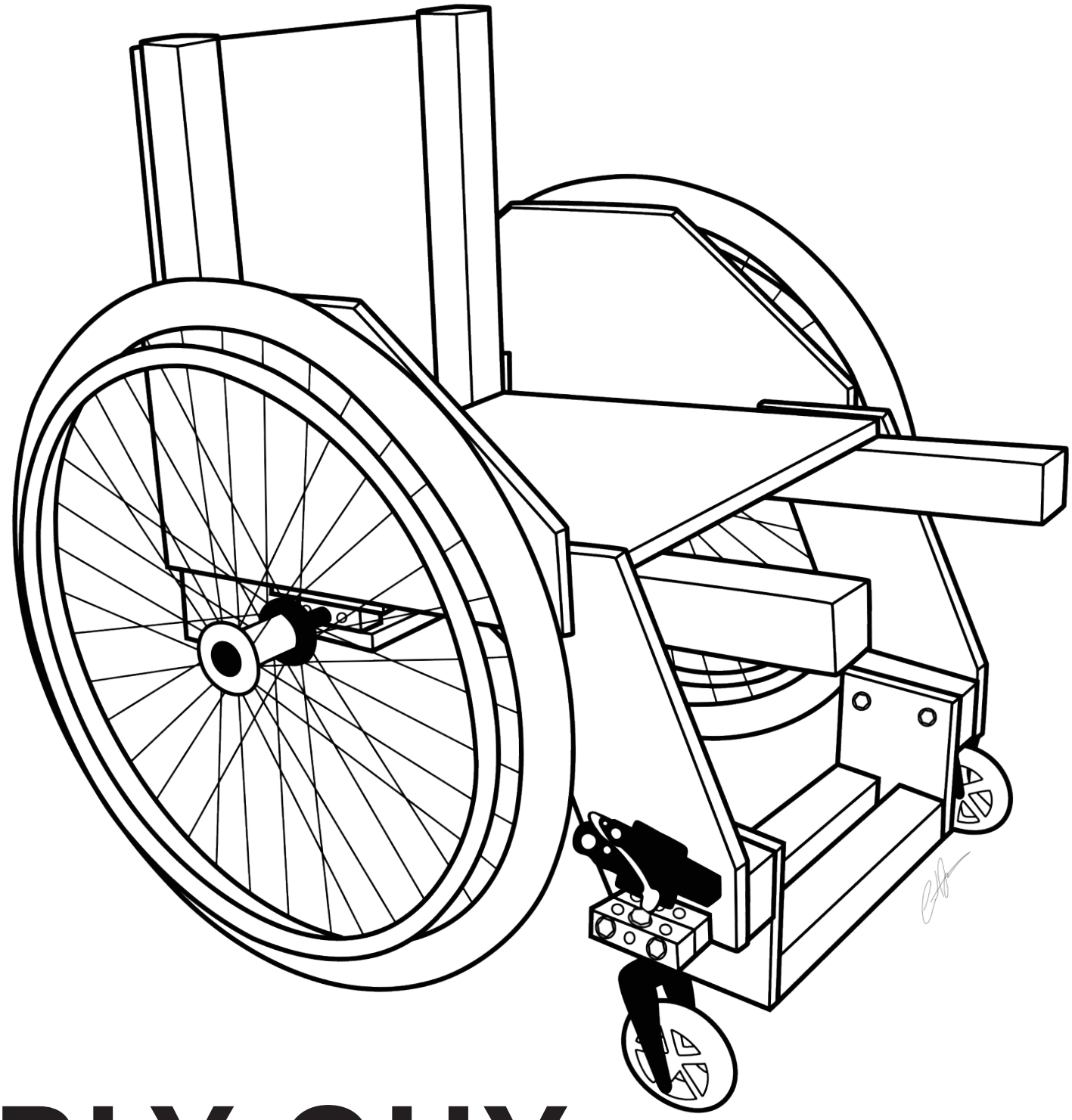
OPEN SOURCE
WHEELCHAIR PROJECT



PLY GUY

FABRICATION MANUAL

DESIGNED BY: ERIK KONDO
ILLUSTRATED BY: COURT JOHNSON

IF YOU CAN BUILD IT YOU CAN REPAIR IT

The advantage of a wooden wheelchair is that it is relatively easy, quick, and inexpensive to fabricate a highly functional and custom-built wheelchair. A wooden wheelchair is not as durable as a metal wheelchair, but it is much easier to repair. If any part of your wooden wheelchair breaks, you can unscrew and replace the component. If a wood component cracks while you are out and about, strong tape will likely hold long enough as a first aid repair.

The life cycle of a wooden wheelchair assumes that you will need to replace some frame components over time.

Unlike traditional wheelchairs, the Ply Guy is designed to be easy and inexpensive to repair by using available materials and manufactured parts.

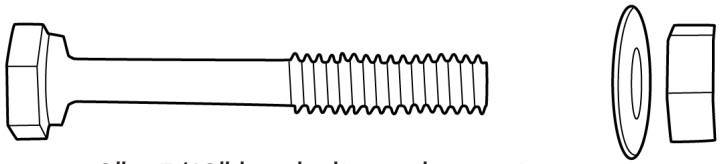
MATERIALS

Frame
- (1) 2″ x 4″x 6′ Wood Stud
- (1) 2″ x 4″ x ½″ Piece of Plywood (Cabinet Grade)
- (1) 2″ x 4″ x ¼″ Piece of Plywood (Cabinet Grade)
- (2) 3″ x 1.25″ Punched Zinc Square Tubes
- (4) 3″x 1″ Punched Zinc Square Tubes

Pre-Fabricated Wheelchair Parts
- (2) Drive Wheels
- (2) Caster Forks and 4″ Wheels
- (2) Wheel-locks and Mounts
- (2) Axle Receivers

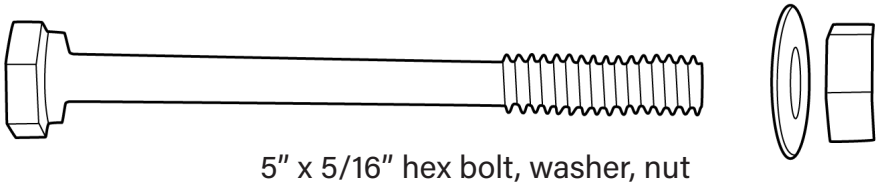
Wood screw

Fasteners
- (4) 3″ x 5/16″ Hex Bolts, Washers, Nuts
- (4) 5″x 5/16″ Hex bolts, Washers, Nuts
- (1) Box of 100 Wood Screws
- (1) Medium Strength Loctite



3″ x 5/16″ hex bolt, washer, nut

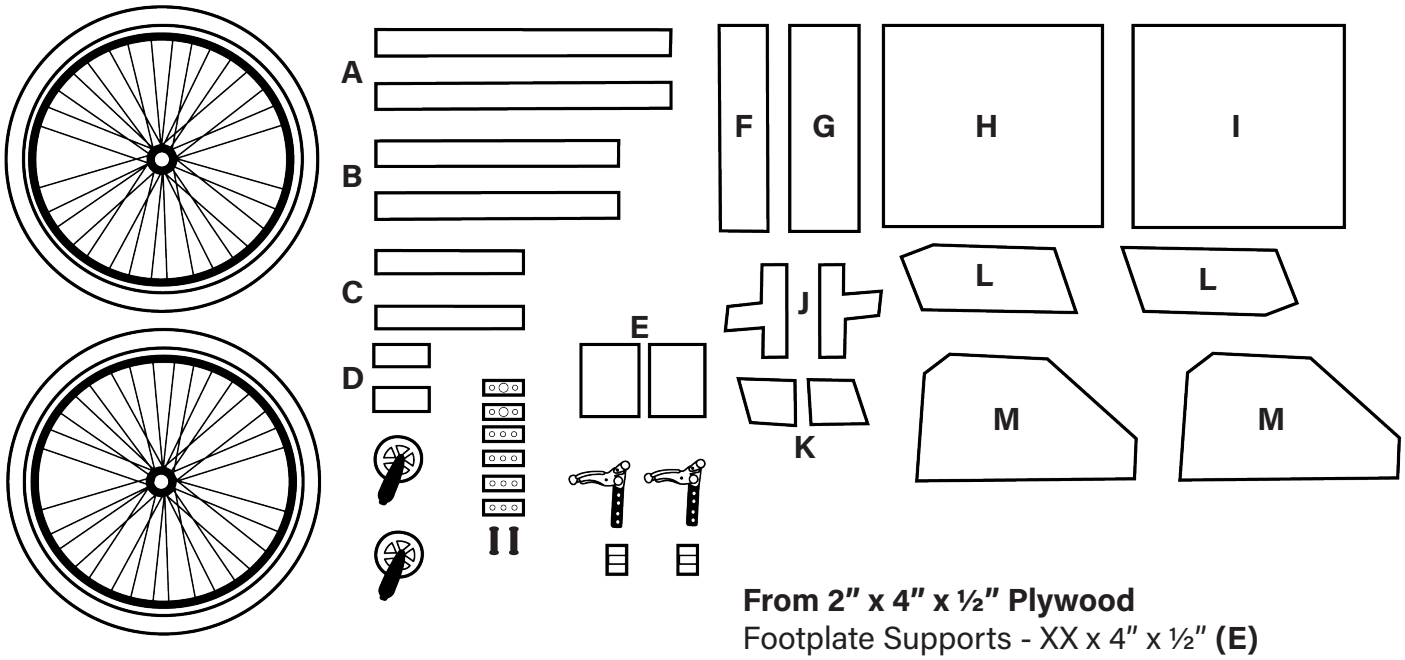
Tools
- (1) ½″ Diameter Rod
- (2) Hand Clamps
- (1) Measuring Square
- (1) Yardstick (or Measuring Tape)
- Screwdriver
- Wrench
- Allen Wrench
- Drill



5″ x 5/16″ hex bolt, washer, nut

The easiest method to determine the dimensions of your Ply Guy is to duplicate the sample dimensions below. These dimensions should "fit" most individuals in the 5′4″ - 6′0″ range with a hip width of 15″ or less. If the dimensions below are not quite the right fit for you, you can use the included measuring guide as a starting point for how to measure components for your best fit.

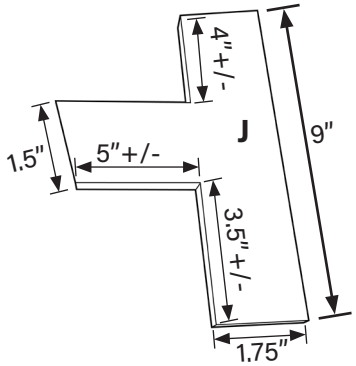
Note: After cutting the wood sections, sand them to remove any sharp edges.

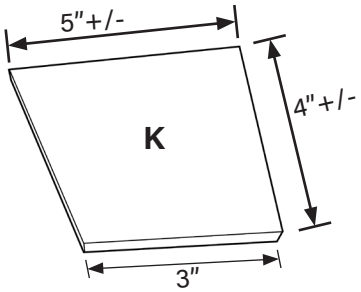


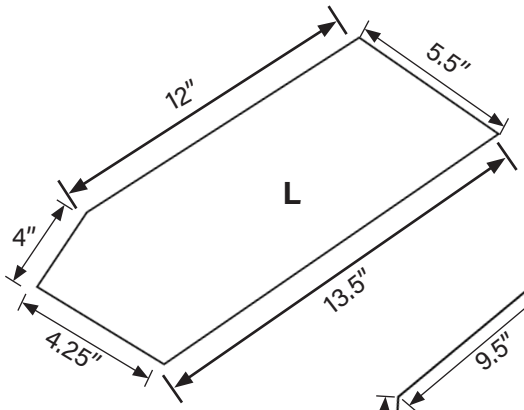
From 2″ x 4″ x 6′ Stud
Upper Chassis - 2″ x 2″ x 22″ **(A)**
Backrest Support - 2″ x 2″ x 18″ **(B)**
Footplate Sections - 2″ x 2″ x 10.25″ **(C)**
Foot Support Blocks - 2″ x 4″ x 4″ **(D)**

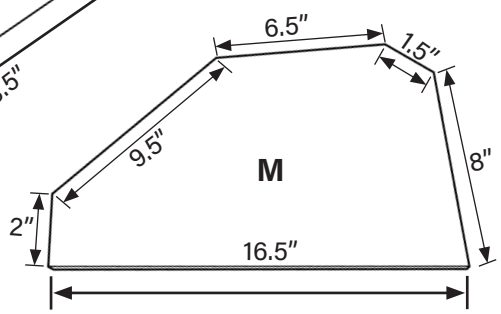
From 2″ x 4″ x ½″ Plywood
Footplate Supports - XX x 4″ x ½″ **(E)**
Lower Camber Tube Board - 3″ x 16.5″ x ½″ **(F)**
Upper Camber Tube Board - 5″ x 16.5″ x ½″ **(G)**
Outer Corner Brackets - *See diagram below* **(J)**
Inside Corner Brackets - *See diagram below* **(K)**
Front Side Supports - *See diagram below* **(L)**

From 2″ x 4″ x ¼″ Plywood
Seat Pan - 15″ x 16″ x ½″ **(H)**
Backrest - 14.25″ x 15″ x ½″ **(I)**
Side Guards - *See diagram below* **(M)**







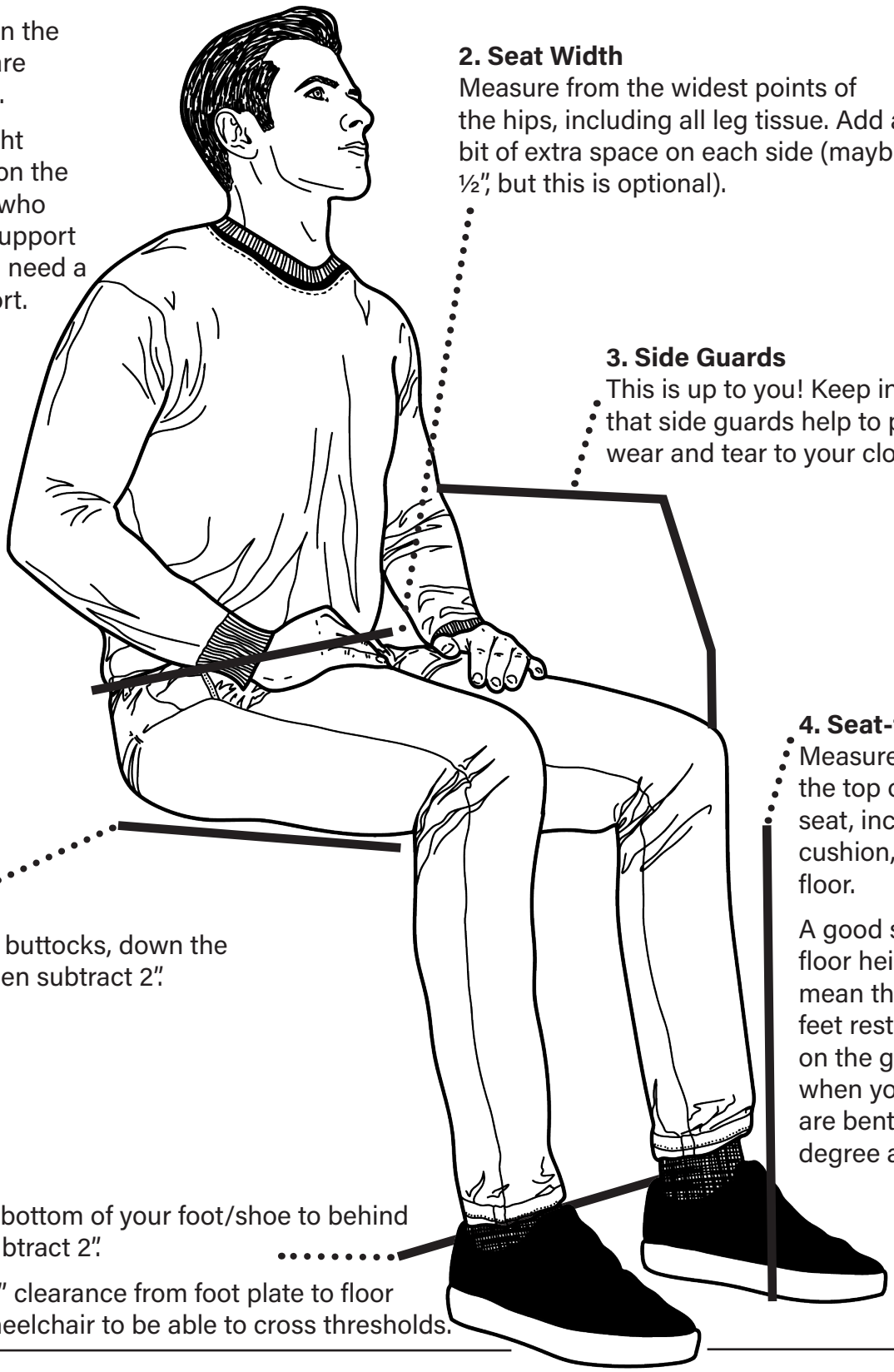


MAKING THE CUT

MEASURING GUIDE

1. Back Support
Measure yourself in the position that you are striving to achieve.

Back support height varies depending on the person; someone who needs increased support for positioning will need a longer back support.



2. Seat Width
Measure from the widest points of the hips, including all leg tissue. Add a bit of extra space on each side (maybe ½", but this is optional).

3. Side Guards
This is up to you! Keep in mind that side guards help to prevent wear and tear to your clothing.

4. Seat-to-floor
Measure from the top of your seat, including cushion, to the floor.

A good seat-to-floor height will mean that your feet rest fully on the ground when your knees are bent at a 90 degree angle.

5. Leg Rest
Measure from the bottom of your foot/shoe to behind your knee, then subtract 2".

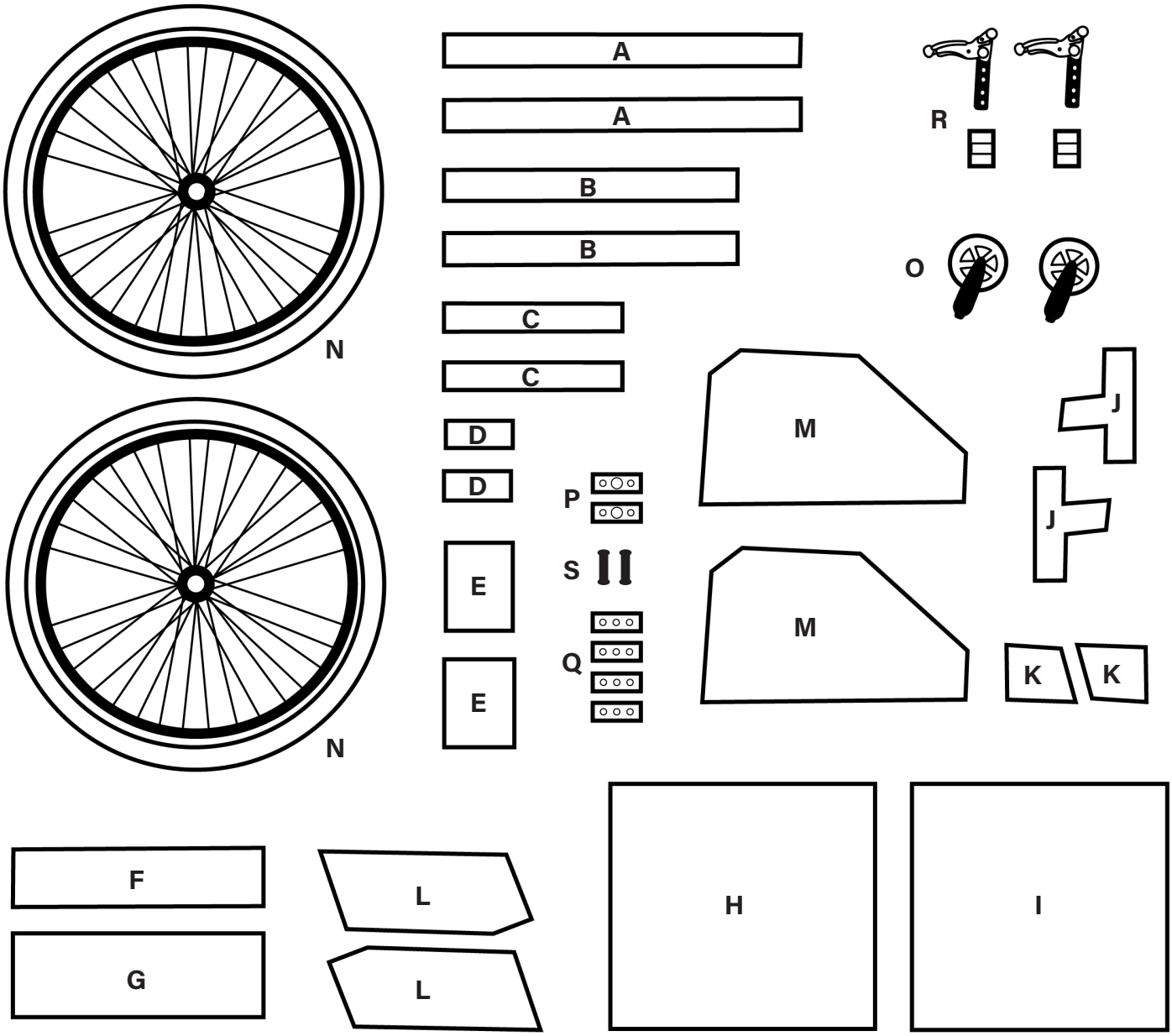
There must be a 2" clearance from foot plate to floor in order for the wheelchair to be able to cross thresholds.

6. Seat Depth
Measure from the buttocks, down the leg to the knee, then subtract 2".

*For more detailed instructions on customization, see the "Customizing Ply Guy" Instructional.

INSTRUCTIONS

PARTS



From 2" x 4" x 6' Stud
(A) Upper Chassis
(B) Backrest Support
(C) Footplate Sections
(D) Foot Support Blocks

From 2" x 4" x ¼" Plywood
Seat Pan **(H)**
Backrest **(I)**
Side Guards **(M)**

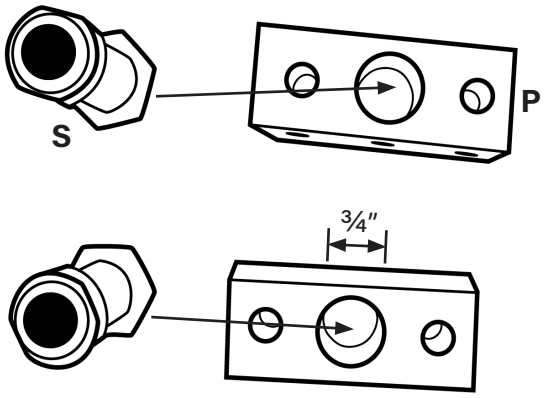
From 2" x 4" x ½" Plywood
(E) Footplate Supports
(F) Lower Camber Tube Board
(G) Upper Camber Tube Board
(J) Outer Corner Brackets
(K) Inside Corner Brackets
(L) Front Side Supports

Pre-Fabricated Parts
(N) Drive Wheels
(O) Caster Forks and 4" Wheels
(R) Wheel-locks and Mounting Brackets
(S) Axle Receivers

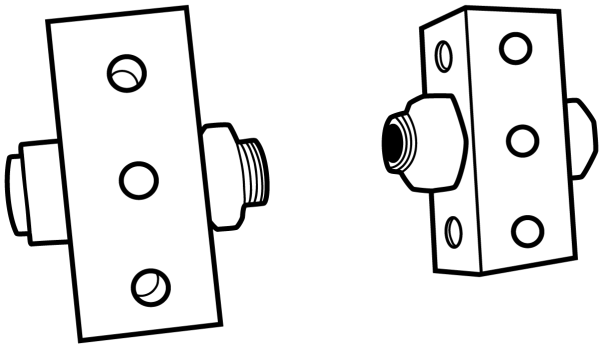
From Punched Zinc Square Tube
(P) 3" Piece of 1.25" with Widened Center (Axle Receiver Brackets)
(Q) 3" x 1" (Caster Fork Assembly)

1. MAKE 2 AXLE RECEIVER BRACKETS

1. Cut (2) 3″ pieces of 1.25″ Zinc Square Tube **(P)**.



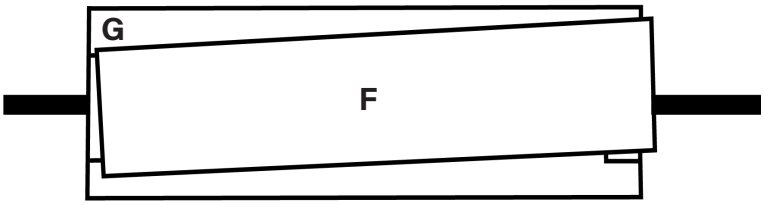
2. Widen the center holes of the Zinc Square Tubes **(P)** to ¾″ diameter such that the Axle Receivers **(S)** fit through the hole.



3. Thread the Axle Receivers **(S)** through the drilled holes and secure the nuts with Medium Strength Loctite.

Note: The nuts will face the inside of the Rectangular Camber Tube.

2. MAKE THE RECTANGULAR CAMBER TUBE

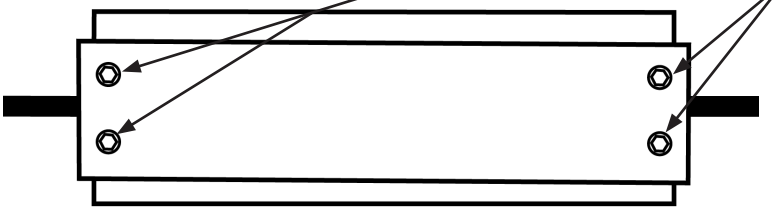


1. Align the Lower Camber Tube Board **(F)** on the Upper Camber Tube Board **(G)**.

2. Use the 1/2″ Diameter Rod as a jig for brackets to align the Axle Receivers squarely at the end of the lower Camber Tube Board **(F)**.

3. Use hand clamps to secure all pieces before drilling holes.

4. Drill (4) 5/16″ holes for the bolts in line with the Axle Receivers **(P)**.



5. Tighten the (4) 3″ x 5/16″ bolts with the 1/2″ diameter rod in place to ensure proper Axle Receiver Bracket positioning between the two boards as shown.

NOTES: RECTANGULAR CAMBER TUBE

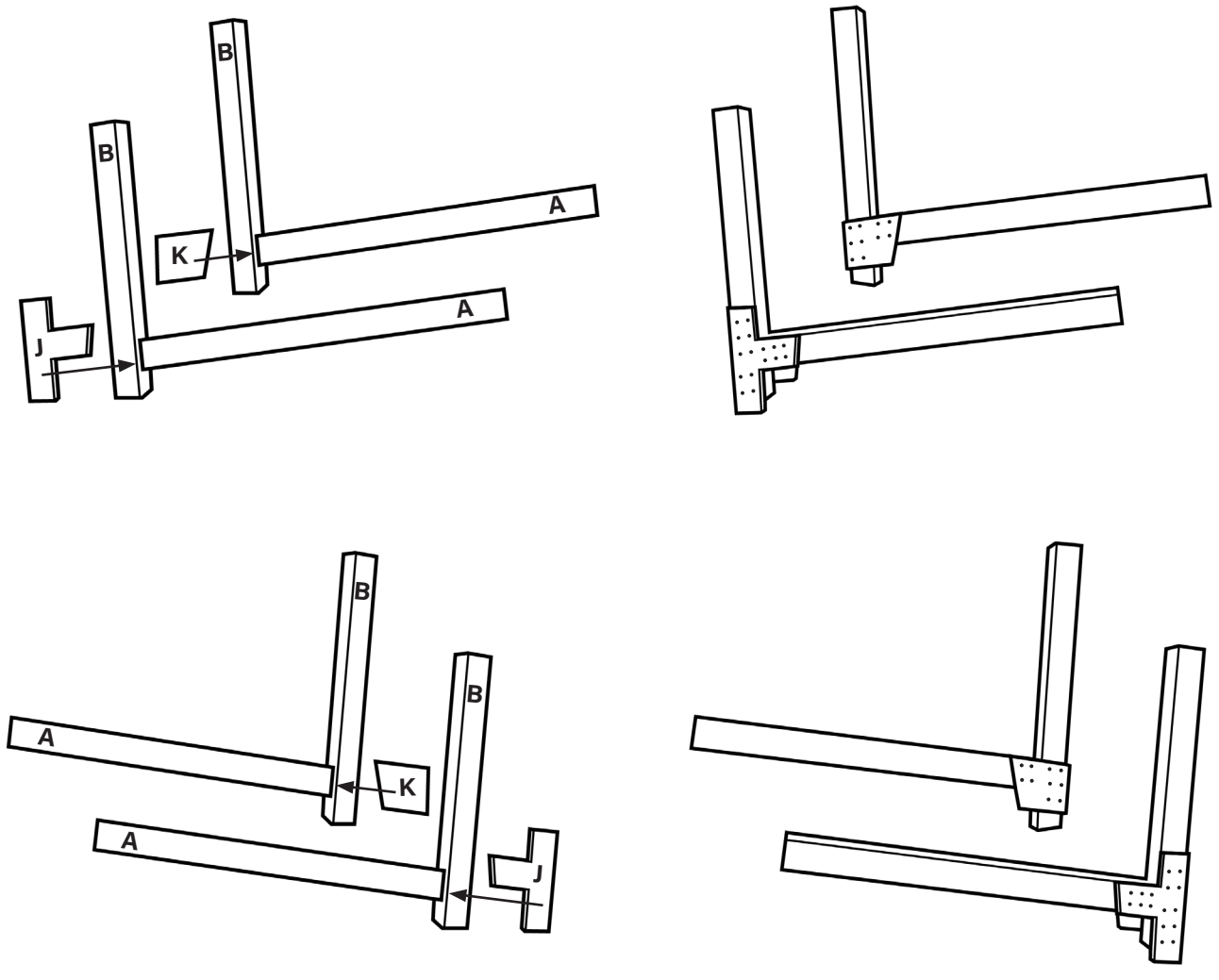
Note: If the Axle Receiver Brackets **(P)** are not square, then the wheels will have:

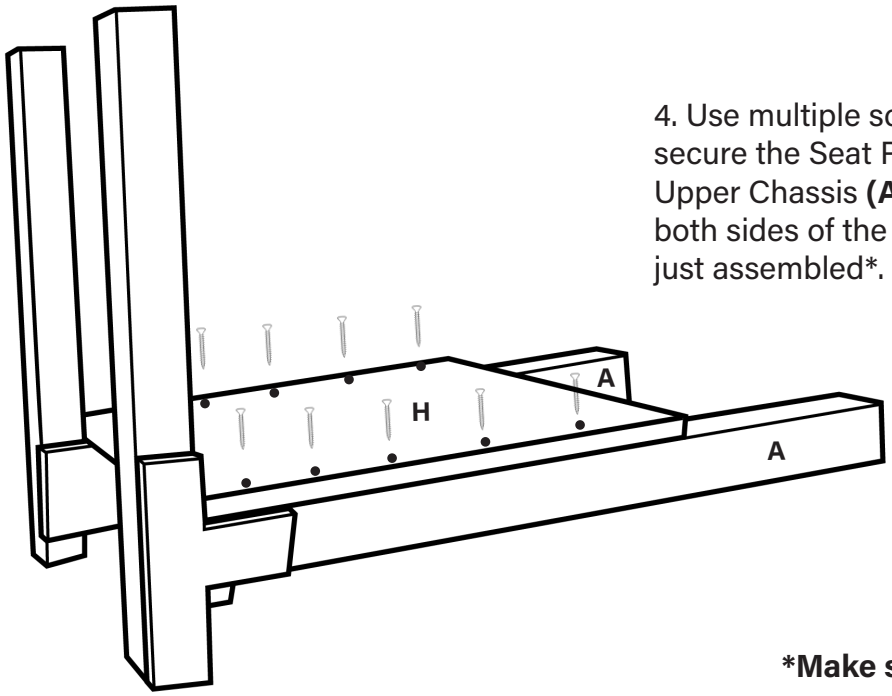
- Toe-In: Front of wheels will angle in like a snowplow.
- Toe-Out: Front of wheels will angle out like a "Y".
- Regular Camber: Bottom of wheels wider than top.
- Reverse Camber: Bottom of wheels narrower than the top.

Toe-In, Toe-Out, and Reverse Camber will all cause problems for the operation of the Ply Guy and **must** be avoided. Having some Regular Camber should not cause problems.

3. MAKE THE 2" X 2" FRAME

1. Use the Outer Corner Brackets **(J)** to secure the Upper Chassis **(A)** and the Backrest Support Pieces **(B)** with wood screws.
2. Use the Inside Corner Brackets **(K)** to secure the frame pieces with wood screws.
3. Repeat these steps once to create the two sides of your frame.



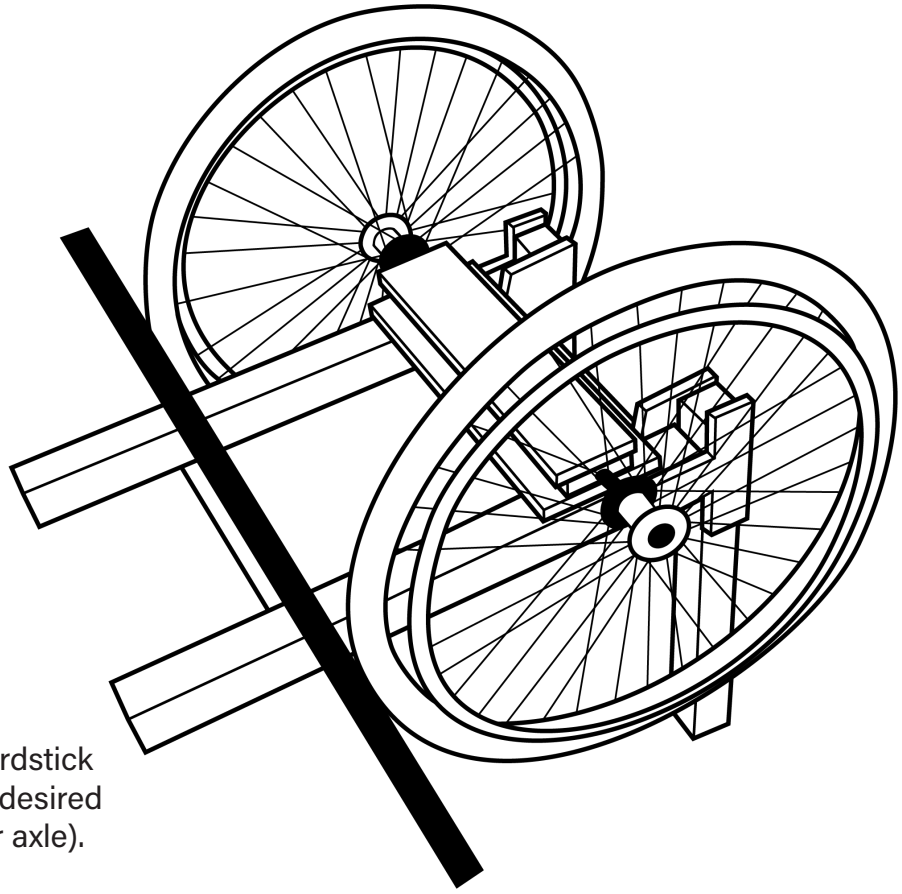


4. Use multiple screws to secure the Seat Pan **(H)** the Upper Chassis **(A)**, connecting both sides of the frame you just assembled*.

***Make sure the frame is square.**

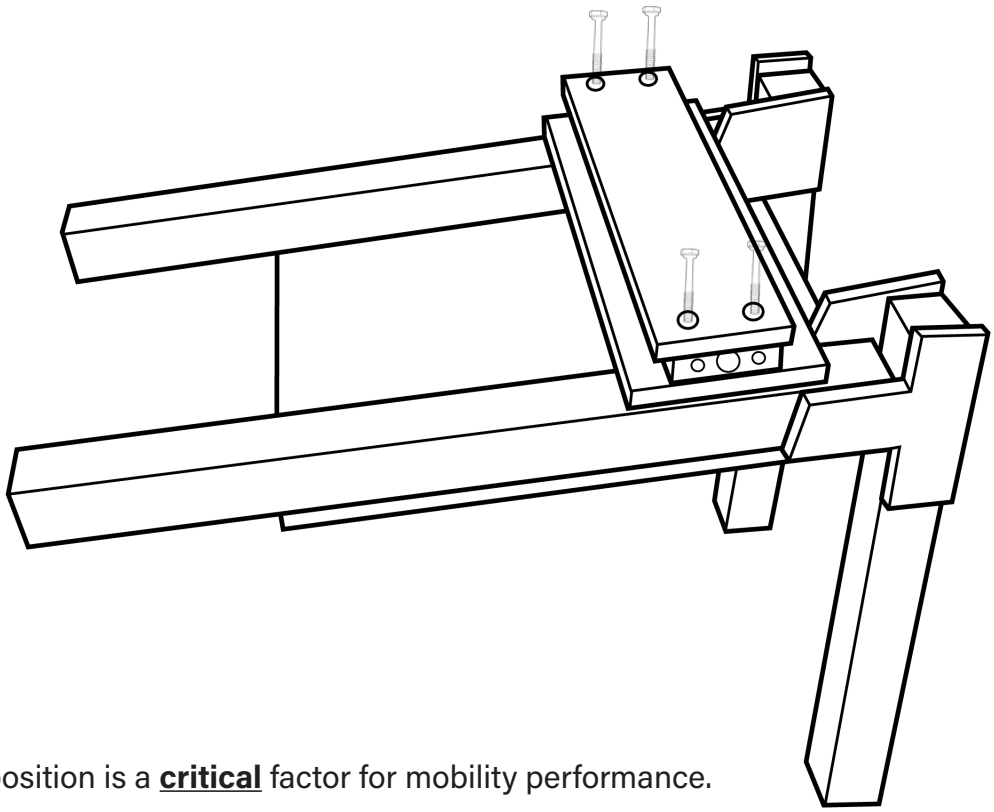
4. ALIGN AND SECURE THE RECTANGULAR CAMBER TUBE

Note: For this step, you may find that mounting the rear wheels on their axles helps with the process of visual alignment.



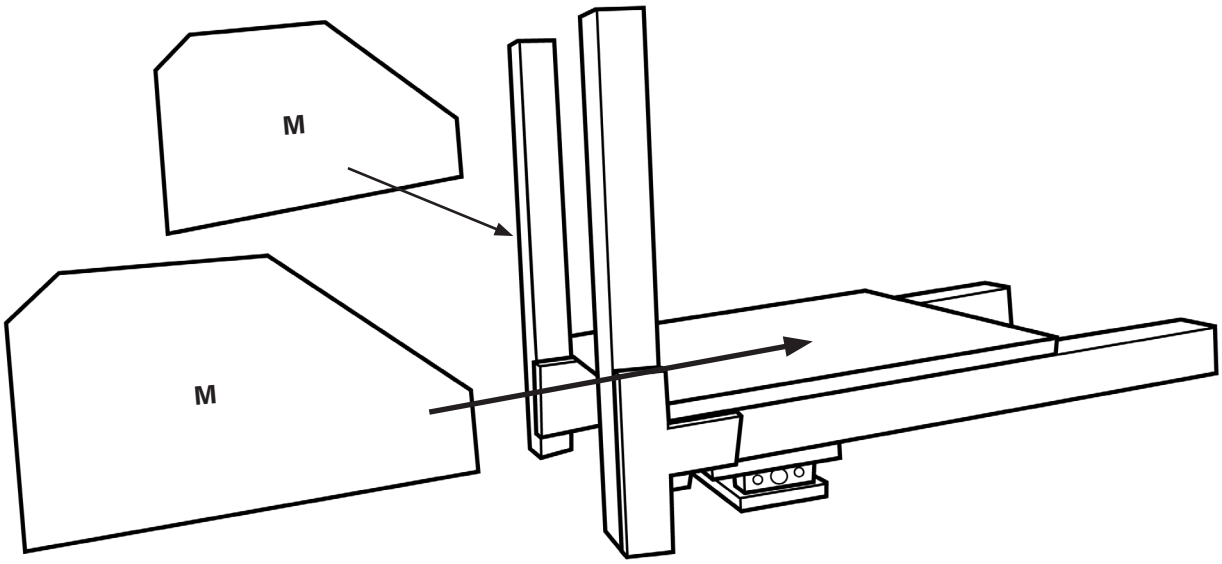
1. Use a measuring square and yardstick (or measuring tape) to locate the desired position of the Camber Tube (rear axle).

2. Once you are confident that you have positioned the Rectangular Camber Tube properly, secure it to the bottom side of the Upper Chassis **(A)** using (4) 3" x 5/16" hex bolts, washers, and nuts.

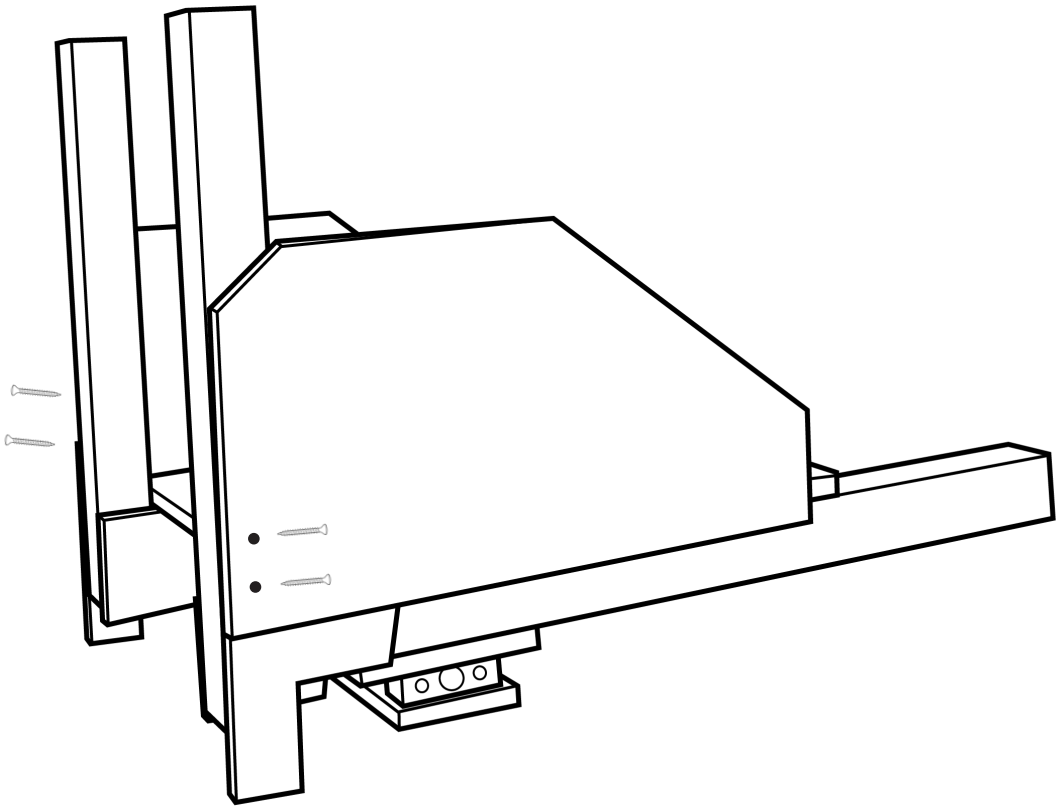


*Proper rear axle position is a **critical** factor for mobility performance.

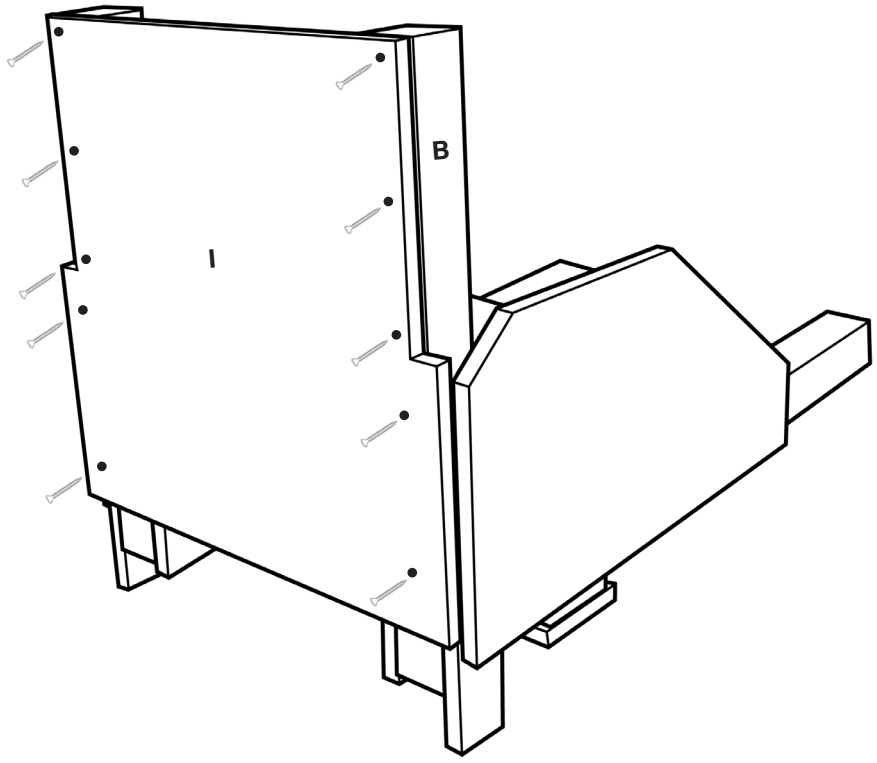
5. SECURE THE SIDE GUARDS



1. Use wood screws to secure the (2) Side Guards **(M)** to the 2" x 2" frame, one on each side.

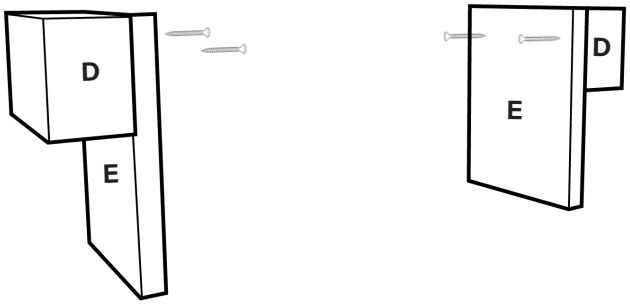


6. SECURE THE BACKREST

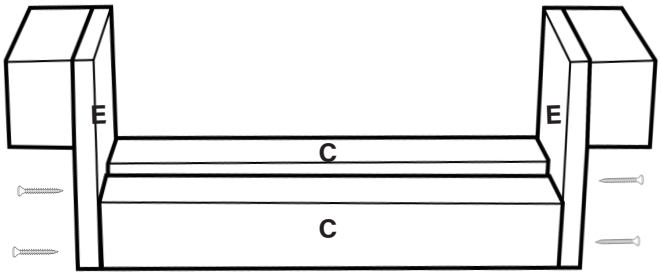


1. Use multiple screws to secure the Backrest **(I)** to the Backrest Supports **(B)**, connecting both sides of the 2″ X 2″ frame.

7. MOUNT FOOT SUPPORT BLOCKS AND FOOT PLATE SECTIONS



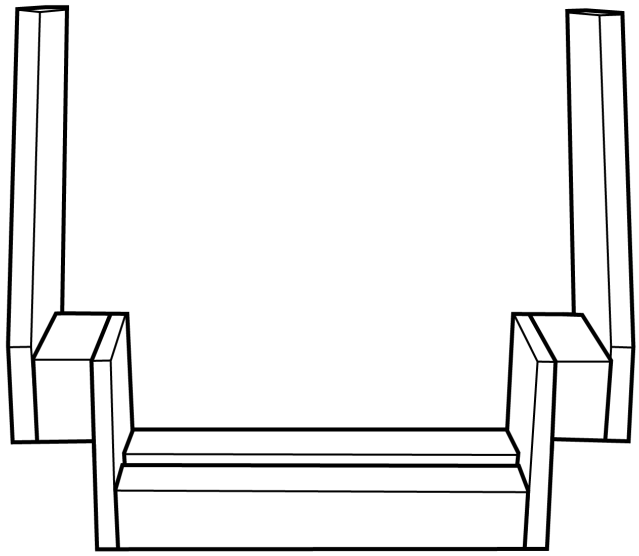
1. Secure the two Foot Support Blocks **(D)** to the Footplate Supports **(E)** using (4) wood screws.

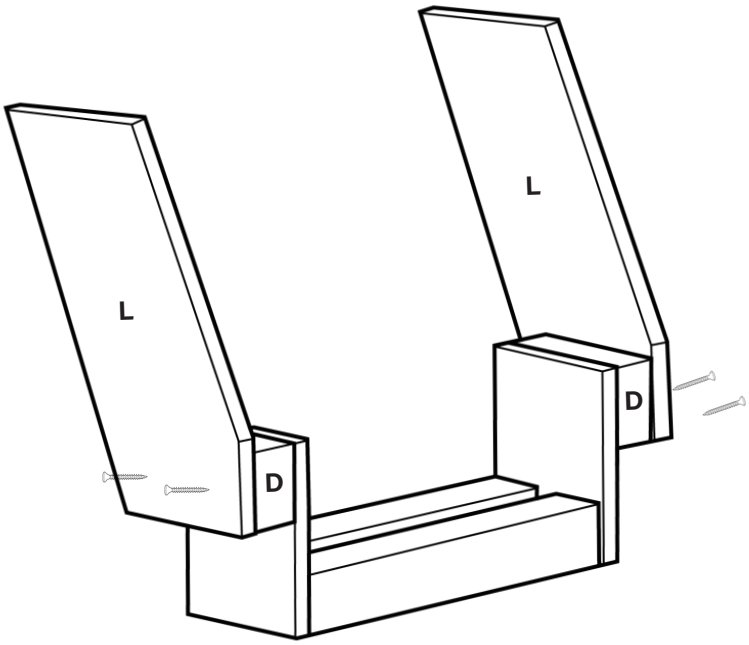


2. Mount the two Footplate Sections **(C)** to connect the two Footplate Supports **(E)**, creating the Footplate Assembly.

8. SECURE FRONT SIDE SUPPORT SECTIONS

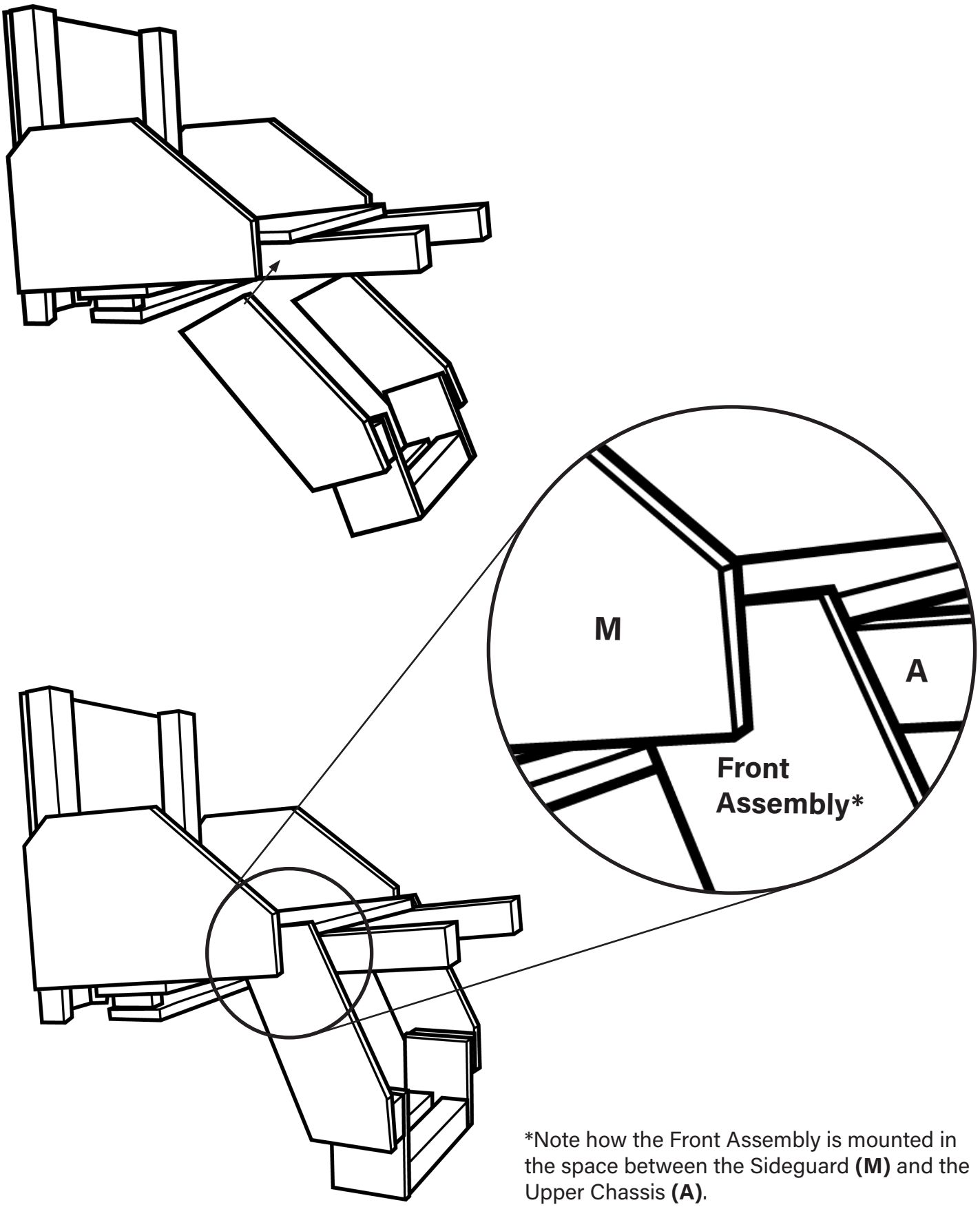
1. Screw the two Front Side Supports **(L)** to the Foot Support Blocks **(D)** into position using wood screws to create the Front Assembly.





9. MOUNT FRONT ASSEMBLY

1. Mount the Front Assembly to the Upper Chassis **(A)** using wood screws.

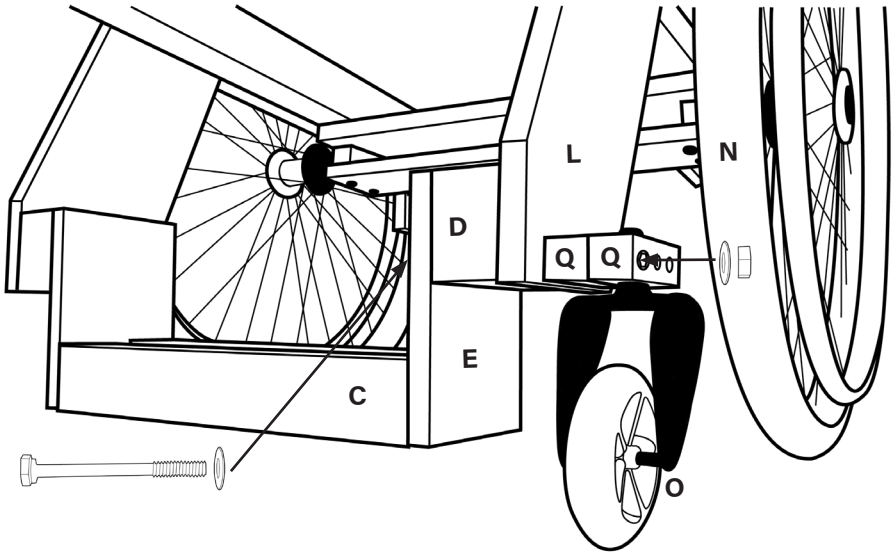


*Note how the Front Assembly is mounted in the space between the Sideguard **(M)** and the Upper Chassis **(A)**.

10. MOUNT CASTER FORKS

*Note: In order to properly position the Caster Fork Assemblies, the Drive Wheels **(N)** must be mounted.*

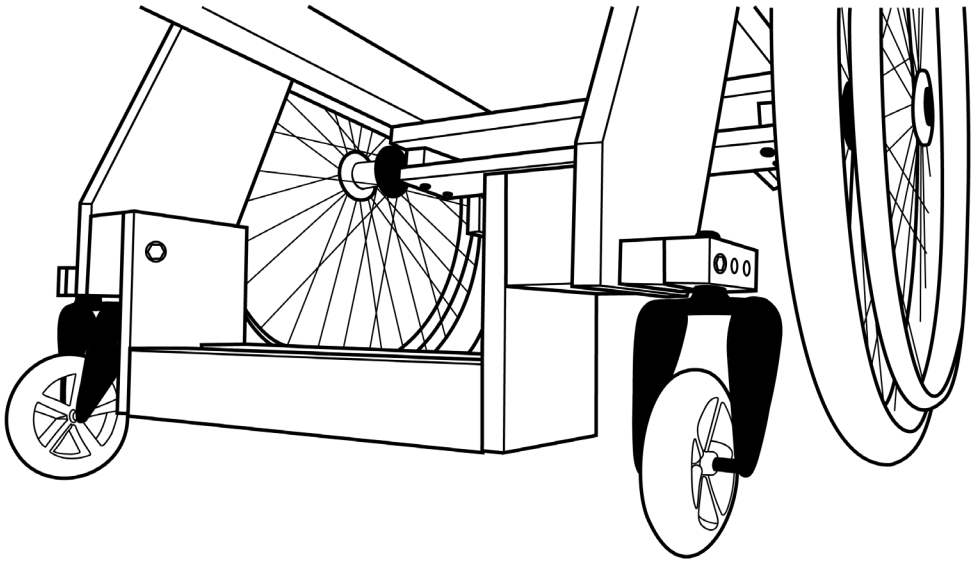
1. Using (1) 5" x 5/16" bolt, attach the Left Caster Fork Assembly **(O+Q)** with an added 2nd metal bracket **(Q)** between it and the Front Assembly.



The 2nd metal bracket **(Q)** serves as a spacer which moves the caster fork outward so that the Caster Wheel does not strike the Footplate Support **(E)**. A 5" caster wheel will require a larger spacer. A 3" caster wheel can use a smaller spacer.

2. **The two Caster Fork Assemblies should be initially mounted with (1) 5" x 5/15" bolt to allow for final adjustment and leveling.**

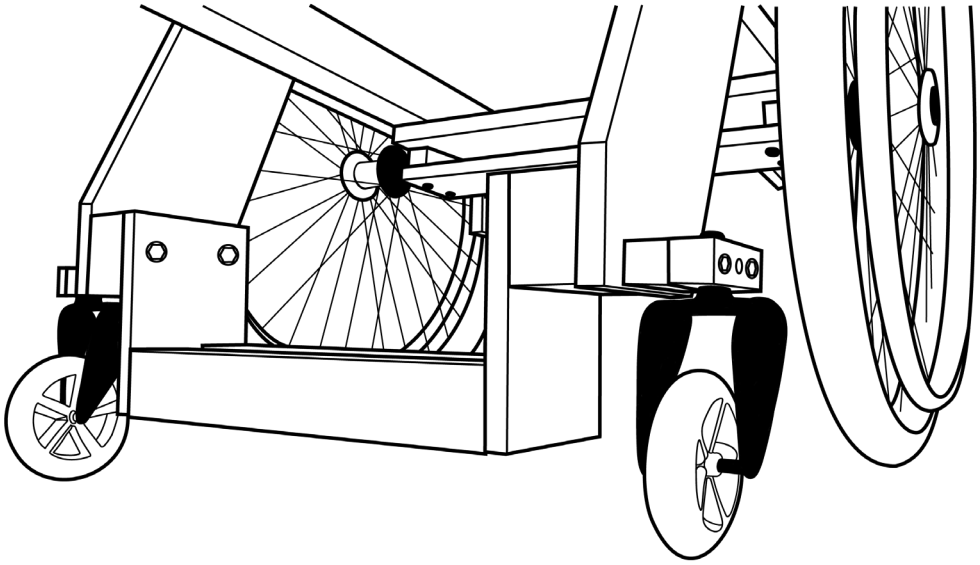
The caster stem bolt should be aligned as close to vertical as possible for proper caster function.



3. After mounting the Left Caster Fork, mount the Right Caster For such that **both caster wheels are touching the ground - This aspect is critical!***

4. Adjust the Footplate Assembly as needed. When there is only one bolt installed, the caster fork angle and the Footplate angle can be adjusted (rotated).

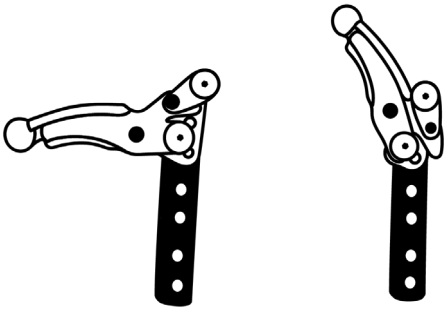
5. Once you are satisfied that both the Caster Fork Assemblies and the Footplate Assembly are positioned properly, you can then secure them with the second 5" x 5/16" bolt. The 2nd bolt will lock the components into position.



*Washers/spacers can be used on the axle stem bolt to adjust the height of the wheel if necessary.

11. SWITCH ORIENTATION OF WHEEL-LOCKS

Typical Configuration

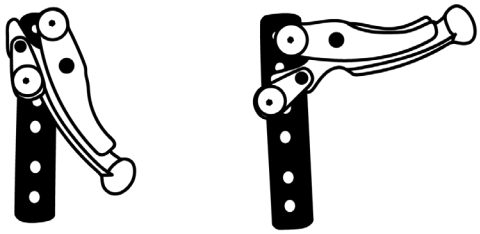


Closed Position Open Position

Typically, Wheel-locks **(R)** come in the position shown in the top two images. The contact lever locks by moving toward the handle.

The Wheel-locks **(R)** will need need to be flipped around so that they lock by moving the contact lever away from the handle.

Ply Guy Configuration



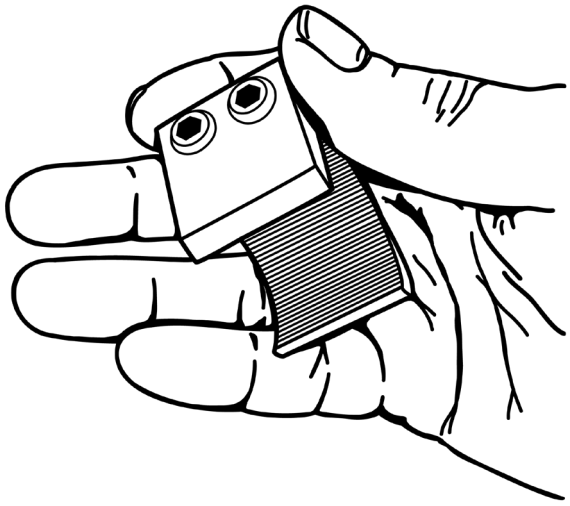
Open Position Closed Position

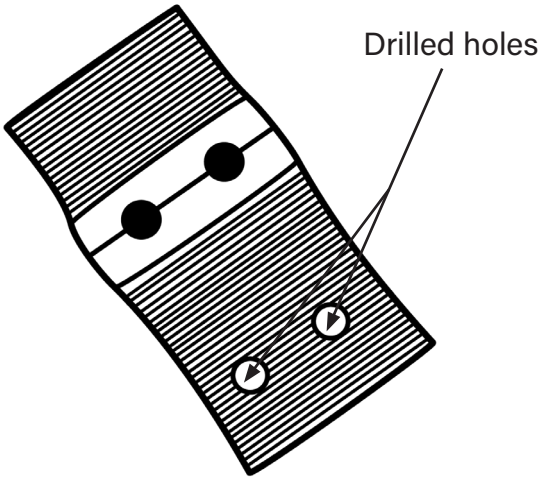
This is done by removing the two Allen Head bolts to (see two bottom images).

Compare the differences in the images of the closed and open positions of the Typical Configuration and the Ply Guy Configuration to better understand how this should look.

12. DRILL MOUNTING HOLES IN BRACKETS

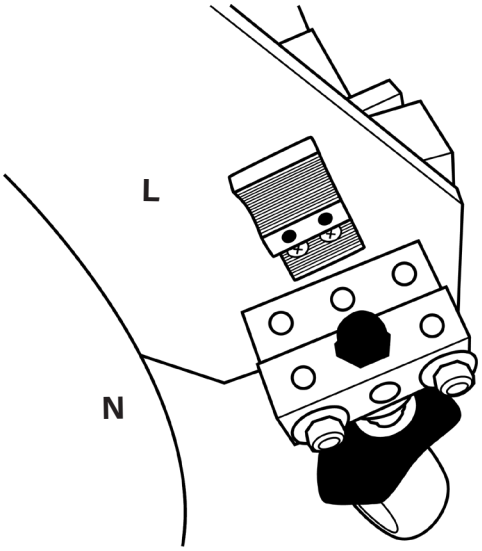
The mounting holes will be used to enable the Mounting Brackets **(R)** to be secured to the Front Side Supports **(L)**.



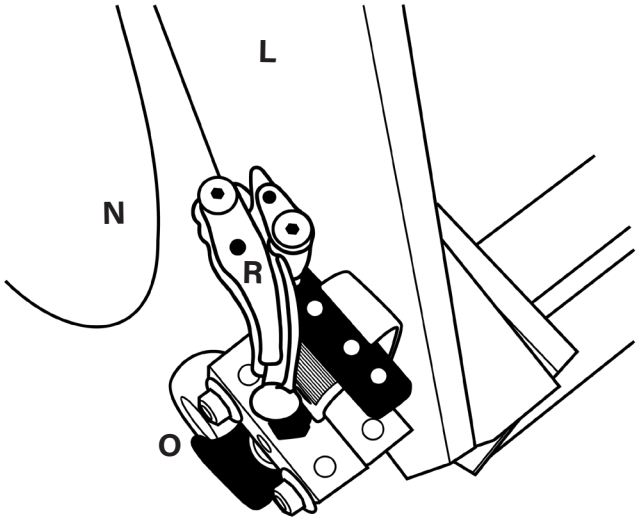


1. The size of the holes drilled depends upon the size of the mounting screws. Drill holes that are the correct size for the screws you are using for this project.

13. POSITION AND MOUNT WHEEL-LOCKS



1. Locate the desired position for the Wheel-locks, and mount the brackets with screws on both sides of the Front Assembly as shown.



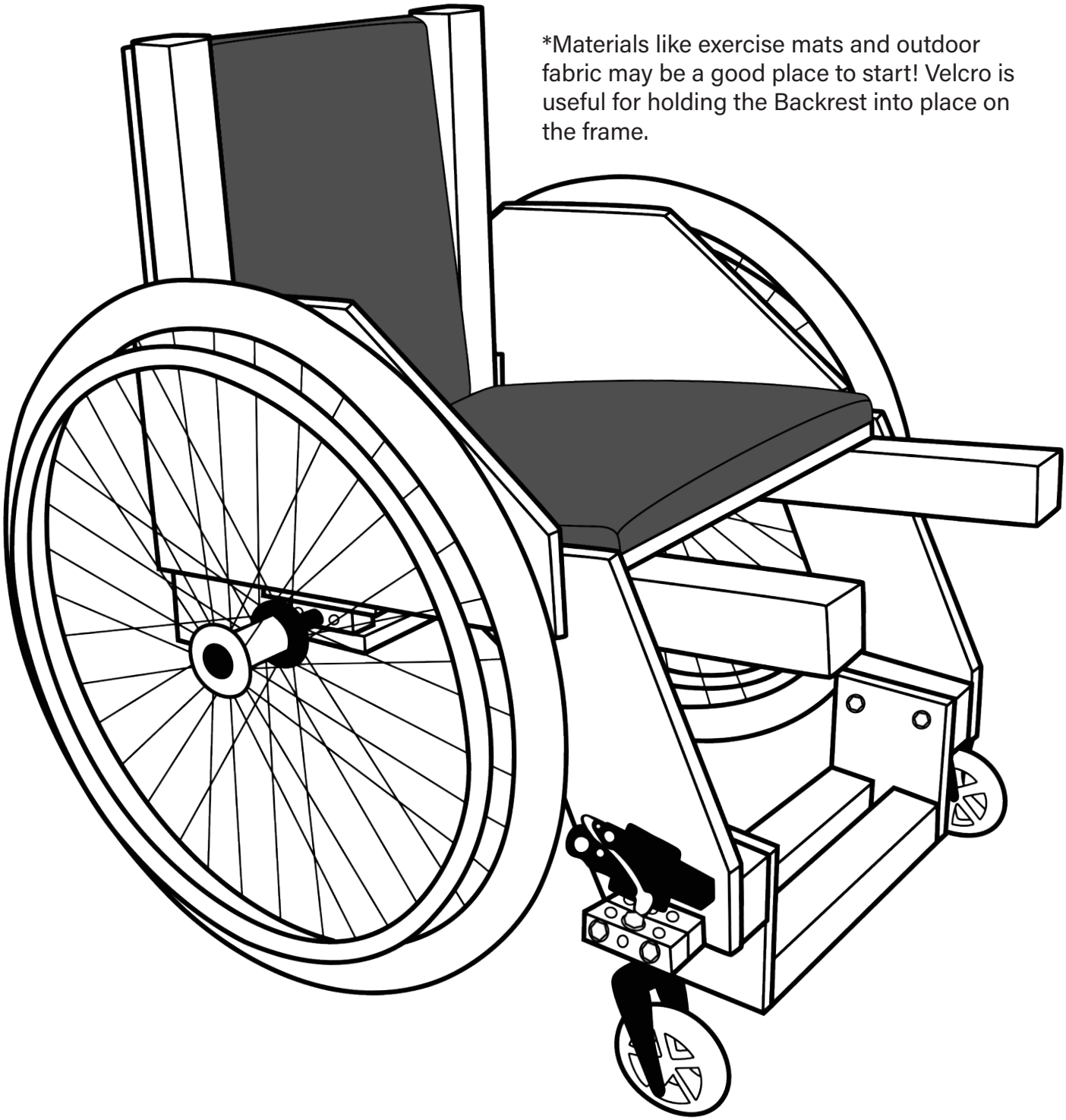
2. Adjust the position of the contact levers of the Wheel-Locks as needed by using the Allen head bolts.

3. Test the Wheel-Locks **(R)** and Caster **(O)** function by making sure the caster wheels spin properly and that the Wheel-Locks **(R)** can hold the Drive Wheels **(N)** into position.

14. ADD BACKREST AND SEAT CUSHIONS

1. Create a backrest and seat cushion to fit the Backrest **(I)** and Seat Pan **(H)** using materials of your choosing, or, purchase cushions that fit.*

*Materials like exercise mats and outdoor fabric may be a good place to start! Velcro is useful for holding the Backrest into place on the frame.



CONGRATULATIONS - YOUR PLY GUY IS COMPLETE!