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16. Abstract <p>With the dilemma of a challenged transportation workforce looming on the horizon, it is crucial that universities take a pro-active role in providing transportation professionals for the 21st century with the necessary tools to perform their roles within the industry. One way in which universities can provide these tools is through education and training. By exposing young students to transportation and the vast array of educational and career opportunities awaiting them, universities can increase the potential work force for the future. In turn, those young students who seek transportation as a career can work to maintain the complex transportation infrastructure in place and ensure mobility and prosperity for the future.</p> <p>A transportation science competition was hosted by the Texas Transportation Institute on the Texas A&M University campus. The competition provided outstanding junior high and high school students an opportunity to present research findings and ideas in a professional arena. Students who excelled in science and mathematics and enjoy academic competition were be targeted for participation.</p>					
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Developing a Transportation Science Competition and Career Fair for Junior High and High School Students

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Report SWUTC/03/167123-1

Project Number 167123

Research Project Title: Develop a Transportation Science Competition and Career Fair
for Junior High and High School Students

Sponsored by the
Southwest University Transportation Center

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TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
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ABSTRACT

A transportation science competition hosted by the Texas Transportation Institute (TTI) on the Texas A&M University Campus provides outstanding junior high and high school students with an opportunity to conduct and present research and ideas. In this pilot program, fair directors, teachers, transportation professionals, parents, and adult volunteers inspire and encourage students to explore and investigate transportation through hands-on research. The student research was then presented and evaluated in a professional arena.

ACKNOWLEDGMENTS

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The research team also wishes to acknowledge the cooperation of the school districts that participated in the competition. Their support was critical to the success of this project and their assistance was appreciated.

DISCLAIMER

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EXECUTIVE SUMMARY

The transportation engineering profession, like every other profession, faces a challenging future. Over the past decade, advances in transportation and technology applications have been staggering, both altering and expanding the list of knowledge, skills, and abilities needed by transportation professionals. This rapidly changing industry needs qualified individuals to design, plan, manage, operate, and maintain the vast infrastructure in place. Such a work force is necessary for the transportation profession to continue to sustain mobility and economic strength across the nation. The next generation of transportation professionals is in the nation's elementary, middle, and high schools and faces decisions regarding college and careers. Hence, it is in the best interest of the profession for the universities to cultivate new professionals early.

A transportation science competition hosted by the Texas Transportation Institute (TTI) on the Texas A&M University campus provided outstanding junior high and high school students an opportunity to present research findings and ideas in a professional arena. The competition was held at the TTI facilities on Texas A&M University campus on April 11, 2002. The competition was a one-day event. The competition participants were placed in one of two divisions: High School Division (9th through 12th grade students) or Junior High Division (7th and 8th grade students). The projects were judged under two main focus areas 1) the student's involvement with science and 2) the student's effort and performance. Competition judges were recruited from TTI staff.

Early on a problem was encountered dealing with the school year calendar and the date of the award. Most students select their science project topics at the beginning of September. The project start date of early September, did not allow the team the ability to reach students during this selection period, as a result not enough students expressed interest in Transportation project topics to make a competition feasible in March 2001. This problem was confirmed by discussions with science teachers from various schools that were conducted by both the principal investigator and the project monitor. As a result the fair was rescheduled for Spring 2002.

Even after the modification of the dates and discussions with a number of teachers who regarded transportation as a great new research topic for students, participation in an additional contest met with lukewarm response. This revelation resulted in the decision to attempt to include a transportation competition as part of the existing Brazos Valley Regional Science and Engineering Fair (BVRSEF). It was felt that by including transportation as a topic for the established fair, students would be encouraged to look at transportation as a topic. This would also allow transportation topics to be explored on an annual basis by interested students. After discussions with the Texas A&M University College of Science, sponsors of the BVRSEF, it was agreed the TTI would sponsor a special award and judge the transportation competition. This collaboration has become an ongoing effort between TTI and the College of Science and TTI has awarded transportation awards for the past two fairs.

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1.0 INTRODUCTION

The transportation engineering profession, like many other professions, faces a challenging future as staggering advances in transportation and technology application continue to alter the expanding list of knowledge, skills, and abilities needed by transportation professionals. Hence, this dynamic industry is searching for qualified individuals to design, plan, manage, operate, and maintain the vast transportation infrastructure. Such a work force is necessary in order for the transportation profession to continue to sustain mobility and economic strength across the nation. Right now, the next generation of transportation professionals in the nation's elementary, middle, and high schools are facing decisions regarding education and careers. Therefore, it is in the best interest of the profession to reach out to these future professionals as early as possible and encourage them to examine careers in transportation. A transportation science competition hosted by the Texas Transportation Institute (TTI) on the Texas A&M University Campus provided an opportunity for junior high and high school students to present research findings and ideas in a professional arena.

1.1 BACKGROUND

With the dilemma of a challenged transportation workforce looming on the horizon, it is crucial that universities take a pro-active role in providing the transportation professional of the 21st century with the necessary tools to perform their roles within the industry. One way that universities can provide these tools is through education and training. By exposing young students to transportation and the vast array of educational and career opportunities awaiting them, universities can increase the potential work force for the future. In turn, those young students who seek transportation as a career can work to maintain the complex transportation infrastructure in place and ensure mobility and prosperity for the future.

The past decade has seen revolutionary changes in the face of transportation in the United States. As the use of technologies in all aspects of life makes monumental leaps, the increase in the use of advanced technologies in transportation also grows. The transportation profession is

therefore faced with a new dilemma of finding enough qualified individuals to grow the workforce. One of every seven jobs in the United States is somehow related to the transportation industry and qualified employees capable of working within this new technology influenced arena are in high demand.

1.2 RESEARCH OBJECTIVES

The objective of this research was to capitalize on the transportation and educational expertise of the Texas Transportation Institute and its staff to encourage students to examine transportation as a field of study. In this inaugural program, competition directors, teachers, transportation professionals, parents, and adult volunteers worked to inspire and encourage students to explore and investigate transportation through hands-on research. The student research was then presented and evaluated in a professional arena. Students were also able to meet and network with career professionals and be exposed to potential educational and career opportunities in transportation.

1.3 PERFORMANCE TASKS

The above listed performance components and objectives were accomplished through the following tasks and subtasks:

Task 1: Conduct Literature and Existing Programs Review

The research team conducted an extensive literature review to investigate similar existing programs. As part of this review, the team interviewed various professors and the staff members of the College of Science and the College of Agriculture at Texas A&M University. This allowed the team to better understand the potentials and pitfalls of conducting student competitions. Both of these University groups conduct numerous student competitions at the state and regional level.

Task 2: Establish Rules for Competition

The team created written rules for a transportation science fair. A draft of the rules was distributed to the advisory team and selected teachers and faculty that are familiar with similar competitions for review. Respondents were asked to provide feedback on the attractiveness of the program, rules and structure of the competition, estimated potential of participation, and other topics as deemed appropriate by the research team.

Task 3: Create Instruments for Marketing

The research team created brochures, applications, and letters for marketing and publicizing the Transportation Science Fair to potential participants. A marketing and outreach strategy for attracting applicants was formulated during this task as well.

Task 4: Market and Publicize the Competition

A concerted marketing effort to publicize the competition and career fair to schools at local, regional, and state levels was then initiated. Science teachers, principals, and group advisors were contacted regarding the competition. Public media and the Internet was also be utilized to identify and attract participant schools.

Task 5: Plan and Develop the Program for Competition Day

The research team planned and developed a program for the Competition and Career Day, which provided participating students the opportunity for exposure to a series of tours, academic exercises, and networking with professionals in the transportation industries. The program provided students insight into transportation issues such as highway design, transportation of people and cargo, intermodalism, laws, regulations, safety, and environmental issues as well as career opportunities. Participation by both private and public sector transportation professionals were sought and encouraged.

Task 6: Conduct Competition and Career Fair

The research team conducted a one day Transportation Science Competition at Texas A&M University. The event was held in early April 2002. The event featured competitions for both Junior High and High School students, as well as activities, speakers, and an opportunity for

networking. Participants were asked to evaluate the event and make recommendations for improvement.

Task 7: Analyze and Evaluate the Program

The results from these evaluations as well as other feedback gathered during the course of the project was compiled and analyzed to improve the program and determine the viability of the program continuing in future.

Task 8: Recommendations and Final Report

Based on the analysis and assessment in Task 7, recommendations regarding the development of an annual Transportation Science Competition and Career Fair program were developed. The literature review, rules of competition, marketing strategies, participant comments, and overall recommendations were also documented and are included in this final report.

2.0 TRANSPORTATION SCIENCE COMPETITION DEVELOPMENT AND MARKETING

2.1 MATERIALS DEVELOPMENT

The project team took the initial effort of reviewing instructional materials used in various science competitions nationwide. This step was crucial in the development of competition guidelines in order to better understand the what could be expected of student competitors as well as to identify the safety concerns generated by student research. Based on the observations made during this task, a Student Participation Handbook was created. A copy of the handbook can be found in Appendix A. It was decided early on that the Handbook would follow the rules for the International Science and Engineering Fair Competition. These are the same rules that local, regional, and state science fairs follow. By utilizing the same rules the projects exhibited could also be exhibited in the local and regional science fairs.

The Student Participation Handbook provided the competitors and their sponsors with information critical to their understanding and participation in the Transportation Science Competition. As a means of general information, the handbook contained all event “Must Know” dates, required submittals (such as a project abstract and research plan) and guidelines for writing the submittals, submission deadlines, when the competition would be held, and contact information for the competition coordinators. Guidance was also provided as to the role of the required adult sponsor. It was important to note that the role of the adult sponsor in this competition was that of a mentor and advisor, the student was to conduct the research on their own. The handbook also gave the general rules and guidelines that must be adhered to during the competition.

A critical portion of the Student Participation Handbook was an explanation of appropriate projects and the interest areas included in the subject of transportation. Within this section the students were provided with categories as well as explanations of the types of research that would fall into each category. An example of the information provided would be:

Example of Category Information

Category	Explanation/Definition
Roadways	This category will include any topic that studies how roadways are designed. Topics could include bridge design or loads, roadway curves or hills, or any aspect of the roadway that relates to its general characteristics or appearance.

Through the examination of this table, students could reach a better understanding of the type of subjects that are related to transportation. One objective was to simply open the eyes of students to the wide variety of work that can be done within the transportation field. Also within this section students were given a list of steps to follow in the development of their research and guidelines for their event exhibit.

The competitors were also provided with a set of safety guidelines that must be adhered to. These included information about glassware, chemicals, hazardous materials, fire hazards, laser hazards, biological hazards, electrical hazards, and mechanical hazards. Additionally, guidelines were established for the use of human subjects within the research.

Finally, an appendix to the Student Participation Handbook contained all required submission forms and examples for the competition submittals.

Other materials developed for this competition included letters to be sent to the schools, judging forms and criteria, and a competition agenda. Copies of these materials can also be found in Appendix A.

2.2 COMPETITION RECRUITMENT AND MARKETING

Once the competition materials were created, it was possible to begin recruiting student participants. Packets containing the Student Participation Handbook and a letter of explanation were sent to area schools. It contained information regarding this project as well as an explanation of what would happen during the competition.

Materials were sent to both middle schools and high schools. The schools selected to receive the competition information were based on location. Since the students would be required to travel to Texas A&M University for the day of competition, all schools needed to be within an easily drivable distance to this location. It was decided that schools within a 100-mile radius of the Bryan/College Station, Texas were sent a copy of the materials. When this perimeter was established, the competition materials were mailed to almost 300 different schools, with multiple copies going to many of the larger schools. Depending upon the location and size of school, information was sent either to the principal, the science coordinator, and/or the math-modeling teacher. Postcards were sent to all of the schools in late January to remind teachers of the February deadline for project registration.

2.3 PROJECT TIMING

By November 2000 it was evident to the team that there was a major problem with the timing of the study. The problem encountered dealt with the school year calendar and the date of the award. Most students select their science project topics at the beginning of September. The project start date of early September, did not allow the team the ability to reach students during this selection period, as a result not enough students expressed interest in Transportation project topics to make a competition feasible in March 2001. This problem was confirmed by discussions with science teachers from various schools that were conducted by both the principal investigator and the project monitor.

It was decided to cancel the Transportation Science Fair scheduled for March 2001 and concentrate on a Fair to be held the following spring. By modifying the time line for the project.

Team members were able to contact science teachers during the summer and recruit potential students for participation. Packets were revamped and mailed to coincide with teachers returning to work in August. This modification resulted in a number of entries for the Transportation Science Fair held in April 2002.

3.0 HOSTING THE TRANSPORTATION SCIENCE COMPETITION

The competition was held at the Texas Transportation Institute (TTI) facilities on Texas A&M University Campus. The competition was a one-day event. An agenda for the day can be found in Appendix B. Students were asked to arrive at 9:00 a.m. to register and setup their projects. The competition participants were placed in one of two divisions: High School Division (9th through 12th grade students) or Junior High Division (7th and 8th grade students). The project judging was scheduled for 10:30 a.m. to noon. The projects were judged under two main focus areas 1) the student's involvement with science and 2) the student's effort and performance. Competition judges were recruited from TTI staff.

After several cancellations due to a conflict with the Houston Regional Science Fair, four projects registered for the Transportation Science Competition. One project was entered in the high school division and three projects were entered in the junior high school division. Justin Kooker, Brian Sims, and Lauren Pickle from the Academy for Science and Health Professions in Conroe, Texas researched the project entered in the high school division. The project, titled Floating Airport – Oceanport, examined the adaptation of airports to be placed on oceans for space conservation.

In the junior high school division the projects submitted were all from Jane Long Middle School in Bryan, Texas. The students and the project topics in the junior high division were:

1. Alex Albanese – (Category: Human Factors): Cell phone use while driving.
2. Terry Anderson – (Category: Pedestrians and Bicycles): Methods for making bicycle travel safer.
3. Kendra Widdison - (Category: Human Factors): Distracted driving as a cause for crashes.

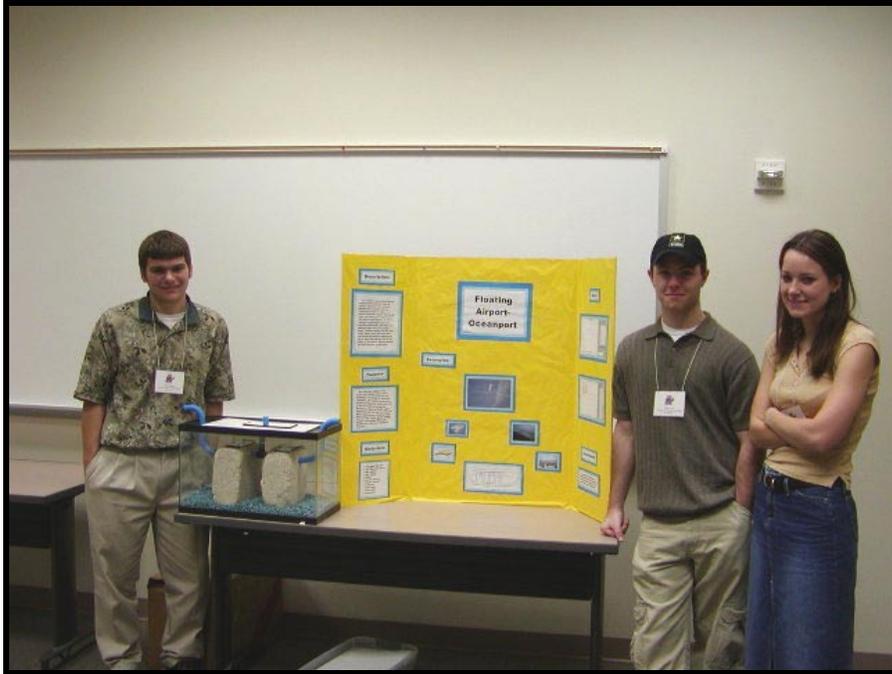


Figure 1. Floating Airport-Oceanport

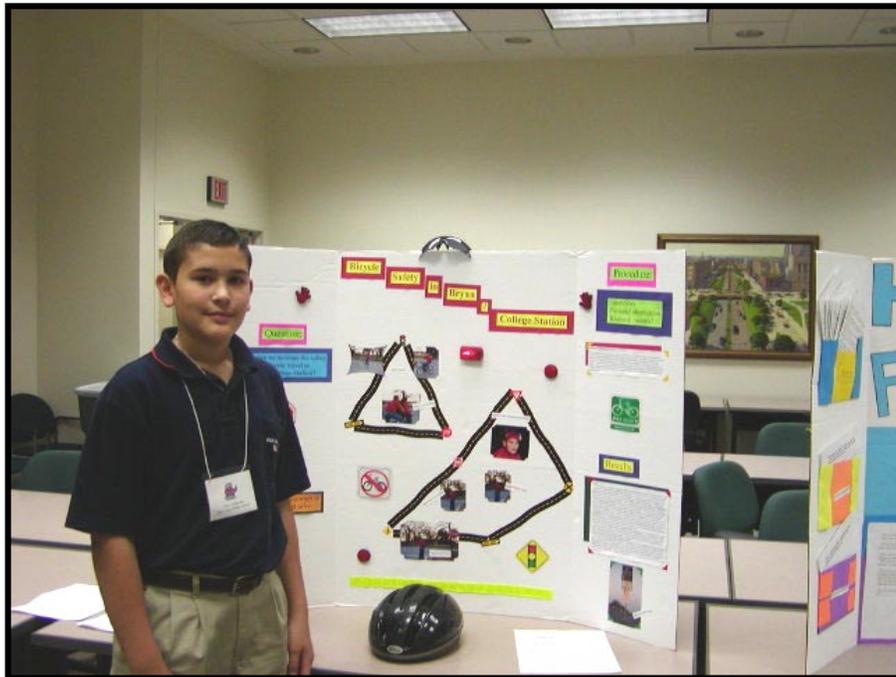


Figure 2. Safe Bicycling in Bryan/College Station



Figure 3. Cell Phone Use While Driving



Figure 4. Distractions While Driving

Following the project judging, the students participated in a pizza luncheon with researchers and TTI staff. This informal luncheon acted as an icebreaker and informal networking session for students and TTI researchers. The luncheon was followed by tours of TTI facilities. The tours included the driving simulator and TransLink® Research Lab. The tours allowed the students an opportunity to network with current professionals as well as obtain a better understanding of the transportation profession.



Figure 5. Students During Tour of Gilchrist Building

The final activity organized for the competition was an awards ceremony and reception. The guest speaker for the awards ceremony was Mr. Dock Burke, Director of the Southwest University Transportation Center. At this event students were presented with certificates of participation as well as plaques for the top participant in each category (high school and middle school). An example of the certificate may be found in Appendix B. The winners for each division were Justin Kooker, Brian Sims, and Lauren Pickle in the High School Division and Terry Anderson for the Junior High Division.



Figure 6. Members of Conroe Team Accept Senior High Award



Figure 7. Junior High Award Winner Accepts Trophy

4.0 ANALYSIS AND FINAL REMARKS

The transportation engineering profession, like every other profession, faces a challenging future. Over the past decade, advances in transportation and technology applications have been staggering, both altering and expanding the list of knowledge, skills, and abilities needed by transportation professionals. This rapidly changing industry needs qualified individuals to design, plan, manage, operate, and maintain the vast infrastructure in place. Such a work force is necessary for the transportation profession to continue to sustain mobility and economic strength across the nation. The next generation of transportation professionals is in the nation's elementary, middle, and high schools and faces decisions regarding college and careers. Hence, it is in the best interest of the profession for the universities to cultivate new professionals early.

A transportation science competition hosted by TTI on the Texas A&M University Campus provided outstanding junior high and high school students an opportunity to present research findings and ideas in a professional arena. The competition was held at the TTI facilities on Texas A&M University Campus. The competition was a one-day event. An agenda for the day can be found in Appendix B. Students were asked to arrive at 9:00 a.m. to register and setup their projects. The competition participants were placed in one of two divisions: High School Division (9th through 12th grade students) or Junior High Division (7th and 8th grade students). The project judging was scheduled for 10:30 a.m. to noon. The projects were judged under two main focus areas 1) the student's involvement with science and 2) the student's effort and performance. Competition judges were recruited from TTI staff.

4.1 PROBLEMS ENCOUNTERED

The project team found that science teachers in particular are interested in the transportation competition and most teachers contacted expressed the opinion that it opens new topics for student research. A major problem was encountered with the school year and the date of the award. Students select their science projects in most schools at the beginning of

September. The project start date of early September, did not allow the team the ability to reach students during this selection period, as a result not enough students expressed interest in Transportation project topics to make a competition feasible this year. This problem was confirmed by discussions with science teachers from various schools that were conducted by both the principal investigator and the project monitor.

It was decided to cancel the Transportation Science Fair scheduled for March 2001 and concentrate on a Fair to be held the following spring. By modifying the time line for the project. Team members were able to contact science teachers during the summer and recruit potential students for participation. Packets were revamped and mailed to coincide with teachers returning to work in August. This modification resulted in a number of entries for the Transportation Science Fair held in April 2002.

4.2 COLLABORATION WITH BRAZOS VALLEY REGIONAL SCIENCE AND ENGINEERING FAIR

Even after the modification of the dates and discussions with a number of teachers who regarded transportation as a great new research topic for students, participation in an additional contest met with lukewarm response. This revelation resulted in the decision to attempt to include a transportation competition as part of the existing Brazos Valley Regional Science and Engineering Fair (BVRSEF). It was felt that by including transportation as a topic for the established fair, students would be encouraged to look at transportation as a topic. This would also allow transportation topics to be explored on an annual basis by interested students. After discussions with the Texas A&M University College of Science, sponsors of the BVRSEF, it was agreed the TTI would sponsor a special award and judge the transportation competition.

In the 2002 BVRSEF TTI sponsored the first special awards for the best junior and senior division projects related to transportation. Seven student projects were judged in the junior division and three projects were judged in the senior division. The winner for the junior division was Kenny Bendikson from College Station Middle School, who presented a project on traffic bottlenecks and flows. Senior division winners were Colby Samford and Eric Clapp of North Zulch High School,

who built a watercraft capable of pulling a 300-pound dead weight. A certificate and a “transportation goody bag” were given to the best project in each division.

In February 2003 the principal investigator for this project was contacted by the College of Science and invited to become a committee member of the BVRSEF. Initial discussions have taken place to make transportation a permanent judging category in future fairs.

TTI once again sponsored special awards for the best transportation related science project for the March 2003 Science Fair. This year over ten junior division and seven senior division projects were judged as transportation related projects. The 2003 special Transportation award winner in the junior division was Joshua Letton from A&M Consolidated Middle School who presented a project on the “Bernoulli Effect.” The senior division award went to the team of Kristen Hibbs and Lindsey Killebrew of Brenham High School. Their project was titled, “How Safe are Teens’ Cars?” This years winners were presented with a certificate, goody bag and t-shirt.

4.3 PARTICIPATION AND MARKETING

As the project progressed it became increasingly evident that many teachers are unwilling to promote or even inform students of competitions that “interfere” with established contests such as local and regional science fairs or University Interscholastic League Competitions. Unless the competition can become established on it’s own or embedded in an existing recognized competition, it has little chance of success. The amount of publicity, marketing, or recognition to winners is irrelevant. The project team mailed over 700 invitations to participate in the fair. Team members also mailed over 2,000 reminder and information cards in the 6 months prior to the Transportation Science Fair. Additionally, team members and the project mentor visited area teachers to promote the fair. All of the teachers felt the Transportation Science Fair was a good idea, however they were generally unwilling to commit to promoting the fair to students. As a result students from only 2 schools participated in the fair.

Once the project idea became affiliated with the regional science fair, the number of science fair projects qualifying as a transportation related project has increased each year at the

regional level. An embedded effort such as this is also less time consuming and more cost effective. The fair itself does the publicity and marketing to the schools. Two volunteer judges must be provided the actual day of the fair. The average cost of the prizes awarded is less than twenty dollars per student.

4.4 PROJECT PUBLICITY

The Transportation Science Fair and the resulting collaboration with the BVRSEF were featured in an issue of the *Researcher*. The article focused on the idea behind the project, which is to provide students with the opportunity to research and present transportation related projects in a professional arena.

5.0 APPENDIX A

Student Participation Handbook for the Transportation Science Competition 2002



April 11, 2002

9 a.m. – 3 p.m.

**Texas Transportation Institute
Texas A&M University Campus
College Station, Texas**

INTRODUCTION

Through the Transportation Science Competition, hosted by the Texas Transportation Institute at the Texas A&M University Campus, **outstanding junior high and high school students** are being provided with an opportunity to present research findings and ideas in a professional arena. Students who have an interest in the fields of science, mathematics, and engineering, and enjoy academic competition, are encouraged to participate. Students who wish to enter a transportation related project originally conducted for science fairs are encouraged to do so.

This student handbook outlines the requirements that must be met in order to participate in the Transportation Science Competition, as well as establishing rules for the competition. The students should review these materials carefully so that he/she has an understanding of all of the guidelines and expectations of this event.

Adult Sponsors

An adult sponsor can be a teacher, parent, or other responsible party who will have close contact with the student over the course of the project. This person should be familiar with the regulations of the event and should be able to advise the student to ensure that they stay within the established restrictions and are eligible for competition. **The role of the Adult Sponsor is not to conduct the research for the student, but to be an advisor during the project.**

“Must Know” Dates

Keep these deadline dates in mind as you are working through your project.

Event	Date
Last day to submit Registration Materials	January 18, 2002
Last Day to Submit: Abstract Research Plan and Approval Form Research Summary	April 1, 2002
Last day to request equipment for display	April 1, 2002
Transportation Science Competition	April 11, 2002

Contact Information

If there are any questions regarding this competition, please contact one of the following people at Texas Transportation Institute:

Debbie Jasek
Phone: 979-845-5239
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E-Mail: b-durkop@tamu.edu

GENERAL RULES AND GUIDELINES

The following points are some general rules that participants must adhere to during project completion and the competition:

1. Projects may be done on either an individual basis or team basis. Teams may consist of up to 3 students.
2. All safety rules, as outlined in these materials, must be followed. Violations may result in disqualification. Please direct all questions you may have about safety to one of the Texas Transportation Institute contact people.
3. Exhibits must be constructed so that they are freestanding and that no wall space is required.
4. The event staff will provide space on a table, a table covering, an identification sign, and an extension cord (if needed). The student must provide all other needs of his/her exhibit.
5. Normal wear and tear on exhibits is to be expected during the time that the fair is open to the public. For this reason, each participant is advised to protect his/her project as completely as possible. Valuable equipment should be fastened securely to prevent its removal and should be safely stored when the exhibitor is away from the exhibit.
6. Students should dress neatly and appropriately for the occasion.

PROJECTS

The work done by the students must be related to transportation. The following categories outline some of the applicable areas of research for this competition. This is by no means an exhaustive list of topics, and students are encouraged to use their own interests and creativity to come up with a topic that is exciting to them.

Categories	Explanations/Definitions
<i>Human Factors</i>	A study where human performance plays a significant role in the transportation issue. This could include such topics as legibility, drowsy driving, cell phone use, older driver topics, etc.
Rail	Any project relating to railroad use issues. This could include issues such as safety at railroad crossings, moving freight, high-speed rail corridors, etc.
Waterways	Investigate of the use of waterways (ports and bodies of water) as a means for transportation. This can include freight issues at ports, navigational information, passenger ferries, etc.
Transportation Operations	This category relates to the study of the performance and safety effects of traffic control devices (signs, traffic signals, etc), the use of technology and management to reduce congestion, work zone safety, etc.
Pedestrians and Bicycles (Non-motorized transportation)	How do pedestrians and bicycles fit into the use of roadways? This is a question that is always in search of an answer; a student could look at safety, convenience, or many other areas to study this issue. This category can include study of <i>any</i> non-motorized transportation.
Public Transit	The use of transit (buses, trains, shuttles) is a good way to move a large group of people at one time. Issues related to this category include consumer convenience, schedules, electronic fare payments, etc.

Aviation	Studying how airports are used, and how this relates to transportation issues. Examples of issues related to this topic are transit access to airports, environmental impacts of airports, efficient use of airport space, etc.
Roadways	This category will include any topic that studies how roadways are designed. Topics could include bridge design or loads, roadway curves or hills, or any aspect of the roadway that relates to its general characteristics or appearance.
ITS (Intelligent Transportation Systems)	ITS is the use of new technologies to improve the performance of all types of transportation. The technologies could improve vehicle detectors, video surveillance, in-vehicle navigation, etc.
Safety	Safety is very important to all parts of transportation. Topics in this category of study can vary from placement of road signs to seatbelt use. Focus on how to make travel safer for everyone, by rail, car, plane, or sea.
General Transportation	Not all of the student projects will fit nicely into one of the defined categories; the categories could overlap in focus or several different categories could all relate to one issue. The General Transportation category will be used as a catchall for these projects.

Project Planning and Selection

The selection of a research topic and the planning of the resulting project are the most critical parts of this competition. During this process, the student should keep in mind things that interest them, as well as the time limitations of the project. Some steps to be followed during this part of the project include:

1. Select a topic of research.
 - § Review the listed categories to determine possible topics that are of interest to you.
 - § Narrow this topic down to a manageable research question.
 - § Discuss the research question that you develop with your adult sponsor (teacher, parent, etc.) to determine if what you are planning to do is possible.
2. Proceed with the project using scientific reasoning.
 - State your question or problem clearly.

- Research your question and find about your topic so you can make informed decisions. (Good places to start with this research would be the library or the Internet.)
- Create a *Hypothesis* for testing. (A *hypothesis* is an educated guess of what your project will find.)
- Find ways to measure, observe, and record what happens during each part of your project. Remember that the use of a *control* is very important to any experiment. (A control is an experiment in which the subjects are treated as in a parallel experiment except for omission of the procedure or agent under test.)
- Do not omit negative results. Use them to modify the hypothesis; then test again.
- Set a schedule for your project.

Exhibit Design

The day of the Transportation Science Competition, the student is expected to appear at Texas A&M University with an exhibit that represents their research. This display will be available for viewing by the public during the day of competition. On the competition day, the students will be expected to stay by their display during judging to answer questions.

The exhibit must not exceed the dimensions of 3 ft deep by 5 ft wide by 5 ft tall. Other guidelines and suggestions for the exhibit are as follows:

1. Construct your own exhibit. Teachers and parents are there to provide only the necessary guidance, encouragement, and constructive criticism.
2. Keep the title of your project brief. Also, display the title clearly on the exhibit.
3. Keep the lettering and visual aids used in the exhibit neat and uncluttered.
4. Make sure all of the words on the exhibit are spelled correctly.
5. Be well versed in as many aspects of the project as possible so you are ready to answer the judges' questions. Be prepared for questions directed at the research, as well as other questions related to the topic.

6. Slides and video may be used as part of the exhibit, however the student must provide the necessary equipment. The student must inform the TTI contact person by no later than April 1, 2002 in order to make arrangements for electric hookup.

REQUIRED STUDENT SUBMITTALS

As part of this competition, every student is required to write an Abstract and a Research Summary regarding his/her project. Depending on the nature of the project, other forms may also be necessary for submittal. Please review all of this information carefully so you are not disqualified due to missing submittals.

All materials for this event should be submitted to the event staff at Texas Transportation Institute at the following address:

Debbie Jasek
Texas Transportation Institute
Gibb Gilchrist Bldg., Room 114
The Texas A&M University System MS 3135
College Station, TX 77843-3135

Abstract

The Abstract is a concise summary of the research to be performed by the student. This abstract must be included as part of the student application, and must be no more than 300 words in length. The abstract should contain information regarding the research purpose, procedure, and principle findings of the project. An example of the abstract layout can be found in the Appendix. **The submittal of the Abstract is due on April 1, 2002.**

Research Plan and Approval

The research plan and approval document provides a roadmap for planning the research. It also serves as a checklist for the required forms. **The Research Plan and Approval must be submitted by April 1, 2002.**

Research Summary

The Research Summary is a written report, attached to the research plan and approval form. The Research Summary includes a detailed account of the project conducted by the student. A clear and concise presentation of data is important in scientific communication, say what is necessary and then stop. **The Research Summary must be submitted by April 1, 2002 in order to allow time for judges' review prior to the competition.**

The Research Summary should be from 2 to 5 pages in length and contain the following sections:

- § Title Page —See Appendix for an example

- § Acknowledgments —A listing of the persons or agencies that gave the student guidance and helped with the project.

- § Purpose and Hypothesis —An explanation of what the student expected to accomplish during this project. A description of the expected outcome should be included.

- § Review of Literature —A discussion of the work that has been done on this problem.

- § Materials and Methods of Procedure —A description of the research conducted and the materials used in this experiment. Drawings and/or photographs are appropriate if they enhance or clarify the explanation.

- § Results —A clear and concise presentation of the data gathered during the research. Drawings, charts, and graphs may be included to help organize and present the data. All of the drawings, charts, or graphs used in this section should be clearly labeled and easy to understand on their own.

§ *Conclusions* —An evaluation and interpretation of the data and results. Opinions of the results may be expressed in this section. The conclusion should be limited to results of investigation and should refer to the stated purpose and hypothesis.

§ *Reference List* —A list of the published articles, books, and other communications that are cited in the Review of Literature.

Other Forms

In addition to the research materials that you must submit, there are also other forms that participants may need to complete depending on the nature of their project.

Human Subjects Form

If a project involves the use of human participants, there are two different forms that must be completed. The first is an Informed Consent Form, in which the person participating in your project must sign a form indicating that they have been told what the study is and what their part in the study will be. Each test subject should sign one of these forms.

The second form is the Human Subject Form. This form must be completed and returned to the event staff along with your registration. On this form, it must be documented as to why and how human participants were used in the project. This form must be reviewed and signed by an Institutional Review Board (IRB). An IRB is a committee that, according to federal law, must evaluate the potential physical or psychological risk of research involving human subjects. An IRB consists of a minimum of 3 members: a science teacher, a school administrator, and one of the following: a psychologist, psychiatrist, medical doctor, physician's assistant or registered nurse. The adult sponsor should assemble this board in order to acquire their signatures prior to the student conducting any research. **All research that proposes to use human subjects must be reviewed before beginning the project.**

Examples of both of these forms can be found in the Appendix. **The Human Subjects Forms should be submitted in conjunction with the Research Plan and Approval Form by April 1, 2002.**

Sponsor and Safety Checklist

The Sponsor and Safety Checklist provides the adult sponsor with a guide for monitoring student research and verifying that the student has been briefed on safety measures prior to experimentation. **The Sponsor and Safety Checklist should be submitted in conjunction with the Research Plan and Approval Form by April 1, 2002.**

SAFETY GUIDELINES

The number one concern during the project and the day of competition is safety. The following are safety measures that must be followed for the completion of the student project and for the exhibit during competition.

Glassware Hazards

No glassware may be displayed in the exhibit. Plastic containers will be substituted for glass. Any container that holds a liquid or other substance must be secured in a stable position.

Chemical Hazards

Chemicals that present any hazard may not be displayed. Possible substitutions for display would be colored water and/or table salt, or use photographs or drawings. All vessels containing any materials must be adequately sealed to prevent spilling.

Hazardous Materials

Explosive, flammable, corrosive, or highly poisonous substances are not to be brought to the exhibit area. This includes gasoline, alcohol, and lighter fluids. Armed rockets and other propellants are prohibited. Cylinders of compressed gas or aerosol cans are not allowed in the display area. Automobile storage batteries containing sulfuric acid are not allowed. All other substances must be shielded in such a way that maximum protection is provided for all parties in the area.

Fire Hazards

Open flames on any type are not allowed in the exhibit area. Electrical heating units must be well protected and must not be near the front on the exhibit area. Electrical units are not

to be connected except upon judge's request. Hotplates must be mounted on a noncombustible insulating material.

Laser Hazards

Only Class I and Class II lasers may be displayed and operated at the competition. If a Class II laser is operated it must: 1) only be done when the exhibitor is present, 2) have a sign displayed reading "Laser Radiation – Do Not Stare Into Beam", and 3) have a protective housing or barricade that prevents human access to the beam during operation. The power source to the lasers must be disconnected when the laser is not being operated.

Biological Hazards

Cigarettes and tobacco may not be displayed

No live or preserved vertebrate animals may be exhibited.

Electrical Hazards

All electrical equipment must be constructed according to standard electric safety codes. If there is doubt, consult with the electric shop teacher or an electrician.

All wiring, switches, and metal parts carrying current must be completely enclosed by barriers on all sides to prevent observers from reaching into the exhibit and receiving an electric shock.

Exhibits requiring electricity must have a three-pronged or polarized electrical plug attached to the end of the electrical cord, except those using lamps only. All electrical extension cords needed during the competition will be provided to the exhibitors.

Doorbell push buttons must not be used to control 110-volt apparatus. Use Toggle or push-button switches designed for proper load. Non-insulated switches, such as knife switches,

will not be permitted. All electrical joints must be properly secured and insulated. All electrical joints must be permanent and soldered.

Mechanical Hazards

All moving parts of machines and/or electrical circuitry must have adequate protective coverings or guards.

Push buttons or levers must be securely mounted on exhibits. They must not be attached to tables or walls.

Materials and construction must be durable. All moving parts must be firmly attached. Power-driven parts must be protected with guards.

RESEARCH INVOLVING HUMAN SUBJECTS

Use of Human Subjects

Rules and regulations regarding the use of human subjects in research exist to ensure the rights and welfare of the individuals who participate as research subjects. If the human subject procedure involves discomforts or risks to the participants, the student researcher must obtain the written consent of the person(s) or the permission of their legal guardian(s) if the person is under 18 years of age. **No experimentation can be performed on human beings unless they sign an informed consent sheet.** This means that they have been informed of the procedures to be carried out and that they agreed to the conditions of the procedures.

Remember that it is illegal to publish information in a report that identifies the subject(s) directly or through identifiers linked to the subject(s) unless prior permission has been obtained.

Projects that involve taste, color, texture, or any other choice will be allowed but are limited to preference only. No project may use drugs, food, or beverages to measure their effects on a person.

APPENDIX

Example Title Page:

THE USE OF RED SIGNS ON ROADS

Category: Transportation Operations

By

George Cameron

Roosevelt High School

Houston, Texas

10th Grade

SPONSOR: Mr. Harry Oberlander

Abstract Example:

THE USE OF RED SIGNS ON ROADS

Category: Transportation Operations

By: George Cameron

In this section of the abstract, the student should write a clear and concise explanation of the project performed. This explanation should be 100-200 words in length.

TRANSPORTATION SCIENCE COMPETITION
Texas A&M University Campus, College Station, Texas
April 11th 2002

Individual Registration Form

Due: Friday, January 18, 2002

Last Name: _____ First Name: _____ Grade: _____
Address: _____ City: _____ Zip: _____ County: _____
Home Phone: _____ Email: _____
Age: _____ Gender: Male _____ Female _____
School Name: _____ Teacher Name: _____
School Address: _____
School Phone: _____ School Email: _____
Sponsor Information: *(complete only if different than teacher/school)*
Name: _____ Phone: _____
Address: _____
Email: _____

Project Title:

Division (Check one): **Junior (Grades 7-8)** _____ **Senior (Grades 9-12)** _____

Category (please select the most appropriate category for your project —see rules sheets):

- General Transportation Human Factors Railway
 Waterways Transportation Operations Public Transit
 Aviation Roadways Safety
 ITS (Intelligent Transportation Systems) Pedestrians & Bicycles (non-motorized transportation)
 Other specify: _____

Exhibit needs (check as needed)

- I **need** a table for my display I **do not need** a table, my display sets up directly on the floor
 I **need electricity** for my display I **do not need electricity** for my display.

\$10 Entry Fee and Research Abstract Must Accompany Each Entry
Make Check Payable to: Texas Transportation Institute

Mail forms and Payment to:

Debbie Jasek
Texas Transportation Institute
Gibb Gilchrist Building, Room 114
Texas A&M University MS 313
College Station, Texas 77843-3135

TRANSPORTATION SCIENCE COMPETITION

This form must be submitted by April 1, 2002

ABSTRACT (please type or print legibly- attach to entry form)

Last Name: _____ First Name: _____

Category: _____ Division: _____

PROJECT TITLE: _____

Abstract: (Must include: purpose, results, conclusions, and possible applications. 300 words or less).

RESEARCH PLAN AND APPROVAL FORM

This form is required for ALL projects
and MUST be submitted with Research Summary by April 1, 2002

Students Name _____ Grade _____

Title of Project _____

Adult Sponsor _____

This research began: _____ and ended _____
(month, day, year) (month, day, year)

Where will you conduct your lab work? _____

The following forms must be completed:

- Research Plan and Approval Form (all projects)
- Sponsor and Safety Checklist (all projects)
- Photographic Release Form (all projects)
- Human Subjects Form (if human subjects are used)
- Informed Consent (if human subjects are used)

Attach a separate, typed (computer printed), research summary on completion of the project including the following parts:

- Title Page
- Acknowledgments
- Purpose and Hypothesis
- Review of Literature
- Materials and Methods of Procedure
- Results
- Conclusions
- Reference List

Student Acknowledgment: I understand the risks and possible dangers to me of the proposed Research Plan. I have been briefed on safety aspects of the research. I will adhere to the rules of the competition.

Student's Printed Name

Signature

Date of Approval

Adult Sponsor Approval: I have read the above plan and reviewed the **Sponsor and Safety Checklist** with the student. I agree to sponsor the student named above and assume reasonable responsibility for compliance with the rules of this competition.

Adult Sponsor's Printed Name	Signature	Date of Approval
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Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the Research Plan. I consent to my child participating in this research.

Parent/Guardian's Printed Name	Signature	Date of Approval
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SPONSOR AND SAFETY CHECKLIST

This form is required for all projects and must be complete prior to experimentation.

Students Name: _____

- I have reviewed and signed the Research Plan and Approval form.
- The student and a parent/guardian have signed the Research Plan and Approval form.
- This project involves the following areas and requires **prior approval** before experimentation begins:
 - Human Subjects.** The student will obtain approval from an Institutional Review Board (IRB), complete a Human Subjects Form, and have each subject complete an Informed Consent Form.
 - Hazardous Substances.** A designated supervisor will provide proper supervision and the following certification is required.
 - Chemicals** (i.e., hazardous, flammable, explosive or highly toxic; carcinogens; mutagens and all pesticides). I have reviewed with the student the Material Safety Data Sheet (MSDS) listing for each chemical that will be used. I have also reviewed and discussed with the student the proper safety standards for each chemical including toxicity data, proper handling techniques, and disposal methods.
 - Equipment** (i.e. welders, lasers, voltage greater than 220 volts). I have reviewed with the student the proper operational procedures and safety precautions for the equipment to be used by the student.
 - This project does not involve any of the areas listed above

Adult Sponsor's Printed Name

Signature

Date

RELEASE FORM PERMISSION TO TAPE OR PHOTOGRAPH

Student Name: _____

Date of Birth: _____

I grant written permission to Texas Transportation Institute, the host of the 2002 Transportation Science Competition, to make videotapes or photographs of the above named child.

I further authorize the use of such photographs or tapes for brochures, press releases, or other recruitment materials without prior inspection on my part.

Print Name (Parent/Guardian) _____

Signature (Parent/Guardian) _____

Date _____

Witness _____

Date _____

HUMAN SUBJECTS FORM

This form is required for all research involving humans. Institutional Review Board approval required before experimentation.

Students Name: _____

Title of Project _____

This portion is to be completed by student researcher. See student handbook

- 1). Explain why human subjects are necessary for this research.

- 2). Describe and assess any potential risk to subject (physical, psychological, social, legal or other).

- 3). Describe how informed consent will be obtained (attach a sample of the completed informed consent form).

- 4). Describe procedures to minimize risk to subjects.

- 5). Describe the benefits to society.

- 6). Compare the benefits of this research to the risks.

This portion is to be completed by an Institutional Review Board (IRB) prior to experimentation.

Note: The adult sponsor, or designated supervisor, cannot serve on the IRB. Risk includes, but is not limited to, exercise, ingestion, physical or emotional stress, and invasion of privacy.

Please check appropriate box below:

- Minimal risks involved.....**Informed consent form** is strongly recommended for all subjects, but is not required.
- More than minimal risks involved...**Informed consent form** is required as well as supervision from a designated supervisor.
- Unacceptable risks involved.....Project is rejected and must be revised.

MINIMUM OF THREE SIGNATURES REQUIRED

Specify Position

Members printed Name	Signature	Psychologist/M.D./Nurse	Date
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Members printed Name	Signature	Science Teacher	Date
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Members printed Name	Signature	School Administrator	Date
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INFORMED CONSENT FORM

This form is recommended for all projects involving human subjects and required for all involving risk.

Use a separate form for each test subject.

Student Researcher's Name _____ Grade _____

School, City & County _____

Title of Project _____

To be completed by the Student Researcher:

1) What are the research procedures in which the subject will be involved?

2). What are the possible discomforts that may be reasonably expected by participating in this research?

3). What procedures will be used to minimize risks?

Attention: This project has been reviewed and approved by an Institutional Review Board.

Adult Sponsor's Printed Name	Signature	Phone Number	Date Signed
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To be completed by human subject prior to experimentation:

____ I have read and understand the conditions stated above, and I consent to participating in this research procedure. I realize I am free to withdraw my consent and to withdraw from this activity at any time.

____ I consent to the use of visual images (photographs, videos) involving my participation in this research project.

Participant's Printed Name

Signature

Date Signed

If the participant is under 18 years old, a parent/guardian signature may be required. If the subject of this experiment or parent/guardian has any questions about this experiment, the Adult Sponsor should be contacted.

Parent/Guardian's Printed Name

Signature

Date Signed

2002 Transportation Science Competition
Sponsored by: Texas Transportation Institute

Judges Score Sheet

Name of Student(s): _____

The Student's Involvement with Science	Maximum Score	Actual Score
Introduction – Statement and Identification of problem <ul style="list-style-type: none"> • Clarity of stating problem under study • Creativity/originality – identification of problem; rationale for study • Background information evident 	(20)	
Acknowledgement of sources of major assistance received	(10)	
Research design, procedures, results <ul style="list-style-type: none"> • Student's involvement in designing the investigation • Originality and ingenuity in the research design • Selection of proper equipment for research tasks • Identification and control of variables; laboratory skills and techniques • Reproducibility • Quantity and quality of data generated (accuracy, organization, recognition of errors, statistical analysis) 	(20)	
Discussion/Conclusions <ul style="list-style-type: none"> • Clarity in stating conclusions; relevance to purpose of study • Interpretation of data; conclusions supported by data • Limitations in accuracy and significance of results acknowledged • Overall problem solving and originality • Evidence of student's understanding of technical principles employed during investigation • Theoretical or practical implications recognized or understood • What was learned? New questions raised? Future research? 	(20)	
	Total (70)	

II. The Student's Effort and Performance		
Duration of Research – Amount of work involved Acknowledgement of major assistance Evidence of Student's understanding	(10)	
Presentation and display during judging <ul style="list-style-type: none"> • Clarity in stating problem • Clarity in describing design, procedures, problems, and how they were handled • Clarity in presenting data, interpretations, and conclusions • Overall organization • Definition of terms as necessary • Appropriate use of visual aids • Response to questions 	(15)	
Abstract <ul style="list-style-type: none"> • Content, format, grammar, organization 	(5)	
	Total (30)	

Comments on back of form.

6.0 APPENDIX B



Transportation Science Competition

Texas A&M University Campus

April 11, 2002

Sponsored by:

Texas Transportation Institute

Competition Agenda

9:00 – 10:30 Student Registration & Display Set-up

10:30 – 12:00 Project Judging

12:00 – 1:00 Lunch (provided by TTI)

1:00 – 2:00 Tour of TTI Facilities

Driving Simulator

TransLink Research Lab

2:00 – 3:00 Awards Reception

Transportation Science Competition

Junior Division

April 11, 2002

Certificate of Participation and Excellence

Presented to:

Joe Smith

White Middle School

Debbie Jasek
Texas Transportation Institute

Brooke Ullman
Texas Transportation Institute