Project 1:

Exploring climate data of Singapore in relation to Traffic Accidents

Contents

- Problem Statement
- Data Used
- Initial Findings
- Findings
- Caveats
- Conclusion and Recommendations

Problem Statement

It was reported in 2013 that more accidents occur on days of thunderstorms. Traffic accidents cause road congestion and Traffic Police and Civil Defence resources need to be deployed.

By using climate information on rainfall and traffic accident statistics, this project aims to help Traffic Police and Civil Defence better facilitate manpower and resource allocation throughout the year by identifying trends between traffic accidents and weather.

The Actual Problem

Image source:
https://www.todayonline.com/singapore/accident-involving-trailer-and-car-pie-causes-traffic-gridlock-around-noon-oct-26

Image source:
https://www.straitstimes.com/singapore/transport/car-crashes-into-scdf-officer-on-his-way-to-medical-emergency-officer-injured

Data Used

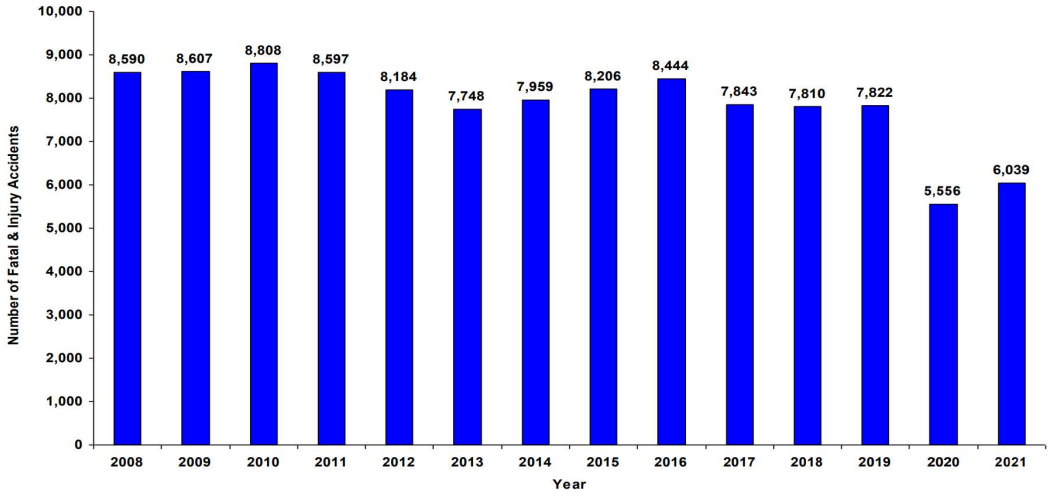
- Monthly total rain recorded in mm(millimeters) from 1982 to 2022.
- Monthly number of rain days from 1982 to 2022. A day is considered to have “rained” if the total rainfall for that day is 0.2mm or more.
- The monthly mean sunshine hours in a day recorded at the Changi Climate Station from 1982 to 2022.
- The highest daily total rainfall for the month recorded at the Changi Climate Station recorded in mm(millimeters) from 1982 to 2022.

Traffic Accidents (2008 to 2021)

TABLE 1A

FATAL AND INJURY ROAD ACCIDENTS BY MONTH OF YEAR (2008-2021)

Year	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	8,590	750	606	713	718	706	714	760	757	747	735	676	708
2009	8,607	709	660	712	704	719	693	707	751	687	764	772	729
2010	8,808	680	665	780	726	777	666	763	811	752	786	744	658
2011	8,597	799	634	709	728	695	673	730	738	737	744	705	705
2012	8,184	691	707	708	677	686	577	690	723	684	681	670	690
2013	7,748	691	612	640	665	642	597	639	656	649	673	645	639
2014	7,959	676	558	604	639	684	657	704	768	667	675	676	651
2015	8,206	638	648	770	645	687	646	714	694	626	686	712	740
2016	8,444	703	697	666	684	695	655	746	794	668	740	753	643
2017	7,843	689	592	676	674	641	636	686	663	629	619	686	652
2018	7,810	713	618	668	648	614	654	626	667	618	642	710	632
2019	7,822	677	581	624	635	660	655	687	622	659	692	676	654
2020	5,556	647	489	520	296	262	365	479	437	476	512	485	588
2021	6,039	556	475	540	499	470	472	474	534	533	440	521	525

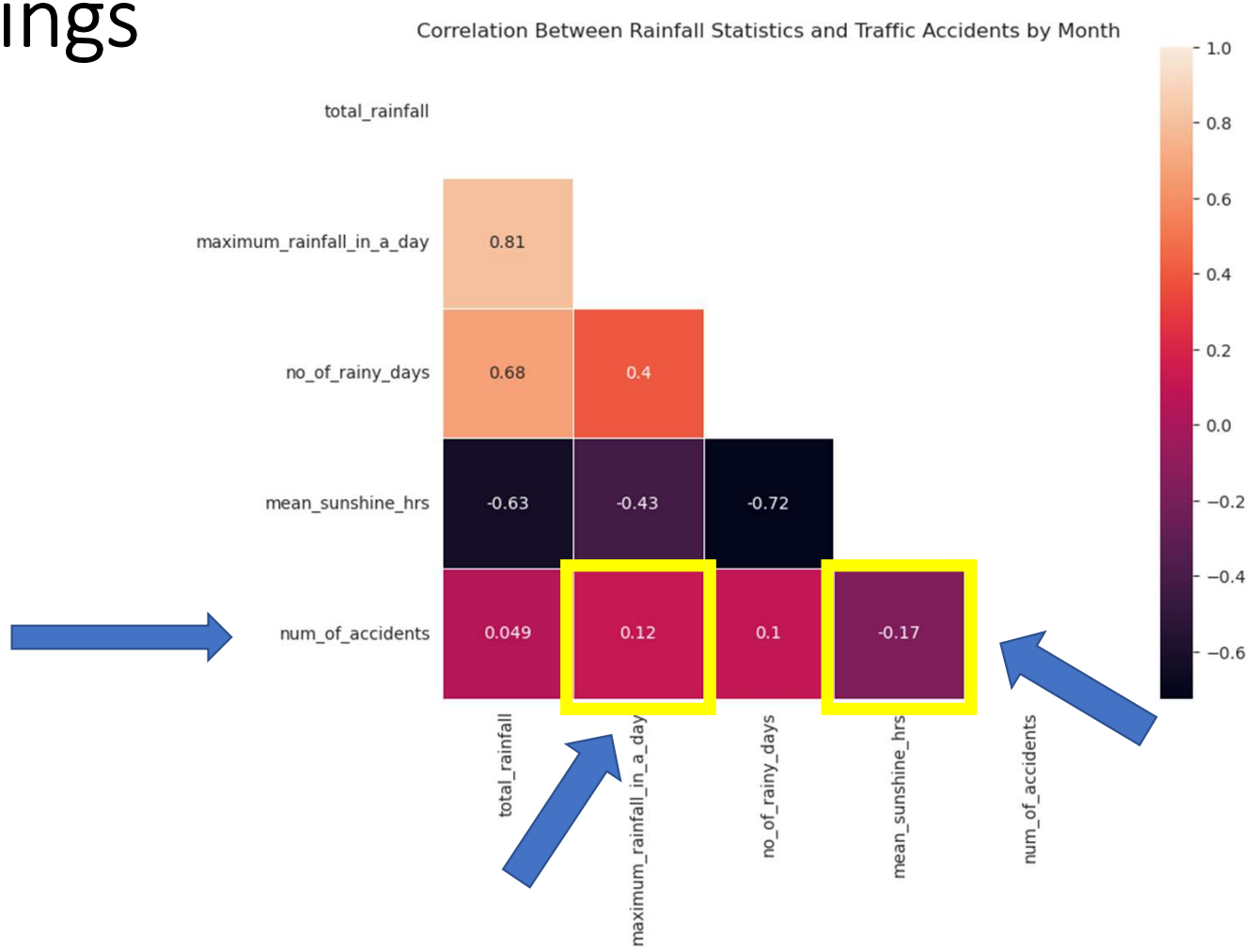


Source:
https://www.police.gov.sg/-/media/1F7F9460FD8F48928B6DEFE096414975.ashx

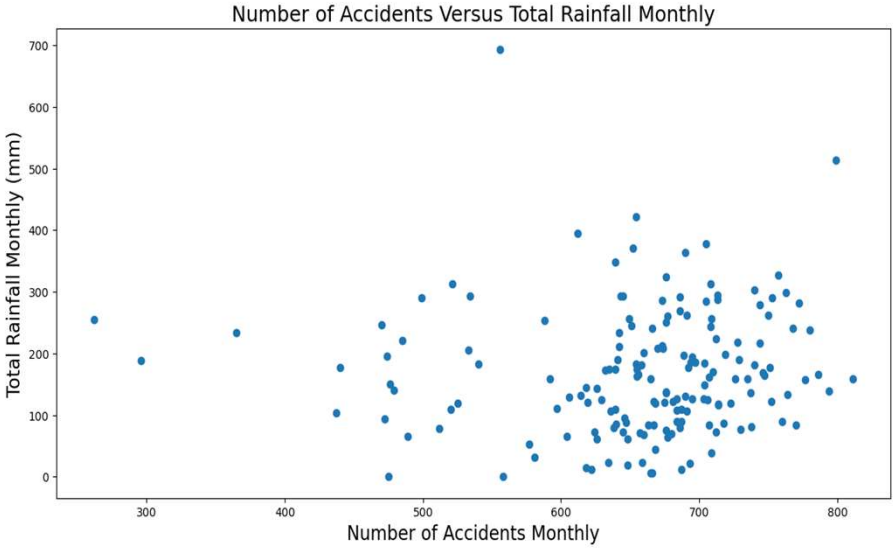
Initial Findings

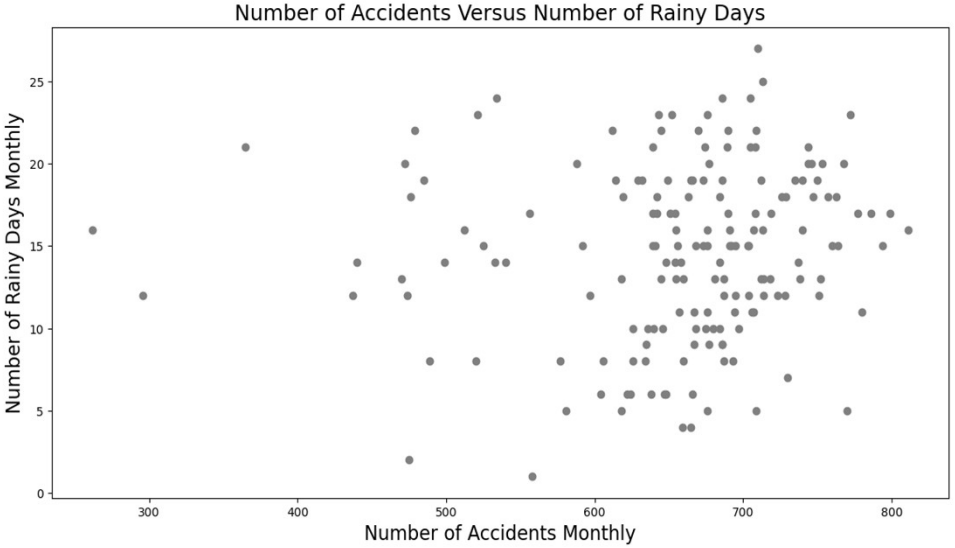
- There were no significant patterns or correlations when matching each metric with Traffic Accident statistics at first glance.
- It was noted that the data for Accident Statistics was significantly lower in 2020 and 2021.
- It was noted that 2020 and 2021 were covid lockdown years.

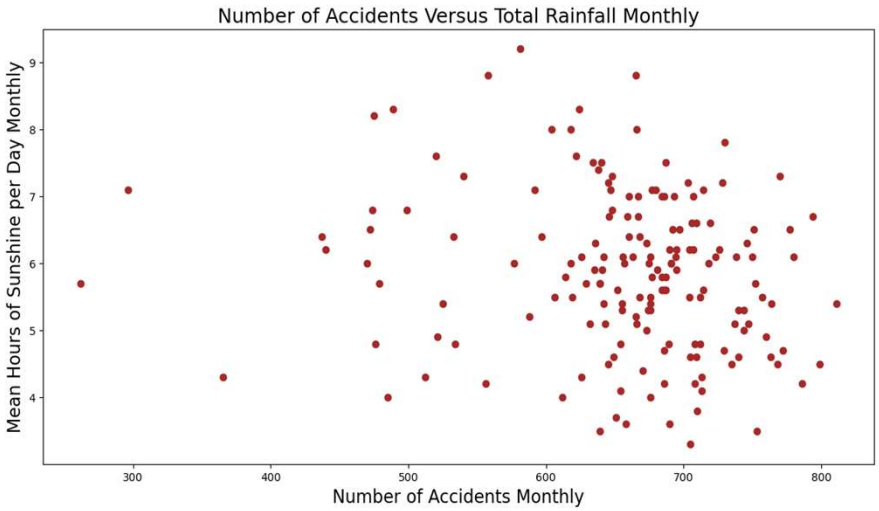
Findings

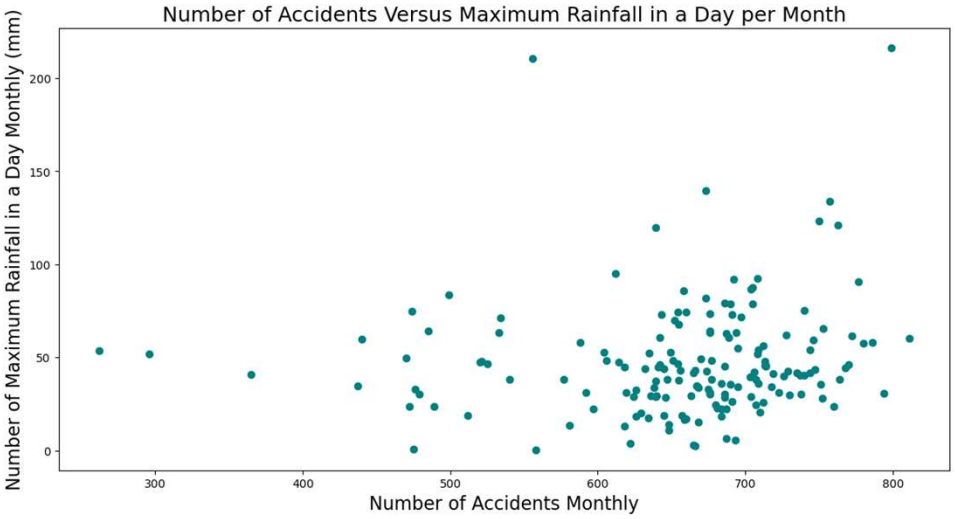

Correlation Between Rainfall Statistics and Traffic Accidents by Month
total_rainfall
maximum_rainfall_in_a_day
no_of_rainy_days
mean_sunshine_hrs
num_of_accidents
0.81
0.68
0.4
-0.63
-0.43
-0.72
0.049
0.12
0.1
-0.17
total_rainfall
maximum_rainfall_in_a_day
no_of_rainy_days
mean_sunshine_hrs
num_of_accidents
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6

Findings (cont'd)



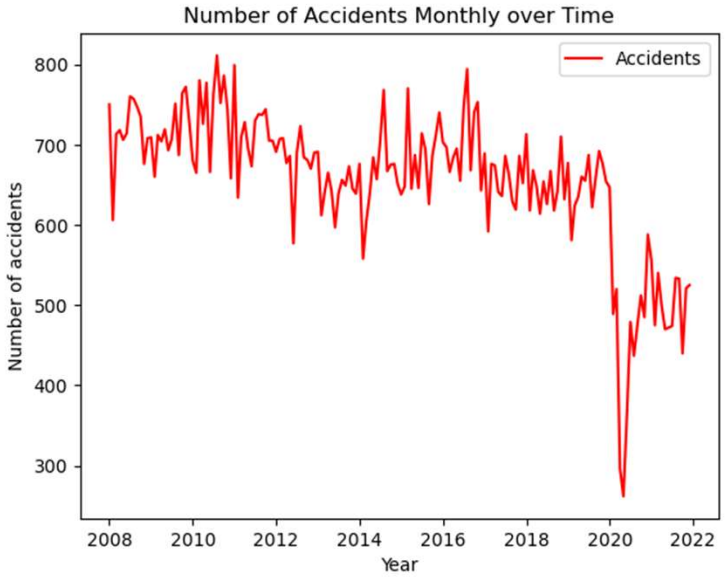


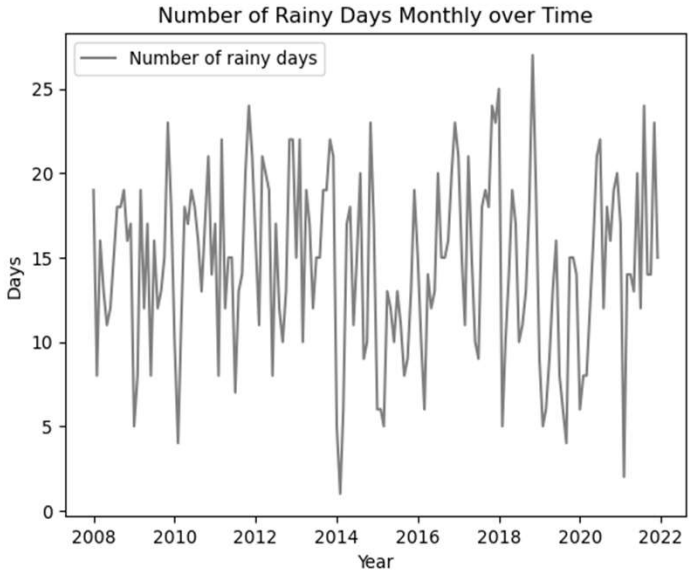


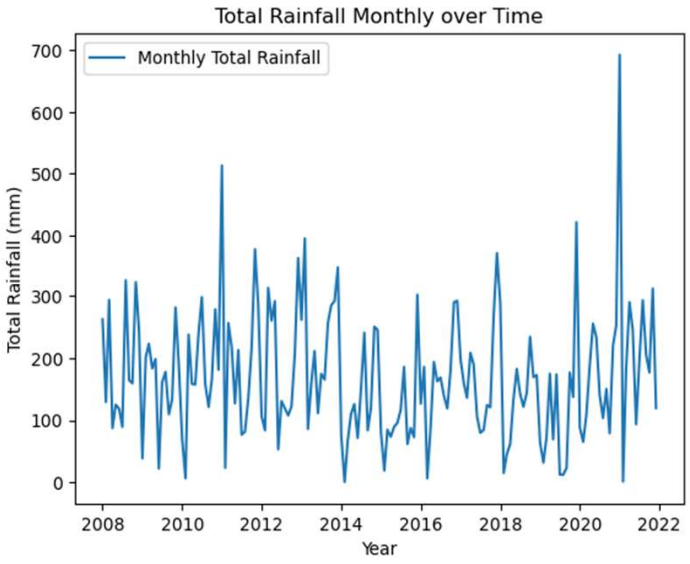


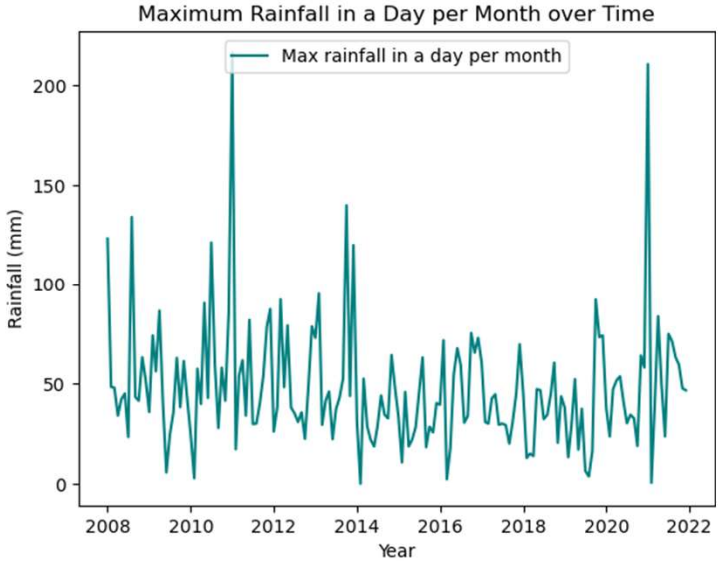
Findings (cont'd)

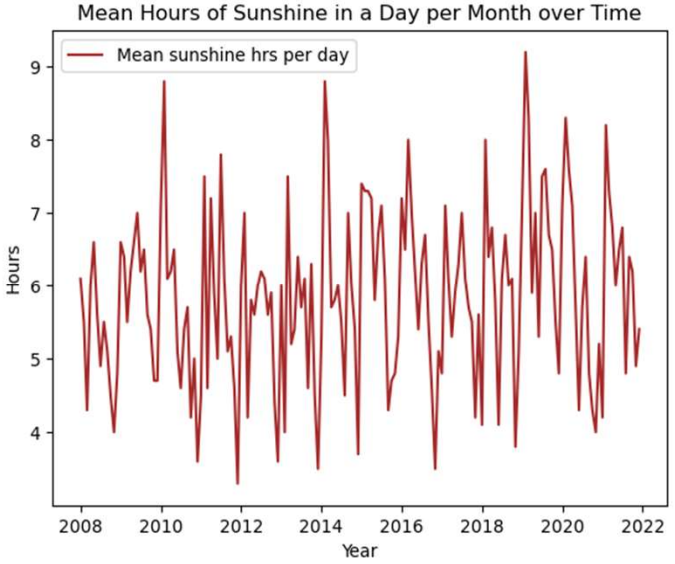
Compare shape of this line with all the others.











Findings (cont'd)

year	mth	total_rainfall	maximum_rainfall_in_a_day	no_of_rainy_days	mean_sunshine_hrs	num_of_accidents
2008	78	2325.1	699.2	182	62.9	8590
2009	78	1920.9	565.5	166	71.4	8607
2010	78	2075.1	653.3	178	68.3	8808
2011	78	2524.2	786.2	188	66.9	8597
2012	78	2159.9	575.5	191	66.4	8184
2013	78	2748.4	744.8	206	65.2	7748
2014	78	1538.4	407.0	152	71.7	7959
2015	78	1267.1	382.0	125	74.0	8206
2016	78	1955.7	592.6	179	72.0	8444
2017	78	2045.6	465.0	204	69.6	7843
2018	78	1708.2	419.2	188	69.0	7810
2019	78	1367.5	454.4	120	81.4	7822
2020	78	1886.6	495.0	178	70.5	5556
2021	78	2809.6	770.6	182	73.5	6039

Findings

- All graphs seem to reaffirm what was found in the initial findings. That the weather data as it is, does not show any meaningful correlation or trends when compared with accident statistics.
- Perhaps what can be explored in future studies as shown in the heat map could be data on weather conditions that affect visibility (e.g no. of days with thunderstorms or intense rainfall)
- Significantly less traffic accidents in 2020 and 2021 would suggest that road usage is a bigger factor than weather in affecting the occurrence of traffic accidents.

Caveats

- The data used was limited as it only takes into account weather statistics taken from Changi climate station.
- Traffic statistics are skewed by the inclusion of data from 2020 and 2021.
- Other factors that might affect traffic accidents even during averse weather conditions may not have been factored in.

Conclusion and Recommendations

- Conclusion: Given the lack of a correlation or clear pattern when comparing weather statistics against traffic accident data, we can conclude that weather on its own is not a significant reason for traffic accidents in Singapore.

- Recommendations: I would recommend maintaining the status quo in terms of resource allocation during months with high rainfall numbers.
- I would also recommend that another project designed to be more robust be explored using the following data, together with the existing weather data when determining how to properly allocate manpower and resources.

1. Obtain weather data from other parts of Singapore and compare them to the corresponding accident statistics in that area.
2. Due to the drastic fall in number of accidents in 2020 and 2021, I would suggest looking at the correlation between road usage and traffic accidents.
3. A quick Google search online will yield many articles suggesting that visibility is a factor in the number of accidents. I would suggest obtaining weather data specifically looking at months with stormy weather and intense rainfall against traffic accident statistics.

- Based on the 2020 and 2021 statistics, I would recommend that instead of allocating additional resources to Traffic Police and Civil Defence during the rainy season, resources should be directed to reducing road usage in general in order to bring down the number traffic accidents.