Analysis Influence Vehicle Emission Parking of The Procurement Shelter Tans Jogja at Universitas Muhammadiyah Yogyakarta (Case Study : South Zone Universitas Muhammadiyah Yogyakarta)

Reza Zulfikar Akbar[a,*], Muchlisin[b]
[a]Jurusan Teknik Sipil, Fakultas Teknik, Universitas Muhammadiyah Yogyakarta
Jl. Lingkar Selatan, Tamantirto, Kasihan, Bantul, Yogyakarta
Email : rezazulfikarakbar@gmail.com
[b]Jurusan Teknik Sipil, Fakultas Teknik, Universitas Muhammadiyah Yogyakarta

Abstract

The rapid development of technology in the transportation sector will have an impact on environmental conditions. Transportation activity increased notably motor vehicles will lead to air pollution. Increasing the number of people living in Yogyakarta will have an impact on the number of motor vehicle resulting in an increase in the concentration pollution. Increasing the number of students at Universitas Muhammadiyah Yogyakarta each year will be followed by the increasing use of private vehicles. Increased use of private vehicles will lead to environmental pollution, especially air pollution. It need to reduce private vehicles in an effort to reduce air pollution one of solutions is did the moda transfer from private cars to public transport. In this research the objective to be achieved is to determine the pollutants produced by the vehicle before and after existence of shelter, comparing pollutants generated before and after existence of shelter with ambient air quality standard DIY, as well as determine the level of air pollution by comparing the density of vehicles with ambient air quality standard parameters DIY. There are four benefits of this research that are, the research data can be used to determine the amount of pollutants produced by vehicles in the southern zone UMY before and after existence of shelter Trans Jogja, give an idea of the dangers of air pollution to human and illustrate the dangers arising from the use of vehicles in order the future can use the vehicle effectively and efficiently, be a good suggestion for UMY as determining policy for the reduction of vehicle emissions, and become a reference for further research.

Research conducted in the southern zone of the parking area on Thursday, March 3, 2016. The primary data obtained by recording the travel time of the type of cars and motorcycles when crossing with a predetermined distance by using research methods of analysis spot speed. And secondary data obtained from the other agencies.

The analysis showed that the pollutants CO and HC amounting to 56.1755 ppm and 9.3075 ppm have been exceeded quality standards and 0.0532 ppm of Nox pollutant and PM 7.6804 ug / m^3 is still below the quality standard before existence of shelter and after existence of shelter decreased exhaust emissions of the pollutants HC generated is equal to

1.1583 ppm, and for pollutants CO has been well below the standards of 7.1875. The greater the volume of vehicles, the emissions of pollutants generated will further increase.
Kata kunci : Emission, Air Pollution, CO, HC, NOx, and PM.

1.Background

The increasing development of technology, particularly in the industrial and transport sectors, gives meaning and a very big role for the improvement and prosperity of human life. But on the other hand, it will have an impact on the natural environmental conditions, like air, soil, or water. Waste material from construction activities, become a serious environmental problem, and become a major factor that causes environmental pollution.In the current era of globalization, environmental pollution, especially air pollution has become a serious problem for the developed countries, especially in big cities in Indonesia. It is characterized by declining air quality and the impact on the health problems of living organisms, especially the human impact is devastating for health, such as the decline in lung function, increased respiratory diseases, eye irritation and other various diseases.Transport activity increased, especially the use of motor vehicles is a major source of environmental pollution, especially air pollution from exhaust emissions produced. In the process of combustion, motor vehicles will emit combustion products in the form of harmful gases include Carbon Monoxide (CO), Hydro Carbon (HC), nitrogen oxide (NOx), Sulphur Oxides (SOx), and Particulate.The increasing number of vehicles will increase the element of air pollutants. (Budiraharjo and Maryanto dkk, 2009 in Ayusti Dirga) said that air pollution caused by motor vehicles amounted to 70-80%, while the industry as a result of air pollution and other things only 20-30%. Along with the rapid development and the number of people living in the city of Yogyakarta, the number of vehicles also increased. With the increasing number of vehicles in operation, it will cause an increase in the concentration pollution, so it is feared affect and endanger the quality of the air in the city.Special Region of Yogyakarta which has an icon as a student city, will always visited by people from various areas for study. Universitas Muhammadiyah Yogyakarta as one of the universities in Yogyakarta would be a destination for students who want to continue their education. Growing number of students also accompanied with the use of private vehicles has increased each year. The condition is influenced by several things, including increasing acceptance of new students each year, and the absence of public transportation that support the activities of the campus where students chose more private vehicles such as motorcycles or cars as supporting campus activities. This results in heavy usage of private vehicles motorcycles and cars in the campus Universitas Muhammadiyah Yogyakarta. Personal vehicles are used more dominant students using motorcycles instead of cars. Thus the number of vehicles in Yogyakarta Muhammadiyah University campus environment will lead to environmental pollution. Exhaust emissions produced would be very dangerous,

especially with the dense vehicle on the campus of University of Muhammadiyah Yogyakarta will cause a detrimental impact both for living beings and the environment. So the magnitude of the impact generated by these emissions should get more attention.It need for a reduction in the use of private vehicles motorcycles and cars in an effort to reduce environmental pollution, especially air pollution. One of the efforts is to do a moda transfer from private vehicles motorcycles and cars to public transport that can support activities at the campus. It is expected the private vehicle at Universitas Muhammadiyah Yogyakarta will be reduced so that pollutants generated will not pollute the environment mainly pollute the air.

2.Methodology

This research was conducted at south parking area Universitas Muhammadiyah Jl. Lingkar Selatan, Tamantirto, Kasihan Bantul. Survey vehicle parking location at Universitas Muhammadiyah Yogyakarta divided on several zones: the first zone is parking area in faculty of law, zone 2 in the parking area faculty of social and politic and zone 3 in the parking area faculty of economics. Research was conducted on the busiest day of activities on campus that on Thursday, March 3, 2016. The survey for primary data collection was done approximately 12 hours and starts at 06.30 pm until 17.30 pm.

Data required in this study are primary and secondary data. Primary data is data obtained by observation or direct observations in the field (the study site). Secondary data were obtained from the other agencies. Primary data obtained by surveying vehicle speed (analysis spot speed). On the campus integrated 3 point survey are used as a place to conduct a survey. Each point of the survey is monitored by two surveyors, every second was observed by two surveyors to calculate the number of vehicles in and out with a 15 minute interval. And estimated traffic data is done by recording the speed of the type of traffic that passes through the specified path length, lane or direction of travel, in this case use 30 meter long track, for ± 12 hours. Recording was conducted over one day from 06:30 to 17:30 pm.Analysis calculation of emission following this formula, (anonim, 2005)

- Vehicle traffic :

$$\text{E Kr} = V_r \times \frac{F_r P_r K_r}{1000} \times F_r K_r K_r K_r$$

- Heavy vehicle traffic :

$$\text{E Kb} = V_b \times \frac{F_b P_b K_b}{1000} \times F_b K_b K_b K_b$$

- Calculation of total emission :

E total = E Kr + E Kb, for each poltutant.

Annotation :

Vr = Traffic vehicle volume (vehicle/hours)

Vb = Traffic heavy vehicle volume (vehicle/hours)

VPKr = Pollutant vehicle factor for each type of pollutant from Tabel 1

VPKb = Pollutant heavy vehicle factor for each type of pollutant from Tabel 1

VKKKr = Vehicle speed convertion factor, for each type of pollutant from Tabel2

VKKKb = Vehicle speed convertion factor, for each type of pollutant from Tabel2

Tabel 1. Pollutant Levels by Distance per 1000 vph

Distance	Light Vehicles (LV's)				Heavy Vehicles (HV's)			
(m)/	CO	HC	NOx	PM	CO	HC	NOx	PM
Pollutant	(ppm)	(ppb)	(ppb)	($\mu g/m^3$)	(ppm)	(ppb)	(ppb)	($\mu g /m^3$))
5	0.505	98.5	200.4	6.56	0.370	46.39	909.8	177.8
10	0.478	93.2	189.1	6.18	0.350	43.90	858.5	167.5
15	0.410	80.0	162.2	5.34	0.300	37.68	736.4	144.7
20	0.350	68.4	138.7	4.58	0.256	32.22	629.7	124.1
25	0.301	58.7	119.3	3.96	0.220	27.65	541.6	107.3
30	0.260	50.7	103.2	3.44	0.190	23.88	468.5	93.2
35	0.226	44.1	89.8	2.98	0.165	20.77	407.7	80.8
40	0.198	38.4	78.4	2.64	0.145	18.09	355.9	71.5
45	0.173	33.7	68.8	2.32	0.127	15.87	312.4	62.9
50	0.152	29.6	60.6	2.05	0.111	13.94	275.1	55.6
55	0.134	26.0	53.4	1.80	0.098	12.25	242.4	48.8
60	0.119	23.0	47.3	1.63	0.087	10.83	214.7	44.2
65	0.105	20.3	41.9	1.46	0.077	9.56	190.2	39.6
70	0.093	18.0	37.2	1.28	0.068	8.48	168.9	34.7
75	0.083	15.9	33.1	1.18	0.061	7.49	150.3	32.0
80	0.074	14.2	29.5	1.04	0.054	6.69	133.9	28.2
85	0.066	12.6	26.4	0.94	0.048	5.93	119.9	25.5
90	0.059	11.2	23.6	0.87	0.043	5.28	107.1	23.6
95	0.053	10.0	21.2	0.80	0.039	4.71	96.2	21.7
100	0.048	8.9	19.1	0.73	0.035	4.19	86.7	19.8
105	0.043	8.0	17.2	0.66	0.031	3.77	78.1	17.9
110	0.039	7.1	15.5	0.59	0.029	3.34	70.4	16.0
115	0.035	6.5	14.1	0.56	0.026	3.06	64.0	15.2
120	0.032	5.8	12.8	0.52	0.023	2.73	58.1	14.1
125	0.029	5.2	11.7	0.49	0.021	2.45	53.1	13.3
130	0.027	4.8	10.7	0.45	0.020	2.26	48.6	12.2
135	0.025	4.3	9.8	0.42	0.018	2.03	44.5	11.4
140	0.023	4.0	9.1	0.38	0.017	1.86	41.3	10.3
145	0.021	3.6	8.4	0.38	0.015	1.70	38.1	10.3
150	0.020	3.3	7.8	0.35	0.015	1.55	35.4	9.5
155	0.018	3.1	7.3	0.35	0.013	1.46	33.1	9.5
160	0.017	2.8	6.8	0.31	0.012	1.32	30.9	8.4
165	0.016	2.6	6.4	0.31	0.012	1.22	29.1	8.4
170	0.015	2.4	6.0	0.28	0.011	1.13	27.2	7.6
175	0.014	2.3	5.7	0.28	0.010	1.08	25.9	7.6
180	0.014	2.1	5.3	0.28	0.010	0.99	24.1	7.6
185	0.013	1.9	5.1	0.24	0.010	0.89	23.2	6.5
190	0.012	1.8	4.8	0.24	0.009	0.85	21.8	6.5
195	0.011	1.7	4.5	0.24	0.008	0.80	20.4	6.5
200	0.011	1.5	4.2	0.21	0.008	0.71	19.1	5.7

(Origin : Design Manual for Road and bridges, volume 11, Environmental Assesment, HMSO, London, 1994)

Tabel 2. Air Quality Assesment - Speed Conversion Factors

Speed	Light Vehicles (LV's)				Heavy Vehicles (HV's)			
(kph)	CO	HC	NOx	PM	CO	HC	NOx	PM
	(ppm)	(ppb)	(ppb)	(μg	(ppm)	(ppb)	(ppb)	(μg /m^3)
5	20.53	15.45	3.51	2.21	4.05	15.01	2.15	2.94
10	11.57	9.29	1.99	1.72	3.45	7.85	1.88	2.10
15	8.30	6.99	1.46	1.50	2.93	5.38	1.65	1.71
20	6.48	5.66	1.19	1.36	2.49	4.09	1.44	1.46
25	5.25	4.74	1.02	1.26	2.12	3.28	1.26	1.28
30	4.34	4.04	0.91	1.17	1.80	2.72	1.10	1.14
35	3.63	3.48	0.83	1.10	1.63	2.30	1.06	1.03
40	3.05	3.00	0.77	1.04	1.43	1.98	0.99	0.95
45	2.57	2.61	0.74	1.00	1.24	1.72	0.92	0.87
50	2.17	2.26	0.71	0.96	1.06	1.52	0.85	0.82
55	1.83	1.97	0.70	0.93	0.89	1.35	0.78	0.77
60	1.56	1.72	0.70	0.91	0.76	1.22	0.73	0.74
65	1.33	1.52	0.71	0.89	0.66	1.12	0.69	0.73
70	1.16	1.34	0.73	0.89	0.59	1.05	0.67	0.73
75	1.03	1.21	0.76	0.89	0.56	0.99	0.67	0.74
80	0.95	1.10	0.79	0.89	0.57	0.96	0.70	0.76
85	0.90	1.03	0.83	0.91	0.61	0.94	0.74	0.80
90	0.90	0.99	0.88	0.93	0.70	0.94	0.80	0.86
95	0.93	0.98	0.94	0.96	0.83	0.96	0.89	0.92
100	1	1	1	1	1	1	1	1
105	1.11	1.05	1.07	1.05	-	-	-	-
110	1.25	1.13	1.15	1.10	-	-	-	-
115	1.43	1.23	1.23	1.15	-	-	-	-
120	1.65	1.36	1.32	1.22	-	-	-	-

(Sumber : Design Manual for Road and bridges, volume 11, Environmental Assesment, HMSO, London, 1994)

- Conversion motorcylces to light vehicle
  FPSp Mt x n = FPKr
- Conversion motorcycles to heavy vehicle
  FPSp Mt x m = FPKb

Annotation :

n = The conversion value of motorcycles to light vehicles

m = The conversion value of motorcycles to heavy vehicles

Motorcycle traffic flow is converted to light vehicles and heavy vehicles.

- Traffic light vehicle motorcycle conversion results

$$Vkr = \frac{V_{SP}\ Mt\ x\ FPSp\ Mt}{FPKr}$$

- Traffic heavy vehicle motorcycle conversion results

$$Vkr = \frac{V_{SP}\ Mt\ x\ FPSp\ Mt}{FPKb}$$

Annotation :

VKr = Volume light vehicle motorcycle conversion results
VKb = Volume heavy vehicle motorcycle conversion results
VSp Mt = Motorcycle volume
VPSp Mt = Factors motorcycle pollutants for each type of pollutant from Tabel 3
FPKr = Factors light vehicle pollutants for each type of pollutant from Tabel 3
FPKb = Factors heavy vehicle pollutants for each type of pollutant from Tabel 3

Tabel 3. Conversion Value Motorcycle

No	Parameter	Sepeda Motor	Kendaraan Berat	Kendaraan Ringan	Nilai Konversi
1	HC	956.667	-	356	2.69
2	CO	5.267	-	1.8	2.93
3	PM	0.113	350	-	0.0003

(Origin : Winaryani, 2006)

3. Results and Discussion

3.1. Vehicle Emission

Total emissions of vehicles in zone 1, zone 2 and zone 3 south parking Universitas Muhammadiyah Yogyakarta, for pollutants CO amounted 170.135 ppm,pollutant HC 23359.274 ppb, pollutants PM 3,840, and pollutants NOx 159.466 ppb. Meanwhile, after the shelter has constructed, results of each type of pollutant is smaller that amounted 21.557 ppm for pollutants CO, pollutants HC amounted 2971.058 ppb, pollutant PM amounted 0.501, and for the pollutant NOx 721.911 ppb. It is due to the moda transfer from motorcycles or cars to Trans Jogja so that the difference in the volume of vehicles significantly to emissions of pollutants produced.

3.2. Emission Vehicle Comparison with DIY Ambient Air Quality Standards

Pollutants CO average analytical results before shelter has constructes is 56.7115 ppm, which is where the value of these pollutants have exceeded the ambient air quality standard Yogyakarta. Pollutants CO after existence of shelter is 7.1857 ppm. The number is smaller than the pollutants CO existence of shelter, so the pollutants generated remain below quality standards and can be said to be uncontaminated. For NOx pollutants analysis results by an average is 0.0532 ppm before existence of shelter and NOx pollutants after existence of shelter is 0.0073 ppm. This means that the levels of pollutant NOx for both analysis before and after existence of shelter was still below quality standards. As well as the pollutants PM before and after the existence of shelter was still below quality standards established by the pollutants each 7.6804 ug/ m^3 and 1.0024 ug / m^3. As for the analysis of pollutants HC before existence of shelter is 9.3075 ppm and HC pollutants after existence of shelter is 1.1583 ppm. This shows that the levels of HC emissions is already

above the quality standards set by the Province of Yogyakarta, so it can be said to have been contaminated.

Tabel 4. Jumlah Total Emisi Kendaraan Ringan Sebelum Adanya *Shelter* TransJogja

Interval waktu	Emisi Kendaraan Ringan Zona 1				Emisi Kendaraan Ringan Zona 2				Emisi Kendaraan Ringan Zona 3				Jumlah Emisi Kendaraan Ringan			
	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)
≤ 06:30	0.262	36.934	0.086	3.528	0.439736	63.62107	0.017441	0.591336	0	0	0	0	0.701	100.555	0.104	4.120
06.30 - 07.30	4.637	643.166	0.382	17.375	9.037113	1240.673	0.070382	2.747184	0	0	0	0	13.675	1883.839	0.452	20.122
07.30 - 08.30	2.059	286.856	0.172	7.030	5.084381	689.1494	0.058893	2.732736	0.755915	105.4963	0.013003	0.520128	7.899	1081.502	0.244	10.283
08.30 - 09.30	5.120	710.787	0.305	11.530	20.17939	2712.899	0.10062	4.883424	1.036459	147.1783	0.012315	0.452016	26.336	3570.864	0.418	16.865
09.30 - 10.30	2.677	380.343	0.229	8.553	12.17463	1634.462	0.148367	7.25496	0	0	0	0	14.852	2014.805	0.377	15.808
10.30 - 11.30	3.249	468.905	0.194	6.709	18.58862	2522.627	0.198763	9.139392	1.120214	154.7456	0.013554	0.5676	22.957	3146.277	0.406	16.416
11.30 - 12.30	2.757	388.776	0.138	5.313	8.976378	1218.371	0.036636	1.68216	0.774325	108.4223	0.019298	0.761616	12.508	1715.569	0.194	7.757
12.30 - 13.30	4.643	652.021	0.172	6.687	12.77195	1764.636	0.134848	5.61408	1.21436	173.7012	0.01806	0.643968	18.629	2590.358	0.325	12.945
13.30 - 14.30	2.395	334.088	0.177	7.217	9.045728	1226.271	0.103544	4.782288	0.728327	104.5783	0.011902	0.414864	12.169	1664.937	0.293	12.414
14.30 - 15.30	4.215	590.266	0.285	11.352	12.4348	1705.248	0.125078	5.442768	1.257205	177.5837	0.006226	0.235296	17.907	2473.098	0.416	17.030
15.30 - 16.30	2.901	399.114	0.174	7.534	7.389572	1010.695	0.07795	3.439656	0	0	0	0	10.291	1409.810	0.252	10.973
16.30 - 17.30	3.954	543.976	0.195	8.409	7.192872	1010.668	0.152736	5.919552	1.062166	153.0175	0.011765	0.404544	12.209	1707.661	0.359	14.733
JUMLAH													170.135	23359.274	3.840	159.466
RATA-RATA													56.712	7786.425	1.280	53.155

Tabel 5. Jumlah Total Emisi Kendaraan Ringan Setelah Adanya *Shelter* TransJogja

Interval waktu	Emisi Kendaraan Ringan Zona 1				Emisi Kendaraan Ringan Zona 2				Emisi Kendaraan Ringan Zona 3				Jumlah Emisi Kendaraan Ringan			
	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)	CO (ppm)	HC (ppb)	PM ($\mu g/m^3$)	NOx (ppb)
≤ 06:30	0.047	6.469	0	0	0.04515	6.55802	0.005814	0.197112	0	0	0	0	0.092	13.027	0.005814	0.197112
06.30 - 07.30	0.876	120.963	0	0	0.915053	125.762	0.026393	1.030194	0	0	0	0	1.792	246.725	0.026393	1.030194
07.30 - 08.30	0.391	54.247	0	0	0.519495	70.5457	0.022085	1.024776	0.145601	20.33987	0.005201	0.208051	1.056	145.133	0.027286	1.232827
08.30 - 09.30	0.990	136.965	0	0	2.037719	274.184	0.037733	1.831284	0.198837	28.25245	0.004926	0.180806	3.226	439.402	0.042659	2.01209
09.30 - 10.30	0.510	72.201	0	0	1.246861	167.74	0.055638	2.72061	0	0	0	0	1.757	239.941	0.055638	2.72061
10.30 - 11.30	0.630	90.696	0	0	1.895851	257.725	0.074536	3.427272	0.21515	29.74203	0.005421	0.22704	2.741	378.163	0.079958	3.654312
11.30 - 12.30	0.536	75.364	0	0	0.904455	122.844	0.013739	0.63081	0.149851	21.01101	0.007719	0.304646	1.590	219.219	0.021458	0.935456
12.30 - 13.30	0.909	127.406	0	0	1.299932	179.882	0.050568	2.10528	0.233311	33.39757	0.007224	0.257587	2.442	340.686	0.057792	2.362867
13.30 - 14.30	0.458	63.606	0	0	0.923932	125.483	0.038829	1.793358	0.140023	20.12164	0.004761	0.165946	1.522	209.211	0.04359	1.959304
14.30 - 15.30	0.810	112.985	0	0	1.265526	173.815	0.046904	2.041038	0.240221	33.94101	0.002491	0.094118	2.315	320.741	0.049395	2.135156
15.30 - 16.30	0.558	76.512	0	0	0.752878	103.142	0.029231	1.289871	0	0	0	0	1.311	179.654	0.029231	1.289871
16.30 - 17.30	0.766	105.096	0	0	0.743174	104.717	0.057276	2.219832	0.203582	29.3442	0.004706	0.161818	1.713	239.157	0.061982	2.38165
JUMLAH													21.557	2971.058	0.501	21.911
RATA-RATA													7.186	990.353	0.167	7.304

Tabel 6. Emission Vehicle Comparison Between Before and After the existence of Trans Jogja Shelter with DIY Ambient Air Quality Standards

No	Polutan	Baku Mutu	Jumlah Polutan Sebelum Adanya Shelter Trans Jogja	Jumlah Polutan Setelah Adanya Shelter Trans Jogja
1	Karbon Monoksida (CO)	35 ppm	56.7115	7.1857
2	Nitrogen Oksida (NOx)	0.212 ppm	0.0532	0.0073
3	Hidrokarbon (HC)	0.24 ppm	9.3075	1.1583
4	Partikulat Matter (PM)		7.6804	1.0024

(Origin : Keputusan Gubernur DIY (No. 153 Tahun 2002) dan hasil penelitian)

4.Conclusion

The greater the volume of vehicles the pollutant emissions of air pollutants generated will increase and it will affect the level of air pollution that occurs.

Emission vehicles before existence Trans Jogja shelter from the calculation results can be concluded that the amount of emissions that occur for pollutants CO and HC have exceeded air quality standards set by Yogyakarta Governor Decree No. 153 of 2002 in the amount are 56.1755 ppm and 9.3075 ppm. However, with the provision of shelter Trans Jogja as a substitute mode of transportation in Universitas Muhammadiyah Yogyakarta, especially for students who move from a motorcycle or a car will be able to reduce pollutants emitted from exhaust emissions from motor vehicles on campus, especially in the parking area south zone Universitas Muhammadiyah Yogyakarta ,

From the evaluation of pollutant emissions to the ambient air quality standard of Yogyakarta Special Region can be said that the parking zone area south of Universitas Muhammadiyah Yogyakarta before existence of shelter Trans Jogja been contaminated by pollutants of 56.1755 ppm CO and HC at 9.3075 ppm and after existence shelter Trans Jogja parking area south zone of the campus was still contaminated by pollutants HC amounted to 1.1583 ppm.

5.Acknowledge

Thanks to Mr. Muchlisin, ST., M.Sc which has provided direction and guidance as well as a correction in this study. And thanks to transport team members who have worked with and provide assistance finest.

6.Reference

Chambers, LA (1976) classification and extent of air pollution problems. Sn. AC Stern(Ads), Air Pollution, 3 rd ed, volume 1 New York : Academic Press

Fardiaz, S, 1992, *Polusi Air dan Udara*, Kanisius, Yogyakarta.

Murwono, D, 2008, *Transport and Environmental Planning,* Magister Sistem dan Teknik Transportasi Fakultas Teknik Universitas Gadjah Mada, Yogyakarta

Oktafiando, 2016, *Analisis Pengaruh Karakteristik Parkir Terhadap Rencana Pengadaan Shelter Trans Jogja di Universitas Muhammadiyah Yogyakarta (Studi Kasus Parkir Zona Selatan Universitas Muhammadiyah Yogyakarta)*, Tugas Akhir Jurusan Teknik Sipil Universitas Muhammadiyah Yogyakarta, Yogyakarta.

Pemerintah Daerah Istimewa Yogyakarta. 2002, Keputusan Gubernur Daerah Istimewa Yogyakarta Nomor 153 tahun 2002, tentang Baku Mutu Udara Ambien Daerah Istimewa Yogyakarta, Yogyakarta.

Republik Indonesia, 1999, Peraturan Pemerintah Tentang Pengendalian PencemaranUdara, Jakarta

Sari, 2016, *Analisis Probabilitas Perpindahan Moda dari Kendaraan Pribadi ke Bus Trans Jogja Menggunakan Analisis Regresi Logit Biner (Studi Kasus Parkir Zona Selatan Universitas Muhammadiyah Yogyakarta)*, Tugas Akhir Jurusan Teknik Sipil Universitas Muhammadiyah Yogyakarta, Yogyakarta.

Winaryani, 2006, *Analisa Emisi Gas Buang Kendaraan Bermotor Akibat Arus Lalu Lintas (Studi Kasus Pada Ruas Jalan Magelang Yogyakarta),* Tugas Akhir Jurusan Teknik Sipil Universitas Muhammadiyah Yogyakarta, Yogyakarta.

Yulifianti, 2004, *Tingkat Pencemaran Udara Di Lingkungan kampus Universitas Gadjah Mada (Lokasi Penelitian : Simpang Magister Manajemen dan Fakultas Hukum),* Skripsi tidak diterbitkan. Tugas Akhir Jurusan Teknik Sipil Universitas Gadjah Mada, Yogyakarta.