DIY Compost Tumbler
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So a tumbler sounds cool and all, but why do we even want to compost in the first place?

Why Compost?

What does that mean for planet earth?

Lots of wasted food = lots of methane = bad for Planet Earth

WE CAN COMPOST!

What is Composting?

What Can Go in the Compost Bin?

"Aerobic" Composting

What to do with Finished Compost?

Turning Compost

The DIY Solution

Design

Fusion 360 Overview

Wooden Parts

Legs

Appearance

The Leg Connectors

Other Parts

Caster Wheels

Compost Can

Assembly

Our gorgeous rendering:

Build

Measuring and Cutting Parts

Connecting the Parts

The Dowel Method

The Doweling Jig

Rinse, Repeat

Using Wood Glue

Wheels

Optimize
Overview

In this tutorial we will be getting down and dirty by chopping up some wood and installing some wheels to make a cheap, simple and efficient compost tumbler [(https://adafru.it/BG5)](https://adafru.it/BG5).

For those that compost "aerobically ([https://adafru.it/BG6](https://adafru.it/BG6))", a tumbler is a great way to "aerate" your compost without having to physically turn the compost itself.

The tumbler works with most compost barrels or trash cans and can easily be integrated into your current compost set up. If you don’t have a can or barrel to compost in and are looking to find one inexpensively, check with a local car wash business to see if they have any extra empty soap barrels you could wash out and use. Old trash cans work great too.

This project will be pretty cheap and quick for those with access to a drill and shop space. Those with out access can consider looking up a local fab lab ([https://adafru.it/BG7](https://adafru.it/BG7)) that would have these resources.

![Compost Tumbler Image]

Project Parts

Required:

- **2 x 8’ Piece of 2X4 Wood**
  16 total feet of 2X4 wood of any type.

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- **4 x Rigid Caster Wheels**
  Single direction caster wheels for rotating compost can or barrel

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16 x **Size 14 x 1" screws**  
Screws to hold wheels in place

16 x **3/8" x 1.5" Dowel Pins**  
Dowel pins for connecting pieces of wood

Optional:

1 x **Drill**  
To drill holes for dowels

1 x **Dowel Jig Kit**  
Jig for connecting pieces of wood. Comes with 3/8" drill bit we'll need

1 x **3/8" Drill Bit**  
Drill bit needed for dowels. Comes in the above dowel jig kit

1 x **Ruler**  
Measure parts

So a tumbler sounds cool and all, but why do we even want to compost in the first place?
Why Compost?

Once in a while I'll go to a buffet, and overwhelmed with all the plentiful options, I'll get 1 (or 5) too many plates of food. Most of which end up going in the trash.

When I found out that 40% of food produced in the U.S. is never eaten, while 1 in 8 Americans struggles to put food on the table* (https://adafru.it/BG8), I decided to change my habits.

* National Resources Defense Council

To make matters worse, the "EPA estimates that more food reaches landfills and incinerators than any other single
material in our everyday trash, constituting 21.6 percent of discarded municipal solid waste." *(https://adafruit.it/BG9)*

Additionally when all that food breaks down in land fills, it does so "anaerobically". This means the decomposing food buried deep in the landfill doesn't get the oxygen it needs to decompose organically and releases methane gas into the atmosphere as a result.

What does that mean for planet earth?

Methane is a greenhouse gas which is 28 to 36 times more effective than CO₂ at trapping heat in the atmosphere. Landfills, which are the third largest human-related methane producer, account for roughly 14% of these emissions. *(https://adafruit.it/BRO)*

Essentially what we have here is a simple but alarming equation:

Lots of wasted food = lots of methane = bad for Planet Earth

* U.S. Environmental Protection Agency

So what can we do to reduce food waste? I'm glad you asked!

WE CAN COMPOST!
What is Composting?

Composting is collecting food scraps and other organic material and letting it decompose into nutrient rich soil. This soil can later be used for growing all types of plants!

By collecting food scraps in a compost bin instead of throwing them in the trash, we can not only reduce the amount of food going to landfills and methane released but we can also create a more sustainable cycle of food consumption.

What Can Go in the Compost Bin?

What you CAN compost:

- Fruits and veggies
- Yard trimmings and grass clippings
- Cotton and wool rags
- Egg shells and nut shells
- Leaves and houseplants
- Shredded newspaper, cardboard, and paper
- Dryer and vacuum lint
- Sawdust and wood chips
- Fireplace ashes
- Tea bags, coffee grounds and filters
- Hay and straw
- Hair and fur

What you CANNOT compost

- Coal and charcoal ash
- Fats, grease, lard and oils
- Meat or fish bones and scraps
- Dairy products and eggs
- Pet waste
- Glazed, color printed magazines
- Yard trimmings treated with chemical pesticides
- Diseased or insect-ridden plants
- Black walnut tree leaves or twigs

*Find out more about what can or cannot be composted and why from the [EPA](https://adafruit.it/BGX)

"Aerobic" Composting
There are many different types of composting but for the purposes of this project we will discuss "aerobic" composting. Aerobic composting is a method of composting where the compost must be turned or "aerated" every so often to feed the microbes breaking down the food scraps with oxygen so they can keep doing their job. With out turning the compost, the microbes can't thrive as well and the food scraps decompose "anaerobically" releasing methane just like in landfills.

**What to do with Finished Compost?**

- You know your compost is finished when it has a crumbly texture and smells like soil.
- Once your compost is finished, you can use it in the garden to grow fruits, veggies, spices, and other plants!
- Compost is sometimes known as "[black gold](https://adafruit.com/BGW)" for your garden because of all the awesome benefits:
  - Increased microbial activity.
  - Attraction of beneficial insects like earth worms.
  - General improvement of soil structure.
  - Lessens need for chemical fertilizers.
  - Your plants will love it :)

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Page 8 of 44
As mentioned earlier, for the compost to break down efficiently and prevent the creation of methane, compost must be aerated or "turned" from time to time. Unfortunately this is back-breaking work. Furthermore it can be considered to be a bit gross by some, especially when that moldy banana peel from two weeks ago looks you right in the eye.

Fortunately we can use the power of gravity to do most of our work for us! This can be done with what’s called a compost “tumbler”.

The tumbler is rotated every so often and the compost is aerated efficiently with much less energy.

Tumblers however can be pricey.
The DIY Solution

If you're looking to build your very own tumbler for a **fraction of the price** and a **thousand times the satisfaction**, you're following the right guide!

Let's get rolling ; )
Design
We'll be using Fusion 360 to design the tumbler. Fusion 360 is a great tool, even for beginners, to design any physical project before building it. By designing the tumbler before buying wood and other parts I was able to figure out exactly what I needed.

Fusion 360 Overview

If you're new to Fusion 360, here's a great video by Noe Ruiz that gives an overview of the software.

To design the tumbler we will first need to know the dimensions of our compost container. The can I'm using is 27" high X 21.5" diameter.
Wooden Parts

We'll be using 2X4 lumber as the material for our tumbler. You can find 2X4 at any home improvement store. 2X4 just means that when the wood is cut from tree logs, it's cut into pieces that are 2" thick by 4" wide with varying lengths. However, after the wood dries out and is sent to home improvement stores, it actually shrinks to about 1.5" X 3.5".

Now that we know the size of our container and the dimensions of our material, we can determine the size of each part for the tumbler.

In the design I sketched out initially, I have 4 legs, 4 connectors and 4 wheels.
Now let's design the parts in Fusion 360!

Legs

Our legs will be 1.5" thick X 3.5" wide X 12" tall

I decided the height of the legs to be 12" so that the tumbler would be high enough off the ground but not too high so the stability of the tumbler can be kept.

- Open up a new design in Fusion 360.
- Make sure you are working in inches
  - If you are in mm, switch to inches, then open up a new design to start working in inches.
- Make sure you're in the "Model" workspace.
- Click on the "Create" tab
- Choose the "Box" option
- Select the top plane to create the box on.
- Click where you want the corner of the box to be.
- Move the mouse to the dimensions of height and width of the leg (3.5" X 12") then click.
- Next set the thickness of the box which is 1.5".
- Lastly, rotate the piece 90 degrees to stand upright. To do this, right click on the object and select "move/copy". Then click and drag on the
rotational interface to rotate.
Appearance

Now we have our legs dimensioned correctly!

Let's add some wood texture to the surface to make this more realistic.

- Switch to the "Render" workspace
- Click on the "Appearance" icon
- Scroll down the list of materials to wood, unfinished, then select what ever wood you want to use.
- Drag the material onto the object.
The Leg Connectors

To hold the legs of the compost tumbler in place we will need to create some connecting pieces that will attach to the legs.

Two of the connectors will be 18" long to correspond with the length of the container and the other two will be 10" long.
to correspond with the diameter of the container.

Now go ahead and create these connectors as new designs following the steps from above.

- Long connector dimensions: 18" X 1.5" X 3.5"

- Short connector dimensions: 10" X 1.5" X 3.5"

- Rotate each connector 90 degrees.
Other Parts
To get the designs for the wheels and compost can, rather than designing them ourselves, we can pull existing designs from Thingiverse which saves us lots of time!

Caster Wheels

Thingiverse user "ShuttleSpace" has an awesome design for the rigid caster wheels we will be using. Find a link to that file here (https://adafruit.it/BGb).

After downloading and opening up the zip file, go to Fusion 360, click the "upload" button, select the .slt file entitled "MO-WL-002-0001-3-1.stl" from the "files" folder in the zip you just downloaded.

Now you have the 3D file of the wheel in Fusion 360!

Let's add a steel finish to the wheels.
Compost Can

Thingiverse user CBiker has a great trash can design on Thingiverse that closely resembles the compost can I use. Find a link to that here (https://adafruit.it/BGc).

Bring the design into Fusion 360 like we did above.
Let's add a steel finish to the can as well.

Now that we have all our virtual parts, it's time to assemble the tumbler!
Assembly
Open up a new design in Fusion 360.

- Right click on your legs design on the left side of the screen.
- Select "Insert into current design".
- Repeat 3X until you have four legs.
Now let's add the connectors.

- Insert two of the shorter connectors into the design.
- Insert one of the long connectors, then rotate it 90 degrees in the X direction.
- Repeat for the second long connector.
Next, choose the "top" view.

Drag each component into place.

Then choose "front" and adjust the pieces.

Now we'll add the wheels and can.
- Insert a wheel into the design.
- Rotate and move the part until it rests on top a leg.
- Repeat for the other three wheels.
- It's ok if the wheels don't fit perfectly over the legs, the actual caster wheels are a bit smaller and will fit.
- Insert the can into the design.
- Move can until it rests on top of wheels.

And that's it! Our virtual design is compete and we have all we need to get building!

If you want to a nice rendering of the design:

- Go to "Render" workspace
- Drag whatever last minute textures you want on the parts of the design.
- Zoom and pan until you get the right size and angle you want.
- Change the environment to "field" in "scene settings" to get a brighter effect with the render.
- Click the play button at the top of the screen.
- The program will render the image for you. The longer you wait the higher quality the rendering.
- Once satisfied with the rendering, you can save the image to a folder.
Our gorgeous rendering:

Now it's time to get building!
Build

To build the compost tumbler we just designed, we'll be using:

- 2, 8' long 2X4s
- A table saw (For cutting wood, can be done at a home improvement store if you have no access, or consider a hand saw and a bit more time)
- A power drill
- 16, 3/8" x 1.5" dowel pins
- Included in the dowel kit
  - Dowel Jig
  - Wood glue
  - 3/8" Drill Bit
  - Drill stopper

The dowel jig will make it much easier for us to drill holes more precisely into the wood at the right length to fit the dowels in. There are more benefits to using the dowel jig which I'll go into when we get to the dowel jig section!
Measuring and Cutting Parts

- Using a table saw, cut the 2 X 8' pieces of 2X4 in half into 4 X 4' pieces.
  - If you don't have access to a table saw, you can get your wood cut at any local home improvement store like Lowe's or Home Depot for pretty cheap.
- Use a ruler and a pencil to measure out the pieces of wood.
- On one 8' piece, measure out 4 X 12" pieces which will be our legs for the tumbler.
- On the second piece measure out 2 X 10" pieces which will be the short connectors.
- On the third piece measure out 2 X 18" pieces which will be the long connectors.
- The fourth piece can be used for any mistakes or just to keep as scrap wood.
• Use a table saw (or home improvement store or a hand saw) to cut the pieces accordingly.
Connecting the Parts
The Dowel Method

To connect the parts we are going to use a doweling jig. A doweling jig will help us drill holes in the wood precisely where we want them so we can place the dowels inside and connect the different pieces.

- The dowel jig first lets us drill the holes.
- Next we will be able to place the dowels and wood glue.
- Lastly we connect the two parts and let them dry.
Now that you have an idea of how we'll be doing this, we'll start by connecting one of the legs with one of the short connectors.
To properly place the dowel jig, we'll first have to draw some reference points on our pieces.

- First use a ruler to find the midpoint of the length of the leg. Then draw a line through that midpoint extending onto the connector.
- Next use the ruler to draw a line on both sides of the midpoint line you just drew. Draw the line from the leg extending onto the connector.
- Now draw a line, extending from the center, right and left lines you just drew, down onto the end. Then draw a line through the center of that connector's end.
- Repeat that process for the leg by extending the three lines onto the end and also drawing a midpoint line on the end to get the three "cross hairs".
The Doweling Jig

- Grab the doweling jig and make sure it is set to the 3/8" setting.
- Now clamp it onto the connector, placing the
"cross hairs" we drew directly in the center of the 3/8" hole.

- Pull out your power drill and make sure you are using a 3/8" drill bit.
- Take a dowel pin and draw a line in the center.
- Put the drill into the doweling jig and with out drilling yet, use this pin to measure with the drill how far the drill stopper should be screwed onto the bit. This will prevent the drill from going too far into the wood.
- Go ahead and drill into the wood until the stopper stops the drill.
- Now repeat these steps with the leg.
- Place dowels in holes and fit pieces together.
Rinse, Repeat

Repeat these steps with each of the connectors and legs until you have the whole structure fitting together.
Using Wood Glue
Next, take apart the tumbler and re-piece it back together glueing each dowel connection one at a time.

Feel free to use a hammer to set the pieces deeper.

Let the structure dry overnight.

Wheels
- Hold a caster wheel on a leg and draw an outline of each hole.
- With a 3/8" drill bit, drill 4 holes on each leg.
- Screw on each wheel.

And voila! That's it! Now you have yourself a handy compost tumbler and you made it all on your own.
*Note, you may have to do some sanding or add some cardboard to some of the legs to make sure the structure is level and steady.
Optimize

So how often should you turn your compost on your new handy tumbler?

There are a couple specific instances:

- When the compost is too dry, you should add food scraps and turn it.
- When the compost is too wet, you should add some dry carbon material like leaves, wood chips, or paper and turn it.
- If the compost isn't heating up, turn it.

But how will you know all these specific moisture and temperature levels? I am working on a compost optimization system with the Circuit Playground Express (https://adafru.it/wpF) as we speak. That will take into account all these readings and let you know when it's time to turn the compost. Stay tuned!