OPEN TRAILER

DIY INSTRUCTIONS
BUILD A TRAILER FOR YOUR WHEELCHAIR

MADE FOR MY
WHEELCHAIR

FOREWORD

How can the everyday life of wheelchair users be supported and enriched?
MADE FOR MY WHEELCHAIR is a project in which we work as a team including wheelchair users, engineers and designers. Over the past year, we have been developing open source wheelchair add-ons through user research, ideation, design, prototyping and testing.

Open Trailer is one of the results. Whether as a shopping aid or for the pleasure of a riding companion, the trailer has proven to be a successful add-on for electric wheelchairs users. You can now build it yourself with materials costing less than 100 EUR. The components are mainly CNC-milled (one of the standard DIY technologies). The 3D file is customizable for different wheelchair models and in different styles.
Can't wait to try it out? Follow our instructions and build your own trailer!

MADE FOR MY WHEELCHAIR is a project by Makea Industries GmbH, Fab Lab Berlin and be able e.V..
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It is the winner of the "Light Cares" contest. The competition "Light Cares - Photonics Technologies for People with Disabilities" was launched in January 2016 by the Federal Ministry of Research.
The associated project partners are Otto Bock Mobility Solutions GmbH and Sozialhelden e.V..

DISCLAIMER
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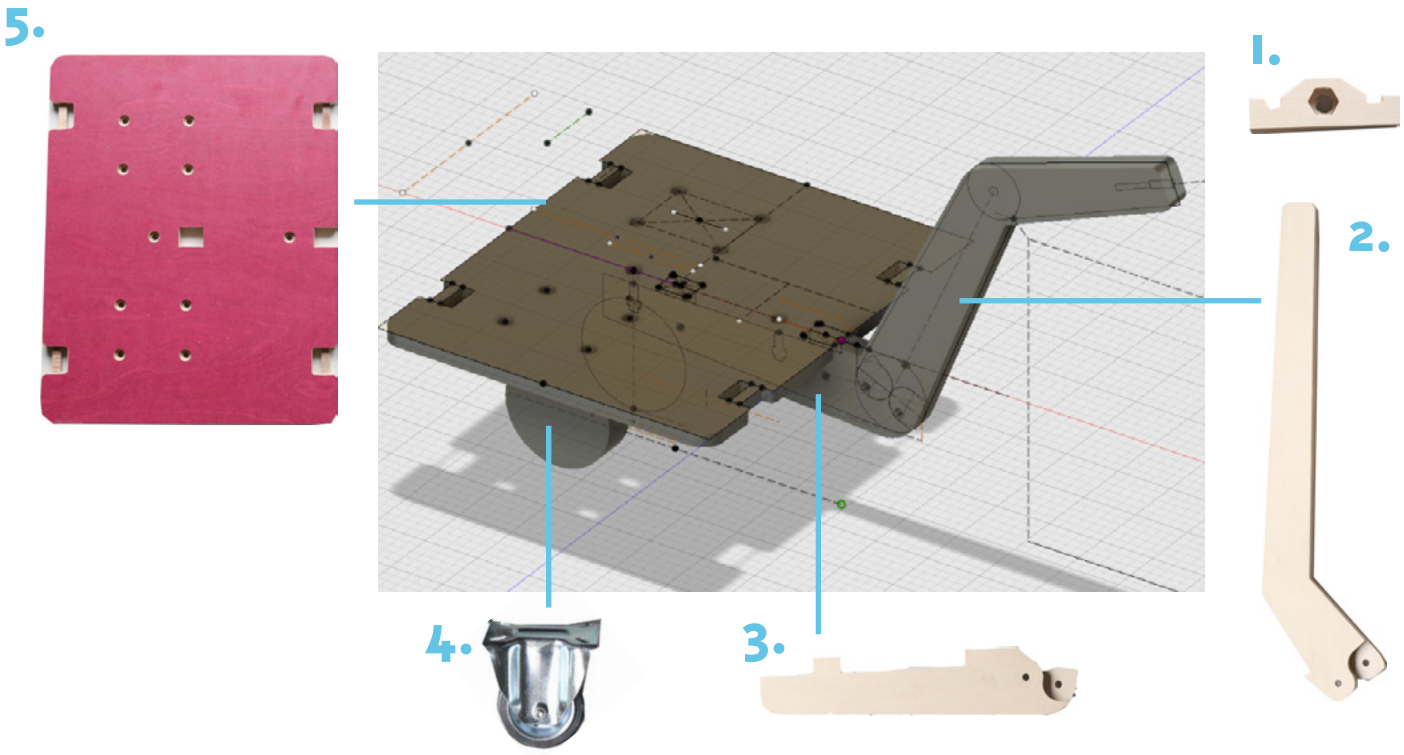
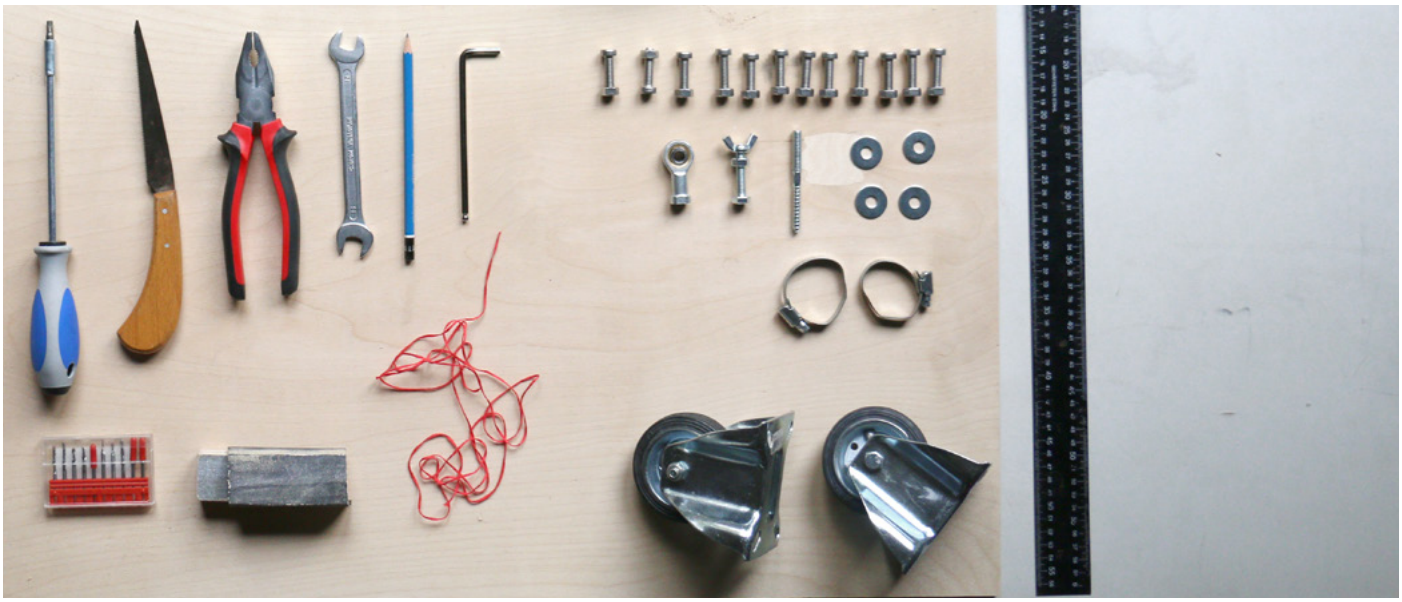
OVERVIEW

1. PREPARATION



1.1. Naming

1. HITCH
2. ARM
3. RAIL
4. GEAR
5. BOARD



1.2. Materials and Tools

a. Plywood 12 and 19 mm thick (size ca 1x0.8m depending on individual needs)
b. 2 Wheels (d. 80-120 mm)
c. 12 Closing screw round headed M8 x 30
d. 1 Hex bolt M8 x 40
e. 4 Washers 24 x 8
f. 13 screw nuts with locking rings M8 x 40
g. 1 Wing bolt M8
h. 1 Ball head bearing M8 inner thread
i. Griptape (size ca 0,4x0,3m depending on individual needs)
j. Wood glue
k. ca. 80 mm long string

A. 3mm end mill with min. 20 mm cutting edge
B. Wrench 13
C. Allen wrench
D. Screw driver
E. Saw
F. Sanding paper
G. 4 screw clamps
H. Pencil
I. Plier
J. Angle with 50 cm boom

1.3. Technologies

- CNC mill
- Laser cutter
- Optional: 3D printer

1.4. Softwares

- Autodesk Fusion 360
- Optional: Slicer for 3D printing

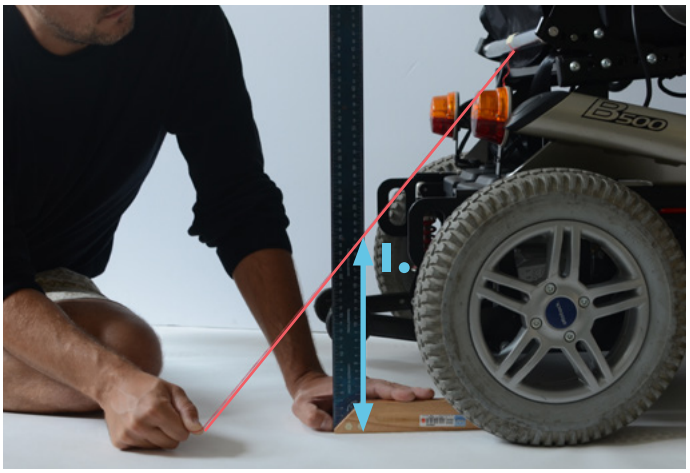
2. MEASURING

2.1. Mounting Situation

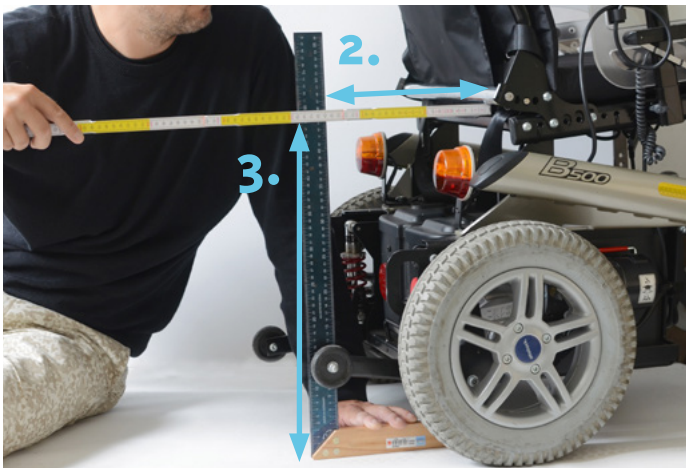
In order to securely mount the trailer to your wheelchair, there must be a horizontal pipe firmly connected to the wheelchair frame. The position of the pipe shall not be altered by the adjustment of the wheelchair. If you don't have such a pipeon your wheelchair, please contact your local health care provider.

2.2. Measurements

To determine the parameters for your individual wheelchair trailer, you have to take 8 measurements from the mounting situation.

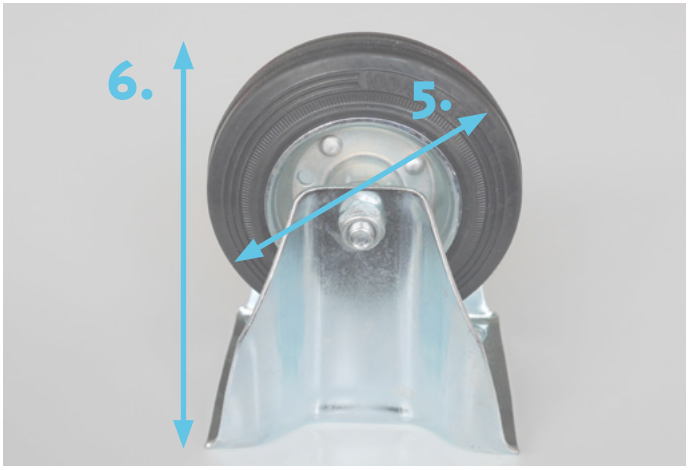


Mark first the middle line of the pipe. Attach a string to the marked line and use an adhesive tape to prevent it from slipping. Run the line collision test and attach the obstacle.



Position the angle at the extreme position of the obstacle and measure from the middle line in the right angle.
Read the following measurements:
1. obstacle_height
2. obstacle_depth
3. hitch_height

Now (ask an assistant to) stand behind the wheelchair and hold its backrest so that it's a pleasant distance.
IMPORTANT: If there are no gripping handles and other possibility for a safe grip, the wheelchair is not suitable for the transport of people on the trailer.
Now measure the distance from toes to the hitch:
4. board_distance_hitch



Measure the wheels:
5. gear_diameter
6. gear_daylight

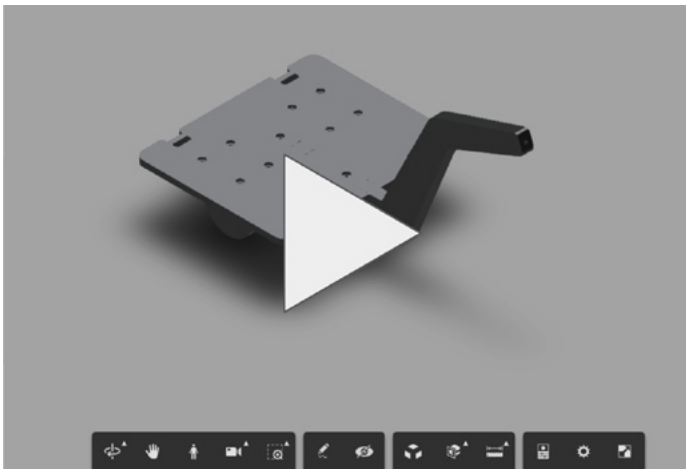
Measure the thickness of the wood panels you use for:
7. material_thick_rail_arm
8. material_board

You can determine the size of the platform yourself. In our example, we chose a size of 320 x 380 mm. This holds up an average person or a beverage box pretty well.

3. Fusion 360

3.1. Installation

If you haven't installed Fusion 360 yet, follow this instruction:
https://www.youtube.com/watch?v=EyuMN2pWpvk



3.2. File editting

Download the project through the link below and open it with your local Fusion 360 software.
http://a360.co/2rEfX5u
Kennwort: madeformywheelchair

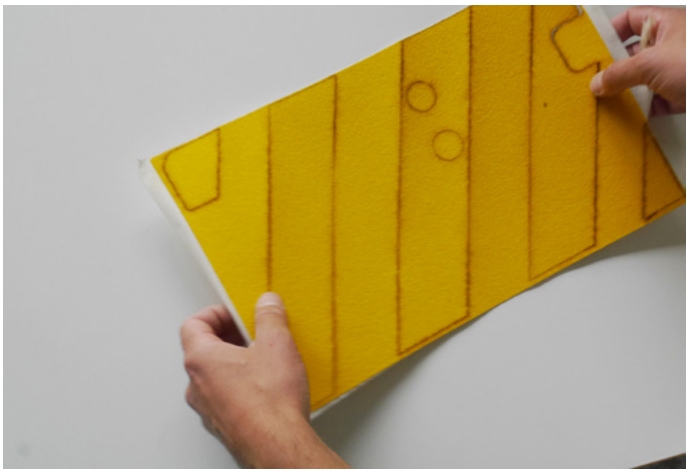
In order to adapt the 3D model to your individual mounting situation you need to add the 5 measurements to the project.

The videotutorial explains all steps from the adaptation of the model to the export of the CAM data (G code).

4. Producing components

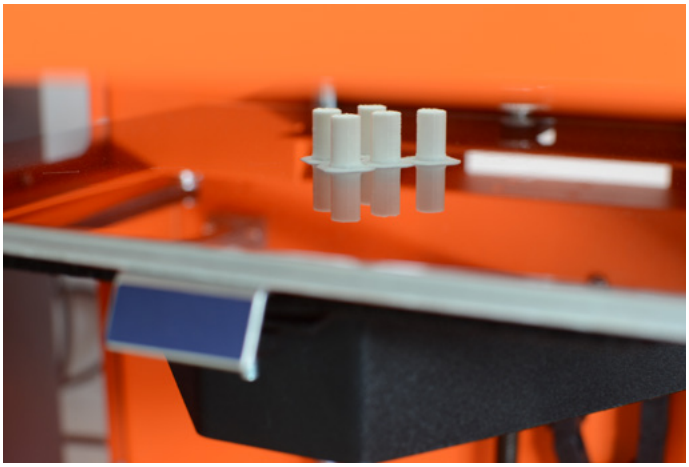
4.1. CNC milling

Mill the parts on the CNC machine with a 3 mm shank cutter.
IMPORTANT: In the created CAM file, Z0 is on the carrier plate.



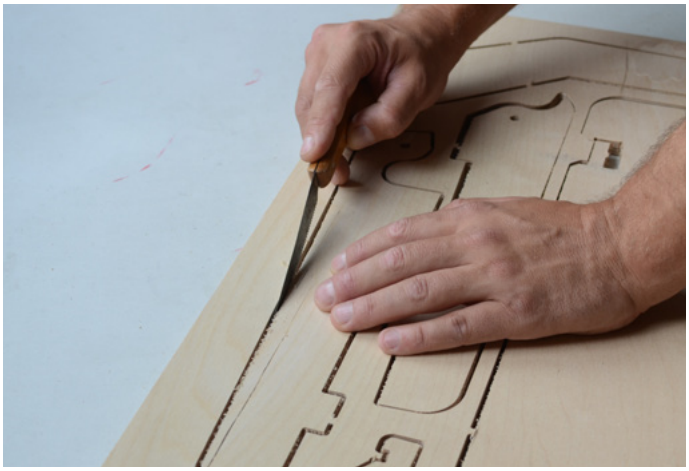
4.2. Laser cutting

You can design the pattern of griptape on your own or export vector file from Fusion 360 as .dxf:
http://a360.co/2rEfX5u
Kennwort: madeformywheelchair



We could produce wooden dowels of 8 mm diameter and 14 mm length.
But because we are lazy we prefer to print them out. ;)
Simply export the dowl from Fusion 360 as .stl and print 4 times.

5. Treating components

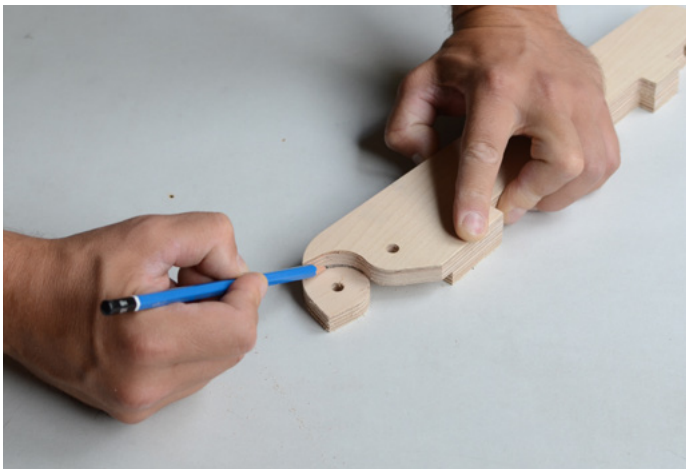


7.1. Clean fibres

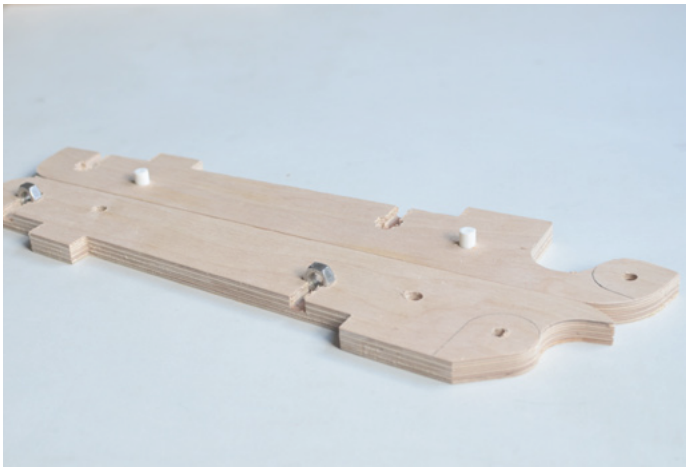
Cut out the milled components with a saw.

First you sand the edges and surfaces for a smooth touch.
ATTENTION: Consider that the components for rail, arm and hitch will be glued. You should sand these contact surfaces and contact edges only after gluing. Then the result is better.

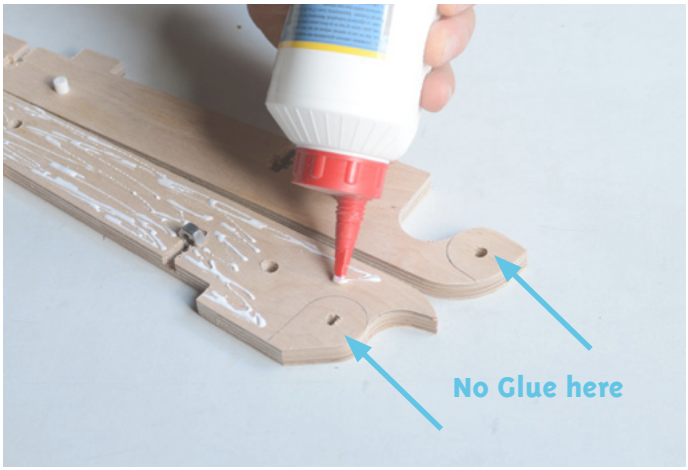
7.2. Glue RAIL, ARM and HITCH



Place 2 nuts and 2 dowels in the designated holes.
The nuts must rest with a flat side in the holes.
CAUTION: The safety ring must be located on the side facing away from the screw.

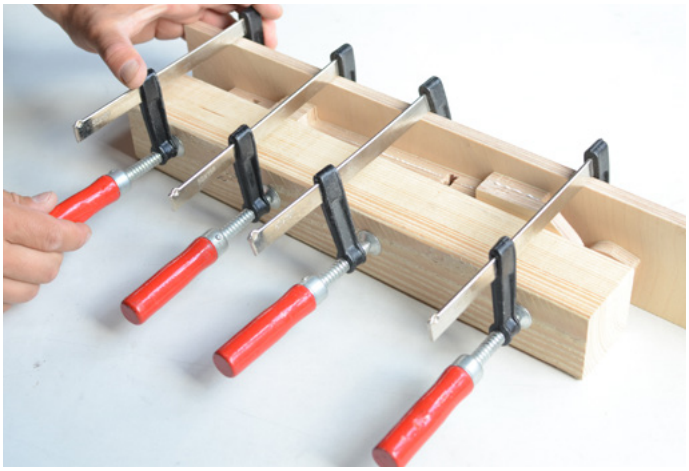


ARM and GEAR fit together positively.
No glue should be applied to the contact points. Bring the two parts together dry and trace the boundary of the exposed surface. In this way you can also check the accuracy of the fit.



Put glue evenly on one side.
Leave the traced area dry.

IMPORTANT: The parts can only be pressed together to a gap of 1 mm. This is good. With the screw clamps you can press them well and the nuts will sit tightly in the wood.

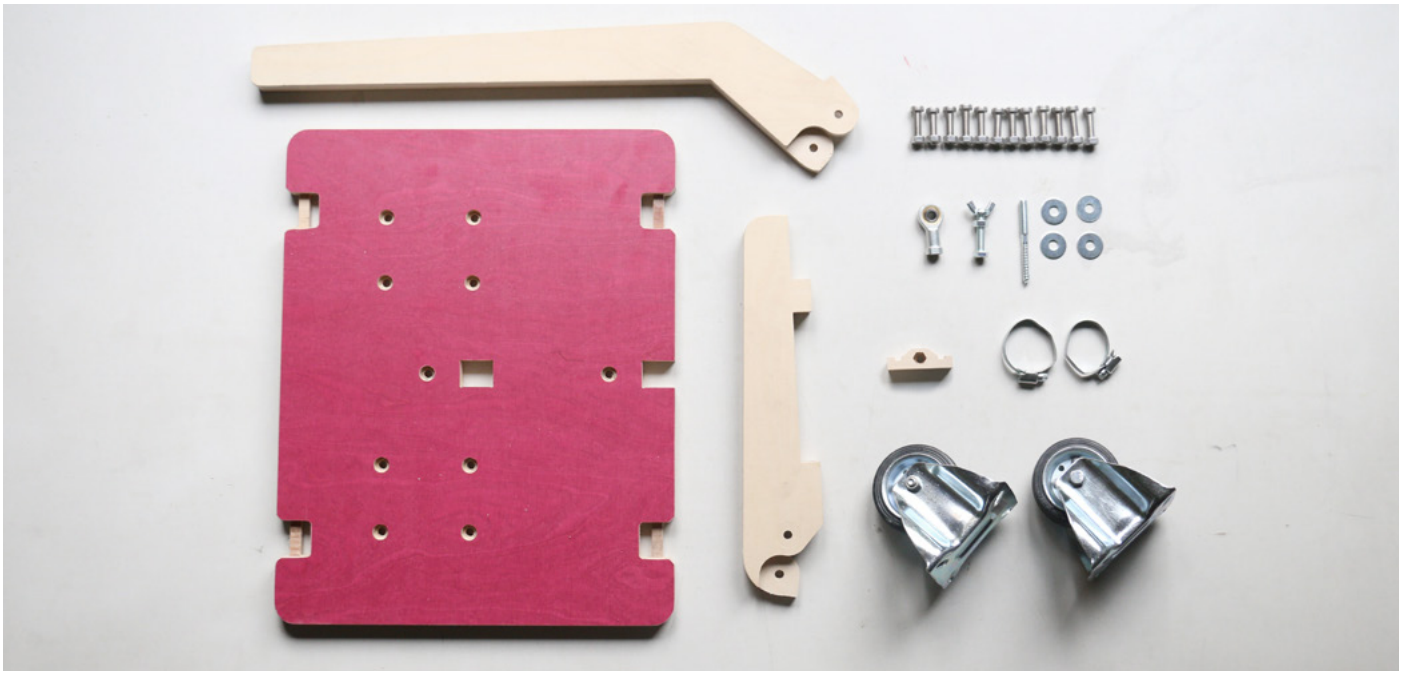


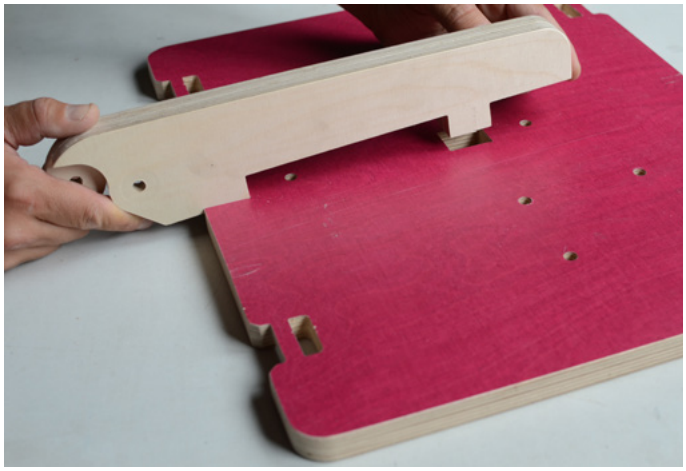
Press the parts together with 2 stable supports and several screw clamps.
Wait until the glue is dry. (See instructions on the glue bottle)

Repeat the procedure with ARM.

Glue the two parts for HITCH so that the pocket for the screw head points upwards.

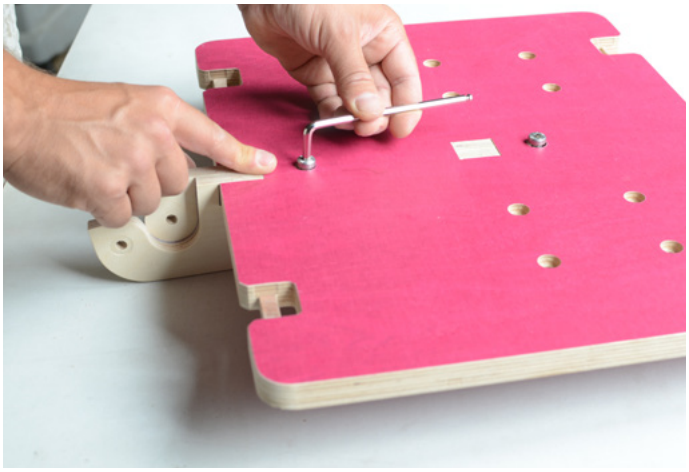
6. Mounting components





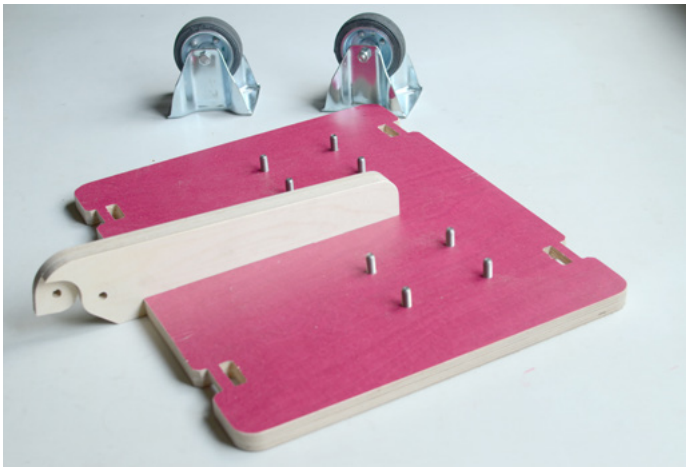
6.1. Screw BOARD and RAIL together

Insert RAIL into BOARD.



Insert screws into the two holes located in the center of BOARD and tighten them.

IMPORTANT: You will have to check these screws regularly and adjust them if necessary.



6.2. Screw GEAR and BOARD together

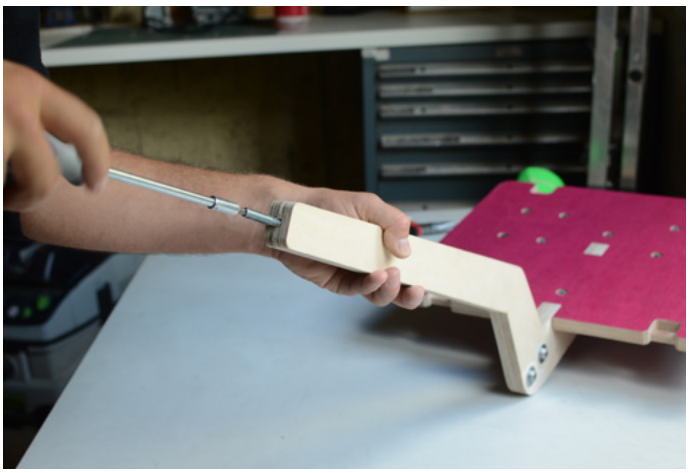
Put screws in the remaining 8 holes on BOARD

Install the wheels and pull the mother firmly. You can get sweaty here. They're supposed to last long. :)

6.3. Screw RAIL and ARM together

Bring RAIL and ARM together and screw them from both sides with washers.

IMPORTANT: You will have to check these screws regularly and adjust them if necessary.



6.4. Screw stockscrew

Now you screw the stockscrew into the hole provided at the upper end of the drawbar.

6.5. Screw on ball head bearing

Finally, you screw up the joint head and pull in firmly with the plier.

ATTENTION: It's possible that you have to correct the position of the stick screw. Because the joint head must be in a horizontal position and sit well on the wood.

6.6. Put griptape onto BOARD

if you want to take someone for a ride you need the griptape to prevent slipping.

Done!

6.6. Install trailor to wheelchair

Almost. :)
The HITCH has to be attached to the wheelchair.
Put two open pipe clamps over the pipe on the wheelchair.

Tighten the screws of the pipe clamps. You also have to check these screws regularly.

ATTENTION: Make sure that the HITCH is located in the center axis of the wheelchair.

Insert the hex bolts into the holes and screw the nut tightly.

Put the joint head on top of the trailer over the screw and connect it to the HITCH by unscrewing the wing bolt. Tighten the wing bolt firmly by hand.

7. Test drive

7.1. Transport objects

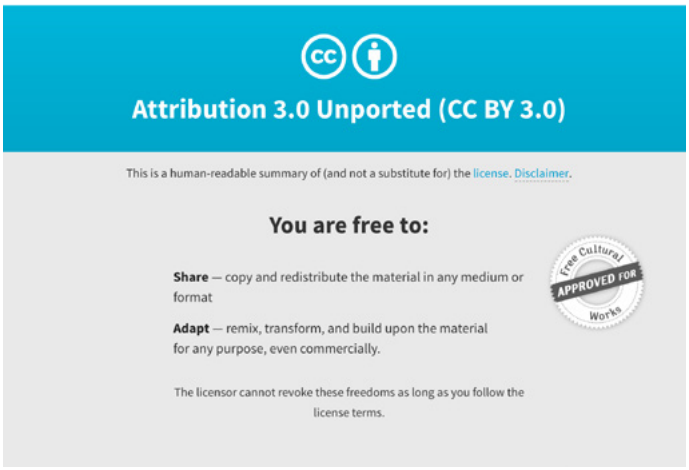
Put a full beverage crate onto the trailer and fix it with a belt. Drive around in different speeds, on different surfaces. Make sharp turns to see if the trailer would hit any part of the wheelchair. If it does, it means you didn't take the measurements properly and you would have to readjust the components.

7.2. Transport a person

If your trailer passed the first test, now test it with a person. Can she/he hold the wheelchair properly and safely?
Be ware of the weight limit of the wheels you bought.

IMPORTANT: You will have to check these screws regularly and adjust them if necessary to prevent accidents!

8. Feedbacks and Iteration



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You're not quite happy with the wheels? You have ideas how the construction or this DIY instruction can be optimized? You can be part of our project and make it better!

Share your Feedbacks in our Facebook group: https://www.facebook.com/groups/1865181750379135/