SCHOOL’S HANDBOOK

PART A: THE IMPORTANT INFORMATION YOU NEED TO KNOW

PART B: RESOURCES

NOV 21-24 2013

RACV ENERGY BREAKTHROUGH

MARYBOROUGH VICTORIA

ONE OF AUSTRALIA’S PREMIER SCIENCE, TECHNOLOGY AND EDUCATION PROGRAMS

A PARTNERSHIP BETWEEN
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For the latest information, visit the RACV Energy Breakthrough website:

http://www.racvenergybreakthrough.net
The RACV Energy Breakthrough has been a sensational success since 1991. The program provides opportunities for students and members of the community to expand their knowledge and understanding of technology as it affects the way we live and learn.

**Your school can be part of it.**

This Handbook is designed to answer all your questions. It contains information about:

- how your school can become involved in the Energy Breakthrough,
- how your school can enter,
- what you need to do to develop an entry,
- what sort of entries you can prepare,
- what happens at Maryborough,
- how your entries will be assessed, and
- design specifications and trial regulations.
Welcome to the 2013 RACV ENERGY BREAKTHROUGH
It’s more than an event, it’s a new way of thinking

“I drive a Porsche 928. Enjoy it tremendously. But I can see huge changes coming, with growing awareness of social and environmental responsibilities. We can’t keep on having inefficient cars. I don’t believe the world can go on consuming fuel recklessly. Wasting fuel. Not just because of diminishing reserves but what it is doing to the planet. Spewing out pollution. Vehicles have to be far more sensible in payload, much lighter, retain passenger comfort because you do need that, and be much safer.

It needs another breakthrough ...”

The RACV Energy Breakthrough, is without doubt, one of the most exciting and important events in the Victorian Education calendar and among the finest student participation events in the world. Developed by the Country Education Project, the Breakthrough offers male and female students, in both city and country schools, exciting real world challenges in science, technology and environmental education, with a particular focus on transport.

It’s more than an event, it’s a new way of learning

The RACV Energy Breakthrough adds new dimensions to curriculum planning for thousands of teachers. The event’s focus on energy and innovation enables teachers to involve primary and secondary students in exciting, ’hands on’ learning experiences throughout the year.

The objective of designing and constructing a vehicle, a machine or an innovation in technology, encourages a team effort and provides rich material for an integrated curriculum approach. As teachers have told us ...

‘It brings the classroom into the real world.’
‘It’s a fabulous concept that provides a real purpose to learn about a great range of curriculum area: maths, science, language, health and human relations.’

It’s more than an event, it’s a passport to a sustainable future.
The RACV Energy Breakthrough can also bring community and school together. It provides opportunities for students, teachers, parents, local industry and other groups to work together.

While having fun and achieving goals, students examine and use the latest technology to explore how we can reduce impact on the environment by changing the way we live and get around. As teachers have told us …

‘A wonderful real life experience with all the pressures of dealing with the unexpected, meeting deadlines and developing procedures and strategies.’

‘It is a great project that provides a great “vehicle” for getting kids involved in their learning.’

It’s more than an event, it’s a new way of having fun.

The 2013 RACV Energy Breakthrough comes together in Maryborough, Victoria from the 21st to the 24th of November, 2013 as a celebration of the year’s work by the students who buzz with the excitement of demonstrating their achievements, talking about their experiences and testing their vehicles in rigorous trials.

Beautiful Maryborough throws itself open to this celebration of young people and their learning. The Green Grand Prix’s lakeside circuit nestles adjacent to Princes Park which is alive with Innovations in Technology and an Energy Expo.

You cannot come away from the three days in Maryborough with anything but a glow about the value of this project for those students involved.’

‘The experience for the children and the whole school community was extremely beneficial and enjoyed by all involved.’

All the best from the RACV Energy Breakthrough Planning Committee.
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Appendices:

- Site Map

All changes and Additions to rules and Specifications for 2013 have been underlined in blue throughout this Handbook.
1. What is the RACV Energy Breakthrough?

The RACV Energy Breakthrough is an exciting program designed to provide opportunities for students, teachers, parents and local industry to work together to design and construct a vehicle, a machine or innovation in technology that will represent an energy breakthrough.

The program encourages participants to examine and use the latest technology while considering its impact on the environment and the way people live locally and globally. The RACV Energy Breakthrough isn’t just a once-a-year event!

School groups work throughout the year to design, build and test vehicles or machines within detailed specifications. It requires a team effort and an across-the-curriculum approach. These groups then bring their vehicles and machines to Maryborough, Victoria, in November, for a huge celebration in which they can demonstrate and trial them in action.

Aims

The RACV Energy Breakthrough aims to:

- actively involve young people in finding solutions for a world they will inherit
- provide an excellent technology studies project for primary and post-primary students
- provide a great opportunity for schools and communities to work and learn together
- provide an opportunity for women and girls to participate in what has traditionally been a ‘male’ area of the curriculum
- be a fun program with real world challenges
- offer students opportunities to explore and address vehicle design, driving skills and vehicle and passenger safety issues.
2. Where and when is it held?

**Dates & Location**
Participants in the 2013 RACV Energy Breakthrough will gather in Maryborough, Victoria from Thursday, November 21st to Sunday, November 24th 2013 to celebrate their achievements. Activities will include:

- judging of the design and construction
- judging of display and presentation
- on track elements.

Maryborough comes alive during this time with a host of great things to see and do. It is appropriate that the event is called the Energy Breakthrough because with so much to do, energy is one thing you must bring when you come to Maryborough.

As always, **the theme is energy.**

**Accommodation & Camping**
Your entry fee to the RACV Energy Breakthrough covers your camp site fees for your team.

There will be an online form to confirm your school’s camping details available on the website in September. On the camping form you will select the camping area in which you prefer to camp. On arrival to the site please proceed to your camping area and camping co-ordinator will direct you to your site. Site numbers will not be known prior to arrival.

**You will need to provide:**
- your own camping equipment
- your own food.

The camping areas are spread throughout the precinct on grassed areas. Some sites are inside the race circuits, whilst others are adjacent to Lake Victoria and the Maryborough Swimming Pool. Facilities provided include:

- Toilets
- Showers
- Water
- Power (for lighting only). All electrical leads must be ‘tested and tagged’.

Teams are welcome to stay overnight on the Sunday after the event to ensure a safe journey home on the Monday. Contact our Energy Breakthrough office in Maryborough for more info.
**Camping Locations**

Please familiarise yourself and all team members and support crew with the Precinct Map, found at the back of this Handbook.

There is ample camping within the RACV Energy Breakthrough site, in the following areas:

<table>
<thead>
<tr>
<th>Camping Area</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princes Park Oval</td>
<td>Primary Schools only</td>
</tr>
<tr>
<td>Jubilee Oval (inside RACV Track)</td>
<td>Secondary Schools only</td>
</tr>
<tr>
<td>Hockey Field (inside Holden Track)</td>
<td>Energy Efficient Vehicle Teams</td>
</tr>
<tr>
<td>Maryborough Caravan Park</td>
<td>Primary Schools <em>(by prior arrangement)</em></td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Try-athlon Teams only</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:**

- **No** caravans, camper trailers or campervans (“wheeled sleeping vehicles”) will be permitted at the RACV Energy Breakthrough. Schools that prefer to bring caravans or camper vans will need to make arrangements through the caravan park.
- You will be allocated a Camping Area by the event organisers and you will be directed to your campsite by a camping co-ordinator upon arrival.

* = **Primary Schools** wishing to camp in the Maryborough Caravan Park must make their own booking arrangements Ph: 03 5460 4848. Only 10 students and two adults per team will be covered by the RACV Energy Breakthrough entry fee for three (3) nights. Additional campers and nights must be paid directly to the Maryborough Caravan Park.

The RACV Energy Breakthrough site is alcohol free.

**Other attractions:**

**Energy Expo**

The **Energy Expo** incorporates displays of commercial applications of new technology and energy efficient systems and hands on interactive displays for young and old, simulators and prize draws. There’s also a range of food and entertainment attractions located on the area. The **Energy Expo** operates during the day on Friday and Saturday.
3. Who can enter?

**Teams**
- Teams can enter via the online registration through our website www.racenergybreakthrough.net.
- All entries are to be team entries and must consist of current school students.
- Teams in the **Human Powered Vehicle**, **Energy Efficient Vehicle** and **Try-athlon** categories will consist of a minimum of six (6) and a maximum of eight (8) riders (except for two-seaters where the maximum number of riders is 12), of whom at least half must be female.
- Teams in the **Pushcart** category will consist of a minimum of eight (8) and a maximum of ten (10) participants, of whom at least half must be female.
- **Innovations in Technology** teams must have a minimum of four (4) and maximum of six (6), at least half of whom must be female.
- All team members must be familiar with the operation of their vehicle, innovation or pushcart and must participate equally in the on track Trials at Maryborough.
- **Team members do not have to all come from the same school.** They could be part of a scout, church, or other community group, however they must all be current school students and be covered by the group’s insurance.

**Categories, Classes & Quotas**

<table>
<thead>
<tr>
<th>Category</th>
<th>Class</th>
<th>Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Powered Vehicles (HPVs)</td>
<td>Class A1: Primary students from schools with enrolment of 200 or less.</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Class A2: Primary students from schools with enrolment more than 200.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class B1: Students from Years 7 and 8.</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Class B2: Students from Years 7 to 10.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class C: Students from Years 7 to 12.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open: Open entries are for any group of school students that cannot fulfill the gender requirements set out above.</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>All Female B/C: Teams consisting of all girls from Years 7 - 12.</td>
<td>10</td>
</tr>
<tr>
<td>Try-Athlon</td>
<td>Class A, B/C and Open: as per HPV Classes.</td>
<td>40</td>
</tr>
<tr>
<td>Energy Efficient Vehicles (EEVs)</td>
<td>Hybrid 1 B/C: Pedal power, plus one other power source.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12, of whom at least half of the team must be female.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hybrid 1 Open: Pedal power, plus one other power source.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12. No gender requirements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hybrid 2 (Open): Two power sources, excluding pedal.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12. No gender requirements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric-Only (B/C): Vehicles are electric power only.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12, of whom at least half of the team must be female.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electric-Only (Open): Vehicles are electric power only.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12. No gender requirements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Petrol-Only (B/C): Vehicles are petrol only.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12, of whom at least half of the team must be female.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Petrol-Only (Open): Vehicles are petrol only.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students from Years 7-12. No gender requirements.</td>
<td></td>
</tr>
<tr>
<td>Pushcarts</td>
<td>Section 1 (A1): Teams from primary schools with enrolment of 150 or less.</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Section 2 (A2): Teams from primary schools with enrolment more than 150</td>
<td></td>
</tr>
<tr>
<td>Innovations In Technology</td>
<td>Open to Primary &amp; Secondary students.</td>
<td>40</td>
</tr>
</tbody>
</table>
Categories, Classes & Quotas continued:

- Entries are received on a 'first come' basis.
- A maximum of three entries per school in any of the HPV events (including Try-athlon) will be accepted.
- Additional entries from a school will be placed on a waiting list and will be notified if accepted into the event.

Human Powered Vehicle Open and Try-athlon Open Class entries have the following conditions:

- A maximum of 20 entries will be accepted in the HPV Open category.
- **Class changes**: Teams registered in the HPV B or C classes or the Try-athlon A or B/C class who request a transfer to an HPV Open or Try-athlon Open class, will incur a 50 (HPV) or 15 (Try-athlon) lap penalty in the trial.
- **Only one entry per school will be accepted in the HPV and Try-athlon Open Class.** This rule applies to both Primary and Secondary schools. Schools that have a team in the HPV or Try-athlon Open Class will not be able to enter further teams into this class.
4. What are the Categories of Entry?

The 2013 RACV Energy Breakthrough has five separate categories designed to cater for different levels of technology application and understanding:

- Innovations in Technology
- Pushcarts
- Human Powered Vehicles (HPVs)
- Energy Efficient Vehicles (EEVs)
- Try-athlon

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**Innovations in Technology**

*Proudly sponsored by Central Highlands Water*

*Craft and Model specifications: page 34*

*The theme is “Working With Water”.*

**Challenge 1: Crafty Design**

*Open to Primary & Secondary Students*

Teams must create a stable craft which will operate under its own power, along a channel of water 9.4 metres x 81.5 cm, carrying a full soft drink can. The depth of the channel is approximately 12 cm. The craft must complete one full length of the channel.

**Challenge 2: Junkyard Challenge**

*Open to Primary Students only*

Do you have creative problem solvers and budding engineers? The Junkyard Challenge where teams of 4 will be provided with a range of materials and be required to create a structure that will span 1.5 metres. This creation will be required to support a 3 litre container of water by the end of a three hour time limit. This is a class for Primary students only. The types of materials available will be a mystery to the teams, but they are likely to include recycled items – some useful, some not! It will be up to the team to decide which materials they would like to use and how they will build their structure.

**Pushcarts**

*For Pushcart Specifications, see page 38*

*Open to Primary Students only.*

The Pushcart event is a challenging but enjoyable way of introducing energy use and technology to young students. The machines are based on the humble billycart, and are pushed energetically through an obstacle course, sprint and circuit events at Maryborough in November. The teams of ten students may obtain the assistance of other students, parents, friends, local trades people, community groups to build their pushcart.
**Human Powered Vehicles (HPVs)**

*Human Powered Vehicle Specifications start on page 41.*  
*Human Powered Vehicle & Energy Efficient Vehicle Trial Regulations start on page 66.*

**Open to Primary & Secondary Students**

Entrants design, build and compete, using a vehicle powered solely by human power on street circuits. Design requirements include a maximum length of 2.7 metres, single seat and a minimum of three wheels. All entrants will be required to participate in the Trial sections on the street circuits at Maryborough in November (including a nine-hour lights-on period). There will be a compulsory eight-hour break for primary entrants (Class A) during the night, making the duration of the primary event 14 hours. The HPV B, C, Open and All Female B/C teams participate on the RACV Track and the HPV A event is held on the Holden Track.

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**Energy Efficient Vehicles (EEVs)**

*Energy Efficient Vehicle Specifications start on page 52.*  
*Human Powered Vehicle & Energy Efficient Vehicle Trial Regulations start on page 66.*

**Only open to Secondary Students**

The Energy Efficient Vehicle category is designed to engage students with current industry trends towards electric vehicles and other alternative fuel vehicles. **In 2013, the Energy Efficient Vehicle category will be run in four sections:**  
- Hybrid 1: Pedal power, plus one other power source.  
- Hybrid 2: Two power sources, excluding pedal.  
- All-Electric: Electric power only.  
- All-Petrol: Petrol only.

The big challenge is seeing how far their limited fuel allocations can carry them in the 24-hour endurance trial (including a nine-hour lights-on period), on a street circuit in November.

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**Try-athlon (For HPVs)**

*Vehicle Specifications: as per Human Powered Vehicles, which start on page 41.*  
*Try-athlon Regulations start on page 73*  
**Open to Primary & Secondary Students**

Quick pit stops, fast acceleration and smooth handling are the key to success in the **Time Trial** and **Obstacle Rally**, whilst the 8 hour **Endurance Trial** on the Holden track alongside the Energy Efficient Vehicles is a chance to really stretch the riders legs. This is the most widely assessed category at the Energy Breakthrough. Entrants use the same design requirements as for Human Powered Vehicles (HPVs).
5. How will our entry be assessed?

All sections must be attempted. Points are awarded in the following sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>HPV &amp; EEVs</th>
<th>Pushcarts</th>
<th>Try-athlon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and Construction</td>
<td>25</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Display and Presentation</td>
<td>25</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Trial elements</td>
<td>50</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>• Endurance</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>• Time Trial</td>
<td>10</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>• Obstacle</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is the responsibility of each team to ensure they complete all sections. The times for each of these sections are outlined in this Handbook and further details are provided in the Information Kit distributed in November.

**NOTE:** Schedules for Scrutineering, Design & Construction and Display & Presentation assessments will assume that teams will have arrived and be available from 12 noon on the day of the assessment. Late arrivals will be accepted only by negotiation.

**Scrutineering**

Human powered and energy efficient vehicles will firstly have to undergo a check to ensure the vehicles are safe and meet all the design specifications.

RACV Scrutineers will examine all vehicles before the assessment process starts. Where vehicles do not comply with specifications, or are considered unsafe, scrutineers will provide assistance and/or direction with work required in order to comply.

Teams will again be allocated hourly blocks in which to complete scrutineering. This will ensure that all vehicles are checked in a timely and efficient manner.

**Please Note:** Vehicles which do not comply with elements of vehicle specifications, but are considered safe may start the trial with a 50 lap penalty. This penalty can only be applied by RACV Scrutineers.

If changes are made to any of the specifications, the event committee will notify all team managers who have entered via their e-mail contact and changes will be published on the website.

All enquiries regarding HPV, Try-athlon and EEV Specifications should be sent in writing to Ernest Litera, Greg Hill and/or Blake Harris of the RACV: ernest_litera@racv.com.au, greg_hill@racv.com.au and/or blake_harris@racv.com.au
Design, Construction and Preparation

Following scrutineering, teams will be required to demonstrate to judges that all members have developed a thorough understanding of the design and construction aspects of their entry. Each team will be allocated a time to complete their Scrutineering and Design & Construction. This will be included in the Information Kit to be sent to schools in November. Teams MUST complete these assessments within the time allocated.

**NOTE:** Schedules will assume that teams will have arrived and be available from 12 noon on the day of the assessment. Late arrivals will be accepted only by negotiation.

**Design & Construction Purpose**

The focus of the Design and Construction is to assess team's understanding of the vehicle and the concepts involved in its design and construction. To this end, teams who have simply purchased a recumbent bicycle (complete or in kit form) and carried out basic modifications, will not score as well as teams who have built a vehicle from scratch. Consideration will be given to teams who have ‘Inherited’ a vehicle from previous teams but who have improved the design and/or construction in some way.

**Design & Construction Format**

As part of the Design and Construction assessment, teams will be required to:

- discuss and explain design and construction processes
- show each team member’s licence to judges.
- show all rider safety equipment, including each person’s gloves, helmets and glasses
- show copies of relevant design drawings.

**Criteria**

The focus for Design and Construction assessment will be:

- **Effort and input** – this is based on issues such as whether the vehicle bought, made from new, modified from the previous year and to what extent the students were involved in the various aspects of design and construction. Teams can show design drawings and models to demonstrate work undertaken by students.

- **Innovation and Quality** – how effective/clever the design concepts are, the materials used, construction methods and types of gears, brakes and steering.

- **Understanding** – the students’ understanding of the vehicle design and key design concepts incorporated, the materials, components, running set-up.

- **Safety – Design and Understanding** – the use of restraints, roll bars, rider protection and visibility.

- **Practicality, Stability and On-road Performance** – vehicle reliability, lighting, seat adjustments, vehicle handling, etc.
• **Driver Training and Skills Development** – presentation of licences for each team member, skills covered in driver training including driving at night, in the wet, etc.

• **Understanding of Environmental Issues** – the relationship between transport and issues including greenhouse, air pollution and the importance of renewable energy, etc.

### Display and Presentation

Each team will be required to present for a maximum of 20 minutes to a panel of judges. This will be followed by up to 10 minutes of questions from the judges. There is ample time prior to your allocated time to set-up your display area. This oral report will relate to the development of the team entry, including ideas that did not work and why. A specific time for each team to complete their Display & Presentation will be included in the Information Kit to be sent to schools in November.

**NOTE:** Schedules will assume that teams will have arrived and be available from 12 noon on the day of the assessment. Late arrivals will be accepted only by negotiation.

### Display & Presentation Purpose

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

Judges consider the different approaches taken in the presentations, such as some students reading from notes versus student presentations with limited reference to prepared notes. Schools are encouraged to be innovative in their presentations. However, care needs to be taken to ensure that ‘distractions’ do not overtake the real purpose, that is, ‘students demonstrating their understandings’.

### Display & Presentation Format

The judging panel consists of three members: a community representative, a young person with an interest in education and/or technology and an education/teacher representative. Judges will ask questions of team members following their presentation.

Each team is allocated time to set up their display prior to their time.

**All registered team members are required to participate equally in the presentation. Teams may chose to include up to two (2) additional students (ie. support crew) to join their registered team members in their presentations. However, the presentation roles must still be shared equally by all participating team members.**

The display may include photos, videos, models, prototypes etc should explain the involvement of students, school, community and/or industry in the program and the development of their entry. To reduce interference from nearby panels, no public address or small music (CD) systems will be allowed without prior approval of the Display & Presentation Coordinator.
The presentation should be designed in a way that ensures good information is well presented by students and enables the students to demonstrate their knowledge, understanding and involvement in all aspects of the entry.

**Display & Presentation Criteria**

Judges are asked to look for evidence of:

- Student involvement
- Levels of participation
- Team work and enthusiasm
- Individual contributions
- Understanding of the project.

It is understood that the levels of student involvement in the technical and practical activities related to the design and building of an entry will vary with age.

The oral presentation will be assessed according to:

- **Presentation Style**, including an introduction and outline of the presentation, awareness of the audience, style of presentation (reading from notes or reciting), clarity of language, use of materials, diagrams and models and topics covered.

- **Team Work**, including the effectiveness of leader’s role and sharing of knowledge and responsibility in the team, acknowledgment of individual team members role, team attitude and enthusiasm and the extent to which the presentation reflects the students’ own work.

- **Knowledge and Understanding**, including knowledge of the aims and values of the Energy Breakthrough, highlights of the school and community participation, team planning, preparation and training and technical aspects of the development of the vehicle.

- **Development of a Story** about the entry, including the trials, the preparations, the school and community’s involvement and the students’ achievements.

The visual display will be judged according to:

- **Layout and Organisation**, including the range of visual media and written text depicting vehicle development, the arrangement of items, the variety of information presented and the acknowledgment of sponsorship/financial support received.

- **Quality of Display**, including the effective use of diagrams, models, photos, text, drawings, etc. to convey message.

**The Trial/s**

In this section the operation of each entry will be tested.

- **Secondary Human Powered and Energy Efficient Vehicles** will complete a 24-hour trial on a street circuit in Maryborough

- **Primary HPV** teams will complete a 14-hour trial on a street circuit in Maryborough

- **Pushcarts** teams tackle a 50 metre sprint relay, obstacle course & an endurance relay.

- **Innovations in Technology** will undertake a performance test.

- **Try-athlon** teams will tackle a time trial, obstacle course and an 8-hour endurance trial.

*Please refer to the relevant section for each in Part B of this handbook for Trial details.*
6. What are the Tracks Like?

The Circuits

There are two tracks in Princes Park, Maryborough surrounding the beautiful Lake Victoria.

The RACV Track, shown above, is a challenging 1.3 km street circuit that reflects real-world conditions.

This track will be used for the Secondary HPVs, the Try-athlon Time Trials and Obstacle course and the Pushcart track events.

The Holden Track, shown above, is located between the Maryborough Caravan Park and the Princes Park oval. It is approximately 1.1 km long and includes a number of challenging left and right hand bends.

This track will be used by the HPV A (Primary) teams, Energy Efficient Vehicle teams and the Try-athlon Endurance teams.

On both tracks there are some unlit sections at night, and the sealed surfaces are not billiard table smooth.
The Pit Areas

There will be designated pit areas within walking distance of the camping area (see map). Each team in the HPV, EEV and Try-athlon endurance trials will be allocated a site in the pit area.

During the event there will be restricted access to the pit area.

Where possible, pit sites are numbered to match the vehicle number and are approximately 2.8 metres by 3 metres in size.

All pit sites must be set-up as per the direction of Event Officials. All teams must leave sufficient clearance area in front of their pit site for rider changeovers and to allow other teams to have line of sight of the track and pit lane.

There is no shelter in the Pit areas but there will be space at the rear of each Pit for teams to erect a small tent, or arrange to share a tent with another team.

Teams should erect a team or school banner in their designated pit area(s) including team numbers. A banner about two by one metres would be ideal.

Please Note: No vehicles or trailers will be allowed in the Try-athlon pit areas. Try-athlon teams are required to cross the circuit after their endurance event on the Saturday night whilst the Energy Efficient Vehicle 24 hour trial is still in progress.
7. How Do We Prepare?

The RACV Energy Breakthrough is an education event that encourages ‘learning by doing’ and focuses on science, technology and the environment.

“Through the RACV Energy Breakthrough, students were given responsibility for their own learning, teachers broke away from the conventional classroom practice and found that it worked, parents were more closely involved in the educational development of their child and community members contributed time, expertise, goods and money.”

- Deakin University, RACV Energy Breakthrough Evaluation – 1997

Schools undertake the Energy Breakthrough in a variety of ways, ranging from an out of school activity to the program being a central part of the formal curriculum. In whatever way the program is undertaken it can contribute to students’ learning in a wide range of areas.

Curriculum

Schools have identified the following curriculum links: technology studies, science, English, arts, environmental science, maths, accounting, computer studies and health and physical education.

The RACV Energy Breakthrough encourages and supports learning that:

- Is fun and engaging
- Is student centered
- Involves hands-on activities
- Requires active problem solving – on ‘real life’ issues (authentic)
- Is collaborative – builds teamwork skills.
- Creates links with the community
- Requires students to act on their learning
- Involves celebration
- Values and requires different skills, knowledge, (inter-disciplinary).

Holden Mentor Program

Holden has a team of mentors ready to support primary school teams entered in the Human Powered Vehicle (HPV) A Class and Try-athlon Primary Classes for the 2013 RACV Energy Breakthrough.

It’s a great opportunity for your school to develop a mentorship with an industry leader from Holden and for your students to hear what industry experts are saying about the future of personal transportation and the environment.

Find out more and how to apply at:
http://www.racvenergybreakthrough.net/about/holden-mentor-program/

Motors, Mentors and Money

Motors, Mentors & Money: the Electric Vehicle Incentive package

The RACV Energy Breakthrough are offering a limited number of exciting packages for teams to convert their human powered vehicles to electric powered vehicles.

We understand that preparing a energy efficient vehicle for the challenge of a 24 hour trial is not an easy feat. For some, a barrier to entry is not having access to the right equipment, resources or knowledge to pull it all together. Other teams are on the human powered vehicle waiting list and may have human powered vehicles ready to go, but no where to race.

Find out more and how to apply at:
http://www.racvenergybreakthrough.net/2012/06/14/electricvehicleincentive/
Advice and Assistance:
Here’s a range of contacts who would be happy to offer some advice and assistance:

<table>
<thead>
<tr>
<th>Human Powered Vehicles (HPV)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenspeed Recumbent Trikes</td>
<td>(03) 9753 3644</td>
</tr>
<tr>
<td>Trisled - Ben Goodall</td>
<td>(03) 5981 0337</td>
</tr>
<tr>
<td>Think HPV – John Taylor</td>
<td>0417 451 467</td>
</tr>
<tr>
<td>Seight Custom Cycling Wear (Clothing)</td>
<td>(03) 9886 0214</td>
</tr>
<tr>
<td>Tim White - Bendigo Senior SC</td>
<td>(03) 5443 1222</td>
</tr>
<tr>
<td>Terry Trevena - St Margaret's School</td>
<td>(03) 9703 8111</td>
</tr>
<tr>
<td>Doug Marr - Maryborough Ed Centre</td>
<td>(03) 5461 7900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pushcarts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter Gerdsen</td>
<td>(03) 5989 1071</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Efficient Vehicles (EEV)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Doug Marr - Maryborough Ed Centre</td>
<td>(03) 5461 7900</td>
</tr>
<tr>
<td>Robert Swain – Toorak College</td>
<td>0424 318 642</td>
</tr>
</tbody>
</table>

Curriculum Resources & Tools

‘Into the Future’ outlines a number of activities designed for upper primary to lower secondary students that can be used to introduce students to the Energy Breakthrough concepts in the 'Downloads' section.

Teachers are encouraged to share resources between schools in order to ease integration into the school curriculum. These can be emailed to: online@racvenergybreakthrough.net

Environmental Information

There are many useful websites that can help you understand the links between transport and the environment. The following sites are a good start for you and your students:

http://www.greenhouse.vic.gov.au
http://www.epa.vic.gov.au

Video

Videos of previous RACV Energy Breakthrough events are available from the Energy Breakthrough office in Maryborough. Phone 03 5461 0621.

Or on our YouTube channel: http://www.youtube.com/EnergyBreakthrough

Official event website:

For curriculum resource ideas, advice & assistance, for sale items, photos, results from previous events, further event info and news, check the Energy Breakthrough web-site:

http://www.racvenergybreakthrough.net

The website is proudly hosted by:

bendigoIT

... and join us on Facebook: http://www.facebook.com/racveb
8. Safety, Training, Log Book and Licence

There are three key elements to Energy Breakthrough preparation:

- Technology and design of the vehicle,
- Fitness and endurance, and
- Vehicle handling skills.

Participants plan and prepare the first two well: Long hours are dedicated to design and construction and diet and physical training plans sometimes rival Olympic efforts. However, time in the vehicle in a range of scenarios is key to safe vehicle handling.

Maneuverability is an extremely important safety issue. Teams will be riding for 24 hours. Well-planned training programs may prevent accidents when riders are tired.

Riders need to have some experience and training in the demands of the track. It is essential that students are well prepared for the varied conditions and challenges at the event through pre-event track conditions simulation and maneuverability practice.

Training Program & Log Book

With the help of VicRoads, we’ve prepared a Log Book for students to record their training and vehicle handling preparation. Although not compulsory, students are encouraged to present their Log Book to the new VicRoads station as part of the Scrutineering & Design and Construction process at Maryborough.

Downloads:

A copy of the Licences and the Log Book, can be downloaded from the Energy Breakthrough website in the ‘Downloads’ section: http://www.racvenergybreakthrough.net/downloads/

What should our training program include?

We recommend that all team members undertake at least 3 hours practice in the competition vehicle.

Practice in many and varied conditions, here are a few areas you might to cover:

- Safety experience
- Skid mitigation: sprinkle sand or gravel on the track turn the wheels into a skid
- Wet conditions training; hose your training track down to simulate rain
- Night riding practice: come back after dinner
- Cornering: chalk some tight corners onto the asphalt
- Cutting in and out of ‘the pack’: use witches hats
- Passing slower vehicles: use a bicycle as the other vehicle
- Defensive driving techniques: be ready for the unexpected.
- Pit Procedure: Practice smooth rider changeovers, including fastening seatbelts, adjusting seats and adding drink bottles
- Traffic lights and flag signals:
  Test each other to know what each light and flag colour means. The traffic lights/flag signals are the main way for Marshals and Traffic Officials to communicate with riders during the trial. During Design and Construction assessment members will be questioned about their knowledge of Traffic Lights/Flag Signals and track Conduct.
Here are some extra tips to help you prepare:

Driver position
Each team driver should be able to reach the pedals and be comfortable over their full range of movement, without stretching the leg straight.

Make sure the back is fully supported so that maximum effort can be applied to the pedals without needing extra support gained by pulling back on the steering wheel.

Both mirrors should be adjusted so that a vehicle following close behind – just to one side or other side – can be clearly seen without undue head movement.

Seat belts must be worn low over the pelvic bone (not high over the waist) and across the chest. The belt should be comfortable, firm and not prone to slipping off the shoulder. The seat position must ensure that the rider does not slide forward and under the seat belt.

Corners
A blue line is marked on the track. Vehicles are required to stay on the inside of the track (that is to the left of the blue line) at all times unless overtaking.

When entering a bend, look where you want the vehicle to go – this will help to pull you through in a smooth curve.

Mirrors
You must always be using your mirrors to know what is behind you, or if you are going to be overtaken, and to be aware of vehicles around you.

Finally, if you are planning to move from one side of the track to the other, give a quick glance over your shoulder to avoid moving into the path of another vehicle.

Steering the vehicle
Use a light grip on the steering wheel or levers; push the pedals from the hips, back and shoulders, with relaxed arms. This will allow you to steer smoothly and keep a straight line.

Licence
All team members are required to present their Licence to the new VicRoads station, which will be part of the Scrutineering & Design and Construction process at Maryborough.

If no licence is presented, any number of riders in your team will be required to demonstrate competence in vehicle control by undergoing a tough test. Safety is the number one priority at the RACV Energy Breakthrough.

By signing the Licence, the Team Manager and Principal both certify that the student has completed the necessary track safety, vehicle maneuverability training and has read and is familiar with the Trial regulations.

Downloads>
A copy of the Licences and the Log Book, can be downloaded from the Energy Breakthrough website in the ‘Downloads’ section: http://www.racenergybreakthrough.net/downloads/
9. What Do We Need?

**Paperwork**

You will need to have completed:

- an on-line entry for each team, and your invoice to be paid,
- a licence for each rider (see section 7),
- your school’s normal Excursion Permission Forms (see below).

**Timeline**

The receipt of your entry will be acknowledged by the organisers.

Throughout the year, you will receive newsletters with further information and shared ideas about Energy Breakthrough. Newsletter articles are always welcome. Feel free to submit updates on your teams progress, good learning programs or curriculum materials. Please feel free to contribute to the newsletter by contacting the RACV Energy Breakthrough Office.

In early November, you will receive an Information Kit, which will provide all details for participating teams about the Maryborough event, including schedule of times for assessment tasks, and other organisational requirements. *These schedules will assume arrival by 12 noon on the day indicated on the program.*

Teams wishing to change their category or any details relating to entries should log-on to the online registration system to manage their entry.

**Safety**

Make sure you fulfill all Department requirements (including insurance), **AS YOU WOULD FOR ALL SCHOOL EXCURSIONS.** This includes the completion of police checks of all attending parents and volunteers as per the requirements of the Working with Children Act.

While every precaution is taken to make the weekend as safe as possible (including first-aid facilities and on-going safety checks) no responsibility can be taken for teams. Be especially careful to ensure that helmets and other safety equipment are organised well before the event.

Please ensure your team is aware of the first-aid stations situated across the precinct.
10. How Do We Get Involved?

How to Enter

Enter online at http://www.racvenergybreakthrough.net after 9 am March 6, 2013.

The entry fee for each entry covers your camping fee and administrative expenses.

<table>
<thead>
<tr>
<th>Entry Fees</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 25</td>
<td>for each Innovations entry</td>
</tr>
<tr>
<td></td>
<td>(max $100 per school for unlimited entries)</td>
</tr>
<tr>
<td>$ 230</td>
<td>for each Pushcart team.</td>
</tr>
<tr>
<td>$ 380</td>
<td>for each Human Powered Vehicle entry.</td>
</tr>
<tr>
<td>$ 380</td>
<td>for each Energy Efficient Vehicle entry.</td>
</tr>
<tr>
<td>$ 380</td>
<td>for each Try-athlon entry.</td>
</tr>
</tbody>
</table>

All entry fees are GST inclusive.

CLOSING DATE FOR ENTRIES

Friday 3rd. May 2013
HUMAN POWERED VEHICLES,
TRY-ATHLON & ENERGY EFFICIENT VEHICLES

Friday 28th June 2013
(Last day Term Two)
PUSHCARTS
and
INNOVATIONS IN TECHNOLOGY

School Team Sponsorship

Individual entries are encouraged to negotiate sponsorship with local businesses or service groups. Such support must be consistent with the health and welfare of young people and the overall objectives of the RACV Energy Breakthrough.

There are enormous promotional opportunities for sponsors of teams and the event itself. Entrants should ensure that sponsors receive a good return for their investment. This includes maintaining a good relationship with sponsors, generating media coverage and reporting back to the sponsors on what their funds have enabled.

If you have any doubts about the suitability of a sponsor, please contact RACV Energy Breakthrough office 03 5461 0621.

Event Sponsorship

Any organisations interested in supporting the RACV Energy Breakthrough should contact the office on 03 5461 0621 for information.

For info on the RACV Energy Breakthrough’s current sponsors, head to: http://www.racvenergybreakthrough.net/about/sponsors/
Volunteer

The RACV Energy Breakthrough simply wouldn't happen without the army of volunteers giving their time and energy! There are endless opportunities for individuals and groups to get involved.

More specifically, we need:

- people with muscles for site set-up in the week prior to the event,
- people who can plan or administrate – either throughout the year or on the weekend itself,
- Individuals or Community Groups who can marshal a corner during one of the 14 or 24 hour trials (don’t worry, we don’t make you stand out there for the whole event!),
- people who have ‘people skills' and would like to assist with media liaison, judging or sponsorship,
- people who want to use their journalistic skills for our on-site newspaper: “Thales What’s Happening”.
- people who love to entertain and would like to be part of our trackside stage teams.

Whilst age is no barrier we'd love to see new young people become more involved in planning and administration of the event. Of course, we won’t turn away willing helpers either!

Want to volunteer or know someone who might?
Contact:
Martin Mark
Email: breakthrough@cgoldshire.vic.gov.au
Ph: (03) 5461 0621
11. Program

(i) Innovations in Technology

THURSDAY 21\textsuperscript{st} NOVEMBER
No activities

FRIDAY 22\textsuperscript{nd} NOVEMBER
All Day Teams Register
Location: Administration Centre

\textit{Innovations in Technology} teams must register on Thursday or Friday.
Saturday registrations will only be completed by prior arrangement with organisers.

SATURDAY 23\textsuperscript{rd} NOVEMBER

9.00 am - 3.30 pm Crafty Design and \textit{Junkyard Challenge} Assessment
Location: Display & Presentation marquees
\begin{itemize}
  \item Design & Construction
  \item Display & Presentation
\end{itemize}

2.00pm Crafty Design Performance Test
Location: Water troughs, near Display & Presentation marquees

4.30 pm Primary School Presentations
Location: Stage in Pushcart Marquee area
\begin{itemize}
  \item Innovations in Technology
  \item Pushcarts
  \item HPV A
\end{itemize}

SUNDAY 24\textsuperscript{th} NOVEMBER
No activities
THURSDAY 21st NOVEMBER
All Day: Teams arrive and set up camp
9.00 am Registration opens
Location: Administration Centre
1.00 pm - 5.00 pm Scrutineering
Location: Pushcart Marquee

FRIDAY 22nd NOVEMBER
8.30 am Compulsory Meeting of Team Manager and Captain
Location: Pushcart Marquee
9.30 am – 3.00 pm Display and Presentation
Location: Pushcart Marquee
10.00am – 12.00pm Obstacle Course (Group A)
Location: Pushcart Marquee
1.00pm – 3.00pm Obstacle Course (Group B)
Location: Pushcart Marquee
4.00 pm – 6.30 pm Endurance Event
Location: RACV Track

SATURDAY 23rd NOVEMBER
9.00 am Design and Construction
Location: Pushcart Marquee
11.00 am Sprint Event
Location: RACV Track
2.00 pm Design and Construction
Location: Pushcart Marquee
4.30 pm Primary School Presentations
Location: Stage in Pushcart Marquee area

SUNDAY 24th NOVEMBER
No activities
### (iii) Human Powered Vehicles - Class A

- **All Track activities are on the Holden TRACK**

#### THURSDAY 21st NOVEMBER
- **9.00 am** Registration opens
  - Location: Administration Centre
- **9.00 am – 5.00pm** Display and Presentations
  - Location: Display & Presentation marquees
- **9.00 am – 5.00pm** Design and Construction and Scrutineering
  - Location: Display & Presentation marquees
- **5.30 pm** Rider Briefing
  - Location: In front of Holden Track Stage
- **6.00 pm – 8.00 pm** Practice Session
  - Holden Track

#### FRIDAY 22nd NOVEMBER
- **11.00 am** Team Managers’ Briefing
  - Location: In front of Holden Track Stage
- **11.30 am** Assembly of Starting Grid
  - Location: Front Straight, Holden Track
- **12.00 noon** HPV A Trial Start
  - Location: Holden Track
- **9.00 pm** Compulsory HPV A Break

#### SATURDAY 23rd NOVEMBER
- **6.00 am** HPV A Restart
  - Location: Pit Lane, Holden Track
- **11.00 am** HPV A Trial Finish
- **4.30 pm** Primary School Presentations
  - Location: Stage near Display & Presentation marquees

#### SUNDAY 24th NOVEMBER
- No activities

---

All teams should have arrived and registered by 12noon on Thursday. Display & Presentation and Design & Construction schedules will be prepared with this in mind.
Human Powered Vehicles (HPVs) - Classes All-Female, B, C, & Open

All Track activities on RACV TRACK

THURSDAY 21st NOVEMBER
All Day  Teams arrive and set up camp
11.00 am  Registration opens
          Location: Administration Centre

FRIDAY 22nd NOVEMBER
All Day  Teams arrive, register, set up camp, set up displays etc.
8.00 am - 6.00 pm  Scrutineering, Design and Construction
          Location: Display & Presentation Marquees
8.00 am - 6.00 pm  Display and Presentation
          Location: Display & Presentation marquees
5:30 pm  Spirit of Competition – Team Captains Meeting
          Location: Hospitality Marquee, RACV front straight.
6.00 pm  Team Managers’ Meeting
          Location: Jubilee Oval Pavilion.
6.45 pm  Assembly for Night Practice
          Location: Pit Lane, RACV Track
7.00 pm – 9.00 pm  Night Practice
          Location: RACV Track

SATURDAY 23rd NOVEMBER
12.30 pm  Assembly of Starting Grid
          Location: Front straight, RACV Track
1.30 pm  Start of Secondary HPV 24-hour Trial
          Location: RACV Track

SUNDAY 24th NOVEMBER
1.30 pm  Finish of Trial
          Location: RACV Track
1.45 pm  Presentation of Trophies (Secondary)
          Location: Stage in near Display & Presentation marquees
Afternoon  Pack up and depart.

Note: Teams may stay overnight on the Sunday after the event to ensure that the team travels home safely.
THURSDAY 21st NOVEMBER
All Day  Teams arrive and set up camp
11.00 am  Registration opens
          Location: Administration Centre

FRIDAY 22nd NOVEMBER
All Day  Teams arrive, register, set up camp, set up displays etc.
8.00 am - 6.00 pm  Scrutineering, Design and Construction
          Location: Marquees on in-field, near Holden Bridge

8.00 am - 6.00 pm  Display and Presentation
          Location: Marquees on in-field, near Holden Bridge

6.30 pm  Team Managers’ Meeting
          Location: near Holden Bridge

9.15 pm  Assembly for Night Practice
          Location: Pit lane, Holden Track

9.30 pm – 11.00 pm  Night Practice

SATURDAY 23rd NOVEMBER
10.00 am  Energy Efficient Vehicles - Fuel-up
          Location: Marquees on in-field, near Holden Bridge

12.30 pm  Assembly of Starting Grid
          Location: Front Straight - Holden Track

1.00 pm  Start of Energy Efficient Vehicles (EEV’s) 24-hour Trial

SUNDAY 24th NOVEMBER
1.00 pm  Finish of Trial

1.45 pm  Presentation of Trophies (Secondary)
          Location: Stage in Energy Expo area

Afternoon  Pack up and depart.

All teams should have arrived and registered by 12noon on Friday.
Display & Presentation and Design & Construction schedules will be prepared with this in mind.
## Try-athlon

### THURSDAY 21\textsuperscript{st} NOVEMBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td>Teams arrive and set up camp</td>
<td></td>
</tr>
<tr>
<td>9.00 am</td>
<td>Registration Opens</td>
<td>Administration Centre</td>
</tr>
<tr>
<td>9.00 am – 5.00 pm</td>
<td>Scrutineering, Design and Construction</td>
<td>Display &amp; Presentation Marquees</td>
</tr>
<tr>
<td>9.00 am – 5.00 pm</td>
<td>Display and Presentation</td>
<td>Display &amp; Presentation marquees</td>
</tr>
<tr>
<td>6.30 pm – 7.00 pm</td>
<td>Team Managers, Timekeepers &amp; Observers Meeting (For Time Trial, Obstacle Rally &amp; Endurance)</td>
<td>Hospitality Marquee, RACV Track</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:** All teams should have arrived and registered by 12noon on Thursday. Display & Presentation and Design & Construction schedules will be prepared with this in mind.

### FRIDAY 22\textsuperscript{nd} NOVEMBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00am – 11.00am</td>
<td>Obstacle Rally (RACV Track - near stage)</td>
<td>A Class Plus OPEN Primary Teams</td>
</tr>
<tr>
<td>11am – 1pm</td>
<td>Open Class</td>
<td>Secondary Teams</td>
</tr>
<tr>
<td>2pm – 4pm</td>
<td>B/C Class</td>
<td></td>
</tr>
<tr>
<td>9.00am – 11.00am</td>
<td>Time Trial (RACV Track - back straight)</td>
<td>B/C Class</td>
</tr>
<tr>
<td>2pm – 4pm</td>
<td>A Class OPEN Primary Teams</td>
<td>Secondary Teams</td>
</tr>
<tr>
<td>9.15 pm</td>
<td>Assembly for Night Practice</td>
<td>Pit Lane, Holden Track</td>
</tr>
<tr>
<td>9.30 – 11.00 pm</td>
<td>Night Endurance Trial Practice</td>
<td>HDRace, Holden Track</td>
</tr>
</tbody>
</table>

### SATURDAY 23\textsuperscript{rd} NOVEMBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.30pm</td>
<td>Assemble on Starting Grid</td>
<td>Holden Track</td>
</tr>
<tr>
<td>1.00 pm – 9.00 pm</td>
<td>Try-athlon Endurance</td>
<td>Holden track</td>
</tr>
<tr>
<td>10.30 pm</td>
<td>Try-athlon Presentations</td>
<td>Lake side of Holden Stage</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:** No vehicles or trailers will be allowed in the Try-athlon pit areas.

### SUNDAY 24\textsuperscript{th} NOVEMBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Day</td>
<td>No activities, Pack up and depart.</td>
<td></td>
</tr>
</tbody>
</table>
12. Specifications

Innovations in Technology

Innovations in Technology teams must have a minimum of four and six participants, at least half of whom must be female.

Innovations in Technology is “Working With Water”. This includes learning about water, where it comes from, its wise use and conservation, its power; learning about the technology of design and construction and of course, the environment in which we live. All Craft and Models are to be designed and constructed by the students in the year of the event.

Challenge 1: Crafty Design
Open to Primary & Secondary Students

The challenge for Crafty Design is to create a craft that resembles some of the Macro invertebrates that live in and around the water. Macro means that we can see it with our eyes. Invertebrates are small animals and are a collective term used for all animals without a backbone which include spiders, crustaceans, worms, insects and molluscs. There will be a special prize for those who demonstrate they have met the objective.

One of the Macro invertebrates we at Waterwatch are intrigued with is the Mayflies; the mayfly nymphs can be identified by their three tails. They are found throughout Australia inhabiting streams, rivers, wetlands and pools, under bark, logs and rocks. The Mayfly nymphs all graze on algae or plants or consume detritus. Secondary students are encouraged to create other ways for craft to travel, e.g. craft must still have contact with water; under water.

Using construction materials such as TEKO, LASY and LEGO in conjunction with scrap material, create a stable craft (in keeping with the above theme) which will run under its own power, along a channel of 9.4 metres x 81.5 cm, carrying a full soft drink can. Please note that the water depth of the channel is approximately 12 cm. Craft must complete one full length of the channel. Craft dimensions: length and width to be under 81.5 cm.

The fuel source must be an alternative to fossil fuel. No dry cell batteries or capacitors permitted.

The craft must be able to maintain a direction within a lane, towards a designated target area on the end and must complete the course within a set time of three minutes.
Challenge 2: Junkyard Challenge

Do you have creative problem solvers and budding engineers?

The Junkyard Challenge will involve teams of 4 will be provided with a range of materials and be required to create a structure that will span 1.5 metres. This creation will be required to support a 3 litre container of water by the end of a three hour time limit. This is a class for Primary students only.

The types of materials available will be a mystery to the teams, but they are likely to include recycled items – some useful, some not! It will be up to the team to decide which materials they would like to use and how they will build their structure.

Materials: Basic Pack

EACH team will receive a BASIC PACK consisting of:

- Retractable tape measure.

Materials:

- 2 bike tubes.
- 6 pieces of tubing (2 thin, 4 thick).
- 4-6 pieces pine (less than 50cm long)
- 2 large boxes of thick cardboard.
- Fine nib texta.

Tools:

- Scissors,
- pliers,
- hacksaw (2 blades)
- silicon gun.
- thin Stanley knife,
- Cutting board (NOT TO BE USED IN STRUCTURE)

Connectors:

- 2 rolls of gaffer tape.
- 3 rolls of sticky tape.
- Roll of thin tie wire.
- 2 packet of zip ties.
- Ball of Rubber bands
- Ball of string.
- Tube of silicon

Junkyard Materials:

Will be available on the day to assist your construction! (That’s the mystery)

There will be a work station where several adults will have a drill if needed. (The adults will operate this drill – No Children) & they will also hold spare Stanley blades, which THEY will replace if teams break theirs.

Students should be assessed at school as being proficient in the use of tools/safety when using tools (e.g. cutting away from the body).
Process:
The teams will start with a 20 minute discussion time and then have 2 hours 40 minutes to build their structure.

Each team may bring a mentor with them to help during the discussion phase to assist in the sharing of ideas, but not to participate in the construction of the structure. The Mentors could be a parent/teacher. If the team is unable to organise a mentor, please let the Planning Committee know prior to the event.

Students may Barter & Swap what is in their BASIC PACKS during the time.

Finished Product
The structure MUST be able to support a 3 litre bottle of water (3kgs).

Judging Criteria
“The Best Bridge Trophy”
Judges will be looking for the structure that resolves the task, effectively and elegantly. Fitness for purpose and aesthetically pleasing, will win the day.

Special Award – The “Gravity Challenge”
For the construction which holds the most weight in the Gravity Test.

Useful Links:
Websites which will encourage the students’ exploration of the broad range of bridge structures from around the world, plus information links that can be useful are:

http://www.civil.iitm.ac.in/node/473
http://www.youtube.com/watch?v=a2jEq4XP0IM
http://www.gravitykills.net/PhysicsOlympics/Bridge.htm
http://www.youtube.com/watch?v=baiPAPsWKOq&feature=related

Gain a greater understanding of bridges:

http://science.howstuffworks.com/engineering/civil/bridge.htm

Judging of Innovations In Technology
All information relating to assessment of Crafty Design and Junkyard Challenge is to be presented on a poster approximately 65cm wide x 85cm high (thick cardboard backing is recommended).

Each team will be allocated 20 minutes in which to present and discuss their entry with the judges.

Judging will include assessments in the following areas and to be included on the poster:
- **Safety** - includes energy source, the load (soft drink can), moving parts shielded.
- Innovative Construction - materials used, design originality, community involvement. Use of recycled material (teams should look to improving craft each year and modify). Recycling does not mean use of exactly the same model.
  Recycling of materials – NOT CRAFT!
- **Planning and Testing** - includes challenges, problems encountered during planning/construction, modifications.
- **Presentation** – use of diagrams, photos, colour, originality, evidence of teamwork, involvement of school, community and/or industry.
- **Cross Curricular Aspects** – demonstration that project has been incorporated into subject areas at school.
- **Model/Craft** - Potential, Appearance and Sustainability – use of originality and imagination, artistic form, sustainability of model working, student input, ability to identify how the model could be improved, given time and appropriate materials.

**Performance Test and Time Trial**

All entries are required to demonstrate their crafty design/water catchment model in operation, and complete a **Performance Test**.

During the performance test, the craft/model will be judged on how it shows advancement in technology along with its reliability, sustainability and efficiency. Higher marks will be awarded for completion of task in a given time without any assistance from the team.

The performance test will involve a time trial for Crafty Design entries – this takes place at the water tanks at 2.00 pm.

Central Highlands Water is committed to environmental Education. They are proud sponsors of the Innovations in Technology section of the RACV Energy Breakthrough and are looking forward to helping provide hands-on learning opportunities for Breakthrough participants again in 2012.

Central Highlands Water has developed a unique Environmental Education Centre, which has been recognised nationally as a finalist in the prestigious Banksia Environmental Awards and the Victorian Landcare Awards.

The latest addition to the Central Highlands Water Education Centre is the ‘Gong Gong Wetlands’. This new and vibrant exhibit is a tour of self-discovery of wetlands and their ecological benefits to the environment.

Visitors and school groups who visit the wetlands can explore above, below and beside the water for information on some of the native plants and animals that live and depend on water. The ‘Gong Gong Wetlands’ demonstrates that water is truly the **Basis of Life**.

**For more Information please contact:**

Peter Blackburn  
The Education Officer  
Central Highlands Water  
PH: (03) 5320 3157  
pblackburn@chw.net.au

The Waterwatch Co-ordinator  
Central Highlands Water  
PH: (03) 5320 3199
**Pushcarts – Team & Vehicle Specifications**

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.

There are two sections in the pushcarts:

- Section 1: schools with a student enrollment of 150 students or less
- Section 2: schools with more than 150 students.

**GENERAL REQUIREMENTS**

- 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 trades people, community groups, etc, in the development of the pushcart. However, adults and other students are not permitted to assist the team when competing.

**DESIGN REQUIREMENTS**

**General**

- The basic design is a billycart with four wheels, a roll-push bar, a brake and front steering. (Roll bar can be 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.

**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.

**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.
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.

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 and must be adjustable for each individual rider.
• 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.

VEHICLE IDENTIFICATION
• Each vehicle is required to have two white identification panels measuring 100 mm x 100 mm for displaying the team’s number. These panels must be fitted to the side and the front of the pushcart. They must be pliable and not constitute a danger to pusher or driver. Numbers will be supplied on registration.
• An ‘RACV Tested’ sticker will be supplied after the scrutineering ‘all clear’ has been obtained. This is to be displayed above or below the number at the front of the pushcart. Provision must be made for this in the front identification panel.
• Provision may need to be made for the display of sponsor panels.

SCRUTINEERING
• All teams must present their pushcart and eight team members to the judges for scrutineering of safety requirements before participating.
• An RACV Tested sticker will be allocated to teams after successful completion of scrutineering.
• Pushcarts will not be permitted to participate without a sticker.
**PUSHCART EVENTS**

**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**
- **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.

**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 participate in all three elements.
- The sprint relay will be conducted over a 50 metre straight track with eight team members having a turn of pushing and driving.
- Four team members will be required to negotiate an Obstacle Course on both sealed and grassed surfaces.
- Points will be allocated on the basis of time.
- The Endurance Relay will be conducted on a street circuit with eight team members each having a turn of pushing and driving. Each person will be required to push for approximately 250 metres, then drive for approximately 250 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.**
- 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.

**Display and Presentation (The display area is not to exceed 2 x 2 metres)**

The purpose of Display and Presentation is for all team members (maximum of 10) to demonstrate their knowledge and understanding of the entry.

The team will be required to present a record, visually and orally, of:

- 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.
Human Powered Vehicles - Vehicle Specifications

Please note these Vehicle Specifications also cover the Try-athlon category.

If changes are made to these specifications, the event committee will notify all team managers who have entered via their e-mail contact and changes will be published on the website.

All enquiries regarding Rules and Specifications should be sent in writing to:

Ernest Litera, Greg Hill and/or Blake Harris of the RACV:

ernest_litera@racv.com.au, greg_hill@racv.com.au and/or blake_harris@racv.com.au

1.0 SCOPE & CONFIGURATION

1.1 Intent
The human powered vehicle category is intended as an experiment in personal mobility. The objective is to build an efficient and stable machine powered entirely by human effort.

Entrants must:
• Design and build a vehicle ‘from a clean sheet’
• Develop or adapt a vehicle from an existing design
• Liaise with local industry or community groups to design and build a machine.

The RACV Scrutineers have the final authority to decide if any vehicle or team competes in the event, based on safety and their interpretation of the following rules.

Clarification of rules and specifications sought from Ernest Litera, Greg Hill or Blake Harris of the RACV must be submitted in writing or by e-mail and a copy of responses presented at scrutineering. Please see the contact details on page 2.

1.2 Seating Capacity, Wheels
The vehicle shall carry a rider alone, and shall have three or more load bearing wheels arranged in a stable configuration.

1.3 Riding Position
The riding position shall not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. (See Section 4.2.1)

1.4 Power Source
Motive power shall be entirely supplied by the rider.

2.0 DESIGN AND MATERIALS

2.1 Inherent Safety
The design shall provide protection for the rider in the event of a collision or rollover. (See Sections 2.3 and 4.0). The design must be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators. Vehicle control and stability shall not be jeopardised by inappropriate design and construction methods.
The onsite repairing, securing or joining of steering, brake or any other safety related components with glue or epoxy resins during the event is strictly forbidden. It is advisable for teams to carry spares of any critical components that may not be repairable during the race.

2.2 Exclusions
Choice of design and construction materials is free, except that:

- Designers and constructors are permitted to freely use any bicycle component except for complete frame sections.
- There must be a forward clearance of at least 300 mm between the rider’s face and the steering wheel.
- Rope or cable steering systems, tilt steering and flexible steering columns are prohibited.
- Our experience has shown Rear Wheel Steer (RWS) vehicles to be highly unstable. For this reason, RWS vehicles will not be accepted at the RACV event.

2.3 Bodywork
Fully or partially enclosed bodywork is encouraged. In any case the bodywork design and structure will be regarded as supplementary in terms of rider protection and is not a substitute for compliance with the roll bars and side intrusion protection requirements (See Section 4.1.1)

Where enclosed bodywork is fitted:

2.3.1 Clearances and Access
- There must be a forward clearance of at least 300 mm between the rider’s face and any bodywork.
- The rider shall be able to open and/or remove bodywork and exit the vehicle without external assistance in less than 6-seconds.
- Bodywork shall be capable of being easily opened and or removed from outside the vehicle independently of the rider in an emergency.
- The location of closure devices for opening body sections must be marked outside with a yellow triangle making it clear for anyone unfamiliar with the vehicle.

2.3.2 Vision and Ventilation
- Rider and vehicle safety shall not be impaired by restricted ventilation or visibility.
- Provision for rain and fogging must be demonstrated.
- Rider vision must not be impaired by excessively enclosed and restricting bodywork.

Vision Tests:
Riders seated in the normal riding position are required to pass the following vision tests during scrutineering:

1. Sight an object on the road 5 metres in front of the vehicle.
2. Sight 180 degrees ahead of the rider, and other vehicles 15.0 degrees behind the rider on each side of the vehicle by turning their head. The intent of this clause is that a rider is able to turn their head to visually check for other vehicles before changing their position on the road.

![Forward and Side Vision Diagram]

3. Riders must be able to demonstrate that the vehicles mirrors provide effective rear vision.

### 3.0 VEHICLE DIMENSIONS

**Length**
2700 mm maximum

**Width**
1100 mm maximum

**Height**
1200 mm maximum

**Wheelbase**
1000 mm minimum wheelbase between the most forward and most rearward axles.

**Track**
600 mm minimum lateral distance between outermost wheels measured at ground level.

**Turning circle**
10 metre maximum diameter (left and right).

**Note:** Due to the hairpins in Try-athlon Time Trial and Obstacle courses, Try-athlon teams are strongly encouraged to set up their vehicle with a maximum turning circle of 8 metres.

### 4.0 OCCUPANT PROTECTION

**4.1 Protection Bars**
Vehicles must have three protection bars;
- “Head bar” (main bar) including brace,
- “forward leg bar” including brace, and
- “side intrusion bar”
Construction
All protection bars, including bracing must be made using one of the three following materials and construction methods:

4.1.1 Steel or Chromoly
   • Steel or chromoly tubing no less than 12.7mm outside diameter (preferably welded)

4.1.2 Aluminium
   • Aluminium tubing no less than 16.0 mm outside diameter (preferably welded)

4.1.3 Composites
   • Fully enclosed bodies made from composites such as Carbon-Fibre Fibreglass or Kevlar can use integral composite roll bars and side intrusion bars provided they comply with the following requirements:
     • Composite roll bars must be a shaped rib moulded integrally with the body and of at least equal strength to a metal roll bar. (eg: The roll bar area should not be able to flex when pressed by hand)
     • All composite roll bar and side intrusion bar ribs must follow the same positioning as the steel protection bars.
     • All composite constructions must have finished edges. That is no protruding fibres or frayed edges.
     • Metal roll bars can be used with composite bodies. Any joins must follow the plate mounting method as described in 4.1.4 Plate Joints.
     • All teams constructing new vehicles with any protection bars made from composite materials (eg carbon fibre, fibre glass, kevlar) must send photos to the RACV technical contacts for review by the end of October.

The onus is on schools to ensure that their vehicle is compliant with the required safety standards. The RACV Energy Breakthrough website includes some advice on composite construction in the 'Downloads' section.

4.1.4 Plate Joints
   • Where metal protection bars are to be attached to a composite body, plates should be used to distribute the loads into the body.
   • These plates must be welded onto the metal protection bar and be no less than 60mm x 60 mm square in size and at least 3mm thick.
   • A matching plate should be used on either side of the composite body and spacers must be used to prevent crushing of the composite.
   • The plates must be joined using at least two 6 mm bolts with locking nuts (eg-Nylock Nuts).
   • Corners and edges should be rounded and smoothed off.

4.1.5 Role of Bodywork in Occupant Protection
    Fully enclosed bodywork alone does not fulfill the protection bar requirements, so all vehicles require protection bars made from either metal or integral composite (refer 4.1.3) meeting all construction specifications, regardless of bodywork.
Positioning of Roll Bars

4.1.6 Head Bar

- The main head bar and brace together with the side intrusion bars must be one continuous welded frame, constructed according to the diagram above and must be solidly attached to the vehicle frame. (See Section 4.1.2: Plate Joints)

- The "head bar" hoop must be braced from its highest point with one bar, preferably two, to a major structural member to form a tripod.

Note: The diagrams above show secure mounting plates; teams can use other mounting approaches but it must be solid, and able to support the weight of the vehicle and rider in a rollover.

4.1.7 Leg Bar

- The "leg bar" (forward bar) must protect the rider's legs, knees and feet from contacting the ground in a rollover or side slide situation and must be mounted across the vehicle above the rider's knee area.

- The "leg bar" must be braced to prevent the bar from folding over in a rollover or sliding situation.

- The protection bars (head bar & leg bar) must be able to support the weight of the vehicle and rider in a rollover (a 40km/h impact is equivalent to dropping the vehicle on its roof from a first floor landing).

Note: For vehicles made from steel the test for this specification is that the vehicle (with the rider in the seated position) must be able to be lifted off the ground by the roll bar. This test will be applied at the discretion of the scrutineers.

4.1.8 Side Protection

- The vehicle must have side intrusion bars (as described and illustrated in 4.1.5) that are an integral part of the continuous "head bar".

- In addition to the side intrusion bars, side protection bodywork or shielding is required to protect the area between the rider's hip and shoulder from making contact with another vehicle and to prevent the rider's shoulders and arms from reaching the ground in the event of a rollover.
- This side protection bodywork should be constructed from suitably strong materials that will withstand sliding contact with the road.

- No part of the rider is allowed to protrude outside the side protection during normal operation and there must be a clearance of 50mm between any part of the rider and the shielding.

### SIDE IMPACT PROTECTION

![Diagram](image)

**Shading denotes area to be protected from side intrusion**

#### 4.1.9 Rider Protection Bar Clearances

With the tallest of the competing riders in the normal riding position, the “head bar” must be fully visible outside the rider silhouette when viewed from the front or rear.

A straight line from the top of one roll bar to the top of the other must have at least 50mm clearance above any part of the rider.

The head bar must conform to the following dimensions:

- **Measurement from helmet to inside of bar**
  - 150mm minimum

- **Measurement from either side of helmet to inside of bar**
  - 150mm minimum

- **Clearance around riders body to inside of bar**
  - 50mm minimum

- **Location forward or rearward of helmet**
  - No more than 150mm

#### 4.1.10 Forward Protection & Nose Cone

All vehicles must have adequate forward protection and a curved nose cone to reduce the chance of injury in the event that the vehicle collides with a person or another vehicle.
4.2 Seats

4.2.1 Position

- The seat shall be fitted to ensure that the riding position does not compromise machine controllability or safety, nor shall the riding position place the rider at risk of neck or back injury in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. This riding position is measured from the hip and shoulder joints, in relation to the road.

- The seat must be shaped and positioned to prevent the rider sliding under the seat belt.

- In vehicles with movable seats, riders must remain fully protected by the side intrusion bars in all seat positions.

4.2.2 Locking of Seat Position

- The seat must be secured and locked into position.

- Adjustable seats must lock securely into position for each rider and must not move forwards or backwards. Seat belts cannot be used as part of the seat lock system.

4.2.3 Extra Padding

Any temporary or removable padding used for riders MUST be fixed into place using a positive attachment to a fixed part of the vehicle. Teams could use strap and buckle, velcro straps, dog clips, canvas zips, etc.

4.3 Seat Belt

4.3.1 Type

- The vehicle must be fitted with an Approved and Certified adult Four (4) point (minimum) seat belt for all riders. Seat belts must have certification attached.

- The seat belt must be completely standard, including buckle, stitching and mounting plates.

- Teams will be required to demonstrate adjustment of the seatbelt to suit each rider.

Suggested suppliers:

  Wayne Fitzgerald, PO Box 444, Ballarat Vic 3353
  Ph: 03 5334 1213

- Klippan, Type "Street Racer" 4 point, 2 inch webbing available through Repco stores.

4.3.2 Mounting

- The seat belt must be mounted to a major, non-moving, structural member of the vehicle or can be mounted to the seat provided it is suitably secured. (See Section 4.2.2)

- Upper belts mounted behind the rider’s shoulders are required to be no more than 40 degrees from horizontal and mounted so as not to allow the seat belt webbing to fall from the shoulders when riding.
4.3.3 Positioning
The positioning of buckles and belts on the rider’s body shall conform strictly to the belt wearing requirements of Australian Design Rules (ADRs) for motor vehicles.

The relevant section of the ADR 4/01 is reproduced below:

"Seat belts are designed to bear upon the bony structure of the body, and should be worn across the chest, shoulders and low across the front of the pelvis; wearing the lap section of the belt across the abdominal area should be avoided. Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer."

This means seat belts must:
- be worn across the chest, shoulders and low across the front of the pelvis
- be adjusted to be as firm as possible on each rider
- fitted to ensure that the seat belt remains properly adjusted on each rider, at all times.

4.4 Shielding
4.4.1 Rider Protection

Chains, sprockets and gear wheels MUST be fully shielded to prevent accidental hazardous contact with rider or clothing.

Shielding or a clearance of 100mm is required between the occupant and any rotating part, such as wheels and controls, during vehicle operation.

A hair shield must be used to prevent long hair from falling anywhere near the rear wheel, chain or gear components.

4.4.2 Protection of other Vehicles
Chains, gear wheels and sprockets shall be suitably shielded to prevent their contact with other vehicles.

Exposed axle ends have to be recessed or flush in the hub, covered by bodywork, bar work, dome nuts or hub caps.

4.4.3 Shielding from Road Surface
Vehicles must be fitted with an under-tray or floor panel which prevents the rider’s feet from contacting the ground when seated in the riding position.

Pedal toe clips, elastic straps or pedal-to-shoe locking devices do not fulfill the requirements of this clause.

5.0 STEERING
5.1 Type
The type of steering mechanism is free, except for:
- Tilt steering, flexible steering columns and rear wheel steer are prohibited.
- A minimum clearance of 300mm is required between the riders face and the steering wheel.
- The rider must have continuous positive control without the need for regular adjustment.
- Rear Wheel Steer (RWS) vehicles will not be accepted at the RACV Energy Breakthrough. Our experience has shown RWS vehicles to be highly unstable.

5.2 Freedom from Binding and Fouling
Steering linkages shall operate freely from full left to full right lock without binding or fouling.

5.3 Lock Stops
To prevent the rotating road wheels from coming into contact with any part of the vehicle or rider, there must be positive steering lock stops. The steering mechanism or any solid component that moves with the steering mechanism must come up against a solid bracket or non-flexible part of the body or frame on full lock in either direction and stop any further steering travel.

In addition, at full lock there must be shielding or a clearance of 100mm between the occupant and any rotating part (such as wheels and controls) and in all steering positions there must be at least 50mm clearance between the hand controls (including brake levers) and the frame or solid bodywork.

6.0 BRAKES

6.1 Independent Systems
The vehicle shall be fitted with a minimum of two (2) separate effective and independent braking systems. Two (2) separate brake levers must be used.

All wheels in contact with the road must have a braking capability.

6.2 Directional Stability
Brakes on the same axle line (e.g. both front wheels) must operate via a single lever, so that independent operation of any braking system shall not have the potential to affect directional stability of the vehicle. That is, the braking power of each and every braking system shall be symmetrical about the vehicle’s longitudinal centre line.

6.3 Simultaneous Operation
The two braking systems shall be able to be operated by the rider simultaneously.

6.4 Steering Control
Full steering control shall be maintained while braking systems are being operated.

6.5 Contact to the tyres
Brake systems must not apply friction contact to the tyres.

7.0 ANCILLARY DEVICES

7.1 Lighting
The vehicle shall be fitted with the following as a minimum requirement.

7.1.1 Headlight
Front lighting must be at least one white light, securely fitted between 250mm and 600mm above road level, at the front of the vehicle (forward of the rider’s feet).

Lighting must have the ability to project a solid beam of light (typically 1 metre wide) onto a wall at 10 metres.

Additional lighting to improve the rider’s vision is encouraged provided at least one light meets the designated requirement.

Headlights are not to be flashing.

Please note: Sections of the track are in darkness at night and sufficient lighting to see the road will be required.
7.1.2 Tail Light
Rear lighting must be at least one red bicycle type LED tail light. It must be:
- robustly mounted between 350mm and 600mm above road level
- mounted within 150mm of the rear-most part of the vehicle
- mounted on the vertical centre line of the vehicle

7.1.3 Outline Lighting
The use of reflective material or strip lighting to indicate machine width and height (especially from the rear) is encouraged.

7.1.4 Mounting
All lights are required to be securely mounted for the duration of the event to maintain correct aim.

7.1.5 Helmet Mounted Lights
Helmet mounted lights are not to be used.

7.1.6 Batteries
Wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.
All connections must be properly insulated.

7.2 Mirrors

7.2.1 Number and Type
The vehicle shall be fitted with two mirrors, one on either side of the rider.
Mirrors may be of the mildly convex type.

7.2.2 Positioning
Each mirror shall be positioned such that:
- the rider can clearly identify overtaking traffic and meet the rear vision test outlined in section 2.3.2.
- The smallest rider must be able to reach and adjust each mirror from the normal riding position.

7.2.3 Size
At least two effective rear view mirrors of minimum area 18 cm² each must be fitted, one on each side of the vehicle, and having similar reflection (i.e. same size image).

7.2.4 Mounting
Mirrors shall be rigidly mounted to non-moving chassis or body members and steps should be taken to reduce vibration.

7.3 Warning Device
An electric audible warning device shall be fitted (e.g. smoke alarm siren) and operate from the normal riding position.
The device must not run continuously and operate via a momentary switch.
The horn must emit sound in excess of 85 dB(A) measured directly in front of the vehicle at a distance of 1 metre. This will be checked at scrutineering.

7.4 Other Devices
Any other equipment, e.g. drink bottle, shall be securely mounted and shall not impair rider control in its mounting or use.
The use of MP3’s or similar music/entertainment devices by riders is NOT permitted.

7.5 Speedometer
All vehicles shall be equipped with a simple electronic speedometer (e.g. Cat-eye) to monitor speed during the event (pit area speed limit of 15 kph, track speed limit of 60kph).
7.6 Transponder
Vehicle design should allow for a lap counting transponder must be mounted inside the vehicle, positioned within 200mm of the road surface, not above carbon fibre or metal; and not within 500mm of any RF source.

Transponder will be issued to Team Managers upon Check-in at the Administration Centre at the event.

8.0 MARKINGS

8.1 School Name
Each vehicle shall have their school name visibly displayed on either side of their vehicle.

8.2 Identification Panels
Each vehicle will be provided with three adhesive identification panels with their competition number on it. These identification panels must be attached to each side of the tail of the vehicle and as close to the rear as possible. The third panel is to be affixed to the nose of the vehicle.
1.0 SCOPE and CONFIGURATION

1.1 Intent
The objective of the Energy Efficient Vehicle category is to encourage the study of power sources and drive mechanisms in a personnel vehicle.

Entrants must:
• Design and build a vehicle ‘from a clean sheet’
• Develop or adapt a vehicle from an existing design
• Liaise with local industry or community groups to design and build a machine.

1.2 Seating Capacity, Wheels
The vehicle shall be designed to carry either a driver alone or a driver and one passenger, and shall have three or more load bearing road wheels arranged in a stable configuration.

1.3 Riding Position
The riding position or driving position shall not compromise machine controllability or safety, nor shall the riding position place the rider in a potentially hazardous position in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. (See Section 4.2.1)

1.4 Power Sources
1.4.1 Number of Power Source
There are four types of vehicle allowed in the Energy Efficient Vehicle category:
- Hybrid 1: Pedal power, plus one other power source.
- Hybrid 2 (Open): Two power sources, excluding pedal.
- Electric-Only Vehicles
- Petrol-Only Vehicles

1.4.2 Principle of Power Generation
The fuel allocation is only available to vehicles fitted with internal combustion engines as one of their driving sources and will only be commercially available pump fuel as supplied from normal retail outlets.

All fuel used for the trial will only be available from the RACV Scrutineers.

Vehicles that are operating on E85 will be eligible to receive a refuel during the race, see Trial Regulations section 9.2.
1.4.3 Minimum Duration of Power Generation
The machine must be capable of sustained operation over a minimum period of 30 minutes when powered separately by each propulsion system.

Pedal assist type vehicles will be eligible to compete in the Hybrid 1 class but must demonstrate the ability to operate on either power source separately.

While satisfying this requirement a power source may be used intermittently during the event to overcome particular loads, such as starting from rest or hill climbing.

The spirit of this clause is that a sacrificial form of propulsion is not acceptable.

1.4.4 Potential Maximum Speed
The maximum speed of all Energy Efficient Vehicles shall be 60 kph, the trial is a test of endurance and fuel efficiency, therefore vehicles should not be designed with achieving high speeds in mind.

2.0 DESIGN AND MATERIALS

2.1 Inherent Safety
The design shall provide protection for the rider in the event of a collision or rollover. (See Sections 2.3 and 4.0). The design must be free of protrusions or other features capable of causing interference or injury to fellow competitors or spectators. Vehicle control and stability shall not be jeopardised by inappropriate design and construction methods.

- Tilt steering and flexible steering columns are prohibited
- There must be a forward clearance of 300 mm between the rider’s face and the steering wheel.
- Rear Wheel Steer (RWS) vehicles will not be accepted at the RACV Energy Breakthrough. Our experience has shown RWS vehicles to be highly unstable.

The onsite repairing, securing or joining of steering, brake or any other safety related components with glue or epoxy resins during the event is strictly forbidden. It is advisable for teams to carry spares of any critical components that may not be repairable during the race.

Major repairs that produce sparks or flames are prohibited in the pit area (refer Trial Reg. 8.7)

2.2 Frames
The design and construction of the frame must provide adequate strength and safety as specified.

2.3 Electrically Powered Vehicles

2.3.1 Motor Type
Choice of motor type and gearing is free.

2.3.2 Total capacity and type of propulsion batteries
Propulsion batteries shall be commercially available, Hybrid vehicles are not restricted on battery type, however Electric-only vehicles must be of a lead-acid construction.

Batteries will be marked by RACV Scrutineers as per Trial Regulation 9.4

2.3.3 Total combined mass of propulsion batteries
The maximum total combined mass of propulsion batteries per vehicle is:

<table>
<thead>
<tr>
<th>Battery type</th>
<th>Hybrid Kg</th>
<th>All-Electric class Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Acid</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Ni Cd</td>
<td>65</td>
<td>n/a</td>
</tr>
<tr>
<td>Ni Zn</td>
<td>60</td>
<td>n/a</td>
</tr>
<tr>
<td>Li Ion</td>
<td>30</td>
<td>n/a</td>
</tr>
<tr>
<td>Ni MH</td>
<td>45</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Note: Where Lithium Ion batteries are used a Battery Management System must be carried on board that is designed to provide adequate protection during charging and discharging.

2.3.4 Mass of propulsion batteries on vehicle
Vehicles are required to carry at least one battery pack at all times so that the electrical circuit is complete. Batteries must be securely mounted in vehicles and all wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.

A battery pack is regarded as the normal quantity of batteries required for the electric motor to propel the vehicle.

2.3.5 Power Limitation
Hybrid: A fuse (up to 30 amps) must be fitted within 200mms of the battery pack.
Electric-only class: see Section 9.

2.4 Vehicles powered by Internal Combustion Engines

2.4.1 Engine Type
Choice of engine type or gearing is free.

2.4.2 Fuel types
Fuels for internal combustion engines must be commercially available pump fuels supplied by the organisers.

Notes: Fuels that must be stored under pressure such as LPG, CNG and hydrogen are not permitted.

2.4.2 Fuel tanks
- Fuel tanks must be of sufficient capacity to contain at least 3 litres of fuel for a single seat vehicle and 4.5 litres of fuel for a two seat vehicle. The total allocation of fuel for each category of vehicle is indicated in Section 9.2 of the Trial Regulations.
- The fuel tank must be securely mounted using a fixed retaining bracket on a structural component of the vehicle.
- The fuel tank must be shielded from the rider by the firewall (see section 2.5 Firewall, below).
- The fuel tank refilling cap and any other tank closure shall be capable of having a mechanical seal (wire cable-tie) applied to prevent unauthorised opening.
- Any plastic fuel tanks must be designated for petrol use and be compliant with AS/NZS 2906 Fuel Containers – Portable – Plastics and metal
- All fuel line connections must be secure and of an automotive standard.

Vehicles that are operating on E85 (85% Ethanol) fuel should be designed with safe refueling in mind. The fuel filler should be easy to access and not near any hot components.

2.4.3 Pressurised Fuel Systems
Pressurised fuel systems can be used, that is, diesel, petrol fuel injection, providing they comply with the following:
- all fuels lines are ASA standard automotive type
- all fuel lines are crimped, or union type fittings at all ends
- all fuel lines must be securely mounted on the vehicle
- all fuel lines must be protected from heated sources and contact with any moving components
- any fuel tanks pressurised must have a relief valve that prevents pressure exceeding 10 psi and must be fitted with a metal, automotive tyre valve for testing.

2.5 Firewall

2.5.1 Description
Vehicle occupants must be separated and fully shielded (ie. No gaps) from any potential fire by a metal firewall that has a minimum of 25mm clearance from the rider’s seat.
This firewall must shield the rider from any direct flame occurring from:
- Engine and other high temperature heat sources.
- Fuel tank and lines
- Exhaust system

2.5.2 Firewall must extend:
- **In height** - above fuel tank, fuel lines, exhaust system, engine and other heat sources or potential heat sources – as well as above the shoulders of the tallest vehicle occupant in the normal driving or riding position.
- **Downward** - to the floor line
- **In width** – As wide as the rider’s shoulders, in any case sufficiently to shield occupants from hot surfaces and potential fire sources.
- Body panels must be kept clear of hot surfaces and fuel lines.

### 2.6 Exhaust Routing
Exhaust fumes, hot gases and vapours shall be routed to discharge clear of occupants and outside the bodywork, at the rear of the vehicle at a minimum angle to the horizontal of 45°, downward. An effective silencer shall be fitted to reduce noise, and the pipe must not protrude beyond the frame of the vehicle.

### 2.7 Seating Arrangements
A two-seat vehicle may be constructed after consulting with RACV technicians on the overall dimensions of the vehicle and provided the driver has sole control of the vehicle at all times.

Both driver and passenger are permitted to monitor and make adjustments to the machine, and to contribute to the generation of energy.

### 2.8 Bodywork
Fully or partially enclosed bodywork is encouraged. In any case the bodywork design and structure will be regarded as supplementary in terms of rider protection and is not a substitute for compliance with the roll bars and side intrusion protection requirements (see section 4.1.1).

Where enclosed body work is fitted:

#### 2.8.1 Clearances and Access
- There must be a forward clearance of at least 300 mm between the rider’s face and any bodywork.
- The rider shall be able to open and/or remove bodywork and exit the vehicle without external assistance in less than 6-seconds.
- Bodywork shall be capable of being easily opened and or removed from outside the vehicle independently of the rider in an emergency.
- For twin-seat vehicles, it must be possible to exit the vehicle from either seat while the other seat is occupied.
- The location of closure devices for opening body sections must be marked outside with a yellow triangle making it clear for anyone unfamiliar with the vehicle.

#### 2.8.2 Vision and Ventilation
- Adequate ventilation must be provided inside the cockpit, and fumes from mechanical components and batteries must be kept separate from the cockpit area.
- Rider and vehicle safety shall not be impaired by restricted ventilation or visibility.
- Provision for rain and fogging must be demonstrated.
- Rider vision must not be impaired by excessively enclosed and restricting bodywork.

### Vision Tests:
Riders seated in the normal riding position are required to pass the following vision tests during scrutineering:
1. Sight an object on the road 5 metres in front of the vehicle.

2. Sight 180 degrees ahead of the rider, and other vehicles at least 15 degrees behind the rider on each side of the vehicle by turning their head. The intent of this clause is that a rider is able to turn their head to visually check for other vehicles before changing their position on the road.

3. Riders must be able to demonstrate that the vehicles mirrors provide effective rear vision.

2.8.2 Materials
Materials selected for bodywork should be chosen with the following in mind:
- Most plastics – especially films – are flammable
- Many plastics give off toxic gas when exposed to flame
- Body panels shall be kept clear of hot surfaces and fuel lines.

3.0 VEHICLE DIMENSIONS

Note: Teams developing dual seat vehicles which do not meet these specifications must obtain approval from the RACV Technical Committee.

Length
- 2700 mm maximum single seat
- 3000 mm maximum dual seat

Width
- 1100 mm maximum for vehicles fitted with bicycle width wheels greater than 400 mm in diameter.
- 900 mm maximum for vehicles fitted with road wheels wider than bicycle rims or less than 400 mm in diameter.

Height
- 1200 mm maximum
**Weight**
- Hybrid 1: 80 kg maximum
- Hybrid 2: 110 kg maximum
- Electric-Only: 60kg maximum for a single seat; 90kg maximum for dual seat vehicles.
- Petrol-Only: 60kg maximum for a single seat; 90kg maximum for dual seat vehicles.

*Note: Weights are measured without driver, fuel or batteries.*

**Wheelbase**
- 1000 mm minimum between the most forward and most rearward axle.

**Track**
- 600 mm minimum lateral distance between outermost wheels, measured at ground level.

**Turning circle**
- 10 metres diameter maximum between kerbs in either direction.

**Tyre width**
- All Energy Efficient Vehicles must have a maximum overall tyre width of 70mm.

## 4.0 OCCUPANT PROTECTION

### 4.1 Protection Bars

Vehicles must have three protection bars;
- “Head bar” (main bar) including brace,
- “forward leg bar” including brace, and
- “side intrusion bar”.

### Construction

All protection bars, including bracing must be made using one of the three following materials and construction methods:

#### 4.1.1 Steel or Chromoly

- Steel or chromoly tubing no less than 16.0 mm outside diameter (preferably welded)
- (See Section 4.1.2)

#### 4.1.2 Aluminium

- Aluminium tubing no less than 19.0 mm outside diameter (preferably welded)
- (See Section 4.1.2)

#### 4.1.3 Composites

- Fully enclosed bodies made from composites such as Carbon-Fibre Fibreglass or Kevlar can use integral composite roll bars and side intrusion bars provided they comply with the following requirements:
  - Composite roll bars must be a shaped rib moulded integrally with the body and of at least equal strength to a metal roll bar. (eg: The roll bar area should not be able to flex when pressed by hand)
  - All composite roll bar and side intrusion bar ribs must follow the same positioning as the steel protection bars.
  - All composite constructions must have finished edges. That is no protruding fibres or frayed edges.
  - Metal roll bars can be used with composite bodies. Any joins must follow the plate mounting method as described in 4.1.4 Plate Joints.
  - All teams constructing **new** vehicles with any protection bars made from composite materials (eg carbon fibre, fibre glass, kevlar) must send photos to the RACV technical contacts for review by the end of October.
The onus is on schools to ensure that their vehicle is compliant with the required safety standards. The RACV Energy Breakthrough website includes some advice on composite construction in the ‘Downloads’ section.

**Note:** A Human Powered Vehicle that has been converted to an Energy Efficient Vehicle will satisfy the occupant protection specifications by duplicating the minimum specified bar dimensions for a HPV. (ie. another bar can be welded alongside the existing bar.)

4.1.4 Plate Joints
- Where metal protection bars are to be attached to a composite body, plates should be used to distribute the loads into the body.
- These plates must be welded onto the metal protection bar and be no less than 60mm x 60 mm square in size and at least 3mm thick.
- A matching plate should be used on either side of the composite body and spacers must be used to prevent crushing of the composite.
- The plates must be joined using at least two 6 mm bolts with locking nuts (eg-Nylock Nuts).
- Corners and edges should be rounded and smoothed off.

4.1.5 Role of Bodywork in Occupant Protection
Fully enclosed bodywork alone does not fulfill the protection bar requirements, so all vehicles require protection bars made from either metal or integral composite (refer 4.1.3) meeting all construction specifications, regardless of bodywork.

Positioning of Roll Bars

4.1.6 Head Bar
The main head bar and brace together with the side intrusion bars must be one continuous welded frame, constructed according to the diagram above and must be solidly attached to the vehicle frame. (See Section 4.1.2: Plate Joints)

The “head bar” hoop must be braced from its highest point with one bar, preferably two, to a major structural member to form a tripod.
Note: The diagrams above show secure mounting plates; teams can use other mounting approaches but it must be solid, and able to support the weight of the vehicle and rider in a rollover.

4.1.7 Leg Bar
The "leg bar" (forward bar) must protect the riders legs, knees and feet from contacting the ground in a rollover or side slide situation and must be mounted across the vehicle above the riders knee area.

The "leg bar" must be braced to prevent the bar from folding over in a rollover or sliding situation.

The protection bars (head bar & leg bar) must be able to support the weight of the vehicle and rider in a rollover (a 40km/h impact is equivalent to dropping the vehicle on its roof from a first floor landing).

NOTE: For vehicles made from steel the test for this specification is that the vehicle (with the rider in the seated position must be able to be lifted off the ground by the roll bar. This test will be applied at the discretion of the Scrutineers.

4.1.8 Side Protection
The vehicle must have side intrusion bars (as described and illustrated in Section 4.1.1) that are an integral part of the continuous "head bar".

In addition to the side intrusion bars, side protection bodywork or shielding is required to protect the area between the rider's hip and shoulder from making contact with another vehicle and to prevent the rider's shoulders and arms from reaching the ground in the event of a rollover.

This side protection bodywork should be constructed from suitably strong materials that will withstand sliding contact with the road.

No part of the rider is allowed to protrude outside the side protection during normal operation and there must be a clearance of 50mm between any part of the rider and the shielding.

SIDE IMPACT PROTECTION

4.1.9 Rider Protection Bar Clearances
With the tallest of the competing riders in the normal riding position, the "head bar" must be fully visible outside the rider silhouette when viewed from the front or rear.

A straight line from the top of one roll bar to the top of the other must have at least 50mm clearance above any part of the rider.

The head bar must conform to the following dimensions:

**Measurement from helmet to inside of bar**
150mm minimum

**Measurement from either side of helmet to inside of bar**
150mm minimum

**Clearance around riders body to inside of bar**
50mm minimum
Location forward or rearward of helmet
No more than 150mm

4.1.10 Forward Protection & Nose Cone
All vehicles must have adequate forward protection and a curved nose cone to reduce the chance of injury in the event that the vehicle collides with a person or another vehicle.

4.2 Seats

4.2.1 Position
The seat shall be fitted to ensure that the riding position does not compromise machine controllability or safety, nor shall the riding position place the rider at risk of neck or back injury in the event of a collision. For these reasons a riding position (body angle) of less than 20 degrees from the horizontal is not allowed. This riding position is measured from the hip and shoulder joints, in relation to the road.

The seat must be shaped and positioned to prevent the rider sliding under the seat belt.

In vehicles with movable seats, riders must remain fully protected by the side intrusion bars in all seat positions.

4.2.2 Locking of Seat Position
The seat must be secured and locked into position.

Adjustable seats must lock securely into position for each rider and must not move forwards or backwards. Seat belts cannot be used as part of the seat lock system.

4.2.3 Extra Padding
Any temporary or removable padding used for riders MUST be fixed into place using a positive attachment to a fixed part of the vehicle. Teams could use strap and buckle, velco straps, dog clips, canvas zips, etc.

4.3 Seat Belt

4.3.1 Type
The vehicle must be fitted with an Approved and Certified adult Four (4) point (minimum) seat belt for all riders. Seat belts must have certification attached.

The seat belt must be completely standard, including buckle, stitching and mounting plates.

Teams will be required to demonstrate adjustment of the seatbelt to suit each rider.
4.3 Shielding

4.3.1 Positioning
The positioning of buckles and belts on the rider's body shall conform strictly to the belt wearing requirements of Australian Design Rules (ADRs) for motor vehicles.

The relevant section of the ADR 4/01 is reproduced below:

‘Seat belts are designed to bear upon the bony structure of the body, and should be worn across the chest, shoulders and low across the front of the pelvis; wearing the lap section of the belt across the abdominal area should be avoided. Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer.’

This means seat belts must:
- be worn across the chest, shoulders and low across the front of the pelvis
- be adjusted to be as firm as possible on each rider
- fitted to ensure that the seat belt remains properly adjusted on each rider, at all times.

4.3.2 Mounting
The seat belt must be mounted to a major, non-moving, structural member of the vehicle or can be mounted to the seat provided it is suitably secured. (See Section 4.2.2)

Upper belts mounted behind the rider’s shoulders are required to be no more than 40 degrees from horizontal and mounted so as not to allow the seat belt webbing to fall from the shoulders when riding.

4.3.3 Positioning
The positioning of buckles and belts on the riders body shall conform strictly to the belt wearing requirements of Australian Design Rules (ADRs) for motor vehicles.

The relevant section of the ADR 4/01 is reproduced below:

‘Seat belts are designed to bear upon the bony structure of the body, and should be worn across the chest, shoulders and low across the front of the pelvis; wearing the lap section of the belt across the abdominal area should be avoided. Seat belts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer.’

This means seat belts must:
- be worn across the chest, shoulders and low across the front of the pelvis
- be adjusted to be as firm as possible on each rider
- fitted to ensure that the seat belt remains properly adjusted on each rider, at all times.

4.4 Shielding

4.4.1 Spillage
Means shall be provided to prevent or contain spillage of dangerous fluids and in particular wet cell batteries must be housed in a sealed box (e.g. plastic) that will prevent spillage if the battery is inverted or damaged.

Rigid Chain Guard

Chain Tube and Sprocket Rings

4.4.2 Driver and Passenger Protection
Chains, sprockets and gear wheels MUST be fully shielded to prevent accidental hazardous contact with rider or clothing.

Shielding or a clearance of 100mm is required between the occupant and any rotating part, such as wheels and controls, during vehicle operation.

A hair shield must be used to prevent long hair falling anywhere near the rear wheel, chain or gear components.
4.4.3 Protection from Other Vehicles
Chains, gears wheels and sprockets must be suitably shielded to prevent their contact with other vehicles.
Exposed axle ends have to be recessed or flush in the hub, covered by bodywork, bar work, dome nuts or hub caps.

4.4.4 Shielding from Road Surface
Vehicles must be fitted with an under-tray or floor panel, which prevents occupants’ feet from contacting the ground when seated in the riding position. Pedal toe clips, elastic straps or pedal-to-toe locking devices do not fulfill the requirements of this clause.

5.0 STEERING

5.1 Type
The type of steering mechanism is free, except for:
- Tilt steering, flexible steering columns and rear wheel steer are prohibited.
- A minimum clearance of at least 300mm is required between the rider’s face and the steering wheel.
- The rider must have continuous positive control without the need for regular adjustment.
- Rear Wheel Steer (RWS) vehicles will not be accepted at the RACV Energy Breakthrough. Our experience has shown RWS vehicles to be highly unstable.

5.2 Freedom from Binding and Fouling
Steering linkages shall operate freely from full left to full right lock without binding or fouling.

5.3 Lock Stops
To prevent the rotating road wheels from coming into contact with any part of the vehicle or rider, there must be positive steering lock stops. The steering mechanism or any solid component that moves with the steering mechanism must come up against a solid bracket or non-flexible part of the body or frame on full lock in either direction and stop any further steering travel.

In addition, at full lock there must be shielding or a clearance of 100mm between the occupant and any rotating part (such as wheels and controls) and in all steering positions there must be at least 50mm clearance between the hand controls (including brake levers) and the frame or solid bodywork.

6.0 BRAKES

6.1 Independent Systems
The vehicle shall be fitted with a minimum of 2 (two) separate effective & independent braking systems. All wheels in contact with the road must have a braking capability.

6.2 Type
Single seat: At least one braking system shall operate directly on wheel hub/s or axle/s (i.e. not acting on wheel rims), and may be either drum or disc type.

Twin seat: At least two braking systems shall operate on wheel hub/s or axle/s (i.e. not acting on wheel rims), and may be either drum or disc type.

6.3 Directional Stability
Brake calipers on the same axle line (e.g. both front wheels) must operate via a single level, so that independent operation of any braking system shall not have the potential to affect directional stability of the vehicle. That is, the braking power of each and every braking system shall be symmetrical about the vehicles longitudinal centre line.
6.4 Simultaneous Operation
The two braking systems shall be able to be operated by the rider/driver simultaneously and in Hybrid 2 a single lever may be used to operate both braking systems provided it is foot operated only.

Any alternative such as motorcycle hydraulic type must be submitted for approval prior to the event.

6.5 Steering Control
Full steering control shall be maintained while any or all braking systems are being operated.

6.5 Contact to the tyres
Brake systems must not apply friction contact to the tyres.

7.0 ANCILLARY DEVICES

7.1 Lighting
The vehicle shall be fitted with the following as a minimum requirement.

7.1.1 Headlight
Front lighting must be at least one white light, securely fitted between 250mm and 600mm above road level, at the front of the vehicle (forward of the rider’s feet).

Lighting must have the ability to project a solid beam of light (typically 1 metre wide) onto a wall at 10 metres.

Additional lighting to improve the rider’s vision is encouraged provided at least one light meets the designated requirement.

Headlights are not to be flashing.

Please note: Sections of the track are in darkness at night and sufficient lighting to see the road will be required.

7.1.2 Tail Light
Rear lighting must be at least one red bicycle type LED tail light.

It must be:
- robustly mounted between 350mm and 600mm above road level
- mounted within 150mm of the rear-most part of the vehicle
- mounted on the vertical centre line of the vehicle

7.1.3 Outline Lighting
The use of reflective material or strip lighting to indicate machine width and height (especially from the rear) is encouraged.

7.1.4 Mounting
All lights are required to be securely mounted for the duration of the event and to maintain correct aim.

7.1.5 Helmet Mounted Lights
Helmet mounted lights are not to be used.

7.1.6 Lighting Batteries
Additional lighting batteries may be used to power lighting and accessories provided such batteries are not utilized to assist propulsion.

All connections must be properly insulated.

7.2 Mirrors

7.2.1 Number and Type
The vehicle shall be fitted with two mirrors, one on either side of the rider.

Mirrors may be of the mildly convex type.
7.2.2 Positioning
Each mirror shall be positioned such that:

- the rider can clearly identify overtaking traffic and meet the rear vision test outlined in section 2.3.2.
- The smallest rider must be able to reach and adjust each mirror from the normal riding position.

7.2.3 Size
At least two effective rear view mirrors of minimum area 18 cm² each must be fitted, one on each side of the vehicle, and having similar reflection (i.e. same size image).

7.2.4 Mounting
Mirrors shall be rigidly mounted to non-moving chassis or body members and steps should be taken to reduce vibration.

7.3 Warning Device
An electric audible warning device shall be fitted (e.g. smoke alarm siren) and operate from the normal riding position. The device must not run continuously and operate via a momentary switch. The horn must emit sound in excess of 85 dB(A) measured directly in front of the vehicle at a distance of 1 metre. This will be checked at scrutineering.

7.4 Fire Extinguisher
A fire extinguisher must be fitted to all Energy Efficient Vehicles. An Australian Standard, dry powder minimum 5BE fire extinguisher of minimum capacity 0.9 kg shall be securely affixed to all hybrid vehicles in such manner and position that it can be readily reached and removed for use by either the rider from the normal riding position or external assistant in an emergency. The location of the fire extinguisher must be clearly indicated on the exterior of the vehicle.

7.5 Other Devices
Any other equipment, e.g. drink bottle, shall be securely mounted, and shall not impair driver control in its mounting or use. The use of MP3 players or similar music/entertainment devices by riders is not permitted.

7.6 Speedometer
All vehicles shall be equipped with a simple electronic speedometer (e.g. Cat eye) to monitor speed during the event (pit area speed limit of 15kph, track speed limit of 60kph).

7.7 Engine Immobiliser
All motorised vehicles are required to fit a cut out switch that shuts down all propulsion sources and is accessible from outside the vehicle. The cut out switch must be clearly visible, marked by a blue triangle and mounted on the left hand side of the vehicle and within 300 mm of the rider’s left shoulder.

7.8 Transponder
Vehicle design should allow for a lap counting transponder must be mounted inside the vehicle, positioned within 200mm of the road surface, not above carbon fibre or metal; and not within 500mm of any RF source. Transponder will be issued to Team Managers upon Check-in at the Administration Centre at the event.

8.0 MARKINGS

8.1 School Name
Each vehicle shall have their school name visibly displayed on either side of their vehicle.
8.2 Identification Panels
Each vehicle will be provided with three adhesive identification panels with their competition number on it. These identification panels must be attached to each side of the tail of the vehicle and as close to the rear as possible. The third panel is to be affixed to the nose of the vehicle.

9.0 SPECIFIC RULES FOR ELECTRIC-ONLY CLASS

9.1 Total capacity and type of propulsion batteries
- The maximum voltage for a battery pack fitted to the vehicle is 48V. Batteries must be of a Lead-Acid type that cannot leak. This includes SLA (Sealed Lead Acid) and AGM (Absorbed Glass Mat) Batteries. Batteries will be marked by RACV Scrutineers, as per Trial Regulation 9.4
- A maximum of 100kg of batteries can be brought to the event and a maximum of 25kg of batteries can be carried on the vehicle at any one time

9.2 Power Limitation
- A 25 Amp circuit breaker must be fitted to the vehicle within 200mm of the battery pack. This circuit breaker must be fitted inside a plastic box that can be sealed such that it can only be reset by RACV track marshals.
- If the circuit breaker trips, the cause of this may be investigated by the team but the circuit breaker can only be reset by RACV track marshals
- If a different type of circuit breaker is to be used, please supply the specifications to one of the RACV technical contacts before the event (see page 2)

10.0 SPECIFIC RULES FOR PETROL-ONLY CLASS

10.1 Petrol Type
All petrol-only vehicles must be run on E85 (85% Ethanol) fuel, as supplied by the organisers.

10.2 Air Restrictor
- All vehicles must have an air restrictor in place on the inlet to the engine.
- This restrictor must be situated on the air inlet side of the carburettor or throttle body (not the engine side) and must be easily accessible to be measured during scrutineering. It may be obscured by an air filter or other such thing that can be removed for measurement.
- The restrictor may be a flat plate (at least 1mm thick), tube or intake trumpet with a circular hole of diameter 15mm. This will be the same size for all vehicles.
- The restrictor must have a provision to allow for it to be lock wired to the engine
13. HPV and EEV Trial Regulations

1. SPIRIT OF THE COMPETITION
The 2013 RACV Energy Breakthrough Trial presents a unique opportunity for students to extend their learning experience beyond the boundaries of formal education. The following competition regulations have been framed so that the efforts and experiences of all participants are maximised, to be bound only by the constraints of safety and the spirit of healthy, but friendly competition.

2. ELIGIBILITY

2.1 Make-up of Teams
Teams will consist of the following numbers of competitors:
- Human Powered Vehicle (6 minimum – 8 maximum)
- Energy Efficient Vehicle – single seat (6 minimum – 8 maximum)
- Energy Efficient Vehicle – two seat (6 minimum – 12 maximum)

2.1.1 Gender balance
Except for Open Class teams and all female team, a minimum of 50 per cent of the competitors in any one team shall be female. Gender ratio in Open Class teams is free.

2.2 Registered Riders
Only registered team riders shall take part in the trial, however rider changes can be made up to the start of the endurance trial. (See Section 2.6).

2.3 Team Member Participation
Team managers must ensure that every nominated team member participates as a driver. Managers are required to keep a log of rider track time, which can be checked by officials investigating incidents.

2.4 Age of Drivers
Drivers of Energy Efficient Vehicles shall be at least 14 years of age, unless special approval is requested by the school and given by organisers.

2.5 Identification
All competitors must have official identification, which must be shown on request during the trial.

2.6 Rider Substitution
Sick or injured riders may be replaced prior to the start of the trial by a registered reserve rider of the same gender. This substitution will require the identification wristband of the replaced rider to be handed to the Administration Centre and a new identification issued to the reserve rider.

2.7 Number of Occupants per Vehicle

2.7.1 Two riders
Dual seat Energy Efficient vehicles shall carry both driver and passenger at all times during the trial and practice sessions.

3. RIDER ATTIRE

3.1 Fit and Adjustment
All vehicle occupants shall wear the following safety attire correctly fitted and adjusted at all times the vehicle is on the track during practice and the trial.

3.1.1 Helmet
For human powered vehicles, minimum requirement is a bicycle helmet approved to AS 2063 or AS 1698.
For Energy Efficient Vehicles, requirement is a motor cycle helmet approved to AS 1698.

3.1.2 Eye Protection
Shatterproof glasses, goggles or helmet visor must be worn at all times. Provision must be made for the lights on period overnight.

3.1.3 Gloves
Strong material BMX or motor-cross type gloves preferred.

3.1.4 Shoes
Full foot coverage, sandals not permitted.

3.1.5 MP3 players
The use of MP3 players or similar music/entertainment devices by riders is NOT permitted during trial or practice sessions.

3.1.6 Clothing
For Human Powered Vehicles: Minimum coverage of shoulders, upper body and mid-thigh e.g: shorts and T-shirt; or cycling knicks and jersey.

HPV Note: Sleeveless triathlon skin suits, sleeveless cycling jerseys, sleeveless t-shirts, tank tops or singlets are not permissible.

For Energy Efficient Vehicles all competitors shall wear ‘overalls or clothes that cover and are neat fitting from ankle to wrist to neck. (Fire retardant material is advised in vehicles that carry raw fuel and for this reason light fabric/disposable overalls are not permitted in these vehicles).

EEV Note: It is not permissible for drivers of fuel powered vehicles to ‘dress down’ when their fuel is used up. Teams that have battery power must provide a pair of full cover gloves and a pair of protective goggles for anyone handling batteries.

4. SCRUTINEERING

4.1 Compulsory
Scrutineering is compulsory for all vehicles and teams, to ensure compliance with vehicle specifications and safety attire requirements.

4.2 Before track
Before entering onto the track for practice, all vehicles must be scrutineered for safety.
RACV Scrutineers can refuse permission to enter the track for any safety reason.

4.3 Subsequent scrutineering
All vehicles will also be inspected at random during the trial for operation of safety items or when the vehicle is involved in a track incident. (See Section 7.11)

4.3.1 Energy Efficient Vehicles – Vehicle Inspections during the 24 hour trial
- EEV on the Holden Track will be subject to a random safety inspection. This inspection will be conducted in each teams pit area. Teams will not be forewarned of an inspection, the team will be asked to call in the vehicle on the next lap. All vehicles will be inspected and for the same period of time to ensure equality.
- The random inspections can take place at any time.
- These inspections are in addition to any other inspections or discussions with Track Marshals that may come as a result of a ‘Return to Pits’ sticker, suspected rule infringements or unsporting behaviour.

5. TRAFFIC LIGHTS/FLAG SIGNALS

5.1 Flags
All competitors shall understand the meaning of the following traffic signals/flag signals:
Blue
Note that a faster vehicle is positioned close to you. Competitors shown the blue flag must move left (inside the blue line) to allow overtaking.

Yellow Flag or Light
A sign of danger or track obstruction in the vicinity of the marshal point.
Riders are required to pass the point of danger at a reduced speed using extreme caution. It is an offence to overtake a vehicle at the corner displaying a yellow flag or light. Riders must not resume competition until they reach the next green flag or light.

Red
An indication of extreme danger.
All vehicles shall come to an immediate stop. Racing has ceased. Riders must follow the directions of the Clerk of Course and flag marshals.

Black
Displayed with vehicle number at the start/finish line. The indicated vehicle shall stop in the pits on the next lap.

Green
The track is clear for competition.

6. START, FINISH AND BREAK

6.1 Pre-Race Briefing
All Team Managers must attend the pre-race briefing by the Clerk of Course and Trial Coordinator.

6.2 Lap Counters
It is the Team Manager’s responsibility to ensure that:
• a transponder is picked up and correctly fitted to the vehicle
• the transponder is working at all times
• the transponder is returned to the Administration Centre at the end of the trial.

6.3 Grid Assembly
The Clerk of Course in conjunction with the event committee will allocate starting grid positions. Vehicles will be called to the starting grid assembly area at least 30 minutes prior to the official start. If a vehicle is not on the grid within 15 minutes of the scheduled start time, officials reserve the right to place the vehicle at the rear of the grid.

6.4 Trial Start
The trial will be started with the drop of the National flag.

6.5 Trial Finish
The trial will conclude with the display of the black and white chequered flag, 24 hours after the start for the secondary HPV and Energy Efficient Vehicle teams; after 14 hours’ of competition for the HPV Class A teams. Try-athlon teams will exit the circuit via the pit lane at the completion of their 8 hour endurance trial.

6.6 Class A Compulsory Break
6.6.1 Primary break
All HPV-A vehicles will leave the track nominally from the specified time on Friday evening and resume their trial at the specified time on Saturday.
6.6.2 Rejoining the trial
HPV-A vehicles will be assembled on the track in their finishing positions for the restart.
7. TRACK CONDUCT

7.1 Speed Limit
Speedometers are mandatory and - ALL competing vehicles shall observe a maximum speed of 60 kilometres per hour during practice and the trial, and 15 kph in pit lane.

Vehicles exceeding the speed limit (60 km per hour) will have a penalty applied (see Section 11.3).

7.2 Blue Line
A blue line has been painted on the track. Vehicles must keep to the left of the track, on the inside of the BLUE line, unless overtaking another vehicle.

7.3 Seatbelts
All vehicle occupants shall wear a correctly adjusted seatbelt or harness when on the track during practice and the trial.

7.4 Injured Riders
Track marshals and RACV officials monitor the trial and where necessary will call for assistance from St John and the Rural Ambulance Service to attend to injured riders.

7.5 Right of Way
Competing vehicles have right of way over disabled vehicles that will be recovered and returned to the pit area.

7.6 Direction of Travel
Under no circumstances is a vehicle to be driven or pushed on the track in the opposite direction to racing.

7.7 Overtaking
Vehicles must overtake on the outside, to the right of the vehicle being overtaken. An overtaking vehicle must ensure a clearance of at least 3 metres (one vehicle length) before assuming an inside running position.

Riders must not change lanes without checking their mirrors to make sure it is safe to do so.

It is the responsibility of the overtaking (faster) vehicle to ensure that the overtaking move is carried out without endangering other competitors. Cutting in, deliberate blocking or leaving insufficient clearance will be penalised.

7.8 RACV Recovery Vehicle
The RACV recovery vehicle will only be on the track when a team is unable to safely recover a vehicle themselves. When on the track it displays flashing yellow lights which indicates extreme danger in the same manner as corner yellow lights. Riders must slow, use extreme caution, must not overtake other competitors and pass when directed by the RACV driver.

7.9 Vehicle Lighting
Front and rear lights as required by vehicle specifications shall be illuminated during the hours of darkness as directed by the Clerk of Course. Riders must stop in the pits as soon as possible to rectify any inoperable or insecure light.

7.10 Lighting Batteries
Batteries used solely for lighting may be charged and/or recharged and/or replaced as required.

7.11 Track Incidents
Vehicles involved in major on track collisions, crashes or rollovers must be tagged by officials and are required to proceed directly to the pits for inspection and if necessary, repair. It is the responsibility of the rider and the team to ensure a crashed vehicle is tagged and any deliberate attempt to avoid tagging will incur a penalty. Tagged vehicles will not be allowed to rejoin the trial until the tag is removed following an RACV inspection.
Vehicles will also be inspected at random during the trial for operation of safety items such as brakes or mirrors which will also require rectification before continuing.

8. PIT PROCEDURE

8.1 Speed in Pits
Maximum speed in the pit area is 15 km/h.

8.2 Direction of Travel in Pits
Under no circumstances shall a vehicle enter the pit area via the pit exit lane.

8.3 Driver Change-Over
All driver and passenger changes shall occur in the designated area adjacent to each team’s pit.

8.4 Stopping in Pits
8.4.1 Brakes only
Vehicles shall come to a halt in the driver change lane under the effect of the vehicle’s own braking system. Stopping with the assistance of others is not permitted.

8.4.2 Full stop
Vehicles shall be stationary prior to unfastening seatbelts or harness.

8.4.3 Riders/Drivers
Driver refreshments and adjustments to clothing etc. shall only be effected when the vehicle is stationary in the pit area.

8.4.4 Pit Crew
A maximum of three students and one supervising adult, in addition to the incoming and outgoing riders, shall attend a vehicle in the pit lane at driver change-over. The four designated people from each team attending the vehicle in pit lane are encouraged to wear a green reflective vest.

8.5 Pit Lanes
Pit entry and exit lanes shall be kept clear at all times.

8.6 Pit Crew Communications
The use of radio communication between rider and pit crew is permitted provided operating the unit does not interfere with the rider’s control of the vehicle.

The use of notice boards for communication between the rider and the pit crew are permitted. However, such notice boards and their use shall comply with the following:

- they must be held and displayed by one person only at a time
- they must be held so they do not go beyond the line of pit lane barriers.

8.7 Major Repairs
Major repairs including welding and grinding equipment must NOT be carried out in the pit lane. The pit lane includes a team’s tent adjacent to the track. These repairs must be carried out in the vicinity of the repair container.

Teams may not substitute or replace power sources or strip the vehicle below its starting weight after the commencement of the event.

8.8 Stationary Vehicles
In pit or driver change lanes, stationary vehicles shall give way to vehicles proceeding along these lanes.

8. Removal of Components
Redundant, superfluous and/or damaged components of substantial mass i.e. greater than 0.5 kg, may not be removed from a vehicle except with the permission of the chief scrutineer or deputy. At the discretion of the Chief Scrutineer his/her deputy, the vehicle may be required to carry ballast.
8.10 Vehicle Restarts
Vehicles that have been involved in a track incident and received a coloured sticker CANNOT restart until a RACV Marshal has checked the vehicle and removed the sticker.

9. FUEL USE AND RECHARGING OF BATTERIES

9.1 Fuel Burning Energy Efficient Vehicles
In accordance with Section 1.4.2 of the EEV specifications, Unleaded fuel burning entries will receive a single allocation of fuel.
E85 fuel burning vehicles, whether Hybrid or Petrol-only, will receive a starting allocation of fuel and a refuel at a designated time during the race.

9.2 Amounts of Fuel Allocated
Are as follows, depending on chosen fuel type:

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Unleaded Allocation</th>
<th>E85 Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Seat Hybrid</td>
<td>3 litres</td>
<td>5 litres (start trial with 3L)</td>
</tr>
<tr>
<td>Two Seat Hybrid</td>
<td>4.5 litres</td>
<td>6.5 litres (start trial with 4.5L)</td>
</tr>
<tr>
<td>Single Seat Petrol-only</td>
<td>N/A</td>
<td>6 litres (start trial with 4L)</td>
</tr>
<tr>
<td>Two Seat Petrol-only</td>
<td>N/A</td>
<td>7 litres (start trial with 4L)</td>
</tr>
</tbody>
</table>

The maximum quantity of fuel to be carried in a vehicle at any time is:

- Single seat vehicle  4 litres
- Two seat vehicle     4.5 litres

9.2.1 E85 burning vehicles – Refuelling
- At a set time after half distance vehicles will be stopped one at a time for refuelling.
- All vehicles will be eligible to receive a further allocation of fuel. This will be the only refuelling throughout the race.
- The period of time for refuelling will be set by Energy Breakthrough officials. All teams will stop for the same amount of time to ensure that the refuelling process is fair. In previous years this refueling period has occurred after 2AM.
- The vehicle must be stopped in the designated area, switched off and students are required to stand away from the vehicle during refuelling.
- The vehicle should be designed with safe refuelling in mind. (ie. fuel filler easy to access and not near to hot exhaust/components)
- Fuel fillers must have provision for sealing as per Vehicle Specification 2.4.2, this lock wire will be cut by Marshalls when refuelling and then replaced.

9.3 Sealing of Fuel Tanks
Fuel tanks on vehicles or on off-vehicle charging machines will be sealed after the allocation of fuel prior to the start of the event.

9.4 Batteries
At scrutineering, teams using batteries are required to present all of their battery allocation for identification marking. All batteries must have manufacturers labels including details of battery type displayed.

9.5 Battery Recharging – Process & Procedure
- There is no limit placed on the amount of time that batteries can be charged for.
- There is a limit of one battery charger per team, and one power point will be provided for each team. This battery charger must not have a peak output rating that exceeds 25 amps.
- All recharging is to be conducted in a designated area as provided by the event organisers. This is to ensure that charging is carried out in a safe manner.
- Any team found to be charging batteries not in the designated area will be penalised.
- All battery chargers must be electrically tested and tagged. The chargers must also be presented at Scrutineering for an extra Energy Breakthrough tag to be applied. Only approved and tagged chargers can be used.
- Battery chargers must be of a commercially available type. The physical dimensions of the charger must not exceed 30cm x 30cm x 30cm. If a battery charger does not meet these requirements please contact the RACV technical contacts (see page 2).
- ‘Smart’ switch-mode battery chargers are the preferred type.
- Bare connections and alligator clips are strictly forbidden. All connections must be made using a properly insulated electrical connector. Anderson plugs are the preferred type of connector and any other type must be approved by the RACV technical contacts (see page 2).
- Hybrid vehicles may only charge one battery pack at a time and Electric-only vehicles may charge two.
- A battery pack is defined as the usual amount of batteries required to run the vehicle.

10. TRIAL POINT SCORING
The vehicle completing the most number of laps in each class in the trial period scores the maximum 50 points. Other vehicles in each class score points for the number of laps completed in proportion to the number of laps.

For example, say team AA in a particular class travels the greatest distance, 200 laps, and team BB in the same class travels 160 laps. Points scored are as follows:

**Team AA:**
200 laps = 50 points

**Team BB:**
160 laps 50 x 160 = 40 points
200

11. INFRINGEMENTS

11.1 Vehicle Design
Vehicles which are considered safe but DO NOT comply with key elements of vehicle specifications may be given permission to start the trial with a penalty. This penalty can be up to 50 laps and will be applied by the RACV Scrutineers.

11.2 Reporting of Incidents
Teams may report track incidents or infringements of these competition rules to the RACV officials who will investigate and act accordingly. If teams wish to proceed with an official complaint they will be provided the appropriate documentation.

11.3 Penalties
A team that breaches any trial regulation including the spirit of competition, will be notified that they are under investigation for an infringement of the competition rules. A panel of officials will review the incident and apply a penalty, which they consider is consistent with the severity and intent of the infringement. An incident review should be conducted within 30 minutes, but in any case will be resolved before the end of the trial.

Penalties may take the form of:
- A warning
- A stop and go penalty
- A time penalty
- 50 lap penalty
- Disqualification of a rider
- Exclusion from trial results; or
- Withdrawal from competition.
Try-athlon Rules and Guidelines

The Try-athlon category was created in 2001 for first time teams who wanted a taste of the Energy Breakthrough. Since its creation the category has quickly grown in popularity and competitiveness.

Vehicles are constructed to the same specifications as the Human Powered Vehicle specifications.

Please note: Due to the hairpins in Try-athlon Time Trial and Obstacle courses, Try-athlon teams are strongly encouraged to set up their vehicle with a maximum turning circle of 8 metres.

Assessment

Teams participate in the Display & Presentation and Design & Construction sections, but also in three physical tests: Time Trial, Obstacle Rally and an 8 Hour Endurance Trial.

<table>
<thead>
<tr>
<th>Section</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display &amp; Presentation</td>
<td>20</td>
</tr>
<tr>
<td>Design &amp; Construction</td>
<td>20</td>
</tr>
<tr>
<td>Time trial</td>
<td>15</td>
</tr>
<tr>
<td>Obstacle</td>
<td>15</td>
</tr>
<tr>
<td>Endurance Trial</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Challenge 1: Time Trial

Location: RACV Track – Back Straight (near Pit 55)
Circuit Length: Approx. 500 metres per lap

- There will be three or four teams per heat, each from the same class.
- Riders will each complete one lap of the Time Trial circuit before changing over in the allocated pit areas under the direction of the track marshals.

Points Allocation for Time Trial

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

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

Where \( Y \) = fastest team time recorded & \( X \) = team’s own time
**Challenge 2: Obstacle Rally**

**Venue:** RACV Track – Front Straight (Near RACV Stage)

**Circuit Length:** Approx. 600 metres per lap

**Event Format:** One round – Riders 1 – 8.

- Each team will complete the Obstacle Rally which will incorporate several stations or control challenges.
- There will be a series of hay bales, barriers set at with small ‘gates’ for riders manoeuvre through – similar to a slalom course.
- There will also be a ramp & rumble strip which the riders will be required to navigate safely.
- Riders will each complete one lap of the Obstacle Rally circuit before changing over in the allocated pit areas under the direction of the track marshals.

**Points Allocation for Obstacle Rally**

\[
\text{Obstacle Rally Score} = 15 - \left(\frac{X}{Y}\right) \times 15 - \text{Penalty}
\]

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

**Obstacle Rally – Penalties & Infringements:**

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

**Challenge 3: Endurance Trial**

**Venue:** Holden Track

**Circuit Length:** 1100 metres per lap

**Duration:** 8 hours

- Teams will compete over eight hour and each rider is encouraged to complete at least 30 minutes riding.
- Try-athlon teams complete the Endurance Trial during the first 8 hours of the Energy Efficient Vehicle trial. (1pm – 9pm)
- Teams assemble as directed and the trial will commence with a rolling start behind the RACV vehicle.

**Points Allocation - Endurance Trial**

Points will be allocated on distance completed by the team. That is, 30 points to the team recording most laps.

Other finishers: \((X/Y)\) multiplied by 30 = points

Where \( Y \) = highest number of laps recorded & \( X \) = team’s number of laps.

**Endurance Trial Penalties & Infringements** – See HPV & EEV Trial Regulations.

**Presentations:**

All teams are all welcome to join the Presentations held behind the Holden Stage at the conclusion of the Endurance Trial on the Saturday evening.