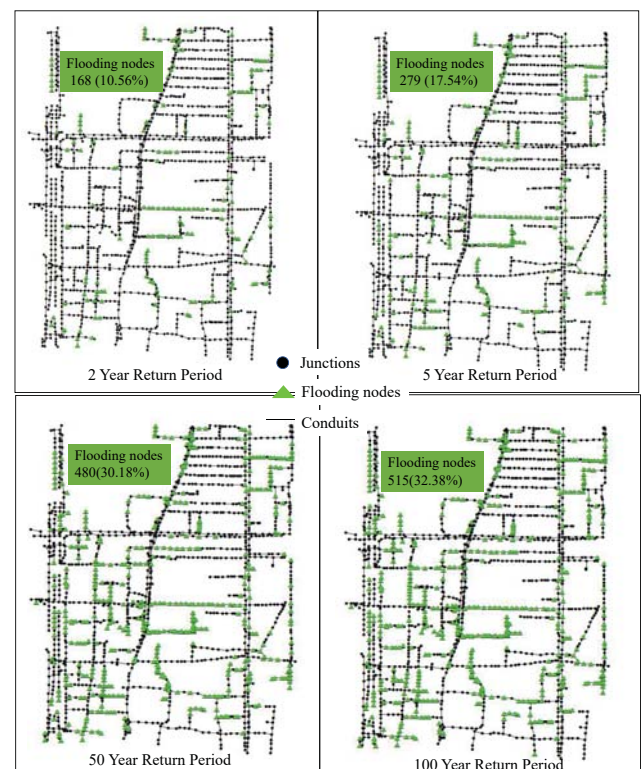
Flooding nodes 168 (10.56%)

Flooding nodes 279 (17.54%)

● Junctions
▲ Flooding nodes
— Conduits

2 Year Return Period

5 Year Return Period

Flooding nodes 480(30.18%)

Flooding nodes 515(32.38%)

50 Year Return Period

100 Year Return Period

If you are interested in learning more, please contact: Ji Xinyu,Tsinghua University   E-mail: jxy20@mails.Tsinghua.edu.cn

44

NO2 concentration trend in Dhaka city during the lockdown and subsequent impact on Aerosol Index (AI) and daily maximum temperature

Noshin Nower

Undergraduate Student, Department of Disaster Science and Management, University of Dhaka

Abstract: NO2 is one of the most significant pollutants in the atmosphere with impacts including but not limited to respiratory diseases, formation of particulate matter and ozone, and acid rain. The aim of the study is to observe the spatiotemporal changes in the concentration of NO2 due to the lockdown implemented in Dhaka City and the subsequent impact on aerosol index (AI) and daily maximum temperature. The netCDF files were then accessed in the Anaconda Spyder Application using python codes. Maps were generated for NO_2 concentration using the Panoply Application which clearly showed a decreasing trend with time. A sequential Mann Kendall trend analysis was also performed on the NO_2 data using the statistical software R Studio to pinpoint exactly how long after a lockdown the decreasing trend starts. NO_2 was observed to started a decreasing trend within the first five days of the lockdown. The results suggested no significant relationship between the concentration of NO_2 and AI. A relatively strong negative correlation was found between AI and daily maximum temperature reached during the lockdown period. It can be concluded that NO_2 in Dhaka city is contributed largely by human vehicular movements and industrial activities but can be brought down using 'lockdown' policies. This means that upon further studies, a guiding policy can be created to control the amount of acid rain in sensitive areas, like conservation forests or important monuments.

Background

Nitrogen dioxide is highly reactive and easily converted to nitric acid in the troposphere, rendering their atmospheric lifespan to be of 5 to 10 days theoretically. This is what makes this gas ideal for study since the lockdown periods in the chosen study area lasts only for around forty-nine days, and it provides the perfect opportunity to investigate the spatiotemporal relationship of nitrogen dioxide with vehicular movement and subsequently the aerosol index and daily maximum temperature reached.

Research Framework

Results

VTC of NO2 on **March 17th**

VTC of NO2 on **March 26th**

VTC of NO2 on **April 7th**

VTC of NO2 on **April 14th**

Tropospheric vertical column of nitrogen dioxide (10^-4 mol m-2)

Results

VTC of NO2 **on April 24th**

VTC of NO2 **on May 6th**

Tropospheric vertical column of nitrogen dioxide (10^-4 mol m-2)

Sequential Mann Kendall Plot

The SQMK plot from the daily NO2 data, with intersection at **day 2** and **day 45**

NO2 and AI change over the Lockdown period

AI and maximum temperature change during lockdown

Graph showing relationship between NO2 and AI, **corr value:-0.031**

Graph showing relationship between NO2 and daily max temp, **corr value:-0.67134**

Conclusions

The concentration of NO2 decreases significantly during the lockdown period, with significantly clearer air within April 7th, as shown by the maps. The concentrations then begin to rise again after movement of vehicles restart. The sequential Mann Kendall Analysis test conducted on the quantitative values of nitrogen dioxide shows that this downward trend begins within the first five days of an obstruction of vehicular movement.

No significant linear relationship was found between the Ultraviolet Aerosol Index (AI) and the concentration of nitrogen dioxide. A relatively strong negative correlation was found between the Aerosol Index (AI) and the daily maximum temperature reached, which may be explained by the radiative forcing properties of aerosols.

For further information, contact below:

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Landslide Hazard Mitigation Through Bamboo Slope Protection in Ukhia, Bangladesh

Subashish Kundu Sunny and Mehedi Ahmed Ansary
Bangladesh University of Engineering and Technology

1. Background

• Slope Failure

➢ Slope failure occurs when Mobilized shear stress exceeds Shear Strength of the soil.
➢ It occurs due to various reasons such as heavy rainfall, deforestation, unstable slope topography, earthquakes etc.

• Bamboo Slope Protection System

➢ It is found effective in various studies.
➢ Eco-friendly, low cost and indigenous solution to slope failure.
➢ 3 to 4.5 m long bamboo piles are inserted into the soil along a row with bamboo head beams keeping straight alignment.
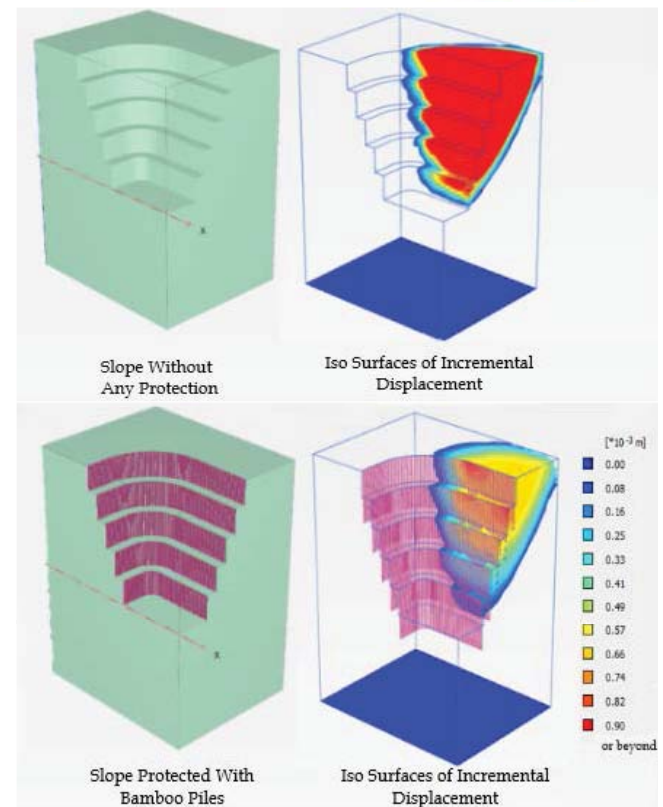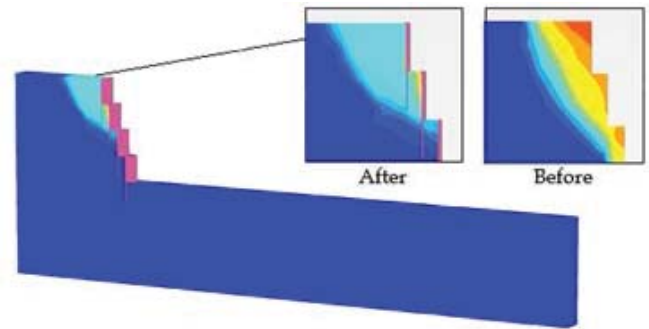
2. Study Area and Method

• Study Area

➢ 31% of landslide episodes all over the country occur around the study area.
➢ Drastic deforestation by 7 million migrated refugees made the area a hotspot to landslides.
➢ Most of the vulnerable slopes are 10m to 15m in height with slope angle varying from 45° to 70°

• Method

➢ Essential soil parameters were obtained from laboratory tests of soil samples
➢ 2D and 3D finite element analysis of slope models were performed in PLAXIS

3. Result

➢ FoS values get higher with the length of bamboo piles.
➢ Bamboo at 2d spacing provides considerably good results. (d= diameter of bamboo)
➢ Displacement of soil largely decreases in all models.
➢ Maximum increment in FoS with bamboo head beams for clay is 35%.
➢ FoS increases more than 200% in sandy soil when the slope is steep.
➢ Recommendations
   ✓ Optimum bamboo spacing 2d
   ✓ Bamboo pile lengths should be 3m, 3.5m, 4m, and 4.5m respectively for 45°, 55°, 65°, and 70° slopes, with each having an embedded portion of 2m.

After   Before

Slope Without Any Protection   Iso Surfaces of Incremental Displacement

Slope Protected With Bamboo Piles   Iso Surfaces of Incremental Displacement

[*10⁻³ m]
0.00
0.08
0.16
0.25
0.33
0.41
0.49
0.57
0.66
0.74
0.82
0.90
or beyond

FACTOR OF SAFETY VS LENGTH OF BAMBOO

10 cm spacing
20 cm Spacing
40 cm spacing
60 cm spacing

FACTOR OF SAFETY
LENGTH OF BAMBOO PILES (M)

FACTOR OF SAFETY VS SLOPE ANGLE

Clay 1
Clay 2
Sand
Treated soil

Factor of Safety
Slope Angle (Degree)

A Comprehensive Factor Analysis of Unauthorized Vehicle Crashes in Dhaka City

[1]Maisha Ghani and [1]Sanjida Meherin
[1]Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
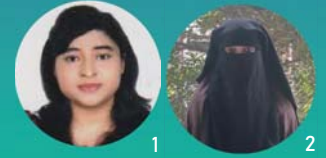
Abstract. Over the last decade, the transport infrastructure in Bangladesh has witnessed a revolutionary expansion of unauthorized vehicles throughout the whole country. However, in the absence of government intervention, these unregistered vehicles primarily consisted of battery-run electric vehicles circulating in most cities of the country and nosimon, korimon, motor van driving especially in rural highways, are causing nuisance for permitted vehicles on roads and highways. Structural defects that make them less stable than other permitted motorized vehicles, as well as unskilled drivers that use them, have made them increasingly prone to accidents. From 2016 to 2020, these unregistered vehicles were responsible for 8.83% of all accidents in DMP with 69.6% and 23.65% of them being fatal and grievous respectively. The majority of the accidents have occurred on national highways (37.16%) and city roads (52.7%), with the most common type of collision being pedestrian collisions (58.12%) followed by rear-end (20.27%) and side(10.14%) collisions. Even if the victims escape death by chance, the long-term consequences include physical disfigurement, disability, and financial ruin. The purpose of this paper is to examine the risk associated with the circulation of vehicles that are not government-listed. In this study, the police-recorded accident database stored at the Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET) using MAAP (Micro-computer Accident Analysis Package), was investigated over the period of 2016 to 2020 for DMP area. Here, ArcGIS was adopted to determine whether the accident patterns are clustered in specific areas and to identify hotspots using data from the aforementioned source. For in-depth accident analysis, data gathered were analyzed using logistic regression model to estimate the probabilities of accidents.MS Excel was also adopted to analyze data using several statistical tools and the findings were summarized in both tabular and pictorial form for everybody to comprehend. The study also revealed trends of crashes and fatalities, root causes of crashes, severity by road users, daily driving time and types of accidents. Hopefully, the paper's findings will contribute to a better understanding of our transportation sector's dreadful situation and motivate policymakers to implement effective strategies and countermeasures to reduce road accidents caused by the unauthorized vehicles.

Keywords. Road Accident, Transportation Safety, Traffic Risk, Accident Analysis, ArcGIS, Hotspot.

Introduction

Road accident – the biggest misfortune in People's life has become quite a normalized term for us lately. Over the last decade, structurally unstable vehicles evolved notably, adding fuel to fire in road accident scenarios. From 2016 to 2020, unregistered vehicles caused 8.83% of all accidents in DMP only & 69.6% of these accidents were found to be fatal. The accident data from the year 2016 to 2020 shows significant Increase trend in number of accidents for these unregistered vehicles. So undoubtedly, the movement and security related to these unregistered vehicles are alarming issues now-a-days in the field of transportation safety.
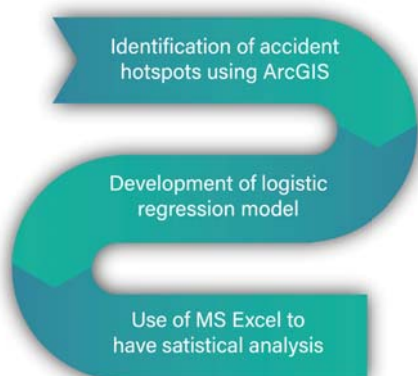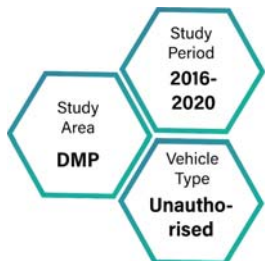
Objectives

AIM of the Study

1. To determine Accident Hotspot in DMP

2. To express accidents as functions of causing factor

3. To reveal trends of crushes, fatalities, severity by road users
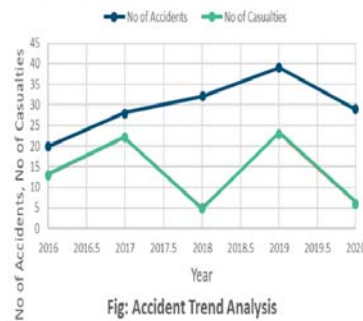
Data Collection and Methodology

Data Collection Source

Police-recorded accident database stored at the Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET) using MAAP, over the period of 2016 to 2020 for DMP, Bangladesh.

Methodology

Study Area **DMP**
Study Period **2016-2020**
Vehicle Type **Unauthorised**

Identification of accident hotspots using ArcGIS

Development of logistic regression model

Use of MS Excel to have satistical analysis

Findings of the Study

Fig: Accident Trend Analysis

Note: Results for the year 2020 has pandemic impact

Fig : Accident Trend Analysis

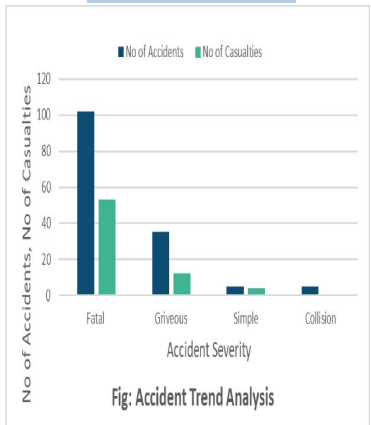### Collision type

Head On 9%
Rear End 20%
Pedestrian 58%
Side 10%
Parked Vehicle 1%
Obstruction 2%
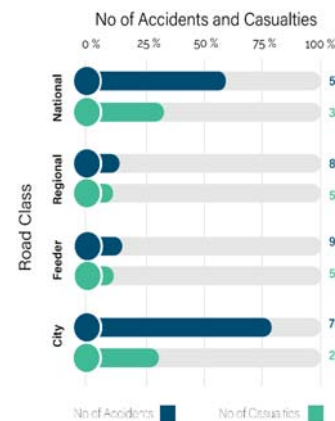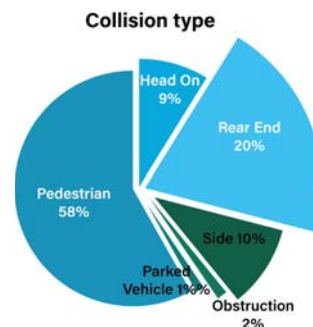
Analysis of contributory factors causing crashes and casualties

1. Speed Limit Crossing

Fig: Accident trend Analysis

2. Careless Driving

Fig: Accident Trend Analysis

3. Alcohol Consumption

Suspected 10%
Non-Suspected 90%
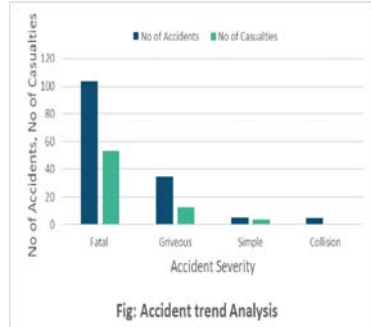
Conclusion and Future Scope

Accidents of unauthorized vehicles are the product of structural instability and reckless driving. Concern regarding this field is getting crucial day by day and extremely demands government patronization and further researches. Studies and researches in this field will only be meaningful if government takes notice on this issue. With government support, several policy studies regarding speed controlling, raising awareness and educating drivers should be conducted.

Prediction of Potential Nighttime Fishing Area by Nighttime light and species distribution model

Yiwei Huang, Institute of Industrial Science,
The University of Tokyo, Japan, M2

Abstract: Light seine fishing, one of the most efficient methods used in modern fisheries. About one quarter of Japanese annual sea surface fishery production is caught by fishing boats that use powerful light to attract fishes, based on their phototaxis. This study focuses on extracting nighttime fishing activities from nighttime light data and develop a methodology for prediction of potential fishing area. Satellite images were used to identify fishing area in Exclusive Economic Zone of Japan (J-EEZ). Nightly boat detection data from 2016 to 2020, which was extracted by U.S. NOAA from the Visible Infrared Imaging Radiometer Suite (VIIRS), was used to examine spatio-temporal patterns of nighttime fishing activities. Using Hierarchical Density-based spatial clustering of applications with noise (HDBSCAN), 127 clustered area were identified. The clustered area had different seasonality, reflecting differences in lighting sources and fishing methods. The results are in good agreement with Japanese historical fishing grounds. The identified fishing area and environmental variables (nighttime sea surface temperature (SST), chlorophyll-α (Chl-α) concentration, salinity and bathymetry) will be used for prediction of potential nighttime fishing area. The results from this study could be helpful to give insights about monitoring and mapping fishing activities in Japan, which are critical components of planning and management for marine fisheries.

1. Background & Objective

In Japan, about one quarter of annual sea surface fishery production is caught by fishing boats that use powerful light to attract fishes, based on their phototaxis.

- For better fishery management and catching, the final goal should be prediction of potential fishing area.
- While local fishermen always keep their catch log and fishing positions in private, the idea is…

  By extracting fishing activities from nighttime light data, can we develop a methodology for prediction of potential fishing area?

Objective

- Identify nighttime fishing area in exclusive economic zone of Japan.
- Develop an appropriate method to generate reliable predictions of potential fishing area.
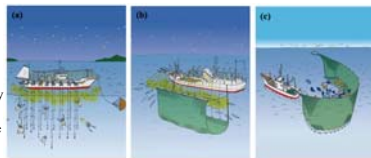
Figure 1. Mainly nighttime fishery in Japan; (a) Squid jigging; (b) Stick-held dip nets; (c) Purse seine fishing

2. Dataset & Methodology

VIIRS Boat Detection

- From the Visible Infrared Imaging Radiometer Suite (VIIRS) produced by the Earth Observations Group (EOG) at NOAA/NCEI, with global coverage and daily revisit time.
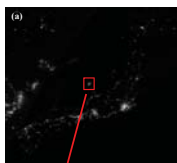

Figure 2. (a) VIIRS Nighttime light image; (b) Yamato Bank area; (c) VIIRS Boat Detection Points; (d) Different lighting sources; (e) Different types of clustered area
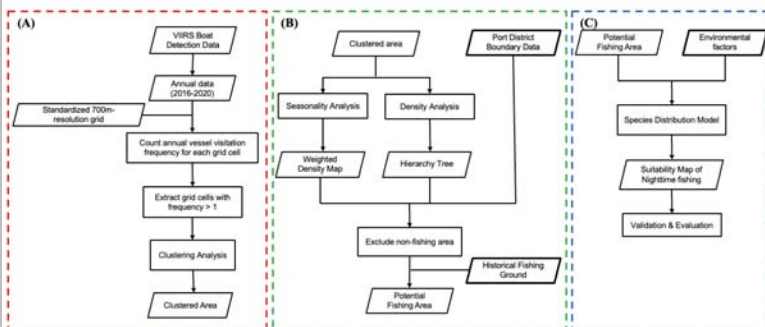

Figure 3. Research workflow; (A) Clustering analysis; (B) Fishing area identification; (C) Prediction of Potential fishing area

3. Result & Discussion

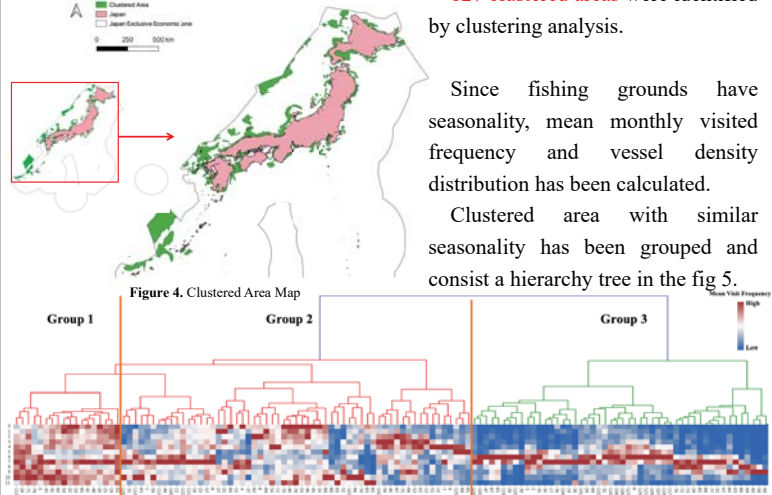127 clustered areas were identified by clustering analysis.

Since fishing grounds have seasonality, mean monthly visited frequency and vessel density distribution has been calculated.

Clustered area with similar seasonality has been grouped and consist a hierarchy tree in the fig 5.

Figure 4. Clustered Area Map

Figure 5. Seasonality of clustered areas based on scaled mean nightly VBD counts per month.

By checking seasonality and density distribution of clustered areas:

- **Group 1** has high visited frequency through the whole year, where may be area clustered by non-fishing vessels near ports.
- The visited frequency of **group 2** is relatively moderate among three groups, where may be fishing area with high catching density through several months, or mixture of fishing area and non-fishing area.
- **Group 3** shows clear seasonality that appears between August and October. They may be fishing area with single peak catch month.
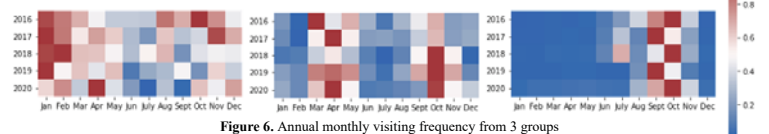

Figure 6. Annual monthly visiting frequency from 3 groups

Potential Fishing Area should have three characteristics:

1. Stable seasonality
2. Evenly vessel density distribution
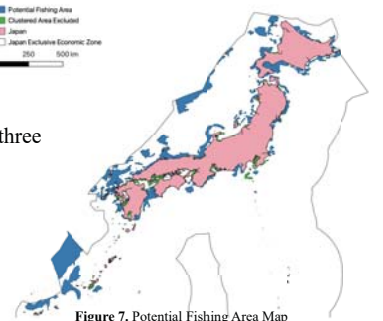3. Outside commercial ports

Figure 7. Potential Fishing Area Map

4. Conclusions & Future Work

- Although there may still be some mixture area, which be consisted of fishing area and non-fishing area. We can extract their peak visited frequency month based on seasonal stability, and by comparing these characteristics with historical fishing ground, the potential fishing areas can be classified to three different nighttime fisheries.
- Develop an appropriate method to generate reliable predictions of potential fishing area by species distribution model.

Finite Element Analysis to Evaluate Impact of Head Injury of Commercial Ride-Sharing Service Helmets

[1]Joydip Paul and [1]Xavier Hebol D Cruze
[1]Bangladesh University of Engineering and technology (BUET), Dhaka, Bangladesh

Abstract: This research work aims to evaluate the safety performance of the motorcycle helmets provided by the commercial ride-sharing services in Bangladesh with Finite Element Analysis. For this purpose, two different helmet models were collected that are commonly provided to the drivers and the passengers. Finite element (F.E.) models were generated for each helmet using the characteristic matrices of different materials comprising the different layers. A simulation test for translational impacts was done for each F.E. model based on the accurate reproduction of the specifications stated in the ECE22.05 standard. A finite element model of a standard M-size headform was modeled according to the specifications and assembled with the helmet models to perform the explicit dynamics simulations. Simulations were run for four different configurations to take the acceleration readings of the headform from four impact sites - B, P, R, and X on both helmets. The peak linear acceleration during impact at the headform's center of gravity (COG) was recorded for each configuration and the Head Injury Criterion (HIC) was calculated. The driver and the passenger helmet's four position-based HIC scores were [1710.7, 3886.8, 3203.4, 5639.3] and [2198.8, 21832.5, 3842.4 5156.8] respectively, while the standard HIC for safe helmets required to be below 2400 at all impact points. This implies, while both the helmets may fail to provide safety during head impacts in accidents, the passenger helmet has greater viability to result in fatal casualties.

Introduction: Crash and fatality data shows significant relation between the increase of motorcycle fatalities and the increase in motorcycle usage over the last decades. The use of motorcycles via ride sharing services has become popular in the urban areas since benefits both the drivers and passengers. Despite its benefits, it increases the chances of road traffic accidents. Ride sharing companies provide helmets to its drivers and passengers that have no published safety standard rating. As there is currently no proper regulation to reinforce use of standard helmets, these are sold without proper certification and are popularly used to meet the minimum requirement of wearing a helmet to avoid being fined.
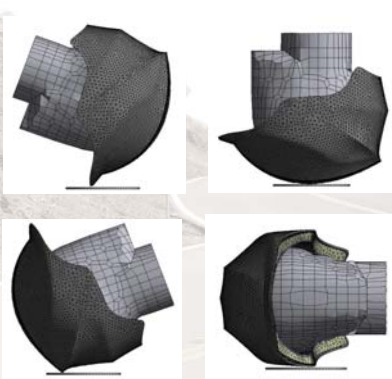
Key points:

- From 2006-2021 year, annual RTA (Road Traffic Accident) went up from 360 to 980.
- The emergence of ride sharing services from 2016 clearly contributes to the rise in annual RTA.
- There are no proper regulations for helmet quality and ride sharing services provide low standard helmets.
- Two helmets, A (Driver Helmet) and B (Passenger Helmet) are collected, virtually modelled and used in dynamic simulations.
- Simulations show that both the driver and passenger helmets are below the standard needed for providing safety.
- The shock absorbing EPS foam layer plays the vital role in maintaining safety.

Recommendations:

- The shock absorbing EPS layer should be thicker in the helmets.
- Helmet regulations, such as the ECE 22.05 should be implemented.
- Proper database should be formed to collect the data regarding the quality of the helmets used in the crashes.
- Mandatory use of seatbelts and helmets

Background:. Road crashes and fatalities are a growing concern in a lower middle-income country such as Bangladesh and in the recent years, most of these fatalities are related to motorcycles. The contribution of motorcycle fatalities to the overall road fatality was 3% in 1998 which increased up to 22% in 2017. However, the actual number of fatalities should be much higher, at least four times the number officially reported [1]. This trend skyrocketed as the number of motorcycle users increased noticeably after the dawn of ride sharing services in Bangladesh from mid-2016.
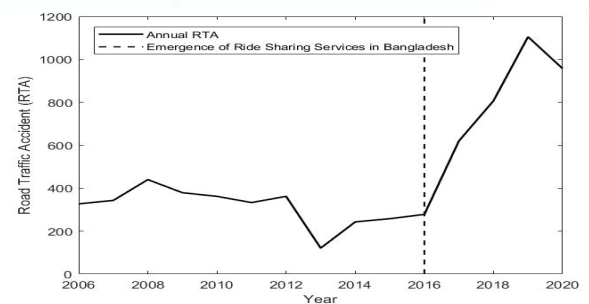
Simulations and Analysis:

Helmet Modelling:

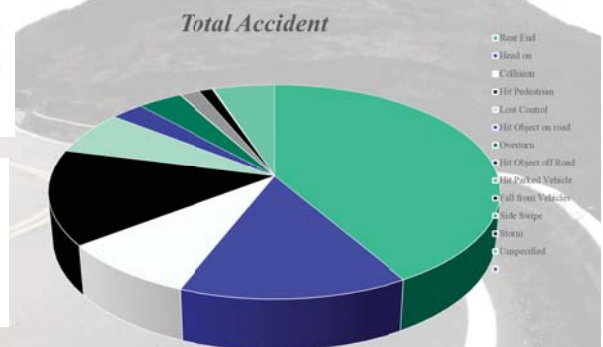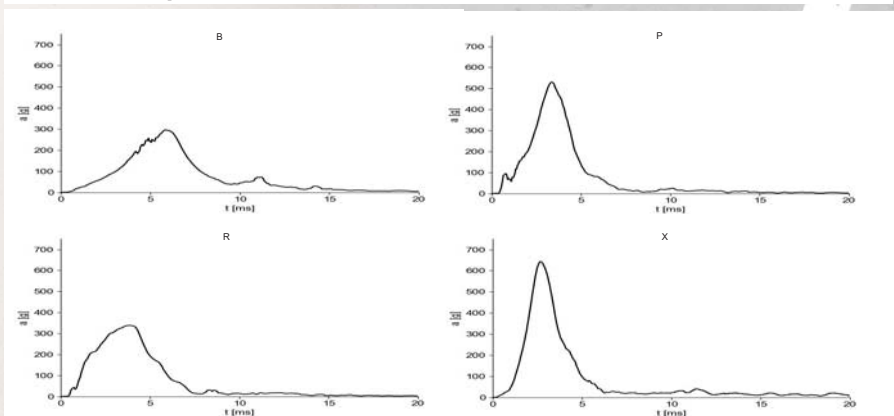**ECE 22.05 regulation impact configurations for Helmet B :**

Reported annual road traffic accidents of motorcycles in Bangladesh

cident Types (2016-2021) :

Total Accident

ECE 22.05 impact results for Helmet A :

Fine-coarse interlayered soil structure adopted in the construction of ancient tomb mounds

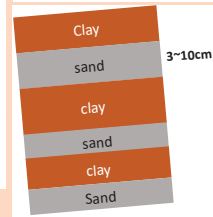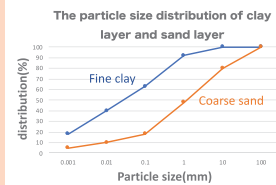## Yutaro Hara, Geotechnical Engineering   Master course

In recent years, **Japanese ancient tombs called "Kofun" have been attracting as historical heritage**, and knowledge of geotechnical engineering is required for excavation. The geotechnical interpretation of the mound construction techniques used in Kofun is not only **an archaeological contribution**, but also has **the potential to lead to the development of new civil engineering technologies**. In this study, the reason for this unique structure was interpreted from the viewpoint of modern geotechnical engineering, based on the research methods of archaeology and geotechnical engineering.
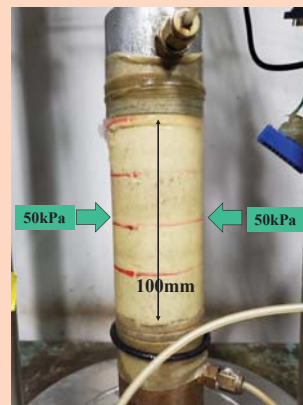
Unique structure of Kofun

In the construction of Kofun, the method of piling fine-grained soil and coarse-grained soil in alternating layers (called **fine-coarse interlayered structure**) was widespread throughout Japan from the early to late Kofun period, about 1500-1700 years ago. This structure can be seen in a wide range of mounds from the Kanto region to the Kyushu region.
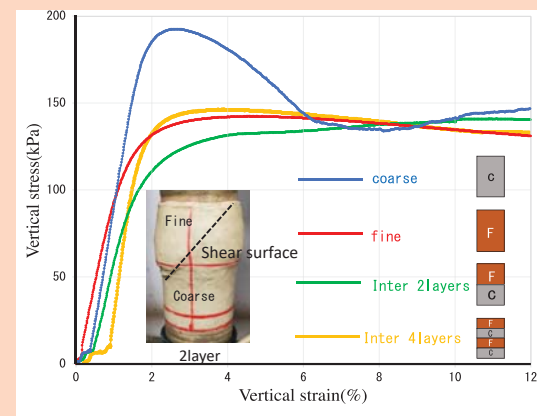
Hodota Hachimanzuka Kofun: Gumma Pref.

The particle size distribution of clay layer and sand layer

Fine clay

Coarse sand

distribution(%)

Particle size(mm)

Clay / sand / clay / sand / clay / Sand   3~10cm

Interlayered structure at Miyakozuka Kofun
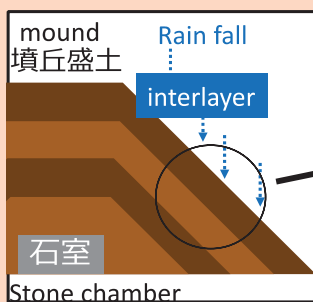
Mechanical property- Triaxial test

First, the strength property of the interlayered structure were verified by conducting triaxial compression tests, assuming a mound height of about 5m. **The result** of this experiment showed that the strength of the interlayered structure was about **the same as that of the single layer of fine-grained soil**. This is because **the fine-grained soil layer twisted before the coarse-grained soil layer in compression**, and the strength of the interlayered structure was affected by the fine-grained soil.
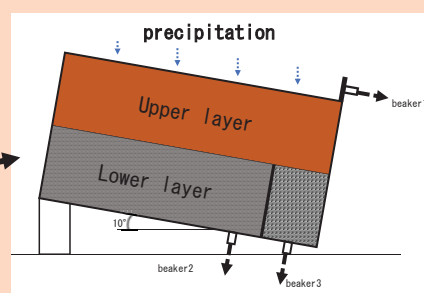
50kPa → ← 50kPa

100mm

The triaxial specimen

Vertical stress(kPa)

Fine / Shear surface / Coarse / 2layer

coarse
fine
Inter 2layers
Inter 4layers

Vertical strain(%)

The result of triaxial compression test

Infiltration property- Sand box test

mound
墳丘盛土
Rain fall
interlayer
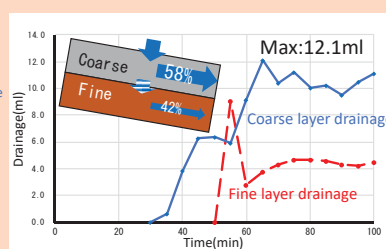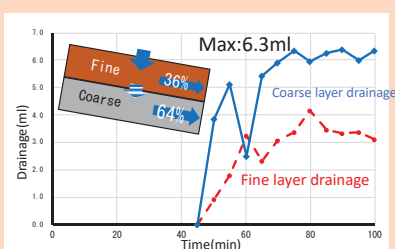石室
Stone chamber

precipitation

Upper layer
Lower layer
beaker1
10°
beaker2   beaker3

The model of infiltration test

Secondly, a rainfall infiltration test using a sand box was conducted. The fine-coarse interlayered structure, whose thickness was 5cm, was reproduced in the sand box. Water was dripped by the precipitation machine above the box. **The results was that it takes longer for the fine layer** to reach saturation than coarse layer, while in coarse layer the flow rate was high and much of the infiltrated water drains outside the mound along the slope. It indicates that **this interlayered structure prevents deterioration of the interior due to rainwater infiltration.**

Max:6.3ml
Drainage(ml)
Fine 36%
Coarse 64%
Coarse layer drainage
Fine layer drainage
Time(min)

Max:12.1ml
Drainage(ml)
Coarse 58%
Fine 42%
Coarse layer drainage
Fine layer drainage
Time(min)

The result of infiltration test

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HP: http://geo.iis.u-tokyo.ac.jp/

QUESTIONNAIRE

Q1. What was the most important (significant, crucial) thing you have learned in this seminar?

- Was my first seminar, so I understood the importance of seminars to speed up work.
- A lot of research fields which is beyond my expertise.
- Application of civil engineering concepts in various fields of study
- Always be prepared.
- presenting research work in an international Seminar
- The seminar was really nice. I learned a lot about the latest state-of-the-art research work that has been going on.
- Board ideas about research
- It was a good experience because it was my first time making a presentation in English and asking and answering questions in English.
- Helped me to know about the research that is being conducted by others in the fields of Infrastructure, Engineering, and Public health.
- Changes in Dhaka's traffic situation due to coronavirus
- People from different languages and cultures can come together when it comes to solving world problems.
- How to present your entire research on a page by making a poster, is quite challenging and interesting to learn.
- The most significant thing that I learned in the seminar is that different countries face crucial situations. We need to integrate our research into future practical applications to contribute to the recovery of the global pandemic.
- The question-answer part was helpful
- Experience and trend of research theme.
- I've learned that for a poster presentation, the poster should include as much information as possible, and keys and methods of making a poster.
- That we have a lot to learn from each other and that a lot of research on so many fields is currently ongoing, it was very important and interesting to hear about so many different research topics.
- Many new aspects and research ideas.
- First impressions of my study
- First is the experience to present our research and get feedback from professors and other participants. Second, I learned many new ideas from the participants. It might be useful for me to develop new research in the future. Third, I joined the party after the seminar. I met new friends from different universities and countries. It was a good experience to learn many things from a different perspective.
- The various important transportation sector problems
- The world issues that we must think about.
- The most important thing I learned from the seminar will be how fellow Asian universities can come together and help each other in research. This worked as a boost for my research interest.
- Since it was my first international seminar, I learned the mannerisms of international conferences and gained experience in presenting in front of the international student body and respected professors.
- Presentation of my research work within a limited time
- What I have learned from this seminar is that there are many scopes for doing research and these researches can be highly effective if the results and recommendations can be applied

Q2. Please let us know if there were any points you would like us to improve next time.

- It was good. An offline seminar would be nice
- I think a short presentation (limited to 5min) may be better than posters.
- Incorporate ice breakers to catch the attention of the audience and encourage participation among other participants
- It would be nice to have a certificate of participation.
- minimize the number of participants or increase the time for presentation with more detailed information so that it is easier to understand the others' research work.
- I think it would be better to have a presentation on a deck of slides rather than the poster itself. As some items on the poster were minimized, it wasn't visible during the presentation.
- Would you please make some Review committee and Select only the papers that h up to some standard?
- Make presentation time 5 mins
- Allow presenter to record presentations in normal format and record in the presentation. In the event, while sharing those presentations, please share their presentation Not video. I mean, if students already recorded, PowerPoint itself stored their recordings. So, each presenter, open their PowerPoint and share. Then viewers can easily see everything clearly without any distractions which happened while in the last event (Vic player)"
- The posters were not visible easily & the approach for the Q&A session was not very effective.
- The updates could be given on a website instead of emails.
- The presentation slides were not so clear therefore, it would be nice if everyone recorded in PowerPoint format then it would be nice to see each piece of content and which can help us to later make necessary comments.
- In my opinion, a 3-minute setup is a short time to explain the research. Also, the video presentation format (poster) is not enough to justify the topic very well. Of course, it is best to conduct it face-to-face, but if it happens again online next time. A ppt presentation video is more appropriate.
- The duration of the presentation is a little short.
- The seminar was a wonderful experience of mine. Thank you! It'd be better if a poster template .pdf file is shared instead of a video.
- As mentioned during the seminar, the presentation visibility was an issue. However, everything else was okay.
- As it is online maybe 3 minutes of slide presentation instead of a poster might make it more engaging.
- Participants can present directly during the seminar, not from the video. Because sometimes the quality of video and sound is different for each participant.
- Give a little more time to present
- Presentations of the students may be presented in PowerPoint format instead.
- No. Even though the seminar was held online, the execution was perfect. Time maintenance was beautifully done.
- I think ppt formats are more suitable for presentation than the poster itself, especially when the conference is taking place online.
- The event was great. I highly appreciate the time efficiency of the organizers.

Q3. Will you join the next student seminar？

| Yes	14
Probably	11
No	1

APPENDIX

1. Field Study

|	
Disaster prevention field	10
Disaster prevention field, Environmental field	5
Disaster prevention field, Infrastructure field, Environmental field, Others	1
Disaster prevention field, Others	1
Environmental field	8
Infrastructure field	10
Infrastructure field, Environmental field	2
Infrastructure field, Environmental field, Others	1
Infrastructure field, Others	2
Others	10
	50

FIELD STUDY

Category	Value
Disaster prevention...	10
Disaster prevention...	5
Disaster prevention...	1
Disaster prevention...	1
Environmental field	8
Infrastructure field	10
Infrastructure...	2
Infrastructure...	1
Infrastructure...	2
Others	10
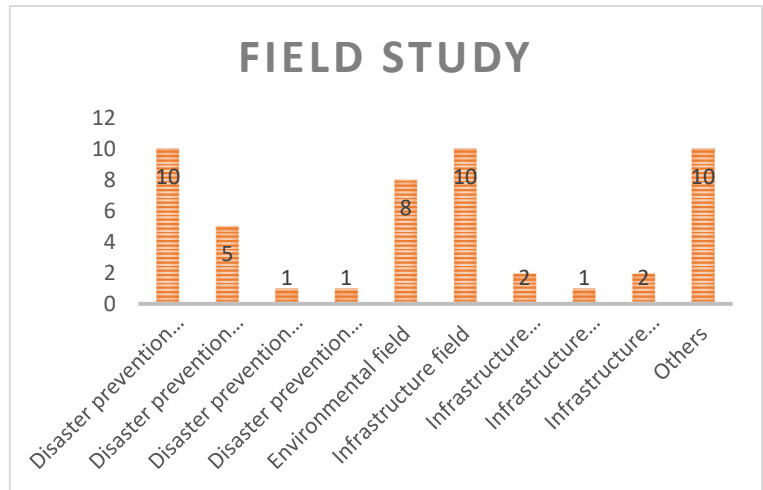
2. Nationality

Bangladeshi	25
Bhutanese	1
Chinese	6
Filipino	3
Indonesia	1
Japanese	4
Kenya	1
Lao	1
Nepalese	5
Sri Lankan	1
Thai	2
	50

NATIONALITY

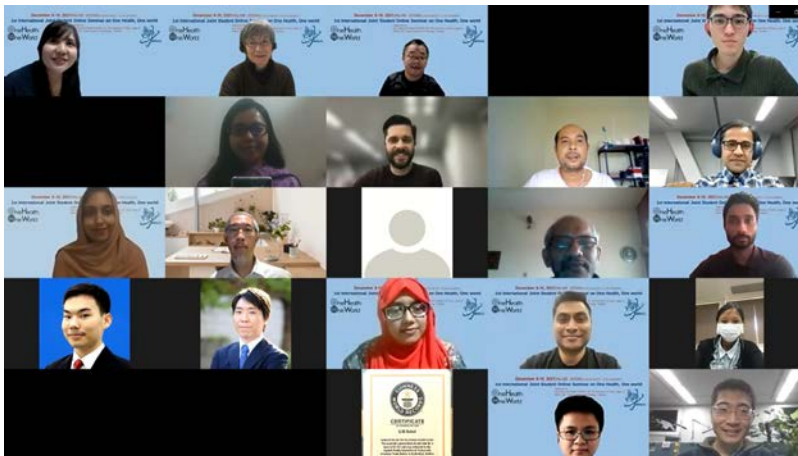| Category	Value
Bangladeshi	25
Bhutanese	1
Chinese	6
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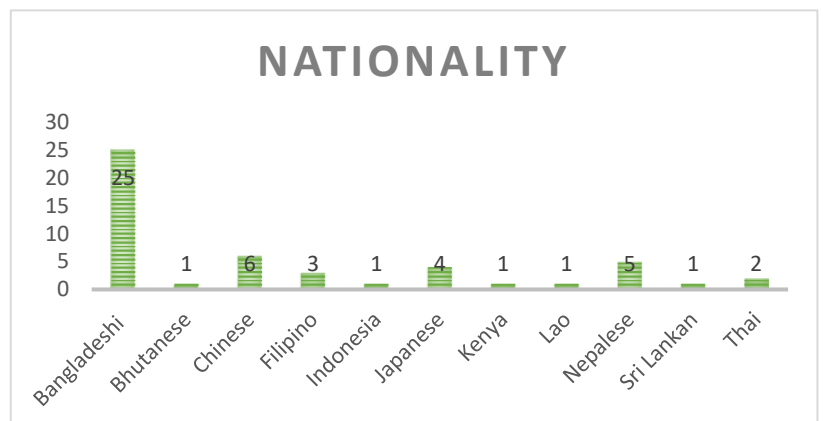
PHOTOS

Chairman: Prof. Wataru Takeuchi UTokyo, Co-chairman: Prof. Pennung Warnitchai, AIT
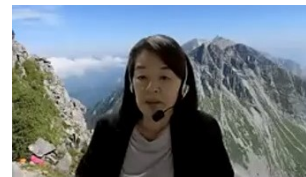
Special Lecture:
Prof. Dr. ASM Maksud Kamal, Dhaka Univ., Prof. Mehedi Ahmed Ansary, BUET, Prof. Reiko Kuwano, UTokyo
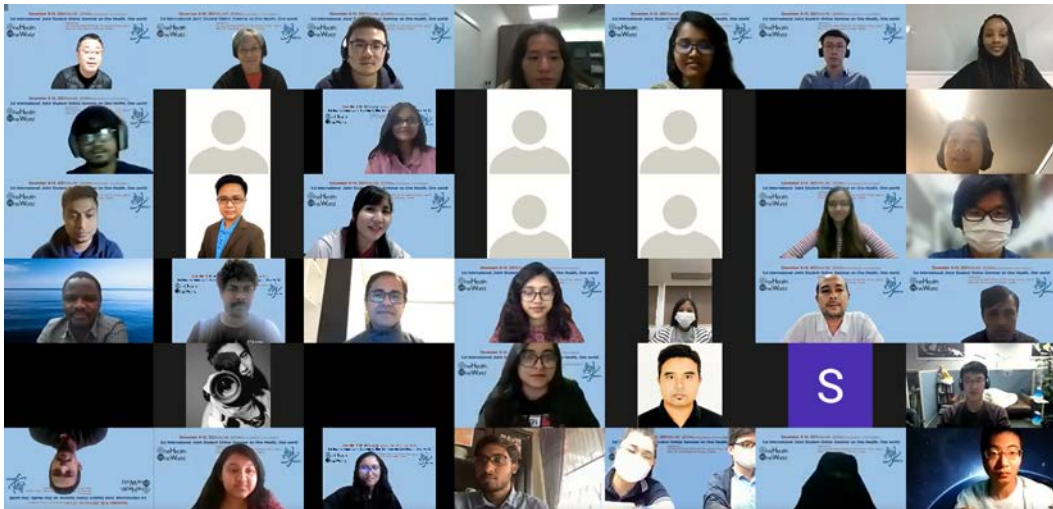

Group photo on 9th December 2021
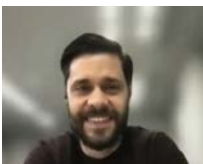
Visit Kuwano lab. on 9th December 2021

Small party at Takeuchi lab. on 9th December 2021

Group photo on 10th December 2021

Special thanks to

Dr. Michael Henry, SIT,   Prof. Kei Yoshimura, UTokyo   MC Ms. Kim Tupaz   RNUS staff Metta Masuttitham

And Prof. Hong Huang, Tsinghua Univ., Prof. Takaaki Ikeda, NUT

REPORTS

The 1st International Student Online Seminar on One Health, One World

　2021年12月9日（木）〜10日（金）に、The 1st International Student Online Seminar on One Health, One Worldがハイブリッド形式で開催された。本セミナーは、本所がアジア工科大学院（AIT）に設置しているRegional Office for Urban Safety（RNUS）と共同で、2007年以来タイで開催していたセミナーを、ワンヘルス・ワンワールド連携研究機構が引き継いだものであり、バングラデシュ工科大学（BUET）に設置しているBangladesh Network Office for Urban Safety（BNUS）の教員や学生、本所OBの清華大学 黄 弘 教授にも参加いただいた。

　初日には、本所 竹内 渉 教授が「Introduction to one health, one world」、ダッカ大学 A. S. M. Maksud Kamal 教授が「Public health hazard and economic perspective」、BUET Mehedi Ahmed Ansary 教授が「Bangladesh's preparedness to manage earthquake disaster」、2日目は、本所 桑野 玲子 教授が「Hidden cavities in the urban ground」と題して講義を行った。学生セッションは、事前に録音した3分間のポスター発表の後、質疑をチャット等で行う形で実施された。参加者の国籍は実に多様で、日本、タイ、バングラデシュ、中国、スリランカ、フィリピン、インドネシア、ラオス、ケニヤ、ブータン、ネパールの11ヶ国から44名の学生の発表があり、聴講を含めた2日間の参加者は13ヶ国（上記とインド、ミャンマー）から140名となった。本所OBの芝浦工業大学 マイケル ヘンリー 准教授と6名の学生が桑野研究室の実験設備を見学し、セミナー開催後には、学生との交流会にも参加し、各国の話と研究の話で盛り上がった。第2回目のセミナーを7月頃に、本所の海外拠点を中心に開催を予定している。

（人間・社会系部門　教授　竹内 渉）

学生セミナーの集合写真

桑野研究室見学

学生交流会の集合写真