

Road Visual Aids and Safety Measurements

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Abstract:

This project is developed to give a clear description of road visual aids i.e., road markings, traffic signs and traffic signals. In this project we designed emergency lanes for emergency conditions and road safety measurements are also developed.

Road markings (IRC 35-1997) are used as a means of controlling and guiding traffic. They are highly important on roads and intersections as they promote road safety and bring about smooth and harmonious flow of traffic along guided paths of travel. They also serve to supplement the messages conveyed by road signals and signs.

Road safety refers to methods and measures used to prevent road users from being killed or seriously injured. Typical road users include pedestrians, cyclists, motorists, vehicle passengers and passengers of on-road public transport.

Sight distance is the length of a road visible ahead to the driver at any instance. Sight distance available at any location of the carriageway is the actual distance a driver with his eyelevel at a specified height above the pavement surface has visibility of any moving object of specified height which is on the carriageway ahead. The sight

distance between the driver and the object is measured along the road surface. In other words the distance visible ahead to the driver is very important for safe vehicle operation on the highway.

Key words: Road safety, sight distance, (IRC 35-1997), markings.

1. INTRODUCTION:

Road visual aids are the aids or model, designed to supplement written or spoken information so that it can be understood more easily. We have some road visual aids like road markings, traffic signs and traffic signals. Road markings are defined as lines, patterns, words or other devices, except signs, set into applied or attached to the carriageway or curbs or to objects within or adjacent to the carriageway, for controlling, warning, guiding and informing the users.

In this project, we had given clear description about the road visual aids i.e., road markings, traffic signs, traffic signals and we had designed an emergency lane on road for and certain steps are taken when an emergency vehicle is approaching in either

direction and easy and quick movement for an emergency vehicles such as ambulance, police, fire brigades, VIP vehicles, army vehicles and goods movements for an emergency places etc., and safety measurements which has to be taken on roads while driving for a safe journey to their destination and some tips are taken such as stay alert, look in front and on both sides of your vehicle. When the emergency vehicle has passed, make sure the way is clear and traffic has to back within 150 meter.

Traffic signals are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control flows of traffic. Traffic lights alternate the right of way accorded to users by displaying lights of a standard color red, amber (yellow), and green following a universal color code.

1.1 TYPES OF ROAD MARKINGS

- Object Markings
- Carriageway Road Markings
- Longitudinal Markings
- Intersection Markings
- Hazardous Location Markings
- Parking
- Word Messages

1.2 FUNCTIONS OF ROAD MARKINGS

- Segregation of traffic
- Stop and go
- Give way instruction
- Overtaking or not
- Two lanes to one lane/ lane traffic
- Inter-vehicle distance
- Parking zone or no parking

- Speed indication
- Direction
- One way
- Pedestrian crossing
- Type of vehicles allowed

1.3 TYPES OF ROAD MARKINGS

Road markings are basically of two types:

- 1) Carriageway markings
- 2) Object markings.

1.1.4 CARRIAGEWAY MARKINGS

A carriageway consists of a width of road on which a vehicle is not restricted by any physical barriers or separation to move laterally.

- i) Center line
- ii) Traffic lane lines
- iii) No-overtaking zone markings

1.5 OBJECT MARKINGS

Object markings are of the following categories:

- i) Objects within carriageway
- ii) Kerb marking for visibility
- iii) Kerb marking for parking restriction
- iv) Objects adjacent to the carriageway
- v) Median Marking

1.7 LONGITUDINAL MARKING

Longitudinal markings are placed along the direction of traffic on the roadway

surface, for the purpose of indicating to the driver, his proper position on the roadway. Some of the guiding principles in longitudinal markings are given below.

i) The lines can be either broken, solid or double solid. Broken lines are permissive in character and allow crossing with discretion, if traffic situation permits.

ii) Solid lines are restrictive in character and do not allow crossing except for entry or exit from a side road or premises or to avoid a stationary obstruction.

2. OBJECT MARKING

Physical obstructions in a carriageway like traffic island or obstructions near carriageway like signal posts, pier etc. cause serious hazard to the flow of traffic and should be adequately marked. They may be marked on the objects adjacent to the carriageway.

2.1 OBJECTS WITHIN THE CARRIAGEWAY

The obstructions within the carriageway such as traffic islands, raised medians, etc. may be marked by not less than five alternate black and yellow stripes. The stripes should slope forward at an angle of 45 with respect to the direction of traffic.

2.2 OBJECTS ADJACENT TO CARRIAGEWAY

Sometimes objects adjacent to the carriageway may pose danger and obstruction to the flow of traffic. Objects such as subway piers and abutments,

culvert head walls etc. are some examples for such obstructions. They should be marked with alternate black and white stripes at a forward angle of 45 with respect to the direction of traffic. Poles close to the carriageway should be painted in alternate black and white up to a height of 1.25 m above the road level.

2.3 MARKINGS FOR PARKING

The marking of the parking space limits on urban roads promotes more efficient use of the parking spaces and tends to prevent encroachment on places like bus stops, fire hydrant zones etc. where parking is not allowed and is undesirable. Such parking restrictions should be indicated with markings that are solid white lines 100 mm wide. Words TAXI, CARS, SCOOTERS etc. may also be written if the parking area is specific for any particular type of vehicle.

2.4 MATERIAL AND COLOUR

The material commonly used for pavement, curb object markings is hot applied thermoplastic paints, which are now-a-days specified for roads. Improved night visibility is obtained by the use of minute glass beads incorporated in the markings to produce a retro-reflective surface.

Thermoplastic marking paint is mainly composed by synthetic resin, glass beads, pigments, packing materials, additives, etc.

1. Synthetic resin has thermo plasticity, make the hot melt coating fast dry and strong adhesive to the road surface.

2. Additives in the paint can increase the plastic of the coating, and make it resistant to subsidence, pollution and color fading.

3. Pigments: the common colors of road lines are yellow and white. White pigments are mainly titanium dioxide, zinc oxide, and lithopone, while yellow pigment is mainly heat-resistant yellow lead.

4. Packing materials, as filling added into the paint, ensure mechanical strength, wear resistance, and color of paint coating. The particle size will affect liquidity and precipitation, as well as the surface processing.

5. Glass beads are added in order to improve the identification of lines at night, to improve the brightness and durability of the marking. Glass bead is colorless and transparent ball, has function of light refraction, focusing and directional reflection. Glass bead mixed in the coating or dispensed throughout the coating surface can reflect car light back to the driver's eyes, thus greatly improving the marking visibility.

3. TRAFFIC SIGNS

Traffic control device is the medium used for communicating between traffic engineer and road users. Unlike other modes of transportation, there is no control on the drivers using the road. Here traffic control devices comes to the help of the traffic engineer. The major types of traffic control devices used are- traffic signs, road markings, traffic signals and parking control.

3.1 REQUIREMENTS

The requirements of traffic control devices are listed below:

1. The control device should fulfill a need: Each device must have a specific purpose

for the safe and efficient operation of traffic flow. The superfluous devices should not be used.

2. It should command attention from the road users: This affects the design of signs. For commanding attention, proper visibility should be there. Also the sign should be distinctive and clear. The sign should be placed in such a way that the driver requires no extra effort to see the sign.

3. It should convey a clear, simple meaning: Clarity and simplicity of message is essential for the driver to properly understand the meaning in short time. The use of color, shape and legend as codes becomes important in this regard.

3.2 TYPES OF TRAFFIC SIGNALS

There is several hundreds of traffic signs available covering wide variety of traffic situations. They can be classified into three main categories.

1. Regulatory signs: These signs require the driver to obey the signs for the safety of other road users.

2. Warning signs: These signs are for the safety of oneself who is driving and advice the drivers to obey these signs.

3. Informative signs: These signs provide information to the driver about the facilities available ahead, and the route and distance to reach the specific destinations

In addition special type of traffic sign namely work zone signs are also available.

3.2.1 REGULATORY SIGNS

These signs are also called mandatory signs because it is mandatory that the drivers must obey these signs. If the driver fails to obey them, the control agency has

the right to take legal action against the driver. These signs have generally black legend on a white background. They are circular in shape with red borders.

3.2.2 WARNING SIGNS

Warning signs or cautionary signs give information to the driver about the impending road condition. They advise the driver to obey the rules. These signs are meant for the own safety of drivers. They call for extra vigilance from the part of drivers. The color convention used for this type of signs is that the legend will be black in color with a white background.

3.2.3 INFORMATIVE SIGNS

Informative signs also called guide signs, are provided to assist the drivers to reach their desired destinations. These are predominantly meant for the drivers who are unfamiliar to the place.

4. TRAFFIC SIGNALS

Traffic control signals are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control flows of traffic. Traffic lights alternate the right of way accorded to users by displaying lights of a standard color (red, amber (yellow), and green) following a universal color code.

4.1 HISTORY OF TRAFFIC SIGNALS

Before traffic lights traffic police controlled the flow of traffic, a well-documented example being that on London Bridge in

1722. Three men were given the task of directing traffic coming in and out of either London or Southwark. Each officer would help direct traffic coming out of Southwark into London and he made sure all traffic stayed on the west end of the bridge.

The first interconnected traffic signal system was installed in Salt Lake City in 1917, with six connected intersections controlled simultaneously from a manual switch.[7]:32 Automatic control of interconnected traffic lights was introduced March 1922 in Houston, Texas.

The first traffic light in South India was installed at Egmore Junction, Chennai in 1953. The city of Bangalore installed its first traffic light at Corporation Circle in 1963.

4.2 TRAFFIC SIGNAL CYCLES

Generally, at least one direction of traffic at an intersection has the green lights at any moment in the cycle. In some jurisdictions, for a brief time, all signals at an intersection show red at the same time, to clear any traffic in the intersection. The delay can depend on traffic, road conditions, the physical layout of the intersection, and legal requirements. Thus modern signals are built to allow the "all red" in an intersection, even if the feature is not used.

4.3 TRAFFIC SIGNAL

A traffic light, traffic signal or a stop light is a signaling device positioned at a road intersection to indicate when it is safe to move through. The traffic signal passes on its information using a universal color code.

4.4 TRAFFIC RULES IN INDIA

The transport department of each and every city around the world has been entrusted with the responsibility of providing a smooth public transportation system on roads, controlling pollution under permissible limits, keeping a record of registration of vehicles, insurance of vehicles, issuing permits and collection of taxes. These departments function by devising policies, implementing them and then monitor and regulate the functioning of the transport in the city.

Traffic rules of the roads are both the laws and the informal rules that may have been developed over time to facilitate the orderly and timely flow of traffic. With the replacement of ancient horse driven carts with cars and trucks, the speed of the traffic increased paving way for the need of smooth roads and yet smoother traffic. So, to curb the need of the smoother traffic, some rules were devised to assure that the traffic runs smooth. Almost all of the roadways traffic rules are built with devices meant to control traffic.

5. EMERGENCY LANE

The developer is responsible for the installation and the property owner is responsible for maintenance of the signs and markings necessary to designate

emergency access lanes. Emergency access lanes must be able to accommodate all emergency vehicles, including fire equipment and must be delineated in a clear and uniform manner. The following is required.

1. Easements for emergency access lanes should allow the shortest practical direct access to points of concern.
2. The emergency access lane will be paved or an alternate surface treatment meeting the requirement of the fire district will be used. The emergency access lane must have a minimum continuous width of 24ft. unless it is a one way aisle or for emergency vehicle use only in which case a 18ft width will suffice. All corners must have a minimum inside radius of 25ft and when turnaround is employed. The minimum radius must be 37ft. Maximum grades must not exceed 8%. Where structures are erected over the lane, vertical clearance must be less than 13.5ft.

In growing metropolis, increase in vehicular traffic is one of the early effects of urbanization, economic growth and increase in floating population. The vehicular traffic in dense areas of the growing city puts lot of pressure on the emergency vehicle movement such as ambulance, fire brigade, police and other emergency lanes and it often results into risk for patients and also to their family

The following data is obtained from the ramanthapur church road(street no.8 road) to uppal:-

Location:	Street no-8			Date:	9 april 2017								
Traffic Movement:	UPPAL to RAMANTH APUR			Time:	6:00A M-10:00 AM								
TIME	2-W	3-W	4-W	Bus/Trk	LCV	2-Axle	Mul-ti-Axle	Artic/Semi Artic	CYCLE	Cycle Rickshaw	OTHER	TOTVEH	
6:00-6:15	71	45	39	40	9	4	0	0	7	7	0	222	
6:15-6:30	82	50	39	35	8	5	0	0	5	0	1	225	
6:30-6:45	117	60	59	45	6	3	0	0	3	0	0	293	
6:45-7:00	147	64	54	35	9	7	0	0	2	0	0	318	
7:00-7:15	163	99	61	58	15	8	0	0	4	0	0	408	
7:15-7:30	166	85	87	87	10	9	0	0	3	0	0	447	
7:30-7:45	170	83	85	64	13	4	0	0	4	0	1	424	
7:45-8:00	170	82	93	72	15	9	0	0	1	0	0	442	
8:00-8:15	172	63	74	63	15	5	0	0	4	0	0	396	
8:15-8:30	215	85	54	70	8	5	0	0	2	0	0	439	
8:30-8:45	187	105	114	61	8	7	0	0	3	0	1	486	
8:45-9:00	277	100	99	50	13	4	0	0	2	0	0	545	
9:00-9:15	337	168	153	93	27	24	0	0	6	0	0	808	
9:15-9:30	249	105	124	40	16	5	0	0	1	0	0	540	
9:30-9:45	231	105	140	33	10	14	0	0	4	0	0	537	
9:45-10:00	299	139	128	34	7	4	0	0	3	0	1	615	

6. SIGHT DISTANCE

Sight distance at any instance is the distance along the center line of the road which is visible to the eye of a driver at an height of 1.2 m from the road surface such that an obstruction of height 0.15 m is visible to him. The heights of the eye of the driver and the obstruction are standardized by the Indian Roads Congress.

6.1 TYPES OF SIGHT DISTANCE

1. STOPPING SIGHT DISTANCE

SSD is the sight distance which is necessary for a driver to stop a vehicle from the design

speed to the 0 speed without any collision with the obstruction on the road

$$\text{SSD} = \text{lag distance} + \text{breaking distance}$$

LAG DISTANCE

The distance travelled by the vehicle during the total reaction of time

According to IRC total reaction time is 2.5sec

$$\text{Lag distance} = \text{velocity} * \text{time}$$

BREAKING DISTANCE

It is distance travelled by the vehicle after applying the break.

$$\begin{aligned} \text{Work done in applying break} &= \text{force} * \text{distance} \\ \text{SSD} &= \text{VT} + \text{V}^2 / 2\text{gf} \end{aligned}$$

OVERTAKING SIGHT DISTANCE

OSD is the sight distance which is necessary for a vehicle running at the design speed to overtake a slower moving vehicle without collision with the vehicles

coming from the opposite direction. Generally it is not possible to provide the OSD at every cross section of the road so, it is provided after a stretch of the road.

$$\text{OSD} = \text{d1} + \text{d2} + \text{d3}$$

D1=the distance travelled by the vehicle by maintaining the velocity of vehicle before overtaking.

D2=the distance travelled by the vehicle within a duration

D3=the distance travelled by the vehicle within overtaking speed

The minimum length of overtaking zone=3*OSD for 1 lane

=3(d1+d2) for 2 lane

The maximum length of overtaking zone=5*OSD

INTERMEDIATE SIGHT DISTANCE

Intermediate sight distance is defined as twice of SSD.

INTERMEDIATE SIGHT DISTANCE=2*SSD

7. SAFETY MEASUREMENTS

General issues of major road accidents are:-

1) Drunken Driving: Impairment by alcohol is an important factor in causing accidents and it has been found as per study reflected on different websites that alcohol was present in between 33% and 69% of fatally injured drivers, and in between 8% and 29% of drivers involved in crashes who were not fatally injured. A study on drivers killed in road crashes has revealed that teenage drivers have more than 5 times the risk of a crash compared with drivers aged 30 and above, at all level of BAC. Drivers 22 to 29 years old were estimated to have 3 times the risk compared with drivers aged 30 years and above, at all BAC levels.

2) Missing Speed Breaker: Speed breakers are traffic-calming devices constructed in accident-prone areas. Driving at high speed in locality is not uncommon and the common road safety violators. In Delhi, if a stretch of road becomes accident prone for some reason and the local residents want to get a speed breaker constructed, an application may be sent to DCP/Traffic (HQ), New Delhi. On receipt of the application, it is analyzed from traffic point of view and recommendation is sent to Speed Breaker Committee, which decides the construction or removal of any speed breaker.

3) Under age driving: Of recently, the driving by underage people is not uncommon on Indian roads. The biggest problem is that parents are encouraging underage driver when law clearly does not permit. Even parents who sit behind the driver's seat when minor is driving, is also wrong under prevailing law. Often when the accident occurs, the culpability of the parents is booked for failing to meet moral and legal responsibility. Schools can play active role in educating students and parents with menace of minor driving.

The following are some of the safety measurements should be taken while driving on the roads:-

1. As they say speed thrills and also kills. Keep a rein on your speed, so that one is in better control of the vehicle. Find out what causes you to speed up? Is there an urge to speed when you have a driver close behind? Or, is it an effort to keep up with the traffic flow.

2. Obey traffic rules. Traffic rules have been designed with safety foremost in mind. It takes into account safety for all, including pedestrians. Follow the lane, and keep the required distance between vehicles. It is important to display appropriate indications/signals especially while changing lanes or before a turn.

3. Wear seat belts. Seat belts are lifesaving. A statistic has revealed that 63% of those who died in accidents had not strapped on their seat belts. According to the National Highway Transportation Safety Administration (NHTSA), lap-

shoulder belt systems cut the risk of serious injury and fatality by 50 percent.

4. Pedestrians and children come first – Preference is to be given to pedestrians and children crossing the road.

5. Read caution signs: Caution signs are very important as they warn about accident prone spots so that the driver can reduce the speed of the vehicle. Signboards on the road are vital clues about road design so that the person behind the wheel can exercise caution.

6. Adopt antiskid break systems in the cars, so that the risk of cars skidding can be reduced.

7. Air bags in vehicles are a must to cushion the impact in case of accidents.

8. Reflectors to be used on the rear of the vehicle. Ensure all lamps are in working condition. Hazard lamp should be switched on when the vehicle is parked on a highway.

9. Vehicle must be in good working condition- there should be no compromise on the quality of brakes and tyres. Further, it is imperative to inflate tyres with the right air pressure to avoid tyre bursts on road.

10. Roads should be in good condition with proper sign boards. It is vital to install reflectors on roads so that deviations and medians are clearly visible to drivers.

11. Avoid drugs and alcohol while driving. Drugs and alcohol can slow down reflexes, disrupt accurate judgments, and cause mental alertness to dip.

12. Falling asleep behind the wheel has led to many grave mishaps on the road. Drivers must rest well as the lack of it can have an adverse effect on mental alertness, slow down reflexes, and even cause momentary sleepiness behind the wheel. What follows is a disaster.

8. CONCLUSION

All the road visual aids like road markings, traffic signs and traffic signals are helpful for a passenger to drive safely, take necessary diversions, and necessary information is drawn from these visual aids while traveling on roads. The essential purpose of road markings is to guide and control traffic on a highway and they are very important to ensure the safe, smooth and harmonious flow of traffic. Traffic signs or road signs are signs erected at the side of or above roads to give instructions or provide information to road users. Traffic signals are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control flows of traffic.

Emergency lane has been designed in this project and we concluded from the above data that the installation of emergency lanes can reduce inconvenience to emergency vehicles such as ambulance, fire brigade, police and some other important vehicles in such a way that a lane is provided to them in order to reach their destination in time so that it may save a life of few people and for people who need help in emergency cases and it doesn't disturb any other people on road.

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