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Design and Development of Movable Traffic Divider

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Abstract: In recent years, with ever-increasing metro cities around the world, there has been a proportional increase in numbers of automobiles on the roads. Although the number of vehicles using the roads has increased, road infrastructure is almost the same and is unable to cope with changes like congestion, unpredictable travel-time delays, and road accidents that are taking a serious shape. Traffic congestion has been one of the major concerns faced by the metropolitan cities today in spite of measures being taken to mitigate and reduce it. It has emerged as one of the main challenge for developers in urban areas for the planning of sustainable cities.

In developing countries, like India, traffic is inherently chaotic and noisy. Identification of the magnitude of traffic congestion is an essential requirement for defining congestion and finding appropriate measures. This paper studies the existing traffic congestion on one of western express highway in Mumbai with the help of instruments like Metrocount, which counts the data for the no. of axles as well as the speed of the vehicles simultaneously recording the results obtained and carefully analyzing the data. The main focus of this study is aimed at understanding the recurring urban congestion, its measurement, and suggests a remedial measure for the same.

The implication of widening existing roads or building new ones will only result in additional traffic that continues to increase until peak congestion returns to the previous level. The total available space within the city for the construction of roads, railways and other transportation is restricted.

The paper discusses the implementation of movable traffic dividers as congestion release strategy for metropolitan areas instead of the traditional solution of widening the roads. The moveable traffic divider helps in there a configuration of road capacity, so as to attain optimum benefit from roadway usage on the existing road.

Keywords: Traffic, Divider, Congestion, Arduino Microcontroller

I. INTRODUCTION

Countries around the world are day by day facing the problem of traffic congestion due to the increase in the number of vehicles in society Although the number of vehicles using the roads has increased, the static road infrastructure is almost the same and is unable to cope with changes like congestion, unpredictable travel-time delays, and road-accidents that are taking a serious shape in spite of actions being taken.

Measuring reasons for congestion is the foremost thing in deciding the solution to it. The designing of the roads is done considering the adverse conditions and the clear the vehicles vary conditions suggesting the difference between theoretical derivation and practical conditions. Regulations & legislations study onsite and the government determined the flow of traffic. Traffic congestion can be determined with respect to travel time delay, speed change, the volume occupied and level of service. Traffic congestion also depends on the pattern of the city, whether it is centric, grid or organic pattern. Depending on different congestion scenarios every country has adopted its own measures like high-density traffic tollway in the US, vehicle exclusion zones in the UK and flexible working hours in UAE.

Many other countries are in progress of different measures for lowering the effects of congestion. India with its growing economy is also in vehicular great variations in the vehicle are seen but traffic free road is still in ideas. Now a day the conventional method of building more roads is no longer a solution.

Traffic intelligent system is the step taken in providing good transport system to the human community. to the above paper study of traffic in Metro cities and movable traffic divider technique for which can be of the topographical, climatic, geographical obstructions and in combination which can help us to solve the traffic congestion problem in an optimal manner. In European countries, the change of divider lane is done with the help of big vehicles. As road security and regions of development, these Road Barrier choices help in preventing vehicles from the collision with obstacles. Further, these additionally discover use in keeping errant vehicles from precluded zones. Some of its advantages include providing for safe and effective usage, extensive tests before they are approved, use of quality material in lasting performance standards and others.

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II. PROBLEM STATEMENT & OBJECTIVE

A. Problem Statement

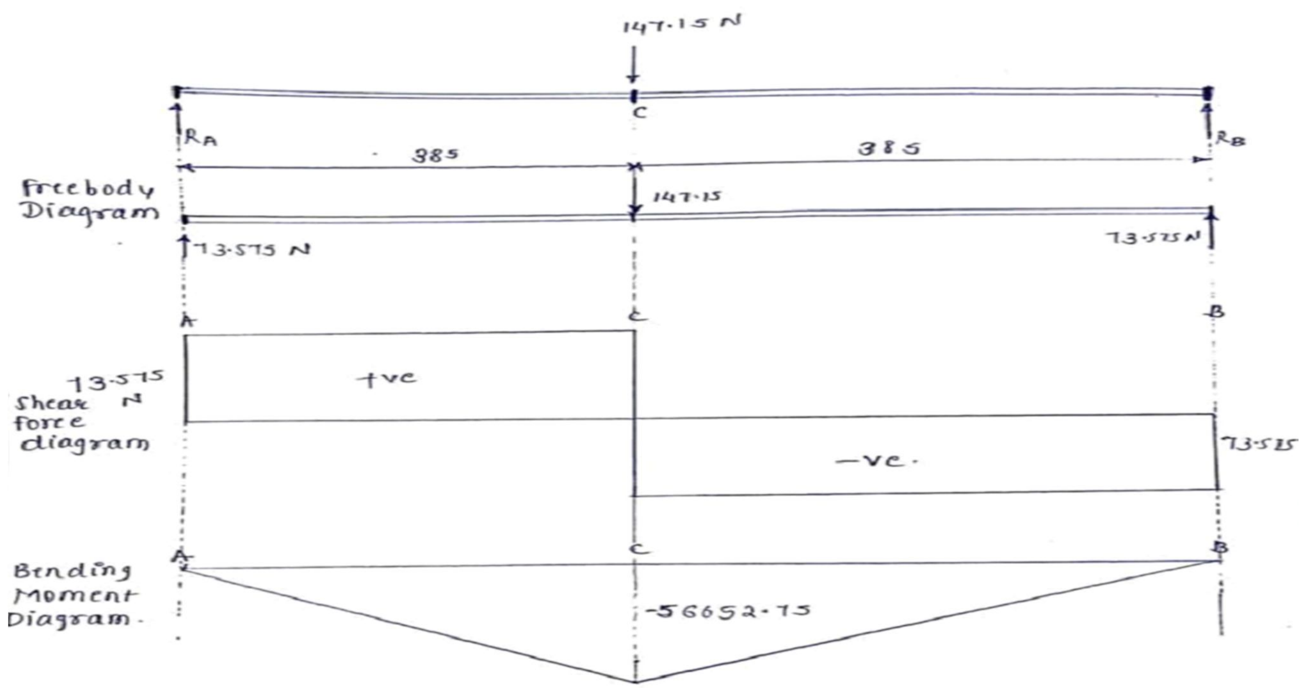
To build an automated road barrier system, which can be, controlled from a location by an administrator with suitable mechanisms along with safety concern.

B. Objective

1) To build an automatic moving divider which can be moved from any location using a remote system.
2) To provide more space on the side where more traffic is present.
3) Help people to reach their destination early.

III. DESIGN CALCULATIONS

A. Shear Force and Bending Moment



Finding the reaction forces:-

Considering the gross vehicle weight= 15kg = 15*9.81=147.15 N

$\sum fy=0$

R A +R B =147.15----------------------- (1) Now,

$\sum M E=0$

[R A *115] - [147.5*(115+385)] + [R B*(385+385+115)] =0

115R A +885R B =73575---------------------- (2) Solving equation 1 & 2

R (A) = 73.575 N, R(B) = 73.575 N

Thus, the weight on wheels =73.575/9.81=7.5kg....................(on each wheel)

Now, Finding out Shear Force at point C -

Force acting at point C = -147.15 N

And, Finding out Bending Moment -

1) Moment at A =Moment at B=0
2) Moment at C=-56652.75 N.m

B. Divider Motion Calculations

While choosing drive wheel engines for portable vehicles, various elements must be considered to decide the most extreme torque required. The accompanying precedent presents one technique for processing this torque.

Vehicle design criteria

1) Gross Vehicle Weight (GVW): 15 kg
2) Weight on each Wheel (WW): 7.5 kg
3) Radius of Wheel (RW): 0.1 m
4) Desired Top Speed (Vmax): 10 m/min
5) Desired Acceleration time (ta): 5 Sec
6) Maximum Inclined Angle (α): 2 degree
7) Road length: 4 m

Let us consider it will take 30 sec. to shift the distance of 4m.

Therefore, The speed of divider = 15m/min

= 0.9Km/hr.

RPM = 2.65*kmph*g / Rw

= 2.65*0.9*1 / 0.1

=23.85

Thus, RPM = 23.85 ≈ 25 RPM.

To pick engines fit for creating enough torque to drive the vehicle, It is necessary to determine the total tractive effort (TTE) Requirement for the vehicle: TTE = RR + GR + FA

TTE = RR + GR + FA Where:

TTE = total tractive effort (N)
RR = force necessary to overcome rolling resistance (N)
GR = force required to climb a grade (N)
FA = force required to accelerate to final velocity (N)
The components of this equation will be determined in the following steps.

a) Step One: Determine Rolling Resistance

Rolling Resistance (RR) is the force necessary to propel a vehicle over a particular surface. The worst possible surface type to be encountered by the vehicle should be factored into the equation.

RR = Crr x GVW

= 0.01 x 15 x 9.81

RR = 1.4715 N Where,

RR = rolling resistance (N)

GVW = gross vehicle weight (N)

Crr = surface friction (value from Table 1)

= 0.9*15.9.81 / 3.6* 5

TABLE I

CONTACT SURFACE	CRR
CONCRETE (GOOD / FAIR /POOR)	0.10 /0.15 / 0.20
ASPHALT (GOOD / FAIR / POOR)	0.12 / 0.17 / 0.22
MACADAM (GOOD /FAIR / POOR)	0.15 / 0.22 / 0.37
DIRT (SMOOTH / SANDY)`	0.25 / 0.37

b) Step Two: Determine Grade Resistance

Grade Resistance (GR) is the amount of force necessary to move a vehicle up a slope or "grade". This calculation must be made using the
maximum angle or grade the vehicle will be expected to climb in normal operation.

To convert incline angle, α, to grade resistance: GR = GVW x sin (α)

= 15 x 9.81 x sin (2) GR = 5.135 N Where,

GR = grade resistance (N)

GVW = gross vehicle weight (N)

α = maximum incline angle [degrees]

c) Step Three: Determine Acceleration Force (FA)

The force (FA) required for accelerating from stop to maximum speed (KPH) or (MPH) in time (t) seconds can be obtained from the following equation:

FA= KPH*GVW / 3.6*t

Thus, FA = 7.357 N Where,

FA = Acceleration Force (Newton)

t = Time (Seconds)

d) Step Four: Determine Total Tractive Effort

The Total Tractive Effort (TTE) is the sum of the forces calculated in steps 1, 2, and 3. (On higher speed vehicles friction in drive components may warrant the addition of 10%-15% to the total tractive effort to ensure acceptable vehicle performance.)

TTE (N) = RR (N) + GR (N) + FA (N)

= 1.4715 + 7.357 + 5.135

TTE (N) = 13.96 N ≈ 15 N

e) Step Five: Determine Wheel Motor Torque

To verify the vehicle will perform as designed in regards to tractive effort and acceleration, it is necessary to calculate the required wheel torque (Tw) based on the tractive effort.

Tw [N.m] = TTE [N] x Rw [m] x RF [-]

= 15 x 0.1 x 1.15

= 1.725 N.m

Where,

Tw = wheel torque [N.m]

TTE = total tractive effort [N]

Rw = radius of the wheel/tire [m]

RF = "resistance" factor [-]

The "resistance factor" accounts for the frictional losses between the caster wheels and their axles and the drag on the motor bearings. Typical values range between 1.1 and 1.15 (or 10 to 15%).

f) Step Six: Reality Check

The final step is to verify the vehicle can transmit the required torque from the drive wheel(s) to the ground. The maximum tractive torque
(MTT) a wheel can transmit is equal to the normal load times the friction coefficient between the wheel and the ground times the radius of the drive wheel.

MTT = Ww [N] x μ [-] x Rw

= 8 x 9.81 x 0.4 x 0.1

MTT= 3.45312 N.m

Where,

Ww = weight (normal load) on drive wheel [N]

μ = friction coefficient between the wheel and the ground (~0.4 for plastic on concrete)

Rw = radius of drive wheel/tire [m]

IV. ADVANTAGES AND APPLICATIONS

A. Advantages

1) Reduces Congestion-Moveable divider gives more lanes to the peak traffic direction for AM and PM commuters.
2) Increase safety.
3) Decrease time travel.
4) Green Benefits include improved air quality, improved fuel efficiency, and reduced atmospheric CO 2 .

B. Applications

1) As the everyday traffic on an extension increments after some time, bridge experts must figure out how to increase the capacity of the bridge to coordinate the traffic stream. New development is amazingly costly, and in many cases, it isn't even an alternative. The savvy and assisted strategy for expanding bridge capacity is to make an overseen paths where the path arrangement of the extension is adaptable and extra paths are made accessible to the pinnacle traffic heading.
2) Small size road-As bridge cannot make on road having too small to moderate size, in this case our system can be implement easily on small road also.

V. CONCLUSIONS

In this report, we conclude that the existing system, zipper machine are analogous to a big truck, which require human labor for its movement and are also not feasible where traffic is scarcely moving. In our proposed framework, we are taking out the restrictions of the existing framework by utilizing an automatic divider, which will physically control the development of the Road Lane Divider System. This will give access, which will defeat the negative marks of zipper machine. Following step of us will be to execute the proposed framework and demonstrate its effectiveness as mentioned.

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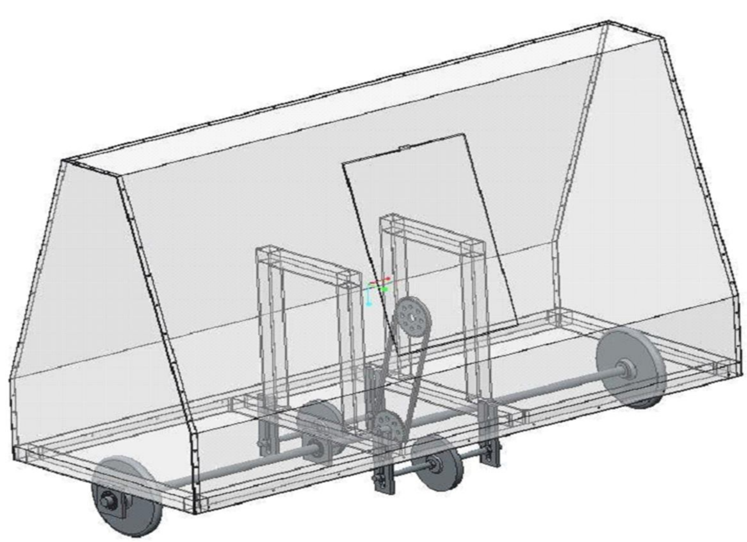
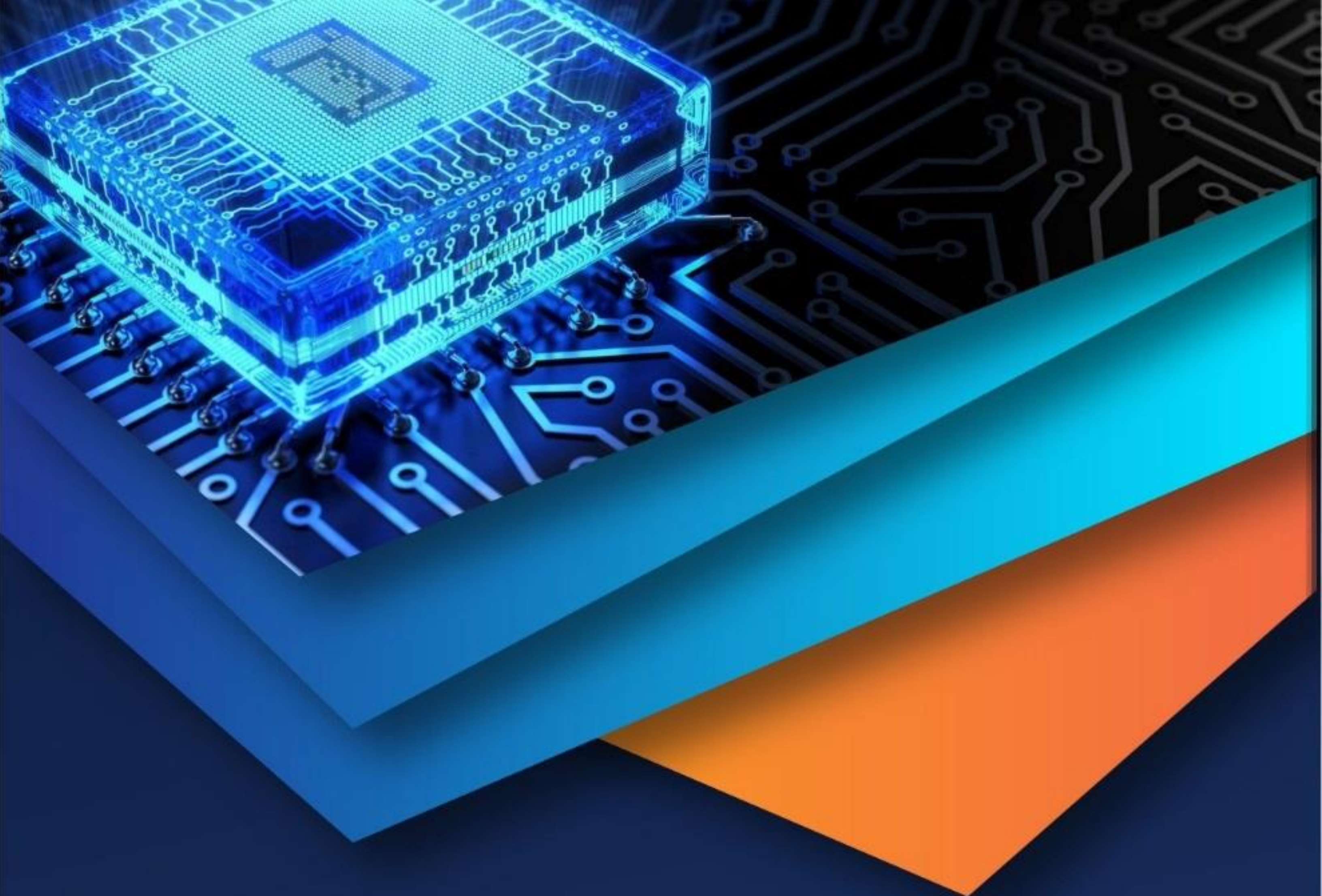
3CAD MODEL





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