

# **SOUND BASICS**

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Consideration of some basic aspects of sound generation is useful for a better understanding of noise measurement.

Sound is a measurable physical entity, while noise is a personal interpretation of that entity. The motorcyclist may hear a healthy exhaust note, while the spectators and nearby residents hear an awful noise. Motorcycles with high sound levels are almost always considered noisy.

## **WHAT IS SOUND ?**

Sound is a physical excitement of air, created by vibration. Sound pressure waves move away from a vibration in much the same way as do wave rings created by a pebble dropped in water. The Decibel (dB) is the unit used to express the sound pressure level, or energy. Decibels are measured in several scales. The "A" weighting scale (dBA) is used in engine sound testing.

A moving motorcycle has many sound energy sources, of which the exhaust and air intake are the greatest. However, it is usually the exhaust noise which is heard at the greatest distance. A doubling of distance generally causes a reduction of 6 decibels. The smallest sound level change detectable to the human ear is about three decibels. Sound energy loss can be varied by conditions such as temperature, altitude, humidity, type of ground surface and frequency of sound source. Objects such as cars, trailers, walls or trees will reflect sound and invalidate a meter reading in the immediate area. Thus we need a clear 5.0 metre radius from the centre where testing will take place. Wind can blow "sound" to or away from the noise meter or listener.

An interesting phenomenon that lessens our problem is that measured sound levels do not double when energy sources double. The level increases only by three dBA. That is, is a Motocross machine, measured from say 100 meters away gave 70dBA, two machines would give 73, four - 76, eight - 79, sixteen - 82, thirty two - 85dBA, and 64 machines - 88dBA.

Sound testing should not take place whilst raining/snowing or in excessive wind speeds, as results will be inconsistent, and expensive equipment could be damaged.

## **SOUND TESTING EQUIPMENT**

Minimum requirements

- TYPE 1 OR 2 Instruments
- International Standard IEC 651
- AS 1259.1
- Range 70 - 130 dBA

Suggested standard equipment for use in Australia

- Tecpel DSL330 Sound Level Meter
- Tecpel DSL336 Sound Level Calibrator
- Measuring Rod
- Adjustable Tripod
- Rev Counter (Treysit)
- Thermometer / Anemometer
- Hearing Defenders
- Noise Report Cards / Forms

## **THE Sound Level Meter (SLM)**

Sound Level Meters fall into several international standards.

Type 1 SLM is accurate to within +/- 1dBA, so an allowance of 1dBA is deducted.

Type 2 SLM is accurate to within +/- 2dBA, so an allowance of 2dBA is deducted.

*These deductions ensure no one is disadvantaged by a SLM reading high or low.*

## **THE Measuring Rod**

A measuring rod can easily be manufactured, with one end at a 45° angle, and a marked 500mm position for the microphone.

The 45° angle can easily be judged, with a deviation of up to 10° either way being allowed.

The 500mm is critical, as a 80mm error either way will give up to one decibel increase or decrease in sound level.

To avoid any amplifying effect, the measuring rod must be removed whilst noise reading is taken.

## **THE Tachometer (Resonating Wire)**

The "Treysit" Sirometer (resonating wire) is very accurate, but requires considerable dexterity and skill to achieve accurate results. It relies on primary out of balance forces. When the wire starts oscillating, it is within 20RPM of the required figure. Always check that the RPM scale is being used and not cycles per second.

## **SOUND TESTING AT EVENTS**

Arriving at an event, Noise Control Officers (N.C.O.) should give themselves plenty of time for introductions to the Clerk of Course, Chief Scrutineer and Pit Marshals in order that a suitable test area can be agreed upon and set up. Also, remember to sign in on the Officials Indemnity Form.

## **STATIC NOISE TESTING**

Here the machine is in neutral, stationary in the middle of a clear 10.0 meter test zone, away from the track and loudspeaker noise, with background sound 10dBA below the maximum allowed.

Have a clipboard with a list of entered riders with rider numbers and standard sound test failure reports. Three copies of this form are required – one each for the Clerk of Course, Rider and N.C.O.'s records.

Ensure the sound level meter is at ambient temperature, and calibrated prior to the start of testing. Note the temperature and time on report form, together with the meter type. Check and if necessary, recalibrate the meter every hour whilst in use. Adjust the meter to the "A" weighted scale with the "slow" response setting.

Before beginning testing, explain the test to the Assistant Examiner, if inexperienced in sound testing. Briefly explain the test to the rider and what is required of him. The test RPM is about 30-40% of the usual maximum. The machine must be in neutral. Bring the machine to the centre of the test area, and position it so any breeze or wind is blowing from behind you. Thus any mechanical sound will be blown forward away from the microphone. Request that the engine be started. The rider will control the throttle, whilst

you're assistant holds the Treysit Tachometer onto the crankcase, or a solid part of the machine, where the Sound examiner and rider can both see it. Ask for the throttle to be gradually opened until the required RPM is reached and held. The N.C.O. needs to position himself so the tachometer is easily seen whilst being able to operate the SLM. The N.C.O. must position the SLM microphone 500mm from the centre line of the exhaust end, and at the angle of 45° measured from the centre line of the exhaust end, and at the height of the exhaust pipe, but at least 200mm above the ground. If this is not possible, the measurement can be taken at 45° upwards. Always advise the rider/guardian or mechanic of the result.

## **PROTOCOL**

As Noise Control Officer (N.C.O.) you are going to experience the occasional resistance and confrontation from some Riders/Representatives with regards to Noise testing and it's procedures.

It is EXTREMELY important that you DO NOT engage in any dispute/argument with a Rider/Representative and furthermore NEVER offer advice on how to lessen the noise of a machine that contravenes the G.C.R.'s.

The Noise Control Officer (N.C.O.) has no powers of penalty/exclusion, it is the Clerk of Course (C.o.C.) that after receiving the information from the N.C.O., will take any necessary action required.

### **DO:-**

1. Introduce yourself to the rider/Representative and maintain a courteous and informative attitude at all times.
2. Explain to the Rider/Representative what you require of them during the test.
3. Always inform the Rider/Representative of their noise level result.
4. At all times be aware of what is happening within your 10 metre noise test area.
5. Ensure that your noise test procedures and protocols are maintained at a consistent level at all times. (*This is extremely important*)

### **DON'T:-**

1. Engage Junior Riders in noise test procedures, seek assistance from their guardian.
2. Enter into any dispute or confrontation.
3. Offer any advice on noise reduction or offer your personal opinions.
4. Keep Riders/Representatives or your assistants exposed to unacceptable weather conditions for prolonged periods.
5. Leave expensive or personal equipment unattended at any time.

## **CONCLUSION**

Always dress smart and if possible wear the shirt of your S.C.B. or series promoter. Avoid wearing clothing that may be considered a "Conflict of Interest" such as a Team shirt, accessory or Motorcycle manufacturer.

Always remember that you, as a licensed N.C.O. are producing a 'STATEMENT OF FACT' and are subject to the usual Protest and Appeals process.

# AERIAL VIEW OF TEST AREA / LAYOUT

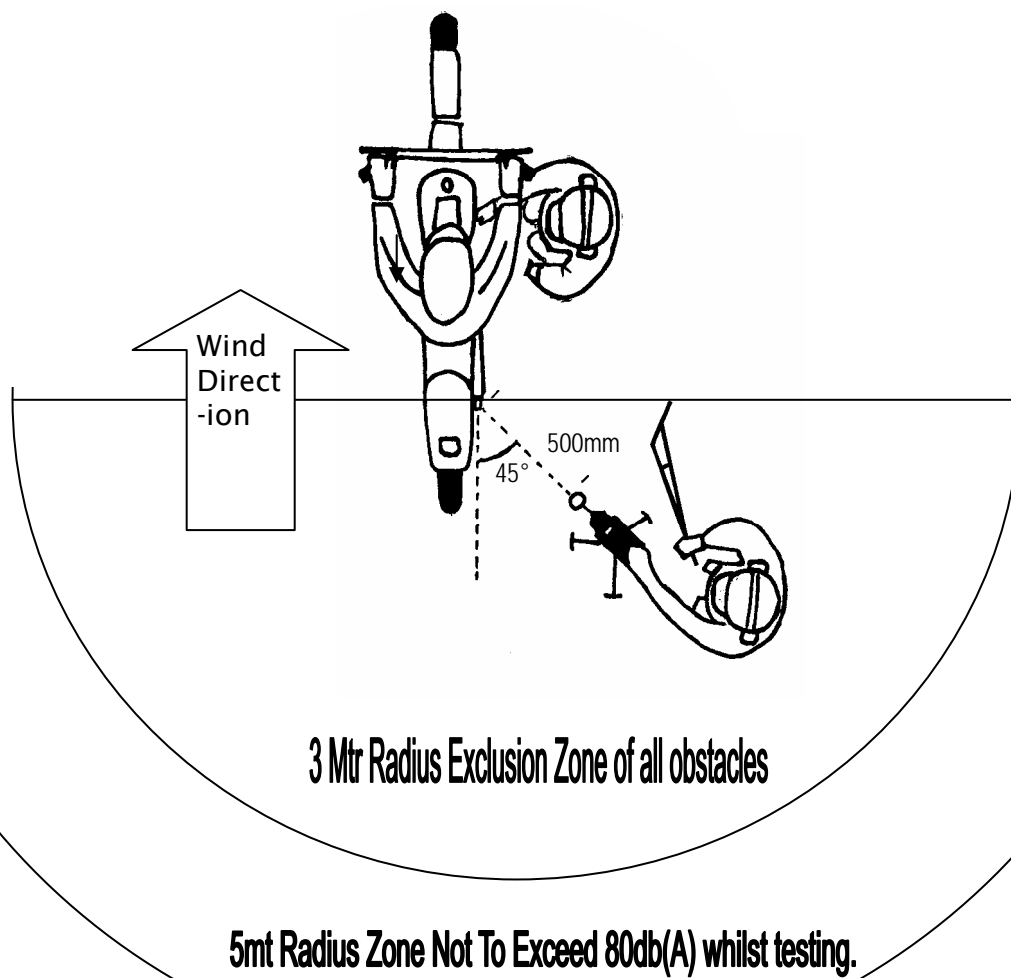


FIGURE 1.0.0



