KENDAT

DTU

Animal Cart Programme

TECHNICAL
40
RELEASE

Double Donkey Harness for Cart Pulling

Development Technology Unit, Department of Engineering, University of Warwick, Coventry, CV4 7AL UK, tel: +44 (0)1203 523523 extn 2339, fax: +44 (0)1203 418922, email: dtu@eng.eng.warwick.ac.uk
KENDAT, PO Box 61441, Nairobi, Kenya, tel/fax: +254 2 766939, email: kendat@africaonline.co.ke

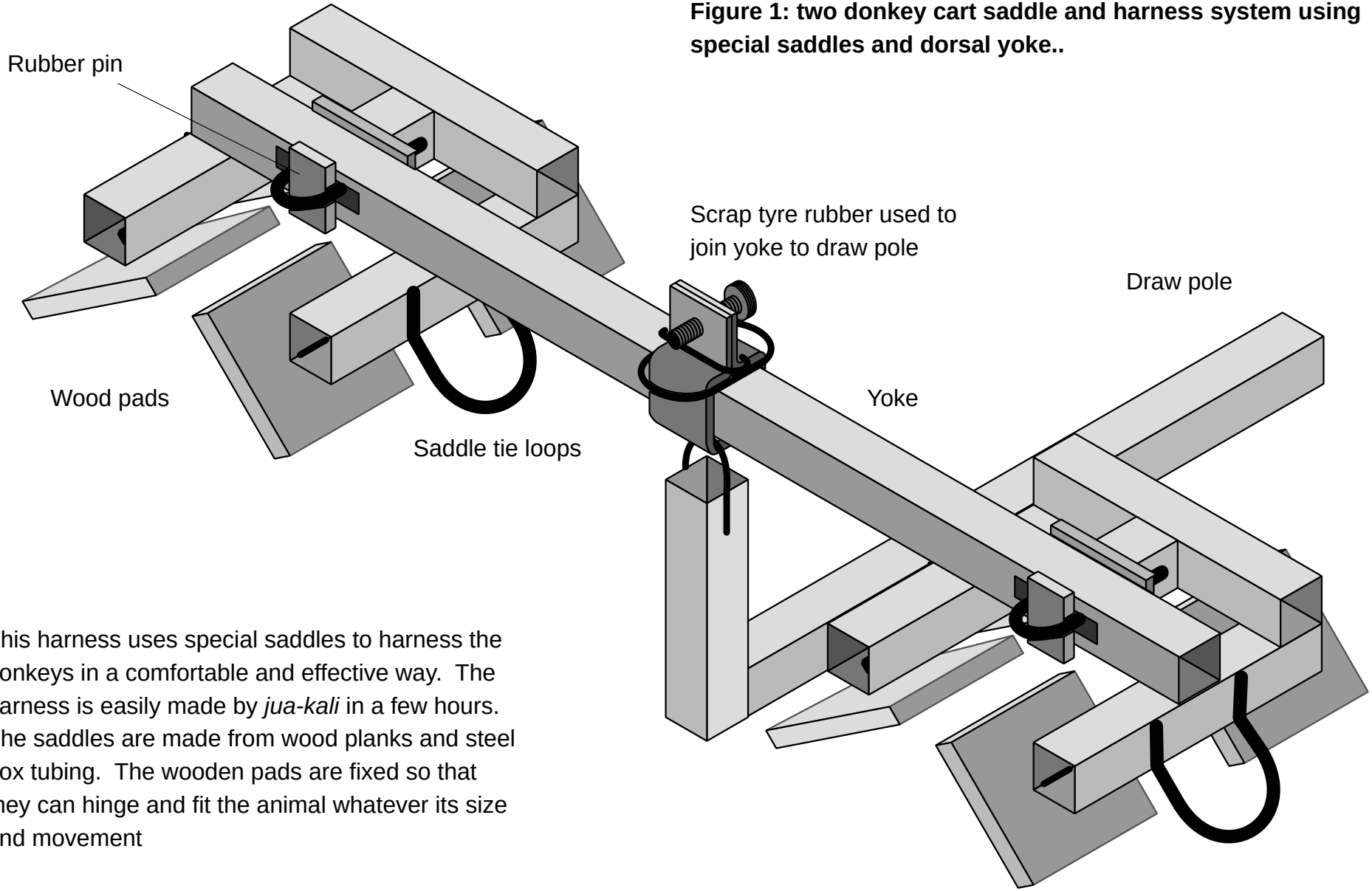

Figure 1: two donkey cart saddle and harness system using special saddles and dorsal yoke..

This harness uses special saddles to harness the donkeys in a comfortable and effective way. The harness is easily made by *jua-kali* in a few hours. The saddles are made from wood planks and steel box tubing. The wooden pads are fixed so that they can hinge and fit the animal whatever its size and movement

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. Another Technical Release tells you how to make a saddle for single animal use.

You should find that you can make the whole harness for two donkeys for less than £$_{UK}$15, depending on the cost of the materials and labour. Once you get organised, two men can 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 simple low-cost axles and carts: we have designs for steel framed and wooden framed carts and for many different kinds of axle. 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

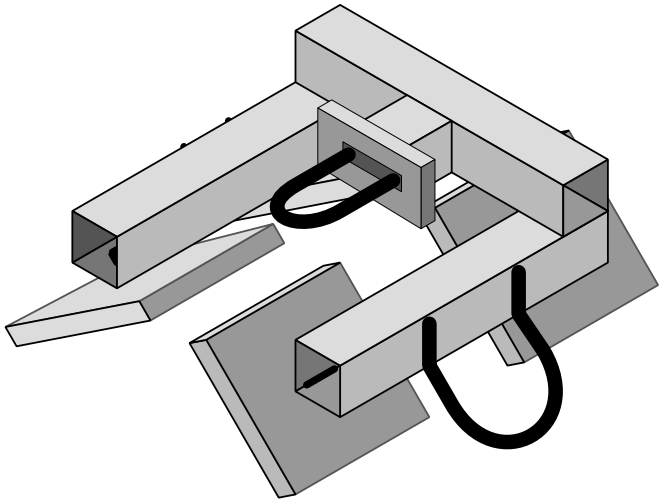

Figure 2: single donkey saddle.

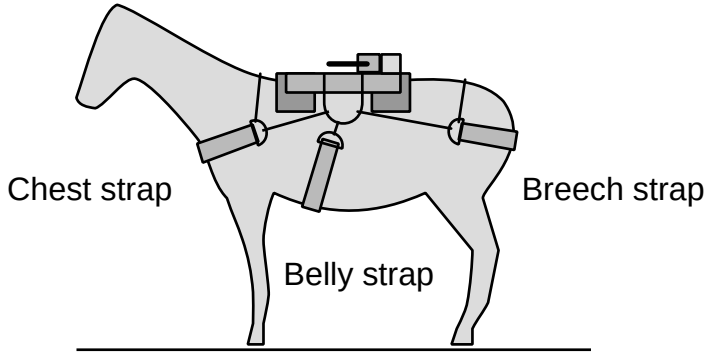

Figure 3: saddle secured to donkey with straps.

draw pole. Using this harnessing method carts can be pulled, steered and braked, and stabilised if the load is too far back on 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 this harness!

Special tools and jigs and hard-to-get materials are not required. The only tools which you must have are a simple welder, a woodsaw, a hacksaw and a hammer.

The saddle frame is welded and the wooden pads are fixed to the frames with nails which are put through holes in the steel frame and welded so that they are loose and allow the pads to follow the shape of the animal.

These saddles have been tested in Kenya and work well but we would like to test them more. Really we need to test them for a year or two to see how the animals react.

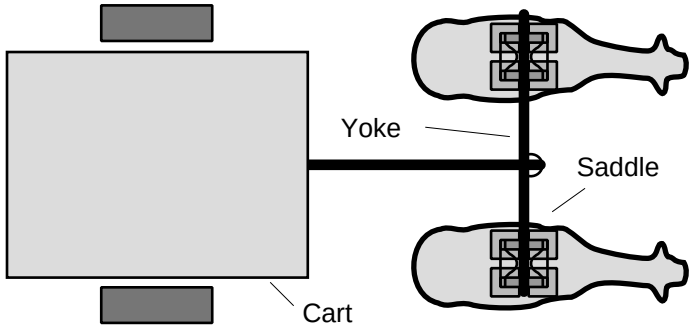

Figure 4: two donkeys harnessed to cart.

Cutting list and costs

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

TABLE 1: harness materials cutting list.

component	material	# components	total mat [mm]	mat cost [£$_{UK}$]
main frames	50×50 box tubing	2×3×300	1800.00	2.11
yoke attachment stub	50×50 box tubing	2×1×60	120.00	0.13
yoke	50×50 box tubing	1×1×1400	1400.00	1.52
yoke fixing loops	12 mm re-bar	2×2×350	1400.00	0.45
strap loops	12 mm re-bar	2×2×300	1200.00	0.39
load pad pivots	12 mm re-bar	2×4×20	160.00	0.05
load pads	25×150 timber	2×4×150	1200.00	0.28
pad fix nails	nails/ 6mm re bar	2×8×50	800.00	0.08
strap rings	6mm re bar	2×6×180	2160.00	0.22
strap clenchers	6mm re bar	2×6×120	1440.00	0.14
strap hooks	6mm re bar	2×6×150	1800.00	0.18
straps	CC5 canvas	2×3×4×65	1560.00	3.94
strap chains	dog chain	2×3×300	1800.00	1.40
saddle/ yoke buffer pad	scrap tyre rubber	2×60×110	120.00	0.20
yoke/ saddle locking pin	scrap tyre rubber	2×90×100	180.00	0.20
yoke/ cart attach strap	scrap tyre rubber	1×70×400	400.00	0.50
			TOTAL =	**11.79**

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.

2) Make up the U-shaped frame as shown in Figure 5. If you have a G clamp you can use it to hold two pieces of the frame together during welding.

3) Then weld the tie loops and the yoke attachment stub and loop onto the U frames so that the frame looks as shown in Figure 6.

4) Next cut the wooden load pads and round off all the edges so that there are no sharp corners to stick into the donkey.

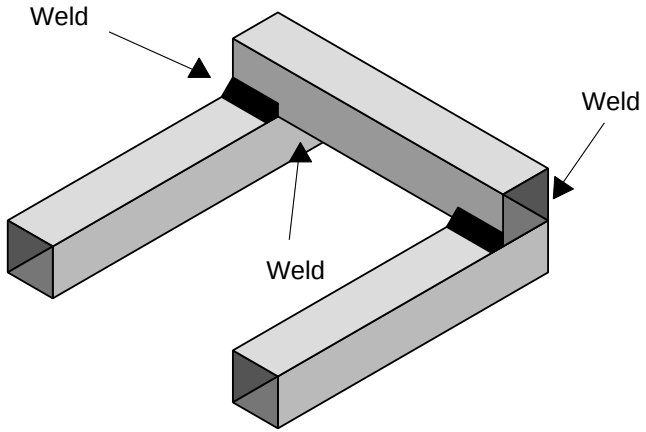

Figure 5: welding of frame cross piece.

Hammer two nails through each of the pads in the positions shown in the drawings. With some timbers you may need to drill holes for the nails to avoid splitting or burn the holes with a hot nail. Then cut the nails so that about 30 mm projects from the timber as shown in Figure 9.

5) Now mark the position of the holes required to accommodate the pad nails in the steel tubing. These holes should be 15 mm and 65 mm from the ends of the square tube as shown in Figure 7. Blow the holes through with the welder at maximum current setting or use an angle grinder or file or hacksaw.

6) Next you can weld on the pad pivots blocks as shown in

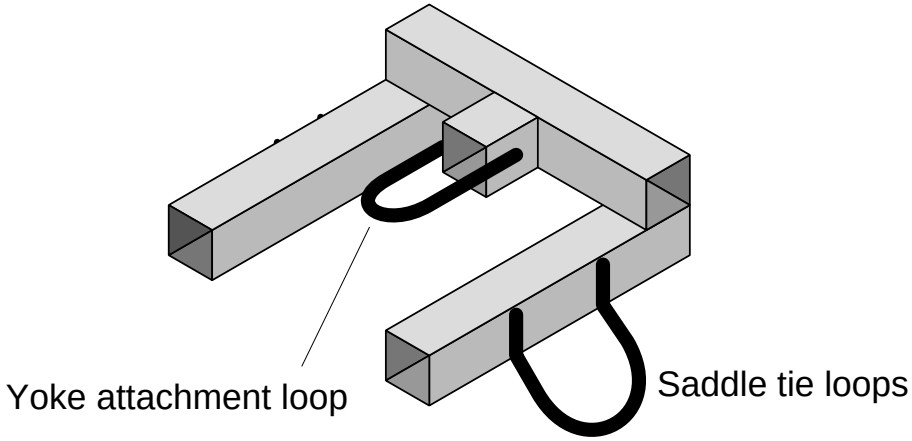

Figure 6: links and yoke loop welded to U- frame.

Figure 7.

7) Now put the nails through the blown holes and weld a piece of nail across the ends of the nails as shown in Figure 10. Welding down inside the tube looks difficult but skilled workers can weld the pads in about one minute.

   An alternative way of doing it is to cut slots 70 mm long along the corners where the holes would be as shown in Figure 8. The slots should be 8 mm wide so that the nails are very loose in them. Make up the pads as shown in Figure 9, put the nail loop into the slot in the right place and weld the pad pivot blocks into place across the slot so that they are in the same place as in Figure 7.

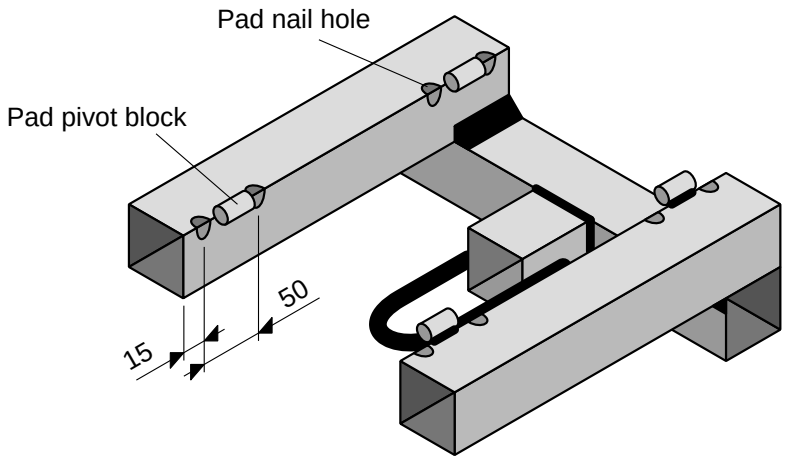

Figure 7: pad nail hole positions and pad pivots.

8) Next you need to make up the six straps to hold the 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.

9) 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.

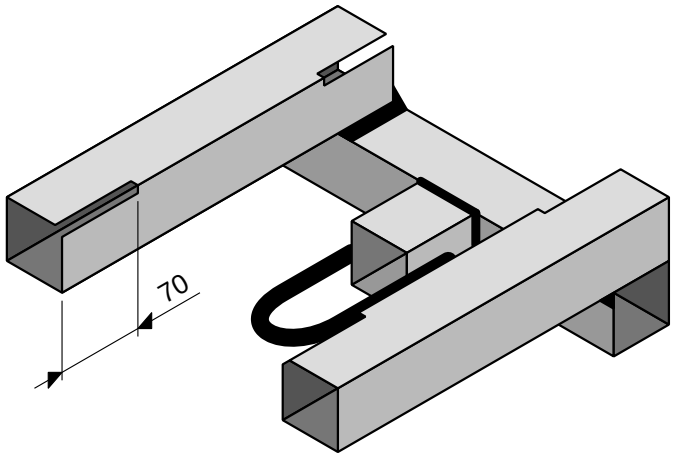

Figure 8: pad nail slots.

10) 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. Make the slots in the ends with a grinder and welder and file. Weld the central tie loop shown in the drawings.

11) Cut two rubber yoke fixing pins and the buffer pads to the shape shown in the drawings.

12) 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.

13) Paint and creosote the saddle. 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 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

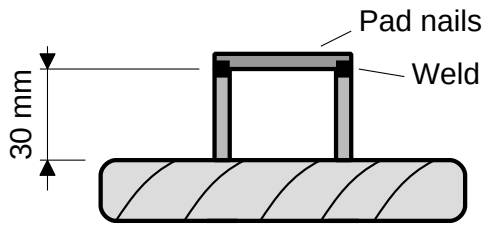

Figure 9: welded pad nails.

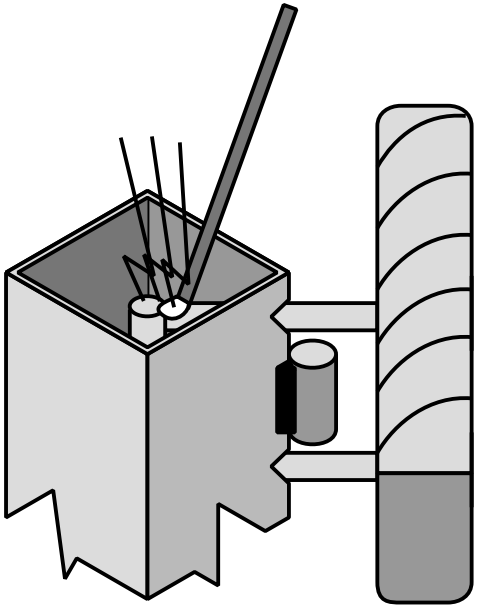

Figure 10: welding re-bar to frames for wooden load pads.

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. Make sure that the breaching strap is pulled up high so that it does not rub the backs of the legs. But it should not be so high that the animal cannot defecate. Tie a piece of thin rope across the animal's back between the rings of the strap to hold the strap up.

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 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.

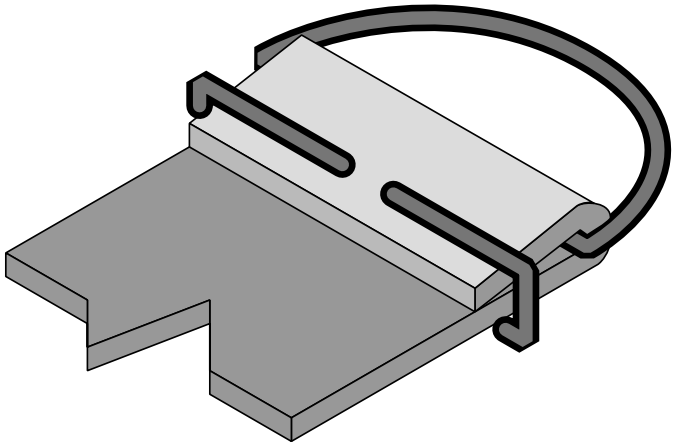

Figure 11: D rings for straps made from re-bar.

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

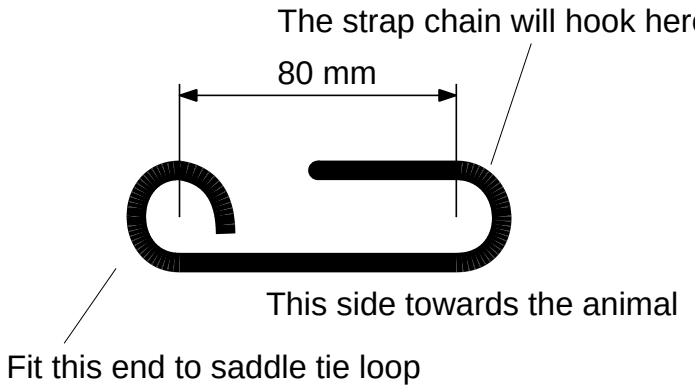

Figure 12: chain hooks for straps.

get practised.

7) Get the two donkeys in position side by side and put the yoke across the two saddles pushing the slots in the yoke over the loops on the saddles as shown in Figure 1. Secure the yoke by pushing the rubber pins into place.

8) Lastly connect the cart to the centre of the yoke using the 400 mm long rubber strap, the 80×15 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.

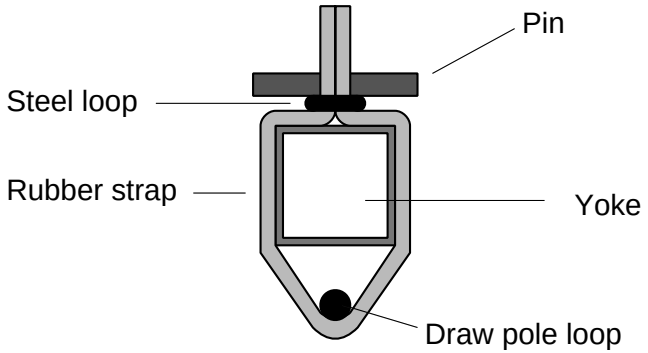

Figure 13: using rubber strap to join cart draw bar loop to yoke.

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.

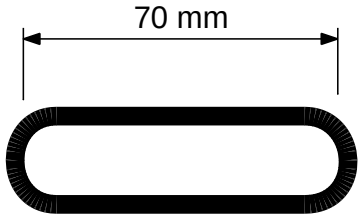

Figure 14: loop for yoke to drawpole strap (R6 steel bar).

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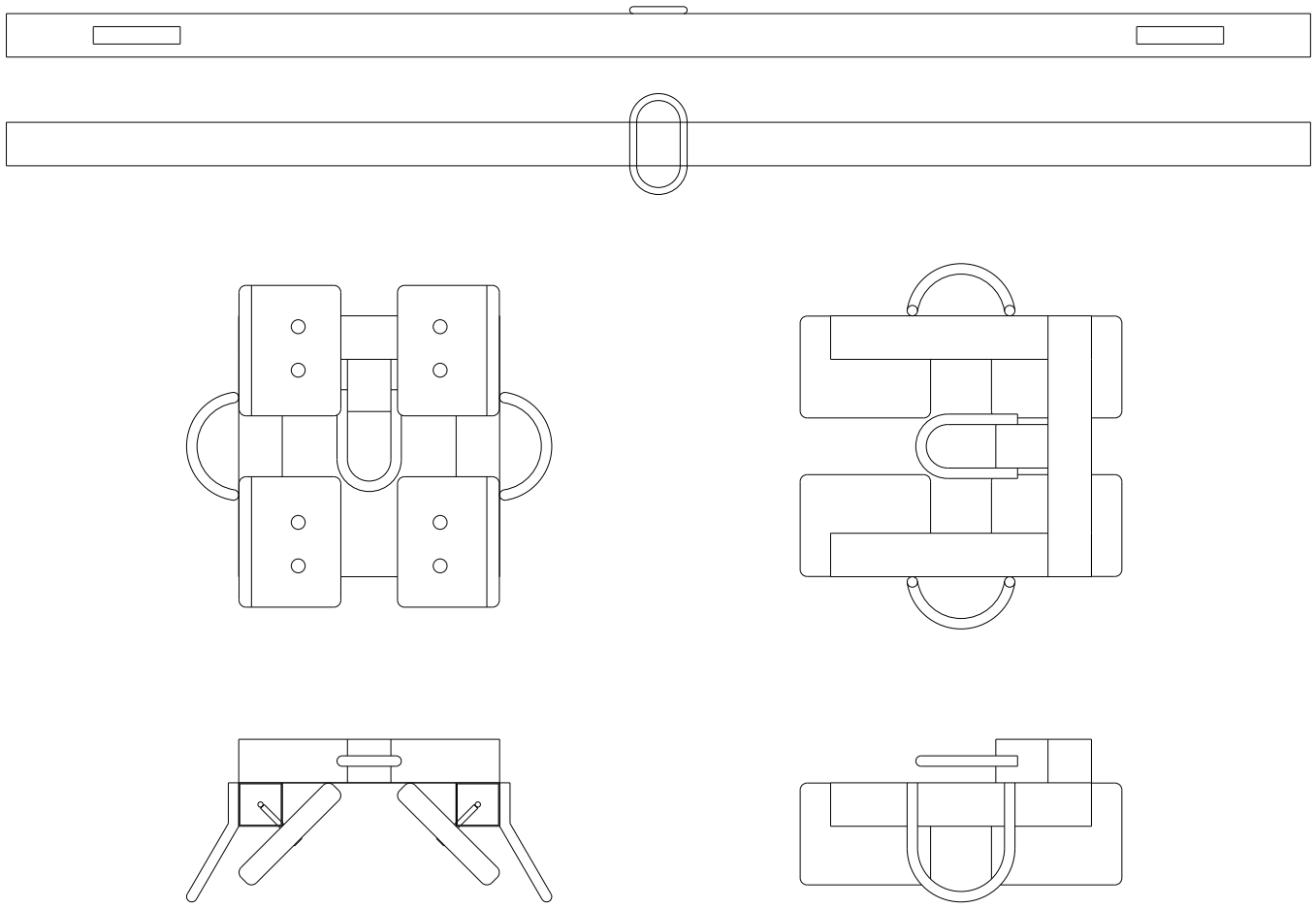
The DTU would also like to thank Dr Pascal Kaumbutho of KENDAT in Kenya and Mr Joseph Mugaga of TOCIDA in Tororo, Uganda for their very considerable help with this project. A large number of other people and organisations have contributed to the success of the project, most notably Mr Anthony Ndungu 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 Kajaido, Mr Patrick Gitari in Wanguru and Mr Mathew Masai in Machakos for their assistance.



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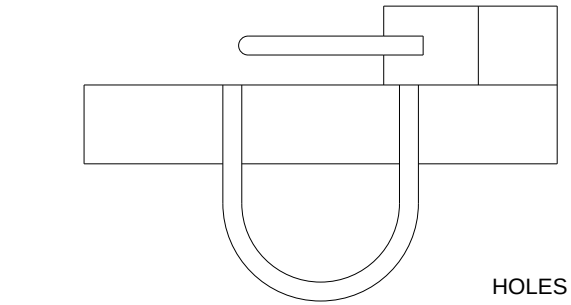
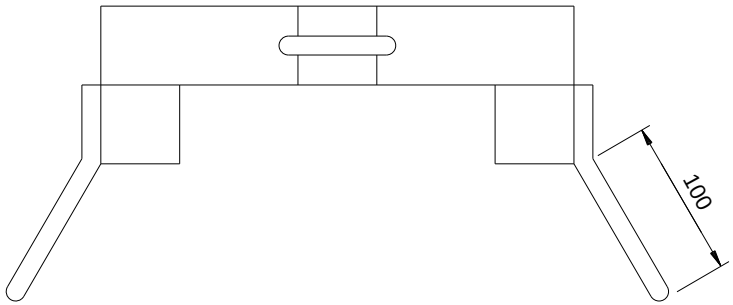
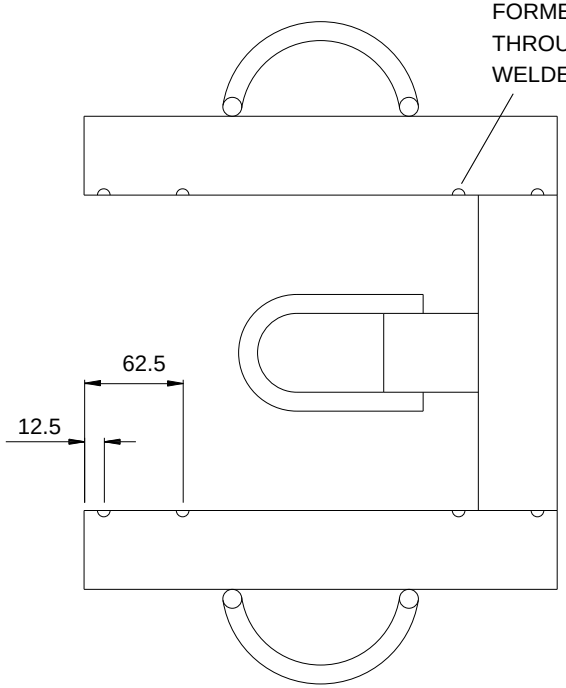
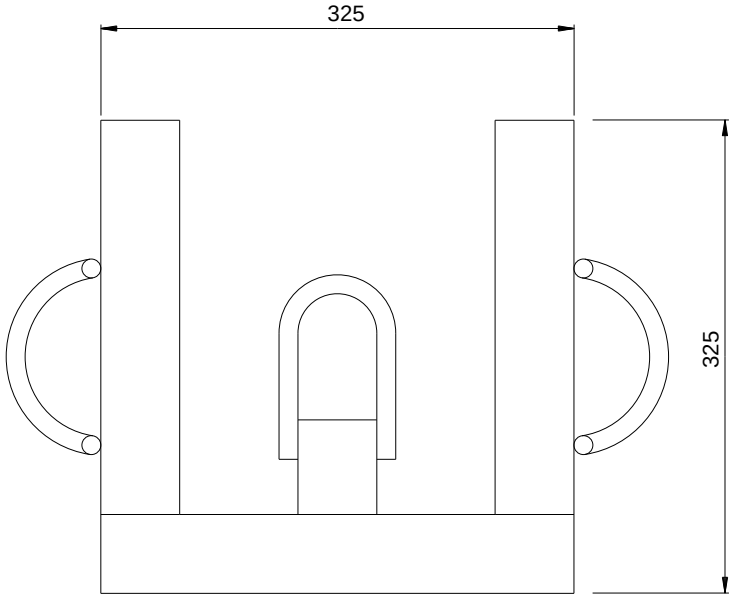




HOLES FOR PADS FORMED BY BLOWING THROUGH WITH WELDER



PLAN VIEW FROM BELOW



PLAN VIEW FROM ABOVE

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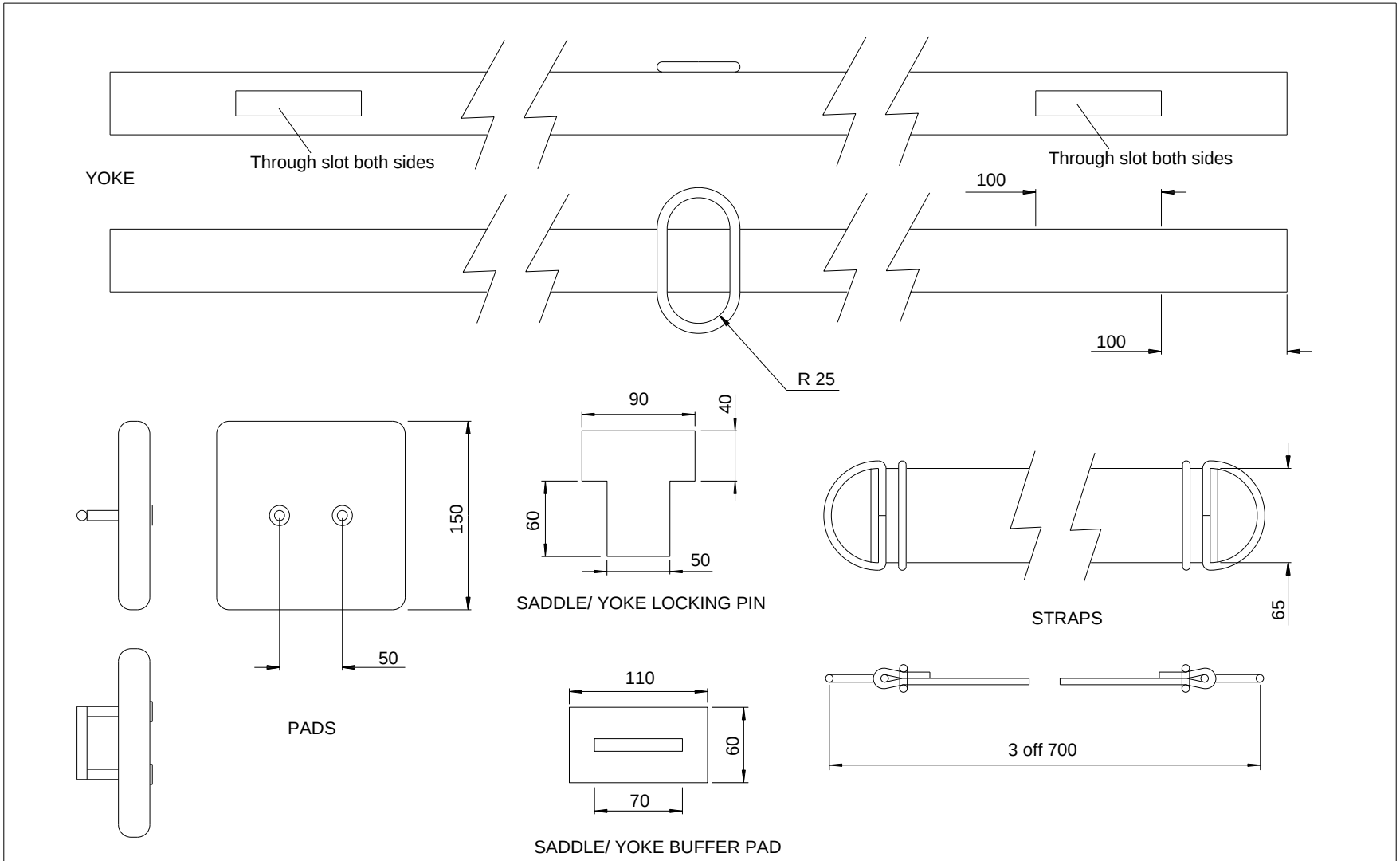

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