The Nepalese Design Standards have sufficiently incorporated the concerns related to the relief and climatic conditions. However, there always remains scope of improvement, taking experiences from analytic and practical exercises. The requirements and measures have to be regularly reviewed, and explored in line with the development take places in the world.

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УЧЕТ ТРЕБОВАНИЙ БЕЗОПАСНОСТИ ДОРОЖНОГО ДВИЖЕНИЯ ПРИ РАЗРАБОТКЕ СТРАТЕГИИ РАЗВИТИЯ СТРОИТЕЛЬСТВА ДОРОГ В НЕПАЛЕ
CONSIDERATION OF ROAD SAFETY REQUIREMENTS IN ROAD DEVELOPMENT STRATEGY IN NEPAL

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Аннотация. *Статья содержит краткое описание условий требований безопасности дорожного движения и их проблемы в Непале. Ситуация в стране с дорожной безопасностью стоит довольно остро и является большой проблемой для сведения к минимуму дорожных инцидентов. Статья освещает, как требования безопасности учитываются в дорожной строительной деятельности в Непале.*

Abstract. *The article contains brief description on the account of road safety requirements and its concerns in Nepal. The country's road safety situation has been degrading and is a big challenge to minimise the incidents. The article highlights how the safety requirements are accommodated in the road construction activities in Nepal.*

Введение

According to the United Nations, nearly 1.3 million will die this year 2013 as a result of road traffic collisions. This is more than 3,000 deaths each day. Beyond this number, between 20 and 50 million more people will sustain non-fatal injuries from a collision. Road-related death and injury have been described by the World Health Organization as a "major public health and development crisis". In March 2010, the United Nations General Assembly proclaimed 2011 – 2020 the "Decade of Action for Road Safety" with the goal of "stabilizing and then reducing the forecasted level of global road fatalities"[6]. The road traffic accident is a serious global problem and is expected to rapidly rise in low to middle-income countries unless effective measures are taken urgently. On this row, Nepal is not an exception.

The 83 % of the country's landscape is covered with multiple young fold mountains ranging from low sub-tropic Churiya hills in the south to Himalayas. Thousands of big and small rivers flow from north to south along unstable and fragile hill slopes. 90 % of monsoon rain falls in a period of three months causing numerous landsides in hills, flooding in plains.

With such physical features, building of road network in Nepal is an excessively difficult task. With an increasing trend of road accidents in the country, building safer roads is even a bigger challenge.

Road Safety is directly related to three components or three 'E's:

– Engineering – how good a road is engineered with all safety precaution

– Education – How well educated the road users about traffic rules and safety;

– Enforcement – how strictly traffic rules and regulations are enforced.

Failing any one of the above three Es will lead to accidents. Or put it other way that any accident is caused by any one or more than one of the three Es. This article focuses on the engineering aspect.

Statistics of Vehicles

In year 1942 the first motorized vehicle entered Kathmandu Valley. At present more than 1,000,000 motorized vehicles are registered in the country.

Considerable number of non-motorized vehicles (cycle, tricycle (rikshaw), oxen carts etc) ply on the roads. Specific record on them is not available but those are highly susceptible for cause of the road accidents. The statistics and composition of different types of vehicle registered in the country in different years are summarised in Table 2 below:

[6] Road Safety, International Road Federation, News Letter, February 2013

Table 1 – Statistics and composition of different types of vehicle registered in the country

Year	Bus/ Mini bus/ Micro bus	Car /jeep/ Van/ Pickup	Crane/ Dozer/ Truck	Tractor	Tempo	Motorbike	Others	Total
Up to 2000	14,507	54,963	21,309	21,072	6,702	150,185	3,715	272,453
2008/09	2,564	8,144	3,643	4,663	20	83,334	202	813,487
2009/10	2,810	14,243	4,524	11,460	9	168,707	31	1,015,271
Total up to 2009/10	34,328	120,072	45,961	56,827	7,382	744,727	5,974	1,015,271

Source: Status Paper on Road Safety in Nepal, 2011 – KK Sharma

Trend of nationwide road accident

Road accidents are increasing in Nepal and have become a serious problem. More than 1734 people were killed and more than 11000 people injured in year 2009/10 alone. Around 130 major accidents and thousands of minor ones are reported everyday in Kathmandu (*Guardian*).

Table 2 – National statistics of road accidents (2001–2010)

Year	Accidents	Fatalities	Serious Injuries	Slight Injuries	Injury/ fatal ratio	Fatality per 10,000 Vehicles
2001-02	3,823	879	458	4,138	5.23	66.2
2002-03	3,864	682	785	4,442	7.66	48.38
2003-04	5,430	802	1,659	3,925	6.96	52.04
2004-05	5,532	808	1,795	4,039	7.22	49.42
2005-06	3,894	825	1,866	3,655	6.69	47.64
2006-07	4,546	953	2,583	5,331	8.30	50.17
2007-08	6,821	1,131	2,663	5,245	6.99	54.9
2008-09	8353	1356	3609	6457	7.42	60.21
2009-10	11747	1734	4130	7383	6.64	67.13
Sum	54,010	9,170	19,548	44,615	7.00	

Source: Nepal Police, Traffic Directorate

Table 3 – Casualties and road users group

Casualties	Pedestrian	Bicycle	Rickshaw	Motorcycle	Tempo	Car/Van	Minibus	Bus	Truck
Minor	249	76	3	229	97	78	66	44	19
Serious	90	17	1	75	13	21	6	15	3
Fatal	42	4	0	19	2	3	4	4	3

Source: Nepal Police, Traffic Directorate

ROAD SAFETY REQUIREMENTS

Design Manual

Section 13 of the Design Manual is dedicated to the Road Safety. The manual has emphasized on the design and engineering aspect and quoted five factors that contribute to road safety – Geometric design; Road surface; Road marking and delineation; Road signs, street lights and other road furniture; Traffic management.

Design Manual has referred to various Road Notes published by DOR at different times.

In spite of having all parameters set in the manual and road standards, the implementation part are apparently weak. The enforcement of the suggested standards do not seem to be effective and that is leading to an increased rise of accidents.

Road Safety Audit (RSA)

Road safety audit was introduced in 1995, and is mandatory for all roads under construction or rehabilitation. Road safety audit at design stage has been made mandatory for new projects.

On this taking an example from the United Kingdom RSA practice needs to be enhanced and should be carried out at each stage at preliminary design stage, detailed design stage, construction stage and operation stage. Any defects or safety hazards identified by audit must be eliminated or mitigated suitably.

Road Safety Law and enforcement

To manage the vehicles plying in roads and public transportation, the government of Nepal has enacted several acts:

– the first Vehicle Act was enacted in 1964 followed by Transportation Management Act, 1970;

– a combined Vehicle and Transportation Management Act, 1993 (VTMA) – governs transport management, vehicle management, managing drivers and helpers, traffic control, insurance education and certification and enforcement of traffic safety;

– VTMRegulations, 1998;

– the Public Road Act, 1975;

– Local Self-Governance Act, 1999;

– Road Board Act, 2002 also considers some part of road safety such as implementation and management of traffic flow, vehicle axle load, and right of way.

Publication of Road Safety Related Notes and Documents from DOR[7]

1. Strengthening Roadside Development Control, June 1995.

[7] Road Safety Experiences in Nepal – DMS Shrestha

2. *Traffic Signs Manual Volume 1 and 2, April 1996.*
3. *Vehicle Fitness Testing in the Kingdom of Nepal, October 1996*.
4. *Bus Accidents in the Kingdom of Nepal –Attitude and Causes, October 1996.*
5. *Designing Safer Side-Drains, November 1996.*
6. *Road Safety Publicity Campaigns –A Practical Handbook for Nepal, January 1997.*
7. *Road Accident Costs, June 1997.*
8. *Road Safety Audit Manual, April 1997.*
9. *Delineation Measures, March 1997.*
10. *Safety Barrier, July 1997.*
11. *Safety at Bridges, July 1997.*
12. *Identifying and Treating Accident Sites, June 1997.*
13. *Road Users Guide, June 1998.*
14. *Set of 10 posters for schools, March 2002.*
15. *Set of 3 posters for drivers, June 2003.*
16. *Set of 2 booklets on traffic signals for the road users, June 2003.*

Problems of Road Safety

Vehicles

- number of old and outdated vehicles are increasing. According to a study conducted in 2010 by the Department of Transport Management (DoTM), of the 3500 vehicles unsuitable for plying, only 525 vehicles were put off road;
- due to high maintenance cost many vehicles are in poor conditions, causing frequent breakdowns on the road;
- with the growing population, the number of vehicles is increasing too. In 1992 registered vehicles 48,188. In March 2012 it was 567,670 in KTM valley. Metropolitan Traffic Division claims now around 800,000 vehicles in the valley.

Engineering

- many rural roads are not properly engineered and constructed without haphazardly;
- traffic intensity in cities and major strategic roads have grown beyond the capacity of many existing roads. Most of the roads were old and designed for much less traffic;
- the existing city roads and the major strategic roads are old and are not properly engineered to meet the fundamental road design principles;
- lagging behind the development and upgrading of roads as compared with urbanization. Due to haphazard and unplanned construction of dwellings the road geometry do not satisfy the basic requirements;
- transport planning has not been properly developed or practised. Many streets are over saturated. Junctions are poorly engineered and controlled.

Education on traffic

- rapid urbanisation and migration to Kathmandu from rural areas have caused degrading of the average knowhow on traffic system and rules among the road users and drivers;
- although highway codes and rules exist enforcement of the rules have been poor. The violations are so rampant that traffic police are often confused about the level of control they should apply;
- a system of educating population on traffic rules and safety is lacking. Generally driving licenses are issued to those who can drive a vehicle, but adequacy of knowledge on the traffic rules and safety are often undermined;
- due to poor know how, driving, parking, overtaking, undertaking are often erratic and often left unwarranted and unpunished due to inadequate legal provisions and their reinforcement. The erratic driving, perhaps, is the biggest reason of road accidents.

Operation and maintenance of roads

- due to poor economic condition of the country, operation and maintenance of the roads often end up at its minimum level. It applies to regular, periodic and major maintenance like improvements and rehabilitation;
- many utilities and services, specially water supply and drainage are laid along the roads under the pavements. For their repair or new connections, the road pavements are excavated, causing serious disruption in traffic movement and safety breaches. This explains about the poor coordination among the agencies.

Road Safety

- all above facts are serious threat to the road safety and are the main contributors to the rise on traffic accidents;
- road safety has not been adequately considered in design, construction as well as operation and maintenance;
- mixed and disorganised traffic flow cause a serious lapse on the road safety;
- traffic hazards are rampant on the roads;
- insufficient coordination among the agencies responsible for road safety issues;
- lack of sufficient fund for improving road safety conditions;
- recently concrete barriers have been seen used in city roads for separating the lanes. However, the barriers cause a serious hazard for the traffic, specially for motorcycles and at night.

Environment

- although there is a system of vehicular emission control, air pollution is on the rise. The high emissions are mainly caused by poor maintenance of the vehicles and use of low grade fuel;
- due to inadequate control, often the roads are blocked by dumped waste materials or construction materials stored at road sides. These also generate large volume of dust;
- cleaning of the roads is irregular and lacking;

- in Kathmandu City mobile shops on the foot paths have become a serious problem.

Ongoing mitigation measures and safety indicators

- improvement in public transport and purchase of new buses with latest facilities by Sajha Yatayat (a government agency running public transport);
- the Metropolitan Traffic Police Division's (MTPD) campaign to clamp down on taxi drivers cheating passengers;
- MTPD booked 11,084 drivers in the last two weeks for defying traffic rules and creating obstacles for the smooth flow of traffic;
- according to the MTPD, 4,659 vehicles were taken into custody for not following lane discipline, 1,681 for haphazardly picking up and dropping off passengers, 78 for overloading and 1,332 for open doors while in operation. Similarly, 914 were booked for violating traffic signals, 339 for haphazard driving and 11 for speeding;
- schools have started scrapping outdated buses and replacing them with new;
- government has launched Kathmandu Sustainable Urban Transport Project (KSUTP), objective of which is to improve public transport condition and the walking environment in Kathmandu valley – a modal shift from private to public transport vehicles.
- control on Road users;
- road Safety Audit;
- the black spots pointed out by the road safety audit and accident data are being improved in road geometry, installing road signs and safety barriers;
- under the New safe crossing program, zebra crossings, pedestrian traffic lights and some over head crossing bridges are built and being used by the pedestrians in urban areas;
- motorcycle lanes have been marked in Bhaktapur section of Arniko Highway. This section has 4 lanes for vehicles, 2 lanes for motorcycle and 2 service tracks;
- raised footpaths are provided in all urban roads;
- department of Roads (DOR) has been carrying out maintenance of road as well as road sides for removing or cushioning roadside obstacles;
- DOR is planting and maintaining road side trees;
- technical and safety requirements for all types of vehicles have been provided;
- DOR has initiated activities to improve the data base on road safety. The traffic police, DOR and hospitals are the key sources for this;
- drinking and driving is prohibited by law in Nepal. Observation test and/ or breathalyzer tests are being applied to check drinking and driving. Traffic police conducts this tests randomly especially in evening and night time. This has shown positive results in reduction of accidents;

- speed limits has been provisioned in vehicle management act and regulation in Nepal.

Conclusion

As noted earlier the road accidents are a serious problem and unfortunately it is on the rise. Solution to this requires a combined effort on improvement of all aspects of the road and safety. The key aspects are, but not limited to:

- proper transport planning with due consideration to the traffic intensity, existing road parameters, important links, peak hour flows, potential traffic generations, traffic projections;
- identify solutions to the traffic movements and management to minimise the congestion;
- based on the transport analysis identify the areas to be improved;
- improvements with proper engineering design, construction, maintenance and operation of road;
- provision of parking spaces;
- improve public transport facilities;
- improve bicycle and motorcycle lanes as far as possible;
- adequate attention to safety of all road users and eliminate traffic hazards;
- improve road markings with more reflective paints and / or glass beads;
- road safety audit by independent auditor at each stages like preliminary design, detailed design, post construction and after some years of operation;
- traffic education to drivers and road users;
- education on road safety;
- enforcement of rules and laws;
- action plan and government support to replace outdated vehicles with new;
- control over the quantity and quality of vehicles;
- emission control;
- control over the issuance of driving license.

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АНАЛИЗ УЧАСТКОВ КОНЦЕНТРАЦИИ ДТП НА АВТОМОБИЛЬНЫХ ДОРОГАХ РЕСПУБЛИКИ БЕЛАРУСЬ И ИНЖЕНЕРНЫХ МЕРОПРИЯТИЙ ДЛЯ СНИЖЕНИЯ УРОВНЯ АВАРИЙНОСТИ

THE ANALYSIS OF SITES OF CONCENTRATION OF ROAD ACCIDENT ON ROADS OF REPUBLIC OF BELARUS AND ENGINEERING ACTIONS FOR DECREASE IN LEVEL OF ROADS ACCIDENT RATE

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Аннотация. *В статье рассматриваются вопросы повышения безопасности движения на сети автомобильных дорог за счет выявления участков концентрации ДТП, принятия мер по их ликвидации и снижения количества погибших и раненых. Приводится анализ причин образования участков концентрации, факторов, способствующих возникновению повторяющихся видов ДТП. А также предлагается перечень возможных инженерных мероприятий по повышению безопасности дорожного движения.*

Abstract. *The article deals with the questions of increasing safety on the road network by identifying the areas of concentration of the road traffic accidents, taking measures for their elimination and reduction of the number of deaths and injuries. There is the analysis of the causes of appearance of the areas of concentration of the road traffic accidents, the factors contributing to the emergence of recurring types of accidents. And a list of possible engineering measures to improve the road traffic safety is also proposed.*