

COST CHALLENGE

Introduction:

In real life, cost accounting and maintaining an accurate bill of materials give engineers a clarity on the number of components used, time taken for production and calculation of cost per part. This in turn helps take strategic decisions to control costs and manufacture parts more efficiently.

Enduro Student India's cost challenge is an effort to put students through the same thought process and help students learn the nuances of cost accounting and the benefits of maintaining bill of materials in the product development process.

Objective:

Cost is a critical aspect of any commercial product but the challenge here is not to report the cheapest possible cost of the component in the prototype or production stage. But instead focuses on how well the team understands what has gone into their part and applies their learning of procurement and manufacturing techniques to optimize the cost, labour, time, material wastage etc.

2017 Brief:

Your team (fictional company) is on the verge of being awarded a contract to produce Front Upright/Steering Knuckle for 25,000 ATVs per year for the next 5 years. All your calculations should be based on these numbers.

The report should reflect the prototyped Upright/Steering Knuckle brought to competition.

Your task is to deliver the final report to the deciding committee (Cost Judges) at the cost event consisting of an accurate cost reporting of the current prototype and a sound production stage plan with comparison.

NOTE: Irrespective of the fact whether teams have manufactured the upright in house or have bought it as an off the shelf item or got it machined through outsourcing the team is assumed for the report that the team have all the necessary machines in the imaginary production facility as an OEM manufacturer except for standard parts like bearing, fasteners, circlip etc. which can be procured from a chosen vendor.

Taking forward this concept that was introduced in 2016, this year's cost challenge is divided into two parts as described below:

Section 1: Prototype Cost

The prototype cost is prepared to show the actual cost of the specified product used in the current vehicle. The cost report serves as a bill of materials for the component.

Section 2: Mass production

This section approximates the project's cost at large scale production. These cost estimates are prepared after the prototype stage. Changes in manufacturing processes from the prototype might be needed to make the high volume production cost effective and more efficient. Hence the report should reflect these new processes and the team should explain the rationale behind the chosen manufacturing methods.

REPORT GUIDELINES

Font: Calibri

Font Size: 12 Line

Line Spacing: 1

Margin: Narrow

Maximum number of pages: 20

Use of inline images is at the teams discretion and not mandatory.

The following format should be followed for the cost report and the completed report should be bound with a cover. Each component of the report has been explained in Appendix 1 .

Title Page: The title “ESI 2017 Cost Challenge” is to be in the center of the page. Below list the following details:

- a) Team Name:
- b) Team Number:
- c) College:

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Section 1: Prototype Cost

1.1 Planned process description

1.2 Bill of material

No	Item	Purchased /Fabricated	Description	Unit	Cost / Unit	Quantity	Sub Total
1	Part name	P	Aluminum 7075-T6	Kg	700		
2	Part name	F	Drilled holes	Holes	30		
3	Part name	F	CNC Machine (Milling)	Hour	300		
4	Part name	F	Bearing	Numbers			
5							
6							
7							
8							
9							
10							

Sub Assembly Time Hour 50

Total

1.3 Cost documentation

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Section 2: Mass production

2.1 Planned process description

2.2 Bill of material (25,000 Units)

No	Item	Purchased /Fabricated	Description	Unit	Cost / Unit	Quantity	Sub Total
1	Part name	P	Aluminum 7075-T6	Kg	700		
2	Part name	F	Drilled holes	Holes	30		
3	Part name	F	CNC Machine (Milling)	Hour	300		
4	Part name	F	Bearing	Numbers			
5							
6							
7							
8							
9							
10							
Sub Assembly Time				Hour	50		
						Total	

Cost per Unit: Total Cost / 25,000

2.3 Cost documentation

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Comparison Table:

No	Factors	Project 1	Project 2
1			
2			
3			

Appendix 1

Planned process description:

Complete description of manufacturing the specified part/assembly. The description should be validated with attached drawings or models for the reviewer to analyze. It is advised that the team attach the illustrative images of each step making the whole process easy to visualize.

For Ex: If a part undergoes 3 processes to manufacture, then each process should be described in detail with engineering drawing in respective steps. The drawing should be in A4 sheets.

All the images must adhere to the following guidelines: -

- All drawings must be dimensioned
- All drawings must be black & white engineering line drawing
- Screenshots taken off a CAD platform is NOT accepted
- All drawings must contain a title box detailing the team name, college name & description of the respective image
- All drawings must be full page & multiple images on a single page is not accepted.

Bill of material:

Part cost consists of only those items included in the final design. A detailed bill of materials includes manufacturer, part number, part description, supplier, quantity, and cost.

No	Item	Purchased /Fabricated	Description	Unit	Cost / Unit	Quantity	Sub Total
1	Part name	P	Aluminum 7075-T6	Kg	700		
2	Part name	F	Drilled holes	Holes	30		
3	Part name	F	CNC Machine (Milling)	Hour	300		
4	Part name	F	Bearing	Numbers			
5							
6							
7							
8							
9							
10							

Sub Assembly Time Hour 50

Total

For Section 1

The standard operations cost listed in Reference Table 1 and material cost listed in Reference Table 2 should be used for creating the bill of material, if any process used by the team is not mentioned in the reference table then the team can provide a valid cost documentation for the same from the supplier.

For Section 2

In large scale production, the set up cost, material cost, machining cost per part are much less since the costs are brought down with economies of scale and hence make the net cost per part more feasible than the prototype. The teams are advised to provide their own operations cost for each process with valid cost documentation.

Reference Table 1

Operations Cost Table		
Labor (all other activities)	₹ 50.00	/hour
CNC Machine (time)	₹ 300.00	/hour
Computer-aided labor (water jet cutting, etc)	₹ 250.00	/hour
Welds	₹ 50.00	/weld
Saw/Tube Cuts	₹ 30.00	/cut
Tube Bends	₹ 75.00	/bend
Non-metallic cutting	₹ 50.00	/m
Radiusing tube ends	₹ 50.00	/end
Drilled holes	₹ 30.00	/hole
Reamed hole	₹ 30.00	/hole
Tapping holes	₹ 30.00	/hole
Sheet Metal Shearing	₹ 10.00	/cut
Sheet Metal Punching	₹ 10.00	/hole
Sheet Metal Bends	₹ 10.00	/bend

Reference Table 2

Material Cost Table		Density	
Mild Steel, e.g. 1010, 1025	₹ 300.00	/Kg	7850 kg/m ³
Alloy Steel, e.g. 4130, Chromoly	₹ 600.00	/Kg	7850 kg/m ³
Aluminum e.g. 6061, 2024	₹ 350.00	/Kg	2700 kg/m ³
Aluminum 7075-T6	₹ 700.00	/Kg	2800 kg/m ³

Cost Documentation –

Cost Documentation is the supporting proof for entries in the bill of material.

It can be any of the following: (a) Receipts or invoices for the items purchased, (b) Catalog pages showing the items and price, (c) On-line prices of the components, (d) Quotations from a manufacturer or fabricator, or (e) Price tags provided that original tag identifies the item to which it was affixed.

- All scan copies, screenshot, invoices, quotations should be labeled with item, process, and material name accordingly

CNC Machining Time – If an item is fabricated using CNC machining, make sure you record the 'run time' and provide the documentation for the same. You should attach it in the cost documentation.

Fabricated/Manufactured parts do not include design or setup time for your manufacturing, **actual run time only.**

Comparison Table:

When comparing the relative merits of different approaches to manufacture the specified component in prototype stage and in mass production, it is important that teams are able to consider the manufacturing efficiency and cost of production together in selecting the processes.

Following are examples of the factors but not limited to that the team should consider for the comparison table.

- Part production technique / methods.
- Implementation of manufacturing techniques that reduces the production lead time and efforts
- Manufacturability and serviceability
- Material Selection & rationale
- Recyclability
- Manufacturing Process(s) selection & rationale
- Ability of meet Engineering Specifications
- Human factors considered
- Cost per unit

Naming Convention for 'Cost Challenge Report'

-The 'Cost Challenge report' file must be saved in the '.pdf' format. The file name must be in the following format:

"Cost Challenge 2017_Team No._Team Name.pdf"

COST CHALLENGE JUDGING CRITERIA

(Total Points: 100)

Prototype points

The Prototype report is to be judged based on its accuracy to the components reported and the ones used in the car brought to the event and the team's understanding of the report.

Prior to the Enduro Student India 2017 event the team submits the cost challenge report for pre-marking. The report will be reviewed for cost accuracy in regards to the material/process tables and to ensure that the teams have followed all the procedures and report guidelines.

The pre-marking is worth 20 points.

Cost Decisions

After compiling a list of teams who have followed all procedures for reporting, the team with the lowest cost will receive 10 points each for both prototyping and production stage respectively. The point to rest of the teams will be awarded relatively.

At the event

Judging at the event accounts for 60 points.

Judging criteria (not limited to):

- Comprehensive reporting
 - If a process or part is not reported in the cost report then team will lose points.
- Team's detailed explanation of the components used.
- Part production technique / methods.
- How well the team addresses and participates in discussion with the judges based on the question raised by the panel.
- Implementation of manufacturing techniques that reduces the production lead time and efforts
- Impact of the cost on design
- Material Selection & rationale
- Recyclability
- Environmental impacts
- Ability of meet Engineering Specifications
- Human factors considered
- Cost per unit