QUALITY FUNCTION DEPLOYMENT, FEASIBILITY ANALYSIS ON DIESEL TANK OF TRUCK VEHICLES

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ABSTRACT

The fuel tank is an important component in any of the automobile vehicles, wherein which the flammable liquid called diesel or petrol is stored to run a vehicle engine. Irrespective of the fuel tank designs, like cylindrical tank and rectangular tank, most commonly seen. Even there are some defects in the running tank design may be the corrosion of the tank. Design of a fuel tank includes its material cost, manufacturing cost, transportation cost, and cost of mounting the tank and so on which reflects reliability, strength and performance and so on. Quality Function Deployment (QFD) is also used to in decision making and selection of materials using feasibility analysis.

KEYWORDS: Fuel Tank, Feasibility, QFD, Manufacturing

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INTRODUCTION

Quality Function Deployment (QFD) is considered and along with the salient factors that need in the design considered in designing an effective fuel tank using feasibility analysis. The choice of shape is generally influenced by the need for maximum fuel capacity and the desire for a stylish look. The most common diesel tank designs are cylindrical, rectangular and D-Style tanks. Cylindrical designs are often selected for their visual appeal while the rectangular tank is most often employed to maximize fuel volume for a given space. The QFD helps in selection of best among the considered materials

QFD METHODOLOGY

By obtaining the components of QFD as shown in Fig 1, relationships are established compared and analyzed. FD-approach provides a great opportunity to work with cross-functional teams, employee involvement and participating management by discussing the meaning and importance of the `WHATs, HOWs, WHY's combinations. These strategic issues indicate that starting a QFD activity yields multiple benefits title. QFD

Figure 1: Components of QFD.

OBJECTIVES

The main objective is to find out better suitable material for diesel tank of truck vehicles upon their application. Using QFD is incorporated in feasibility of fuels tank. The methodology adopted is questionnaire for QFD and design for feasibility analysis. After the collection of information from various mechanics, demographics, experience prime changes are incorporated in the design, the complete 3D model of existing and proposed design was created by using Pro-E software.

The comparative study was made and conclusions of Factors considered are aesthetics, performance, functional, failure reasons, and time frequency of failure

Table 1: Demographic Information

Age <40	Age >40	
16	16	
100	100	Response rate

MATERIAL COMPARISON

The suitable materials for fuel tanks are steel, aluminum and high-density polyethylene (HDPE). Here the comparison of above three materials is shown based on the self-weight of the tank, and also fuel efficiency due to decrease in weight of fuel tank. The material properties are as shown below.

Table 2: Material Properties Comparison

Material Parameter	STEEL	ALUMINUM	HDPE
Density (g/cm ³)	7.89	2.70	0.95
Poisson's Ratio	0.3	0.33	0.46
Yield Strength (Pa)	210×10^3	55×10^3	26×10^3
Capacity of the Tank (liters)	160	160	160
Self-Weight of the Tank (kg)	77	27.25	9.77

Figure 2

MODELING & FEASIBILITY ANALYSIS

Table 3: Comparison of Different Materials

SL. No.	PARAMETER	MATERIALS		
		STEEL	ALUMINUM	HDPE
1	Manufacturing	The raw material used is metal sheets. These tanks are made by welding the stamped sheet.		These tanks are made by blow molding or injection molding.
2	Corrosion Resistant	Steel tanks corrodes very rapidly and it is prevented by corrosion resistant paints and zinc coatings	It is also a corrosion resistant where coatings on the surface are not required	These tanks are non-corrosive for long life.
3	Easy Design	The complex shapes are difficult to manufacture and there are standard shapes like cylindrical and rectangular tanks.		As compared to the metal fuel tank manufacture, HDPE tanks are easy to manufacture to their complex shapes.
4	Recycle	Steel material can be recycled easily and used for further applications.	It is also having an advantage of recycling the material for other uses.	Recycle of this plastic material is hard because of lack of infrastructure and scrap rate is more compared to steel
5	Weight Difference	Weight of the steel tanks is high because of high density material (7.89g/cm^3).	Compared to steel tank it is lower in weight (2.7g/cm^3).	This is a lighter material and has a least weight (0.9g/cm^3).
6	Cost	Steel material is generally cheaper than the other two materials.	Cost of aluminum is slightly higher than compared to steel.	Material cost depends on low tooling cost for low volumes and high tooling cost for high volumes.

Table 4: Feasibility Analysis for Different Materials

SL. No.	PARAMETER	MATERIALS		
		STEEL	ALUMINUM	HDPE
1	Manufacturing	5	5	3
2	Corrosion Resistant	3	3	5
3	Easy Design	4	3	5
4	Recycle	4	4	5
5	Weight Difference	3	4	5
6	Cost	4	4	5

No Relationship 0 Low Correlation 1

Medium Correlation 3

High Correlation 9

Table 5: Important Relations of HOQ

MATERIALS	Priority	Steel	Aluminium	HDPE
WHAT'S				
Corrosion	1	1	3	3
Easy Design	3	0	3	3
Manufacturing	2	0	0	0
Recycle Weight		0	0	6
Load Applied	4	0	3	1
Cost	5	1	3	1
Easy Modification	7	0	0	3
Life /Reliability	8	1	3	6
	Total	3	15	23

CONCLUSIONS

In this paper, an attempt has been made to explore the various applications of QFD in different areas or fields in such as design organization.. A quick look of QFD is summarized as a quality tool, universal tool, for majority of the applications with flexibility and quality as main motto.

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