

## **Tyre road noise Close ProXimity Measurement: Characterisation of aerodynamic noise**

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### **Summary :**

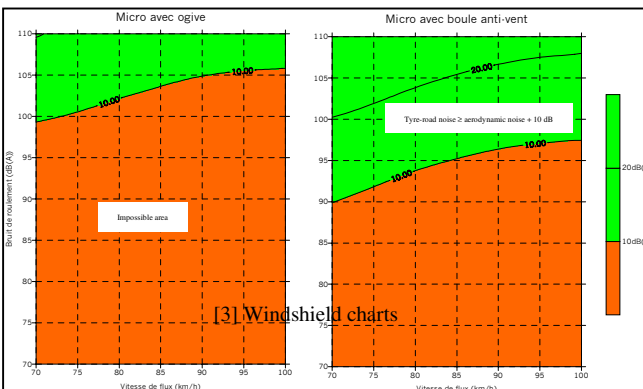
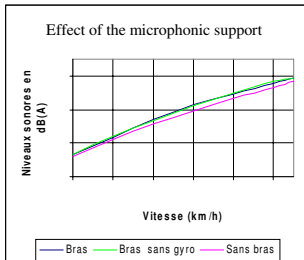
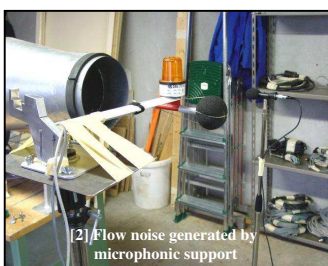
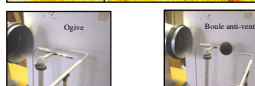
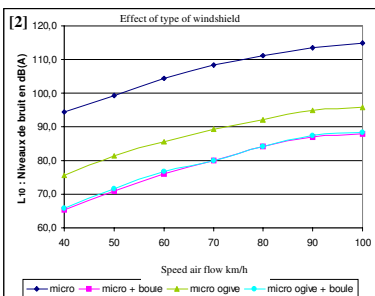
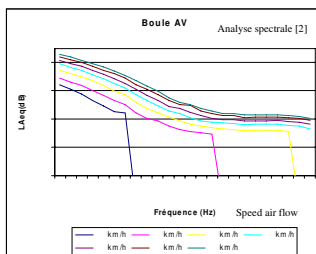
The laboratoires des ponts et chaussées network are working on continuous driving noise measurement equipment. This equipment is for people working on public issues and characterises acoustic properties of road materials. This equipment is composed of a special car on which are fixed 3 microphones, among which there is a lateral microphonic system, put as described in ISO 11819-2 norm, and linked on a data acquisition system. Numerous studies work on interference noise reduction during the record of noise level created by the wheels on road. The laboratory of Autun studies the aerodynamic noise due to the wind drag on microphones in a variable speed flow simulating the displacement of a car from 50 to 100 km/h. The experiments show the necessity of protecting microphones and the presence of a turbulent flow which speed profiles and pressures field are highly dependent on protection's Cx. The aerodynamics phenomena have a direct impact on produced interference noise which change in terms of level and spectral composition from one tested protection to another. In the same time, racing circuit tests show air flow speed gets weaker than car speed when closer to protections, hence a relative noise immunity on temporal measurements. Nevertheless the spectral contribution of these noises is concentrated on low frequencies and can penalize following analyses. So, use of streamlined shape against wind made of acoustically invisible material, is the solution experimented today.

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## Objectifs

- n This research is part of a large project aiming at the development of a CPX measurement vehicle (French LREP vehicle + ISO draft 11 819-2),
- n to analyse the aerodynamic effects in the vicinity of the measuring microphones,
- n to evaluate the temporal and spectral contributions of the aerodynamic noise to the tyre-road noise,
- n to design, if necessary, adequate mounting and shielding systems, that minimise the air-flow and turbulence noise.

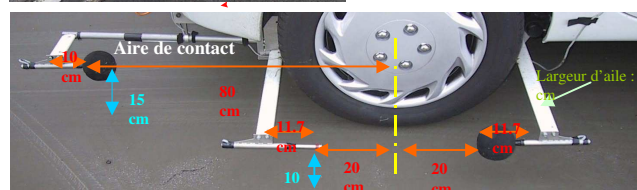
## Laboratory tests [1], [2] and [3]



## Test vehicle



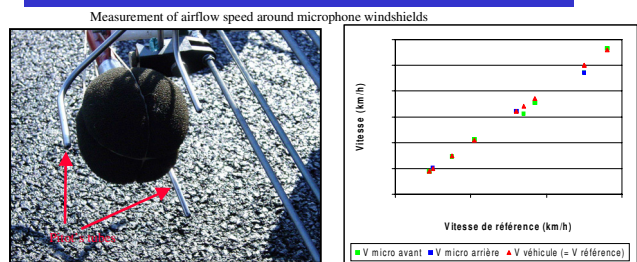
- n Standard passenger (Renault SCENIC)
- n Standard tyre (Michelin 195 mm)
- n Leq( $\Delta m$ ) analysis



## Principles

- n [1] Static reproduction in laboratory of the aerodynamic conditions observed during the vehicle displacement,
- n [2] Qualitative and quantitative investigations of air flow and flow noise generated by different parts of the system,
- n [3] Définition of the limits of validity for each tested windshield systems : charts,
- n [4] On site tests : wind speed measurements around the microphones in real measuring situation,
- n [5] Optimization of the acoustic system

## Outdoor tests (on track) [4]



## Microphone windshield design [5]

