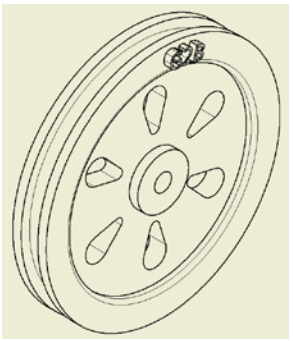
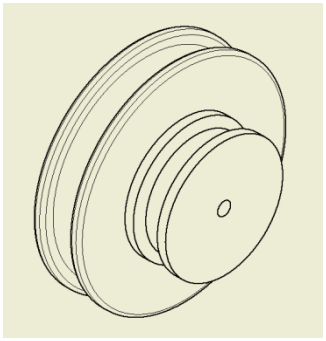
EGR 110 Due date: _____
Engineering Graphics
File: N110IA4A

Inventor Assignment #4 – Cable Car Wheels





Reading Assignment:
Read Chapters 3, 4, and 10 in Parametric Modeling with Autodesk Inventor 2013, by Randy Shih

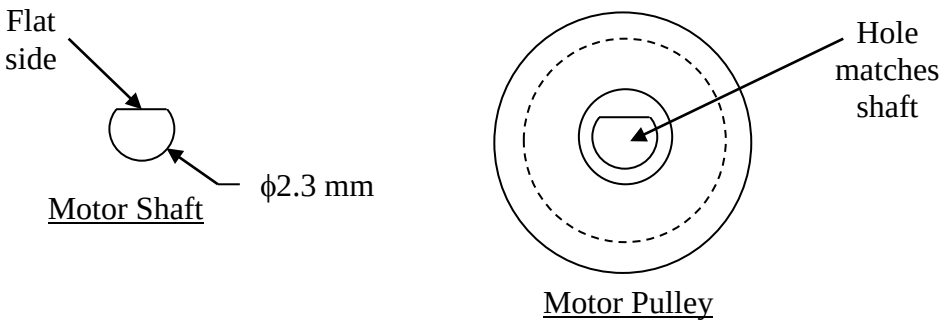
Computer Assignment:
Each team member should create at least one wheel for their cable car. The wheels might include:

- Drive wheel (double-pulley) to roll on the cable
- Non-drive wheel to roll on the cable
- Motor wheel pulley

If the team needs more wheels than team members, then some team members will need to design multiple wheels.
If the team needs fewer wheels than team members, then different team members can make different versions of the same wheel. All wheels (ipt files) should be posted in the File Exchange for the team. The team can decide later which of the versions to build out of ABS plastic using the 3D printer in the lab.

Team Meeting:
Before you begin you should meet with your group to discuss the types of wheels needed, wheel diameters, axle diameters, etc. For example:

- Will the cable car be propeller driven, belt driven, or use direct drive?
  - Belt driven: Design one double wheel/pulley and one single wheel. Also design one motor pulley.
  - Propeller driven or direct drive: Use two single wheels. Also design one motor pulley.
- What diameter wheels should be used?
- What size axle hole should be used? Note: A good idea is to make the hole a little smaller than necessary and to drill it to the final size with a drill press in lab.
  - What material will be used for the axle? Stiff wire? Bolt?
  - Will a bushing (sleeve) be used?
  - Will bearings be used (such as from a skateboard)?
- Note that only one set of wheels will be built for each team.
- Identify group members by letter (A, B, C, …). The group number (G1 and the member letter should be ***embossed*** on each wheel (for example, G2A, G2B, etc). This will help the instructor identify them as we might build many wheels at the same time on the 3D printer and they will later soak in a parts bath to remove support material. Make sure that the embossed letters will not interfere with any part of the cable car.
- If a pulley is to be used on the motor, a good way to mount the pulley is to flatten part of the motor shaft with a flat file (the steel is soft and easy to file). Then design an appropriate hole for the pulley. An example is shown below.



Wheel Specifications: (check with the instructor for exceptions to these rules)

- Wheels diameters should generally be between 25 mm and 75 mm (1" - 3").
- The diameter of the plastic-coated cable is about 4.75 mm (3/16"), so the wheels should perhaps be designed for a 5 mm cable so that the cable will not fit too tightly in the wheel.
- Since the 3D printer makes parts by adding layers that are 0.25 mm (0.01") thick, make dimensions accurate to the nearest 0.25 mm unless you are using a standard hole size.
- Be sure to strengthen the hub (area around the axle hole) by making the material thicker.
- No part on the pulley should be thinner than 3 mm (1/8") and main body of the pulley should be at least 6 mm thick.
- All single wheels must include cutouts (using a circular pattern) to reduce weight (but note the 3 mm requirement above).
- If two non-drive wheels are to be used (such as with a propeller-driven cable car), they must be different (different circular patterns, for example).
- Consider using fillets to avoid sharp edges and to strengthen the wheel.
- Use symmetry as much as possible in your wheel design.

Inventor Part Specifications:

- Create a separate Inventor part for each wheel (with metric units).
- Use a file names for each wheel as noted earlier (for example, G2A, G2B, etc).
- Draw the profile for each wheel and use dimensions and constraints to precisely control features in the wheel. Use no random dimensions!
- Include a center line with the profile and use ***linear diametric dimensions***.
- All wheels must be created using a ***revolution***.
- Add the circular cutouts to all single wheels (and to the other wheels if desired).

Inventor Drawing Specifications:

- Create a separate drawing file (metric units) for each part (wheel).
- Use an A-size (portrait) sheet.
- Include a front, side, and isometric view. If the two sides of the pulley are different (as with a double pulley), include views that show both sides clearly.
- Use the Styles Editor to change the number of digits after the decimal point to 2 (but use more digits for any standard holes that require more digits).
- Retrieve dimensions from the part and/or add new dimensions. Be sure to add enough dimensions to precisely define all features on the wheel except the embossed text. Be sure that all circular dimensions are shown using ***linear diametric dimensions***. You might want to ask your instructor to look at your drawing for suggestions to improve the dimensioning.
- Use good dimensioning style.
- Add information to the title block including:
    - Your name (author of the part)
    - EGR 110 – Engineering Graphics
    - Filename: G2A.ipt (for example)
    - Part Description: Front wheel for cable car (for example)
    - Date (specify)
    - Scale (specify)
    - Inventor Assignment #4A
- Print the drawing.

Assignment Submission:

- Print the drawing files for all wheels and turn them in to the instructor.
- Each wheel (ipt file) must be uploaded to the ***Group File Exchange*** in Blackboard ***by the author of the part***.

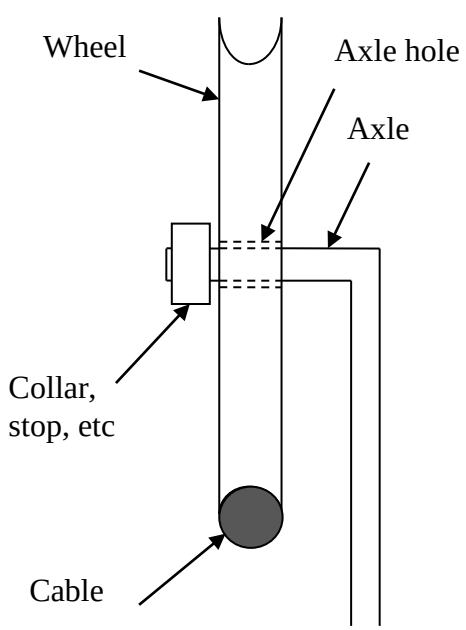
Adding Embossed Text

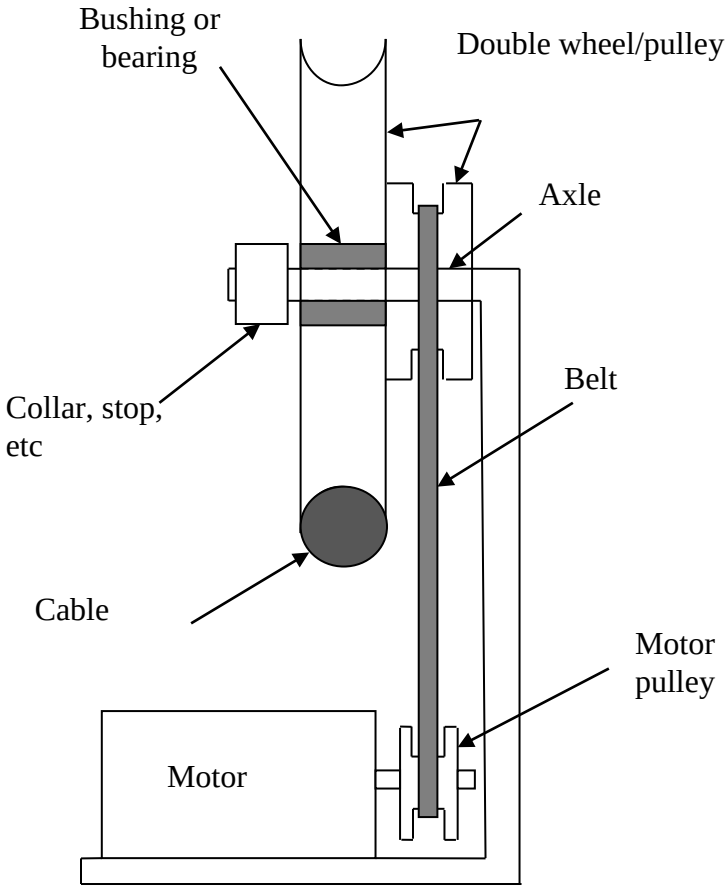
- Add a new sketch plane on the surface where you want the text.
- Select Text – Geometry Text – then select the feature where you want the text (circular edge of wheel)
- Enter the desired text. Adjust the offset. Adjust the size of the text.
- Close the sketch plane.
- Select Emboss from the Model menu.
- Select the text box just created as the Profile.
- Enter the height for the embossed text.

Axle Selection

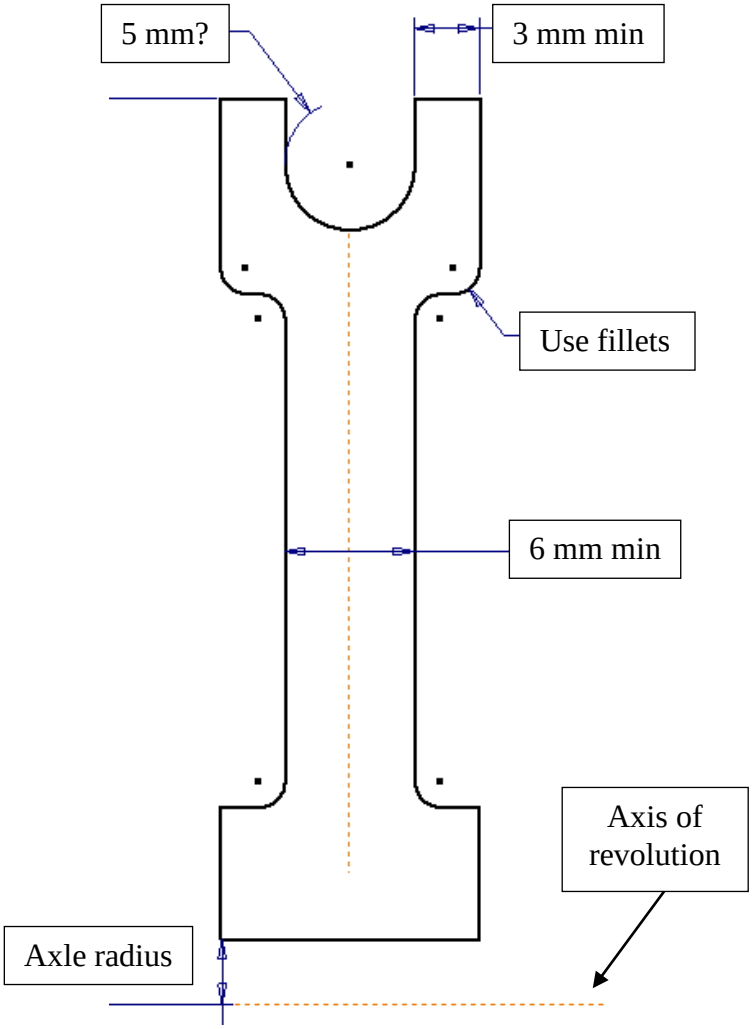
The instructor will pass around some sample wheels, bushings, and axles. Some possible choices are:

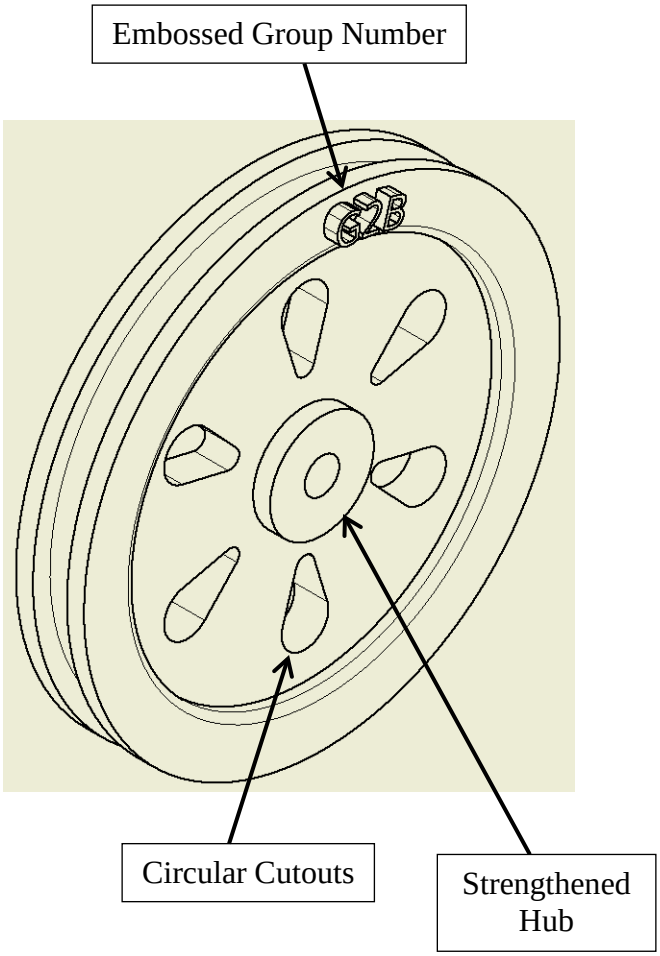
1) ***Axle only***: An axle could be created using a stiff wire, a bolt, or something else.
2) ***Bushing:*** A bushing (tube or spacer) could be inserted in axle hole and then an axle inside the bushing. The axle should easily spin inside the bushing. This should reduce axle friction. See the illustration below.
3) ***Bearing:*** A bearing (from a skateboard or elsewhere) could be inserted in the axle hole and then an axle would be fitted ***tightly*** into the bearing (so that the bearing turns, not the axle). See illustration below.



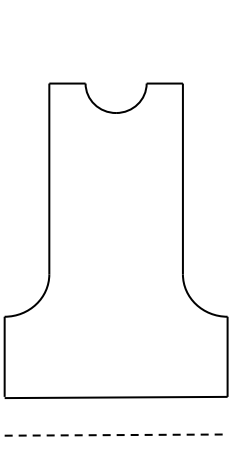


Examples and Illustrations:
(Dimensions not shown, but are required)

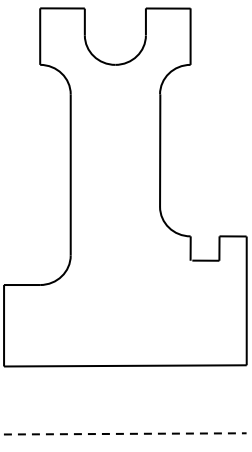




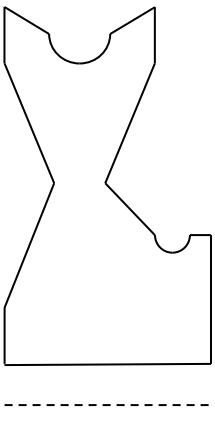
Other examples of profiles (be creative!):



Single Wheel



Double Wheel/Pulley



Double Wheel/Pulley