

2016 SPECIFICATIONS

PUSHCARTS

RACV



ENERGY 
BREAKTHROUGH

17-20 NOVEMBER 2016 | MARYBOROUGH, VICTORIA

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THE PREMIER SCIENCE, TECHNOLOGY, ENGINEERING AND MATHS, ACTIVE LEARNING PROGRAM

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PUSHCARTS

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1. Spirit of Competition

Designing and developing a Pushcart can be an enjoyable and productive way of introducing primary students to technology, science and environmental education. The machine, powered solely by students, is based on the old fashioned billycart.

An integral part of the building of this Pushcart involves students thinking creatively and innovatively in the design, development and construction of such a vehicle to ensure that it performs efficiently and effectively across all areas of the event.

Scrutineering:

All teams must present their pushcart and eight team members to the judges for scrutineering, along with their safety equipment (see 4.4) of safety requirements before participating.

An 'RACV Tested' sticker will be allocated to teams after successful completion of scrutineering and teams will not be permitted to participate without a sticker. This is to be displayed above or below the number at the front of the pushcart.

2. Classes of entry

There are two sections in the pushcarts:

A1: schools with a student enrollment of 200 students or less

A2: schools with a student enrollment of more than 200 students.

3. Team Composition

- Teams of between eight and ten students will, with assistance if required, design and build a pushcart according to the specifications which follow.
- Each team must comprise of at least 50% females.
- All team members must participate in the Design and Construction and Display and Presentation elements of the event.
- Each team member must participate in at least two of the three track components: sprint, endurance and obstacle.
- The team may obtain the assistance of other students, parents, friends, local trade's people, community groups, etc, in the development of the pushcart. However, adults and other students are not permitted to assist the team when competing.

4. Design Requirements

4.1 General:

- The basic design is a billycart with four wheels, a roll-push bar, a brake and front steering. (Roll bar can be the push bar or they can be separate.)
- Any construction material may be used, provided that the safety requirements are met. No car or motorbike parts may be used except seat belts, which are a safety item.
- Every component of the cart in its dismantled state must fit into an imaginary box 10 cm deep. The cart can be as high or as elaborate as desired, providing it can be disassembled to meet this requirement.

- The front of the pushcart must have foam protection (minimum of 4 cm thickness of foam) to prevent injury should the cart collide with another, or the feet or legs of another pusher.
- Moving bolts on the pushcart must have lock nuts or double nuts **or be designed** so that they don't work loose during the trial.

4.2 Brakes:

- A brake must operate on at least one rear wheel.
- The brake control or pedal must be controlled by the rider and have a definite 'off' position.
- The brake is to be operated by the driver.

4.3 Wheels and Steering:

- Wheels, including tyres, must not exceed 250 mm in diameter.
- Front wheels must not contact the cart on full steering lock causing front wheels to lock.
- The steering is to be operated by the **driver, that is, not the pusher.**

4.4 Safety:

- Protruding bolts must be cut off and jagged edges filed smooth.
- The design shall be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators.
- The roll bar must provide protection to the driver. It must be at least 100 mm above the head of the tallest team member while sitting in the pushcart. It can also serve as a push bar.
- Each member of the team must wear knee and elbow pads, an approved bicycle helmet and protective gloves.

4.5 Seat Belts

Type:

- The vehicle shall be fitted with an approved (Australian Design Rules) adult three point (minimum) automotive static or inertia reel seat belt.
- Automotive full harness types are acceptable.
- The seat belt will be completely standard, including buckle, stitching and mounting plates.
- Second-hand belts free of visible damage are acceptable.
- Seat belts must be adjustable to fit all individual team members.

Mounting:

- The seat belt should be mounted to a major structural, non-moving member of the cart.
- Upper belts should be mounted behind the rider's shoulders, to suitably braced points on the roll bar.

Stability:

- If a rear step is installed to enable the pusher to scoot the vehicle, the cart must be stable while the heaviest pusher is standing on the step and the lightest driver is sitting in the pushcart.
- Pushcarts must demonstrate stability to compete in all events of the Breakthrough.

4.6 Vehicle Identification:

- At registration, each pushcart will be provided with two adhesive identification panels (200mm x 200mm) with their competition number on it.

- One of these identification sticker must be attached to a panel on the front of the pushcart, whilst the other sticker must be attached to a panel on the left hand side of the pushcart.
- Number panels must not constitute a danger to pusher or driver.
- Provision may need to be made for the display of sponsor panels.

5. Pushcart Assessments and Events

5.1 Design and Construction:

The purpose of Design and Construction is to assess the team's knowledge and understanding of the pushcart and its design and construction.

This event also enables the judges to assess teamwork, practical skills and understanding as well as the design features of the vehicle. In this component, they will be looking for competence at assembly, innovation in design, construction of pushcart, overall team approach, use of recycled materials, technology skills, and involvement of other people in design.

Within the Design and Construction component, each team (without support crew) will be required to:

- rebuild the dismantled pushcart within 30 minutes. In the unlikely event of a team taking more than 30 minutes to assemble the pushcart, the attempt will be abandoned for assessment purposes.

Judges allocate points out of 30 for this component.

5.2 Display and Presentation:

The purpose of Display and Presentation is for all team members to demonstrate their knowledge and understanding of the entry.

The team will be required to present their record, visually and orally, showing:

- The various aspects of the project, including sketches, mock ups.
- How the pushcart was developed, what problems arose and how they were overcome.
- How other students and other people were involved.
- How studies were integrated in the development of the pushcart.
- How the team prepared for the Breakthrough.

Judges allocate points out of 30 for this component.

5.3 The Trials

- A Sprint relay, Obstacle and an Endurance Relay will test all aspects of vehicle design, construction and reliability as well as student fitness and teamwork.
- All teams must participant in all three elements.
- Points will be allocated on the basis of time for all events.
- Power for the vehicle must come solely from the single team member who is pushing the pushcart.
- The pusher may ride on the back of the cart while scooting along.
- Ultimate success on the track will depend as much upon fitness and teamwork as on the design of the vehicle.

Sprint relay:

The sprint relay will be conducted over a 50 metre straight track with eight team members having a turn of pushing and driving.

Points Allocation for the Sprint Relay

- Points will be allocated on the total team time recorded. That is: 15 points to the team recording the fastest time.

$$\text{Time Trial Score} = 15 - \left[\left(\frac{X - Y}{Y} \right) \times 15 \right]$$

- Where Y = fastest team time recorded & X = team's own time

Obstacle course:

Four team members will be required negotiate an Obstacle Course on both sealed and grassed surfaces.

Points Allocation for Obstacle Course

$$\text{Obstacle Course Score} = 10 - \left[\left(\frac{X - Y}{Y} \right) \times 10 \right] - \text{Penalty}$$

- Where Y = fastest team time recorded (in seconds) & X = teams own time (in seconds).

Obstacle Rally – Penalties & Infringements:

<u>Infringement</u>	<u>Penalty Points</u>
<u>Contact with hay bale or barrier, loose seat belt and/or helmet,</u>	<u>0.2</u>
<u>Careless driving, contact with other vehicle, no seat belt, no helmet, incorrect pit change over</u>	<u>0.5</u>
<u>Very dangerous driving</u>	<u>1</u>

Endurance Relay:

- This relay will be conducted on the HOLDEN track with eight team members each having a turn of pushing and driving.
- Each person will be required to push for approximately 150 metres, then drive for approximately 150 metres before change-over.
- The endurance will be run in a *time trial format*, that is, each team starting with a 20-30 second gap.

Points Allocation - Endurance Trial

- Points will be allocated on time taken to complete the trial by the team. That is, 15 points to the team recording the fastest time.
- Other finishers: (X/Y) multiplied by 15 = points
- Where Y = highest number of laps recorded & X = team's number of laps.