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ROCK CREEK ENDURO SOUND TESTS

Eldorado National Forest
May 1993



Rock Creek Enduro Sound Tests Eldorado National Forest, May 1993

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INTRODUCTION

Background

The Rock Creek area of the Georgetown Ranger District, Eldorado National Forest, has been used by off-road motorcyclists for over 20 years. One of the activities associated with its use has been enduro events. An enduro is not a race. The objective of this competition is meeting a strict schedule. The Georgetown Ranger District prepared an Environmental Assessment in 1987 to develop a management plan for off-road vehicle use in the Rock Creek area (reference 1).

When challenged in court, a judge ordered that an Environmental Impact Statement be prepared. The San Dimas Technology and Development Center was then contacted by the Georgetown District seeking assistance for further analysis of possible sound related impacts caused by enduro events.

The Center conducted a study in which sound levels were measured in the area with five motorcyclists riding on assigned trails (reference 2). The study concluded that the "sound produced by five motorcycles ridden on typical motorcycle trails are detectable, at least occasionally, by observers listening for motorcycles at distances up to one half mile under terrain, vegetation and weather conditions presented in the Rock Creek OHV Area." Also, "at distances of 400 feet or greater, motorcycles that meet the State of California (reference 4) and USDA Forest Service 101 dBA limit (reference 5) would not cause sounds loud enough to impact the hearing of people," and "no direct physiological effect upon animals in the area could be expected" from the motorcycle sounds.

It also concluded that it would be "impossible to say that five motorcycles, normally ridden, increase the measurable ambient sound level when such level is assessed using equivalent level. "The FS study recommended that "where motorcycle use is expected, some notice to other users that they may encounter motorcycle sound in the area should be given," and "SAEJ1287 levels (reference 6) and environmental levels should be obtained during the next enduro."

This report describes measurements conducted by SDTDC during an enduro event in May 1993, in which 201 motorcyclists participated.

Objective

The test objective was to gather sound level data during an enduro event on the Eldorado NF for use in calibration of service-wide sound prediction models (reference 7), to assist the Georgetown Ranger District in preparing an Environmental Impact Statement in the area of sound, and to learn what percentage of these motorcycles comply with California standards for sound levels when using the SAE measurement methods.

To accomplish this, sound levels during the enduro event in May 1993 were recorded using sound level meters and tape recorders at three different sites along the course. The recordings were analyzed later in the laboratory. In addition, each motorcycle was tested in accordance with SAEJ1287 procedures, and the results were recorded along with the year, make, and model of each motorcycle for later analysis.

MEASUREMENTS

Instrumentation

A Sony TCD-D10 Digital Audio Tape (DAT) recorder, a Nagra III tape recorder, a video camera, two B&K Type 2231 Sound Level Meters, and a B&K Type 2204 Sound Level Meter were used to record the data. Wind screens were fitted to all microphones. Calibration tones were placed at the beginning and end of each data segment using a B&K Sound Level Calibrator (Type 4230). All instruments were laboratory calibrated prior to testing. Laboratory analysis was accomplished using a B&K 2131 Digital Spectrum Analyzer and BBN's Laboratory Data Acquisition Software (LabWare Version 2.1).

Test Method

Three test sites at different locations along the enduro route were chosen by the Georgetown Ranger District for sound measurements. At each site, the sound levels were recorded at 50 feet, 100 feet, and 200 feet from the trail. A video camera was set up to allow identification of the types of motorcycles when analyzing the data later in the laboratory. Recordings at each site were started as soon as the approaching motorcycles could be heard, and continued for 30 minutes. A shot was fired from a starter's pistol at the beginning and end of each 15-minute segment to provide reference points on the tapes and to allow synchronization of both audio and video tapes during playback in the laboratory. Background sounds were also recorded without motorcycle activity to allow comparisons of overall levels.

The District also performed the SAEJ1287 Stationary Test on each motorcycle prior to the event for sound limit enforcement purposes. The test results are summarized in this report.

Laboratory Analysis

For the laboratory analysis, signals from the data tapes were input to the B&K Model 2131 Digital Spectrum Analyzer and sampled at half-second intervals by BBN's Data Acquisition Software to obtain the Leq values, 1/3 octave band levels, minimum and maximum levels, centiles, and overall linear and A-weighted Leq's. The Leq values were used in this study, and the remaining data is stored at BBN for analysis and possible use in the current project to update the Forest Service's Recreation sound prediction models (reference 7).

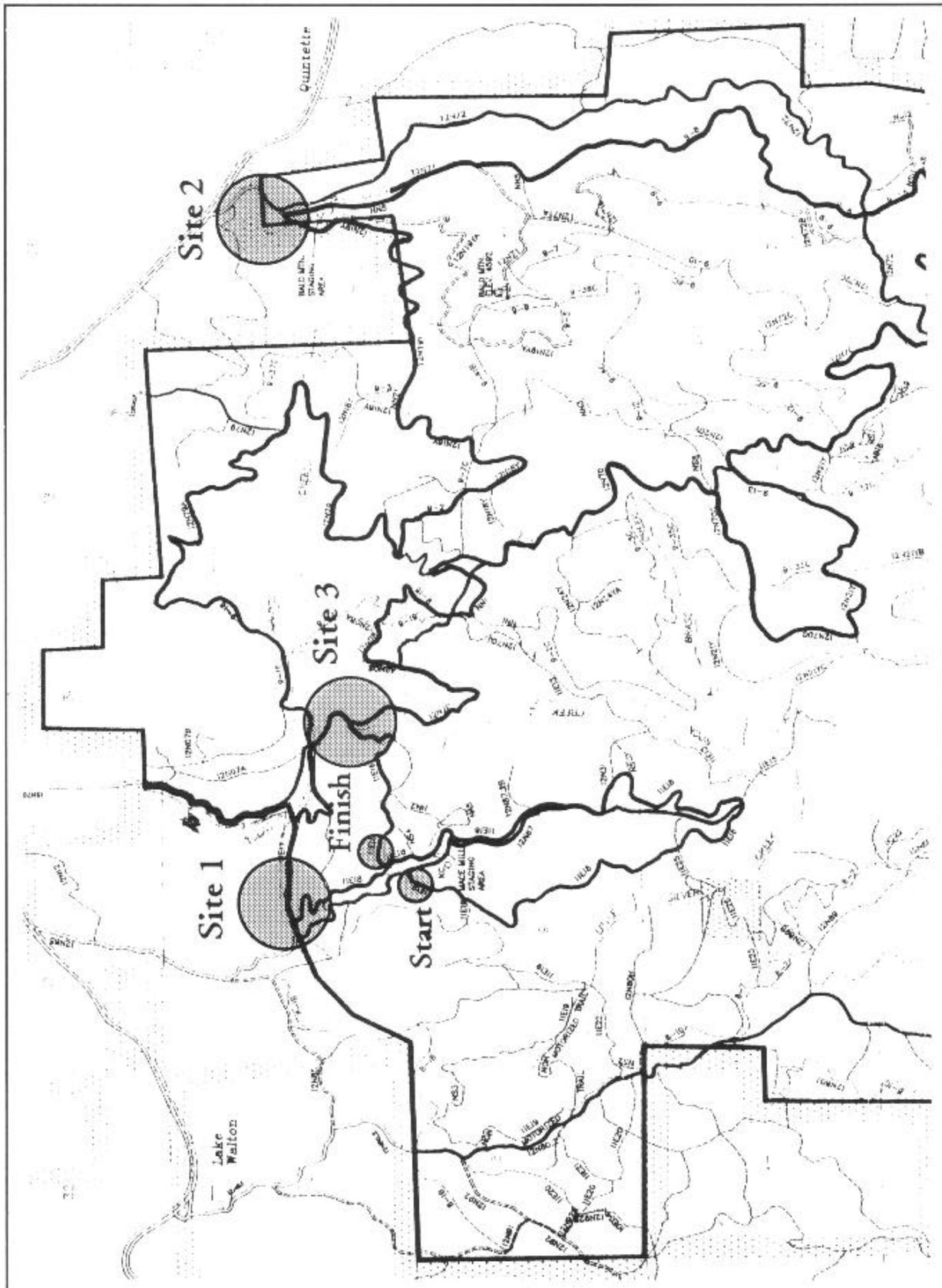


Figure 1.—Rock Creek Enduro, Northern Section of Course Route.

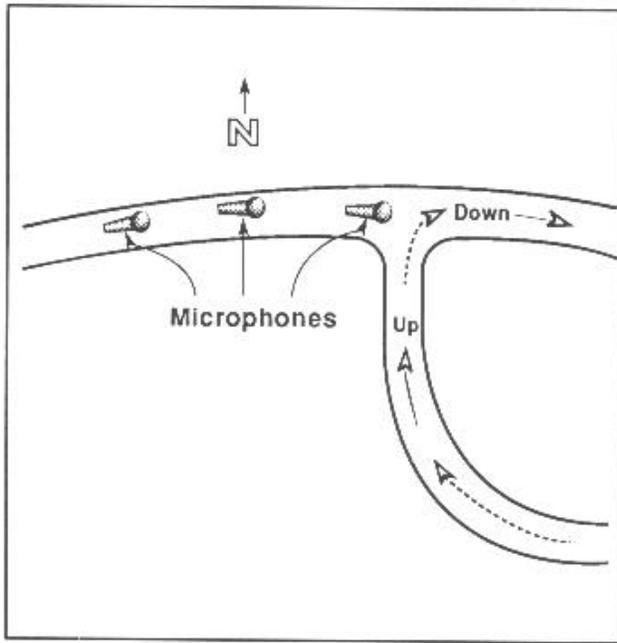


Figure 2.—Sound recording site #1.

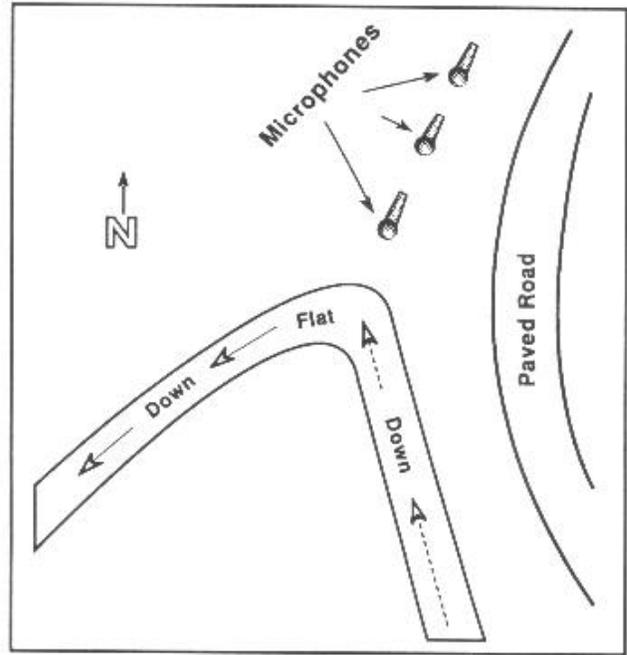


Figure 3.—Sound recording site #2.

Measurement Site Descriptions

The location of each sound test site in relation to the enduro route is shown in figure 1. Site #1 was located near the beginning of the enduro course at an elevation of approximately 3200 feet in an open Ponderosa Pine/Manzanita stand with bear clover understory. The instruments were positioned at a "T" intersection of two trails as shown in figure 2. The riders would approach the site on a slight uphill grade, turn right 90 degrees at the intersection, and ride away from the site on a slight downhill slope. Testing began at 8 a.m. with calm winds, and a temperature of 54° F, and a relative humidity of 58 percent.

Site #2 was located at an elevation of approximately 4200 feet in an open and mature Ponderosa Pine and Douglas Fir stand with light Manzanita understory. The sound level meters and recorders were positioned at the apex of a left hand turn in the trail as shown in figure 3. The riders would approach the turn travelling downhill on a gradual slope, make the turn, then ride away from the site, continuing downhill. Testing began at 11 a.m. with calm wind, a temperature of 80° F, and a relative humidity of 25 percent.

Site #3 was located at an elevation of approximately 2900 feet in a relatively open stand of Pine and Douglas Fir with Manzanita understory and a major stream nearby. The instruments were positioned along a dry, rocky creek bed near a steep, rocky section of the trail as shown in figure 4. The riders would approach the site on a dirt forest road, then climb the steep,

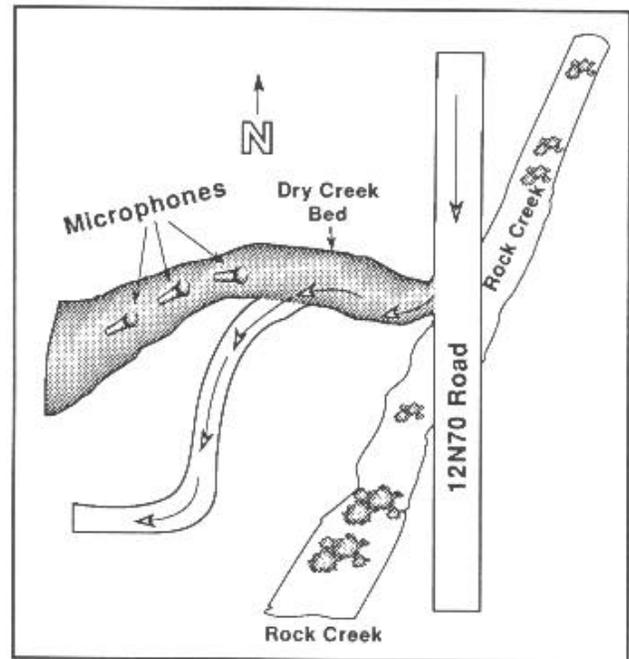


Figure 4.—Sound recording site #3.

rocky trail with a sharp left hand turn. From there they would proceed past the site, and continue uphill. Testing at this site began at 12:09 p.m. with light and variable winds, a temperature of 81° F, and a relative humidity of 28 percent.

DISCUSSION

The EPA, in its "levels document," defines "the level necessary to protect human health and welfare with an adequate margin of safety" as a Day Night Average Sound Level (Ldn) of 55 dBA (reference 3). Ldn is defined as the 24-hour average sound pressure level, with a 10 dB penalty added to the levels between 10 p.m. and 7 a.m. This standard of measurement is intended for use when studying community noise issues where the sound is fairly continuous and the 10 dB penalty is intended to adjust for the increased sensitivity to unwanted sound during normal sleeping hours. The sounds from the motorcycles, in this case, are far from being continuous over a 24 hour period and do not occur late at night when the Day Night Level penalizes sound events. Because the Day Night Level method would include long periods of time when the motorcycles do not contribute to the total sound energy, the lower sound levels during that time would tend to "cancel" the higher, shorter duration levels, resulting in a misleadingly lower overall average level.

For this reason, a more selective methodology was used which measured the sound levels in 15-minute segments for a total of 30 minutes at each site, to obtain the Equivalent Sound Pressure Level (Leq). Leq is a single descriptor that represents the continuous sound level that would have the same acoustic energy as a fluctuating sound, when measured over the same time period. This 15-minute Leq can be compared with an "ambient" 15-minute Leq at the same location and time of day to assess the motorcycles' contribution to the total sound environment over the time period during which the event occurs. This methodology is more consistent with the typical short-term exposures likely to be experienced by forest recreation users, as opposed to the relatively continuous, daily exposures experienced in a community setting.

Although "a sound source such as a motorcycle can be clearly audible above the background, even though its measured sound level is below that of the background" (reference 2), for the purposes of this test, we assume that most people will not be annoyed when the equivalent sound level (Leq) of the motorcycle sound is equal to that of the background or ambient sound. Therefore, we can roughly predict the distance at which most people will not be annoyed by the motorcycle sounds.

RESULTS

Stationary Test Results

The overall average sound level of the 201 motorcycles measured with the SAEJ1287 Stationary Tests was 92 dBA. The data was separated into two groups; pre-1986 motorcycles—the year the EPA changed the requirements for the 50 ft test (reference 5)—and later models. Seventy five percent of the motorcycles participating in the event were 1986 or newer models.

The 1986 and later models averaged 92 dBA. The pre-1986 models averaged 94 dBA, but since they accounted for only 25 percent of the total number of motorcycles, the overall average sound level was not affected.

Running Test Results

A summary of test results is shown in the following table:

Table 1.—Running test results.

| Site # | 50' Leq | 100' Leq | 200' Leq | Background Leq |
|--------|---------|----------|----------|----------------|
| 1 | 66.5 | 59.6 | 54.1 | 30.7 |
| 2 | 63.6 | 56.5 | 51.9 | 39.2 |
| 3 | 66.0 | 56.3 | 49.1 | 30.9 |

CONCLUSIONS

At distances as close as 200 feet, the overall sound levels are less than those specified in the EPA's "levels document," even when measured with the more conservative 30-minute Leq method. Analysis using Ldn would result in much lower levels.

No one, except possibly the riders themselves and those performing the SAE tests, would be exposed to sound levels high enough to pose a risk to their hearing health (reference 8).

If the effects of terrain, vegetation, and wind are excluded and a conservative assumption of 6 dB attenuation per doubling of distance (line-of-sight propagation) is used, the distance at which the Leq from the motorcycle sounds equals that of the background sounds is approximately 3200 feet. Therefore, most people would not be annoyed at that distance. When the effects of terrain, vegetation, wind, and higher background sounds are included, that distance can be considerably shorter.

RECOMMENDATIONS

Given the very limited time the enduro events are run, the fact that the EPA's criteria are met, and the low levels created, the acoustic impact of this activity should be considered insignificant.

REFERENCE LIST

1. "Rock Creek Off-Road Vehicle Use, Environmental Assessment," *G867*, USDA Forest Service, Georgetown Ranger District, Georgetown, CA 95634.
2. "Sound Levels of Five Motorcycles Travelling Over Forest Trails," USDA Forest Service, Technology and Development Center, San Dimas, CA 91773, August 1993.
3. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," US Environmental Protection Agency, Washington, DC 20460, March 1974.
4. "Off Highway Motorcycles, Noise Limits," *Section 38370 (g) California State Vehicle Code*.
5. "Prohibition, Use of Vehicles Off Road," *36 CFR 261.13D*, Office of the Federal Register National Archives and Records Administration, Washington, DC 20460, July 1988.
6. "Measurement of Exhaust Sound Levels of Stationary Motorcycles," Society of Automotive Engineers, Inc., Warrendale, PA 15096, June 1980.
7. "Noise Control in the Forest," *Project 0E11A40*, USDA Forest Service, San Dimas Technology and Development Center, San Dimas, CA 91773.
8. "Occupational Noise Exposure," *29 CFR 1910.95*, Office of the Federal Register National Archives and Records Administration, Washington, DC 20460, July 1988.