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SHORTCOMINGS IN TRAFFIC CONTROL DEVICES ON RURAL HIGHWAYS OF PAKISTAN AND THEIR RECTIFICATIONS

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ABSTRACT

Traffic signs, signals and road markings installed on the roads and highways need a lot of improvements in Pakistan. They do not fulfill the fundamental conditions as per international standards i.e. peculiar shapes, sizes and colors. Among all the reasons the most important being the lack of a proper Manual, outlining the warrants and other details essential for putting up proper signs. The problem is further being made worse by the lack of qualified traffic engineers, not fully familiar with the art and science of traffic signs. As a result, the field engineers and contractors were left to their own wishes with regard to design and installing of the road signs. Where as in developed countries there are many signs manufacturing firms who are specialized in this particular field. Many international organizations making efforts for the uniformity of markings and road signs in order to improve the safety of roads and to enhance international roads traffic, but in Pakistan not much significant work has been done and is still very much lagging in this industry. This study is aimed to investigate about the improvements that need to be done in traffic signs and markings, there installation and their maintenance. This will help to make the traffic flow more safe and efficient. The up short of all this study is to enhance the best possible safety of the road users by awaking and changing the aptitude and attitude of users towards the traffic control devices.

Contribution/Originality: This study contributes in the existing literature by suggesting improvement measures for traffic control devices used on rural highways in most of developing countries in terms of its manufacturing, installation and maintenance and also the road users response that can be enhanced by taking these measures.

1. INTRODUCTION

Traffic control devices (TCD) are all type of markings, signs, islands and signals placed on or adjoining to a highway by local authorities and the officials having authority to guide, regulate or warn the traffic. The need of uniform standard for traffic control devices has been felt for long time by all countries of the world. Various

international agencies are making effort for the uniformity of markings and the road signs in order to improve the safety of road and to enable international road traffic [1].

Markings and traffic signs are provided for legal compulsions and give information and guidance, there by manipulating the behavior of road users. Moreover, they are used to guide and control traffic and to endorse road safety keeping in view the legal requirements of marking and signs. In considering traffic signs and markings it is critical that they should be provided such that they support through movement and surrounding movements safely.

Poškiene and Sokolovskij concluded that by introducing traffic control devices in the road infrastructure, improve road safety and reduce the number of accidents. Traffic control devices, which improve road safety and reduce the number of accidents but on the other hand reduce mobility on roads and streets. So compromise between safety and mobility is possible. In addition, traffic control devices will reduce pollution by exhaust gases and noise which keep the environment clean [2].

Arund in 2005 stated that regulating access control leads to service improvement, priority to through traffic and reduce road crashes. Access to the main highways should be minimal to control crashes. Best alternative is to reduce accidents in the junctions are to provide stop signs which gives more time for the road users to judge and decide before entering the highway at junction. Traffic control devices such as traffic signals provide traffic safety at intersections. The major cause of accidents at intersections is the absence of control device, which leads to crashes between drivers, bicyclists and pedestrians [3].

In 1992, Faure demonstrated that reduced number of accidents on the main street is mostly because of traffic control devices. Speed limit signs should be provided to reduce accidents on pedestrian's streets because these streets are largely vulnerable to crashes. Also because of the availability of traffic control devices on urban streets indicate low accident rate. Pedestrian crossings at signalized intersections reduce road crashes and injury by 5 to 10% compare to the un-signalized intersections. However, pedestrian crossings, which are signalized by traffic control devices, which come as a surprise to the road users, will lead to abrupt speed reduction and cause more rear-end collisions [4].

Sometime it looks like that traffic control devices, which are mainly proposed to improve road safety and increase mobility (such as right turn on red, speed limits signs etc.) do not reduce the accidents rate on a highway. While on the other side, the World report of 2005 based on road safety demonstrated that traffic control devices such as traffic signs, lower speed limits etc. leads to fewer accidents record [5].

Dissanayake and John Lu tested the performance of international and domestic drivers and found that domestic drivers performed well than international drivers, which indicates that improvement is necessary. Different research should be conducted to recognize weak zones so that road safety and transportation requirements for international drivers could be provided. Two major countermeasures to improve traffic control devices such as road markings, traffic signs etc and to provide transportation linked facts available to international drivers. Additional investigations are necessary on how to improve road traffic signs to convey clear information. Furthermore, standardization of traffic rules and regulations would be more advantageous not only for international drivers in the states of US but also for the overall world [6].

According to the current situations, human losses injuries and damages are main and rising public health epidemic. World Health Organization demonstrated that in the year of 2002, about 50 million people were injured and 1.2 million deaths were occurred world widely. If necessary actions were not taken, forecast of universal road deaths are to be double in the year of 2020. However, a lot of these injuries and deaths can be preventable by traffic control devices. Furthermore, 85% of these injuries and deaths occurred in middle and low income countries. In the middle and low income countries, these injuries and deaths due to the road accidents enforce huge economic costs on the economy, which are estimated as $64500 million - $100000 million [7].

Robert L et al. stated that traffic control devices are necessary on every type/class of highways either it is urban, suburban or rural and routes. Traffic control devices must be provided near school, hospitals and populated

area so that children, patients and mobility-impaired people can cross a busy traffic routes safely. People accept the demand of traffic control devices to assure mobility and safety [8].

Finley et al. in 2018 carried out a research and stated, to better understand the existing traffic control device guidance and standards, 2009 MUTCD (Manual for Uniform Traffic Control Devices) were reviewed. To recognize possible conflicts in the past language and dimensions of the alphabets compare to the current language and dimensions of the alphabets on the signboards, the past versions of MUTCD were also reviewed. Through this manner, researchers recognized many issues with current figures, language and dimensions of alphabets on the signboard [9].

In Pakistan, signs, signals and road markings installed on the road facilities need a lot of amendments. They fundamental requirements of traffic control devices are not up to standard. The field staff installing these devices are also not that much skilled in terms of message to be conveyed by those particular devices. Traffic control devices in Pakistan are erected in very haphazard way, without regard to the need. The erection/installation of these devices is governed by the individual whims. As a result, they often create problems. There are a number of reasons for this, the most important being the non-implementation of a proper Manual, outlining the warrants and other details essential for putting up proper signs. The problem is further being made worse by the lack of qualified traffic engineers, fully familiar with the art and science of traffic signs. As a result, the field engineers and contractors are left to their own wish with regard to design and installing of the road signs [10]. More over in developed countries, there are many sign manufacturing firms who are specialized in this particular field. In comparison Pakistan is still very much lacking in this industry. Secondly even the local language in most developed countries use English alphabets for the purposes of road signs, letters capital as well as small have been standardize in terms of their shapes, size, width, height and spacing. Templates are provided for each letter which makes the job of sign composition very easy. On the other hand, the same cannot be done for Urdu language due to distinct styles of calligraphy. The only helpful hint which can be given in this regard is that person composing the sign must do so in such a way that the Urdu version is in harmony with the English message. According to the Pakistan Economic Survey, 2017-2018 as Pakistan is still a developing country with literacy rate of approximately 58%, majority of the drivers are unable to perceive the necessary information from sign boards because of language barrier[1].

Even though, Highway Code provides detail information about the rules for pedestrians, users of powered wheel chairs and mobility scooters, rules for drivers, cyclists and motorcyclists as well as techniques and advice for all riders and drivers. Still in Pakistan, there is no accessibility consideration for the pedestrian with special need (mobility impaired and sensory impaired) as well as there is no proper channelization for the mobility of senior citizen and children. Therefore, it is the need of the day to proposed improvements in standards of pavement marking and road signs keeping in view the internationally practicing standards [11]. Improvement of the standards and applications of traffic signs and road markings is an on-going process. We commenced a comprehensive study on manual of signs, signals and marking by National Transport Research Centre Planning Commission Pakistan [12]. On basis of these studies and our daily life observations, we have identified improvement measures. Based on the analysis of the identified common problem areas and a study on practices adopted by major overseas countries, we have developed an improvement strategy that include three main areas i.e. design standards, installation and monitoring/maintenance.

2. PROPOSED IMPROVEMENTS TO TRAFFIC CONTROL DEVICES

2.1. Proposed Improvements to Design Standards

Traffic signs must be provided to fulfill the need and convey clear message to road users. We have identified a number of existing regulatory traffic signs and markings that could be improved by redesigning their size, colour

[1] https://www.thenews.com.pk/print/309542-pakistan-s-literacy-rate-stands-at-58pc

and shape for better readability and aesthetic appearance. Following are types of Traffic Signs and the design standards that are necessary for safety of the road users.

Warning signs, such as Curve sign, Pedestrian crossing sign, Animal crossing sign, Pavement narrows sign, Two-way traffic sign and U turn sign appeal consideration to unforeseen situations on highway or private roads used by public and to circumstances that might not be voluntarily obvious to road users. An engineering judgment or engineering study should be carried out while using warning signs. The use of warning signs should be optimum as the needless use of warning signs tends to raise disrepute for all signs. In circumstances, where the activity or situation is temporary or seasonal, the warning sign should be detached when the condition or activity does not exist. Regulatory signs, such as stop sign, slow sign, speed limit sign and mandatory speed limit are used to notify facility users of certain regulations or traffic laws and specify the applicability of the legal necessities and shall be mounted at or near where the regulations apply. The signs shall evidently specify the necessities forced by the regulations and shall be planned and mounted to deliver satisfactory legibility and visibility in order to attain compliance. Regulatory signs shall be retro reflective to illustrate similar colour and same shape and by both day and night, unless specifically indicated [11]. Information signs, such as Hospital sign, Advance direction sign and Petrol pump sign are used to inform the road users of the purpose of an object or to give some instruction on the use of something. These should contain a user friendly color as well as sign according to the design manual for road signs.

2.2. Proposed Improvement in Markings

Vital purposes of markings along with the signs on highways are to provide information and guidance for the facility users. Foremost marking types comprise of delineators, curb and pavement markings, islands and collared pavements. However reflectivity of the markings can be flawed by debris, snow and water on or adjacent to the markings. Retroreflective road markings should be used as these reflect back the headlights of vehicle to the driver's eyes, making the marking more visible and easy to read.

2.3. Installation

In addition to design standards, we have also carried out an assessment of the existing practices and procedures relating to the installation of traffic signs, signals and road markings in Pakistan and suggested some improvements in installation. In order to improve the putting in place of signs and markings, we should include drawings in the Works Request Forms that shows the elevation view of the proposed signs and the minimum visibility requirement. This will helps to reduce obstruction to pedestrians and to deal with sign clustering or visibility problems. Multiple signs (up to a maximum of three) should be placed on a single post to reduce the number of street furniture. Landscape works along roads need be so designed to minimize the sign visibility problem. Sign poles, sign mountings and their bases shall be built to grip signs in stable position and appropriate orientation, to stand firm fluctuation in the wind and dislocation by wreckage. Following are the improvements in installations of signs.

A warning sign is usually positioned in advance of the situation to which it calls consideration. Warning signs explain consideration to unforeseen circumstances on or neighboring to a highway that might describe for a reduction of speed. The use of such signs shall be also based on an engineering study. The use of these signs should be preserved to a lowest. Perception-Response Time should be kept in mind for determining warning sign location. On rural highways where feasible, these signs should be located at least 3.6 m and a maximum of 9 m from the verge of travelled way section. In rural zones, these signs should generally be positioned about 150 m in advance of the situations. Typical positions and situations that may justify the use of these signs include:

- Changing horizontal alignment
- Congregating traffic lanes
- Intersections

- Tapered roadways
- Changes in highway design
- Facility situations
- Change in Grades
- Entrances and crossings
- Railroad intersections

Regulatory signs inform road users of selected traffic rules and shall be mounted at or nearby where the regulations apply. The regulatory signs shall plainly specify the regulations and shall be fixed to provide satisfactory visibility to obtain obedience. These signs shall be retro reflective to show similar colour and same shape by both day and night. Excluding parking limitations, two of these signs for dissimilar purposes fronting the same traffic stream should not be attached on the same pole. All regulatory signs shall be illuminated or retro reflected to show the same shape and colour both by day and by night, unless accepted in the Traffic Sign Specifications. These signs should be placed at least 3.6 m and a maximum of 9 m from the verge of travelled way section same like the warning signs. Guide or information signs are sited where desirable to inform motorists up to date of the direction to their station. Signs which are demanded chiefly for publicity or recognition commitments shall not be mounted. Neither sign nor its pole shall endure any profitable advertising material. Never place a diverting legend on these signs. The letter height for the standard legend shall be at least 100 mm. These signs should be positioned in advance of a point where a driver decision is obligatory so that they can be read helpfully. If approaching speeds are high, a supplementary advance guide sign should be deliberated that need to be installed. A positioning of at least 60 m between these signs should be preserved on rural highways. These signs should be positioned as far from the travelled way as possible, up to a maximum of 9 m when it is preferred to deliver a clear roadside recovery area [13].

2.4. Maintenance

Maintenance activities should be carried out on regular bases to reflect suitable legibility, location, concentration and daytime and night time reflectiveness. Scratched signs should be substituted. To guarantee satisfactory conservation, a plan for cleaning, examining and substituting object markers and signs should be reputed. Staffs of highway, law execution and other public agencies should be encouraged to report any worsened and scratched post or signs at the first break. A systematic plan of replacement of lighting features for illuminated signs should be conserved [14].

2.5. Materials

The prominence of edge and centerline markings at night can be enhanced by using retro reflection paint because in case of fog and rain especially the visibility of centerline becomes very low. Curb, pavement and markings are usually positioned by using thermoplastics or paints though collared pavements, elevated pavement markers, channelizing devices and delineators can also be used as pavement marking. It is significant that particular color should be provided by the materials used for marking throughout their useful life. Attention should be given while selecting pavement marking materials that decrease the loss of grip for facility users, including bicyclists, pedestrians, and motorcyclists.

2.6. Brink Marker Posts

To delineate the alignment of the roadway a head brink marker posts or post mounted delineators are used, particularly at vertical and horizontal curves [15].

These can be placed on the following locations.

- Where there are frequent vertical or horizontal curves.
- Over segments where there is a greater number of crashes.
- Through regions normally subjected to fog and heavy rain.
- Where there are substantial night traffic movements.
- Where there are hefty non commuter traffic movements.
- The fixing of brink marker posts on the facility is not generally essential for roads carrying less than 500 vehicles per day; however, situations may happen where the fixing of either isolated or continuous unit of brink marker posts is required.

They are mainly of use for night time regulation and have the following benefits:

- They can be noticed far ahead, mostly in reduced visibility situations.
- They can be noticed even when the pavement has become invisible because of horizontal or vertical curves.
- They remain safe from traffic wear.
- Unlikely pavement markings, they do not become covered by water, sand or snow.
- They are positioned on the neighboring side of the road, thus away from the headlights glare of opposing vehicle.

2.7. Raised Reflective Pavement Markers (RRPMS)

Raised Reflective Pavement Markers offer both 'near' and 'far' demarcation at night. When crossed by vehicle wheels RRPMs can also deliver a perceptible and noticeable signal [15].

The colours coding of RRPMs are as follow:

- No passing line: yellow
- Centerline: white
- Left brink (special circumstances): red
- The desirable spacing between the RRPM is from 15 to 20 m.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. Conclusions

- Manual formed by the Planning Commission of Pakistan back in 1989 is not reviewed since it is developed.
- Due to the deficiency of Qualified Traffic Engineers irregularities have been found and proper standards are not been followed.
- Field engineers and contractors were left to their own will with regard to design and installing of the road signs due to lack of proper supervision.
- Maintenance of sign and marking is not carried out regularly after initial installation.
- The work done in field of traffic engineering in Pakistan is not satisfactory.
- Very less work done specially in case of rural highways.
- The highway department work in this field in not matching with international standards.
- Authorities are not implementing internationally recognized methods, techniques and principles.
- MUTCD illustrate how to implement internationally recognized methods and the ways which are to be followed.

3.2. Recommendations

Based on the conclusions made from the study, following are the some recommendations,

- The manual developed in 1989 should be reviewed and should be updated according to the new standard practice in world.

- The implementation of manual should be made sure.
- The maintenance of the sign and markings should be done on regular interval.
- The contractor and field engineer should not be left at their own to post a sign or marking wherever they want but a proper engineering study should be carried out by traffic engineer that should be followed in the field.

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