Technical Analysis

Name

Date

# Introduction

My project is making a traffic sign cleaner without infecting the traffic flow. To make this project we have decided to use the drone setup that will fly in the air and will clean the sign board using the shower system with the bunch of pipes in the drone to carry it in air. In this way the traffic will not disturb and sign boards can easily control.

And this paper is talking about the individual analytical analysis, the subject selected to do the analysis is the construction of frame. In this analysis I will analyze the pipe that will use to build the complete drone and the shower system, whether the pipes will be solid filled pipes or hollow pipes. As the strength of pipes is quite important so it will analyze which pipe is best to use for the frame and the next thing is it will examine the material that will use for the pipes. The pipe material will examine to see the best material to use for the pipe. This analysis will help the team in selecting the final material and the final type of pipe to build the structure of drone.

# Assumptions

Following few assumptions have considered to do this analysis.

1. Outer side of pipe radius
2. Inner side of pipe radius
3. The shear stress in both hollow pipe and solid pipe is same.
4. The polar inertia of the pipes is
5. And the length of pipe to consider in this analysis is
6. Force to consider
7. Cross section area
8. Changes happened in the length

0.00053 mm

# Equations to use

Following equations will use for the calculations in this analysis

Where

*

Ratio equation for the weight to compare the weight of both types

Where

Strength to weight ratio of hollow pipe

Where

Strength to weight ratio of solid pipe

Where

Stress can calculate

Stress

Strain

Yield strength

# Physical Modeling

For doing the physical modeling we have to make a real model for the pipe and use them in the drone to see the behavior of each pipe.

# Governing Calculations

Calculating the shear stress

Calculate the weight ratio

As the weight of hollow pipe and weight of solid pipe, and their ratio is less than 1, means the weight of hollow pipe is less than weight of solid pipe hence it is recommending to use hollow pipe according to this calculation because drone need to fly in the air and it will have to carry the shower system with the water so the structure weight has to be light.

Strength ratio of hollow pipe

Reducing the above equation gives

Now put the values into the equation

Strength ratio of Solid pipe

Reducing the above equation gives

Now put the values into the equation

Comparing the strength to weight ratio of hollow pipe and solid pipe, the best option is hollow pipe because its strength is even better comparing with the weight. As the strength to weight ratio is actually determining the strength considering the weight. Hence hollow pipe is good to use for this project. Now find the best material to build the structure.

There are two options considering in this analysis, aluminum and carbon fiber, because both are strong and light weight so let’s see which is effective to use in this project.

**Aluminum**

Force is

Area and Length

Stress

Strain

Yield strength

**Carbon Fiber**

Stress

Strain

Yield Strength

The best material to use is carbon fiber, because it is stronger than the aluminum and use the hollow pipe with the carbon fiber is the best combination to build the drone structure.

# Conclusion

This analysis is focusing on the project of traffic sign cleaner and in the analysis structure of the drone has considered. To develop the structure, hollow pipe and solid filled pipes are available and from the analysis it has found that using the hollow pipe is best option because it is light weight and it has higher strength to weight ratio. And the material to use for building the pipe structure is either aluminum or carbon fiber and it has found that carbon fiber has higher strength that’s why it is better to use carbon fiber with the hollow pipe to build the drone structure. This analysis will help the team in selecting the material and final design of the drone during the manufacturing process of the product.

# References

[1] F. Foe, G. Posh, “Shaft and Pipe Analysis for the calculation of Strength and Weight” ,9th edition. http://www.staff.city.ac.uk/~ra600/ME2105/Analysis/ME2104-A-1.pdf

[2] T. Won, “Designing of the shaft and Pipes”, available [online], https://fac.ksu.edu.sa/sites/default/files/fatigue-chap9-rev-1-part4.pdf

[3] G. John, “Analysis strength to weight ratio for the hollow and solids”, available [online], https://www.sciencedirect.com/topics/engineering/hollow-shaft

[4] T. George, “Materials Analysis Force and Stress, Strains”, available [online], https://www.linearmotiontips.com/mechanical-properties-of-materials-stress-and-strain/