

Trip Chaining and Mode Choice Model for Work Trips: A Structural Equation Model (SEM) approach

A thesis submitted by

MD. SHAMSUL KABIR
13105001

RAFSHAN JAHAN RUSHO MAZUMDER
13105004

NOORJAHAN BEGUM MITU
13105054

TURSHINA RAHMAN
13105069

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Md. Shamsul Kabir, Rafshan Jahan Rusho Mazumder, Noorjahan Begum Mitu, and Turshina Rahman** entitled **Trip Chaining and Mode Choice Model For work Trips: A Structural Equation Model (SEM) approach** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

Farzana Rahman

Dr. Farzana Rahman
Professor
Department of Civil Engineering
University of Asia Pacific

14.5.17

Member (External)

Sharmin Nasrin 15.5.17

Dr. Sharmin Nasrin
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

Dr. Muhammad Mizanur Rahaman 15.5.17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This thesis was aimed to explore comfort level assessment of mode choice and trip chain by structure equation model (SEM) in Dhaka city. The study examined survey questions for 14 different points in Dhaka city to collect the data and to get an idea of user's perception about their selection of mode of travel and trip chain making. Several types of modes are available for user's usage. These are bus, CNG, tempo, bi-cycle, rickshaw etc. Modes are used for trip chain completion. Several types of trip chains are done by users. Some do only "home to work and work to home" or some make "home to non-work stop to work and work to home" type trip chain. In this research, a two-step methodology has been adopted. The first part was data collection approach for a purpose built survey questionnaire. Trip chain and mode choice variables included in the survey are selected from various group discussion and expert academicians' opinions. Structure equation models are developed in the second part for this study. Trial and error approach is adopted with considering accommodating variables by observing the overall goodness of fit values for each empirical model. Exogenous, endogenous and latent variables are used in structure equation modeling (SEM) which is an advanced technique for equation generation. Mainly three latent variables (Mode choice, Trip chain, Trip planning) are influencing comfort level. Analysis result indicates that Trip planning is more influencing factor than other two factors. That means users are more focused on whole planning of a trip than trip chain & mode choice individually. "Simple home to work and work to home", "Owning private car" and "Monthly travel expenditure" are found to be the most significant observed variables in models that influence comfort level (CL). CL (Comfort Level) always has a negative relationship with "Waiting at stations" and "Time to reach destination" which indicates users do not feel comfort in waiting at stations and also need extra time to reach their respective destination. This counterintuitive result may be because of the congestion in Dhaka city. This forces the vehicles to run slowly. That's why vehicles do not reach the station in time which makes users' travel experience bitter. So, necessary steps should take immediately to remove the limitations. These study findings can be utilized by the city transportation officials of developing countries to improve the conditions which will also contribute in national revenue.

EVALUATING THE COAGULATION POTENTIAL OF SAMPLES OF DIFFERENT RIVER WATER OF DHAKA CITY.

A thesis submitted by

ABIZER YOUSUF KAPADIA
12205081

ANIK MAZUMDER
12205064

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

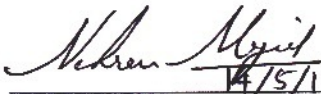


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

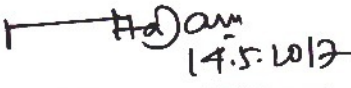
CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Abizer Yousuf Kapadia** and **Anik Mazumder** entitled **EVALUATING THE COAGULATION POTENTIAL OF SAMPLES OF DIFFERENT RIVER WATER OF DHAKA CITY**. is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.


(Supervisor)


14/5/17
Dr. Nehreen Majed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)


14.5.2017
Dr. Md. Mahmudul Hasan
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)


14.5.17
Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

With a population of over 15 million Dhaka is one of the most congested cities of the world. Dhaka is located on the northern bank of the river Buriganga and surrounded by other rivers, namely, the Turag to the west, the Tongi Khal to the north and the Balu to the east. The rivers surrounding Dhaka are an advantage to it and essential for the survival of the mega city as these provide drainage system, drinking water, different kinds of fishes and also waterways for traveling. Degrading river having reduced water amount, more sediments, narrowing, cordoning, diversions, dry ups, commercialization, so called developments, unplanned excavations, changing characters, sluggish flows due to all the misbehaviors on the rivers mentioned above accelerate pollution & induce deaths of rivers finally, through more human accessibility & interventions in the rivers e.g. cross roads, sub-width bridges & culverts, regulators, long uninterrupted embankments, fishery projects, fishing traps & ponds, application of dirty fish feeds, chemical agriculture etc inside. This paper studies coagulation on the samples collected from the three main rivers surrounding Dhaka City namely, Buriganaga river, Turag River and Shitalakkhya River. The main objective was to find out the optimum dose of coagulants with which the best results could be obtained. The samples were collected from the center of the river and were carried to the lab and kept for 24 hours for the sample to settle. After 24 hours jar test was carried out on the samples. Every step of the study was done as carefully as possible and the maximum output was obtained. Locally available alum and ferric chloride were used for the experiments. The results were then analyzed and graphically represented. The results were discussed and the optimum dosage for Alum was found to be 10mg/l, 15 mg/l, 20mg/l and for Ferric Chloride the optimum dosage was found to be 5mg/l, 10mg/l, 15mg/l. These results came out to be very satisfying. Further study on coagulation of water samples from different rivers should be done.

**OPTIMIZING THE OPERATION OF THE WATER
DISTRIBUTION SYSTEM AT DAKSHINGAON, DHAKA
USING EPANET 2.0**

FALL 2016

**SHORIFUL ISLAM
REGISTRATION NO: 12105088**




**Department of Civil Engineering
University of Asia Pacific**

CERTIFICATE OF APPROVAL

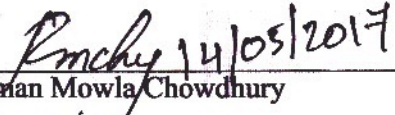
The thesis titled "Optimizing the operation of the Water Distribution System at Dakshingaon, Dhaka using EPANET", prepared and submitted by **Shoriful Islam** has been satisfactory in partial fulfillment of the requirement for the degree of Bachelor Science in Civil Engineering.

BOARD OF EXAMINARS


14/5/2017


Dr. Nehreen Majed
Assistant Professor
University of Asia Pacific
Dhaka, Bnagladesh

Chairman of the Committee
(Supervisor)


14/05/2017

Rumman Mowla Chowdhury
Assistant Professor
University of Asia Pacific
Dhaka, Bnagladesh

Member
(External)


14-05-2017

Dr. Muhammad Mizanur Rahaman
Professor and Head
University of Asia Pacific
Dhaka, Bnagladesh

Member
(Ex Officio)

ABSTRACT

This thesis is about the optimization of Water Distribution System by using Hydraulic simulation software EPANET version 2.0 in the study area Dakshingon, Dhaka. The objective of this thesis work was to analyze the existing water distribution network to find out the existing operational problems of this network. During this research work the existing water distribution system has been studied and analyzed for developing an optimum water distribution system at that specific area. The study parameters include water demand, pipe materials, pressure head, velocity head & the age of the distribution system. The field survey data shows some drawbacks of the existing system. The simulation of this water distribution network was performed through incorporating the information such as the characteristics of the pipes, junctions, the control components and as well as the water demand. The simulation results enabled the observation of different levels of demands, velocities & pressure at various junctions at different periods during the day. The analysis of the existing water supply system showed that in spite of providing the estimated water demand of 200000 gpd in the focused area, the distribution of water from a single pump and single reservoir proved inadequate to supply the water in some junctions. The inadequate pressure, headloss & velocity of water through the distribution conduits caused the insufficiency of water in that specific remote junction. While analyzing the existing Rural Water Distribution in the EPANET software, the junctions located nearer to the pump & reservoir were found with high velocity & pressure head compared to the allowable demand of those junctions. It was also found through increasing the pressure & velocity head to a greater amount that the existing pipe line system was incapable of meeting the future demand with sufficient supply of water at all the nodes. Simulation through EPANET for optimizing the water distribution network enabled to observe that the water reservoir tank and pump appeared to be misplaced. The reallocation of the pump and reservoir appeared necessary for the optimized supply. The EPANET simulation results also indicated that instead of reallocation of pumps and reservoirs, the problem could be solved by increasing the diameter of pipes, velocity & pressure head independently or simultaneously for specific amount of required water.

EFFECT OF AGING ON THE SHEAR STRENGTH OF COHESIVE SOILS

A thesis submitted by

RAFI MAHMOOD
12205080

AKRAM SHAKIL TURJA
13105017

S. M. AL-TOUFIK
11205054

In partial fulfillment of the requirements
for the degree of Bachelor of Science in Civil Engineering

Under the supervision of

Dr. Sarah Tahsin Noor

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Rafi Mahmood, Akram Shakil Turja and S.M. Al -Taufik** entitled **Effect of Aging On the Shear Strength of Cohesive Soils** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the committee
(Supervisor)


14.5.17

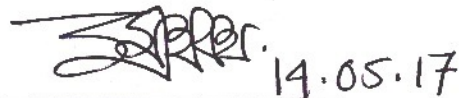
Dr. Sarah Tahsin Noor
Associate Professor
Department of Civil Engineering
University of Asia Pacific

External
(Member)


14.05.17

Emtazul Haque
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Head of the department


14.05.17

Dr. Muhammad Mizanur Rahaman
Professor and Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

The safety of many engineered structures is dependent upon the strength of the underlying soil. Bearing capacity, lateral earth pressures, and slope stability are examples of common geotechnical applications that depend on the shear strength of the soil. The bearing capacity of a foundation, such as a footing, which transmits loads from the superstructure on to the soil below, is also a function of the shear strength of the soil. The shear strength of soil varies time to time. A series of unconfined compression strength test and Triaxial shear test have conducted on normally consolidated soils, in order to examine the influence of aging on their shear strength behavior. In this study, comparison between Unconfined Compression Test and Triaxial Shear Test in terms of shear strength parameters have carried out. Based on the experimental results it is found that apart from an increase in shear strength soils exhibited an increase in their angles of shearing resistance when aged for long period of time.

**ESTIMATION OF BEARING CAPACITY AND SETTLEMENT OF RAFT
FOUNDATION IN COHESIVE SOIL.**

FALL 2016

MD. MOSTAFIZUR RAHMAN

REG NO: 12205030

AMINUL ISLAM KANON

REG NO: 12205010

MOSTAFIZUR RAHMAN

REG NO: 12205025



**Department of Civil Engineering
University of Asia Pacific (UAP)**

Certificate of Approval

We thereby recommend that the thesis prepared by Md. Mostafizur Rahman, Aminul Islam Kanon and Mostafizur Rahman and entitled "Estimation of bearing capacity and settlement of raft foundation in cohesive soil." is accepted as fulfilling the part of the requirement for the degree of Bachelor of Science in Civil Engineering.

Supervising Committee

Sarah Tahsin

Chairman of The Committee

Dr. Sarah Tahsin Noor

(Supervisor)

Associate Professor

Department of Civil Engineering

University of Asia Pacific

Head of The Department

A. Habib

(Member)

Dr. Alamgir Habib

Professor and Head

Department of Civil Engineering

University of Asia Pacific

External

Ahmed

(Member)

Sheikh Sharif Ahmed

Assistant Professor

Department of Civil Engineering

University of Asia Pacific

ABSTRACT

Raft foundations are mainly used where soil (clay or sand) bearing capacity is very low and the soil is not suitable for shallow foundation. For many multi-story projects, a single raft foundation is more economical than shallow foundations. Raft foundations due to their continuous nature provide resistance to independent differential column movements, thus enhancing the structural performance. In the literature, different equations for estimating the bearing capacity and settlement of raft foundation are available. In this square size rafts of different dimensions in cohesive soil deposits soft, stiff and firm type have been considered to study the b/c and settlement of the foundation. The settlements estimated using the equation including compression index C_c and volume compressibility m_v . A unique straight line relation between q_{net}/F_{cd} (the ratio of net allowable B/C to depth factor) and cohesion is noted.

As a result of performed analyses in context of this thesis, raft's contribution on the bearing capacity and settlement of clay soil in the foundation system is clearly observed.

SKILLED WORKERS OF CONSTRUCTION SECTOR IN BANGLADESH UNDER GOVERNMENT PROJECT

A Thesis paper submitted by

SAIM UDDIN
REGISTRATION NO: 13105032

MD. ZAHID HASAN
REGISTRATION NO: 13105059

RAJIB SAHA
REGISTRATION NO: 13105063

MD. RAIHAN KAWSAR
REGISTRATION NO: 13105080

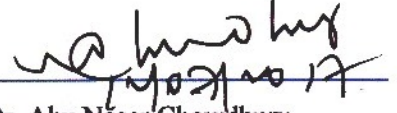
This thesis paper is submitted to fulfill the requirements for achieving the degree of Bachelor of Science in Civil Engineering under the supervision of

Dr. Abu Naser Chowdhury
Executive Engineer (PWD)
Former Assistant Professor
Department of Civil Engineering
University of Asia Pacific

University of Asia Pacific
Department of Civil Engineering
Certificate of Approval
Fall 2017


We hereby recommend that the thesis prepared by Saim Uddin , Md. Zahid Hasan , Rajib Saha and Md. Raihan Kawsar entitled “SKILLED WORKERS OF CONSTRUCTION SECTOR IN BANGLADESH UNDER GOVERNMENT PROJECT” is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Supervisor



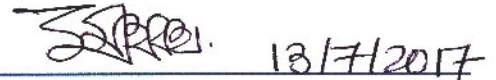
Dr. Abu Naser Chowdhury
Executive Engineer (PWD)
Former Assistant Professor
Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

External Examiner



Dr. Sharmin Nasrin
Assistant Professor
Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

Head of the Department



Dr. Muhammad Mizanur Rahaman
Professor and Head
Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

ABSTRACT

Construction industry in Bangladesh offers diverse employment opportunities for a multifarious group of people with little or no skills to highly skilled professionals such as engineers, architects, and planners. The sector is consistently growing and clearly experiencing a transition from 'traditional' to 'modern technology' based constructions which inevitably require deployment of skilled and semiskilled workers. The study was designed and conducted following a combination of secondary research and primary survey. The study made use of a mix of various research techniques and tools. The study basically tried to put on a scenario of skilled workers at the construction industry of Bangladesh under Government projects through different parameters and discussed their various problems they are facing. Proper identification of problems and information about the skilled workers and their solutions will enrich the contributions to the national economy. Primary data was collected directly from seven different Government projects in Dhaka. Professional level questionnaire survey was conducted among 110 skilled workers. Data was analyzed through SPSS software. This research paper shows a wide range of analysis about skilled workers. In the construction sector 100% workers start their career as unskilled worker. By practicing under the supervision of skilled workers, unskilled workers become skilled. The analysis shows that majority of the workers are illiterate. Most of the workers know about safety while working in construction sector, but only a few of them use Personal Protective Equipment (PPE). Majority of the married skilled workers are not satisfied with their salaries, but satisfied with their job. Where the scenario of the unmarried skilled workers differs from married workers.

Keywords: Construction Industry, Skilled Workers, Government Projects

EVALUATION OF FUTURE DEVELOPMENT OF CAR SHARING IN DHAKA CITY

A thesis submitted by

Md. Anamul Haque Shohan
13105050

Nayeem Ibn Habib
13105056

Mushfiqul Islam Tusher
13105061

Md. Jubayer al Mahmud
13105065

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Md. Jubayer al Mahmud, Mushfiqul Islam Tusher, Nayeem Ibn Habib and Md. Anamul Haque Shohan** entitled **Evaluation of future development of car sharing in Dhaka city** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

Farzana Rahman

15.5.17

Dr. Farzana Rahman
Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)

Sharmin Nasrin 15.5.17

Dr. Sharmin Nasrin
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

Muhammad Mizanur Rahman 15.5.17

Dr. Muhammad Mizanur Rahman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Ridesharing is the sharing of vehicles by passengers to ensure the best use of occupancy of the cars and reduce vehicle numbers, traffic congestion and automobile emissions. This study investigates the service quality (SQ) of rideshare in Dhaka city. This is the first attempt to work on rideshare in developing countries like Bangladesh and also to develop models by Structural Equation Model (SEM) for ridesharing. The main objective of this study is evaluation of future development of car sharing in Dhaka city. We considered those respondents, who had at least one time past experience about rideshare. The age of selection respondents were above fifteen. The questionnaire was set up 27 different questions. Fourteen different locations were selected for field survey from 30th August to 1st September in the year of 2016. Targeted sample size was 700 but after checking the completeness 628 questionnaires were used for the model development. Specially, for this study we developed four models (M1, M2, M3 and M4). These models are developed based on structural equation modeling (SEM) by using STATA 2014 and represented by AUTOCAD 2007 software. For developing SEM we used thirty two SQ parameters. From four models, the best one is selected using statistical parameters and compare with real life expectations. The Goodness-of-fit (GFI) of model depends on the values of Root Mean Squared Error of Approximation RMSEA, Standardized Root Mean Square Residual (SRMR) and Comparative Fit Index (CFI). The best model is model 2 (M2) where RMSEA is 0.046 which is less than 0.08, SRMR is 0.035 which is less than 0.1, CFI is 0.711 which is near to 1 and AIC is 24140.96 which is smallest of all four models. Out of thirty two SQ variables, 'Importance of rideshare', 'Comfort level', 'Improvement of ridesharing' and 'Rideshare as safer mode' are the observed variables that have great influence on rideshare SQ. All the study findings support the data that are collected from rideshare users. The research outcomes give future recommendation according to field survey report and user's opinion to improve overall service quality to increase interest level about ridesharing. Increasing the number of respondent & locations will provide a better result of the model. Incorporating more variables will help to improve the model of service quality. If safety is assured rideshare will be one of the best solutions to reduce traffic congestion, participation of women will be increased and comfortable journey will be ensured for developing countries.

ASSESSING VULNERABILITY OF LOW INCOME COMMUTERS WITH RESPECT TO THEIR TRANSPORT MOBILITY- CONSIDERING DHAKA AS A CASE STUDY

A thesis submitted by

JAHID HASAN BAPPY
13105036

SAJEEB KUMAR DAS
13105039

Md. MAZHAR IBNE MOBARAK
13105078

MD. RAKIBUL HASAN
13105084

In partial fulfilment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Jahid Hasan Bappy, Sajeeb Kumar Das, Md. Mazhar Ibne Mobarak, and MD. Rakibul Hasan** entitled **Assessing Vulnerability of Low Income Commuters with respect to their Transport Mobility- Considering Dhaka as a Case study** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

Sharmin Nasrin 14.5.17

Dr. Sharmin Nasrin
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)

Farzana Rahman 14.5.17

Dr. Farzana Rahman
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

Muhammad Mizanur Rahaman 14.5.2017

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Low income commuters in Dhaka are facing a big challenge to find a better and efficient transport system. Even though many research have been conducted in Dhaka on transport vulnerability with respect to traffic accident, transport vulnerability considering social circumstance of low income earners has seldom got importance.

Combination of qualitative and Quantitative analysis was the methodological approach adopted for this research Quantitative analysis comprised exploratory analysis of the survey data and Calibration of Multinomial Logit model (MNL). Qualitative analysis comprised review of National Transport Plan (NTP), National Integrated Transport Plan (NITP), and revised Strategic Transport Plan (RSTP) based on the evaluation criteria achieved from analysing survey data and MNL model result.

A travel survey has been conducted on low income commuters in Dhaka from different locations. Participants of the travel survey were selected randomly. Exploratory analysis of the survey data showed among the low income commuter different social demographic characteristics, such as age, gender, educational qualification and occupation, has insignificant influence on their mode choice decision. Distance, moving time, waiting time and travel cost are the main variables that lead them toward their modal preference. MNL results also provide similar scenario. However, result shows magnitude of coefficient of moving time is more compared to magnitude of coefficient of travel cost. Therefore, low income commuters are more sensitive to moving time than travel cost. Another important finding from the analysis is low income commuters who are in the lower end of the income live near to their work place sacrificing their living condition by living in slums. These commuters mainly walk to their work place. Those who are in higher end of income usually have financial independence to spend more on their transport. .

Evaluating transport plan, policy and study showed except NITP NTP and RSTP did not address low income commuters' transport issue directly. Other issues such as, travel cost, travel cost, and alternative transport option have been addressed in these plan, policy and

DIFFERENT TYPE OF PAVEMENT DISTRESS AND THEIR SOLUTIONS

A thesis submitted by

MAZUZ-A-RABBI
13105045

MD. SAJJAD KABIR
13105049

AKRAM HOSSAIN FERDOUS
13105079

ASHIQL ALAM KHAN
13105081

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Mazuz-A-Rabbi, MD. Sajjad Kabir, Akram Hossain and Ashiqul Alam Khan** entitled is **DIFFERENT TYPE OF PAVEMENT DISTRESS AND THEIR SOLUTIONS** accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

Sharmin Nasrin 15.5.17

Dr. Sharmin Nasrin
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)

Farzana Rahman 16.5.17

Dr. Farzana Rahman
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Officio)

Muhammad Mizanur Rahaman 16.5.17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This study deals with the identification and investigation of the pavement surface condition and pavement maintenance practices regularly adopted for the most important road network of Panthapath to Dhaka-Sadarghat road .The maintenance practices increase the pavement life to such an extent that leads improved and satisfied serviceability of the road.The investigation of pavement distress can be done in a systematic manner .The focus of this thesis is on creating a systematic and yet simple and easy to understand guide that flexible enough for use in variety of situation .By accomplishing this thesis we will find that different types of pavements have failed for different reasons .There are different types of pavement of pavement distress such as Alligator cracking ,Bleeding ,corrugation and shoving ,potholes etc .Each of its own unique causal classifications and repair approaches knowing the types of distress and its cause is absolutely essential to providing an accurate long-lasting repair solution that not only repair the distress but also addresses root cause.

NONLINEAR TIME-HISTORY RESPONSE EVALUATION OF FRAMES SUBJECTED TO DYNAMIC LOADS AND EXTRA MASS

A thesis submitted by

MD. MAMUN HOSSAIN

13105060

EMTIAZ AHMED

13105058

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

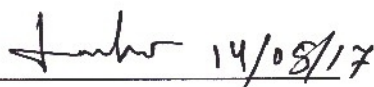


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

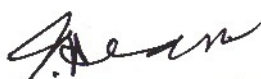
We thereby recommend that the thesis prepared by **MD. MAMUN HOSSAIN** and **EMTIAZ AHMED** entitled **Nonlinear Time-History Response Evaluation of Frames Subjected to Dynamic Loads and Extra Mass** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



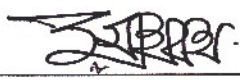
Dr. M. Shamim Miah
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Dr. Iftekhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

 14-5-2017

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This thesis work describes the results of a study on the structural responses of multistoried frames with and without external mass subjected to dynamic loads (earthquake loads, wind loads). Effectiveness of the external mass and height of the column of the frame are demonstrated for three steel frames which column heights are different. Deflections of the structures with and without external mass due to the seismic ground motion are examined both experimentally and numerically as well as deflections due to wind loads are evaluated numerically. The SAP2000 18 software is used for nonlinear dynamic analysis of structures subjected to ground motion from scaled EL Centro 1940 earthquake. Wind load analysis is also performed in this study according to BNBC.

Validation of numerical results with experimental results are also important part of this thesis. Experimental results from laboratory are compared to the results from software which was performed via MATLAB® R2012a to know the effectiveness of external mass as well as the accuracy of the analysis. Additionally, the post processing of this work was performed by MATLAB®. The ground motion from scaled El Centro 1940 earthquake of 25sec time duration is used in this study to generate the record of time vs. displacement curve. The ground motion is scaled to laboratory data prior to their applications.

The results gathered from both numerical analysis and experimental test are reasonably close overall, both quantitatively and qualitatively. It includes some excellent matches and some results vary slightly.

KEYWORDS: Structural response, External mass, Nonlinear dynamic analysis, Ground motion, MATLAB®.

NUMERICAL ANALYSIS AND SHAKE TABLE TEST OF SOIL AMPLIFICATION AND TILTING OF BUILDINGS

A thesis submitted by

MD. IFTAKHAR-UL ISLAM
13105071

MASUD RANA
13105075

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

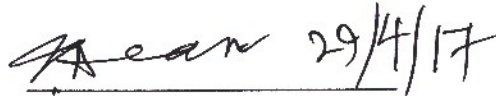


Department of Civil Engineering
University of Asia Pacific
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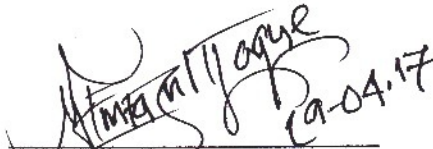
We thereby recommend that the thesis prepared by **Md. Iftakhar-UI Islam** and **Masud Rana** entitled **Numerical Analysis and Shake Table Test of Soil Amplification and Tilting of Buildings** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



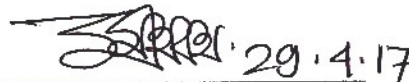
Dr. Iftakhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Emtazul Haque
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This thesis presents the results of a study on soil amplification by numerical analysis and shake table test of soil model subjected to seismic ground motion. Nonlinear dynamic analysis by ETABS 15 is used for numerical analysis of both soil model and structures. The main concern of this study is to find out the reasons behind tilting of tall building by varying the distance between foundations of two structures with a constant depth.

Foam materials are used to make soil model in-stead of spring or real soil and test it on shake table for modified El-Centro earthquake ground acceleration data. An overhead water tank is used as a real structure, which is considered as a Single Degree of Freedom (SDOF) structure.

Verification of ETABS 15 analysis results with experimental results is also an important part of this study. Laboratory experiments provides the results of displacement vs. time graph from shake table and acceleration vs. time graph from mobile apps (Attached at the top of the model structure) that are compared to the analysis results of ETABS 15 software.

Three ground motions are used in this study to evaluate the soil amplification results of displacement vs. time curves (using scaled El-Centro ground motion data of 15 sec, 20 sec and 25 sec durations). Full El-Centro ground acceleration data is used to calculate the soil amplification for real soil data and real structural vibration.

The numerical results matched reasonably well with the laboratory data.

**INVESTIGATION OF VARIOUS STRUCTURAL ANALYSES
APPROACHES IN PRACTICE: BANGLADESH PERSPECTIVE**

A thesis submitted by

JANNATUL FERDUSI BINTHE KAFIL

13105028

KAZI SALEHIN HASAN

13105047

KAKOLY AKTER

13105070

**In partial fulfillment of the requirements for the Degree of
Bachelor of Science in Civil Engineering**

Fall 2016



Department of Civil Engineering

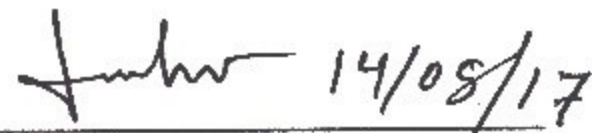
University of Asia Pacific

Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Jannatul Ferdusi Binthe Kafil, Kazi Salehin Hasan and Kakoly Akter** entitled *Investigation of Various Structural Analyses Approaches in Practice: Bangladesh Perspective* is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



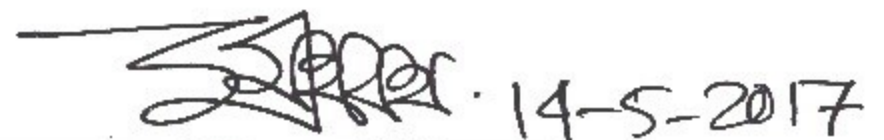
Dr. M. Shamim Miah
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Dr. Iftekhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

From the structural view point, building means a multi-story construction in which the effects of horizontal actions and need to limit the relative displacements take on primary importance. Buildings is increasing day by day in whole world. A profound understanding of the force flow in these complex structural systems is often difficult, and a huge commitment in terms of design, technology and economic resources is required. Simple quasi-static treatment of wind loading and earthquake ground motion, which is universally applied to design of typical low to medium-rise structures, can be unacceptably conservative for design of very tall buildings. On the other hand such simple treatment can easily lead to erroneous results and under estimations. More importantly such a simplified treatment for deriving lateral loads does not address key design issues including dynamic response (effects of resonance, acceleration, damping, structural stiffness) interference from other structures, wind directionality and cross wind response, which are all important factors in wind design of tall buildings. This paper provides an outline of advanced level of wind design and the design criteria and the resulting design must be able to produce a structure that will adequately resist earthquake that will affect the building during its intended useful life. Design must be based on design code. The development of these code as well as the building code for older buildings that may still be in use and in need of strengthening. This thesis paper present some of the loads and analyses on three building structure cases, such as; (i) Beam-Column System, (ii) Beam-Column-Slab System, (iii) Beam-Column-Slab-Infill System. Nonlinear dynamic analyses are performed on three cases using computer software ETABS2015. And the post-processing of the results are performed via MATLAB®.

KEYWORDS: Wind Loads, Earthquakes, Linear Time-History Analysis, MATLAB®.

**A STUDY ON ANALYSIS OF FOUNDATION
SYSTEM FOR SELECTION OF TYPE AND DESIGN
OF FOUNDATION FOR A PROPOSED MULTI-
STORIED FACTORY BUILDING**

Md. Shahriar Ibn Shams

REGISTRATION NO: 13105024

Md. Rifat Hasan

REGISTRATION NO: 13105090

**DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF ASIA PACIFIC
DHAKA**


FALL 2016

We hereby recommend that the thesis presented by MD. SHAHRIAR IBN SHAMS and MD. RIFAT HASAN entitled " A STUDY ON ANALYSIS OF FOUNDATION SYSTEM FOR SELECTION OF TYPE AND DESIGN OF FOUNDATION FOR A PROPOSED MULTI-STORIED FACTORY BUILDING" is accepted as fulfilling this part of the requirements for the degree of Bachelor of Science in Civil Engineering.


Chairman of the Committee
(Supervisor)


Emtazul Haque
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Member


Dr. Sarah Tahsin Noor Kakoli
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Head of the Department


Dr. Muhammad Mizanur Rahaman
Professor
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

The main theme of this study is to select and design safe and economic foundation for a multistoried Ready-Made-Garments (RMG) factory building. While doing so, a comparative study has also been conducted to investigate the pile capacities as estimated by different established methods.

A review of project site geological sub-soil condition reveal erraticism in the consistency of the cohesive deposits within the near-surface shallow foundation bearing stress influence zone. As per prevailing sub-soil condition, the southern portion and a localized mid-northern portion of the site is generally comprised of near-surface deposits of soft to medium stiff to stiff clays, whereas significant middle portion is generally of very soft to soft consistencies. As punching shear failure is found to be the governing shallow-footing-induced shear failure criterion, the choice of this type of foundation within this zone (middle portion) is found to be not feasible. Whereas at the other locations it is found to be feasible. Pile foundation is found to be a feasible option within the middle portion of the site. However, dual foundation system (deep in the middle and shallow within the remainder portions) is generally non-promising and is especially discourgeous for this erratic site for anticipated differential settlement. Thereby, a pile foundation system is found to be the feasible option for the entire site in this case.

In analyzing capacity of pile foundation, it is revealed that piles are to be founded at the medium dense to dense sand deposits in order to generate enough capacities for induced column loads of conventional multi-storied industrial buildings. While doing so, it is also revealed that pile end bearing capacities for different established methods have quite a high range for non-cohesive sandy soils. These capacities are analyzed, evaluated and compared. Finally, recommendations are provided for safe and economic design of the foundation system for the proposed development.

SEISMIC VIBRATION CONTROL USING SHEAR WALL

A thesis submitted by

**Shishir Chandra Roy
13105023**

**Fazlay Rabbi
13105005**

**In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering**

Fall 2016



**Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh**

CERTIFICATE OF APPROVAL

We hereby recommend that the thesis prepared by **Shishir Chandra Roy** and **Fazlay Rabbi** entitled **Seismic Vibration Control using Shear Wall** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

 29/4/17

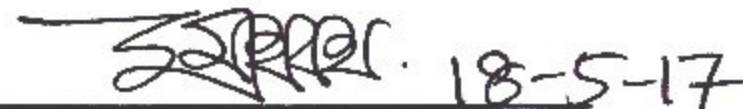
Dr. Iftexhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member(External)



Dr. M. Shamim Miah
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

 18-5-17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

In the first part of thesis three dimensional 3-storied steel frame models and spring supported structural models are selected for numerical analysis by ETABS 15 and experimental analysis in the Structural Mechanics and Strength of Materials Lab at UAP. A scaled El Centro earthquake data is used for both numerical and experimental analysis with different combination of models. First the model is analyzed without shear wall then with shear wall where the bottom and top floor are kept for soft story. An android app (vib-sensor) also used for taking acceleration from floor vibration.

In the second part of the thesis from the analysis results the relative displacements are compared with both numerically and experimentally. From the top floor deflection of the models analysis the peak values matched closely. The spring supported model has been found to provide better results and matched very well without shear wall and with shear wall, compared to the steel frame model because of model's flexibility and the deflection reduced through shear wall.

COMPRESSED EARTH BLOCK FOR LOW COST HOUSING

A thesis submitted by

MD. HASIBUL HASAN SHAWAN
13105011

MD. MOHIBUL HASAN
13105066

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016




Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Md. Hasibul Hasan Shawan and Md. Mohibul Hasan** entitled **Compressed Earth Block for Low Cost Housing** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



29.4.17

Dr. Iftekhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Co-Supervisor)



29.04.17

Emtazul Haque
Associate professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



18-5-17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

To approach the acute affordable housing problem in Bangladesh, an attempt has been made to produce Compressed Earth Block (CEB) by using compressed pressure. It should be reduce construction cost almost half which is little affordable for the poor people.

For investigation, CEB samples (of size 2"×2"×2" and 9.5"×4.5"×3") are made with different mixture properties by varying stabilizer and pressure to produce the blocks. The samples are cured for 7, 14, 28 days to gain sufficient compressive strength. From the result of compression test, it is revealed that the compressive strength of the CEB's increase with the increase of compaction pressure and suitable mixture of stabilizers. Compaction pressure of 10 MPa and 5% cement stabilizer turned out to be the optimum combination for this work.

It is possible to make CEB of strength about 4 MPa that satisfies the minimum strength requirement of 2 MPa as per ASTM D1633-00 and 2.8 MPa as per BS6073. Based on the test results and cost of CEB, it is concluded that they can be used for low cost housing in Bangladesh. On the other hand, compressed earth block will also contribute to the global challenge for achieving sustainability of construction materials.

SEISMIC PERFORMANCE OF CONFINED REINFORCED CONCRETE COLUMN MODELS

A thesis submitted by

MOHAMMAD MOSHARRAF HOSSAIN
13105052

RIFFAT FARJANA
13105055

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

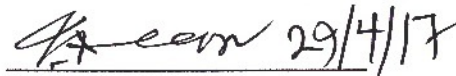


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University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

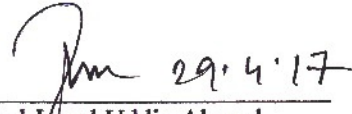
We thereby recommend that the thesis prepared by **Mohammad Mosharraf Hossain and Riffat Farjana** entitled **Seismic Performance of Confined Reinforced Concrete Column Models** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



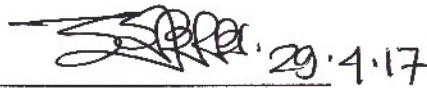
Dr. Iftekhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Syed Jamal Uddin Ahmed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

In this thesis, the main focus is to evaluate the seismic performance of confined reinforced concrete columns. The main objectives of this study are to investigate the seismic performance, identify the confinement variables, and evaluate the effect of ground motions. To achieve these objectives, a series of shaking table tests and analytical studies were performed.

A combined experimental and numerical investigation was conducted to achieve the goals of this thesis. The experimental work consisted of small-scale RC column, unconfined and confined with FRP material and close ties to test the strength and ductility of columns. A numerical model was developed to simulate the behavior of unconfined reinforced concrete and confined reinforced concrete columns. In this thesis, FRP (Fiber reinforced polymer) is used which is quite expensive. Numerical and experimental investigation of concrete columns that have displacements following severe earthquake shaking.

ETABS 15 software capable of performing nonlinear dynamic analysis, is used to perform the numerical analysis in this study.

A parametric study using the developed model confirmed the effectiveness of the confined column in ground motion, with different column dimensions. The results can provide the basis for comparison with numerical and experimental small-scale shake table test to evaluate the reliability of confined column and significance of confinement effects under dynamic conditions and also provide a unique capacity of FRP and close ties that can be used to evaluate the nonlinear behavior of models.

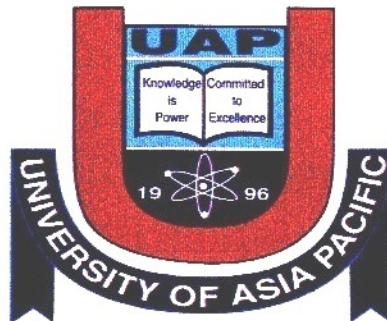
ANALYSIS OF WATER PRICING FOR DOMESTIC USE AT BOGURA MUNICIPALITY IN BANGLADESH

A Thesis

Submitted for partial fulfillment for the B.Sc in Civil Engineering to the
Department of Civil Engineering, University of Asia Pacific.

By

Md. Neamul Islam 13105022
Md. Abul Bashar 13105006




University of Asia Pacific
Fall 2016

In partial fulfilment of the requirements for the degree of
Bachelor of Science in Civil Engineering

UNIVERSITY OF ASIA PACIFIC
DEPARTMENT OF CIVIL ENGINEERING
CERTIFICATE OF APPROVAL

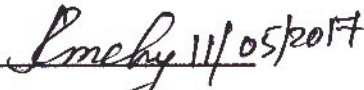
We hereby recommend that the thesis presented by Md. Neamul Islam and Md. Abul Bashar entitled
“ANALYSIS OF WATER PRICING FOR DOMESTIC USE AT BOGURA MUNICIPALITY IN
BANGLADESH” be accepted as fulfilling the requirements for the degree of Bachelor of Science in
Civil Engineering.

Chairman of the committee (Supervisor)

 11-05-17


Dr. Muhammad Mizanur Rahaman
Professor and Head
Department of Civil Engineering
University of Asia Pacific

Member (External)

 11/05/2017

Rumman Mowla Chowdhury
Assistant Professor
Department of CE, UAP

Member (Ex Officio)

 11-05-17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

Department of Civil Engineering
University of Asia Pacific
Dhaka 1205, Bangladesh. FALL 16

Abstract

In determining domestic water prices, policy makers often need to use information about the demand side rather than only relying on information about the supply side. Household surveys have frequently been employed to collect demand discrete choice household survey model. It discusses how the model can be utilized to collect and analyze information about the acceptability of different water prices by different types of households. As well as household's willingness to pay for water service improvement. The results obtained from these surveys can be directly utilized in the development of water pricing and subsidy policies. The paper also presents an empirical multiple bounded discrete choice study conducted in Bogura, Bangladesh. In this case, domestic water service quality was seriously inadequate, but financial resources were insufficient to improve service quality. with a survey about 75 households in Three study area in Bogura Municipality.

**Restaurants food waste management survey (a case study
over Dhanmondi area)**

A thesis submitted by

**S.M. TOUKIRUL ISLAM
12105049
MD. MAIDUL ISLAM
12105082**

**In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering**

Fall 2016

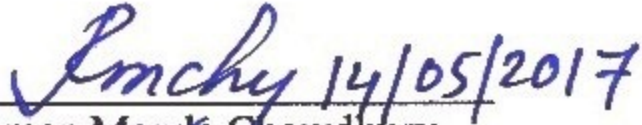


**Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh**

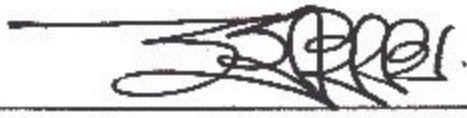
CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **S.M. Toukirul Islam**, and **MD. Maidul Islam** entitled **Restaurants food waste management survey (a case study over Dhanmondi area)** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.


Chairman of the Committee
(Supervisor)


Rumman Mowla Chowdhury
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)


Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)


Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Food waste occurs at every stage of the value chain. The issue of food waste within Dhaka City has recently received more attention from policy makers, industry and consumers for its economic, environmental and social impacts. Study and policy efforts though have focused predominantly on Dhanmondi area and how to reduce food waste in this location.

This study examines how restaurants in Dhanmondi handle their waste, and in what way current policy encourages or discourages waste reduction by restaurants, in order to propose a waste reduction strategy for the future. Municipalities in Dhaka City currently face serious issues regarding the management of their solid waste, with a general acceptance emerging of the unsustainability of landfills, and with decreasing space for them. Further, with food waste, it is not just the products themselves that are lost; it is the energy, water, packaging and human resources used in production, transportation and food service. Education initiatives are needed to gain support of both restaurant owners, workers and the consumer to commit to waste reduction.

This study uses a mixed-method approach relying on document analysis and interviews with relevant persons in the restaurant industry. The study begins by exploring issues in restaurants food system that result in the current levels of food waste. It then identifies the current context of restaurants in Dhanmondi area. This study found that substantial regulatory changes are required to achieve substantial reductions in restaurant food waste.

WATER PRICING OF FOUR SLUMS IN BARISAL CITY CORPORATION: AN ANALYSIS

A thesis submitted by

MD SHAFIM KHAN
13105085

MD. MAHADI HASAN RABBY
13105007

MD. TARIQUL ISLAM
13105035

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

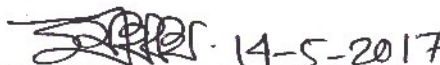


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

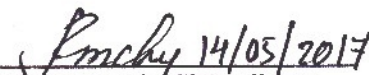
CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Md Shafim Khan, Md. Mahadi Hasan Rabby and Md. Tariqul Islam** entitled “**water pricing of four slums in barisal city corporation: an analysis**” is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

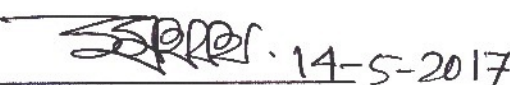
Chairman of the Committee
(Supervisor)


14-5-2017
Dr. Muhammad Mizanur Rahaman
Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)


14/05/2017
Rumman Mowla Chowdhury
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)


14-5-2017
Dr. Muhammad Mizanur Rahaman
Professor and Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

'By means of water, we give life to everything' (Al Qur'an, Surah Al-Anbiya', 21:30)

From this verse of Holy Qur'an, it is clear that water is the most important thing of Earth. But nowadays, getting quality water has become very expensive for many other developing countries like Bangladesh. Though Bangladesh is a riverine country, it has become a major challenge for her to provide quality water at a reasonable price to the citizens. Mostly the poor citizens from slums suffer in this issue. That's why an analysis of water pricing is necessary to find out the current water pricing of the study area & to compare the pricing with other places from all over the world.

This study focuses on some major slums in "**Barisal City Corporation**" named **Stadium colony Slum, Vatar Khal Slum, Palaspur Guchchhogram & Namar Char Slum**. A field survey has been performed during January 2017. It involves semi structured questionnaire survey & focused group discussion with slum dwellers & various stakeholders.

It is observed that 75% slum dwellers of Barisal City Corporation uses water without any cost. They mainly use the tube well water as they are not capable of acquiring the legal connection from BCC because of poverty & easy water accessibility. On the other hand the rest 25% stakeholders who are using legal connection from BCC paying a huge amount for water than others even from Dhaka WASA & many other developed countries. It's a pure injustice for them because these people are earning very low & their lifestyle is much more unhealthy & poor from most of the people.

According to Bangladesh Water Act 2013, access to drinking water and water for domestic usage is a basic right of everyone. But getting quality water at a right price has become very tough nowadays. This is why a study is essential to improvise the situation with higher investment, effective private sector participation, improved billing and revenue collection, structural reforms, establishing a regulatory body and finally converting BCC into a truly service oriented commercial organization.

VIBRATION MITIGATION OF STRUCTURES USING PASSIVE CONTROL SCHEMES SUBJECTED TO DYNAMIC LOADS

A thesis submitted by

MD. SAHIN HALDER

REG. NO: 13105002

MAHFUZ AHMAD

REG. NO: 13105034

MD. MIZANUR RAHMAN

REG. NO: 13105062

**In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering**

Fall 2016




**Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh**

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **MD. SAHIN HALDER, MAHFUZ AHMAD and MD. MIZANUR RAHMAN** entitled **Vibration Mitigation of Structures Using Passive Control Schemes Subjected to Dynamic Loads** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)


14/05/17


Dr. M. Shamim Miah
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Dr. Iftekhar Anam
Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)


14-5-2017

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Typically, earthquake is one of the biggest natural hazard faced for the real structures. In order to control the vibration of buildings during seismic events, energy absorbing passive damping devices are most commonly used for vibration mitigation. Now a day, there are a number of manufactured dampers available in the market, which uses a variety of materials and designs to obtain various levels of stiffness and damping. Some of them include friction, yielding, viscoelastic and viscous dampers. These dampers are usually installed between two load bearing elements (walls or columns) in new building. In existing buildings, which require retrofiting, they could be installed in cut-outs of shear walls, as evidenced from recent investigations. An effective damping system can result in higher levels of safety and comfort, and can also lead to considerable savings in the total cost of a building.

The aim of the study is to evaluate the performance of frames using defferent passive control systems. Three types of passive mechanisms, such as; (i) Spring, (ii) Bracing and (iii) Weight of water as extra mass. Finite element methods were employed in the analysis using the SAP2000 version 18. A direct integration dynamic analysis was carried out to obtain the damped and undamped responses of the structures in order to evaluate the effectiveness of the damping system for mitigating the seismic response. The scaled EL Centro 1940 earthquake has been used in this study.

KEYWORDS: Structural response, Extra mass, Dynamic analysis, Passive mechanism.

POLLUTANT REMOVAL VARIATION IN UNSATURATED AND PARTIALLY SATURATED VERTICAL FLOW WETLAND

A thesis submitted by

RAIHANUL ISLAM SOURAV

12205003

MD. IMAMUL HOSSAIN

13105019

MD. ROCKY

13105025

INJAMAM UL HAQUE

13105086

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016



Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

**UNIVERSITY OF ASIA PACIFIC
DEPARTMENT OF CIVIL ENGINEERING**

CERTIFICATE OF APPROVAL

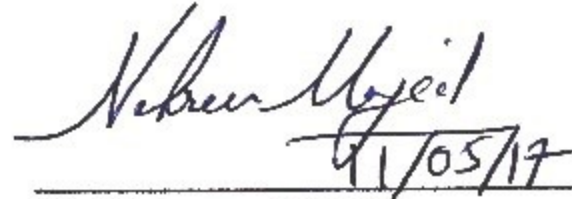
We here by recommend that the thesis presented by Raihanul Islam Sourav, Md. Imamul Hossain, Md. Rocky and Injamam ul haque entitled "Pollutant Removal Variation in Unsaturated and Partially Saturated Vertical Flow Wetland" be accepted as fulfilling this part of the requirements for the Degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)



11/5/17
Dr. Tanveer Ferdous Saeed
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



11/05/17
Dr. Nehreen Majed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



11-5-17
Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This paper reports on the pollutant removal variation in unsaturated and partially saturated in vertical flow wetlands in domestic waste water. This paper mainly represents the capacity of removal of Ammonia, Nitrate, Total Nitrogen, COD, BOD and E. Coli by VSSF system.

Four cylindrical shapes made with high strength plastic materials. The dimension of the VSFCWS had diameter of 0.56 m with 0.96 m height. Outlet valves VF systems A₁, A₂, A₃ and A₄ were fitted at 0.96 m, 0.82 m, 0.67 m and 0.53 m respectively from the top. Organic Straw was used as media for the growth of microbial community. The drainage domestic wastewater was collected from Dhanmondi Rd No.7 and 25 liters of drainage wastewater were dosed into each VSSF system for 5 days a week. The experiment was continued for 9 weeks.

The overall Ammonia removal capacities were 43% and 48% in the outlet of A₁ and A₂ respectively. Similarly the overall Nitrate removal capacities were -140% and -180% in the outlet of A₁ and A₂ respectively. Similarly the overall total nitrogen removal capacities were 37% and 38% in the outlet of A₁ and A₂ respectively. On the other hand the removals the overall COD capacity were -57% and -74% in the outlet of A₁ and A₂ respectively. Similarly the overall BOD removal capacities were 32% and 11% in the outlet of A₁ and A₂ respectively. Also the overall E. Coli removal capacities were 53% and 71% in the outlet of A₁ and A₂ respectively.

The Vertical Sub Surface Flow (VSSF) Wetland could sustain and able to remove about 33% and 37% Ammonia respectively in the Outlet A₃ and A₄. Similarly Nitrate was removed about -21% and -28% respectively in the Outlet A₃ and A₄. On the other hand the removal percentages of total nitrogen were 28% and 27% respectively in the Outlet A₃ and A₄. Similarly COD were removed about -24% and -24% respectively in the Outlet A₃ and A₄. Similarly the overall BOD removal capacities were -3% and 21% in the outlet of A₃ and A₄ respectively. Also the overall E. Coli removal capacities were 67% and 57% in the outlet of A₃ and A₄ respectively.

A₁ and A₂ was unsaturated condition, A₃ and A₄ was partially saturated. The result also influenced by aerobic and anaerobic condition.

INFLUENCE OF WATER DEPTH VARIATION ON POLLUTANT REMOVAL IN VERTICAL FLOW

A thesis submitted by

Md. Resalat Ullah khan Akib
13105033

Sadman Sadik
13105041

Shaikh Raziur Rahman Shawon
13105064

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

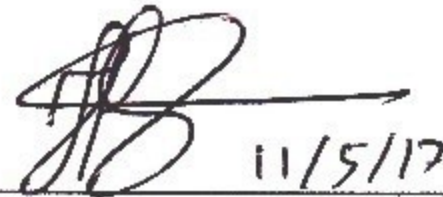


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

We thereby recommend that the thesis prepared by **Md. Resalat Ullah khan Akib, Sadman Sadik, and Shaikh Raziur Rahman Shawon** entitled **Influence of Water Depth Variation on Pollutant Removal in Vertical Flow** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

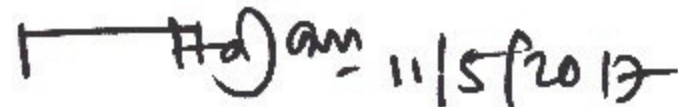
Chairman of the Committee
(Supervisor)



11/5/17

Dr. Tanveer Ferdous Saeed
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



11/5/2017

Dr. Md. Mahmudul Hasan
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



11-5-17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

This paper reports on the pollutant removal efficiencies of vertical wetland in treating Pollutants present in Dhanmondi road no. 7 domestic wastewater. This paper mainly represents the influence of water depth variation on pollutant removal in vertical flow Wetlands under constant and variable hydraulic loading. The water bodies of this area was explored and the pollution of the water of the came into focus.

Four cylindrical shape tanks were used to the research. Straw was used as a media for the growth of microbial community. The system used for this purpose was cylindrical shape tank on which straw was set up where a variety of aquatic plants were allowed to grow with their roots submerged in water.

Polluted domestic wastewater from Dhanmondi road no. 7 was dosed into the system and Pollutant hydraulic load in influent domestic waste water from the system was tested over a period of last 7 weeks. The study was conducted in two phases namely 'Phase-I' and 'Phase-II' of first 9 weeks and last 7 weeks respectively. An amount of 25 liters waste water was dosed into the System in Phase-I and 12.5 liters waste water was dosed into the each day of the week in Phase-II.

In regular dosing of 10th to 16th Week Phase-II the overall Ammonia removal capacity of the system A₁,A₂,A₃,A₄ are 65%, 41%, 24%, 34% respectively. The highest Ammonia removal was achieved in system A₁ in 13th week. Then it was reduced in the following weeks at first Ammonia is converted to Ammonium, and then Ammonium is converted to Nitrite then to Nitrate. The system didn't get enough time to transform into Nitrate So that the removal percentage of Nitrite is 67%, 0%, 30%, 88% respectively. the overall TN removal capacity of the system A₁,A₂,A₃,A₄ are 61%, 37%, 23%, 32% respectively. The highest TN removal was achieved in system A₁ in 13th week. COD removal capacity of the system is 17%, 14%, 17%, -3% respectively. E.Coli removal capacity of the system is 65%, 46%, 29%, 11% respectively. The highest E.Coli removal was achieved in system A₂ in 12th week.

Performance Evaluation And Comparison Among Effluent Treatment Plants With Different Configuration

A Thesis Submitted By:

Md. Palash Raihan

Mohammad Mokter Hossain

**In partial fulfillment of the requirement for the degree of Bachelor of Science
in Civil Engineering**

Certificate of Approval

We hereby recommend that the thesis prepared by **MdPalashRaihan and Mohammad Mokter Hossain** entitled “**Performance evaluation and comparison among Effluent Treatment Plants with different configuration**” is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.


14/05/17

Dr. NehreenMajed

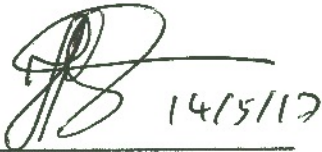
Assistant Professor

Department of Civil Engineering

University of Asia Pacific (UAP)

Chairman of the Committee

(Supervisor)


14/5/17

Dr. Tanveer Ferdous Saeed

Associate Professor

Department of Civil Engineering

University of Asia Pacific (UAP)

Member

(External)


14-5-17

Dr. Muhammad Mizanur Rahaman

Professor

Department of Civil Engineering

University of Asia Pacific (UAP)

Head of Department

(Member)

ABSTRACT

The increasing number of industries in Bangladesh, including textile dyeing operations, have seriously elevated the level of water pollution that the country had already been experiencing. The main attempt of this thesis was to study the evaluation of existing condition of textile effluent treatment plants (ETPs) of Dhaka city. In this motivation, at first we visited four textile industries that have ETPs around Dhaka city. The probable discharge points of these industrial ETPs were alongside the major water bodies of Dhaka city such as Turag River, and Buriganga River. In this study, we also surveyed two standard biological ETPs and two standard chemical ETPs along with their operational configurations, discharge water quality and typical contaminant removal rates in order to check the adequacy of the ETPs. The ETPs that were surveyed are Zaber & Zobaer Fabrics Ltd, Spring Trade Ltd, Color City Ltd and L U Sine Ltd. Samples were collected from the inlet and outlet of the ETPs to obtain the percent removal of the contaminants. The analyzed water quality parameters were compared with the national water quality guidelines for discharging into inland waters. The amount of effluent that is discharged from Zaber & Zobaer Fabrics Ltd ETP is 7500 m³/day, from Spring Trade Ltd ETP is 240 m³/day, from Color City Ltd ETP is 11500m³/day and from L U Sine is 1440 m³/day. Percent removal of total dissolved solid for Zaber & Zobaer Fabrics Ltd. and Color City were 40.5% and 30% respectively whereas for Spring Trade Ltd and L U Sine Ltd there was no significant removal. Percent removal of total suspended solid of Zaber & Zobaer Fabrics Ltd. was 88.5% ,for Spring Trade Ltd was 77.5%, for Color City Ltd was 90% and for L U Sine Ltd was 75%. Percent removal of biological oxygen demand (for 5 days) of Zaber & Zobaer Fabrics Ltd was 94%, for Spring Trade Ltd was 94.84%, for Color City Ltd was 93.8% and for L U Sine Ltd was 93%. Evaluation of Percent removal of chemical oxygen demand of Zaber & Zobaer Fabrics Ltd. revealed no removal, for Spring Trade Ltd was 40%, for Color City Ltd was 85% and for L U Sine Ltd was 47.5%. Thus satisfactory removal was optimum with respect to total suspended solid, BOD5 and color for all of the ETPs, whereas other water quality parameters need to be treated with better efficiency.

**USE OF RICE HUSK ASH AS PARTIAL REPLACEMENT
FOR CEMENT IN MORTAR**

**MINHAZ ZAMAN
REGISTRATION NO: 12205032**

**MD. SHALEH AHMED
REGISTRATION NO: 12205051**

**OLLIULLAH LIPON
REGISTRATION NO: 12205059**

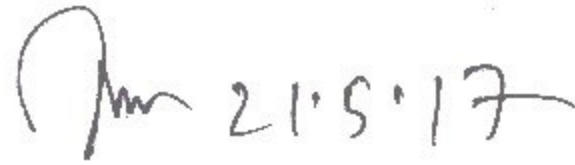
**MD. MAHMUDUR RAHMAN
REGISTRATION NO: 12205075**

FALL 2016

**DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF ASIA PACIFIC
DHAKA**

CERTIFICATE OF APPROVAL

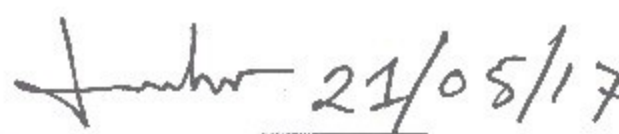
We hereby recommend that the thesis presented by **Minhaz Zaman, Md. Shaleh Ahmed, Olliullah Lipon and Md. Mahmudur Rahman** entitled **USE OF RICE HUSK ASH AS PARTIAL REPLACEMENT FOR CEMENT IN MORTAR** be accepted as fulfilling this part of the requirements for the degree of Bachelor of Science in Civil Engineering.

 21.5.17


Chairman of the Committee
(Supervisor)

Syed Jamal Uddin Ahmed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)

 21/05/17
Dr. M. Shamim Miah
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

 21-5-17
Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Rice Husk Ash (RHA), obtained from controlled combustion, can be used as an alternative construction material for concrete and bricks. Each year large quantity of RHA produced by uncontrolled combustion, is an environmental concern. However, Rice husk ash (RHA) has been used as a highly reactive pozzolanic material to improve the microstructure of the interfacial transition zone (ITZ) between the cement paste and the aggregate in high-performance concrete. Rice husk which consists of non-crystalline silicon dioxide with high specific surface area and high pozzolanic reactivity. It is used as pozzolanic material in mortar and concrete, and has demonstrated significant influence in improving the mechanical properties of mortar and concrete.

Much attention has been paid to the characterization of the structure and properties of rice husk ash (RHA), but little to the burning temperature dependence of its structure and properties. This dependence is important for the structure and property optimization of RHA in a controllable manner. In this paper, we present the burning temperature and burned at various ways at Rice husk (RH).

Also, the paper presents the experimental investigation conducted on rice husk ash (RHA) mortar to evaluate the compressive strength. In the preparation on of rice husk as a partial replacement of Ordinary Portland Cement (OPC) on the structural properties of mortar cement was replaced at various percentage levels such as 0%, 2%, 4%, and 6%.

We collected Rice husk at Karanigang Upazila. We Used field and oven burning method. The oven burning method found to be more suitable for quality RHA. The compressive strength results show higher percentage of RHA develop better strength at later stage.

DEVELOPMENT OF CORRELATION AMONG RI, UPV, AND CORE STRENGTH OF CONCRETE

A thesis submitted by

C.M. MAINUL ISLAM
13105067

RAKIBUL ISLAM
13105074

MD. MAHBUBUR RAHMAN
13105076

MD. MUHIB HOSSAIN
13105083

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

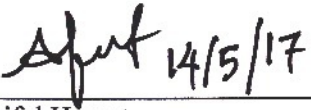


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

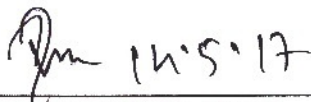
We thereby recommend that the thesis prepared by **C.M. Mainul Islam, Rakibul Islam, Md. Mahbubur Rahman, and Md. Muhib Hossain** entitled **Development of Correlation Among RI, UPV, And Core Strength Of Concrete** is accepted as fulfilling the part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)




Ariful Hasnat
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Sayed Jamal Uddin Ahmed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Accurate prediction of concrete compressive strength is imperative for investigating the in-situ concrete quality. To avoid destructive testing, developing reliable predictive models for concrete compressive strength using nondestructive tests (NDTs) is an active area of research. However, many of the developed models are dependent on calibration and/or concrete past history. This reduces their utility for in-situ predictions. This paper develops predictive models for concrete compressive strength that are independent of concrete past history.

To this end, ultrasonic pulse velocity (UPV) and rebound hammer (RH) tests were performed on 22 concrete building structures. Next, compressive strengths were determined using destructive testing (Core test) and predictive models were developed using NDT results. Furthermore, to ensure generalizability to new data, all models were tested on independent data collected from ten different research papers. The results support combined usage of UPV and RH in an exponential and linear model structure. Therefore, the final model was proposed based on combining models from a threefold cross-validation of the experimental data. This model predicted the independent data with very something like good accuracy. The method can be easily applied to, concrete specimens as well as existing concrete structures. The final results were compared with previous ones from literature and also with actual results obtained from samples extracted from existing structures.

**EFFECT OF SAND TO TOTAL AGGREGATE RATIO ON
MECHANICAL PROPERTIES OF STONE AGGREGATE
CONCRETE :PART II**

A Thesis submitted by

**RAFI AHMED
FAKHRUL ALAM
HIMEL KANTI DAS
MD. KHAIRUL BASHAR**

**In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering**

FALL 2016

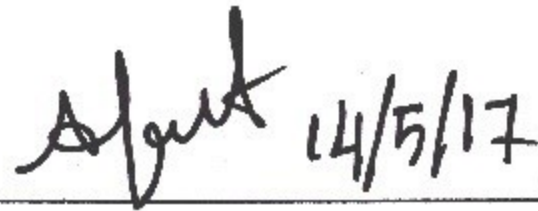


**DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF ASIA PACIFIC**

Certificate of Approval

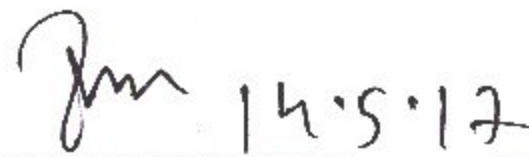
The thesis titled “**Effect of Sand to Total Aggregate ratio on Mechanical Properties of Stone Aggregate Concrete**”, Submitted by: **Rafi Ahmed, Fakhrul Alam, Himel Kanti Das and Md. Khairul Bashar**. Session: Fall 2016 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)


14/5/17

Engr. Ariful Hasnat
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)


14.5.17

Syed Jamal Uddin Ahmed
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)


14.5.17

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

Abstract

Concrete is widely used in modern era of construction. Concrete has many properties among them strength is an important property. This study examines to evaluate the effect of sand to total aggregate volume ratio on mechanical properties of stone aggregate concrete. In this study, twelve mixes were made with different sand to total aggregate (s/a ratio 0.35, 0.40, 0.45, and 0.50) and w/c ratio (0.50, 0.60, and 0.70). We used a gradation for coarse aggregate which was (3/4 down and in 12.5 mm 70% retained and 4.75 mm 30% retained) .Portland composite cement content kept constant 340 kg/m³. The properties of stone aggregate such as specific gravity, unit weight, and abrasion value were tested. The fresh-state properties were executed by Slump cone test. About 144 cylinder concrete specimens of diameter 4 in and height 8 in were made. . Concrete specimens were tested at 7, 14, 28 and 56 days to determine the compressive strength, tensile strength, stress-strain response and Young's modulus of hardened concrete. From this test we got some important points. The compressive strength of concrete increased with the increased of s/a ratio and compressive strength decreased with the increased of w/c ratio. Stress-strain indicates that all twelve cases follow a parabolic shape which means when the strain is increased, stress also increased.

ROADSIDE URINATION AND PUBLIC TOILET FACILITIES IN DHAKA, BANGLADESH

A thesis submitted by

KAZI RAYHAN

12205036

MD. JOBAER AHAMED

13105008

KOUSHIK BASAK

13105038

**In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering**

Fall 2016

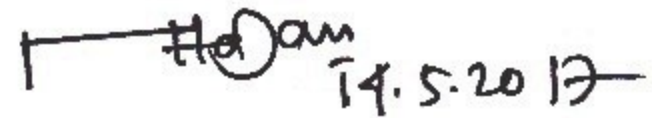


**Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh**

CERTIFICATE OF APPROVAL

We hereby recommend that the thesis prepared by **Kazi Rayhan, Md. Jobaer Ahamed and Koushik Basak** entitled **Roadside Urination and Public Toilet Facilities in Dhaka, Bangladesh** is accepted as fulfilling part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)

 14.5.2017


Dr. Md. Mahmudul Hasan
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)

 14.5.2017

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)

 14.5.2017

Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

Dhaka, the capital city of Bangladesh faces terrible crisis of proper sanitation in terms of public toilet and urinal facilities which ultimately results roadside urination. Mass migration, booming populations, unplanned and over urbanization boosts this unacceptable practice of roadside urination which impacts on society, environment and public health. This research work focused very first time on this usual and regular incident of the city to identify spots, to find out the reasons and impacts, to evaluate the existing facilities and to assess public perceptions. The study was carried out through manual and random field survey throughout the different spots of Wards No. 15-21 of Dhaka South City Corporation (DSCC). Total four different questionnaire forms were prepared for four different groups of people corresponding i) roadside urinator, ii) affected people, iii) public toilet users and iv) public toilet operators. All the questionnaires focused on public awareness and acceptance of this bad practice, frequency of the incidents, willingness of paying fees for using public toilets, public expectation regarding facilities, Government and Non-Government initiatives to stop roadside urination etc. Global Positioning System (GPS) device was also used during the survey. The collected survey data were analyzed using a statistical software. The results indicated that majority percentages (80%) of people were aware of this unacceptable practice but they were bound to urinate at roadside due to intense insufficiency of the existing facilities. Lacking of law enforcement was also accountable for remaining this problem. Besides causing acute odor problem roadside urination also influenced the public health. Nearly half of the users were unsatisfied about the hygienic conditions of the existing public toilets. More than 70% of people relied on the effectiveness of privatization of this sector. The possibilities of earning revenues from this sector were also come out through this study.

EVALUATION OF DUCKWEED BASED WASTEWATER TREATMENT SYSTEM FOR TREATING DOMESTIC WASTEWATER

A thesis submitted by

MAHMUDUL HASAN SAJIB

12205085

MEHEDI HASAN

13105042

SOHANUR RAHMAN SAJAL

13105048

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Civil Engineering

Fall 2016

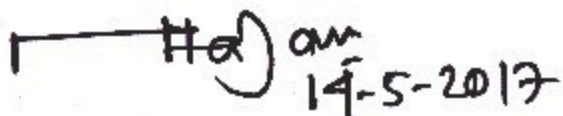


Department of Civil Engineering
University of Asia Pacific
Dhaka, Bangladesh

CERTIFICATE OF APPROVAL

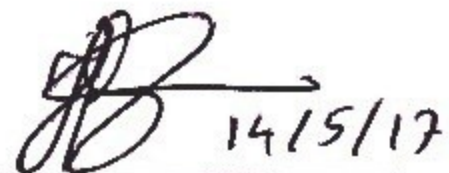
We hereby recommend that the thesis prepared by **Mahmudul Hasan Sajib, Mehedi Hasan and Sohanur Rahman Sajal** entitled **Evaluation of Duckweed Based Wastewater Treatment System for Treating Domestic Wastewater** is accepted as fulfilling part of the requirements for the degree of Bachelor of Science in Civil Engineering.

Chairman of the Committee
(Supervisor)




Dr. Md. Mahmudul Hasan
Assistant Professor
Department of Civil Engineering
University of Asia Pacific

Member (External)



Dr. Tanveer Ferdous Saeed
Associate Professor
Department of Civil Engineering
University of Asia Pacific

Member (Ex Officio)



Dr. Muhammad Mizanur Rahaman
Professor & Head
Department of Civil Engineering
University of Asia Pacific

ABSTRACT

A study was carried out in Dhaka; Bangladesh to evaluate the duckweed (*S. Polyrhiza*) based wastewater treatment system for improving the quality of domestic wastewater. The actual raw domestic wastewater was collected from a residential building and was poured in a small scale reactor (20 L) which was set up at open atmosphere with an experimental condition of 5 days Hydraulic Retention Time (HRT). The study was carried for 11 weeks to find out the nutrient removal and organic removal performances. Actual domestic wastewater samples as influent and effluents from the reactor were collected and analyzed weekly from November 2016 to February 2017. The results showed that $\text{PO}_4\text{-P}$, $\text{NO}_3\text{-N}$, $\text{NO}_2\text{-N}$, $\text{NH}_3\text{-N}$, COD, TDS and TSS decreased by 91.1%, 70%, 100%, 76.1%, 94.3%, 40.9% and 93.8%, respectively. It indicated that duckweed based wastewater treatment system can be successfully used for treating domestic wastewater in developing countries. Further studies with different experimental conditions (HRT 1 day, HRT 3 day) were also recommended.