Analysis & Prediction of Road Accident

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ABSTRACT

In order to anticipate the number of traffic accidents in Indian states, this research paper examines the linear trend mathematical model, which is based on time series. Forecasting is done for five categories: total accidents, total injuries, total fatalities, and total fatalities on national roadways. We Analysis and forecasting are done for top five metro states: Tamil Nadu, Maharashtra, West Bengal, Delhi, Gujarat. This model is state variant and forecasts the accident data for the year 2020 , 2021 , 2022 , 2023 (Data for 2020 is not available till date). The data taken for modeling is from the year 2009 to 2019.

INTRODUCTION

Road accidents are negatively related to urbanization, motorization, and expansion with road length. Urbanization, the use of motor vehicles, and the lengthening of roads all have a detrimental impact on traffic accidents. Road accidents are now acknowledged as a significant health issue on a global scale. Road accidents are one of the main reasons for deaths and disabilities. This imposes the huge socio-economic cost. In India, road accidents are one of the most important causes of death and health loss. This is more among the person of age group 15 to 49 years.

We take data till(2019), the total no. of reported accident data is 4,49,002, in which 451,361 are injuries and 1,51,113 people are killed. If we compare this to the year 2018, the number of accidents reduced by 3.86 percent, the number of fatalities decreased by 0.20%, and the number of injuries decreased by 3.85 percent.

Parameter	2018	2019	% Change over year
Total Accidents in the country	4,67,044	4,49,002	-3.86
Total number of Persons Killed in the country	1,51,417	1,51,113	-0.2
Total number of Persons Injured in the country	4,69,418	4,51,361	-3.85

Table -1 : Road accident parameters 2018 & 2019

In statewise comparison, top three states in road accidents in 2019 are Tamil Nadu, Madhya Pradesh, Uttar Pradesh. Tamil Nadu has 12.7% share in total no. of road accidents, while Madhya Pradesh has 11.3% and Karnataka has 9.5 % share.

UP ranks 1st even in 2019 in terms of accident related deaths and has shown an increase of 1.8% over the previous year. However, Tamil Nadu experienced the biggest decline in the number of fatalities.

Sl. No.	State	2018		2019		Increase /decrease 2019/2018	
		Persons killed	% share	Persons killed	% share	In Numbers	% age terms
1	Uttar Pradesh	22,256	14.7	22,655	15.0	399	1.8
2	Maharashtra	13,261	8.8	12,788	8.5	-473	-3.6
3	Tamil Nadu	12,216	8.1	11,249	7.4	-967	-7.9
4	Karnataka	10,990	7.3	10,958	7.3	-32	-0.3
5	Madhya Pradesh	10,706	7.1	10,563	7.0	-143	-1.3
6	Rajasthan	10,320	6.8	10,525	7.0	205	2.0
7	Gujarat	7,996	5.3	7,984	5.3	-12	-0.2
8	Andhra Pradesh	7,556	5.0	7,390	4.9	-166	-2.2
9	Telangana	6,603	4.4	7,205	4.8	602	9.1
10	Bihar	6,729	4.4	6,964	4.6	235	3.5
11	West Bengal	5,711	3.8	5,500	3.6	-211	-3.7
12	Odisha	5,315	3.5	5,333	3.5	18	0.3
13	Haryana	5,118	3.4	5,057	3.3	-61	-1.2
14	Punjab	4,740	3.1	5,003	3.3	263	5.5
15	Chhattisgarh	4,592	3.0	4,525	3.0	-67	-1.5

Table 2: Top 15 states in term of accident related to death.

METHODOLOGY

For the analysis and forecasting of road accident linear regression mathematical models are used. To develop this mathematical model, road accident data from year 2009 to year 2019 is collected from internet sources and other government agencies. The moving average of data is calculated to generate trend line(y = mx + b). After regression analysis, with the help of excel trend equation is generated. With the help of this trend equation, forecasting is done for next four years.

ANALYSIS & FORECASTING

The study is done for four categories and each for top five metro states. Categories are listed below:

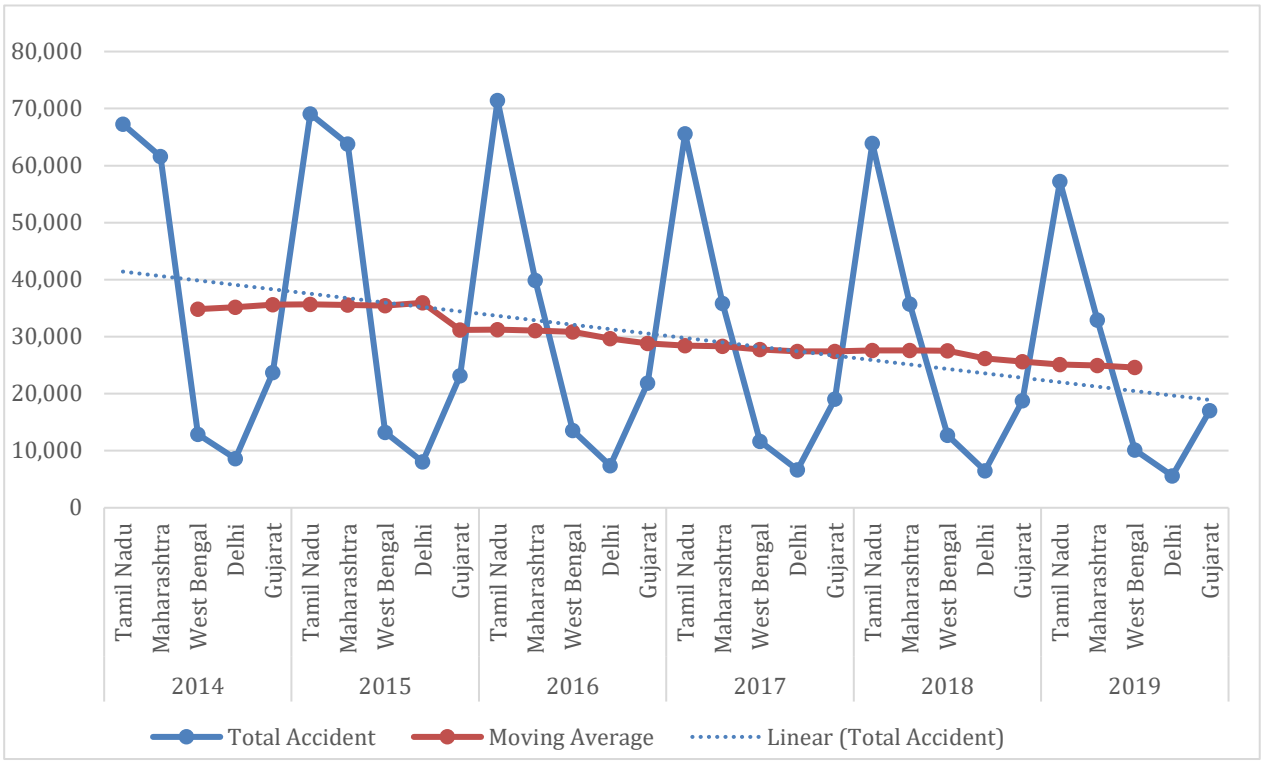
- Total no. of road accidents
- Total no. of people injured in road accidents
- Total no. of people killed in road accidents
- Total no. of people road accidents happened on National highways .

A .Analysis & Forecasting for Total no. of road accidents:

Table 3 displays the data that was gathered.

S. No.	States/Uts	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	Tamil Nadu	60,794	64,996	65,873	67,757	66,238	67,250	69,059	71,431	65,562	63,920	57,228
2	Maharashtra	71,996	71,289	68,438	66,316	63,019	61,627	63,805	39,878	35,853	35,717	32,925
3	West Bengal	11,134	14,888	14,945	12,290	12,414	12,875	13,208	13,580	11,631	12,705	10,158
4	Delhi	7,516	7,260	7,281	6,937	7,566	8,623	8,085	7,375	6,673	6,515	5,610
5	Gujarat	31,034	30,114	30,205	27,949	25,391	23,712	23,183	21,859	19,081	18,769	17,046

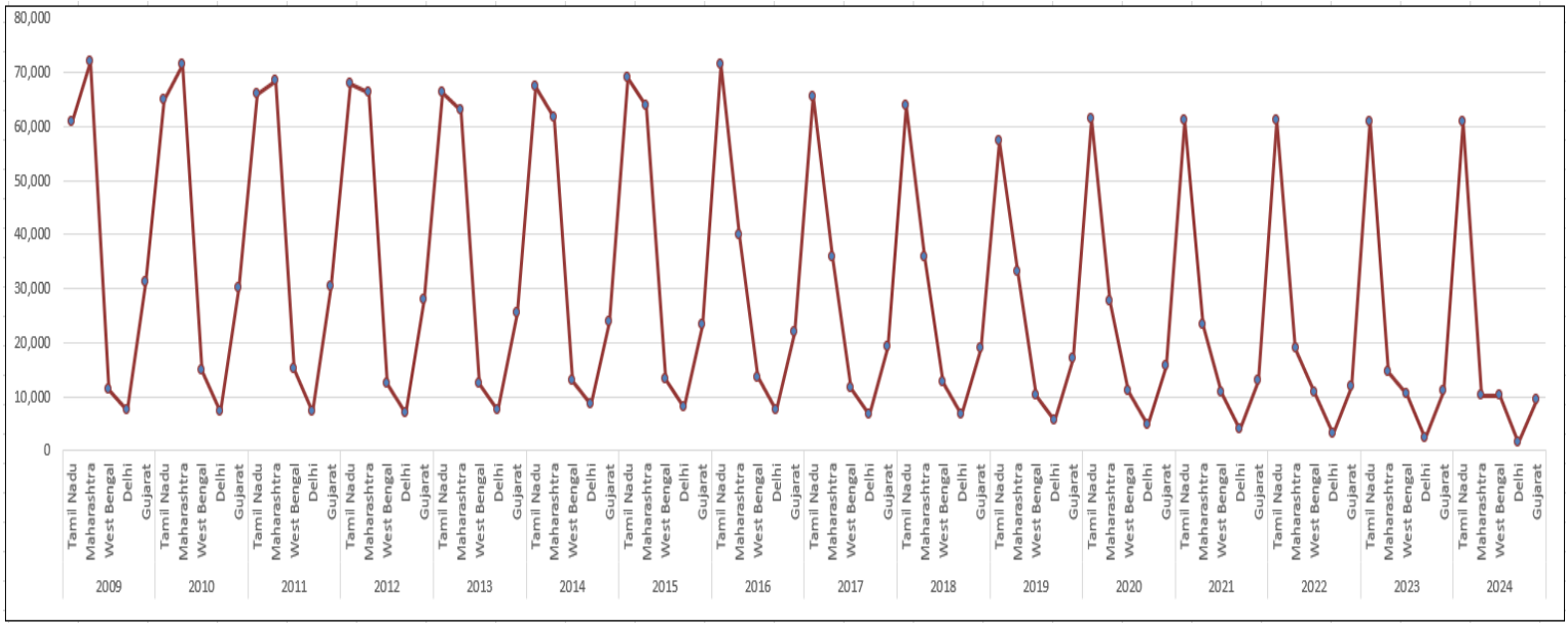
Table 3: Total no. of road accidents for year 2009 to 2019



Graph 1: Analysis for total no. of road accidents

The linear trend equation for the total number of accidents obtained using regression analysis is,

Total no. of accident y = 42190 - 775.83x



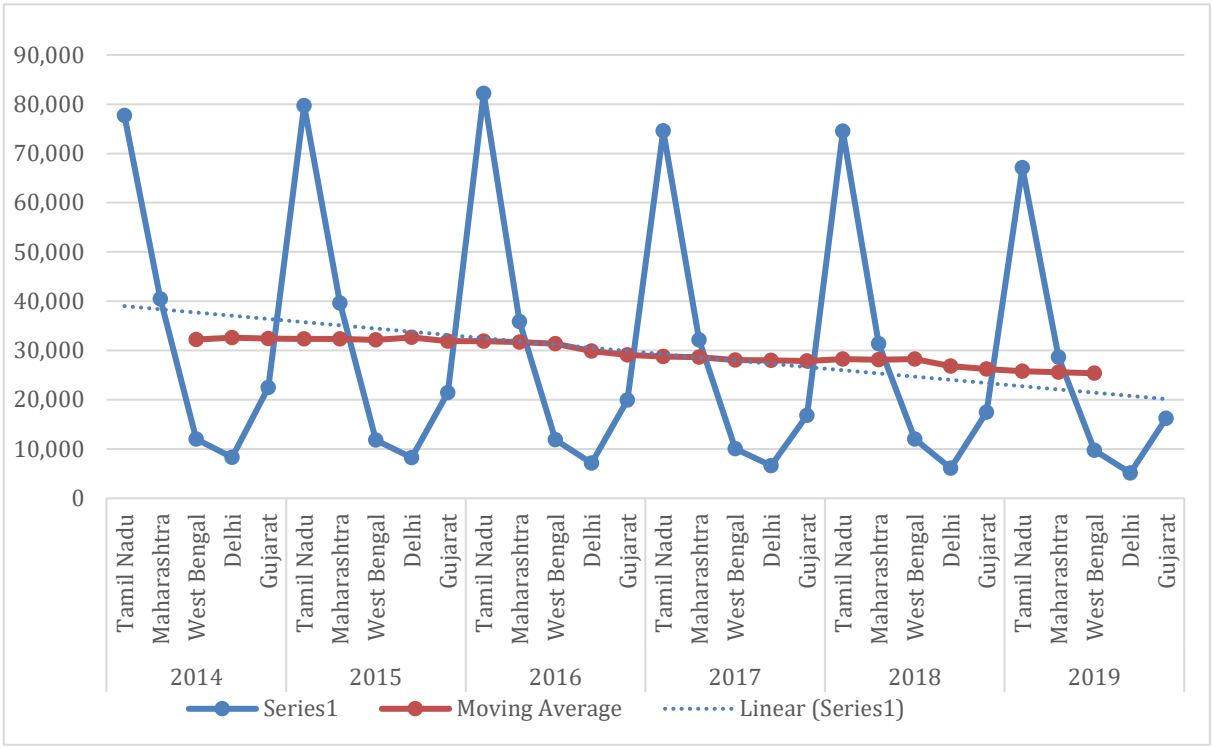
Graph 2: Forecasting for total no. of road accidents (by using excel)

B .Analysis & Forecasting for Total no. of people injured in road accidents:

Table 4 displays the data that was gathered.

S. No.	States/Uts	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	Tamil Nadu	70,504	75,445	74,245	78,348	75,681	77,725	79,746	82,163	74,571	74,537	67,137
2	Maharashtra	47,878	46,985	45,628	43,847	41,972	40,455	39,606	35,884	32,128	31,365	28,628
3	West Bengal	12,186	15,760	14,962	13,773	13,182	12,018	11,794	11,859	10,091	11,997	9,757
4	Delhi	6,936	7,108	7,226	6,633	7,098	8,283	8,258	7,154	6,604	6,086	5,152
5	Gujarat	32,944	32,449	29,744	27,650	24,836	22,493	21,448	19,949	16,802	17,467	16,258

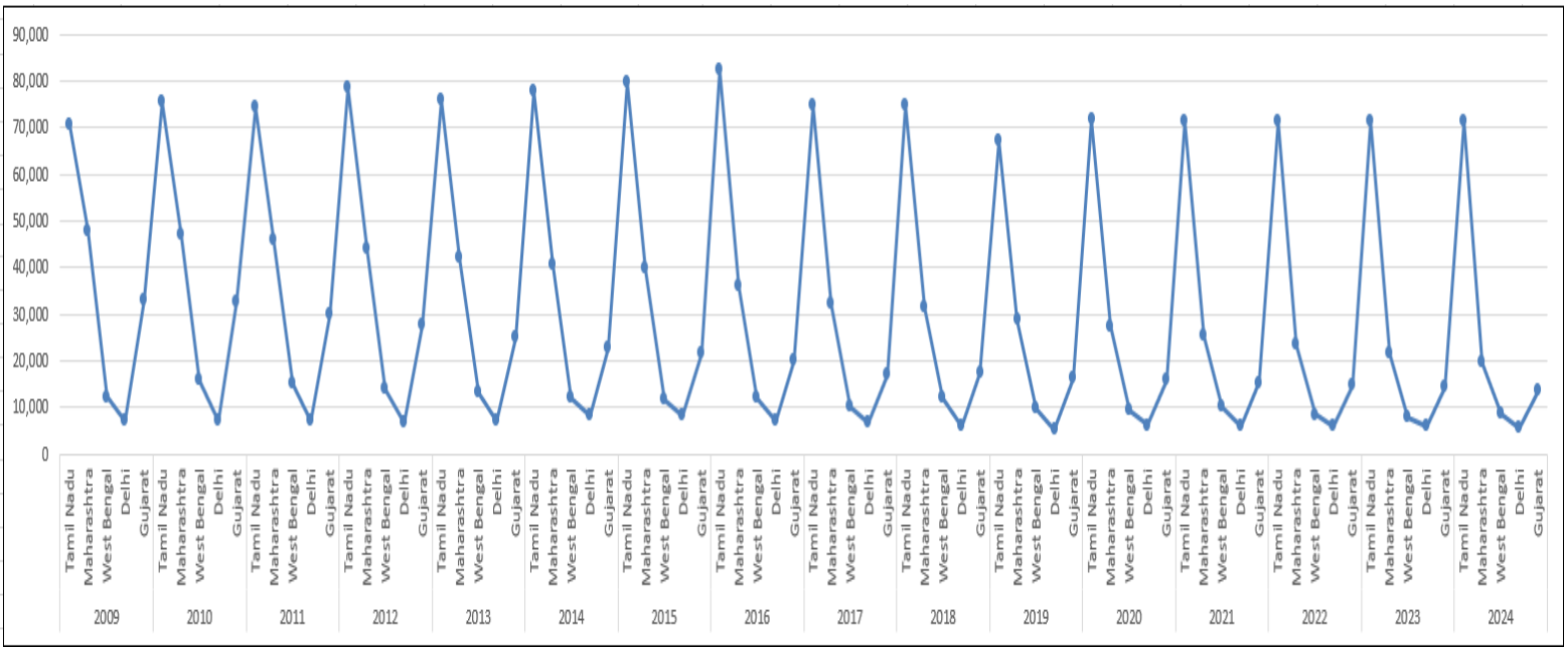
Table 4: Total no. of people injured in road accidents for year 2009 to 2019



Graph 3: Analysis for total no. people injured in road accidents.

The linear trend equation for the total number of injured people obtained using regression analysis is:,

Total no. of people injured y = 3966-650.73x

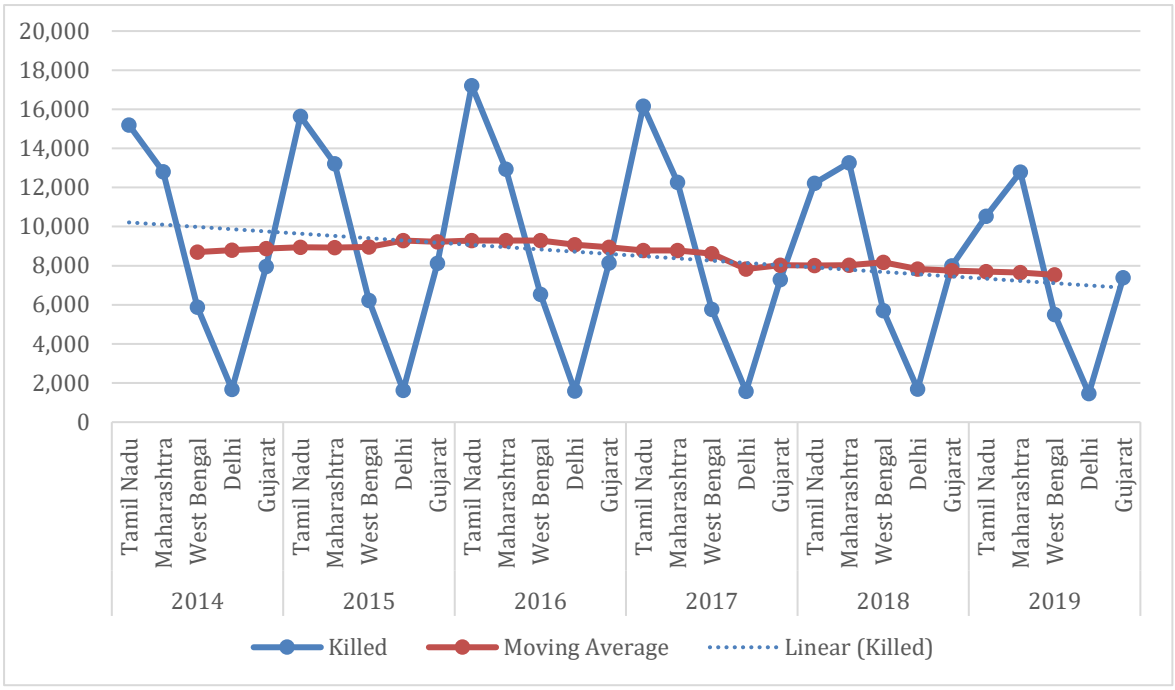


Graph 4: Forecasting for total no. people injured in road accidents

C. Analysis & Forecasting for Total no. of people killed in road accidents:
Table 5 displays the data that was gathered.

S. No.	States	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	Tamil Nadu	13,746	15,409	15,422	16,175	15,563	15,190	15,642	17,218	16,157	12,216	10,525
2	Maharashtra	11,396	12,340	13,057	13,333	13,029	12,803	13,212	12,935	12,264	13,261	12,788
3	West Bengal	4,860	5,680	5,664	5,397	5,504	5,875	6,234	6,544	5,769	5,711	5,500
4	Delhi	2,325	2,153	2,065	1,866	1,820	1,671	1,622	1,591	1,584	1,690	1,463
5	Gujarat	6,983	7,506	8,008	7,817	7,613	7,955	8,119	8,136	7,289	7,996	7,390

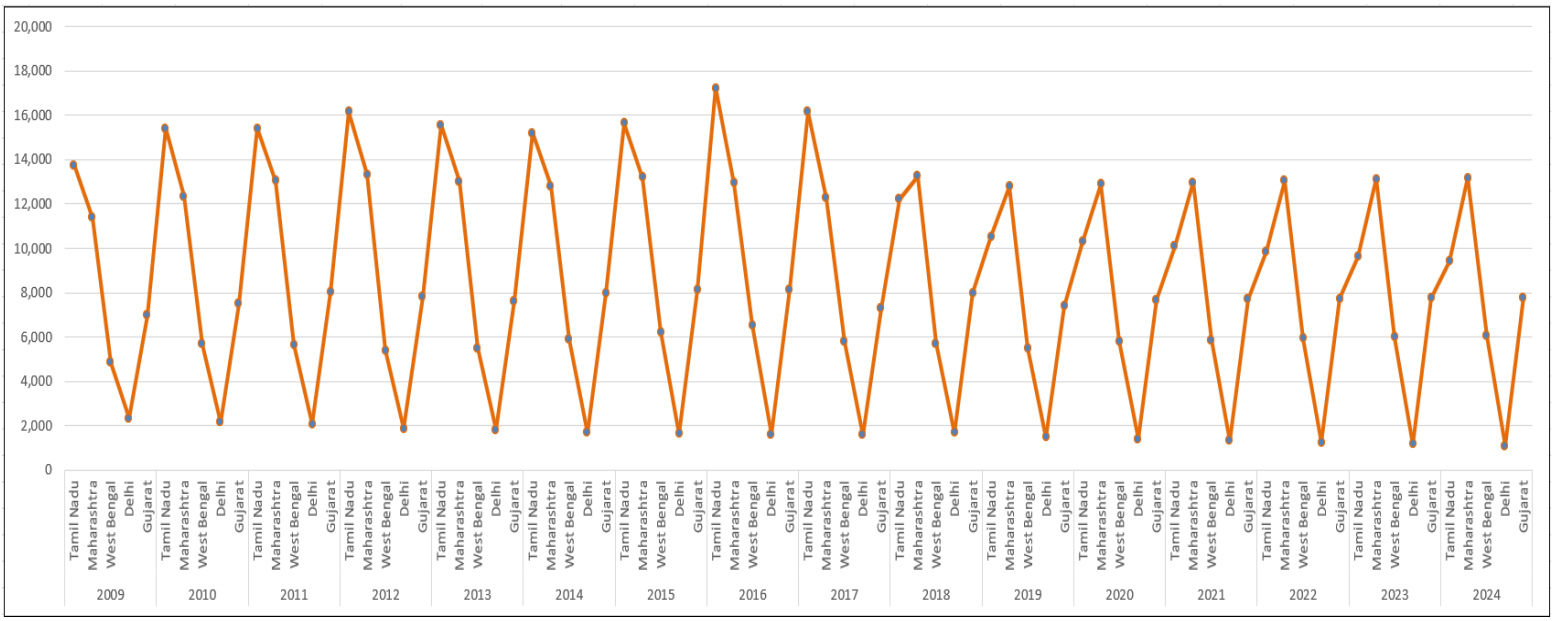
Table 5: Total no. of people killed in road accidents for year 2009 to 2019



Graph 5: Analysis for total no. people killed in road accidents

The linear trend equation for total nodes is derived via regression analysis,

Total no. of people killed y = 10329 - 115.1x



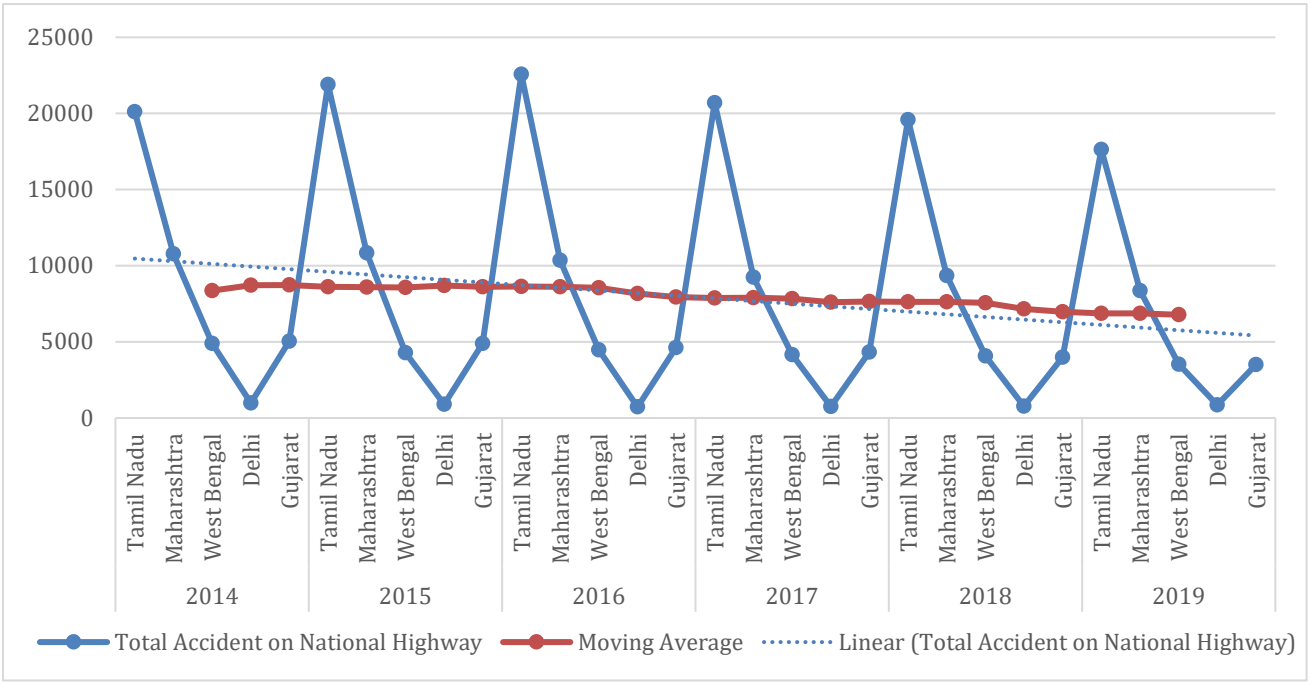
Graph 6: Forecasting for total no. people killed in road accidents

D. Analysis & Forecasting for Total no. of road accidents on National highways:

Table 6 displays the data that was gathered.

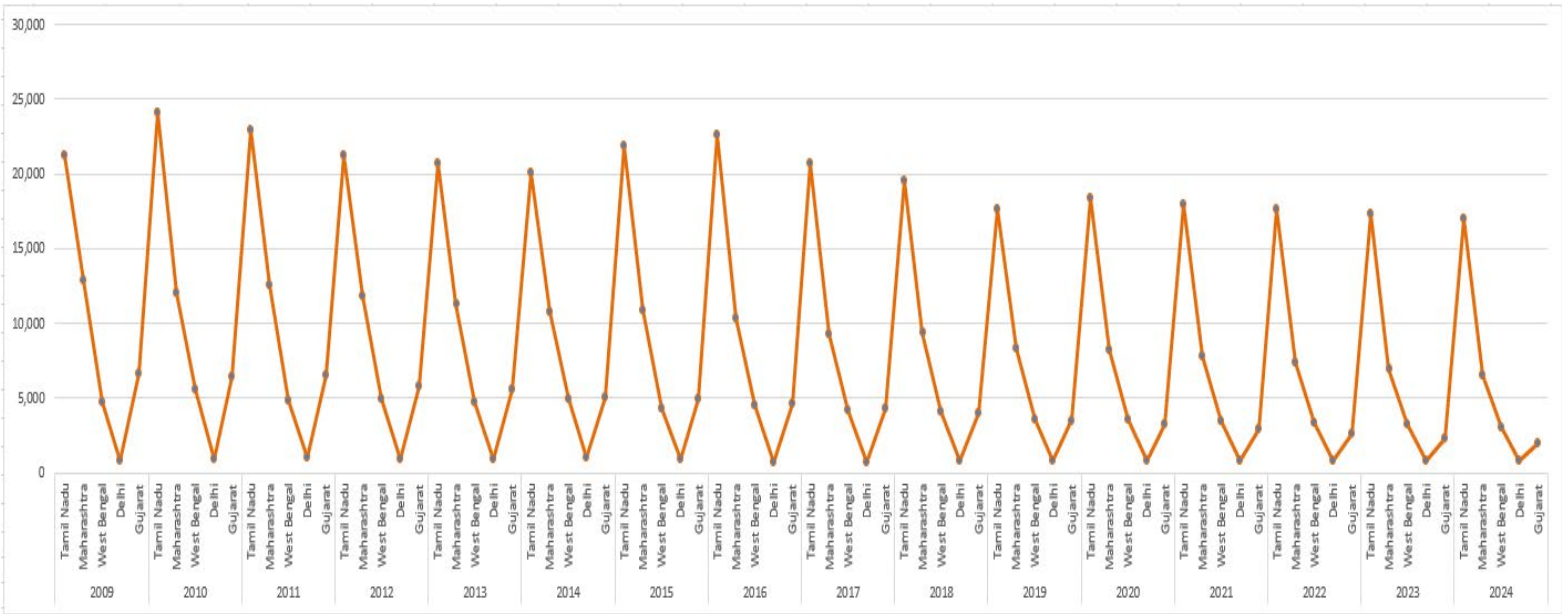
S. No.	States	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	Tamil Nadu	21,198	24,083	22,932	21262	20686	20109	21902	22,573	20,696	19,583	17,633
2	Maharashtra	12,911	12,026	12,530	11805	11289	10788	10839	10,364	9,237	9,355	8,360
3	West Bengal	4,714	5,547	4,787	4904	4718	4895	4288	4,468	4,158	4,071	3,537
4	Delhi	796	886	986	890	898	976	897	723	755	783	857
5	Gujarat	6,640	6,440	6,485	5823	5600	5038	4897	4,617	4,333	3,997	3,511

Table 6: Total no. of people killed in road accidents on National Highways for year 2009 to 2019



Graph 7: Analysis for road accidents on National highways

From regression analysis, the linear trend equation for road accident on National Highways are :
Total no. of accident y = 10643 - 174.27x



Graph 8: Forecasting for road accidents on National highways

RESULTS

From above study, following results are drawn:

- **Forecasting for total no. of accidents:** Forecasting for total no. of accidents for year 2020 to 2024 is given in table 7.

	Tamil Nadu	Maharastra	West Bengal	Delhi	Gujarat
2020	61,279	27,663	11,014	4,777	15,517
2021	61,165	23,264	10,834	3,943	12,877
2022	61,051	18,865	10,654	3,109	11,772
2023	60,937	14,467	10,475	2,275	10,958
2024	60,823	10,068	10,295	1,441	9,428

Table 7: Forecasting for total no. of accidents

- **Forecasting for total no. of people injured in accidents:** Forecast for total number of accident injuries: Table 8 provides a forecast for the total number of accident injuries from 2020 to 2024.

	Tamil Nadu	Maharastra	West Bengal	Delhi	Gujarat
2020	71,426	27,370	9,174	6,114	15,746
2021	71,358	25,397	10,024	6,002	15,233
2022	71,291	23,425	8,390	5,891	14,721
2023	71,223	21,452	7,806	5,779	14,209
2024	71,155	19,479	8,656	5,667	13,696

Table 8: Forecasting for total no. of people injured in accidents

- **Forecasting for total no. of people killed in accidents:** Forecast for total number of accident injuries: Table 9 provides a forecast for the total number of accident injuries from 2020 to 2024.

	Tamil Nadu	Maharastra	West Bengal	Delhi	Gujarat
2020	10,302	12,904	5,803	1,387	7,668
2021	10,079	12,975	5,864	1,311	7,696
2022	9,857	13,045	5,925	1,235	7,723
2023	9,634	13,115	5,986	1,159	7,751
2024	9,411	13,186	6,047	1,083	7,779

Table9: Forecasting for total no. of people killed in accidents

- **Forecasting for total accidents on National highways:** Forecasting for total accidents for year 2020 to 2024 is given in table 10.

	Tamil Nadu	Maharastra	West Bengal	Delhi	Gujarat
2020	18,346	8,252	3,601	838	3,294
2021	17,996	7,829	3,465	828	2,977
2022	17,646	7,406	3,330	818	2,659
2023	17,296	6,983	3,195	808	2,342
2024	16,946	6,559	3,059	797	2,024

Table 10: Forecasting for total accidents on National highways

CONCLUSION

The following conclusions can be taken from the preceding results:

1) The total number of accidents is falling in all states.
2) Because road accidents are determined by three E's. This acronym stands for Engineering, Education, and Law Enforcement. As a result, each state has its unique topography as well as its own set of rules and regulations. This study solely demonstrates trend analysis based on prior data.

The study reveals that road accidents are negatively related to urbanization, motorization, and expansion with road length. The study predicts a decrease in the number of accidents, fatalities, and injuries in the coming years. However, it is important to note that the study only uses historical data and assumes that the future will follow the same pattern. Therefore, the actual number of accidents, fatalities, and injuries may differ due to changes in the environment, laws, and policies.

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