Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 1, No. 2, January : 2024

THE INVESTIGATIVE STUDY OF FATAL ACCIDENTS THAT OCCUR ON URBAN ROADS

Biradar Sharath Chandra Research Scholar (GU19R7577), Department of Civil Engineering, Glocal university, Saharanpur, U.P
Dr. T L Ramadasu , Professor, Department of Civil Engineering, Glocal university, Saharanpur ,U.P

ABSTRACT
Examining secular patterns becomes an effective way to forecast the future after excluding non-secular elements, including cyclical, seasonal, and irregular variation. Analysis of positive and negative outliers in relation to the trend line may be done using cyclical variation. The zone where changes are most noticeable is highlighted by seasonal shifts, which permit more stable circumstances there. Once the seasonal components have been eliminated from the depersonalized data, other irregular components must be present if oscillations are still seen. These seasonal and periodic changes may be investigated using graphical analysis and mathematical estimations. On the other hand, estimating the presence of irregular components is challenging conceptually. The smoothed line becomes the trend line when the non-secular elements are removed.

1. INTRODUCTION
Seasonal changes are those that happen on a regular basis and may be predicted for a year or less. Periods of days, weeks, months, or quarters are best for identifying seasonal shifts. This seasonal variation is used to forecast future trends and ascertain the pattern of past changes. Using a ratio to a moving average is one method of measuring seasonal change. An index that describes the degree of seasonal volatility is produced by this approach. This indicator measures how highly seasonal it is by measuring deviations from a mean value of 100, which serves as the starting point. In 1993, Richard et al. A seasonal index begins with obtaining the time series' 4-quarter moving total. For this computation, the values for each of the quarters in 2000 are added together. The moving total that is calculated from a set of variables is related to the average of those values. The sum for each quarter is increased by the cumulative accidents for 2001. These types of calculations were performed until 2006.

We average the two 4-quarter moving averages that are just above and below it for each quarter in order to guarantee that our moving averages are consistently centered. The graph produced by displaying the 4-quarter moving average against the year shows that the moving average smoothed out the volatility in the original time series the best. By figuring out the ratio of the actual value to the moving average value for each quarter, the seasonal component for the quarters in a time series with a 4-quarter moving average entry may be retrieved. Venkaji Rao (1973) evaluated the management problems affecting state transport undertakings, focusing on Mysore State in particular. He has found certain organizational roadblocks to raising the productivity of state transport undertakings. To balance the community's transportation demands with the other facilities supplied, they had to manage peak loads, the most effective use of workers and vehicles depending on the number of people moved, and future traffic planning. The automobile can accommodate fifty passengers on a basic basis. At least 60% of the buses that are now in operation need to be converted to express (non-stop) bus services in order to serve the approximately 60% of passengers who want to go from origin to destination.

This study aims to convert a portion of the fleet into express services during rush hour, with the precise quantity determined by passenger demand. During rush hour, five buses depart for Thuvakudi every hour from the central bus station. More than 300 passengers prefer to use these buses during peak hours. During rush hour, around 160 out of 300 people try to get to the terminal via the central bus station. (Report from TNSTC). To accommodate the increased demand from passengers, three of the current buses will be converted into express bus services.

1.1 Percentage of Fuel Consumption

Fuel prices are a significant commodity that account for the majority of the variable costs in the cost structure. Any savings realized here will help the bottom line. How many kilometers a car can go on a single tank of high-speed diesel (HSD) is a key indicator of how fuel-efficient it is.

The formula for calculating kilometers per liter (KMPL) is given below.

$$\text{Kilometer obtained per liter} = \frac{\text{Total gross kms covered by the vehicle of fuel}}{\text{Total liter of fuel consumed by the vehicle}}$$

It seems that all businesses have increased their production after using the fuel productivity concept. It is possible that the following elements contribute to the observed increase in fuel efficiency. Improvements in road conditions, increased engine power, bus driver education, improved engine technology, regular engine maintenance, etc.

1.2 Reduced Fuel Consumption Rate per Mile Journeyed

There are several methods to increase fuel economy. Encouraging fuel-efficient driving practices is one tactic; increasing automobiles' inherent fuel efficiency is another. One popular strategy is to control traffic speeds, which leads to a significant decrease in fuel consumption for the same distance traveled. This research also examines a second, alternate strategy for reducing gasoline use. (Walter Wahlberg, 2007).

1.3 Improving the operational fuel efficiency of vehicles

Poor vehicle maintenance and operation may result in reduced fuel economy. Some examples of these are improper tire inflation, improper injection timing, and unpredictable acceleration and deceleration. Higher fuel consumption is always the outcome of slower injection times. Low tire pressure increases rolling resistance, which may result in an increase of 5–10% in engine power and fuel consumption, as well as an increase in particulate matter and NOx emissions. (Patankar, 1988). You may be able to save a few percent on gasoline by braking less often, driving under the speed limit, and not accelerating too rapidly.

Maintaining your vehicle's condition might increase its gas economy by several percent. Badly maintained roads make it hard to travel at a steady speed, which drastically lowers fuel economy. Furthermore, even in situations where a small car would be enough, larger four-wheel-drive vehicles or state-owned vehicles may be required if the roads are in very bad shape. Overloaded cars cause road damage more rapidly in many third-world countries. Preventive measures like routine car and road maintenance and skilled driving might result in better gas economy. (Tapade, 1988).

This paper highlights the possibility of lower maintenance costs if the alternative mode of operation is taken into account.

2. METHODOLOGY

This research analyzed data on the number of accidents that have happened along the NH-40 stretch in Andhra Pradesh, which links the towns of Chagalamari and Kurnool, in order to discover four strategies for detecting dangerous places. The goal of this research is to examine the variables, such as road conditions, that affect traffic accidents. Reducing collisions and accidents on the National Highway in compliance with IRC 35-1997 and IRC 67-2012 is another goal of the operation. As part of this work, a prototype IoT-based safe driving system for cars has been built.

Typically, Road accidents are caused by a combination of factors, including human error, the state of the roads and the cars themselves, and the interactions between these. Route 40. The frequency of deaths and injuries on NH 40, which runs from Kurnool to Kadapa and on to Chittoor and Rani Pet in Tamil Nadu, seems to be increasing annually. This is one of the busiest roadways because of the range of cars that use it. To calculate the basic, multiple, and poison model parameters, linear regression

models have been developed. It has been shown that a number of variables significantly predict traffic accidents. ADT, speed, bends, carriageway width, road markings, shoulder quality, and other variables are among them. Furthermore, in light of the correlation between several variables and traffic accidents, alterations to the configuration of the Chagalamari to Kurnool National Highway have been suggested for all potentially dangerous locations.
Thanks to the IoT, all of our smart devices can now seamlessly connect to the internet and interact with one another. Using sensors in automobiles and their surroundings, the Internet of Things has greatly aided in the collection of a broad variety of contextual data. The proposed approach has been developed to help drivers be safe and alert to any possible dangers while they are on the road. In the modern world, transportation is not only necessary but also quite practical. Even though there will inevitably be more traffic, there is a chance that there may also be more accidents, which has to be carefully considered. The growing frequency of mishaps emphasizes how important safety precautions are. The responsibility of managing traffic and finding novel solutions to safety issues has been taken on by this paper. The study was conducted in Tiruchirappalli, one of Tamil Nadu's contemporary cities. This seven-year investigation, which was mainly concerned with traffic inflow and safety management, was conducted using data from the TNSTC. Depending on how many people and automobiles are on the road at any one moment, the city's incoming traffic is divided into peak and off-peak hours.
The classification of fatal, major, and minor accidents is dependent on whether they happen during peak or off-peak hours. Analyzing features such as accident causes, accident kinds, accident timings, pedestrian and passenger reactions, and so forth makes the study more comprehensive and rigorous. Human error is responsible for more than half of accident causes, including driving too fast, passing someone in the wrong direction, and not paying attention. The conduct of the passenger, which will divert the driver's attention and cause accidents, is also reflected in the passenger's response, as is the passenger's reaction after the accidents. From the standpoint of public health, it is critical to comprehend the variables that raise the risk of a traffic collision as well as the distinctions among those most immediately impacted (drivers, passengers, and pedestrians). Enables us to suggest preventative actions with a multidisciplinary approach that takes into account the domains of communication, work, education, transportation, and medicine.
The two analyses were carried out using SPSS. By using this method to compare accidents throughout the years under review, it was possible to conclude that 2002 had a higher-than-average accident rate because of flood-related road damage and inadequate maintenance.

3. RESULTS & DISCUSSIONS

Cyclical variation in a time series often causes oscillations above and below the secular trend line over time periods greater than a year. The method used to identify recurring changes is called the residual approach. The majority of the variation not explained by the trend is accounted for by the cyclical component.
Divide the actual value (Y) of each value in the time series (consisting of annual data) by the trend value () to get the proportionate trend. By taking the result and multiplying it by 100, one may get the percentage.

$$\text{Percentage of Trend} = \frac{Y}{\hat{Y}} x100$$

The relative cyclical residual is another measure of cyclical variation. This method allows us to determine the percentage that each number deviates from the average. The formula may be used to get the relative cyclical residual.

$$\text{Relative cyclic residual} = \frac{Y-\hat{Y}}{\hat{Y}} x100$$

These two techniques for identifying cyclical variation are used to study total accidents, peak and off-peak total accidents, fatal accidents, day and night fatal accidents, peak and off-peak hour fatal accidents, major accidents, peak and off-peak major accidents, day and night major accidents, etc. This research was conducted using data from Kumbakonam Division II and TNSTC, spanning the years 2000 through 2006. Using this approach to monitor changes in the accident rate over time makes perfect sense.

Table 1 Modified mean for fatal accidents.

Year	Quarter I	Quarter II	Quarter III	Quarter IV
2000	-	-	102.13	107.04
2001	108.84	80.54	109.09	90.00
2002	123.08	65.57	122.45	85.98
2003	116.74	79.05	120.93	110.57
2004	92.95	65.80	143.50	79.65
2005	105.53	80.33	123.81	83.90
2006	111.43	85.22	-	-
Total	110.64	76.43	119.07	91.73

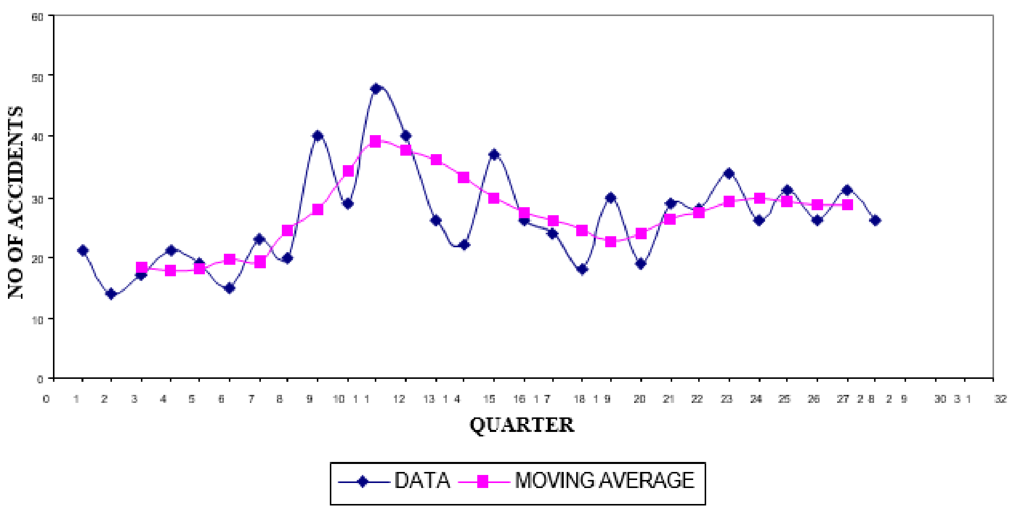
Total =397.87
Total of Indices 400/397.87=1.005353507

Table 2 Seasonal indices for fatal accidents

Quarter	Unadjusted Indices	Adjusting constant	Seasonal indices
I	110.64	1.005353507	111.23
II	76.43	1.005353507	76.84
III	119.07	1.005353507	119.71
IV	91.73	1.005353507	92.22
Total			**400.00**

Mean of Seasonal Indices 400/4=100

Figure 1: Seasonal variation for total off-peak hour accidents.



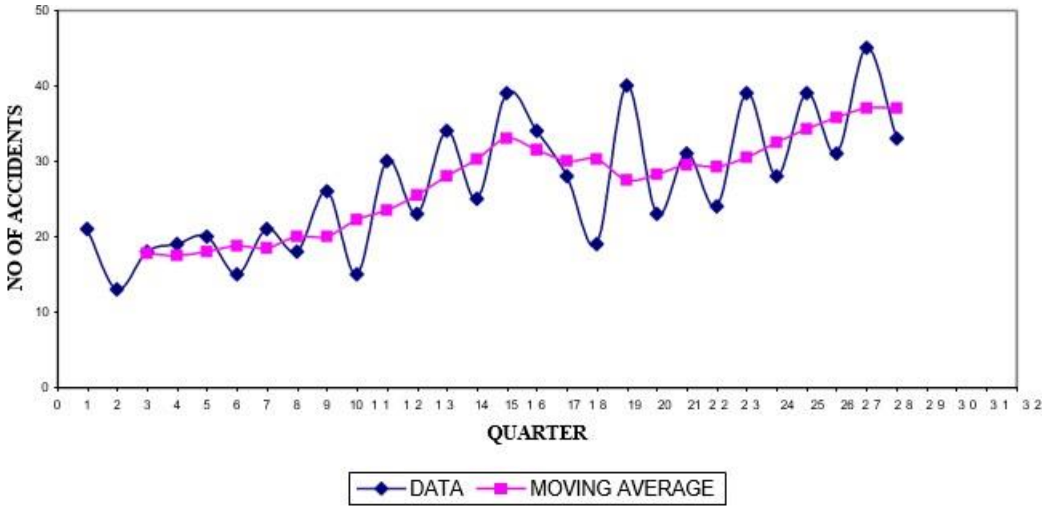


Figure2: Seasonal Variation for Fatal Accidents

4. CONCLUSION

In addition to irregular aspects, cyclical and seasonal fluctuations are also considered non-sacred elements of time series. We were able to analyze the trend variance by breaking the seven-year study period (2000–2006) into quarters, each with three months. The trend line's positive and negative outliers may be readily identified thanks to the cyclical variation analysis. The frequency of accidents may decrease as long as they are tracked, both during and after peak hours. The seasonal component of each kind of accident is computed, and the recovery of the accident from one quarter to the next is shown as a percentage of the actual value in relation to the moving average value. The modified means are calculated in order to exclude irregular and seasonal impacts from the time series.

5. REFERENCE

[1]. Richard I. Levin and David S. Rubin (1997), 'Statistics for Management', Prentice - Hall of India, New Delhi. ISSN *0197–2234.*

[2]. Richard L. Dukes, Stephanie L. clayton, Lessie T. Jenkins, Thomas L.Miller and Susan E.Roadgers (2001), 'Effects ofaggressive driving and driver characteristics on road rage', The Social Science Journal, ISSN *0887–2224.*Vol.38, pp. 323-331.

[3]. Roberts I. (2001), 'Will we all continue to ignore deaths and injuries from road traffic crashes?' Lett. Br. Med. J. ISSN *2041-8205*, Vol.323, No.402, Secretariat de Salud. Mortal dad 1995. Mexico.

[4]. Sasieni Maurice, Arthur Yaspan and Lawrence Friedman (1957), 'Operations Research – Methods and Problems, Wiley International Edition. ISSN *1758-1923*.

[5]. Satyanarayana Y. (1988), 'Energy Conservation in service Industries – Road Transport', Journal of Transport Management. *ISSN:0377-9254*., pp. 5-12.

[6]. Satyanarayana Y. (1990), 'Behavioral aspects in Management Control of Diesel Conservation', Journal of TransportManagement, *ISSN:0368-9354*, Vol.14, p.7.

[7]. Simms B.W., Lamarre B.G. and Jardine A.K.S. (1984), 'Optimal buy, operate and sell policies for fleets of Vehicles', Journal of Operations Research, ISSN *0097–6326,* Vol.15, pp.183-195.

[8]. Sirpa Rajalin and Heikki Summala (1997), 'What Surviving Drivers learn From a Fatal Road Accident', Acid. Anal. Prev. ISSN: *0785 - 9244*, Vol.29, pp.277 -283.

[9]. Sirpa Rajalin, Sven- Olof Hassel, and Heikki Summala, (1997), 'Close - following Drivers on Two – Lane Highways' Acid. Anal. Prev. ISSN *0785 - 9244*,Vol.29, pp. 723-729.

[10]. TNSTC (2000), 'Tamil Nādu State Transport Corporation', Kumbakonam Division - II, Trichy, Tamil Nādu.