WIND/COMMUNICATION NOISE AFFECTING HEARING OF OCCUPATIONAL MOTORCYCLISTS

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Introduction It has long been recognised that motorcycles are a noisy form of transport. Legislation has been introduced to decrease environmental levels and to meet these legislative requirements manufacturers have been developing quieter machines. In tandem with noise reduction technology, modern engineering principles have allowed increasingly faster motorcycles. Increasing speed is of concern to the rider; not just from greater risk of injury, but from noise induced hearing loss (NIHL). NIHL can be attributed to noise from the turbulent airflow around the rider's helmet, so called 'wind noise' and is exacerbated with the use of radio communications. This research investigates 'at-ear' noise levels of occupational motorcyclists from wind noise and radio communication headsets.

Methods A miniature microphone was placed over a rider's ear and helmet donned in such a way as to avoid any displacement of the microphone or wires. A section of public road with a generally low traffic flow and few adjoining road junctions was selected as the test road. When a gap in the traffic became available the rider travelled along the road at set speeds for 20 seconds at a time. A number of runs were recorded using different helmet types, speeds and motorcycle styles. The recordings were downloaded to a sound level meter (CEL-593) from which the data could be transferred to Microsoft Excel for further analysis.
Headset exposure levels were assessed, using a test population and an audio recording of motorcycle wind noise at 60 mph, played through a loud speaker. A speech intelligibility test was simultaneously played through a headset to the test subjects and a head and torso simulator was used to obtain equivalent continuous sound levels in dB(A) for the range of headset volume settings dictated by the test subjects.
Using an estimated, typical driving pattern for occupational motorcyclists, their daily exposure levels ($L_{Aeq,\ 8hr}$) were calculated. These daily exposure levels were then used to determine the long term 'noise imission level' (NIL) an index of the total energy incident on the ear over a specified period of time. Using BS 5330 which considers the NIL and age of the subject, the expected incidence of hearing handicap resulting from such noise exposure was assessed.

Results

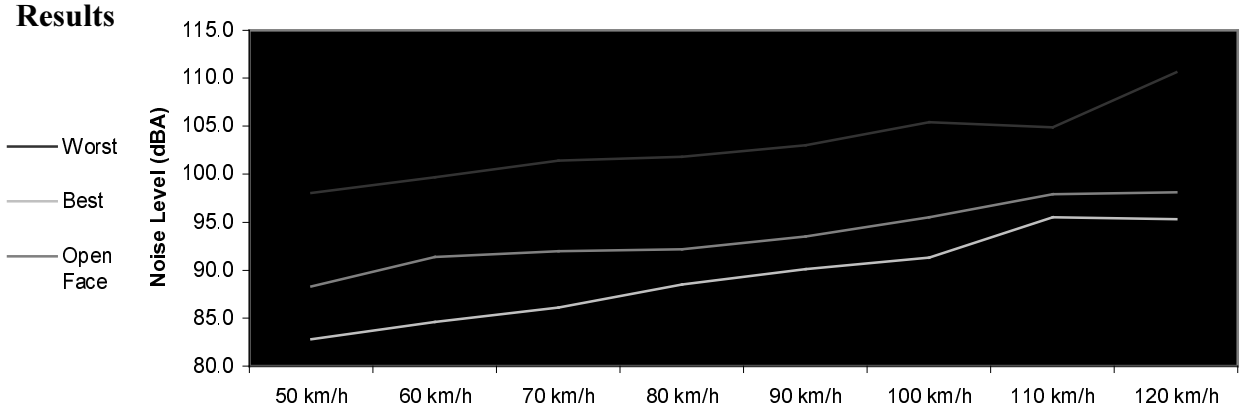

Figure 1.0 Wind noise levels in relation to speed

	$L_{EP,D}$ dB	NIL 45 years	NIL 30 years	NIL 25 years	% persons exceeding 30dB HL for 45 years	% persons exceeding 30dB HL for 30 years	% persons exceeding 30dB HL for 25 years
Police	109.4	123.7	120.2	117.9	68	44	35
Courier	93.6	107.9	104.4	102.1	12	4	2
Driving Instructor	92.3	106.6	103.1	100.8	8	3	1
Paramedic	106.0	120.3	116.8	114.5	52	33	22
Breakdown	101.6	115.9	112.4	110.1	36	17	11
Tour Guide	96.1	110.4	106.9	104.6	16	7	3
Taxi Bike	100.4	114.7	111.2	108.9	30	14	9

Table 1 Estimated Hearing Handicap for various occupational motorcyclists

Discussion As expected wind noise level increased with increasing speed. The lowest level recorded was 83.6 dB(A) with the highest level recorded at 109.4 dB(A). It can be seen from Figure 1.0 that even the best performing helmet produced noise levels above 90 dB(A) at speeds over 90 km/h (a relatively slow speed for a motorcycle). The noise levels on average, increased by 2 dB(A) per 10 km/h increase in speed for the roadster and 2.5 dB(A) for the faired motorcycle. The faired motorcycle wind noise results were on average 1.5 dB(A) higher than the equivalent roadster results.

The speech noise levels from the headsets, dictated by the subjects' volume setting, ranged from 98 to 117.5 dB(A), with intelligibility scores ranging from 4 to 45%. Although there was not a direct relationship between volume setting and intelligibility, it was noted that the greater number of subjects used volume settings above 110 dB(A), presumably in an attempt to improve intelligibility. It can therefore be assumed that occupational motorcyclists will tend to adjust their headsets to near maximum volume setting, in an attempt to improve their speech communications.

The estimated percentage population of occupational motorcyclists which showed a 30 dB drop in hearing ability is considered to give rise to concern, ranging from 1% for a 25 year old driving instructor with 7 years noise exposure to 68% for a 45 year old Police motorcyclists with 27 years noise exposure. Every type of rider in this investigation was noted to have a daily exposure level above the second action level (90 dB(A)) of the UK Noise at Work Regulations (1989).

The research indicates the need to reduce the overall noise exposure of occupational motorcyclists. This would require the reduction of exposure from wind noise, but also the development of a more efficient communication system, which would provide riders with protection from the risk of hearing loss but still allow effective communication.

Keywords: helmets, noise induced hearing loss (NIHL), occupational motorcycles, police, wind noise, radio communications