

ELECTRIC VEHICLE 2023

1. **DESCRIPTION:** Teams must design, build and test a "vehicle" which uses electrical energy as its sole means of propulsion. They should be able to adjust the vehicle to travel a distance specified by the event supervisor.

A TEAM OF UP TO: 2

IMPOUND: Yes

APPROXIMATE TIME: 8 minutes

2. **EVENT PARAMETERS:**

- a. Each team must bring and impound one Vehicle, alignment devices (if used), and additional/spare parts. The Vehicle must be impounded in its lowest potential energy state.
- b. Teams may bring a stand-alone calculator of any type and non-electronic tools which do not need to be impounded.
- c. All participants must properly wear eye protection at all times.
- d. Teams must be able to answer questions regarding the design, construction, and operation of the device.

3. **CONSTRUCTION PARAMETERS:**

- a. Vehicles should be designed to travel between 9.00 and 12.00 meters and come to a complete stop. The exact distance will be chosen by the Event Supervisor in an interval of 0.10 meters and will not be announced until the impound period is over.
- b. Electrical energy used to propel the vehicle must be stored in common, commercially available batteries labeled with their voltage by the manufacturer. Lead acid batteries are not allowed.
- c. Batteries may be connected in parallel or series as long as the voltage across any two points is less than or equal to 9 volts, as stated by the manufacturer labels. Batteries need not be installed until immediately prior to the run.
- d. All energy for propulsion must be electric and come from the batteries. The batteries must be in easily accessible locations for inspection by the Event Supervisor.
- e. No other internal or external electrical storage devices, microcontrollers, or micro processing devices of any kind may be attached or used in any capacity to propel, operate, and or/regulate the vehicle including non-propulsive functions (e.g. braking system, steering).
- f. Additional non-electrical energy storage devices may be used to operate other functions (e.g., braking system steering) provided they do not store energy that helps to propel the vehicle in any way.
- g. Components may be purchased or made by the contestants.
- h. In the ready-to-run configuration, the entire Vehicle must fit in a 60.0 x 60 x 60 cm space.
- i. The vehicle must have an approximately ¼-inch wooden dowel approximately perpendicular to the floor so as to be the foremost part of the Vehicle at all times during its run.
 - i. The dowel must extend to at least 20 cm above the Track's surface to interrupt the photogates or timing lasers if used.
 - ii. The dowel must also extend to within 1.0 cm of the Track's surface so that its front bottom edge will be the Vehicle's Measure Point for Distance Measurement.
- j. No part of the Vehicle, including the wheels, can extend beyond the ¼-inch dowel, other than the dowel attachment device.
- k. Teams must start the vehicle using the eraser part of an unsharpened #2 pencil with an unused eraser to actuate a button or switch perpendicular to the floor.
- l. All parts of the Vehicle must move as a whole; no anchors, tethers, tie downs, launching ramps, or other separate pieces are allowed. The only parts allowed to contact the floor during the run are the wheels/treads. Pieces falling off during the run constitutes a Construction violation.
- m. The Vehicle may not be programmed, remotely controlled or tethered. The stopping mechanism must work automatically.

4. **THE TRACK:**

- a. The Track will be on a smooth, level, and hard surface.
- b. The Event Supervisors must mark the track as follows:
 - i. Start Point - an approximately 5 cm x 2.5 cm tape with the Start Point marked at the center of the tape.
 - ii. 0.25 m Timing Line - a line of 2.5 cm tape, approximately 70 cm long, to be placed perpendicular to and centered on the imaginary Center Line. The edge of the line closest to the Start Point must be 0.25 cm from the Start Point.
 - iii. 7.25 m Timing Line - a line of 2.5 cm tape, approximately 70 cm long, to be placed perpendicular to and centered on the imaginary Center Line. The edge of the line closest to the Start Point must be 7.25 m from the Start Point.
 - iv. Target Point - an approximately 5 cm x 2.5 cm tape with the Target Point marked at the center of the tape.
- c. The exact Target Distance from the Start Point to the Target Point will be between 9.00 m and 12.00 m (at a 0.10 m). The exact distance will be chosen by the Event Supervisor and announced after the impound period is over.
- d. A photogate timing system is highly recommended. See www.soinc.org for information. If used, the system will be installed at the Timing Lines with the beams at a height of 17.0 ± 2.0 cm. At least one manual timer should be used as a backup. If photogates are not being used, three timekeepers should be utilized with the middle time used as the official Run Time - lasers are recommended to be placed at the Timing Lines so the timekeepers only have to watch for the flash of light as the dowel cuts through the laser beam.
- e. At the Event Supervisor's discretion, more than one Track may be used. If so, the team may choose which Track they want to use but must use the same Track for both runs.

5. **THE COMPETITION:**

- a. All vehicles and batteries must be impounded before the start of the competition. Tools, data, and calculating devices need not be impounded.
- b. Only teams and judges will be allowed in the impound area and track areas. Once competitors enter the event area, they may not receive outside assistance, materials, or communication.
- c. Teams will be given 8 minutes to set up their vehicle and complete up to 2 runs. Vehicles in the ready-to-run configuration before the end of the 8 minutes will be allowed to complete a run.
- d. Teams may use their own measuring devices to verify Track dimensions during their Event Time and may use any sighting/aiming devices. Teams must not damage or leave any residue on the floor. Teams may clean the Track during their Event Time, but it must remain dry.
- e. Teams may not verify the distance by rolling the vehicle on the track surface (floor) between the start and finish line at any time prior to or during the competition.
- f. Teams must start the Vehicle using any part of an unsharpened #2 pencil with an unused eraser, supplied by the Event Supervisor, in a motion approximately perpendicular to the floor, to actuate a trigger. They may not touch or "push" the Vehicle to start it or hold it while actuating the trigger. Teams must not follow their Vehicle and must wait until called by the Event Supervisor to retrieve the vehicle.
- g. If the Vehicle does not move upon actuation of the trigger, it does not count as a run. The team may continue to work on their device to attempt 2 runs within the Event Time.
- h. A Failed Run can occur if the Vehicle starts before the Event Supervisor is ready, if its distance cannot be measured (e.g., the participants pick it up before it is measured), or if the team pushes the Vehicle down the track. Construction and/or Competition Violations must still be recorded for Failed Runs. A team having only one successful run during the 8-minute Event Time will be assessed a Failed Run for a 2nd run score. If the Vehicle does not move during the Event Time, the team will be assessed 2 Failed Runs.
- i. If the Vehicle passes the 0.25 m Line but stops before the 7.25 m Line, it is considered a Competition Violation. The Event Supervisor records the run measurement.

- j. If the Vehicle travels in the wrong direction (e.g., propelled backwards) or if its distance or time cannot be measured (e.g., it starts before the Event Supervisor is ready, if it moves but does not go at least 0.25 m, or the participants pick it up before it is measured), the run is a Failed Run.
- k. Teams may remove their vehicle once they finish competing; however, if they wish to file an appeal, they may not retrieve their vehicle without permission from the appeals committee. Once they have taken their vehicle, they may not file an appeal.

6. **SCORING:**

- a. Each team's Final Score is the better of the 2 Run Scores. Low score wins.
- b. **Run Score** = Time Score + Distance Score + Run Penalties.
- c. **Time Score** = Run Time x 2. Run Time begins when the dowel of the Vehicle reaches the 0.25 m Timing Line and ends when it passes the 7.25 m Timing Line. The Run Time must be recorded in seconds to the precision of the timing device used. The Run Time will be recorded as 0.00 seconds for Failed Runs or if the Vehicle passes the 0.25 m Line but stops before the 7.25 m line.
- d. **Distance Score** is the distance from the Vehicle's Measurement Point to the Target Point in centimeters measured to the nearest 0.1 cm. This is a point-to-point measurement. The Distance for a Failed Run is 1200 points.
- e. **Run Penalties**
 - i. Competition Violation: 150 points are added to the Run Score per violation.
 - ii. Construction Violation: 300 points are added to the Run Score per violation.
 - iii. Failed Runs should also be assessed violations.
- f. Two or more teams tied with 2 Failed Run scores, without Competition or Construction Violations will remain scored as ties. Other ties are possible.
- g. Tiebreakers in order: 1. Better Vehicle Distance of the scored run; 2. Shortest Run Time of better scored run; 3. Better Vehicle Distance of the non-scored run.