Noise reduction of passenger cars due to maintenance activities

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Noise reduction of two types of passengers cars due to some maintenance activities has been studied. The noise levels of the cars were measured before and after maintenance activities in service stations, as per the standard stationary test. A total of 91 cars were tested. The results of the measurements indicated that the routine maintenance activity of servicing and tuning resulted in an average noise reduction of about 1 dB(A). Noise reduction was greater in the case of the cars with specific problems such as in silencer, water pump and tappet. The rectification of a silencer problem resulted in an average reduction of about 5 dB(A) whereas about 3 dB(A) noise reduction was measured due to the rectification of water pump and tappet problems.

1. Introduction

Passenger cars are one of the main contributors to city road traffic noise. The noise from a car is generated by its engine, body, gears and tires [1,2]. At normal speeds, the engine is usually the major source of car noise. The noise generated by an individual car is measured as per a standard pass-by test [3] in which the maximum noise at 7.5 metres distance from road centre line, is measured when the car under test passes a start and an end line on the road. The car is to be given full acceleration during this test. The noise of the cars in use can also be assessed by a stationary test [4]. This test is easier to perform as it does not require a test track. In this test method, the noise of stationary car is measured at two locations "a" and "b" (Figure 1) at constant engine speed.

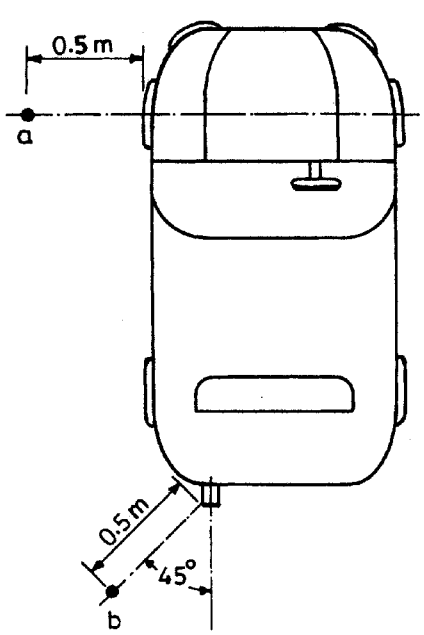

Figure 1. Location of car noise measurement points

The noise generated by cars is expected to reduce after their servicing and maintenance. The present work deals with quantification of such noise reduction. Two types of cars – a four cylinder (1100 cc) and a three cylinder (800 cc) car have been used in the present study. These have been referred to as car X and car Y respectively. The noise generated by these cars has been measured before and after maintenance using the stationary test method to study their noise reduction.

2. Methodology

Noise levels of both types of cars was measured in service centres with their engine running in idle. The speed was monitored and was maintained constant before and after maintenance of the cars. Care was taken that there was no wall/reflecting surface within 3 metres of the body of the cars and that there was no other noisy activities in the service centres during the measurements. Overall A-weighted sound pressure levels were measured at locations "a" and "b" (Figure 1) with the help of a precision sound level metre (B&K 2215). The height of the microphone was 0.5 metre and 0.2 metre above the ground for location "a" and "b" respectively. Most of the cars tested were those that came in for general servicing and tuning. Some cars with specific problems in silencer water pump and tappet were also tested.

3. Results and discussions

The results of the noise measurements of the cars for locations "a" and "b" are given in Tables 1 and 2 respectively.

As mentioned earlier, most of the cars tested, came in for servicing and tuning (car X - 26 nos. and car Y - 43 nos.). The noise at location "a" is more than at location "b". Table 1 shows that the average noise level at location "a" before servicing and tuning is 66.9 dB(A) for car X and 64.2 for car Y. As expected, in case of silencer problem, the initial noise level is the highest. The noise reduction due to servicing and tuning is 1 dB(A). Since a large number of cars were tested before and after servicing and tuning, the distributions of noise reduction due to this maintenance activity have been plotted and are shown in Figures 2 to 5. The noise reduction after servicing and tuning of cars is mainly due to tuning – proper adjustment of air fuel mixture in carburettor, change of oil, cleaning of air intake filter and greasing/lubrication of rotating/moving parts.. This is not a specific problem for which a car is brought to service station but a routine preventive maintenance activity.

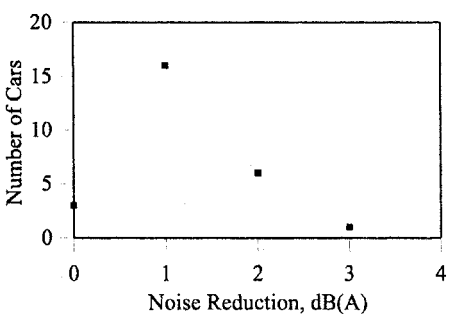

Figure 2. Noise reduction of car X due to servicing and tuning (location "a")

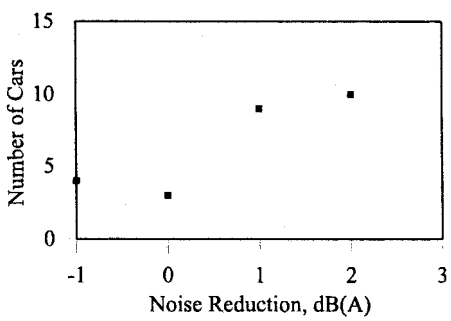

Figure 3. Noise reduction of car X due to servicing and tuning (location "b")

Table 1. Noise reduction of cars at location "a"

Maintenance Activity	Car X			Car Y		
	Total number of cars	Mean initial noise level dB(A)	Mean noise reduction dB(A)	Total number of cars	Mean initial noise level dB(A)	Mean noise reduction dB(A)
Servicing and tuning	26	66.9	1.2	43	64.2	1.0
Silencer problem rectification	6	70.3	5.3	2	68.5	4.5
Water pump problem rectification	5	68.6	2.6	–	–	–
Tappet problem rectification	9	67.3	2.9	–	–	–

Table 2. Noise reduction of cars at location "b"

Maintenance Activity	Car X			Car Y		
	Total number of cars	Mean initial noise level dB(A)	Mean noise reduction dB(A)	Total number of cars	Mean initial noise level dB(A)	Mean noise reduction dB(A)
Servicing and tuning	26	64.1	1.0	43	61.7	0.95
Silencer problem rectification	6	67.7	5.2	2	65.5	3.5
Water pump problem rectification	5	66.6	2.8	–	–	–
Tappet problem rectification	9	65.3	3.0	–	–	–

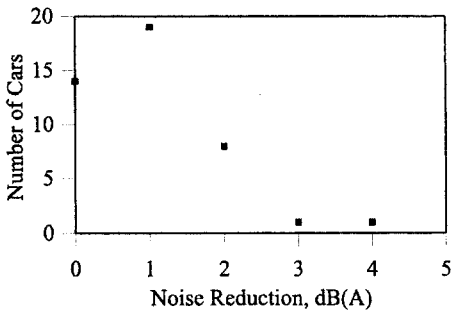

Figure 4. Noise reduction of car Y due to servicing and tuning (location "a")

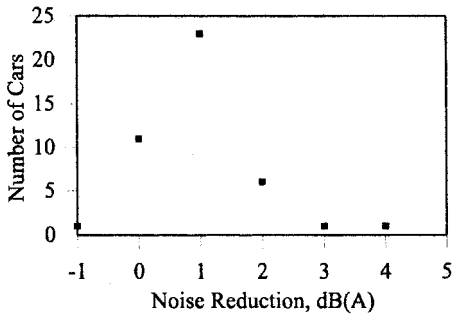

Figure 5. Noise reduction of car Y due to servicing and tuning (location "b")

In the case of cars with silencer problems, a reduction of around 5 dB(A) in noise level has been measured. The problems included, broken silencer clamps/loose silencer, leakage in silencer due to corrosion etc. and inner sound absorbing material burnt. Water pump and tappet problem rectification resulted in noise reduction of about 3 dB(A) (Table 1 and 2). The water pump problems reported were: worn bearing, impeller cracks, broken fan and leaking seals. The noise reduction related to tappet was due to the adjustment of valve stem clearance and setting of rocker arm point.

4. Conclusions

The noise reduction of two types of passenger cars in stationary test has measured as a result of some maintenance activities. Due to the routine servicing and tuning the noise reduction was about 1 dB(A). The noise reduction due to rectification of some specific problems was also measured. The rectification of silencer problem resulted in a reduction of about 5 dB(A) whereas about 3 dB(A) noise reduction was measured due to the rectification of water pump and tappet problems.

Acknowledgement

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References

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2. *Priede, T., Road vehicle noise, Chapter 18, Noise and Vibration, Ed. White, R. G. and Walker, J. G., Ellis Horwood Ltd., Chichester, 1982.*

3. *ISO R362, Measurement of noise emitted by vehicles.*

4. *ISO 5130, Measurement of noise emitted by stationary road vehicles – Survey method.*

QTD

The joint Boeing and Rolls Royce "Quiet Technology Demonstrator" (QTD), a modified Rolls Royce Trent 800 engine on a B777-200 ER completed its flight tests recently. Takeoff jet exhaust noise was reduced by up to four decibels and inlet fan noise by up to 13 decibels. Although the purpose of the QTD program was to reduce noise heard on the ground, levels within the cabin registered reduction of forward cabin buzz-saw noise by seven decibels. These successful tests mark one of the final stages before QTD noise reduction technology is implemented in service.