

## **Bicycle and Rickshaw Improvement - Need for Vigorous development**

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### **Problem**

There are millions of bicycle and rickshaws in India transporting human beings and goods. Bicycle is the only means of cheap and reliable transport in villages. Yet it suffers from various drawbacks such as:

1. Single speed bicycles and rickshaws are inefficient energywise.
2. Continuous break down of gears and punctures etc. makes the maintenance cost of bicycle very high. On an average it requires Rs. 150/year for maintaining the bicycle of which Rs. 110/year are tyre related costs.
3. The present way of riding the bicycle or rickshaw is inefficient and does not allow the full forces of legs to work on the pedals. In fact it is really interesting that for last 100 years no improvement in bicycle has taken place.

In order to appreciate the above points one has to just look at the plight of rickshaw pullers who toil extremely hard to go uphill, and even on level roads against slight wind have great difficulty in making headway. Frequently the back axle gear slips and breaks down and chain comes off easily resulting in constant getting down of the puller. The rickshaw puller than pulls the rickshaw on foot-an extremely inefficient process with very poor force distribution. The present day inefficient rickshaw therefore results in an extreme hardship for the puller and statistics have shown that maximum incidence of T.B. has been found among them. Thus there is a great need to design rickshaws which can be efficient, can go uphill easily and provide a degree of comfort to its puller.

Besides, efficiently designed rickshaws can play an important role in transporting goods both in cities and villages. They are pollution free, employment generators and are more energy efficient (with good design) than other modes of transport.

Table 1 lists the energy cost in various transportation systems and as can be seen bicycle power comes out to be best.

**Table 1. Energy cost of various Transportation systems**

<b>Vehicle</b>	<b>Weight carried (g)</b>	<b>Energy cost (Cal/g-km)</b>
Cockroach	5	65
Bee	0.1	14
Rabbit	2500	4.5
Helicopter	4,000,000	3.5
Small jet plane	20,000,000	1.5
Small propeller plane	1,000,000	1.2
Automobile	22,00,000	0.8
Bullock cart	2,500,000 (including 1 ton freight)	0.85
Human walking	70,000	0.75
Larger jet plane	100,000,000	0.6
Human on bicycle (Indian bicycle)	100,000	0.32
Human on bicycle (10 speed)	100,000	0.15

Some recent improvements and developments in this area all over the world have given hope for improving bicycles and rickshaws.

#### **Recent Developments in Pedal Power:**

1. Recently researchers at M.I.T. in U.S.A. have shown that a reclining seat with backrest and foot pressure at such an angle that the foot pedal remained at same level as seat gave the maximum muscle efficiency for bicycle rider. In this case the legs were fully stretched and the power came directly from hips – an extremely efficient muscular processes.

In fact this is the same mechanism and posture which powered the first man powered air plane to cross the English Channel and some speed bicycles working on the above reclining posture principle have clocked 60 miles per hour on level roads.

2. With 10 speed gears, as found in most European and American cycles, going uphill and against wind becomes very easy and such a gear put on the regular rickshaw may make it more efficient.
3. A recent breakthrough by French and Canadian inventors hopes to revolutionize pedal power. It is an automatic bicycle transmission system attached to the pedal. In the old gearing systems as mentioned above in point 2 there were couple of leavers which one had to pull to change the gears. It was not very easy during transit often resulting in chain breaking and quite inconvenient during uphill travel.

In the French design, a slight pressure by pedal on the automatic system changes the gear so that going uphill and against wind becomes extremely easy.

4. The biggest drag for a cycle or rickshaw is the air friction on puller and passengers. In order to reduce this drag drastically, some bicycles in U.S.A. have been designed with covers such that the rider and the bicycle are completely covered. These covers are aerodynamically designed and bicycles with these covers have clocked 60 mph on level roads.

Present rickshaws do have covers for the protection of passengers against rain and sun. However these covers act like sails thereby increasing the drag on rickshaw and increasing the misery of the puller.

Thus an aerodynamically designed cover for rickshaws can be put on them. Besides reducing the air drag they will also provide protection for both puller and the passengers from rain and harsh such.

### **What needs to be done?**

The present cycle and rickshaw manufacturers in India have such a large market that they are not bothered to change to new design or innovate. Hence government has to play a key role in this manner. The following needs to be done:

- a) Government should provide liberal subsidy to manufacturers for producing rickshaws which incorporate the above advances.
- b) Soft loans should be made available for people to buy rickshaws and ply them.

- c) Nobody has yet produced a rickshaw incorporating the above advances as they are too recent for that to take place. Hence a suitable national prize be announced to design a rickshaw for both city and urban use. Once a good design is available then government should ask private manufacturers to manufacture them (point (a) above).
- d) Liberal incentives should also be given for tyre manufacturers to produce tubeless tyres such that frequent punctures and repairs of the tubes and tyres does not take place. As has been pointed out earlier tyre related maintenance costs are about 75% of the total yearly maintenance bill.

In the modern world the individual transport system (the automobile) is the largest consumer of petroleum and one of the reasons of present energy crisis. Besides being guzzlers of fuel, automobiles are also creators of pollution in cities. Rickshaws and cycles provide an answer to both energy and environment pollution crisis. An efficient cycle rickshaw will greatly modify the transportation systems of cities. It is also envisaged that with better designed and efficient rickshaws more and more cities will have them. Besides providing partial solution to energy crisis they will provide increased employment and an impetus to transmission industry in the country. It is quite possible that with development of efficient rickshaw transmission system, they can also be used to power efficiently hoards of various tasks like water pumping etc.

As was pointed out before no real improvement in the bicycle technology has taken place in last 100 years and there is no doubt that with better and present day materials and technology considerable improvement can take place.

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Note submitted to Shri Bahuguna in 1983 and put on the web in July 2014.