2009 SUMMER TRANSPORTATION INSTITUTE

FHWA/MT-09-007/6439-901

Final Report

prepared for
THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

in cooperation with
THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

September 2009

prepared by
Susan Gallagher

Western Transportation Institute
Montana State University - Bozeman

RESEARCH PROGRAMS

MDT

2009 SUMMER TRANSPORTATION INSTITUTE

Final Project Report

by

Susan Gallagher

of the

Western Transportation Institute
College of Engineering
Montana State University – Bozeman

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16. Abstract The Western Transportation Institute hosted a two-week residential Summer Transportation Institute for sixteen high school students on the Montana State University campus from June 14 to June 26, 2009. Participants included Montana residents, one student from California, one from New Mexico, and one from Indiana. The students ranged from rising tenth to rising twelfth graders. They participated in a comprehensive academic program that introduced them to various modes of transportation and highlighted transportation safety issues. Team design-build activities encouraged leadership and problem-solving skills. Students learned about college and career opportunities in the transportation field. The STI enhancement program promoted career and college survival skills and encouraged sportsmanship and collegiality among the STI cohort.			
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EXECUTIVE SUMMARY

The Western Transportation Institute at Montana State University in Bozeman, Montana hosted a Summer Transportation Institute (STI) for sixteen secondary school students from June 14 to June 26, 2009. Susan Gallagher, Education Program Coordinator at the Western Transportation Institute, served as Project Director for the STI. Montana has one congressional district. The STI recruited rising tenth, eleventh, and twelfth grade students from a mix of backgrounds and hometowns. The residential program hosted participants from eight different Montana towns and three out-of-state participants (representing California, New Mexico, and Indiana). Students lived on MSU campus while learning about career opportunities in transportation. The two-week program provided a comprehensive academic program, which included guest speaker presentations, field work, hands-on laboratories, and field trips. Students learned about all modes of transportation and gained leadership skills while working on team design-build projects. Highlights included a field trip to the Montana Department of Transportation headquarters in Helena and thirty minute discovery flights with flight school instructors from Summit Aviation. In addition, the participants learned about college preparation and career planning. During the evenings and weekend, STI students participated in educational, sports, and team-building activities.

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1 INTRODUCTION

The Summer Transportation Institute (STI) hosted by the Western Transportation Institute at Montana State University serves to attract high school students to participate in an innovative summer educational program in transportation. The STI aims to address the nation's need for a diverse pool of transportation professionals capable of developing creative long-term solutions to a growing host of complex and intermodal transportation issues. In order to meet this goal, the STI serves to heighten pre-college student interest in transportation careers and to enhance the necessary skills of students from diverse backgrounds to achieve careers in the transportation field.

The objectives of the STI are to:

- Increase students' awareness of the significance of transportation in their daily lives;
- Expose high school students to the variety of transportation careers available and demonstrate how transportation professionals work to identify and solve real-world issues that have society-wide impacts;
- Increase students' understanding of the importance and need for creative and innovative transportation solutions;
- Improve students' analytical skills and problem-solving skills;
- Develop communication, collaboration, and leadership skills;
- Increase student awareness of the importance of cultural diversity; and
- Bolster student confidence by improving academic skills and by providing college and career guidance.

To meet these objectives, the 2009 STI provided a well-balanced curriculum that included a comprehensive academic program, field trips and site visits, guest speakers, a career and college counseling component, and team-building activities. The participants were able to evaluate all aspects of the program through evaluation surveys. Results from evaluations are included in the *Evaluations* portion of this report.

The curriculum, guest speaker presentations, hands-on team activities, field trips, enhancement program, and evening/weekend program were all designed to meet core outcomes for the STI host site. Core outcomes included the ability to:

- Apply analytical skills to basic transportation problems;
- Identify career opportunities in transportation;
- Explain topics in the core areas of surface transportation, aviation, and safety;
- Understand steps necessary to enter college;
- Describe continuing transportation-related educational opportunities;
- Work in teams;
- Understand the principles of effective leadership;
- Develop and use employability tools; and
- Recognize and appreciate the value of diversity in the workforce.

Detailed information on the curriculum and enhancement activities is provided in Section 6 and Appendix B.

2 INTERMODAL ADVISORY BOARD

An Intermodal Advisory Board (IAB) for the STI program is made up of representatives from government, industry, and academia. The role of the IAB is to assist the STI in securing program funds, developing a well-balanced curriculum, planning activities and field trips, obtaining technical expertise, and conducting strategic planning. Members of the 2009 IAB are listed below in Table 1.

Table 1: Intermodal Advisory Board Members

Name	Contact & Affiliation
Susan Gallagher Education Program Coordinator STI Project Director	Western Transportation Institute Montana State University PO Box 174250 Bozeman, MT 59717-4250 Phone: 406-994-6559
Danielle Scharf, PE, PTEO, LEED AP Associate/Senior Engineer	Sanderson Stewart 705 Osterman Drive, Suite F Bozeman, MT 59715 Phone 406-522-9876 dscharf@sandersonstewart.com
Lloyd Rue Safety/Traffic/Design Engineer	Federal Highway Administration Montana Division 2880 Skyway Drive Helena, MT 59602 Phone: 406-449-5302 x232
Dr. Ahmed Al-Kaisy Associate Professor	Department of Civil Engineering Montana State University Cobleigh Hall 230 Bozeman, MT 59717 Phone: 406-994-6116
Scott Keller Design Supervisor & Adjunct Instructor	Montana Department of Transportation Design Unit Montana State University Cobleigh Hall 204 Bozeman, MT 59717 Phone: 406-994-1843
Sue Sillick MDT Research Programs Manager	Montana Department of Transportation Research Section 2701 Prospect Avenue Helena, Montana 59620-1001 Phone: 406-444-7693

The IAB met together with the Montana Department of Transportation (MDT) Technical Panel on May 11, 2009 to discuss the program. The meeting began with an overview of what had been accomplished to date. At the time of the IAB meeting, there were 18 confirmed participants for the STI (11 males and 7 females). Three requests had been received for need-based travel support to and from MSU campus. A draft schedule of activities was compiled and all STI staff had been hired. Feedback from IAB members was then solicited regarding the proposed curriculum and field trips, technical and human resource support, financial support, and partnership building. Appendix A provides minutes from the IAB meeting.

IAB members from the Montana Department of Transportation contributed a three-hour presentation and tour of their headquarters in Helena for participants. The MDT Design Unit at Montana State University also hosted a barbecue in Bozeman for STI students, undergraduate MDT interns, and undergraduate research assistants.

3 PARTNERS/SPONSORS

A number of university departments and personnel provided in-kind support to the STI program. The Department of Civil Engineering provided access to classrooms, laboratories and laboratory equipment, and the Tait Computer Laboratory. The Western Transportation Institute (WTI) provided usage of the Driving Simulation Lab, Transportation Research Applications and Instrumentation Laboratory - TRAIL (traffic operations/management), and Materials Laboratories, as well as use of its classroom and A/V equipment for classroom activities. The Montana Department of Transportation provided staff time during several activities. In addition, MDT developed a promotional video about the program for distribution to schools and to post on project websites. Private sponsors also contributed to the program. Summit Aviation provided a number of "discovery flights" for students in its training Cessna aircraft and a tour of its facilities at the airport. The Montana Institute of Transportation Engineers (ITE) Chapter contributed $200 to the program to cover travel costs for students with financial need. Cost share for the 2009 program is estimated to total $7,200.

4 PROGRAM FACULTY AND STAFF

In addition to the Project Director, a full-time Academic Program Coordinator and a full-time Teaching Assistant were hired for the duration of the 2009 STI. The Academic Program Coordinator, Larry Lucero, is a high school teacher and administrator from Harrison Public Schools. The Teaching Assistant, Andy Creighton, is a current MSU undergraduate in Chemical Engineering and a WTI research assistant in the Corrosion and Sustainable Infrastructure Laboratory. Teaching staff were responsible for assisting with the development of classroom and hands-on activities that demonstrated the scientific process in transportation-related applications, leading classroom activities, and assisting guest instructors with classroom management.

Two Residence Hall/Recreation Program Advisors were hired to supervise students during weekends and evenings and to plan and lead leadership and team-building activities. Jared Hall (male resident advisor) is a current undergraduate in Civil Engineering at MSU. Amanda Menge-Tebay (female resident advisor) is currently Resident Director for a residence hall at MSU during the academic year.

A number of full-time research staff from the Western Transportation Institute as well as faculty from the Civil and Industrial Engineering Departments and staff from MSU administrative offices contributed to the development of the STI curriculum. The academic staff designed and conducted various modules covering different transportation topics and modes. Modules included instruction and hands-on activities. Administrative staff developed enhancement modules on career and college preparation. Teaching staff are listed in Table 2 below.

Table 2: STI Teaching Staff

Name/Affiliation	Specialty Area	STI Curriculum Component
Mike Berry, Assistant Professor, Civil Engineering	Infrastructure Design and Materials	Concrete design and testing
Laura Stanley, Assistant Professor, Industrial Engineering	Human Factors; Driving Simulator; Safety	Safety/Human Factors/Driving Simulation Lab tour
Suzy Lassacher, WTI Research Scientist	TRAIL lab	TRAIL lab tour
Angela Kociolek, WTI Research Ecologist	Road Ecology	Road Ecology; Animal Detection Systems and Data Collection
Jerry Stephens, Professor, Civil Engineering	Structures/ Commercial Vehicle Operations	Bridges and Commercial Vehicle Operations
Robert Mokwa Associate Professor, Civil Engineering	Geotechnical Engineering	Soils
Tiffany Rochelle Graduate Research Assistant, Civil Engineering	Transportation Engineering	Transportation Planning; SimCity
Scott Keller Supervisor, MDT Design Unit	Geometric Design	Wetlands and MDT field trip
Brett Gunnink Department Head, Civil Engineering	Materials	Introduction to degrees & careers in Civil & Construction Engineering
Ahmed Al-Kaisy Associate Professor, Civil Engineering	Transportation Engineering	Traffic Engineering; Traffic Simulation and Speed Analysis
Tyler Cegler Admissions & New Student Services	College Recruitment	College Entrance & Preparation session
Erin McCormick Counselor, Career Services	Career Planning	Strong Interest Inventory and Career Planning session
Jaydeep Chaudhari WTI Research Associate	Transportation planning	Alternative transportation; transit
Rebecca Gleason WTI Research Associate	Transportation planning	Alternative transportation; biking
Matt Blank WTI Research Associate	Road Ecology	Fish Passage through culverts and hydrology
David Kack WTI Program Manager	Public Transportation and Mobility	Aviation

5 2009 PARTICIPANTS

Posters, announcements, and applications about the program were sent in February 2009 to principals, guidance counselors, and math and science teachers at Montana high schools. Information was additionally distributed via the WTI website, MDT, and the Montana ITE Chapter. Tribal schools and program coordinators from programs that serve Native American students and other underrepresented or underserved groups including Upward Bound, Gear Up, and Talent Search also received STI information. Students entering the 10^{th}, 11^{th}, or 12^{th} grade

were encouraged to apply for the program. Nineteen applications were received. Selection letters were sent out to applicants together with detailed information about the planned STI and scheduled parent/student orientation session. Several forms were also enclosed in the information packet, which included a student/parent agreement, certificate of health, housing regulations, permission to tape or photograph form, permission to allow Internet research, and permission to use data. Eighteen of the accepted applicants initially confirmed attendance and returned the requisite permission forms and requested information. Two of the selected applicants later declined to attend the STI because they received opportunities to participate in alternative camps more aligned with their academic and career interests. The sixteen participants all received a full scholarship to attend the program. The scholarship covered all room and board expenses for the two-week program as well as any laboratory or student fees and field trip expenses. Two students with financial need received travel assistance to attend the program. A demographic summary of 2009 STI participants is provided in Table 3.

Table 3: Demographic Summary

	Number of Participants
Ethnic Background	
Hispanic	1
African American	0
Native American	0
White/Non-Hispanic	15
Gender	
Male	10
Female	6
Geographic representation	
Number of Cities	11

6 ACADEMIC PROGRAM

The 2009 Summer Transportation Institute at MSU involved students in a comprehensive academic program that introduced STI participants to various modes of transportation and highlighted transportation safety concerns. Students received instruction and participated in hands-on activities related to traffic engineering, infrastructure design and maintenance, road ecology, urban planning, and human factors. STI participants visited the Montana Department of Transportation headquarters in Helena where they received a first-hand view of how transportation professionals contribute to transportation operations.

In addition to classroom activities, students participated in a number of team design/build projects, including a boat building, a glider, a soil retaining wall, and a balsa wood bridge competition. Students gained experience in teamwork and learned leadership skills through these projects.

Various components of the academic program are outlined in detail below, and a daily schedule is provided in Appendix B.

Road Ecology

Angela Kociolek, Ecologist at the Western Transportation Institute, discussed green transportation systems with STI participants. She introduced basic concepts in ecology and how they relate to the way the transportation system interacts with its surrounding environment. The group discussed the impacts that transportation systems have on the environment and what can be done to mitigate the negative effects. The students then learned about specific mitigation measures in use to protect wildlife and travelers from animal-vehicle collisions, which include highway fencing, overpasses, underpasses, and driver warning systems. The students viewed a demonstration of an animal-detection system and then went out into the field to test a GPS unit designed for roadkill data collection.

Matt Blank, Research Associate at the Western Transportation Institute, introduced issues related to road stream crossings. He described how engineers study the hydrology of streams and of the culverts that pass under roads to determine whether culverts present barriers to the passage of fish. The impact that fish passage barriers may have on fish migration patterns and population viability were discussed. The students then learned how to measure flow in a nearby stream.

Urban Planning

Tiffany Rochelle, Graduate Research Assistant in Civil Engineering at MSU, discussed urban transportation planning and introduced the students to traffic simulation programs Synchro and TrafficSim. The participants used the software to redesign an intersection in Bozeman.

Students then experienced being urban planners using the computer game SimCity. The students were asked to design a workable city transportation infrastructure without bankrupting the treasury.

Traffic Engineering

Ahmed Al-Kaisy, Associate Professor of Civil Engineering at MSU, facilitated a number of activities designed to introduce students to the field of transportation engineering. Through classroom presentations, students learned about the purpose of the road system, its users, various road classifications, and how roads relate to land use.

Students discussed the concept of carrying capacity and issues of congestion and explored the impact speeds had on congestion. They collected speed data in the field using a radar gun, entered the data into Excel in order to obtain mean speeds, and then populated a traffic simulation model with this data. By manipulating the speed data in the simulation software, they could compare how different speeds impacted road capacity and congestion. The combination of classroom, computer, and field exercises provided the students with a robust overview of traffic engineering concepts.

The students also tested out a Mirror Game, designed to develop route decision-making skills in a simulated environment. The game was designed and facilitated by members of the MSU Institute of Transportation Engineers (ITE) Student Chapter.

Suzy Lassacher, WTI Research Associate, demonstrated how a traffic management center could be used to monitor and improve traffic flow issues in small urban communities during a demonstration of the WTI Traffic Management Lab.

Geotechnical Engineering

Robert Mokwa, Associate Professor of Civil Engineering, introduced STI participants to the field of geotechnical engineering. After learning basic concepts, various soil properties were physically demonstrated. The importance of soils as foundations for structures, including roadways, was emphasized.

Students demonstrated their acquired knowledge of soil properties in a laboratory competition. Student teams designed and built small scale, reinforced soil retaining walls. The walls were subjected to increasing loads until they collapsed.

Concrete

STI participants were introduced to concrete, a frequently used material for construction of transportation infrastructure. They learned about the various components that make up concrete and concepts behind concrete mix design. The students then made trial concrete batches in the laboratory using different mix designs. Samples were cast and cured from each trial batch for material property testing. Equivalent samples that had been previously cast and cured were then subjected to material property testing using compression equipment in the lab. The compression tests demonstrated the differences in concrete strength that resulted from different design mixes. Mike Berry, Assistant Professor of Civil Engineering, facilitated these activities.

Bridge Design

Civil Engineering Professor Jerry Stephens introduced students to bridge design and demonstrated a number of basic mechanics principles using foam, balsa wood, and reinforced and unreinforced concrete beams. Once students were comfortable with bridge design concepts, they formed two-person teams for a design/build challenge. Each team was charged with designing and building a small scale, balsa wood truss bridge (see Figure 1). The activity was facilitated by the STI teaching staff, which first reviewed the various forces acting on a bridge and then demonstrated typical failures using several pre-built models. Each design team then brainstormed various design ideas, ultimately selecting one idea to pursue. They then sketched plan and elevation views of their chosen design. Once complete, they carefully drew their design to scale, and used this drawing as a guide in constructing their bridge. Each team received an identical kit of materials for their bridge construction, which included balsa wood pieces, glue, stick pins, wax paper, masking tape, ruler, and cutting knife.

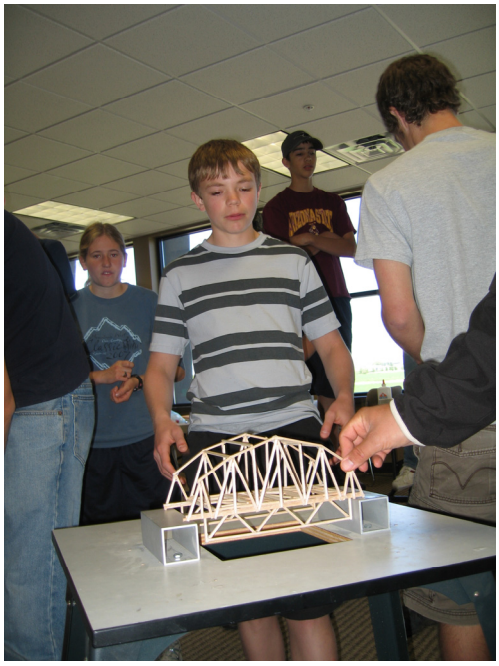

Figure 1: Balsa Bridge Competition

A formal competition was held between the student teams when the bridges were completed. Each team presented their design and described how much weight they expected their bridge would hold and where they thought their bridge would fail. Each bridge was weighed prior to testing. The bridges were then supported at each end and loaded in the center using a bucket that was incrementally filled with water until the bridge failed. The efficiency of the bridge was determined based on how much weight the bridge held and how much the bridge itself weighed. Awards were given based on efficiency, aesthetics, and craftsmanship.

Aviation

David Kack, Research Associate at the Western Transportation Institute and licensed pilot, introduced students to aviation careers and airline regulation. The students visited the Gallatin Field Airport and toured a number of its facilities. They spoke to professionals in security, fire and rescue operations, and airplane maintenance and examined a variety of aircraft and gliders. The students met flight instructors at Summit Aviation, viewed the school's state-of-the-art flight simulator, and were treated to a thirty-minute "discovery flight" in the school's small training aircraft. While at the airport, they had the fortuitous opportunity to speak to military pilots who had arrived with Black Hawk helicopters and consented to show the students these aircraft and talk to them about the technology.

As part of the aviation module, students also participated in a hands-on glider design/build exercise. Working in teams of two, gliders were designed and built based on knowledge gained during flight trials that experimented with wing placement and nose weight. Final glider designs were reviewed and tested in a competition. Awards were given for aesthetics and engineering

Traffic Safety and Human Factors

Human responses to roadway signage, traffic, and driving environment are a key element in safety, and students were introduced to human factors research as a critical component of traffic safety studies. They learned how researchers use driving simulation laboratories to safely conduct human factors research, and they "drove" WTI's state-of-the-art driving simulator. Industrial Engineering Assistant Professor Laura Stanley facilitated these activities.

Alternative Modes of Transportation

WTI Research Associates Jaydeep Chaudhari and Rebecca Gleason gave a presentation on alternative modes of transportation, focusing on transit and biking. They discussed what some urban communities are doing to promote biking and transit ridership. The students were able to ask questions as they rode the Streamline bus from the university to downtown Bozeman.

Andy Creighton provided a presentation on alternative fuels and demonstrated how fuel cells work using a model car.

Field Trips

Field trips supplemented classroom and laboratory activities, providing students with an opportunity to meet and speak with practicing transportation professionals. The two field trips made during the 2009 program are described below.

Gallatin Field Airport

STI participants toured airport fire and rescue, the airport terminal and baggage claim area, aircraft maintenance operations, and Summit Aviation flight school during a field trip to the airport (described above as part of the aviation module).

Montana Department of Transportation

STI participants visited MDT headquarters in Helena, Montana. MDT staff introduced the students to the variety of careers available at MDT and provided an overview of the history of transportation in Montana, including land and water transportation. STI students were treated to tours of both the photogrammetry unit and the CAD unit at MDT. The tour concluded with a question and answer session.

Gates of the Mountain

Following the tour of MDT, the students took a boat ride on the Missouri River through the Gates of the Mountains just north of Helena, MT. The ferry tour covered the history of water transportation on the Missouri, beginning with Lewis and Clark's historic journey. The guide described the natural history of this region and covered major historic events in the area.

Guest Speakers

Scott Keller, from the Montana Department of Transportation Design Unit, introduced students to the concept of conservation banking and presented a wetlands mitigation project that the MDT Design Unit is conducting with assistance from undergraduate student interns. Jerry Stephens, with the Civil Engineering Department at MSU, discussed commercial vehicle operations during a presentation to STI participants.

Enhancement Program

The enhancement program was designed to prepare students for college and to promote career self-awareness.

College Preparation

Tyler Cegler from the MSU Admissions Office spoke with STI participants about college entrance exams, college preparatory coursework, choosing an academic major, obtaining financial aid, and academic support services available for college students.

Brett Gunnink, Civil Engineering Department Head, provided an overview to STI participants on the different subfields within Civil and Construction Engineering that relate to transportation. He outlined the required coursework and high school courses that would be especially helpful for students interested in enrolling in an engineering program. He also provided information about careers available in the field of civil engineering.

STI participants also interacted with current college students to gain a better understanding of college life. MDT hosted a barbecue for STI participants and undergraduate student interns from the Montana Department of Transportation's on-campus Design Unit and the Western Transportation Institute.

Career Awareness

STI students participated in a number of workshops designed to enhance their career awareness and employability skills. First, students took the on-line "Strong Interest Inventory," a test designed to highlight a person's strengths and interests in relation to potential career fields. Erin McCormick from the MSU Career Services Office met with students to distribute and discuss the results of the Strong Interest Inventory and to help students put the information into context. She outlined some steps students could take to narrow their career choices and provided some basic career statistics. She also helped students to understand the importance of developing a good resume and honing their interviewing skills.

Evening/Weekend Program

The objectives of planned weekend and evening activities were to provide students additional experience working in teams and to promote a spirit of collegiality and good sportsmanship among the STI participants. Each evening, the Resident Advisors (RAs) organized ice-breakers, team-building activities, and team sports (see Figure 2). Activities were varied to cater to the variety of interests within the group. Recreational activities and outings included a visit to the Bogart Farmers Market, a hike to Grotto Falls in Hyalite, a hike up the M in the Bridger Mountains, an outing to the Gallatin Recreation Area to swim and walk. Indoor activities included movies in the dorms and board games. Sports events included Ultimate Frisbee, volleyball and basketball games.

Figure 2: Ultimate Frisbee Match during MDT Picnic

Orientation and Closing Awards Program

STI participants arrived on campus on Sunday, June 14 and moved into their dormitory rooms with the assistance of the RAs and teaching staff. After the new arrivals were situated, an orientation was held for the students and parents. All staff members were introduced and an overview of planned STI activities provided. STI rules, regulations, and expectations were reviewed in detail as well as consequences for non-compliance. Both students and parents signed a contract indicating their understanding of these obligations. All permission forms previously mailed out in the information packet were collected and any questions and concerns addressed. The parents then departed and the students played a number of ice-breaker games before dinner.

The following day, students received an orientation to the academic program. The students took a pre-program survey and WTI Research Director, Jerry Stephens, provided an overview of the transportation field. Students also participated in a tour of the Montana State University campus.

Family members of STI participants as well as STI instructors, sponsors, and IAB members were invited to the STI Closing Ceremony held on June 26, 2009. The closing ceremony was completely planned by the STI students. They chose decorations for the room and organized the agenda. The participants prepared a musical slide show and presented in small teams on a topic covered during the STI. They designed posters and props to demonstrate activities and topics. Participants also presented STI instructors with certificates of appreciation. Each student received a certificate of completion from STI staff. Winning design teams received special recognition.

7 EVALUATIONS

7.1 Classroom Session Evaluations

STI students completed evaluations during the camp to provide program staff feedback on the curriculum and classroom activities. The classroom evaluations were used to gauge whether the students found the activities and instructors to be engaging and to elicit comments and suggestions for improvements. In addition to eliciting open-ended responses regarding each course module, students indicated their level of agreement with a specific statement on evaluation forms using the following scale:

5 = Strongly agree
4 = Agree
3 = Neutral
2 = Disagree
1 = Strongly Disagree

Average scores for agreement with statements on classroom activities are summarized in Table 4. Student responses were generally positive, with average scores ranging from 4.0 to 4.94.

Table 4: Student Classroom Evaluation Summary Scores

Statement	Concrete Design	Soils / Geotech	Driving Sim	Traffic Engineering	Fish Passage	Road Ecology	TRAIL Lab
The instructor was available when I had a question or needed assistance.	4.69	4.56	4.75	4.25	4.81	4.38	4.75
The instructor was friendly and considerate.	4.94	4.75	4.69	4.50	4.81	4.38	4.69
The instructor was enthusiastic and knowledgeable about program topics and activities.	4.75	4.63	4.75	4.19	4.63	4.44	4.50
The instructor encouraged students to strive for excellence in projects and activities.	4.94	4.56	4.44	4.25	4.50	4.19	4.19
The instructor explained assignments well and provided assistance when necessary.	4.63	4.19	4.56	4.25	4.50	4.0	4.31
The instructor treated everyone fairly.	4.88	4.69	4.75	4.69	4.88	4.38	4.63

Student comments reflected genuine interest in demonstrations of new transportation technologies. Regarding the tour of the driving simulator, students commented:

- *Very high tech. Loved it!*
- *It was so much fun! It amazed me that the entire simulation was made with Java and JavaScript. I know the languages personally, and seeing them perform at the heights of their potential in graphics was inspiring.*

Regarding the Road Ecology session, one student commented that "It was fun to use the GPS tracking system," and two other students especially enjoyed the Lego Mindstorm Animal Detection System demonstration. The TRAIL lab (traffic management center) demonstration also elicited interest in new technologies:

- *This was a really cool subject area. I think Lassacher could have showed us more of the videos/information on her computer but all the sensors and cameras were enjoyable.*

- *It was interesting to see the cameras that went up on the poles to watch the roads.*
- *It was interesting to see solar power used so efficiently and well.*

Student comments on classroom activities also revealed the importance of course instructors' enthusiasm for their topic. Students were apt to notice if the presenters did or did not convey special enthusiasm for their topic.

- *He could add a little more enthusiasm as it is his topic of choice.*
- *She was very enthusiastic about her job and was a lot of fun.*
- *His enthusiasm for his subject was encouraging. It presented his subject/job as enjoyable.*
- *The best professor to give presentation. Was enthusiastic and added humor. Enjoyable.*
- *He knew how to encourage us to enjoy his lesson. He showed passion for his subject.*

Topic areas outside students' conception of traditional transportation also drew participant comments. Students had the following to say about the Road Ecology and Fish Passage modules:

- *Interesting lecture. Not what a person might expect to hear at a transportation camp but after the lecture the relevance was very clear.*
- *I never realized how much work is put into an area like this. I learned a lot.*
- *Taught us a lot about environmental impacts of transportation.*
- *I never knew so much was put into road kill.*

7.2 Team Design-Build Project Evaluations

STI participants also evaluated the various team projects they worked on (see Table 5), which included the balsa wood bridge and the glider activity. All of the students agreed that the activities were well organized, challenging, and enjoyable. The participants enjoyed the creative design process and the majority felt that they gained some leadership and teamwork skills.

Table 5: Team Design-Build Project Evaluation

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
Activities were well organized.	*6	10		
I was challenged by the activities.	13	3		
Adequate time was allotted for the activities.	8	7	1	
I felt free to ask questions.	15	1		
I learned to work in a team better.	8	6	1	
I gained some leadership skills.	9	5	2	
I enjoyed the creative design process.	13	3		
I received adequate instruction.	9	7		
Competitions were fun and challenging.	13	3		
I enjoyed the glider project.	14	2		
I enjoyed the balsa wood bridge project.	15	1		

* Number of respondents. N=16

Student comments regarding what they enjoyed most about the balsa wood bridge competition included:

- *The process allowed for more creativity and improvisation.*
- *I loved the hands-on-ness.*
- *Breaking the bridges and seeing how strong they were.*
- *The craftsmanship required to complete the bridge was fun.*

Students enjoyed the team glider project because:

- *We were able to test and experiment with different designs.*
- *It took a lot of trials and attention to detail.*
- *I enjoyed testing the gliders and finding where the wings should be placed and the amount of clay on the nose.*
- *How the changes of wing position changes how it flies.*
- *Figuring out how to optimize the glider's flying capabilities.*

Comments regarding what students learned about working in teams included:

- *Compromise.*
- *It is important to value others' opinions.*
- *I learned that the team members should look at everyone's ideas before making a decision.*
- *Have something for everyone to do.*
- *You can't always have your way.*
- *Work together. No 'I' in team.*
- *Let people do what they are good at.*
- *More work gets done, better ideas.*

Suggestions for improvements to the design team activities included:

- *[Need] a better way to add weight to the bridges, the water and bucket idea didn't work.*
- *Maybe more time for gliders.*
- *A little more time to work on projects would have been nice.*
- *Have more weight available for the bridge testing.*
- *Give us more information on gliders and how they work best.*
- *Have pre-designated supplies and instructions on both.*

7.3 Field Trip Evaluations

The students were very positive about the field trip they took to the airport. The field trip consisted of tours of the hangars and airplane maintenance areas, fire and rescue operations, and the airport terminal. In addition, the students were able to speak to instructors at Summit Aviation, who explained the process of becoming a licensed pilot and took groups of three to four students up for 30-minute discovery flights in the school's training Cessna aircraft. All of the students "strongly agreed" that the flight was informative and enjoyable. The most common suggestion made in participant comments was for "more flight time." They also found it hard to wait for their turn to fly. As an unexpected bonus, a couple of National Guard military helicopters landed at the airport while the students were there, and they were treated to an impromptu tour, which they thoroughly enjoyed. Summary scores for the airport field trip evaluation are given in Table 6.

Table 6: Field Trip Evaluation Summary Scores - Gallatin Field Airport

Statement	Airport/Summit Aviation
The field trip was informative.	4.94
Field trip activities helped me understand transportation careers better than before.	4.88
Enough time was allotted for questions.	4.94
Enough time was spent at each site/point of interest.	4.75
The airport tour was informative.	4.94
The flight was informative and enjoyable.	5.0

Scale: 5=Strongly agree; 1= Strongly disagree

The field trip to the Montana Department of Transportation was also popular and informative. Aspects that students enjoyed most included:

- *The discussion of different transportation careers at the beginning of the tour.*
- *The administrators and director of MDT were very knowledgeable and explained things very clearly. The information they presented was very interesting.*
- *I enjoyed viewing the photogrammetry unit and seeing how the pictures are taken and used.*
- *I enjoyed the photogrammetry unit. It was interesting to see how they figured out the topography and made three-dimensional images.*

All of the participants agreed that the tour helped them understand transportation careers better than before, including the opportunities available at departments of transportation. Summary evaluation scores for the MDT tour are provided in Table 7.

Table 7: Field Trip Evaluation Summary Scores - MDT Headquarters, Helena

Statement	MDT Tour Summary score
The field trip was informative.	4.5
Field trip activities helped me understand transportation careers better than before.	4.38
Enough time was allotted for questions.	3.94
Enough time was spent at each site/point of interest.	3.5
The transportation historian presentation was interesting.	3.69
The CAD (Computer Aided Design) presentation and demonstration was interesting.	3.13
The photogrammetry unit presentation was interesting.	4.44
I understand more about careers available at departments of transportation.	4.38
The ferry trip was informative and enjoyable.	4.81

Scale: 5=Strongly agree; 1= Strongly disagree

7.4 STI Staff Evaluations

Evaluations of STI staff were also conducted. The Residence Hall Advisors received a lot of acclaim. The group unanimously "strongly agreed" that:

1. The RAs were available when I had a question or needed assistance.
2. The RA staff was friendly and considerate.
3. The RAs helped to build group atmosphere through team projects and games.
4. The RAs treated everyone fairly.

Participants also "strongly agreed" or "agreed" that:

1. The RA staff was very helpful when I had problems.
2. The RAs were enthusiastic.
3. The RAs planned fun recreational and sports activities that were inclusive.

Comments regarding RA staff included:

- *Both RAs helped us as teens to get comfortable enough to get to know the others.*
- *The RAs did a wonderful job keeping people busy with activities and such and helped bring everyone closer together.*
- *I had tons of fun and they were fun and inclusive.*
- *Amanda and Jared allowed us to decide the activities we wanted to do.*

Evaluations of the teaching staff were also uniformly positive. All sixteen students "strongly agreed" or "agreed" with the following evaluation criteria:

1. The staff was available when I had a question or needed assistance.
2. The staff was friendly and considerate.
3. The staff was enthusiastic and knowledgeable about program topics and activities.
4. The staff encouraged students to strive for excellence in camp projects and activities.
5. The staff explained assignments well and provided assistance when necessary.
6. The teaching staff treated everyone fairly.

Comments regarding teaching staff indicated that they made a positive impact on the students' overall experience at STI:

- *The staff was able to help us stay comfortable, they had fun things planned.*
- *The staff made things more enjoyable.*
- *These two individuals were a great pick for this position. They helped liven-up the day and make it more enjoyable.*
- *Kept the energy going.*

7.5 2009 STI Overall Program Evaluation

An end of program survey was administered to gauge how students' attitudes toward college preparatory courses, engineering, and MSU, may have been changed by the program. The survey also queried participants' program expectations and perceptions. Observations based on these survey results include:

1) More participants were interested in engineering as a degree choice after the STI than were interested prior to attending the STI;
2) More participants were interested in attending MSU for college following the STI than were interested prior to the STI;
3) Participants felt more knowledgeable about careers in transportation following the STI;
4) The students enjoyed the STI program and all but one participant would recommend the STI to other students.

A summary of the survey results is given in Table 8.

Table 8: End of Program Survey Summary

	Number of Responses (n=16)				
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
STI Participant Goals					
1. I was able to meet other students with interests similar to mine.	9	6	1		
2. I was able to design and build projects.	14	2			
3. I was able to learn more about careers in transportation.	12	4			

	Number of Responses (n=16)				
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
4. I had fun while attending STI.	13	3			
5. STI helped me prepare for college.	10	3	2	1	
6. I was able to learn more about engineering.	9	6	1		
7. I would recommend the STI to other students.	12	3		1	
8. I was able to learn more about Montana State University.	10	6			
9. Before the STI, I was interested in majoring in engineering.	6	2	5	3	
10. After the STI I would consider majoring in engineering.	7	4	4	1	
11. Before the STI, I was interested in attending MSU.	4	1	7	4	
12. After the STI, I would consider attending MSU.	7	3	5	1	
13. I will take different classes in high school after attending STI.	2	5	3	5	1
Speakers					
1. The speakers aligned with what you expected out of the camp.	4	8	3	1	
2. I enjoyed the speakers.	1	11	2		2
3. The speakers led me to consider majoring in engineering.	7	5	3	1	
4. The speakers led me to consider attending MSU.	6	4	4	2	
Projects					
1. The projects helped me understand transportation careers better than before.	9	6			1

	Number of Responses (n=16)				
	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
2. In general, the projects gave me some practical experience related to transportation.	11	4		1	
3. Enhancement activities were beneficial.	12	3	1		

8 SENIOR SURVEY DATA

In order to gauge the impact that the Summer Transportation Institute had on participants' career and college choices after high school, a survey was emailed and mailed to former STI participants the spring term of their senior year in high school. To boost response rates, follow-up phone calls were made over the summer to graduated seniors. In total, thirteen participants from the 2007 and 2008 programs had graduated high school by summer 2009. Of the thirteen graduates, program staff was able to contact five respondents for the survey (a 38% success rate). The full survey is provided in Appendix C.

All five respondents had applied to college after high school (two were attending four-year institutions, two were pursuing two-year degrees, and one was not currently enrolled in a program). All five responded that the STI experience impacted their decision regarding college enrollment and their chosen major. One respondent is currently enrolled in an Aerospace Engineering program and has a coop at NASA for three semesters working on operations engineering and flight testing. The other four respondents are not enrolled in programs as directly linked to transportation as Aerospace Engineering, although their fields of interest have indirect applications to transportation depending on the participants' later career choices (Business, Electrical Engineering, History).

The senior survey asked respondents for narrative comments on how the STI affected their choices after high school. Their comments illuminate the many ways that the STI can impact college and career choices:

1) *STI helped me decide on what my major should be. Before I was thinking about entering into an engineering field. STI helped me narrow the field. Although I decided not to go into engineering, I would not trade the experience I had at STI.*
2) *I was already planning on going into aerospace engineering, but felt the exposure to all fields of transportation engineering at STI was helpful as was seeing an engineering school. The experience helped to reinforce my decision.*
3) *It was a very fun camp and showed me a broad spectrum of engineering. I really enjoyed myself. Gave me a brief insight to what college dorm life is like so now I know what to expect when going to college.*
4) *Became interested in engineering thanks to STI. Currently enrolled in 2-year electrical program at MSU-Northern with plans to transfer to 4-year electrical engineering program at MSU-Bozeman.*

9 RESULTS AND CONCLUSIONS

The 2009 Summer Transportation Institute at Montana State University provided a diverse group of 16 secondary school students with exposure to the field of transportation, opportunities to learn about the variety of transportation careers available, and college preparatory and career planning experience. Student feedback and evaluations show that the participants were very positive about the STI staff, classroom activities, field trips, and design-build team projects that were incorporated into the program curriculum.

The academic program was made up of a variety of activities catering to different learning styles and interests. Students especially enjoyed hands-on activities such as those provided in the concrete and geotechnical modules. The aviation module, including a tour of the Bozeman airport and discovery flights with Summit Aviation, was also very popular.

Participants were uniformly enthusiastic about team design-build activities, which included a balsa wood bridge competition and glider competition. The majority of participants confirmed that their teamwork skills improved over the course of design-build team projects. Academic program staff members were also highly rated for providing adequate assistance throughout the program.

Overall, the program was very successful in meeting its stated objectives and the curriculum. Recommendations for the 2010 program include utilizing activities developed for the 2009 Summer Transportation Institute as a template for future STI programs at MSU. Recruitment efforts were also more successful for the 2009 program than in the past due to an earlier start in sending out materials to schools. A similar approach is recommended for future years. Funding awards as early as possible in the calendar year are recommended to FHWA with fewer last minute revisions and budget stipulations.

10 APPENDIX A: IAB MEETING MINUTES

Summer Transportation Institute
Intermodal Advisory Board Meeting Minutes
May 11, 2009

Attendees: Susan Gallagher, Scott Keller, Danielle Scharf (teleconference), Sue Sillick (teleconference), Lloyd Rue (teleconference), Ahmed Al-Kaisy, Kris Christensen (teleconference), Lisa McFarland (teleconference)

1. **Overview**

   Susan Gallagher reviewed the planned 2009 program. The program will run from June 14 to June 26, 2009 and activities will be based on last year's successful program.

2. **Action Items completed to date:**

   - Contract in process with MDT for funding. Project charge account expected in next week or two.
   - Applications/brochures/posters sent out to Montana schools and education program coordinators (Talent Search, Indian Education offices, tribal schools) in January with a March 1 application deadline.
   - STI website updated with new application materials: www.wti.montana.edu/Education/SummerTransportationInstitute.aspx
   - Nineteen applications received by deadline. Eighteen confirmed participants (11 males and 7 females). Fifteen applicants are Montana residents, three are from out-of-state (New Mexico, Indiana, and California).
   - STI staff hired (2 new Residence Assistants and 1 new Teaching Assistant). The Program Coordinator will be returning from last year. All STI staff will live in the dorms with the students during the program.
   - Contract completed with MSU Conference Services (includes meal plan, dorm room reservations, MSU OneCards).
   - Group coverage organized for program through American Life Insurance.
   - A draft program curriculum/schedule has been compiled.

3. **Discussion**

FHWA award policies/procedures

- Lloyd Rue does not expect any big changes to the process for next year (including the schedule for award notifications) due to the Highway Program continuing resolution.

Senior Survey return rates

- Susan discussed low return rates for senior surveys distributed to past participants. Lisa McFarland suggested talking to career counselors at schools to obtain information, although it was not clear whether or not they collected this data.

Montana ITE Chapter Support

- The Montana Chapter of ITE has again provided funds to cover need-based travel expenses for STI participants. Scott Keller volunteered to act as a liaison to the chapter for getting out a thank you card after the program.

Activities

- Scott Keller will work on coordinating a tour of MDT HQ for the 2009 group as well as a joint barbecue for STI participants and undergraduate interns at the MDT Design Unit.

11 APPENDIX B: STI SCHEDULE

2009 Summer Transportation Institute at Montana State University

Week 1: June 15 – June 19

Monday, June 15	Thursday, June 18
8:30-10:00am: [WTI Classroom, Rm 333] STI Orientation (Transportation knowledge pre-test; Program overview-schedule & expectations; Transportation overview presentation) (STI Staff) **10am-noon:** Human Factors/Driving Simulator demo (Stanley) **Noon-1pm:** Lunch (Miller Dining Hall) **1-2pm:** Campus Tour (Meet at Admissions Office) **2-4pm:** [CB Soils Lab 202] Geotechnical Engineering introduction and soil tower competition (Mokwa)	**9-11am:** [WTI Classroom] Fish Passage/Hydrology (Blank) **11am-noon:** Trucking/freight (Stephens) **Noon-1pm:** Lunch (Miller Dining Hall) **1-3pm:** Boat float design competition; alternative fuels and fuel cell car demo (Creighton) **3-5pm:** Mirror Game Traffic Challenge (Al-Kaisy)
Tuesday, June 16	Friday, June 19
8:30am-9:00am: [Tait Lab] Strong Interest Inventory (STI staff) **9:00-noon:** Alternative Modes of Transportation (Chaudhari & Gleason) **Noon-1pm:** Lunch (Miller Dining Hall) **1-3pm**: [WTI Classroom] Bridge Design (Stephens) **3-5pm:** [WTI Conference Room] Balsa wood bridge team design activity (STI Staff)	**6:30am**: Breakfast and pick up sack lunches **7am:** Depart for Tour of Montana Department of Transportation Headquarters (Helena) **2pm:** Gates of the Mountain ferry ride
Wednesday, June 17	Saturday/Sunday June 20-21
8:30-10:30am: [WTI Classroom] Balsa wood bridge work **10:30-noon:** Traffic Engineering activity (Al-Kaisy) **Noon-1pm:** Lunch (Miller Dining Hall) **1-3pm**: [Transportation Lab CB 426] Speed study/Transportation simulation lab (Al-Kaisy) **3-5pm:** [CB build lab] Concrete Introduction and lab (Berry)	- Sports and Enhancement activities

Week 2: June 22 – June 26

Monday, June 22	Thursday, June 25
9-10am: [WTI 204] TRAIL lab demo (Lassacher) **10-noon:** [WTI 333] Balsa bridge completion **Noon-1pm:** Lunch (Miller Dining Hall) **1-2pm:** [SUB 168] College Entrance & Planning (MSU Admissions Office) **2-5pm:** [Tait Lab] Sim City transportation/urban planning activity (Rochelle)	**9am-10am**: Team glider design tests/presentations (STI staff) **10am - noon**: Final evaluations; transportation knowledge post-test (Jeopardy); Closing ceremony preparation (STI staff) **Noon-1pm:** Lunch (Miller Dining Hall) **1-5pm:** Closing ceremony preparation (STI staff-WTI Classroom)
Tuesday, June 23	Friday, June 26
8-9am: [CB 326] Career Planning (Erin McCormick) **9-10am:** [CB 202] Intro to Civil and Construction Engineering (Gunnink) **10am-noon:** Balsawood bridge competition **Noon-1pm:** Lunch (Miller Dining Hall) **1-3pm:** Road Ecology [WTI classroom] (Kociolek) **3-5pm:** Wetlands presentation (Keller) **5:30pm:** MDT Design Unit BBQ (Lindley Park)	**Morning:** Packing and Dorm Check Out **11am-Noon** (WTI Classroom) STI Closing Ceremony and Farewells
Wednesday, June 24	
9am-1pm: Field trip to Gallatin Field Airport and discovery flights with Summit Aviation (Picnic lunches) **1-2 pm**: [WTI Classroom] Intro to Aviation (Kack) **2-5pm:** Team Glider project (STI staff)	

12 APPENDIX C: SENIOR SURVEY

Summer Transportation Institute Participant Senior Survey

Summer you participated in the Summer Transportation Institute: _____
High School graduation date: _____

1) Did you apply to college? __ yes __ no (if no, skip to #2)

If yes, what type? __ Two-year __ Four-year
Are you currently enrolled in college? __ yes __ no
If yes, what program? _____ what school? _____
Did your STI experience impact your decision? __ yes __ no
If yes, please describe: _____
_____
Did your STI experience help you in choosing a major? __ yes __no
Did your STI experience help prepare you for college entrance? __yes __no

2) Are you currently employed? __yes __no

If yes, your current employer? _____ Position? _____
Is this position transportation-related? ___yes ___no

3) Please comment on how your participation in the Summer Transportation Institute affected your choices after high school: