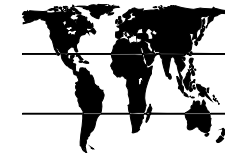


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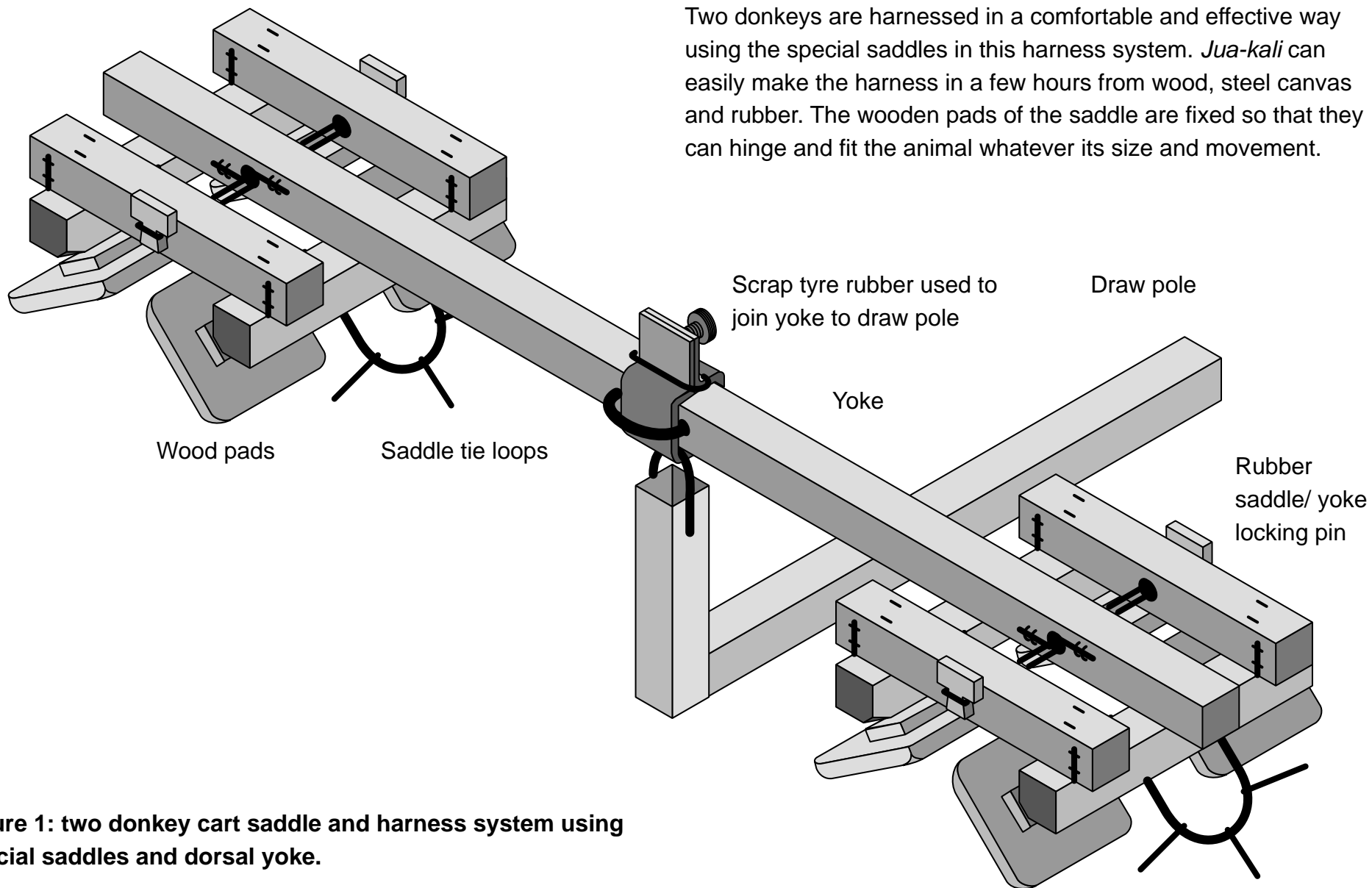


Animal Cart Programme

TECHNICAL
50
RELEASE

Wooden Double Donkey Harness for Cart Pulling

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Two donkeys are harnessed in a comfortable and effective way using the special saddles in this harness system. *Jua-kali* can easily make the harness in a few hours from wood, steel canvas and rubber. The wooden pads of the saddle are fixed so that they can hinge and fit the animal whatever its size and movement.

Figure 1: two donkey cart saddle and harness system using special saddles and dorsal yoke.

Donkey Harness for Carts Made From Steel Box Tubing, Timber and Canvas/Sacking

Introduction

This Technical release tells you how to make a saddle and harness system for two donkeys to pull a cart with a single draw pole. The system can also be used for pulling a light plough or other field operation.

You should find that you can make the whole harness for two donkeys for less than £_{UK} 20, depending on the cost of the materials and labour. Once you get organised, two men can



Figure 2: single donkey saddle.

probably make a complete set of harness in four hours - we have designed this harness to be easy to make.

Other booklets in this series tell you how to make a saddle for a single animal and how to make steel versions of these harness. We also have designs for simple low-cost axles and for steel framed and wooden framed carts. All carts and axles can be made without special tools - even drilling metal is not required.

Idea Behind Design

Saddles are used in many countries to hitch animals to carts. Our saddles provide strong points on the animals' backs and a yoke can easily be fixed to them to carry the end of the cart draw pole. Using this harnessing method, carts can be pulled, steered and braked, and stabilised if the load is too far back on

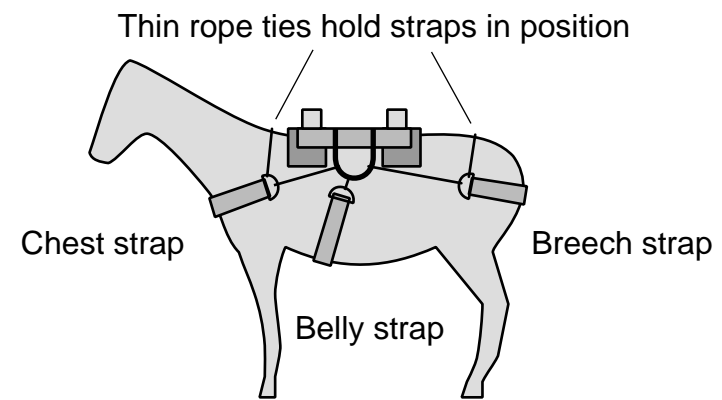


Figure 3: saddle secured to donkey with straps.

the cart body. This harness allows animals of different sizes to be used together and does not need them to walk exactly side by side. We have even had donkeys jump over a hedge pulling a cart with the steel version of this harness!

The wooden pads are fixed to the frames with cord which is loose enough to allow the pads to follow the shape of the animal.

The steel version of this saddle and yoke system has been tested and used for months at a time in Kenya and works well.

Cutting list and costs

Table 1 shows a cutting list for a complete harness - recent prices of materials in Kenya are shown converted into £_{UK}.

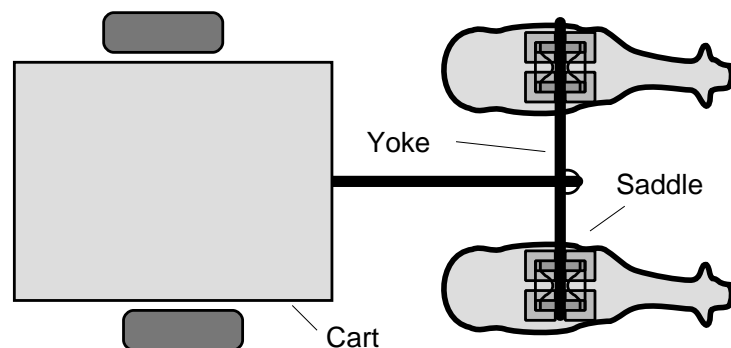


Figure 4: two donkeys harnessed to cart.

TABLE 1: harness materials cutting list.

component	material	# components	total mat [mm]	mat cost [£ _{UK}]
main frames	50x50 sawn timber	2x4x370	2960.00	1.76
load pads	25x120 sawn timber	2x4x120	960.00	0.64
load pad packing	25x50 sawn timber	2x4x100	800.00	0.19
load pad fix cord	6 mm dia rope	2x4x300	2400.00	0.30
pad cord fix U nails	staples = U nails	16	0.07	0.40
saddle tie loops	10 mm re-bar	2x2x300	1200.00	0.35
yoke	60x60 sawn timber	1x1400	1400.00	1.25
yoke to saddle attach pin	scrap tyre rubber	2x2x90x100	180.00	0.20
yoke to saddle fix cord	6 mm dia rope	4x500	2000.00	0.30
yoke/ saddle cord U nails	staples = U nails	4x2	0.033	0.20
strap rings	6mm re bar	2x6x180	2160.00	0.22
strap clenchers	6mm re bar	2x6x120	1440.00	0.14
strap hooks	6mm re bar	2x6x150	1800.00	0.18
straps	CC5 canvas (1m wide)	2x3x4x65	1560.00	7.25
strap chains	dog chain	2x6x300	3600.00	1.80
yoke to drawbar loop ring	6mm re bar	300	300.00	0.03
yoke/ drawbar attach strap	scrap tyre rubber	1x70x400	400.00	0.50
yoke/ drawbar strap bolt	M10/ M12 steel bolt	50mm		0.50
			TOTAL =	16.22

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 workbench or a flat area of concrete.
- 2) Make up the frame as shown in Figure 5. Each of the four corner joints is made by clench nailing with pieces of R5 or R6 (5 or 6 mm diameter round steel bar or rod often used for concrete reinforcement) through holes drilled in the wood (to make sure the wood does not split). Figure 7 shows the hole positions.

If you have a G clamp you can use it to hold two pieces of the frame together while you drill the holes. The holes should be a bit smaller than the rod, say 4mm or 5mm

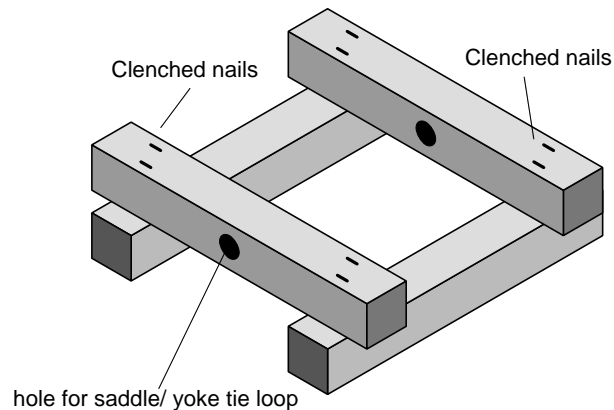


Figure 5: clench nailed frame.

diameter. It is best to sharpen the pieces of R5 or R6 so that they go through the holes smoothly. (Clench nailing just means knocking the ends of the pieces of rod over so that they grip tightly, as shown in Figure 6.)

- 3) Make up the saddle tie loops from 300 mm lengths of R10 or R12 if the saddle is to be used for heavy work.
- 4) Drill holes for the saddle tie loop on each side of the saddle frame in the positions shown in Figure 7. Hammer in the loops and clench the ends over so that the frame looks as shown in Figure 8. As before the drilled holes should be a little smaller than the round bar.
- 5) Chamfer the inside of the frame as shown in Figure 7 and Figure 8.
- 6) Cut the wooden load pads and round off all the edges so

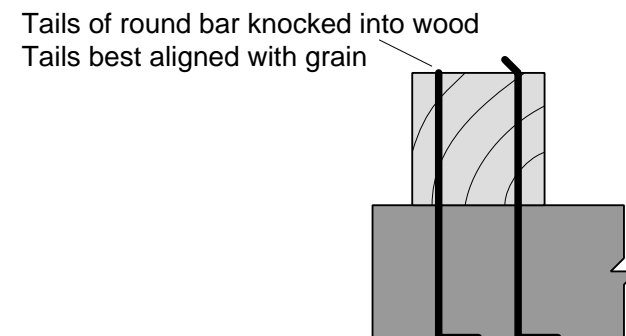


Figure 6: details of clench nailing.

that there are no sharp corners to stick into the donkey. Hammer two 100 mm or 120 mm long nails into the edges of each load pad so the nails run across the grain as shown in Figure 9. This should prevent the pads splitting across the grain. Drill two holes through each of the pads in the positions shown in Figure 9 for the pad-to-frame fixing cord or rope. Cut a slot between the holes to accommodate the cord using a chisel or screwdriver.

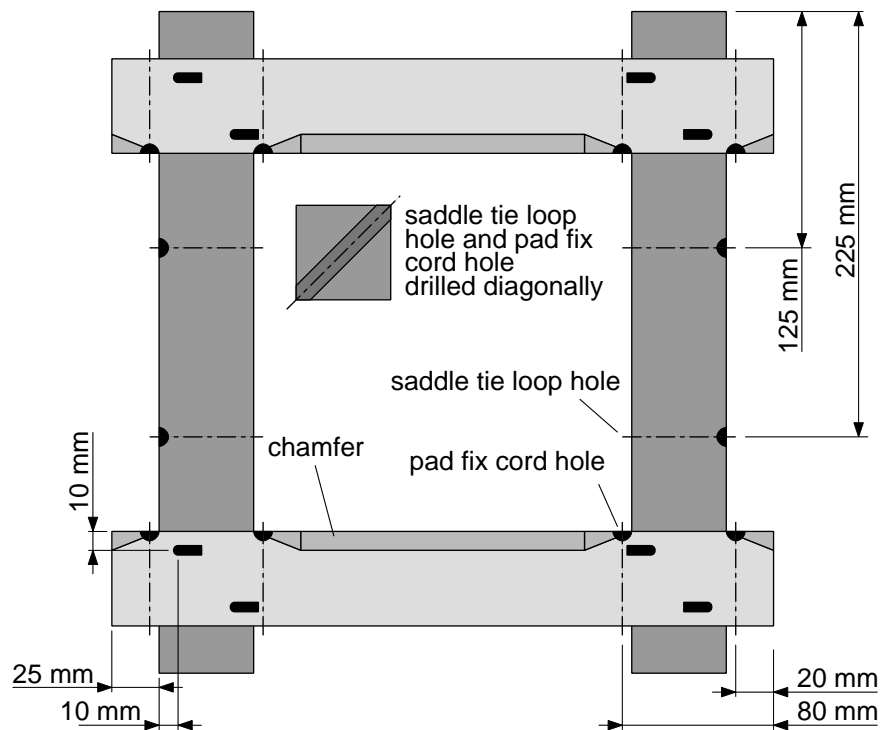


Figure 7: frame joint clench nail layout and pad fix holes.

- 7) Make the pad packing from pieces of wood 25x50x100 mm. Drill holes 60 mm apart to match the holes in the pads as shown in Figure 10.
- 8) Now drill the holes required to accommodate the load pad fixing cord in the saddle frame. These holes should be 20 mm and 80 mm from the ends of the timber frame as shown in Figure 7.
- 9) Push the cord through the holes in the pad and the frame and fix the cord with woodscrews and washers or U nails to the frame as shown in Figure 1. The cord should be tight but should still allow movement of the pads.
- 10) Next you need to make up the six straps to hold the

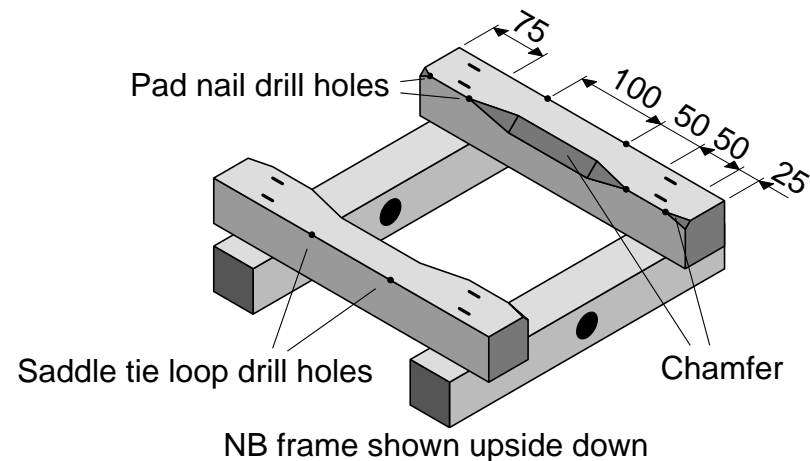


Figure 8: chamfered inside of frame.

saddles onto the donkeys. The D rings at the end of the straps can be made from 6 mm diameter concrete reinforcing bar as shown in Figure 11. A separate piece of the re-bar is clenched over the strapping using hammer blows to fix the D rings to the ends of the straps as shown.

The straps themselves can be made from heavy canvas or hessian sacking. You should use three or four thicknesses of material for them to make them strong enough and soft enough not to hurt the donkey.

- 11) Make the strap chain hooks from more 6 mm re-bar as shown in Figure 12 and fit the fixed ends to the saddle tie loops.

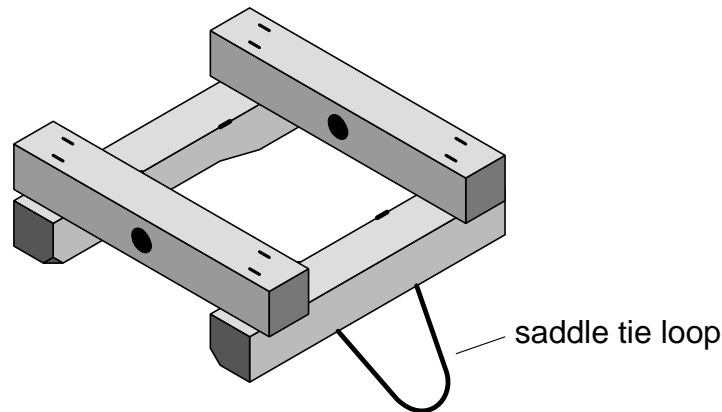


Figure 9: tie loops fitted through holes drilled in frame.

- 12) Cut the yoke to length. You can make the yoke different lengths but we have found that a longer yoke helps the animals turn in a narrow track. Drill 19 mm holes 225 mm from the ends and two other 19mm holes 50 mm either side of the centre as shown in the drawings - nb the axes of all three holes must be horizontal in use.
- 13) Using U-nails, fix 500 mm lengths of rope through the holes at the ends of the yoke so that when the yoke is central in the saddle as shown in Figure 1, the rope will be tight when secured with a rubber pin.
- 14) Cut four rubber yoke fixing pins to the shape shown in the drawings.

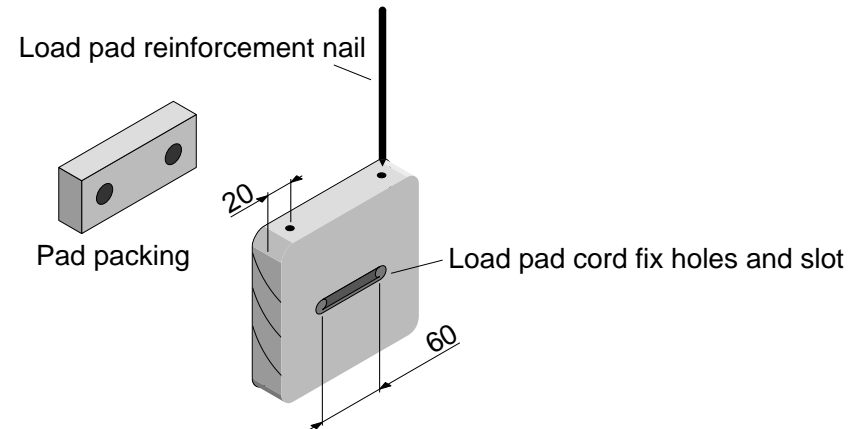


Figure 10: load pad reinforcement by nails across grain.

15) Cut another piece of scrap tyre rubber about 400 mm long and 70 mm wide. Make a hole about 15 mm diameter about 40 mm from each end. Make a loop of 6 mm diameter steel reinforcing bar about 70 mm long as shown in Figure 14 that will just go over two thicknesses of the rubber strip.

16) Paint and creosote the saddles and yoke. You've finished it!

Method of harness use

Harness each animal separately, then fix the yoke to the saddles, then fix the yoke and animals to the cart.

1) First put a blanket or two folded hessian or jute sacks (not plastic) onto each donkey's back to protect them.

Remember that protecting the donkey will save money because it can work harder if it is comfortable and will not

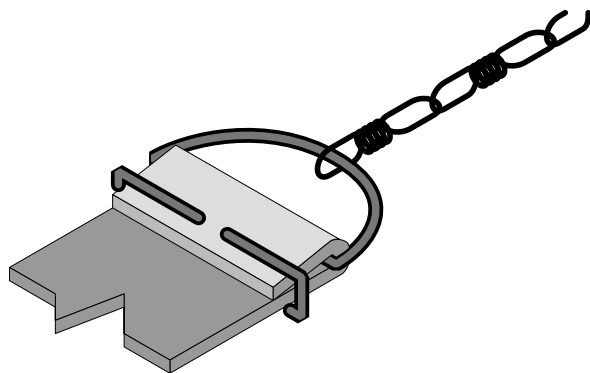


Figure 11: D rings for straps made from re-bar.

get sick from skin wounds.

2) Put the saddle on so that the fronts of the wood pads are about 100 mm behind the animal's shoulder blades. This means that the saddle should never come near parts of the animal's back which move.

3) Next hook the breaching strap to the loops hanging from the side of the saddle. It should be tight enough to tend to pull the saddle a little rearwards. Tie a piece of thin rope across the animal's back between the rings of the strap to hold the strap up so that it does not rub the backs of the legs. But it should not be so high that the animal cannot defecate.

4) Now hook the chains for the belly strap onto the hooks fixed to the saddle tie loops. The strap should be 50 mm or

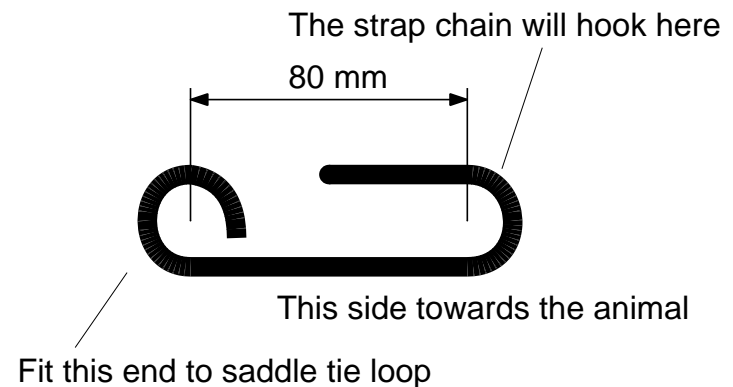


Figure 12: chain hooks for straps.

100 mm behind the front legs - check that the legs do not rub on the strap when the animal walks. Tighten the strap so that you can just get a couple of fingers under it between the strap and the animal. This will be much tighter than the other straps.

- 5) Hook the chest strap to the loop and adjust the tension so that it is a little loose. Use another short piece of rope to hold the chest strap up so that it is just below the wind pipe. The strap goes tight when the animal pulls really hard. We have noticed that the belly strap and breaching strap are nearly enough without the chest strap and so we leave the chest strap a bit loose.
- 6) Saddle the second animal in the same way. You should be able to saddle an animal in only a few seconds when you get practised and know how many links of chain you need

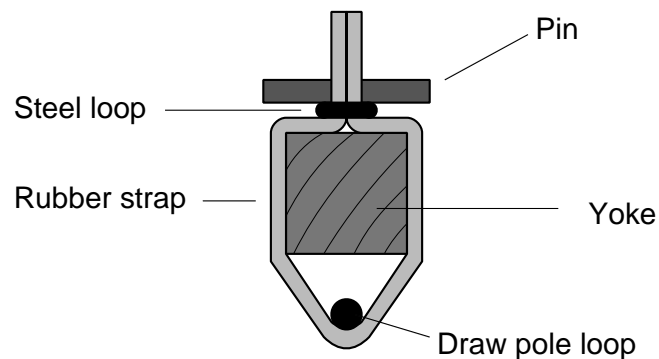


Figure 13: using rubber strap to join cart draw bar loop to yoke.

on each strap.

- 7) Get the two donkeys into position side by side and put the yoke across the two saddles. Push the cord fixed to the ends of the yoke through the holes in the saddles as shown in Figure 1 and secure the cords with the rubber saddle/ yoke locking pins.
- 8) Lastly connect the cart to the centre of the yoke using the 400 mm long rubber strap, the 80x15 loop and a bolt as shown in Figure 13.
- 9) You are ready to go!

Saddle Drawing

You will find drawings of the saddle and yoke on the last pages of this Technical Release.

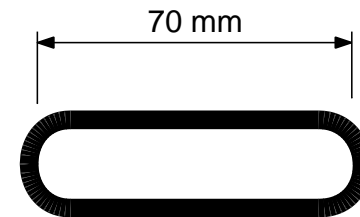


Figure 14: loop for yoke to drawpole strap (R6 steel bar).

Other DTU cart developments

The DTU has been working on a range of cart designs for use with both donkeys and oxen. It has designs for wooden and steel framed types. You can make either type of cart in only a few hours, if you are reasonably set up with tools and materials.

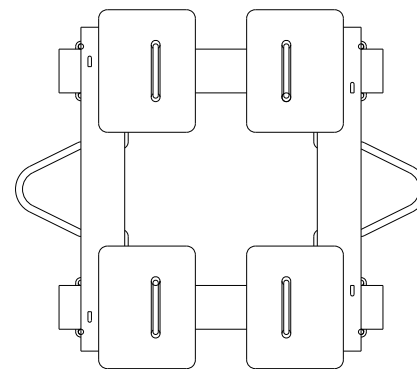
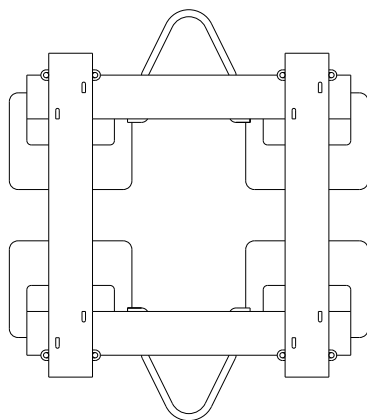
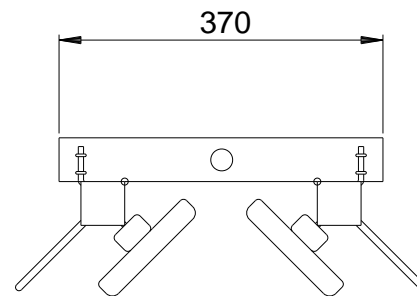
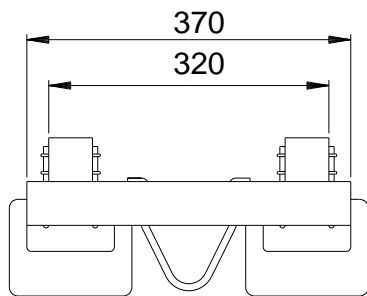
The DTU has also been working on new designs of wheels, hubs and bearings to bring down their costs and make things more locally manufacturable. It has a system of axles with bearings made from PVC pipe, another with wooden bearings and a third using scrap ball bearings. None of these axles need machining and they only take two men a day to make.

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Acknowledgements

The DTU is grateful to the DFID (British Government) for the financial support necessary to carry out the research and development project under which this product was developed.

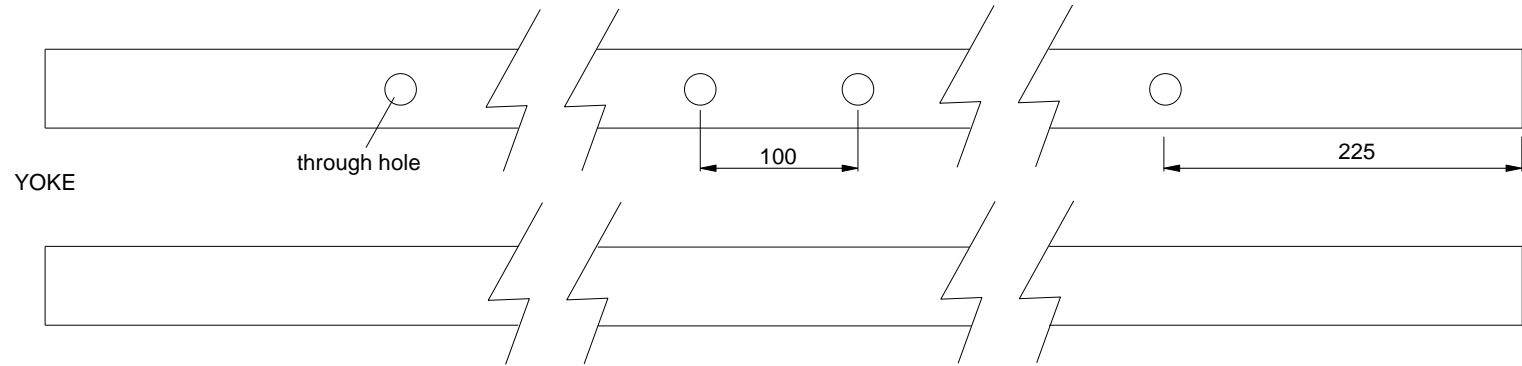
The DTU would also like to thank Dr Pascal Kaumbutho of KENDAT in Kenya and Mr Joseph Mugaga of TOCIDA in Tororo, Uganda for their very considerable help with this project. A large number of other people and organisations have contributed to the success of the project, most notably Mr Anthony Ndungu in Kajiado Kenya, Mr JD Kimani in Kikuyu Kenya and Mr Joseph Gitari in Wanguru Kenya in whose workshops most of the development work of this project was performed. Thanks are due also to Mr Stanley Lameria in Kajiado, Mr Patrick Gitari in Wanguru and Mr Mathew Masai in Machakos for their assistance.



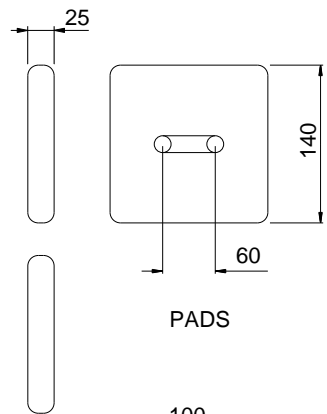
PLAN VIEW FROM ABOVE

PLAN VIEW FROM BELOW

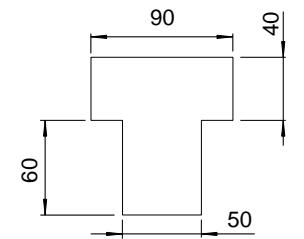
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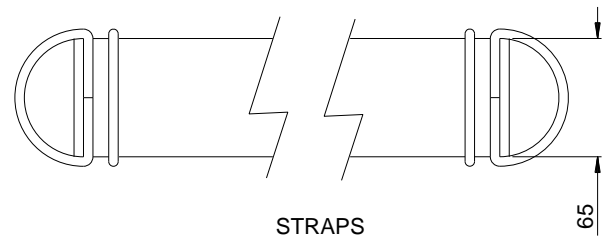
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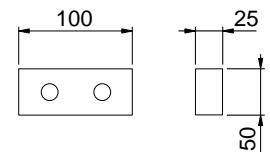
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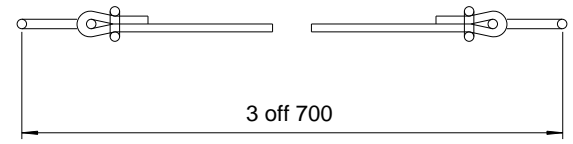
SADDLE/ YOKE LOCKING PIN



STRAPS



PAD PACKING



3 off 700

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