

## REDUCTION OF AXLE LENGTH OF RICKSHAW AND ITS IMPLICATIONS

Dr. Md. Ehsan and Md. Hamidul Haque

Department of ME, BUET

**Abstract** The extended axle length beyond the rear wheels of rickshaws have been the reason of a number of problems associated with road traffic and human safety. This is very much prominent in cities like Dhaka with congested traffic, narrow roads and with huge number of rickshaws. The problems identified includes – side-collision between rickshaws, damage to wheel-spokes, damage to road-side walls and other vehicles, instantaneous traffic-jam, and bodily injuries to pedestrians. A statistical survey of existing length of rear axle extended beyond the wheels was made on over 100 rickshaws from different parts of Dhaka city. A modified design of wheel attachment to the rear axle have been tried out, which reduces the rear axle length by 7-8 cm for each rickshaw. The advantage is nearly doubled in narrow roads or traffic lanes created for only two columns of rickshaws. The designed was tested in real traffic conditions for 6 weeks fitted on a rickshaw and the performance proved to be satisfactory. The modifications would cost about 100 Tk per rickshaw (less than 2 US\$) and could be very effective in mitigating the traffic and safety relevant problems mentioned above.

*Keywords :* Rickshaw, Design, Axle length, Road-safety.

### INTRODUCTION

Bangladesh is a country of high population density. Dhaka the capital is one of the most populous cities of the world with more than eight million inhabitants. The large population and their poor economic condition has led to the use of various types of road vehicle running at various speeds in the streets of Dhaka city. The cycle rickshaw one such vehicles used for passenger as well as goods carriage. This human powered three wheeler is used in huge numbers (estimated about 200,000 [Gallagher, 1992] ) in Dhaka city. Being a poor country with enormous number of unemployed people, flexible maneuvering capacity in narrow streets and low cost of fabrication has led to the use of huge number of rickshaws. Although being a part of Dhaka traffic or nearly a century the basic design of rickshaw, which has a number of limitations, have not been finally changed much although a number of attempts have been made [ Khan et. al, 1986] [Wahaj Uddin, 1986]. Economic as well as socio-economic factors have been the main cause of rickshaw design not improving, rather than lack of technology [Mannan, 1983]. Presently the increase of number of mechanized vehicles, as well as the poor traffic consciousness of the mostly illiterate rickshaw pullers, have led the government to try to limit the movement of rickshaws to some extent.

This work is focussed in one particular limitation of the presently practiced rickshaw design - the extended length of rear axle beyond the wheels. This have been an unnecessary cause for a number of problems relevant to road traffic and pedestrian safety. A survey work

have been done to get an idea of the extent of the problem and an attempt have been made to make a low-cost modification of the axle design, which could mitigate the problem to a great extent.

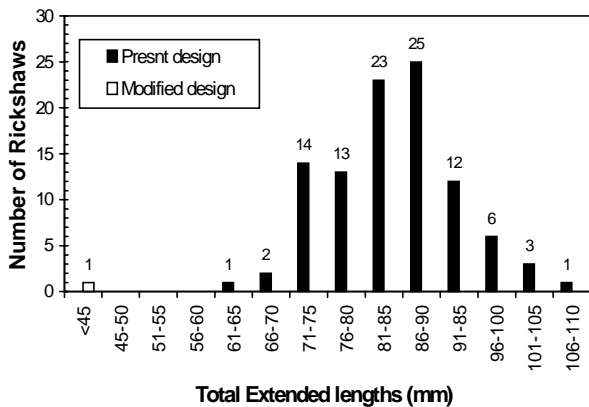


Fig.1 Extended rear shaft beyond the wheels

**PROBLEM WITH THE REAR AXLE**

In presently practiced rickshaw design, the wheels are mounted on the shaft of the rear axle using hexagonal nuts and other features which remain extended outside. As a result the shaft length is extended beyond the wheel as shown in figure-1. This is clear when you look at a rickshaw from the back.

In addition to hexagonal nuts and washers, mounting of a number of locking elements on the shaft are practiced. These include the use of another hexagonal nut for locking, locking pins or twisted spoke wires. This creates extended parts beyond the wheels ranging 6-9 cm on both sides (3-5 cm on each side), in different rickshaws. To gather an estimation of the extended length a survey was made on over 100 rickshaws at four locations – Nilkhet, Farmgate, Shahbag and Nawabpur of Dhaka city. Figure-2 shows the extended shaft length wise distribution of 100 rickshaws. For most of them the value lies from 7-9 cm.



**Fig.2 Extended lengths of 100 rickshaws**

The extended length of the rear wheel shaft is the cause of a number of problems. These include - side-collision between rickshaws, damage to wheel-spokes, damage to road-side walls and other vehicles, instantaneous traffic-jam, and bodily injuries to pedestrians.

The extended lengths are the main reason of side-collisions between rickshaws. This is very frequent when rickshaws are plying in two or more parallel columns – a common scenario in narrow roads and rickshaw lanes in main roads. Often this causes instantaneous rickshaw traffic jams, loss of time and damage of wheel spokes. Some times the rickshaw pullers have to physically lift one of the rickshaws involved to release the other.

In addition to problem to fellow rickshaws, these extended parts are often cause of damage to other vehicles like cars and scooters. In narrow roads and sharp road corners this causes damage to roadside walls. Figure-3 shows a damaged road in old part of Dhaka city damaged by rear axle of rickshaws. Specially in old

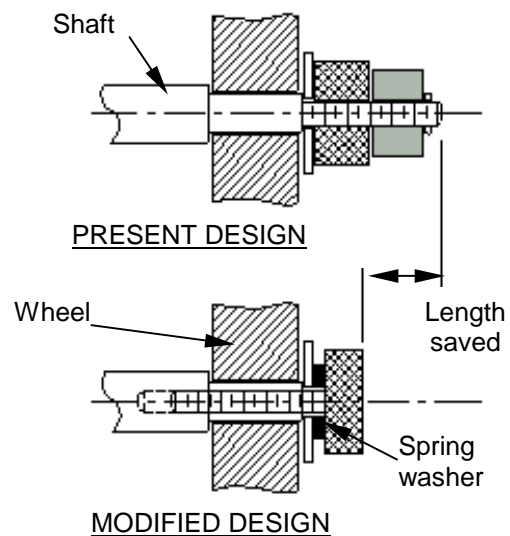
Dhaka pedestrians are sometimes injured by these extended rotating parts. In rickshaw garages where a large number of rickshaws are parked side by side, the extended shafts cause extra space requirement.



**Fig.3 Damage of roadside wall, old part of Dhaka**

**MODIFICATION TO THE WHEEL ATTACMENT**

A modified design of wheel attachment to the rear shaft was developed. Simplicity and Cost of modification have been considered as the primary factors. In the present design the externally threaded part after the wheel use a washer a hexagonal nut and a locking element for wheel attachment. In the modified design internal threads inside the axle shaft and a nut with hexagonal head (3/8 inch dia, 1.5 inch length) is used for wheel attachment. This allows considerable reduction in the extended length. A spring washer is used as the locking device. Figure-4 shows the comparison of the two designs and figure-5 shows the resulting differences. Compared to an extended length of 7-10 cm per rickshaw, the modified design has an extended length of about 4 cm. This could result up to 6-12 cm of road space, which is critical in traffic



**Fig.4 Reduction of extended length in the modified design**

conditions described before. The extended parts could be further reduced using cap-screws, but these are relatively costly and the mud-guards on the wheels remain extended to some length in any case.



**Fig.5 Rear axle with wheel. Present design at the left and modified design at the right, reduced overhanging of shaft beyond the wheels.**

The modified design was tested in real traffic conditions for a period of six weeks. The spring-locks held the wheels well. The performance was found satisfactory and the side-collision escapes could be really felt in narrow streets and congested traffic. The modification cost was about 100 Tk with 10-15 Tk for components (Mild steel hexagonal nut, washer and Spring-lock washer) and 35-40 Tk for machining the internal threads into the shaft. Refitting the modified shaft costs about 40-50 Tk more. Replacing a used shaft with a modified used shafts will save the time cost for the rickshaw not plying. The general response of most of the rickshaw-pullers to the modification was very positive.

### CONCLUSIONS

The modified design could be a simple and cost effective solution to reduce the problems related to extended rear shaft length. Road test of six weeks showed satisfactory performance. A pilot project for modifying a good number rickshaws may increase the public confidence and get the rickshaw owners interested.

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