Newport Beach, CA, USA
inter-noise 95
1995 July 10-12

BEHAVIOUR OF NORMAL HEIGHT SOUND BARRIERS COMBINED WITH LOW BARRIERS PLACED AT MINIMUM DISTANCE FROM THE RAILWAY TRACKS

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This simulation was performed using the program "Soundplan".
With this program it is possible both to complete the result of the measurements and to optimize the solutions.
The software works according to the German standards RLS-90 and DIN 18005 for vehicular traffic and SCHALL 03 for railway traffic.
The acoustical simulation phases are the following:
1. topographic description of the territory
2. imput of noise sources
3. description of acoustical sources
4. outdoor noise propagation analisys
5. presentation of results
The sound levels are calculated with a Ray-tracing algorithm that considers the characteristics of the territory.
The Ray-tracing tcnique assumes that the sound sources emit energy as sound beams.
Search rays, radiating from the receiver location, scan the model geometry between specified initial and final angles.
Sound level contributions are calculated for each angular increment.
Diffraction edge, elevation informations and reflecting surfaces are logged, if within the scope of the angular increment.
The forecasting program allows us to simulate different solutions and compare the benefits in order to chose the best one.
We can simulate the use of traditional barriers, banks, groves, sound absorbing surfaces.
The noise sources was simulated on the model with a line 240 m long.
Along this line were placed 25 spots (noise sources), spaced 10 meters apart and placed at a height of 0,3 m above the groun level, to simulate the noise generated by the wheel to track contact (one source for each bogie).
The spectrum of the sources was chosing after measuring the component of the noise emitted by a train ETR 500 travelling at the speed of 250 km/h.
This noise is caused by the rolling of the wheels on the tracks, the sliding of the pantographs and the aerodynamic noise;
The noise sources in the computer model have the following spectrum of acoustic power:

63 Hz	106 dB
125 Hz	99 dB
250 Hz	99 dB
500 Hz	102 dB
1000 Hz	109 dB
2000 Hz	118 dB
4000 Hz	110 dB
8000 Hz	97 dB

In the simulation we considered the effect of the train body by introducing a reflecting surface with low reflection loss (about 1 dB).
The listeners are placed at different distances from the tracks (7,5, 25 and 50 m).
For each distance 3 listeners are considered one at the beginning, one at the center and one at the end of the train length. this was done for taking into account the phenomenon of diffraction at the edges.
Two types of sound barriere were used:

- one placed at a distance of 2 meters from the center of the tracks, 0,5 m high and 0,1 m thick.
- one 4,5 m from the center of the tracks, 1,8 m high ant 0,6 m thick at the top for anti-diffraction purposes.

CONCLUSIONS

The results without barriers for the listeners facing the train at the middle of its length are:

111.102 dB	at a distance of 7,5 m
104.59 dB	at a distance of 25 m
100.675 dB	at a distance of 50 m

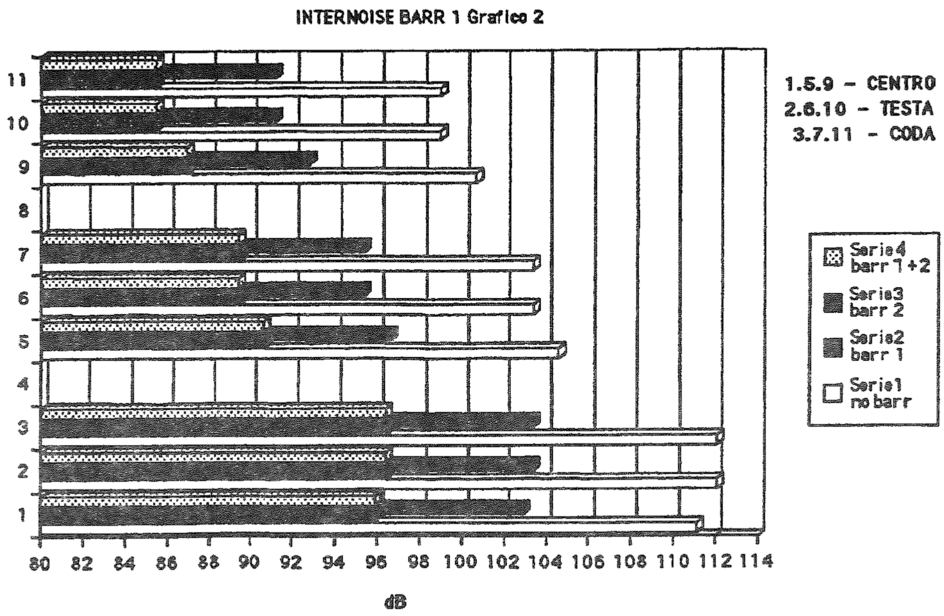
The results with only the high, distant barriers for the listeners facing the train at the middle of its length are:

95.968 dB	at a distance of 7,5 m
90.621 dB	at a distance of 25 m
86.925 dB	at a distance of 50 m

The results with only the low, close to the tracks barriers for the listeners facing the train at the middle of its length are:

102.698 dB	at a distance of 7,5 m
96.729 dB	at a distance of 25 m
92.764 dB	at a distance of 50 m

In this simplified simulation the values for the two barriers working together are the same as those obtained with the use of the high barrier only.
This is due to the fact that the analisys was performed in a simplified way, with the noise sources placed at track heigth only.
Neverthless we consider thet a small barrier with low environmental impact would be suitable for noise abatement along the railway tracks, expecially for the high frequency noise.



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No.	Receiver_name	X	Y	H	Level(d)	Level(n)	Level(s)
1	Project : IN95			Date : 03.04.95			
2	Run file : 001			Time : 12:34			
3	Run command:						
4	IN95;ASP3 SB SW1 RD PB KP;Q1 R1 I1 B2 /						
5							
6							
7							
8	7.5 CENTRO	0.000	7.500	10.000	102.968	102.968	102.968
9	7.5 TESTA	-120.000	7.500	10.000	103.364	103.364	103.364
10	7.5 CODA	120.000	7.500	10.000	103.364	103.364	103.364
11	25 CENTRO	0.000	25.000	10.000	96.729	96.729	96.729
12	25 TESTA	-120.000	25.000	10.000	95.370	95.370	95.370
13	25 CODA	120.000	25.000	10.000	95.370	95.370	95.370
14	50 CENTRO	0.000	50.000	10.000	92.764	92.764	92.764
15	50 TESTA	-120.000	50.000	10.000	91.213	91.213	91.213
16	50 CODA	120.000	50.000	10.000	91.213	91.213	91.213

Output results Leq day, night and special

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INTERNOISE 1995 NEWPORTH BEACH CA Results File : 004 page 1

No.	Receiver_name	X	Y	H	Level(d)	Level(n)	Level(s)
1	Project : IN95			Date : 03.04.95			
2	Run file : 001			Time : 12:38			
3	Run command:						
4	IN95;ASP4 SB SW1 RD PB KP;Q1 R1 I1 B1 B2 //						
5							
6							
7							
8	7.5 CENTRO	0.000	7.500	10.000	95.968	95.968	95.968
9	7.5 TESTA	-120.000	7.500	10.000	96.377	96.377	96.377
10	7.5 CODA	120.000	7.500	10.000	96.377	96.377	96.377
11	25 CENTRO	0.000	25.000	10.000	90.621	90.621	90.621
12	25 TESTA	-120.000	25.000	10.000	89.446	89.446	89.446
13	25 CODA	120.000	25.000	10.000	89.446	89.446	89.446
14	50 CENTRO	0.000	50.000	10.000	86.925	86.925	86.925
15	50 TESTA	-120.000	50.000	10.000	85.529	85.529	85.529
16	50 CODA	120.000	50.000	10.000	85.529	85.529	85.529

Output results Leq day, night and special

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User        : UGHI - ARTOM                                    04-03-95   15:10

INTERNOISE 1995 NEWPORTH BEACH CA   Results          File  : 001        page  1
-------------------------------------------------------------------------------
No. _Receiver_name_ ____X____ ____Y____ ____H____ Level(d)_ Level(n)_ Level(s)_
-------------------------------------------------------------------------------
  1      Project   : IN95                Date  : 03.04.95
  2      Run file  : 001                 Time  : 12:29
  3      Run command:
  4        IN95;ASP1 SB SW1 RD PB KP;Q1 R1 I1 /
  5
  6
  7
  8 7.5 CENTRO         0.000     7.500    10.000   111.102   111.102   111.102
  9 7.5 TESTA       -120.000     7.500    10.000   112.083   112.083   112.083
 10 7.5 CODA         120.000     7.500    10.000   112.083   112.083   112.083
 11 25 CENTRO          0.000    25.000    10.000   104.590   104.590   104.590
 12 25 TESTA        -120.000    25.000    10.000   103.370   103.370   103.370
 13 25 CODA          120.000    25.000    10.000   103.370   103.370   103.370
 14 50 CENTRO          0.000    50.000    10.000   100.675   100.675   100.675
 15 50 TESTA        -120.000    50.000    10.000    99.019    99.019    99.019
 16 50 CODA          120.000    50.000    10.000    99.019    99.019    99.019
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Output results Leq day, night and special
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-------------------------------------------------------------------------------
No. _Receiver_name_ ____X____ ____Y____ ____H____ Level(d)_ Level(n)_ Level(s)_
-------------------------------------------------------------------------------
  1      Project   : IN95                Date  : 03.04.95
  2      Run file  : 001                 Time  : 12:31
  3      Run command:
  4        IN95;ASP2 SB SW1 RD PB KP;Q1 R1 I1 B1 /
  5
  6
  7
  8 7.5 CENTRO         0.000     7.500    10.000    95.968    95.968    95.968
  9 7.5 TESTA       -120.000     7.500    10.000    96.377    96.377    96.377
 10 7.5 CODA         120.000     7.500    10.000    96.377    96.377    96.377
 11 25 CENTRO          0.000    25.000    10.000    90.621    90.621    90.621
 12 25 TESTA        -120.000    25.000    10.000    89.446    89.446    89.446
 13 25 CODA          120.000    25.000    10.000    89.446    89.446    89.446
 14 50 CENTRO          0.000    50.000    10.000    86.925    86.925    86.925
 15 50 TESTA        -120.000    50.000    10.000    85.529    85.529    85.529
 16 50 CODA          120.000    50.000    10.000    85.529    85.529    85.529
-------------------------------------------------------------------------------
Output results Leq day, night and special
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No.	_Receiver_name_	____X____	____Y____	____H____	Level(d)_	Level(n)_	Level(s)_
1	Project : IN95			Date : 03.04.95			
2	Run file : 001			Time : 12:34			
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5							
6							
7							
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9	7.5 TESTA	-120.000	7.500	10.000	103.364	103.364	103.364
10	7.5 CODA	120.000	7.500	10.000	103.364	103.364	103.364
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Output results Leq day, night and special

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