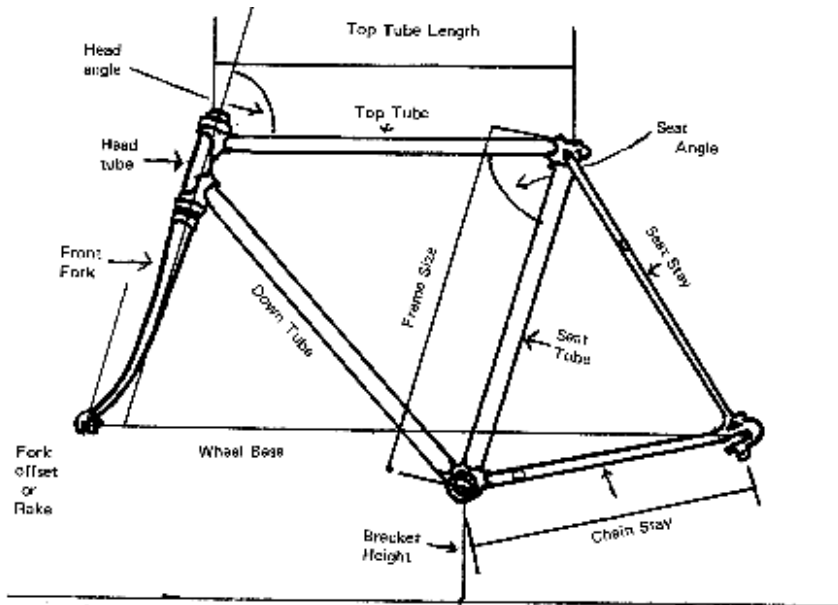


## LESSON 9 - Build a recumbent bike

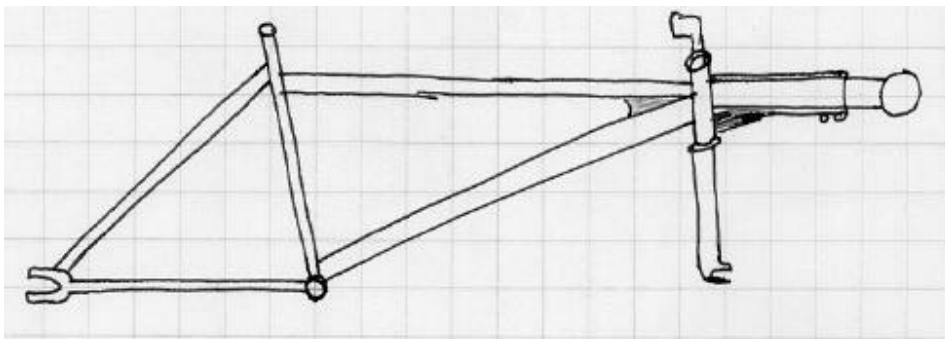
### Designing and Building Your Own Recumbent HPV

[reprinted by permission from "Bohn, R. (1999). *Pedaling adventure...sustainable approaches to education and transportation*. St. Louis: Small Blue Planet."]

We will start this exercise with a look at the standard bike frames you will need to construct your recumbent. The drawing below will familiarize you with the names of the frame tubes you will be using. Take some time to study this. We often pair up participants to quiz each other while they learn these important terms.



The next drawing is a sketch of one of the recumbents we made for this project. It uses a BMX frame and an extension tube brazed on from another bike we cut up for parts.



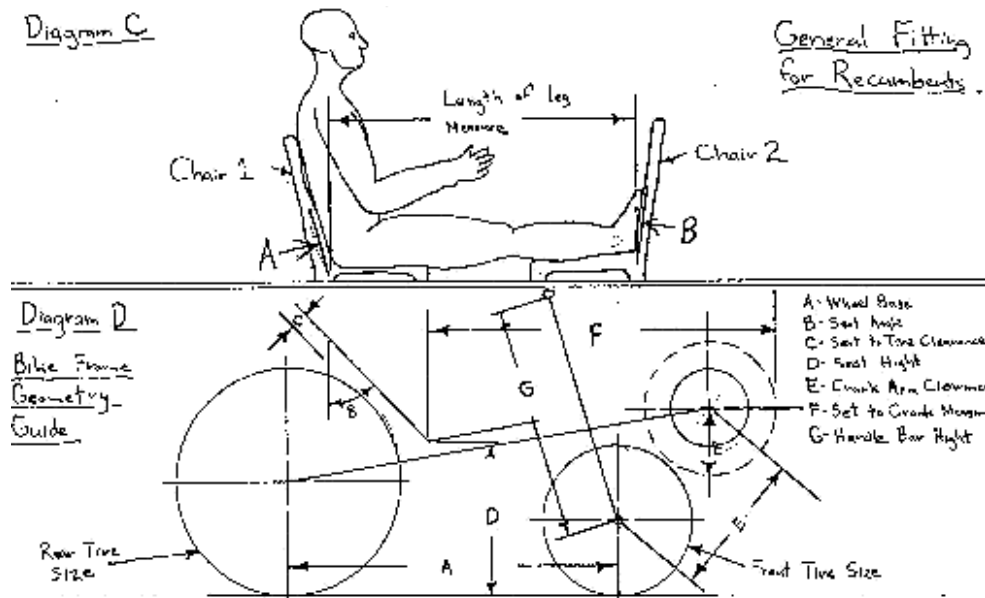
We have over forty hours invested in building these three prototypes. We learned from our mistakes and got better with each successive attempt. This has been an exciting learning adventure. The youth look forward to building more HPV's in the future. Their friends gaze in amazement and curiosity as their friends pedal past them.

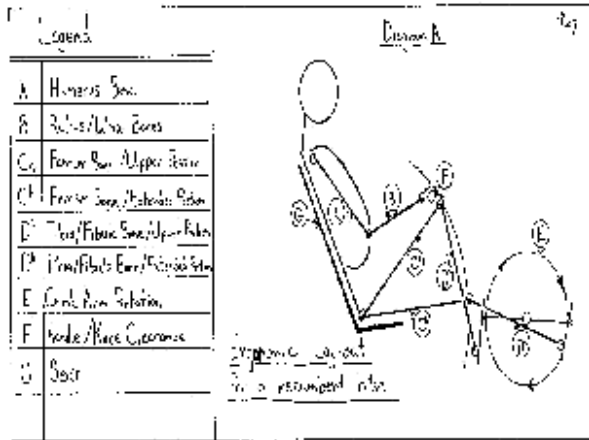
## Designing Your Recumbent

The next few pages include worksheets we used to measure our leg length. This measurement is vital to positioning the seat and in determining how long the extension tube needs to be. These measurements and the drawings we produced were real world examples of how important math, measuring and drawing skills can be.

We are indebted to Steve Robson for his valuable drawings and plans as well as to Recumbent Cyclist News (RCN) for Issue # 47 (dedicated to homebuilders and full of ideas and advice). You can order plans from Steve Robson and back issues from RCN.

We began by tracing our BMX frames on two large sheets of paper we taped together. These full-size drawings were our introduction to coordinate measuring, calculating angles and sizing the extension tube for our recumbents. From the full size drawings, we then make scaled drawings on 1/4" graph paper. This was another opportunity to explore drafting. The following drawings are from Steve Robson's plans and are useful in determining some design considerations early on.





## Recumbent Bike Design Project

### Measurement Worksheet

You will be making a full scale drawing of your recumbent. After completing that drawing, you will make a reduced scale drawing using dimensions from the full scale drawing.

Sketch your frame using the frame you will be starting with. You may trace it if you wish. Calculate the following dimensions and transfer them to your full size drawing:

We will be using a coordinate measuring system as is common in computerized manufacturing and design. Work from an "x axis" (horizontal) and a vertical "y axis."

The origin is the center of the rear axle. It is dimensioned (0,0)

Seat measurement \_\_\_\_\_ inches  
(sit against door or wall, measure from buttocks to sole of feet to nearest inch)

Wheelbase \_\_\_\_\_ Bottom bracket center (x \_\_\_\_\_ , y \_\_\_\_\_ )

Seat & Top tube center ( \_\_\_\_\_ , \_\_\_\_\_ )

Top & Head Tube Ctr ( \_\_\_\_\_ , \_\_\_\_\_ )

Extension tube ctr ( \_\_\_\_\_ , \_\_\_\_\_ )

Seat tube angle \_\_\_\_\_ degrees      Fork rake angle \_\_\_\_\_ degrees

Name \_\_\_\_\_ today's date \_\_\_\_ / \_\_\_\_ / 1999

**You are off on an exciting adventure that introduces you to design skills of drawing and measuring – enjoy our learning by doing adventure!**

## Supplies and Tools

### Supplies and Tools

This list is what we used. You may substitute in some cases based on what you have available. There is no one way to do this. The main thing is to get started and learn by doing. This is not all that difficult. The results are most rewarding and hopefully will lead to more sophisticated designs. This bike is intentionally simple in that we selected single speed coaster brake wheels. Gears will be added to our next generation HPVs.

### Supplies

BMX frame – paint will be removed so finish is not important  
 fork and headset  
 20" Wheels, front wheel and coaster brake  
 handle bars, stem  
 three lengths of chain from coaster brake or three speed bikes  
 one piece Crank assembly, pedals and bottom bracket assembly  
 kickstand (optional)

another bike frame to cut up for extension tube ( one piece or three piece crankset)  
 1/2" conduit for seat back support ( 24" – 32" depending on seat height)  
 1/2" plastic conduit (one 8 foot length) for chain guides per bike  
 1/2" – 3/4" plywood for seat and brazing fixture  
 angle iron for seat support (we used Jason's old bunk bed frame)  
 nuts, bolts and washers for seat assembly  
 cans of spray paint OR a local painter  
 electrical or duct tape

large sheets of paper for full size drawing  
 graph paper  
 pencils, plenty of erasers, compass, protractor and tape measure  
 camera and film to document this adventure

### Tools

Safety glasses and work gloves (respirator if you paint your own frames)  
 Hacksaw and at least a half dozen saw blades OR  
 Metal chop saw (we used this and it was much faster)\*  
 4" hand grinder for removing paint and smoothing welds\*  
 files (round, half round and flat)  
 oxy-acetylene brazing tanks and torches (you may decide to visit to a local welder instead)\*  
 wrenches for disassembly and reassembly of bike parts  
 electric drill and metal drill bits\*

\* We had access to these tools. You may decide to locate a local welder and painter to assist in the welding and painting. If you decide to go this route, it also provides a good opportunity for a career field trip to acquaint the students with these job/career options. You may be charged a small sum for the time and skills of these trades workers.