

# Implementing Renewable energy electro-kinetic road ramp and comparing it with piezoelectric road ramp

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## ABSTRACT

*Renewable energy sources are more important in day to day life. No matter it is small or big. Hence we implemented renewable energy electro kinetic road ramp and piezo electric road ramp and comparing one with another. And we seen that the mechanical ramp is more effective than piezoelectric road ramp. This ramp can be used on toll ways and generated electricity energy can be used for appliances like computers, bulbs, printers, CCTV etc.*

**Keywords:** -Renewable Energy, speed breaker, Piezoelectric generator, electro-kinetic

## 1. INTRODUCTION

An innovative and useful concept of generating electricity from speed breakers, our step to improve the situation of electricity. We are throwing same light on the very new and innovative concept i.e Generating electricity from a speed breaker is a new concept that is undergoing research. The availability of regular conventional fossil fuels will be the main sources for past generation, but there is a fear that they will get exhausted eventually by the next few decades. Therefore we have to investigate some approximate alternate new sources for the power generation which is not depleted by the very few years. The number of vehicles on roads is increasing rapidly and if we convert some of the kinetic energy of these vehicles into the rotation motion of generator. Then we can produce considerable amount of electricity. This is the main concept of this research. The renewable energy speed break will work on the principle of kinetic energy to electrical energy conversion.

## 2. LITERATURE REVIEW

Recently some study is done on the models suggested and tested by some scholars. Naveen Kumar [1] designed and fabricated reciprocating ramp for power generation in which they used rack and pinion arrangement and hence there are more vibration and power losses. Hasan Qureshi [2] designed energy generated speed breaker by wing rack and pinion arrangement with flywheel for storing kinetic energy and ratchet mechanism to give the rotational motion in only one direction. Rajat Gupta [3] implemented hydraulic speed breaker power generator by using piston, cylinder, crank and lever mechanism which is highly effective with no power loss but have very high cost. Ankita and Meena Bata [4] in 'power generation from speed breaker' suggested electrodynamics based models. But they are not only expensive to fabricate but can't be used on large scale very easily. Hence we used crankshaft mechanism with 3 slabs in our model.

### 3.METHODOLOGY

#### 3.1 Basic Outline of system

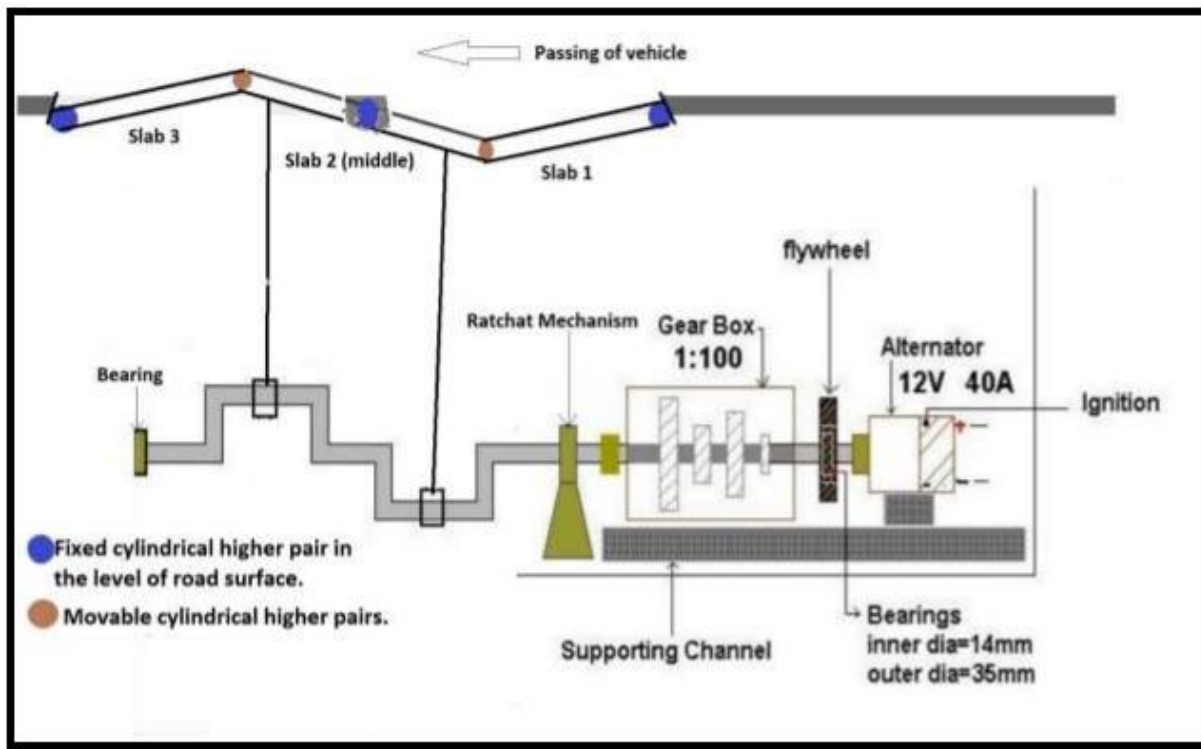


Fig.1 Basic Outline of system

#### 3.2 Construction and Working-

Electricity can be generated with the help of speed breaker by making gear arrangement and using electronics gadgets, thus a huge amount of electricity can be generated saving lot of money. When a car passes over the ramp, the ramp gets pressed, activating an alternator that charges an accumulator. The large amount of energy is wasted through speed breaker. There is great possibility of tapping this energy and generating power by making the speed-breaker like device. This ramp is not like usual speed breakers. It is not harmful for the vehicles or cannot become the cause of waste petrol when a car passes over it. The block diagram of ramp is as shown in fig 4.2.

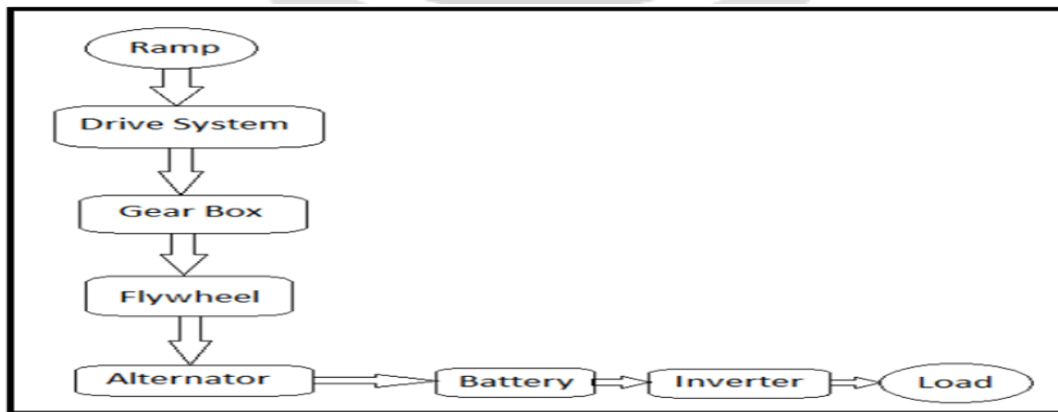


Fig 2 – Block Diagram of Electro-Kinetic Road Ramp

The hardware model consists 3 slabs linked to each other and middle slab is linked at center with lower pair. When the vehicle is passes over the slabs, one side of the middle slab is getting down while other side is lifting in upward direction and again vehicle is going towards the second side, then the third slab and second side of the middle slab is going in downward direction and first side is lifted in upward direction and voice-versa. The crank is attached to the slab and shaft which contains ratchet mechanism (for only one directional revolution of shaft), Gearbox, Flywheel & Alternator. For the storing purpose, a Battery is attached to the Alternator. Inverter is place with the Battery and a Load Bank is also attached. The Energy Ramp structure is as shown in fig4.1. As the slab moves in downward direction crank start rotating (in only one direction because of ratchet mechanism). The rotating shaft is connected to the gear DC generator which gives the electric supply. One car can produces 12-14 Volts and 9-10 Ampere for 3-5 sec and flywheel is mounted on shaft for storing of the kinetic energy and for continues rotation of shaft. Upto 110W of power is generated by the system. In this system spring is not used, hence there is minimum power loss and friction. In this way this system can be use on toll ways of India in effectively.

#### Types of Mechanisms

We can develop electricity from speed breakers by using 2 Mechanisms basically

They are as follows:

- 1) Crank-shaft mechanism
- 2) Ratchet Mechanisms

### 3.3 Different Parts

#### Parts Used-

- 1) Hump
- 2) Flywheels
- 3) Freewheels
- 4) Shafts
- 5) Gear box
- 6) Generator
- 7) BEARINGS

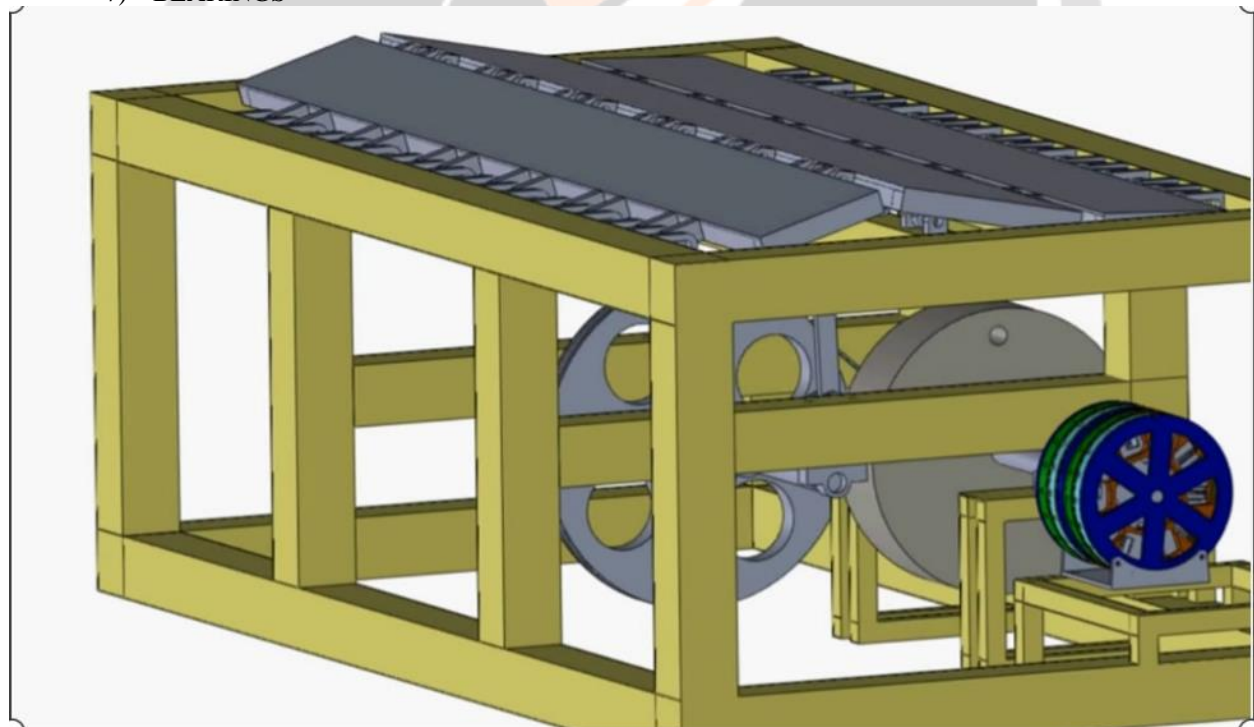


Fig 3.Solidwork Model of Ramp



Fig 4. Implemented Speed Breaker

#### 4. DESIGN AND CALCULATIONS

- 1) Connecting Rod
  - Flange thickness,  $t = 6.45\text{mm}$
  - Web thickness,  $t = 6.45\text{ mm}$
  - Width of flange  $B = 4t = 25.8\text{ mm}$
  - Depth of section  $H = 5t = 32.25\text{ mm}$
- 2) Crank Shaft
  - length of connecting rod  $= 300\text{ mm}$
  - Max displacement of hump  $= 120\text{ mm}$
  - Length of crank  $= 60\text{ mm}$
- 3) Crank Pin Diameter
  - $D = 33\text{mm}$

#### 5. RESULTS AND DISCUSSION

If the vehicle of 300 Kg at a speed of 5 Kmph passes over speed breaker then,  
Theoretically, Consider front mass and vehicle 150 Kg

$$\begin{aligned}
 \text{Force} &= m \cdot a \\
 &= 150 \times 9.81 \\
 &= 1471.6\text{ N}
 \end{aligned}$$

$$\begin{aligned}\text{Torque} &= F \times \text{perpendicular distance or length of crank} \\ &= 1471.5 \times 0.060 \\ &= 88.25 \text{ N.m}\end{aligned}$$

$$\begin{aligned}V &= 5 \text{ Kmph} \\ &= 1.388 \text{ m/s}\end{aligned}$$

$$\begin{aligned}W &= \frac{0.25}{1.388} = 0.1801 \text{ rad/sec} \\ W &= \frac{\pi D N}{60}\end{aligned}$$

$$0.1801 = \frac{\pi \times 0.5 \times N}{60}$$

By the specification of the generator

At  $T = 88.29 \text{ N.m}$  &  $N = 6.8796 \text{ rpm}$ , 60 Volts is generated.

As input power,

$$\begin{aligned}P &= \frac{2\pi NT}{60} \\ p &= \frac{2 \times \pi \times 6.8796 \times 88.29}{60}\end{aligned}$$

$$P = 63.65 \text{ watt.}$$

### 5.1 Result Table-

| Speed of the Vehicle<br>(Km/hr) | Power Generated<br>(Theoretical) | Power in volts<br>(Practically) | Power Generated by<br>Piezoelectric Generator<br>(Practically) |
|---------------------------------|----------------------------------|---------------------------------|--|
| 5                               | 60                               | 55                              | 28   |
| 10                              | 54                               | 48                              | 28.38  |
| 15                              | 49                               | 43                              | 23   |

## 6. CONCLUSION

1. Various types of non-conventional sources are solar energy, wind energy, biogas etc. Now by using these speed breakers, we can generate electricity without any external sources.
2. This day, vehicle traffic is a major issue in most big cities. This can be used to our advantage by installing these speed breakers in heavy traffic roads and toll booths we can generate electricity almost continuously by using the weight of the vehicles to produce mechanical power in the shafts by using the Crank shaft mechanism.
3. From the above results we can see that the electro-kinetic road ramp have higher life than Piezoelectric ramp.
4. As this method does not require any external power source and the traffic never reduces, these speed breakers are more reliable and have a greater life span.

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