

# RESEARCH PRESENTATION

## 2014 Civil Engineering Graduating Class

### Faculty of Technology, University of Guyana

Every year the Civil Engineering Graduating Students are required to undertake a year long research/design project in an engineering area of their choice. For more than two decades, students have prepared, presented and defended their projects to their peers, instructors and a few special invitees.

The Civil Engineering Department of the Faculty of Technology, UG, wishes to share with you a brief description of what each class member of the Civil Engineering Graduating Class of 2014 has attempted to do under this requirement.

Below are project profiles written by each of the students for their respective projects.

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Akua Alder



#### **Structural Modeling, Analysis and Design of the Conceptual Science Pentagon Building Model from the University Of Guyana Turkeyen Campus Master Developmental Plan**

The project will assess the conceptual building model of the proposed Science Pentagon which will accommodate the faculty of Health and Natural Sciences in their research activities and aims to not only model the building structurally but also to analyze and design the structural frame work of the proposed building. The conceptual model is part of the master developmental plan of the University of Guyana.

#### **The Investigation of Rice Husk Ash (R.H.A) as an Admixture in Road Sub-bases (white sand) to Increase Strength and Stability.**

At the peak of our country's engineering and construction stand point, white sand being one of our front runners in road construction, the means of best satisfying the numerous voids that lay between each particle is essential. Given the abundance of rice husk ash being produce at rice mills around our country, and the strong properties which it possesses, this was deemed a suitable addition for this study. Thus, an interest arose on how, and what can occur with the joining of these two materials. These researches entails the investigation of the resulting effects of adding rice husk ash to white sand, in controlled proportions, (50, 40,30,20,10 and 5) per cent by weight to white sand and compare the results to standard white sand.



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Trimaine Alphonso



**Imran Baksh**

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### **Foundation Design for the Conceptual Structure (Science Pentagon) as part of the Master Plan for the Development of the University of Guyana, Turkeyen Campus**

To meet the increasing facility demands on the Turkeyen Campus, the University of Guyana has drafted a development plan. The plan includes a number of conceptual buildings to be erected across the campus. Of particular interest is the design of the “Science Pentagon” which is a new facility to be added to the Faculty of Natural Sciences. This project seeks to tackle the design aspects of the substructure through a systematic approach via data collection and analysis of both the existing soils conditions at the site and the loads imposed by the superstructure. As the superstructure is of a significant magnitude, there will be a necessity for the application of deep foundations as the soil above is known to be unable to safely sustain such imposed loads. Displacement piles will be utilized to approach the problem, with pre-cast reinforced concrete and timber piles being the options of the design. Both materials will be scrutinized to obtain a design that is focused on both safety and economy.

### **An Evaluation of the Functionality of the Groyne Field extending west of the Kitty Groyne, to Fort Groyne, Georgetown, Guyana**

The Ministry of Public Works is currently undergoing works for the rehabilitation of the Groyne Field West of the Celina’s Resort. These efforts are aimed at achieving the stabilization of the beach, utilizing Geotube Groynes and the proactive prevention of the deposition of sediment into the Demerara navigational channel, through the rehabilitation of Fort Groyne. This project thesis intends to evaluate the functionality and structural effectiveness of Fort Groyne and propose apt rehabilitation measures. Additionally, with the installation of the Geotube Groynes, work will be done to evaluate their functionality at beach stabilization.



**Uwe Best**

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### **Kimberley Bradford**



### **The stabilization of sand clay by the addition of cement**

Cement Stabilized Soil is soil or aggregate treated with a relatively small proportion of Portland cement with the objective of amending undesirable properties of problem soils or substandard materials so that they are suitable for use in construction. This project focuses on the stabilization of a sand clay mixture by the addition of varying percentages of cement. The major objective of this project is to analyze the strength properties of sand clay, the properties of the cement stabilized sand clay and to examine how it performs when applied to everyday construction activities.



Shaunette Braithewaite

### **Development of a Strategic Improvement Program to Critical Signalized Intersections**

This project is based primarily on developing a strategic program to improve critical intersections within the city of Georgetown focusing on ONLY signalized intersections. The basic purpose is to improve traffic operations in terms of developing strategies to relieve congestion and crash rates, while safeguarding the human factor. Georgetown the capital city of Guyana is the central and the most business oriented city, therefore producing the busiest and the heaviest vehicular traffic and although safe driving is being addressed and accidents are defined as unexpected, unintentional and unforeseen events, but they are still measures that can be put in place to reduce the fatalities of such occurrences.

### **An Evaluation of the Extent of Potential Saline Intrusion in the Supenaam River as the Irrigation Supply of the Aurora Land Development Project**

Saline intrusion is a serious threat to low lying, river fed agricultural areas since it threatens not only current yields but future ones by poisoning the lands, such as those on the Coastal Plain of Guyana. The proposed 5,500 acre, \$3.7B Aurora Land Development Project currently under development by the Government of Guyana and designed to be irrigated from the Supenaam River is one such area under threat. The objective of this project was to determine the extent of saline intrusion in the Supenaam River, assess the implications for the Aurora Land Development Project and make necessary recommendations for future study. Salinity and other data were collected and analysed and the results compared with a prior study done as part of the design of the agricultural scheme. These results were then presented and discussed in the paper. The data presented was analysed qualitatively but mathematical methods of determining saline intrusion were foregone due to the extremely intense level of calculations, resources and expertise required.



Crystal Conway

Mark DeFreitas

### **Investigation to Determine the Effectiveness of Ground Support Commonly Utilised in Underground Mines in Guyana**



The common method used for underground support by local miners is synonymous to square set stopping or mine timbering, however, no prior investigation is carried out to determine the effectiveness of these structures. The study, which was carried out in the Little Arimu area, Cuyuni, is divided into two areas, the first being a geotechnical investigation of the soil in the immediate vicinity of one of the shafts of the mine, and the second a structural analysis of the timber structure that offers ground support for the shaft. The geotechnical investigation intends to classify and determine the strength parameters of the soil in order to know the lateral earth pressure that will act on the structure. After the loading is determined and the relevant data obtained for the timber structure, a structural analysis will be done to determine the adequacy of the ground support utilized in the shaft.



Joel Flatts

### **Design of Motorway Directly Linking the University of Guyana to Dennis Street, Sophia**

This project seeks to expand the transportation system of the University of Guyana by providing a design for an alternative route of entry for vehicular traffic into the Turkeyen Campus. The proposed route is through the undeveloped field towards the southern end of the campus connecting the current roadway to the east of the Faculty of Technology to Dennis Street, Sophia. Implementation of this project will expedite the smooth flow of vehicular traffic in and out of the university's campus, save time and money for commuters and encourage further development of the surrounding landscape. The project will involve field investigations and subsequent determination of the appropriate specifics through value engineering while considering environmental effects, safety and geometrical details. Secondary aims include further correlation of California Bearing Ratio (CBR) and Dynamic Cone Penetration (DCP) values and incorporation (if successful) of colleague research into the design.

### **An Investigation into the Partial Replacement of Cement by Rice Husk Ash in Concrete Mix Designs with the Aim of Strengthening/Preserving the Integrity and Improving the Economical Capabilities of Concrete Mixes**

This project seeks to utilize the grinded amorphous form of rice husk ash to substitute increments of cement mass in an ACI (American Concrete Institute) concrete design. These increments of 5%, 10%, 15% and 20% cement replacement by RHA are specifically utilized in an attempt to achieve the central aim of the intended project which is; to identify the optimal cement replacement percentage by rice husk ash to produce an economical mix design while simultaneously preserving the physical and strength characteristics of concrete. The mentioned increments were additionally incorporated in sifting and mortar hollow block mixtures primarily for compressive strength and water tightness investigations. The project investigations further include a cost benefit analysis and a proposed practical economic usage of how RHA can be utilized in the local concrete construction sector.



Anthony Flett

### **An assessment and redesign of the Haags Bosch Sanitary Landfill (HBSL) Access Road**

Candacy Joris



The HBSL Access Road is located approximately 4 km south of the geographical center of Georgetown with a west-east entrance, from the East Bank public road, bordered by Eccles and Peters Hall Plantation. The road designed to transport solid waste and GUYUCO's sugar workers now caters for new housing development in the area. It is deteriorating in some sections. The main objective is to design a suitable pavement structure that would safely distribute the imposed traffic loads. An assessment of the current condition of the HBSL Access Road and a redesign of the pavement structure will be proposed. The most economical combination of pavement materials and layer thicknesses that will provide satisfactory service for a design life selected will be determined.





Joel Klass

**To analyze the current water storage system that the University of Guyana Turkeyen campus has and to design a new system to capture the new upgrades in which the campus would be embarking on.**

This project serves analyzing the current water storage system currently at the University of Guyana Turkeyen campus and to design a new upgrades system to aid in the campus new upgrades. Poor water storage can cause significant damage to University of Guyana Turkeyen Campus daily activities. This study come at a time when the university of Guyana Turkeyen campus is having a steady increase of the student population, staff population and the advances in technologies, the university is faced with the need for expansion and modernization. So with this new projected increase in students and staff due to development, comes a new challenge for the university, which is how to supply fresh water supply to all their building effectively and efficiently on a daily basis.

**To Research the feasibility of using waste glass as a partial replacement for cement in concrete production in Guyana**

This project suggests the use of waste glass as a partial substitute for cement in concrete production in Guyana as a means of recycling the waste glass. It has been suggested by previous studies that replacement of cement with waste glass can benefit the properties of the concrete matrix produced. Growing environmental concerns and the scarce availability of land for use encourages recycling of materials in the solid waste stream. Using waste glass as a replacement for cement in concrete production partially addresses this problem. It is possible that Soda lime glass (bottle glass) could be used in concrete as a partial replacement for cement as it has a desired chemical composition and reactivity for use as a supplementary cementitious material.



Robert Mansell

**Seenarine Nandram**



**Wave refraction and an Analysis of the wave effects along the foreshore of the Rupert Craig Highway along with a possible mitigation plan.**

The concept behind this project is to determine the wave behavior and the effects that it has on the foreshore, it seeks to address the basic wave mechanic properties that has over the years caused the wave pattern to change along the said foreshore inducing overtopping events and heavy erosion along the shoreline. Basic wave properties such as the energy transmitted on the existing shoreline, the energy transferred to the foreshore along the critical sections and the particles sizes that are transported by the wave along the foreshore are the key areas addressed in this report.

## Kurupung Runway Development Project



Ahmad Nizamudeen

KURUPUNG RUNWAY DEVELOPMENT PROJECT seeks to plan and design a runway of appropriate length to accommodate a larger aircraft. Currently, the runway is most unsuitable to accommodate the Cessna Caravan (C208) because of its length and physical state. The Cessna Caravan (C208) is the most widely used aircraft in Guyana's interior. It has a better safety record and is a more efficient aircraft used in Guyana. However, it cannot comfortably land at this airstrip without some amount of weight restriction. This project seeks to extend the runway, taking all factors relevant to the area into consideration. The runway is approximately 1500 feet with a geographical position of 060934.72N, 0601622.25W. It is estimated that another 1500 feet is required to accommodate the aircraft. The runway is surrounded by mountains that are in excess of 4 nautical miles from the runway. This project is expected to guarantee a more efficient aircraft operation, reduce cost for operators and make air transportation more affordable for commuters.

## An Analysis of the Design Of The Drainage and Irrigation Network for the Vigilance/Paradise Area, East Coast Demerara

This project will entail a detail investigation into the drainage and irrigation system in order to remove the excess water, reduce flooding and recommend mitigating measures for the improvement of the existing system. This project seeks to provide insight and benefits to the residential and agricultural sector of the Vigilance/Paradise area by identifying reasons for failure of the present drainage system, assess the need for additional canals and assess if the capacity of the pump being installed by the Ministry of Agriculture, National Drainage and Irrigation Authority (NDIA) is sufficient for the capacity of the drainage channel. Additionally this project aims to implementing a working solution by means of improving the current drainage system as a results; protection for buildings, roads, and other utilities, increasing property values, residents to have comfort and easy access to their homes and producing an environmentally friendly surrounding.



Rudolph Persaud

## Komal Rajana



## Adequacy of the Constructed Stub Wall to Prevent Overtopping on the Kitty/Liliendaal Seawall both hydraulically and Structurally and a Possible Long Term Solution.

This thesis seeks to evaluate the effectiveness of the constructed stub wall on the Kitty/Liliendaal seawall both structurally and hydraulically. The overtopping experienced by the seawall forced the Ministry of Public Works into finding an emergency solution. The temporary solution decided on, was the construction of 1.5 kilometres of stub wall with a height of 0.7 m on the existing retaining structure. The thesis entails the prediction of wave overtopping discharge and run up level using empirical expression from EuroTop to assess the height of the wall; (Using range of fetch parameter with various foreshore elevations and freeboards height); a structural analysis of the of the sea defence under a range of dynamic and static wave loading on the structure; (dowel connection assess and reinforcement in stub-wall); a hydro-graphic survey of foreshore to determine the current elevation and mean gradient (parameters in assessing overtopping, run up and pressure loading) and finally a global stability analysis under likely extreme storm events to using Geo-Studio.



Amanda Ramgobind

### **Re-engineering Tucville Sewage Station into an Efficient Waste Water Treatment Facility**

This project seeks to propose a design for the conversion of Tucville Sewer Station into an efficient waste water treatment facility. The facility will treat and discharge Sewage from Tucville/ Stevedore Area and waste from septic tanks around Georgetown in an environmentally friendly manner. The proposed design will include both the aerobic process and a cost benefit analysis. The existing system will be carefully analyzed to determine whether the existing receiving chambers can be converted to allow for the various treatment processes. The volume of wastewater per person will be calculated as a percentage of the daily consumption. Waste water from Industries, run off and infiltration will also be considered. The design flow rates such as the average daily flow, maximum daily flow, peak hourly flow, and minimum hourly and daily flow and design peak flow will be calculated for sizing and choice of apparatus. The relevant tests will be conducted to determine the concentration of the wastewater constituents since the physical, chemical and biological characteristics of the wastewater are vital for the design, operation and management of collection treatment and disposal.

### **Feasibility study on the rehabilitation of University of Guyana’s Treatment Plant, Turkeyen Campus and possibly enhancing its treatment process for biogas production.**

The goal of this report is to conduct a feasibility study on the rehabilitation of University of Guyana’s Treatment Plant Turkeyen Campus, carefully assessing the present conditions and possibly enhancing its treatment process for biogas production. This research was also aimed at developing sound alternatives to improve or restore the capacity and capabilities of the plant. In its present condition, the system is not functional. Even if it is rehabilitated, the calculated inflow at 55% seem to be too much for the plant to handle, therefore other solutions were explored. However, because of the low quality of sewage, only through testing of sample produced by the plant will we be able to determine if the plant is truly able to handle the inflow or the detention rate can be reduced to minimize and equalize the flow. It is believed however that the calculated flow is much higher than the actual flow produced. The research will help readers and other professionals understand what is needed to be done to have the plant operating at the most economical capacity, considering the environmental impacts and solutions along with contingency measures.



Kirk Sam

Jana Sarran



### **The Re-Modeling of the Mahaicony Abary Rice Development Scheme (Mards) to Provide Improved Irrigation Supply**

The proposed project is entitled “The Re-modeling of Mahaicony Abary Rice Development Scheme (MARDS) to Provide Improved Irrigation Supply.” This project involves (i) An investigation in the current manner of water delivery to the farmers’ fields and (ii) The collection of data relevant to the re-modeling and proposed re-modeled scheme. The Mahaicony Abary Rice Development Scheme (MARDS) deals primarily with rice cultivation. When it was developed in the 1960’s, farmers were able to deliver irrigation water to their fields by gravity feed from adjacent secondary canals. At present, water delivery is being done by mechanical pumping from the secondary system to the fields with the mechanical pumping being done at a high cost to the farmers. Over the recent years, the water delivery to the fields has been on an “on demand” basis and the scheme has been operating at unknown project efficiencies. The purpose of this study is to investigate the current manner of operations of the scheme and to make recommendations that will result in improvements in water delivery to the farmers’ fields by employing better water management practices.



Lorrisa Singh

### **The Design of a Water Treatment Plant to Supply from Walton Hall to Charity on the Essequibo Coast**

Based on the large population in the village at Charity, supplying potable drinking water to all of its residents can be a bit of a challenge. The water is currently being used for Domestic, Industrial, Public Uses, etc. It is critical to determine the possible sources of water, venues for its conservation, also for the efficient utilization of the water to its optimum. This project aims to alleviate the quality of water the residences of Walton Hall to Charity villages are currently supplied with through the construction of a pure water treatment facility. The project intends to give readers information on water quality standards and design criteria for water treatment processes. The document will also establish criteria's to be followed in determining the necessity for and the extent of water treatment required, the evaluation of the of different treatment plant design and types, and on procedures applicable to the planning of water treatment projects. The design will be solely focused on the layout and design of the individual treatment components within system commencing from the well to the storage reservoir. The electrical components for operation and appurtenances will not be designed for, likewise for the provision of pumps and analysis of the network for distribution of water from the system.

### **The Design of Precast Pre-stressed Concrete Bridges to Replace the Steel bridge Connecting Liliendaal and Turkeyen along the East Coast Demerara Railway Embankment**

The Liliendaal and Turkeyen villages on the East Coast of Demerara are connected on the Railway embankment road by an Acrow Panel bridge. Acrow Bridge components were very easy to assemble and they were of standard dimensions, construction of these bridges were fully utilized and implemented on the East Coast Demerara Railway Embankment Road Project in the year 1994 to 1995. The present Bridge is narrow with high truss walls at the sides which drivers try to avoid by moving closer to the center of the bridge resulting in several accidents. Being located along the coast of Guyana, the Acrow Panel bridge components are susceptible to corrosion from the high salt content in the atmosphere and being constructed over 12 years ago and are now subject to high maintenance, with the replacement of a single deck plate costing as much as \$300,000. The new structure is designed to resolve the problems and issues stated above. The new structure is designed of Precast Pre-stressed concrete components in accordance with AASHTO LRFD Specifications and AASHTO HS20 design truck loading.



Ian Smith

Vaughn Solomon



### **A feasibility study on the use of biogas produced from sewage sludge for power generation for the University of Guyana, Turkeyen Campus**

This research is a feasibility study of power generation for the University of Guyana by means of the combustion of biogas produced from sewage sludge. As the world becomes conscious of global warming and climate change, Guyana has its part to play. There is hydropower and wind power schemes in the pipeline, likewise premier learning institutions like the university should contribute to the cause, therefore this research is being done to look at the feasibility of producing alternative power from the anaerobic digestion of sewage emanating from the sewer system of the university. Such a project has never been done in Guyana, but has benefits such as the reduced reliance on Guyana Power & Light for power, possibility of providing power to nearby residents and release of treated effluent into the environment.