Determine The Number And Type Of Vehicles Traveling Through The Traffic Circle In Atalaya

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Abstract

The traffic circle located in the city of Cúcuta in the Claret neighborhood, is one of the main structural axes of transportation; and therefore, due to the high rate of vehicular growth experienced in the city, it has evidenced problems related to congestion, becoming one of the critical points of the road network of the city of Cúcuta; being identified, according to figures stipulated by the direction of traffic. Therefore, in this study the methodology used was to perform a vehicle count in situ, where the amount and type of vehicles that travel through the traffic circle road network is obtained, in order to subsequently make new designs of this road seeking to improve traffic. In this case, 4 entrances were identified, where each one of them was checked on 3 days of the week during peak traffic hours according to the country's established work schedules. Important data was obtained on the number and type of vehicles transited, which identifies that entrance 1 is the one that receives the greatest flow of vehicles and entrance 4 is the one that receives the least number of vehicles. In addition, it is identified that at entrances 1, 2 and 3 the type of vehicles that mostly travel are cars and those with the lowest flow are 3-axle cargo trucks, although on Saturdays the highest flow is by motorcycles and 2-axle cargo trucks have the lowest flow on this road network.

Keywords: flow; vehicles; type; quantity; traffic, roundabout.

1. Introduction

The interval acceptance theory was defined by Harders in Germany and by Siegloch in 1973 and Troutbeck and Brilon, (Sánchez, E. S., Movilla, S. C., & Cruz, M. S. (2022). The German, U.S. and Swiss capacity manuals contemplate this criterion. This theory assumes that driver behavior is consistent and homogeneous (Llopis Castelló, D. (2018). The sources consulted agree that it is not possible to

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directly measure critical intervals, only a driver can be observed, accepting or rejecting intervals. Under consistent behavior, an accepted interval is a top mark for the driver's critical interval. Low speeds in a traffic circle facilitate this acceptance process (NCHRP 672, 2010) (Hillary Isebrands, P. E., & Lindsey Van Parys, P. E. 2021). The operational efficiency of traffic circles is higher when traffic speeds are lower (Farag, N., Choudhury, F. T., Cao, Y., Ponce, D., Del Rosario, C., Alkarawi, S., ... & Easa, S. M. 2022). This phenomenon is due to the fact that, if the circulating traffic is faster, the intervals will be smaller so that the incoming traffic can accept them comfortably, i.e., they can accelerate and enter it (Baker, B. 2020). Thus, there will be a smaller number of acceptable intervals with a larger number of vehicles accumulated at the entrance, which translates into delay in entering the traffic circle (Koohi, M., & Shabaani, S. (2022).

2. Method

  – Determine the number of vehicles that pass through each entrance of the traffic circle on Mondays, Wednesdays and Saturdays (Echevarría Ramírez, C. A., & Silva Ruiz, M. E. (2020).
  – A summary of the information collected is made to determine the entrance with the highest influx of vehicles (Lozano Jachero, L. C. (2019).
  – Determine the type of vehicles transiting through each entrance of the traffic circle (Muentes Lucas, C. A. (2019).

3. Results and discussion

3.1. Number of vehicles transiting each day observed per entrance.

It should be noted that observations were made to determine the number of vehicles (Pulido, P. & Gómez, M. 2018) entering the traffic circle under study in order to determine the number of vehicles entering the system at each of the four entrances to the traffic circle. In this regard, the following results were found:

Table 1. Number of vehicles transiting the system on Monday per entrance

Entrance	Vehicles	
	Quantity	%
Entrance 1 East-West	7.758	34,40%
Entrance 2 North-South	6.933	30,80%
Entrance 3 West-East	4.855	21,50%
Entrance 4 South-North	2.988	13,30%
Total-	22.534	100%

Source: Own elaboration

On Mondays at the traffic circle, the largest number of vehicles enter the intersection through entrance number 1 or transversal 17 in an east-west direction, with 34.4% of the vehicles entering the aforementioned distributor. On the other hand, 30.8% of the vehicles entering the aforementioned distributor do so through entrance number 2 or avenue 24 in the north-south direction. Likewise, entrance 3 West-East receives 21.5% of the vehicles entering the system, and finally, only 13.3% of the vehicles using the traffic circle enter through entrance 4 or Avenue 23 in the South-North direction (Ministerio de Transporte. 2014).

Table 2. Number of vehicles that transited the system on Wednesday by entrance.

Entrance	Vehicles	
	Quantity	%
Entrance 1	8.297	38,00%
Entrance 2	7.218	33,00%
Entrance 3	4.051	19,00%
Entrance 4	2.316	10,00%
Total	21.882	100%

Source: Own elaboration

On the other hand, on Wednesday, most of the vehicles (Sosa, P. & Dueñas, I. 2018) entering the traffic circle enter the intersection through entrance number 1 or transversal 17 in an east-west direction, with 37.92% of the vehicles entering the aforementioned distributor. On the other hand, 32.99% of the vehicles entering the aforementioned distributor enter through entrance number 2 or avenue 24 in the north-south direction. Likewise, entrance 3 West-East receives 18.51% of the vehicles entering the system and finally, only 10.58% of the vehicles using the traffic circle enter through entrance 4 or 23rd Avenue in the South-North direction.

Table 3. Number of vehicles transiting the system on Saturday by entrance.

| Entrance	Vehicles	
	Quantity	%
Entrance 1	8.440	39,00%
Entrance 2	7.180	33,00%
Entrance 3	4.094	19,00%
Entrance 4	1.852	9,00%
Total	21.882	100%

Source: Own elaboration

Finally, in the observations made on Saturdays, it was determined that, on that day, the entrance of vehicles to the traffic circle (Pereda, C. & Montoya, M. 2018) is mostly through entrance number 1 or transversal 17 in the East-West direction with 39.14% of the vehicles entering the aforementioned distributor. On the other hand, 33.29% of the vehicles entering the aforementioned distributor do so through entrance number 2 or avenue 24 in the north-south direction. Likewise, entrance 3 West-East receives 18.98% of the vehicles entering the system and finally, only 8.59% of the vehicles using the traffic circle enter through entrance 4 or 23rd Avenue in the South-North direction.

3.2. Overall number of vehicles by entrances.

A graph was made to determine the entrance with the highest number of vehicles. The following results were obtained:

Figure 1. Overall number of vehicles per entry.
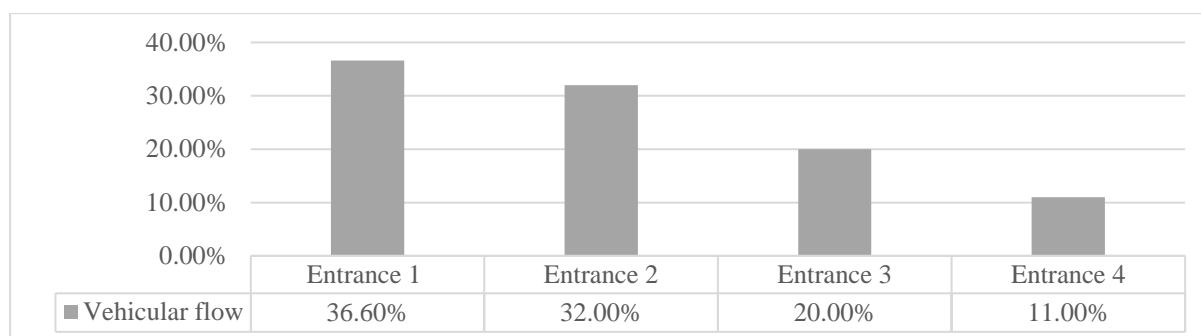
Source: Own elaboration

Types of vehicles (Barrios Villanes, R. (2022) entering the roundabout per day. Additionally, the type of vehicles circulating through the traffic circle on Mondays, Wednesdays and Saturdays was analyzed to determine, by day, the type of vehicle (Eche Tuesta, J. C., & Palacios Amaya, P. D. S. 2022) using the traffic circle on those days. The following results were obtained:

Table 4. Types of vehicles entering the roundabout on Mondays

Type	Cars	Motorcycles	Buses	C2P	C2G	≥ C3
%	49,1%	35,5%	6,9%	5,0%	3,2%	0,3%
Quantity	11074	8010	1559	1120	713	58

Source: Own elaboration

Table 4 shows that 49.1% of the vehicles entering the traffic circle on Mondays are cars, 35.5% are motor vehicles, while the remaining 15.4% are buses and cargo trucks with 2 or more axles.

Table 5. Types of vehicles entering the roundabout on Wednesdays

Type	Cars	Motorcycles	Buses	C2P	C2G	≥ C3
%	47,90%	35,63%	7,60%	5,47%	3,25%	0,14%
Quantity	10482	7797	1663	1197	712	31

Source: Own elaboration

Table 5 shows that 47.9% of the vehicles entering the traffic circle on Wednesdays are cars, 35.63% are motor vehicles, while the remaining 15.2% are buses and cargo trucks with 2 or more axles.

Table 6. Types of vehicles entering the roundabout on Saturdays

Type	Cars	Motorcycles	Buses	C2P	C2G	≥ C3
%	52,78%	33,16%	7,43%	4,09%	2,49%	0,05%
Quantity	11.382	7.152	1.603	881	537	11

Source: Own elaboration

Table 6 shows that 52.78% of the vehicles entering the traffic circle on Saturdays are cars, 33.16% are motor vehicles, while the remaining 14.1% are buses and cargo trucks with 2 or more axles. There is a decrease in the traffic of cargo vehicles of 2 or more trucks with three or more axles on Saturdays (Sanchez Cruz, L. A. (2019).

3.3. Type of vehicle per entry

Additional measurements were made to determine the type of vehicle (Cigüeñas, D. M. A. 2018) used at each of the four entrances to the traffic circle, determining what type of vehicles make the most use of the traffic circle and what type of vehicle uses each entrance the most. This in order to properly determine the type of inconveniences that occur due to the type of vehicle. The following results were obtained:

Table 7. Types of vehicles at Entrance 1 (East-West)

Type	Cars	Motorcycles	Buses	C2P	C2G	≥ C3
Quantity	9061	5444	1634	427	564	26
%	52,82%	31,73%	9,52%	2,49%	3,29%	0,15%

Source: Own elaboration

Figure 2. Types of vehicles at entrance 1 (East-West)
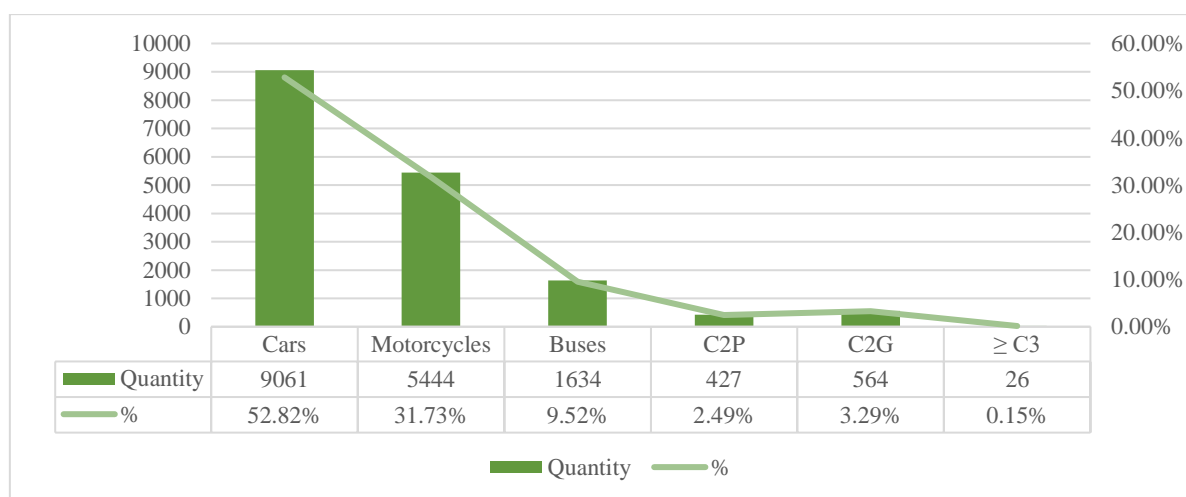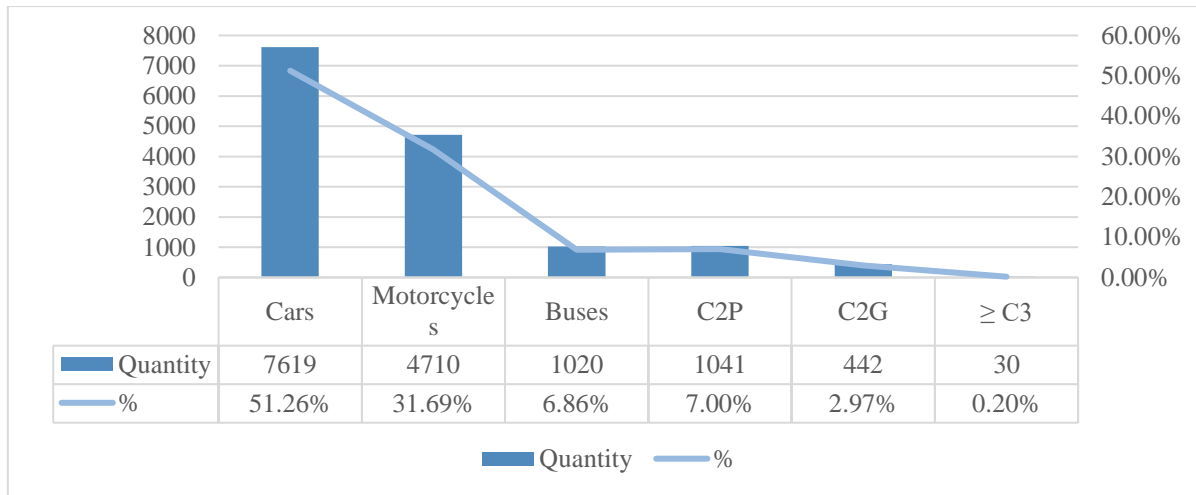

Source: Own elaboration

The graph shows that at the entrance to the East-West distributor or transversal 17, the majority of vehicles using this entrance are classified as automobiles (Acuña Herrera, B. E., & Amaya Mejia, L. C.) with more than 52%, followed by motorcycles and further away by buses. This implies that any solution used should take this data into account.

Table 8. Types of vehicles using Entrance 2 (North-South)

Type	Cars	Motorcycle	Buses	C2P	C2G	≥ C3
Quantity	7619	4710	1020	1041	442	30
%	51,26%	31,69%	6,86%	7,00%	2,97%	0,20%

Source: Own elaboration

Figure 3. Types of vehicles at entrance 2 (North-South)
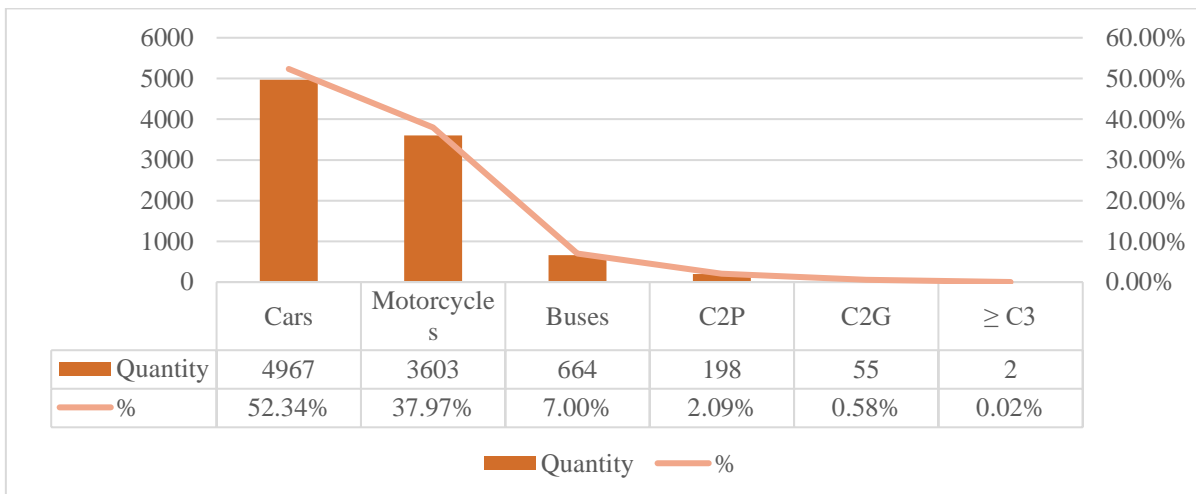
Source: Own elaboration

The graph shows that at the entrance to the distributor in the north-south direction, the majority of vehicles that use this entrance are classified as automobiles, with more than 51%, followed by motorcycles with 31.6%, and further away, buses with 6.86%. This implies that any solution used should take this data into account.

Table 9. Types of vehicles at Entrance 3 (West-East)

Type	Cars	Motorcycle	Buses	C2P	C2G	≥ C3
Quantity	4967	3603	664	198	55	2
%	52,34%	37,97%	7,00%	2,09%	0,58%	0,02%

Source: Own elaboration

Figure 4. Types of vehicles at entrance 3 (West-East).

Source: Own elaboration

The graph shows that at entrance 3 to the distributor in the west-east direction, the majority of vehicles using this entrance are classified as automobiles, with more than 52%, followed by motorcycles with
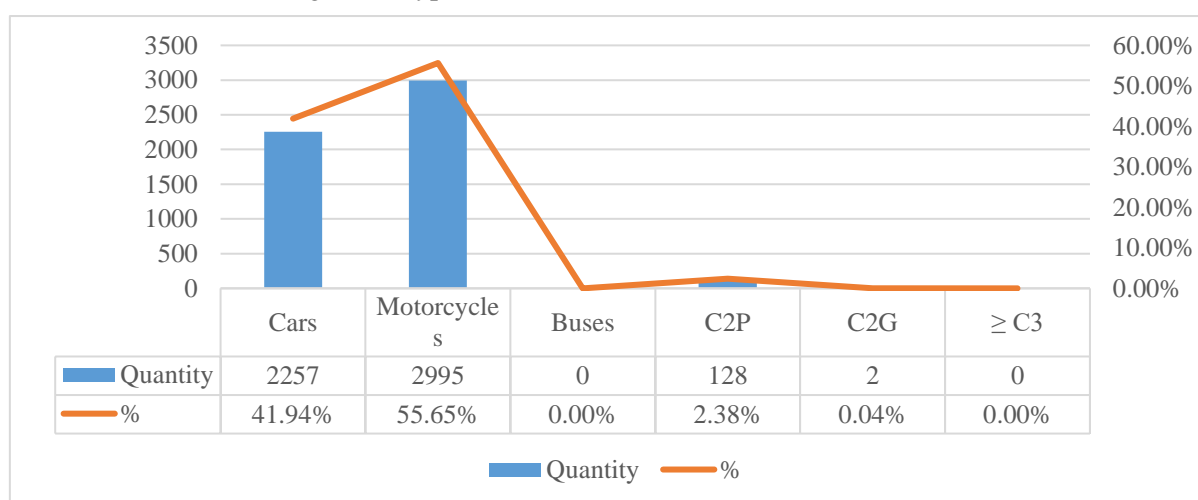
37% and, further away, buses with 7%. This implies that any solution used should take this data into account (Angulo Condori, D., & Vargas Mamani, A. A. (2021).

Table 10. Types of vehicles at Entrance 4 (South-North)

Type	Cars	Motorcycles	Buses	C2P	C2G	≥ C3
Quantity	2257	2995	0	128	2	0
%	41,94%	55,65%	0,00%	2,38%	0,04%	0,00%

Source: Own elaboration

Figure 5. Types of vehicles at Entrance 4 (South-North)

Source: Own elaboration

The figure shows that at entrance 4 to the distributor, in the south-north direction, the majority of vehicles using this entrance are classified as motorcycles, with more than 55.6%, followed by cars with 41.9%, these two types of vehicles (Cuenca Chamba, F. A., & Saltos Estrada, R. A. 2022) make up almost 98% of the means of transport using the traffic circle. One aspect to note is that no buses or heavy goods vehicles with more than 3 axles circulate on this road, and a very small percentage are vehicles with 2 and 3 axles. This is important when designing solutions to the problems identified at the traffic circle.

5. Conclusions

When reviewing the information provided to estimate the number and type of vehicles transiting through the traffic circle road network in the city of Cúcuta, it can be concluded that the entrance with the highest number of vehicles is Entrance 1, or transversal 17. It can be concluded that the entrance with the highest number of vehicles is Entrance 1, or Transversal 17, which receives the highest number of vehicles with 36.6%, and the one with the lowest vehicular flow is Entrance 4 or Avenue 23, oriented south-north with 11%. In addition, it is identified that on Saturdays the highest number of vehicles pass through with 52.78% and that at Entrance 1, Entrance 2 and Entrance 3 the majority of vehicles pass through, with a total of 52.82%, 51.26% and 52.34% respectively, and the lowest flow of vehicles is of the 3-axle truck type with a total of 0.15%, 0.20% and 0.02% respectively. While at entrance 4, the vehicles with the highest flow are motorcycles and the lowest flow are 2-axle cargo trucks with 0.04%.

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