



FINAL REPORT

K-12 OUTREACH

2021

2021 Virtual Mississippi Summer
Transportation Institute (MSTI)
at Jackson State University

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STRIDE

Southeastern Transportation Research,
Innovation, Development and Education Center

UF | Transportation Institute
UNIVERSITY of FLORIDA

TECHNICAL REPORT DOCUMENTATION PAGE

| | | | |
|---|---|---|------------------|
| 1. Report No. K-12 Final Report JSU | 2. Government Accession No. | 3. Recipient's Catalog No. | |
| 4. Title and Subtitle 2020 Virtual Mississippi Summer Transportation Institute at Jackson State University | | 5. Report Date December 2021 | |
| | | 6. Performing Organization Code | |
| 7. Author(s) Dr. Robert W. Whalin, Ph.D., M.S., Jackson State University Dr. Kejun Wen, Ph.D., M.S., Jackson State University | | 8. Performing Organization Report No. | |
| 9. Performing Organization Name and Address Jackson State University 1400 John R Lynch St. Jackson, MS 39217 | | 10. Work Unit No. | |
| | | 11. Contract or Grant No. Funding Agreement Number - 69A3551747104 | |
| 12. Sponsoring Agency Name and Address University of Florida Transportation Institute Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) 365 Weil Hall, P.O. Box 116580 Gainesville, FL 32611 U.S Department of Transportation/Office of Research, Development & Tech 1200 New Jersey Avenue, SE Washington, DC 20590 United States | | 13. Type of Report and Period Covered January 1, 2020 – December 31, 2021 | |
| | | 14. Sponsoring Agency Code | |
| 15. Supplementary Notes | | | |
| 16. Abstract 1. A reorganization and curriculum revision of the 2021 Mississippi Summer Transportation Institute (MSTI) from a 3-week residence program to a 2-week residence program. 2. Recruitment and preparation to host the 2021 MSTI in June 2021. Plans are to recruit JSU faculty and transportation engineer majors to implement the revised 2-week residence curriculum, recruit high school students for the 2021 MSTI, coordinate MSTI with the Mississippi Department of Transportation, and solicit participation by MDOT engineers that includes a tour of MDOT facilities. A JSU civil engineering faculty member will be selected to lead the MSTI. The residence MSTI will be held during a 2-week period in June 2021. (The project was revised as a virtual program to meet COVID-19 restrictions.) | | | |
| 17. Key Words K-12 education outreach, workforce development, STEM, civil and transportation engineering | | 18. Distribution Statement No restrictions to all. | |
| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages 13 pages | 22. Price |

Form DOT F 1700.7 (8-72)

Reproduction of completed page authorized

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ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS

This work was practically sponsored (non-financial) by a grant from the Southeastern Transportation Research, Innovation, Development, and Education Center (STRIDE). The program was majorly supported by the Mississippi Department of Transportation (MDOT), the Federal Highway Administration (FHWA), NASA, and the Department of Civil and Environmental Engineering at Jackson State University.

Funding Agreement Number - 69A3551747104

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TABLE OF CONTENTS

| | |
|---|----|
| DISCLAIMER | 3 |
| ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS | 3 |
| LIST OF AUTHORS | 4 |
| LIST OF FIGURES | 6 |
| ABSTRACT | 7 |
| EXECUTIVE SUMMARY | 8 |
| 1.0 INTRODUCTION | 9 |
| 2.0 EDUCATIONAL PROGRAM | 9 |
| 2.1 Narrative | 9 |
| 2.2 Collaborations | 11 |
| 2.3 Impacts | 11 |
| 3.0 CONCLUSION | 12 |
| 4.0 ATTACHMENTS | 13 |

LIST OF FIGURES

Figure 1 Engineering Box 8
Figure 2 Bridge Project..... 10
Figure 3 pH test, wastewater treatment design, and viscosity test 11

ABSTRACT

The Mississippi Summer Transportation Institute (MSTI) aimed to introduce a diverse group of motivated high school students to the transportation industry. This program has been operating for more than 10 years in Jackson State University and this is first time that a virtual program was held due to COVID-19. The Inter-modal Advisory Committee recruited twenty-five rising 9th-12th grade students for the program. The high school students participated in academic and extra-curricular activities designed to improve their Science, Technology, Engineering, and Mathematics (STEM) knowledge and leadership skills. This program provided a well-balanced curriculum in an environment that was conducive to both academic and personal development, promoted interpersonal skills, and exposed students to real-world transportation issues. These were accomplished through a series of virtual lecture activities, lab tours and recreational activities. Five program assistants (graduate/undergraduate students) worked closely with the students during these two weeks. Most of the activities are successfully implemented through this virtual guidance. There was positive feedback from the students at the end of the program. All students did a presentation on what they learned and created in the two-week program. Meanwhile, challenges were encountered in the implementation of some projects.

Keywords: transportation engineering, virtual summer camp, high school students, STEM

EXECUTIVE SUMMARY

The Civil and Environmental Engineering Department at Jackson State University in Jackson, Mississippi, hosted the Mississippi Summer Transportation Institute (MSTI) from July 12 to July 23, 2021. Dr. Kejun Wen, assistant professor at the Department of Civil and Environmental Engineering, served as the Program Director. Due to the impact of COVID-19, the Department of Civil & Environmental Engineering and Industrial Systems and Technology, Jackson State University (JSU), hosted the 2021 Mississippi Summer Transportation Institute (MSTI) virtually through Zoom meeting. The Inter-modal Advisory Committee (IAC) recruited twenty-five rising 9th-12th grade students for this virtual MSTI program. Twenty-three students participated in the full virtual program. The two-week virtual program had students from different counties around Jackson, Mississippi.

The MSTI consisted of two distinct program components: the academic and the enhancement component. The Academic Component was designed to introduce participants to the field of transportation. They were exposed to many of the dynamic modes of transportation and career opportunities associated with each. The Enhancement Component exposed students to vital supplementary sessions that aid in academic achievement and preparation for college.

At the beginning of the virtual program, an "Engineering Box" was provided to each student. It contained the activities materials for a week. Parents picked up the "Engineering Box" for their kids every Sunday afternoon. In this virtual program, a series of lecture classes regarding transportation engineering was given through Zoom. Many engineering activities were implemented by students at home using materials in the "Engineering Box" (Figure 1). Instructors demonstrated how to do the project to all students. Then, the students were divided into five groups (5 students in one group) and assigned a program assistant to help each student with their project. The goals of the program were for students to 1) have a more comprehensive understanding of transportation-related topics and 2) be more interested in transportation-related majors in their future academic careers. By giving students an opportunity to study STEM-related topics before going to college, they will have greater familiarity and confidence in the STEM profession in the future.



FIGURE 1 ENGINEERING BOX

1.0 INTRODUCTION

The Jackson State University (JSU) hosted a two-week virtual Mississippi Summer Transportation Institute (MSTI) program to attract high school students to pursue studies in transportation at Jackson State University or elsewhere in the country. The MSTI aims to introduce a diverse group of motivated pre-college students to the transportation industry and encourage them to pursue transportation-related studies and careers. Students participated in academic and enhancement activities designed to improve their mathematical, scientific, technological, and leadership skills. Furthermore, the MSTI strives to

- Increase students' awareness of different transportation modes
- Heighten students' understanding of the importance of different transportation modes and solutions
- Expose students to a variety of transportation careers
- Improve students' creativity, analytical and problem-solving skills
- Develop students' interpersonal, collaboration and leadership skills

To meet these objectives, the MSTI provided a well-rounded curriculum in an environment that was conducive to both academic and personal development, promoted interpersonal skills, and exposed students to real-world transportation issues. Students participated in computer training, academic enhancement activities, and hands-on projects. Core outcomes included the ability to:

- Apply analytical thinking skills to basic transportation problems
- Understand the steps necessary for college entry
- Understand education opportunities in transportation
- Describe transportation career options
- Understand the principles of effective leadership
- Develop and apply tools needed for employment purposes
- Recognize and appreciate diversity in educational setups and work environments

2.0 EDUCATIONAL PROGRAM

2.1 Narrative

Academic Lectures: A series of educational lecture classes were introduced by professional instructors from the Department of Civil and Environmental Engineering, including Introduction to Civil Engineering, Introduction to Bridge Engineering, Introduction to Geotechnical Engineering, Introduction to Environmental Engineering, and Introduction to Environmental Engineering. Students learned the basic concepts and content of different engineering disciplines.

Virtual Lab Tours: The engineer from MDOT Materials Division delivered a virtual tour to all participants. The program director, Dr. Wen also gave all participants a virtual lab tour.

Bridge Design Project: Students were required to design and build a bridge with three different materials: paper, straw, and wood. The bridge was evaluated by its self-weight and load capacity. Students learned about bridge design, how the bridge works, the type of the bridge, and how materials affect the bridge's capacity (Figure 2). This activity also taught students how to simplify the math behind the risk and estimation process that takes place at every engineering firm prior to the bidding phase—when an engineering firm calculates how much money it will take to build the project and then "bids" against other competitors.



FIGURE 2 BRIDGE PROJECT

Environmental Engineering Project -Wastewater Treatment: Student teams designed and then created small-sized models of working filter systems to simulate multi-stage wastewater treatment plants. Drawing from assorted provided materials (gravel, pebbles, sand, activated charcoal, algae, coffee filters, cloth) and staying within budget, teams created filter systems within 2-liter plastic bottles to clean the manufactured simulated wastewater (dirt mixed with water). Typical water quality tests (such as chlorine, pH, etc.) were conducted to check the water quality before and after treatment (Figure 3).





FIGURE 3 PH TEST, WASTEWATER TREATMENT DESIGN, AND VISCOSITY TEST

Hydraulic Engineering Project - Measuring Viscosity: Students calculated the viscosity of various household fluids by measuring the amount of time it took marble or steel balls to fall given distances through the liquids. Through this project, the students experienced what viscosity means and also practiced using algebra and unit conversions.

Geotechnical Engineering Project - Geoexplorer: Students learned about a field test in Geotechnical Engineering: CPT test (Cone Penetration Test). The geoexplorer is a game-based learning software for students to perform the CPT test in a virtual environment.

NASA program - Land Cover/Eggstronaut Parachute Challenge: By photographing and classifying the land cover over an area the size of a soccer field, students were assisting those scientists working to enhance global maps of land cover use with a finer spatial resolution than is possible when using satellites alone. Students also designed and built parachutes to slow the descent of an egg and minimize the force of impact when landing.

2.2 Collaborations

MSTI was made possible through collaborations with many agencies and organizations. Collaborators provided guest speakers, campus lab visits, and field trips. Guest Speakers including faculty from the Department of Civil and Environmental Engineering at JSU and experts from the Mississippi Department of Transportation (MDOT) provided talks on transportation engineering and inspired students' interest in the field.

2.3 Impacts

Most of the activities were successfully implemented through virtual guidance. There was positive feedback from the students at the end of the program. All students did a presentation on what they have learned and created in this two-week program. Meanwhile, challenges were encountered in the implementation of some projects. Below is the feedback from the students on each activity.

General:

- "The thing I like about this program is that it doesn't focus on one subject. Most of the things I learned helped with the questions that were never answered during my 8th grade year. I learned how to appreciate science a little more."
- "We also learned that teamwork and accepting someone else's opinion is very important."

Lecture Class:

- "There are many things that we have learned in the JSU Engineering Program."
- "CPT test, a test to identify numerous qualities or properties within the soil. This data is used for information about what type of soil it is and whether it'll be a good location for buildings and such."

"We're introduced to environmental engineering, and various things such as some environmental issues, such as the dangers of poor air quality, which applies to global warming, smog, and acidic rain."

Bridge Competition Project:

- "These bridges span many types, over various environmental challenges. From simplistic wooden bridges, we learned how they evolved over time, from the aforementioned simplistic bridge into truss or arch bridges and the massive, suspension bridges and cabled stayed bridges. We dived into the process of dewatering, what engineers need to consider when choosing their preferred type of bridge for their usage, and even more!"
- "The project taught me that when you are constructing something always sketch it first to get your ideas together."

Hands-on Lab Activities:

"In the second week, we also learned about acids and bases, and more specifically, how to determine that quality in various liquids by testing its pH value."

3.0 CONCLUSION

Jackson State University is an urban HBCU whose core mission and vision should play a vital role in the program design. The program outcome was to create an interest in transportation. The variety of presentations by professionals across the various modes of transportation and operations were able to generate interest in the participants.

The proposed project was postponed from June to July due to the late notice of major funding release. The original proposed start date was June 6, and the revised start date was July 12. Due to the impact of the COVID, the original two-week residential MSTI program was switched to a virtual program in 2021. It was a big challenge for the counselors and educators to assist the students in implementing those hands-on activities. The bridge competition project was canceled due to the difficulty of quality control. The bridge was only evaluated based on the appeal and weight eventually.

The MSTI program only received a total of 25 applications due to the late notice. Since JSU did not release the policy of the summer camp program until late May, the advertisement was not available till May 30. To obtain a desirable composition of students for future MSTI Programs, we are anticipating starting with the program announcements as early as February. Meetings with the counselors will also be scheduled early enough to allow ample time for counselors and math and science teachers to nominate students for the program. The purpose of this initiative is to have a larger pool of students to select from. Through all the activities, students learned the connection between traffic engineering and their own lives.

Many students became more interested in transportation-related majors and some of them enrolled at JSU's College of Science, Engineering and Technology (CSET) Academy. Expanding the knowledge of K-12 students can help guide them in their future career choices.

4.0 ATTACHMENTS

Please contact the author for the following attachments.

- Virtual program schedule
- Bridge project guidance
- Presentation slides:
 - 1) Introduction to Civil and Environmental Engineering
 - 2) Introduction to Bridge
 - 3) Introduction to Atmosphere