

CE 405: Civil Engineering Project 1 - 2022

Project titles

Project Number (C/16/)	Supervisor's Name	Project title	Brief description on the project
Environmental Engineering			
1	Prof. KGN Nanayakkara	1. Hydrodynamic and reaction modelling of electrochemical cells for water treatment	Enthusiasm and some understanding (or willingness to learn) of programming can be an added advantage to carry out this project. More than 80 % of the project work will be based on computer simulation and data collected during previous research will be used to validate the models. However, if the need arises, some experimental studies might be needed. This is going to be a new research focus in our laboratories.
2		2. Hydrodynamic and reaction modelling of membrane-based treatment systems	Enthusiasm and some understanding (or willingness to learn) of programming can be an added advantage to carry out this project. More than 80 % of the project work will be based on computer simulation and data collected during previous research will be used to validate the models. However, if the need arises, some experimental studies might be needed. This is going to be a new research focus in our laboratories.
3		3. Variability and rainfall trend analysis	Willingness to learn and apply statistics and programming is expected. Background knowledge in ArcGIS (or willingness to learn) will be an advantage. The project does not include fieldwork or laboratory analysis.
4	Dr RMLD Rathnayake	1. Identification of key sources of pollution of water at the Abathale intake.	Although the Kelani river is an essential source of drinking water for the country, the River water quality at Ambathale intake is threatened by various uncontrolled anthropogenic activities. However, Abathale water treatment plant purifies the raw water extracted from the Kelani river to satisfy the Sri Lankan Standards (SLS). SLS 614:2013 specifies the drinking water quality parameters of the potable water. It was observed that the chemical usage of Ambathale water treatment plant has increased over the years even though the production of the water volume remains approximately the same. It can be because of the temporal variation of water quality. Therefore, it is needed to identify the key sources of pollution to water quality at Ambathale Water Treatment Plant. This project does not include field work or experimental work. Project student needs analyse the existing secondary data and achieve the project objectives.
5		2. Use of STOAT software investigate the performances WasteWater Treatment Plants (Activated sludge system)	To control environmental pollution, the Wastewater Treatment Plant (WWTP) plays a vital role in treating wastewater to comply with quality standards before being discharged into the environment. However, not all WWTPs have worked optimally, so the periodic evaluations must be carried out to determine problems and what efforts can be made to improve WWTP processing quality. STOAT software can be used to model water treatment processes and optimize the processes. Therefore, the aim of this project is to optimize WWTPs under different problematic situations. More than 90% of project work based on computer simulation.
6		3. Performance improvement of trickling filter wastewater treatment system using STOAT software.	To control environmental pollution, the Wastewater Treatment Plant (WWTP) plays a vital role in treating wastewater to comply with quality standards before being discharged into the environment. However, not all WWTPs have worked optimally, so the periodic evaluations must be carried out to determine problems and what efforts can be made to improve WWTP processing quality. Trickling filters are widely used in wastewater treatment. There are some issues in treatment efficiency due to various reasons. STOAT software can be used to model water treatment processes and optimize the processes. Therefore, the aim of this project is to optimize WWTPs under different problematic situations. More than 90% of project work based on computer simulation.
7	Dr WCTK Gunawardana	Analyzing water quality in a pipe distribution network	This study aims at analysing water quality variation within water distribution network, arises due to leakages and pressure variations. Distribution network modelling will be done and relevant data for the study can be collected from NWDB. Minimum lab experiments (<10%) would be required to analyze water quality of few samples collected from an identified distribution network.
8		Modelling stormwater management systems in response to different rainfall and land use patterns	The study aims at evaluating the effectiveness of stormwater management practices for high intensity less frequent events with different land use practices. The research involves modeling using SWMM software. The research work will be mainly based on computer simulations.
9		Assessing the effect of air quality and atmospheric deposition	The objective of the study is to examine the air quality and deposition behavior associated with changes in emission and weather parameters. A limited amount of field data collection (within the university premises) and laboratory experiment will be involved in the study.
10	Dr GMPR Weerakoon + Prof. GBB Herath	Clogging in vertical subsurface flow constructed wetlands	Clogging of wetlands is a major operational and a maintenance problem in constructed wetlands due to various activities happening within wetland systems. This study aims at evaluating clogging in vertical subsurface flow constructed wetlands and to propose a suitable remedial measure for clogging
11		Evaluation of pharmaceuticals and personal care products (PPCPs) in hospital wastewaters within the Kandy Municipal Council area	Many researchers have reported adverse effects in aquatic environments due to improper release of wastewaters containing pharmaceuticals and personal care products (PPCPs) residues. However, available research works on PPCPs in Sri Lankan waters is limited. Therefore, this study aims at identifying common pharmaceuticals in hospital wastewaters in Kandy and to assess the efficiency of them in a few wastewater treatment plants.
12		Assessment of hygienic risk of waterborne pathogenic organisms in water using novel indicator pepper mild mottle virus	Fecal contamination of water sources via improper sanitation systems is a major problem all over the world. Even though bacterial indicators such as Fecal Coliform and <i>Escherichia Coli</i> (E. Coli) have been used in many studies to identify the hygienic risk of waterborne pathogenic organisms, latest research have shown pepper mild mottle virus (PMMoV) is a better indicator to identify human specific fecal contamination. Therefore, this study aims at evaluating the use of pepper mild mottle virus in different types of water sources to investigate its applicability to identify-fecal contamination.
Fluids, Hydraulics and Hydrology			
13	Prof. KDW Nandalal	Recent changes in the characteristics of rainfall events over Maha Oya basin	Maha Oya basin was affected by flooding during the recent past and these are suspected to be due to changes that may have occurred to the rainfall pattern over the basin. This study will focus on investigating whether changes have occurred to the extreme rainfall events and their frequency and duration. Changes to rainfall at time scales of annual, seasonal and monthly durations will be investigated. Historical rainfall data over 30 years collected at gauging stations in the basin will have to be collected for the study. The results will be useful to identify the impacts of rainfall and its recent changes on flooding in the basin.
14		Spatial and temporal distributions and characteristics of regional drought in North-West Province of Sri Lanka	Drought is a major hazard that has adversely affected agricultural production in the North-West Province of Sri Lanka. Thus, it is vital to evaluate the characteristics of the spatial and temporal distribution of drought and its characteristics in the province. In this study, a suitable drought index, such as palmer drought index or standard precipitation index, etc., will be calculated based on rainfall and temperature data gathered at the gauging stations in the province. The results of this study can respond to the adverse effects of drought.
15		Improved operation of Minipe Left Bank Canal irrigation system	The 74 km long Minipe Left Bank canal supplies water to an irrigable area of about 6000 ha (Mahaweli System E). An anicut built at Minipe across the Mahaweli river diverts Mahaweli water to the canal. However, the irrigable areas towards the tail end have suffered from water inadequacy during many seasons in the past. Thus, the raising of the Minipe anicut with the intention of improving the irrigation water supply is currently under progress. This study focuses on investigating the present water distribution pattern and studying the impact of the raised anicut on irrigation water supply during Yala and Maha seasons. The irrigation system will have to be modelled and irrigation water requirements will have to be estimated in the project. The study will reveal the impact of the raising of the anicut on the irrigation water supply to the Mahaweli System E.

16	Dr Hemalie Nandalal	Modelling the Effects of Land-Cover Change on Rainfall-Runoff	This project is based on computer models. Students should follow GIS & RS for Civil Engineers (CE598). Should be capable of handling software problems effectively. Students will investigate the effect of the changes in Land Cover on a rainfall-runoff characteristic of a selected watershed
17		Development of Unit Hydrograph for a watershed using ArcGIS	This project is based on computer models. Students should follow GIS & RS for Civil Engineers (CE598). Should be capable of handling software problems effectively. The students have to use their knowledge in Hydrology in developing a unit hydrograph of a selected watershed incorporating the knowledge of Geographical Information Systems.
18		Parameter identification in rainfall runoff modelling	This project is based on computer models. Students should follow GIS & RS for Civil Engineers (CE598). Should be capable of handling software problems effectively. The selected students have to investigate the different types of Rainfall-runoff models and identify the parameters to be optimised to get the best fitting on the rainfall-runoff relationship.
19	Dr MGMT De Silva	Demand center analysis by identifying raw water sources: A case study in Kegalle	Rapid urbanization and development are causing severe problems of raw water extraction and related environmental and social impacts. Hence, identification of available raw water sources is one of the most important steps involved in water supply planning and designing. This study aims to identify raw water sources in Kegalle to effectively establish the demand centers by identifying various water demands in each demand cluster. At the meantime, a registry of raw water sources can also be developed.
20		Scale effect on rainfall-runoff modeling in upper Kelani river basin	In rainfall-runoff modeling, lumped modeling technique is popular among the research community as it is the most convenient way of modeling. However, the accuracy of a lumped model can be increased by sub dividing the basin into number of sub basins. This study aims to consider the scale effect on the accuracy of rainfall-runoff model results as a case study to upper Kelani river basin. Initially, lumped model of HEC-HMS will be applied to model the runoff at Hanwella. Then the basin will be subdivided in to number of sub basins to model the runoff at Hanwella for comparison and evaluate the scale effect on the runoff accuracy.
21	Mr DD Dias	HYDRODYNAMIC AND WATER QUALITY MODELLING OF TANKS in Mi Oya basin	Global Lake Model (GLM) is intending to be deployed to comprehend how changes in climate drivers are likely to affect important lake processes such as seasonal oxygen dynamics in selected reservoirs in Mi Oya basin.
22		Impact of bathymetric condition on the Tsunami bore and strture interaction	Experimental and CFD blended approach will be used to explore what is the impact of the slope of the bathymetry and its nature on the impact force on a structure due to the collosion of a debri carried by a bore / wave.
23	Dr Panduka Neluwala	Numerical weather forecasting capabilities during Heavy rainfalls	Weather forecasting is important to predict floods, landslides, traffic, air pollution, etc. Numerical weather prediction models are capable of forecasting weather. However, the selection of physics schemes is highly dependant on regional climate. This study aims to develop a realtime weather forecasting model for Kandy
24		Impact of abstraction losses from precipitation in flood routing	Abstraction losses are sensitive parameters in hydrological models, and directly determines the amount of runoff. The study aims at investigating the impacts of precipitation losses in 2D hydrodynamic flood modelling.
25		Flood controlling with sustainable drainage systems	Urban floods can be controlled by introducing porous drains constructed using construction waste. This study aims to investigate the effectiveness of using porous drains to control urban floods. The study would be carried out using numerical 2d Hydrodynamic simulations. Depending on the context, an experiment to investigate the behaviour of porous drains would also be conducted.
Geotechnical Engineering			
26	Dr D de S Udakara	Location identification and Characterization of Expansive soils in matala District	Visit the field and identify the locations with expansive soils in Matala Wilgamuwa area, and characterize them using laboratory testing
27		Characterization of Expansive Soils with Plasticity	Obtain samples from the already identified locations, chacterize them using laboratory testing
28		Effect of Area Correction on the Shear Strength Parameters Obtained from Direct Shear tests	Carry out laboratory Direct shear tests on sandy soil samples, apply an area correction as the test progresses and compare the result with no area correction
29	Dr MCM Nasvi	Stability analysis of road embankment constructed by treating marginal soils with fly ash based stabilizer systems	This project will predict the feasibility of using fly ash (FA) and FA-based geopolymer stabilized marginal soils as sustainable road base materials. Two different types of marginal soil samples will be obtained from the borrow pits of the iRoad project. Different stabilized mixes will be prepared by varying the stabilizer mix compositions and the optimum stabilizer mix will be obtained. Further, the stability of the road embankment constructed using FA as a filling material and the stabilized marginal soil as a cover material will be predicted using numerical software such as GeoStudio and PLAXIS
30		Triaxial mechanical behavior of blended fly ash-rice husk ash based geopolymer well cement under different temperature conditions	This project will use geopolymers as wellbore cement instead of conventional Portland cement for underground geological CO2 sequestration wells. Aim of this project is to analyze the triaxial mechanical behavior of FA-RHA blended geopolymers cured under different curing temperatures. A series of triaxial experiments will be conducted using the rock triaxial equipment available in the Geotechnical Engineering laboratory by varying the temperature of the samples. Activator modulus (AM) based mix design will be adopted to prepare geopolymer specimens . A confining pressure range of 0 - 20 MPa and tempeature range of 25 - 80 deg will be used for the testing simulating deep underground geological conditions
31		Novel analytical method to predict the geotechnical engineering properties of clayey soil stabilized with different cementitious binders	This research will use artificial neural network (ANN) machine learning toolbox in MATLAB to develop correlations to predict the geotechnical properties of clayey soils stabilized with Portland cement, lime and fly ash. The required parameters for the model including Atterberg limits, MDD, OMC, UCS, CBR, etc. will be collected from the literature. The developed ANN model will be validated by performing laboratory experiments for clayey samples stabilized with the above cementitious binders.
32		Dynamic response of Under Sleeper Pad (USP) used in ballasted rail track: A numerical study	Using rubber inclusions to reduce deformation and degradation of railway foundation is a novel technique to improve the performance on ballasted tracks. This project aims to investigate the influence of USP thickness and stiffness on the dynamic response of ballasted rail tracks using a 3-D finite element train-track model. The specific objectives are the development and validation of a numerical model to capture the static and dynamic response of USP, development and validation of a numerical model of ballasted rail track system with and without USP and evaluate the influence of USP on rail track response using validated numerical models and conducting a parametric study to investigate the USP thickness and stiffness on rail track performance. Note: Two Supercomputers (Workstations) are available at the Geotechnical Laboratory will be used to facilitate the numerical simulation work.

33	Dr SK Navaratnarajah	Experimental and Numerical Study of Shear and Degradation Response of Railway Ballast with Modified Under Sleeper Pads (USPs)	The past study shows that the use of rubber pads under the sleepers (USPs) significantly reduce the deformation and degradation of railway ballast materials. In order to improve the performance further, this study is to investigate the influence of surface texture of USP on shear and degradation response of railway ballast using a series of large-scale direct shear tests and a Discrete Element Method (DEM) simulation. The specific objectives are, development and validation of a numerical model to capture the static and dynamic response of USP using DEM approach, conducting a series of large-scale direct shear tests to investigate the effect of the surface texture of USP on shear and degradation response of railway ballast, development and validation of a DEM model of large-scale direct shear test with textured USPs and conducting a parametric study to investigate the influence of different texture types of USP on shear and degradation behaviour of ballast. Note: Two Supercomputers (Workstations) are available at the Geotechnical Laboratory will be used to facilitate the numerical simulation work.
34		Performance enhancement of rail track ballast by the inclusion of rubber and geosynthetic.	Rubber is a great energy absorbing element and geosynthetic grids work well increasing the shearing resistance of ballast materials. This study is to analyze the shear, dilation, and breakage behaviour of rail track ballast stabilised with rubber and geosynthetic grids under direct shear loading. The specific objectives are conducting large-scale direct shear tests on ballast with geogrids of two different aperture sizes, rubber elements placed in combination with geosynthetic grids, and comparing the combined performance of rubber and geosynthetic grids stabilised with ballast materials.
35	Dr DTKK Chamindu	Gas diffusivity-based Characterization of Sri Lankan Paddy Soils	Paddy ecosystems constitute a large source of methane, a high potent greenhouse gas, emission from local and regional agro-ecosystems. Paddy emissions, which primarily occur by gas diffusion, are largely underrepresented in the global methane footprint due to lack of reliable measurements from regional paddy systems. Characterization of paddy soils is an essential prerequisite to estimate the diffusive gas emissions. This study involves characterization of paddy soils from Sri Lanka based on soil-gas diffusivity measurements for complete saturation scale and investigation of existing descriptive/predictive models to adequately describe measured soil-gas diffusivity.
36		Numerical Investigation of Thermal Conductivity in Differently –characterized Porous Media	Thermal conductivity is an important parameter to characterize heat transport through porous media. Thermal conductivity responses systematically to the change of moisture regimes in porous media. Since measuring thermal conductivity is instrumentally challenging, predictive models offer a convenient alternative to predict thermal conductivity against degree of saturation. This study will investigate an extensive thermal conductivity database representing a wide range of porous media and a wide array of existing predictive models to select best models capturing distinctive features of conductivity-saturation relation.
37		Experimental and Numerical Investigation of Microparticle Transport in Saturated Soil	Micro-scale particles are ubiquitous in natural environmental systems. Such particles can potentially carry contaminants through soils to groundwater, a largely hidden and downplayed mechanism of contaminant migration in subsurface. This study will examine the transport of such particles in saturated soils under varying hydrophysical conditions. Measurements from a controlled-laboratory column study will be numerically simulated using a one-dimensional particle transport model.
38	Dr AMRG Athapaththu	Assessment of Geotechnical Properties of Dredge Sand	Geotechnical properties vary with factors such as confining pressure, relative density, mineralogy, particle crushing, particle size distribution etc. This research aims to primarily to determine the shear strength parameters of dredge sand of Colombo port city project. The Colombo port city development project, which is in coastal region, reclaimed dredge sand over 13 m depth. This project was proposed to include low rise and high rise buildings all over the reclaimed land where the type of foundation may vary depending upon the structural loads and subsurface conditions. Therefore, determination of shear strength parameters for different loading condition is of utmost importance to determine the bearing capacity and to select the dimensions of foundations.
39		Suitability of Existing Rock Mass Classification Systems to Analyse Slope Failures in Weathered Metamorphic Rocks	Rock mass classification systems are integral part of rock mechanics which can be used to determine the behaviour of rock masses depending upon intact rock strength, conditions of discontinuities, ground water conditions etc. Most of the rock mass classification systems are developed to find the behaviour of sedimentary and igneous rock masses. However there are very limited studies for tropically weathered metamorphic rock masses. This study intends to find the suitability of existing rock mass classification systems to analyses slope failures in weathered metamorphic rock masses of central part of Sri Lanka.
40		Comparison of shear strength parameters of jointed rock masses.	The ultimate strength and deformation of jointed rock mass are important parameters in selecting sites for foundations of civil and mining engineering structures in rocks. Also, Shear strength parameters are important to determine the stability of rock masses. Shear strength properties vary with the conditions of discontinuities and other factors. Rock masses, implying problems of large-scale interaction with engineering structures, may have both cohesive and frictional strength components. This study is proposed to compare the shear strength properties of jointed rock masses based on various methods available in the literature.
41	Prof. SBS Abayakoon	Determination of Mechanical Properties of some Sri Lankan Timber species (Part I)	Although timber is a construction material that is commonly used in Sri Lanka there is a need to develop a proper design procedure for such constructions. The lack of such a procedure stems from the fact that some fundamental mechanical properties of commonly used Sri Lankan timber species are yet to be established. Anisotropy of timber needs to be considered in analysis of the strength properties and the considerable variation of properties across different specimens should also be addressed. These projects aim at developing and conducting an experimental procedure to determine material properties of some common Sri Lankan timber species that are used in construction.
42		Development of a Response Spectrum for Colombo, Sri Lanka (With Dr. KK Wijesundara)	Even though, Sri Lanka is located far from the Indo-Australian tectonic plate boundaries, the seismic treat to Sri Lanka can not be discarded. This is mainly due to intra-plate earthquakes recorded in the past in and around Sri Lanka. In the recent studies, the seismic hazard map of Sri Lanka and the corresponding design spectra were developed for the bed rock motion. However, the modified design spectra for different types of soft soils have not been developed yet. Therefore, the objective of this study to develop seismic response spectra that can incorporate the soft soil amplifications in Colombo area.
43		Determination of Mechanical Properties of some Sri Lankan Timber species (Part II)	Although timber is a construction material that is commonly used in Sri Lanka there is a need to develop a proper design procedure for such constructions. The lack of such a procedure stems from the fact that some fundamental mechanical properties of commonly used Sri Lankan timber species are yet to be established. Anisotropy of timber needs to be considered in analysis of the strength properties and the considerable variation of properties across different specimens should also be addressed. These projects aim at developing and conducting an experimental procedure to determine material properties of some common Sri Lankan timber species that are used in construction.
Materials and Structures			
44		Performance of Non-structural Wall-Panels under Thermo-Mechanical Loading in Building Structures	Non-structural walls, external or internal walls, play a significant role in building structures by creating better interior and exterior for buildings. While considering the effect of different loadings on structural elements, non-structural elements also should be investigated under thermal and mechanical loadings. In this study, the overall performance of the internal and external walls will be numerically analyzed under mechanical and thermal loadings. For the numerical analysis, different software can be used, and coupled analysis will be simulated to check the behavior of walls under fire and wind loadings. Then improvements for the better performance of non-structural walls can be suggested and proved with different sizes and materials by numerical studies.

45	Dr JASC Jayasinghe	Modification of Wind Response Caused by Shape of Structure Considering Interfering Effects: A Study based on CFD Simulations	The conventional methods to analyses the wind loads, such as code-based methods, have not been able to give accurate results to the structures with irregular geometries. Most of the wind codes are restricted with simple geometries. Therefore, wind tunnel test and CFD are widely used to analyses the structure with irregular geometries as they have the flexibility to modal the general civil structure as it is. Additionally, it represents the actual surrounding with the neighboring buildings, which facilitates considering the shielding effect. Studies show that the shielding effect may increase the wind load with respect to the upstream structure's geometry and orientation. Therefore, this study is mainly focused on studying the impact of the upstream structure configuration on a downstream structure by using the CFD.
46		Enhance the Performance Partially Concrete Filled Steel Box Column using High Strength Steel	The strength, ductility and energy dissipation capacity of rectangular hollow steel columns subjected to cyclic loads is significantly upgraded by filling with concrete. In addition to that, the lateral capacity of CFT piers can be further improved by replacing the high strength steel instead of conventional steel because most of the compressive stress will be transferred and resisted by the concrete. In contrast, the steel column resists only the tensile strength. Whereas in hollow box pier sections, usage of high strength steel is restricted to a certain extend (up to SM490) due to its premature local buckling in the compressive plates due to the compressive stress. For this analysis, it is necessary to develop a FE model that can be taken into account local buckling of steel plates, confinement of the in-filled concrete and interface action between steel tube and in-filled concrete.
47	Dr AJ Dammika	Numerical investigation on Lateral Distortional Buckling behavior of steel concrete composite beams with the influence of combined negative bending and torsional moments.	This study aims to study the behaviors of steel-concrete composite beams subjected to combined negative bending and torsional moments on Lateral Distortional Buckling (LDB). Development of a Finite Element model to investigate the influence of combined negative and torsional moment on LDB behavior of SCC beams and its validation using past experimental data is required. Then a parametric study need to be conducted to investigate the negative bending - torsion interaction relationship and its influence on LDB. Finite element software package ABAQUS is recommended for this study.
48		Effect of damages on damping signature of vibrating structural elements: A finite element approach	Members in bridge structures operate under different loading conditions and often expose to aggressive environment conditions during their service life causing damages and deteriorations. Past research has shown that the damping (energy dissipation characteristics) of a vibrating structure is highly dependent on its stress which may change with the existence of damages. Therefore, it is intended to study the behaviour of selected structural members which subjected to different damage scenarios by using finite element (FE) method while embedding suitable material damping models (based on available relationship between stress and damping) to the FE model and to validate them using existing experimental data. Then feasibility of using energy dissipation characteristics of vibrating structures for their damage detection need to be explored. Finite element software package ABAQUS or suitable any other package need to used in this study.
49		Damage detection of post-tension concrete girder bridges using deep learning approach	This involves possible damage detection of a selected post-tensioned concrete bridge(s) using deep learning. Development of necessary deep learning model with data generated from FE model is necessary with the help of many number of models probably with the help of API. Experimental dynamic characteristics identification of selected bridge(s) is also required in order to validate the FE models of the bridges. Bridge modeling need to be done using SAP2000 or any other appropriate software platform.
50	Dr CS Bandara	Development of degradation prediction models for railway track considering axle load and speed	Track geometry refers to the position of each rail in three-dimensional space and the track geometry parameters used to assess the track quality and plan maintenance activities are the longitudinal level, alignment, gauge, cant, and twist. Maintenance is an efficient way to guarantee the level of reliability during the asset lifetime. Maintenance strategies are of two types: corrective maintenance; takes place after a defect or failure occurs, and preventive maintenance; planned beforehand and performed at proper times. However preventive maintenance schedules' maintenance activities regardless of asset condition, can lead to a high maintenance cost and lower achieved availability. Axle load, speed of rolling stock, temperature, fatigue are some factors affecting the degradation of the model. In this research, it is expected to perform a statistical analysis to identify the behavior of the rail with the variations in these parameters and develop a model using Markov chain Monte Carlo simulations.
51		Performance of welds of geometrically complex steel box piers subjected to combined loading	Welds are generally weak in joints of thick plated structural members and structural members subjected to cyclic loads. Continuous welds are performing better than the discontinuous welds. However, in geometrically complex sections, there are limitations for executing continuous welds. In this research, the performance of geometrically complex thick plate steel box type piers with welds will be studied. The performance of continuous and discontinuous welds will be investigated for combined loading cases for both static and cyclic loading. The cyclic properties will be investigated using the available experimental data from literature. Welded joint design approaches of existing design codes such as EN1993-1-8:2005 and fatigue performance as per EN1993-1-9:2005 will also be studied. The research mainly requires nonlinear numerical modeling.
52		Nondestructive and semi-destructive tests to determine the properties of concrete with plastic aggregates	Considering the sustainability aspects, recycled plastic waste is incorporated in concrete manufacturing as one of the most ecologically and economically sustainable solutions for the rapid trends of annual plastic disposal. However, the bonding between plastic aggregates and cement is weak due to which the strength of concrete mixed with plastic aggregate is comparatively low. The possibility of predicting the strength of concrete with plastic aggregate using nondestructive and semi-destructive tests are yet to be studied. In this research, UPV, rebound hammer and pull out tests will be performed for concrete mixed with HDPE to investigate the effects of the volume fraction of HDPE aggregates on those tests. This study will mainly be an experimental work with a comprehensive literature review.
53	Dr SR Herath	Evaluation of Elastic Properties of Foam Concrete	Foamed concrete is a lightweight mixture of a cementitious binder, water, a stable preformed foam, and, possibly, fine aggregates. It possesses a cellular microstructure, which makes it a highly air-entrained system with typical physical and mechanical properties. In recent years, its use has increased noticeably, mainly due to its low-energy consumption, favorable thermal response, ease of manufacturing and demolition, and a relatively low production cost, especially in comparison to other lightweight materials used for the same purpose. Foamed concrete is used in many sectors of infrastructure mostly as an engineered nonstructural fill, in precast panels, as thermal and acoustic insulation and as a refractory material. This study is aimed to model elastic properties of foamed concrete in order to be effectively used in engineering applications.
54		Analysis of Mechanical properties of Bamboo using Finite element method	Bamboo is a fiber-reinforced bio-composite with superior structural behavior. The hollow structure as well as the gradient distribution of bamboo fiber is the embodiment of the material. It is intended to use existing experimental evidence and model the structure of bamboo using FEM and estimate the mechanical properties considering geometry and constituent properties.
55		Design of lattice structures for 3D printing	Lattice structured materials are popular light weight materials. It is intended to model a few lattice structured materials using numerical and analytical techniques and propose a process for possible 3D printing,
56	Dr KRB Herath	Finite element study of rainflow through porous media in road pavements	Complete study of rainflow passing through the porous media in road pavements using finite element method
57		Shape optimization of reinforced underground tunnels	Shape of underground tunnels will have to be changed and optimized under different surrounding soil, rock and water conditions. A complete finite element study of that.
58		Energy dissipation devices and mechanisms in seismic design	Damages of structural components due to earthquakes could be minimised if the energy in those components during an earthquake could be dissipated effectively. Energy dissipation mechanisms in earthquake engineering and devices are studied under this project.

59	Dr KK Wijesundara	Wind -structure interaction of tall buildings by numerical simulations: Large Eddy Simulation	Main focus of this study is to predict the wind-structure interaction of tall buildings using the Large Eddy Simulation (LES). The wind-structure interaction is the phenomenon that when the wind pressure acts on a flexible building, it tends to deflect significantly and then the deflection causes to change the initial wind pattern and the pressure distribution around the building. Due to this phenomenon, many structural failures were recorded in the past. Therefore, in this study, you will learn how to predict this phenomenon numerically using the finite volume method. you will develop a building model with the surrounding using ANSYS programme to simulate the wind-induced response. The flow will be simulated using the LES which is more potential to provide accurate and more reliable results than the Reynolds Averaged Navier Stokes simulations.
60		Direct displacement based design of planer irregular buildings for seismic loadings	In this project, you will learn a new design philosophy called direct displacement based seismic design of structures that has many advantages over the standard force based seismic design methodology implemented in many codes of practices. There are many studies conducted in validation of this design methodology for different structural configurations. However, very limited studies are available in the literature focusing on how to incorporate the effects of planer irregularities in the design. For the validation purposes, you will learn how to perform nonlinear analysis of frame structures using OpenSees computer programme.
61		Performance based design of stiffened extended end-plate beam-to-column connections	In typical code based practices, you will be guided to design stiffened extended end plate beam-to-column steel connections, which are widely used in steel moment resisting frame structures, using the limit states design approach. However, in this study, you will investigate the application of the performance based design method in designing such connections. You will develop a new design methodology based on the performance based approach and it will be tested numerically using the validated finite element models of the connections developed in MIDAS software.
62	Dr HAD Samith Buddika	1. Earthquake Response Analysis of Reinforced Concrete Minarets in Sri Lanka	Minarets are one of the most important architectural cultural inheritances. They are slender tower-type structures constructed generally as adjacent to the main body of the mosques at the corner side or built individually. A large number of traditional cylindrical reinforced concrete minarets collapsed or were heavily damaged during past earthquakes around the world. From the literature survey, it becomes evident that there were no studies dealing with the dynamic response of reinforced concrete (RC) minarets in Sri Lanka. It is crucial to understand the dynamic behaviour of minarets to improve life safety and to preserve and strengthen the monumental structures. This is one of the first studies carried out to investigate the dynamic response of Sri Lankan minarets under earthquake loading. Finite element analysis are expected to carry out using ETABS finite element software.
63		2. Identification of Natural Frequencies and Dampings of Tall Buildings Using Ambient Wind Vibration Data (Measured data is available, Additional measurements can be done if necessary)	Monitoring of buildings is becoming an increasingly popular topic of research. It allows to evaluate the structural health and check for any possible damage through changes on their dynamic properties. Widely accepted modal testing techniques for such a purpose are Experimental Modal Analysis (EMA) and Operational Modal Analysis (OMA). The main goal is to extract dynamic parameters (natural frequencies, mode shapes and damping) of the building using different OMA techniques: Basic Frequency Domain (BFD), Frequency Domain Decomposition (FDD) and Random Decrement Technique (RDT). Obtained results are then compared to those provided by a Finite Element Model (FEM). Students like to work in the area of high-rise buildings are welcome Willingness to learn MATLAB software or any other programming language will be an added advantage
64		3. Development of Guideline for Scaling Ground Motions for Response-History Analysis of Tall Buildings in Sri Lanka	Even though, Sri Lanka was believed to have no seismic threats, it is now realized that Sri Lanka can no longer be considered as a country safe from seismic threats following the recent events that occurred in and around the island. With the development of tall buildings around the capital city of Colombo, there is a need to identify and develop an accurate method for seismic analysis of structures for Sri Lankan soil conditions. The main objective of this study is to discuss the impact of ground-motion scaling procedures on the performance of tall structures.
65	Dr HD Yapa	1. Efficient retrofitting of dapped-end beams	The retrofitting performance of impaired dapped-end beams is identified to be governed by the type of the initial reinforcement design and the level of internal distress. It is proposed to conduct a parametric study using non-linear numerical simulations to identify optimum strengthening configurations for different scenarios. Depending on the context, an experimental study would also be conducted.
66		2. Assessment of size-effects on shear strength of retrofitted concrete deep beams without stirrups	Several size-effect laws have been proposed and verified for concrete-like quasi-brittle materials. However, there is no such universal law that can quantitatively describe the influence of related factors on size effect in strengthened concrete components without stirrups, for example, the shear failure of beams. In this light, it is proposed to conduct a numerical study to assess the potentials of a novel size effect law to capture the sensitivity of shear span ratio and amount of retrofitting on the shear failure behavior of RC beams.
67		3. Strengthening effect assessment of prestressed near-surface mounted CFRP bar system of aged reinforced concrete beams	The flexural performance improvement of age-deteriorated reinforced concrete (RC) beams by a near-surface mounted carbon fiber-reinforced polymer (NSM CFRP) bar system is proposed to be assessed with non-linear numerical simulations.
68	Dr NMSH Bandara	Structural Health monitoring of piles using wave based techniques	Aim of this study is to monitor the condition of piles using guided wave based techniques. Defects and imperfections in piles can occur due to various reasons and it is critical to identify the presence of these defects. Also, the location of the defects and the defect severity needs to be evaluated using the health monitoring scheme. Numerical simulations of wave propagation with in a pile need to be carried out by developing a soil-pole model in ANSYS software. Recorded wave traces can be subjected to signal processing tools in order to extract the health information of piles.
69	Dr CK Pathirana & Dr KC Chandrasiri	Correlation between Compressive strength development and the porosity of cellular lightweight concrete	The cellular lightweight concrete (CLC) or often call that foamed concrete is either a cement paste or mortar, classified as lightweight concrete, in which air voids are entrapped in mortar by suitable foaming agent. It is widely produced and used for building construction around the world as it has special properties. As a cement-based material, CLC forms a microstructure with pores through the introduction of foam. The pore structure and porosity affect the physical and mechanical properties of CLC. Therefore, the cement skeleton structure is the primary source of CLC strength. This study is focused to identify the effect of porosity on the properties of CLC.
70		Impact of Alkali-Aggregate Reaction for the durability of concrete structures in Sri Lanka	Alkali-Aggregate Reaction (AAR) is a chemical reaction taking place in concrete between alkali in pore solution of cement paste and reactive phases in aggregates. It causes the concrete to undergo expansion with time, resulting in premature cracking of concrete, and unwarranted deformations in structures, which could shorten their service lifetime. In Sri Lanka there are massive concrete structures which are being used for different purposes in which AAR failure could be anticipated. This study is aimed to interpret the impact of AAR for the durability of such concrete structures in the country.
71		Application Prefabrication in the Construction Industry of Sri Lanka	Prefabrication has wide ranging benefits from speed of work, profitability, reduced use of resources, etc. and ultimately leading to sustainability. One important aspect is the construction waste reduction, including reuse, recycle, and reduction in disposal etc. The objective of this study is to explore the impacts of pre-fabrications and how it could help to increase the efficiency and profitability of the construction industry of Sri Lanka.

	72	Dr PBG Dissanayake	Preparation of Extension of Time (EOT) Claims and Delay Analysis Techniques used in the Construction Industry of Sri Lanka	Extension Of Time (EOT) has become a common construction industry related activity in many construction projects, particularly when standard forms of contract is applied and it has been treated as an excusable delay in ordinary construction contract. Contractor and supervising engineer often spend substantial time to verify and assess the delays. A variety of techniques have been employed for such assessments. However, the effectiveness of techniques adopted has been a critical factor in this process. The purpose of the study is to analyze different EOT evaluation techniques and the preparation EOT claims.
	73		Challenges faced by Contractors in the Construction Industry of Sri Lanka under the Prevailing Economic and Health Restrictions	Construction Industry is severely affected by the prevailing economic and health restrictions affecting Sri Lanka. This study is to find the impacts on the construction industry and explore possible solutions to mitigate project delays and overall financial losses incurred by the industry.
TRANSPORTATION, HIGHWAY AND TRAFFIC ENGINEERING				
	74	Dr WMVSK Wickramasinghe	Estimating the Delay generated to mainstream traffic due to reversing of On-Street parked vehicles in Urban Streets	On-Street parking is common on downtown streets to cater supply and demand balance. However, when a parked vehicle reverses, it disturbs the main stream traffic developing queues, which creates delays. The aim of this research is to develop a queue generating model using shock wave theory. Finally, on-street parking pattern and the queue generation will be simulated using VISSIM.
	75		Estimating the Queue generation due to 'U' turn vehicles in divided highways	Highway geometric designs allow centre-median openings in divided-highways without any proper study related to risk or traffic conflicts. "U" turn vehicles on centre-median openings make fully or partially slowdown of flowing vehicle platoon. This research has the aim of estimating the queue generation due to "U" turning vehicles at centre-median opening at divided highways. Time series analysis or Neural Network analysis is used for the study. Further, this phenomenon needs to be simulated using VISSIM.
	76		Estimating the Delay caused by side-friction near 'School Zones'	The primary aim is to analysis the impact created by side-friction on main stream traffic in undivided urban arterials. This study is limited to the side friction created at the vicinity of schools located along main arterial roads. Reduction of travel speed and roadway capacity will be estimated with different intensities of side-frictions. Modifications for already existing traffic flow theories will be suggested by introducing factors incorporated with side friction. Finally, impact of side-frictions on main stream traffic near school zones are simulated using VISSIM.
	77	Dr WRSS Dharmarathna	Effect of roadside garages on smooth flow of traffic (Co-supervised by Dr. A.G.H.J. Edirisinghe)	Road side garages provide important services for the vehicles. Certain services/facilities are quick and short term and other services need a longer time. Depending on the services each garage type provides, certain facilities should be available according to the rules as well as considering the convenience of the users. When the facilities are not provided, not only the customers seeking services of such garages, vehicles moving on adjacent roads also will suffer. Hence, this study is to estimate the nature and magnitude of effect of road side garages on vehicles moving on roads while finding the adequacy of parking facilities for vehicles, violation/compliance with rules and regulations according to the nature of the services provided, floor area of the garage, category of the adjacent road, zone (urban/rural) of the garage.
	78		Testing model stability and sensitivity of Multinomial Logit (MNL) modeling approach for travelers' mode choice	Understanding choice behavior regarding travel mode is essential in forecasting travel demand. Multinomial Logit (MNL) modeling approach is used to fulfil the above purpose by estimating travelers' mode choice parameters. The model estimates the likelihood of a commuter choosing a certain mode based on the utility maximization. However, the accuracy of the parameter estimations is heavily depended on the number of samples/trips in the data. In addition, trip characteristics may also play a significant role in above accuracy. Hence this study plans to find out optimum number of trips for accurate MNL estimations and respective trip characteristics.
	79		Machine learning approach for mode choice modeling (Co-supervised by Dr. Upul Jayasinghe, Department of Computer Engineering)	During the past few decades, traditional Multinomial Logit (MNL) models are the dominant approaches for predicting travelers' mode choice. This was mainly due to its simplicity and readability. However, the basic assumption of MNL, that is independence of irrelevant alternatives (IIA) caused misleading predictions, and the correlations between travel modes have been addressed by the advanced structure of the MNL model such as the nested logit and mixed logit model. Still the linear relationships in parameter estimations and inability to capture all the features included in data, seeks for new modeling approaches. Accordingly, Machine Learning (ML) approaches are emerging as alternative approach for mode choice modeling. Hence this study is set to look at possible ML approach to predict/estimate travelers' mode choice parameters.
	80	Dr IMS Sathyaprasad	Estimation of link-wise traffic information of an urban road network using data extracted from Google Maps (co-supervisor: Dr Dhammika Elkaduwa)	Google Map data are extensively used for navigation and travel time by individual drivers. As compared with the huge cost involved in traffic data collection of road networks, extracting traffic-data at road-link level will be very useful in developing traffic flow models of urban road networks. This study attempts to develop a methodology to extract link-wise traffic flow data of an urban road network real-time and to study the trends using historic data
	81		Estimation of the economic benefits of using expressway network for containerized cargo transport in Sri Lanka	Containerized cargo movements in the normal road networks cause delays to cargo movements as well as regular traffic especially in urban areas. The Origin Destination data of containerized cargo movements May Bo obtained from the Colombo port and SL Customs. This study attempts to quantify the proportion of container traffic divertable to the expressway network and the economic benefits of such diverting, taking into consideration a fair tolling policy for containers in the expressways
	82		Development of a Green toolkit to evaluate the sustainable urban mobility of small and medium-sized cities	This study aims at developing a Green toolkit to assess the compliance of an urban mobility plan with the green guidelines for medium and small urban centers, using a system of carefully selected measurable indicators that represent the sustainable urban mobility of an urban area exhaustively
	83	Dr AGHJ Edirisinghe	Engineering significance of Ambalam (co supervised by Dr. HADS Buddika)	Network Ambalams on Sri Lankan roads indicates rich history of technological knowledge of Sri Lankans. Ambalams are good monumental structures to investigate and identify some of the ancient transport networks as well as to understand the knowledge of construction methods, materials selection etc of ancient Sri Lankans. Hence, the aim of this study is to trace as many Ambalams as possible to identify ancient transport network in Sri Lanka and to identify ancient knowledge of use different construction materials construction techniques.
	84		Rider behaviour of Food Delivery Motor Bicycles	Services of food delivery riders were very important during the pandemic period. Most of the food delivery riders had to ride during odd hours as well as extreme weather conditions. The aim of this study is to investigate the riding patterns and behaviors of and the accident pattern of food delivery riders.