

# Road Accidents In India

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## Introduction

### Why road accidents?

Every day when you read the newspaper, you must have come across news about the occurrence of road accidents in some form or the other. And must have wondered what all are the causes of such occurrences and how can they be minimized. Deaths due to road accidents are a leading cause of death in India. Road accidents are multi-causal and are often the result of an interplay of various factors like:

- Human errors
- Driving under the influence of drug or alcohol
- Vehicular condition
- Weather condition
- Time of occurrence of Accidents

This project aims to analyze these various factors and how they individually affect road accidents in India.



Figure 1: Road Accidents

# Drunk Driving In Gujrat

**Did banning alcohol in Gujarat in the year 2009 help in reducing road accidents in the state?**

The data for analyzing the question posed was scraped from <https://cot.gujarat.gov.in/road-accidents.htm> .i.e. The official website of the Commisionerate of Transport, Government of Gujarat. The data has the following columns:

1. Year
2. Number of Accidents
3. Number of Deaths
4. Number of Persons Injured
5. 100 Accident Average
6. Number of Accident per 1000 (thousand) registered Vehicles
7. Number of Vehicle Registered

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## Road Accidents Record from Year 1999 TO 2017

Year (Calender)	No. of Accidents	No. of Deaths	No. of Persons Injured	@100 Accident Average		No. of Accident per '000 (thousand) registered vehicles	No.of Vehicle Registered Ason
				No of Death	No of Injured		
1999	37428	4687	25033	13	67		
2000	36029	4539	24316	13	67	7	5490608
2001	32523	4502	22023	14	68	6	5911196
2002	31735	5094	34415	16	108	5	6382708
2003	30604	5161	33680	17	110	4	6925727
2004	30630	5423	34436	18	112	4	7621550
2005	30515	5642	34901	18	114	4	8399892
2006	31547	6161	33984	20	108	3	9278965
2007	33623	6915	35768	21	106	3	10091452

<https://cot.gujarat.gov.in/road-accidents.htm>

Figure 2: Data for Road Accidents in Gujrat

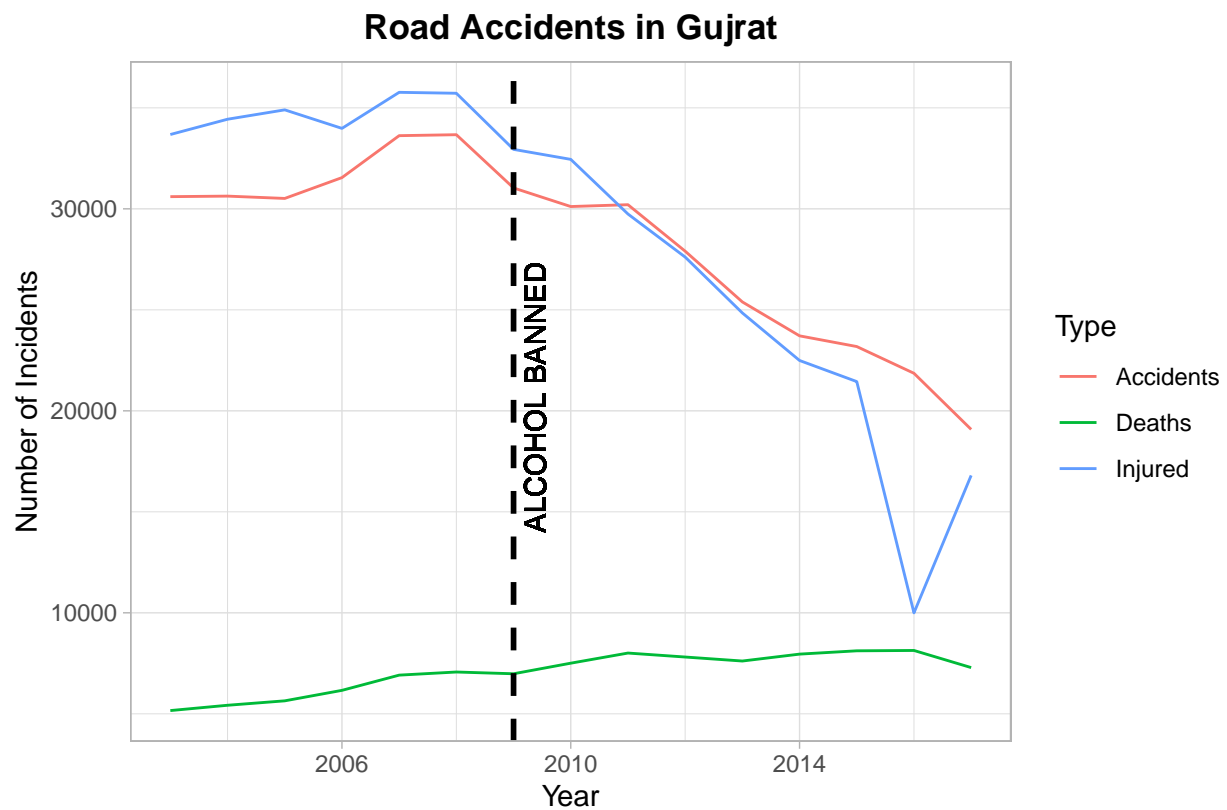
The data was cleaned and only the first three columns were kept in the final data frame.

To analyze this data, a multiple-line graph was plotted in R. This graph was suitable for the given dataset as it shows the trend clearly and justifies the dataset.

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## Warning: Using 'size' aesthetic for lines was deprecated in ggplot2 3.4.0.  
## i Please use 'linewidth' instead.
```

	Year	Accidents	Deaths	Injured
1	2003	30604	5161	33680
2	2004	30630	5423	34436
3	2005	30515	5642	34901
4	2006	31547	6161	33984
5	2007	33623	6915	35768
6	2008	33671	7070	35722
7	2009	31034	6983	32944
8	2010	30114	7506	32449
9	2011	30205	8008	29744
10	2012	27904	7812	27612

Figure 3: Data frame of Road Accidents in Gujrat



### Observations

1. The trend line of the number of road accidents can be seen having a clear dip after the year 2009, which implies that banning alcohol probably has helped curb road accidents in Gujarat.
2. The trend line of the number of deaths which was increasing as the years passed, shows control in the

number of deaths after the year

2009.

## Effect of the Number of Vehicles

**Is there any relationship between the number of registered vehicles in a city with the total number of accidents in the city with respect to the population of the city?**

The objective is to analyze road accidents in major cities of the country in 2020. By major cities here we mean cities having a population of more than 1 million.

### Data

- The data on the number of vehicles registered in each city was obtained from <https://data.gov.in> in csv format.
- The population for the states was downloaded from Wikipedia . [https://en.wikipedia.org/wiki/List\\_of\\_cities\\_in\\_India\\_by\\_population](https://en.wikipedia.org/wiki/List_of_cities_in_India_by_population)
- The number of road accidents in the cities was obtained from <https://data.gov.in> in csv format.

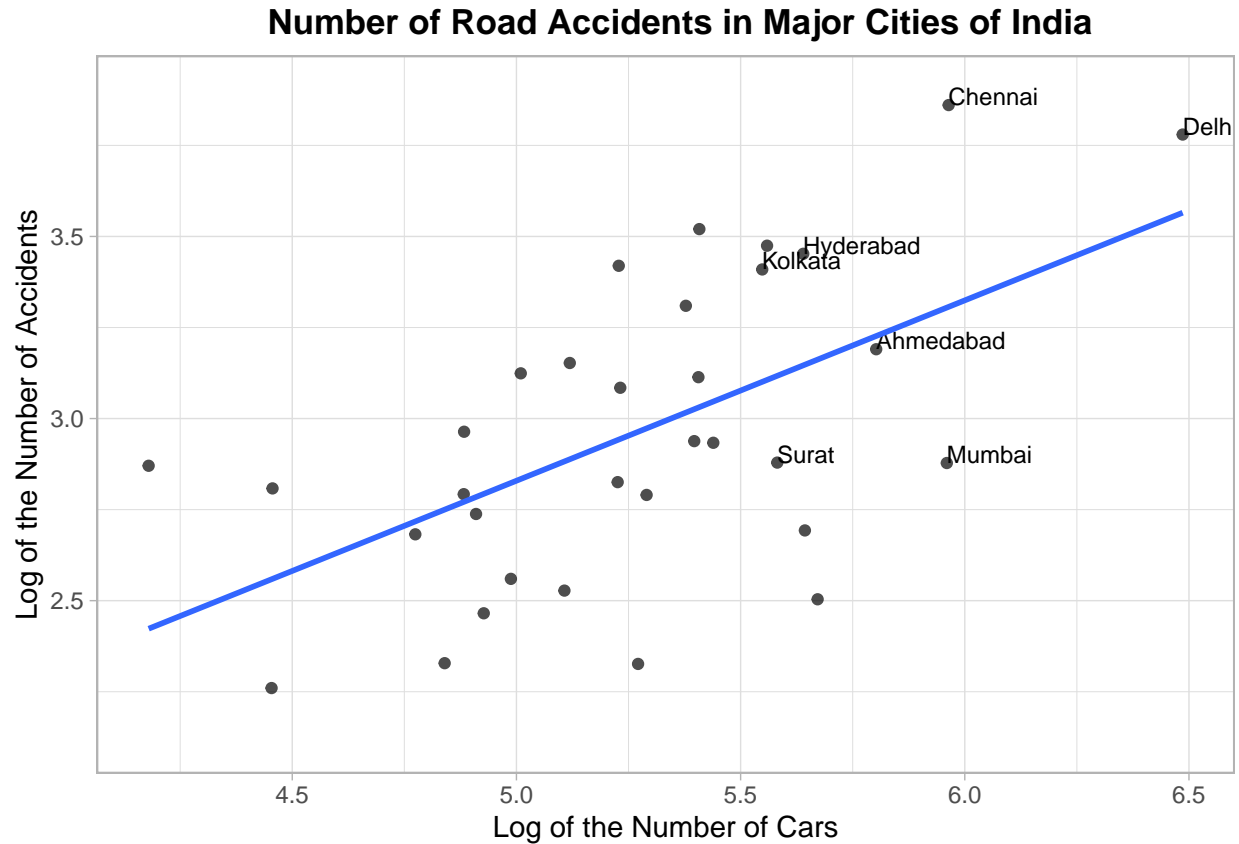
The data sets were then merged but it required some cleaning. The following steps were taken to clean the data:

1. There were some cities in the file containing the number of vehicles registered in each city, that were not present in the dataset containing the accidents in each state. And, hence those cities were then omitted from both files and only the common ones were retained.
2. And the population of only these cities was filtered and the final data frame was made having these three variables.

City	Cases	Injured	Deaths	Transport	Two_wheeler	Cars	Non_transport	Population
Agra	292	227	292	35916	784546	84557	925705	1585704
Ahmedabad	1550	1297	349	379370	2765309	634533	3525582	5570585
Allahabad	742	441	327	57918	902871	15125	965077	1112544
Aurangabad	643	450	193	47383	408546	28576	468098	1175116
Bhopal	2627	2171	169	66411	977726	169138	1189373	1795648
Chandigarh	319	279	109	21758	366541	469672	861031	960787
Chennai	7257	6975	1299	494303	3789692	920473	4804580	4681087
Coimbatore	1299	1191	277	92154	1670823	254639	1966460	1050721
Delhi	6023	5496	1406	600407	6595993	3061817	9659645	11007835
Dhanbad	213	109	100	66456	493551	69176	584602	1162472
Ghaziabad	212	29	227	53369	652520	186784	864231	1648643
Hyderabad	2834	2370	310	225413	1992499	436231	2489097	6809970
Indore	3313	2516	314	140099	1460286	255835	1794489	1960631

Figure 4: Data frame used for analysis

In the following figure, log of the number of accidents in a given city is plotted against the log of the total number of registered Cars of a given type. The base of the logarithm is 10.



### Observations

There are clear visuals of two outliers in the plot, namely Mumbai and Chennai as they deviate strongly from the average trend line.

- *Mumbai*: We can see that this state has a large population, but has less number of registered vehicles and fewer road accidents.
- *Chennai*: The state has a moderate population but has a high number of registered vehicles and a large number of road accidents.

A possible reason for this can be

- Mumbai has invested a great deal in road safety by installing CCTV cameras, traffic lights, and good traffic policing. They have imposed a fine ranging from 1000-5000 rupees for overspeeding and other traffic rule violations.
- Chennai on the other hand has everything that can cause a road accident, from dysfunctional traffic signals and street lights to bad traffic policing. They have imposed a fine ranging from 150-300 rupees for overspeeding and other traffic rules violations

It can be observed that the number of road accidents in a city is positively correlated to the number of registered motor vehicles it has.

# Causewise Distribution of Road Accidents

## What are the major causes of road accidents in Indian states?

The objective is to analyze the causes affecting road accidents in all states of India and also compare which cause is the major cause affecting road accidents in each state.

### Data

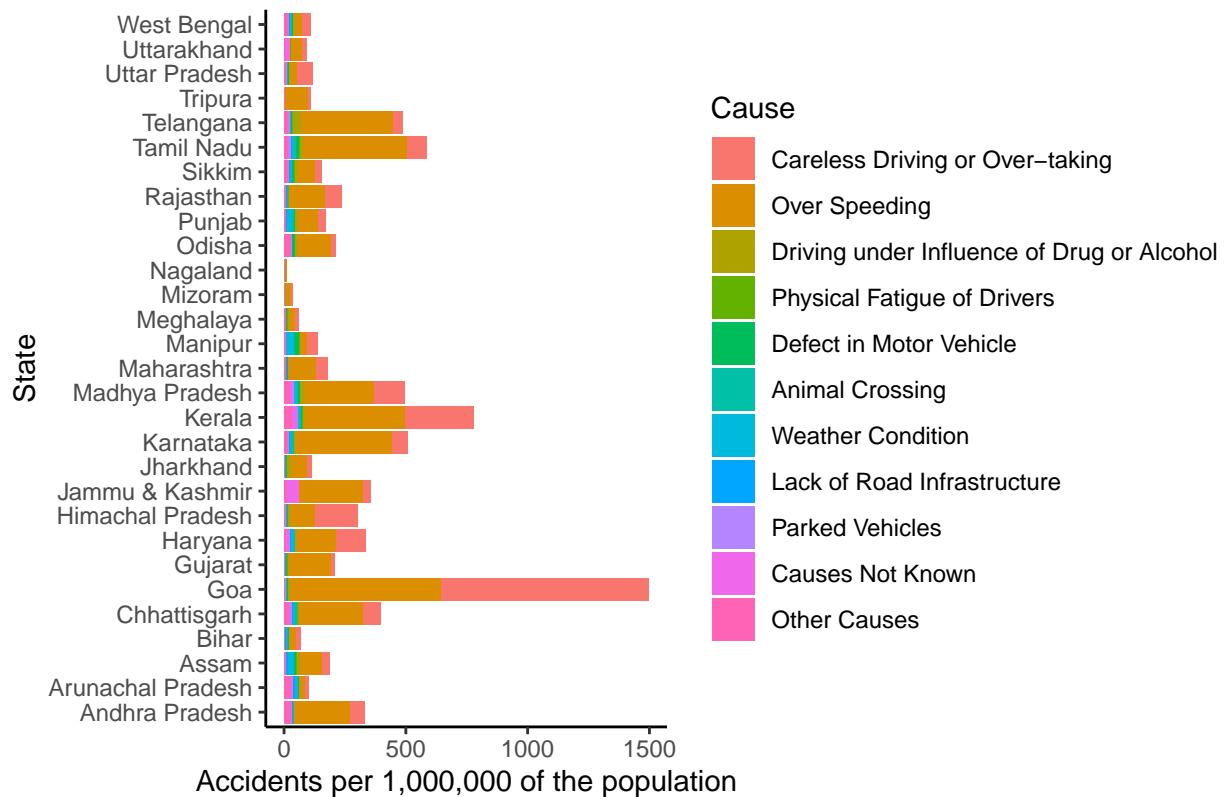
1. Cause-wise distribution of road accidents in each state has been downloaded from <https://data.gov.in> in .csv format for the years 2015 to 2020.
2. Estimated population of the states of 2019 for a better comparison of causes has been scraped from <https://statisticstimes.com/demographics/india/indian-states-population.php>

State	Careless Driving or Over-taking	Over Speeding	Driving under Influence of Drug or Alcohol	Physical Fatigue of Drivers	Defect in Motor Vehicle	Animal Crossing	Weather Condition	Lack of Road Infrastructure	Parked Vehicles	Causes Not Known	Other Causes
Andhra Pradesh	142.217393	206.350647	2.4488254	6.0478568	12.07716182	0.7235166	18.27343225	7.6804071	3.26510058	0.8162751	23.801841
Arunachal Pradesh	33.111360	32.474603	10.1881107	0.0000000	16.55567994	1.9102708	12.09838149	8.2778400	0.00000000	7.6410830	58.581637
Assam	65.520753	67.683247	8.3972161	2.3309998	9.09932443	0.7301927	20.33305830	5.3360236	5.11134891	5.1394332	5.757289
Bihar	18.020844	15.937509	6.2179524	0.8493595	2.51602713	1.7147446	5.83333679	2.0352576	0.70512862	1.0657058	21.762833
Chhattisgarh	120.939396	184.432579	5.1976763	7.1680372	22.82900960	2.2081631	29.24966855	4.7220719	2.24213487	9.9537200	101.813306
Goa	1203.467297	1037.037037	11.9779354	0.6304177	0.00000000	15.7604413	6.93459417	0.6304177	0.00000000	1.2608353	457.052797
Gujarat	79.016916	243.610703	0.9237167	3.2095240	5.83976813	2.0979328	9.61291590	2.8181187	1.95702685	2.1135890	14.560280
Haryana	221.168875	87.574082	12.2674624	2.7654973	7.05556366	8.0837614	33.82415947	4.8928029	4.71552747	4.1127909	13.721121
Himachal Pradesh	206.522986	156.200621	6.8438416	0.0000000	7.11222760	0.0000000	6.03868381	0.0000000	0.00000000	0.0000000	21.202490
Jammu & Kashmir	83.490613	191.308157	0.5879621	0.0000000	4.92418229	0.0000000	13.59662275	1.2494194	0.14699052	19.5497387	114.873088
Jharkhand	51.795686	32.414409	19.7699391	2.4356150	11.24528644	0.5959484	10.20885451	1.9173991	0.77732395	0.7255024	1.865577
Karnataka	244.972499	284.461752	3.9370844	3.1970310	33.89444878	1.5985155	24.31815692	8.3774052	4.52912722	4.4403208	37.683523

Figure 5: Data frame used for analysis

UTs and city wise data for all causes has been removed from cause wise distribution of road accidents. For fair comparison, total number of accidents per million of population was calculated for every state by using estimated population of states of 2019.

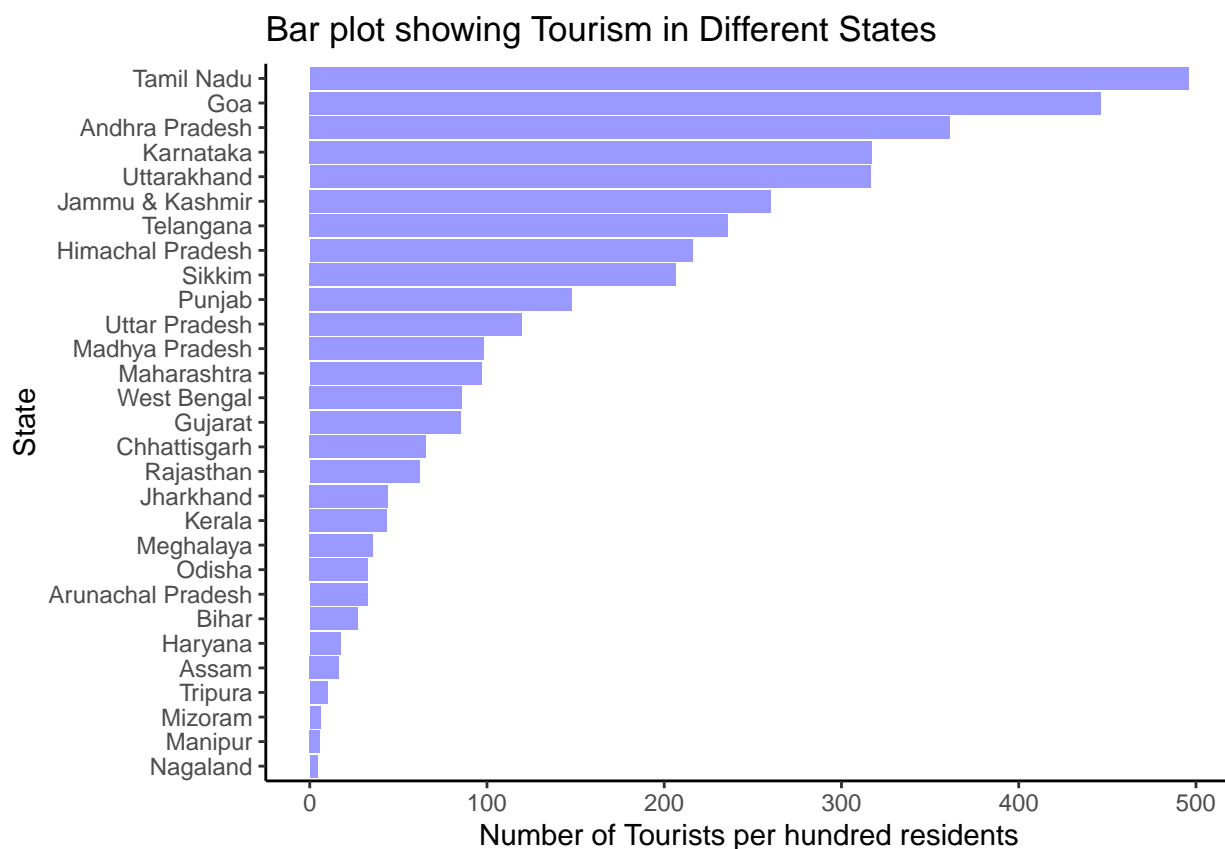
## Causes of Accidents in States of India



### Observations

1. Overspeeding and careless driving are major causes of road accidents in every state.
2. The plot is plotted against the “Accidents per million population”. And we can see observe that despite Goa and Sikkim having similar populations, Goa has recorded more accidents than Sikkim. This could be due to a large number of tourist (driving) visiting goa as they will increase the number of accidents but will not be counted in the population thus creating a bias in the data. Also Goa has a greater number of vehicles than Sikkim which could also play a role in the large number of accidents observed.

Here is the tourism data for indian states. It should be noted that Tamil Nadu has more Tourist to Population ratio but has a low number of accidents per million of the population, so we may only conclude that there are multiple factors at play here.



## Effect of Weather on Road Accidents

### How does weather affect road accidents in different states of the country?

Weather impacts not just the road surface condition but also the visibility of the road user thereby increasing the chances of road accidents. Heavy rain, dense fog, and hail storms reduce visibility and make the road surface slippery thus posing serious risks to road users.

#### Data

The data set is available in table form in the publications (PDFs) released every year by the Ministry of Road Transport and Highways of the Road Accidents in India. <https://morth.nic.in> The PDF is first converted to a word document through online available converters and then the required table is copied into a .csv file and is now ready to use.

We have used data from the year 2018 for the visualization from [https://morth.nic.in/sites/default/files/Road\\_Accidednt.pdf](https://morth.nic.in/sites/default/files/Road_Accidednt.pdf)

The data has 5 weather conditions, namely

1. Sunny/clear
2. Rainy
3. Foggy & Mist
4. Hail
5. Other

All of them have subheadings, namely



- Total accidents
  - Number
  - Rank
- Persons killed
  - Number
  - Rank
- Persons injured
  - Grievously injured
  - Minor injured
  - Total injured

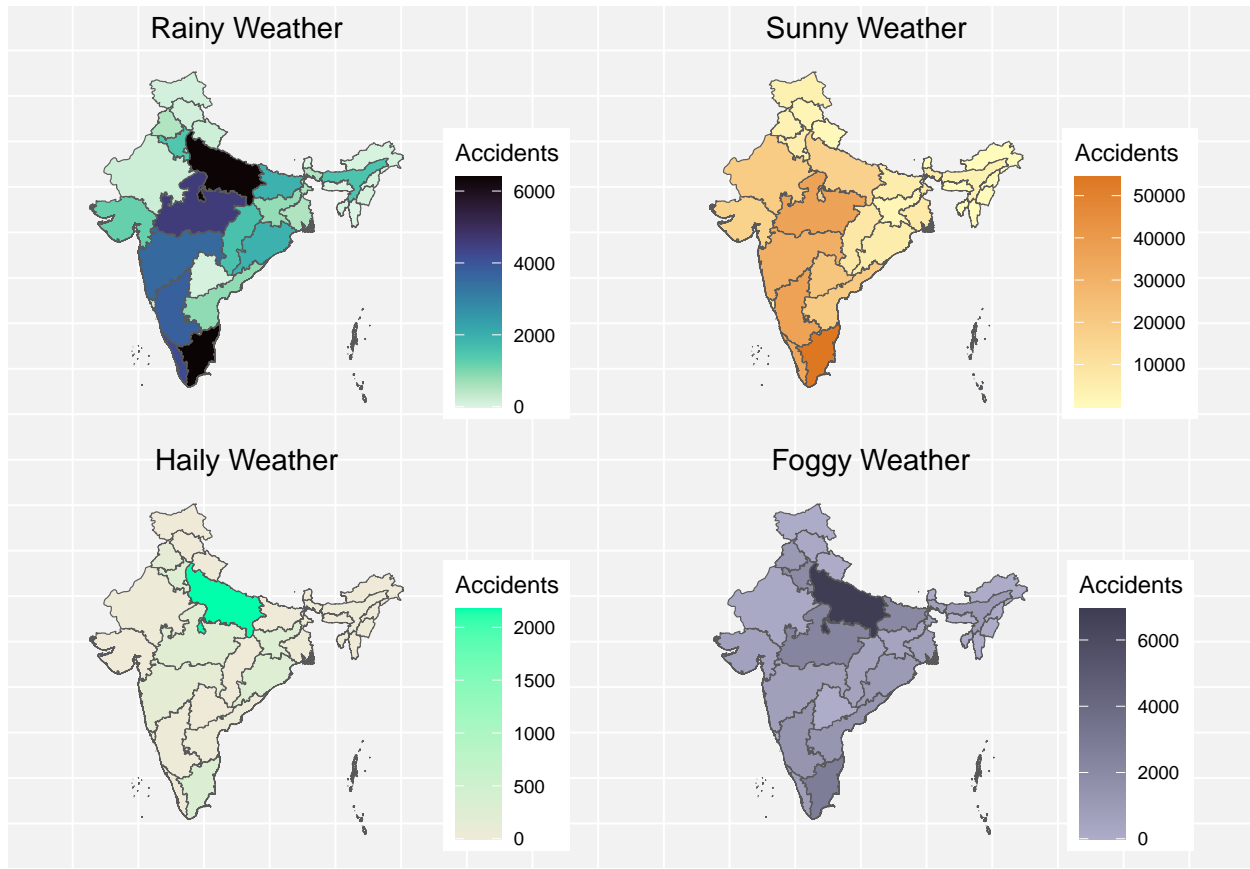
Rows have all states and UTs of India.

We removed Others from weather conditions and rank, grievously and minor from sub-subheadings. Now, this is the data frame that we used to analyze the effect of weather conditions on road accidents in different states.

States/UTs	Sunny/Clear - Total Accidents - Number	Sunny/Clear - Persons Killed - Number	Sunny/Clear - Persons Injured - Total Injured	Rainy - Total Accidents	Rainy - Persons Killed	Rainy - Persons Injured - Total Injured	Foggy & Misty - Total Accidents	Foggy & Misty - Persons Killed	Foggy & Misty - Persons Injured - Total Injured	Hail/Sleet - Total Accidents	Hail/Sleet - Persons Killed	Hail/Sleet - Persons Injured - Total Injured
Andaman and Nicobar Island	231	17	232	23	2	28	0	0	0	0	0	0
Andhra Pradesh	19793	5880	18461	852	282	1017	1305	506	1261	55	28	45
Arunachal Pradesh	80	49	91	71	47	89	40	26	49	0	0	0
Assam	3891	1456	3477	1555	525	1804	1018	315	805	34	9	49
Bihar	5532	3966	3736	1980	1276	1333	2088	1487	1610	0	0	0
Chandigarh	314	97	300	0	0	0	2	1	0	0	0	0
Chhattisgarh	8132	2615	7341	1610	487	1385	579	224	575	0	0	0
D & N Haveli	39	25	41	12	9	3	26	20	16	0	0	0
Daman & Diu	63	30	84	8	3	5	5	2	5	0	0	0
Delhi	3203	871	2954	792	169	855	943	252	895	0	0	0
Goa	3482	239	1449	227	23	100	0	0	0	0	0	0

Figure 6: Data frame use for Ploting

The map of India is plotted to see the effect of weather conditions on road accidents in all states and UTs. The shade of color shows the number of road accidents in that particular state, the darker the shade, the more the number of road accidents.



### Observations

1. Uttar Pradesh and Tamil Nadu record the maximum number of road accidents, be it any type of weather.
  - Being the maximum populated and fourth largest state in the country might be the reason for Uttar Pradesh having a maximum number of road accidents.
2. Assam and Odisha have reported comparatively more road accidents in the rainy season than in any other weather condition.
  - Heavy rainfall in these states might be a possible reason for this increase in the number of road accidents in these states.
3. The Foggy and Hail Season witnesses comparatively low road accidents all over India, specifically in the coastal regions.

## Effect of Latitude on Road Accidents in States

**Does the latitude of a place affect the occurrence of accidents in that area ?**

The maps above indicate a general trend that south india experiences more road accidents than north india, so to find the truth about this the number of accidents were plotted against the latitude for each state.

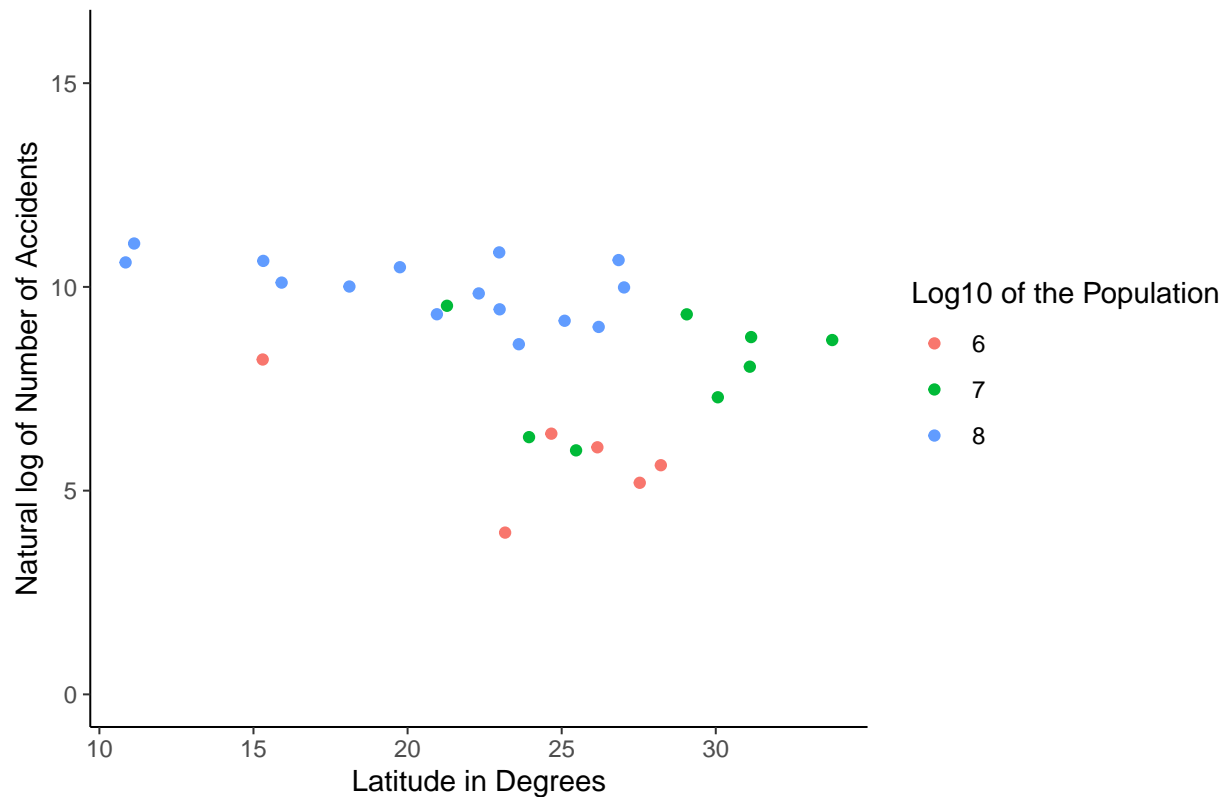
**Data**

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We have used data of number of accidents in each state for the year 2018 from [https://morth.nic.in/sites/default/files/Road\\_Accident.pdf](https://morth.nic.in/sites/default/files/Road_Accident.pdf)

The data of latitude of all the states is web scrapped from the website <https://www.classmate4u.com/latitude-and-longitude-of-india/> while the column of longitude was removed and the latitude of Gujarat was added manually.

### Number of Accidents V/S Latitude for Indian States



#### Observations

From the plot, we see the following: -

- A decrease in the number of accidents is observed as the latitude increases.
- But when States are grouped according to the population, no correlation is obtained between road accidents and the latitude of a state. So, it would be inappropriate to conclude that the occurrence of accidents decreases with an increase in latitude.

### Time of Occurrence

#### What hours of the day witness the most number of accidents?

The data set was available in table form in the publications (PDFs) released every year by the Ministry of Road Transport and Highways of the Road Accidents in India. <https://morth.nic.in> The PDF was first

converted to a word document and then the required table was copied into a .csv file and was then ready to use.

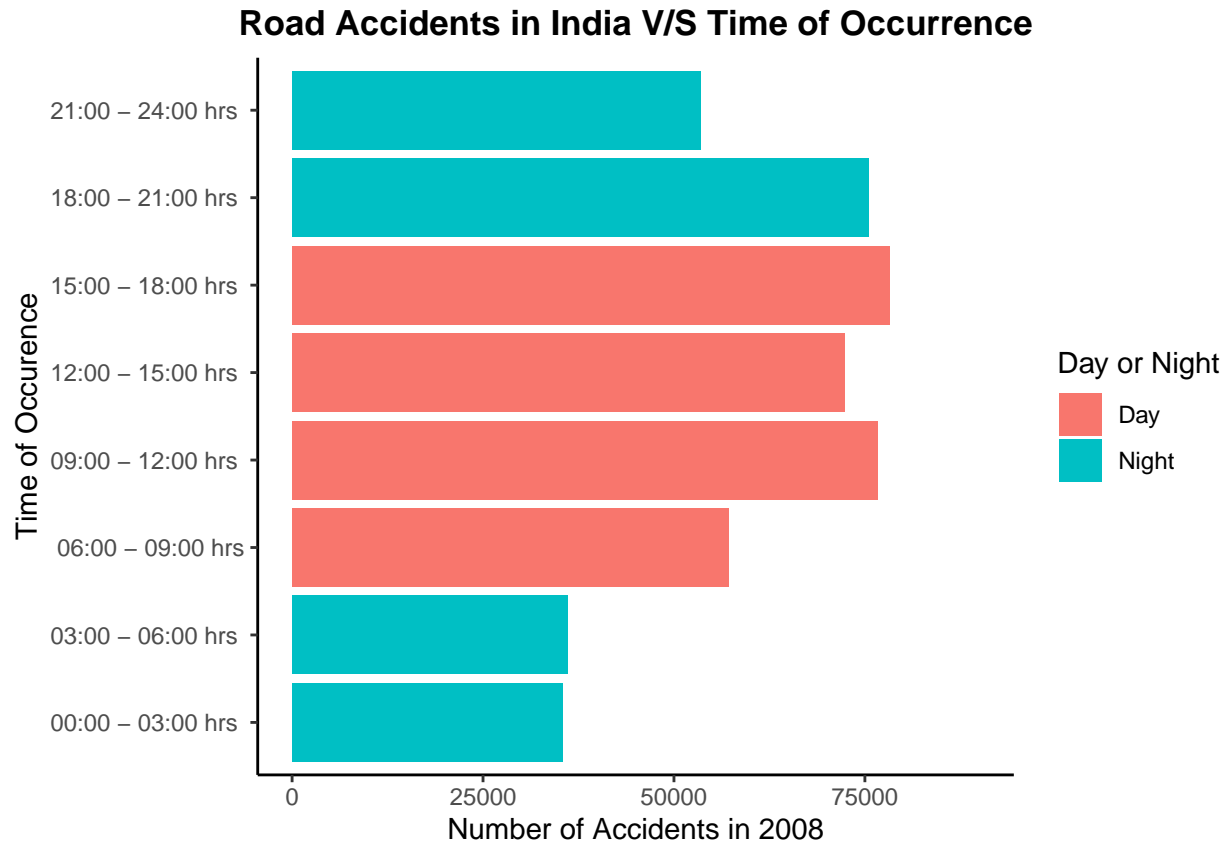
The data set has three columns: 1. Hours 2. Number of Accidents 3. Type

The third column 'TYPE' was manually added in the dataset to categorize the hours into day and night.

Time of Occurrence	Number of Accidents	Day or Night
06:00 - 09:00 hrs	57170	Day
09:00 - 12:00 hrs	76626	Day
12:00 - 15:00 hrs	72290	Day
15:00 - 18:00 hrs	78201	Day
18:00 - 21:00 hrs	75430	Night
21:00 - 24:00 hrs	53492	Night
00:00 - 03:00 hrs	35439	Night
03:00 - 06:00 hrs	36056	Night

Figure 7: Data for Year 2008

A bar graph was plotted to see the time of occurrence of road accidents which observes the maximum number of road accidents in a day. The color was added with respect to the 'TYPE' variable that is it colored the graph categorizing it into day and night.



#### Observations

The maximum number of road accidents occur in the time period of 9:00 a.m. to

1. 6:00 p.m. in the day.
2. 6:00 p.m. to 9:00 p.m. witness maximum road accidents in the night.

#### References

- <https://timesofindia.indiatimes.com/city/mumbai/mumbai-5th-among-cities-to-curb-road-accidents-in-a-year/articleshow/78801577.cms>
- [https://en.wikipedia.org/wiki/Road\\_accidents\\_in\\_Tamil\\_Nadu](https://en.wikipedia.org/wiki/Road_accidents_in_Tamil_Nadu)
- <https://www.dailypioneer.com/2013/page1/states-asked-to-emulate-guj-in-good-spirit.html>