

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

1999 SUMMER TRANSPORTATION INSTITUTE

UNIVERSITY OF MISSOURI-ROLLA
DEPARTMENT OF CIVIL ENGINEERING



FINAL REPORT

submitted by:

Dr. Gary S. Spring, P.E.
Associate Professor



208 Butler-Carlton Building
University of Missouri-Rolla
1870 Miners Circle
Rolla, MO 65409-0030

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INTERMODAL ADVISORY COMMITTEE

<p>NAME: Lenell Allen TITLE: Assistant Director AFFILIATION: University of Missouri-Rolla Minority Engineering Rolla, MO 65409</p>	<p>NAME: Robert T. Berry TITLE: Vice President AFFILIATION: Burns & McDonnell 1630 Des Peres Road St. Louis, MO 63131</p>
<p>NAME: Gloria Larivee TITLE: A+ Coordinator AFFILIATION: Rolla High School 900 Bulldog Run Rolla, MO 65401</p>	<p>NAME: Arthur Lieber TITLE: President AFFILIATION: Civitas Associates 232 No. Kingshighway, #2101 St. Louis, MO 63108-4002</p>
<p>NAME: Gabriele Mack TITLE: Vice President, Diversity AFFILIATION: Sverdrup Civil, Inc. 13723 Riverport Drive Maryland Heights, MO 63043</p>	<p>NAME: Jim Murray TITLE: Division Engineer AFFILIATION: MODOT RD&T Division 105 W. Capital, PO Box 270 Jefferson City, MO 65102-0270</p>
<p>NAME: Glenn Smith TITLE: Civil Rights Officer AFFILIATION: Federal Highway Administration 209 Adams Street Jefferson City, MO 65101</p>	<p>NAME: Sherrie Koechling-Andrae TITLE: Assistant Professor AFFILIATION: Lincoln University College of Business Jefferson City, MO 65101</p>

PROGRAM OBJECTIVES

In concert with the stated STI goals and with our Team's unique strengths, the objectives of this effort were to provide an educational experience for ninth and tenth grade high school students which explored a wide spectrum of the transportation industry and its role in our society. To that end, the STI curriculum provided educational opportunities for its students in critical areas of transportation, math and science, and computers. The students were exposed to university life, leadership and team building activities, and a series of lectures, seminars, hands-on laboratories and field trips. Although, given the extremely short time available for implementing this Year's STI, no formal measures were developed to assess outcomes, several informal measures indicate the Program's success in meeting the outcomes described below. Measures include student newsletter articles, homework submitted, and in-class questions. The following discussion provides examples from the Institute's curriculum specifically targeted at the originally stated student outcomes. Upon completion, students:

- Are aware of the various career alternatives in the transportation sector. The Program provided repeated exposure to a variety of career paths via classroom presentations, field trips, videos and exploration on the Internet.
- Are able to identify the various transportation modes and their providers. A different mode of transportation was introduced each week, thus aiding in the identification of separate transportation modes.
- Appreciate what is involved in the planning, design, construction and operation of transportation facilities. At several site visits the STI students were shown plans and told how long the planning and design periods existed prior to the construction phase. The scope of details necessary for the successful operation of airports, traffic flow, highway safety, and waterways were highlighted by many field trips.
- Understand the interactions among the various modes. Comparisons were made to give the students an idea of the relative capacities of hauling freight by railroads, waterways, and highways.
- Discuss the major environmental and social issues facing tomorrow's transportation professional. In St. Louis, the proposed expansions of the Metrolink, The Municipal Airport, and Highway 141 presented fertile ground for several presenters to discuss these issues.
- Understand the need for sustainable development. A presentation on the history and planned development in the Central West End of St. Louis effectively demonstrated the need for a master plan and discussed issues related to sustainable development.
- Understand the role of math and physics in transportation design and analysis. In addition to homework and frequent admonitions from presenters who stressed the necessity of math and science, there were many examples on field trips and in video presentations that accented the need for math and science. The TRAC Program encouraged the students to apply concepts from math and physics in designing bridges and vehicles.
- Are able to make simple transportation-related calculations, such as simple kinematics, geometry and so on. The students received homework assignments which used a variety of math models. In several "hands-on" activities an awareness of models was combined with a bit of fun as students (1)built structures using first only index cards and later a variety of office supplies, (2) designed and constructed aluminum foil boats to float and hold pennies (3) worked with MODOT volunteers to construct and race magnetic track cars, and (4)used computer software under the guidance of the MODOT volunteers to design, construct, and test bridge stability.
- Are fluent with the internet - know how to access it, to find information on it and to use it. On a regular basis assignments designed to give practice in using the Internet were given. These included at least four separate computer labs on and off campus.

ABSTRACT

The Transportation Institute in the Department of Civil Engineering at the University of Missouri-Rolla hosted its first U.S. Department of Transportation Summer Transportation Institute (STI). The goals of the Institutes Program are to (1) expose secondary school students to and allow them to participate in a series of academic and practical experiences designed to motivate them toward professions in the transportation industry, and (2) provide secondary school students with mathematics, science and technological enrichment to enable them to pursue a career in the transportation industry.

In concert with these STI goals and with UMR's unique strengths, the objectives of this effort were to provide an educational experience for high school students which explored a wide variety of aspects of the transportation industry and its role in our society. To that end, the STI curriculum provided educational opportunities for its students in critical areas of transportation, math and science, and computers. The eighteen ninth and tenth grade students who were chosen for the Program were exposed to university life, leadership and team building activities, and a series of lectures, seminars, hands-on laboratories and field trips described in detail in the following pages. The Institute was comprised of 4 weeks: Orientation, Highway, Public and Intermodal Transportation weeks (see Appendix 4) and was headquartered at the Transportation Institute in the Civil Engineering's Butler-Carlton Building. Classes, however, were held in a variety of facilities across Campus.

The Federal Highway Administration's money was used as "seed" money to fund the Institute which cost approximately three times the amount funded. The four week Institute was conducted by faculty, staff and students from the Department of Civil Engineering. Government agencies and private firms provided substantial support in funding, staff assistance and educational materials as well. See Appendix 10 for a

complete listing of sponsors.

Given the late start date for this year's STI, youths in the St. Louis area were recruited. The National Society of Black Engineers and local MODOT personnel were used to identify and recruit likely candidates. These candidates were contacted via telephone, email and mail and were invited to apply. Fifty application packages were distributed through high school counselors, church groups, the National Society of Black Engineers and Ms. Julia Davis at the St. Louis Public Library. Twenty two applications were received and twenty were accepted. Copies of the Brochure and Application are provided in Appendix 1. Applicants were selected based upon their academic standing, recommendations from high school counselors and teachers, and their essays explaining their interest in transportation. The Project Director and Project Coordinator assessed the applications and accepted eighteen of the twenty two submitted. The average grade point average of the chosen group was in excess of 3.0 on a 4.0 scale. Half were ninth graders and half were tenth graders ranging in age from 13 to 15 years. The students represented the schools listed in Appendix 9. Two students were unable to attend given lack of funds and two were expelled due to behaviour problems during the third week, leaving sixteen to complete the Program.

Program Description

As was explained earlier, the Program consisted of four weeks, an orientation week followed by three “content” weeks - highway, public and intermodal transportation. Each week began with a half day introduction to its topic and included field trips, hands-on labs and seminars (see Appendix 4 for detailed curriculum descriptions). Students were given ample time, throughout the four week period, to compose newsletter articles reporting on what they had seen and to work on homework assignments (see Appendix 6 for sample assignments). A web site was designed containing electronic application forms, that were used by a few of the students to apply for the Institute, and photos from the Institutes sessions and field trips. The photos were used extensively for preparation of newsletters and for the students’ final presentation at the closing banquet.

ORIENTATION WEEK

Orientation to the Institute began with a meeting with parents, students and Institute staff



Mrs. Whittington, Dr. Spring and Coach Knapp share a profundity

during which the parents and students were acquainted with faculty and staff, and



Cathleen Hill with parents

expectations for the program. Copies of the Student Handbook, the Agenda for the session, and a curriculum summary were distributed. A copy of these materials are provided in Appen-



Nate and Neal Hopson with Mom and Dad

dix 1.

Orientation week consisted of sessions aimed to introduce students to college life, teamwork and interpersonal skills, using the library, using the internet, taking and passing the ACT examination and to the transportation profession. In addition, since students would, as



Candice Houston with parents



Celeste Grayer with Mom hard at work



Randal Falker with Dad

a major part of their contribution to the Institute, prepare newsletters to report on their experiences



Aaron Whittington and family

- rather than technical papers, a newsletter workshop was offered during the first week.

Dr. Spring began the week, on Monday morning, with an orientation session in which he outlined what the students were to expect during the Institute, his expectations of the students, the objectives of the Institute, and the rules and regulations that were to apply during the four week period. In the afternoon Ms. Beth Morgan, UMR Admissions, Dr. Ronald Fannin, Department Head of UMR's Freshman Engineering Program, and Mr. Floyd Harris, Director of



Ms. Morgan fielding questions from Candice (left) and Cathleen (right)

UMR's Minority Engineering Program, provided introductions to University life followed by a tour of the Rolla Campus.

A session offered by Ms. Diane Stutts, a counselor in the UMR Center for Personal Development and Leadership, dealt with the importance of teams, stages in the team building process, and understanding each other's motivations. She administered a Meyers-Briggs test for the students, explained the various different personality types and how they play a role in forming successful teams. Coach Knapp, STI Academic Aid, led the group in an application of those team principles with a canoe building competition. Students built canoes from 6" x 6" pieces of aluminum foil. The team whose canoe held the most pennies while remaining afloat won the competition.

Ms. Michelle Wilde, UMR Librarian, offered sessions on the use of the University



Drill sergeant (aka Coach) Knapp giving instructions

Library and Computer system, and using the internet. Students were given a scavenger hunt



Ms. Wilde giving a guided tour of the UMR Library

through the Library and used the Internet to gather the information required and to write a short article on UMR's solar car.



Students on their scavenger hunt

Mr. Tom Ryan, Assistant Division Engineer for Missouri Department of Transportation, Mr. Al Walls, Planner for East-West Gateway, and Officer Ralph Lemongelli of the Missouri State Police made presentations on various current transportation issues and career opportunities.

Ms. Lelia Flagg, STI Academic Coordinator, offered a one-day review of the ACT examination. She provided study guides for the



Officer Lemongelli talking about highway safety



Mr. Ryan explaining career opportunities in MODOT

workshop.

Ms. Rebecca Frisbee, Manager of UMR's



Mr. Walls discussing issues in transportation planning

Publications Department, provided a half day workshop on preparing newsletters. The workshop included graphic design techniques, good writing practices and layout design.

The week ended with a barbeque at Shuman Park near the UMR Campus to which all parents and students were in-



Working hard on their newsletters, from left to right:
Jennifer Goodloe, Aaron Whittington, Russell Anhalt, Sonia Brison, Carla Minter and Randal Falker.



Cathleen Hill and Mom -
"I didn't do it Mom!"



Danielle Perkins with Mom
and little brother. Coach
Knapp hard at work
preparing our meal.

Waiting eagerly for Chefs Spring
and Knapp to prepare their meal are,
from left to right: Aaron Whittington
(sitting), Joshua Morgan, Ms. Flagg,
Candice Houston, Joshua's Dad and
Grandmother.



THE PICNIC PHOTOS

Jennifer Goodloe and
Celeste Grayer
sharing their first
week's experiences



Mr. Hill, Carla Minter,
Cathleen Hill and Randal
Falker prepare to chow
down.



HIGHWAY TRANSPORTATION

The week was introduced by a half day session about highway engineering. Dr. Spring, as an introduction to the session, provided an overview of civil engineering and transportation and led a brief open discussion on these topics. Mr. Randy Mayo, District Engineer of MODOT, provided an overview of the road construction process - from planning to design to construction. He led a discussion of the primary issues involved in the process.



Plan of proposed construction project in Rolla used by Mr. Mayo to illustrate the construction process.

Dr. Tony Nanni, Director of the Center for Infrastructure Engineering Studies, described work that he is doing involving the design and construction of bridges using smart materials. He shared a slide show of a Missouri Bridge on which he installed sensors just prior to its destruction.



Dr. Nanni describing the demolition of a bridge

Highway week included sessions on intelligent transportation systems, geographic information systems, bridge building and the use of the internet, field trips to MODOT and FHWA headquarters in Jefferson City, a large steel manufacturer, a traffic operations center, a sign fabrication facility, and a large road construction project. Dr. Spring explained through the use of videos the many applications of ITS followed by an extended open discussion with the students regarding its potential in improving efficiency, safety and sustainability. Following the work-



Springfield TOC engineer explains the use of machine vision for traffic control to, from left to right: Russell, Randal and Neal

shop, the group traveled to the Springfield, MO, traffic operations center. Students were given a description and tour of the facility, and were



A good time had by all, from left: Angel, Danielle, Celeste, Sonia, Maurice, Carla, Russell, Nate, Candice, Neal, Jennifer and Dominic

allowed to manipulate traffic cameras in the center.

A trip to the more mundane MODOT sign shop was a high point of the day. Students

were given a tour of the shop by Mr. Tom Ryan.



Tom Ryan explains the uses of changeable message signs



Jennifer and Randal were shocked at at the size of these signs



Candice & Joshua couldn't believe this lense costs \$300.

Dr. Spring gave a half day workshop on the applications of geographic information systems for transportation. Students were



Dr. Spring with the Group in the GIS Lab

provided with tutorials designed to train them to use a popular GIS software (MapInfo). They were then given several simple queries to do relating to land use and were asked several questions on how GIS relates to transportation. Dr. Spring also led an interactive exercise on the use of mathematical models for transportation design problems. This session provided background for a half day workshop on the design of bridges using an interactive structural design software put on by volunteers from the MODOT TRAC (TRANSPORTATION and Civil engineering)



TRAC instructors with the Group

program (TRAC is an American Association of State Highway and Transportation Officials program which engages high school students in the application of science and math to real-world transportation problems). Students were able to choose bridge type, and materials and members

to be used. The software simulated the loading process and students were able to see in real time the consequences of their choices and exactly

the bridge design laboratory. After lunch, also provided by MODOT, MODOT gave a tour of



A successful design!



MODOT Materials Testing Lab

which choices were bad and why. Additionally, students were assigned a scavenger hunt on the internet to gather answers to a variety of highway related questions, and a materials estimating example for homework. See Appendix 6 for sample homework assignments.

its research laboratories at which demonstrations were conducted such as materials testing, the

MODOT hosted a tour of Delong Steel Corp. during which students were provided an



MODOT Lab Tech explaining the failure process of concrete



Mr. Lawrence Cook of Delong Steel explains the fabrication process

in-depth look at the steel fabrication process. This was especially valuable given subsequent trips to various bridge construction projects and

chemistry of paint and so on.

Mr. Allen Masuda, FHWA Division Administrator, provided an excellent overview of transportation in the US, and led a lively discussion with the students on current issues.

The week ended with a field trip to the multi-million dollar Route 141 highway construction project in St. Louis. The highway is unique in that there are sections of the project

which have not yet been constructed, some that



Neal Hopson getting his hands dirty with asphalt concrete



The Group examining an excavator up close and personal



STI Students showing off



Concrete paving operation in progress



Allen Masuda explaining FHWA's role in highway transportation



Mr. Ethan Bryant of MODOT explaining the excavation process

are currently under construction, and some that are complete. It includes several million dollars in right of way takings, huge earthwork quantities - thus using scrapers for excavation activities, and some very unique bridge work.

MODOT personnel provided a comprehensive tour of the project and fielded questions from the students.



Ms. Wanda Jackson, MODOT design engineer, explaining the relationship of design to construction

PUBLIC TRANSPORTATION

The week began, once again, with an introduction to public transportation - a description of the various modes and a discussion of the major issues involved in planning, designing and operating public transportation facilities. Mr. Mel Sundermeyer and Mr. Brian Weiler, both of MODOT, provided excellent presentations on these topics which were followed by some very lively discussions with the students. They were especially interested in air transportation and

Professors Koechling-Andrae and Westergaard of Lincoln University's Business School hosted the group for a day long series of seminars



Mel Sundermeyer, Director of MODOT's Intermodal Operations Unit



Mr. Lieber graciously providing lunch at a St. Louis eatery

concerning marketing and management issues. The following day, Mr. Arthur Lieber, Director of Civitas, gave a multimedia presentation on mass transit in the US which included an histori-

how it works.

The week consisted of a series of field trips to various public transportation facilities.



The Scavenger Hunt begins



Arthur Lieber at the Plaza

cal overview of transit in the US and in St. Louis, a description of transit issues such as economic impacts of transit on communities, discussions of how transit affects the economy and vice versa, and a description of the St. Louis MetroLink past, present and future. After lunch, provided by Mr. Lieber at a local restaurant, students were treated to a scavenger hunt along

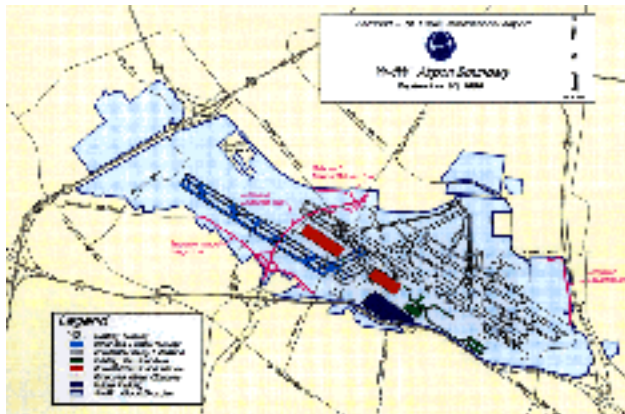
the route from the restaurant to the Metro station, followed by a free ride on the MetroLink to the



Mr. Lieber explains the impacts of MetroLink on the Urban landscape

airport.

At the airport the group reconvened at the



Lambert Expansion Project

Lambert Operations facility where Mr. ?? described the Lambert Expansion Project to take place over the next 10 years. Students were especially interested in the amount of money and time required for such a project. Subsequent trips to the airport involved a tour of the Airport proper and of its Operations Center by Ms. Nancy Benson during which she discussed career opportunities, the functions of the Center as well as pointing out items of historical interest, such as the Black Americans in Flight mural and Lindbergh's airplane; and tours of the air traffic and ground traffic control centers.

Mr. Steve Lang at the air traffic control center brought the group through their radar facility and allowed students to listen in on conversations between controllers and pilots. Mr. Greg Barrett brought the group up to the control tower and explained the process by which traffic is controlled in near air



The Lindbergh Plane on the tour

space and on the ground. Mr. ?? of Burns and McDonnell hosted the group for lunch and described several of that firm's current projects.



"Black Americans in Flight"

The week ended with a tour of St. Louis's public transit facilities.

Students, once again, rode on the MetroLink to a tour bus specifically meant for transporting them to the bus maintenance facility where they received a wealth of information about how buses are maintained and associated problems.



Mr. Delester Jefferson giving a very entertaining and informative tour of the Bi-State Bus Maintenance facility

INTERMODAL TRANSPORTATION

The speakers scheduled for the introductory lecture for this last week were unexpectedly unable to attend. Students were therefore given additional time to prepare newsletters and final presentations.

The remainder of the week focused on a variety of things crucial to intermodalism in Missouri. Ms. Gabrielle Mack of Sverdrup arranged for a series of activities at Sverdrup headquarters that were thoroughly enjoyable and enlightening for the students. The day began with some group design exercises, followed by demonstrations of



Contenders for 1st place structure



Ms. Christina Streddo, transportation engineer for Sverdrup describes the geometric design process

traffic simulations, planning projects and CAD-based simulations of the earthquake design of the Alton Lock and Dam Number 27. After a lunch provided by Sverdrup during which Mr. Robert Crowley, a principal in the Firm, gave an overview of how Locks work, the group was given a tour of Lock and Dam Number 27 on the Mississippi River. US Army Corps of Engineers personnel provided a lively tour of the facility beginning with a slide show which gave a his-



Joshua Morgan reviews a conceptual design plan

tory of the Dam and the need for Locks along the River and ending with a visit to the Lock's



Mr. Robert Victor, Bridge Design Engineer for Sverdrup, explains the design of locks and dams under earthquake conditions using CAD-based simulations



Maurice and Neal observing the lock in operation

control tower.

The following day, MODOT's TRAC people returned for a day long workshop dedicated to designing, building and testing working



Tim Fisher and Candice Houston intent on their design



Neal Hopson tests his group's design as teammates Danielle Perkins and Jennifer Goodloe look on

models of MAGLEV trains.

The final "work" day of the Program was spent at Lincoln University. The morning was a visit to two additional construction projects- a bridge project and a road excavation project. MODOT's personnel (the projects' designer and resident engineer) described the projects first then brought the group out to each. Students were able to walk out on a half constructed bridge deck - reinforcing information gained from previous weeks, and to observe a fairly substantial explosion during a ledge excavation



The Group with MAGLEV instructor Ms. Stacia Patterson

operation at the road project. During the afternoon Professors Koechling-Andrae and Westergaard led a brief search of the internet meant to gather some information for a planned class exercise on transportation logistics. As Professor Westergaard described a simple example of the simplex method for finding optimal solutions to the transportation distribution problem, one of the students, who had been up to that point a marginal participant showing little interest in anything substantive, popped off answers as though he were on Jeopardy. He was the only one in the room who "got it." This was a defining moment for him and satisfying, in the extreme, for the STI faculty present. To experience that rare "sudden light of understanding" in a student's eyes is the reason many faculty enter academe.

CLOSING CEREMONY

The week ended with the closing luncheon to which all parents, students, faculty, staff, advisory committee members and dignitaries were invited. The Program began after lunch with welcoming comments from Gary Spring, STI Director, Jerry Bayless, Associate Dean of Engineering, on behalf of the University, Allen Masuda, Missouri Divi-



Dr. Spring



Dean Bayless

sion Administrator, on behalf of FHWA and Carol Hurt, Human Resources, for MODOT. Each speaker urged the students to use the information they have gained from and their experiences during the Institute in positive ways.

Their comments were followed by a presentation by the students - first a comedic skit followed by a more serious



Mr. Masuda

slide presentation of their four weeks here. This was their opportunity to share with their parents their experiences at the Institute.



Ms. Hurt

Certificates of completion were given to all attendees who successfully completed the four weeks and special commemorative plaques were awarded for the following:

- ◆ Newsletter for best writing, best aesthetics and outstanding reporting in a Newsletter. The Newsletters were used as the primary means by which students reported what they had learned during their four weeks.
- ◆ Scholarship for an unflagging, assiduous quest for knowledge during the 1999 USDOT Summer Transportation Institute - to Ms. Jennifer Goodloe. Criteria used for this award included quality of homework, attitude during activities, number and quality of questions asked.
- ◆ Citizenship for exemplary behaviour, demonstrated leadership and cooperation during the 1999 USDOT Summer Transportation Institute - to Russell Anhalt. Mr. Anhalt was always punctual, taking on leadership roles in his groups, studious and cooperative with both instructors and his fellow students.

Closing comments by Dr. Spring included expressions of appreciation to the STI sponsors, Advisory Committee and staff. He gave a special thanks to parents for taking the initiative to involve their children in the STI , and appealed to the students to use their experiences at the Institute when making career decisions and to keep in contact with him as they proceed in making their decisions. The luncheon adjourned at 3:00 PM.



The "boys" doing their skit about "life in the STI Classroom". Tim Fisher, far right, did an excellent imitation of Dr. Spring in the classroom



The "girls" used a slide show, containing over 60 slides, to describe their experiences over the past four weeks.



Students, from left, receiving their "Best Newsletter" Award are: Neal Hopson, Sonia Brison, Nate Hopson, Randal Falker and Russell Anhalt (editor-in-chief)



A final shot of the little darlin's with staff. From left: Celeste Grayer, Cathleen Hill, Joshua Morgan, Tim Fisher, Jennifer Goodloe, Candice Houston, Mrs. Flag, Neal Hopson (and brother Nate, kneeling), Dr. Spring, Dominic Harris, Aaron Whittington, Randal Falker, Russell Anhalt and Maurice Gibson



Jennifer Goodloe receives the Scholarship Award from Mrs. Flag



Russell Anhalt receives the Citizenship Award

ENHANCEMENT PROGRAM

The Gateway Alumni Chapter of the National Society of Black Engineers(NSBE) assumed an important role in the success of the First Annual Summer Transportation Institute at the University of Missouri-Rolla. Before the STI began concerned members helped recruit more than half of the students who attended.

The NSBE members felt very strongly that the STI young people should meet African American engineers and engineering students. During a cookout dinner that NSBE sponsored at The Cornerstone Partnership in St. Louis STI students were introduced to members of both the Alumni and Junior NSBE groups. A video on the work of Dr. George Washington Carver emphasized his genius, inventions and sheer dedication.

After the meal the STI students were taken on a tour of The Cornerstone Partnership facilities by Glenn Harris, the manager of recruitment and placement. Persons are trained at Cornerstone to participate in high-technology manufacturing in tasks ranging from designing in CAD to high precision machining of parts in a well equipped machine shop. During the tour Mr. Harris stressed the necessity of developing the traits required for successful employment.

These traits included punctuality, self-motivation, dependability, self discipline, self respect, adequate training and education. Posters on the walls at Cornerstone reinforce these positive traits.

Reinforcement of positive traits was woven into the fabric of the STI on many occasions. The classroom we used at Lincoln University displayed the following quotation:

“When declaring your rights, don’t forget your responsibilities”

The evening program exposed the STI students to a variety of activities that may not be experienced on a regular basis by inner city youth. They attended a small town fair/carnival that is held at the Rolla Lions Club Park annually the week of July 4. The evening staff took them to Lane Springs which is an area that local young people frequent to wade and play in the water.

The dress culture ranged from wearing protective eyeglasses and transportation safety vests in the field when necessary to daily school clothes to one dressy affair. It was planned that all students would dress up for the STI closing luncheon. The variety of clothing worn is somewhat symbolic of the range of experiences afforded the STI students at UM-Rolla.

APPENDICES

- Appendix 1. Application Package
- Appendix 2. Opening Ceremony Agenda
- Appendix 3. Student Handbook
- Appendix 4. Curriculum Description
 - a. Summary
 - b. Details
- Appendix 5. Sample Class Handouts
- Appendix 6. Sample Homework Assignments
- Appendix 7. Closing Program
- Appendix 8. Sample Newsletters
- Appendix 9. List of Participants
- Appendix 10. List of Sponsors
- Appendix 11. Demographic Summary Sheet
- Appendix 12. Evaluation Summary