Effect of Vibration Due to Two Wheeler Driving

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Abstract : *In general two wheeler vehicles are one of the popular vehicle in city transport. Two wheeler vehicles are exposed to vibrations due to irregular surface of roads. This affects the health as well as discomfort of the driver and passengers. The oscillations are transferred into the body of driver and passenger through the body tissues, organs and systems of the individual causing various effects on the structures within the body before it is dampened and dissipated. From literature survey reveals that vibrations are most hazardous to the health if it exceeds the limit. In the present work the experimental analysis is carried out. To measure the magnitude of the vibrations acting on driver as well as passenger for the different road profile at different speed. The methodology adopted is as per the International Organization for Standardization (ISO) guidelines for whole body vibration (WBV) exposure having frequency ranges from 0 to 100 Hz. The study emphasis on vibration tests for different road and speed conditions by referring, ISO 2631 and human comfort charts*

I. INTRODUCTION

All vehicles are exposed to vibrations because of unevenness of the road or soil Profile, moving elements within the machine. Increased vehicle speed and engine capacity produce a lot of vibration problems which affects the vehicle life span. This has also resulted in increased number of people getting affected by whole-body vibrations during transportation. These vibrations are known to have effects such as sensory responses like discomfort, injuries and health issues. Human response to whole body vibration is very complex and nonlinear in nature. There are a number of standards which provide guidelines for measurement and evaluation of whole-body vibration such as ISO 2631 or BS 6841.[2] The vibrations generated in two wheeler vehicle produce Mechanical Damage, Physiological Response, & Subjective Responses to humans. Human Engineering deals with various effects of vibrations on the different parts of human body. The present paper highlights the effect of vehicle vibration on human body. This data is also useful in vehicle design & dynamic analysis of vehicle.

The vehicle vibration produces physiological effect on humans. The evidence suggest that short time exposure to vibration causes small physiological effects such as increase in heart rate, increase in muscle tension long term exposure to vibration causes effects such as disk to spine & effects on digestive system peripheral veins & the female reproductive organ. When spring supported mass such as that of a motor vehicle chassis is given an impulse, it is set in to vibratory motion & it keeps on vibrating until the energy of the impulse completely dies out in overcoming damping forces. There are different sources of vibration of vehicle i.e. road roughness, the unbalance of the engine, whirling of shafts the cam forces & tensional fluctuations etc. Depending upon the cause the vibration may be free or forced. The free vibration may occur when the vehicle passes over an isolated irregularity in the road surface, which may die off as a result of dissipation of energy in damping. the forced vibration may result when disturbances occur persistently such as passing over obstacles on a proving road.

In this case even if there may be damping, the vibration may persist & build up an undesirable level.

II. EXPERIMENTAL METHODOLOGY

The whole experiment was conducted with a two wheeler on different road profiles having different road conditionsin Coimbatore, India. Out of two road conditions firstly rough road is selected on each road; two speed conditions are selected (10 kmph, 20 kmph, 30Kmph). Then on rough road two wheeler is run for constant speed of 10 Kmph and then readings are taken. After this the readings are taken for 20 kmph & 30 Kmph. Then same procedure is follow for next road conditions. The driver had driven the two wheeler on the road profile having rough, urban road condition and Bumpy road condition .Two minutes of vibration data were recorded by FFT analyzer while operating the vehicle as shown in fig 1. The data for particular time span is selected and graphs are plotted with the help of MS – excel Software. Finally these graphs are used for analysis work

Fig 1.Module

The bellow fig. 2 shows that it is rough road on this road condition different readings are taken at different speed conditions which have been already explained in experimental methodology.

Fig 2.Rough road

The bellow fig. 3 show that it is urban road i.e. town road condition, on this road different readings are taken at
different speed conditions and the road is smooth so reading obtained are efficient than rough road condition.

Fig 3.Urban road

III. RESULT

For analyzing effect of speed condition on acceleration level, speed condition of vehicle is taken on x-axis & acceleration level corresponding to that speed is taken on Y-axis & then graphs are plotted with MS – excel Software. By observing fig. 4, it is clear that the acceleration level for two wheeler vehicle increases from 10 to 20 kmph & then decreases as speed increases for state highway. Change in acceleration level is slowly decreased as speed increases

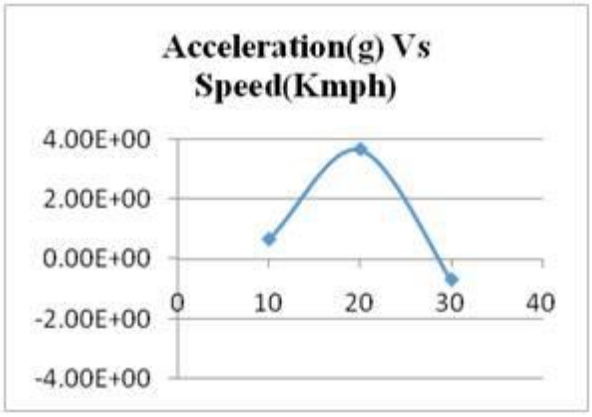

Fig.4 Acceleration(g) Vs Speed(Kmph)

fig. 5 shows that the graphical representation in between time and acceleration. The acceleration level is on y-axis and time is on x- axis

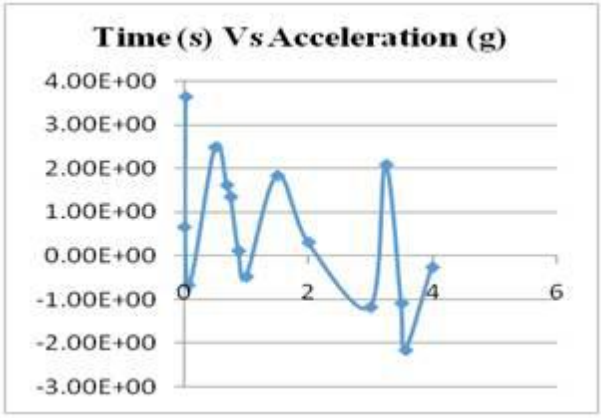

Fig.5 Time (s) Vs Acceleration (g)

Vibration	Reaction
Less than 0.315m/s2	Not uncomfortable
0.315 to 0.63m/s2	A little uncomfortable
0.5 to 1 m/s2	Fairly uncomfortable
0.8 to 1.6 m/s2	Uncomfortable
1.25 to 2.5 m/s2	Very uncomfortable
Greater than 2 m/s2	Extremely uncomfortable

Table 1: Range for Comfort

IV. CONCLUSION

The experimentation is carried out to study effects of vehicle vibration on humans through vibration analysis and feasibility of it, practically investigated. The vibration Spectrum obtained for different speed are presented in figure 6 and based on acceleration level following conclusion are drawn

1. As road condition varies rough to smooth the acceleration level decreases,
2. For rough road condition the acceleration levels are higher therefore the man seating in vehicle feels very uncomfortable
3. For rough roads if the driver is exposed more than 90 to 120 minutes he will feel uncomfortable.

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