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ANALYSIS OF TRAFFIC FLOW OF HELMET CROSS ROAD, AHMEDABAD AND PREVENTION OF ACCIDENTS AT ROAD INTERSECTION USING SOLID PLASTIC BARRIER ALONG WITH TRAFFIC SIGNAL

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Abstract: Vehicle accidents took place due to many reasons. Many of them fatal and they occur due to violation of red lights. These accidents lead to serious injuries and economic loss. Here in this research we proposed a method to reduce accidents due to red light violation at intersections by stopping vehicles by help of barriers. The method involves providing a barrier which will work on the road to stop the vehicles during the red light. The barrier will be in operation during red light and at other time it will be acting as a speed-breaker.

Keywords: Road Accidents, Traffic Signal, road junction

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INTRODUCTION

1.1 Barrier:

- A barrier is a physical structure which blocks or impedes something. Barriers are of many types depending on their purpose and location at which they are provided. For e.g., Road block, Automatic barrier, Boom barrier, Traffic barrier, etc. [1]
- Traffic barriers are used to keep vehicles within their roadway.
- Use of barrier for the particular purpose decides the material and strength of barrier.

1.2 Purpose of barrier:

- To stop the vehicles entering the intersection during red light [10]
- To serve as a speed breaker for the remaining time
- To meet the worst climatic conditions on the road, i.e. temperature rise and fall, rain
- To be strong enough to resist the peak-hour vehicular load

1.3 Speed breaker:

A speed breaker is a hump surface across the roadway having a rounded shape with width greater than the wheel base of most of vehicles using the road.

Speed bumps of various sizes can be placed on a road, with two four-foot or six-foot devices on it with a space on either side. The space is for drainage, and to allow emergency vehicles (with a wider tire spacing than passenger cars and trucks) to pass over without hitting the speed bumps. A speed bump may also be connected across the entire road surface.[8]

2. Design of speed breakers:

- Speed breakers are formed basically by providing a rounded (of 17m radius) hump of 3.7m width and 0.10m height for the preferred advisory crossing speed of 25km/h for general traffic.
- Trucks and buses having larger wheel bases may feel greater inconvenience on passage at such humps.[7]

- To facilitate appreciable and comfortable passage for larger and heavier vehicles (where their proportion is quite high humps may be modified with 1.5m long ramps (1:20) at each edge.[2]

3. Traffic Volume Count Survey conducted on Helmet Cross Road:

- A survey on traffic volume count at Helmet cross road, Ahmedabad, Gujarat, India conducted in order to obtain the value of design peak hour flow on 03/03/2015.
- Using these data calculations of signal timings, cycle timings for model were done.

3.1 Turning movement of traffic flow

Table 1 Junction A (south)

TIME INTERVAL	2W	3W	4W	CYCLE	BUS/TRUCK
10:00 to 10:10	250	52	197	20	2
10:10 to 10:20	351	95	293	15	6
10:20 to 10:30	517	81	273	14	5
10:30 to 10:40	489	89	335	19	4
10:40 to 10:50	456	72	274	16	7
10:50 to 11:00	498	82	310	11	7
11:00 to 11:10	445	93	213	6	8
11:10 to 11:20	443	92	247	14	4
11:20 to 11:30	519	90	264	10	4
11:30 to 11:40	466	85	197	6	5
11:40 to 11:50	412	74	224	11	8
11:50 to 12:00	366	90	216	14	3

Table 2 Junction B (west)

TIME INTERVAL	2W	3W	4W	CYCLE	BUS/TRUCK
10:00 to 10:10	96	12	63	7	0
10:10 to 10:20	61	29	71	42	0
10:20 to 10:30	110	40	67	65	1
10:30 to 10:40	122	36	55	62	0
10:40 to 11:50	94	42	79	37	1
10:50 to 11:00	69	29	59	34	0
11:00 to 11:10	110	40	55	21	0
11:10 to 11:20	98	47	63	27	0
11:20 to 11:30	105	39	62	27	0
11:30 to 11:40	82	42	57	8	2
11:40 to 11:50	80	38	52	15	3
11:50 to 12:00	91	44	54	7	0

Table 3 Junction C (north)

TIME INTERVAL	2W	3W	4W	CYCLE	BUS/TRUCK
10:00 to 10:10	349	62	203	12	4
10:10 to 10:20	434	87	198	7	5
10:20 to 10:30	261	74	184	14	2
10:30 to 10:40	296	84	245	16	5
10:40 to 11:50	320	91	233	17	7
10:50 to 11:00	291	93	302	11	7
11:00 to 11:10	298	88	262	8	8
11:10 to 11:20	290	98	233	18	5
11:20 to 11:30	288	94	247	11	2
11:30 to 11:40	322	90	237	9	6
11:40 to 11:50	277	87	195	15	8
11:50 to 12:00	347	96	238	10	3

Table 4 Junction D (east)

TIME INTERVAL	2W	3W	4W	CYCLE	BUS/TRUCK
10:00 to 10:10	252	9	35	18	1
10:10 to 10:20	390	17	95	52	9
10:20 to 10:30	194	25	70	21	3
10:30 to 10:40	199	42	96	23	6
10:40 to 11:50	211	22	84	24	11
10:50 to 11:00	191	31	97	9	2
11:00 to 11:10	107	16	81	5	3
11:10 to 11:20	412	30	119	2	5
11:20 to 11:30	122	24	105	7	0
11:30 to 11:40	87	21	101	6	4
11:40 to 11:50	115	22	88	4	3
11:50 to 12:00	132	27	83	0	0

3. Signal design (for one hour)

Table 5

	N	S	E	W
Design hour flow(q) in pcu	3084	3600	1500	1383
Saturation flow(s) in psu S=525w W=width of lane	7200	7200	5440	5440
y=q/s	0.42	0.50	0.27	0.25
Ymax		0.50	0.27	

Calculations:

The signal is designed as per 2-phase system.[3]

As per British practice

- Min intregreen period(I)= 4 sec
- Amber period(a)= 2 sec
- Let gNS=effective green time for North-South flow

gEW=effective green time for East-West flow

Y=0.50 + 0.27

=0.77

Time lost due to starting delays L= 2 sec per phase

L=Σ (I-a) + ΣL

= (4-2) + (4-2) +2+2

=8 sec

Optimum cycle time (Co) = 1.5L+5/1-Y

= 74 sec

So effective time per cycle = Co-L

= 74-8

= 66

gNS = 0.50(66) / 0.77= 42 seconds (green)

gEW= 0.27(66) / 0.77= 25 seconds (red)

4. Working mechanism of barrier:

Fig 1 Movement of barrier on road [6]

4.1 Material for barrier: Solid Plastic [4][5]

Solid Plastic is an Environmentally Conscientious Product, Superior Strength and Durability

- Easy Installation
- Maintenance Free
- Light Weight - Yet Stable
- Chemical and Weather Resistant
- 100% Recycled Material
- Includes installation instructions and hardware
- All dimensions are nominal - allow for up to 3-6% mold shrinkage
- Lifetime warranty
- Made from 100% recycled LDPE.
- built to last
- Repeat exposure to chemicals in road salts and ever-changing weather conditions will not cause chipping, and cracking.
- solid 100% recycled plastic
- Maintenance-free since they never need painting

- Plastic resist damage from sun, salt, oil, and chemicals
- Easy to move if you want to change traffic patterns
- Bright 'safety yellow' color is molded into the plastic, not just coated on the surface where it might wear or scratch off

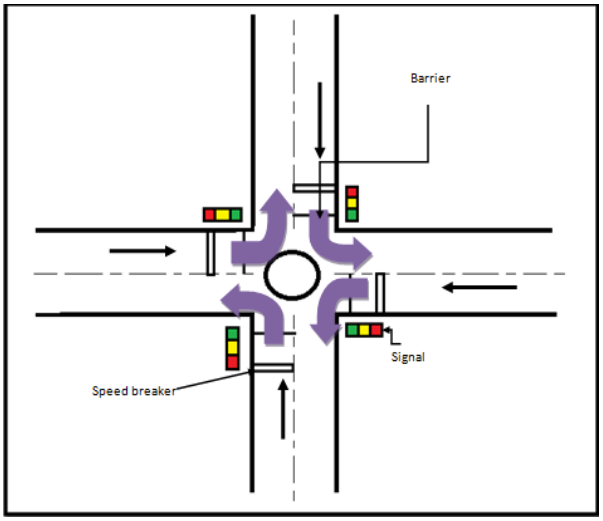

Fig 2 Model showing arrangement of barrier

4.2 Barrier dimensions:

Width of road = X

Width of island = Y

Width of barrier = X-Y-clearance on both sides

Height up to which barrier will raise = 1.05m

Angle with road = 90 degrees

Distance of bump from barrier = 5m

Operating speed = 3 seconds[9]

5. CONCLUSION:

The barrier when provided on intersections where accidents occur at high rates will reduce or completely eliminate the chance of accidents. Accidents occurring due to intentional signal breaking will not occur. Thus, we can save many lives and economic loss every year.

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