



**Comparative Accidental Analysis of N-55 Jamshoro-Manjhand Section, Sindh, Pakistan**

M. A. H. TALPUR<sup>++</sup>, I. A. CHANDIO\*, T. H. ALI\*\*, M. NAPIAH\*\*\*

Department of City and Regional Planning, Mehran University of Engineering and Technology, Jamshoro, Pakistan

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**Abstract:** This research was conducted to analyze the accidental data of *National Highway 55 (N-55)*, also called *Indus Highway* between *Jamshoro-Manjhand* section for the years 2004-2008. In this regard, the data were obtained from the office of *Police Department District Jamshoro* with the help of a questionnaire. Henceforth, the data were assembled to determine the severity index, accident rate, i.e. rate per million entering vehicles and rate per 100-million entering vehicles. These analytical techniques were executed to highlight black spots, and to offer recommendations, as calamities can be avoided. Consequently, this study was executed to promote the smooth flow of road traffic on N-55, which lies along the western bank of the *River Indus*. Thus, this route could allow the free flow of heavy and light vehicles safely, which could reduce the travel time both for passengers and goods transport. Further, it can be concluded that by improving, constructing and maintaining this route; the objectives like, safe and efficient movement of traffic can be achieved, which can induce socioeconomic development.

**Keywords:** N-55, Black Spots, Accidents, Road Traffic.

**1. INTRODUCTION**

An accident, i.e. collision, overturning or slipping can occur on a road open to public traffic, resulting in either injury, loss of life or property damage, in which at-least one moving vehicle can be involved (Mamčič and Sivilevičius, 2013). Accidents may be categorized into four basic parts, i.e. fatal, non-fatal, slight, and property damage (Dadashova, Arenas-Ramírez, Mira-McWilliams, and Aparicio-Izquierdo, 2016; Ernstberger *et al.*, 2015). The fatal accident is a type in which one or more persons died. Whereas, non-fatal is a type of the accident in which a victim received grievous injuries, such as fractures, concussions, internal lesions, crushing severe cuts and lacerations, etc. Meanwhile, slight denoted to minor injuries, and property damage referred to an accident in which no casualties occurred, but only the damage or loss denoted to property or vehicle, etc.

The problem of the accident is acute in highway transportation, due to complex flow patterns of vehicular traffic, the presence of mixed traffic and pedestrians (Bougueroua and Carnis, 2016; Jiménez-Mejías *et al.*, 2016). Traffic accidents may involve property damages, personal injuries, or even casualties (Zhang, *et al.*, 2016). Accidents do not happen by themselves; however, these are often caused by extraneous factors, such as roads, vehicles, drivers, pedestrians and environment (Nævestad, *et al.*, 2015).

Analysis of the accident is an interpretation of certain constituents, which leads to the occurrence of accidents (Kanchan *et al.*, 2012). The purpose of accident analysis is to find out the possible causes of

accidents related to drivers, vehicles or roadways, and to protect the general public by reducing the frequency and severity of accidents. Presently, the enormous number of accidents, and consequently a large amount of data make it possible to analyze accidents manually.

**Table 1. Geometric design specifications N-55**

S. No	Specification	Unit	Rural Areas		
01	Design Speed	Km/hr	90	80	65
02	Minimum Stopping Sight Distance	m	137	122	115
03	Formation Width	m	13.3	13.3	13.3
04	Minimum Radius of Curve	m	270	220	130
05	Maximum Super Elevation on Curve	Degree	6.50	8.2	13.4
06	Maximum Rate of Super Elevation	%	10	10	10
07	Minimum Length of Super elevation	m	50	46	38
08	Length of Tangent of Run Out	m	16	15	13
09	Vertical Clearance	m	5.03	5.03	5.03
10	Maximum Gradient	%	7	7	7
11	P.S.D on Crest Of Vertical Curve	m	600	550	450
12	S.S.D on Segregation of Vertical Curve	m	140	120	85
13	Taper Length of Climbing Lane	m	50	50	50

<sup>++</sup>Corresponding author: Mir Aftab Hussain Talpur; email: aftab.talpur@faculty.muett.edu.pk

\*Department of City and Regional Planning, Mehran University of Engineering and Technology, Jamshoro, Pakistan.

\*\*Department of Civil Engineering, Mehran University of Engineering and Technology, Jamshoro, Pakistan.

\*\*\*Department of Civil and Environmental Engineering, Universiti Teknologi, PETRONAS, Malaysia.

Thus, in this study, one of the major sections on N-55 was selected, i.e. *Jamshoro-Manjhand*, to interpret the historic accidental data. As, positive steps may be taken to curtail the losses, specially life and property.

This highway has a major impact upon the economy of Pakistan; the driving time from *Jamshoro* to *Manjhand* is decreased after the construction of the one-way vehicular flow system. The geometric design criteria of N-55 can be seen in (Table 1), the same were retrieved from the concerned authorities.

The design specifications, as mentioned in (Table 1), exemplified rural areas, because most of the road is situated within the countryside. Besides, wide lanes, paved shoulders, smooth curves and fatal grades were utilized throughout, to provide the optimum driver convenience, the economy of vehicles, operation and safety.

## 2. METHODOLOGY

Most of the national highways were constructed during or prior to the 1960's by *Provincial Highway Departments* are basically of low specification. *Indus Highway-N-55* is also one of them. The N-55 is a main road, which lies along the western bank of the *River Indus* and runs nearly the entire length of Pakistan from north to south. In recent years; however, the *Indus Highway* has been unable to cope with the increasing traffic volume and the larger size of vehicles sufficiently. The reasons for pre-defined problems can be the lack of road capacity and deterioration of the road surface. Therefore, in this study, accidental data were acquired from the years 2004 to 2008, and then the same were analyzed by computing severity index and accident rate.

### 2.1 Accident Record Analysis

This analysis is based upon the data collected through a questionnaire. The data also reflected accidents, as registered by *Pakistan Motorways & Highways Police N-55*. This complete sector consists of four beats, start from 6km to 65km. (*The total length of the section is 59km, because the starting point is 6km, which can be considered as an initial point*).

#### 2.1.1 Severity Index

It is the ratio of fatal accidents to the total number of accidents, expressed in terms of percentage and denoted by "IS."

$$IS = \frac{FATAL}{TOTAL} \times 100 \quad (1)$$

#### 2.1.2 Accident Rate

The rate of accident data is based on the exposure data, such as traffic volume and the length of the road

section being considered. Commonly used rates are as follows:

- (a) Rate per million of entering vehicle;
- (b) Rate per 100 million vehicles-miles.

#### (a) Rate per million of entering vehicle (RMEVs)

It is the number of accidents per million vehicles entering the study location during the study period. It is expressed as follows:

$$RMEVs = \frac{A \times 1000000}{V} \quad (2)$$

Where,

RMEVs = accident rate per million entering vehicles;

A = total number of accidents during the period (for one year);

V = Average Daily Traffic (ADT) × 365.

#### (b) Rate per 100-million vehicle-miles (RMEV)

It is the number of accidents per 100 million vehicles-miles of travel.

It is expressed as;

$$RMEV = \frac{A \times 100000000}{VMT} \quad (3)$$

Where,

RMEV = Accident rate per 100-million vehicle-miles; A = Total number of accidents during a given period; VMT = Total vehicle miles of travel during the given period = Average Daily Traffic (ADT) × number of days in study period × length of road.

## 3. RESULTS AND DISCUSSION

(Table 2) highlights the data gathered through a questionnaire from the concerned police department. Later on, the data were assembled to ascertain the severity index, rate per million entering vehicles and rate per 100-million entering vehicles-miles, with the help of pre-defined mathematical models 1, 2 and 3 respectively. Years 2004 and 2008 received a massive number of accidents as compared to other three years. Meanwhile, the severity index of the year 2006 was recorded highest, because of negligence of drivers, violation of traffic regulations and engineering design faults.

Table 2. Five years accidental data

Years	Total Accidents	Fatal Accidents	Severity Index	Rate per million entering vehicles	Rate per 100-million entering vehicles-miles
2004	27	04	14.81 %	29.40	80.22
2005	12	01	08.33 %	12.28	33.50
2006	17	11	64.70 %	16.35	44.62
2007	17	01	05.88 %	15.37	41.94
2008	76	21	27.63 %	64.60	176.27

On the basis of data as depicted in (Table 2), the locations (black spots) were found with the maximum number of fatal, non-fatal and slight accidents, i.e. *Jamshoro Thermal Power House, Khan Petroleum Service, Lakhara Coal Mines and Shah OwaisQarni*. The aforementioned locations or black spots were pointed out in the study section of N-55 north. As mentioned in (Table 2), the rate of accidents in the year 2008 was at its peak. Although, the accident severity gets reduced in the same year, probably because of the maintenance-operation of the *National Highway Authority Unit Dadu*. In order to highlight the days and timings of severe traffic accidents, (Table 3) was formed. The maximum number of accidents were related to the vehicles, such as buses, trucks, and cars. The ratio of trucks was recorded higher, as compared to other vehicles responsible for accidents. From the traffic volume aspect, the proportion of the trucks, cars and buses was higher than other vehicles. Buses and trucks are commercial vehicles and used to travel for long mileages. Mostly, trucks and buses were overloaded and at the same time, the largest percentage of these vehicles were found unfit to be used for transportation. From (Table 3) comparative analysis, it is apparent that accident's severity is increased from the years 2004 to 2008 in moderate percentage. The only understandable reason is from the start of the year 2007, the road was maintained properly, and at the same time, sign boards were placed to guide drivers. In the years 2004 and 2008, the highest number of accidents was recorded in the months of January, February and September. These months are the coolest months of the year; therefore, the volume of the traffic was increased as compared to the hottest months. Whilst, April, May, October and

November also exhibited the higher intensity of accidents, probably because of the harvesting season. On the other hand, the days, i.e. Thursday, Monday and Sunday confirmed the maximum number of accidents. Although, the flow of the traffic was recorded as usual in the whole week; however, on Sundays the ratio of un-experienced and unskilled drivers became immense. This happened possibly because of the public holidays, as people loved to go out for recreation.

#### 4. RECOMMENDATIONS

To curtail the possibilities of accidents, proper traffic rules and regulations should be followed. The overloaded passenger and goods vehicles should not be allowed on N-55, and at the same time heavy fines should be imposed on the one, who found guilty. From the analysis of five years data, it was found that the frequent causes of accidents are over speeding, reckless or careless driving. Mechanical faults like, busting of wheels and overtaking were also found as the causes of the maximum number of accidents. From *Sehwan* to *Jamshoro* cities, on side B of section N-55 north, there was a problem of shoulders. Shoulders should be provided for the safety and the easy flow of traffic. Shoulders should be designed of sufficient span, i.e. minimum shoulder width = 4.6m; so that a truck stationed at the side of shoulder would have a clearance of 1.85m from pavement edge. It is also recommended that bridges found on N-55 must be repaired immediately, as to avoid accidents and free-flow of traffic. Pedestrian ways should be given at *Manjhand* and *Khanot* crossings, together with bus stop facility. To avoid accidents near renowned education institutions,

Table 3. Comparative analysis of five years accidental data

Description/Years		2004			2005				2006	2007			2008		
Fatal		04			01				11	01			21		
Non-fatal		20			09				06	05			40		
Slight		03			02				00	11			15		
Severity Index		14.81			08.33				64.70	5.88			27.63		
Accident rate	A/MV	29.41			12.28				16.35	15.37			64.60		
	A/100MV	80.22			33.50				44.62	44.94			176.27		
Months of Highest Accidents		Jan	Sept	Nov	Jan	Mar	May	Oct	Sept	Feb	Apr	Feb	May	Sept	
Days of Highest Accidents		Mon	Thu	Sun	Wed	Tue		Mon	Thu	Wed	Sat	Sun	Mon	Fri	
Hours of Highest Accidents		0600-0700, 1000-1100, 2000-2100			0000-0100, 1200-1300, 1800-1900				1800-1900, 2000-2100	1200-1300, 1600-1700, 1800-1900			0200-0300, 1400-1500, 2200-2300		
Involvement of Type of Vehicles		Trucks, Buses, Pickups			Trucks, Others				Trucks, Pickups	Cars, Buses			Buses, Trailers, Others		

i.e. Mehran University of Engineering and Technology, Sindh University and Liaquat University of Medical and Health Sciences; it is recommended to construct T- sections properly with extra right and left turning lanes to diminish the potential of passing accidents. As T- intersections ordinarily required more illumination than others; hence, it is imperative to install glitters and street lights for motorists. Nowadays, with the construction of *Aamri-Qazi Ahmed Bridge on River Indus*, heavy vehicles are often opting the N-55 route, resulting accidents and casualties. Therefore, appropriate measures must be taken immediately to avoid further mishaps. At the end, it is also suggested that new lanes should be constructed immediately on sides A and B of N-55, as to allow one-way heavy traffic easily.

## 5.

### **CONCLUSION**

The aim of the study was achieved successfully. Five years accidental data were collected and analyzed efficiently. Likewise, the severity index, rate per million entering vehicles and rate per 100-million entering vehicles-miles were also computed to clarify black spots on N-55, *Jamshoro-Manjhand* section. To avoid the further traffic misfortunes, this study advised aforementioned future recommendations, based on five years accidental data and its analysis. Therefore, it is concluded that suggestions, as recommended in this study, can be supportive in reducing the possibilities of accidents on N-55.

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