ANALYSIS OF THE CAUSES OF TRAFFIC ACCIDENTS ON SIMÓN BOLÍVAR AVENUE

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Simón Bolívar Avenue, located in the city of Quito-Ecuador, has been identified as an area with a high rate of traffic accidents. To establish the main causes of traffic accidents, this study investigated a specific 15.4 km stretch extending from Guajaló to the Ruta Viva interchange on Simón Bolívar Avenue. The aim of the research is to analyze factors involved in traffic accidents and propose actions to mitigate them. To carry out the aim, data obtained from the Visor de Siniestralidad Nacional of the Agencia Nacional de Tránsito (ANT) on accidents occurring between 2019 and 2023 were compiled. These data made it possible to identify the most common causes of traffic accidents in this particular area. Upon knowing the reasons for these incidents, it was possible to determine the reasons that significantly influence traffic accidents on the avenue. Besides, an analysis was made of the critical points where most traffic accidents are concentrated. These critical points provided valuable information to generate and make proposals to reduce the accident rate and improve road safety. The implementation of these proposals and improvements can in turn contribute to reduce the accident rate and increase safety on the road section studied. Therefore, these findings will serve as a starting point to generate proposals to reduce the accident rate and improve road safety on Simón Bolívar Avenue and thus fulfill the aim of understanding the main causes of traffic accidents in order to mitigate the incidence of accidents in the area studied.

Keywords: Interchange, Road safety, Identify, Traffic.

1 INTRODUCTION

Traffic accidents represent one of the most significant global issues and are a leading cause of death. Each year, approximately 1.2 million people lose their lives in these events, with around 50 million sustaining injuries. Alarming, 85% of these accidents occur in areas with limited resources and poor road infrastructure (Nazif and Pérez 2009). In the case of Ecuador, according to data from the Visor de Siniestralidad Nacional, there were 21,739 traffic accidents in 2022, resulting in 2,202 fatalities and 19,006 injuries. These figures underscore the urgent need to thoroughly analyze and study the causes behind these accidents.

A traffic accident can lead to physical injuries, loss of lives, and significant vehicle damage (Maura et al. 2019). These accidents arise from the interaction of various factors that can be identified, making them predictable and largely preventable (García-Ramírez et al. 2017). Therefore, it is essential to meticulously study each of the contributing factors to understand the occurrence of these accidents. The main factors involved in traffic accidents include: (1) the human factor, (2) the vehicle factor, (3) the road factor, and (4) the environmental factor.
According to a study carried out in Mexico, 80% of traffic accidents are attributed to the human factor, 7% to the vehicle factor, 9% to the environmental factor, and 4% to the road factor (Congacha et al. 2019). On the other hand, in Ecuador according to data provided by the Agencia Nacional de Tránsito (ANT), the human factor is involved in between 77% and 88% of traffic accidents (Román 2015).

Given the importance of this information, it is crucial to delve into the analysis of each of the contributing factors. The incidence percentage of these factors may vary depending on the area or location under study. The aim of this research is to analyze the main factors involved in traffic accidents on Avenida Simón Bolívar, located in the city of Quito, Ecuador. This avenue is one of the city’s main thoroughfares, connecting various urban and suburban sectors. The study area has been delimited to a 15.4 km stretch, from Guajaló to the Ruta Viva interchange.

The study conducted by Sánchez (2017), mentioned that traffic accidents on Avenida Simón Bolívar are primarily attributed to the human factor, stemming from inexperience, recklessness, alcohol consumption, and speeding. A detailed study of these factors on this important road will help identify possible actions and measures to improve road safety in the area and protect the lives of citizens. With this focus, we aim to contribute to accident prevention and promote responsible driving on Avenida Simón Bolívar.

2 METHODOLOGY

The methodology focuses strategically on Avenida Simón Bolívar, providing a localized view of traffic accidents while at the same time providing a significant contribution to the broader field of road safety research. The research lays special emphasis on the human factor, providing insights into drivers’ road safety behavior. Proposing actionable recommendations, it goes beyond theory and offers practical strategies adaptable to urban environments around the world. This interdisciplinary approach draws on road construction, civil engineering and transportation engineering, providing a comprehensive understanding of urban road safety challenges.

2.1 Study Area

The selected area for this research is Avenida Simón Bolívar, covering the stretch from Guajaló to the Ruta Viva interchange, with a total length of 15.4 km (Figure 1).

![Figure 1. Delimited study area for the research.](image-url)
2.2 Instrument and Sample

The instrument used in this research was based on the utilization of the Visor de Siniestralidad Nacional, a tool that compiles information on traffic accidents registered by the corresponding authorities (Alava-González et al. 2023). The sample used for the study included traffic accidents that occurred from 2019 to the present date, totaling 209 events during this period. From this set, 115 injured individuals and 23 fatalities at the scene of the accidents were quantified.

The Visor de Siniestralidad Nacional provides data classified by province, canton, parish, road network, year, month, day, and time range, as well as information about the probable cause, type of accident, vehicles involved, type of service provided by the involved vehicle, the entity that recorded the information, and urban or rural zoning. For the research, this information was processed, classified, and organized according to the factors that caused each traffic accident, grouping them into the following categories: (1) human factor, (2) vehicle factor, (3) road factor, and (4) environmental factor.

Once the information was quantified and grouped according to the contributing factors to traffic accidents, the main causes of accidents in the study area were identified. Based on this analysis, measures were proposed to mitigate the frequently occurring traffic accidents in this area. With this methodological approach, we aim to contribute to a better understanding of the causes behind traffic accidents in the study area and provide effective solutions to enhance road safety in the region.

3 RESULTS ANALYSIS

Table 1 shows the number of traffic accidents that occurred in the study area each year. A slight increase in the incidence of accidents over time can be observed. The year 2021 recorded the highest number of accidents, totaling 47, while the year 2019 had the highest number of injured individuals, with a total of 29. On the other hand, the year with the highest number of fatalities at the scene of the accidents was 2022, with a total of 8 fatalities.

Table 1. Traffic accidents per year in the study area.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Total Injured</th>
<th>Total Fatalities</th>
<th>Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>36</td>
<td>29</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>2020</td>
<td>40</td>
<td>15</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>2021</td>
<td>47</td>
<td>20</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>2022</td>
<td>46</td>
<td>26</td>
<td>8</td>
<td>58</td>
</tr>
<tr>
<td>2023</td>
<td>40</td>
<td>25</td>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
<td>115</td>
<td>23</td>
<td>268</td>
</tr>
</tbody>
</table>

Regarding the results obtained the probable cause of traffic accidents in the study area, it was identified that the human factor is the main cause, accounting for 84% of the total. Within this factor, situations such as speeding, failure to respect safe following distances, driving under the influence of alcohol, and distractions play a significant role. The environmental factor ranks second, contributing to 8% of the accidents. These accidents primarily occur due to adverse weather conditions, such as rain or fog. The vehicle factor accounts for 5% of the incidence of traffic accidents, while the road factor represents only 3% (See Table 2).
Table 2. Probable causes of traffic accidents grouped by the contributing factor.

<table>
<thead>
<tr>
<th>Intervening Factor</th>
<th>Total Accidents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Factor</td>
<td>175</td>
<td>84%</td>
</tr>
<tr>
<td>Vehicle Factor</td>
<td>11</td>
<td>5%</td>
</tr>
<tr>
<td>Road Factor</td>
<td>6</td>
<td>3%</td>
</tr>
<tr>
<td>Environmental</td>
<td>17</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>209</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Another relevant aspect highlighted in the research is the analysis of the most common types of accidents within the study area. These accidents are closely linked to the human factor, which is the main cause of accidents in the study area.

Among the most frequent types of accidents, it was observed that collisions represent 39% of the total, followed by lane departure with 19%. Additionally, rear-end collisions constitute 10% of the accidents, while collisions represent 9%, and side collisions 7%. These types of accidents are directly related to speeding, failure to respect safe following distances, and driving under the influence of alcohol. In order to better understand the frequency of each type of accident in the study area, Figure 2 shows these percentages.

![Figure 2. Types of accidents presented in the study area.](image)

It is of utmost importance to consider that a total of 234 vehicles were involved in the traffic accidents within the study area, distributed as follows: 58% were automobiles, 13% were pickup trucks, 11% were trucks, another 11% were motorcycles, and the remaining percentages were divided among vans, buses, bicycles, and others.

This analysis highlights the relevance of paying greater attention to the regulation and control of automobiles, as they represent the largest proportion of vehicles involved in traffic accidents in the study area. Implementing specific measures to improve the safety and behavior of automobile drivers could have a significant impact on reducing the incidence of these accidents.
4 DISCUSSION OF RESULTS

The results obtained in this research exhibit a notable similarity and relationship with findings from previous studies. For instance, Román (2015) also found that, within the context of our country, the human factor accounts for approximately 77% to 88% of traffic accidents. In the study carried out by Constante (2016), determined through surveys and interviews with law enforcement agents and drivers that the human factor is the main cause of traffic accidents, with speeding and failure to respect traffic signals being the primary contributing factors traffic accidents on Avenida Simón Bolívar. Furthermore, the investigation conducted by Sánchez (2017), based on data from the Metropolitan Transit Agency of the Metropolitan District of Quito between 2014 and 2015, also concluded that the human factor is the main cause of traffic accidents, highlighting speeding and alcohol consumption as the primary factors. Additionally, it was emphasized that automobiles play a major role in traffic accidents.

The detailed review of the literature supports and strengthens the information found in the Visor de Siniestralidad Nacional. However, it is imperative to be aware of potential inaccuracies that may have arisen during the data digitization process, and of the possible omissions by the institutions responsible for providing information to the viewer. It becomes essential to compare the georeferenced information from the viewer with the findings from a Road Safety Audit. By integrating both data sources, it is feasible to outline relevant strategies for the area under study. These findings underscore the urgent need to allocate resources and efforts toward preventive actions and awareness campaigns focused on the human factor, viewing it as a crucial tool to reduce the incidence of vehicular accidents on Avenida Simón Bolívar.

5 PROPOSAL

It has been determined that 84% of the traffic accidents on Avenida Simón Bolívar are caused by the human factor (see Table 2). These accidents are evenly distributed along the 15.4 km study area, spanning from Ruta Viva to the Guajaló area. The main causes of traffic accidents include speeding, failure to respect safe following distances, as well as alcohol consumption and the use of distractions during driving, primarily involving automobiles.

Based on the analysis conducted on the causes of accidents in the study area, the following actions are proposed to improve road safety (1) **Signage and Vehicle Speed Regulation:** Establish appropriate signage throughout the area, including speed limits in accordance with the geometric design of the road. Additionally, the implementation of speed detection radars and enforcement measures is suggested. Where necessary, speed bumps should be installed. This approach is in line with the results obtained, which indicate that speeding is one of the main factors contributing to traffic accidents. (2) **Awareness Campaigns:** Conduct massive awareness campaigns that promote respect for traffic signs, adherence to speed limits, and the importance of avoiding alcohol consumption and distractions while driving. The proposal aims to influence drivers’ behavior based on empirical data by providing information on the importance of respecting traffic signs and avoiding risky behavior.

Implementing these actions in a coordinated and consistent manner could significantly contribute to reducing the incidence of accidents on Avenida Simón Bolívar and, consequently, enhance road safety throughout the study area. Furthermore, fostering a culture of responsible driving among motorists is essential to achieve safe road coexistence and prevent risky situations in traffic. In general, decisions regarding both the factors on traffic accidents and the actions that can be implemented to improve road safety should be a high priority for stakeholders who are engaged either in the areas of (1) road construction and design, (2) road engineering, (3) civil engineering, or (4) transportation engineering.
6 CONCLUSIONS

The relevance of this type of research becomes evident, since it is imperative to analyze road sections with high traffic accident rates in order to identify the determining factors and take effective measures to reduce incidents. The results of this study conclusively highlight the preeminence of the human factor, which is attributed to 84% of the accidents recorded on Simón Bolívar Avenue. The constant problems related to speeding and the lack of respect for safety distances, which lead to vehicular collisions, emphasize the imperative need to implement specific strategies to modify driver behavior.

The demand to the authorities and entities responsible for intervening in the education and retraining of the population is not only a reactive response, but a strategic move based on the critical analysis of the study's findings. Awareness of traffic rules and the promotion of responsible driving practices are indeed vital. Moreover, the recommendation to implement road infrastructures compliant with national and international standards is not a mere procedural formality, but an essential requirement. Critical analysis of accidents highlights the need for infrastructures not only to conform to standards, but also to be designed with careful consideration of observed behavior patterns, thus creating an environment conducive to safer driving practices. Finally, the competent authorities must strictly enforce compliance with regulations and ensure the safety of road users.

References


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