



# Animal Cart Programme

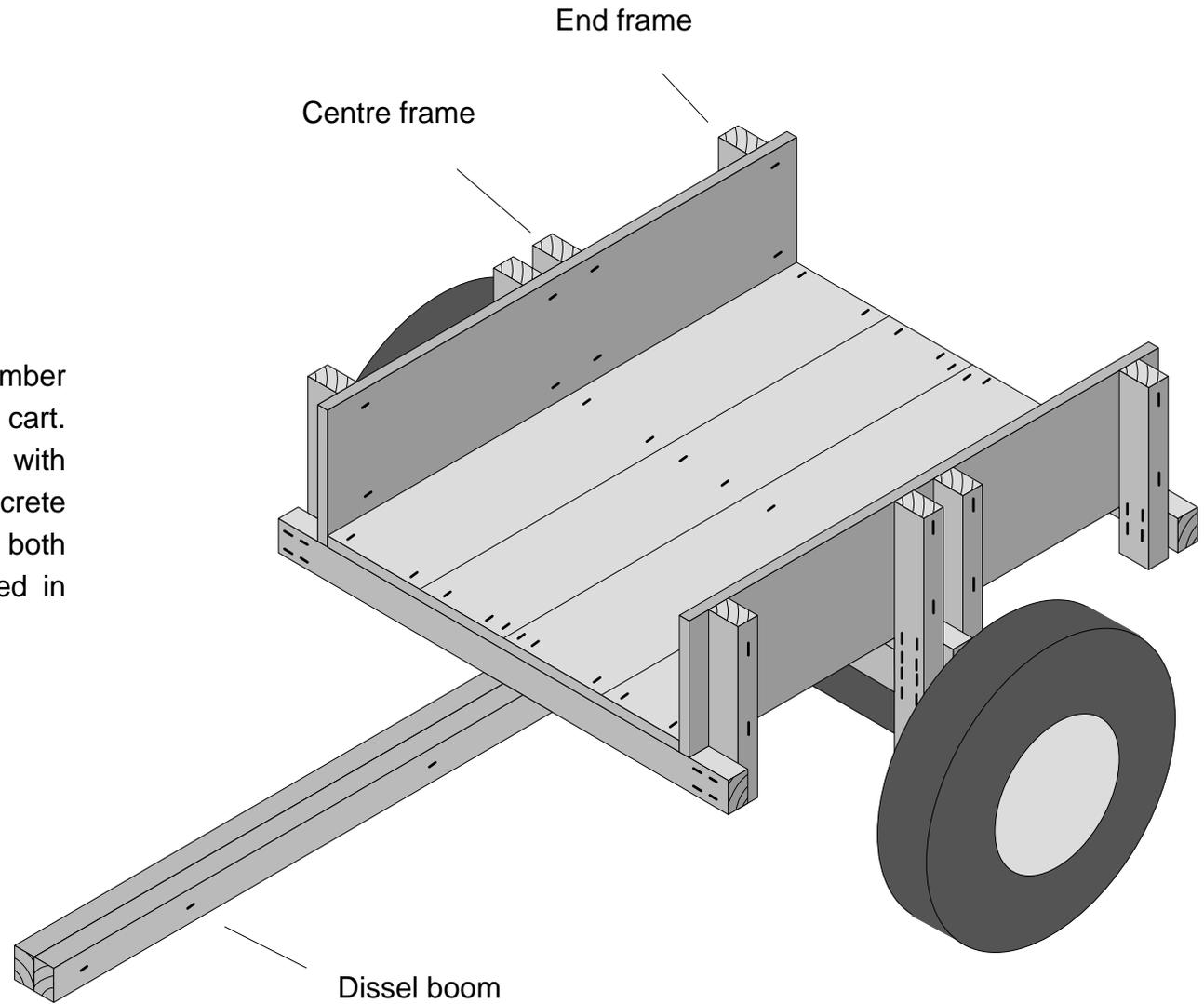
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## SIMPLE LOW-COST WOODEN OX CART



**Figure 1: wooden oxcart**

This cart uses wooden planks and timber for a quickly made and economical cart. The planks are fixed to the frames with 6mm diameter steel rod (small concrete reinforcing bar) clenched over at both ends a bit like copper nails are used in boat building.



# Ox Cart Body Made From Timber

## Introduction

Not enough farmers in Africa have animal carts. Those who have carts can take their produce to places where they can get the best prices. They can also get into town and buy fertilizer and better seeds and move things around their farm easier. The trouble is that carts are too expensive for many farmers. The question is what can be done about it?

What you need is a body which carpenters can make quickly with their simple tools. These people will probably be in the small market towns used by the farmers. Experts think that having the cart maker close to the farmer is a good thing because they can talk to each other easily and sort out any problems. And of course if the cart is made locally, it can be repaired locally, so there should not be any problems with spare parts.

Carts are made in many different places. Some carts are made in factories in industrial countries and some are made in factories in Africa, but most are made by local blacksmiths or carpenters using scrap car and Land-Rover axles. These people cannot get enough axles to meet the demand so the carts are expensive. Even if they did have the axles, they still

end up building heavy bodies that take ages to make. In another booklet in this series we have told you how you can make simple low-cost axles; in this booklet we tell you about a simple timber body. You should find that you can make the body for about \$<sub>US</sub>20, depending on the cost of the materials and labour. Once you get organised, two men can probably make two bodies per day. This is quite a lot faster than most carts can be made and it follows from the simplifications which we have made to the design. We've designed it to be easy to make.

## Idea Behind Design

The idea behind the design of oxcart described in this technical release is to allow construction without lots of special tools and jigs, and without any hard-to-get materials. The only tools which you must have are a woodsaw, a hacksaw or cold chisel, a hammer and a drill able to make a 6mm hole in wood. In fact you can make the drill yourself if you have to. If you need to make a drill read the section **Making a flatbit** below - it's not too difficult, and its quite handy sometimes to be able to make very long drills. You might find that a couple of 4" or a 5" G clamps (or something like it) are useful too. (The symbol " means inches so 4" means about 100mm because there are about 25mm in an inch.)

The way that all the parts of this cart are joined together is like the one that used to be used to fix small boats together. It's called clenched nailing and is a bit like riveting. What you do is make a hole right through the wood to be joined, and then put a straight piece of 6mm diameter re-bar (concrete reinforcing bar) right through so it sticks out about 25mm both sides. Then you just knock one end over with a hammer so it lies on the surface of the wood. Next you bend the other end over. Then you put a big hammer or something hard and heavy like a piece of steel against one of the ends and then hit the other with another hammer. What happens is that you tighten the two bits of wood together and you get quite a strong joint. If you put some washers or something like them made from sheet steel on the re-bar before you bend it over it will make the joint a bit stronger still. It does not make a very rigid joint, but you might find that the flexibility gives the cart some resilience so that it takes knocks better.

You will see that there are no mitres and complicated angles to cut in the timber so you save time when making the cart. Also the exact lengths of the components are not very critical - again it saves a little time, but you will find that the carts look better if you take a little trouble to get things square and even etc.

These carts have been tested a bit in Nigeria, but we have not tested them enough. We think that they are strong enough, but we cannot be sure. Really to get a reasonable price you need

to experiment a bit to see how the farmers treat their carts and what they expect their carts to stand. It's no good saying it must be strong enough so that they cannot ever break it - somebody will always break anything - and it will very expensive to make it nearly unbreakable. At least you can repair these carts easily and cheaply.

## Cutting list and costs

Table 1 shows a cutting list for a complete cart - Recent prices of materials in Nigeria are shown converted into \$<sub>US</sub>.

TABLE 1: cutting list for wooden oxcart.				
component	material	number of lengths & length required [No.xmm]	total material in cart [mm]	materials cost in Nigeria [\$us]
animal shaft/ boom	75x50 or bush pole	2x3700	7400	2.39
body frame bottoms	75x50 roughsawn timber	3x1100	3300	1.06
body frame sides	75x50 roughsawn timber	6x300	1800	0.58
axle struts	75x50 roughsawn timber	4x600	2400	0.77
tray bottom planks	25x300 or similar timber	4x1800	7200	4.64
tray side planks	25x300 or similar timber	2x1800	3600	2.32
tray ends	25x300 or similar timber	2x1100	2200	1.42
plank fixing staples	6mm dia re-bar or similar	30x250	7500	0.80
body frame staples	6mm dia re-bar or similar	12x150	1800	0.19
axle fixing studs	M12 threaded rod or bolts	2x100	200	0.64
axle fixing loops	6mm dia re-bar or similar	2x200	400	0.04
TOTAL->				14.86

## Construction step by step

- 1) The first job, is to get all the material together and clear a space to work. Ideally you will be able to work on a flat area of concrete. Start by cutting the 75x50 timber into the right lengths, as in the cutting list, and then you can cut the bottom and side planks. Then cut the 6mm dia re-bar for

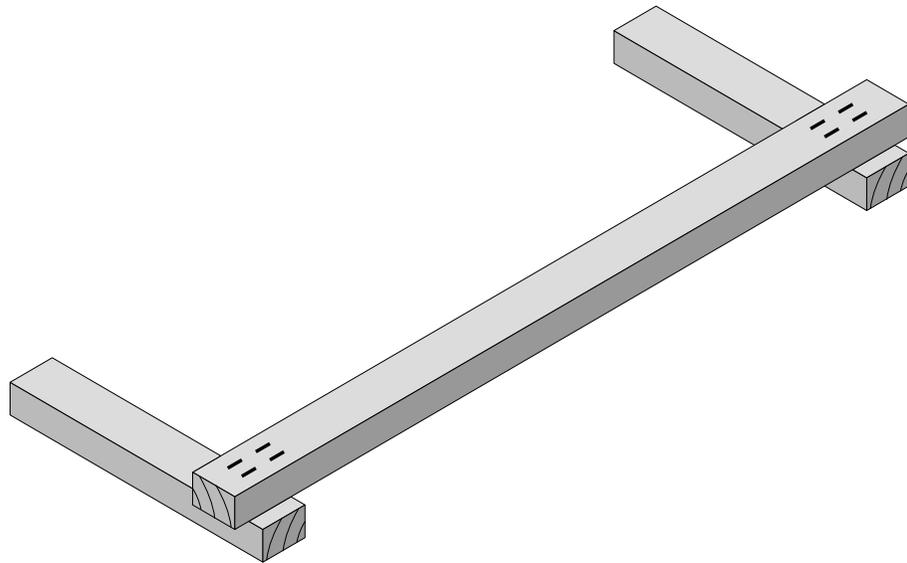


Figure 2: a finished end frame.

the fixings.

- 2) Next make up the two U-shaped front and back frames (endframes). If you have a G clamp you can use it to hold two pieces of the frame together during drilling and clenching. It's quick and you can tap the bits with a hammer until everything is square and straight and then drill the holes. You might also find that leaving the G clamp on makes it easier to get the re-bar fixings through.

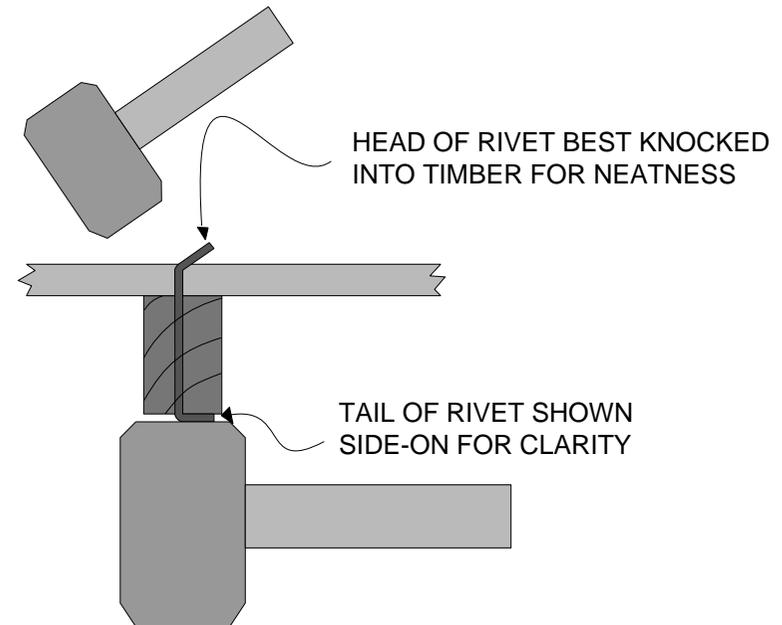


Figure 3: Using two hammers to clench rivet.

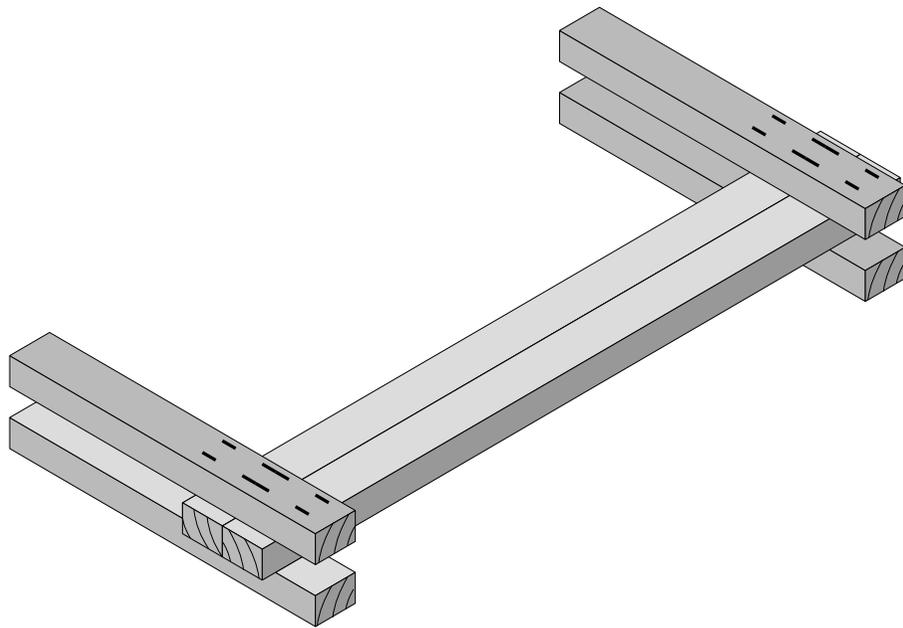


Figure 4: a finished midframe/ axle support frame including spacer.

- 3) Then you can make up the frames that go in the middle - the ones that support the axle. You can start with the frame bottom and then fix the uprights to it either side with four rivets. When you've done both ends you will end up with an H shaped assembly.
- 4) Next you can fit the side and the bottom planks to the end frames and then the middle frame with more rivets.

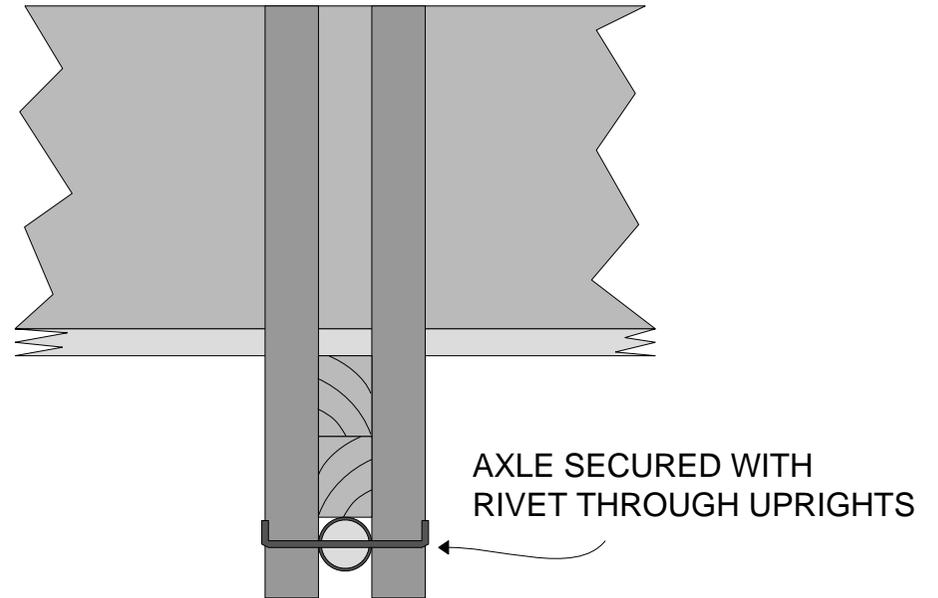


Figure 5: method of fixing axle to axle supports.

- 5) Nearly there! Fix the axle with a rivet right through the middle of it where it goes between uprights of the middle frame - obviously you need to drill through the axle to do this. Another way is to bolt the axle in with a bolt right underneath the axle, but you need a long bolt to do this.
- 6) If you want to make it so that the ends of the load tray can be removed easily you can do in the way we have shown in

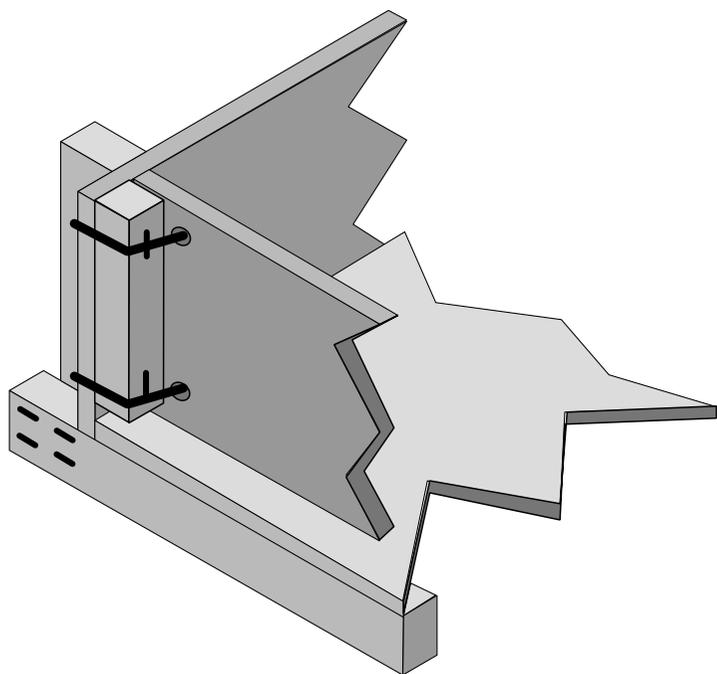


Figure 6: method of fixing tray ends with rubber or rope

7) Paint or creosote the cart. You've finished it!

## Modifications

There are many different versions of this cart. You can try longer or shorter carts and you can make them wider or

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narrower. When you do this, check the length and width of the planks of wood that you will use - you do not want to find that you are two inches short of being able to get two runs of plank out of one piece of timber, or that its just too narrow and you have to fiddle about and fit in a narrow strip.

This cart design does not have ends to the load tray, but if your farmers really want ends you can make them from some more plank. A good way to fix the end planks might be to fix them to the inside of these with bits of truck inner tube as giant bungees or elastic bands. This is an appropriate way because it is cheap and very easily repairable, but the farmers may want some flashy looking thing which will be very expensive to make. You will probably find that things like latches take longer to make than the rest of the cart. Explain to the farmers that they will cost extra too!

## Other DTU cart developments

The DTU has been working on a range of cart body types for use with both donkeys and oxen. It has designs for wooden and steel framed types. The wooden types are cheaper in material terms, but the steel framed ones are easier to make because the joints are more straightforward - nevertheless you can make either type of cart in only a few hours, if you are reasonably set up with tools and materials.

The DTU has also been working on new designs of wheels, hubs and bearings to bring down their costs and make things more locally manufacturable. For example it has pioneered a system of hubs using steel pipe such as water pipe which do not need machining to make a roller bearing hub. Obviously friction is low with these hubs and they usually give good milage before being worn out too - we usually get 15 000 km before they are very badly worn, but they may need cleaning and relubrication several times before they get this far. Still they are reasonably cheap - we can make them in Nigeria for about \$<sub>US</sub>20, they only take one man a day, and they do not need any special tools.

Other hub designs using, for example aluminium castings, are in production in Nigeria and we are trying to reduce or eliminate the machining in these. Also wheel designs in steel sheet, cast aluminium and timber are in manufacture or under development.

### **Making a flatbit**

Flatbits for drilling wood are easy to make and quite useful because you can make them very long and drill holes in quite awkward places.

To make the bit, get some round steel bar of the same size as the hole you want to make, or a little bit smaller. Then hammer the end to flatten it a little (a bit like a screwdriver). The drawing shows what we mean. In fact if you can harden the cutting edges you can use the flat bit to drill holes in metal too as long as you do not want to drill deep holes. To get hard cutting edges you will need to use either 'silver steel' or say spring steel or even to case harden the edges - though you will lose the hardness as soon as you re-sharpen the drill if it's just case hardened.

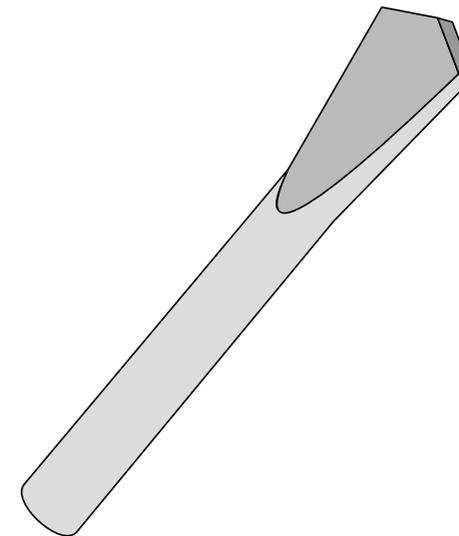


Figure 7: flat bit for drilling holes

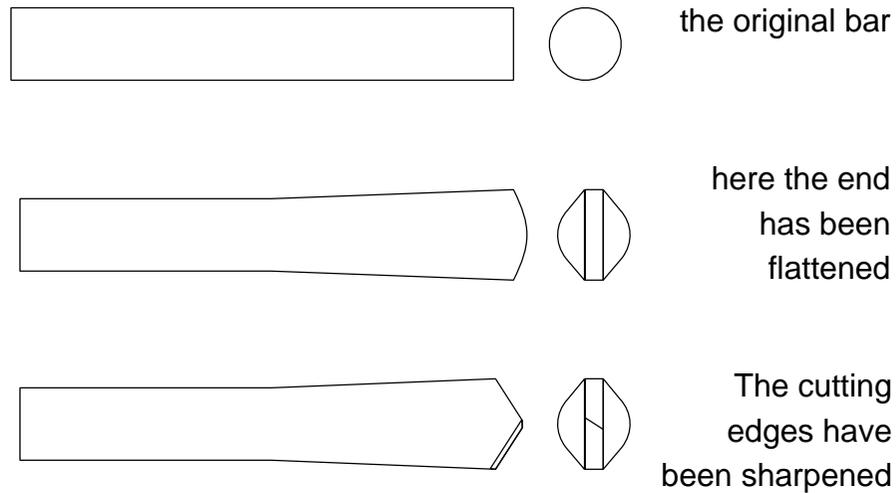


Figure 8: stages in the making of a flat bit for drilling holes.

## Cart Drawings

You will find two drawings below, the first one gives a general view of the cart and the second, a view of the main components. As we have said you can vary the size of the cart quite a bit and even make it much longer if you add extra frames. You could even make a four wheeled cart like this!

