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Atmospheric Pollution due to Road Traffic Case of the Greater Casablanca Region

HADER Khadija[1] and Lahcen BAHI[2]

1. Research Laboratory for the Quality of Air and the Water, Section of Environment, Mohammadia School of Engineers (EMI), B.P. 765 Agdal, Rabat, Morocco

2. The Director of the Centre Doctoral Studies and the Responsible of the Applied Geophysics Laboratory, the Engineering Geology, and the Environment, Mohammadia School of Engineers (EMI), B.P. 765 Agdal, Rabat, Morocco

Abstract: In the Greater Casablanca, road transport is the second largest emissions source of gaseous pollutants and particles after the industry [1]. The emitters are mobile and include different categories of vehicles in circulation, in the road network of the region [2]. Air emissions from road transport considered in this study are the exhaust emissions from combustion of fuel during vehicle movement. This is mainly SO_2 (sulfur dioxide), NO_x (nitrogen oxides), CO (carbon monoxide), CO_2 (carbon dioxide), SP (suspended particulate) [3], VOC (volatile organic compounds), benzene, lead Pb and cadmium. These emissions depend mainly on the technology of the vehicle (type, fuel, engine size, and age), the vehicle speed, the engine temperature and ambient temperature [4].

Key words: Atmospheric pollution, road traffic, NO_2, SO_2, CO.

Nomenclature

0.45	The region of Greater Casablanca;
LS	Linear sources;
DRCR	Direction of roads and road traffic;
UDP	Urban displacement plan

1. Introduction

The transport sector is an essential link in the development of national and regional economy [5]. However this sector, particularly road transport, weighs heavily in the overall assessment of the emissions of substances involved in air pollution. In this study we will get hold of the causes behind this kind of pollution, while studying the nature, type and concentration of each pollutant by (PREFECTURE/ MUNICIPALITY).

2. Road Network of the Region of Greater

The road network of the RGC is a relatively dense network which extends over 644 km long [6] distributed between:

- Highway: 64 km
- National road: 103 km
- Regional road: 70 km
- Provincial road: 404 km

3. Road Traffic of the RGC

The estimation of air emissions associated with the linear sources in the region [7], is based on traffic counts for characterizing the intensity of the daily flow of the traffic on urban and interurban roads in the RGC for each type of vehicle.

3.1 Interurban Road Traffic

The results of traffic counts at the national interurban network and highway carried out continuously give at RGC:

- The annual average daily traffic of vehicles in all categories identified by 24 counting stations on national, regional and provincial roads located within the region. According to DRCR, about 70% of this traffic is due

Corresponding author: HADER Khadija, engineer, research fields: geographic information systems, the air quality, the water quality and medical waste.

to light vehicles and 30% for heavyweight [8];

• The average daily traffic of light vehicles and heavyweight raised by 7 tollbooths Highway Casablanca—Settat and Highway Casablanca bypass.

The DRCR counts cover a network interurban about 334 km or 52% of the length of interurban road network of the RGC.

3.2 Urban Road Traffic

Urban traffic is the subject of the traffic counts by vehicle category performed in the major urban roads in the region as part of the study of UDP (Urban Displacement Plan) of the RGC [9].

• The results of the counts carried out over 24 hours allowed to observe that the traffic flowing from 22:00 to 6:00 represents 5% of total daily traffic of the business day and 7% on Saturday.

• The results of the counts between 06:00 and 22:00 show that the traffic in the morning peak period (7:30 to 10:30) represents 21.1% of the volume of 24 hours to Tuesday, and 19.3% for Saturday.

Counts cover a network of approximately 292 km, or 25% of the length of the avenues and boulevards of the RGC.

4. Results

The distribution of pollutants by prefecture and municipality [10]:

Table 1 Distribution of the emission of pollutants by prefecture/municipality.

Prefecture/Municipality	CO_2		SO_2		NO_X		CO	
	t/year	%	t/year	%	t/year	%	t/year	%
Casablanca-Anfa	63,468	10,4%	269	9%	344	9%	1,689	15%
MersSultanElFida	28,882	4,7%	121	4%	156	4%	824	7%
Ain SebaaHayMohammadi	76,114	12,5%	344	12%	433	11%	2,024	18%
Hay hassani	13,641	2,2%	61	2%	80	2%	327	3%
AinChock	24,385	4,0%	117	4%	154	4%	379	3%
Sidi Bernoussi	76,452	12,6%	374	13%	483	13%	1,127	10%
BenM'sick	27,208	4,5%	129	4%	167	4%	505	4%
Moulay Rachid	36,652	6,0%	169	6%	224	6%	674	6%
Pachlik Mechouar	4,208	0,7%	18	1%	23	1%	103	1%
Sous-total Casablanca	**351,010**	**57,6%**	**1,602**	**56%**	**2,065**	**55%**	**7,653**	**68%**
Mohammedia	11,987	2,0%	60	2%	81	2%	142	1%
Ain harrouda	12,620	2,1%	61	2%	79	2%	230	2%
Sidi moussa benali	8,394	1,4%	43	1%	58	2%	79	1%
Sidi moussamajdoub	6,991	1,1%	36	1%	48	1%	66	1%
Bniyakhlef	16,533	2,7%	85	3%	113	3%	172	2%
Echellalate	38,627	6,3%	203	7%	257	7%	366	3%
Sous-total Mohammedia	**95,153**	**15,6%**	**488**	**17%**	**635**	**17%**	**1,055**	**9%**
Mediouna	3,455	0,6%	17	1%	22	1%	56	1%
Tit Mellil	4,358	0,7%	21	1%	27	1%	81	1%
Lahraouiyine	9,268	1,5%	48	2%	57	2%	139	1%
Mejjatia-ouledtaleb	15,809	2,6%	77	3%	101	3%	263	2%
Sidi hajaj-Oued hassar	24,426	4,0%	119	4%	155	4%	444	4%
Soustotal Mediouna	**57,316**	**9,4%**	**283**	**10%**	**361**	**10%**	**983**	**9%**
Bouskoura	37,508	6,2%	184	6%	245	6%	553	5%
Dar Bouaza	36,851	6,0%	175	6%	242	6%	617	5%
Nouacer	12,617	2,1%	60	2%	90	2%	165	1%
OuledSalah	18,721	3,1%	89	3%	130	3%	241	2%
Sous-total Nouaceur	**105,697**	**17,4%**	**508**	**18%**	**706**	**19%**	**1,577**	**14%**
Total	609,175	100,0%	2,881	100%	3,768	100%	11,268	100%

Prefecture/Municipality	MPS		Pb		Benzene		VOC	
	t/year	%	kg/year	%	kg/year	%	t/year	%
Casablanca-Anfa	66	9%	22,8	13,5%	19889	15%	399	14%
MersSultanElFida	31	4%	10,6	6,3%	11245	9%	220	8%
Ain SebaaHayMohammadi	87	12%	23,9	14,2%	29405	22%	602	21%
Hay hassani	16	2%	4,3	2,6%	3,788	3%	95	3%
AinChock	29	4%	6,5	3,9%	4,040	3%	97	3%
Sidi Bernoussi	91	13%	19,1	11,3%	11,694	9%	269	9%
BenM'sick	32	5%	7,5	4,5%	6,947	5%	142	5%
Moulay Rachid	42	6%	10,9	6,5%	8,628	7%	179	6%
PachlikMechouar	4	1%	1,4	0,8%	1,088	1%	23	1%
Sous-Total Casablanca	**401**	**56%**	**107,0**	**63,5%**	**96,723**	**74%**	**2,025**	**71%**
Mohammedia	14	2%	2,7	1,6%	946	1%	23	1%
Ain harrouda	15	2%	3,3	2,0%	2,896	2%	62	2%
Sidi moussa benali	11	2%	1,7	1,0%	377	0%	14	0%
Sidi moussamajdoub	9	1%	1,4	0,9%	314	0%	12	0%
Bniyakhlef	20	3%	3,4	2,0%	823	1%	26	1%
Echellalate	48	7%	7,2	4,3%	1,553	1%	56	2%
Sous-totalMohammedia	**117**	**16%**	**19,8**	**11,7%**	**6,907**	**5%**	**193**	**7%**
Mediouna	4	1%	0,8	0,5%	829	1%	17	1%
Tit Mellil	5	1%	1,1	0,7%	1,184	1%	24	1%
Lahraouiyine	11	2%	1,8	1,1%	1,792	1%	37	1%
Mejjatia-ouledtaleb	20	3%	3,9	2,3%	3,855	3%	79	3%
Sidi hajaj - Oued hassar	31	4%	6,2	3,7%	6,954	5%	139	5%
Sous-total Mediouna	**72**	**10%**	**13,9**	**8,3%**	**14,615**	**11%**	**297**	**10%**
Bouskoura	42	6%	9,2	5,5%	3,177	2%	116	4%
Dar Bouaza	46	6%	10,1	6,0%	7,571	6%	172	6%
Nouacer	14	2%	3,4	2,0%	838	1%	21	1%
OuledSalah	20	3%	5,1	3,0%	937	1%	26	1%
Sous-totalNouaceur	122	17%	27,8	16,5%	12,522	10%	336	12%
Total	711	100%	169	100,0%	130,768	100%	2,851	100%

5. Discussion

The road transport sector is the origin of the emissions from passenger cars and commercial vehicles in the first place. It is the main emitter of benzene and CO, as he takes relatively large share in NO_x emissions, VOC, MPS and CO_2, and less important SO_2 and heavy metals. A small share of emissions of VOCs in the road transport sector is due to evaporation of petrol in service stations. Ordinarily, road transport emissions depend on the type of fuel used and the age and speed of vehicles. Thus:

- The petrol vehicles emit more NO_x, CO, VOC and diesel vehicles. Conversely, these emit more SO_2 than gasoline vehicles;
- Only gasoline vehicles are the source of Pb emissions from road transport;
- NO_x emissions increase with speed;
- Emissions of pollutants from road transport decrease with fleet renewal, represented by vehicles less polluting.

6. Conclusion

Emissions from road transport are largely rejected in territorial units characterized by a diffuse dense urban traffic and an important interurban traffic. This is the case of the prefectures of the districts of Casablanca-Anfa and Ain Sebaa-Hay Mohammadi, the prefecture of Mohammadia and Mediouna provinces and Nouacer [11].

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