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TITLE: Performance analysis of drive shaft used in three wheeler vehicle by using FEA tool.

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Abstract

Drive shafts are mostly used to transmit power from engine to wheels. These are highly capable and able to work in worst conditions. They can sustain maximum torque applied by engine on wheels. Drive shaft is also a key member in clutching system as it engages and disengages with gear box. Hence for complete generated power transmission, drive shaft should be in proper working condition. In three wheeler vehicle we found two drive shafts with different length and hole tilt angle. One shaft is smaller in length as compared to second.

In this paper the performance of drive shaft is analysed with the help of FEA tool and possible deformation and stress development is find out. For this purpose the ANSYS 14.5 software is used and further analysis is carried out. CATIA V5R19 software is used to design the drive shafts. Obtained results are shown in conclusion.

Index Terms: *Drive Shaft, FEA Tool, Power Transmission*

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1. Introduction to Three wheeler drive shaft

A drive shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them.

As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, while avoiding too much additional weight as that would in turn increase their inertia.

Figure 1 show a typical drive shaft used in CNG auto rickshaw. Drive shaft must operate through constantly changing angles between the transmission and axle. Most shafts are subjected to fluctuating loads of combined bending and torsion with various degrees of stress concentration [2, 3]. Shaft failure leads to heavy loss due to stoppage and repairing cost associate with the breakdown and extensive boring journey experience.

Fig. 1.1: Three wheeler drive shaft [1]

During operation several factor affect the drive shaft leading to early breakdown. But for analysis it is not feasible to consider the minor terms. Thus some assumption is under consideration for standard analysis of a drive shaft. They are the followings

- The shaft rotates at a constant speed about its longitudinal axis.
- The shaft is a solid cylinder of uniform circular cross sectional area.
- The shaft is fastened with perfect balancing.
- All damping effects are avoided.

- The stress-strain relationship for material follows conventional law.
- Any fluid interactions and change of temperature are neglected.

2. Outcomes from literature survey

- Sufficient amount of research work is available to understand the study direction in case of drive shaft.
- Torque produced by engine and loading condition is mainly responsible for drive shaft failure.
- Most of the authors have focused on shaft material to analyse the shaft behaviour.
- Vibrations occurred during working affects shaft performance.
- FEA tools may act as a reliable tool for structural, vibration and wear analysis of a drive shaft.
- CAD software is mostly used for virtual modelling of drive shaft to avoid material failure.

3. Preparation of Drive Shaft CAD model.

CAD models of both drive shafts is prepared in part module window. Figure 2 shows the big drive shaft (420mm length) while. Dimensions are taken from actual shafts directly. Drive shaft has a cross sections of 15mm diameter. Also the angle of inclination of both circular ends are different.

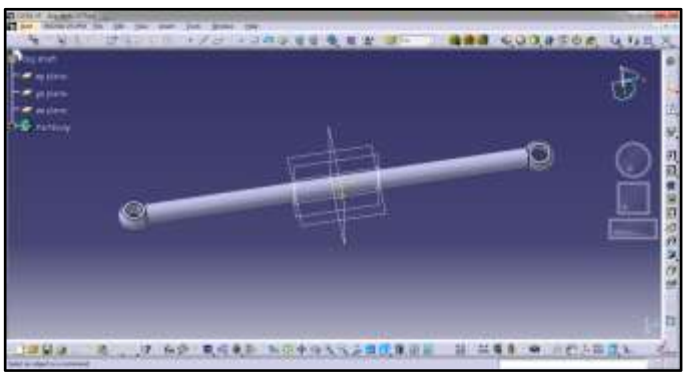

Fig. 2: Big Drive Shaft CAD model prepared in CATIA V5R19.

IGES format is used to import CAD file into FEA tool ANSYS 14.5. The **Initial Graphics Exchange Specification (IGES)** (pronounced *eye-jess*) is a vendor-neutral file format that allows the digital exchange of information among computer-aided design (CAD) systems.

4. FEA Analysis of Drive Shaft

For this purpose we have used ANSYS 14.5 software. We have performed Torque test, Tension Test and Compression test whose results are shown and explained as follows.

4.1 Meshing/Discretization

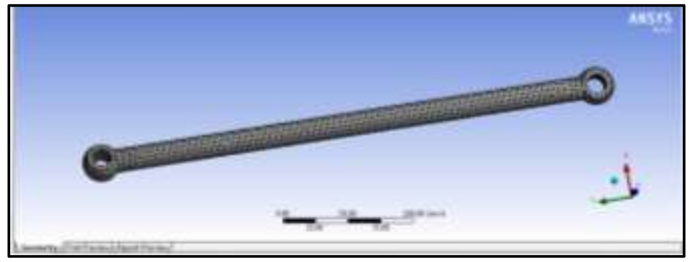

Fig. 3: Meshing of big drive shaft along with nodes and elements.

A **mesh** is a network of line elements and interconnecting nodes used to model a structural system and numerically solve for its simulated behavior under applied loading. Fig. 3 shows the meshed drive shaft. It has 5021elements and 9501 nodes.

4.2 Material Properties

Medium Carbon Steel is the material which is used for manufacturing of drive shaft. We need some specific material properties to perform analysis which are listed below.

Table -1: Properties of Medium Carbon Steel for Structural Analysis.

Property	Value
Young's Modulus (E)	2e5 MPA
Poisson's Ratio	0.29
Density	7870 m^3

4.3 Big Drive Shaft Tensile Test Analysis results:

Fig. 4 shows the deformation in big drive shaft. The maximum deformation accrued 0.15mm at the end where the tensile load is applied and it is minimum where the shaft is fixed. The colour contour shows the entire deformation in shaft as per the location. Even though this deformation is in the acceptable range, still the repetition of such load may reduce the life of shaft.

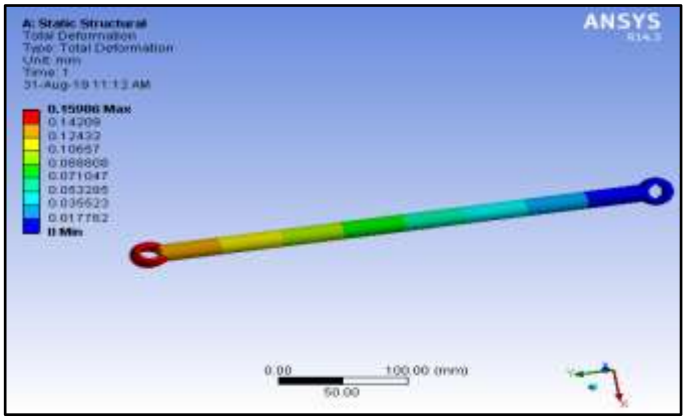

Fig. 4: Total Deformation due to application of load.

Fig. 5 shows the shear stress in big drive shaft and it is maximum 61.563 MPA. If we carefully observe the drive shaft, it appears red on one end where the force is applied. Means this could be the region of failure**.** As the shaft is in complete green colour, it indicates its stability for applied load. And where the maximum load is applied on that region also, the stress value is, in acceptable range.

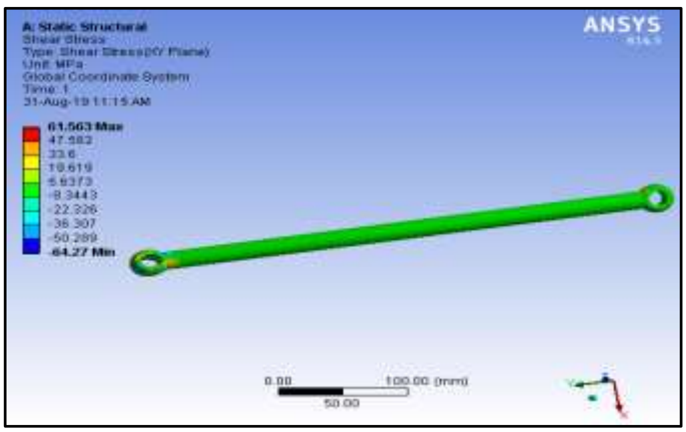

Fig. 5: Shear Stress

Fig. 6 shows the normal stress in big drive shaft and it is maximum 85 MPA. If we carefully observe the drive shaft, it appears red on one end where the force is applied. Means this could be the region of failure. As the shaft is in complete pale green color, it indicates its stability for applied load. And where the maximum load is applied on that region also, the stress value is, in acceptable range.

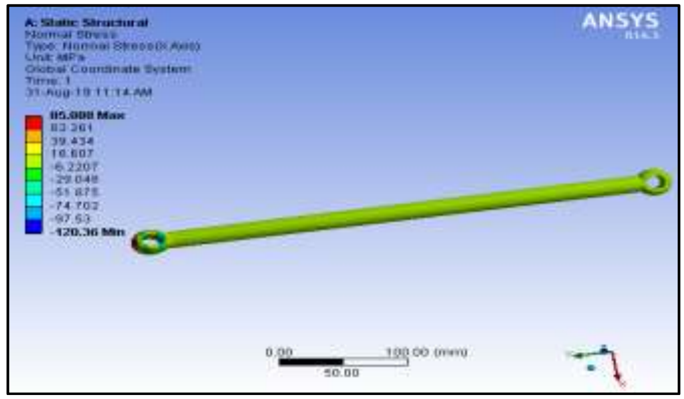

Fig. 6: Normal Stress

Fig. 7 shows the equivalent stress in big drive shaft and it is maximum 207 MPA. This value is maximum in all stress values obtained. Also, it appears red on some regions of end where force is applied. Means this could be the region of failure. As the shaft is in complete sky-blue colour, it indicates its stability for applied load. And where the maximum load is applied on that region also, the stress value is higher than other values.

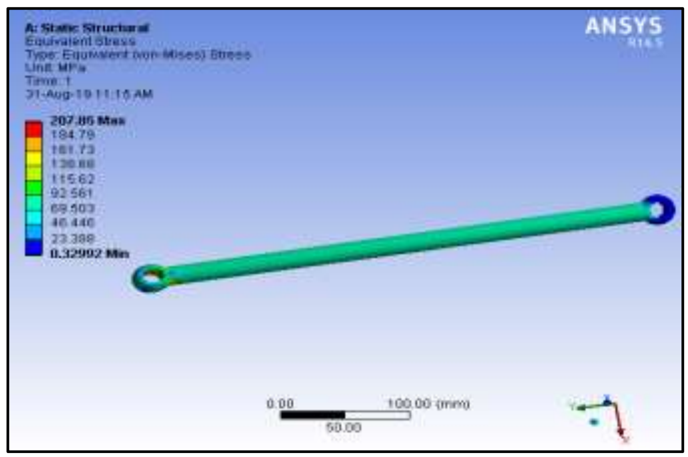

Fig. 7: Equivalent stress

Same way we have performed compression and torque test whose results are shown in following table.

Table 2: Analysis Results for Big drive shaft.

Sr. No.	**Type of Analysis**	**Total Deformation (mm)**	**Shear Stress MPA**	**Normal Stress MPA**	**Equivalent Stress MPA**
1	Tensile Test	0.159	61.56	85	207.85
2	Compression Test	0.159	64.27	120.36	207.85
3	Torque Test	0.131	21.978	14.032	42.305

5. CONCLUSION

By studying above results we can conclude that the existing Drive shaft material is tough enough to withstand a generated torque and FEA method is a best suitable method for performance analysis of drive shaft. Results obtained in case of torque test are better as compared with tension and compression test.

REFERENCES

[1] Vinodh Kumar S, Sampath V and Baskar P. (2015),"Analysis of Propeller Shaft for Composite Materials". Research Journal of Recent Sciences, ISSN 2277-2502, Vol. 4(9), September 2015, 9-15.

[2] Bhirud Pankaj Prakash, Bimlesh Kumar Sinha. (2014),"Analysis of Drive Shaft". International Journal of Mechanical and Production Engineering, ISSN: 2320-2092, Volume- 2, Issue- 2, Feb.-2014, 24-29.

[3] R. P. Kumar Rompicharla, Dr. K. Rambabu. (2012),"Design and Optimization of Drive Shaft with Composite Materials". International Journal of Modern Engineering Research (IJMER), ISSN: 2249-6645 Vol.2, Issue.5, Sep-Oct. 2012, 3422-3428.

[4] Naveenkumar Dasanagoudar, Vinayak Koppad. (2015)," Numerical Analysis and Optimization of Passenger Car Drive Shaft". International Journal for Research in Applied Science & Engineering, Technology (IJRASET), ISSN: 2321-9653 Volume 3 Issue IX, September 2015, 415-422.

[5] P. Jayanaidu, M. Hibbatullah, Prof. P. Baskar. (2013),"Analysis of a Drive Shaft for Automobile Applications". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 10, Issue 2, Nov. - Dec. 2013, 43-46.