

# KART AND FORMULA STUDENT CAR SET-UP RACK

## GENERAL PROJECT DESCRIPTION

Design teams are asked to design, build, and demonstrate a set-up rack capable of locating 4 automotive scales to allow the corner weights of both karts and formula student cars to be measured. The rack will be used by the City Racing team to accurately measure the corner weights of this year's and subsequent year's formula student entries. The rack will also be used by the City Karting project to measure the weight distribution of each kart, but will also be used for demonstrating weight transfer under cornering as a function of a kart's geometry. As the wheel base of a formula student car and a kart are different, the set-up rack must be adjustable to allow for this difference. Furthermore, weight distribution can only be accurately measured on a level surface so any design must include a method of adjusting the rack to ensure that it is level both laterally and longitudinally. Ideally, the vehicles should be able to roll on and off this rack. The set-up rack must be easily assembled and easy to store as well as not being too heavy to move or transport in its disassembled form. The rack should be a reasonable size (shipping volume less than 500 x 500 x 1000 mm) and easy to assemble and use. The available fund to build the machine is limited to £50 per team. The machine must be completely portable and independent of any external source of energy.

## ADDITIONAL DEVICE CONSTRAINTS

1. The device must be safe to operate. The design should reflect consideration for the safety of individuals operating it, holding it, or standing nearby.
2. The rack, plus any stand or structure that you may need, must have a shipping volume of less than 50 x 50 x 100cm. The combined weight of all machine elements including a stand must be less than 35 kg.
3. The machine, plus any stand or structure you may need, must have a set-up time of less than 5 minutes.
4. The rack and any structure or stand must exhibit good workmanship in its construction, be painted or decorated, and have some type of team logo.
5. The total cost of materials used to construct the machine and any stand or structure is limited to £50. The cost of materials must be completely and accurately documented.
6. The machine must exhibit significant design creativity and/or innovation. (Note: This requirement is intended to prohibit solely commercial or off-the-shelf solutions to the problem.) The design instructor will make the final determination as to whether this requirement is met.
7. When constructing the machine, cutting and drilling operations are permissible, while milling and lathe operations are not.

## FIGURE OF MERIT

The performance of the serving machine will be computed by the following figure of merit (FOM):

$$FOM = 10 \cdot (50 - C) + 100 \cdot \left( 5 - \frac{T_a + T_d}{2} \right) + 20 \cdot (35 - W) + 20 \cdot A + 20 \cdot E + 40 \cdot DI + 30 \cdot OI$$

Where:

- C** Cost of materials in £
- T<sub>a</sub>, T<sub>d</sub>** Times (min) for the assembly and disassembly of the set-up rack.
- W** Total weight of machine plus any stand or structure needed (kg)
- A** A number ranging from 0 - 4 assessing the workmanship and aesthetic appeal of the machine. Aesthetics also includes the ease and reliability of operation.
- E** A number ranging from 0 - 4 assessing the ease of set-up and use of the machine.
- DI** A number ranging from 1 - 4 measuring the creativity and/or innovation of the design.
- OI** A number ranging from 0 - 4 assessing the quality of the operating instructions.

## DELIVERABLES

1. In addition to designing, constructing, and demonstrating the product, teams must also document and report on their progress as well as provide a final report on the project.
2. Teams will provide weekly memo reports documenting their progress.
3. Teams will have three design reviews, Term 1 presentation and the final presentations on dates specified in the Timetable.
4. A user's manual for the device detailing assembly, disassembly, and operation of the product must be made available at the time of testing.
5. A final report documenting the entire project from initiation to completion will be required at the completion of the project.
6. Each team will be required to deliver a computer-based presentation of their project around the time of testing. This will be a sales-oriented presentation designed to convince the instructor that their device is worthy of purchase.