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**University Transportation Center for Mobility™**

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# **Transportation Workforce Development: Sustaining and Expanding High School Outreach Programs and Multi-agency Partnerships**

## ***Final Report***

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and William Stockton**

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# **Transportation Workforce Development: Sustaining and Expanding High School Outreach Programs and Multi-agency Partnerships**

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## **EXECUTIVE SUMMARY**

The main goal of this project was to develop and expand a Summer Transportation Institute (STI) bridge program, called STI Scholars, between high schools and Prairie View A&M University (PVAMU) or any other institution. The goal of the program is to motivate students to take an interest in civil engineering and more specifically in transportation engineering-related education and proceed to transportation careers. The program, which is a multi-university/agency partnership between PVAMU, the Texas A&M Transportation Institute (TTI), and Texas A&M University (TAMU), focuses on producing high-quality transportation professionals from underrepresented groups. For this project, STI Scholars program curriculum was redesigned to provide a stimulating environment that would attract, inspire, and encourage students from various high schools within and outside the state of Texas to be part of this program during the two summers before they graduate from high school and pursue higher education. The newly developed curriculum for the STI Scholars program is challenging and introduces various concepts related to civil and transportation engineering, for example, the use of surveying equipment and techniques in transportation, as well as an introduction to AutoCAD and environmental issues related to transportation. This program also provides opportunities for the Scholars to mentor new STI participants as well as gain valuable experience working with transportation professionals at TTI. This program provides a unique combination of mentoring and real-world experiences through TTI, TAMU, and other partnerships with governmental agencies and private and public corporations. Various fellowships, such as the Eisenhower Transportation Fellowships for juniors and seniors, are leveraged to increase the quality of experiences for the participants.

For this project, a database of the past STI participants was updated, and communication links were established. The research team developed a strong presence for STI on the internet for alumni and other friends to interact with members and with each other. The team used the social networking site Facebook to help accomplish this goal. The STI Facebook page and the STI webpage through PVAMU are updated frequently and serve as a key link between current and former students and the university. The STI Scholars program has been implemented for three consecutive years, with two students in 2008, three in 2009, and three in 2010. The grant awarded for this project helped the program recruit a record number of six students for the 2012 program.

To ensure long-term sustainability of the program, this project produced a network of (a) former students, (b) educational professionals (counselors and teachers), and (c) public and private agencies including academia. Also, this program was able to track graduates of the STI Scholars program as part of monitoring their education and careers post-program. One hundred percent of the participants who were able to be tracked (seven out of eight) are pursuing higher education, and more than 70 percent are pursuing education in science, technology, engineering, and mathematics (STEM)-related fields. One student is pursuing finance and one is pursuing broadcast journalism.

The success of this project is having a positive impact on the civil engineering programs at PVAMU and TAMU, and efforts are being made to expand this partnership to other universities in the Texas A&M University System as well as to community colleges and other universities. This program can serve as a model to similar outreach programs at other locations across the nation.





## **INTRODUCTION**

Shortage of a skilled workforce is an issue that the U.S. is currently facing, and the situation is going to get worse. According to the U.S. Department of Labor, more than 165 million jobs will be available in the year 2012. However, just 162 million people will be in the workforce during that same period. Various efforts have been made to bridge this gap, one of which is to encourage and promote technical education/careers among underrepresented groups of society. The Federal Highway Administration (FHWA) has been sponsoring the National Summer Transportation Institute (NSTI) for the last 15 years to address this growing gap between the workforce demand and the pool of available candidates. Prairie View A&M University (PVAMU) has been part of the Summer Transportation Institute (STI) program since 2000. The STI program has been administered on the PVAMU campus with partial support from grants from the University Transportation Center for Mobility™ at the Texas A&M Transportation Institute (TTI). The program focuses on preparing high school students for careers in transportation-related fields and more specifically in civil engineering. It is believed that early guidance and training will result in a higher number of people from underrepresented groups pursuing careers in transportation-related fields. Though this program focuses on the broader transportation profession, developing the transportation/civil engineering workforce is a major part of this effort. So far, STI, along with the fairly new STI Scholars program, has directly educated 230 middle and secondary school students. Long-term sustainability of transportation and its infrastructure depends on these types of outreach programs. The ultimate objective of the STI program is to produce transportation professionals with strong research and other real-world transportation engineering experiences. This project was part of the outreach to develop an academic pathway for these STI students into civil engineering programs.

## **OBJECTIVES**

The primary objective of this project was to create interest, particularly among high school students in traditionally underrepresented groups, in the field of transportation engineering so that they could pursue higher education in this field and be a part of a pool of qualified transportation professionals. In addition, this project aimed to ensure long-term sustainability of the program by creating a network of former students/graduates of the STI program who could act as mentors for incoming students. The network also included educational professionals who have played a significant role in making this program a great success as well as various public and private academic agencies that have had a vital role in the overall program. The project team's efforts were focused on achieving the above objectives successfully, and a comprehensive plan and careful implementation were required to do so. Other, more specific objectives of this project included the following:

- Develop a new paradigm (i.e., academic path with relevant connectors) for high school students with the two summer programs during the last two years of high school and the subsequent undergraduate and graduate experiences before entering the transportation engineering workforce.
- Create a database of all the STI participants who graduated from PVAMU in the last 10 years and establish communication links.

- Prepare marketing resources (brochures and other promotional materials).
- Review/develop admission criteria, identify potential high schools to target including magnet schools and charter schools, and engage four to six teachers/counselors from the identified schools to work with the program in advisory roles.
- Establish corporate partnerships to work with PVAMU and TTI on this long-term effort. A relationship with TTI will help in attracting major sponsors that have established connections to TTI.

The project team set the following performance measures over the duration of this project:

- The number of high schools solicited for participation in the STI program will increase from 100 to 150.
- The number of applications received for new STI students will increase from 30 to 50.
- Three to four STI students will attend the STI Scholars program.
- At least 50 percent of the students will pursue higher education in science, technology, engineering, and mathematics (STEM) fields.

Continued success of this program, as shown by its impacts on the community in generating interest among students from underrepresented groups, suggests that it could serve as a model for similar programs at other locations nationwide. One of the parameters of the success of the program is its positive impact on civil engineering programs at PVAMU as well as TAMU. There are various institutions within the Texas A&M University System, and this program could be expanded to some of them, which would result in greater outreach and impact. This year, focused efforts are being made to expand the partnership between PVAMU, TAMU and TTI by involving various educational institutions within the Texas A&M University System. Similar efforts have already been made to expand this partnership to community colleges and other universities.

## **METHODOLOGY**

This section explains in detail the project tasks and the performance measures. These tasks correspond to the objectives outlined earlier in this report. The tasks are defined in a way that specifically assigns a set of deliverables and covers all aspects of the program.

The specific tasks completed as a part of this project were:

1. Revise and complete a streamlined academic pathway for the students to follow starting with their junior year in high school and extending through their graduate education.
2. Review and revise curricula for the two summer programs, STI and STI Scholars.
3. Continue implementing the STI Scholars program at PVAMU and provide supplemental support for the STI program at PVAMU.
4. Develop and foster a stimulating environment on the internet for former students to network and promote PVAMU and its programs.
5. Continue to develop the network for sustainability with the goal of self-sustainability.

## Task 1: Revise and Complete a Streamlined Academic Pathway for Students to Follow Starting with Their Junior Year in High School and Extending through Their Graduate Education

This task focused on students' overall academic progress starting with their junior year in high school, extending to their graduate education at PVAMU/TAMU, and ultimately resulting in transportation-related careers. In this effort, the earlier pathway was revised to guide high school students, both junior and seniors, through the two summer programs that provide increasingly more hands-on activities designed to introduce them to and promote awareness of transportation careers and attract them to STEM disciplines, and more specifically, to civil engineering. The pathway was revised in a way that includes students from the state of Texas as well as other states. It gives them greater exposure to hands-on experience in research and an opportunity to learn from technical professionals and leaders who are active in all capacities. This pathway shows various options available to students for their overall academic enhancement including outside/real-world work experiences in transportation fields. Eisenhower Transportation Fellowships for juniors and seniors are leveraged to increase the magnitude and value of the experiences for the participants. Upon successful completion of the four-year civil engineering degree, students will be encouraged to pursue graduate education at TAMU with research assistantships through TTI or pursue careers in the transportation field. Students are encouraged to pursue graduate degrees and are made aware of options available to them after completion of their graduate degrees as compared to options available after undergraduate degrees.

The revised streamlined pathway is presented in Figure 1. The majority of the components identified in this diagram (marked in blue) existed already. The STI and STI Scholars programs have established relationships with TTI and other private and public entities (marked in red) involved in the transportation field to provide opportunities in research and real-world experiences. Both these projects have also helped in developing strong relationships with many high schools in Texas and other states.

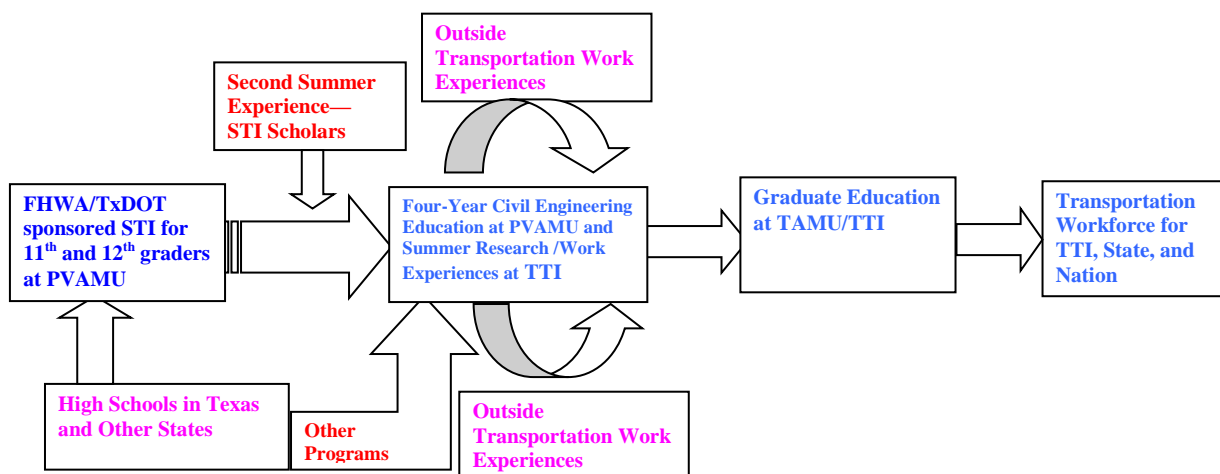


Figure 1. Concept Diagram for the Academic Pathway

The revised program is designed to generate excitement and stimulate curious minds toward a more challenging and technical education. Hopefully, it will result in more students choosing technical careers related to civil and transportation engineering. The program started with high school juniors being invited to participate in the STI program. Successful STI participants were then invited back for the second summer program, the STI Scholars program. This year, a total of six students, a program-high number at PVAMU, were recruited into the STI Scholars program.

Dr. Kommalapati, the principal investigator (PI) and interim department head of the Civil and Environmental Engineering Department at PVAMU, and Dr. Stockton, a senior administrator at TTI, have significant resources and personnel available at their disposal to develop and promote this pathway among the faculty and researchers at both institutions and are able to identify and coordinate research and other real-world transportation workplace experiences for the students. These experiences are aimed at stimulating and fostering the students' curiosity and continued interest in the transportation engineering field. Both Dr. Stockton and Dr. Kommalapati have worked to promote research collaborations among PVAMU, TAMU, and TTI, and during this project, they increased these efforts to enhance opportunities for the students following this academic pathway.

### **Task 2: Review and Revise Curricula for the Two Summer Programs—STI and STI Scholars**

The FHWA has mandated certain curricula to be included in the four-week STI program. These include air, water, and land transportation and transportation safety. The program also incorporates several enhancement activities such as preparations for the SAT, technical writing, time management, public speaking, mathematics, English, and other career-planning activities such as college admission and résumé preparation.

STI and STI Scholars curricula were revised to expose students to various roles technical people play in the real world and how exciting and rewarding these roles can be in terms of personal satisfaction and otherwise. Other summer programs and outreach activities were reviewed and adopted to improve the curriculum and enhance student learning experiences. For example, the American Society of Civil Engineers and other professional organizations developed materials and projects for inclusion. Also, various commercially available building kits that focus on certain scientific and engineering mechanisms were added to give students a visual and hands-on experience of basic science and engineering fundamentals. This has made the learning process entertaining and more educational. Success of the revised curricula is evident from students' participation and increased understanding of various scientific and engineering topics.

STI program curriculum was revised and enhanced to include more hands-on engineering applications and projects to generate excitement and curiosity. Technical topics that have not been part of previous programs were incorporated this year based on their appropriateness and significance in the civil and transportation engineering fields. For example, students are now introduced to surveying topics that include hands-on experience with auto levels and total stations and their applications and importance in construction, highway, civil, and transportation engineering.

The original curriculum for the STI Scholars program was developed through funding from the University Transportation Center for Mobility™ (UTCM), and the project team reviewed that curriculum to make sure it was both challenging and stimulating for students to enhance their interest in pursuing a transportation career. The team used experts in various aspects of transportation and broader civil engineering to then develop new activities. The enhanced curriculum for the STI Scholars program is more challenging and aimed at providing a better transition for participants into an undergraduate engineering program. STI Scholars get to mentor the younger STI participants by sharing their experiences and giving talks on some technical topics that are not covered in the STI program, and this activity has helped with their public speaking skills. Participants also gain invaluable real-world experience by working with transportation professionals. Some of the curriculum improvements, such as an introduction to technical writing and the importance it plays in the professional world as well as the application of surveying, are the same for the STI and STI Scholars programs, but STI Scholars program involves a higher level of learning. Dr. Kommalapati worked closely with TTI and TAMU personnel to continue to develop a challenging curriculum and to coordinate facilities, work experiences, and mentoring opportunities for the STI Scholars participants.

The grant that funded this project helped with hiring support staff, specifically Dr. Sanjay Tewari as a consultant/instructor, Ms. Carla Foster as an experienced high school teacher, and Mr. Sanjay Tillmot as the undergraduate program assistant, to support the STI Scholars program. Dr. Radha guided and worked with the team to make this program a success.

### **Curriculum for the STI and STI Scholars Programs**

The project team developed and implemented some new modules in the 2012 STI and STI Scholars programs. Below is a list and brief description of some of the new modules developed as part of this project. These new modules were developed first for the STI Scholars program; however, many of them were used for the STI program as well.

- **Material Testing: An Introduction and Discussion on Destructive and Non-Destructive Testing**—Students were introduced to the concepts and need for material testing in various civil engineering, especially transportation engineering, projects. Differences between destructive and non-destructive testing were explained during an interactive session. Students also watched multiple educational videos of some of the machines being used during these tests.
- **Concrete Mixture and Destructive Material Testing Activities**—Students learned fundamentals of making concrete mixtures and various related issues like keeping proper ratios of sand, cement, and water. They made their own concrete and made a small beam, which they later tested with weights.
- **Environmental Issues Related to Transportation Engineering: Air and Water Pollution**—An interactive discussion on the roles that various modes of transportation play in air and water pollution was held with students. The discussion was guided toward issues and possible ways for remediating those issues. Later, students were divided into three groups and asked to choose one mode of transportation from air, ground, and water. They then exchanged ideas and views on these issues with other groups.

- **Road to Becoming An Engineer: Soil Particle and Sieve Analysis**—A lecture was given about how to make the best decisions as engineers based on available information. For example, students were shown how to do soil particle and sieve analysis and utilize information to make the best decision for a project. Students participated in a laboratory activity and performed this analysis on various soil samples.
- **Field Surveying: Introduction to Leveling Fundamentals and Auto Level**—The role of field surveying in general civil engineering and specifically in highway construction and transportation engineering was explained in this module. Students were shown how to do a leveling survey with an auto level instrument. They were given an opportunity to go outside and take some measurements to better understand how to use an auto level.
- **Surveying: Advanced Leveling Project**—Once students were familiar with the leveling concept and instrument, they were given a task to run a vertical level loop and find the elevation of a certain point based on the given elevation of the starting point. Students were taught how to calculate error of closure and compare it to allowable error for the loop.
- **Traffic Safety: Stopping Distance**—This module focused on factors affecting stopping distance of vehicles. Students were explained the science involved in stopping distance and how various physical characteristics of surfaces involved play a significant role. Also, they were given a sense of how fast things happen when driving at various speeds and how fast reflexive action is.
- **Science Behind Rockets**—Various components of rockets were explained. The concepts of conservation of momentum and energy, effect of shape and balance, and types of fuel were discussed.
- **Rocket Building**—This session provided students an opportunity to put together a working rocket complete with engine and launching mechanism. Students also put together launching pads and controllers. Later, they launched these rockets under the instructor's supervision.
- **Building a Bridge (Balsa Wood)**—Commercially available bridge building kits were used in this session. Students had the freedom to choose any design they wished following certain rules. They were supposed to follow the truss concept that was taught to them earlier. This session gave students a better understanding of bridges.
- **Testing a Bridge**—The bridges prepared by students were tested under different loading conditions. Students learned about various types of failure. This was a fun activity that was educational in nature.
- **Challenge Activity: Preparing a Bridge from Pasta Material**—Students were given a limited amount of spaghetti pasta and were asked to experiment with bridge design. They were to improve their design based on lessons learned from the Testing a Bridge module.

- **Dream Transportation Project: City with Ideal Surface, Water, and Air Transportation**—Students prepared a dream transportation model with three modes of transportation—ground (highways and rails), water, and air—for an ideal city. They did a lot of planning and demonstrated that planning in the form of a physical model that illustrated the use of the three modes of transportation within a city.
- **Science Behind Efficient Boats**—Archimedes’ law of buoyancy was explained in this module. Students watched two videos that explained visually how it works. Later, center of gravity and how it affects stability of boat was discussed. Streamlined shapes and how they are incorporated in boat designs were discussed.
- **Building Boats from Styrofoam and Testing Them with a Solar-Powered Fan**—This activity involved students designing boats out of Styrofoam blocks. Commercially available solar boat kits were used. Boats were driven by solar-powered fans, so students were briefed about the possible uses of solar power in transportation. Students were given multiple opportunities to demonstrate how fast their boats were and how straight they were able to navigate in water.
- **Introduction to AutoCAD and Its Applications**—A basic introduction of AutoCAD was given to students. Students learned to draw simple drawings using basic commands. They also learned various applications of AutoCAD in the construction and transportation fields. They were given different sports grounds dimensions and were asked to create AutoCAD drawings.
- **Introduction to Advanced and Environmental Friendly Mass Transportation Systems: Magnetic Levitating Trains**—Students watched videos on how magnetic levitating trains are being used for faster mass transportation around the globe. They were able to see how these trains look and work. They also discussed, in an interactive session, environmental impacts of such trains.
- **Building Magnetic Levitating Trains from Commercially Available Kits**—Magnetic levitating train kits were used for this fun and creative activity. Students used their knowledge of magnets and forces between two similar and opposite polarities of magnets to prepare a magnetic levitating train and then got to see it in real life.
- **Total Station as Versatile Surveying Equipment and Introduction to Traversing in Surveying**—How to use Total Station for a higher level of surveying was discussed. Students were shown how to run a horizontal loop with Total Station. They ran a traverse and measured horizontal distances and horizontal angles and found the surface area of a given traverse with the help of Total Station.
- **Application of Total Station in Transportation Engineering: Horizontal Curves**—Students were shown how to use Total Station for laying out horizontal curves for highways. They also learned about various applications of this equipment in general construction projects including bridges, highways, and drainage and sewer lines.

- **Technical Writing**—This year, extra efforts were made on teaching technical writing skills. Students had multiple sessions, during which they improved their technical writing skills under the supervision of an experienced high school instructor with an English major.
- **Report Writing and Creating a Poster**—In addition to learning technical writing skills, students enhanced their report writing skills by learning how to make posters in PowerPoint for exhibitions.

### **Program Website**

Two brochures and a website ([www.pvamu.edu/STI](http://www.pvamu.edu/STI)) that were developed for the STI and STI Scholars programs as part of a prior grant were utilized during this program. The website was enhanced with new information. More details can be found on the website. A snapshot is presented in Figure 2.



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STI Scholars Program

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## Summer Transportation Institute

### STI and STI Scholars Program Update

20 students for the STI program and 6 students for the STI Scholars Program completed the program this year. The program culminated with a closing/award ceremony on June 29, 2012. The students talked about their experiences and how this program helped them to understand the world little better and learned to appreciate the field of engineering.

We hope to continue to offer this program again next year. Please check this website for more updated information periodically. Photographs and reports will be added to this site in late summer.

**Updated: July 1, 2012**



Department of Civil and Environmental Engineering at Prairie View A&M University is hosting 2012 Summer Transportation Institute (STI) from June 4 - June 29, 2012. This four-week program is a residential program. Support for this program comes from [Federal Highway Administration \(FHWA\)](#) through [Texas Department of Transportation](#) and [University Transportation Center for Mobility \(UTCM\)](#). STI recruits about 20 bright students and exposes them to various exciting activities and field trips that provide them an understanding of the engineering and broader civil engineering with a special focus on transportation industry and careers. The students selected for this program will be offered a scholarship of \$4000, which will cover all the expenses for the program. Thus the program has no out of pocket expenses for the participants. The program includes class room lectures, hands on activities, educational and recreational field trips in addition to evening and weekend enhancement and recreational activities. The participants will develop professional skills, experience college life, interact with like-minded peers and learn the college admission and financial aid procedures. The participant will also receive a certificate of completion in addition to other merit awards during the closing ceremony for which the parents and family are invited. STI 2012 is scheduled to start on June 4, 2012. The application deadline is May 21, 2012. To apply for admission download the [application package](#). Discuss the program with your parents/guardian and your science or math teacher and counselor. Parents or teacher/counselors must nominate the student for this program. Students must complete the application materials and attach the required documentation (two page application, teacher recommendation form, letter of nomination, essay, school transcript and other standardized test scores if available) and send to us before the deadline. The selected applicants will be notified by the end of May 2012.

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**Figure 2. Snapshot of STI Web Page**

### **Task 3: Continue Implementing STI Scholars Program at PVAMU and Provide Supplemental Support for STI Program**

One of the most important deliverables from an earlier UTCM project was to develop and offer the new STI Scholars program. The program has been a great success. PVAMU recruited two students from the 2007 STI program for the 2008 Scholars program and three students for each of the next two years. Under the grant that funded this project, the project team recruited six students for the 2012 STI Scholars program. This number is the highest for a given year in the program history. The STI Scholars program coordinator acted proactively to keep participants engaged in learning and provided significant help to the STI program as well. Supplemental support to the STI program included taking interactive technical sessions, organizing outdoor activities related to civil engineering measurements, mentoring students, and helping students with their general as well as specific queries related to experiences gained during undergraduate and graduate degrees in civil engineering.

Dr. Radha and Dr. Kommalapati both acted in an inspirational manner and provided monitoring as well as managerial support to both the STI Scholars and STI programs. Their careful planning and stress on implementation helped the program coordinator, graduate assistant, and undergraduate counselors provide their best to the STI Scholars and supplemental STI programs. The curriculum for the STI Scholars program includes job shadowing of research personnel and hands-on work experiences at TTI and other transportation-related agencies. Like STI, the Scholars program offered many enhancement and recreational activities during evening hours and weekends to keep the young minds completely engaged.

#### **Program Modules**

Some of the curricula and topics developed and/or revised were discussed in Task 2. This section provides a more detailed description of some of the modules for the benefit of readers. Detailed information on each module is included in the Appendix.

- **Material Testing: An Introduction and Discussion on Destructive and Non-Destructive Testing**—STI Scholars students were introduced to the concept of material testing and why there is such a need to test materials in construction-related projects including highway and bridge construction. They were introduced to destructive and non-destructive material testing and the pros and cons of each type of testing. Multiple videos with different types of materials being tested were shown. Students learned about various properties of construction material that usually are tested and were asked to name some of the materials that are used in various highway and bridge-related projects. Also, they were asked to identify what qualities of material they should test and why. Discussion was interesting, and students enjoyed talking about their choices. Students watched educational videos about the consequences of choosing construction material without testing. Students also chose various topics related to material testing and did online research for a presentation that they were required to give to Summer Transportation Institute students.
- **Environmental Issues Related to Transportation Engineering: Air and Water Pollution**—An interactive session with STI and STI Scholars students was held to direct

their attention toward environmental issues relating to transportation. This session focused specifically on air and water pollution. Different sources of air pollution were discussed. Students were divided into three large groups and were asked to choose one mode of transportation: ground, water, or air. Groups were asked to identify various kinds of pollution-related issues from other modes of transportation, and each group was supposed to think of counter arguments. This discussion was guided and controlled, but students were allowed to explore all options. Highways, railroads including magnetic levitation, water transportation, air transportation, and other innovative modes of transportation were compared based on their contribution to pollution. Air pollution dominated the discussion. However, various aspects of water pollution-related issues were also brought up by the instructor. Different ways to minimize pollution were also discussed. Issues such as how vehicles contribute to different types of pollution during their lifetime—from manufacturing, to active use, to disposal (after being out of service)—were discussed to provide a better understanding of pollution control. In addition, basic water quality parameters were discussed. Students were introduced to the concepts of turbidity, pH, and conductivity, along with the science behind these measurements. Students were shown how to take measurements of turbidity, pH, and conductivity. They were divided into small groups, and each group took turns demonstrating the turbidity of various water samples and their corresponding turbidity measurement with the help of a turbidity meter. They also measured pH of water samples.

- **Soil Particle and Sieve Analysis**—STI and STI Scholars students participated in soil particle and sieve analysis. This activity was preceded by a discussion on geotechnical engineering that focused on importance of soil particle analysis and how it can be used in decision making in various construction projects. Students came to know that soils are generally called gravel, sand, silt, or clay. They also learned how to identify type of soil based on particle analysis. They were given a handout with background information and instruction on how to perform sieve analysis. Once the discussion was finished, they were taken to a geotechnical lab where they were divided into small groups with not more than four students per group. Separate soil samples were given to each group. Each group performed weighing, sieving, and weighing mass of soil retained on each sieve. Once each group finished its activities in the geotechnical lab, it moved to a computer lab and performed calculations and used spreadsheets to plot grain-size distribution obtained from sieve analysis in a semi-logarithmic plot, with grain size plotted on the log scale and percent finer plotted on the natural scale. Students learned about various options and features available in a spreadsheet for data display.
- **Field Surveying: Introduction to Leveling Fundamentals and Auto Level**—Students were introduced to the leveling concept and its application in various construction projects including pavement construction. Students were shown an auto level and leveling rod. How to read a leveling rod was discussed, and students were asked to read various measurements off the leveling rod while still in the classroom to make sure that they understand how to do so before going into the field and taking actual measurements. In addition, the basic mathematics involved in finding the elevation of a foresight point given the elevation of a benchmark or back sight point was explained to students.

Important factors to consider while making a decision about choosing a spot to set up a tripod were discussed.

- **Surveying: Advanced Leveling Project**—Once students were familiar with the leveling concept and instrument, they were given a task to run a vertical level loop. Once out in the field, the instructor demonstrated how to use a tripod to set up the auto level and the technique to level it accurately and then showed students how to focus the telescope and take various measurements. The rocking-the-rod technique was demonstrated so students could take error-free measurements. In the afternoon, students were asked to complete a vertical loop around the Wilson Engineering building starting from a point of known (assumed) elevation and to find the elevation of point on the other side of the building and complete the loop by coming back to the starting point. Error of closure was calculated and was compared to maximum allowable error. This exercise gave students good experience with practicing leveling fundamentals and operating the equipment.
- **Introduction to Advanced and Environmental Friendly Mass Transportation Systems: Magnetic Levitating Trains**—Students were given instruction on magnetic levitation; they were shown how it works and the science behind it. They also watched educational videos about the application of magnetic levitation in transportation and specifically in trains. This session was about the challenges and benefits of having an operational magnetic levitating train system. The videos were informative but focused on discussing the concepts without going too much into the science.
- **Building Magnetic Levitating Trains from Commercially Available Kits**—After the introduction to magnetic levitating trains, students were given a magnetic levitation kit. The kit had step-by-step instructions for making a train that would levitate magnetically. Students were also shown a video on how to make the train. Students were required to identify north and south poles of magnets using compass and place magnets in a certain order for the train to levitate. This activity took about two hours and some additional time for the glue to dry. In the end, the instructor inspected each group's train and its performance. This activity exposed students to new modes of high-speed ground transportation systems, and they were able to recognize the use of forces from magnetic to balance weights.
- **Science behind Efficient Boats**—Archimedes' law of buoyancy was explained in this module. Students watched two videos that explained visually how it works. A discussion focused on various aspects such as shape, size, center of gravity, and balance of a boat followed. Streamlined shapes and how they are incorporated in boat designs were discussed. In one of the videos, students were asked to do calculations and compare the weight of a boat and weight of the water displaced by it in various conditions.
- **Building Boats from Styrofoam and Testing with Solar Powered Fan**—Once students understood the concept and science behind boats, they were given a solar boat kit and were asked to design a boat. Each kit had one block of foam that was to be transformed into a boat. The boats were driven by solar energy, so students were also given instruction on how solar panels work. They were asked to align the solar panels to

capture maximum sunlight. Once all students were finished preparing their boats, the boats were judged on two parameters: the speed of the boat and the ability of the boat to navigate in a line. Students were given multiple attempts to achieve their best performance. Appropriate scientific explanations were given based on performance of each boat. Overall, it was fun activity, and students learned about the science behind boats while competing against each other. The wind and clouds were an issue during this activity, so in the future, the weather should be taken into consideration while planning for this activity.

- **Rocket Building and Launching**—There were two separate sessions for this project. The first session focused on building rockets, and each student put together his/her own rocket from a rocket kit provided. The second session involved activities related to rocket launching. Both STI and STI Scholars students participated in each session. The rocket kit given to students had a complete set of parts for them to build one rocket complete with engine and rocket recovery parachute. It took about three hours for students to complete their rockets and some additional time for the glue to dry. Significance of balance and symmetry of rockets was discussed before construction activities began. Also, a discussion on the science behind the rockets was led by the instructor. Students came to know about the principle of conservation of momentum, different types of fuels used in rockets, and other factors governing flight of a rocket. In the second session, students went into an open field away from any structures and put together four launch sets and corresponding launch controller. Then they took turns, four students at a time, putting igniters in the rocket engines and making necessary connections to the controllers. The instructor demonstrated how to do this activity in a safe manner. Once everybody was away and clearance was given by the instructor, students launched their rockets. Extra precautions were taken with rockets that needed to have their igniters replaced. This session was about two hours long.
- **Introduction to AutoCAD and Its Applications**—An introductory AutoCAD session was held for STI and STI Scholars students. AutoCAD is being used in a range of industries; it is employed by architects, project managers, and engineers, just to name a few. The importance of AutoCAD in engineering as a tool was discussed. Students were given an opportunity to play with AutoCAD and learn at the same time. Students were given measurements of various sport fields/courts and were asked to create drawings in AutoCAD. Basic commands used to draw various shapes were then taught. Students were asked to put notations in their drawings and were shown how to set the dimensions of each drawing, including height of texts and size of notation arrows. Students were divided into groups of two, and each group was given a different assignment. Students took their time to understand AutoCAD and how it helps in preparing construction- and surveying-related drawings and the fact that the software supports both 2D and 3D drawing formats.

## **Program Schedule**

The schedule of the STI Scholars program showing the daily activities over the four-week program is illustrated in Table 1.

**Table 1. Summer Transportation Institute—Scholars: Daily Schedule**

<i>Sunday</i>	<i>Monday</i>	<i>Tuesday</i>	<i>Wednesday</i>	<i>Thursday</i>	<i>Friday</i>	<i>Saturday</i>
<p>June 3 * Daily Items*</p> <p>8–8:30 and 1–1:30 Computer Lab</p> <p>11:30–1 Lunch</p> <p>Breaks (subject to change) 10–10:15 &amp; 2:30–2:45</p> <p>4:30–4:45 Preparation for Dismissal</p> <p>4:45 Dinner</p>	<p>4 8 a.m.–10 a.m. Welcome and Check-In /Room Assignments</p> <p>10:30 a.m.–11 a.m. Orientation and STI Overview (Dr. Kommalapati)</p> <p>1 p.m.– 2 p.m. IDs</p> <p>2 p.m.– 2:30 p.m. Rules/ Expectations (Ms. Glover and STI Staff)</p> <p>2:45 p.m.– 4:30 p.m. Pre-THEA Test</p>	<p>5 8:30 a.m.– 9:45 a.m. SAT Practice (Ms. Foster)</p> <p>10 a.m.–11:30 a.m. Material Testing: Introduction, Discussion on Destructive and Non-Destructive Testing (Dr. Tewari)</p> <p>1:30 p.m.– 3:30 p.m. Concrete Mixture and Destructive Material Testing Activities (TxDOT)</p> <p>3:30 p.m.– 4:30 p.m. Bridge Worksheet/Activity</p>	<p>6 8:30 a.m.– 9:25 a.m. Research period for talk on material testing techniques</p> <p>9:30 a.m.– 11:30 a.m. Environmental Issues Related to Transportation—Air/Water Pollution (Dr. Tewari)</p> <p>1 p.m.– 1:30 p.m. Computer Lab /Social Activity</p> <p>1:30 p.m.– 4:30 p.m. - Presentations by STI Scholars on destructive/non-destructive material testing - Road to Becoming an Engineer— Soil Particle and Sieve Analysis (Dr. Tewari)</p> <p>4:30 p.m. – 4:45 p.m. Complete Bridge Worksheet</p>	<p>7 8:30 a.m.–11:30 a.m. Pavements Planning and Design (Austin &amp; Funetes)</p> <p>1:30 p.m.– 4:30 p.m. Bridge Design (Jaime Castaneda)</p> <p>6 p.m.– 8:30 p.m. Groups Bridge WestPoint Software</p>	<p>8 8:30 a.m.– 11:30 a.m. Technical Writing ( Ms. Foster)</p> <p>1:30 p.m.– 4:30 p.m. Traffic Signals and Intelligent Transportation Systems (TxDOT)</p> <p>6 p.m.– 8:30 p.m. Group Reports</p>	<p>9 Educational Field Trip</p> <p>NASA—Johnson Space Center</p>
<p>10</p> <p>10:30 a.m.– 12:30 p.m. Religious Activities— Mt. Corinth MBC</p> <p>1:30 p.m.– 4:30 p.m. Bonding Time</p> <p>6:30 p.m.– 9 p.m. Recreation</p>	<p>11 8:30 a.m.– 11:30 a.m. Field Surveying—Leveling Fundamentals (Dr. Tewari)</p> <p>1:30 p.m.– 3:30 p.m. Surveying—Leveling Project (Dr. Tewari)</p>	<p>12 9 a.m.– 10 a.m. Presentation—Stopping Distance (Dr. Tewari)</p> <p>10 a.m.– 11:30 a.m. Talk—Science Behind Rockets (Dr. Tewari)</p> <p>1:30 p.m.– 4:30 p.m. Activity—Rocket Building</p>	<p>13 Field Trip</p> <p>Seamen’s Church Institute, Port of Houston, &amp; Sam Houston Boat Ride</p> <p>2:30 p.m. –4:30 p.m. Bridge Model (Group Project)</p> <p>6:30 p.m. –8:30 p.m. Evening Session Bridge Model (Group Project)</p>	<p>14 8:30 a.m.– 10 a.m. Technical Writing (Ms. Foster)</p> <p>10 a.m.– 11:30 a.m. Activity — Magnetic Levitation Train (Dr. Tewari)</p> <p>1:30 p.m.–3 p.m. Activity — Solar Boat Construction (Dr. Tewari)</p> <p>3 p.m.– 4:30 p.m. Challenge/Activity —Solar Boat Project (Dr. Tewari)</p>	<p>15 8:30 a.m.– 4:30 p.m.</p> <p>Field Trip</p> <p>TxDOT Construction</p> <p>TRANSTAR</p>	<p>16 Juneteenth Celebration</p> <p>Parade—Hempstead City Park</p>

**Table 1. 2012 Summer Transportation Institute—Scholars: Daily Schedule (Continued)**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<p>17</p> <p>9 a.m.– 9 p.m.</p> <p>Field Trip</p> <p>Galveston Museums: Railroad, Lonestar and Ship</p> <p>Ferry Ride—Galveston, TX</p>	<p>18</p> <p>8:30 a.m.– 4:30 p.m.</p> <p>Field Trip</p> <p>METRO Train Station, Houston</p>	<p>19</p> <p>Juneteenth Celebration</p> <p>Parade—Hempstead City Park</p>	<p>20</p> <p>8:30 a.m.– 4:30 p.m.</p> <p>Field Trip</p> <p>TAMU TTI</p>	<p>21</p> <p>8:30 a.m.– 4:30 p.m.</p> <p>Field Trip</p> <p>TAMU TTI</p> <p>(Crash test demonstration and other activities)</p>	<p>22</p> <p>8:30 a.m.– 10 a.m. Technical Writing</p> <p>9:30 a.m.– 11:30 a.m. Project Model Construction</p> <p>1:30 p.m.– 2:30 p.m. AutoCAD Concepts</p> <p>2:30 p.m.– 4:40 p.m. Sports Complex Design Using AutoCAD</p>	<p>23</p> <p>Field Trip</p> <p>Houston Museum of Natural Science</p>
<p>24</p> <p>Religious Activities— Greater St. Peters BC Jellystone Swimming Park/Recreational Activities</p>	<p>25</p> <p>8:30 a.m.– 11:30 a.m. Horizontal Curves in Highways Using Total Station (Dr. Tewari)</p> <p>1:30 p.m.– 4:30 p.m. Advanced Surveying Project Using Total Station (Dr. Tewari)</p> <p>6:30 p.m.– 9:30 p.m. Building Projects</p>	<p>26</p> <p>8:30 a.m.– 4:30 p.m.</p> <p>Field Trip</p> <p>TAMU TTI</p>	<p>27</p> <p>8:30 a.m.– 10:30 a.m. Group Activities—Rocket Launching</p> <p>10:30 a.m.– 11:30 a.m. Speech Preparation for Closing Ceremony</p> <p>1:30 p.m.– 2:30 p.m. Closing Ceremony Rehearsal</p> <p>2:30 p.m.– 4:30 p.m. Project Posters Preparation for Display</p>	<p>28</p> <p>8:30 a.m.– 11:30 a.m. SAT/ACT Scholarships Prep</p> <p>Afternoon Closing Ceremony Preparation</p> <p>Evaluations</p>	<p>29</p> <p>Closing Ceremony</p>	

## **Tracking of STI Scholars Program Participants**

The program has been able to successfully track the careers of seven out of the total eight past graduates. One hundred percent of the students who have been tracked are pursuing higher education. More than 70 percent (five of seven) students pursued careers in STEM-related fields post-program. One student, LaSasha Walker, is a senior in the Civil Engineering Program at PVAMU with a 4.0 CGPA. Out of the two students who did not pursue careers in STEM-related fields, one is pursuing an undergraduate degree in finance at Howard University and another is seeking a degree in broadcast journalism at Sam Houston State University.

## **Task 4: Develop and Foster a Stimulating Environment on the Internet for Former Students to Network and Promote PVAMU and the Programs**

The Facebook page of the STI program is updated with the latest information and activities on a regular basis. Some of the announcements are made via the Facebook webpage, and students participate by liking the webpage. This has created an additional medium for the project team to reach current and former STI students. A Facebook presence is a very powerful tool for exposing the program to a larger number of students. As part of this project, the project team communicated with the former student network, which was developed as a part of the previous UTCM project, and invited those students to be part of the STI page by liking it so that the team can expand its reach to them. About half of the total participants of the 2012 STI and STI Scholars programs are already connected with the Facebook page. The project team believes that as pictures of this year's camp are posted, word will spread online and the rest of the students will check out the page and connect to it. Hopefully, this exposure will lead to more online traffic of students to the PVAMU and TTI webpages. This will result in students knowing more about PVAMU and TTI and how they can fit these two institutions in their future plans. A snapshot of the latest Facebook page of the STI program showing some of the announcements is provided in Figure 3. Also, a snapshot of the same page with network data is shown in Figure 4. About 30 students from 14 different cities recently (from June 6 to July 24, 2012) liked the STI Facebook page. This number is further broken down, in percentages, by audience age, gender, city, and country.



facebook  Pvamu STI Home

Admin Panel Edit Page Build Audience Help Show + Create A Page



**Pvamu STI**  
30 likes

Education  
STI- Summer Transportation Institute introduces and provides insights on the transportation field. The program includes class room lectures, hands on activities and educational field trips in addition to evening and weekend enhancement and recreation

About Photos Likes

Add a Cover

Like **30**

See Your Ad Here  
**Pvamu STI**  
STI- Summer Transportation Institute introduces and provides insights on the transportation field. Th...  
Like · Pvamu STI likes this.  
Get More Likes

**Now**  
June  
2012  
2011  
Joined Facebook

Highlights

Status Photo / Video Event, Milestone +

What's on your mind?

**Pvamu STI** July 9

STI students are gone. STI Camp is over but our work is not finished yet. Working on reports.

Like · Comment · Share

10 people saw this post

**Pvamu STI** June 29

Rockets that were put together by STI students and STI scholars were launched yesterday. It was great experience. Will share some pictures soon.

Like · Comment · Share

Like · Kirsten Mariahh and 2 others like this.

Write a comment...

**Pvamu STI** June 21

Department of Civil and Environmental Engineering at Prairie View A&M University is hosting 2012 Summer Transportation Institute (STI) from June 4 - June 29, 2012. We accepted 20 students for STI program and 6 students for the STI Scholars Program scholarship this year.

Like · Comment · Share 2

Recent Posts by Others on Pvamu STI See All

**Phyllis Darden-Caldwell**  
@ Prairie View A&M Foundation  
May 23 at 7:47am

Activity Recent

Pvamu STI added a milestone from June 2012 to their timeline: 2012 STI Summer Ca...

**Pvamu STI** June 29

Just had closing ceremony of 2012 STI and STI Scholars Programs today. It was amazing to see great presentations by student participants and their public speaking skills. Great atmosphere.

Like · Comment · Share

Like · Kirsten Mariahh and 2 others like this.

Write a comment...

Activity July

**People Who Like This**

**30**

Like · Pvamu STI likes this.  
Get More Likes

Joined Facebook

June

Facebook © 2012 · English (US) About Create an Ad Create a Page Developers Careers Privacy Cookies Terms Help Get More Likes

Figure 3. Snapshot of STI Facebook Page

facebook Search for people, places and things Pvam STI Pvam STI Home

Pvam STI Timeline

Overview Likes Reach Talking About This

06/01/2012 - 07/24/2012 Export Data

**People Who Like Your Page (Demographics and Location)** See Likes

**Gender and Age?**

Female	66.7%	30%	10%	13.3%	6.7%	6.7%	
		13-17	18-24	25-34	35-44	45-54	55-64
Male	33.3%	10%	10%	10%		3.3%	65+

**Countries?**

- 28 United States of America
- 1 India
- 1 Kuwait

**Cities?**

- 11 Houston, TX
- 2 Fort Worth, TX
- 2 La Villa, TX
- 2 Katy, TX
- 2 Temple, TX
- 1 Magnolia, TX
- 1 Aurora, CO
- 1 Frisco, TX
- 1 New Orleans, LA
- 1 Pflugerville, TX
- 1 Kuwait, Al Kuwayt, Kuwait
- 1 Madurai, Tamil Nadu, India
- 1 Cameron, TX
- 1 Hempstead, TX

**Languages?**

- 30 English (US)

Where Your Likes Came From

New Likes?  Unlikes?

Like Sources?

Facebook © 2012 · English (US) About · Create an Ad · Create a Page · Developers · Careers · Privacy · Cookies · Terms · Help

Figure 4. Snapshot of STI Facebook Data Page

## **Task 5: Continue to Develop the Network for Sustainability with the Goal of Self-Sustainability**

Long-term self-sustainability of these programs could be achieved by cultivating a partnership with a network of local private and public institutions. The project needs constant support from high school teachers, a bigger network of high schools so that a larger number of students can be reached, and continued partnerships within PVAMU, TTI, and TAMU. Increased efforts are being made to solicit support from governmental agencies and private corporations. There is definite potential for private sponsorships that could be harnessed with greater efforts. The Federal Highway Administration and the Office of Civil Rights for the STI programs have helped greatly, and the project team looks forward to their continued future support.

This year, the project team has explored numerous options and invited various individuals and agencies to be a part of the STI programs. Some of the invitations were on a volunteer basis. This has not resulted in much success so far, but the team intends to explore this option more in the future. A larger network of institutions and individuals will provide more opportunities for a comprehensive support of STI programs.

## **PERFORMANCE MEASURES**

Following is a review and detailed description of the performance measures set by the project team:

- Advance and expand the STI program and develop the STI Scholars program with a rigorous curriculum at PVAMU.
  - We developed an academic pathway in which a student who attends the STI after completing the 10<sup>th</sup> grade will be brought back to attend the STI Scholars program after the 11<sup>th</sup> grade and join a PVAMU civil engineering program after graduation from high school. Students were mentored and provided transportation engineering exposure along with transportation internship opportunities. Students were encouraged to pursue graduate degrees in transportation. We brought two STI students to the STI Scholars program in 2008 and increased this number to three for each of the next two years (2009 and 2010). We have one of the two 2008 STI Scholars in the civil engineering program at PVAMU and another pursuing engineering at Texas Tech University.
- Increase the number of high schools solicited for participation in the program from 100 to 150.
  - We finalized two brochures, one for the students and the other for teachers and parents, along with a postcard that provides information on the STI program. The brochures are printed in hardcopy and are also made available on the STI website.
  - We improved the website ([www.pvamu.edu/STI](http://www.pvamu.edu/STI)) for the STI and STI Scholars programs.
  - We developed a Facebook page to promote STI among youth.
  - We contacted 160 schools, exceeding the goal of 150.
  - We emailed 1,000 school teachers and counselors from the above-listed 160 schools, informing them of the STI program and directing them to the STI website.

- Increase the number of applications received for new STI students from 30 to 50.
  - We received an average of more than 55 applications for the last three years, exceeding the goal of 50.
- Have three to four STI students apply to return to the STI Scholars program for a second year (the STI program did not provide for multiple years of participation prior to this project).
  - A total of six students were recruited in 2012 under this project, exceeding the targeted number of three to four students.
- Track the careers of former graduates of the STI Scholars program to ensure that at least 50 percent of the students pursued higher education in STEM fields.
  - Eight students graduated from the 2008, 2009, and 2010 programs. We were able to track seven out of the eight students successfully. One hundred percent of the students pursued higher education, and over 70 percent (five out of seven) pursued careers in STEM-related fields. One student (LaSasha Walker) is a senior in the Civil Engineering Program at PVAMU and has a 4.0 CGPA. Of the two students who are in non-STEM fields, one is pursuing finance and the other, broadcast journalism.

## **APPENDIX**

This Appendix contains the 2012 Summer Transportation Institute (STI) Scholars program annual report. The annual report provides a detailed overview of the program's administration, curriculum, activities, and evaluation.



**2012 Summer Transportation Institute  
Scholars Program  
at  
Prairie View A&M University**



**ANNUAL REPORT**

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July 30, 2012

**FY 2012**  
**2012 Summer Transportation Institute Scholars Program**  
**Prairie View A&M University**

**Annual Report**

**Transmittal Sheet**

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## **Part I: 2012 Summer Transportation Institute Scholars Program**

### **Program Overview**

The STI Scholars program, hosted at Prairie View A&M University (PVAMU) and funded by the University Transportation Center for Mobility™ (UTCM), was designed to pique the awareness of underrepresented high school students in the field of transportation. This program is conducted in conjunction with the STI program, which is funded by the Federal Highway Administration (FHWA) through the Texas Department of Transportation (TxDOT).

This year marks the fourth time that PVAMU has conducted the STI Scholars program. STI Scholars was previously offered in 2008, 2009, and 2010. In 2012, PVAMU received nine applications for the Scholars program. Eight applications were received from within the state of Texas and one was from Colorado. A composite mix of six 12<sup>th</sup> graders was selected through a competitive screening process. These bright young minds showed an aptitude in science and technology and/or transportation-related careers. This year's STI Scholars program started on June 4, 2012, and concluded on June 29, 2012, alongside the 2012 STI program, which recruited 20 high school participants.

The Prairie View A&M University STI Scholars participants were provided comfortable room and board on the PVAMU campus at the University College residential dormitory. The resident program guided each student to become acquainted with campus life and to acquire the skills necessary for success in postsecondary education. Therefore, the PVAMU STI Scholars program helped to bridge each student's interest toward the attainment of higher education.

The PVAMU STI Scholars program vision and program objectives were met by introducing the six scholars to the major modes of transportation, which are road, rail, air, and water transportation, and then focusing on the in-depth analysis and discussion of the transportation industry as a whole and more engineering-related aspects in particular. This was accomplished by bringing in more than 15 guest speakers comprised of both on- and off-campus presenters of various organizations from the industry, including FHWA and TxDOT. In addition, STI Scholars participants performed a higher level of in-depth research in various aspects of the transportation industry, thus achieving the major goal of encouraging participants to pursue civil engineering and become viable contributors to the transportation workforce.

As an enhancement to the rigorous academic curriculum, the PVAMU STI Scholars participants were afforded hands-on experiences through laboratory tests and educational field trips. This supported the kinesthetic learning styles of many of the participants. Field trips provided learning through observation and, in many cases, hands-on activities. When questioned, many participants favored this learning style. Statistically, students often are more served by this instructional method than the traditional didactic methods including reading, lecturing, or watching videos. These field trips inspired the STI participants through visiting places, meeting new people, and seeing and experiencing a plethora of transportation-related entities.

The STI Scholars closing ceremony was held on June 29, 2012. Mr. Jackie Freeman, PE, deputy executive director of the Harris Public Infrastructure Department and PVAMU alumnus, was the keynote speaker. Mr. William Stockton, who is the co-PI on this project as well as the executive

associate agency director of the Texas A&M Transportation Institute (TTI), was also one of the main speakers; he addressed the students and encouraged them to pursue transportation careers. All STI Scholars participants received completion certificates, and top-ranking participants were recognized with individual merit awards for the best overall performance.

### **Program Administration**

The 2012 STI and STI Scholars program specifics were as follows:

- Host site: Prairie View A&M University.
- Address: Department of Civil & Environmental Engineering, PO Box 519, MS 2510, Prairie View, Texas 77446.
- Project director: Dr. Raghava R. Kommalapati, PhD, PE, BCEE.
- Length of program: four weeks (June 4, 2012–June 29, 2012).
- Type of program: residential.
- Congressional district: Texas 10<sup>th</sup> Congressional District.
- Grade levels: incoming 11<sup>th</sup> and 12<sup>th</sup> graders.
- Students per grade: 10 participants from 11<sup>th</sup> grade and 10 participants from 12<sup>th</sup> grade for STI program and six participants from 12<sup>th</sup> grade for Scholars program.
- Applications received: 58 STI and nine Scholars.
- Selected students: 20 STI and six Scholars.
- Number completing: 20 STI and six Scholars.
- Demographic data summary of Scholars—ethnic background by number: one Caucasian, five African American; gender: two male, four female; geographic representation: five cities, five counties, two states.

### ***STI Scholars Program Intermodal Advisory Committee, Partners, and Staff***

#### **2012 STI Intermodal Advisory Committee**

The Intermodal Advisory Committee (IAC), which was formed to support the STI program, also supports the Scholars program and consists of representatives from a broad spectrum of the transportation community. The duties of IAC include but are not limited to the following: (a) review program proposals; (b) assist with securing resources (speakers, field trips); (c) review classroom curriculum; (d) provide technical assistance; and (e) assist with program planning. Table A-1 lists the individuals who served on the IAC for the 2012 STI at PVAMU.

**Table A-1. 2012 STI Intermodal Advisory Council**

<b>Name</b>	<b>Title</b>	<b>Organization</b>	<b>City/State</b>	<b>Email</b>
Mark Arrington	Civil Rights Specialist	FHWA Texas Division	Austin, Texas	mark.arrington@fhwa.dot.gov
Mike Alford	District Engineer	TxDOT—Houston	Houston, Texas	malford@dot.state.tx.us
Stephen A. Hrcir	Associate Vice President	HNTB Corporation	Houston, Texas	shrncir@hntb.com
C. James Kruse	Director	Center for Ports & Waterways—TTI	Houston, Texas	j-kruse@ttimail.tamu.edu

## **2012 STI Scholars Program Partners/Sponsors**

A number of partners and sponsors supported the 2012 STI Scholars program. Table A-2 lists the partners and sponsors, their affiliations, and their role/contribution to the program.

**Table A-2. 2012 STI Scholars Program Partners/Sponsors**

<b>Name</b>	<b>Title</b>	<b>Organization</b>	<b>City/State</b>	<b>Role/Contribution</b>
Dr. Kendall Harris	Dean, Roy G. Perry College of Engineering	Prairie View A&M University	Prairie View, TX	Provided Salary Support
Dr. Raghava Kommalapati	Interim Department Head Civil/Environmental Engineering	Prairie View A&M University	Prairie View, TX	Served as Director
Dr. Ramalingam Radha	Associate Professor Civil/Environmental Engineering	Prairie View A&M University	Prairie View, TX	Served as Co-Director
Dr. Melissa Tooley	Director	University Transportation Center for Mobility™	College Station, TX	Leveraged STI Funds
Ms. Martha Raney Taylor	Business Manager	University Transportation Center for Mobility™	College Station, TX	Facilitated and Guided TTI Field Trips
Ms. Debbie Jasek	Research Specialist	Texas A&M Transportation Institute	College Station, TX	Facilitated and Guided TTI Field Trips

## **2012 PVAMU STI Scholars Faculty and Staff**

Dr. Raghava Kommalapati, the interim department head of the Civil and Environmental Engineering Department at PVAMU, served as the 2012 program director for STI Scholars. Prior to the beginning of the program, the advisory board evaluated curriculum, provided technical assistance, and contributed to the planning process. The program was properly staffed with competent employees who successfully implemented these tasks. All STI and STI Scholars program personnel (see Table A-3) were employees of the university or were hired specifically for the STI and STI Scholars programs.

**Table A-3. 2012 STI and STI Scholars Program Faculty and Staff**

<b>Name</b>	<b>Title</b>	<b>City/State</b>
Dr. Raghava Kommalapati	Director	Prairie View, Texas 77446
Dr. R. Radhakrishnan	Co-Director	Prairie View, Texas 77446
Ms. Samantha Glover	Coordinator	Hempstead, Texas 77445
Ms. Carla Foster	Coordinator	Hempstead, Texas 77445
Dr. Sanjay Tewari	Consultant	College Station, Texas 77840
Ms. Vicki Mays	Summer Clerk	Prairie View, Texas 77446
Ms. Johanna Tush	Program Aide	Cypress, Texas 77429
Mr. Sanjay Tillmot	Program Aide	Prairie View, Texas 77446
Ms. Courtney Dickey	Program Aide	College Station, Texas 77840
Mr. Greg Adebowale	Teacher Aide/Counselor	Prairie View, Texas 77446
Ms. Kendramia Prestage	Program Aide /Counselor	Pearland, Texas 77581

### ***Program Objectives***

The 2012 PVAMU STI Scholars objectives were to provide awareness to high school students on transportation careers, to encourage high school students to consider transportation-related courses of study in their higher education pursuits, and to provide participants in-depth details of transportation aspects and exposure to research.

The 2012 PVAMU STI Scholars program objectives and methods of measurement are listed in Table A-4.

**Table A-4. 2012 STI Scholars Program Objectives and Methods of Measurement**

<b>Objective</b>	<b>Method of Measurement</b>
To expose high school students to a series of academic and practical experiences designed to motivate them toward professions in the transportation industry.	Journal Entries
To attract a broad and diverse selection of bright minds and acquaint and stimulate them with the various aspects of the transportation industry.	Journal Entries
To provide high school students with mathematics, science, and technological enrichment to assist them in the pursuit of a career in the transportation industry.	Academic Quizzes
To increase the number of students who choose a career in the transportation industry.	Evaluation Survey

The four core objectives stated above were further broken down. The participants of the program were expected to:

- Become aware of career opportunities in the transportation industry.
- Identify methods of moving people and cargo.
- Identify consumers and providers in the transportation system.
- Understand transportation system management devices and methods.
- Examine local, state, and federal regulations related to the transportation industry.
- Explore aspects of transportation safety.
- Become acquainted with intermodal transportation.
- Investigate construction/engineering issues related to the transportation industry.

### ***Participant Recruitment and Selection***

#### **Recruitment**

The 2012 Summer Transportation Institute at PVAMU extended an invitation to students enrolled in public and private high schools across the state of Texas for the STI program, which is the first-year program. Though the STI Scholars program is intended only for past STI program participants, this year, an invitation was extended to other 12<sup>th</sup> grade students who have high GPA and expressed interest in transportation/civil engineering. Applicants were required to

submit, on or before May 20, 2012, an application; a written statement expressing their interest in transportation; a letter written by a parent, teacher, or counselor nominating them for the program; and a letter of recommendation from one of their school's mathematics, technology, or science faculty or a guidance counselor. Upon completion of the quantitative selection process, the co-director notified the successful applicants during the third and final week of May 2012.

### **Selection**

The selection committee comprised of the director, co-director, and staff assistant used the following criteria for selecting the STI Scholars participants:

- Students must have passed the 11<sup>th</sup> grade.
- Students must have completed algebra or be qualified for enrollment in Algebra for the coming school term.
- Students must have a minimum cumulative grade point average of 3.00 on a 4.0 scale.
- Students must have an expressed interest in engineering, science, transportation, or technology careers.

Students who accumulated the most points were chosen to join the program. Nine high school students applied, and six were selected. Selected applicants were notified by phone, followed by an email that included the notification package. Detailed information about the program at PVAMU and the required forms, such as the participant profile, waiver of liability, medical release, and permission to photograph, were sent to the participants as part of the notification package. The parents were required to provide a copy of a medical insurance card for the student. The selection committee also provided the participants with information on what things they should bring with them when they came to check in on the campus of PVAMU, as well as what things they should not bring to the campus.

### **Orientation**

At the PVAMU University College Auditorium on June 4, 2012, the STI staff welcomed the six 2012 STI Scholars participants and the 20 STI participants, along with their families and friends, as they entered the University College Panther Room. A continental breakfast was provided. Check-in included the review of each participant's documents, the dissemination of rules and regulations, the assignment of dormitory rooms with key distributions, and photo shots of each member and his or her entourage in front of the STI Scholars banner. Parents were given a take-home packet that included staff contact information, a project calendar, a field trip schedule, classroom activities, and other pertinent information for the four-week period. Folders with the same information were provided to the participants.

The STI Scholars orientation was designed to give an overview of the 2012 Scholars program to both parents and participants. This orientation extended a welcome to all, formally introduced the staff, and discussed the expectations of all participants and their families during the course of the program. The co-director reiterated the expectations for the participants for the next four weeks and encouraged the participants and the parents to consider PVAMU as a choice for higher learning. He also requested that they create awareness about the PVAMU Summer Transportation Institute Scholars program in their communities.

Ms. Glover, the program coordinator, reiterated the process for the four-week program. Parents were then given the opportunity to ask questions and raise any other concerns they had. The orientation was very successful and set the tone for the exciting, fun-filled weeks ahead. At the conclusion of the STI Scholars orientation, participants, escorted by their counselors, enjoyed their first college campus meal of the summer program. The Scholar participants' profiles and school information are shown in Tables A-5 and A-6, respectively.

**Table A-5. Participant Profiles**

<b>Name</b>	<b>Gender</b>	<b>City, State</b>	<b>Zip</b>
Kendall Taylor	F	Round Rock, TX	78664
Madison Rhodes	F	Aurora, CO	80017
Tralon Jackson	F	Pflugerville, TX	78660
Tralae Jackson	F	Pflugerville, TX	78660
Taylor McKnight	M	Dallas, TX	75252
Howard II Watts	M	San Augustine, TX	75972

**Table A-6. Participant School Information**

<b>Name</b>	<b>Grade</b>	<b>School</b>	<b>School Address</b>	<b>City, State</b>	<b>Zip</b>	<b>Counselor</b>	<b>Counselor Phone</b>
Kendall Taylor	12 <sup>th</sup>	Round Rock High School	300 Lake Creek Dr.	Round Rock, TX	78664	Malisa Barnes	(512) 903-4577
Madison Rhodes	12 <sup>th</sup>	Denver School of Arts	711 Montview Blvd.	Denver, CO	80220	Kathy Thompson	(720) 254-7120
Tralon Jackson	12 <sup>th</sup>	Pflugerville High School	1301 W. Recan St.	Pflugerville, TX	78660	Jeanne Burns-Sloan	(512) 689-5270
Tralae Jackson	12 <sup>th</sup>	Pflugerville High School	1301 W. Recan St.	Pflugerville, TX	78660	Jeanne Burns-Sloan	(512) 689-5270
Taylor McKnight	12 <sup>th</sup>	David W. Carter High School	1819 W. Wheatland Rd.	Dallas, TX	75232	Rosalyn Freeman	(469) 765-4565
Howard II Watts	12 <sup>th</sup>	San Augustine High School	200 High School Dr.	San Augustine, TX	75972	Rebecca French	(936) 201-6631

## **Program Curriculum**

### ***Academic and Enhancement Programs***

Classroom activities were built to enhance and develop each individual over the four-week period that the STI Scholars camp was held. Classroom activities included team-building exercises, individual classroom worksheets, and speaker presentations. Participants were divided into several groups to work on team-building exercises, such as boat construction and pasta bridge construction, over the course of the four weeks, and classroom worksheets were given to participants at least once per week on topics of transportation, bridges, traffic planning, and environmental issues in transportation. Through the guest speakers, participants were introduced to various modes of transportation including those that are under research and could possibly be used in the near future. Also, participants were exposed to how some common modes of transportation operate on a daily basis, and they had to identify the different aspects of



transportation, such as land, air, water, and engineering safety. The participants also researched the different types of bridges and components as they were exposed to the basic structure of a bridge. Participants were also exposed to soil mechanics and environmental laboratories, where they learned how the different types of soil are classified and specified for road construction. Even though it seemed as if the classroom was a work-oriented environment, the participants were often given short breaks and would sometimes do fun activities while working on their respective projects. The main goal was to allow the participants to have fun while completing their activities.

## **Projects**

As one student said in the closing ceremony, “We did so many projects, our heads spun! But we learned so much, we would each do it again!” The projects that the 2012 STI Scholars participants worked on were:

- **Dream Transportation**—Participants were divided into groups and required to design and construct a form of transportation: road, train, ship, plane, and space rocket models. The mode of transportation had to be safe, cost efficient, affordable, and able to travel from Houston, Texas, to Buenos Aires, Argentina, and transport 5,000 people in the year 2050.
- **Bridge Model Construction**—Participants were divided into groups and were asked to design and construct a bridge using popsicle sticks and a hot glue gun. The bridge model had to be cost efficient and have high tensile strength. Participants had to identify the strongest designs with shapes such as triangular, rectangular, triangulation, or redundant member.
- **Solar Powered Boat**—This project was a two-partner group effort. Participants designed a boat from a foam block. The goal was to see which group’s boat was the fastest and would stay afloat on water while being powered by solar energy. The materials used were a foam block, a paper cutout of the boat, a pencil, a solar panel, red and blue wires, two-sided sticky squares, sand paper, a plastic fan, and a foam cutter that used heat.
- **Levitation Train**—Each group first watched an instructional video explaining how to construct an electromagnetic levitation train. Then they were given a levitation construction kit that consisted of four wooden blocks, six disc magnets, 10 rectangular magnets, a compass, magnetic tape, four plastic strips, and glue.
- **Ship the Chip**—Each group had to build a ship that would hold a Pringles chip without breaking it during the shipping process. This project allowed the participants to explore manufacturing in engineering with production efficiency. Participants learned that packaging is a critical part of a product’s design and the overall engineering process. They also learned that good packaging must protect the product and eliminate any damages while moving, shipping, or storing. In addition, they learned that they must make the product attractive if it is to be displayed in a consumer environment. The only materials participants were allowed to use were cardboard, one Pringles chip, markers, and glue.
- **Prototype Tower**—Participants were divided into groups and had to design and construct a tower that did not fall through a 200 mm by 200 mm opening. The top had to support a block that was 50 mm by 50 mm. The overall minimum height had to be 10 inches by 12 inches. Only the materials provided could be used in the construction of the tower. Those materials were a pencil, sketch paper, a ruler, an ink pen, a building board,

wax paper, T-pins, an X-Acto knife, B-size graph paper, 15 pieces of 1/8-inch by 24-inch balsa sticks, and one tube of Tacky Formula Glue.

- **Concrete Beam**—In this project, participants were hired as material consultants to create a mix for a reinforced concrete highway. They were to design the strongest and most cost-effective mix possible. Participants prepared a batch of concrete using a mix of coarse aggregate, fine aggregate, cement, and water. They placed the concrete in the cylinder molds in three equal layers, rodding each layer 25 times with a 3/8-inch rod. They then struck the top smooth and covered it with plastic. They placed all the cast specimens in a moist area. The materials used were Portland cement Type I or III, coarse aggregates, scales, tamping rods, pans, trowels, cylinder molds, and gloves.
- **Rocket Models**—Participants were expected to build a rocket model from a rocket kit. The rocket kit included the parts to build one rocket with an engine and a recovery parachute. It took about three hours for participants to complete their rockets and some additional time for glue to dry. The significance of balance and symmetry of rockets was discussed before construction activities began. Also, there was a lecture entitled “Science Behind Rockets” taught by the instructor. Participants learned about the principle of conservation of momentum, different types of fuels used in rockets, and other factors governing the flight of a rocket.

### **Speakers and Presenters**

The 2012 STI Scholars participants learned about transportation and different types of engineering, mainly civil engineering. Speakers from TxDOT, HNTB Corporation, FHWA, and PVAMU shared interesting information with the STI Scholar participants. Some of the topics covered by the speakers included:

- How to be successful in the field of engineering and transportation.
- Careers, jobs, scholarships, and intern opportunities.
- Different types of equipment used in road construction and how they work.
- Materials used to build and maintain roads and highways.
- How to test building materials used.
- How to make concrete models.
- The difference between compression and tension.
- The shape that makes a good bridge model.
- How to make a cost-efficient bridge that will hold the most weight.
- Intelligent transportation.
- How to design a highway in a city.
- Environmental impact of transportation activities.
- Transportation planning and management.
- How to build a city by reflecting on the environment, safety, and which types of bridges should be used and where they should go.
- Auto CAD design of a sports complex.

### **Enhancement Programs**

All projects and team-building activities were considered hands-on enhancement activities. Also, as part of enhancement, mathematics and technical writing concepts were covered. Emphasis was also placed on preparation for state standardized tests, college entrance exams, and the

2012–2013 school year core subjects. A detailed description of the enhancement activities is provided in Part II of this Appendix.

### ***Field Trips***

Being able to experience engineering firsthand and see the different areas of transportation through field trips was a big opportunity for the 2012 STI Scholar participants. The major goal of the field trips was to provide the participants an opportunity to learn more about land, air, and water transportation. The field trips also emphasized the importance of safety in all areas of transportation and/or civil engineering careers. These field trips included NASA/Johnson Space Center in Houston, Texas; HTNB Engineering Consultants in Houston, Texas; the Port of Houston and the Seaman’s Church in the Houston Ship Channel; Texas A&M Transportation Institute and Texas A&M University in College Station, Texas; Metro Rail Operations in Houston, Texas; the Texas State Hwy 290 Project; the Texas Seaport Museum/the Elissa in Galveston, Texas; the Galveston Railroad Museum in Galveston, Texas; and the Lone Star Flight Museum, also in Galveston, Texas.

### ***Sports and Recreation/Weekend Activities***

Recreation time provided STI Scholar participants with fun, safe ways to socialize and relieve stress. During this time, they were encouraged to play basketball, football, volleyball, and dodge ball, work out, and participate in other various group activities. Also during this time, the participants created friendships and bonds that will most likely last for years to come. As a point of interest, the entire diverse STI Scholars group created its own version of a popular dance. Those who were more skilled helped the others participate and perfect the dance. None were left out.

On the weekends, participants took part in recreational activities specifically designed for them to mix, mingle, and continue to merge as a cohesive group. They enjoyed evening socials, a trip to the Premiere Outlet Mall, a day-stay at Jellystone Water Park, movie nights, and a cultural Juneteenth celebration with the local Hempstead community.

### ***Residential Life***

STI Scholar participants were provided with dormitory rooms. Girls were housed in one building and boys in another. Each room held two STI Scholars participants. One female counselor guided the girls, and one male counselor guided the boys. Together, they facilitated the structure for the STI Scholar participants’ residential experience. Typically, the participants woke up at 6:30 a.m. and were ready to leave the dorms to walk to breakfast at 7:10 a.m. Around 11:30 a.m., the counselors accompanied the participants to lunch, and in the evenings, the counselors walked the participants to dinner. The counselors made sure the participants were on time to complete their strenuous academic schedules.

Most evenings, between 6:30 p.m. and 9:30 p.m., the counselors led participants in recreational activities; on a few evenings, they led participants back to the classroom to work on unfinished assignments and/or projects. They strictly enforced the lights-out policy at 10 p.m.

### *Detailed Daily Schedule*

The STI Scholars were given a detailed daily schedule that they were expected to follow. Most times, this was attainable. However, due to the action-packed program filled with projects, field trips, and other academic curricula, the optimal schedule had to be amended on occasion. This taught the participants that in higher education as well as in life, one must be flexible.

A typical 2012 PVAMU STI Scholars day is illustrated in Table A-7. Table A-8 shows a detailed weekly schedule.

**Table A-7. Typical STI Scholars Day**

<b>Activity</b>	<b>Time</b>
Breakfast	7 a.m.–8 a.m.
Social Media/Journaling	8 a.m.–8:30 a.m.
Morning Session	8:30 a.m.–11:30 a.m.
Lunch	11:30 a.m.–1 p.m.
Social Media/Journaling	1 p.m.–1:30 p.m.
Afternoon Session	1:30 p.m.–4:30 p.m.
Dinner	4:30 p.m.–6 p.m.
Recreation	6 p.m.–8 p.m.
Evening Class/Dorm Room Time	8 p.m.–10 p.m.
Bedtime	10 p.m.

**Table A-8. 2012 STI Scholars Weekly Schedule**

**Week 1**

<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Monday, June 4</b>		
8:00–10:00	Check-In	PV Panther Room
10:00–10:30	Break	Blg 39(f) & 40(m)
10:30–11:30	Orientation	Theatre Room
1:30–2:15	Classroom Rules/Expectations	Rm 109K
2:15–2:45	Team Building “We Are...”	Rm 109K
2:45–3:45	PowerPoint	Computer Lab
3:45–4:15	Presentation	Rm 109K
4:15–4:45	Transportation	Rm 109K

**Tuesday, June 5**

8:30–9:55	Practice THEA Test	Rm 109K
10:00–3:30	Speaker—Mr. Smith	Rm 109K
	Topic: Materials Testing	Rm 109K
3:30–4:30	Bridge Worksheet	Computer Lab

**Wednesday, June 6**

8:30–9:25	THEA Test Review	Rm 109K
9:30–11:30	Environmental Issues	Rm 109K
1:30–4:30	Sieve Analysis	GeoTech Lab

**Thursday, June 7**

8:30–11:30	Pavement Planning and Design	Rm 109K
	Speakers: F. Austin & Fuentes	Rm 109K
1:30–4:30	Bridge Design Speaker: J. Castanedo	Rm 109k
6:00–8:30	Groups—Westpoint Bridge Software	Rm 109K

**Friday, June 8**

8:30–10:00	Technical Writing Intro (Mrs. Carla Foster)	Rm 109K
10:15–11:30	Design Paper Airplanes	Rm 109K
1:30–4:30	ITS Signals—Speaker: Mr. Stuart Corder	Rm 109K

**Week 2**

<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Monday, June 11</b>		
8:30–11:30	Field Surveying—Leveling	109K/Outside Engineering
	Dr. Tewari	
1:30–2:00	Airplane Testing	Hallway
2:00–3:40	Transportation Projects/Activities	
	Groups 1 & 2	Environmental Lab
	Groups 3 & 4	Computer Lab
	Group 5	Concrete Lab
4:00–4:45	WASH (all must be in)	Laundry Mat
4:45–5:45	Dinner	
5:45–6:30	Complete WASH	Laundry Mat
6:30–8:30	Clean/Organize Rooms	Dorm Rooms
8:30–10:00	Study/Journal/etc.	Dorm Rooms

**Table A-8. 2012 STI Scholars Weekly Schedule (Continued)**

<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Tuesday, June 12</b>		
8:00	Roll Call for Field Trip	GL Wilson Parking Lot
8:10	Load Vans—Field Trip	HTNB (Houston)
1:20	Return to Campus	
1:30–3:00	Rocket Building	109K
3:15–4:30	Transportation Projects/Activities	109K
	Groups 1 & 2	Computer Lab
	Groups 3 & 4	Concrete Lab
	Group 5	Environmental Lab
6:30–8:30	Transportation Projects/Activities	109K
	Groups 1 & 2	Concrete Lab
	Groups 3 & 4	Environmental Lab
	Group 5	Computer Lab
8:30–9:30	Start Bridge Model Design (Layout)	
<b>Wednesday, June 13</b>		
6:45	Load Vans	GL Wilson Parking Lot
6:55	Depart for Port of Houston	Houston Ship Channel
8:00	Seaman’s Church	Houston Ship Channel
9:00	Port of Houston	Houston Ship Channel
11:00	Ship Channel Boat Ride	Houston Ship Channel
3:00	Return from Field Trip	
6:30–9:30	Transportation Project/Activity: Work on Bridge Model	109K
<b>Thursday, June 14</b>		
8:30–9:45	Concrete Model Beams Testing	109K
10:00–11:30	Magnetic Levitation Train	109K
1:30–4:30	Solar Boat Construction	Environmental Lab
<b>Friday, June 15</b>		
8:00	Roll Call	109K
8:15	Depart for Field Trip—TxDOT	Bauer Road Construction
12:30	Depart for Houston Transtar	Houston
<b>Week 3</b>		
<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Monday, June 18</b>		
8:00–4:30	FIELD TRIP—METRORAIL	Houston
<b>Tuesday, June 19</b>		
	*****JUNETEENTH DAY OBSERVANCE*****	
11:00.	BRUNCH	PVAMU
1:00.	Depart for Cultural Celebration	GL Wilson
4:00	Return to PV for Dinner	PVAMU
6:00	Return to Cultural Celebration	Hempstead
10:00	Return to PV	

**Table A-8. 2012 STI Scholars Weekly Schedule (Continued)**

<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Wednesday, June 20</b>		
8:30–9:45	Travel to TTI	
10:00	Driving Simulator	
1:00	Asphalt and Concrete Lab	
2:00	Bonfire Memorial	
<hr/>		
<b>Thursday, June 21</b>		
8:30	TTI Field Trip	College Station
10:00	TTI Overview	
10:45	Environ & Emissions Research Facility	
2:00	Crash Test	TTI
3:00	TAMU MSC Tour	TAMU
6:30–9:00	Dream Transportation—Group Project	109K
<hr/>		
<b>Friday, June 22</b>		
8:30–9:30	Dream Transportation Group Project	109K
9:30–11:30	Final Project Brainstorm/Collaborate	109K
1:30–2:30	AutoCAD concepts	Computer Lab
3:30–4:40	Sports Complex—AutoCAD Software	Computer Lab
<hr/>		
<b>Week 4</b>		
<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Monday, June 25</b>		
8:30–11:30	Surveying/Horizontal Curves in Highways using Total Station	109K 109K
1:30–4:30	Scholars Group Assignment	109k
6:30–9:30	Project Completion Time	109k
<hr/>		
<b>Tuesday, June 26</b>		
8:30–9:45	Travel to TTI	College Station
10:00	ATM	
11:00	Freight Shuttle	
12:00	Lunch	
1:30–2:50	Test Concrete Cylinder Samples	Concrete Lab
3:00–4:00	Texting and Driving	
4:00	Depart for PVAMU	
6:30–10:00	Work on Assigned Scholars' Project	109K
<hr/>		
<b>Wednesday, June 27</b>		
8:30–10:30	Ship the Chip Effects of Yellow Light Timing Change Activities	
10:30–11:30	Closing Ceremony Speech Preparation	
1:30–2:30	Closing Ceremony Rehearsal	
2:45–4:30	Project Poster Preparation for Display	
7:30–11:00	Project Completions	
<hr/>		

**Table A-8. 2012 STI Scholars Weekly Schedule (Continued)**

<b>Time</b>	<b>Activity</b>	<b>Location</b>
<b>Thursday, June 28</b>		
8:30–11:30	College Readiness	
11:45–1:00	Lunch	
1:30–3:30	Finalize Scholars Project for Display	
3:30–4:30	Speaker: Dr. Kommalapati—STI Director	
4:30	Complete Overall Evaluation	
7:30	Projects to New Electrical Engineering Building	
	Clean Dorm Rooms and Pack	
	Parent Reminder Calls	
<hr/>		
<b>Friday, June 29</b>		
<b>9:00</b>	<b>CLOSING CEREMONY</b>	
	Check-out immediately after the ceremony	
<hr/>		

### **Closing Awards Ceremony**

The Summer Transportation Institute’s Closing Ceremony was held on Friday June 29, 2012, at the PVAMU Electrical Engineering Building in room 137. Between 8 a.m. and 9 a.m., parents and guests arrived, checked in, and reconnected with the STI Scholar members. Together, they perused the participants’ projects on display and viewed the ongoing PowerPoint show that highlighted the participants’ achievements. The participants proudly presented their dream transportation models, their design project, and their solar boats, bridges, towers, and rockets. Promptly at 10:15 a.m., the award ceremony commenced. The service, led by STI student Joe Sedillo and STI Scholars student Kendall Taylor, ran smoothly and efficiently. The guest speaker, Mr. Jackie Freeman, PE, deputy executive director of the Harris County Public Infrastructure Department, shared his views with the audience and presented the keynote address entitled “Rebuilding America’s Infrastructure: The Role of Civil Engineering.” Participation certificates were given to each STI Scholar participant. Awards were presented to recognize outstanding performance.

### **Evaluations**

The STI Scholars staff conducted weekly formative evaluations to understand how the 2012 STI Scholars participants felt about the speakers, classroom activities, field trips, recreational activities, enhancement activities, and staff and counselors. An overall program evaluation was also conducted as a culminating summative assessment of the program, and the results are shown in Table A-9. The remaining evaluations are summarized and presented in Part II of this Appendix.

The evaluations were done on a 4-point scale, with 1 being *strongly disagree* and 4 being *strongly agree*. It has been proven that different avenues of education (i.e., learning styles) must be explored with diverse groups of participants. This ensures each participant is given multiple and adequate opportunities to master the objectives. Engaging the participants in tactile and kinesthetic activities and projects proved effective in keeping their attention and interest. It was evident that the participants enjoyed the speakers, particularly on the topics related to environmental impacts of transportation activities. The participants also appreciated the projects;



though some were thoroughly challenged, they persevered and excelled. The field trips were also well received and appreciated.

One goal of the STI Scholars staff is to make each program year better. These evaluations are used to make the necessary adjustments to improve the quality of the program.

**Table A-9. Overall Program Evaluation Results**

Area	Average Score*
<b>Speakers</b>	
The speaker presented materials in an organized manner.	3.41
I was academically challenged by the activities the speakers provided.	3.65
Speakers responded well to the questions posed to them.	3.38
<b>Staff</b>	
The staff was very interested in my career awareness.	3.41
The staff was very helpful when I had problems.	3.24
The staff encouraged students to strive for excellence in all their academic pursuits.	3.53
The staff was very friendly at all times.	3.29
The staff was very knowledgeable of transportation-related careers.	3.29
The staff was enthusiastic about the transportation-related careers.	3.35
The counselors were helpful when in the dormitories.	3.41
<b>Activities</b>	
Project activities helped me understand transportation careers better than before.	3.41
Generally, adequate time was allotted for project activities.	3.18
Generally, adequate time was allotted for audience participation.	3.59
Project activities gave me some practical experience related to transportation.	3.59
Project activities often included competition between groups.	3.65
<b>Campus Life</b>	
Life in the dormitory was fun.	3.82
The food in the dining hall was nutritional.	3.35
Enhancement activities were educational.	3.65

Note: Evaluation was done at the conclusion of the program.

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

## **Part II: STI Scholars Program Supporting Documentation**

### **Academic Program, Residential Life, and Sports and Recreation Activity Descriptions**

#### *Classroom Activities*

Following is a detailed list of the classroom activities:

- Individual Activities:
  - Pre-tests—Pre-tests were given to identify STI Scholars participants' critical areas for needed improvement in mathematics and writing.
  - Describe yourself using “PVAMU”—In this activity, participants had to use adjectives from the letters PVAMU to describe themselves, their likes, and their dislikes.
  - Mathematics—This subject is one of the most important subjects in any field of study, especially transportation and engineering. In several of the team-building activities, participants had to take into consideration the mass, volume, surface area, speed, and ratio in order to complete and design the best product. Specific topics covered are listed under Enhancement Program Activities.
  - Writing—Participants were made aware of the importance of writing at all levels of the transportation industry, especially at the engineering level. They were introduced to the important aspects of technical writing.
- Team Building Activities:
  - Aluminum Foil Boat—Groups were given one square sheet of aluminum foil and asked to design and construct four boats that could float in the water. The participants then decided the best out of the four boats that would hold the most weight.
  - Ship the Chip—Groups designed a shipping box that could ship potato chips without cracking. The chip had to be in good condition when it arrived at its designated location.
  - Concrete Beam—Groups created a concrete beam using a specific water and cement ratio. Each beam was then tested to determine its tensile strength.
  - Tower Design—Each group designed a tower using paper clips and index cards that had a minimum height of 10 inches and maximum height of 12 inches. This project was an introduction to the actual tower model that each group designed for competition and display.
  - Computer Bridge Design—Groups designed a computer model of a bridge using WestPoint Bridge Software that would pass the truckload test.
  - Timely Traffic—Groups designed a traffic system that would allow visitors to enter the Houston Reliant Stadium in a timely manner.
- Enhancement Program Activities:
  - Mathematics—Once the pre-test was scored, the STI staff was able to determine the areas in which the participants experienced the most difficulties. The staff concentrated on those particular areas throughout the program. Solving equations (linear, quadratic, and trigonometry), solving systems of equations (linear and quadratic) using all methods, identifying parent functions, and factoring were topics that the STI staff taught to prepare the participants for their upcoming mathematics

- class or standardized test. Also, an introduction to pre-calculus and calculus were given to those participants who would be enrolling in those math classes.
- Scholarships—The participants had to write/type a list that included their hobbies, honors/awards, and clubs/organizations as preparation for filling out scholarships and college applications.
  - Writing—The participants developed better writing skills to improve their ability to develop reports, both technical and composite. The need for writing skills was emphasized and highlighted as a necessity in the transportation field and engineering profession.
  - City Planning—The STI Scholars participants learned about city planning by applying the concept of geometry and systems of equations to determine at what point two streets would meet or cross one another.
  - GeoTech Lab:
    - In this lab, the participants learned about sand, rocks, gravel, and how to separate them using sieve analysis method.
    - The participants were exposed to sieve analysis and how to graph their calculations and results.
    - Participants were taught the Proctor's Standard Compaction Test to determine optimum moisture content in the lab to use in the field for road construction.
  - Environmental Lab:
    - In this lab, the effect of transportation activities on the environment was emphasized in two videos. The first was on the effect of transportation activities on the environment. The second video was on wastewater treatment/management from cradle to grave/use.
    - The students were then trained on the use of the Hach turbidity meter to measure the turbidity or cloudiness of water and the use of the pH meter to measure acidity/alkalinity of water.
    - Each student was given an opportunity to perform the experiment of measuring either parameter while working in groups.
    - The participants had to complete a worksheet and write a report on the experiments.

### ***Projects (Transportation Concepts)***

Following is a list of the transportation projects completed:

- Dream Transportation—Participants were placed into groups to design a transportation vehicle representing air, land, space, rail, or water transportation to transport customers from Houston, Texas, to South America (Buenos Aires) in the year 2050. The project had to include a comparison of the fuel required now and then, the route that would be taken to get to the destination, and a comparison of the maximum traveling speed now and then (for example, how would a land mode [car or bus] cross over water to get to Buenos Aires).
- Sports Complex Facilities Blueprint—This project was done using AutoCAD software. Each group was given the dimensions of a baseball field, football field, basketball court, or tennis court, and after a classroom lesson on AutoCAD and its purpose, the participants designed a sports complex using AutoCAD.

- Bridge Model Construction—The purpose of this construction project was to design a bridge model that would be cost efficient and have a high load carrying strength. This was an individual project from the beginning. Once all participants designed and built their bridge model, they were then put into groups to choose the best bridge as a group. The groups constructed their models using craft or popsicle sticks and glue for bonding.
- Tower Model Design and Construction—The participants designed and constructed a tower using balsa, wood, and glue for their material. The tower design had to be in the range of 25 to 30 inches tall.
- The Effects of Intersection Length on Yellow Traffic Light Timing—The purpose of the activity was to determine how yellow light time varied according to various factors, such as intersection length, vehicle length, braking distance, speed, and deceleration. The yellow light time and braking distance were calculated using the specified formulas after all of the necessary factors were considered.

### *Field Trips*

The following field trips, divided by transportation category, were enjoyed by participants:

- Air Transportation:
  - The participants visited Bush Intercontinental Airport in Houston where they were given a tour of the airport control office, the airport runway level where the airplanes take off and land, and the airport fire department. The participants were also given a presentation of the various careers offered at the airport. They visited the area where plants, fruit, etc., coming from foreign countries are sprayed to remove all pests.
  - Participants took a field trip to NASA Johnson Space Center in Houston where they were able to enjoy the different activities at the Space Center and learn about space station activities, space exploration, and more.
- Land Transportation:
  - Participants visited the Metro Rail Operation Center in Houston and were able to enjoy a Metro Rail train ride from Fannin Street to the end of the Metro Rail line.
  - Participants visited TTI in College Station where they learned how materials were tested to improve the roadways, resulting in better traffic control and safer travel. Participants experienced a live crash test of an automobile (pick up) crashing into a concrete bridge side barrier and toured the large vehicle emissions testing chamber.
  - Participants visited the Hwy 290/Bauer construction site and learned about the purpose of the project, the cost of the project, and the design process that is put into creating Texas roadways, entrances, and exits.
  - At the Transtar field trip, participants learned the responsibilities of traffic control and were shown how to monitor traffic all around the city of Houston. They learned how to communicate with the public when there is an accident, amber alert, or any other type of incident or events such as hurricanes.
- Water Transportation:
  - The participants toured the Port of Houston and container terminal loading facility. The Port of Houston is one of the busiest ports in the world. The participants were able to see many commercial ships provide import and export services. They learned how pieces of equipment such as cranes are operated to ensure safe movement of products. In addition, participants saw the importance of the trucking industry and

how these modes of transportation work together to move virtually everything across the nation.

- Participants visited the Seamen’s Church Institute in Galveston where they were given a briefing on the various career opportunities available through the Port of Houston and the advantages and disadvantages of working on a ship. They were able to view mini-representations of ships that were on display. Also, the participants enjoyed driving the ship simulators. Each participant had the opportunity to attempt to steer the ship through the channel and/or through an opening under a bridge. Several of the participants were successful in their attempt to steer the boats through the water without crashing into piers, ships, beams, and other obstacles.

***Residential Life***

Following is a summary of the residential life aspects of the program:

- PVAMU dorm rooms equipped with two twin beds, a restroom with a shower, a microwave, and a refrigerator were provided to participants.
- To promote socialization, personal televisions were not allowed in individual rooms. Instead, participants congregated to watch television in the dorm’s TV room.
- Cell phones and other electronic devices were allowed only during recreation and quiet time. Those devices were prohibited during class time.
- “Lights out” was observed when all the preparatory tasks for the next day were completed. This time was amended by the counselors. All lights in the room were to be turned off at the given hour, usually 10 p.m.
- Overall, dormitory living gave participants the chance to develop new friendships and learn about diverse cultures. One of the main lessons they learned was to work together and be flexible. They also certainly strengthened their abilities to show tolerance and compassion, as well as empathy and respect.

Table A-10 shows a typical daily schedule for the dormitory.

**Table A-10. Daily Schedule for the Dormitory**

<b>Wake Up</b>	<b>Depart for Breakfast</b>	<b>Report to Room in Dormitory</b>	<b>Lights Out</b>	<b>Room Check</b>
6 a.m.	6:45 a.m.	9:30 p.m.	10 p.m.	10:30 p.m. (or any time after 9:30)

***Sports and Recreation Activities***

Table A-11 provides a detailed schedule of the sports and recreation activities that took place on the weekends.

**Table A-11. Sports and Recreation Weekend Activities**

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**Weekend Activities—Week 1**

**Friday, June 8**

8–11 p.m. STI/ Scholars Social

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**Saturday, June 9**

11:00 a.m.–12 noon Brunch  
 12:00 noon Roll Call  
 12:10 p.m. Depart for Field Trip  
 12:15–7:00 p.m. NASA—Johnson Space Center, Houston, TX  
 4:00 p.m. Dinner—NASA Diner  
 4:30–6:15 p.m. Continue the NASA Tour  
 Complete Activity Sheet  
 6:15 p.m. Report to Main Entrance for Departure  
 7 p.m. Wal-Mart/Evening Snack—McDonalds  
 9 p.m. Return to PV

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**Sunday, June 10**

10:45 a.m. Mt. Corinth MBC  
 12:30 p.m. Brunch  
 1:30–4:30 p.m. STI Bonding Time  
 4:30–6 p.m. Dinner  
 6:30–8:30 p.m. Enhancement Evening  
 Airplane Software Design

**Weekend Activities—Week 2**

**Friday, June 15**

6:30–9 p.m. Houston Outlet Mall  
 9:30–11:30 p.m. Movie Night

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**Saturday, June 16**

9:30 a.m. Load Vans (pick up by dorms)  
 9:45 a.m. Arrive in Hempstead for Juneteenth Parade  
 10:00 a.m. Parade Starts  
 11:00 a.m. Hempstead City Park (lunch will be provided)  
 4:00 p.m. Dinner (PV)  
 7–9 p.m. Recreational Activities

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**Table A-11. Sports and Recreation Weekend Activities (Continued)**

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**Sunday, June 17**

Field Trip to Galveston Museums—Galveston, Texas	
7:30 a.m.	Load Vans (Pick up from dorms; donuts provided)
7:45 a.m.	Depart PV for Field Trip
9:30 a.m.	Bolivar Ferry Ride
10:30 a.m.	Texas Seaport Elissa Tour
Lunch	Box Lunches on the Beach
2:00 p.m.	Galveston Railroad Museum
3:30 p.m.	Lonestar Flight Museum
4:30 p.m.	Dinner “The Spot”—Seawall Boulevard
8:30 p.m.	Return to PVAMU

**Weekend Activities—Week 3**

**Friday, June 22**

7:30 p.m.	STI Social
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**Saturday, June 23**

9:30 a.m.	Depart for Houston Museum of Natural Science
12 noon	Lunch—Herman Park
4:00 p.m.	Return to PV for Dinner
Evening	STI Game Night—Dorm TV Room

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**Sunday, June 24**

10:45 a.m.	Depart for Church—Hempstead; St. Peters Baptist
12:45 p.m.	Return to PV for Lunch
2:00 p.m.	Depart for Jellystone Park
5:00 p.m.	Depart Jellystone for Dinner @ PV
6:30 p.m.	Return to Jellystone Park
8:30 p.m.	Movie in the Park
9:30 p.m.	Return to PV

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## Program Evaluations

The STI Scholars program had weekly evaluations for participants to fill out pertaining to staff members, speakers, classroom sessions, enhancement programs, and recreational programs. The evaluation data were transferred to Microsoft Excel, and the summary data were extracted and are presented in Tables A-12 through A-17. Sports and recreational activities were evaluated every week, and also some specific activities were evaluated. Enhancement programs and classroom sessions were evaluated per each activity. These evaluations were completed either immediately after the event or at the end of the week. A 4-point scale was used for these evaluations, with 4 = *strongly agree* and 1 = *strongly disagree*. These evaluations will be used to improve the quality of the program. The evaluation forms were provided by the National Resource Center at South Carolina State University. The overall program evaluation was conducted on the final day of the program and was summarized in Part I of this Appendix.

**Table A-12. Staff Evaluations\***

Week	STI Staff and Instructors			
	1	2	3	4
The staff was very interested in my career awareness.	3.64	3.64	3.50	3.64
The staff was very helpful when I had problems.	3.68	3.73	3.36	3.64
The staff encouraged students to strive for excellence in all their academic pursuits.	3.73	3.73	3.55	3.77
The staff was always available when I had a question or needed assistance.	3.55	3.73	3.41	3.64
The staff was very friendly at all times.	3.27	3.68	3.32	3.36
The staff was very knowledgeable on transportation-related careers.	3.59	3.59	3.36	3.63
The staff was very enthusiastic about transportation-related careers.	3.59	3.64	3.50	3.73

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.



**Table A-13. Speaker Evaluations\***

Topic →	Bridge Design	Geo-Tech Lab	Material Testing	Best Study Practices	Intelligent transportation	HNTB Structural Model	Space Transportation
Speaker's Name →	Mr. Sunderman (TxDOT)	Dr. Radha (PVAMU)	Mr. Michael Smith (TXDOT)	Mr. Dave Tovar (TxDOT)	Mr. Stuart Corder (TxDOT)	Mr. Simmons (HNTB)	Mr. Marty (TSGC)
The presentation objectives were made clear to me.	3.23	2.95	3.41	3.18	3.45	3.64	3.82
The concepts presented were sufficiently related to the field of transportation.	3.50	3.27	3.68	2.91	3.41	3.55	3.91
The speaker presented materials in an organized manner.	3.18	3.05	3.68	3.27	3.45	3.50	3.82
The speaker used examples to clarify the material presented.	3.41	3.05	3.50	3.18	3.59	3.55	3.91
The speaker used audio/visual aides to enhance the presentation.	3.27	3.05	3.27	3.09	3.59	3.45	3.86
I felt free to ask questions.	3.45	3.00	3.50	3.27	3.50	3.50	3.91
Adequate time was allotted for audience participation.	3.23	3.14	3.55	3.18	3.55	3.45	3.82
The number of speakers was appropriate.	3.27	3.18	3.36	3.23	3.50	3.59	3.73

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

**Table A-14. Academic Field Trip Evaluation\***

	HNTB	Houston	TTI	TTI College Station (Seniors)	Port of Houston
Field trips were informative.	3.64	3.68	3.77	3.91	3.55
Concepts from the field trips were related to the field of transportation.	3.64	3.73	3.77	3.91	3.55
Field trip activities helped me understand transportation careers better than before.	3.59	3.55	3.64	3.82	3.41
Generally, adequate time was allotted for project activities.	3.55	3.64	3.68	3.82	3.41
Adequate time was allotted for questions.	3.64	3.59	3.73	3.91	3.45
Transportation to and from the site was comfortable.	3.64	3.59	3.68	3.64	3.36
Transportation to and from the site was safe.	3.73	3.68	3.73	3.82	3.55
Transportation to and from the site was clean.	3.73	3.73	3.73	3.73	3.36
The number of field trips was appropriate.	3.59	3.59	3.77	3.91	3.41

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

**Table A-15. Sports and Recreation Evaluation\***

	<b>Week 1</b>	<b>Week 2</b>	<b>Week 3</b>	<b>Week 4</b>
A good variety of sports and recreation activities were provided.	2.95	3.14	3.09	3.32
Facilities were adequate for the activities provided.	2.82	3.36	3.23	3.41
Sports and recreation activities were well organized.	2.73	2.95	3.09	3.00
Sports and recreation activities were well supervised.	3.14	3.55	3.14	3.45
Sports and recreation activities encouraged teamwork and spirit.	2.95	3.09	3.00	3.14
Generally, I enjoyed the sports and recreation activities provided.	2.82	3.36	3.14	3.36

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

**Table A-16. Enhancement Program Evaluation\***

	Bridge Model, Concrete Beam, West Point	Building Tower Model	Physics Day	Rocket Preparation and Launching	Yellow Light Intersection	Dream Transportation	Tower Project (Junior Class)	Auto-CAD Project (Senior Class)
Activities were well organized.	3.32	3.41	3.36	3.77	2.95	3.55	3.09	3.64
I was academically challenged by program activities.	3.32	3.55	3.32	3.77	3.18	3.55	3.09	3.82
Computer training activities were very stimulating.	3.14	3.18	5.50	3.68	2.71	3.36	3.18	3.82
Computer training activities were very enlightening.	3.05	3.09	3.45	3.68	2.67	3.27	3.00	3.82
Adequate time was allotted for the activities.	3.32	3.45	3.45	3.91	3.23	3.59	3.36	3.82
I felt free to ask questions.	3.32	3.45	3.45	3.91	3.18	3.45	3.55	3.82
All enhancement activities were educational and beneficial.	3.36	3.41	3.50	3.86	3.05	3.45	3.27	3.91

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

**Table A-17. Classroom Session Evaluations\***

	Mathematics	Bridge and Transportation worksheet	Ship the Chip/ Aluminum Foil Boat	Traffic Design Control	Bridge Competition
Class activities were well organized.	3.35	3.35	3.35	3.18	2.94
Class activities were logically sequenced such that simpler activities preceded more complex activities.	3.29	3.29	3.29	3.18	3.06
Participants were able to ask questions and discuss related issues during the course of class activities.	3.59	3.59	3.59	3.06	3.12
Subjects and topics discussed in class were related to the purpose of the project.	3.35	3.35	3.35	3.06	3.29
Faculty and presenters provided sufficient explanation of the concepts covered.	3.41	3.41	3.41	3.00	3.18
Faculty and presenters provided valuable assistance to participants.	3.35	3.35	3.35	3.29	3.12
The classroom area(s) were adequate to carry out the activities.	3.35	3.35	3.35	3.29	3.24
Enough time was spent discussing the subjects and topics of the project activities.	3.29	3.29	3.29	3.06	3.18
The number of projects was appropriate.	3.47	3.47	3.47	3.24	3.06
Enough time was allowed for most students to adequately understand what was being taught.	3.24	3.24	3.24	3.12	3.29

\*On a 4-point scale, with 4 = *strongly agree* and 1 = *strongly disagree*.

## Instructional Projects

### *Dream Transportation Project Assignment*

**Objective:** To design and construct a form of transportation (road, train, ship, plane, space) that will be safe, cost efficient, and affordable for all types of consumers to travel from Houston, Texas (North America), to Buenos Aires, Argentina (South America), to transport 5,000 people in the year 2050.

**Name:** HCT 2.0 (Hover Craft-Thorium)

**Materials:**

Poster Board	Paper	Markers	Computer
Glue	Tape	Clay	Popsicle Sticks

**Specified Criteria:**

**What's the name of your transportation?**  
HCT 2.0

**What type of materials will be needed?**

- Solar Panels
- Thorium
- Carbon-Fiber
- Titanium-Alloy Metals
- Carbon Steel
- Hot-Hydrogen Gas Cells

**Map of the Route:**



**Travel Distance:**  
Around 9,000 Kilometers

**List & Describe Parts:**

- Thorium reactor for a safe, cost-efficient, and fuel-efficient passage.
- Inflatable tubes to decrease water friction.
- Fins on both sides shaped like wings for balance and stability.
- Carbon-fiber composed tubes to increase the stability of the craft and also to add elasticity to the tubes.
- Solar panels for back-up fuel, also used on daily basis for non-essential compartments of the craft.
- Under-water propellers to increase the speed of the craft.

**Compare the fuel in 2050 to 2011 of your vehicle:**


In 2011, sea-based vehicles such as the hover craft use diesel and other sorts of non-renewable resources. These fuels are very costly and require a large number in volume and weight. These fuels are also very poisonous to the environment. In 2050, if the thorium reactor is made portable, it will be very efficient, due to the requirement of a very miniscule amount of fuel, and very cost efficient. Also, thorium-based fuel is known to be very safe to human beings because in most conditions, it is extremely less likely to combust compared to fossil fuels.

**What type and how much fuel will be needed for the transportation to work?**

A few kilograms of Thorium-232 is needed to power the thorium reactor, which then will help power the propellers and other essential system on board the craft. The price for thorium fuel is about \$150 per ounce, but in the future, it will be even cheaper as the extraction of thorium increases. Also, the use of solar panels will be implemented to power all the non-essential systems and also as a backup source of fuel if needed in an emergency. Solar panels need to cover the decks and other parts of the vehicle to increase the intake of the solar power, and specialized portable-sized need to be added to make it more efficient.

The following transportation vehicles were assigned to the following groups:

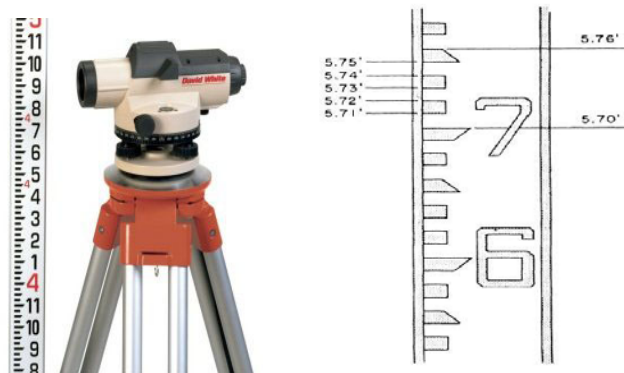
Group 2: Car 

Group 3: Train 

Group 4: Space

### *Surveying—Leveling with Auto Level*

Participants were introduced to the leveling concept and its application in various construction projects including pavement constructions. Participants were shown an auto level and leveling rod. How to read a leveling rod was discussed, and participants were asked to read various measurements off the leveling rod while still in the classroom to make sure that they understood how to read a leveling rod before they went out into the field to take actual measurements. In addition to this, basic mathematics involved in finding the elevation of a foresight point if given the elevation of a benchmark or back sight point was explained to participants. Important factors to consider while making a decision about choosing a spot to set up a tripod were discussed.



**Figure A-1. Auto Level Tool**

Once out in the field, the instructor demonstrated how to use a tripod to set up the auto level and the technique to level it accurately, and then the instructor showed participants how to focus the telescope and take various measurements (see Figure A-1). The Rocking the Rod technique was demonstrated so participants could take error-free measurements.

In the afternoon, participants were asked to complete a vertical loop around the Wilson Engineering building starting from a point of known (assumed) elevation and to find the elevation of a point on the other side of the building and complete the loop by coming back to starting point. Error of closure was calculated and was compared to maximum allowable error. This exercise gave participants good experience with understanding leveling fundamentals and operating the equipment.

### *Surveying—Total Station*

Participants were introduced to a total station and its application in various construction projects including pavement and highway constructions. The concept of reflectors and their use with a total station was discussed. The difference between a total station and an auto level was explained. In addition to this, basic mathematics involved in finding the elevation of a foresight point if given the elevation of a benchmark or back sight point was explained to participants.



Also, how to enter temperature, pressure, and humidity data in a total station so that it would give accurate measurements was shown.



**Figure A-2. Total Station Tool**

Once out in the field, the instructor demonstrated how to use a tripod to set up a total station and the technique to center and level it accurately, and then the instructor showed participants how to focus the telescope and take various measurements (see Figure A-2). How to find coordinates of target stations based on coordinates of an instrument station was demonstrated.

In the afternoon, participants were asked to complete a traverse around the Wilson Engineering building starting from a point of known (assumed) coordinates and to complete the loop by coming back to the starting point. The concept of error of closure was discussed. Also, how to lay horizontal curves using deflection angles was discussed.

This exercise gave participants good experience in understanding the fundamentals and operating the equipment.

### ***Magnetic Levitation—Train***

Participants were given a lecture on magnetic levitation. During this talk, they were shown how magnetic levitation works and learned the science behind it. They also watched a couple of educational videos about application of magnetic levitation in transportation and specifically in trains. This session was about the challenges and benefits of having an operational magnetic levitating train system. The videos were informative but discussed the concepts without going too much into the science.

After the talk, participants were given a magnetic levitation kit. The kit had step-by-step instructions for participants to follow to make a train that would levitate magnetically. They were

also shown a video on how to make the train step by step. Participants were required to identify the north and south poles of magnets using a compass and place magnets in a certain order for the train to levitate.

This activity took about two hours and some additional time for the glue to dry. In the end, the instructor inspected each group's train and its performance. This activity exposed participants to new modes of high-speed ground transportation systems. Also, they were able to recognize use of forces from magnets to balance weight.

### ***Rockets***

There were two separate sessions for this project. The first session was about building rockets, during which each participant put together his or her own rocket from a rocket kit provided. The second session was about activities related to rocket launching.

The rocket kit given to participants had a complete set of parts for building one rocket with an engine and recovery parachute. It took about three hours for participants to complete their rockets and some additional time for the glue to dry. The significance of balance and the symmetry of rockets were discussed before construction activities began. Also, there was a talk entitled "Science Behind Rockets" given by the instructor. Participants came to know about the principle of conservation of momentum, different types of fuels used in rockets, and other factors governing flight of a rocket.

In the second session, participants went outside in an open field away from any structure. They put together four launch sets and a corresponding launch controller. Then they took turns, four participants at a time, putting igniters in the rocket engines and making the necessary connections to the controllers. The instructor demonstrated how to do it in a safe manner. Once everybody was away and clearance was given by the instructor, participants launched their rockets after countdown. Extra precautions were taken with rockets that needed to have their igniters replaced. This session was about two hours long.

### ***Soil Particle and Sieve Analysis***

Participants took part in soil particle and sieve analysis. This activity was preceded by a talk on geotechnical engineering that focused on the importance of soil particle analysis and how it could be used in decision making in various construction projects. Participants came to know that soils are generally called gravel, sand, silt, or clay. They also learned how to identify the type of soil based on particle analysis.

Participants were given a handout with background information and instruction on how to perform sieve analysis. Once the discussion was finished, they were taken to the geotechnical lab where they were divided into small groups of not more than four participants per group. Separate soil samples were given to each group. Each group performed weighing, sieving, and weighing mass of soil retained on each sieve. Once the groups finished their activities in the geotechnical lab, they moved to the computer lab where they performed calculations and used a spreadsheet to plot grain-size distribution obtained from sieve analysis in a semi-logarithmic plot with grain

size plotted on the log scale and percent finer plotted on the natural scale. Participants learned about various options and features available in a spreadsheet for data display.

### ***Solar Boats***

In this activity, participants were shown videos on Archimedes Principle of Buoyancy. A discussion focused on various aspects such as shape, size, center of gravity, and balance of a boat followed these videos. In one of the videos, participants were asked to do calculations and compare the weight of a boat and weight of the water displaced by it in various conditions.

Once participants understood the concepts, they were given a solar boat kit and were asked to design a boat. Each kit had one block of foam that was to be transformed into a boat. The boats were driven by solar energy, so participants were also given a talk on how solar panels work. They were to use solar panels and align them in a way so that they would capture maximum sunlight.

Once everybody was finished preparing their boats, they went outside with the instructor. Each boat was judged on two parameters. One was the speed of the boat, and the second was the ability of the boat to navigate in a line. Participants were given multiple attempts to achieve their best performance. Appropriate scientific explanations were given based on performance of each boat.

Overall, it was fun activity and participants learned about the science behind boats while competing against each other. Wind and clouds affected this activity, so weather should be taken into consideration while planning for this activity in the future.

### ***Environmental Issues Relating to Transportation—Air/Water Pollution***

An interactive session was held on environmental issues related to transportation. This session focused specifically on air and water pollution.

Different sources of air pollution were discussed. Participants were divided in three groups and were asked to choose one mode of transportation out of ground, water, and air. They were asked to identify various kinds of pollution-related issues from other modes of transportation, and each group was supposed to think of counterarguments.

This discussion was guided and controlled, but participants were allowed to explore all options. Highways, railroads including magnetic levitation, water transportation, air transportation, and other innovative modes of transportation were compared based on pollution. Air pollution dominated the discussion. However, various aspects of water pollution-related issues were also brought to participants' attention by the instructor.

Different ways to minimize this pollution were also discussed. Issues such as how vehicles contribute to different types of pollution during their lifetime—from manufacturing, active use, and disposal after being out of service—were discussed for a better understanding of pollution control.

In addition, basic water quality parameters were discussed. Participants were introduced to the concept of turbidity, pH, and conductivity, as well as the science behind these measurements. Participants were shown how to take measurements of turbidity, pH, and conductivity. They were divided into small groups, and each group took turns demonstrating the turbidity of various water samples and their corresponding turbidity measurement with the help of a turbidity meter. They also measured pH of water samples.

### ***AutoCAD***

An introductory AutoCAD session was held. AutoCAD is being used in a range of industries and is employed by architects, project managers, and engineers, among others. Importance of AutoCAD in engineering as a tool was discussed. Participants were given an opportunity to play with AutoCAD and learn at the same time. Participants were given measurements of various sports fields/courts and were asked to create drawings in AutoCAD. Basic commands to draw various shapes were then taught. Participants were asked to put notations in their drawing. Also, they were shown how to set dimensions of each drawing, including the height of texts and size of notation arrows.

Participants were divided into groups of two, and each group was given a different assignment. Participants took their time to understand AutoCAD and how it helps in preparing construction and surveying-related drawings and the fact that the software supports both 2D and 3D drawing formats.

### ***Material Testing***

STI Scholars participants were introduced to the concept of material testing and learned why there is such a need for testing when it comes to construction-related projects including construction of highways and bridges. They were introduced to destructive and non-destructive material testing, and the pros and cons of each type of testing were discussed. Multiple videos in which different types of materials were being tested were shown.

Participants learned about the various properties of construction materials that are usually tested. They were asked to name some of the materials that are used in various highway and bridge-related projects. Also, they were asked to identify what qualities of material they should test and why. The discussion was interesting, and participants really enjoyed talking about their choices.

Participants watched educational videos about the consequences of choosing construction materials without testing. They chose various topics related to material testing and did online research for a presentation they were expected to give to a group of STI participants, as they didn't have the opportunity to be part of this session.

### ***Index Card Tower***

The objective of this activity was to make a tower from index cards and paper clips to sustain the weight of a 5-lb brick 12 inches above the ground at the lowest cost possible. Materials that were used in this activity were paper clips, index cards and 5-lb brick.

Students as a group came up with a number of configurations one of which was a tower that was 12 inches high. It had nine cards for each level, of which there were four. Each base of the tower was formed as a triangle that curved in, and in between each base, they had two cards to hold up the next base. Students had to keep count of all the bends and the number of materials because it all added to the total cost.

### **Closing/Award Ceremony Program**

Figure A-3 includes a copy of the Closing/Award Ceremony Program.

**2012 SUMMER TRANSPORTATION INSTITUTE  
AND  
STI SCHOLARS PROGRAM PARTICIPANTS**

<b>Name of Student</b>	<b>Grade</b>	<b>High School</b>	<b>City</b>
Bradley, Lanique	11	Reagan High School	Houston, TX
Byars, Quinton G.	12	James Martin High School	Arlington, TX
Carrillo, Esteban	11	Seven Lakes High School	Katy, TX
Clark, Kristin	12	Cypress Spring High School	Cypress, TX
Cortez, Raul	12	LaVilla High School	LaVilla, TX
Ford, Tajanae	11	Empowerment College Pre High School	Houston, TX
Haynes, Terriana	11	Magnolia West High School	Magnolia, TX
Keitt, Nykea	11	Elsik High School	Houston, TX
Leal, Keith	12	Cypress Lakes High School	Katy, TX
Manns, Kirsten	11	Hempstead High School	Hempstead, TX
Martinez, Otilio	12	Austin High School	Houston, TX
Miles, Khalil	11	Glenda Dawson High School	Pearland, TX
Ramirez, Rubye	12	Carter Riverside High School	Forth Worth, TX
Rivas, Marlon	12	Booker T. Washington High School/HSEP	Houston, TX
Sedillo, Joe	11	Waller High School	Waller, TX
Sylvester, Grant	12	Grace Academy	Humble, TX
Takacs, Nathaniel	12	LaVilla High School	LaVilla, TX
Terrell, Kelli	11	Milby High School	Houston, TX
Thomas, Nykeem	11	Cypress Ranch High School	Cypress, TX
Wiley, Jamisha	12	Cypress Lakes High School	Katy, TX
<b>2012 STI Scholars</b>			
Jackson, Tralae	12	Pflugerville High School	Pflugerville, TX
Jackson, Tralon	12	Pflugerville High School	Pflugerville, TX
McKnight, Taylor	12	Carter High School	Dallas, TX
Rhodes, Madison	12	Denver School of the Arts	Denver, CO
Taylor, Kendall	12	Round Rock High School	Round Rock, TX
Watts, Howard	12	San Augustine High School	San Augustine, TX

**Prairie View A&M University**  
*(A Member of the Texas A&M University System)*

**2012 SUMMER TRANSPORTATION INSTITUTE**



Hosted by  
**Department of Civil & Environmental  
Engineering**

**Awards Ceremony  
Friday, June 29, 2012**

**Room 137  
New Electrical Engineering Building  
10:15 A.M.**

**Dr. George C. Wright  
President**

Figure A-3. Closing/Award Ceremony Program

**PROGRAM OVERVIEW**

The Summer Transportation Institute (STI) is a four-week program that introduces promising 11<sup>th</sup> and 12<sup>th</sup> grade students to the transportation industry. STI is funded by the Federal Highway Administration (FHWA) through the Texas Department of Transportation. Partial support is provided by the University Transportation Center for Mobility (UTC/M). Since one in seven jobs in the United States relates to the transportation industry, a career in transportation field is worth considering. The STI program offers participants the opportunity to engage in a wide range of activities that are both educational and enriching. PVAMU has offered this program since year 2000 and has graduated 230 students, including 20 students from this year’s program.

The STI Scholars program is specifically developed for past STI program participants to explore the Civil Engineering profession further. These students work with faculty and researchers from Prairie View A&M University and Texas Transportation Institute. This particular program is funded by the University Transportation Center for Mobility. To date, 14 students, including 6 from this year have graduated from this program.

**STAFF**

- Dr. Raghava R. Kommalapati, PE, BCEE, Director
- Dr. Ramalingam Radhakrishnan, P.E., Co-Director
- Ms. Samantha R. Glover, Teacher and Program Coordinator
- Ms. Carla Foster, Teacher and Program Coordinator Assistant
- Dr. Sanjay Tewari, Instructor
- Mr. Sanjay Tillmurt, Teacher Assistant
- Ms. Vicki Mays, Teacher Assistant
- Ms. Courtney Dickey, Program Aide
- Ms. Johanna Tush, Program Aide
- Ms. Kendramia Prestage, Peer Female Counselor/ Program Aide
- Mr. Greg Adebowale, Peer Male Counselor/ Teacher Assistant

*Special Acknowledgment to the Supporters:*  
 University Transportation Center for Mobility (UTC/M), Texas Transportation Institute (TTI), Department of Civil & Environmental Engineering and Roy G. Perry College of Engineering, PVAMU, HNTB, Metro Rail Operations and Texas Department of Transportation.

*Dr. Melissa Tooley and Mrs. Martha Raney Taylor (UTC/M), Dr. Kendall Harris, Dean, College of Engineering, PVAMU, and Mrs. Sharon Evans, Admin Asst., Department of Civil & Environmental Engineering.*

*“Making a Difference in the Lives of Youths”*  
**CLOSING CEREMONY**

**Kendall Taylor and Joe Sedillo**  
*PRESIDING*

**PRELUDE**

- Invocation .....Kirsten Manns
- Welcome .....Teriana Haynes
- Introduction & Welcome .....Dr. Raghava Kommalapati, PE, BCEE  
 STI Director & Interim Dept. Head of Civil & Environmental Engineering
- “Future Leaders in Transportation” .....Dr. William Stockton, PE  
 Executive Associate Agency Director, Texas Transportation Institute

**PARTICIPANTS’ PRESENTATIONS**

- Classroom Activities & Projects .....Marlon Rivas & Kristin Clark
- Field Trips .....Otilio Martinez & Quinton Byars
- Dorm Life & Recreational Activities .....Grant Sylvester
- Scholars Program Activities .....STI Scholars
- Introduction of Speaker .....Kelli Terrell
- Keynote Address:  
 “Rebuilding America’s Infrastructure: The Role of Civil Engineers”  
 Mr. Jackie Freeman, P.E., Deputy Executive Director,  
 Harris County Public Infrastructure Department
- Presentation of Certificates & Awards ..... Ms. Samantha Glover  
 Ms. Carla Foster
- Acknowledgements .....Tajanae Ford
- Closing Remarks .....Dr. Kendall T. Harris, PE  
 Dean, Roy G. Perry College of Engineering, PVAMU

Figure A-3. Closing/Award Ceremony Program (Continued)



## **Selected Moments of STI Scholars' Activities**

Figures A-4 through A-20 show participants taking part in specific activities.



**Figure A-4. Dr. Tewari Mentoring Scholars to Design Roadway Curves**



**Figure A-5. Scholars Viewing Concrete Testing Facility at TAMU**





**Figure A-6. Scholars Measuring Aggregates for Concrete Mix**



**Figure A-7. Scholars Visiting Bonfire Memorial at TAMU**





**Figure A-8. Scholar Designing Bridge Truss**



**Figure A-9. Dr. Tewari Explains How to Compute Elevation Using Data from Leveling—Survey**



**Figure A-10. Dr. Tewari Pointing Out How to Avoid a Common Error**



**Figure A-11. Participants Working on Final Calculations**





**Figure A-12. Scholars Evaluating Their Final Calculations**



**Figure A-13. Scholars Preparing Rockets**



**Figure A-14. Scholar Reading Specifications before Developing Rocket Design**



**Figure A-15. Scholars Experimenting with Various Concrete Mixtures at TTI**





**Figure A-16. Scholars in the Middle of Concrete Mixture Preparations at TTI**



**Figure A-17. Scholars Preparing Concrete Specimens for Testing**





**Figure A-18. Scholars with Their Concrete Specimens**



**Figure A-19. Scholars Learn the Dangers of Texting and Driving Using the TTI Driving Simulator**



**Figure A-20. Scholars Learning about the Driving Simulator at TTI with Dr. Radha**







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