



# ANIMAL DRAWN CARTS

3-16 April 2005  
Rustenburg  
North-West Province  
Republic of South Africa

**Jaakii**

Ibo

**Donkie**

Afrikaans

**Lü**

Chinese

**Burro**

Spanish

**Eşek**

Turkish

**Dangnagui**

Korean

**Idonki**

Zulu

**Hamor**

Hebrew

**Âne**

French

**Esel**

German

**Punda**

KiSwahili

**Ass**

American

**Donkey**

English

**Åsna**

Swedish

**Ghadda**

Hindi

**Măgar**

Romanian

**Gadhado**

Gujarati

**Hemar**

Iraqi

**Roba**

Japanese

**Esele**

Tswana

**Ezel**

Dutch/Flemish

**Kahzida**

Malayalam/Tamil

## RURAL TRANSPORT



Despite a wide spectrum of transport technologies, in rural areas much transport involves either walking or carrying. Rural people need intermediate means of transport that increase capacity & reduce human drudgery at an affordable cost.  
SSATP World Bank Group

## GROUP WORK

Three focus areas

- Harnesses and hitching
- Low capacity carts
- High capacity carts
  
- Each section dealt with the development of concepts and solutions
- The groups also considered carefully the economic aspects related to how these systems could be implemented

## DESIGN PROCESS

Research – village, gathered data and experts

Dissemination of information

Conceptual work

Village feedback session

Refinement

Kuruman carters were used to assist in the understanding of concepts, technical feedback and direct input when trying out new concepts

Further village feedback session

Referred back to Kuruman carters and villagers

Solution production

## BRIDLES, HARNESSING & HITCHING



Humane husbandry, handling, harnessing & use of working animals is the basis from which their power emanates and can be effectively used in a sustainable manner to the benefit of the owners, the animals & the community at large.

Morgane James , SPCA

## PROBLEM STATEMENT

- Commercially available harness and hitching systems are currently too expensive
- Yoke Braking system is hard on animal neck
- Environment is harsh on harness materials
- Harness systems are often made by owner with minimum technology (cutting, sewing by hand, weaving wire)
- Good materials for home made harnesses are not readily available or inexpensive enough
- Social resistance to new harness systems (SPCA and research experience)
- Loose and neglected harnesses cause problems
- Varying donkey sizes when attached to cart



## DESIGN BRIEF

To offer improvements:

- hitching system (from donkey to cart)
- harnesses system (on donkey)

Reasoning:

- Improve donkey welfare through good products
- Optimise energy transfer between the donkey and cart
- To offer recommendations on best systems

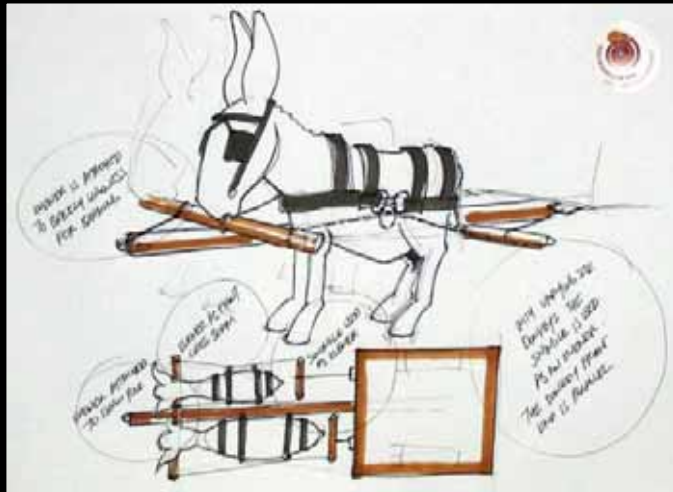
## HITCHING

Very difficult to develop hitching solutions:

- Social resistance to new harness systems
- Materials required to make decent systems are expensive
- Few craftsmen in village that can assist with such manufacture
- Good systems include a lot of components

Design solution

- Looked at a good system (Peta Jones)
- Looked at yoke braking system
- Developed our own minimum component system that requires testing



## SOLUTION

Positive:

- Fewer components
- Cost is lower
- Simple hitching assembly

Negative:

- Still needs to be tested

## HARNESSING

Aims:

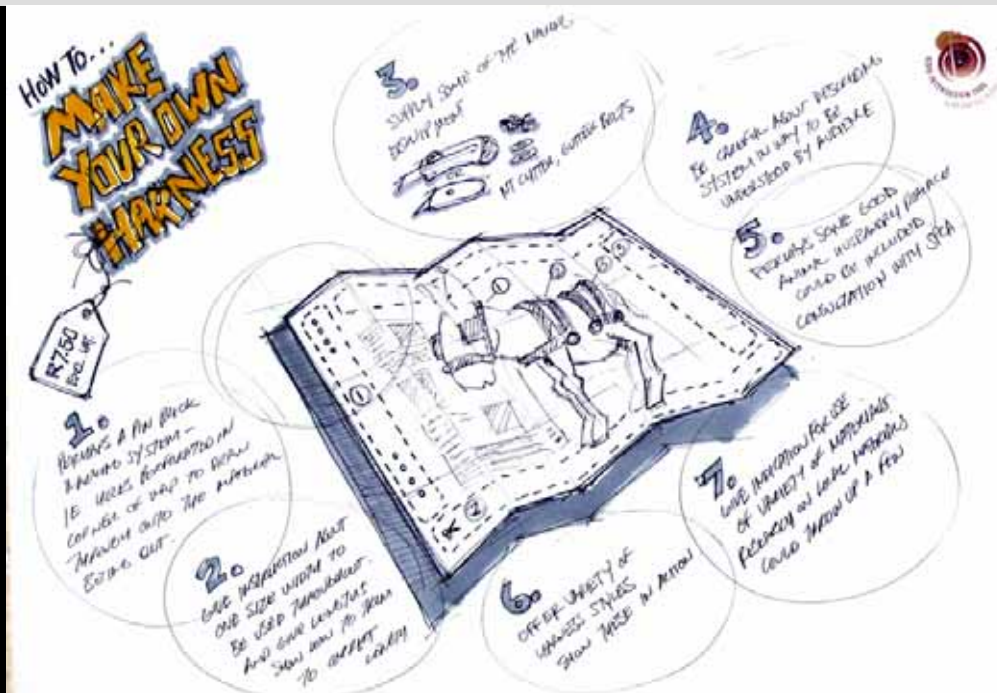
- Economically viable
- Skills transfer possibilities
- Easy adoption

Solutions:

- "Make Your Own Harness System"
- "Pre-punched Harness System"

## "MAKE YOUR OWN HARNESS SYSTEM"

- Allows for a pattern making of the harness and bridle by the cart owner
- Carters met during the Interdesign all repaired their own carts, and most made their own harness systems
- The guide would also have animal husbandry issues included and assist with animal care issue
- The system would be sensitive to regional material availability and try to work with materials from the carters local area





## “PRE-PUNCHED HARNESS SYSTEM”

- Manufactured from conveyer belt material
- Reflective paint on the harnesses (visibility at night for safety)

Booklet:

- DIY pictogram assembly instructions for harnessing donkeys
- Clear descriptions of best hitching and harnessing systems
- Information on animal husbandry and harness maintenance

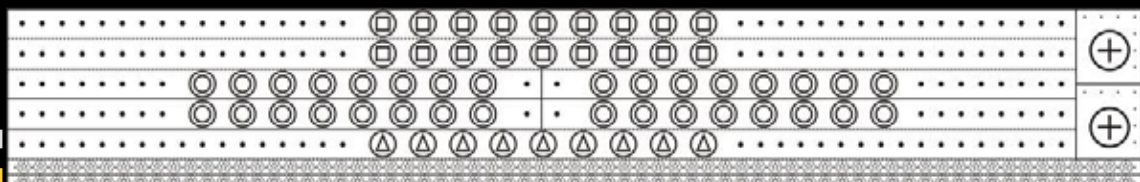
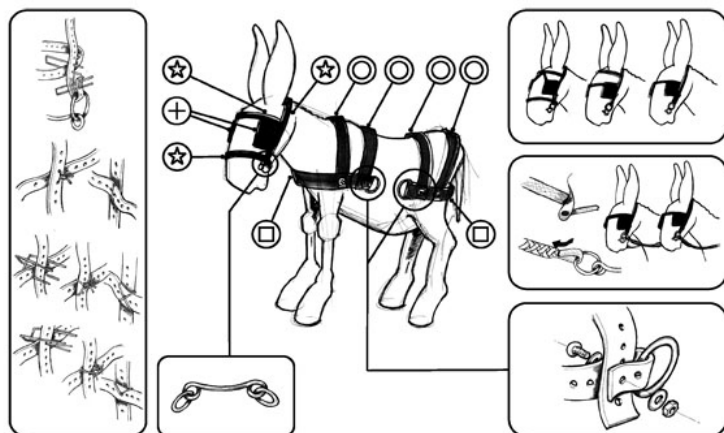
Fastening:

- Only equipment required for assembly: pliers and screw driver

### Pre-punched package (single donkey harness)

1 X conveyer mat  
1 X booklet  
12 X gutter bolts  
12 X lock nuts  
24 X washers  
1 X bit  
4 X rings (for traces)  
7.5 m nylon rope  
3 m wire

### Bridle and Harness Assembly





## CONCLUSION

### “Make Your Own Harness System”

- Sponsored and distributed by SPCA

### “Pre-punched Harness and Bridle System”

- Costs offset through advertising space on mat
- Minimum cost of approximately R 35 per donkey
- First prototype to be field tested next week in Hammanskraal

## LOW-CAPACITY CARTS



Donkeys and small carts have come to be very important for reducing the drudgery in rural communities – particularly for hauling water, firewood, groceries, people, and for the transportation of live giving harvests.

“Empowering Farmers with Animal Traction” Kaumbutho et al.

## PROBLEM STATEMENT



Access to efficient and adequate transport in and around the village can contribute to increased economic opportunity, lowered domestic workloads, and the ability to access to essential services.

High Capacity

Animal Drawn Carts

Low Capacity

Refurbish

•Legislated standards

Plain Jane

•Locally made

Tin Lizzy

•Locally assembled

Fancy Pants

•Mass manufactured

Low Capacity

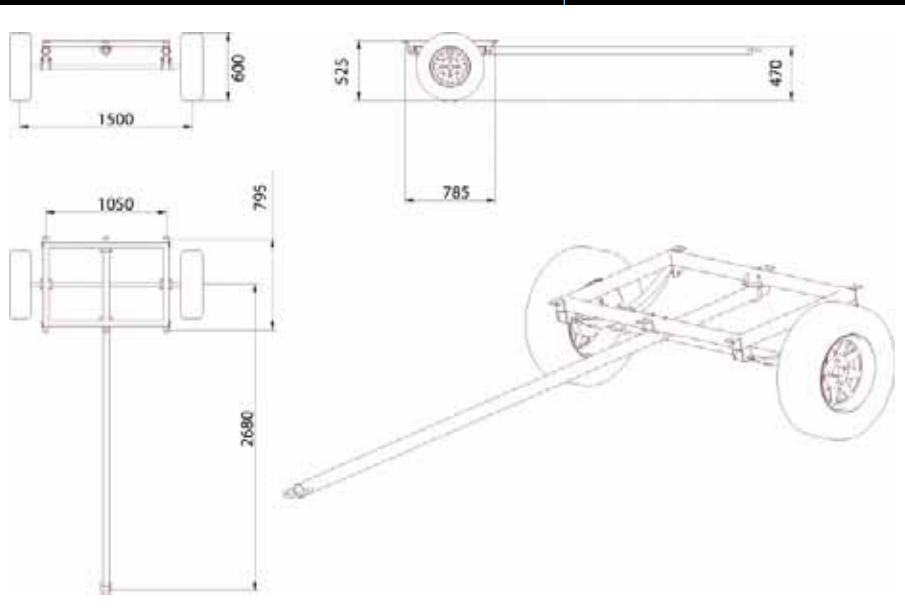
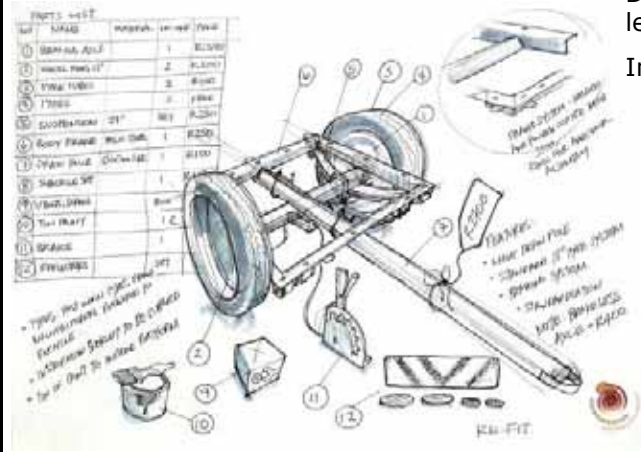
CART OPTIONS

# Refurbish

Pre-assembled kit for refitting existing carts

Designed to meet legislated standards

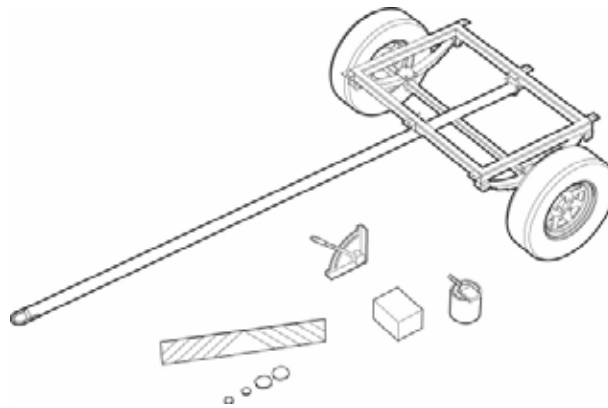
Improved safety



Kit contains:

- Pre-assembled chassis
- Brake system
- Fasteners
- Paint
- Chevrons and reflectors

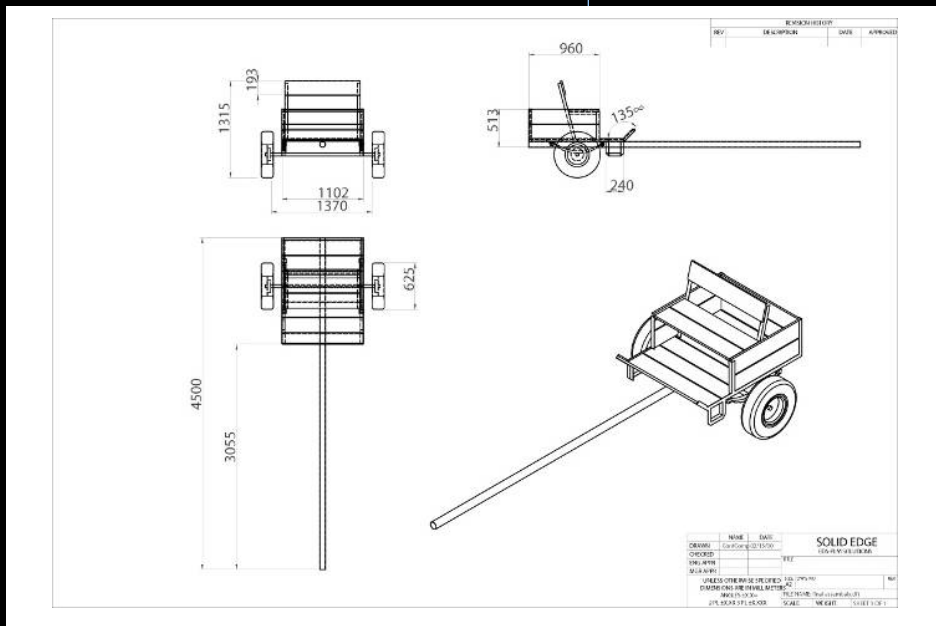
**Total cost: R2700**



## Plain Jane

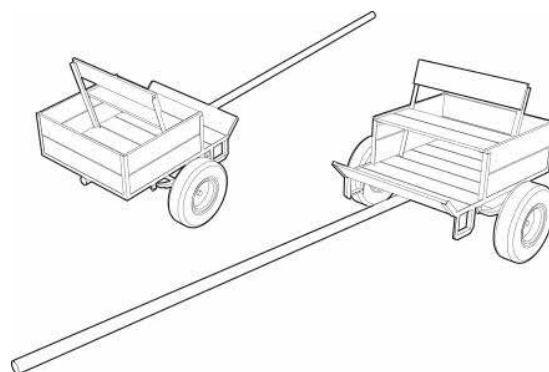
Locally manufactured  
Use of local materials  
Relatively inexpensive  
Easy to maintain  
Durable





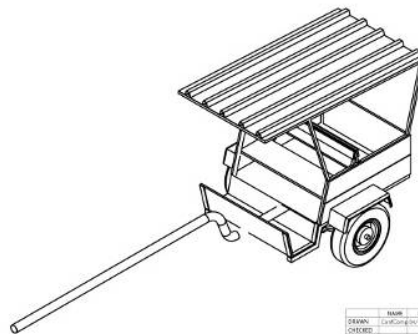
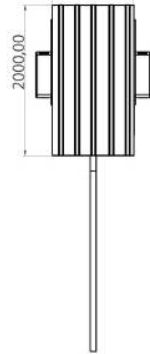
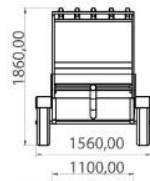
- Angle iron frame
- Wood plank body
- Removable tailgate
- Plank bench seat
- Flat loading bed

• **Total cost: R3396**



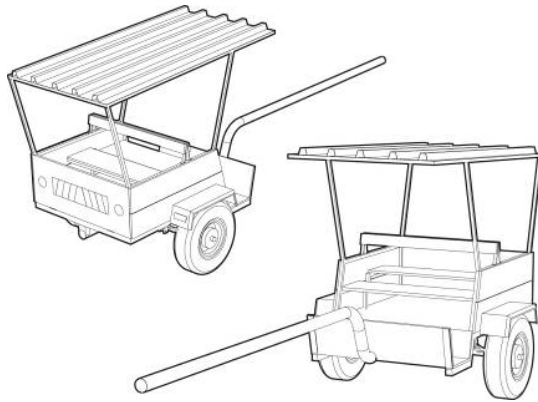
# Tin Lizzie

Industry manufactured  
Locally assembled  
Designed to be maintained locally  
Higher comfort standards  
Family-oriented



REVISION HISTORY			
REV.	DESCRIPTION	DATE	APPROVED

NAME	DATE	SOLID EDGE	
DRAWN	DATE	BY	CHK
CHECKED	DATE	BY	CHK
REV. DATE	DATE	BY	CHK
APPROVED	DATE	BY	CHK
DIMENSIONS ARE IN MILLIMETERS		SCALE	SHEET 1 OF 1
20% (A3) 1:10, 2000		SCALE	WEIGHT



- Square tube frame
- Corrugated metal roof
- Hinged tailgate
- Foldable back seat
- Mudguards
- Step-down chassis
- Chevrons and reflectors

• **Total cost: R 5660**

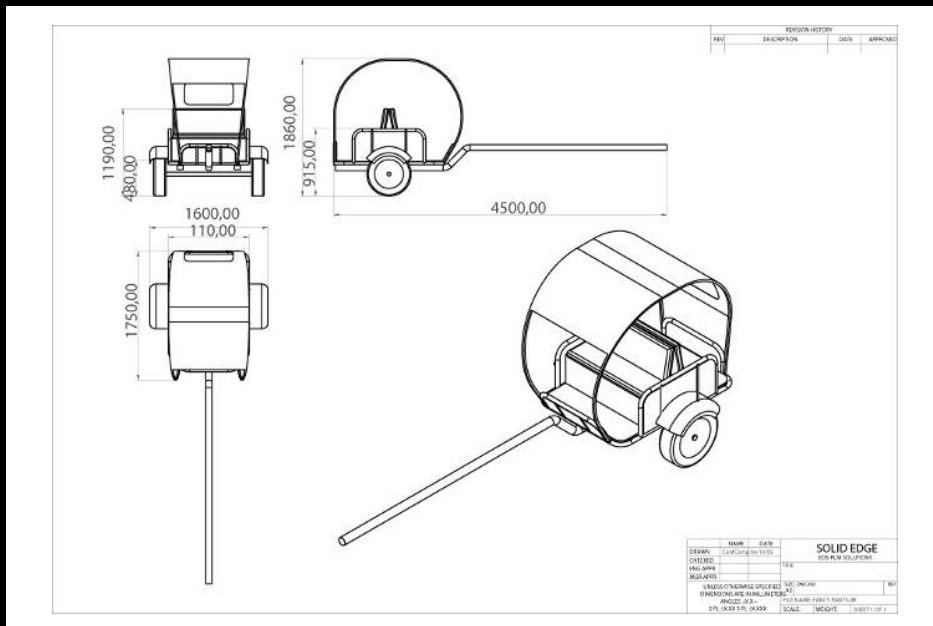
## Fancy Pants

Mass manufactured  
Primarily for people  
transport

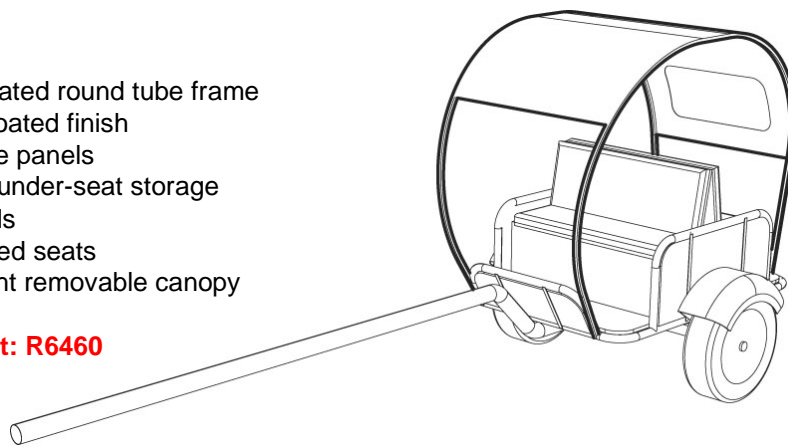


ht frame  
age oriented  
st comfortable model  
hbest price point

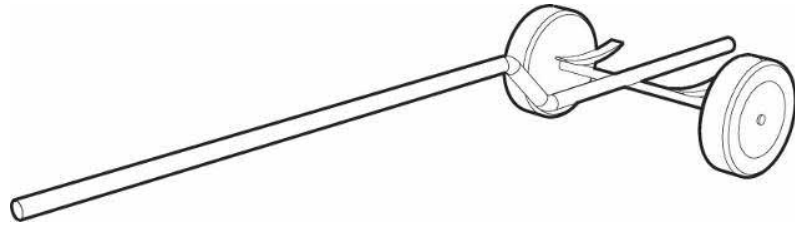




- Pre-fabricated round tube frame
- Powder coated finish
- Wood side panels
- Lockable under-seat storage
- Mudguards
- Upholstered seats
- Lightweight removable canopy
- **Total cost: R6460**



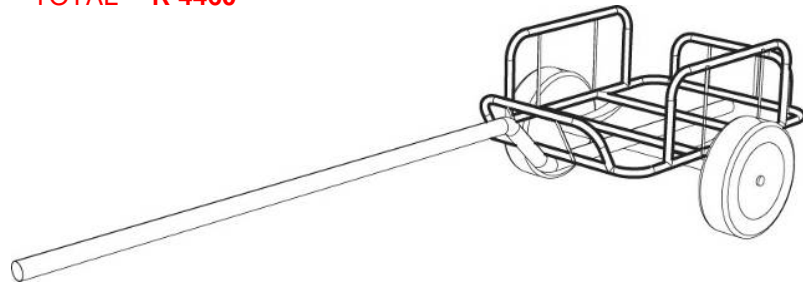
Wheels, axle & draw pole : R 2710



Wheels, axle & draw pole : R 2710

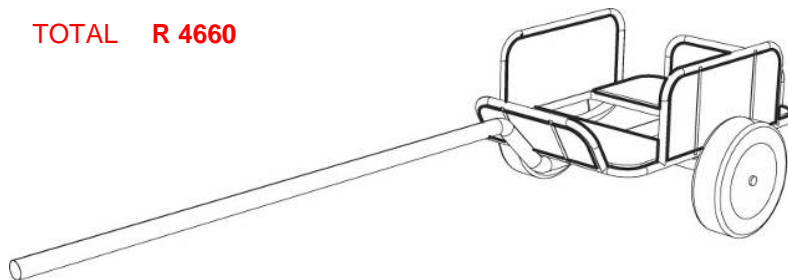
Frame & powder-coating : R 1750

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TOTAL R 4460



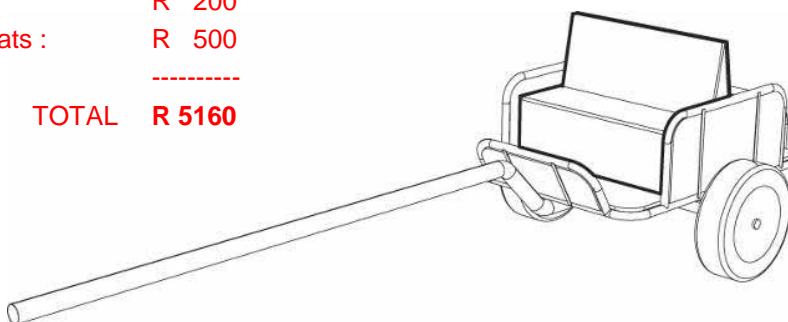
Wheels, axle & draw pole : R 2710  
Frame & powder-coating : R 1750  
Wood planks : R 200

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TOTAL R 4660



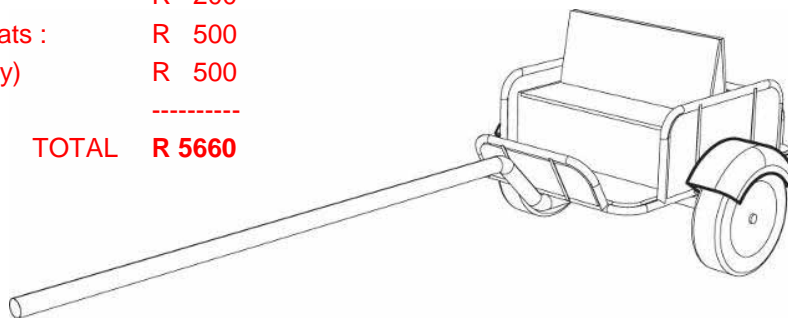
Wheels, axle & draw pole : R 2710  
Frame & powder-coating : R 1750  
Wood planks : R 200  
Storage box & seats : R 500

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TOTAL R 5160



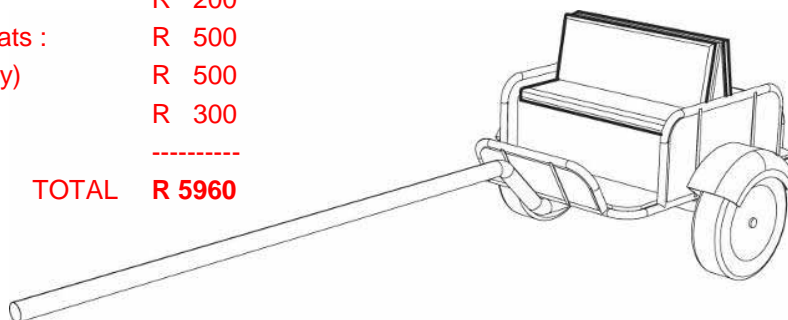
Wheels, axle & draw pole : R 2710  
Frame & powder-coating : R 1750  
Wood planks : R 200  
Storage box & seats : R 500  
Mudguards (safety) R 500

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**TOTAL R 5660**



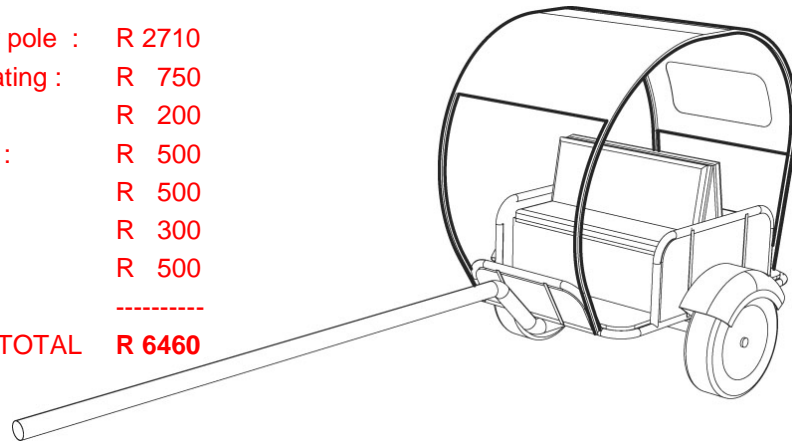
Wheels, axle & draw pole : R 2710  
Frame & powder-coating : R 1750  
Wood planks : R 200  
Storage box & seats : R 500  
Mudguards (safety) R 500  
Cushions : R 300

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**TOTAL R 5960**



Wheels, axle & draw pole :	R 2710
Frame & powder-coating :	R 750
Wood planks :	R 200
Storage box & seats :	R 500
Mudguards (safety)	R 500
Cushions :	R 300
Canopy & tubes :	R 500

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**TOTAL R 6460**



## WOMEN AND TRANSPORT



It is about women gaining control over the means to make a living. It is about women lifting themselves out of poverty & vulnerability. It is about women achieving economic & political empowerment within their homes, their villages, their countries.

UN Dev Fund For Women

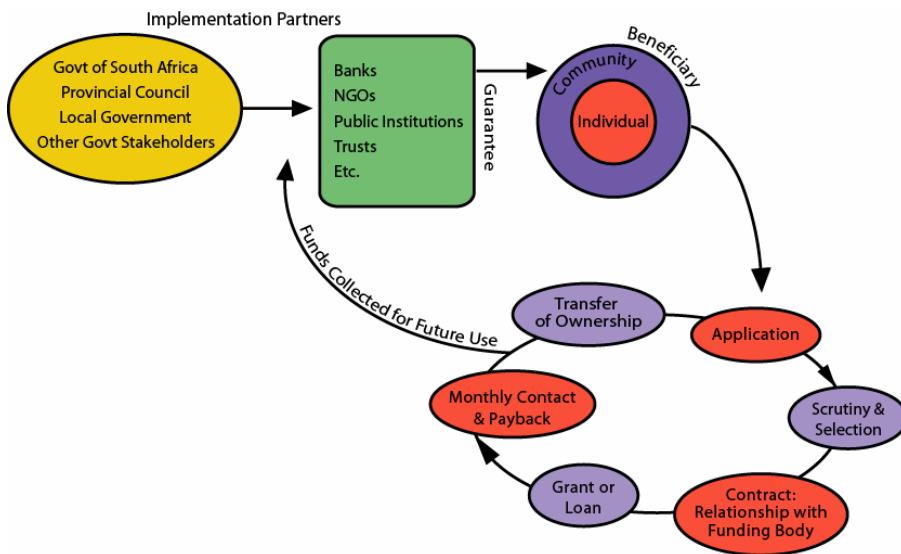
## SUSTAINABILITY MODEL: MICRO-CREDIT PROGRAMME

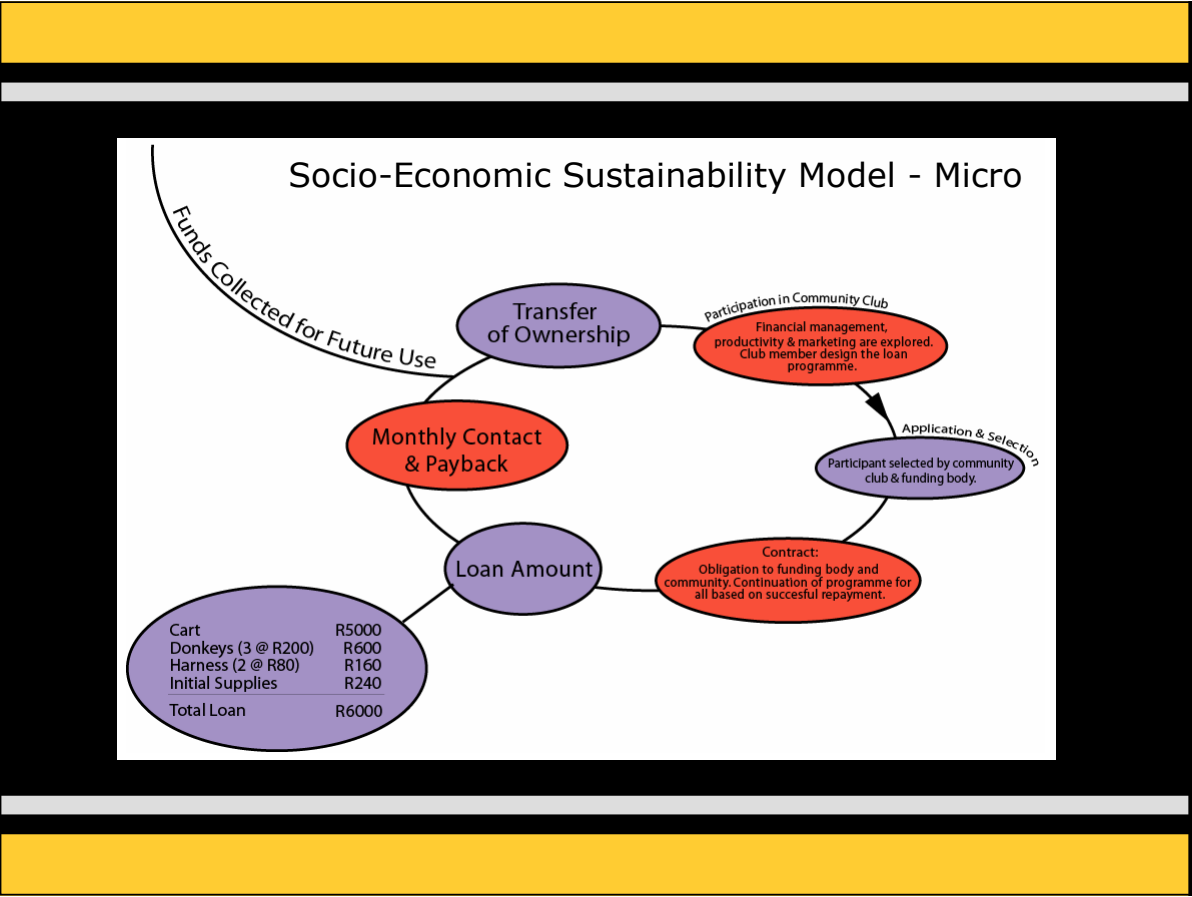


### Benefits

- Accepted method of poverty alleviation
- For women who would not normally have access to credit
- Increased access to community services
- Potential changes in communities perceptions of women's roles
- Improvement in women's role in household

## Socio-Economic Sustainability Model - Macro







Did you know that DONKEY CARTS can provide a viable solution to high-capacity rural transportation needs ?

**Serious ?**

**Seri – ass !**

**Seri – Ass ?**

**SERI-ASS DONKEY CARTS...**

### **EXISTING HIGH-CAPACITY PROTOTYPES**

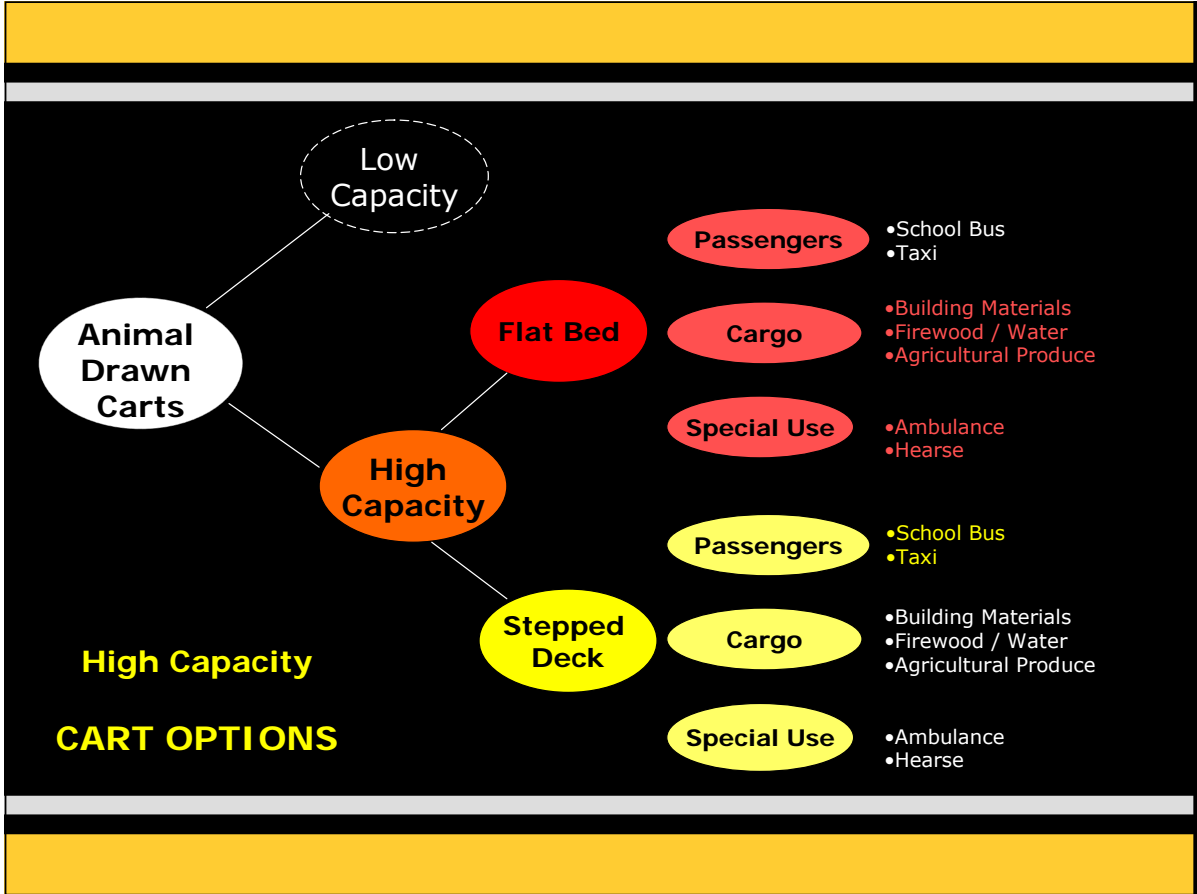


## PROBLEM ANALYSIS

PROBLEMS	PRINCIPLES	INITIAL DESIGN	FEEDBACK	SOLUTIONS
Acceptability	•Cultural sensitivity	practicality	"Cool" factor	Upgrade the existing products/prototypes
Accessibility	•Design-for-all	ingress/ egress	Elderly/Disabled	Lower deck height/steps
Aesthetics	•Attractiveness	branding	Popular brands	Provide spaces for promotional graphics
Affordability	•Low-cost	appropriateness	Simplicity	Government subsidies needed
Comfort	•User-friendliness •Ergonomics	shelter/seats	Canopies/Cushions?	Provide canopies

## PROBLEM ANALYSIS (continued)

PROBLEMS	PRINCIPLES	INITIAL DESIGN	FEEDBACK	SOLUTIONS
Durability	•Ruggedness	structural integrity	Metal & some wood	Durable finishes & robust fittings
Flexibility	•Modularity •Design for disassembly	multi-functional	Cargo & People	Removable & adjustable features
Maneuverability	•Stability	weight	Low centre-of-gravity	Optimized chassis
Safety	•Accident prevention	visibility	Passenger safety	Omit sharp edges
Sustainability	•Technology transfer	use of local resources/skills	Export potential	Appropriate production methods
Welfare of Draft Animal	•Humane treatment •Good husbandry	Weight limitation/ distribution	Avoid overloading	Provide food storage & weight indicator



**ERGONOMICS**

- Overall Dimensions
- Accessibility
- Comfort
- Safe Edges
- Functional Accessories
- Textures

**SAFETY FEATURES**

- Reflectors
- Handbrake
- Indicators
- Mirrors
- Safety Strapping



## PAYLOADS

- People
- Bricks, Wood, Sand & Stone
- Food
- Water
- Furniture
- Scrap metal

## FUNCTIONALITY

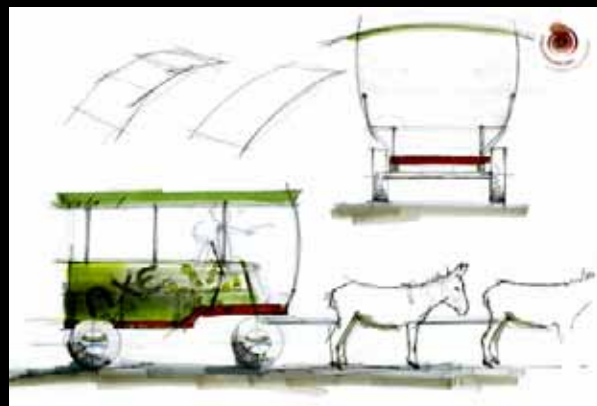
- Loading Methods & Means
- Ingress & Egress
- Fastening Methods
- Stability
- Utility Holders

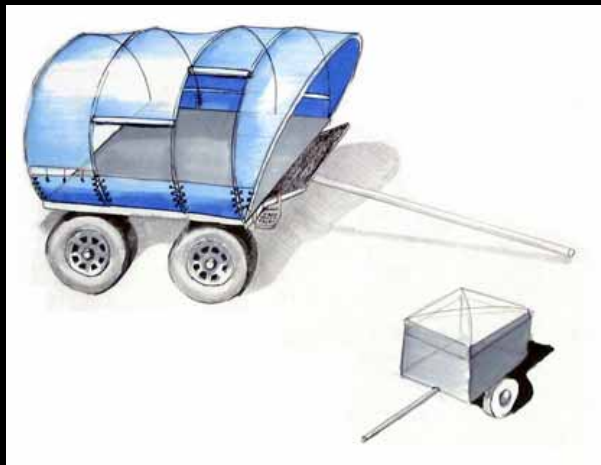
## AESTHETICS

- Branding " The COOL Factor "
- Graphic Surfaces
- Colour choice & Surface finishes

## CONTROLS/ DISPLAYS

- Radio
- Hooter
- Indicators
- Lighting





## SHELTER

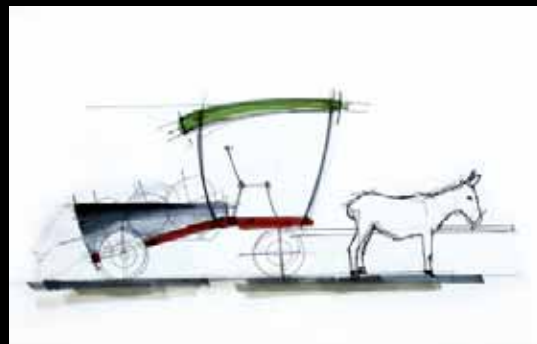
- Canopy (ease of use & flexibility)
- Side Walls
- Drainage
- Windscreen

## MATERIALS & PROCESSES

- Rubber Weaved floor mats
- Polyester Web Hammock Seating
- Woods, Metals & Plastics
- Welding & Standard Fasteners

## STORAGE

- Multi-Purpose Utility Spaces
- Toolbox & First-Aid Kit
- Water Containers
- Fold Away Features (e.g. seats, canopy, etc)
- Animal Feed



## ECONOMIC COMPARISONS

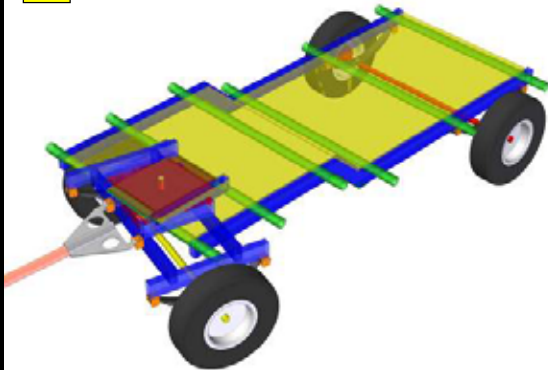
Modes of Transport	Purchase Price	Maintenance Cost/Year	School Fee Income	Additional Income
• Bicycle	R2400 (6 bicycles)	R600 (6 bicycles)	R0	R0
• Donkey Cart	R2880	R1000	R0	R4000-8000
• <b>(upgraded)</b>	<b>R10000</b>	<b>R2000</b>	<b>R2400</b>	<b>R5000-10000</b>
• Cheap Bakkie	R12000	R6000	R2400	R20000-40000

## SOCIAL COMPARISONS

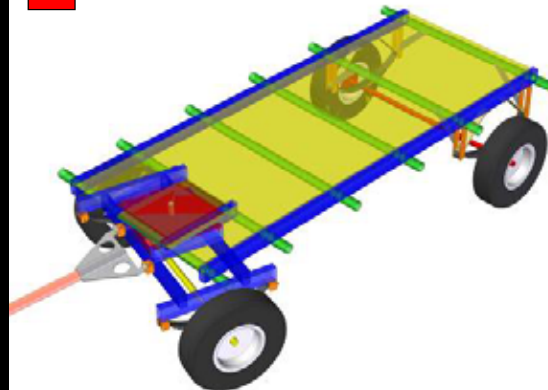
Modes of Transport	Maintenance Skill Level	Travel Conditions	User Energy Consumption	Cool Factor Perception
• Bicycle	Low	Poor	High	Medium
• Donkey Cart	Low	Poor	Low	Low
• <b>(upgraded)</b>	<b>Medium</b>	<b>Good</b>	<b>Low</b>	<b>High</b>
• Cheap Bakkie	High	Good	Low	High

## HIGH-CAPACITY CHASSIS OPTIONS

 Stepped Deck

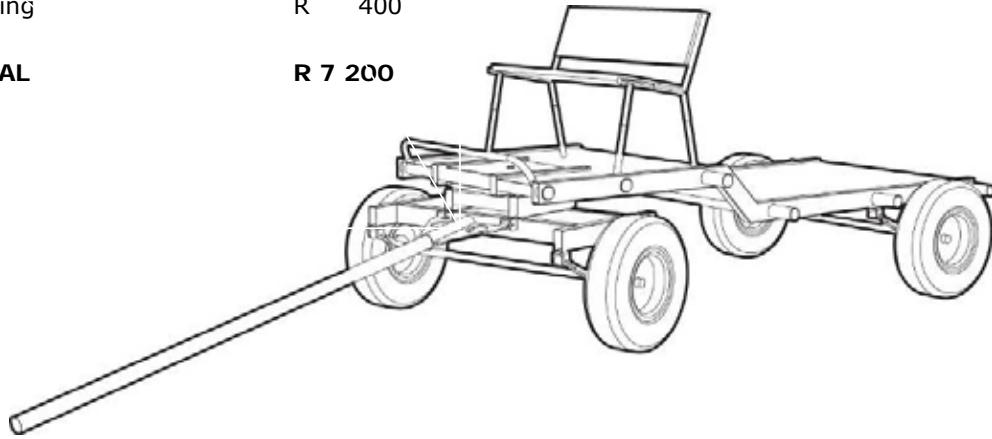


 Flat Bed



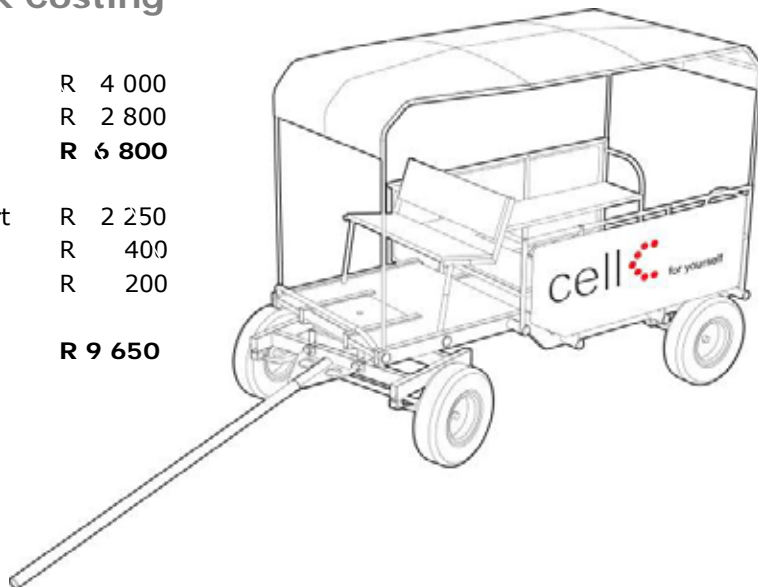
## Stepped Deck Costing

Chassis Structure	R 4 000
Moving Gear	R 2 800
Seating	R 400
<b>TOTAL</b>	<b>R 7 200</b>



## Stepped Deck Costing

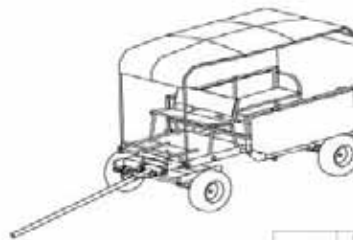
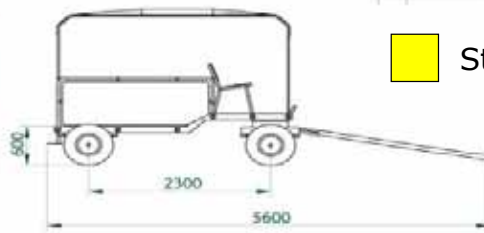
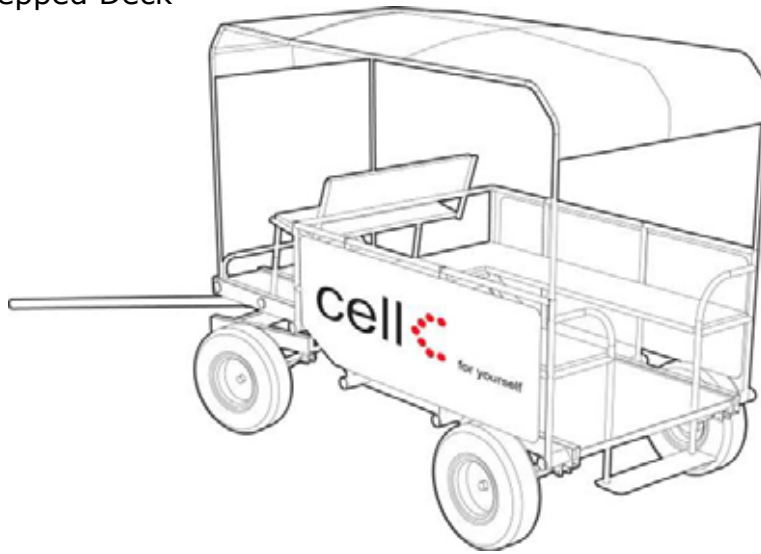
Chassis Structure	R 4 000
Moving Gear	R 2 800
<b>Sub-Total</b>	<b>R 6 800</b>
Side and Canopy Support	R 2 250
Seating	R 400
Roof Canvas	R 200
<b>TOTAL</b>	<b>R 9 650</b>







Stepped Deck



Stepped Deck

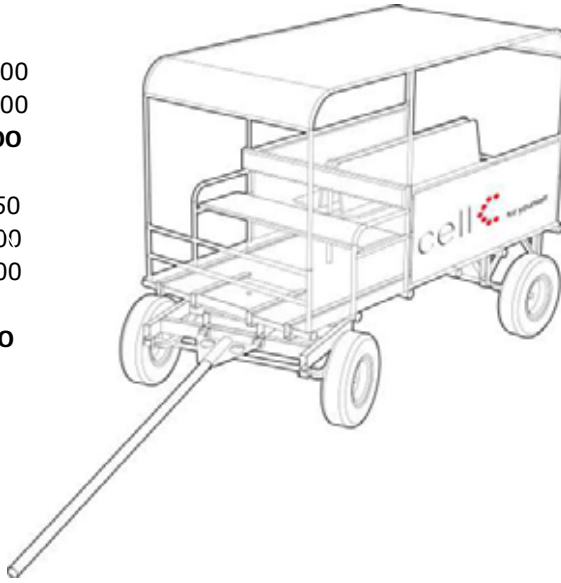
REVISION HISTORY

REV DESCRIPTION DATE APPROVED

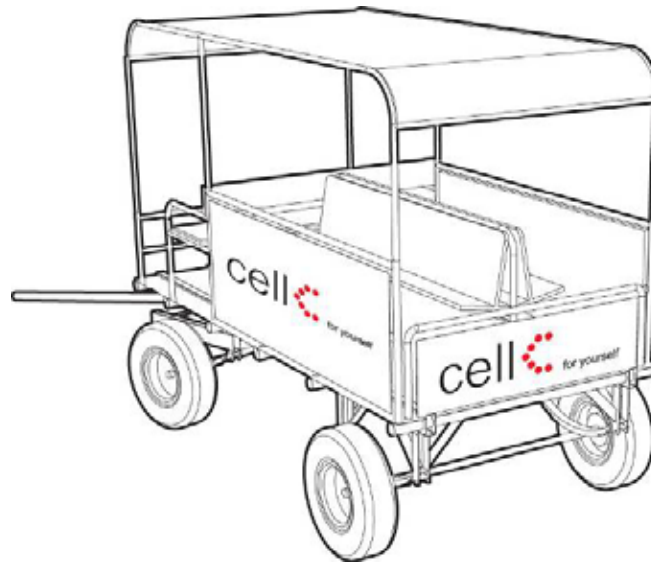
DRAWN	NAME	DATE	SOLID EDGE	
CHECKED	Cur	04/15/05	EDI-PUR SOLUTIONS	
ENGR APPR			SEE	
MGR APPR				
UNLESS OTHERWISE SPECIFIED:			3/8" TUBING	REV
DIMENSIONS ARE IN MILLIMETERS			A3	
ANGLES 2X X=			FILE NAME: FULL PACKAGE DRAFT A3.01	
2 PL. 1X.75 1 PL. 1X.000			SCALE	WEIGHT
			1-SHEET 1 OF 1	

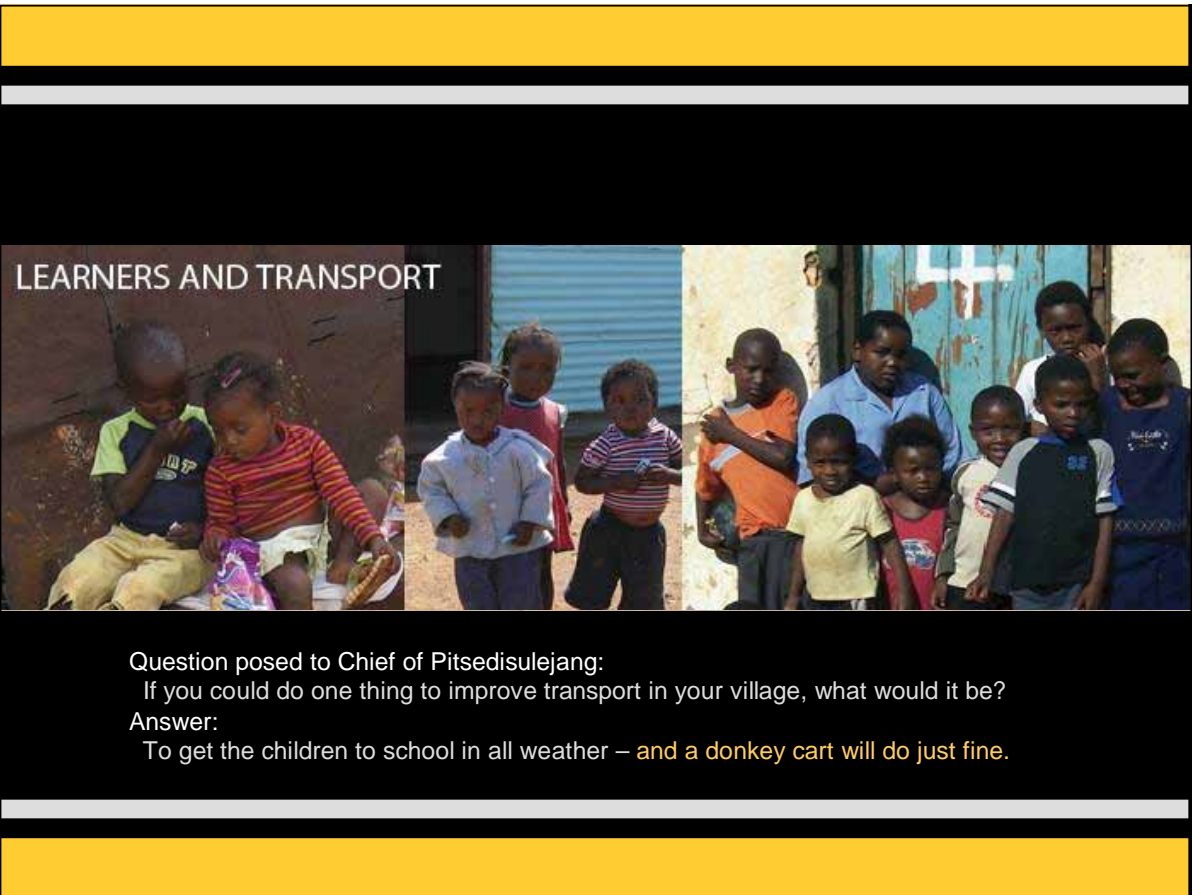
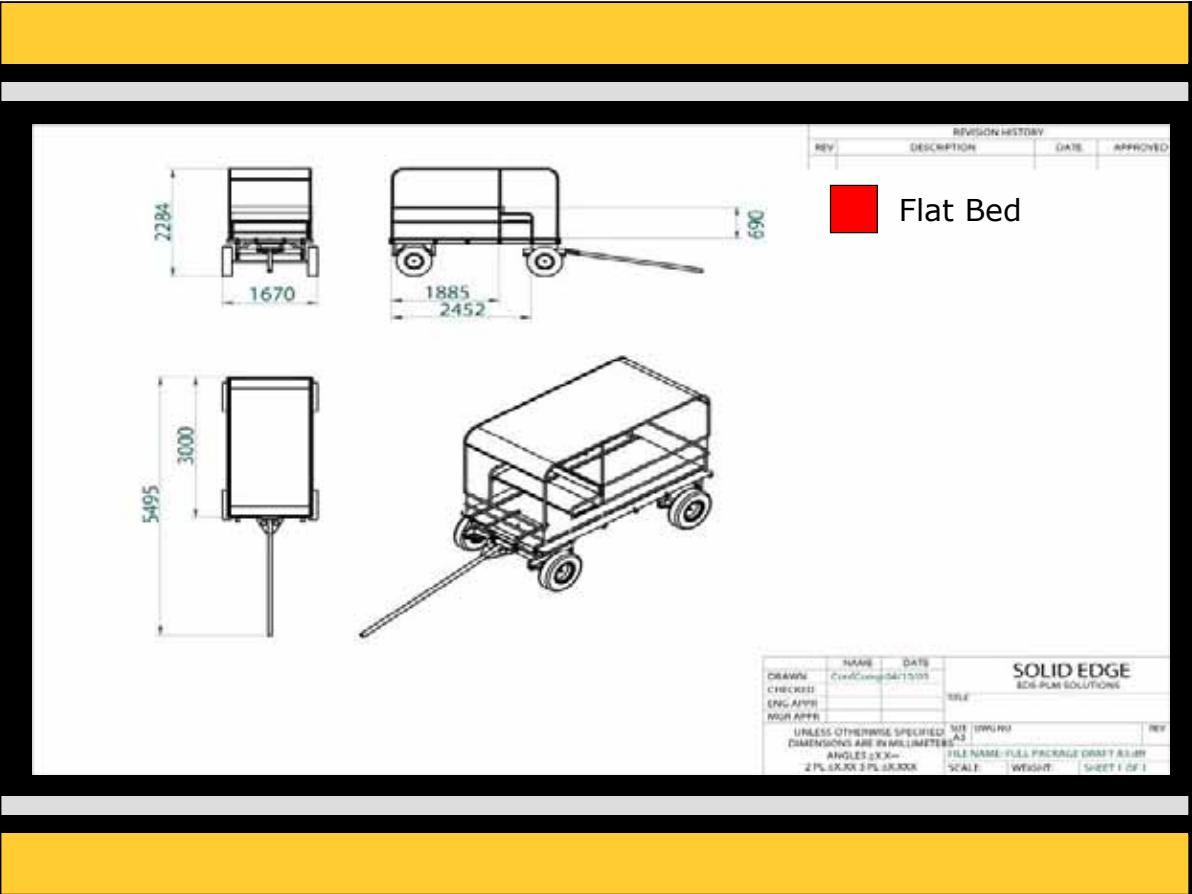
**Flat Bed Costing**

Chassis Structure	R 4 000
Moving Gear	R 2 800
<b>Sub-Total</b>	<b>R 6 800</b>
Side and Canopy Support	R 2 250
Seating	R 400
Roof Canvas	R 200
<b>TOTAL</b>	<b>R 9 650</b>



**Flat Bed**





## SUSTAINABILITY MODEL

6am - 8am

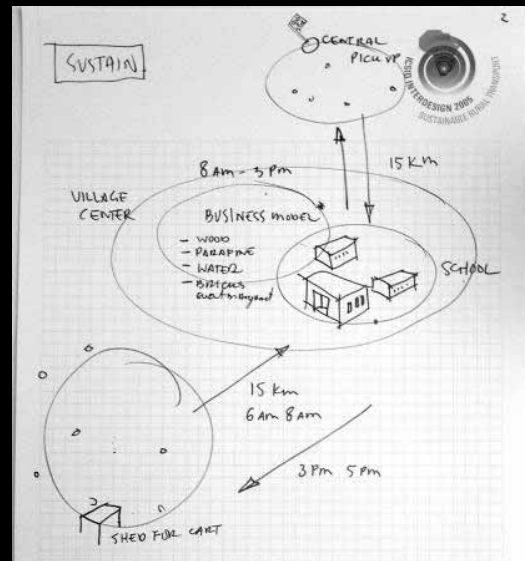
Transport of learners to school  
(50c/child)

8am - 3pm

Transport of goods for operator  
income

3pm - 5pm

Transport of children back home  
(50c/child)



## SUSTAINABILITY MODEL (continued)

Cart and donkeys would be school-owned and supported by outside funding

Operator responsible for:

- Care and maintenance of donkeys and carts
- Transport of learners to and from school

In exchange for:

- Learner transport fees (R 1.00 / child / day)
- Income derived from off-hour economic activity

## MOOD BOARD

### Musicians

- Mzekezeke
- Mandoza
- Zola 7

### Soccer Stars

- Benedict Vilokazi
- Steve Lekoela
- Sibusiso Nzuma

### Brands

- Loxion Kulca
- Network Jeans
- OBR

### Music

- Hip Hop
- Kwaito



## CONCLUSION

## WAY FORWARD

### This is the start...

- Department of Transport to sponsor manufacture of a cart
- Development work still to be done by Industrial Design students
- CPUT and UJ students to manufacture prototypes
- Harnessing and bridle system has been made into a working prototype with a guide and will be field tested by the SPCA in Hammanskraal from next week
- Extension of this system for horse and mule use to follow

## THANKS

Thank you to the community leaders and villages for giving us the opportunity to visit your villages and to share your knowledge

The experts, most especially: Morgane James, David Serepelo, Whitey Maphakela, Peta Jones, and Linda Jele

The Animal Drawn Carts Design Group: Mike Nieuwoudt, Dakie Kaikai, Koos Kaekae, Benjamin Mabilu, Paul Kaelo, William Bodumele, Joost Alferink, David Christer, Niki Dun, Mugendi M'Rithaa, Mark Volger, Marius Botha, Adriaan Hugo, Goerge Gower, Berno Wellmann and Chris Bradnum

