

# Generation of Electricity by Multi-plate Ramp System

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**Abstract:** In this paper, we proposed system of generation of electricity through the multi-plate ramp mechanism. It includes the study and development of design and analysis of a prototype model of multi-plate ramp mechanism. This research work used a permanent magnet D.C. generator, thereby generating 12 Volt DC supply which can be store in the lead acid 12-volt battery. It also includes rack and pinion mechanism, and various components like flywheel, spring, shaft, etc. Electricity stored in battery is used to activate the light, fan etc. By increasing the capacity of the battery power rating can be increase.

**Keywords:** Multi- Plate Ramp, Rack and Pinion, Permanent Magnet D.C. Generator, Flywheel, shaft, Road power generator (RPG), etc.

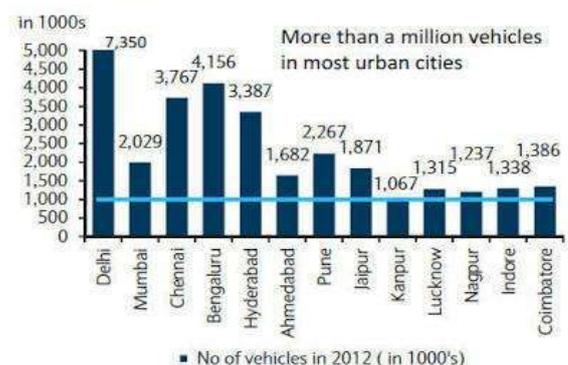
## I- INTRODUCTION

Amongst all form of energies electricity is most widely used form of energy. There is shortage of electricity in today's world, which we have to overcome [8]. As we know the vehicles on road are increasing very fast in the world. As these vehicle are moving on the road they possess some kinetic energy, which can be used for generating rotational motion of generator and then with the help of this we can produce considerable amount of electricity. As we know that the resources to generate the electricity are lasting very rapidly and there is great increase in population which uses the electricity for their day to day requirements. These has been generated the problem of energy crisis in the world. So we need to bring such ideas which can generate the electricity from the things which we can uses in day to day life. So from the vehicles we can generate the

electricity by using their kinetic energy as these vehicles passes over the ramp. These generated energy can be utilized for many purpose like street lights, lighting of signals, toll plazas villages where the shortage of electricity is more.

The India has second largest road network in the world, which contributes of over 5472144 km as on 31st march 2015[1]. Amongst which 1455 km of expressway are operational now a day in India. An additional 18637 km of expressway is aim to be constructed by government of India by the year 2022[1]. National Highway Authority of India(NHAI) which is responsible for development and management of the network of over 50000 km of a national highway out of 115000 km in India. The 148000 km of a state highway are operational in India and the Maharashtra state has 33705 km of state highway which is largest of state highway as compare to other states [1]. So using these road network and vehicles we can generate electricity using “Multi-plate Ramp System” installed on road.

More than a million vehicles in most of the leading developed cities in India



Source: MORTH, Barclays Research

Fig.1. Graphical representation of vehicle usage throughout various cities [1]

## II- LITERATURE REVIEW

Piyush et al. [2] In this study a novel technique has been projected to gate electricity from speed breakers. This method will help to preserve our natural resources. For a vehicular flow of 40400 per day, which includes 2/3/4/6/8 wheelers, the energy formed will be much more significant related to the experimental results obtained, thus making it a good energy creating setup as energy of vehicles on impact with the speed breakers is nevertheless lost. This is lost to heat and sound. This energy can be tapped, stored and used as back up or for small tenders.

Watts., [3] this paper deals with the crises of energy resources to an economy. The studies to leads towards shortcoming of energy crises by the idea of generating power using speed breaker. Firstly, South African electrical crisis has made them executed this method to light up small villages of the highway. The idea is basic physics, to transform the kinetic energy into electrical energy that departed wasted when the vehicle runs over speed-breaker.

Totaram [4] this paper says about uses a platform plate which is kept persuaded on a raised base level to permit vehicles to pass over the raised surface. This system will not work till a vehicle passes on road way and by Ankit Gupta, Kuldeep Chaudhary & B.N Agrawal and slider crank by Noor Fatima and Jiyaul Mustafa in "Production of electricity by the method of road power generation" [5] in "An Experimental study of Generation of Electricity using Speed Breaker"[6] have been suggested for producing electricity.

Priyadharshini.M [7] the application of energy is a sign of the development of a nation. For example, the per capita energy partaking in USA is 9000 KWh (Kilo Watt hour) per year, while the consumption in India is 1200 KWh (Kilo Watt hour). One might accomplish that to be substantially rich and prosperous; a human being needs to ingest more and more energy. A recent survey on the energy depletion in India had published a pathetic report that 85,000 villages in India do not still have electricity. Supply of power in most part of the country is poor according to the study by Priyadharshini.M in "Every Speed Breaker Is Now a Source of Power".

## III- SYSTEM OVERVIEW

The principle of electric power generation using Multi-plate Ramp Mechanism is very simple. It is based on the same principle as in the case of electricity generation in case of hydroelectric power plant, thermal power plant, nuclear power plant, geothermal energy, wind energy,

tidal energy etc. in all of the above power plants, mechanical energy is converted into electrical energy. In this setup also mechanical energy is converted into electrical power using DC Generator. Here vertical motion of the plates is converted into the rotational motion, which in turn rotates the generator and generates electricity.

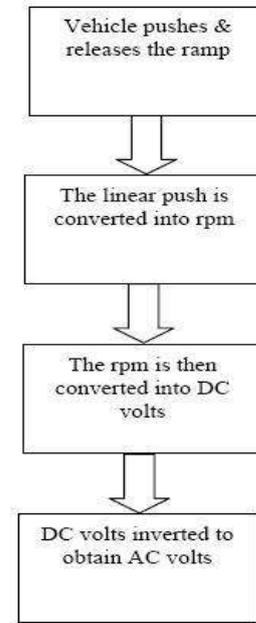


Fig. 2- Process diagram of multi-plate road ramp system

## IV- WORKING PRINCIPLE

Multi-plate Ramp is a system design to capture waste and kinetic energy from all vehicles. This device converts the kinetic energy of the vehicles into electric energy. This is done by moving plates in Multi-plate Ramp installed on the road, this plates captured very small movement from the road surfaces and it transferred to a key way flywheel system. From hundreds of wheel lies a single flywheel having used to driving machinery. The Multi-plate Ramp System included the method of driving one flywheel to another, once it reached predetermining velocity. The flywheel system has been developed to achieve large amount of moment of inertia in relatively small space. The captured energy is converted into electricity which is fed into power grid.

In this project the Four plates are mounted on the Ramp System and these plates are followed by the rack and pinion arrangement. Pinion is mounted on the shaft which is attached to the frame via bearing. Frame is installed under the road. The flywheel with Larger Gear is mounted on the shaft and smaller gear is mounted on the D.C generator and these two Gears are coupled with

each other. As wheel of the vehicle reaches upper most position of the plate, plates get compresses due to load of the vehicle, simultaneously rack moves downward provide torque to pinion. The pinion transmitted this torque to shaft. Shaft is supported by two bearings attached on wall of frame. The shaft having flywheel and gear arrangement on shaft through one way bearing. This arrangement functions to enhance rotation of flywheel for small motion of shaft. The bigger gear is coupled with smaller gear mounted on the D.C. generator shaft. The d. c. Generator converts the rotation of smaller gear into electricity.

List of components used in this arrangement are as follows:

1. Rack and Pinion
2. Springs
3. Permanent Magnet DC Motor
4. Flywheel
5. Shaft
6. Gear and Pinion
7. Bearings
8. Wooden Plates

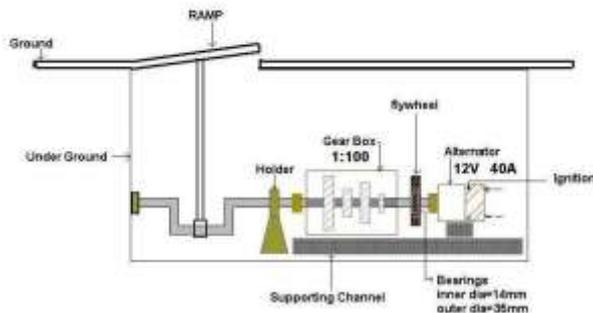


Fig.3. Structure of multi-plate ramp system [9]

## V- CALCULATIONS

Assuming the weight of the two wheeler with driver = 200Kg. [8]

Assuming the location as toll booth Assume Average speed of the vehicle = 20km/hr

Maximum height of the plate = 10cm

We know that,

For mechanical system the power is the combination of force and movement. Therefore power is the product of a force on an object and its velocity.

Output Power calculations:-

Let us consider,

The mass of a vehicle moving over the flip plate = 200 Kg. [8]

Height of the plate from surface = 10 cm.

Work done = Force x Distance

But,

Force = mass x acceleration due to gravity =  $200 \times 9.81 = 1962\text{N}$

Therefore,

Work done / sec =  $(1962 \times 0.10/60) = 3.27$  watt (for one pushing force)

Therefore,

Power developed for 1 vehicle passing over the Multi-plate Ramp for one minute = 3.27 watt

Power developed for 60 min (1 hr) = 196.2 W/hr

Power developed for 24 hrs = 4708.8 W/day

Total No. of Plates = 4

Power developed for 24 hours =  $4708.8 \times 4 = 18835.2$  watt/day

= 18.83 KW/day

## VI- APPLICATIONS

Power generation using speed breaker system can be used in most of the places such as:

1. This technique can be used in all highways, roadways, toll plaza, etc
2. The power is generated when the vehicles pass through it. Which in can be stored in the battery.
3. This power can be used in many Places after using the inverter, which enhances in the voltage from 12 volts to 230 volts.

. This power can be used in the following:

- Street Lights.
- Road Signals.
- Sign boards on the roads.
- Lighting Of the bus stops.
- Lighting of the check post on the highways etc.

## CONCLUSION

Multi-plate Ramp system is a new type of unconventional source of energy. It gives higher amount of energy as compared to the RPG system by converting kinetic energy developed from moving vehicles to electrical energy. The higher frequency of passing vehicles provides higher capacity of Generator.

## SCOPE FOR FUTURE EXPANSION

This project is designed for road power generation is specifically used on roadways, highways, entrance and

exit of school, college, companies, and malls. It also can be install at toll booths, bus stands, airports and railways parking zone, etc.

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