Ferguson Structural Engineering Lab Newsletter

THE UNIVERSITY OF TEXAS AT AUSTIN - STRUCTURAL ENGINEERING

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Breen's Corner: Drop it Like it is Hot! (By Jason Stith)

AUSTIN, TX Those that do not study history are doomed to repeat it. Thus reviewing the history of the lab is important to those that currently spend their time here. Toward this end and with the help of a senior faculty, Dr. Breen, this story should inform and serve as a warning.

In 1960, the United States had just entered a new conflict in the former French colony of Indochina. The policy of Containment was being tested again after the Korean peninsula had been divided and the spread of Communism had been stopped at the 38th parallel (thanks in part to the service of young men like John Breen). However, the army was fighting a new kind of war with guerilla warfare tactics where rapid deployment was critical and the use of modern airplanes allowed not only men, but equipment and supplies to be dropped from low flying aircraft. The problem was the parachutes could only slow the decent of equipment and the damage was often catastrophic. Thus, a research project to design packing that would withstand the impact was initiated. Because the equipment needs to be subject to both horizontal and vertical velocity upon impact, the project was not as simple as dropping packaged Humvees from a tower. This is where the FSEL crane came in handy. The idea was to lift a packaged piece of equipment with the crane then send the crane moving along the tracks as fast as it would travel until the military equipment was over the drop zone and have a quick release pin drop it onto an impact area. This is exactly what was done. Humvees, howitzer guns, and armored personnel carriers were tested. Figure 1 is a picture of a 105-mm howitzer ready for a drop test. Figures 2 and 3 show a Humvee before and after a drop test.

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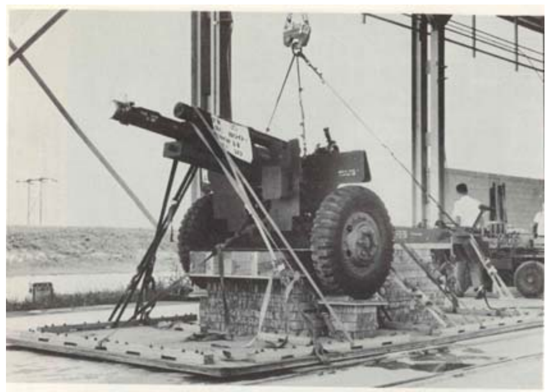


Figure 1: A 105-mm howitzer ready for a drop test from a height of 14 ft. For a drop from this height, the impact velocity will be 30 fps. This is as good approximation of the velocity at impact when this gun is dropped by parachute in the field. The cushioning under the gun is designed to limit the acceleration to 20g.

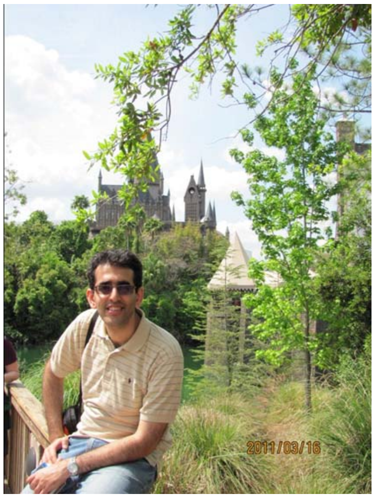
Figure 2: A 3/4-ton truck rigged for a simulated aerial-delivery drop. This vehicle was dropped in free fall from a height of 14 ft.

Figure 3: This is a photograph of the truck shown in Figure 2 after the drop. Note how the paper honeycomb cushioning has been crushed in absorbing the shock of the impact.

Inside this issue:

New Faces at FSEL....

Hossein Yousefpour



I was born in Babol, North of Iran, on January 1, 1986. Having received bachelor's and master's degrees from University of Tehran, I was a structural engineering PhD student there when I decided to pursue my education at UT… My previous research was focused on computer simulation of buildings for performance-based earthquake engineering. I am now working on a completely different field: bridge instrumentation. This motivates me greatly since I feel I have started a totally new stage in my professional life. I love Austin; the city actually reminds me of many of my hometown and childhood memories.

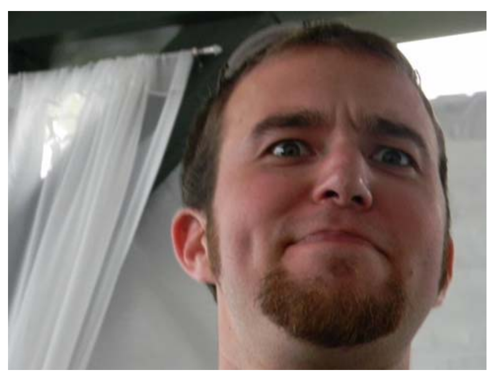
Nick David

I was born in Houston, TX, and I moved to Austin in 2006 to begin my B.S. in Architectural Engineering at UT. I began my MS this past Fall and I'll be finishing up in December of 2011. I plan to begin my "day-job" as a professional engineer once I finish with my master's degree. I'll be working here at the lab through the summer, while also working for SpawGlass at the Liberal Arts Building job-site on campus. In my free time, I enjoy playing golf, playing bass guitar in my cover band, and spending time with my lovely wife, Jenna (we just got married this past January!).

Scott McCord

I was born and raised in Littleton, Colorado, which despite its name is not little at all. I graduated in civil engineering from Colorado State University (Go Ramies!) and married my high school sweetheart amidst the Rocky Mountains. Alas, the eyes of Texas were upon me and three days later we moved to Austin, TX. I am excited to trade in my curled horns for long ones and ready to change the world. Outside of school I am an avid athlete and outdoorsman. I enjoy team sports, hunting, fishing, etc. - oh and I am kind of a cowboy at heart.

Steven Blair



I am 100 percent "Okie" and a proud native of Oklahoma City (Thunder UP!). I received my BS in Architectural Engineering from Oklahoma STATE University in 2010, and set off to UT Austin that fall. Do not worry; the Sooners have long been a rival of mine, so transitioning to Longhorn country was rather easy after hearing the chants at football games. Aside from architecture and engineering, I enjoy running, soccer, playing guitar, taking road trips, and making burritos. I am left-handed, a fan of the outdoors, and able to do a backflip off of a car.

Wireless Fatigue Monitoring - Jeremiah Fasl, Vasilis Samaras, & Matt Reichenbach

We are finally done trouble-shooting the fracture-critical bridge over the Medina River Bridge (south of San Antonio)! Some series problems had kept the data acquisition offline for most of the winter. In the spring, a larger solar panel and new charge controller were installed and the system is back online. Now that the system is back on, we can remotely see how the bridge behaves. Thus, for this summer, we will convert to computer g(r)eeks! Though, later this summer, we will install the new NI WSN strain nodes at a bridge in Austin .

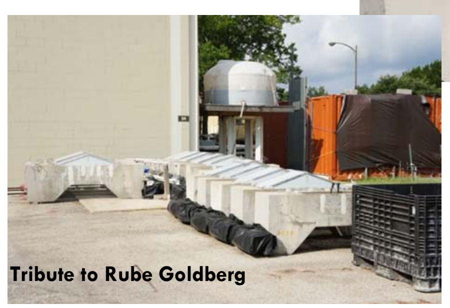
The strain gage durability tests outside FSEL and inside the environmental chamber at ECJ continue as before. The current data indicates that the amplified weldable gages perform the best, followed by the foil gages, and the regular weldable gages perform the worst. Thus, it seems that you do not have to get fancy with weldable gages in order to obtain good strain data. Just use foil gage with the appropriate environmental protection.

We plan to stay inside our offices and create FEA models of several bridges. Well, at some point we may get our laptops and hit the beach as an alternative way to beat the (Miami) heat.

Corrosion Resistance of New PT Systems - Kevin Moyer

This project is an accelerated corrosion study of various components of post-tensioned concrete, such as strand, duct types, and anchorages. A few years ago, beams containing different component combinations were constructed according to TxDOT standards. They are currently being exposed to a salt solution by a spray system, to simulate the splash zone, and by a wet-dry cycle in basins formed in the tops of the beams, to simulate a corrosive environment that is likely to occur in de-icing operations and/or coastal regions.

The autopsy of the remaining fourteen beams will be conducted next spring. Meanwhile the specimens are still being lovingly maintained and monitored and are showing visual signs of corrosion and half-cell readings on some indicate signs of corrosion.

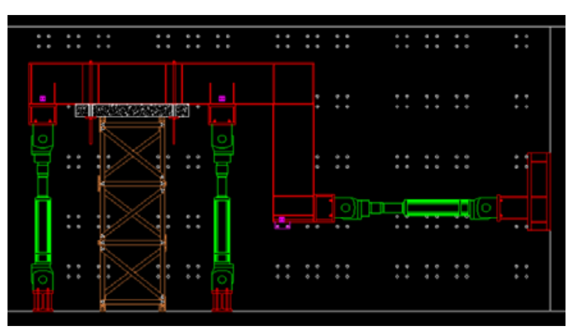


I keep watering them, but they still will not grow bigger!

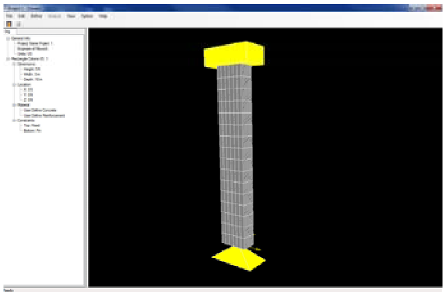
Testing of Urban Search & Rescue Shoring Systems - Scott McCord & Steven Blair

Urban Search & Rescue (US&R) wood shoring towers will undergo destructive testing as part of a new project at FSEL. These towers are constructed on-site when the potential for further collapse of a structure exists, allowing for the relatively safe entry of US&R teams. Two different types of shoring towers will be investigated to determine vertical and lateral capacities, so as to recommend of design improvements. Testing under non-ideal conditions such as a sloped header or combined vertical and lateral loads will also be conducted. Building and testing of specimens will begin around the middle of July 2011.

Special thanks to Matt LeBorgne for the design and construction of the test frame.



Vulnerability Assessment Tool for Blast-Loaded Bridge Components - Eric Sammarco, Rob Hendryx, & Joeny Bui



This is a snapshot of our "program in progress." The bridge component being analyzed here is a rectangular RC bridge column.

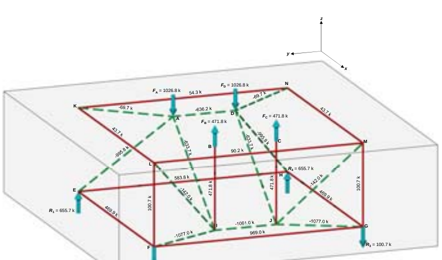
As a result of an increasing trend in worldwide terrorist-related attacks against public transportation infrastructure – along with various terrorist threats received by the U.S. against major highway bridges – considerable research has been carried out in the area of bridge-specific protective design over the past decade. An essential next step in enhancing the security of the nation's highway bridge inventory is to synthesize this newly developed scientific knowledge and protective design technology into an expedient and user-friendly engineering tool. Such a tool will enable practicing bridge engineers to implement blast-resistant design strategies without having to rely on more time consuming, costly, and complex resources such as physical testing and/or high-fidelity finite element simulations. Accordingly, the main thrust of the subject research is aimed at developing a PC-based software program capable of characterizing blast loads on critical bridge components given a particular threat scenario, accurately predicting the dynamic response of the selected component, and providing an estimate of incurred damage and associated loss of load carrying capacity.

Shear Cracking of Inverted Tee Bent Caps - Eulalio Fernandez, Nancy Larson, Dave Garber, & Michelle Wilkinson

Inverted Michelle demonstrates the necessity of holding up the inverted-inverted-tee beam while marking cracks.

Summer brings another exciting round of building and breaking concrete beams for your friends in Team IIT (inverted-inverted-T). We have been busy investigating several cases of unexpected diagonal web cracking in straddle bent caps in cities across the state of Texas, including your very own Austin. By examining beams with varying heights, levels of reinforcement, ledge depths and lengths, and shear spans, we hope both to provide better design practices and determine if the straddle bent caps in the field need to be repaired. Throughout the summer we will be testing more beams in our inverted-inverted-T setup, after which we will compare our results to the associated 3-D strut-and-tie model. Come out and watch a test; it should be fun for the whole family!

Strut-and-Tie Model Design Examples for Bridges - Chris Williams



After being tied up by this project for two years, I'm ready to strut along.

The project's objective is to assist bridge engineers at TxDOT with the implementation of the new strut-and-tie model (STM) provisions developed as a result of TxDOT Project 0-5253, "Strength and Serviceability Design of Reinforced Concrete Deep Beams."

To aid in the implementation of the provisions, a comprehensive design examples document, that includes five STM example problems, is being created and is currently nearing completion. The most recent and final example added to the document is the design of a drilled-shaft footing. The design of such a structural component requires a complex 3-dimensional STM. The example acts as a culmination of the other material within the document.

Upon the completion of the design examples document, design seminars will be conducted in both Austin and Houston to further assist bridge engineers with the updated STM provisions.

Seismic Design of Reinforced Masonry - Farhad Ahmadi, Jaime Hernandez Barredo, Steven Blair, & Nick David

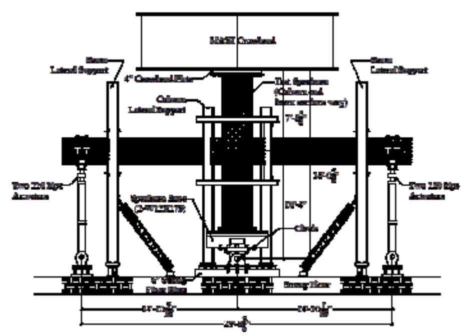
This project is intended to produce much-needed experimental data to better understand the seismic performance of reinforced masonry shear-wall structures and to develop improved design methodologies, detailing requirements, and analytical methods for the design and performance assessment of these structures. The seismic design provisions are primarily force based with overlays of prescriptive requirements, some of which have not been fully substantiated with experimental research. There is almost no data on the dynamic performance of full-scale masonry shear-wall structures, including the effect of wall rocking on component and system performance. In this project we will develop and validate an innovative displacement-based design methodology for masonry shear walls to have predictable and consistent seismic performance. We will produce much needed experimental data to improve current design requirements and will develop an effective boundary element confinement method for flexure-dominated walls.

A total of 44 quasi-static masonry wall segments will be tested at UT and WSU. In these tests the relationship between the most important design parameters (aspect ratio, axial load, percentage and arrangement of reinforcement, and confinement of boundary elements) and the nonlinear hysteretic behavior of masonry cantilever wall segments, especially with respect to the ductility, plastic-hinge length, and shear capacity will be evaluated. Also, two full-scale, 3-story and 2-story, reinforced masonry wall systems will be tested on the large high-performance outdoor shaking table at UCSD.

The first quasi-static masonry wall specimen tested.

Seismic Behavior of Steel Beam-Column Connection - Sungyeob Shin & Hamid Amiri

The panel zone is defined as the portion of column within the connecting beam depth in a steel moment frame. In order to investigate the effect of panel zone yielding on the behavior of steel moment frames under seismic loading, ten full-scale interior connection specimens were designed. The test program included four variables: (1) column and beam sizes, (2) panel zone strengths, (3) column axial stresses, and (4) connection configurations. The main objective of this research is to evaluate the effect of panel zone strength. The effect of weld access hole configuration, continuity plate, and doubler plate weld details are also of interest. Finite element models will be analyzed using ABAQUS to validate the solutions against experimental data.



Test setup in NEES MAST Laboratory (University of Minnesota)

Beams Fabricated from SCC - José Gallardo

Self-consolidating concrete (SCC) mixture is designed so that it can be placed without the use of vibration. In order to achieve that goal, SCC mixtures generally include additives and a high fraction of fine aggregate particles (in relation to conventional concrete mixtures). Differences between self-consolidating and conventional concrete mixtures can (among others) result in substantially different material behavior under load.

In this project, we will try to verify the shear capacity of prestressed concrete beams made with SCC. In addition, the adequacy of code provisions for structural components made with SCC will be verified and modifications to those provisions will be proposed as necessary.

This spring we had an exciting casting day. We collaborated with Hossein Yousefpour and Joel Blok to instrument beams for the New Prestress Loss Provisions project (TxDOT 0-6374). In the near future we will load SCC beams in shear; stay tuned to see how it works.

Some nice pictures of our beloved beams.

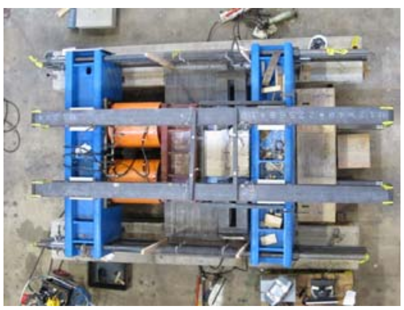
NDT Evaluation of ASR/DEF Damaged Bent Caps - Eric Giannini, Kerry Kreitman, & Zach Webb

Andrew was cold, so we had him repeatedly hit the beam until he warmed up.

ASR and DEF cause extensive expansion and cracking in concrete. Despite this deterioration, most RC structures experience little or no loss of load-carrying capacity because of confinement by the reinforcement. However, fracture of shear reinforcement has been found in some Japanese ASR-affected structures, possibly jeopardizing the structural integrity. This project seeks to improve the evaluation of affected structures, incorporating nondestructive testing (NDT), and to investigate the implications of stirrup fracture.

Three beams (north of the lab) and four "beam segments" (four-feet long beam cross sections) have been monitored using a variety of NDT methods, including UPV, impact echo, surface wave techniques, and the Hawaiian Sledgehammer Test (see photo). A stirrup in one of the beam segments was severed to simulate a stirrup fracture. The beam segments have recently emerged from their hot tub at the south end of the lab so Zach could write his thesis and re-enter the real world. Kerry loves FSEL so much she will be here for another three to four years.

Spliced Prestressed Concrete I-Girders - Andy Moore, David Wald, Katie Schmidt, Trang Nguyen, Josh Massey, & Trey Dondrea

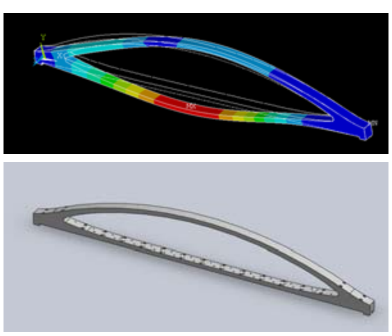


A little hard to see from this picture, but just for the record, Andy really likes boats.

After months of construction, the spliced girder team's new four-million pound compression test machine is finally up and running. The team will be using their new toy over the summer to test a series of 24"x24" concrete panels that are 5-, 7-, and 9-inches thick and contain either grouted or ungrouted steel or plastic post-tensioning ducts. These panels are intended to represent a portion of a post-tensioned I-girder acting as a compressive strut under load. Limited experiments conducted by researchers in the past have not only shown that the strength of concrete panels is reduced by the presence of a post-tensioning duct, but that the effects of plastic ducts are more detrimental than steel ducts. With a growing reliance upon plastic ducts for post-tensioning in the U.S., there is much cause for concern.

Finally, the team is working through the details of designing the project's first full-scale girders. We anticipate that full-scale testing will begin in the fall.

Monitoring Stresses in Prestressed, Precast Concrete Arches - Hossein Yousefpour & Joel Blok



An exclusive sneak preview of the models in progress, brought to you by hard work, sleepless nights, and gallons of the finest Earl Grey tea.

The primary objective of this project is to assist in the construction of an innovative arch bridge for downtown Fort Worth. The massive precast, prestressed arches will be instrumented so that stresses can be monitored throughout the casting, transportation, and installation phases. The first arches are scheduled to be cast in early 2012; in the meantime, the primary focus will be on instrumentation calibration.

Several slender post-tensioned specimens will be constructed, instrumented, and tested at FSEL this summer. The investigation will focus on the vibrating wire gage resolution, ability to indicate cracking and buckling, and the reliability of gage output in assessing member performance. The results of these tests will provide valuable validation data for the finite element models as the models are refined to accurately depict member behavior. This will ultimately enhance the confidence and efficiency with which team members can assess the arches on the job site.

Elevated Temperature Material Properties - Jinwoo Lee

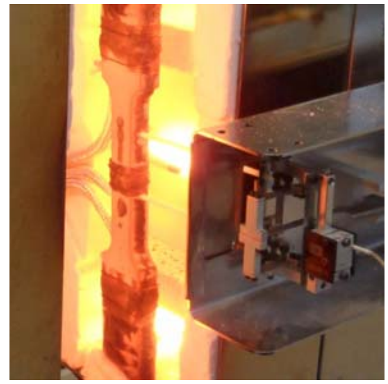
There is an increasing interest in the US in developing engineered approaches to structural fire safety of buildings as an alternative to conventional code-based prescriptive approaches. In steel buildings, one of the key elements of an engineered approach to structural fire safety is the ability to predict the material properties during and after fire or post-earthquake fire.

The major purpose of this project is to figure out the mechanical properties of ASTM A992 steel for the following use.

- Provide the fundamental mechanical properties for analyzing the building behavior during and after fire including earthquake event.
- Evaluate the structural integrity of buildings due to fires of varying severity and different causes
- Provide basic data for the building design code for fire-resistant design

The experimental tests were performed by simulating the real fire situation such as In-Fire, Post-Fire, Earthquake Fire, and Post-Earthquake Fire.

The results of this research will include the elastic modulus, yield strength, and stress-strain curve at multiple elevated temperatures. The material properties will prove useful in the evaluation of the combined effect of earthquake and fire events.



Testing at elevated temperatures

Creep Buckling Due to Fire - Mohammed Ali Morovat & Victoria Segrest

This project focuses on testing the time-dependent buckling behavior of ASTM A992 steel columns at elevated temperatures. These particular creep buckling tests have not been done within the United States for structural steel. For this research, a specific setup has been designed to run these tests properly. The first phase involves predicting the behavior of the steel columns using the finite element program called ABAQUS®. We have used this program to run simulations for future experimental preparation. The experimental phase includes material and column testing. As seen in the picture, we will be using a pin-ended setup for our column tests that will be placed in a furnace and exposed to temperatures up to 700 °C. The parts for the setup are almost complete giving the project leeway to start material testing. The objective is for the creep analysis to give us a perspective on the buckling behavior of steel columns during a fire and possibly improve on building standards.

Tubular Cross Frames - Anthony Battistini, Weihua Wang, & Guy Bergel

Over the spring semester, we finally began testing the T-stem connection for use with tubular members in cross frames. The first test focused on the static behavior of the connection, with emphasis on being able to accurately model and predict the overall member stiffness. We ran several elastic tests to validate the finite element model and then loaded it to failure.

We are currently performing fatigue tests in order to rate the connection for use in bridge applications. Both tension and fatigue tests will be ongoing throughout the summer as we look at a variety of tube and connection sizes. As for the cast steel connection, the foundry will be casting our first set in the next few weeks. Once completed, we will be performing similar tension and fatigue tests on those connections.

The fatigue tests are all they are cracked up to be.

High Mast Illumination Poles: Field Instrumentation - Luca Magenes & Jeremiah Fasl

Wanted: An adventurous person to participate in an awesome field trip!

Finally the project seems to be coming to an end. A significant amount of data has been collected by the data acquisition systems on the HMIP in Corpus Christi, El Paso, and Lubbock. The stress data revealed the dynamic behavior of the poles under wind loading. To estimate the remaining fatigue life for the in-service poles, the field data together with the lab data obtained from fatigue load tested performed in the previous years were used. Approximately one year of data was used to define a stress history that can represent the average stress which the HMIP will be subjected to during its service life. The use of field data with load test results will provide a good estimate of the remaining fatigue life for the poles of various designs and differing cracking conditions. These estimates will help TxDOT identify the most critical cases and determine whether a replacement, a repair, or more frequent ultrasonic inspections are the most suitable choice for each critical pole. The experience gathered from this long-term instrumentation will also contribute to the development of reliable, remote data acquisition systems for long-term structural monitoring.

In the future, a HMIP taken out of service will be load tested at the lab. This pole was reported to be heavily cracked at the base connection. The results from the test will define a conservative estimate of the fatigue performance of a typical in-service cracked pole. The final field trip to El Paso and Lubbock to take down the instrumentations will take place during the second week of July. We are looking for an adventurous person to take on board with us!

Flexure-Shear Critical Columns - Matt LeBorgne, Matt Homer, Eliud Buenrostro, & Wanching Wang

System test

The structural welding has been completed on the test frame and all the connections have been bolted together. Just before the semester's end Eric finished writing the control software and it was successfully tested on the steel column. The test frame is now being configured for its first test on a concrete column. The first column will have an axial load applied of 150 kips and will be cycled until axial collapse occurs and the residual shear capacity is reached. Matt Homer, who wrote all of the photometric visualization software has graduated and accepted a position as a design engineer in San Antonio. Thus, Eliud Buenrostro and Matt LeBorgne have taken a crash course on the use of the vision system so the photometric data can be extracted for the two columns. Guillermo Huaco has started helping out on this project since he will be repairing and testing these columns as part of his research after we are done with them. In addition, a new undergraduate student, Wanching, has started working with us a few days a week.

L-Frame Erection

Cracked Panels - Kiyeon Kwon, Aaron Woods, & Umid Azimov

We have concluded that TxDOT can reduce panel cracking and exceed serviceability requirements by reducing the initial prestress force from 16.1 to 14.4 kips. We are continuing to monitor the prestress loss of our precast concrete panels (PCP) outside of FSEL to verify long-term behavior is also satisfactory.

To recommend top mat reinforcement options, we have prepared wireless data acquisition systems for two bridges. The construction schedule of the bridges is currently on hold; thus, in the meantime we are planning to conduct a constrained shrinkage test. We will focus on resistance of various top mat reinforcement options (in transverse direction) against constrained shrinkage and creep. We plan to test three different reinforcing details: (1) current TxDOT, (2) reduced TxDOT, and (3) WWR.

Several series of Double Punch Tests are being prepared to evaluate the effectiveness of high performance steel fibers . The test variables include fiber type and manufacturer, fiber volume fraction, surface preparation of specimens, and testing machines. Batching, mixing, and testing, will be conducted over the course of the summer.

Aaron has substituted his beach workout for buckets of aggregate at 18B!

Shear Strengthening of Concrete Elements Using CFRP - Yungon Kim & José Garcia

From the test results of the T-beam, simple shear behavior model and design recommendations for U-wrapping with CFRP anchors have been developed. Basically the CFRP anchor allowed the CFRP sheets to reach rupture strain in strengthened beams because failure due to debonding was precluded. However, the effective strain for design should be less than rupture strain because all CFRP sheets crossing the critical crack would not rupture simultaneously. Those are the main findings from this project.

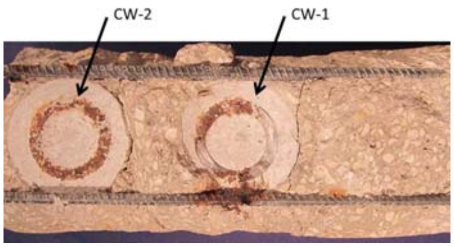
We just finished installing CFRP sheet on the last I-beam of this project. It took about five and half hours in the middle of summer and we made it! From previous I-beam tests, CFRP sheets increased the cracking load and ultimate capacity. In this test, the effect of horizontal FRP strips will be evaluated. We are getting more guests to watch the explosive failure of brittle material. Do not miss the last explosion. Coming soon.

High Masts: Thermal Study - James Kleineck

As you all probably know by now, high mast illumination poles can crack during galvanizing. For the past two years, I have been working to determine why this happens by galvanizing miniature specimens, galvanizing full-scale specimens, and fighting ABAQUS to give me reasonable output with respect to the formation of stresses at weld toes. I am excited to say that I am nearly at the end of my chapter in this story. The solution, as determined though full-scale testing and supplemented by computer modeling, appears to be easy enough; our recommendation will be to increase the thickness of the pole shaft: this decreases the shaft diameter to shaft thickness ratio which reduces the likelihood of crack formation (for more information, reference Kleineck, 2011—coming to a university thesis storage facility in August). And with that, I will pass the metaphorical acetylene torch to the future graduate student who will take my place working on this problem and trudge forward towards the glimmering, silvery finish of a project known to cause researchers residual stress.

This image has absolutely nothing to do with galvanizing cracks in high mast illumination poles.

Passive Wireless Corrosion Sensors - Ali Abu Yousef & Jason Harlan



Autopsy of Beam CW once sensors indicated corrosion.

An accelerated corrosion testing program was initiated in June 2010. The primary objective was to evaluate the ability of the new passive sensor design to detect the initiation of corrosion in reinforced concrete members. Beam CW was constructed with two #3 rebars and two sensors fabricated with 0.001-inch thick washer elements. Once the response of both sensors shifted to the corroded state, an autopsy was performed to determine the extent of corrosion in the reinforcement and the condition of the sensors (see figure). It is evident that corrosion had just initiated in the beam reinforcement and the anodes formed at the cracked regions near the embedded sensors. The choice of the thin washers allowed for early detection of corrosion damage.

Currently we are developing a non-linear circuit's model using NI's Multisim™ software. The goal is to associate the measured change in sensor response to the electrical properties of the washer (resistance and inductance). This will allow better understanding of the correlation between the damage in the sensor and the measured response.

Retrofit, Retrofit, Retrofit - Guillermo Huaco

To repair a structure or element, the structure or element must be first damaged. For research purposes, a specimen must be created and then damaged in a controlled manner. A controlled damage is desired so that the amount of damage can be assessed and then repaired appropriately. Controlling the damage is often very difficult, but it is the most exciting part of this research.

My research focuses on retrofitting reinforced concrete columns. Axial and lateral load will be applied to those columns with the expectation that the rebar will buckle and concrete will crush. The repair job involves the use of CFRP for ductile response of the retrofitted column and the use of mechanical couplers to replace the buckled rebar.

A lot of repair fun is coming this summer. Amen!


As I say: "The key to success is perseverance."

Horizontal Shear & Shear Testing of Texas U-Beams - Catherine Hovell, Alejandro Avendaño, David Langfeld, & Brian Hanson


One hobo house available for rent. Minor cracking in the walls. Inquire in Office 202.

The Texas U-Beam project load-tested the anticipated final beam in late May with a bang; the 63-kip beam (with 26-kip deck) failed in web-crushing and was cut in half and shipped out in fast order. The two beams tested this spring -- in January and May -- were fabricated with reinforcement and geometry designs proposed by the research team to prevent horizontal shear from controlling behavior. As the performance of these beams was favorable -- the first failed in flexure-shear, the second in web-crushing, the design is being recommended to TxDOT for implementation into the bridge standard. In the meantime, the project participants have since scattered to other work -- Catherine to her dissertation and Alejandro to his box-beam testing and dissertation. The U-Beam study may be wrapping up, but the legacy of the work is expected to last forever... or at least, until someone hires a crane to ship off that last test section outside the lab

Passive Wireless Conductivity Sensors - JinYoung Kim

A passive, wireless, and inexpensive sensor has been developed to monitor the conductivity of concrete and thereby provide information on the progress of chloride-induced corrosion of embedded reinforcement in concrete structures. Sensors are designed to be attached to the reinforcement cages before placement of the concrete in new construction or in portions of rehabilitated structures. Sensors will then be interrogated intermittently over the service life during routine inspections. Conductivity sensors were embedded in concrete cylinders and interrogated over a 50-week period during initial set and curing of the concrete. Analysis of the measured data shows that the passive conductivity sensors were successful in detecting a variety of conductivity levels in the concrete.

Embedded conductivity sensor in concrete cylinder.

End-Region Optimization of Box Beams - Alejandro Avendaño, Catherine Hovell, David Langfeld, & Brian Hanson

After studying the early-age and shear behavior of three beams fabricated with the current TxDOT standard detail, two more beams with improved reinforcement details were fabricated and tested. The reinforcement details were successfully modified to better manage the initial tensile stresses in the end-region of the beam upon prestress transfer. The last beam fabricated (see figure to right) also incorporates thicker webs and a thicker bottom slab to accommodate more prestressing strands at a higher eccentricity. This beam was designed to be used in a "spread box beam" configuration seizing the advantages of its superior flexural strength. The shear performance of all box beams tested in this program were deemed excellent. Experimental shear strengths were on average 30% greater than calculated strengths.

Due to its extra strength, the new box beam (Next-Box) is referred to as an "X-Box." Bent caps and top decks are sold separately.

Congratulations to the 2011 FSEL Spring Graduates!!

Spring 2011

- Seong-Hoon Kee (PhD)
- Rangsan Wongjeeraphat (PhD)
- Matthew Homer (MS)
- Eisuke Nakamura (MS)
- Eleanor Reynolds (MS)
- Juan Diego Rodriguez (MS)
- Hunter Smith (MS)

*Committee Vision: Increase **productivity** at Ferguson Laboratory through improved **communication** and **collaboration** of students, staff, and faculty*

Breen's Corner: Drop it Like it is Hot (Cont'd)

While the test was interesting and the results helped save lives during this controversial war, there is a much more relevant story to FSEL behind these tests. At that time, a laboratory technician named Jerry Crane was helping out on the drop testing. One day after a set of rainstorms had hit the Austin area, Jerry thought it would be fun to drive the tracked armored personnel carrier around Balconies Research Campus. In one part of the campus, the physical plant division was working on a building storm drain pond to control flooding. Jerry thought that would be a great place for a test of the track vehicle. The personnel carrier performed beautifully, powering through the mud and the muck (figure 4). As Jerry continued his escapade, he went over the mounts created for digging the pond and that was his undoing. The carrier was running along the side of one of the berms when the personnel carrier flipped. While the tracked vehicle can go through any mud the narrow track spacing did not work well on a hill side. Dr. Breen, as director of the lab at the time, had to call the army and get them to send a crane to the lab to turn it over and haul it out. Subsequently, the lab did not perform another drop test for the army. I wonder why? Jerry left the lab a little later and moved on to better things. He obtained a master's degree in electrical engineering and is the president of a company today. The lesson here is to work hard and play hard (one of my personal life mottos). Just make sure you are playing with your own toys, because as we get older our toys get more expensive.

Figure 4: Armored personnel carrier pushing a Humvee out of the mud (downloaded from http://www.defense.gov)

Special points of interest:

- Ice Cream Social, July TBD, Large conference room
- FSEL Welcome BBQ - Septemeber TBD

Football season is almost here!

Once students can purchase tickets, an email will go out with information about the group created so that we can all watch the game together in the stadium. Be on the lookout for more information in the coming weeks! We plan on tailgating similar to last year.

Information about the Newsletter

The goal of this publication is to keep those working at FSEL aware of the status of ongoing projects around them. In addition to projects, we may also highlight special events, people, or news of interest. The newsletters will come out once a semester, three times a year.

In this second issue of 2011, twenty-five research projects at FSEL are summarized. Hopefully you will learn something new about each project so as to initiate more discussions with your fellow researchers.

Feedback
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