inter·noise 96
25th Anniversary Congress - Liverpool

INCE: 69.3

TOTAL NOISE RATING AT OSLO AIRPORT GARDERMOEN

S Solberg

KILDE Akustikk A/S, PO Box 229, 5701 Voss, Norway

1. SUMMARY

Dwellings near to the new Oslo Airport Gardermoen will be exposed to airport- , road traffic- and railway noise. A calculation of the total noise rating for 290 houses within the airport noise zones has been made, using a model of total annoyance (Vos, 1992). For each type of noise, $L_{Aeq,24h}$ and the source- specific annoyance has been determined. Where two sources are giving the same annoyance, the total noise rating is set 5 dBA higher. The additive correction is reduced to 1 dBA where the difference in percentage highly annoyed reach 12%. At larger differences, only the noise rating for the dominating source is considered. For about 35 houses, the total rating noise level is higher than that from aircraft noise alone. For about 20 houses, the road traffic noise annoyance dominate.

2. INTRODUCTION

The new Oslo Airport Gardermoen is being built in an area which originally had about 1000 dwellings inside the contours of noise zone 1 in year 2000, i.e. will be affected by current aircraft noise land use guidelines in Norway. Some of these have been abandoned, but a substantial number of dwellings remains. A number of dwellings will be covered by a noise protection program.

In addition to the noise from aircraft take off and landings, the suroundings will be exposed to noise from aircraft taxiing, a new rail connection, new and existing roads. Should this additional noise exposure lead to a significant increase in total rated noise and to an enlargement of the protection program ? The present study was made in order to answer these questions .

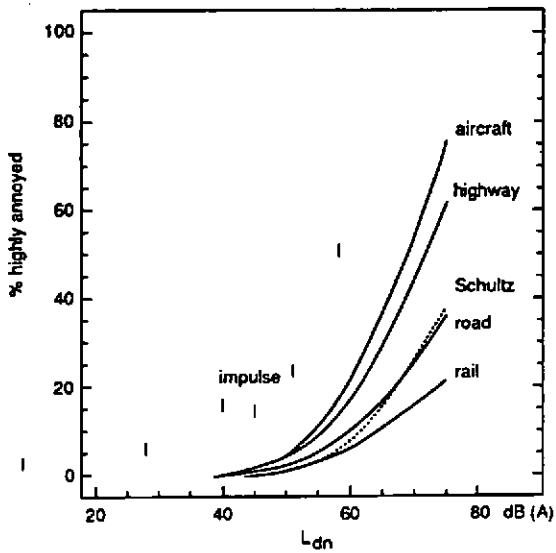
3. METHOD FOR TOTAL NOISE RATING

Vos has proposed a quantative model on annoyance caused by different simultaneous sounds [1] . For combinations in which the annoyance of one source is considerably higher than that of another source, total annoyance is equal to the maximum annoyance of the separate sources. For combinations in which both sounds are about equally annoying, total annoyance seems to be higher than the maximum source-specific annoyance. The model predicts the overall or total rating noise level for combinations of several types of noise, expressed as the L_{Aeq} of road traffic noise giving the same annoyance as the combined sounds. L_{Aeq} of equally annoying road traffic noise are found from source-specific dose-respons relationship. When two equally annoying sources are combined, the model propose a total rating noise level 4.5 dBA higher than the single source level expressed in L_{Aeq} for road traffic. If one contribution is 10 dB lower than the other - expressed in L_{Aeq} for road traffic noise - the total sum will be 1 dB above the highest.

The model is adopted under the assumption that the actual noises are not simultaneous from a stringent definition, but occur in the same periode of some hours time. In the author's opinion, this necessitates a caution in the adding procedure when annoyance contributions are obviously different in magnitude. The original model is used with two alterations. First aircraft noise is the reference noise instead of road traffic noise. Second the summation procedure is made more "narrow", fading to an additive correction of 1 dB when the difference in percentage Highly annoyed is 12% or the level difference in L_{Aeq} for road traffic noise is about 6 dB.

The specific dose-respons relationship for actual noise sources are taken from Miedema[2], having an unified description of both noise exposure and annoyance, see fig. 1. For our use, the road traffic noise relation - covering the nominal speed range of 60-80 km/h - is averaged from the "Highway" and "Road" curve. The relation for aircraft taxing noise is assumed equal to this averaged road relation, but shifted 5 dB towards higher annoyance, which is practically the same relation as that for aircraft (take off and landing) noise.

Fig.1 Noise-annoyance relationships for different sources, from Miedema [2]



4. CALCULATION OF NOISE FROM 4 DIFFERENT SOURCES

For 290 houses, noise exposures from aircraft take off and landing and eventually noise from taxiing, rail- and road traffic were determined. Aircraft noise exposures were taken directly from noise maps made on purpose by SINTEF-DELAB [3] for OHAS (Oslo Main Airport Management) using the NORTRIM calculation model. The other noise exposures were calculated, using the Joint Nordic calculation models for road traffic noise [4] and railway traffic noise [5]. The model for external industrial noise [6] was used for the calculation of taxiing noise. All exposures were calculated from traffic prognoses for the year 2000. For taxiing noise, a rather conservative estimate of emision was used (DC9 with two JT8D-9A, idling).

Rail traffic noise gave no important exposures. The highest specific exposures, occuring at different locations, were (free field, 4m above ground):

Aircraft TO&L :	EFN = 76 dBA (Ldn ≈ 74 dBA)
Aircraft taxiing :	$L_{Aeq,\ 24h}$ = 60 dBA
Road traffic :	$L_{Aeq,\ 24h}$ = 73 dBA
Railway traffic :	$L_{Aeq,\ 24h}$ = 56 dBA

5. RESULTS

For most of the 290 houses, noise from aircraft take off and landings alone determines the total rated noise. For 35 houses only, annoyance from road traffic or taxiing noise gave level additions. 5 of these came from taxiing noise (+1,+2 dB), the 30 others came from road traffic (+1, +5 dB). For about 20 houses, the annoyance from road traffic noise dominated.

The level addition in the total rated noise is more than 1 dB for 20 houses and more than 3 dB for 9 houses.

If the summation procedure had been done strictly according to Vos [1], the level additions would include about 60 more houses at a +1dB level. About 2/3 of theese would come from taxing noise and the rest from road traffic noise.

The present work [7] is a revision of an earlier report based on a different reference year and a different calculation model for aircraft noise [8]. All the work is made under contract from OHAS.

References

[1] J.Vos, J.Acoust.Soc.Am., 91(6), 3330-3345 (1992).
[2] H.Miedema, Proc. Noise & Man -93, vol 3, p 428-433, Nice, 1993.
[3] K.Liasjø andl.Granøien: 'Beregning av flystøybelastning rundt Oslo Hovedflyplass Gardermoen, SINTEF-DELAB, report STF 40 F95041, Trondheim, 1995.
[4]'Joint Nordic calculation model for road traffic noise', Statens Naturvårdverk, Stockholm, 1989
[5] M.Ringheim: 'Noise from railway traffic' KILDE report R67 for the Nordic Noise Group, Voss,1984.
[6] 'Environmental noise from industrial plants' report no.32, Lydteknisk Lab, Lyngby, 1982.
[7] S.Solberg, KILDE report R674, Voss , 1994.
[8] S.Solberg, KILDE report R796, Voss , 1995.