Buffalo Traffic Incident Analysis Report For Period: 2006–2025

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1. Introduction

Public safety has been the top priority for Buffalo, especially when it comes to motor vehicle crashes that harm drivers, pedestrians, and cyclists. As urbanization increases and traffic patterns become more intricate, it is necessary to learn the subtleties behind crash patterns. The purpose of this report is to synthesize two decades of traffic data into actionable conclusions to inform policy, enforcement, and infrastructural decisions. The focus is on concise, actionable outcomes that are relevant to the city's safety objectives.

1.1 Project Objectives

The overall objective of this project is to establish significant patterns in traffic crashes by geography, time, and type of incident. This entails establishing risky intersections, city council wards, ZIP codes, and hours of the day where the majority of the accidents happen. The study also categorizes the incident type to cover prioritization of the response and interventions. The overall objective is to aid the City of Buffalo Traffic Safety Department in reducing the frequency and severity of accidents by making informed decisions.

2. Background

Traffic accidents aren't just an issue of public safety, they also cost the city and its residents. Whether they're a minor fender crunch at low speeds or one where someone gets injured, each collision consumes emergency personnel time, blocks traffic, and diminishes the quality of life. Buffalo's complex infrastructure in densely populated inner-city neighborhoods through high-volume roads demands multi-faceted traffic safety responses. Keeping this in view, our team analyzed complete information for the period from 2006 to 2025, stored in a normalized schema of the database.

3. Methods

We began by placing the data available into sensible categories to make the data more comprehensible and analyzable. Those categories included individual incident reports, details about the places where incidents occurred, ZIP code areas, council and police divisions, and type of accident (i.e property damage or injury). By doing so, we had a sensible framework allowing us to examine the data more closely. Then we combined all of this data into a single comprehensive complete dataset. This allowed us to search for patterns and associations between different categories, such as where and when accidents happened and what kinds of accidents were most common. For example, we examined the hour of day, day of the week, and year to determine when incidents would tend to occur. We also closely monitored the areas that repeatedly showed up with high volumes of incidents, including individual ZIP codes, districts, and intersections. This allowed us to identify priority areas where public safety campaigns might be needed most.

We were stringent in this exercise that the information we used was reliable and true. We corrected inconsistencies, most notably in records of date and time, and made sure ambiguous or missing information would not bias results. To this level of detail, we were able to produce findings one can use to confidently inform decisions.

4. Results and Conclusion

An examination of accidents on Buffalo streets uncovered several noteworthy patterns and trends in accidents by contrasting where and when accidents occurred and what types occurred most often we were able to determine areas of main risk and opportunity high areas of risk and areas of opportunity indicating higher-risk times and places and larger trends that can be used to inform future safety strategies and resource allocations these results provide a sensible foundation for well-informed decision-making on how to improve traffic safety in the city

4.1 Types of Accidents

The majority were property damage only (161,528). The types of accidents involving injuries were also exceedingly high, exceeding 44,000, while accidents that occurred on the actual high-speed highways totaled approximately 11,700. The exceedingly high proportion of property damage accidents indicates a prevention need in the form of facilities like traffic-calming devices and driver education. One more pattern emerges if we look at the proportion of all three types of incidents over the years. We find that accidents with property damage only and injury related have decreased over the years while accidents that occurred on the actual high-speed highways have more or less remained the same. Injuries and road accidents on high-speed highways due to their severity require certain interventions such as enhanced illumination, speed regulation, and periodic maintenance.

4.2 High-Incidence Areas

University Council District in Police District E and ZIP Code 14215 had the highest number of incidents with over 17,000 incidents. NORTH District with ZIP Code 14207 and DELAWARE District in 14216 areas were other high-incident places. You will also find 14214 not too far below in the table. Overlapping pattern of geographical area suggests that the area covering 14214, 14215, 14216 is a hotspot for accidents. This area would be best addressed through enhanced patrol visibility, traffic calming, and community-based campaigns of awareness.

4.3 Intersections with the Highest Incidents

There was one set of intersections that had the highest traffic accident rates consistently. The most prominent ones were:

1. Scajaquada EB Exit at Delaware Ave: 1,027 accidents
2. Hertel Ave at Delaware Ave: 854 accidents
3. Clinton St at Bailey Ave: 803 accidents

Each of these zones needs to be taken into account for safety audits. Countermeasures may vary from retiming traffic signals, signage addition, lighting enhancement, or road geometry reconstruction. Coordination with the Department of Public Works and Urban Planning will be extremely significant here.

4.4 Time-Based Patterns

Incident times analysis indicated peak traffic incidents during the late afternoons also known as peak hours , 3 PM to 5 PM. The 3 PM hour alone accounted for 18,689 incidents during the period of study. This pattern is expected with school letting out and post-afternoon work commute, indicating rises in travel and potential driver distraction or fatigue.

On the other hand, morning periods between 1 AM and 5 AM had the lowest rates of occurrences, i.e., lower traffic volumes. Such findings can be used to determine deployment schedules for traffic police officers and inform public service announcements about dangerous driving periods.

4.5 Trends Over Time

Annual incidence rates were generally similar, with the peak of over 12,400 cases in the year 2018. There was a steep decline in the year 2020 owing to reduced mobility during the COVID-19 lockdown. The numbers have been rising thereafter but are yet to reach pre-pandemic levels. However, the data suggest that the last four years from 2021-2024, the traffic incidents have seen a continuous decline which speaks for the effectiveness of the strategies employed. Year-to-year comparability of statistics suggests that while interventions to prevent safety in some instances may prove to be fruitful, residual risk factors continue to be at play.

5. Recommendations

Based on these findings, the following actions are recommended:

1. Perform road safety inspections on the top 10 locations with the most crashes to look for offenders like insufficient signage, unclear lane markings, or signal phase. Resolving these small but significant problems can lead to amazing crash reduction.
2. Double traffic calming measures (like speed humps, roundabouts, or bold signs) in the hardest-hit ZIP codes 14215, 14207, and 14216 where high traffic and residential areas meet most often.
3. Station more traffic police and CCTV cameras in the afternoon peak periods (especially 1 PM to 5 PM), which always record the highest number of occurrences.
4. Coordinate with big employers and schools so that the dismissal times could be staggered. This would possibly disperse the traffic through the peak hours and lower the risk of pedestrian-bicyclist collisions.
6. Collaborate with city planners and transit agencies to implement long-term road improvements—e.g., lane reconfiguration or pedestrian spaces—on sites repeatedly defined as high-risk to make sure that the trend of declining incidents of the last four years continues.
7. Finally, because highway accidents have not improved over the years, there is a need to collaborate with state transportation officials in re-studying highway safety elements. Having such elements like better lighting, clearer lane lines, and targeted speed checks may reduce these repeat accidents.

6. Technical Appendix

The Technical Appendix gives the reader a behind-the-scenes look at the data structure, cleaning, and querying underlying the findings in this report. It summarizes our normalization strategy and how the SQL logic works to pull out salient information from the dataset.

6.1 Normalization

To ensure data consistency and minimize redundancy, the original traffic incident dataset was normalized into multiple related tables following principles of database normalization, up to the Third Normal Form (3NF):

1.First Normal Form (1NF): All tables contain atomic (indivisible) values. Each record is unique and stored in rows with a defined primary key. For example, each incident in the Incidents table has a unique incident_id, and every location is uniquely identified by location_id.

2. Second Normal Form (2NF): All non-key attributes are fully functionally dependent on the entire primary key. Composite keys were avoided by assigning a surrogate key (like location_id) wherever applicable. For example, address details were separated into a Locations table to prevent partial dependency on an incident ID.

3. Third Normal Form (3NF): Transitive dependencies were removed. Fields such as ZIP code, council district, and police district information were moved into their own respective dimension tables (ZipCodes, CouncilDistricts, PoliceDistricts) with unique identifiers. This allows the data to be stored and maintained without duplication and enables efficient updates without inconsistency.

The final normalized schema consists of the following tables:

- Incidents (incident_id, location_id, report_date, report_time, accident_type)
- Locations (location_id, address, zip_code, police_district_id, council_district_id, neighborhood_id)
- ZipCodes, PoliceDistricts, CouncilDistricts, Neighborhoods – each containing metadata related to their respective geographic entity.

6.2 Queries

1. Types of Accidents - This query groups records based on the accident_type field and counts the number of entries per type. It helps distinguish between property damage, injuries, and highway-specific accidents.
2. High-Incidence Areas - This query aggregates incident records by three spatial dimensions—council district, police district, and ZIP code—using the GROUP BY clause. COUNT(*) returns the total number of incidents per combination. Results are sorted by descending frequency and capped at the top 10 using LIMIT.
3. Intersections with the Highest Incidents - Each address from the Locations table is grouped and counted. Since addresses are tied to specific incidents via a foreign key relationship, this reveals accident-prone locations.
4. Time-Based Patterns - The hour (%H) is extracted from the report_time field. After grouping by hour and counting, the results are ordered to show the most active times of day in descending order.
5. Trends Over Time - The SQLite ‘strftime’ function extracts the year component from the report_date field. Records are grouped by year and counted, helping visualize temporal trends.. Second part of the query groups incidents by both year and accident type. It enables stakeholders to compare shifts in the nature of accidents e.g reduction in injuries or persistent highway crashes over time

7. References

[1] https://data.buffalony.gov/Public-Safety/Received-Traffic-Incident-Calls/6at3-hpb5/about_data