



# Student Forum

# University of Houston-Downtown

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FACULTY ADVISOR: Dr. Arash Rahmatian Ph.D., P.E.





#### 2017 FRP Composite Competition





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**University Name**: University of Houston - Downtown

Faculty Advisor: Arash Rahmatian Ph.D., P. Eng.

Team Code:UHDCE



The Concrete Convention and Exposition





#### 2017 FRP Composite Competition



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Team Code:UHDSE



The Concrete Convention and Exposition

# Objective

- To Design, construct, and test a concrete structure reinforced with Fiber-Reinforced Polymer(FRP).
- Predict loading that causes a 3.5mm mid-span deflection.
- Predict the ultimate loading on the structure.
- Achieve the lowest cost-load ratio.



## Requirements

- Structure must weight between 5kg 15kg.
- Beams should be able to fit into a 200mm wide by 200 mm high by 1000mm long box. Overall length should not be less than 950mm nor more than 1000mm.
- No structure should be more than 56 days old.



## Designing Concrete Mix













#### Team UHDCE – Arch Beam





#### Team UHDCE – I Beam









Daniel E. Salazar

Joe Salinas

Jose Zelaya

#### 2016 Mortar Workability Competition







FACULTY ADVISOR: Arash Rahmatian Ph.D., P.E.





# Objective

 While some of ACI competitions focus over strength and hardening of concrete, this competition mainly focus on workability and rheological properties of concrete. Students were asked to create a mortar mix in which gave maximum flowability rate and was cost effective. Flowability, mixture stability, and mixture costs were evaluated.



## Requirements

- Mortar must use cementitious materials as a binder and must not have a maximum 30% of the whole mix.
- Maximum w/c should be .50
- Chemical admixtures meeting ASTM C494 of C1017 may be used.
- Aggregate shall be non-metal meeting fine aggregate requirements described in ASTM C33.
- The mixture must contain 60% (by mass of the whole mixture) aggregate as minimum.
- The total volume of the mix should be 650±100 mL



## **Mix Performance**



During practice, we measured and recorded that our mix took in average of 20 seconds to fill up the entire mold.



## Mix Performance at competition







Due to some complications, we ended being short 5 ml of superplasticizer giving us a slower flowability than expected. Since we were short, our mortar mix was only able to fill 75% of the mold.





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#### What's Going On In Houston?







- Houston majorly composed of surrounding bayous and soils that don't drain too well is a city that is constantly being concern about flooding. Majority of the city now being covered by pavement and concrete has placed people and structures in vulnerable risk of flood damage. As the water level rises, streams and currents pick up debris that eventually causes water blockage that leads to more flooding. Soon as the water level decreases, we are left with nothing but scattered trash that is time consuming to pick up.
- In May 2015 and April 2016 the city of Houston experienced some of the worst flooding in recent history. Streets flooded, major highways were shut down, vast property damage occurred and most devastating the loss of life transpired.



#### Objective



- Having the need to find a solution to help clean and filter our bayous from floating debris, we immediately made our priority to engineer something innovative that was cost effective and didn't required much maintenance. Our objective was to design a structure in where it could be placed in the buffalo bayou and help collect all sorts of trash from soda cans to tires or floating branches in effort to help combat flooding.
- Also, to create a floatable platform intended to aid the community by providing a floating vessel; a temporary safe zone in case of flood.



#### Concept

- Having all the issues in mind, from the size of trash to be collected to the changes of current, we ultimately decided to incorporate light weight concrete and fiber reinforced polymer (frp) to create sets of floating trash collectors that would be placed a cross a bayou in effort to efficiently collect trash when it rains. Our design consists of 2 rows of concrete pots with frp gates that are utilized as means to gather trash and make it more efficiently to collect after water levels decreases.
- Also, by incorporating the same materials for the floating trash collector, we decided created a floating vessel that could be utilized as a safe zone for the community.







#### Prototype

 After weeks of pondering on the design, we finally decided to put our calculations to the test. By constructing a scale down replica of our structure, we could predict the functionality of our structure in a reallife scenario. By making a simple prototype out of the same light weight concrete mix, we could confirm the buoyancy and the max weight our structure could withstand before completely sinking.









2.4

Lightweight Concrete Pot

Maximum Shell Stresses

#### Conclusion

 Overall, with determination and dedication, we finally managed to get the job done. With these projects, we managed to apply our knowledge and skills to design, evaluate, analyze, and fabricate our floating structure with also achieving hands on experience. Since our designs works its purpose, we hope that this is an idea that can be further expanded to help collect trash and reduce vehicle and human losses.







## Thank You!