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AN ANALYSIS OF DIESEL EXHAUST IN RURAL TRANSPORT SYSTEM

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Abstract: *Diesel engine emissions are a mixture of gases, vapors, liquid aerosols and substances made up of particles. They contain the products of combustion including carbon, nitrogen, water, carbon monoxide, aldehydes, oxides of nitrogen, oxides of sulphur, polycyclic aromatic hydrocarbons etc., The carbon particle content varies from 60% to 80% depending on the fuel used and the type of engine. The quantity and composition of diesel fumes in the workplace may vary depending on the quality of diesel fuel used, the type of engine, the state of engine tuning, the fuel pump setting, the workload demand on the engine, the engine temperature and maintenance of the engine. Workers exposed to high concentrations of diesel exhaust have reported the short-term health symptoms like cough, irritation of the eyes, nose and throat, light headedness, heartburn headache, weakness, numbness and tingling in extremities, chest tightness, wheezing, vomiting, etc., In the present study focused mainly on the nature of the work and the diseases related to diesel exhaust. From the study it was found out that there is a close co-relation between the maintenance of the buses and diesel exhaust.*

Keywords: *respiratory, diesel exhaust, transport, maintenance, emission*

INTRODUCTION

Diesel engines provide power to a wide variety of vehicles, heavy equipment, and other machinery used in a large number of industries including mining, transportation, construction, agriculture, maritime, and many types of manufacturing operations. The exhaust from diesel engines contains a mixture of gases and very small particles that can create a health hazard when not properly controlled. All transport systems have diesel engine. Diesel engines are a mixture of gases, vapors, liquid aerosols and substances made up of particles. They contain the products of combustion including carbon, nitrogen, water, carbon monoxide, Aldehydes, oxides of nitrogen, oxides of sulphur, polycyclic aromatic hydrocarbons [1-8]. The carbon particle content varies from 60% to 80% depending on the

fuel used and the type of engine [9-14]. Most of the contaminants are adsorbed onto the soot. Most of the carbonaceous matter formed (80% to 98%) is oxidized during combustion, most likely by hydroxyl radicals [15]. The quantity and composition of diesel fumes in the workplace may vary depending on the quality of diesel fuel used, the type of engine, the state of engine tuning, the fuel pump setting, the workload demand on the engine, the engine temperature and maintenance of the engine. Workers exposed to high concentrations of diesel exhaust have reported the short-term health symptoms like cough, irritation of the eyes, nose and throat, light headedness, heartburn headache, weakness, numbness and tingling in extremities, chest tightness, wheezing, vomiting, Although there have been relatively few studies on the long-term health effects of diesel exhaust, the available studies indicate that diesel exhaust can be harmful to our health [16-19].

According to the National Institute for Occupational Safety and Health (NIOSH) diesel exhaust should be treated as a human carcinogen (cancer causing substance) [20]. These findings are not surprising since several substances in diesel exhaust are known to cause cancer. It may take many years after the first exposure for diesel-related cancer to develop. Exposure to diesel exhaust in combination with other cancer causing substances may increase your risk of developing lung cancer even more [21]. Other exposures that are known to cause lung cancer include cigarette smoke, welding fumes and asbestos. All of these exposures may interact with diesel exhaust to magnify your risk of lung cancer and should be kept to a minimum.

Some studies have suggested that workers exposed to diesel exhaust are more likely to have chronic respiratory problems (such as persistent cough and mucous) bronchitis and reduced lung capacity than unexposed workers. People with preexisting diseases, such as emphysema, asthma and heart disease, may be more susceptible to the effects of diesel exhaust [22-24]. All these studies reveal that the adverse effects of diesel are closely correlated with the respiratory problems among the workers in transport industry. Hence the present study focuses mainly on the maintenance and replacement of buses.

METHODS

The data was collected for the buses from the depots of Tamilnadu State Transport Corporation of Sivagangai and Ramnad districts and the head quarters were at Karaikudi. The Karaikudi headquarter covered the several branches and are Paramakudi, Ramanathapuram, Rameswaram, Mudukulathur, Kamuthi, Karaikudi, Sivagangai, Devakottai

and Thirupathur. There are 248 private emission testing centers are available. One among them is Rajamalligai emission testing center, Paramakudi. The secondary data have been collected from the sources available with the organization itself. They are Emission test reports from Rajamalligai emission testing center, Paramakudi, Booklets, Library sources and other magazines.

The statistical methods used in the study are Simple percentage method, H-test, and U Test The aim of the study was to collect the secondary data related to the emission test (smoke test) from the Paramakudi emission testing center, to analyze the collected secondary data statistically, to provide the suitable suggestions to wear the proper personnel protective Equipments during working hours.

RESULTS AND DISCUSSION

The emission test is the most important component in the life cycle of a bus. There are several factors that decide the life cycle of the bus. Diesel exhaust lead to severe environmental pollution, emission test is considered to be one among the prime concern in transport industry. Based on the RPM level the buses will be assessed. The allowed RPM level of vehicles is 1080. The vehicles will be passed from the emission test only when the RPM level is 1080 and above 1080. If the value is lesser than the RPM level 1080 then the vehicles will be rejected during the emission test.

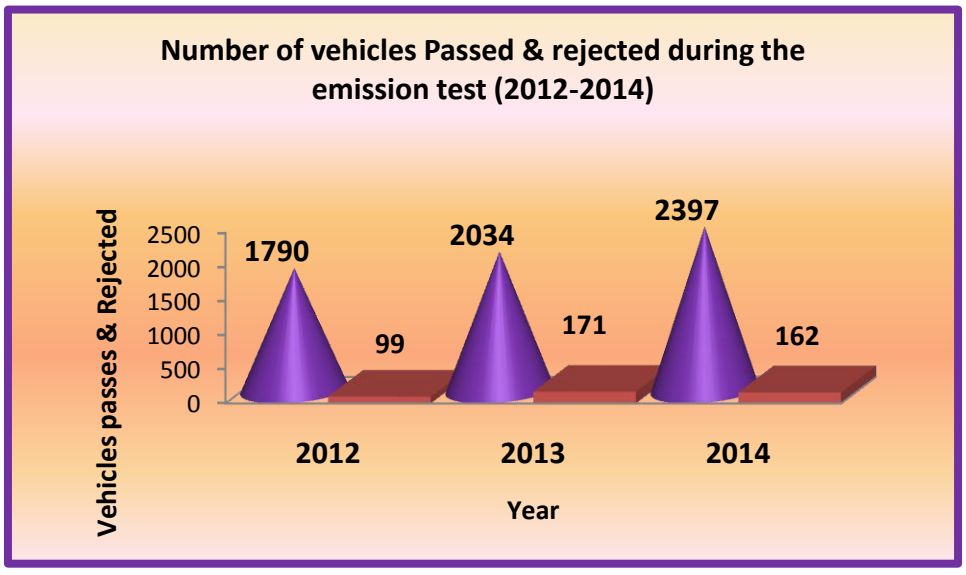

Figure -1 Number of vehicles Passed & rejected during the emission test (2012-2014)

In this study the number of vehicles passed and rejected during emission test at allowable RPM level 1080 during 2012-2014 was taken. From the table-1 it was quite understood that during the years 2012, 2013 and 2014 the number of vehicles passed from the emission test

are 1790, 2034 and 2097 and the number of vehicles rejected from the emission test are 99,171 and 161 respectively.

The secondary data related to maintenance of vehicles were collected from the files of Rajamalligai emission testing center and analysed statistically. The significant difference between smoke test of vehicle and the years (2012, 2013and 2014) was analysed using H – Test. The Hypothesis framed was:

H_o: There is no significant difference between smoke test of vehicle and the years (2012, 2013 and 2014)

Table -1 Smoke test of vehicle and the years (2012, 2013and 2014)

Month	2012	R1	2013	R2	2014	R3
January	81	2	94	4	158	13
February	140	8	174	16	181	20
March	196	25	145	10	221	29.5
April	189	23	178	17.5	237	32
May	188	22	169	15	240	35
June	198	26	235	31	239	34
July	207	28	238	33	253	36
August	159	14	221	29.5	179	19
September	65	1	124	7	157	12
October	92	3	154	11	144	9
November	97	5	112	6	186	21
December	178	17.5	190	24	202	27

The H value was calculated as follows:

R1=174.30 R2=204 R3=287.5

$$H = \frac{12}{(N+1)}\left(\frac{R1^2}{N1} + \frac{R2^2}{N2} + \frac{R3^2}{N3}\right) - 3(N+1)$$

$$= \frac{12}{36*37}\left[\frac{(174.5)^2}{12} + \frac{(204)^2}{12} + \frac{(287.5)^2}{12}\right]$$

$$= \frac{12}{1332}[2537.52 + 3468 + 6888.02]$$

$$= \frac{12}{1332}[12893.54]$$

$$= 116.158 - 3(37)$$

$$= 116.156 - 111$$

H= 5.156

Here Degrees of freedom is k-1 = 2-1 = 1, hence the table value of H test is 3.841.

The calculated value is greater than the table value. Therefore the null hypothesis was rejected. Therefore it was concluded that there is a significant difference between the maintenance and the years.

The U- Test was carried out to compare RPM Level of passed vehicle and rejected vehicle over the years (2012-2014) during Emission Test. The hypothesis framed was:

H_o: There is no significant difference between RPM level of passed vehicle and rejected vehicle over the years of 2012-2014 during emission test.

Z = (U-Mean)/S.D

Mean = 4.5, S.D=2.161

Z = -2.082

Table value is 1.96

The calculated value is lesser than the table value. Hence there is no significant difference between RPM level of passed vehicle and rejected over the years of 2012 to 2014 during emission test.

The trend analysis was carried out by Least Square method. During the analysis, the straight line obtained is:

a= $\frac{\sum y}{N}$ =$\frac{6221}{3}$ =2073.66

b= $\frac{\sum xy}{\sum x2}$ =$\frac{607}{3}$ =303.50

So the trend curve in 2012 to 2013 period changes is constant in absolute RPM level.

Y=2073.66+303.50X

For 2015=2073.66+303.50(2) =2680.66 the maintenance of vehicle with RPM is 2680.66

For 2016=2073.66+303.50(3) =2984.16 the maintenance of vehicle with RPM is 2984.16

For 2017=2073.66+303.50(4) =3287.66 the maintenance of vehicle with RPM is 3287.66

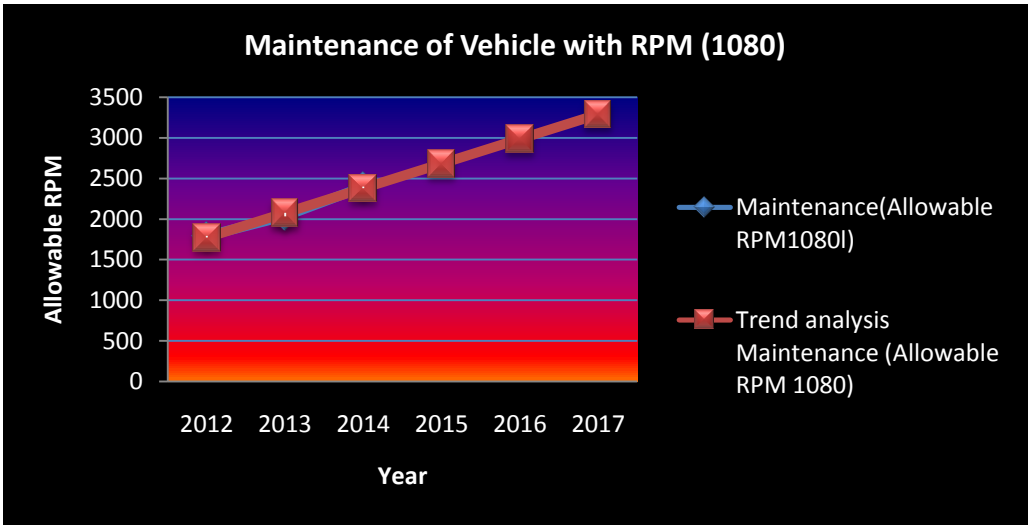

Figure -2 Maintenance of vehicles in Paramakudi division between higher RPM level of vehicle and years

The number of rejected vehicles over the years 2012- 2014 was known. From that the number of vehicles will be rejected in near future was calculated using the trend analysis.

The equation of the straight line trend Y=a + bx

a= $\frac{\sum y}{N}$ =432/3 =144

b= $\frac{\sum xy}{\sum x2}$ =63/2 =31.5

Y_{2012} = 144+31.5(-1)=112.50

Y_{2013} = 149+31.5(0)=144.00

Y_{2014} = 144+31.5(1)=175.50

Y_{2015} = 144+31.5(2)=207.00

Y_{2016} = 144+31.5(3)=238.50

Y_{2017} = 144+31.5(4)=270.00

So the trend curve in 2012 - 2013 period increases in absolute RPM level. The trend analysis shows that in 2017 more number of (nearly 270) vehicles will be rejected during emission test.

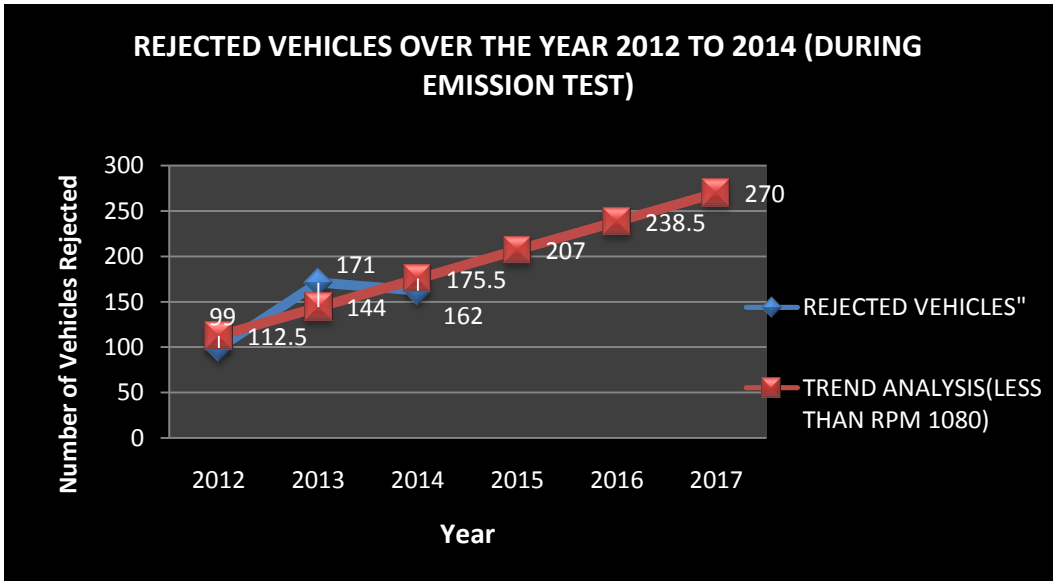

Figure -3 Rejected vehicles during the year 2012 to 2014 (during emission test)

CONCLUSION

The emission test is the most important component in the life cycle of a bus. There are several factors that decide the life cycle of the bus. Diesel exhaust lead to severe environmental pollution, emission test is considered to be one among the prime concern in transport industry. Based on the RPM level the buses will be assessed. The allowed RPM

level of vehicles is 1080. The vehicles will be passed from the emission test only when the RPM level is 1080 and above 1080. If the value is lesser than the RPM level 1080 then the vehicles will be rejected during the emission test. If new regulations and technology to reduce Diesel Engine Emissions are fully implemented the emission from the diesel engines will be minimized.

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