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LOSS TO ASSETS: PRODUCTION OF POWER FROM SPEED BREAKER

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Abstract*- In this work, prospect and feasibility of power generation by using speed breakers has been investigated. In this project a mechanism to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into kinetic energy. This arrangement is made one rotation as soon as the vehicle moves over the speed breaker and has been increased using gears. After the production electricity, a storing unit has been used to hoard the generated electricity during the day and will be used during the night. Two prototypes have made using rack and pinion gear, spur gear, springs and generator .From which a considerable amount of energy is obtained. Nonetheless the cost of the prototype was inexpensive which proves the feasibility of this project and the idea can be applied on heavy traffic roads. Further investigation is being carried on to introduce the technology for practical approach.*

Keywords: Highway, Vehicle weight, Speed breaker, Electrical power, Street lamps

1. INTRODUCTION

Power plays a great role wherever man lives and works-in industry, agriculture transportation and so on. The living standard and prosperity of a nation vary with increase in use of power. As technology is advancing the consumption of power is steadily rising. The energy consumption mix was estimated as: indigenous biomass 60%, indigenous natural gas 27.45%, and imported oil 11.89%, imported coal 0.44% and hydro 0.23% [1]. Bangladesh has one of the lowest per capita energy consumption in the region and about 51% of its 155 million populations have no access to power. The government of Bangladesh has undertaken a master plan under the Vision-2021 to reach electricity facilities to every village of the country. Approximately 48,754 villages out of 87,372 villages have been brought under electricity facilities till April 2011[2]. Even then, the national power generation capacity is only 4500-4750 MW against a peak demand of 6000 MW. At the current rate of increase in consumption 10% annually [3]. Moreover, per capita power generation is only 236 kWh. The cumulative efforts of exploration for oil and gas resources in Bangladesh has resulted in the discovery of 23 gas fields of various sizes producing 2000 mncft of natural gas . Currently, from our 5 discovered mines only Barapukuria Coal Mine is producing at this stage. In 2008 it produced about 0.8 million tones. The estimated reserves of coal are close to 3300 million tons, while the proven reserve is about 884 million tones [4]. The scope of hydropower generation is very limited in Bangladesh because of its plain lands, except in some hilly region in the northeast and southeast parts of the country. At present only 230MW of hydropower is utilized in Karnafuli hydro station through 5 units of Kaplan turbine [5]. However, the chronic energy crisis is now an alarming issue. Consequently, any type of attempts to produce electricity is of the essence. In this work, an idea endeavors to show how energy can be trapped from a commonly used system, the road- speed breakers. The number of vehicles passing over the speed breaker in roads is increasing day by day. There is possibility of tapping the energy and generating power by making the speed breaker as a power generation unit. Moreover, the useful purpose for these types of generators is as a remote source of small power generation (mW to W range) where access to a fixed grid supply is not available and other options of remote power are less viable (such as solar, batteries, diesel generator, etc). Next time on the roads, don't scoff at the speed-breakers. They could actually light up small villages off the highway. An amateur innovator in Guwahati has developed a simple contraption that can generate power when a vehicle passes over a speed breaker. The innovation has caught the eye of the Indian Institute of Technology (IIT), Guwahati, which will fund a pilot project to generate electricity from speed-breakers. IIT Guwahati has evaluated the machine and recommended it to the Assam ministry of power for large scale funding. A K Das, a professor at IIT's design department says it is a 'very viable proposition' to harness thousands of mega watts of electricity untapped across the country every day. [6] A survey has been conducted about electricity consumption from Tamil Nadu electricity board website. It says that: The amount of electricity consumed in one night by all

the street lights around Chennai city is equal to consumption of electricity in a remote village for one month and 14 day. This survey inspired us a lot and made us to think about saving this wasted power which made us introduce this new technique [7]

2. ROAD AND TRANSPORTATION SCENARIO OF BANGLADESH

In Bangladesh, under the communication ministry the total length of road 20893 km in which 3476 km national

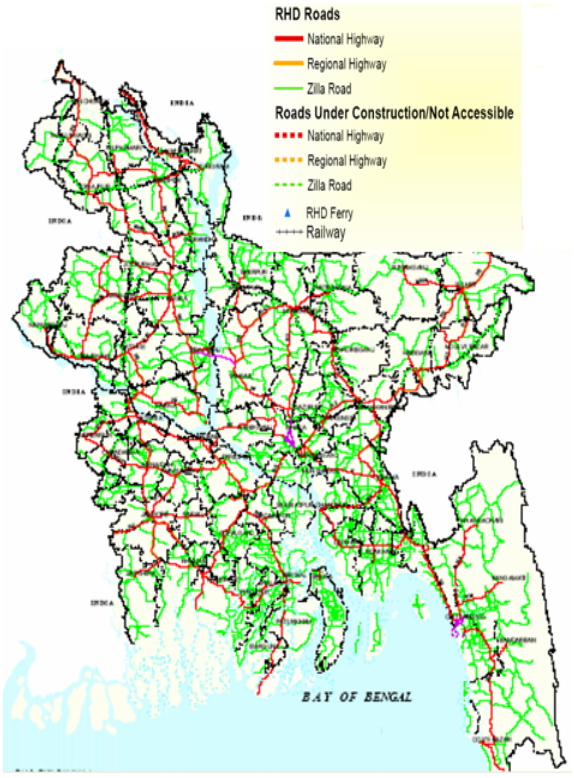

Fig.1: RHD road network Bangladesh

highways, 4164 km regional Highways, 13253 km Zilla roads are available. Table 1 represents Road and Highway Department (RHD) road network [8]

Table: 1 RHD Road network

Road type	Total road (Km)
National highways	3476
Regional Highways	4146
Districts Roads	13253
Total	20893

Information on the Bangladesh vehicle fleet was collected from Bangladesh Road Transport Authority (BRTA), which is responsible for motorized vehicle registrations and renewals in Bangladesh. The organization does not publish an annual report on registrations but provides data to the Bangladesh Bureau of Statistics (BBS) which is published annually in the Statistical Yearbook of Bangladesh. BRTA is not responsible for non-motorized traffic registrations, which are left to the local authorities to regulate. Non-registration is common and the actual number of NMTs is unknown. However, this report has dealt with the operating costs of both motorized vehicles as well as NMTs. Table 2 shows BRTA figures for vehicles registered in Bangladesh from 1995 to 2001.

Table: 2 Number of registered vehicles

Type	1995	1996	1997	1998	1999	2000	2001	AAGR (%)
Car/Taxi	63218	74493	82861	88840	94042	98682	106028	9.09
Jeep/Microbus	29207	32015	33774	36479	38748	40260	43337	6.81
Bus	13406	13287	13386	13762	13939	14269	14859	1.74
Minibus	10466	11052	11918	12520	12999	13399	14597	5.72
Truck	33210	35475	36257	38990	41008	43728	46203	5.67
A Rick/Tempo	52340	62548	69094	73497	75637	78767	79144	7.31
Motorcycle	178257	188669	200749	215274	231785	246395	271204	7.25
Other	8161	8685	10286	11534	14151	15511	18402	14.65
Total	388265	426224	458325	490896	522309	551011	593774	7.34

Note: AAGR= Annual average growth rate 1995 to 2001

The BRTA figures indicate that to date some 594,000 motorized vehicles have been registered in the country. The Bangladesh vehicle fleet is characterized by a large number of different vehicle types spanning up to three decades in age. Road and Highway Department(RHD) has derived a classification of motorized vehicles and non-motorized vehicles for traffic counting which categorizes vehicles into two broad groups: one for eleven standard motorized vehicles and the other for four standard non-motorized vehicles. Table 3 set out the physical characteristics of the representative vehicle.

Table:3 Vehicle characteristics : Weight and dimension

Category	Make	Axles No.	TARE kg	GVW kg	Length mm	Width mm	Height mm
Medium Truck	Tata SE 1612/42	2	4,015	15,660	6,970	2,434	3,625
Small Truck	Isuzu NKR55L	2	2,750	5,200	6,025	1,880	2,220
Large Bus	Hino AK3HMKA	2	4,145	12,500	10,005	2,430	1,995
Mini Bus	Tata LP909/36	2	3,300	9,000	5,970	2,159	1,900
Micro Bus	Toyota Liteace	2	1,180	2,150	4,453	1,695	1,870
Utility (Jeep)	Mitsubishi Pajero	2	1,930	2,800	4,645	1,695	1,865
Car	Toyota Corolla Sedan 1300GL	2	998	1,510	4,270	1,685	1,380
Auto Rickshaw	Bajaj Baby Taxi	2	200	580	1,900	745	1,020
Motor Cycle	Honda CG125	2	96	N	1900	745	1020
Bicycle	nc	2	nc	50	nc	nc	nc
Rickshaw/van	na	2	nc	304	nc	nc	nc
Animal Cart	na	1	nc	1800	nc	nc	nc

2.1 Speed Breaker

Speed breaker is a speed-reducing feature of road design to slow traffic or reduce through traffic. A speed breaker is a bump in a roadway with heights typically ranging between 3 and 4 inches (7.6 and 10 cm). The length of speed breaker are typically less than or near to 1 foot (30 cm); whereas speed breaker are longer and are typically 10 to 14 feet (3.0 to 4.3 m) in length. Speed bumps can be made of recycled plastic, asphalt or rubber. The advantages to the recycled plastic version are that they consistently will keep the original bright color, warning drivers of their approach without fading or having paint chip off. Speed bumps of various sizes can be placed on a road, from using two four foot or six foot devices on it with a space on either side for avoiding the bump on one side of the car, or connected across the entire road surface. The use of speed breaker is widespread around the world, and they are most commonly found where vehicle speeds are statutorily mandated to be low, usually 25 mph. Although speed breakers are very effective in keeping vehicle speed down, their use is sometimes controversial as they can cause noise and possibly vehicle damage if taken at too great a speed.

2.1.1Provision of speed breaker on the following critical locations

(1) All manned and unmanned railway crossings.
(2) Junction of rural road with higher order roads (MDRs, SH & NH).
(3) Near Schools / Health Centers.
(4) Entry points of habitation
(5) Entry of bridge to receive toll

3. EXPERIMENTAL SETUP

Producing electricity from a speed breaker is a new concept that is undergoing research. The number of vehicles on road is increasing rapidly and if some of the kinetic energy of these vehicle is converted into the rotational motion of roller then it can produce a considerable amount of electricity, this is the main concept of this project. In this project, two prototypes shown in figure 1, have been prepared comprising flexible speed breaker, rack and pinion gear, spur gear, generator and battery to store power at day time. When the vehicle moves over the speed breaker, it gains height resulting in increase in potential energy, which is wasted in a conventional rumble strip. When the plates come down, they crank a rake gear fitted to a ratchet-wheel type mechanism. This in turn rotates a geared shaft loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electricity. This electricity is stored in a battery. Then the output of the battery is used to lighten the street lamps on the road. Now during daytime electricity is not required for lightening the street lamps so a control switch incorporated in order to automatic control of electricity output. The control switch is connected by wire to the output of the battery. The control switch has ON/OFF mechanism which allows the current to flow when considered necessary

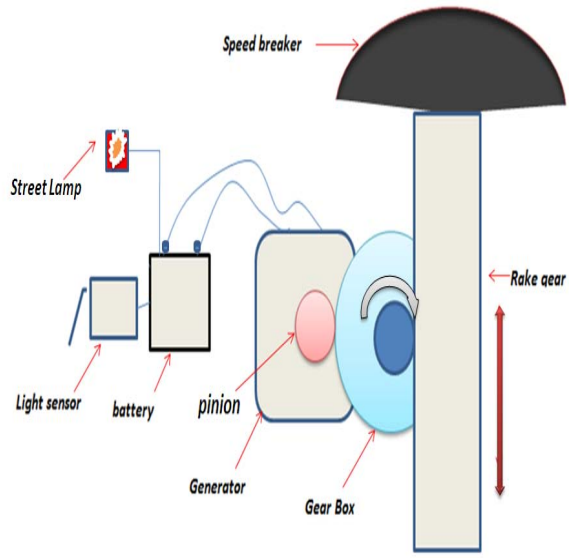

Fig.2: Schematic diagram of power generation from speed breaker

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4. RESULT AND DISCUSSION

Several investigations have been accomplished to find out the performances of the two prototype systems. From the collected data the power output from the systems are acquired. Figure2 shows the output power of the smaller prototype with maximum power 0.3W for the object (vehicle) weight of 3 kg. the graph also represents increasing weight produce higher power.

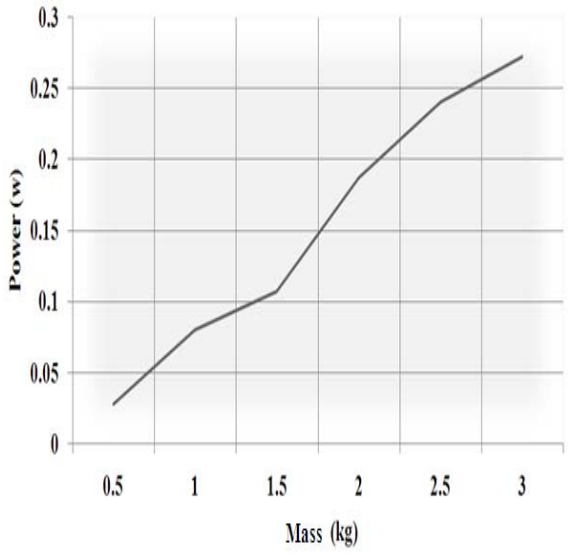

Fig.3 Output power of the smaller prototype

The power output for the larger prototype has shown in figure 3. It reveals higher power generated from the greater prototype with increasing vehicle load. As the

limited rated output of the generator is 5.5 W, the maximum output is obtained with weight (vehicle) 20 kg.

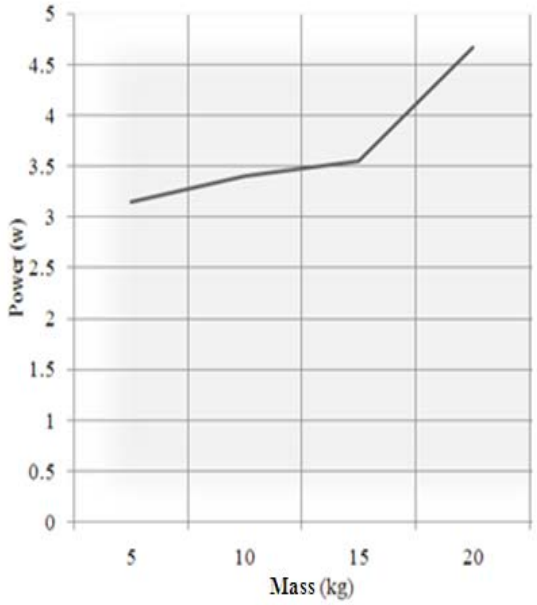

Fig.4 Output power of the larger prototype

From the abovementioned performance of the prototypes implies vivid prospect of the project. Implementation of the concept in highways, where enormous vehicles run in everyday will generate massive power throughout the day.

5. CONCLUSION

In this world where there is shortage of electrical power supply, this project will be helpful to solve the power crisis to some extent. This project has some advantages such as; it is economical and easy to install, free from all types of pollutions well as maintenance cost is low .Two speed breaker power generator prototypes have been designed, built and experimentally tested. The generator relies on the use of different gear combination to harness power from the speed breaker. This concept is quite promising due to its good efficiency as well as energy recovery criteria.

6. REFERENCES

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7. NOMENCLATURE

Symbol	Meaning	Unit
W	Power	(W)
kg	Mass	(kg)
km	Kilometer	(Km)