Safarlabs

Case Study

August 2022

Road Safety in Purba Bardhaman, West Bengal:

Analysis of Road Accidents (2018 - 2021)

Solution Summary and Broad Overview:

Safar Labs harnesses the power of big data and AI to make road travel safer. Our proprietary AI/ML engine conducts root-cause analysis at the hyperlocal level (street, neighbourhood levels), and recommends hyperlocal policy and regulatory action. SafarLabs dashboard has three modules as follows.

Safar View: The first module - a largely map-based interface - visualises road accidents at a street/hyperlocal level, and identifies black spots, plots causes of accidents or accidents by vehicle type and other parameters.

Safar Cause: The second module identifies causes of different kinds of accidents and predicts the nature of injuries and fatalities in different scenarios. Simple machine learning-based analysis such as clustering of incidents and classification using Decision Trees or Random Forests are used.

Safar SIM: The third and final module is a traffic simulation module which measures the impact of any intervention planned. The user can choose multiple parameters and understand which intervention will give the best result.

Using the aforementioned approach, a pilot demonstration of SafarLabs was conducted in Purba Bardhaman district of West Bengal, India. Data of road accidents spanning 2018-21 was analysed. Safar View module and associated results are presented in this case study report. This is Part 1 of the case study, with the results of Safar Cause and Safar SIM analyses to be published in subsequent parts of this case study series.

![Safarlabs logo]
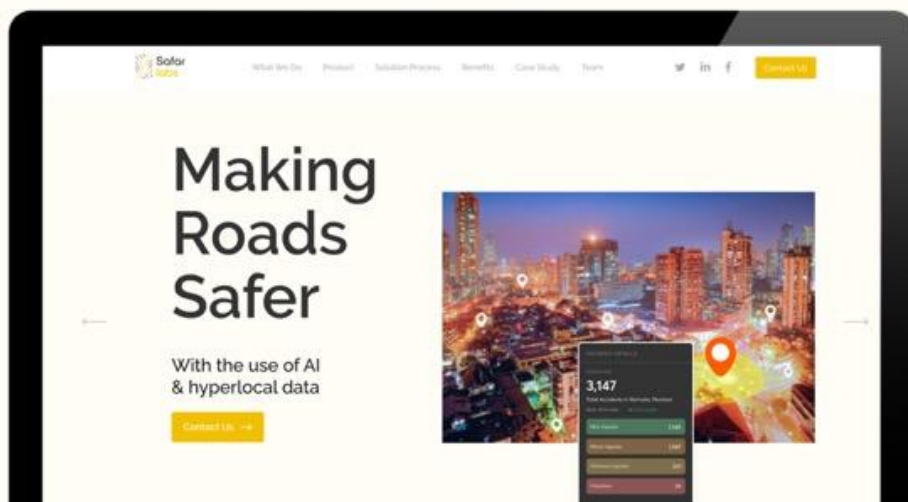
Safar View Results: Analysis of Road Accidents in Purba Bardhaman, 2018-21

Hotspot map
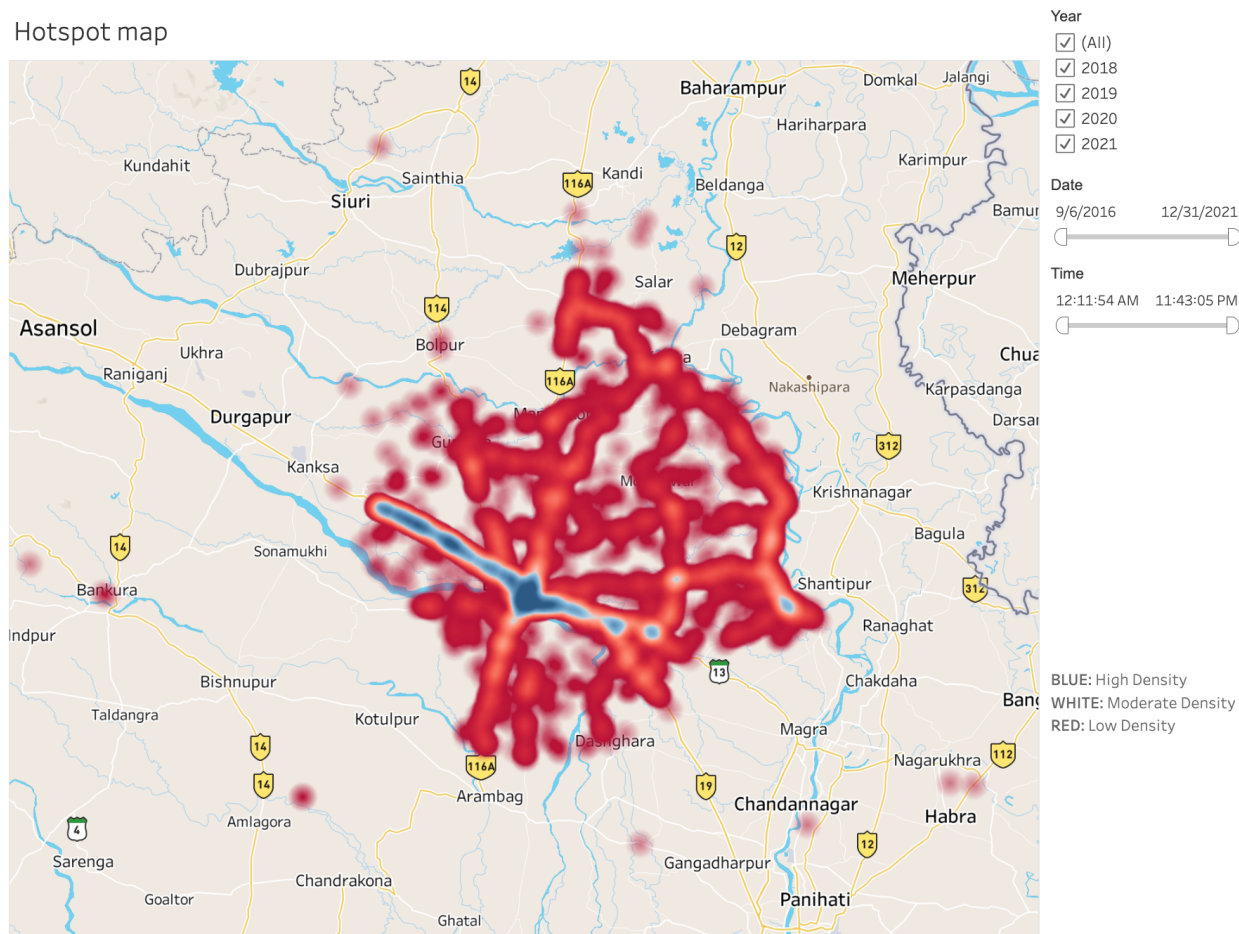
Map 1: Map showing hotspot areas of accidents with the colour coding, Blue - high density of accidents, White - medium density of accidents, Red - low density of accidents.

Hotspots in Purba Bardhaman, West Bengal

The accidents are majorly taking place on National Highway 19 (NH 19), National Highway 114 (NH 114), National Highway 116A (NH 116A), State Highway 6 (West Bengal) , especially at the intersection of NH19 with NH 114 and NH 116A.

Coordinates of few local hotspots on NH19 are (23.287, 87.785) , (23.312, 87.738) , (23.320, 87.725) , (23.328, 87.712), (23.336, 87.699), (23.350, 87.671), (23.356, 87.657), (23.366, 87.637), (23.369, 87.631), (23.370, 87.628), (23.374, 87.619), (23.379, 87.607), (23.389, 87.580).

Another local hotspot is the intersection of the State Highway 15 (West Bengal) with Kalna Road with approximate coordinates (23,264,88.142).

With the use of time filter it can also be seen that-

- Near the intersection of SH14 (West Bengal) and NH114 , near Guskara, the accident density is very high in the time interval (12 AM to 4 AM). The reason might be poor lighting in that particular region.

- Near the intersection of SH6 (West Bengal) and Kalna Road the accident density is very high in the time interval (8 PM to 12 AM).The reason might be heavy traffic during this time or poor lighting.

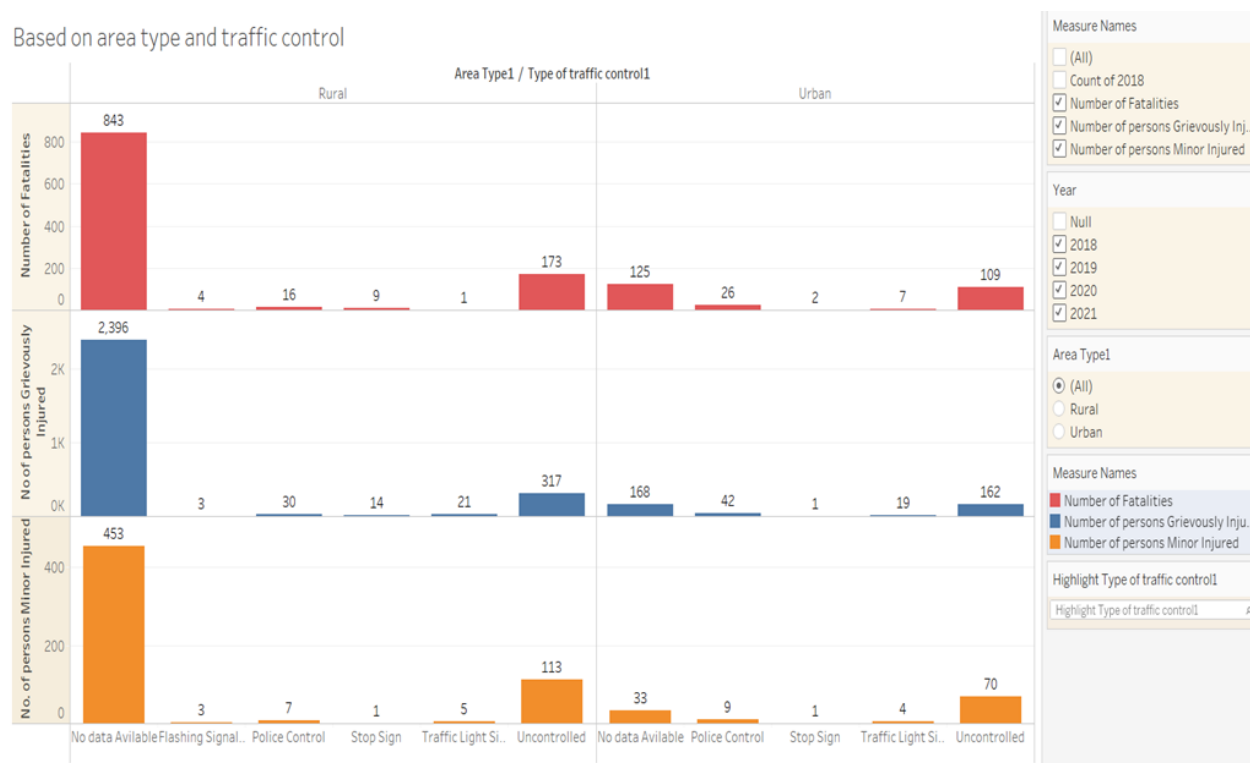## *Area type and traffic control system*

Fig. 1 : No. of accidents based on area type and traffic control system

The rural area has more fatalities, major injuries, and minor injuries, especially where traffic is uncontrolled. Following are the possible reason for this: -

- The roads in rural areas may be unpaved. They may have large holes and steep drop-offs. A driver can lose control of the vehicle, especially if the driver is speeding or driving recklessly.
- Rural areas have fewer traffic-controlled roads, and drivers of rural areas are involved more in drinking and driving.
- Drivers on rural roads often exceed the posted speed limit. There is very little traffic, and roads may not be patrolled often by police officers. Therefore, drivers feel they can drive faster on rural roads than on busy urban roads.

- Individuals in rural areas tend to drive older vehicles. These vehicles lack the safety features of newer model vehicles. In a crash, the lack of safety features could result in a higher risk for traumatic injuries and deaths.
- Drivers and passengers are less likely to wear seatbelts when driving in rural areas.
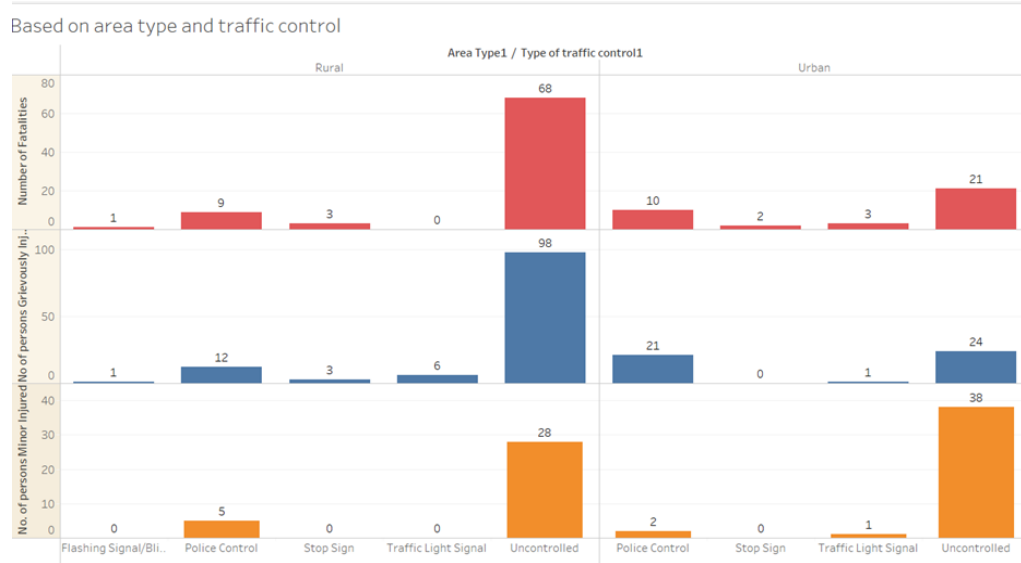

Fig. 2: No. of accidents in the year 2018

Fig. 3: No. of accidents in the year 2021

From the above plots, we can observe the number of accidents has reduced significantly from the year 2018 to 2021. This might be due to improvements in road facilities and the establishment of a proper traffic system. There might be an improvement in medical facilities which leads to a lesser number of fatal accidents. Also, lockdown due to Covid-19 might be the reason for a lesser number of accidents after 2018.
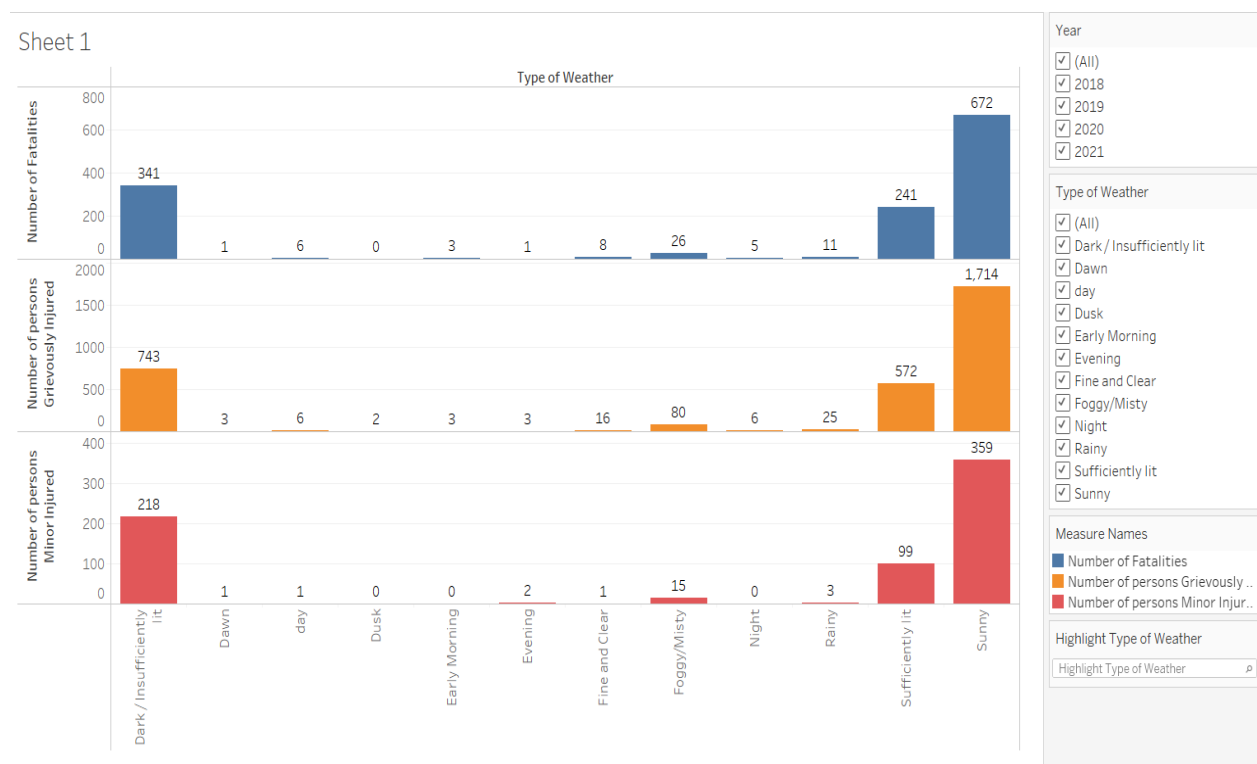
Weather type

Fig. 4: Accidents by weather type

The graph shows the number of fatalities and injuries based on the type of weather from 2018 to 2021. From the graph we can compare the no. of fatalities, no. of persons grievously injured and no. of persons minor injured for different weather types.

From the graph one can observe that no. of injuries are highest on Sunny day in all three type of injured persons. The second highest no. of injured persons are in Dark/Insufficient lit weather. Observe that order of injured persons in a particular weather type follow the order no. of persons grievously injured > no. of fatalities > no. of persons minor injured. Also the no. of injured persons is the sum of injured persons from the year 2018-2021.

The key value we can infer from the graph is that since we have the data based on the weather type, we can find out the weather type for which the maximum accidents occur and accordingly more precaution should be taken to minimise the accidents.

For example, on a sunny day most no. of accidents occurred as one can see from the graph. So, we can take responsive steps in order to minimise the accidents.
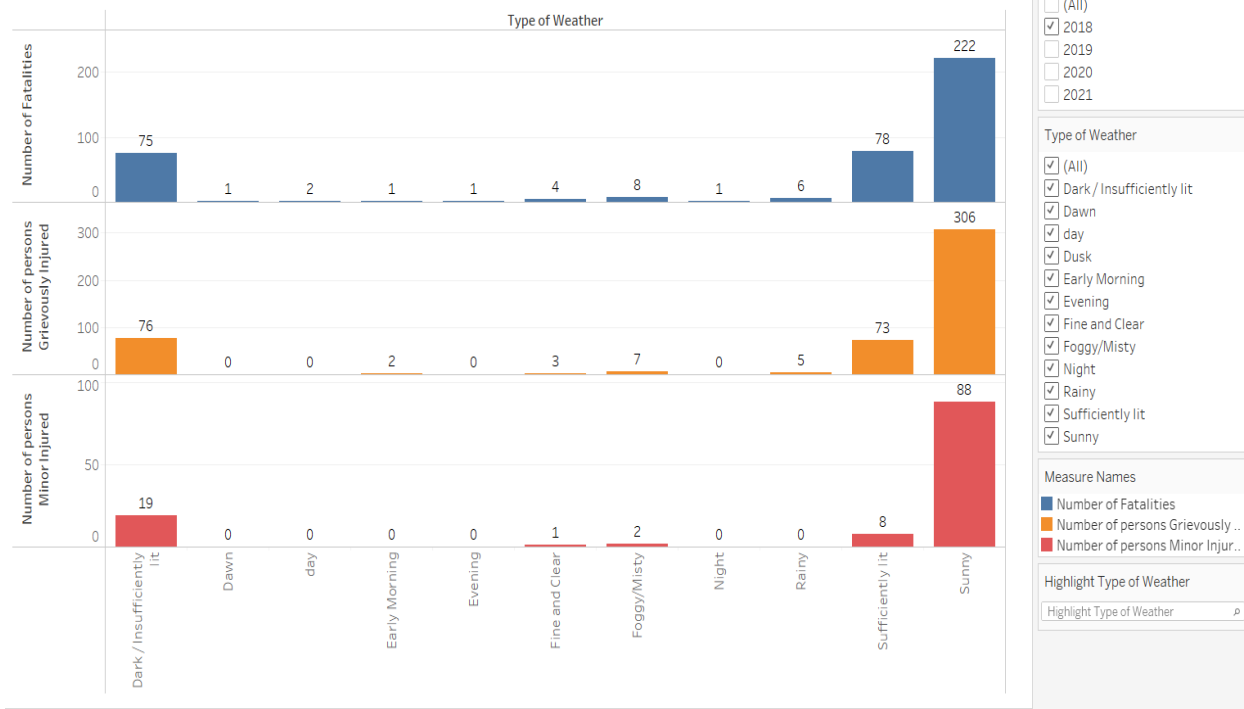
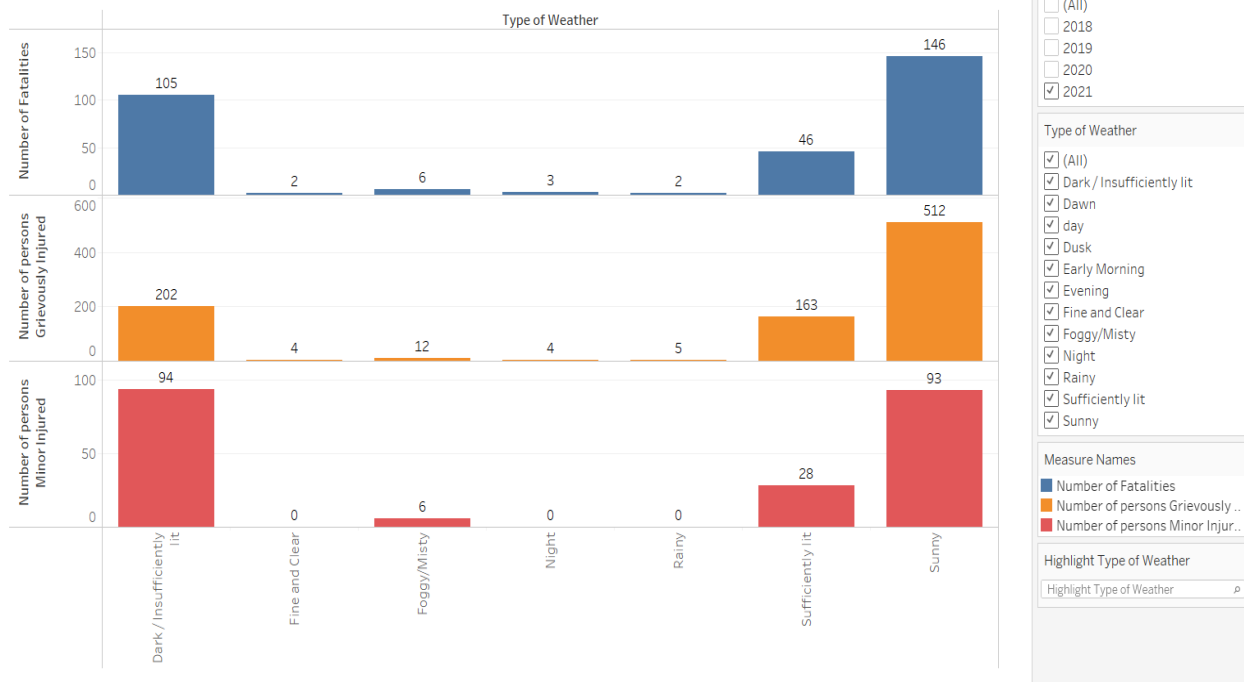Fig. 5: No. of accidents in 2018 by type of weather

Fig. 6: No. of accidents in 2021 by type of weather

Comparing the graphs of 2018 and 2021, a significant increase in the no. of accidents can be observed from the year 2018 to 2021. For example, in Dark/ Insufficiently lit weather, no. of accidents has increased from year 2018 to 2019. However on a sunny day, no. of fatalities has decreased from 222 to 146 from the year 2018 to 2021.

Speed limit

As we know when we talk about the chance of an accident in real life, we know that the speed limit is an important factor to determine the severity of an accident and also the chance of accident.We plot data of different roads from the year 2018 to 2021.
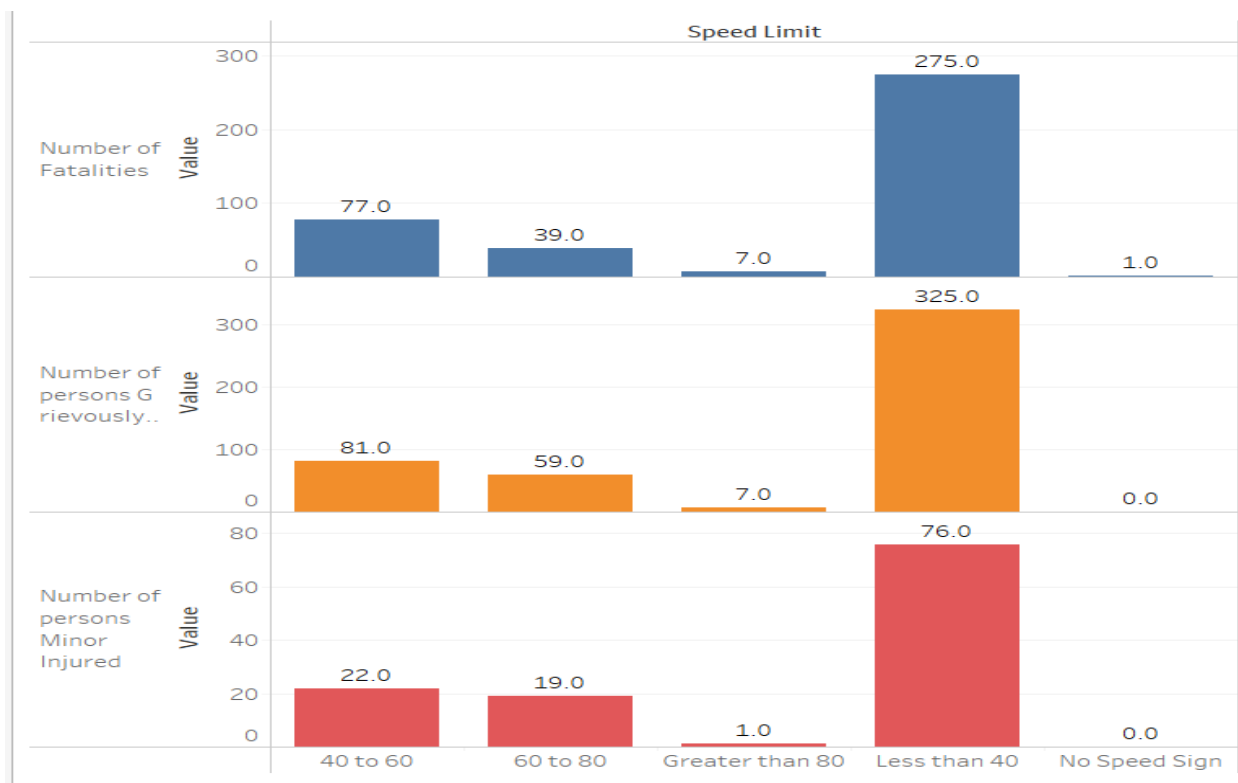

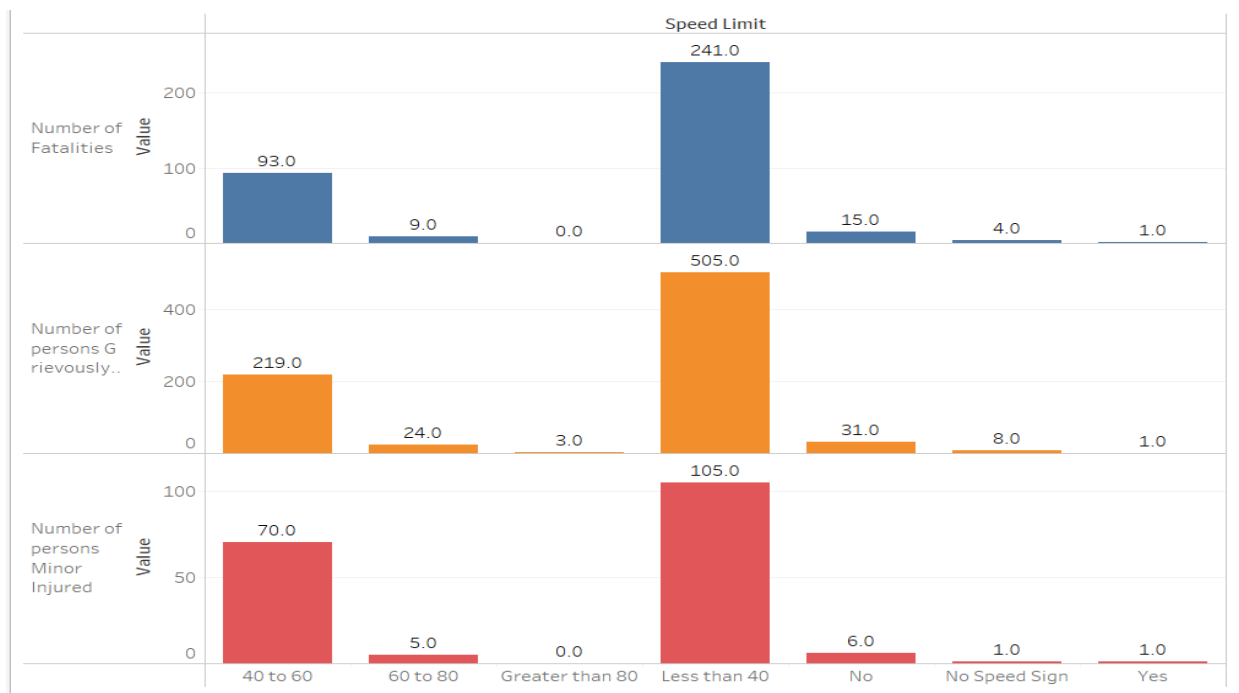Fig. 7: No. of accidents in 2018 by speed limit

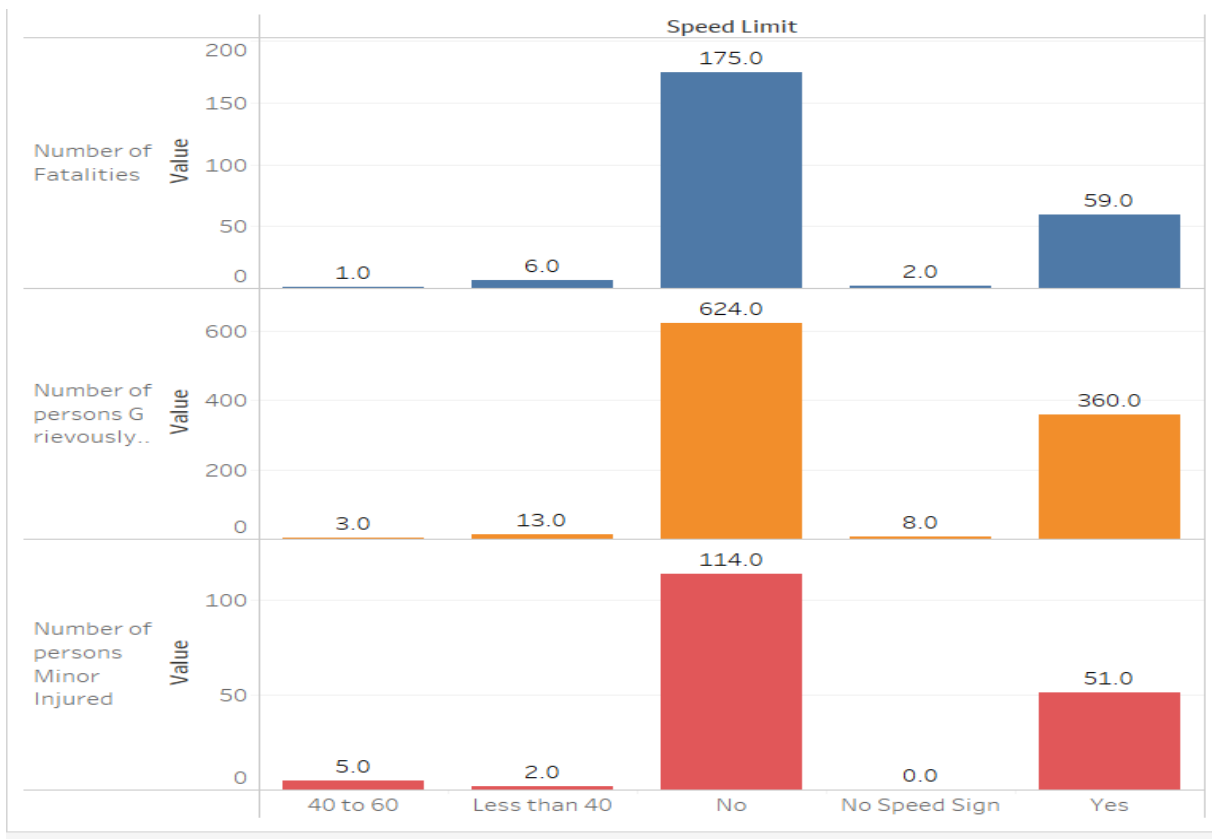Fig. 8: No. of accidents in 2019 by speed limit

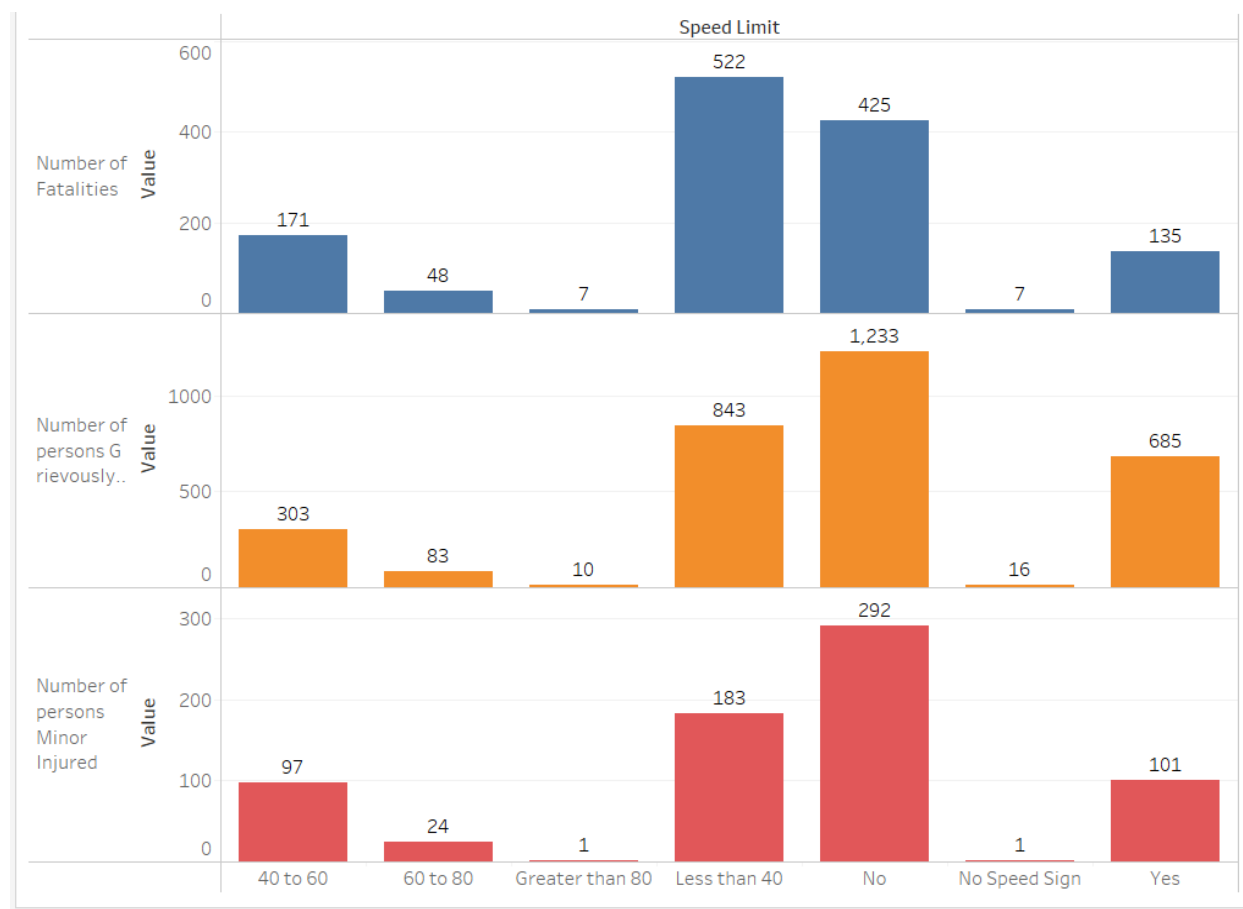Fig. 9: No. of accidents in 2020 by speed limit

Fig. 10: No. of accidents in 2018-21 by speed limit

The graph shows the number of fatalities and injuries based on the type of weather from 2018-2021. From the graph we can compare the no. of fatalities, no. of persons grievously injured and no. of persons minor injured for speed limit.We can observe by the help of a plotted graph that all the measurable values are more for the speed less than 40km/h which shows that less speed for that type of track is not safe in some cases. As we increase the speed limit the number of cases are decreasing fast which shows that these limits of speed are more safe.

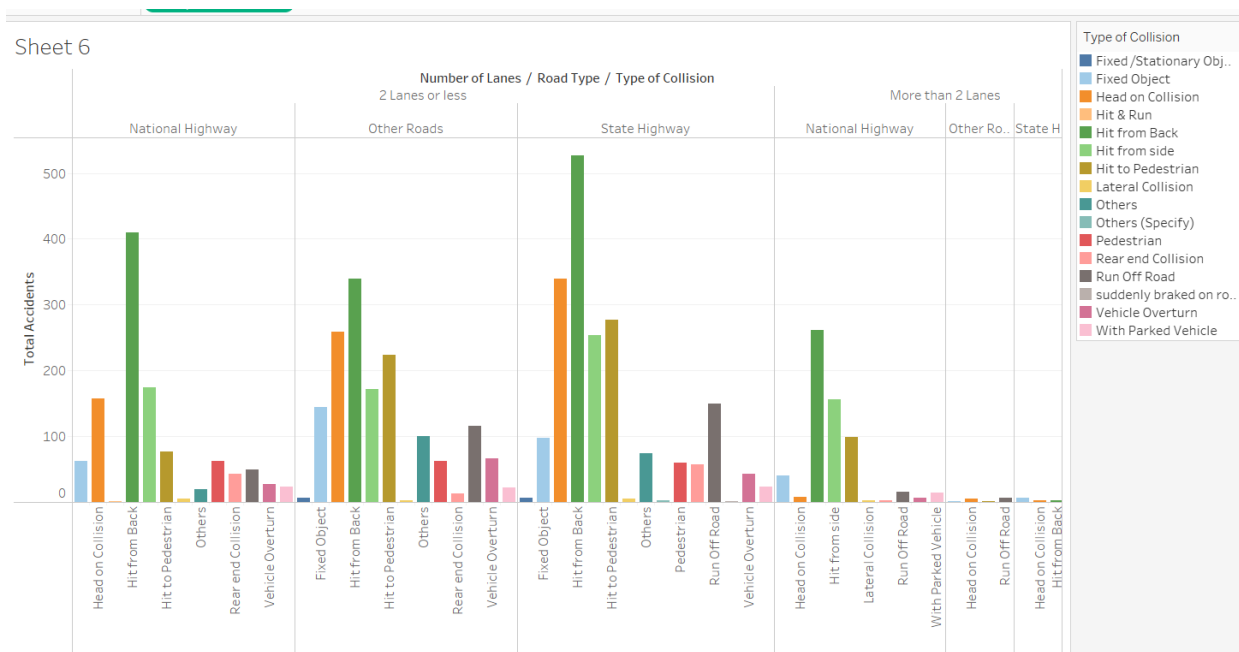## Number of lanes, type of road, type of accident

Fig. 11: No. of accidents in 2018-21 by number of lanes, road type, and accident type

The above graph takes into consideration the following three factors.

1) Number of Lanes (2 or More)

2) Type of Road (National Highway)

3) Type of Collision/Accident

And compares it with the total number of accidents.

The following inferences can be drawn from the graph:

- The number of accidents are significantly higher on roads with 2 or less lanes.

- Most of the accidents occur on the State Highways followed by National Highways.

- And the most common type of accident with the highest frequency has occured due to collision from behind, followed by head on collision.

- On the roads with 2 or more lanes the accidents are significantly less & there is no clear distinct type of accident which occurs with the highest frequency.

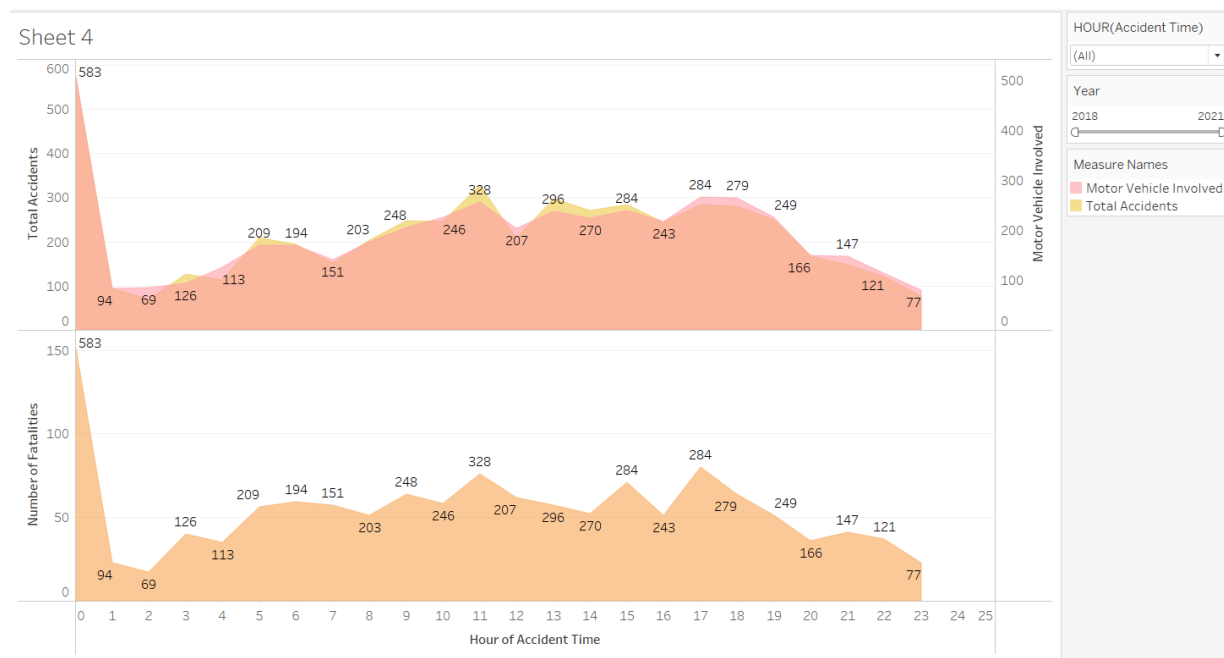## Time of the accident and type of vehicle involved

Fig. 12: No. of accidents in 2018-21 by time of accident and type of vehicle involved

The above graph takes into consideration the following three factors.

1) Time of the accident (24 hour format)
2) Year of The Accident
3) Motor Vehicles Involved
4) Number of Fatalities

And compares it with the total number of accidents.

The following inferences can be drawn from the graph.

- The highest number of accidents occur during 12-1 AM, whereas in the time period between 8AM to 8PM the number of accidents almost remains constant with not much variation.

- Now if the total number of accidents is compared with the accidents involving motor vehicles it can be observed that almost 95% of the time the accidents involve motor vehicles.

- As the year passes the number of accidents remain more or less constant but the % of motor vehicle accidents significantly increases.

- Most of the accidents have been observed to be fatal with very less survival rate.

![Safarlabs logo]

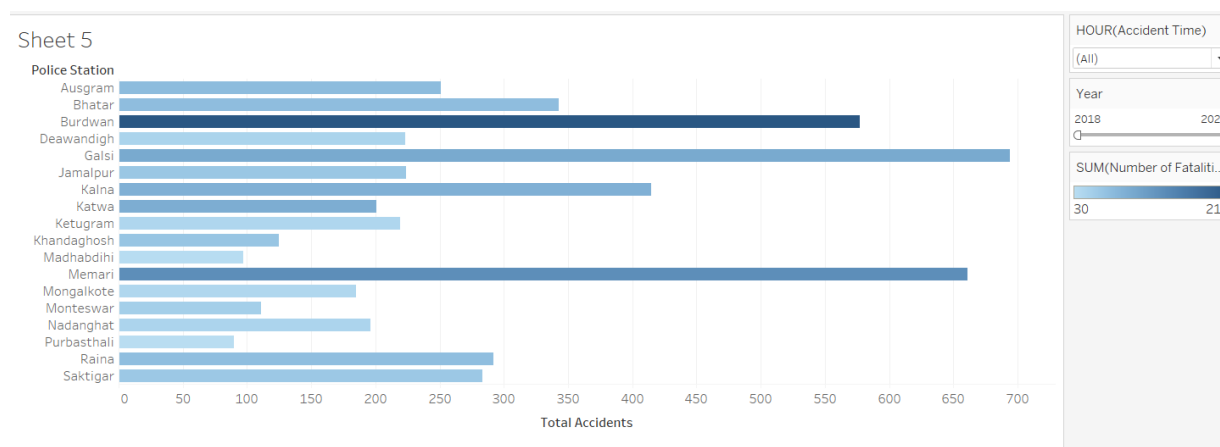## *Police station to which the accident was reported*

Fig. 13: No. of accidents in 2018-21 by the police station to which the accident was reported

The above graph takes into consideration the following three factors.

1) Police Station where the accident was reported
2) Year of The Accident
3) Number of Fatalities
4) Time of The Accidents

And compares it with the total number of accidents.

The following inferences can be drawn from the graph.

- The police station with the highest number of accidents can be ordered as follows:

  - Dewandighi

  - Memari

  - Burdwan

- Although Dewandighi has the highest number of accidents, it can be seen that Burdwan has a higher fatality rate than Dewandighi.In fact among the three Dewandighi has the lowest fatality rate.

- Even with changing year and time the order involving total accidents & number of fatalities remains more or less the same.

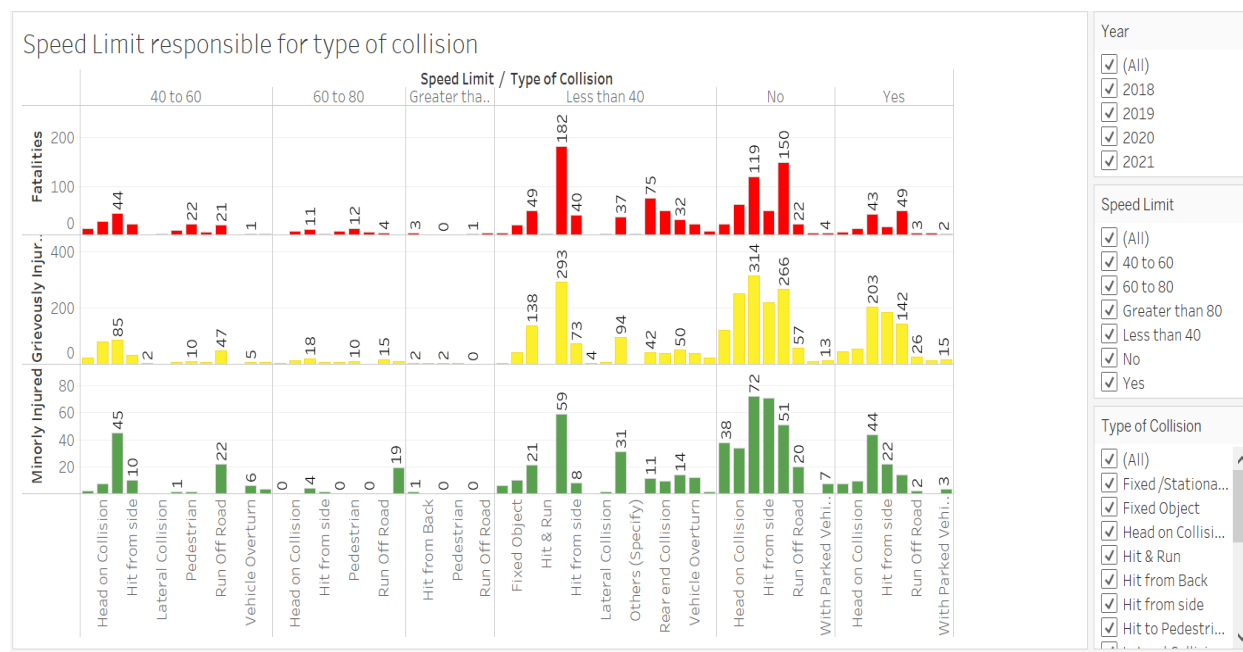## Speed Limit, Type of Collision, Number of people injured

Fig. 14: No. of accidents in 2018-21 by Speed Limit, Type of Collision, Number of people injured

The graph gives an idea of what type of road collision can occur in a zone with a specific speed limit. It also shows an approximation of how many people can be injured in such an accident and how grievous the injury can be.

Observing the data of the year 2021 or 2020, we can conclude that the number of accidents is much less where speed limits are imposed than where they are not. Hence speed limits serve as a way of ensuring road safety.

We can also infer from the graph that the most common reason for any accident is 'Hit from Back' and it is most prevalent in zones with low-speed limits (less than 40 and 40 to 60).One reason for this observation could be that these kinds of roads are busy and have too many vehicles moving at the same time, causing accidents due to tailgating. Hence, even though the speed is not very high, the number of accidents (people injured) is much more than in sparsely crowded areas where vehicles move with a much higher speed. Some other reasons could be bumper-to-bumper traffic or poor road quality resulting in reduced traction and panic stops. The presence of pits can cause the front vehicle to stop immediately and as a consequence, it might get hit from the back. The lack of traffic signals could also be responsible for these accidents. The front vehicle might come to a halt suddenly in order to avoid an accident with a pedestrian crossing the road and thus get hit by the vehicle behind it.

The other most common type of collisions are 'Head on Collision' and 'Hit from Side'. These accidents mainly occur due to distracted driving, bad weather conditions causing low visibility, loss of traction due to worn pavement, lack of proper traffic control system.

Hence, only imposing speed limits cannot solve the problem of road safety. Each zone must have traffic control measures based on how crowded the zone generally is, condition of the road and what type of accidents are common there.

Safar Labs is a 21st-century initiative which harnesses the power of big data and AI to make road travel safer. The initiative is supported by Salzburg Global Seminar and the Japan India Transformative Technology Network (JITTN). Salzburg Global Seminar is an independent non-profit organisation founded in 1947 with a mission to challenge current and future leaders to shape a better world. JITTN, launched in 2020 by Salzburg Global Seminar and The Nippon Foundation, connects tech entrepreneurs from India and Japan to foster collaborations and surface creative ideas to use tech and artificial intelligence as a force for good, solving some of the pressing challenges of today: mobility, equity and access, economic development. Safar Labs founders, Aishwarya and Adway, are Salzburg Global Fellows participating in the JITTN fellowship programme.

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Acknowledgements

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