

The Influence of Road Infrastructure in Road Safety

Luiza Lluri

“ Aleksandër Moisiu ” University, Professional Studies Faculty, Department of Mechanic and Transport, Durrës, Albania

Abstract

Road infrastructure is the central element of a road transport system. In general, the road infrastructure would need to be designed and operated in such a way that road users understand what they can expect and what is expected from them. As a wide area, it covers land use and network planning, (re)construction and design of road sections and intersections, signing and marking, maintenance etc.

Modern road traffic systems and roadside design can significantly reduce injury in the event of an accident. Roundabouts, for example, can reduce collisions by up to 40% and serious injuries and fatalities by up to 90%.

This study analyzes the factors of road accidents as a result of the poor infrastructure. The conclusion is that the design and condition of all roads therefore road, road sections and road elements (as junction, pedestrian crossings etc.) should be assessed under the point of view of road safety. New roads should be audited at the construction planning stage and existing roads should be inspected regularly. Sections and locations with high accident concentration should be identified and remedial measures should be taken.

To improve the situation of road safety in the 3656 km of state roads and 14644 km of urban, rural and local roads in Albania, institutionally through attendance and action plans programmed by the respective ministries, should be possible realization of three tasks defined for this purpose:

1. Design of road construction or reconstruction of their own, accompanied by projects of road signs and other elements of security circulation.
2. Monitoring process for quality realization of these projects, performing and their audit in accordance with international standards.
3. The process of periodic or routine maintenance, necessarily include works related to improving the road infrastructure and elements defender of the road.

KEYWORDS: road infrastructure, road safety, the road performance indicators.

Introduction

Road infrastructure can be defined as the basic of facilities, services and installations needed for the functioning of transport on highway, roads, and streets. There is very important taking into account the limited human information processing capacity and resulting mistakes human beings are capable of. Road locations that have a record of large numbers of crashes are stretches of road within a distance of 200-300 m where accidents have happened during a period of 2 up to 3 years. That means there is a potential risk for accidents to happen again in the future therefore road infrastructure and road signs should improve with engineering methods.

There are already about 144 spots identified in the road network that are particularly dangerous. Having available a road accident data is very important for any system of road

safety management. Details of the accident are required to identify the purpose of road safety problems and rising public information. The data provide the best way to explore the prevention of accidents and ways of implementing the measures for reducing the size of serious accidents.

Contribution of factors such as the characteristics of the road and traffic parameters of vehicles, information on the persons involved in the accident should be recorded in the most good. A number of projects have to be identified and designed for the elimination of dangerous roads in the Albanian national roads network. Implementation of the works designed will then be followed by the Albanian Roads Authority that is the entity in charge for management of the national road network. For the maintenance of roads in our country are applied performance contracts with private contractors. The contracting authorities for this service are Road Regional Directories a total of three divisions. These types of contracts currently maintained about 70% of the national road network (from 3656 km of the national road network, 2560 km are serviced by third parties (contractors)).

Methodology

This study is based on results of the causes of road accidents for the period 2010-2014 as a result of poor road infrastructure. A site is considered to be dangerous when its priority value (P), calculated using the following formula, equals 15 or more: $P = X + 3*Y + 5*Z$, where X = total number of light injuries; Y= total number of serious injuries; Z = total number of deadly injuries. The analysis is based on annual reports on road accidents by INSTAT¹ of the number of deaths and seriously injured. It will also respond to the performance indicators which should be changed to improve road safety by halving the number of deaths by 2020. Then brought the best practices used in developed countries to eliminate dangerous roads. Finally are given recommendations for creating a safe road infrastructure.

Procedure

"Road" is a basic component of road safety. With all the work that has been done and continues to be to build new roads or rehabilitation of existing ones, it is not realized at the level required, accordance with the provisions of the Highway Code, completion of all elements of road safety. A part of the road network is incomplete and, as such, lacks road protection dhe road signaling and completion with other elements of road safety, as: pedestrian crossings, guardrails, delineators, chevrons etc. Lack of security conditions, on our country roads occur each year around 2100 accidents with 340 fatalities and 2600 injured, a number that is due to roads without construction standards and with signs missing, or mislead. Below, in table 1, is given the distribution of road network in Albania.

¹ INSTAT is the statistics institute in Albania

Table 1

Distribution of road network			
Nr	Type of road	Item	Quantity
1	National road	km	3656
2	Rural road	km	13644
3	Urban road	km	1000

According to INSTAT report on road accidents, we have the following data:

Table 2

Accidents causing casualties	Year				
	2010	2011	2012	2013	2014
Prefectures					
Durrës	297	286	233	242	236
Elbasan	89	100	114	204	111
Fier	130	124	196	240	200
Lezhë	74	178	162	164	156
Shkodër	121	163	150	152	128
Tiranë	570	656	623	718	695
Sum	1,564	1,876	1,870	2,075	1,914

Table 3

Accidents resulting in death	Year				
	2010	2011	2012	2013	2014
Prefectures					
Durrës	66	38	36	42	30
Fier	48	29	47	25	41
Lezhë	32	36	34	34	25
Shkodër	38	28	28	34	23
Tiranë	70	68	71	57	50
Sum	352	322	334	295	264

Because of this number of accidents, we ranked countries with the highest level of accidents in Europe. Accepted by road specialists, the roads in Albania are outside of the technical and physical parameters in many national axes, as: Fier-Berat, Tepelenë-Ballsh, Këlcyrë-Leskovik, Lushnjë-Berat, Gjirokastër-Sarandë, Bushat-Pukë, Fier-Ballsh, Tiranë-Burrel-Peshkopi etc. The causes of accidents due to road geometry and lighting conditions, referring to the data of road safety report for 2013 of TMI², are given respectively in tables 4, 5.

² TMI² is Ministry of Transport & Infrastructure

Tabel 4 According to the geometry of the road³

Accident	Seriousness		
Geometry of the road	Fatal	Flesh-wound	Injuries serious
Total			
-- Straight road	176	926	267
1369			
+ Crossing	10	71	12
93			
= Crossing road/Hekurudhe		2	
2			
C-turn	43	230	68
341			
O-round	5	33	2
40			
T- crossing	14	131	21
166			
Tunnel		1	
1			
X-crossing	8	26	7
41			
-Crossing	3	13	6
22			
Total	259	1433	383
2075			

Tabel 5 According to the lighting conditions

Accident	Seriousness		
Lighting Conditions	Fatal	Flesh-wound	Injuries serious
Total			
Dawn/ twilight	20	100	25
145			
Day	144	969	237
1350			
Unknown		5	2
7			
Night	95	359	119
573			
Total	259	1433	383
2075			

According to INSTAT data on road accidents during 2015, results an increase of 15.8% compared with the third quarter of 2014. The number of accidents during the quarter was 586 where the number of deaths in road accidents turns out to be 72. Compared with the

³ Source: <http://www.instat.gov.al/al/home.aspx> Road traffic accidents (1995-2014)

third quarter of 2014 the indicator is decreased by 1.4%, while the number of people injured is 733, compared with the same period of last year this number is increased by 19.4%.

Some indications of uncertainty in Albania's roads are:

1. In 85% of the length of the Albanian national roads, have no overpasses or underpasses, while on the national axes have 473 switch nodes in settlements, forced crossings movements of population and intermediate input-output.
2. In about 40% of the length of the Albanian national roads, lacking the necessary mandatory signs self-management for a normal and safe traffic of the drivers.
3. In about 35% of the length of the Albanian national roads, orientation tables and signs of circulation are located in complete contradiction with practical concrete terms orientation for normal road traffic and safe.
4. In about 20% of the length of the Albanian national roads, tables and traffic signposts are invisible and disposal of injuries, stealing or deleting the imagery.
5. In about 60% of the length of the Albanian national roads, especially highways, even on overpasses, signposting traffic are covered by advertising giant private firms, which are adjacent to the side walls of the streets, while according to the law should be more than 20 meters away from their.
6. In 70% of cases, policemen of road control, unlawfully, remain hidden dhe suddenly appear on the road setting up tables for stopping only 30-40 meters in front of vehicles, introducing the drivers in the penalty pressure, anxiety, stress and sudden loss of control of vehicle.
7. In about 65% of the length of the Albanian national roads, only 30% are completed with technical and physical security to move normally without consequences. In figure 1 is given a Black Spots Map, with 210 spots, which will help us in our future work to plan the investments fund for road safety. One of the most problematic is the Tirana-Durres motorway that has 39 black spots or different hazardous saying because in each of them within a year have occurred at least three accidents.

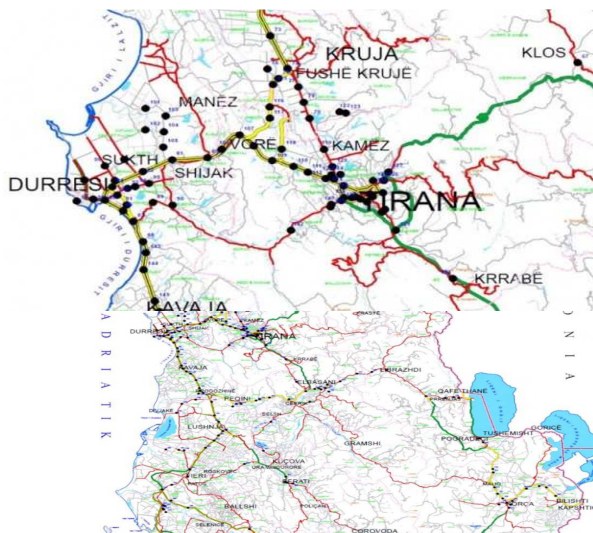


Figure 1 Black Spots Map of Albania

Best practices

a. **Re construction and design.** There are numerous handbooks on road design and road construction, some of them specifically focusing on designing for safety, e.g. the Highway design and traffic safety engineering handbook and the Road Safety Manual.

Two central requirements for a safe design are:

- The design characteristics need to be consistent with the function of a road and the behavioural requirements (e.g. speed);

- The design characteristics need to be consistent along a particular stretch of road. A part of the road that should not be forgotten is the roadside. Obstacles alongside the road, such as trees, severely aggravate the consequences of a crash, once a vehicle runs off the road. Paved shoulders increase the opportunity for a driver to correct and return to their lane in time. Obstacle avoidance roadsides or roadsides protected by guard rails prevent secondary collisions once a driver cannot correct in time. Flexible or break-away roadside fixtures such as, light poles and signs, reduce the chance of serious injury in case of a collision.

b. **Low speed zones** in residential areas. For safety, low speeds are essential when motorised vehicles use the same space as pedestrians and cyclists. In many countries, low speed zones have been introduced in residential areas, near schools and in shopping areas. In Europe, 30 km/h zones are most common. In home zones the maximum speed is even lower: 10-15 km/h. In both cases, it is insufficient to just put up a speed limit sign. Low speeds must be maintained by physical measures, such as road narrowings, speed humps and curves. Benches, flower beds, play areas, and trees improve the aesthetic experience. Low speed zones can be part of more general traffic calming activities. Traffic calming not only aims to establish low speeds, but also to reduce the amount of motorised traffic in specific areas or urbanwide, by discouraging through traffic and promoting walking, cycling and public transport. The implementation and maintenance costs depend on the size of the zone and the features installed.

c. **Roundabouts** are aimed at lowering junction speeds and removing right angle and head-on collisions. Roundabouts also have a greater capacity than normal give-way or signalized junctions. A driver approaching a roundabout is forced to lower his entry speed, which reduces crash severity. The roundabouts, in general, are characterized by a pure circular design, a narrow carriageway, radially oriented entry roads and right-of-way of the traffic on the roundabout. Replacing a junction with a roundabout is generally the initiative of the road authorities and has to be decided on by local or regional governments. When converting an ordinary junction to a roundabout, injury crashes will decrease by 32% for a three-leg junction and 41% for a four-leg junction. The benefit-cost ratio when converting a typical three or four leg junction to a roundabout is around 2.

d. **Signs and markings** can provide important information to improve road safety. They regulate, warn and guide road users. By letting people know what to expect, chances are greater that they will react and behave appropriately. Signs and markings need to be applied in a consistent way, to be placed at logical locations, and be easy to understand and visible. This also means that underlying traffic regulations such as local speed limits need to be established on clear and consistent principles. The visibility of signs and markings needs to be checked regularly to avoid them being hidden by overgrown trees or blurred by sunlight. The use of retro-reflective material is needed to ensure night-time

visibility. Road side signs must be used sparsely. Road users are only able to process a limited amount of information at a time. Too many signs at a particular spot may confuse and distract road users rather than help them. Too many signs may also result in non-compliance and disrespect.

e. **Rumble strips** are milled into the asphalt surface of a road shoulder or between lanes in opposite directions in combination with ordinary road markings. Rumble strips vibrate and make a noise when a vehicle passes over them and alert drivers to the potential crash danger changing lanes poses. Crashes resulting from lane departure, head-on collisions and off-road crashes mostly have severe consequences and contribute to a large segment of severely injured or killed road users. The installation of rumble strips is usually the responsibility of national or regional roads administrations. The number of injury crashes can be reduced by over 30% by shoulder rumble strips and by over 10% by centreline rumble strips. Therefore the immediate task is completion of the roads with all elements of road safety, as well as intervention for the improvement of black spots in the national axes.

Other factors to be considered

A. The role of lighting in road safety

About 30% accidents occurred in conditions of darkness are generally heavier, referring to deaths and injuries. The main cause lies in the fact that darkness reduces the quality and quantity of visual information needed by the driver in a correct direction of vehicle. Actually reduced visual ability, contrast sensitivity, ability to gauge distances vehicles, speed of perception, the difference of colour and the tolerance of blinding lights. The final result is a drastic reduction of visibility at night. Headlights of car dealerships are not enough to provide the driver with information on safety and efficacy, especially when the roads are trafficked or characterized by a complex geometry with the presence of intersections and interventions. It has been confirmed by numerous studies, run by different countries on the relationship between lighting and accidents, whereby lighting brings an overall reduction in the number of accidents at night, including 13% to 75% according to the type of road. Such studies, among others, identify an average reduction of accidents at intersections not less than 40%. It is understood however that road intersections (or phased plan) and the entrances to the main roads, are key points of a road network.

B. The influence of moisture on the asphalt in road safety

Collection and disposal of waste water as a result of changes in the weather (rain) from road surfaces if not supported correctly, can lead to reducing the levels of safety offered by the road infrastructure. Wastewater collection and their slow removal causes obstacles in reducing road traffic and conditions of friction This can cause a dangerous phenomenon called "aquaplaning" represented by a progressive loss of contact between the wheel (rubber) and the floor of the road, caused by a layer of the liquid (fluid) between the two surfaces. Have considered the fact that pour water on the road plan could generate serious difficulties in the movement of pedestrians and consequently the reduction of visibility caused by an increase in the level of hydro layer, present in the road plan. Statistics on road accidents in recent years, about 20% of accidents on the road are made on wet road background.

Trends and forecasts for the future include:

- reducing the number of road accidents in the action plan of the national road safety strategy,
- placing the barriers between the carriageways and side barriers, to minimize the possibility of overtaking vehicles,
- elimination of overlapping of secondary roads with main roads, the lightness of roundabouts on national roads, completion of all road network with contemporary signage,
- intervention for the elimination of black spots initially in the national road network, gradually and local,
- reducing of speed limits on all road networks, especially in urban routes.

Conclusions

To improve the situation of road safety, in 3656 km of state roads and 14644 km of urban roads, rural and local by pursuing institutionally and by programmed action plans from ITM and IM, it should be possible realization of three tasks defined for this purpose:

- Signs (horizontal, vertical and complementary) should provide a good readability of road in all weather conditions and visibility (day, night, humidity, drought, fog) to ensure clear readability and safe direction.
- Monitoring process for quality realization of these projects, and audit conducted in accordance with international standards.
- ARA⁴, developing institutional capacities within it, shall schedule and conduct during road construction design, or their reconstruction, the design of further implementation of the road signs and other elements of traffic safety.
- The process of periodic or routine maintenance, necessarily have to include works related to improving the road infrastructure and defense elements of it.
- Expenses related to road safety, should be seen as a high priority and as an investment in time and space.
- Towards achieving the objective of the national road safety should be given special importance completing roads with traffic sorter, metal protectors (guardrails), delineators and other elements of road signs conform to standards, especially on roads national.

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