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THE RENDE-COSENZA HIGHWAY: FORECASTING CALCULATION OF THE ACOUSTICAL RECLAMATION

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INTRODUCTION

The purpose of the study is to evaluate the existing situation on the Rende-Cosenza highway and to plan the technical characteristic of structures and materials needed for the intervention.

ITALIAN LEGISLATION

According to the Italian legislation we divide the area around the highway in three areas:

-Industrial area (including areas for new industrial plants or similar) with a day-time limit of 70 Leq in dB(A) and a night-time limit of 70 Leq in dB(A).
-Residential areas with a day-time limit of 60 Leq in dB(A) and a night-time limit of 50 Leq in dB(A).
-Rest of the territory with a day-time limit of 70 Leq in dB(A) and a night-time limit of 60 Leq in dB(A).

A second step involves a division of the territory in six areas:

	maximum levels in Leq(A)	
Particularly protected areas	50	40
Residential areas	55	45
Mixed areas	60	50
Areas with intense human activity	65	55
Industrial areas (with some habitations)	70	60
Industrial areas	70	70

The instrumentation is qualified class 1 according to I.E.C. standard 651 and 804.

MEASUREMENTS

Measurement n° (day/night)	Leq(A) day-time	Leq(A) night-time	Limits
1	72	69	70/60
2	70,5	68,5	60/50
3	75	71,5	60/50
4	69	59	60/50
5	80	78	60/50
6	60	57,5	60/50

The sound pressure levels are over limits in every point detected.

ACOUSTICAL FORECAST

We use a forecasting software to plan acoustical interventions; using this software it is possible both to complete the results of the measurements and to optimize the solutions.

The software works according to the German standards RLS-90 and DIN 18005 for the vehicular traffic and SCHALL 03 for the railway traffic.

Acoustical simulation phases:

1: topographic description of the territory
2: input of noise sources.
3: acoustical sources description
4: outdoor noise propagations analysis
5: result presentation

The analysis of the acoustical interaction between the source and the receiver requires a detailed description of the territory. This description has to supply the program with the following informations:

- location of the receivers where we want to calculate the Leq(A)
- Sound sources description; these sources are represented by tridimensional lines.
- description of obstacles between sources and receivers and of reflecting surfaces: the program looks for reflection upon obstacles or buildings, for banks or groves, etc..

We have to insert all these data into the computer: we can do this by using a digitizer or by scanning the map and translating the bitmap image into vector data.

Roads are linear sound sources. The amount of noise from a road is due to several elements: the average daily traffic, percentage of trucks, vehicle speed and additional factors , such as different kinds of road surfaces, gradient of the road and presence of traffic lights.

The sound levels calculations are processed by a Ray-Tracing algorithm that considers the territory characteristics. The Ray-Tracing technique assumes that the sound sources emit energy as sound beams. Search rays, radiating from the receiver location, scan the model-type geometry between specified initial and final angles. Sound level contribution are calculated for each angular increment, accounting for the influence of found emitters. If the search beam intersects a reflecting surface, an additional beam is sent out from the point of reflection in search of other emitters. Diffraction edge, elevation information and reflecting surfaces are logged, if within the scope of the angular increment. Ground attenuation calculations are influenced by the elevation of the receiver points and emitters. Topographical information is evaluated within the scope of the search beam. The program verifies the presence of a single or multiple reflection point for a given emitter, if a change in elevation is noted or if the beam intersects an intervening diffraction edge.

The program can produce different type of output such as grid noise maps, sound level diagrams and tables referred to each receiver (with percentages for direct and reflected sound).

The forecasting program allows us to simulate different solutions and compare the benefits in order to choose the best one. We can simulate the use of traditional barriers, banks, groves, sound absorbing surfaces, speed limits or heavy vehicles traffic interdictions.

THE HIGHWAY PROBLEM

We exploit the use of the following data sources:
- acoustical measurements
- photographic and video documentation
- military maps
- traffic volume data

Maps and photographic documentation are used to create the model-type geometry.

Traffic volume data describe the sound source. We consider 20000 vehicles/ 24hours, of which 20% during the night. Heavy vehicles are 25% of the total during the day and 35% during the night.

Maximum speed for cars is 110 km/h ,for trucks 70 km/h.

All this data are supplied by the ANAS (Azienda Nazionale Autonoma delle Strade)

This data yield a sound pressure level at 25 m from the center of road of 71.9

dB(A) in day-time and of 69.7 dB(A) in night-time on the superelevation way (see Fig. 1). In the way with separate tracks we obtain the following levels: 68.9 dB(A) in day-time and 66.7 dB(A) in night-time.

We consider the standard weather conditions (temperature: 293°K, humidity: 70%) because we did not find any anomalies such as very high thermal gradients etc.)

The first calculation simulates the existing situation; by comparing measurements and calculations we can adjust the model to fit the reality.

Now we have the tool to study several way to reduce the noise.

Trying different solutions we figure out that traditional barriers are not enough to match the requirements. We exclude solutions such as banks because of the kind of the road and we also exclude limitations to the traffic volumes because of the nature of the road. Using phonoabsorbant asphalts toghether with barriers is the best way to reduce the noise to fit the limits.

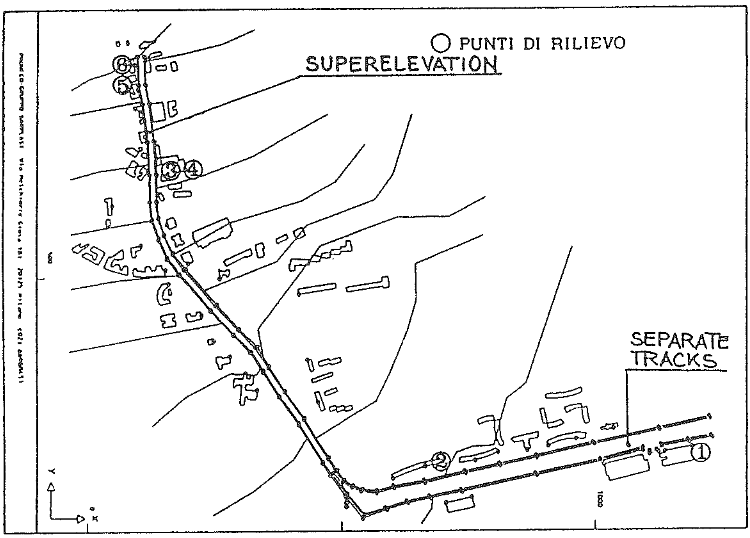

Fig. 1

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