The capability of green open space in absorbing carbon monoxide and carbon dioxide emissions in Balai Kota Makassar

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Abstract. The economic growth will increase the transportation sectors role in supporting the achievement of development goals. But transportation activities have negatives impact, where one of the negative impact of transportation activities is the high levels of pollutants due to emissions or release of smoke from motor vehicles. This study aims to determine the capability of green open space that exists, especially in the ability of trees and shrubs in absorbing carbon monoxide and carbon dioxide emissions generated by motor vehicles operating in Balai Kota Makassar. The research is qualitative. All data required for the analysis of the research are primary data or data obtained directly in the field. Primary data in this research are data obtained by counting the number of vehicles and the area cover by vegetation canopy. In this research, zonation system is applied because each area has different green open space requirement based on the emission load generated by motor vehicles passing in the area so that the research location is divided into 4 zones. To calculate the vehicle's emission, it applies the equation of emission strength, and to calculate the emission absorption by vegetation is use vegetation area covers. The results showed in zones 1, zone 2 and zone 3, green open space existing already can absorb 100% carbon dioxide emissions and carbon monoxide. But in zone 4, green open space existing cannot absorb 100% carbon dioxide emissions and carbon monoxide.

1. Introduction

The success of city development will increase economic growth so that it can improve the lives of the community to strengthen national stability. Increasing economic growth will increase the role of the transportation sector in supporting the development goals and results; otherwise, the function of the transportation sector will stimulate the increase of economic development, because between the functions of the transportation sector and economic development have a causal relationship [1].

Transportation activities will create negative consequences in results. One of them is the impact on the environment. Uncontrolled transportation activities, especially transportation by motorised vehicles, can harm the environment and the surrounding ecosystem. One of the negative impacts is the high levels of pollutants due to emissions or the release of smoke from motor vehicles. According to Fardiaz, the main source of air pollution in urban areas is derived from transportation, where almost 60% of pollutants produced consist of carbon monoxide and around 15% consists of hydrocarbons. One of the efforts to overcome the air pollution problem, according to Government Regulation No. 41
of 1999 about the Control of Air Pollution, the control of air pollution from mobile sources includes monitoring the quality of exhaust gas emission, inspection of exhaust gas emissions for new vehicles and old vehicles, monitoring air quality around the road, checking the exhaust emissions of motor vehicles on the road and supplying lead-free fuel oil and low sulfur diesel fuel according to international standards. As for pollutants that have been released into the environment, it can be reduced by the use of vegetation. Trees can reduce CO2 pollutants in the air (569.07 tons / ha / year) more than grass (12 tons / ha / year) [2].

Based on Law No. 26 of 2007 concerning Spatial Planning, the need for green space in an urban area is required to covered 30% of the area. The Act states that the area of green open space is allocated 10% of green open space, including the private green open space and the other 20% is the public green open space. The fundamental reason for the 30% size of urban green open space is because it is believed to naturally be able to overcome the critical physical environment in the region [3].

1.1. Research objectives
- Analysing the amount of carbon monoxide (CO) and carbon dioxide (CO2) emissions from motor vehicles in Makassar City Hall.
- Analyzing the availability of green open space in Makassar City Hall.
- Analyzing the ability of green open space to absorb carbon monoxide (CO) and carbon dioxide (CO2) emissions from motor vehicles in Makassar City Hall. Dioxide emissions and carbon monoxide

2. Methodology

2.1. Emission power
Emission strength shows the volume of emissions released per unit time [4]. To determine the emission strength (Q) obtained by the equation:

\[ Q = n \times FE \times K \times L \]

Where:
- \( Q \) = emission strength (gram / hour)
- \( n \) = number of vehicles (units / hour)
- \( FE \) = emission factor (gram / liter / vehicle)
- \( K \) = fuel consumption (liters / 100km)
- \( L \) = road length (km)

2.2. Emission factors
Emission factors are representative values that connect the number of pollutants released into the atmosphere from an activity related to the source of pollutants [4]. The emission factors can be seen in the following table 1:

| Type of Vehicle/Type of Fuel     | Emission Factor (gram/liter) | Notes (km/l) |
|---------------------------------|-------------------------------|--------------|
| Fuel                            | Nox  | CH4  | NMVOC | CO   | N2O  | CO2  |              |
| Passenger Vehicle               | 21.35| 0.71 | 53.38 | 462.63| 0.04 | 2597.86| Ass 8.9     |
| Small Commercial Vehicle        | 24.91| 0.71 | 49.82 | 295.37| 0.04 | 2597.86| Ass 7.4     |
| Big Commercial Vehicle          | 32.03| 0.71 | 28.47 | 281.14| 0.04 | 2597.86| Ass 4.4     |
| Motorcycle                      | 7.12 | 3.56 | 85.41 | 427.05| 0.04 | 2597.86| Ass 19.6    |
| Diesel                          |      |      |       |       |      |       |              |
| Type of Vehicle/Type of Fuel | Nox  | CH4 | NMVOC | CO   | N2O | CO2 | Notes (km/l) |
|-----------------------------|------|-----|-------|------|-----|-----|--------------|
| Passenger Vehicle           | 11.86| 0.08| 2.77  | 11.86| 0.16| 2924.9| Ass 13.7     |
| Small Commercial Vehicle    | 15.81| 0.04| 3.95  | 15.81| 0.16| 2924.9| Ass 9.2      |
| Big Commercial Vehicle      | 39.53| 0.24| 7.91  | 35.57| 0.12| 2924.9| Ass 3.3      |
| Lokomotif                   | 71.15| 0.24| 5.14  | 24.11| 0.08| 2924.9|             |

2.3. Specific energy

To calculate the fuel consumption of motorised vehicles can be seen in the following table 2:

| Type of Vehicle | Consumption Of energy (lit/100km) | Type of Vehicle | Consumption Of energy (lit/100km) |
|-----------------|-----------------------------------|-----------------|-----------------------------------|
| Bajaj           | 10.99                             | Taxi            | 10.88                             |
| Gasoline        | 11.79                             | Diesel/solar    | 6.25                              |
| Diesel/solar    | 11.36                             | Big Truck       | 15.82                             |
| Big Bus         | 23.15                             | Medium Truck    | 15.15                             |
| Gasoline        | 16.89                             | Small truck     |                                  |
| Diesel/solar    | 13.04                             | Gasoline        | 8.11                              |
| Medium Bus      |                                   | Diesel/solar    | 10.64                             |
| Small Bus       |                                   | Gasoline        |                                  |
| Gasoline        | 11.35                             | Motorcycle      | 2.66                              |

2.4. Calculation of vegetation area

Canopy measurements were carried out to determine canopy area [3]. The longest diameter and the shortest diameter of the crown is measured by the meter in the tree canopy projection which is observed by standing under the canopy. Measurement of the longest diameter and the shortest diameter of the crown is done using a measuring tape, as shown in Figure 1. The longest diameter and the shortest diameter of the canopy is then averaged using equations:

$$D_{\text{average}} = \frac{(D_{\text{long}} + D_{\text{short}})}{2}$$  \hspace{1cm} (2)

Where:
D = Diameter

**Figure 1.** Measured tree head projection.

The canopy area is obtained from the diameter of the canopy in meters and then calculated using the equation of the building area:

$$L = 14 \times \pi \times d^2 \quad L = p \times l$$  \hspace{1cm} (3)
With:
L = Vegetation area (m)
D = canopy diameter (m)

2.5. *Calculate the absorption power of vegetation*
Calculating the absorption capacity of vegetation is done by multiplying the canopy area (in hectares) with the ability to absorb the CO₂ emissions based on the type of tree cover as in the following table 3:

| Type of Vegetation Cover | CO Absorption Power of Vegetation |
|--------------------------|-----------------------------------|
|                          | (kg/ha/hour) | (kg/ha/day) | (kg/ha/year) |
| tree                     | 129.925      | 1559.1      | 569.07       |
| bush                     | 12.556       | 150.68      | 55           |
| grassland                | 2.74         | 32.88       | 12           |
| rice field               | 2.74         | 32.99       | 12           |

To calculate CO absorption, need to be converted to CO using the equation:

\[ M_{CO} = (MCO2Mr CO2) \times Mr CO \]  

(4)

Where:
M = Emission load
Mr = Relative mass (CO₂ = 44) and (CO = 28)

2.6. *Remaining emissions*
After calculating the total emissions due to motor vehicles and data collection on the number, types and types of existing green space vegetation, to determine the capacity of the current vegetation in absorbing CO₂ emissions, the remaining emissions must be calculated from the processing of the two data [2]. To calculate the remaining emissions used the equation:

\[ \text{Remaining Emissions} = \text{Emissions} - \text{Total absorption of vegetation} \]

(5)

2.7. *Location and time of research*
The calculation of the volume of motorised vehicles carried out on working days, which are at 6:00 to 18:00. Vehicle volume measurements took at peak hours. This research was conducted in Makassar City Hall. Makassar City Hall is located on Jalan Ahmad Yani, Makassar, South Sulawesi.

2.8. *Data collection methods*
This activity was carried out to gain an overview of the condition of the green open space of Makassar City Hall in reducing motor vehicle emissions. Data collection includes primary and secondary data collection described in figure 2.

Before conducting data collection, zoning systems were carried out at the research location, namely the determination of several zones in the calculation of emissions and calculation of plant absorption. This zone was created because in the calculation of emission load requires the same length of the road so that it has the same motor vehicle density and the needs of green space for each section are also different according to each emission load. The zoning is divided based on the road in Makassar City Hall and the direction of the wind at the time of measurement.
3. Results and Discussions

3.1. Motor vehicle analysis

The analysis of the volume of motor vehicles aims to determine the number of motorised vehicles operating in units of time, in this case, one hour. Where is the volume of motor vehicles in the four zones can be seen in table 4:

It can be seen that the largest total of the motorcycle at the time of measurement was in Zone I was with a total of 14183 vehicles/hour while the smallest total of vehicle was in Zone IV which was 549 vehicles/hour. From Table 4 it is also known that the largest vehicle volume occurred in Zone I at 16.00-17.00 at 2799 vehicles/hour. Mostly of vehicles occur in Zone I because Zone I is a secondary road. The minimum vehicles total occurred in Zone IV at 12.00-13.00 which is 70 vehicles/hour.
Table 4. Motorcycle volumes.

| PERIOD       | Motorcycle Zone (Unit) | Light Vehicle Zone (Unit) | Large Vehicle Zone (Unit) |
|--------------|------------------------|---------------------------|---------------------------|
|              | I         | II      | III     | IV   | I        | II      | III     | IV   |
| 07.00-08.00  | 2407      | 1099    | 1481    | 146  | 3457     | 1135    | 488     | 15   |
| 08.00-09.00  | 2108      | 1165    | 1140    | 80   | 3017     | 1050    | 364     | 59   |
| 11.00-12.00  | 2131      | 1285    | 1150    | 51   | 2060     | 982     | 489     | 27   |
| 12.00-13.00  | 2107      | 1070    | 1165    | 70   | 1846     | 1003    | 405     | 44   |
| 16.00-17.00  | 2799      | 1372    | 1254    | 122  | 3337     | 1160    | 511     | 50   |
| 17.00-18.00  | 2631      | 1133    | 1270    | 80   | 3405     | 1005    | 506     | 33   |
| Total        | 14183     | 7124    | 7460    | 549  | 17140    | 6335    | 2763    | 228  |

In Table 4 it can be seen that the largest total volume of light vehicles at the time of measurement occurred in Zone I which was 17140 vehicles/hour. From Table 5 it is also known that the largest total volume occurred in Zone I at 07.00-08.00, which is 3457 vehicles/hour. Large vehicle volumes occur in Zone I because Zone I is a secondary road. The largest total volume of heavy vehicles at the time of measurement occurred in Zone I, which was 50 vehicles/hour. From Table 5 it is also known that the largest vehicle volume occurred in Zone I at 16.00-17.00 at 12 vehicles/hour. Large vehicle volumes occur in Zone I because Zone I is a secondary road. This volume of vehicle represented the carbon dioxide emissions produced by motor vehicles during peak hours in each zone.

3.2. Motor vehicle analysis

This analysis is carried out to determine the carbon dioxide (CO₂) and carbon monoxide (CO) emissions produced by motor vehicles during peak hours in each zone.

In Figure 5, it can be seen that the greatest emission strength in Zone I occurs at 07.00-08.00, which is 24.51 kg/hour. For Zone II, the greatest emission strength occurs at 16.00-17.00, which is 7.04 kg/hour. For Zone III, the greatest emission strength occurs at 07.00-08.00, which is 3.71 kg/hour. For Zone IV, the biggest emission strength occurs at 08.00-09.00 and 16.00-17.00, which is 0.18 kg/hour. The strength of the different emissions at each measurement time is influenced by the volume of the vehicle, the type of vehicle, and the type of fuel used by the vehicle. Based on Figure 6, it is also known that Zone I is the Zone that produces the largest CO₂ emissions; it is due to the Jl. Jend Ahmad Yani, which is one of the secondary roads in the city of Makassar.
Figure 6. CO emission in each zone.

In Figure 6, it can be seen that the greatest emission strength was in Zone I occurred at 07.00-08.00 and 17.00-18.00, which is 4.31 kg/hour. For Zone II, the greatest emission strength occurred at 16.00-17.00, which is 1.22 kg/hour. For Zone III, the biggest emission strength occurs at 07.00-08.00, which is 0.64 kg/hour. For Zone IV, the biggest emission strength occurs at 08.00-09.00 and 16.00-17.00 which is 0.03 kg/hour. The strength of the emissions different at each time because it was influenced by the volume of the vehicle, the type of vehicle, and the type of fuel used by the vehicle. Based on Figure 7, it is also known that Zone I is the zone that produces the largest CO emissions.

3.3. Analysis of vegetation amount in Makassar city hall

In each zone, the number of trees and shrubs/shrubs in each zone can be known, as follows:

Table 5. The amount of vegetation in each zone.

| No | Zone   | Amount |
|----|--------|--------|
|    |        | Tree   | Shrub |
| 1  | Zone I | 106    | 80    |
| 2  | Zone II| 80     | 183   |
| 3  | Zone III| 14   | 34    |
| 4  | Zone IV| 0      | 32    |
|   | TOTAL  | 200    | 329   |

In Table 5, it can be seen that the total number of trees in the study location is 200 trees, and bushes/shrubs are 329. The zone with the highest number of trees is Zone I with 106 trees, while Zone IV has no trees. In Zone II, there were the most bushes/shrubs, which were 183, while the smallest number of shrubs were in Zone IV. Based on the Guidelines for the Provision and Utilization of Green Open Space in Urban Areas in 2008 by the Minister of Public Works, the type of vegetation planted in Makassar City Hall has met the criteria for green space.

3.4. Analysis of vegetation cover area and absorption

The total CO2 and CO absorption are shown in Table 6. The absorption accumulated to determine the overall absorption of the vegetation after knowing the CO2 absorption of trees and bushes/shrubs. In Table 11, Zone II is the zone with the highest CO2 absorption, which is 16.88288 kg/hour. While the lowest CO2 absorption of 0.0105 is found in Zone IV.
Table 6. Total coverage area and absorption

| Zone   | CO₂ Absorption Total (kg/jam) | CO Absorption Total (kg/jam) |
|--------|-------------------------------|-----------------------------|
| Zone I | 5.0334                        | 5.0334                      |
| Zone II| 10.7092                       | 10.7092                     |
| Zone III| 2.1861                       | 2.1861                      |
| Zone IV| 0.0067                        | 0.0067                      |

3.5. The efficiency of green open space absorption against CO₂ and CO emissions each zone

After calculating the amount of emissions from the vehicles and data collection on the number, types and types of existing green open space vegetation in 2017, to determine the ability of the current vegetation in absorbing CO₂ emissions, the remaining emissions from the processing of both data must be calculated using Equation (4) about the remaining emissions.

Considering the distribution of emissions by the wind direction according to the measurement time, at 07.00-08.00 and 08.00-09.00 Zone I received emissions with the westward wind direction, vegetation in Zone I has not been able to absorb carbon dioxide emissions from motor vehicles properly. At 16.00-17.00 and 17.00-18.00 with the direction of the wind to the northeast, vegetation in Zone I has not been able to absorb carbon dioxide emissions from motor vehicles properly. Emissions of motor vehicles that cannot be absorbed well due to the volume of motor vehicles that produce emissions greater than the absorption capacity of vegetation in Zone I. To optimize the absorption capacity of emissions in Zone I, it can be revegetated (replacing vegetation types) the shrubs with vegetation that has a greater ability to absorb emission, or adding more plants in the form of shrubs that can be planted in pots.

Zone II receives emissions with the wind direction to the southeast at 11.00-12.00 and 12.00-13.00, vegetation in Zone II can absorb carbon dioxide emissions from motor vehicles properly. At 16.00-17.00 and 17.00-18.00 the direction of the wind to the northeast, vegetation in Zone II can absorb carbon dioxide emissions from motor vehicles properly. A positive value on Absorption Capacity indicates that there are still residual emissions that cannot be absorbed by vegetation, while negative values indicate vegetation can still absorb emissions.

Zone III receives emissions with the westward wind direction at 07.00-08.00 and 08.00-09.00, vegetation in Zone III can absorb carbon dioxide emissions from motor vehicles properly. The minus value on Absorption Capacity indicates the remaining emissions that cannot be absorbed by vegetation. A positive value on Absorption Capacity indicates that there are still residual emissions that cannot be absorbed by vegetation, while negative values indicate vegetation can still absorb emissions.

Zone IV receives emissions with the wind direction to the southeast at 11.00-12.00 and 12.00-13.00, vegetation in Zone IV has not been able to absorb carbon dioxide and carbon monoxide emissions from motor vehicles properly. A positive value on Absorption Capacity indicates that there are still residual emissions that cannot be absorbed by vegetation, while negative values indicate vegetation can still absorb emissions. Emissions of motor vehicles that have not been absorbed well are due to the volume of motor vehicles that produce emissions greater than the absorption capacity of vegetation in zone IV. To optimise the absorption capacity of emissions in Zone IV revegetation can be done by replacing shrubs with vegetations that have better emission absorption or adding more plants in the form of shrubs that can be planted in pots. Based on research conducted by Laksono in 2013, the greater the area of vegetation cover, the greater the carbon dioxide absorption. It is consistent with the data analysis results conducted by researchers.
Table 7. The efficiency of green open space absorption against CO$_2$ emission in each zone.

| Zone | Period       | Area (ha) | Vegetation Coverage Area | Vegetation Coverage Area Percentage | Coverage Vegetation Type     | Vehicle CO$_2$ Emission (kg/hour) | CO$_2$ Emissions Absorption by Vegetation (kg/hour) | CO2 Emission absorption capacity by vegetation (kg/hour) |
|------|--------------|-----------|--------------------------|-------------------------------------|-----------------------------|----------------------------------|---------------------------------------------|-----------------------------------------------------|
|      | 11.00-12.00 |           |                         |                                     |                             | 24.5100                         | 16.6004                                    | unable to absorb emissions from the vehicle maximally during the measurement time |
| I    | 12.00-13.00 | 0.44      | 0.0704                   | 15.99%                              | Tree and Shrub              | 21.4200                         | 7.9096                                     | 13.5104                                              |
|      | 16.00-17.00 |           |                         |                                     |                             | 24.3300                         |                                           | 16.4204                                              |
|      | 17.00-18.00 |           |                         |                                     |                             | 24.5100                         |                                           | 16.6004                                              |
|      | 11.00-12.00 |           |                         |                                     |                             | 6.0900                          |                                           | -10.739                                               |
| II   | 12.00-13.00 | 0.42      | 0.4095                   | 97.50%                              | Tree and Shrub              | 5.9500                          | 16.8288                                    | -10.879                                              |
|      | 16.00-17.00 |           |                         |                                     |                             | 7.0400                          |                                           | -9.789                                               |
|      | 17.00-18.00 |           |                         |                                     |                             | 6.0300                          |                                           | -10.799                                               |
|      | 07.00-08.00 |           |                         |                                     |                             | 3.7100                          |                                           | 0.2747                                                |
| III  | 08.00-09.00 | 0.18      | 0.0294                   | 16.36%                              | Tree and Shrub              | 2.8200                          | 3.4353                                     | -0.6153                                               |
|      | 11.00-12.00 |           |                         |                                     |                             | 0.0900                          |                                           | 0.0795                                                |
| IV   | 12.00-13.00 | 0.1       | 0.0008                   | 0.84%                               | Shrub                       | 0.1400                          |                                           | 0.1295                                                |
Table 8. The efficiency of green open space absorption against CO emission in each zone.

| Zone | Period | Area (ha) | Vegetation Coverage Area | Vegetation Coverage Area Percentage (ha) | Coverage Vegetation Type | Vehicle CO Emission (kg/hour) | CO Emissions Absorption by Vegetation (kg/hour) | CO Emission absorption capacity by vegetation (kg/hour) |
|------|--------|-----------|--------------------------|------------------------------------------|--------------------------|-------------------------------|-----------------------------------------------|---------------------------------------------------|
|      |        | I 11.00-12.00 | 0.44 | 0.0704 | 15.99% | Tree and Shrub | 4.31 | 5.033 | -0.723 | Able to absorb emissions from the vehicle maximally during the measurement time |
|      |        | 12.00-13.00 | 0.42 | 0.4095 | 97.50% | Tree and Shrub | 1.04 | 10.709 | -9.649 | Able to absorb emissions from the vehicle maximally during the measurement time |
|      |        | 16.00-17.00 | 0.42 | 0.0294 | 16.36% | Tree and Shrub | 0.48 | 2.186 | -1.706 | Unable to absorb emissions from the vehicle maximally during the measurement time |
|      |        | 17.00-18.00 | 0.1 | 0.0008 | 0.84% | Shrub | 0.02 | 0.007 | 0.013 | Unable to absorb emissions from the vehicle maximally during the measurement time |
Considering the spread of emissions by the wind direction according to the measurement time, Zone I receives emissions with the westward wind direction at 07.00-08.00 and 08.00-09.00, vegetation in Zone I has not been able to absorb carbon monoxide emissions from motor vehicles properly. At 16.00-17.00 and 17.00-18.00 with the direction of the wind to the northeast, vegetation in Zone I has not been able to absorb carbon monoxide emissions from motor vehicles properly. Emissions of motor vehicles that have not been absorbed well are due to the volume of motor vehicles that produce emissions greater than the absorption capacity of vegetation in zone I. A positive value on the Absorption Capacity, indicates that there are still residual emissions that cannot be absorbed by the vegetation, while a negative value indicates vegetation can still absorb emissions. To optimise the absorption capacity of emissions in Zone I can be revegetated (replacing vegetation types) shrubs with vegetations that have better emission absorption capacity, or add plants in the form of shrubs that can be planted in pots.

Zone II receives emissions with the wind direction to the southeast at 11.00-12.00 and 12.00-13.00, vegetation in Zone II can absorb carbon monoxide emissions from motor vehicles properly. At 16.00-17.00 and 17.00-18.00 with the direction of the wind to the northeast, vegetation in Zone II can absorb carbon monoxide emissions from motor vehicles properly. A positive value on Absorption Capacity indicates that there are still residual emissions that cannot be absorbed by vegetation, while negative values indicate vegetation can still absorb emissions.

Zone III receives emissions with the westward wind direction at 07.00-08.00 and 08.00-09.00, vegetation in Zone III can absorb carbon monoxide emissions from motor vehicles properly. A positive value on Absorption Capacity indicates that there are still residual emissions that cannot be absorbed by vegetation, while negative values indicate vegetation can still absorb emissions.

Zone IV receives emissions with the wind direction to the southeast at 11.00-12.00 and 12.00-13.00, vegetation in Zone IV has not been able to absorb carbon monoxide emissions from motor vehicles properly. Emissions of motor vehicles that have not been absorbed well are due to the volume of motor vehicles that produce emissions greater than the absorption capacity of vegetation in zone IV. To optimise the absorption capacity of emissions in Zone I can be revegetated (replacing vegetation types) shrubs with vegetations that have better emission absorption capacity, or adding more plants in the form of shrubs that can be planted in pots. The results showed that the greater the area of vegetation cover, the greater the carbon monoxide absorption capacity which is compared with the other research conducted explained that, the greater the area of vegetation cover, the greater the carbon monoxide absorption capacity [6].

4. Conclusion
Based on the results of research conducted at Makassar City Hall, it can be concluded that:
Carbon dioxide and carbon monoxide emissions from motor vehicles in each zone are different at each measurement hour.
In each zone, there is a Green Open Space, in terms of diversity of types and amount of vegetation. But there are differences in the area of vegetation cover that is affected by the diameter of the canopy/canopy of each vegetation contained in each zone
The ability to absorb vegetation in each zone is different. For Zone II and Zone III, carbon dioxide and carbon monoxide emissions from motor vehicles are 100% absorbed by existing vegetation. While for Zone I carbon dioxide emissions from motor vehicles have not been able to be absorbed completely by existing vegetation and in Zone IV carbon dioxide and carbon monoxide emissions from motor vehicles have not been able to be absorbed by existing vegetation. This 100% absorption ability is based on emission data during measurement hours (daytime).

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