2011 MORESE Colloquium Final Program

Date: **Friday, September 23, 2011**
Time: **1:30 pm to 6:00 pm**
Where: **BSB 3.03.02**

Dear students and mentors:

Thank you for taking time from your busy schedule to contribute to the success of the MORESE Program. The colloquium contains 17 research papers (15 MORESE-supported students and 2 other students), including 8 oral and 9 poster presentations. The content covers a diverse spectrum of contemporary topics from geology, environmental science, and civil engineering. Six graduate students from different fields of Geology, Environmental Science and Engineering will serve as a judge committee to evaluate all the presentations. Each talk will be 20 minutes maximum including questions/answers; each poster consists of 5 minutes presentation with 5 minutes of judges asking questions, maximum 10 minutes. For each category (talk and posters) they will evaluate the first, second, and third best presentations in terms of overall quality and professionalism. Cash awards will be given for the first place ($250), second place ($150), and third place ($100) talks and posters.

Refreshments and Pizzas will be provided by the Center for Water Research. The MORESE management would like to thank Dr. Hammond for supporting this event.

Judge Committee:

Chris Reyes – Civil Engineering Masters student

Eric Kouba – Geology Masters student

Jinxuan Hu – ESE PhD student

Tanzina Rahman – ESE PhD student

Newfel Mazari - ESE PhD student

David Prado – ESE PhD student

Table 1. The final program of 2011 MORESE Colloquium

	Students	Mentors	Majors	Title
1:30-1:50pm	Alex Colby	Blake Weissling	Geology	Glacial Delineation and Ice Retreat on Pico de Orizaba, Mexico
1:51-2:10pm	Alex Hilario	Hatim Sharif	Civil Eng.	Fatalities caused by flooding during the last fifty years in Louisiana
2:11-2:30pm	Ben Cardenas	Hongjie Xie	Geology	Seasonal changes in albedo and frost coverage in the Martian crater Louth
2:31-2:50pm	Francisco Cantu	Mijia Yang	Civil Eng.	Innovative Beam-to-Column Joint Design of Fixed Moment Resisting Steel Frames for Seismic Areas
2:51-3:30	**Coffee Break and Poster Session**			
3:31-3:50pm	Jessica Jimenez	Steve Ackley	Civil Eng.	Castle Hills: Renewable Energy and Energy Conservation Options
3:51-4:10pm	Marcus Garcia	Lance Lambert Xiaofeng Liu	Civil Eng.	*Chaetetes* Modeling and Flow Calculations
4:11-4:30pm	Nicholas Vasquez	Drew Johnson	Civil Eng.	Root-template Geotextiles
4:31-4:50pm	Stephen Contreras	Judy Haschenburger	Geology	Characteristics of Floodplain Sediments at the San Antonio River
4:51-5:30pm	**Poster Session, Judge meeting and discussion**			

Posters

	Andres Munoz	Hatim Sharif	Civil Eng.	Flood Fatalities in Colorado
	Anthony Arricale	Hongjie Xie	Geology	Analysis of Lake Level and Temperature Variation in the Great Salt Lake using ICESat, MODIS, and In-Situ Data
	April Escamilla	Ruoting Pei	Civil Eng.	The effect of *Bacillus subtilis* and cell fraction additives as a method to improve cement strength
	Crystal Gonzalez	Routing Pei	Civil Eng.	Performance of Microbial Fuel Cells Using a Bee-Hive Structure Anode and a Comparative Analysis to Carbon Fiber Brush Electrodes
	Jessica George	Heather Shipley	Civil Eng.	Stability of Metal Oxide Nanoparticles: Solution Chemistry and Mechanical Effects
	Marvin Lopez	Lance Lambert	Geology	Defining an Undescribed Species of Ammonoid to be either *Demarazites* or *Waagenoceras*
	Oscar Garza	Heather Shipley	Civil Eng.	Removal of Arsenic from water using nano iron oxide-zeolite
	Robert Erazo	Jie Huang	Civil Eng.	Numerical modeling of piles subjected to an internal lateral load
	Shelby Williams	Steve Ackley	Environ Sci.	Computing Arctic ice thickness from space measurements of snow surface elevation
5:31-6:00pm	**Award Ceremony and Pizzas**			

Abstracts

Glacial Delineation and Ice Retreat on Pico de Orizaba, Mexico

Alexander E Colby and Blake Weissling, Geology

Pico de Orizaba, a dormant stratovolcano at the eastern end of the Trans-Mexican Volcanic Belt at approximately 19 degrees of latitude and the third largest peak in North America (5636 m), hosts what is likely the last significant tropical zone glacier (Jamapa Glacier) in the Northern Hemisphere. Not since the International Geophysical Year of 1957-58 has Pico's glacial environment been studied with any focused effort, perhaps due to the difficulty of the approach and general inaccesablilty. High altitudes, steep slopes, and hazardous weather make studying Pico de Orizaba that much more difficult. As are most glaciers around the world, the Jamapa Glacier is retreating, with a remarkable loss of ice in the past 2 decades. The rate and pattern of retreat is important to understanding climate change forcing as well as understanding environmental and water supply impacts to a substantial human population who live along the base of the volcano.

Through the use of satellite imagery (LandSat, ASTER, IKONOS), legacy hand-drawn maps, aerial photographs, and first-hand accounts from climber's expeditions, a reasonably accurate map of almost 60 years of glacial retreat has been produced. Legacy hand-drawn maps of the ice edge, that pre-date the satellite era, did not fit perfectly with modern images when layered in ArcGIS. Oblique perspectives in Google Earth and various aerial and surface-based photographs of the mountain were used to help fit the ice edge to the actual topography. Dated pictures posted on image and video hosting websites (Flickr, Photobucket, Pict) were useful in providing more angles of the mountain. Internet blogs and published articles/books based on climbing expeditions (recreational and scientific) to Pico de Orizaba provide first-hand accounts of the mountain. These first-hand accounts of expeditions to Pico de Orizaba describe conditions present on the mountain. Some climber reports give details on the ice edge as well as describing geologic features that restrict where glacial ice can form and flow. Different types of satellite data and satellite imaging programs (Envi 4.8) were also used. The disparity of satellite image pixel resolution (from 1 m IKONOS to 60 m LandSat) was addressed using various imagery analysis tools (eg. edge detection convolution filters and pixel unmixing) in order to delineate an approximate ice edge for the respective image date. The final map shows the nature of ice edge retreat on Pico de Orizaba from 1945 up until the present (Feb 2011).

Submitted for Poster Presentation (I am comfortable with an Oral Presentation if needed)

Fatalities Caused by Flooding During the Last Fifty Years in Louisiana

by Alex Hilario
Department of Civil & Environmental Engineering

This research looks at the fatalities caused by flooding in the state of Louisiana that occurred during the last fifty years. The research covers deaths that happened within the sixty-four parishes which conform the state of Louisiana.

The data used to develop this research was the storm data collected or developed by National Climatic Data Center (NCDC) which is the world's largest active archive of weather data. NCDC provides data requests from all over the world and produces a number of publications about climate. The NCDC operates two centers: one is located in Asheville, North Carolina, which is the World Data Center for Meteorology and the other is the World Data Center for Paleoclimatology located in Boulder, Colorado.

The NCDC storm data was used to develop this research. This data provided information such as the date of the event, the location of the event, and a description of each individual event when available. The research was done by carefully analyzing each individual case where flooding was present. The data collected starts in January of 1959 and ends in December of 2009.

The general results show that there is an increase in casualties caused by flooding. The gender of the casualties are predominantly male but also female casualties are present. Even though the age group varies, the predominant age ranges from adults (18-69) to youngsters (2-10). A large number of casualties occur when the victims are inside a vehicle.

In conclusion, this research clearly shows that the number of fatalities caused by flooding in Louisiana is steadily increasing. It is a challenge for future engineers to continue to collect accurate data so that we can develop ways to prevent or decrease fatalities due to flood in the future.

Oral Presentation

Flood Fatalities in Colorado

Andres Munoz, Civil Engineering

This study reviewed information related to the events that lead to flood fatalities in Colorado in the past 51 years. Information on these event and the flood fatality victims was obtained from the National Climatic Data Center (NCDC). All the information is collected using NCDC Storm Data reports. The data will be including; date, time, location, flood event, gender, and age. The total study will be including a detailed description of the flood event involving fatalities, such as vehicle involvement and what exactly happened. All the information from the data and detailed description will be collected in an excel spreadsheet, along with different graphs and tables to summarize events by month, time of occurrence, gender, area, vehicle involvement, and location.

From 1959 to 2009 there is a total of 189 fatalities due to flood events. Colorado ranked sixth in the nation from flood fatalities. With one event causing more than half of that total in the month of July of 1976, making up 69 percent of the total. There are 43 fatalities caused by drowning, 15 being killed, and 131 unspecified. All fatalities came during the summer months of May to August, with May recording the fewest with 3 and July having the most with 153. 22 different counties recorded a flood fatality with Larimer having the most with 141 and 9 other counties tied with the fewest of 1.

Submitted for Poster Presentation.

Analysis of Lake Level and Temperature Variation in the Great Salt Lake using ICESat, MODIS, and In-Situ Data

Anthony J Arricale, Geology, University of Texas San Antonio, San Antonio, TX
Hongjie Xie, Geology, University of Texas San Antonio, San Antonio, TX
John D Bolten, Hydrological Sciences, NASA GSFC, Greenbelt, MD
Guoqing Zhang, School of Earth Science and Resources, China University of Geosciences, Beijing, China

Many of today's lakes are without in-situ gauges to measure lake level or lake water temperature due to their remote locations. Retrieving this data from individual remote lakes and comparing them is important for investigating changes in climate, anthropological, or watershed changes in an area. Today remote sensing equipment is being used to gather data for areas that have no previous in-situ data. It is important to check the reliability of the remote sensing data by investigating lakes that have previous in-situ data and comparing both data sets.

This study utilizes remote sensing data from the Geoscience Laser Altimeter System (GLAS) onboard the Ice, Cloud, and Land Elevation Satellite (ICESat) and data from the Moderate Resolution Imaging Spectrometer (MODIS) onboard the Aqua and Terra satellites. Global Land Surface Altimetry Data (GLA14) from GLAS is compared with in-situ lake level measurements for the Great Salt Lake (GSL) from 2003 to 2009 to check the reliability of the instrument. Both data sets revealed a decreasing trend in lake level with an r^2 value of 0.88 between the ICESat and in-situ data. Thermal imagery from MODIS included 818 (1028) images from the Aqua (Terra) satellite from 2002 to 2011 (2000 to 2011). The images from both satellites are separated by 8 days and have a spatial resolution of 1km. These thermal images were used to calculate the surface water temperature (SWT) of the Great Salt Lake north and south of the railroad causeway which divides the lake in half. After analyzing the data it is evident that the shallower north half of the lake has a higher SWT in the summer and cooler SWT in the winter than the south half by 1 C°. The average monthly SWT and in-situ air temperatures for the GSL are compared with each other and from 2002 to 2010 there is a decreasing trend in air temperatures resulting in a decreasing SWT trend for both Terra and Aqua data sets.

There is great potential for the use of satellites to measure certain remote lake characteristics in place of in-situ measurements. This study validates that idea by showing that the data satellites provide are reliable because of their similarity to in-situ measurements.

Submitted for poster presentation

The Effect of *Bacillus subtilis* and Cell Fraction Additives as a Method to Improve Cement Strength

April R. Escamilla, Shuangshuang Wang, and Routing Pei

Department of Civil and Environmental Engineering

The University of Texas at San Antonio

Environmental stress on concrete infrastructures has led to costly repair by current remediation techniques that use resins, epoxy and other synthetic materials. The use of microorganisms to strengthen concrete has been explored as a potential cost effective solution to this continuous rise in repairs. It is suspected that *Bacillus subtilis* and its cell fractions (BCF) facilitate calcium carbonate precipitation through mineral ions by increasing the pH in their surrounding. Therefore, the viability of *B. subtilis* and BCF as concrete additives were tested.

Preparation of dead *B.subtilis* cells, cell fractioning and BCF preparation was accomplished using the methodologies of Mastromei et. al with substitution of Nutrient Broth (NB) medium for B4 liquid medium. Preparation of portland cement mortar cubes containing biomass was accomplished using the methodologies of Ramachandran et. al, 2001, with biomass concentrations of live and dead *B. subtilis* at 0, 0.00333, 0.333, and 33.3 mg wet weight/mL and BCF at 0, 0.333, and 3.33 mg wet weight/mL. Compressive strength testing was accomplished using the methodologies of Ramachandran et. al, 2001.

The compressive strength of the 7 day portland cement mortar cubes containing live and dead *B.subtilis* decreased as concentrations increased. Maximum stress increased significantly from the 7 day control by 29.15% and 22.99% through the addition of live and dead *B. subtilis* respectively at the 0.00333 mg/ml wet weight concentration. (p-value 0.0024, p-value 0.0208 respectively) The remaining treatment levels cured for 7 days expressed no other significant differences from the control. After a 28 day cure the mortar cubes treated with 0.00333 mg/ml wet weight concentration of live *B. subtilis* resulted in a significant stress increase of 16.90% from the control. (p-value= 0.0428,) However, stress significantly decreased from the control when treated with 33.3 mg/ml wet weight concentration of dead *B. subtilis* by 34.36%. (p-value = 0.0006,) The remaining treatment levels cured for 28 days expressed no other significant stress differences from the control.

Given the success of live and dead *B. subtilis* at lower concentrations, further analysis is still needed on the application of low concentration BCF in order to determine its full potential. The production time of BCF was the limiting factor in the maximum number of samples available as 2.5 grams of BCF required three months to collect under current laboratory techniques. Therefore, BCF additive may be an expensive, time consuming avenue in industry for strengthening cement. Greater compressive strengths may be achieved using microorganisms, however, the concentrations of each type of additive must be carefully measured to avoid a substantial decrease in strength.

Seasonal changes in albedo and frost coverage in the Martian crater Louth

Ben Cardenas, Hongjie Xie, Geology

The study of Martian ice is a critical component in understanding Mars in general; the ice may hold clues to Mars' past climate and the search for life, and to the ultimate goal of human settlement and terraforming.

This case study focuses on the Louth crater (70.1 N, 103.5 E), the southernmost Martian crater in the northern hemisphere which holds a body of ice all year long. High resolution photographs from the HiRISE camera on the Mars Reconnaissance Orbiter (MRO) have been used to support previous conceptual models of sublimation/deposition and seasonal albedo change of the ice mound in the Louth crater. The CTX context camera, along with models of the crater's geometry and the positions of incoming sunlight, have been used to determine cause of preferential sublimation in certain areas of the crater; in particular, to determine why the southern wall holds frost much longer than the rest of the crater floor and walls.

HiRISE images needed to be converted to show I/F, or the fraction of light reflected to incoming light. This is corrected for sun and satellite angles, though not for atmospheric disturbances. On Mars, these disturbances are negligible, so I/F can be considered a true albedo. I/F values of the center mound were averaged from all photographs and graphed in excel to show the I/F change through time. Geometer's Sketch Pad was used to create models of the crater and how sunlight hits the crater area, dependent on time of year. These models provided information on the maximum sun angle at a certain time of year, the angle needed to expose the southern wall, the hours spent in daylight, and more.

The I/F results appear to agree with the conceptual model of albedo change. The four-phases of the model are visible when the data is observed in I/F vs time, although the phases occur earlier in the year than the model suggests. Actual values of albedo could not directly be compared, however, because HiRISE offers a limited number of bands compared to the previously used TES images. The southern wall of the crater was found to receive about 30% less sunlight than the rest of the crater floor, which must be enough of a difference to preserve frost longer. It was also found that when an area hits about 60% sunlight/day, frost tends to begin visibly disappearing. This could hold some information for creating a future model relating sun exposure, surface temperature, and ice thickness.

Performance of Microbial Fuel Cells Using a Bee-Hive Structure Anode and a Comparative Analysis to Carbon Fiber Brush Electrodes

Crystal Gonzalez, Routing Pei, Civil and Environmental Engineering

Each day, on average a person uses approximately 14,000 kW·h per capita of energy. In today's modern society everything revolves around electricity specifically and renewing such energy by using microbial fuel cells will soon become implemented on large scales in treatment plants. In sum a microbial fuel cell (MFC) is a device that converts organic material into electricity by a catalytic reaction of bacteria or any microorganism.

Working with bacteria provides an inexpensive yet effective source of electricity which has positive effects on our environment as well. The initial idea in this project was to determine if the bee hive anode produced a higher voltage or increased power generation from the MFCs than the carbon brush electrode. While simultaneously recovering more energy into electricity. The method used in this project was developed by creating bee hive anode structures, by varies percentages of graphite, clay and carbon and selecting the most durable samples.

After some successful structures of anode were formed, testing would proceed; where bacterial can be uses as MFC to transfer the electrons originating from the microbial absorption. The electron then flow from the anode to the cathode, and generate the current and voltage to make electricity. The bacteria get its energy by removal of electrons from the organic material and give those electrons to any accepting substance such as oxygen or nitrate. Once the configuration ran every 30min, a slightly greater voltage can be seen with the created anode structure. This slight increase in the voltage led to the structure of the anode. More because the anode had multiple pores which allowed the bacteria to move freely versus the carbon fiber brush which had a limited surface area.

Poster Presentation

Innovative Beam-to-Column Joint Design of Fixed Moment Resisting Steel Frames for Seismic Areas

Francisco J Cantu, Mijia Yang
Civil Engineering

To attenuate the seismic response of stiff and low ductile steel frame configurations, existing and standard beam-to-column joints have been reengineered. In this paper, several innovative joint designs are suggested to optimize the resistance of structures under dynamic forces. The target joints discussed in this paper is a typical beam-to-column connection.

Though rigid steel joints have been known to somewhat resist dynamic forces, failures have occurred due to low ductility, therefore the use of high ductile joint systems have been adopted. One of the reoccurring problems with the use of rigid joints is that joint members such as beams and columns shift much of their stress directly to the stiffest part of the structure, in this case, the rigid joints. At that point the bolts and welding tend to experience more stress, causing the joints to decouple. With the possibility of producing a domino effect the structure is more likely to fall on the ground. Thanks to modern design procedures, the uses of higher ductile joint systems have proven to have the capability to decouple stiffness and yield strength and reach ductility quicker, therefore demanding less elasticity from the beam and column members. However, the use of these systems could prove to take more time in the construction process and are more expensive than the conventional rigid frame system.

Since our goal is to dissipate more energy coming from the ground, joints with higher ductility are needed for higher magnitude earthquakes. Even though, the amount of energy transmitted from ground to the structure depends on the interaction between the foundation and structure itself, that interaction will not be discussed here. In this paper, we focus on the innovative design for higher ductility and energy dissipations. In order to increase the ductility and energy dissipation, we will add special elements, such as elastomeric pads, special cut beam areas and additional stiffeners to change the joint failure modes.

To analyze the effect that elastomeric materials, reduced beam area connections and the bolted stiffened extended end plate connections had, a standard W24x146.5 steel beam and column is being considered. The joint systems for the members will connect flange to flange, and consist of two standard W24x146, 5 foot steel beam sections. The area of this section is approximately equal to 43.0 inches squared, and consists of common structural steel that has a Young's Modulus of 29,000.00 ksi, density of .284 pounds per inches cubed, a poisons ratio of 0.25, and a yield stress of 36 ksi. The bolts and seats connecting the two sections will be made up of the same steel properties as the beam sections, and will have a nominal diameter of one inch. The behavior of the joints will be analyzed through finite element analysis software called Abaqus.

The seat joint connection, analyzed at a 30 kip cyclic load condition, proved more beneficial when using the elastomeric paddings. The padded joint experiences significantly less stress at the column middle section to where the beam is applied, and it is also evident that stress on the web portion of the beam where the seat is located in nearly nonexistent under the same loading conditions. The model consisted of a 20 step cyclic loading process that simulates an

idealized earthquake event. It can be noted, given the same applied cyclic load of 30 kips perpendicular to the ground, that the displacement of the padded joint is greater than that of the control joint. With the sacrifice of some deflection one can conclude that the area under the curve increases. Mathematically, the area under the force vs. displacement curve is also known to be energy. As the area under the curve increases more energy is absorbed by the system and therefore decreases the chance of failure of the frames themselves. Understanding that seismic conditions can vary, it is important to be able to provide a flexible system that can dissipate energy in multiple directions. In the case of the joint studied, elastomeric pads were useful in the absorption of energy, therefore reducing the amount of stress induced on to the steel members themselves.

To the RBS and the BSEEP design, multiple cases were run in Abaqus in order to better visualize the changes between their control joint and their modified joints. These connections were both ran 3 times, first at a 30 kips cyclic load level, second at a 50 kips load level, and lastly at a 100 kip load level. Because of their semi rigid nature, these joints undergo the same cyclic type of loading; prove to be a lot more resistant than the conventional seat joint. In fact the bolted web connection without RBS alone proved to not even reach elasticity until a larger than 50 kip load was applied. Notably the energy absorbed by the system starts to grow as the elements in the system start to yield. In this system plasticity is reached somewhere between 50 and 100 kips. As seen in a plotted graph the RBS section is actually encompasses more area therefore providing more ductility. The RBS, unlike the BWJ, yields at the beam. In this case, the Reduced Beam Section actually acts as a hinge that would cause the system to yield at given locations before causing any real harmful structural damage to the system.

Similarly the BSEEP graph shows that the system itself outperforms a conventional system. The energy sustained by the system was simply too much to hold together for the conventional joint. However when stiffeners were added the stiffness of the joint is increased and energy consumed was a lot less, therefore it would be able to sustain the whole cyclic loading of 20 times steps of the applied reversal moment.

Summary

With the development of computational technologies, it becomes increasingly easier to model complex systems before any actual construction process. In this paper Abaqus was adopted to analyze the effectiveness of elastomeric materials, reduced beam sections, and stiffeners, when it comes to seismic design. Through the results presented one can conclude that the extra padding can provide more flexibility to a system, and in turn reduce the amount of stress that structural members are subjected to under cyclic loading conditions. Likewise, it has been showed that the reduction of the beam size can help induce failure at areas in which failure is preferred. Stiffeners have also been studied and found to be helpful in reducing the flexibility of a system, and in turn help a system dissipate energy better by spreading out what would normally be a much localized stress in a less rigid joint.

Stability of Metal Oxide Nanoparticles: Solution Chemistry and Mechanical Effects

Jessica S. George and Heather J. Shipley

Department of Civil and Environmental Engineering

University of Texas at San Antonio

Nanoparticles have great potential to change both the scientific and consumer communities. The applications of nanoparticles range from solar cells to cosmetics to cancer treatment to computer chips. Yet the characteristics and fate of nanoparticles must be carefully examined since engineered nanoparticles are entering the environment. In this particular study, the effect of different ionic solutions as well as the effects of mechanical aggravation on metal oxide nanoparticles was studied. By studying the size of the nanoparticles over time under varying conditions, the behavior of nanoparticles could be observed.

The size of the metal oxide nanoparticles was observed by a Beckman Coulter Delsa Nano C Particle Analyzer. This machine employs photon correlation and Brownian motion to determine the size of particles in aqueous solution over a specific period of time. A concentration of 100 mg/L of Al_2O_3 was used for the bulk of the experiments. Different types of mechanical aggravation were employed, including: sonicating, vortexing and centrifuging to determine the best method to produce uniform dispersed nanoparticles under 100nm. Results showed, after many different combinations, that sonication and then centrifuging was the best method to obtain uniform distributed particles around 100 nm. The established method was used in nanoparticle column transport experiments to observe how the size of the nanoparticles changed as they migrated through porous media.

The effect of different ionic solutions (10 mM NaCl, 50 mM NaCl, 10 mM $CaCl_2$, 50 mM $CaCl_2$, 10 mM $NaPO_4$ and 50 mM $NaPO_4$) on Al_2O_3 was also studied to investigate the chemical effect of certain ionic solutions on nanoparticle aggregation. Results found that 10 mM $NaPO_4$ and 50 mM $NaPO_4$ had the most effect on nanoparticle aggregation compared to the other solutions.

Submitted for Poster Presentation

Castle Hills: Renewable Energy and Energy Conservation Options

J. Jimenez, H. Rashed-Ali, A. Nocito, S.F. Ackley

An investigation for the potential implementation of renewable energy, conservation initiatives, and building envelope efficient retrofits was undertaken for Castle Hills TX. The city of Castle Hills is a small municipality located in the desirable north central quadrant of Bexar County, and it is surrounded by the City of San Antonio with loop 410 crossing through the city. An old church in the city was converted to the city's administrative offices, meeting room for City Council meetings, and police facilities. This conversion has raised many energy problems due to the difference in building occupancy and additional structural implementations. Through the energy audit and HVAC survey conducted by UTSA College of Architecture, the understanding of the high energy pay shows a direct linkage to the lack of insulation, inadequacy in light fittings placement design, and low HVAC efficiency. Through ongoing research and data collected, results showed high thermal diffusion due to a poor building envelope. This study has lead to a potential plan of action for the city to undertake and be able to see significant savings that would fit the designated budget. Additionally, the exploration for potential application of renewable energy usage lead to a photovoltaic system design which was analyzed, designed and proposed to the state for grant funding.

Chaetetes Modeling and Flow Calculations

Marcus Garcia,

Department of Civil and Environmental Engineering

-Introduction-
Chaetetes, a very prominent fossil found in some Carboniferous-aged limestones is a coral-like sponge, yet little is known about its paleoecology. In west Texas a 16-kilometer biostrome (reef-like) complex has yielded large amounts of *Chaetetes*, even though little is known why they aren't more prominent in similar limestone formations. *Chaetetes* growth characteristics vary in size, type of growth, and location, but understanding of the fluids acting on these sponges may explain some of these unanswered questions.

-Objective and methods used-
Our objective was to understand force created by fluids acting on different growth forms of *Chaetetes* to better understand living conditions and toppling in their environment. *Chaetetes* had a dermal base and grew between 2 and 30 meters deep in water. By using average grain size to find average velocity and therefore applying a flow program called Flow-3D to calculate the forces and movements the fluids created. After creating 3D replications in an AutoCAD model based on pictures of the most common *Chaetetes* shapes, and importing to Flow 3D (a computational fluid dynamics program), and assuming open channel for calculations for velocity can be averaged at a depth of 2 meters—the forces and moments in X, Y and Z were calculated. By assuming viscosity of zero and a weight of zero, we were able to make calculations using the Flow-3D software.

-Summery of results-
The results vary for each growth type, but there are some common forces related to the different types. This means that, using our assumptions, we were able to provide some interpretation of *Chaetetes* living conditions.

-Conclusion-
After reviewing the results, a better understanding of forces relative to fluid flow on the *Chaetetes* organism can be made. An understanding of toppling from fluid dynamics will require more data on *Chaetetes* and more paleoenvironmental specifics in Flow-3D, like body porosity and weight. This will require some assumptions and further data on *Chaetetes*. Therefore we have successfully modeled *Chaetetes* using engineering programs, which gives us a better understanding of the living conditions and should lead to further results on toppling in the future.

Defining an Undescribed Species of Ammonoid to be either *Demarazites* or *Waagenoceras*

Marvin Lopez, Geology

An undefined species of ammonoid, found on the base of the Type Guadalupian along the El Paso Natural Gas pipeline in the Delaware Mountains in Culberson County, Texas, has been initially described by C. Spinoza and W.W. Nassichuck (1993) to be classified under the genus *Demarazites*. Upon his review, Dr. Lambert has looked at specimen SUI 32407, which he thought should be assigned to the *Waagenoceras* genus. This is significant for evolution due to the fact that, if it is confirmed as a *Waagenoceras*, it is transitional from *Demarezites* and would be the earliest *Waagneoceras*.

During this investigation, depictions of the undefined species were sketched precisely under a Nikon microscope with a camera lucida apparatus, and then compared to those published by Spinoza and Nassuchuck (1993). The sutures indicate how far along the evolutionary chain the specimen can be found, and determines which genus it should fall under. Multiple sutures were drawn from successive whorls on the specimen, ranging from 15mm to 50mm diameter on the specimen. This duplicates the growth characteristics of the specimen, and is important to understand in ammonoid evolution.

Based on the sutures drawn during this project, and in comparison with those that have been published in Spinoza and Nassuchuck (1993), it can be determined that the specimen SUI 32407 would be better aligned taxonomically with the *Waagenoceras* genus. Major evidence for the re-assignment includes the advanced ventral lobe and the more complex saddles, especially as shown at 50mm diameter, when the specimen had reached full maturity.

Root-template Geotextiles

Nicholas Vasquez, Department of Civil and Environmental Engineering

Soil stability is a problem with soil slopes and embankments. If the piece of land has poor soil stability it can lead to embankment failures and excessive erosion. To improve soil stability, synthetic geotextile grids can be placed in the soil. A problem with this method is trying to distribute the grid evenly throughout the soil using excavation which is costly. An alternative to geotextiles, is natural plants which can be used to help soil stability. The problem with plants is, maintenance requirements to prevent death during droughts. The purpose of this research is to combine both approaches where polymer is injected in the roots of the plants so they behave like geotextiles without requiring excavation. This research tested shear strength enhancement of roots with polymer and resistance of these root to degradation.

Plants help stabilize the soil because of the tension strength in the root structure provides a shear strength to the soil. The plant roots can span out in every direction and branch off each other to form a natural interlocking grid that grabs a hold of the soil and "locks" it in place. Most plants have a primary root, a secondary root and little hairs on all of the roots.

To make the root act as a geotextiles mesh, polymer is injected into the plant. A 2:5 ratio of Epo-thin hardener to Epo-thin resin is used to make approximately 14ml of epoxy. The epoxy is loaded into a syringe, and connected to the stem with 3.175mm tubing and pumped (model KDS410) at a rate of 60 ml/hr to reach a pressure of at least 206 kilopascal. Once the 206 kilopascal is reached, switch the pump to a constant rate of 2.5 ml/hr is used for 7200 seconds or until the pump stalls from high pressure.

To see the effect of polymer in the roots a Humboldt Vane Shear gauge was used to test the soils shear strength. A residential garden bed of *Ruellia squarrosa* was divided into two sections. 16 plants on the left side were infused and 16 on the right side were untreated to be the control. There was a 28% increase in soil strength of the infused roots compared to the uninfused roots.

In order to test the degradation of the roots with polymer in them, root stems of *Artemisia annua* of 5 cm length were individually infused with the same polymer and procedures used in the soil testing measurement infusions. Letting the root dry for 86400 seconds, then mass of the roots were measured. After mass measurements were taken, the roots were soaked in 30% acid (H_2SO_4) for 86400 seconds, sonicated for 3600 seconds, and mass measurements repeated and compared for the plant mass loss. The results were a 8% mass loss in the infused root stems, a 16% mass loss for the uninfused stems and a 6% mass loss for the control stems. The polymer appears to protect the infused stems from degradation.

To conclude, activities included infusing plants with polymer, shear testing of soil and testing acid degradation of plants. There was a 28% increase in soil strength of the infused roots compared to the uninfused roots and the polymer appears to protect the infused stems from degradation.

Submitted for oral presentation

"Removal of Arsenic from Water Using Nano Iron Oxide-Zeolite"

Oscar Arturo Garza, Heather J. Shipley

Department of Civil and Environmental Engineering

Arsenic contaminated water is a problem that can be found in nearly all parts of the world, due to the fact that arsenic contamination can occur both naturally and from products of industry. In 2007 it was estimated that over 137 million people were suffering from at least one of the effects of arsenic poisoning of drinking water worldwide. As of now, the more common methods used to remove arsenic from drinking water include coagulation and filtration, lime softening, using activated alumina, ion exchange, reverse osmosis, electrodialysis reversal, and nanofiltration. However, recently a large interest has developed in exploring the possibility of removing arsenic from water by adsorption.

The objective of this research was to assess the arsenic adsorption capabilities of a nano iron oxide-zeolite by performing several batch experiments at various initial arsenate concentrations as well as various sorbent concentrations at ~ pH 4.5. From the 24-hour batch experiments at varying initial arsenate concentrations a Langmuir isotherm was fitted to the data. Kinetic studies were also conducted for arsenate adsorption to nano iron oxide zeolite. The rate constant was calculated using a first order rate equation and was 0.04 min^{-1} at a sorbent concentration of 1.0 g/L. The rate constant can be surface area normalized, assuming a particle surface area of 40 m^2/g, which was 1×10^{-3} L/min/m^2. These normalized rate constants were compared to other values in the literature. Kanel et al. (Kanel et al. 2005) showed unaged nano zero-valent iron had a normalized rate constant of 5.7×10^{-3} L/min/m^2, which is 6 times faster than the results in this study. Furthermore, a distribution coefficient or K_d value was calculated for this sorbent, which is a partition coefficient of the solution to the sorbent. In general it is said that a good sorbent should have a K_d value of 1×10^3 and any sorbent possessing a greater value than this standard should be considered exceptional, Shipley et. al. The K_d value for nano iron oxide-zeolite sorbent was 3.2×10^5, which proves that the sorbent can retain arsenic exceptionally well. This study determined that the nano iron oxide zeolite was good if not better than similar sorbents in the literature in equilibrium conditions; however, when considering the kinetics of the sorbent studied in this report and of other previously studied sorbents referenced in this report than potentially other sorbents are better.

Submitted for poster presentation

Numerical modeling of piles subjected to an internal lateral load

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Civil Engineering Department

Piles are constructed to support vertical and lateral loads. In most of the time, loads are applied at the heads of piles. However, sometimes piles are subjected to lateral force at some distance below ground surface, called internal lateral force in this paper. An example of this lateral force is the pressure induced by pressure grouting to the adjacent piles. The effect of the internal lateral force on pile deflection becomes a concern since the pile deflection would directly influence the superstructures and adjacent structures. Due to unavailability of analytical methods, a three-dimensional numerical modeling was adopted to evaluate the influence of the internal lateral force on the pile deflection. In the numerical simulation, the soil was modeled as a linearly elastic perfectly plastic material, with Mohr-Coulomb failure criteria. The pile was modeled as a linearly elastic material. An internal lateral force was applied. The modeling was implemented in a force control mode. A curve of the pile deflection against the applied internal force was developed. The parameters were varied to examine the influence of different parameters on the pile deflection. The investigated parameters included modulus and friction angle of soil, lateral force location and magnitude, pile length, and vertical load magnitude and fixity of pile head.

Based on the study, the following findings were disclosed:
- The lateral force location, the lateral force magnitude, the soil modulus and fixity condition have significant influence on the pile head deflection.
- The soil friction angle and pile length has influence on the pile head deflection. But the degree of influence varies and depends on magnitude of friction angle and pile length.
- The vertical load has insignificant influence on the pile deflection.
- Lateral force location has significant influence on the pile tip deflection.
- The lateral force, soil modulus and friction angle may have considerable influence on the pile tip deflection but the degree of influence depends on the magnitude of the lateral force, soil modulus and friction angle.

- Pile length, vertical load and fixity have insignificant influence on pile tip deflection.
- The lateral force location influences the direction of the pile deflection for both the head and tip.

Based on the above findings, the design or construction recommendation can be developed if the piles are anticipated to subject to substantial internal lateral load.

Submitted for Poster Presentation

Computing Arctic ice thickness from space measurements of snow surface elevation.

Shelby Williams, S.F. Ackley, Hongjie Xie UTSA, and B. Holt JPL

Air and space campaigns such as IceSAT, IceBridge, and CryoSAT have gathered data on either the elevation of the snow surface or ice surface to estimate ice thicknesses, using isostatic equilibrium, over the Arctic ice pack. A major uncertainty for airborne or spaceborne lidar elevations conversions has been lack of knowledge regarding the snow depth under the measured elevation. We are attempting a different approach, that may not require estimation of an unknown snow depth. Measurements made during ice drilling campaigns conducted over several decades were used in this study. From either gridded or ice line profile measurements, each data set composed of several hundred to around a thousand measurements was analyzed separately. It was found that, when averaged over lengths of several 10's to one hundred meters, that snow top elevation correlated with ice thickness with R2~ 0.80. However, individual data sets showed different linear coefficients. These coefficients have some universality, so that cutoff elevations could be chosen where different linear coefficients gave best fits to the data. These sets of equations were then applied to the data sets of elevation and a predicted ice thickness calculated was compared to the measured ice thickness. Optimum averaging distances were also determined. RMS error in predicted versus measured ice thicknesses will be presented. Application of this technique to satellite data sets of elevation will allow higher confidence in estimates of Arctic ice thicknesses that are decreasing under climate change.

Characteristics of Floodplain Sediments at the San Antonio River

Stephen Contreras, Geology

The San Antonio River builds its floodplain by overbank vertical accretion. The purpose of this research was to investigate the grain size characteristics of sediment deposited by recent overbank flows.

The San Antonio River watershed is 10,583 square kilometers in size. Major tributaries include the Medina River and Cibolo Creek. Sediments were collected from the floodplain and upper banks along the river in the lower portion of the watershed between Floresville and Goliad. Sediment sample were sieved to determine the grain size distributions. Trends were evaluated by, comparing grain size curves and three percentiles and comparing the Trask sorting index

Results show that the Goliad site has the finest average sediment, compared to the Floresville and the overall study reach. This suggests that sediment must be coarser in locations other than Floresville and Goliad. The standard error indicates that Goliad sediment is the most similar, followed by Floresville sediment and the overall study reach. The Trask index also shows that the sediment at Goliad is better sorted than that at Floresville and the overall study reach. Similarities in the grain size distribution curves concluded that the Goliad sediment was more similar overall than both the Floresville curve and the curve of the overall study reach. Thus showing that the Goliad sediment is finer than the Floresville and overall study reach.

Submitted for Oral Presentation