



## 2003 ASEE MODEL DESIGN COMPETITION

Sponsored by the Two Year College Division of ASEE

Date: September 10, 2002

Dear Colleague,

On behalf of the American Society for Engineering Education (ASEE) - Two Year College Division (TYCD), we invite you to encourage the submission of student design projects for the 5<sup>th</sup> Annual ASEE Lower Division MODEL DESIGN COMPETITION. This event will be held in conjunction with the 2003 ASEE Annual Convention, June 22-25, 2003 in Nashville, TN. This competition is open to 2<sup>nd</sup> and 1<sup>st</sup> year students at four and two year colleges and universities.

This year a competition of battery - powered model vehicles will take place. The models must adhere to the guidelines of the model design competition and an oral presentation is included as part of the competition.

The main reason for this competition is for students to gain a better understanding of the design process from start to finish. Designing and building something from an idea is probably why they chose engineering in the first place. Use this design competition as a platform to reinforce their ideas and have some *engineering fun!* We hope to see you and your students' entries in Nashville.

Please find enclosed the guidelines and registration forms for this event. The interest and registration forms are on the back of this letter.

Sincerely,

Paul E. Gordy  
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Fax: 757-427-0327  
Email: PGordy@tcc.vccs.edu

William C. Beston  
Staff Associate  
National Science Foundation  
Arlington VA  
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### **Results from the 2002 ASEE National Two Year College Division Model Design Competition in Montreal, Quebec:**

#### **1<sup>st</sup> Place: Cedarville University - Cedarville, OH**

**Team members:** Michael Walker (team captain) and Dave Bartlett

**Advisor:** Dr. Clint Kohl

#### **2<sup>nd</sup> Place: Illinois Central College – East Peoria, IL**

**Team members:** Robert Watson (team captain), Dale Johnson, Bryan McIntosh, and Shaun Woolard

**Advisor:** Robert Bloompott

#### **3<sup>rd</sup> Place: Tidewater Community College – Virginia Beach, VA**

**Team members:** Craig Byl (team captain), Robert Sereno, Jennifer Martin, Michael French, Jayson Humrich, Josh Dart, and Brett Byers.

**Advisors:** Paul Gordy and Steve Ezzell

**Web Site:** Visit the following site for rules, photos, videos, and more.

<http://www.tcc.vccs.edu/studorgs/vbeng/aseecar/index.htm>



**2003 ASEE MODEL DESIGN COMPETITION**  
Nashville, TN  
**MODEL COMPETITION GUIDELINES**

The American Society for Engineering Education (ASEE) Two-Year College Division (TYCD), Model Design Competition will be held Monday, June 23, 2003 in conjunction with the ASEE Annual Convention in Nashville, TN.

**MODEL PROJECT:**

**Objective:**

To design and build a battery-powered vehicle that travels one of three possible paths on a designated track as quickly as possible.

**Vehicle Specifications:**

**Allowable battery types:**

9 volt alkaline	(Duracell™ MN1604 or equivalent)
1.5 volt D alkaline	(Duracell™ MN1300 or equivalent)
1.5 volt C alkaline	(Duracell™ MN1400 or equivalent)
1.5 volt AA alkaline	(Duracell™ MN1500 or equivalent)

**Maximum number of batteries:**

9 volt	: One
1.5 volt	: Eight (any combination of D, C, and AA).

**Maximum vehicle size:**

Height: 5 inches  
Width: 7 inches  
Length: 15 inches

**Components, Fabrication and Cost:**

Team members using tools and component parts, which are commonly available to the general public must perform all fabrication. Use of a commercially available battery-powered vehicle will not be allowed. The total cost of all components must not exceed \$300.

**Vehicle Navigation:**

The vehicle must be capable of navigating the course without any input from the team. Team members may not operate radio, infrared, ultrasonic, electrical, or other remote controls once the vehicle begins moving.

**Vehicle Inspection:**

Prior to the race the judges will inspect each vehicle for the following:

- 1) Each vehicle must meet the required specifications for dimensions, allowable batteries, etc.
- 2) Each vehicle must pass a safety inspection. Any vehicle that presents a safety hazard, or has the potential to damage any property or the track will not be allowed in the competition.

**Track Specifications:**

- See Figure 1 for the track dimensions.
- Vehicles will be tested on a non-painted, light colored, non-carpeted, BC grade plywood surface.
- The track shall be formed by placing three 4'x8' pieces of plywood side by side to form a surface that is 8'x12'.
- 2" x 2" (typical actual size is 1.5" x 1.5") boards will be fastened to the top surface of the track as shown in Figure 1 to form barriers, which define the areas of the track to be navigated. (Additional joints in the barriers than those shown in Figure 1 are recommended so that the three sheets of plywood may be transported separately.)
- 3/4" electrical tape will be placed on the track as shown on the diagram. All curves have a 12" radius.
- The track includes two tunnels (see Figure 2). The opening to the tunnel should be at least 4.5" x 4.5". A test block that measures 4.5" x 4.5" should be able to slide through the tunnel. The exact dimensions of boards A, B, C, D, and E in Figure 2 are arbitrary as long as the proper tunnel opening is provided.
- The track includes a bridge (see Figure 3). The bridge is formed using two boards with dimensions 5.75" x 7" x 0.25". No beveling of edges is allowed. The boards should be made of light-colored plywood that is as similar in color to the BC track plywood as possible.

**Speed Test:**

In order to complete the course successfully, the vehicle must:

- 1) The vehicle must follow one of the three paths indicated in Figures 7, 8, and 9. Note that the vehicle is not required to follow the tape on the track. The paths shown simply indicate around and between which barriers the vehicle must travel.
- 2) The vehicle must begin behind the Start/Finish Line as indicated in Figure 5 (anywhere between the barriers to the left and to the right of the vehicle). The judges will indicate when the car is to begin the race with a signal such as "On your mark, get set, Go!" Only one starting signal will be given by the judges per time trial (no restarts allowed).
- 3) The vehicle should cross the Start/Finish line, travel around one of the three paths specified, and cross the Start/Finish line again. When the vehicle has completely crossed the Start/Finish line, the time for its speed trial will end. Note that the car is not required to stop so a team member may stop it or pick it up after it crosses the Start/Finish line.
- 4) Since the three paths have different lengths, scale factors are used to determine a vehicle's **adjusted time** as follows:
  - If Route 1 is followed (Longest Path) – No scale factor is used
  - If Route 2 is followed (Bridge Path) – **Adjusted time** = (Actual time) x 1.29
  - If Route 3 is followed (Tunnel Path) – **Adjusted time** = (Actual time) x 1.75
  - The scale factors were determined as follows: Vehicles following the tunnel path or the bridge path are given slight advantages since they have the additional requirements of either climbing a bridge or navigating through a small tunnel. If each vehicle follows the tape on its path, the vehicle following the longest path needs to travel about 10% faster than the other two vehicles in order for the three vehicles to finish in a dead heat. In the example table below, the vehicles following the tunnel path and the bridge path travel at 2.5 ft/s and the vehicle following the longest path travels at 2.75 ft/s (10% faster) and all three vehicles finish the course in about 15.6 s.

Path	Distance (ft)	Speed (ft/s)	Time (s)	Scale Factor	Adjusted time (s)
Tunnel	22.28	2.50	8.91	1.75	15.60
Bridge	30.28	2.50	12.11	1.29	15.63
Longest	42.85	2.75	15.58	1.00	15.58

- 5) Other requirements: Vehicles may touch the sides of barriers, but cannot touch the tops of barriers or climb over any of the barriers except by using the bridge or else their current trial will be disqualified. If a vehicle using the bridge moves off of the side of the bridge and touches the top of the barrier that passes under the bridge, its current trial will be disqualified.

**Scoring and Test Procedures:**

- 1) During the competition, each team may perform a maximum of three trials (the judges may opt to reduce the number of trials if they find it necessary due to time constraints).
- 2) Teams may make repairs or adjustments to their vehicles between trials. No components may be added or permanently removed with the exception of programmable circuit elements and batteries. Replacement of malfunctioning parts between trials is allowed.
- 3) The batteries on board the vehicle are the only allowable source of energy.
- 4) The team may not touch or communicate with their vehicle while it is performing a test.
- 5) The object of this event is to perform the required task in the least amount of time. A team's lowest time of the trials performed will be used in the judging. If a team fails to complete the test in three trials then the team will receive zero points for the event based upon time trials. For the cars that complete the test satisfactorily, the following points will be awarded:
  - **1<sup>st</sup> place**: 55 points for the fastest car's **adjusted time** in seconds (i.e., its actual time multiplied by the appropriate scale factor).
  - All other teams receive a score less than 55. The number of points will be determined by taking the fraction formed by taking the fastest car's **adjusted time** in seconds and dividing it by their **adjusted time** in seconds. This fraction will then be multiplied by 55 and rounded off to the nearest whole number. This is the score for that team.
  - Judges are allowed to add up to 10 points to any team's score based upon judgment of performance criteria not specified by the competition rules.

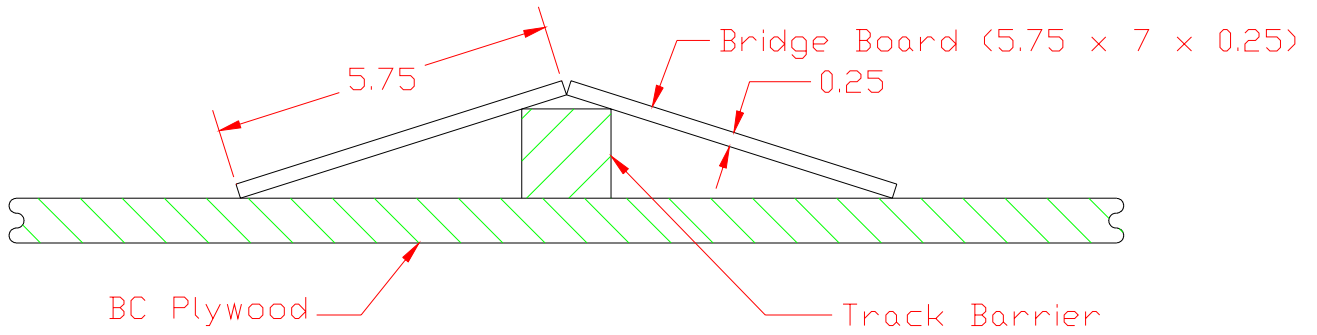
**Judges Discretion:**

If questions arise regarding the rules of the competition:

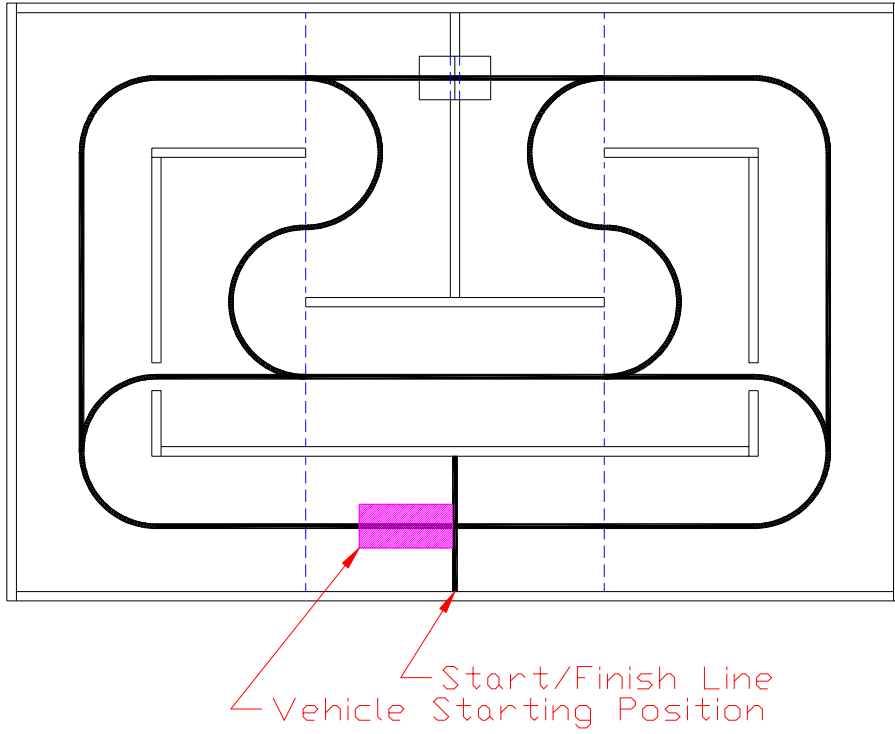
- Before the date of the competition: Contact Paul Gordy or Bill Beston
- On the date of the competition: Judges may be asked to clarify the rules. All decisions by the judges are final.



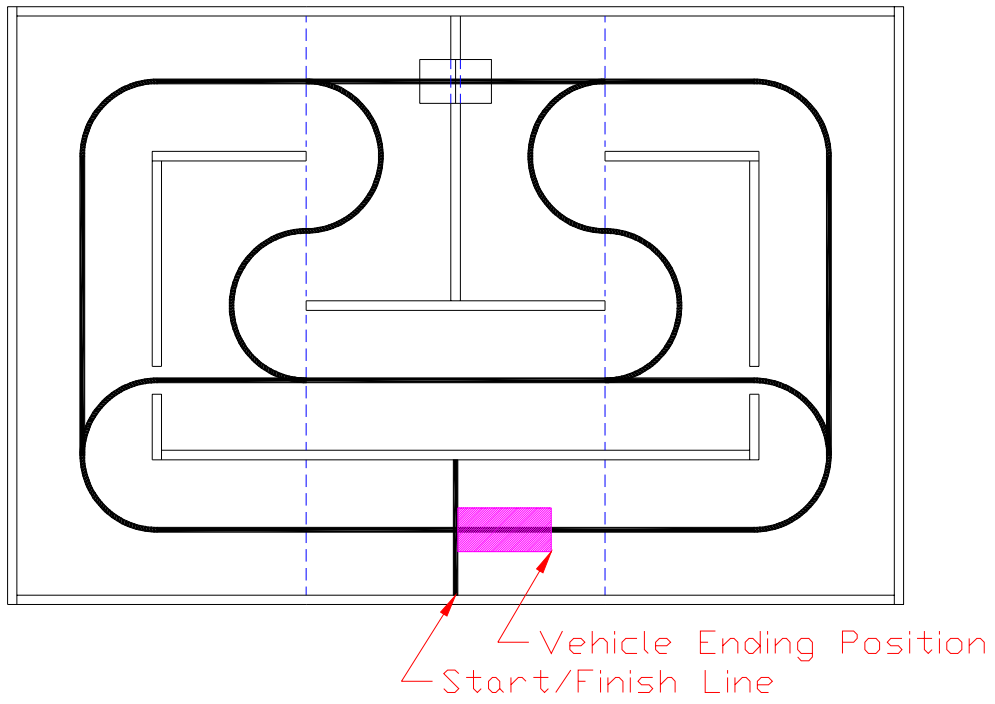
# Bridge Detail



**Figure 3 – Bridge Detail**



**Figure 5 – Starting Position**



**Figure 6 – Ending Position**



**Oral Presentation:**

Prior to the testing of the vehicles, each team shall make a maximum 10-minute oral presentation. The judges may reduce the actual length of the presentations if the number of entries does not allow the presentation component of the competition to be completed in a reasonable period of time. The oral presentation will be followed by up to 3 minutes of questions by the judges. If time allows the judges may allow additional questions. Only one spokesperson for each team will be allowed to ask questions if recognized by the judges. Other competing team members or spectators may not ask questions or make comments during the oral presentation or questioning period.

The oral presentations should include the following components (each component is worth 5 points):

1. **Problem Identification:** A description and history of why the vehicle was designed and built.
2. **Preliminary Ideas:** Problem Formulation
3. **Abstraction and Synthesis:** Refinement of goals and ideas
4. **Analysis:** Comparison and evaluation of alternate designs (Scaled drawings of the vehicle need to be included)
5. **Final Solution:** A discussion of what improvements could be made on future designs is required

In addition, the assessment of the presentation will include two components worth 5 points each.

6. **Presentation Quality and Adherence to the Guidelines of the Project**
7. **Written report:** A written summary (max of 3 pages) of the presentation shall be given to each judge (5 copies). An appendix should be included containing a parts list, detailed cost estimate, CAD drawings, and copies of the receipts or vendor price list for all parts having a retail of more than \$10 is required.

**Scoring:**

The judges will evaluate the content and form of the oral presentation. Teams may receive any integer number of points between 0 and 35. The judges may give an equal score to two or more teams.

**PROJECT TEAM / ENTRY LIMITATIONS:**

Each construction team must have at least one faculty advisor and at least 2 student members but no more than 10 student members. Each team member must primarily be enrolled in freshmen or sophomore level classes.

**PROJECT INTEREST AND REGISTRATION FORMS:**

Please find the entry forms on a separate page. The Interest Form must be received no later than March 1, 2003. A Registration Form for each model design team must be received no later than June 1, 2003.

**ASEE ANNUAL CONVENTION PASSES:**

It is not required that student team members or faculty advisors be registered for the ASEE Annual Convention. Passes will be provided for all team members and advisors so that they can enter the conference area and exhibition area on the day of the competition. Details for obtaining passes will be made available a couple of weeks prior to the competition.

**JUDGING:**

Oral Presentations will take place Monday prior to the Vehicle competition at 10:30 AM unless otherwise specified. Specific location will be published within the ASEE Final Program and Proceedings booklet.

Vehicle judging will take place Monday afternoon, June 23, 2003 in the Exhibitor's Hall Area at about 2:00 PM.

All decisions made by the judges are final.

**PRACTICE SESSION:**

The official track will be available in the Exhibition Hall for teams to practice following the oral presentations. Teams should be considerate and only use the track for brief periods if other teams are waiting to use the track. No cars should be on the track after 1:45 as the judges will be preparing to begin the time trials at 2:00pm.

**AWARDS:**

First, second, and third-place teams will receive plaques. Please direct questions to:

Paul E. Gordy  
Tidewater Community College  
1700 College Crescent, Virginia Beach, VA 23453  
Phone: 757-822-7175  
Email: PGordy@tcc.vccs.edu  
Web page: <http://www.tc.cc.va.us/studorgs/vbeng/>

William C. Beston  
Staff Associate  
National Science Foundation  
Arlington VA  
Phone: 607-778-5344  
Email: wbeston@nsf.gov





**2003 ASEE MODEL DESIGN COMPETITION  
INTEREST FORM**

Number of Model Entries Expected

College/University:

Faculty Advisor Name:

Mailing Address:

City, State, Zip

Phone:

Fax:

e-mail:

Please submit to: Paul E. Gordy, Tidewater Community College  
1700 College Crescent, Virginia Beach, VA 23453  
Phone: 757-822-7175  
Fax: 757-427-0327  
Email: PGordy@tcc.vccs.edu  
<http://www.tc.cc.va.us/studorgs/vbeng/>

This form is due by March 1, 2003 (by mail, fax, or email)

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**2003 ASEE MODEL DESIGN COMPETITION**

**REGISTRATION FORM**

College/University:

Faculty Advisor Name:

Student Names: 1) 6)  
2) 7)  
3) 8)  
4) 9)  
5) 10)

Please submit to: Paul E. Gordy, Tidewater Community College  
1700 College Crescent, Virginia Beach, VA 23453  
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Fax: 757-427-0327  
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This form is due by June 1, 2003 (by mail, fax, or email)