LMAX NOISE AT NIGHT, A SUPPLEMENTARY INDEX TO THE EU DIRECTIVE ON NOISE

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Introduction The new European Directive, on Assessment and Management of Environmental Noise (DAMEN) has been edicted in June 2002, after a long preparation process and the proposals of several groups, especially the WG1, in charge of the noise indexes. This WG has suggested Lden, and after discussion, a specific index for the night has been retained, to avoid a transfer of the acoustical energy from the day period towards the night.
The article 5 of the DAMEN is dealing with "Noise indicators and their application". The indicators choosen are Lden and Ln. Data obtained with other indicators, used previously in the Member States should be converted in Lden and Ln values. In the § 2 of this article it is precised that "the Members States may use supplementary noise indicators for special cases such as those listed in Annex1". The first application is when there is noise "during a small proportion of the time, less than 20%", the second is when the "average number of noise events in one or more of the period is very low", one event being less than 5 minutes long. "Lmax or SEL may be used for night period protection in the case of noise peaks" This paper is dealing with the interest of a complementary index; Lmax seems to be a good index, mainly in the field of transportation noise, ie aircraft and railway traffic. This proposal is done after the analysis of the scientific data from the research on sleep disturbance, and give a review about the use of the Lmax in several European airports. It is needed to check the literature on the effects of the peak noise on sleep disturbance , and the possibility to predict the level of this indicator in air and rail traffic.

Lmax and sleep disturbance The impact of the sonic booms on sleep quality was the first aim of the research on the effects of Lmax on sleep, and Griefahn, Vallet and Pearsons (1,2,3) have proposed to combine the number and the Lmax level to assess the probability in sleep disturbance. Vernet and later Schumer-Kors (4,5) have used Lmax as an indicator of the sleeping troubles, due to the railway noise during the night. These types of traffic don't provoke a modification of the global organisation of the sleep, as the road traffic noise does. The sleep responses appear and disappear when the noisy event occurs. Only one research work reported a structural modification of sleep, among the neighbours of Los Angeles airport, in 1973, when aircraft engines were so noisy: Friedman et al (6) have shown the recovery in deep sleep after the cessation in the use of one runway for night operations**.**
The limitation of noise in term of Lamax should also smooth the acoustical signal, and avoid the person to react to the whole noise situation: Griffiths and Delauzun (7) have studied the variation of annoyance during the season, and they observed that during summer, when residents open their windows, the degree of annoyance is the same than in winter, with windows closed; the annoyance is similar with a 15dBA Leq difference. A possible interpretation of this finding is that a part of annoyance is memorised in the brain, and not in complete relationship with the physical level of noise, and consequently if Lmax is reduced, the global reaction to noise does'nt appear, because a low Lamax doesn't excite the "site of the brain" , which is the biological basis of the annoyance. The recent report from TNO (Passchier, 8) shows the effects of noise events considered through Lmax, on instantaneous motility, is better than indoor Leq, and "the threshold of aircraft noise-induced motility…. during events is

Lmax indoor of 32dBA, which is lower than assumed until now". This short analysis demonstrate the interest in the choice of a supplementary noise indicator, such as Lmax.

A field application of Lmax The certification of the vehicles, aircraft as well as cars is based on Lmax. Chapter 2 aircraft are now suppressed. The restriction of the use of hushkitted aircraft is another problem. Hushkitted Chapter 2 aircraft are older technology machines which have been fitted to make them less noisy. Some freight carrier, frequently operating at night has changed the engine for a better effectiveness. The European Commission, by the Council Regulation no 925/ 1999 will not permit a greater number of hushkitted aircraft than registered in 1999. In France ACNUSA have just recommended a Lmax, at night, not over 85 dB(A) outdoor, at a certain distance of the runway. This rule, if adopted by the Civil Aviation authority, would have the consequence essentially of not allowing the hushkitted aircraft to operate at night. The idea of limiting the movements of noisy aircraft at night (quota counts) has come from United Kingdom in the early nineties. This country has developed a system of quota counts and has been applying it since 1993. This is a classification of aircraft into seven bands, according to the noise certification data collected when the aircraft was tested. An aircraft is classified into one or other of the seven 3 EPNdB- wide QC, and also separately for take off and landing. This "metrics" supposes that a QC 4 is double of QC 2. This system has been partly adopted by Madrid Barajas: at night, from 2330 to 0700, QC 8 and 16 are banned.

EPNdB	QUOTA COUNT (QC) NOISE QUOTA
102 and more	CR-16
99-101.9	CR-8
96-98.9	CR-4
93-95.9	CR-2
90-92.9	CR-1
Less than 90	CR-0.5

Noise limits for London airports are for take off: 94dB(A) at 0700-2300, 89 at 2300-2330 and 87 at 2330-0700. For Manchester noise limits for take off are 92 dB(A) day and 87 at night. In several other countries or airports this type of countermeasures have been adopted as part of action plans (Sweden, Belgium, NL), in response to the strong claim from the population exposed.

Conclusion Despite there is no similar rule for railways, such a supplementary indicator should be adopted, as a complement to Ln, or as a substitute to this night index. As it is difficult to draw noise maps with Lmax, the Lden must be kept as the indicator for the whole day.

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