

**Activity 2.1.2 Mass Properties Analysis**

Introduction

Based on the information presented to you in the Design Considerations for Manufacturability presentation, let’s explore mass properties of some known models. Now that we know the part properties and attributes, we can make some educated decisions about our approach to manufacturing, packaging, shipping, and finishing. In the end these decisions could save a company millions in invested capital as well as increase the profit margin of the product.

Equipment

* Computer with solid modeling software
* Course binder

Procedure

1. Use a solid modeling program to recreate four of the models shown below.
2. When each part is finished, apply the physical properties for the part material and fill in the values for mass, volume, and surface area, then answer questions for each.

Model 1 – Slotted Angle Block

|  |  |
| --- | --- |
|  | *Model Material:*  Mild Steel (Steel, Mild)  *Material Properties:*  Density: 7.850 g/cm^3  Mass: 5.121 lbmass  Volume: 18.059 in^3  Surface Area: 52.081 in^2 |

1. Answer the following questions using model 1.
2. What is the material cost of the part assuming that the cuttings are remelted and the cost of mild steel is $6.25 per pound?

6.995 - 5.121 = 11.7125

1. What is the material cost of the part assuming that the cuttings are not remelted?

7.85 x (18.059)2.54 = 360.07/12 = 30 x 6.25 = 187.54

1. What is the mass of the material lost in a typical machining process?

1.75 x 5.125 x 2.75 = 24.664 – 18.059= 6.605

-

1. What is the cost of the lost material based on your calculations above?

6.605 /12 x 6.25 = 3.44

1. What will the volume of the box (in cubic feet) need to be in order to ship 1000 parts packed without spacers?

18.059 x 1000 =< 18059

1. What other processes could be used to create the same part?

You could use additive orsubtractive manufacturing

Model 2 – Mounting Bracket

|  |  |
| --- | --- |
|  | *Model Material:*  Stainless Steel  *Material Properties*  Density: 8.000 g/cm^3  Mass: 3.608 lbmass  Volume: 12.484 in^3  Surface Area: 53.655 in^2 |

1. Answer the following questions using model 2.
2. What is the mass of the material lost in a typical machining process?

1.5 x 5 x 3 =22.5 -12.484 = 10.016 = 18.25

1. What is the cost of the lost material based on your calculations above if the cost of stainless steel is $15.75 per pound?

10.016 x 15.75 = 157.752

1. What is the material cost of the part assuming that the cuttings are remelted?

3.608 x 15.75 = 56.826

1. What is the material cost of the part assuming that the cuttings are not remelted?

22.5 x 15.75 = 354.375

1. What is the cost to ship 1000 parts if current shipping costs are $3.75 per pound?

3.608 x 1000 = 3608 x 3.75 = 13530

1. What other processes could be used to create the same part?

You could either use additive or subtractive manufacturing

Model 3 – Support Bracket

|  |  |
| --- | --- |
|  | *Model Material:*  Aluminum 6061  *Material Properties*  Density: 2.700 g/cm^3  Mass: 3.524 lbmass  Volume: 36.122 in^3  Surface Area: 173.623 in^2 |

1. Answer the following questions using model 3.
2. What is the material cost of the part assuming that the cuttings are remelted and the cost of aluminum 6061 is $0.62 per pound? What is the material cost of the part assuming that the cuttings are not remelted?

3.524 x .62 = 2.18488

9 x 3.5 x 4 = 126 x .62 = 78.12

1. What is the mass of the material lost in a typical machining process?

3.524 x 1.7142 = 6.041

1. What is the cost of the lost material based on your calculations above?

78.12 – 2.184

75.935

1. How many parts can be painted with one gallon of paint that covers 400 ft2?

27 parts

400/ 14.4685

1. What other processes could be used to create the same part?

Additive or subtractive manufacturing

Model 4 – Pipe Support

|  |  |
| --- | --- |
|  | *Model Material:*  Soft Yellow Brass (Brass, Soft Yellow)  *Material Properties*  Density: 8.470 g/cm^3  Mass: 1.395 kg  Volume: 164648.363 mm^3  Surface Area: 29881.694 mm^2 |

1. Answer the following questions using model 4.
2. What is the material cost of the part assuming that the cuttings are remelted and the cost of soft yellow brass is $13.50 per pound? What is the material cost of the part assuming that the cuttings are not remelted?

3 x 13.5 = 40.5

1.5066 x 3 = 4.52 x 13.5 = 61.02

1. What is the mass of the material lost in a typical machining process?

1.52 pounds

4.52 -3

1. What is the cost of the lost material based on your calculations above?

61.02

1. What other processes could be used to create the same part?

**Additive or subtractive manufacturing**