Urban Physics, 7S0X0

Urban Acoustics, Exercises week 6

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1) A residential area is located close to a highway. The façade of the closest house is 110 m from the center of the highway. The road has a total vehicle flow of 4000 vehicles per hour which is composed out of 90 % lightweight and 10 % heavy duty vehicles. The lightweight vehicles have a speed of 120 km/h and the heavy duty vehicles a speed of 80 km/h. For the source, a height of 0 m can be used. The ground between the road and the residential area is of the type compacted lawn and the highway asphalt type 'very hard and dense'. We consider the highway as a line source.

   a) Compute the sound power $L_{w,eq,i,m}$ of the highway for the 1/1 octave band range 63-4000 Hz, per vehicle type. Also, compute the total sound power $L_{w,eq,i}$ for the vehicles together.

   b) Compute the noise level per 1/1 octave band $L_{p,i}$ at the closest façade due to the highway, at a height of 4 m. Make use of figure 1 for computing the ground effect and $A_{div} = 10log_{10}(d)+8$.

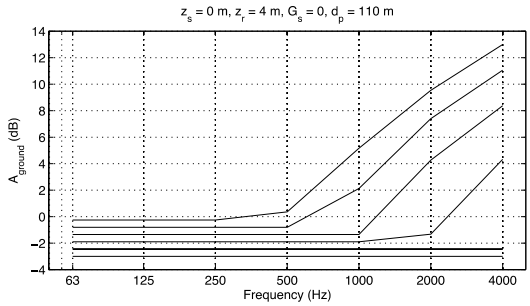

Figure 1. A_{ground} for various values of G'_{path}. Lines for G'_{path} = 0 (lowermost line) to G'_{path} = 1 (upper line). Other lines with increment of G'_{path} = 0.2.

c) For the same receiver point as b), compute the A-weighted sound level $L_{p,A}$.

d) In winter time, the ground between the residential area and the road is occasionally covered by snow. How much does the A-weighted sound level $L_{p,A}$ change due to this?

e) To reduce the noise level, a thin 4 m tall barrier is erected at 10 m from the road. At the receiver point of b), compute the reduction in A-weighted sound level $L_{p,A}$ due to the barrier. Make use of figure 2 for this purpose.

f) To even further reduce the noise level, it has been suggested to reduce the speed limit to 100 km/h for the lightweight vehicles. How much would the A-weighted sound level $L_{p,A}$ reduce due to this measure?

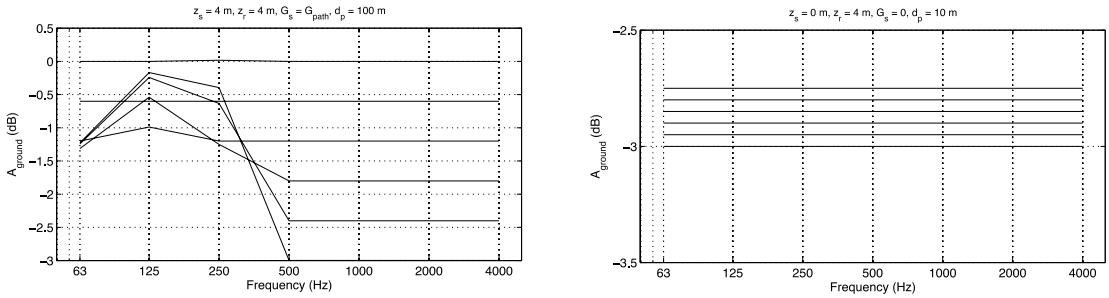

Figure 2. A_{ground} for various values of G'path. Lines for G'path = 0 (lowermost line) to G'path = 1 (upper line). Other lines with increment of G'path = 0.2.