Welcome All, We will begin shortly ....
Welcome, Hope you all will make this season more joyful with your enthusiasm & willingness to learn.
EVENT STATUS

Just 4 months for the D-Day...
WORKSHOP

TRAINING  GOAL  IDEA  SKILLS

TEAM  PRACTICE  RESULTS  TREND
WAY FORWARD ...

Section A- General Guidelines

Section B- Vehicle Requirements

Section C- Driver Rules

Section D- Reports & Documentation

Section E- Events and Procedures

Section F- Documents for Main Event

Section G- Contact Details
SECTION A :
GENERAL GUIDELINES
"EFFI CYCLE" derived from Efficient-Cycle

Opportunity to conceive, design and fabricate a 3W configuration vehicle powered by human-electric hybrid power and capable of seating 2 passengers catering to the day to day urban mobility needs.

The vehicle must be aerodynamic, engineered for performance & safe and ergonomically designed.

The objective is to promote innovation and generate consciousness amongst the young engineers towards environment friendly mobility solution.
ABOUT THE EVENT
[ Power Enhancement Season ]

- Design, Documentation and Manufacturing of an innovative Futuristic Vehicles.
- The Efficycle is not just Mechanical Design and Manufacturing it involves Electronics, Futuristic technologies, Product designing, Digital Marketing, team building, Brainstorming on new ideas and a lot more.
- Teams are given a challenge to design a vehicle designed for this purpose must be aerodynamic, highly engineered, safe and ergonomic.
- All participating teams compete against each other where the cumulative scores of all the events would decide the overall ranking of the teams.
THEME FOR THE EVENT
[ Power Enhancement Season ]

- Power Enhancement Season
  - Segment-1: Conventional
  - Segment-2: Advanced Hybrid
  - Segment-3: Effi-Que
- Theoretical to a practical engineering
- Interactions with Industrial Expertise
- Awareness of the methodologies being used by the industry
- Skills are not mere certificates, its passionate experiences
- No matter win or loose, making a challenge builds courage
- Flying high, starts with spreading swing
What EFFICYCLE Offers?

- A platform to normalize the background of student's locality and bring different mindsets together.
- Develop a legacy of designing an innovative model using Industrial Norms at an under graduation level.
- End of the day, it’s a nation-wide competition, performances, willingness to learn, & the spirit of winning.
RULES AND ORGANIZING AUTHORITY

SAE-NIS Effi-Cycle Rules and Organizing Authority

- **Authority of the rules** - Official announcements from the Effi-Cycle Technical Committee shall be considered part of rules.

- **Rules Validity** - dated for the calendar year 2022 of the competition.

- **DO NOT ATTEMPT** to design your vehicle as per the rules of any previous season.

- **Rules Compliances:** Rules for all the teams and their faculty advisors are normalized and compliance.

- **Understanding the Rules:** To seek the clarifications regarding the rules, teams can contact Effi-Cycle.technical@saenis.org.

- **Violations on Intent & Misinterpretation:** If the team wants to use some particular parts/methods/procedures which are not included in the rulebook directly or indirectly, teams must get a clarification from EffiCycle Technical Committee. Special permissions (through emails only) may be given in some cases upon the discretion of the committee. Else considered as Violation and investigated.
TEAM ELIGIBILITY

Eligibility Limits for Teams

- **Student Status** - must be enrolled as degree seeking undergraduate or graduate students in India.
- **Team Size** – 5 to 13 students
- **SAE Membership** - Team members, faculty advisor must be member of SAE INDIA
  Age – 18+
- **Driver’s License** - Driver of the vehicle must be with the Driving licenses
- **Medical Insurance** - Individual medical/health insurance coverage is required for at least 2 team members designated for driving the vehicle during competition.
- **Faculty Advisors** can support the team with project management theory as a guide.
VEHICLE ELIGIBILITY

- Student Developed Vehicle - conceived, designed, fabricated and maintained by the student team members.
- Information Sources – May use the standard sources of Vehicle dynamics and Related literature.
- Professional Assistance – Prohibited.
- Proof of In-house Vehicle Fabrication – Photos, Videos during fabrication.
- Limitation on Fabrication at External Facilities - Bills, Invoices, Machinery Rent Receipt along with College/Faculty Advisors Permission will be required as a proof of such works.
- Previously Participated Teams - Significant improvements in their design with proper justification.
Any Queries so far?
SECTION B:
VEHICLE REQUIREMENT
- What exactly the difference between the Conventional and Advanced Efficycle?

- What's new in Effi-Que?
# VEHICLE CONFIGURATION / DIMENSIONS

## Vehicle Configuration:

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of drivers</strong></td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Drivers Height &amp; Weight</strong></td>
<td>6’3” &amp; 115 kg (each)</td>
<td>6’3” &amp; 115kg</td>
<td>6’3” &amp; 95kg</td>
</tr>
</tbody>
</table>

## Vehicle Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>100”</td>
<td>100”</td>
<td>86.6”</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>60”</td>
<td>60”</td>
<td>47.2”</td>
</tr>
<tr>
<td><strong>Kerb Weight</strong></td>
<td>Max. recommended: 150 kg</td>
<td>Max. recommended: 125 kg</td>
<td>Max. recommended: 170 kg</td>
</tr>
</tbody>
</table>
Any type of Holes, Cracks Dents etc in frame members are forbidden

Protection for the impact from front, sides, rear and rollover are mandatory.

All the members of chassis much accomplish with the respective rules.

Members are mentioned below:

- **Overhead protection (Same for All Variants)**
  - A minimum 6-inches clearance should be provided between OHPM and driver head (with helmet).
  - The outer OHPM must have at least 36 inch (914.4mm) internal clearance when measured horizontally in lateral direction.
Cross Bracing (Same for Conventional and Advanced Segment)

- At least 2 Cross Bracing with a Diagonal Brace (DBM) or a gusset must be provided to Strengthen the cage.

Cross Bracing (Same for Conventional and Advanced Segment)

- First LCM should connect the outer OHPMs at the topmost point of their bend portion behind the driver’s head.
- Second LCM should be provided at the one of the following locations:
  1. 24 inch (609.6 mm) forward to rear LCM
  2. Within 2 inches (50.8 mm) before the termination of OHPMs; in case of open hoop
  3. Within 2 inches (50.8 mm) before the front bend of OHPMs; in case of close hoop
VEHICLE FRAME – DBM

DBM (Diagonal Bracing Member) – For Convetinal Efficycle & Advanced Effi-cycle:
- The diagonal bracing can be joined within 4 inch (101.6 mm) from corner joints of OHPM and LCM.
- Gussets are Not allowed.

DBM (Diagonal Bracing Member) - (For Effi-Que)
- The diagonal bracing can be joined within 4 inch (101.6 mm) from corner joints of OHPM and LCM.
- If DBM is not provided in between OHPM and LCM, a gusset plate or a gusset tube must be provided on at least 2 diagonal joints.
- Length of gusset plate/tube should be at least 3 times the diameter of OHPM tube. Thickness of a gusset plate should be at least 5mm and it must be welded on the upper side of OHPM tubes.
VEHICLE FRAME – SPM

SPM (Side Protection Member) - For Effi-Que

- Ensure that under no condition Driver’s Torso shall be exposed to any Debris.

SPM (Side Protection Member) – For Conventional & Advance Effi-cycle.

- SPM loop should be extended at least 8 inches (203.2mm) forward to the front face of seatback when measured at 16 inches (406.4mm) above Point ‘A’ on seat.
**VEHICLE FRAME – Other Frame Members**

**USM (Under Seat Member) (Only in Effi-Que)**
- To prevent the driver from passing through the floorboard in the event of seat failure. The USM may also serve as the mounting location for the seat.

**LFS (Lower Frame Side Members) (Only Effi-Que)**
- Two Member (one on each side) shall run from rear end of the roll cage up to FBM and must be used for Either Direct or Indirect mounting of Front Wheels.

**Second Rider Hand-holds (Conventional and Advanced Segment)**
- The handhold must be provided inside the frame to both hands of second rider.
- Side protection members and handholds must be placed such that these do not hinder the ingress and egress of drivers noticeably.
FBM (Front Bracing Members) – For Effi-Que

This shall be Rigidly mounted Frame member that prevents driver during any frontal impact and even in the event of Roll Over. Also, this shall be a mounting plane for Front Fairing. An LCM shall be present at the Termination of FBM and LFS which can be used for mounting of Tow Point.

Front Fairing - (For All 3 variants)

- A fairing, made up of transparent sheet, is compulsory in front of drivers.
- Fairing should be extended vertically from the top of head of drivers till the seat cushion surface plane when viewed from front.
- Horizontal edges should cover the whole width of driver seating area. If fairing is made by joining different parts, the gap between 2 joining edges should not be more than 1 inch (25.4mm).

For Hybrid Variant: It is allowed to provide sufficient access, in form of profile cut through fairing sheet, for drive train component placement and drivers’ legs movement.

For Electric Variant: Fairing must be without any cut-outs or access paths.
**VEHICLE FRAME – LCM**

**LCM (Lateral Cross Member) – For Effi-Que**
- There Shall be LCM wherever any Primary member joins to another primary member by using proper and suitable Joints.

**LCM (Lateral Cross Member) – (For conventional and Advanced segment)**
- First LCM should connect the outer OHPMs at the topmost point of their bend portion behind the driver’s head.
  Second LCM should be provided at the one of the following locations:
  - 24 inch (609.6 mm) forward to rear LCM or
  - Within 2 inches (50.8 mm) before the termination of OHPMs; in case of open hoop
  - Within 2 inches (50.8 mm) before the front bend of OHPMs; in case of close hoop
Rain Protection & Body Enclosures - (Same for all 3 variants)

- Protection of driver from rain & should be covered from top, sides, front and rear.
- Any flexible, light weight but durable materials like use light weight sheet metals or sheets of plastic materials can be used for this purpose.
- The material should have a minimum thickness of 1.5 mm.
- Body enclosures should not be transparent and must mandatorily include doors on both sides and wind shield in the front (transparent).
- The inclusion of back door is optional.
- All 4 wheels should be either accommodated within the frame members or the wheel covers may be provided.

For Electric Powertrain Parts: Battery, BMS and motor should be provided with rain (IP65)
**Towing Point**

*Towing Point – (same of all 3 variants)*

- Should be provided at the rear portion of vehicle for attaching a payload with the vehicle with the help of rope/cables/metal bars etc.

**Specifications:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>--</td>
<td>Steel</td>
</tr>
<tr>
<td>Mounting Method</td>
<td>--</td>
<td>Welded to Frame</td>
</tr>
<tr>
<td>Tab Thickness</td>
<td>--</td>
<td>Min: 8 mm (0.31 in)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max: 9.5 mm (0.375 in.)</td>
</tr>
<tr>
<td>Hole Diameter</td>
<td>D</td>
<td>Min: 25.4 mm (1.0 in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max: 31.75 mm (1.25 in.)</td>
</tr>
<tr>
<td>Hole-to-Tube Offset</td>
<td>X</td>
<td>Min: 19.0 mm (0.75 in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max: 25.4 mm (1.0 in.)</td>
</tr>
<tr>
<td>Edge Distance</td>
<td>R</td>
<td>Min: 15.9 mm (0.625 in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max: 25.4 mm (1.0 in.)</td>
</tr>
<tr>
<td>Width at Frame Connection</td>
<td>Y</td>
<td>Min: 76.2 mm (3.0 in.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max: Unrestricted</td>
</tr>
</tbody>
</table>
**RIDER COMPARTMENT FLOOR**

*Rider Compartment Floor - (Same for all 3 variants)*

- Rider compartment so that riders do not touch the ground
- Protective from debris particles and water splash from underneath.
- Floor material must be metal, fiberglass, plastic, or similar material.

**FRAME MATERIAL**

*Frame Material & Cross-Section Requirements : Same for all 3 variants:*

**Material Testing Report**

A material testing report must have materials’ –
- Yield strength (in MPa)
- Ultimate Tensile Strength (in MPa)

The material testing report should be prepared in the format released by organizers.
The certificate provided by material dealers will not be accepted.
FRAME MATERIAL

Frame Material & Cross-Section Requirements: Same for all 3 variants:

- Use of multiple shapes, cross-sections sizes and material is allowed.
- Teams should work out upon the material availability, weld-ability, weight reduction, structural strength etc.
- For all materials used in building the frame, following criteria must be fulfilled:

“The bending strength & bending stiffness of the cross section used in frame must not be less than bending strength & bending stiffness when a circular cross section of 1 inch (or 25.4mm) outer diameter and 0.078 inch (2 mm) wall thickness with carbon percentage 0.18% is used.”

Bending Strength of Y > Bending Strength of X
Bending Stiffness of Y > Bending Stiffness of X]

Teams are encouraged to work upon alternate materials for making the vehicle light weight.
# DRIVER SEATS

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seat Requirements</strong></td>
<td>Separate seats should be provided to individual drivers</td>
<td>Separate seats should be provided to individual drivers</td>
<td>Single seat must be placed at the center of the cabin.</td>
</tr>
<tr>
<td><strong>Thigh &amp; Torso Supports</strong></td>
<td>must end at maximum 2 inch (50.8mm) below the driver shoulders</td>
<td>must end at maximum 2 inch (50.8mm) below the driver shoulders</td>
<td>must end at maximum 2 inch (50.8mm) below the driver shoulders</td>
</tr>
<tr>
<td><strong>Seat Height (d)</strong></td>
<td>Maximum height (d) of the top surface of seat cushion cannot be more than 24 inches (609.6mm) from ground for both driver seats.</td>
<td>Maximum height (d) of the top surface of seat cushion cannot be more than 24 inches (609.6mm) from ground for both driver seats.</td>
<td>Maximum height (d) of the top surface of seat cushion cannot be more than 20 inches (508 mm) from ground for driver seat.</td>
</tr>
<tr>
<td><strong>Seat Belt Requirements</strong></td>
<td>3-point seat belts with retractor is mandatory for both the drivers.</td>
<td>3-point seat belts with retractor is mandatory for both the drivers.</td>
<td>3-point seat belts with retractor is mandatory for the driver.</td>
</tr>
</tbody>
</table>
SITTING SPACE HEIGHT FOR DRIVERS

Sitting Space Height for Drivers ($h_s$) – Conventional & Advanced format only

Sitting space for drivers is vertical space available between seat cushion top surface and the bottom edge of overhead protection members.

This will be measured in vertical direction from Point ‘A’ to the point ‘B’.

Sitting height ($h_s$) must be provided according to the seatback angles ($\alpha$):

1. $\alpha < 25$: = 40 inch (1016mm)
2. $25: < \alpha < 45$: = 37 inch (939.8mm)
3. $45: < \alpha = 32$ inch (812.8mm)

**Effi-Que**: The sitting space height is not restricted. However, sufficient head clearance should be provided.

***Advance Efficycle [Segment 2]: Please refer conventional rulebook for details of sitting ht. / seat angle etc. Advance Rulebook has also been revised for the same.***
## CLEARANCES

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body Clearances</strong></td>
<td>minimum 3 inches (76.2mm)</td>
<td>minimum 3 inches (76.2mm)</td>
<td>minimum 3 inches (76.2mm)</td>
</tr>
<tr>
<td><strong>Ground Clearance</strong></td>
<td>All rigid parts of the vehicle must have</td>
<td>All rigid parts of the vehicle must</td>
<td>All rigid parts of the vehicle (both</td>
</tr>
<tr>
<td><strong>For Rigid parts</strong></td>
<td>minimum 6 inches (152.4mm) clearance from</td>
<td>have minimum 6 inches (152.4mm)</td>
<td>rotating and non-rotating) must have</td>
</tr>
<tr>
<td></td>
<td>the ground</td>
<td>clearance from the ground</td>
<td>minimum 150 mm &amp; maximum 220 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>clearance from the ground</td>
</tr>
<tr>
<td><strong>Ground Clearance</strong></td>
<td>minimum 3 inches (76.2mm) from the ground</td>
<td>minimum 3 inches (76.2mm) from the</td>
<td>Same as above.</td>
</tr>
<tr>
<td><strong>For Moving Parts</strong></td>
<td></td>
<td>ground at their lowest position.</td>
<td></td>
</tr>
</tbody>
</table>
Power: Conventional and Advanced Format

Vehicle must have the provision to drive it on Human power and Electrical Power both simultaneously or alternatively.

Human Power
The vehicle must have the capability to be driven by human power. Both the drivers must be provided with individual power-trains to drive the vehicle in both single passenger mode and dual passenger mode. Use of hand operated or foot operated drives or both is permitted to deliver maximum power to wheels through human powertrains.

Electrical Power
Vehicle must have the option to run on electrical power. A 48V BLDC motor of maximum 600W rated power can be used for this purpose. To provide a uniform basis to performance events, all vehicles must use the same motor. The motor kit will be provided by Vikson India. Internal Combustion engines and solar cells are excluded from the competition.
A Effi-Que will have electric powertrain. Vehicle must have the provision to do Power Regeneration as per the following guidelines:

- Any nature of energy regeneration is mandatory.
- It should be a working concept. It should at least power an accessory; charge the battery; brake the vehicle etc.
- The concept will be evaluated based on the following three categories:
  - Energy regenerated is extending the vehicle range by storing the energy in the battery,
  - Energy regenerated is being utilized in vehicle performance eg. brake performance etc.
  - Energy regenerated is being utilized for vehicle electric loads like accessories.
Acceptable Motors for Effi-cycle 2022 same for all 3 formats:

Motor Part Number: KTC600R

Motor Kit Content:
All motor kits will be provided with following contents:
- KTC 48V 600W BLDC Motor
- KTC 48V Controller
- Junction Box (Yellow)
- General Purpose Wiring Harness
- Key Switch with Meter Assembly
- Handle Bar Accelerator (Throttle)
- Chain-Sprocket Set

Purchasing Motor Kit
- Teams must order the motors at least 4 months Prior to the Event Starting Date by direct payment to Vikson India.
- Teams should take care by themselves for shipment & delivery.

Purchasing Additional Motor Kit
- Teams may purchase additional motor kit directly from Vikson India.
## Battery & Motor Specifications

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor</strong></td>
<td>48V, 600W</td>
<td>48V, 600W</td>
<td>48V, 600W</td>
</tr>
<tr>
<td><strong>Battery</strong></td>
<td>48V, 35AH</td>
<td>48V, 35AH</td>
<td>48V, 50AH</td>
</tr>
<tr>
<td><strong>Battery Type</strong></td>
<td>Any Type of Battery can be use</td>
<td>Only Li-Ion batteries with BMS can be used</td>
<td>Only Li-Ion batteries with BMS can be used [LFP Chemistry only]</td>
</tr>
<tr>
<td><strong>Motor – Battery Protection</strong></td>
<td>All batteries must be sealed and leak proof.</td>
<td>All batteries must be sealed and leak proof.</td>
<td>All batteries must be sealed and leak proof.</td>
</tr>
<tr>
<td><strong>IP protection</strong></td>
<td>IP65 protection</td>
<td>IP65 protection</td>
<td>IP65 protection</td>
</tr>
<tr>
<td><strong>Mountings</strong></td>
<td>mounted on a rigid frame attached to vehicle frame</td>
<td>mounted on a rigid frame attached to vehicle frame</td>
<td>mounted on a rigid frame attached to vehicle frame</td>
</tr>
<tr>
<td><strong>Batteries for Additional Circuit</strong></td>
<td>Allowed</td>
<td>Allowed</td>
<td>Allowed</td>
</tr>
</tbody>
</table>
## Power Transmission System

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Transmission</td>
<td>Hybrid</td>
<td>Hybrid</td>
<td>Only Electric</td>
</tr>
</tbody>
</table>
**ENERGY REGENERATION SYSTEM**

[All 3 Segments]

**Energy Regeneration System (ERS)**
Kinetic Energy of vehicle should be converted into electrical energy during braking through Energy Regeneration System (ERS) equipped in vehicle and the regenerated electrical energy should be further stored into an electrical storage device (e.g. battery or capacitor). For any such arrangements the teams may be asked for explanation at the time of technical inspection and design evaluation. Circuit diagram and calculations to be presented to judges for evaluation.

Vehicles equipped with Energy Regeneration System shall be evaluated for their regeneration capability in the dynamic event also. This dynamic event is optional for teams.

**Solar Panel**
The solar panels can be used for charging of batteries. Solar panels can be mounted in multiple units on the roof or front of the vehicle provided these do not restrict the visibility of drivers. Teams must select the size of solar panels according to the vehicle requirement. For calculation, 4 hours of full sunlight may be considered.

Solar panels must be securely attached to vehicle frame using tabs and should not be removed during any event. A solar tracker can also be provided to get the maximum input from solar energy. Circuit diagram of solar charging system should be made available to judges for reference during inspection and evaluations.
## BRAKES

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting of Brakes</td>
<td>All 3 wheels</td>
<td>All 3 wheels</td>
<td>All 4 wheels</td>
</tr>
<tr>
<td>Type</td>
<td>hydraulic or non-hydraulic brakes.</td>
<td>hydraulic or non-hydraulic brakes.</td>
<td>Drum/Disk Hydraulic Brake systems</td>
</tr>
<tr>
<td>Braking Control</td>
<td>least one driver</td>
<td>least one driver</td>
<td>driver</td>
</tr>
<tr>
<td>Parking Brake</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
</tbody>
</table>

i. The brake and accelerator pedal shall be designed to withstand a force of 2000 N without any failure of the brake system or pedal box. This may be tested by pressing the pedal with the maximum force that can be exerted by any official when seated normally.

ii. The brake pedal must be fabricated from steel & aluminum, Team should present material testing report in case of self-fabrication, Purchase bill is required for OEM pedal.

iii. Pedal should be inside the vehicle periphery in the rearmost & front most position If pedals are adjustable, it will be positioned in forward position when not actuated.
iv. Must act on all four wheels and operated by single pedal. Hydraulic circuit must have independent reservoir placed inside the vehicle periphery & should not hinder the actuation of Brake. No part of brake system mounted on sprung part should be lower than lowest frame member. Brake by wire is not allowed. Brakes must be capable of locking all 4 wheels and brake to be installed which actuates during braking.

v. Positive pedal stops to be placed with pedal to avoid over pressing of pedal. Plastic brake lines are prohibited.

vi. The Throttle pedal should be placed as per regulation on the right side of the Brake pedal mechanically mounted on chassis in front of the driver. Thethrottle pedal must be actuated through mechanical linkage/wire. Ride by wire is not allowed. The throttle pedal cable must be protected from being bent or kinked by the driver's foot when it is operated by the driver or when the driver enters or exits the vehicle.

vii. The Throttle pedal must be fabricated from steel & aluminum, Team should present material testing report in case of self-fabrication, Purchase bill is required for OEM pedal.
<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. turning radius</td>
<td>4 meter</td>
<td>4 meter</td>
<td>4 meter</td>
</tr>
<tr>
<td>Turning radius will be checked in</td>
<td>Fig. of 8 test</td>
<td>Fig. of 8 test</td>
<td>Fig. of 8 test</td>
</tr>
<tr>
<td>Steering control</td>
<td>Right Side Driver</td>
<td>Right Side Driver</td>
<td>Driver</td>
</tr>
<tr>
<td>Mini. Dist. Of steering and driver chest</td>
<td>NA</td>
<td>220mm away from driver’s chest horizontally</td>
<td>220mm away from driver’s chest horizontally</td>
</tr>
</tbody>
</table>
## Utility Requirement

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (internal)</td>
<td>16 inches (406.4mm)</td>
<td>16 inches (406.4mm)</td>
<td>16 inches (406.4mm)</td>
</tr>
<tr>
<td>Width (internal)</td>
<td>12 inches (304.8mm)</td>
<td>12 inches (304.8mm)</td>
<td>12 inches (304.8mm)</td>
</tr>
<tr>
<td>Height (internal)</td>
<td>8 inches (203.2mm)</td>
<td>8 inches (203.2mm)</td>
<td>8 inches (203.2mm)</td>
</tr>
<tr>
<td>Pay Load</td>
<td>20 Kg</td>
<td>20 Kg</td>
<td>20 Kg</td>
</tr>
</tbody>
</table>

The utility requirements will be checked by putting a payload of 20kg in the utility box during ‘Drive Excellence Test’
**KILL SWITCH**

**Kill Switch – all 3 formats**

- Push-to-off kill switch must be provided on the vehicle.
- Whole electrical circuit of drivetrain must get dead by pushing off the kill switch.
- **AT LEAST ONE** kill switch must be easily accessible to each driver.
- Rotary-to-off kill switches, electric switches, self-retracting switches and MCBs are not acceptable for this purpose.

**INFOTAINMENT SYSTEM**

**In-Vehicle Infotainment System – all 3 formats**

A vehicle must be equipped with **at least one** of the following infotainment systems

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Music System</strong></td>
<td>optional</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong>Hands Free Smart Phone Connection</strong></td>
<td>optional</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong>Dashboard with cyclo-computer</strong></td>
<td>optional</td>
<td>yes</td>
<td>yes</td>
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</tbody>
</table>
Advance Driver Assistance System (ADAS)

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAS</td>
<td>Optional</td>
<td>At least 1</td>
<td>At least 2</td>
</tr>
</tbody>
</table>

1. Speed Alert System (SAS)

A speed alert system should provide audible warning to driver when the vehicle speed reaches **above 25km/h**. The feedback of speed may be taken from cyclo-computer installed in the vehicle or through a GPS bases system or any other suitable sensing device.
2. Reverse Parking Assist System (RPAS)
- Reverse parking assist is a mechanism which gives alert to driver about obstacles on rear side of vehicles during parking in reverse mode.
- The mechanism shall give an acoustic signal to warn the driver on the obstacles detected in the monitoring range.
- The monitoring range shall be from 0.2 meter to 1.0 meter in horizontal plane from vehicle rearmost surface.

3. Adjustable Headlamp
The adjustments in headlamps should be provided to illuminate the road surface ahead of the vehicle according to vehicle speed or steering angle.
At least 2 adjustments should be provided in horizontal plan (during steering) or vertical plane (high beam and low beam adjustment) or both.
Only angle adjustment to focus different part of road surfaces may be provided.
4. Driving Range Information

- The driving range is the distance which the vehicle can travel in remaining charge of battery.
- The range estimation is done through various parameters such as vehicle speed, recent driving pattern, road grade, traffic topology, remaining battery energy, driving style etc.
- It is recommended to estimate the driving range on the basis of driving range and current vehicle speed/recent driving pattern.
- The driving range should be provided in ‘unit of km/h’.
- The logic and calculations of the driving range should be included in the advance technology report.

5. Seat Belt Reminder (SBR)

- Seat belt reminder provides the alert to driver if they are not wearing the seatbelts while the vehicle is in running condition and attains a minimum speed.
- A vehicle should have the seat belt reminder for at least primary driver.
- It is desired that the warning should be provided by the SBR system when the driver is seated in the vehicle and the electric drive is ON.
- The warning should be in form of continuous or intermitted audible signals or through visual display on screen or both.
- It is mandatory to provide signals only when the driver is seated and it must go OFF as soon as the driver is unseated.
SAFETY AND DRIVER ASSISTANCE FEATURES

Safety and drive Assistance Features:

1. Navigation – Mandatory
   - In case teams are using Mobile/Tablet/Ipad for navigation purpose, the device should be clamped with rigid and permanent mounting.
   - System should not hinder & restrict the movement of Driver Body part, Ingress- Egress for normal vehicle operation.

2. Anti-theft mechanism (NEW) – Mandatory
   - This device or method prevents unauthorized access to a Vehicle.
   - The team have to fit such a device to prevent it from being used by an unauthorized person.
   - The Anti-theft alarm system shall work with the help of sensors installed in and around the vehicle.
   - An impact or the movements outside the vehicle activates the sensors. This, in turn, triggers the Anti-theft alarm system and sounds the alarm, alerts the owner/people. Even, the change in the vehicle’s position can alert the tilt sensor and activates the anti-theft alarm system.
3. Accident Alert System (New) Mandatory

- Its main purpose is to detect an accident and alert to the control room/designated person so the driver can find some help.
- Teams should make a working system of accident alert with using suitable sensors and equipment’s.
- All sensors used with the system should be securely and firmly mounted at designated locations & should be water & dust proof (IP65).
- There must be a system in the vehicle to detect any frontal or rear crash of the vehicle and notify the emergency contact number designated (minimum 2) about the location of the vehicle in the form of notification/text message.
Other Electrical & Electronic Devices

<table>
<thead>
<tr>
<th>Electric features</th>
<th>Conventional</th>
<th>Advanced</th>
<th>Effi-Que</th>
</tr>
</thead>
</table>

1. Headlamp
- The headlamp should be mounted at the front of vehicle to increase the visibility during low or no daylight conditions.
- Either a single headlamp should be provided at the centre of vehicle width or a set of 2 lamps can be provided on both sides.
- The headlamp should be mounted at a height between 450mm and 1200mm measured vertically from ground.
- Any white light emitting device can be used as headlamp.
- Teams must select the lights of sufficient intensity according to night driving condition.
- Head lamp ON-OFF switch should be provided.

The headlamp should illuminate the region covered by angle 15deg upward and 10deg downward in vertical plan.
In horizontal plane it should cover 45deg on either side in case of single headlamp and 45deg outward, 10deg inward in case of separate headlamps when measured from vehicle longitudinal axis.
2. Brake Lights

- A red brake light should be mounted on rear of vehicle to indicate about braking to other vehicle/s approaching from rear.
- The brake light shall be illuminated when the brake system is actuated, and completely extinguished when the brakes are released.
- The light should be mounted at a height between 350mm and 1500mm measured vertically from ground.
- The brake light must turn on during the brake test and it must be activated immediately when the brakes are actuated.
3. Turn Indicator

- Amber color turn indicators will be provided at front and rear both.
- The indicators for left and right side should be separately identified.
- The flash-light frequency shall be 90+30 per minute and it should be same for all indicators. Same side indicators may flash simultaneously or alternatively.
- Operation of indicators can be done through lever type switches, toggle switch or push button or rotary type switch can be provided.
- The lateral distance between left and right indicators should be at least 800mm and these should be symmetrically placed from the vehicle longitudinal plane.
- Mounting height shall be between 350mm and 1500mm measured vertically from ground.

**Recommended specifications:** The indicators should be visible up to an angle of 80° outward and 20° inward in horizontal plane when measured from vehicle longitudinal axis.
4. DRL (Day time Running Light)

- DRL should be provided at the lower part of front members.
- Height between 450mm to 700mm below the Headlamp.
- DRL is started when your vehicle power is ON or when the parking brake is activated, 2 lamps can be provided on both sides.

5. Battery and Range Indicator

- Battery and range indicator shall provide the visual indication of the battery’s state of charge.
- This indication is required in at least 4 levels. The indication can be displayed in either analogue or digital form (such as LEDs of same or different colors, a digital screen showing percentage/bar icon/text etc.).
- The display should be given in front of primary driver without restricting the field of view.
## FEATURE LIST

<table>
<thead>
<tr>
<th>Essential Features</th>
<th>3W Conv Efficycle</th>
<th>3W Advanced Efficycle</th>
<th>4W Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear View Mirror</td>
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<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Side View Mirror</td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Parking Brakes</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Foot Operated - Brakes and Accelerator Pedal</td>
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<td></td>
<td>●</td>
</tr>
<tr>
<td>BMS [ Mandatory parameters ]</td>
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<td>1</td>
<td>2</td>
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<tr>
<td>Safety &amp; Driver Assistance Features</td>
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<tr>
<td>Pedal Assist</td>
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<td></td>
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</tr>
<tr>
<td>In-Vehicle Infotainment [ Mandatory system ]</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>ADAS [ Mandatory parameters ]</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Accident Alert System</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>
Any Queries so far?
SECTION C :
DRIVER RULES
Rider Clothing & Safety

- Driver is advised NOT to wear loose clothing during the dynamic events.
- Driver MUST wear cycling helmet, cycling jersey, full length trousers, shin, elbow and knee guards and running shoes.
- Riders should have their eyes protected while driving either by safety glasses.
- All moving parts such as chains, idlers, gears etc. should be provided with guards to protect the driver from injury.

Rider Rules

- A rider cannot push any other person or vehicles during the event.
- A vehicle with a flat tire or other mechanical problems are not allowed to drive into the event.
- Drivers MUST comply with the instructions of the track volunteers & announcements, else may be penalized.
- Drivers are allowed to drive the vehicle only after clearing Technical Inspection.
SECTION D:
REPORTS & DOCUMENTATIONS
There are 2 Types of Events planned by SAE NIS i.e. Physical Event or Virtual Event, details are as follows:

**Package 1**
- Static Evaluation
  - 1. Project Plan
  - 2. Design
  - 3. Validation Plan
  - 4. BOM Report
  - 5. Vehicle Specification Sheet
  - 6. IPG Parameter Sheet

**Main Event**
- Static Evaluation
  - 1. Design Report
  - 2. CAD/CAE Report
  - 3. Business Plan
  - 4. Innovation Report

- System Performance Evaluation
  - **System Level - Technical Inspection**
    - 1. Figure of 8
    - 2. Steering Effort
    - 3. Reverse Parking Tests
    - 4. Water Shower Test
    - 5. Design Conformity tests

- Vehicle Level
  - 1. Acceleration Test
  - 2. Gradability Simulation Test
  - 3. Electric Drive Test
  - 4. Brake Test
  - 5. Rough road test
  - 6. Final Endurance

- Misc. Evaluation
  - 1. Best Vehicle Aesthetics
  - 2. Best Girl Participant
  - 3. Dronacharya Award
  - 4. Best Faculty Award
  - 5. Team Clean Pit
All teams are required to submit the following documents in packages as per document formats released by Technical Committee:

Package 1
- Project Plan
- Design Validation Plan
- BOM Report
- Vehicle Specification Sheet
- IPG Carmaker Parameter Report (Effi-Que only)

Package 2
- Design Report
- CAE Report
- Business Plan
- Innovation Report
# REPORT SUBMISSION DEADLINES

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Project Activity</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Document Package-1 Submission</td>
<td>30-Sep-2022</td>
</tr>
<tr>
<td>2.</td>
<td>Vehicle Readiness and running vehicle video submission</td>
<td>30-Sep-2022</td>
</tr>
<tr>
<td>3.</td>
<td>Documents Main Event Submission</td>
<td>30-Oct-2022</td>
</tr>
<tr>
<td>4.</td>
<td>College Level Technical Assessment</td>
<td>30-Sep-2022 to 20-Oct-2022</td>
</tr>
</tbody>
</table>

- The deadline will be 1700hrs on each date of submission.
- Document should be submitted through email with following subject line: “Team ID_Package-#_Rev# “
- **Design Readiness** – At the time of design report submission, all design related work must be complete and can start the prototype.

- **Vehicle Readiness** – The vehicle must be 100% complete by 30-Sep-2021.

- **Running Vehicle Video Submission** - submit the video of their vehicle in running condition by 30-Sep-2021, on late submission Penalty will be 2 marks per day.

- **Late submissions** - A penalty of 5 marks per day shall be levied for late submission up to maximum 100 marks for each document package.

- **Early submission** – On early submission, 5 marks per day will be added up to maximum 25 marks for each document package.

- **College Level Technical Assessment** - Appointed by EffiCycle Technical Committee, will visit the institute and perform necessary inspections. Technical Inspectors shall thoroughly inspect the vehicle in the same way as it will be performed during the event. Ex: - Brake test

- **Feedback given by Technical Assessment** Teams must be considered and improved furtherly.
Disqualification from Participation:
- Performance of teams will be monitored in terms of reports submission, quality of reports etc. If there is any excessive delay or no submission of document packages it may be disqualified from participation in final event after an intimation.

Example of a Case of Disqualified:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Possible Cases</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Non-Submission/delayed submission of Document Packages</td>
<td>Upon reaching total 200 marks penalty against delay in submission of document packages, team may be disqualified from participation in main event.</td>
</tr>
<tr>
<td>2.</td>
<td>Vehicle not ready at the time of inspection and completion not expected till start of event</td>
<td>Team may be disqualified from event.</td>
</tr>
</tbody>
</table>
SECTION E :
EVENT & PROCEDURES
# Event & Procedures

## Main Event
There will be following categories of events:

### i. Static & Dynamic Inspections
1. ‘Figure of 8’ Test
2. Electric Drive Inspection
3. Brake Test
4. Steering Effort
5. Reverse Parking Test (on gradient & with parking assist sensors)
6. Water shower test
7. Ground Clearance test (static & dynamic)
8. Build Quality and Rule/Safety Compliance Check

### ii. Dynamic Events
1. Acceleration Test
2. Gradient Simulation Test
3. Rough Road Test
4. Electric Drive Inspection & Energy Regeneration Test
5. Endurance Run

### iii. Static Events
1. Design Evaluation
2. Business Plan Evaluation
3. CAE Evaluation
4. Innovation & Technology Evaluation
## COMPETITION PENALTIES

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Case</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Violation or Breaching of Event Protocols</td>
<td>30-50 marks for each case</td>
</tr>
<tr>
<td>2.</td>
<td>Misconduct with volunteers or officials</td>
<td>100 marks</td>
</tr>
<tr>
<td>3.</td>
<td>Unauthorized entry in restricted area or tracks</td>
<td>50 marks</td>
</tr>
<tr>
<td>4.</td>
<td>Tampering with vehicle after Tech-OK</td>
<td>100 marks</td>
</tr>
<tr>
<td>5.</td>
<td>Intended tampering with tracks or event</td>
<td>50 marks</td>
</tr>
<tr>
<td>6.</td>
<td>Unjustified or false protest</td>
<td>50 marks</td>
</tr>
</tbody>
</table>

- These penalties will be imposed by the Competition Organizers with the immediate effect on occurrence of each case.
- All penalties will be deducted from overall score not from any individual event scores.
# EVALUATION MATRIX

## Efficycle season 13: Virtual cum Physical Event - Evaluation Matrix

<table>
<thead>
<tr>
<th>Package 1</th>
<th>Static Evaluation (Part 1)</th>
<th>#</th>
<th>Evaluation parameter</th>
<th>3W Conv Efficycle</th>
<th>3W Advanced Efficycle</th>
<th>4W Effi-Que</th>
<th>Score</th>
<th>Segment Score</th>
<th>3W Conv Efficycle</th>
<th>3W Advanced Efficycle</th>
<th>4W Effi-Que</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  Project Plan</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td>50</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>2  Design Validation Plan</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>3  BOM Report</td>
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<td>●</td>
<td>●</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>4  IPG Car Maker Simulation</td>
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</tr>
<tr>
<td></td>
<td>5  IPG Model Parameters report</td>
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<td></td>
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<tr>
<td></td>
<td>6  Vehicle Specification Sheet</td>
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</tbody>
</table>
## Evaluation Matrix

### Efficycle season 13: Virtual cum Physical Event - Evaluation Matrix

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Type</th>
<th>#</th>
<th>Evaluation parameter</th>
<th>3W Conv Efficycle</th>
<th>3W Advanced Efficycle</th>
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<th>Score</th>
<th>Section Score</th>
<th>3W Conv Efficycle</th>
<th>3W Advanced Efficycle</th>
<th>4W Effi-Que</th>
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<tbody>
<tr>
<td>Static Evaluation (Part 2)</td>
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<td>Design Report</td>
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<td>System Level - Technical Inspection</td>
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<td>Figure of 8</td>
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<td>Reverse Parking [gradient]</td>
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<td>Water Shower Test</td>
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<td>Ground Clearance Static &amp; Dynamic</td>
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## EVALUATION MATRIX

### Efficycle season 13: Virtual cum Physical Event - Evaluation Matrix

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Type</th>
<th>#</th>
<th>Evaluation parameter</th>
<th>Score</th>
<th>Section Score</th>
<th>Segment Wise Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>Vehicle Aesthetics</td>
<td>●</td>
<td>●</td>
<td>-</td>
</tr>
<tr>
<td>Misc. Evaluations</td>
<td></td>
<td>26</td>
<td>Best Women Participant</td>
<td>●</td>
<td>●</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27</td>
<td>Dronacharya Award</td>
<td>●</td>
<td>●</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>28</td>
<td>Best Faculty Advisor</td>
<td>●</td>
<td>●</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>29</td>
<td>Team Clean Pit</td>
<td>●</td>
<td>●</td>
<td>-</td>
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<tr>
<td>Additional Scores</td>
<td></td>
<td>30</td>
<td>Light weight score</td>
<td>●</td>
<td>●</td>
<td>50</td>
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<tr>
<td></td>
<td></td>
<td>31</td>
<td>Energy Regeneration - Range Extension</td>
<td>●</td>
<td>●</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32</td>
<td>Endurance - Durability Advantage</td>
<td>●</td>
<td>●</td>
<td>100</td>
</tr>
</tbody>
</table>

### TOTAL EVENT SCORING

- 3W Conv Efficycle: 2000
- 3W Advanced Efficycle: 2100
- 4W Effi-Que: 2300
Any Queries so far?
SECTION F:
DOCUMENTS FOR MAIN EVENT
**DOCUMENTS FOR MAIN EVENT**

- Additional Documents (other than Package documentation) Required for Inspections & Evaluations
- Teams must carry the following documents to the event site for vehicle inspection

<table>
<thead>
<tr>
<th>Sno.</th>
<th>Document</th>
<th>Soft Copy</th>
<th>Hard Copy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Material Testing Report for all frame materials</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2.</td>
<td>Photos and videos of In-house fabrication</td>
<td>Y</td>
<td>--</td>
</tr>
<tr>
<td>3.</td>
<td>Copy of any special permission related to vehicle / rule compliance or clarification as received from <a href="mailto:Efficycle.technical@saenis.org">Efficycle.technical@saenis.org</a></td>
<td>Y</td>
<td>--</td>
</tr>
<tr>
<td>4.</td>
<td>Circuit Explanation Diagram for each electrical and electronic circuit to understand the working mechanism during evaluation process</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
**DOCUMENTS FOR MAIN EVENT (Contd...)**

- **Document Required for Team Registration at Event Site**
  - Original Hard Copy of Team Registration Form with sign and stamp of college authorities.
  - Original copy and Student ID cards of all the team members issued by college.
  - Valid SAE membership cards of all the team members & faculty advisor.

- **Document Required for Driver Registration at Event Site**
  - Following documents will be required for registration of at least 2 (Two) Drivers, who will drive the vehicle at any time during the competition
  - Valid, government issued driving license of 4-wheeler.
  - Copy of Medical insurance
<table>
<thead>
<tr>
<th>Sno.</th>
<th>Categories</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Registration &amp; General Communication</td>
<td><a href="mailto:Efficycle.teams@saenis.org">Efficycle.teams@saenis.org</a></td>
</tr>
<tr>
<td>2.</td>
<td>Technical Queries &amp; Rulebook Clarification</td>
<td><a href="mailto:Efficycle.technical@saenis.org">Efficycle.technical@saenis.org</a></td>
</tr>
<tr>
<td>3.</td>
<td>Reports Submission</td>
<td><a href="mailto:Efficycle.reports@icat.in">Efficycle.reports@icat.in</a></td>
</tr>
<tr>
<td>4.</td>
<td>Official announcements &amp; information (through online-official channels) &amp; Glue-up mobile application</td>
<td>effi.saenis.org, <a href="http://www.facebook.com/groups/EfficycleSAENIS/">www.facebook.com/groups/EfficycleSAENIS/</a></td>
</tr>
</tbody>
</table>