

EM204 Fall 2008 Project 1

You are working for a automotive supplier that makes driveshafts for front-wheel drive cars (sometimes called halfshafts). You have been asked to bid on a job to supply the halfshafts for a new car. You have been supplied with the power curve for the engine (see included spreadsheet) and told the automatic transmission gear ratios (1st 3.2, 2nd 1.9, 3rd 1.2, 4th 0.949, 5th 0.727, Reverse 1.9). You also know that the shaft is 20 inches long. You have been asked to determine the diameter of the shaft that will meet the function (no permanent deformation) with a safety factor of 1.8.

Besides carrying engine torque, your design will have to pass a test used to evaluate the transmission's ability to hold park. In this test the vehicle is pushed from a trailer moving at 40mph onto an asphalt skid pad. The driveshaft should not permanently deform (safety factor of 1 since you only have to meet the test once).

Your boss would like to know the lowest mass solid shaft and lowest mass hollow shaft that would meet specifications. You are asked to use a SAE 4340 heat treated steel. To prevent buckling the minimum wall thickness for the hollow shaft is 0.100 inches

Additionally, there is a limit to the outside diameter of the shaft of 1.5 inch due to possible interference with other components.

Reporting

- Report the material properties (and source of properties) for the material.
 - Report the geometry, weight, and stiffness of each shaft (solid and hollow).
 - Report the assumptions used to size the shaft for the skid pad test.
 - Report your selection as lightest shaft.
 - Show all calculations in standard engineering problem solving format on plain white or engineering problems paper. Output from software such as Maple, Matlab, or Excel should be attached as appendices.
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Grading

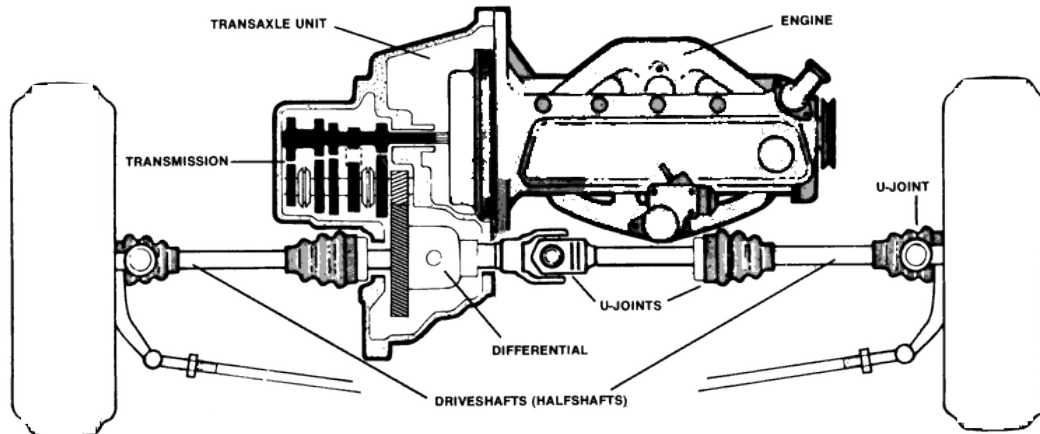
-0	FOS of selected lightest is between 1.77 and 1.85
-10	FOS of selected lightest is between 1.85 and 2.05
-20	FOS of selected lightest is between 2.05 and 2.15
-30	FOS of selected lightest is between 2.15 and ∞
-50	FOS of selected lightest is less than 1.77

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Background info

The following will give you a little better idea of the location and appearance of halfshafts and an overview of the power curve.



www.procarcare.com/.../encyclopedia/8852LG09.gif



YAMADA manufactures a variety of half-shaft assemblies for the drive trains of 4-wheeled vehicles.

www.yamada-s.co.jp/english/products/4w/frame.html

