

Proper Setting of Traffic Safety facilities on Rural Highway

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Abstract. According to the rural highway traffic accident rate has a rising trend year by year due to traffic safety facilities no perfect, and considering the actual situation of rural highway traffic safety, the paper analyzes the common pattern of the rural highway traffic safety facilities, and fully augments setting conditions, theoretical foundation and standard of the various traffic safety facilities, and explores setting method of the rural highway traffic safety facilities to be suited to the characteristics of the rural highway and traffic.

Introduction

In recent years, the implementation of the "Village-to-Village" project, the rural highway network has basically formed has effectively promote the development of rural social and economic. But due to the limitation of funding and technical level, rural high-way traffic safety situation is not optimistic. Frequent grave traffic accidents do great harm to the broad masses of farmers' life and property safety. Therefore, on the basis of strengthening safety management on rural highway traffic, how to reasonably set up traffic engineering facilities and improve the poor situation rural road traffic safety has become a pressing problem.

The characteristics of rural highway

Rural highway has wide coverage and long mileage and the index level, such as longitudinal slope, horizontal curve radius, stadia and the basic technology for the safety is low. At the same time, the roadbed is generally narrower. There are quite a part of "three faces" (in the mountain, near water, cliff) highway which are lack of safety protection facilities and formed with complicated traffic participants. These features are the main factors influencing the rural road traffic safety and comfort.

The commonly used pattern and the effect of the rural highway traffic safety facilities

Rural highway is different from other higher level highway; Traffic engineering facilities of it normally involves only part of the traffic safety facilities mainly including signs, marking, roadside anti-collision, induction and boundary tablets, hundreds of meters pile, milestones, and etc. But these facilities are obviously restricted to the terrain, linear and capital. So, setting up reasonable traffic safety facilities is a more complex task.

Traffic signs. Currently, parts of the traffic signs are set up on the vast majority of the rural highway. But they are always characterized by simple facilities, fuzziness mark layout, improper sign position setting and the inconvenience to identify [1]. Although all levels of road traffic signs are clear in such aspects as color, shape, character and design basic. But there are no clear rules for different grade highways in setting up location, form, material selection, size, etc. Therefore, the actual condition of roads, design speed and other factors should be taken into account when setting rural highway traffic signs.

Structure forms. At present, the vast majority of rural highway is level 3 and level 4 highways and substandard roads. Most roads are two-way two-lane and the rest are one lane. For more than 95% of the rural road, the design speed is under 40 km/h. Adopting single column type of the traffic signs structure will be

able to achieve good use effect which has low cost, convenient construction, and better coordination to the road.

Installation location. The corresponding design speed and visual cognition distance under corresponding speeds of the rural highway is shown as Table 1.

Table 1. Design Speed and Visual Cognition Distance

road grade	design speed /(km/h)	visual cognition distance /m	static visual cognition distance /m
3	40	33.7	51.1
	30	37.4	46.6
4	20	49.8	56.0

According to the visual cognition distance and general reaction time after drivers seeing the traffic signs and taking the time needed for braking. The distance from the traffic sign to the dangerous point is during 20 ~ 50 m that can meet the requirements of vehicle safety as long as the traffic sign is marked and visibility.

Reflective requirements. According to the statistics, traffic volume at night accounts for about 14% of the total traffic throughout the day in rural highway. The number of the traffic accident at night accounts for more than 20% of the total number of accidents. So, the reflective effect of traffic signs on driving safety is also very important. According to the relationship among the mark brightness and identification distance, safe parking stadia, driving speed and the readable distance, the brightness of the engineering materials with low level is 22 ~ 50, and The readable distance is at the range of 113 m ~ 155 m which is enough to meet the general rural highway design speed requirements for traffic signs reflective effect [2].

Sign size. According to the relationship among the speed, visual cognition and visual cognition size, the traffic signs will be able to meet the requirements of train operation safety when choosing the smaller size. Considering the lack of capital in rural highway, the structure and plank can use non-national standard.

Setting method of traffic marking. At present, the minimum width of the driveway in rural highway is 3 m, so when the pavement width is 6 m or higher, there should be the center line. For some road with small plane curve radius and poor visibility, there should be the center line even if the pavement width is less than 6 m. Besides, the road edge lines can guide the vehicle close to the center line and avoid the roadside accident. For some road with single lane, it is better to set traffic line markings on both sides of road in a sharp and poor visibility road. A lot of research shows that the width of the vertical line does not of impact the traffic and the driver's psychological. So the rural highway traffic line markings should not be too wide.

If possible, visual and illusion deceleration marking should be set in some easy over the speed limit sections.

Materials of traffic marking. Marking material must be with good visibility and durability. And the raw materials should be with moderate price and easy to obtain and construct. Commonly used type pavement marking paint can be divided into the normal temperature, heating and melting according to the construction of temperature. Due to the low level of construction technology and the shortage of funds, it is advisable to use normal temperature in rural highway.

Roadside anticollision facilities. Due to the high cost and the high-demanding on technology for half rigid or flexible anti-collision facilities, rigid anti-collision facilities are usually used in rural highways. There are cement concrete guard-rail with wall type, fender pier and warning pile etc. Warning pile is generally made of reinforced concrete and the distance is set to 2 ~ 3 m. it should be buried deep under the ground above the ground with 80 cm and colored with red and white appearance.

Fender pier was created by pouring concrete with basement at the bottom.

Wall guardrail has warning function; And can absorb collision energy, for a wide variety of vehicles, vehicle trip resistance, prevent vehicles from the out-let, cause more serious secondary accidents.

Sight guidance facility. According to the statistical results, after setting warning piles and sights in the sharp curve and bad visual field, the average number of accidents, deaths and injuries were 19%, 13% and 19%

respectively of before, especially the death [3]. It shows that a warning pile has good effect to prevent smaller, speed slower vehicles from running outside the way.

Due to the high cost of delineator, engineering grade reflective film can be attached to the sides above warning pile instead. According to the height of warning pile and delineator, the reflective film could be stick on top of the 60 cm off the ground [4].

The choice of safety facilities in different road

Small radius curve and stadia bad road. According to the design speed, for the road with minimum radius or smaller plane curve radius and bad visibility, the measures of speed limit should be taken. The warning signs, such as sharp, reverse de-tours, winding road can be set with speed limit signs (or speed Suggestions signs) together while setting prohibit change lanes lines and speed hump and the corresponding orientation arrows. When the total length of winding road is more than 500 m, signs should be set repeatedly or added with auxiliary sign with the explanation of the winding road length. According to the rural highway design speed and the vehicle's cornering ability, the top speed should not be more than 20 km/h and tractor should not be more than 15 km/h [5].

Steep slope, long downhill and straight sections. There should be the warning signs with slope value in steep slope and long downhill sections. When the total length of continuous downhill is more than 3 km, there should be an auxiliary sign shows the length of continuous downhill slope or duplicate signs. And speed limit and speed hump signs is set at the starting point of downhill. Considering the vehicles may be out of the roadbed, concrete guardrail should be adopted a roadside. According to the general design speed of rural highway, the straight segment length should not be more than 800 meters. When the length is more than this value, the speed limit should be made for the road and there should be a sign of keeping distance in rear-end collision accident black-spots and set the deceleration facilities [5]. According to the characteristics of rural roads, cheap pebbles deceleration zone is more appropriate. If possible, the hot melt type deceleration zone can be employed.

Roadside dangerous road. By the statistics, roadside accident accounted for more than 20% of traffic accident in low level rural highway [2]. So, in addition to set up the corresponding signs and lines, but also should be set up necessary roadside protective facilities in the roadside where are ponds, lakes, reservoirs, rivers, steep cliffs, deep groove, high slope and high retaining wall, etc.

Because the warning pile can provide better sight guidance, and be able to stop the smaller, the speed slower vehicles outside the outlet, so it can be chosen as roadside anti-collision facilities in a normal curve, ramp, and high fill section and the bridge approach road.

The cost of fender pier is high. For some of the dangerous sections with higher design speed, should consider setting up concrete pier.

The cost of Wall guardrail is high and the construction is difficult. It is effective to prevent the vehicle outside the way. It is Suitable for the dangerous road with larger models and high speed. This form does not use in general rural roads. But in the special road, it is appropriate.

Villages and towns and the school road. When there is village which is not easy to find ahead the road, the village sign should be set in front of the village. Rural roads is often through towns and even become street. So there should be signs of speed limited on both sides of the road. There should be the signs of pay attention to the pedestrian if the pedestrian crosswalk is not easy to notice. Signs and lines need to be set in pedestrian crosswalk complying with the stop lines, guide, lane line and pedestrian crossing warning marks. The signs of pay attention to children should be set in the road which is at the ends of schools or kindergartens.

Bridge and tunnel. The structure of bridge in rural highway is simple. Bridge deck is narrow than the road. Or even the number and the width of the lane is not lessen, but the shoulder is narrow because that the footwalls which is higher than the pavement extend to the shoulder. It is dangerous for driving on both ends of

the bridge. A sign of narrow bridge should be set. If the principal part of the project is not set protective measures, guardrail and fender pier should be set.

Rural tunnel is usually a single hole of two-way road without lighting. There should be signs of tunnel and lighting before the tunnel entrance as well as speed hump and the line of sight induced facilities. It is forbidden to pass in the tunnel, so the raised pavement markers should be set at roadway edge line and lane line.

Intersections. Guide signs. When the county road intersect with national highway and provincial highway, the sign of information and confirmation should be set at the country road and signs of advance warning should be set at the national highway and provincial highway. When the county road intersect with county road, the sign of information should be set. When the village road intersect with village road, the sign of information should be set.

Management method. If there is a primary and secondary relationship or the traffic volume is obviously differences, signs of priority and giving way and should be set cooperating with the marking.

Traffic marking of intersection. Intersections on rural highway which meet third level would take channelization design when turning traffic volume is high. When there are many people crossing the highway intersection, a pedestrian crosswalk and necessary orientation arrow, stop line and other traffic lines would be set. If conditions permit, a lane boundary line would be designed to prohibit vehicles overtaking and driving through opposite lane.

Summary

Proper and complete setting of traffic safety facilities on rural highway is acting an important role on both reducing number and injure in traffic accidents, and keeping safety of rural highways. In this case, it would be an important topic in planning, designing and instruction of rural highway that deserved to be noticed and study.

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