Forgiving Roads Design – Way to achieve SDG 3.6

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ABSTRACT

Road engineering is a major component of entire road ecosystem and its design plays a significant role in creating safe or unsafe road environment for any crash to be happen or not. Pillar 2 of Decade of Action for Road Safety talks about “Safer Road Infrastructure” where roads are to be designed to meet atleast 3 star safety ratings to 5 star ratings of safety standards of all types of road users – pedestrians, bicyclists, 2-wheeler and four wheeler motorized vehicles. Thus, a concept of Forgiving roads adopted where roads are designed with considering safety features that accepts the mistakes of road users and reduces the chances of intensity of fatalities and injuries on roads.

Key words: Forgiving Roads, SDG, MoRTH, WHO, Road Safety, Road Engineering, iRAP

Introduction

Road crashes deaths are listed as a leading cause of fatalities among 5-29 years of age group which has become a high public health problem as per the report on Road Traffic Injuries for 2018 published by World Health Organization. The 2nd Decade of Action for Road Safety (2021-2030) having focussed on 5 pillars of road safety viz : i. Road Safety Management, ii. Safe Roads and Mobility, iii. Safer Vehicles, iv. Safer Road Users, v. Post-Crash response. Pillar 2 is dealt with developing safe roads for all types of road users.

The Stockholm Declaration resolution on road safety passed in February 2020 in Stockholm extended the target of Sustainable Development Goals (SDG) 3.6, i.e reducing 50 percent road crash fatalities and injuries globally by 2020 to 2030. All member countries including India is signatory of this resolution and abide to achieve target of 50 percent decrease in road crash deaths and injuries by adopting various safety measures.

Road design and infrastructure is an important component of Safe System Approach to achieve this target of saving lives on roads.

Black Spot Observational Study

One black spot study is been carried out in January 2020 in the State of Jharkhand to identify the major causes of road crashes and issues in road designs which has resulted in black or crash prone spots. Following are the findings which explains about the need of improving safety standards of Road designs focusing on vulnerable road users including pedestrians, bicyclists and 2 wheeler motorized vehicles.

While studying India’s road accident data of year 2018, major road crashes are occurring on State highways in the State of Jharkhand. Following Table-1 shows the pattern of road crashes in Jharkhand and India as per road types:

These crashes are severe and put Jharkhand State on 6th position among other States of country. Following Table 3 also depicts that severity rate is more than double of average country rate of India and is
State/UT | Road Type | Road Accidents | Death | Injuries | 2016 | 2017 | 2018 | Number | Rank | 2016 | 2017 | 2018 | Number | Rank | 2016 | 2017 | 2018 | Number | Rank
Jharkhand | NH | 1112 | 1130 | 1027 | 1935 | 1828 | 1616 | 19 | 1222 | 1250 | 1122 | 18
SH | 936 | 959 | 1035 | 1704 | 1678 | 1686 | 18 | 982 | 1035 | 1139 | 15
Other | 633 | 945 | 1199 | 1293 | 1692 | 2092 | 19 | 823 | 971 | 1281 | 17
India | NH | 46406 | 47223 | 48550 | 142359 | 141466 | 140843 | 52075 | 53181 | 54046 | 17
SH | 37497 | 35987 | 36429 | 121655 | 116158 | 117570 | 42067 | 39812 | 40580 | 15
Other | 52168 | 51586 | 52747 | 216638 | 207286 | 208631 | 56643 | 54920 | 56791 | 19
(Source: Road Accidents in India 2018, MoRTH, GoI)

Table 2: Severity of Deaths per 100 road crashes in India: 2015-2018.

Findings

Above stated various classification of road accident data clearly depicts those major fatal crashes are occurring on State Highways on straight and curved roads at T and Y junctions. Motorized two-wheeler riders and pedestrians are most vulnerable to these crashes and losing their lives in maximum number. The major cause of these fatal crashes is speeding and driving under influence of alcohol and drugs. These crashes are severe and shares more than double severity rate of average country rate.

Ensuring the minimum safety performance standards for all types of road users while adopting an
integrated road safety approach are an important necessity for road infrastructure developments and its investments as per recommendation of Stockholm Declaration on Road Safety, 2020.

Also, to lower down speed of 30km/h maximum at those areas where mix traffic of VRUs and high-speed vehicles are prominent to protect the pedestrians and other VRUs from fatal road crashes by strengthening speed management programs and its law enforcement on ground is the key recommendation of Stockholm Declaration.

Further, there are 12 Global Performance Road Safety Targets to improve the road safety scenario by 2030 where target 3 and 4 dealt with achieving minimum three-star rating or better for all road users by 2030.

Motor Vehicle Rules Regulations 2017, Govt of India, point no. 16 defines “Speed Rules”, where point no. 16.5 fixes maximum Speed Limit of 25kmph nearby School, Hospitals, Pedestrian Zones and Construction zones by all means of vehicles at all types of roads.

### The Forgiving Roads

In 1960 a new concept has been emerged popularly known as Forgiving roads which stated that road infrastructure plays an important role in contributing enhance or decrease the impact of road crashes intensity. There are various contributing factors of road crashes such as behavior of driver including driving in fatigue, high speed, under influence of alcohol, vehicle defects such as failure of tyre pressure, breaks or steering etc and poor road infrastructure such as low visibility, poor alignment, non-availability of road markings and signs, inadequate drainage, pavement friction and delineation etc.

Thus, according to Dupre and Bisson, the forgiving roads are self-explaining which provide safer road environment to driver by providing appropriate speed designed road infrastructure which reduces the need for various multiple road signs in a complex traffic which reduces the risk of driving errors as well.

Also, as per Herrstedt, there are multiple factors which depends on a road user behaviour that has been adapted while designing road network such as speed management, traffic laws, road markings and signages, road geometry, road lighting, road surface and curvatures etc. Hence the self-explaining roads or forgiving roads are designed as per combination of there factors.

### Summary of Method Used for Black Spot Observational Study

A team of researchers visited over 40 km stretch from Bhagat Singh Chowk, Khunti to Marcha Mod...
Location Name: Marcha check post GPS Coordinator: 22.064723, 85.806437
Location No.: 61 Road Name: SH03

Location Summary: Two lane undivided road with a T-intersection. Small road is joining from left side. This road has shops and houses on both side of the road. Pedestrian movement and bus stop is also present.

ROAD SAFETY CONCERNS POSIBLE INFRASTRUCTURE COUNTER MEASURES
1. Wrong Speed Humps design and No warning sign of Speed Hump and Intersection
   a. Painted Speed Humps designs and warning signage in accordance with IRC 67 2012 to be visible at all time of the day.
   b. Doppler Audible lines can be implemented at least 200m prior to intersection in both directions. (Details given in the Appendix)
   c. Provide an intersection sign board to warn vehicles about upcoming intersection in accordance with IRC 67 2012 for vehicles traveling in both directions.
   d. Blinkers can also be provided to warn vehicles approaching the intersection at night.

2. Insufficient pedestrian infrastructure on the intersection
   a. Provide pedestrian crossing at the intersection to be visible at all times of the day.
   b. Warning signage for Speed limits, joining road and pedestrian crossings in accordance to IRC 67 2012 to be placed on both sides of the road in either travel direction.

Location Name: Left turn to Marcha-Tanisa way 500 mts Marcha chowk Sand GPS Coordinator: --
Location No.: L.1 Road Name: Other District Road linked to SH03

Location Summary: Single lane undivided road with S-Curved shape. This road is joining from left side to Marcha Mod, SH03. Mostly barren land however Hatwada market opens every Wednesday and Friday at corner of this road. Heavy pedestrian and vehicle flows on both days every week. This road also has layby movement. Vehicles travelling on high-speed at both sides.

ROAD SAFETY CONCERNS POSIBLE INFRASTRUCTURE COUNTER MEASURES
1. Speed limit Signs is present however no speed calming measures adopted leading to the Bharmate Market heavy pedestrian and vehicles movement days.
   a. Painted Speed Humps designs and warning signage in accordance with IRC 67 2012 to be visible at all time of the day.
   b. Warning signage for Speed humps, joining road and pedestrian crossings in accordance to IRC 67 2012 to be placed on both sides of the road in either travel direction.
   c. Blinkers can also be provided to warn vehicles approaching the intersection at night.

3. Visible Obstruction on joining roads and main roads due to roadside parking of vehicles.
   a. Provide speed breakers and other markings for joining roads in accordance with IRC 67 2012 to be visible at all times of the day.
   b. Posting warning signage for intersection ahead and speed limit signs on highway in accordance with IRC 67 2012 for vehicles traveling in both directions from side road merging to main road of State Highway.
   c. Reconsider placement of STOP signage. Without STOP on the road marking and solid lines, the STOP is misleading at this position. Also it is encroached by illegal parking.
   e. Trimming of bushes and trees time to time hours.
   f. Electric Poll also obstruct and could be dangerous object which is wrongly placed. Must be shifted to safer place.
on SH03, Jharkhand for observational field study. Two major spots named Marcha Mod and Dorma Village Intersection, identified black spots, were studied.

- The most frequent concern identified is faded speed humps, its design and wrong placement of warning signs. IRC codes observe the importance of speed humps in guiding and mandates that the speed humps are to be visible at all times of the day. The identified locations requiring repainting and updating of these faded speed humps designs and its warning signage placements.

- Another important concern identified is the missing pedestrian facilities like pedestrian crossing, pedestrian refuge spaces and pedestrian crossing signage. Pedestrian refuge spaces are of importance given that most locations are on highways. Refuge spaces are clear spaces of 2m width accommodated within the median space. The space should be at-level with the pedestrian crossing. This will provide space for pedestrians to wait and be without physically interacting with motor traffic.

- Most locations were improperly lit or not lit. Provision of light does improve conspicuity and a sense of security but further studies are recommended to be done to quantify the need for the lights to decide on the modalities of lighting.

Conclusion

A major concern for all the roads is higher speed limits according to the road type and environment which is leading severity of road crashes and increasing deaths and serious injuries. Thus, it is highly recommended to notify new safe speed limits as per road type and environment according to MoRTH Speed limit guidelines and rules.

A proven measure for speed control, Doppler Audible Lines, is recommended at locations with high-speed accidents. This measure has been proven to be effective in reducing the accidents on a busy highway in India.

The compilation is a preliminary report based on the site visit and the pictures taken then. Hence, the recommendations are limited to those immediately identifiable concerns. It must be noted that some locations have concerns of speeding, vision obstruction, exposure road side objects, channelizing of traffic and the like which would require further in-depth study to make informed recommendations.

References


Global Road Safety Performance Targets https://www.who.int/violence_injury_prevention/road_traffic/12GlobalRoadSafetyTargets.pdf


Road Accidents in India 2018, published by Ministry of Road Transport & Highways, Government of India, New Delhi, https://morth.nic.in/road-accidents-india

Road Engineering Counter Measures, a report developed by Ms. Prerana Arora, 2020, submitted to SHAJ, Jharkhand, India


Scientific Road Engineering Guidelines, a report developed by Ms. Prerana Arora, 2020, submitted to SHAJ, Jharkhand, India


The Safe System approach, (Department of Transport and Main Roads QLD, unpublished, adapted from WA Government, 2008)