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Reducing Environmental Impact at an Intersection Through the Implementation of Electric Vehicles.

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Abstract: In the first part of the paper is made a brief presentation of the harmful consequences that traffic has on the population in urban areas. Due to the high level of pollution (of the air, sound, and soil), a simple solution was used, more precisely, the use of electric vehicles. This type of vehicle does not release any noxious substances into the atmosphere, is silent and does not use fossil fuels. Electric vehicles (cars, buses, scooters) have become highly appreciated by the inhabitants of Brasov.

Keywords: pollution, electric vehicles, roundabout, intersection, charging stations

1. INTRODUCTION

With the increase of the automobile industry, the degree of pollution also increased substantially, so that transport became one of the main factors because of this pollution took such a significant scale. A direct consequence of atmospheric pollution is the definitive reduction of the quality of life caused by the greenhouse effect, which has as a consequence global warming, a fact that has led to the development of strategies to combat pollution.

2. TECHNICAL RESEARCH

2.1. OBJECTIVES

The study of traffic volumes refers to the recording of the number of vehicles that pass through a section of a road in a certain interval (in this case an hour). Thus, traffic volumes are expressed in unit vehicles and reference vehicles per hour. The following table shows the steps necessary to collect the data and the calculations performed in the studied intersection.

- To identify the current level of pollution present in urban areas
- To establish the importance of electric vehicles in reducing emissions from the atmosphere
- To identify the lifetime and recycling methods of electric vehicle batteries

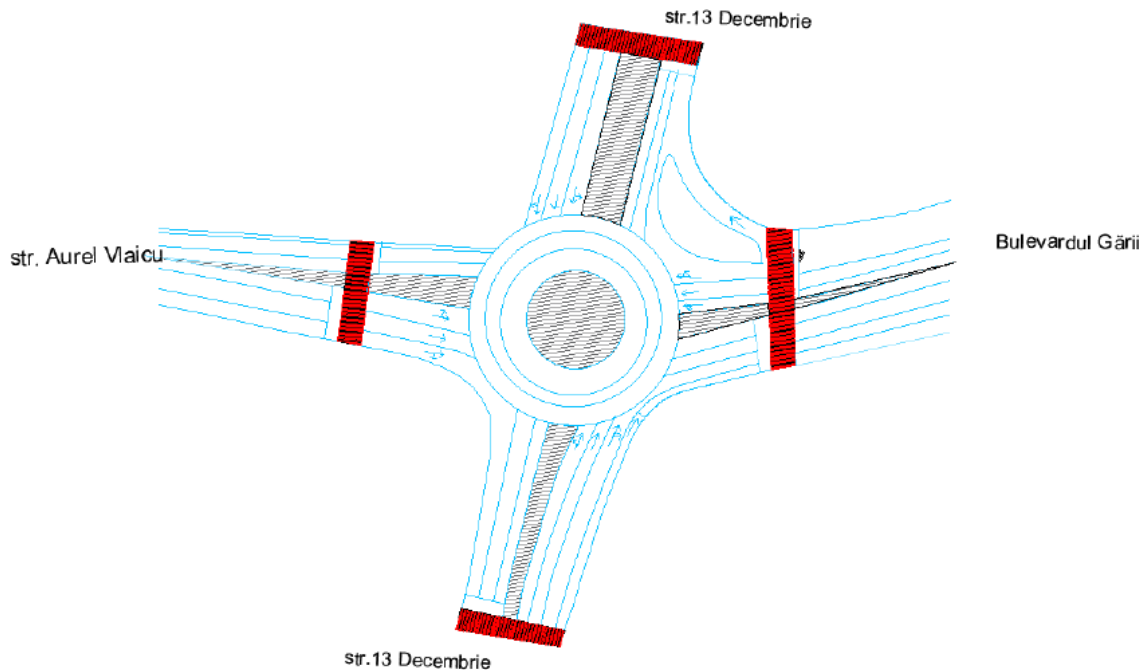


Figure 1: Intersection sketch

2.2. METHODOLOGY

The vehicle flow counters are done with the help of a team of observers. The most efficient method for data collection is done with the help of this team of observers, since each one records only one specific element of the traffic.

The basic parameters of road traffic are:

- 1) Road traffic volume: q , expressed in standard vehicles/hour/traffic lane and represents the number of vehicles that pass through a section of the road in a time interval
- 2) Road traffic density: K , expressed in standard vehicles/km/traffic lane and represents the number of vehicles located on a traffic lane of the specified length at a given time
- 3) Speed: v , expressed in km/h;
- 4) Intervals between vehicles: measured in time or space

Table1. Traffic volumes for all four directions

	Vehicles	Benchmark vehicles
Totally left	150	154
Totally ahead	472	521,5
Totally right	188	206,5
Total return	0	0
Full access	810	882

After entering the data in the table, the following will be calculated:

1) Peak hour factor:

$$F_i = \frac{V_t}{4 * V_{15min}} \quad (1)$$

2) Maximum corrected traffic volume:

$$V_i = F_i * V_t \quad (2)$$

3.ELECTRIC VEHICLES AND THE EFFECTS ON THE LEVEL OF POLLUTION

3.1. THE BATTERY LIFE OF THE ELECTRIC VEHICLE

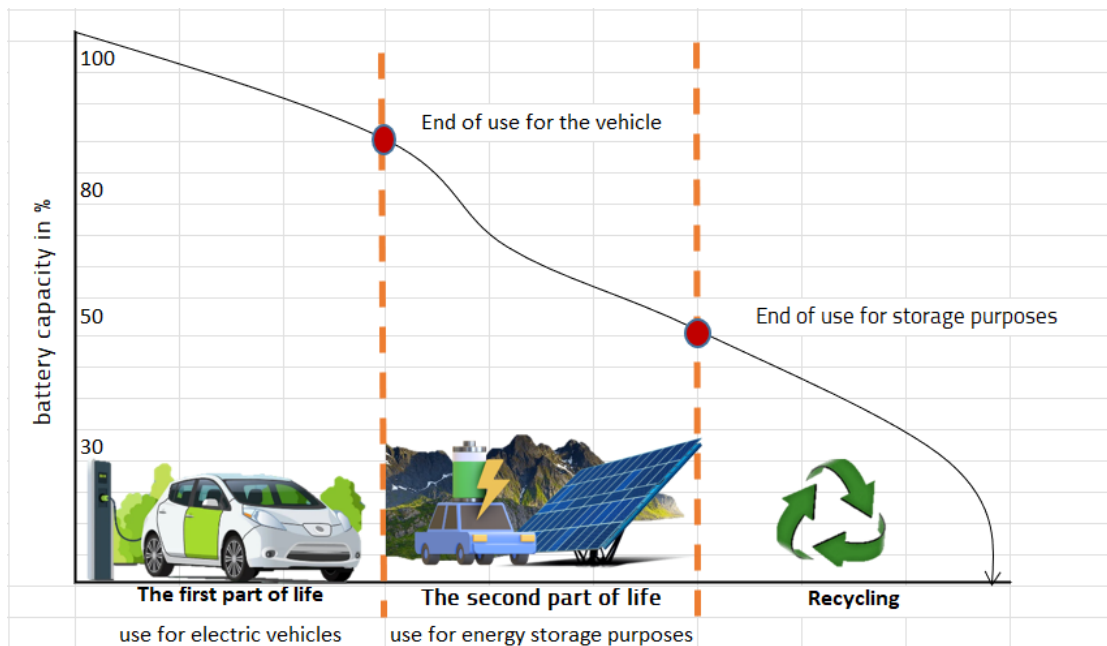


Figure 2: Chart of battery lifetimes

The average life of a battery is around 300,000 km, approximately 10 years with average driving under the conditions in which the main factors that affect the life of the battery are avoided as much as possible [1], more precisely:

- driving at excessive speed
- the number of passengers
- low temperatures
- use of air conditioning
- frequent charging at fast charging stations

3.2. DECREASING THE LEVEL OF POLLUTION

The study carried out by MIT (Massachusetts Institute of Technology) claims that the manufacture of electric vehicles generates more emissions than the manufacture of vehicles with a thermal engine, but over time they become insignificant. This result is related both to the energy required to charge the batteries, as well as to the current infrastructure of electrical networks.

According to Deloitte's global car consumer study 2022, the main reason why Romanians hesitate to buy electric vehicles is the lack of public charging infrastructure, after which the autonomy of the car and the high price will be brought to the fore. [2]

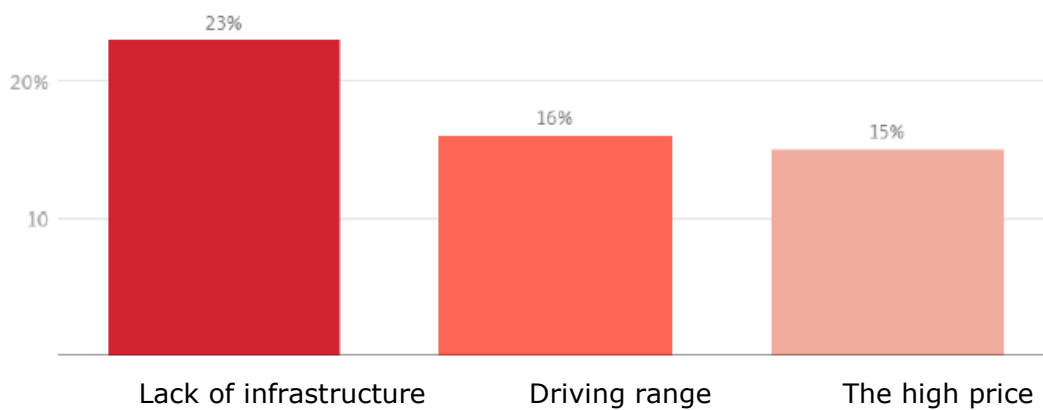


Figure 3: The reasons for the low number of electric vehicles purchased [3]

In order to reduce polluting emissions, it would be necessary for most of the inhabitants of urban areas to purchase electric vehicles. For this to be possible, it will be necessary to mount a larger number of charging stations. At the moment the number of vehicles/charging stations is 18 vehicles at one station. Also, with the increase in the number of stations, there will have to be parking lots specifically for electric vehicles. The charging time is determined by how many kilowatts the station can provide and how many of those kilowatts will be accepted by the battery. [4]

Table2. Classification of charging stations

TYPE	POWER	TIME
Slow charging stations	3kW	8 hours
Fast charging stations	7-22kW	3 sau 4 hours
Very fast charging stations	43-50kW	30 minutes
Ultra-fast charging stations	100kW-350kW	> 30 minutes

After months of negotiations, the European Parliament, municipalities, and EU member states agreed to increase the number of charging stations to

encourage the purchase of electric vehicles, which have a positive impact on the environment.

According to the European Commission, the main installation targets to be achieved by 2025 or 2030 are:

- Car and van charging infrastructure must grow at the same rate as car usage. To this end, publicly accessible charging infrastructure must guarantee a power of 1.3 kW for all battery electric vehicles registered in certain Member States.
- From 2025, every 60 km of the trans-European network will have to be equipped with a fast-charging station of at least 150 kW. [5]

The proposed vision of the Watt concept is to charge the electric vehicle without a cable. This makes it perfectly easy for electric vehicle owners to have a hassle-free commuting experience in the city or on the highways. Vehicle manufacturers such as BMW are already working on this technology, with prototype testing underway. [6]



Figure 4: Electric vehicle charging without cable

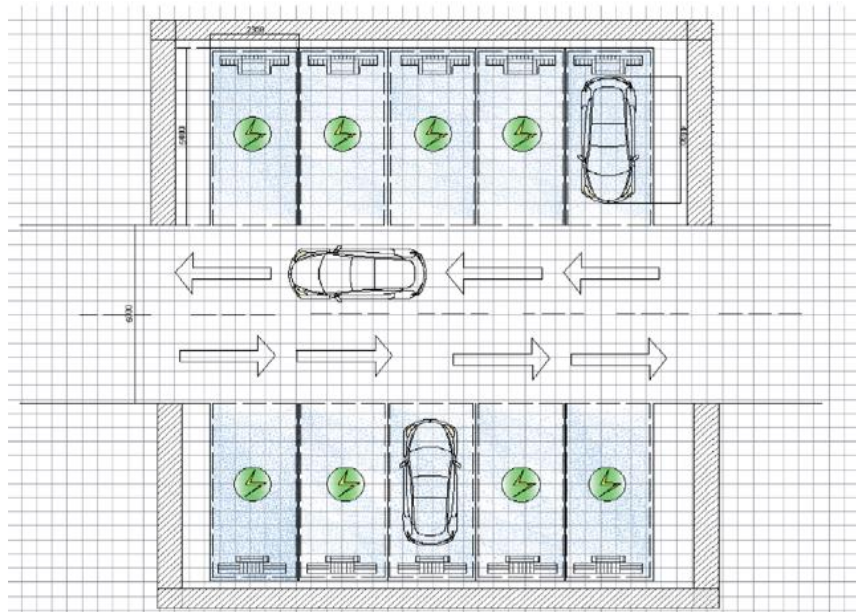


Figure 5: Sketch of a parking for 10 electric vehicles

4. CONCLUSIONS

Electric vehicles are the most suitable for improving air quality in more congested areas. The advantage of these vehicles is that charging the battery to get from point A to point B is less polluting than the emissions from burning diesel or gasoline.

The European Green Deal and the Paris Agreement oblige the big car companies that the production lines, respectively the finished product, be as least polluting as possible.

5. REFERENCES

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