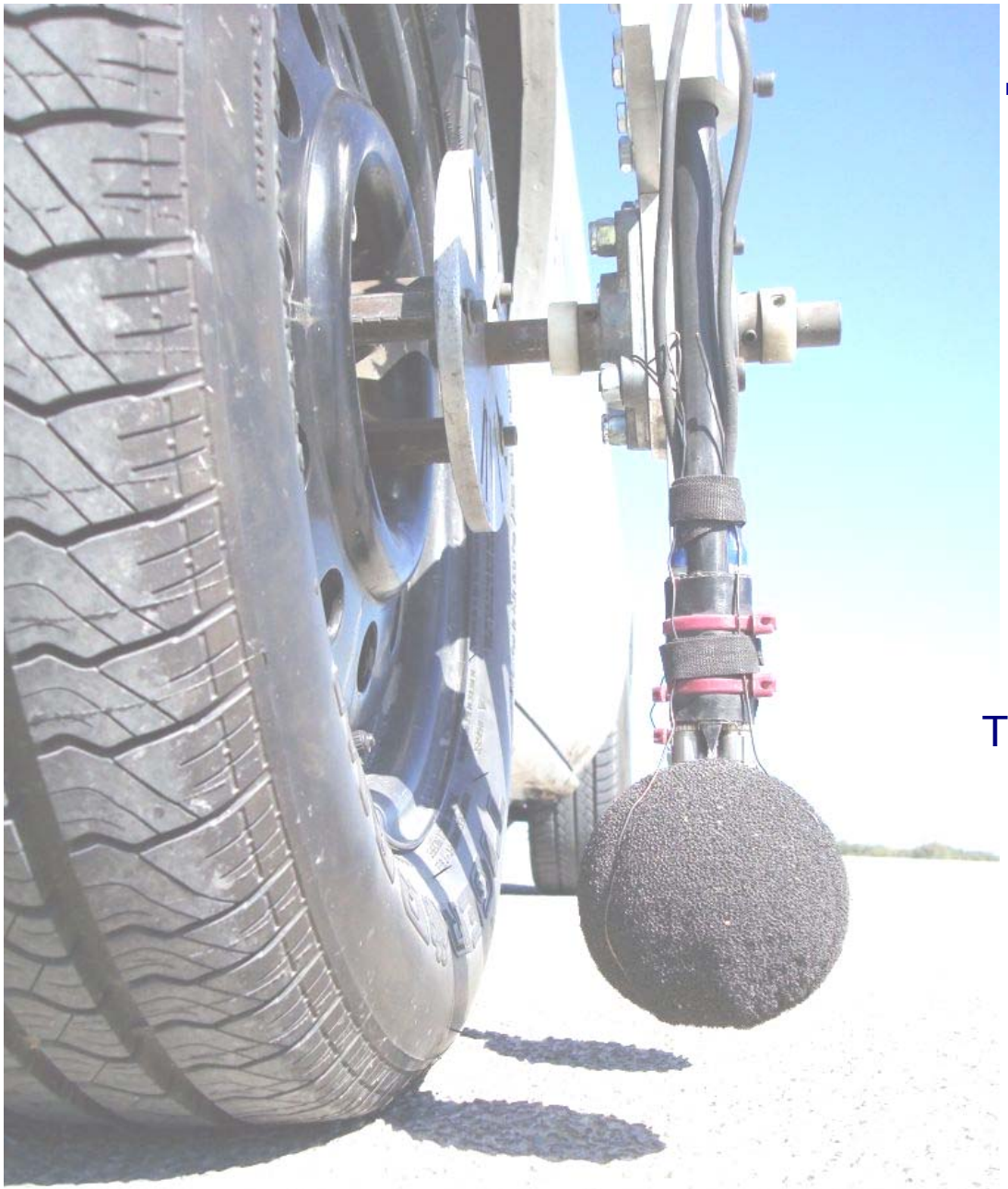


Tire-Pavement Noise 101 (Bite Size)

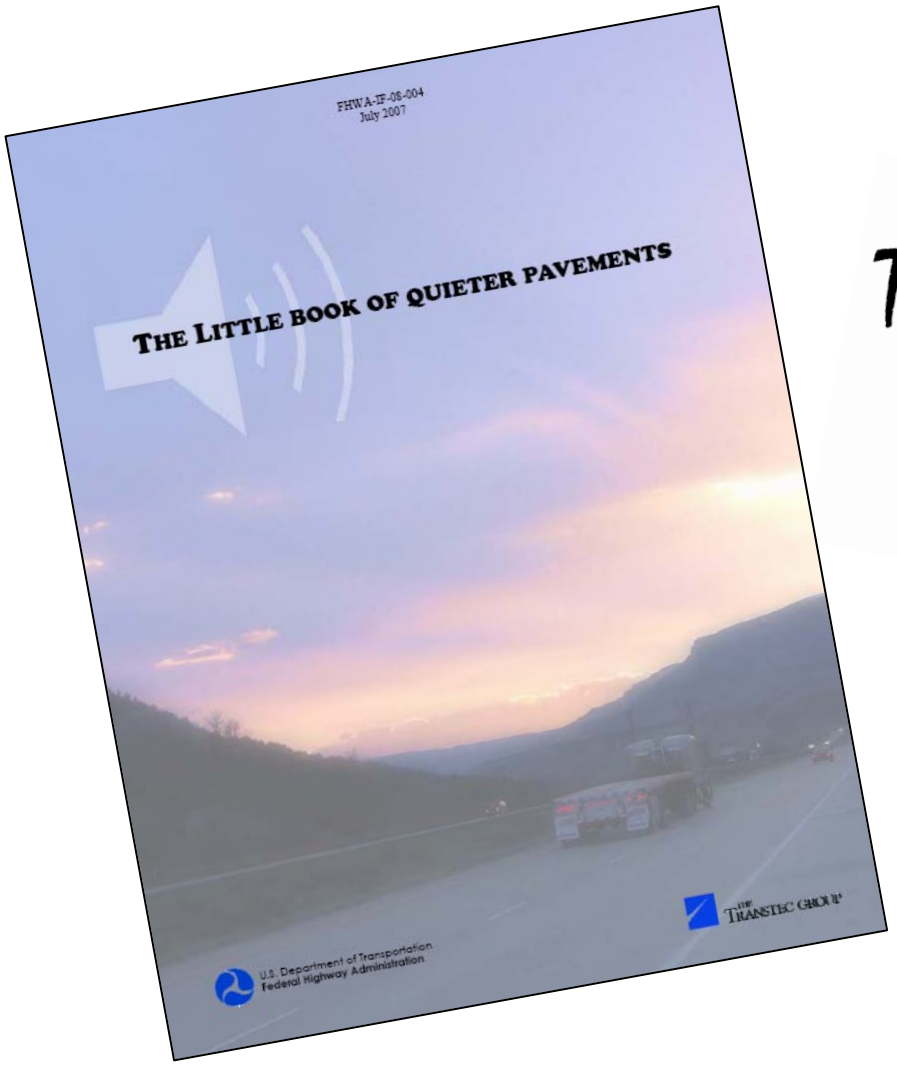
TRB Annual Meeting – OBSI Workshop

10 January 2010

Robert Otto Rasmussen, PhD, INCE, PE (TX)

The Transtec Group, Inc.

More Resources



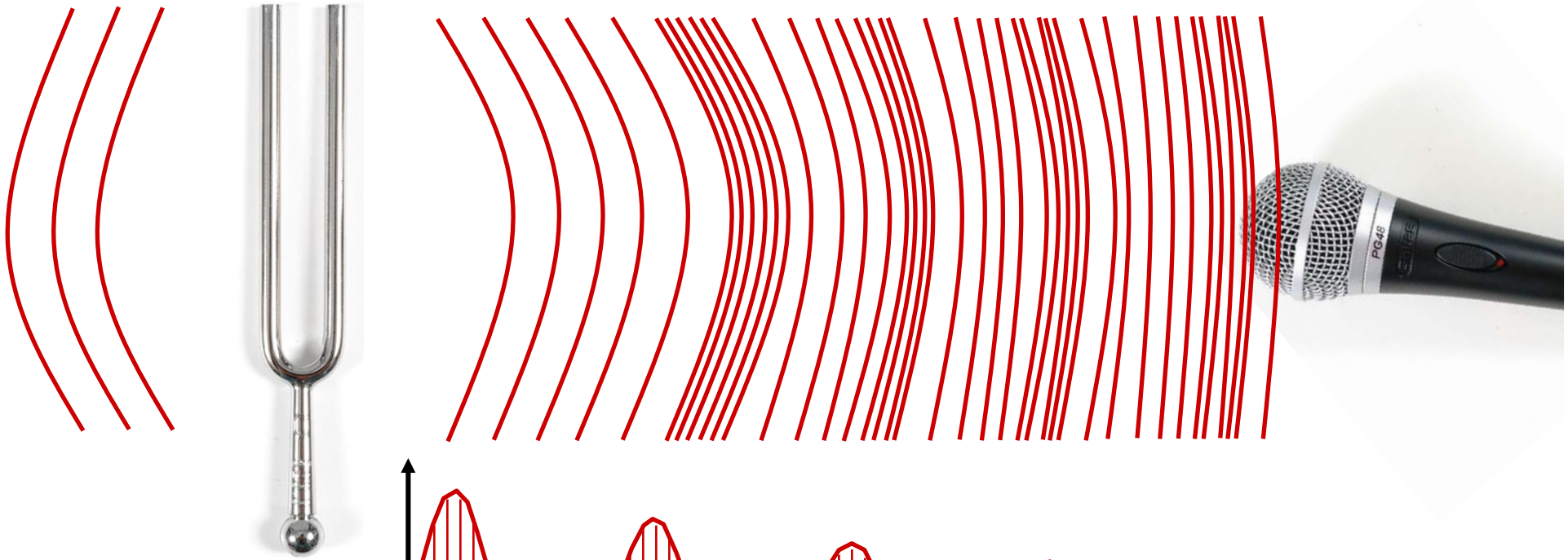
Tire-Pavement Noise 101

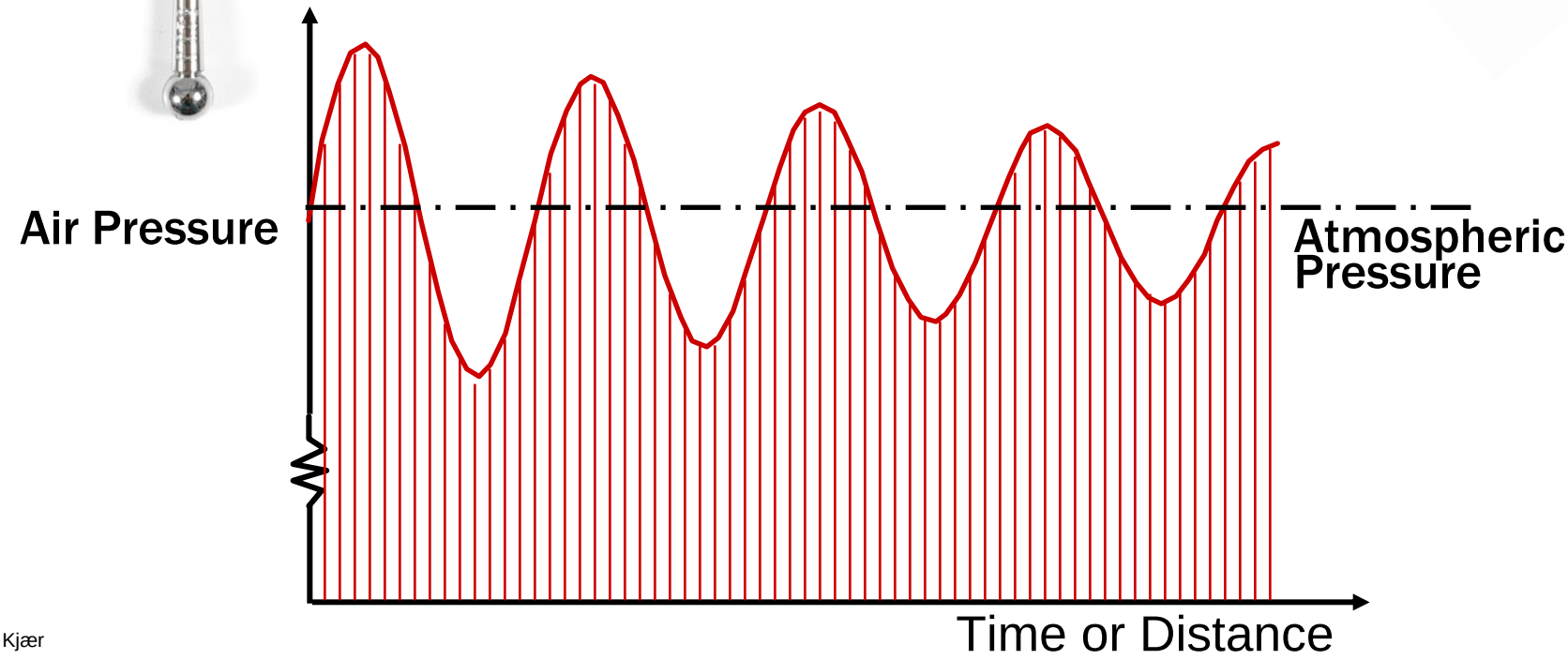
Download from
www.TCPSC.com/LittleBookQuieterPavements.pdf

Some Terminology

- Before we begin… let's define a few terms:
  - Noise – any sound believed to be objectionable
  - Traffic noise – noise generated by a traffic stream
  - Tire-pavement noise – noise generated by a tire rolling along a pavement

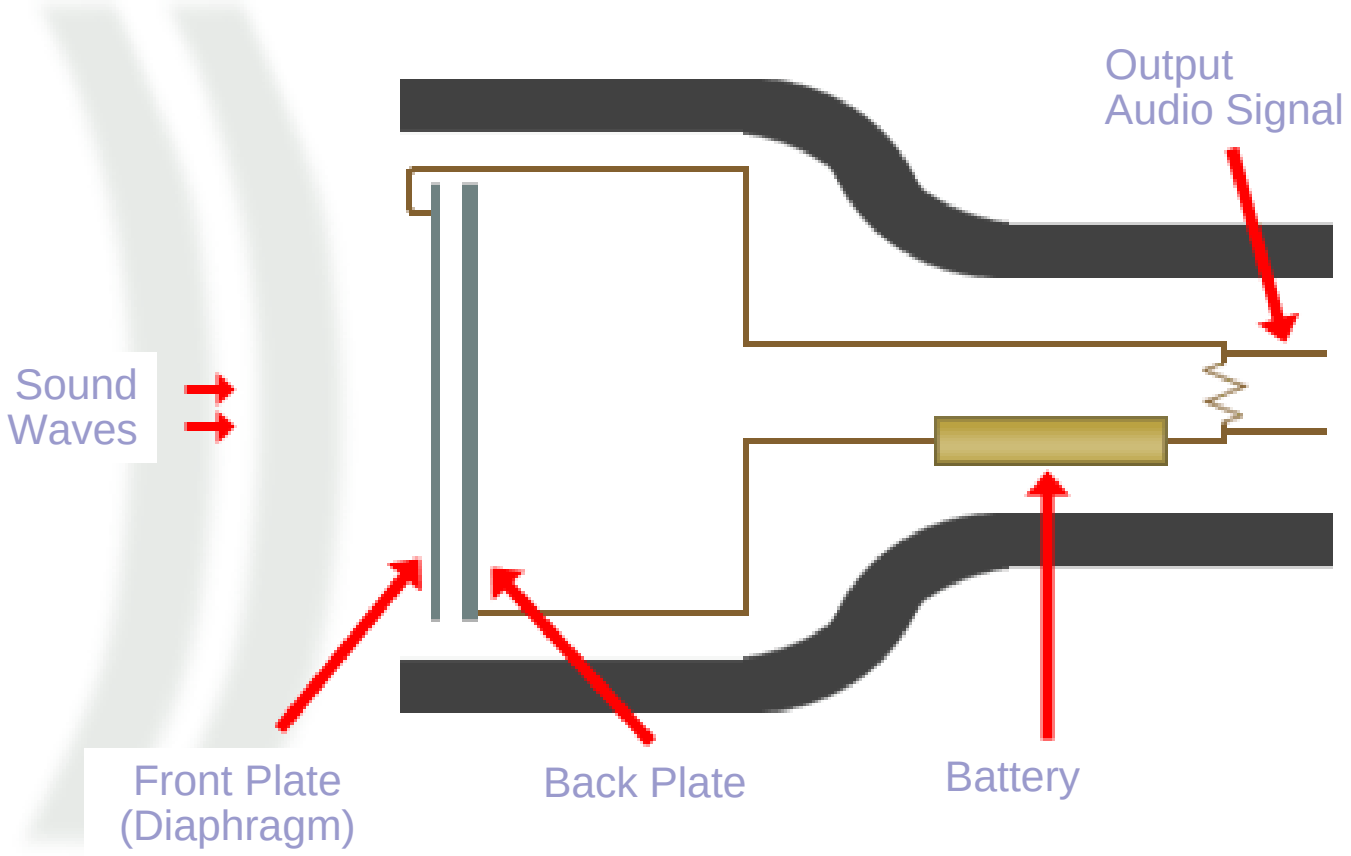
Sound





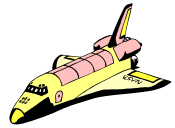
Source: Brüel & Kjær

Sound Measurement



Source: mediacollege.com

Sound Levels

	dB	Pa		
	180	20,000	Space shuttle (@ 100’)	
Pain Threshold	120	20	Rock concert	
	100	2	Jet plane (@ 1000’)	
Hearing Hazard	80	0.2	Truck (@ 30’)	
	60	0.02	Normal conversation	
	40	0.002	Whispering	
	20	0.0002	Quiet bed room	
Hearing Threshold	0	0.00002		

Sound Levels vs. Loudness

Change in Sound Level (Δ dB)	Change in Loudness
1 to 3 dB	“Just perceptible” change
5 dB	“Noticeable” change
10 dB	“Twice” (or ½) as loud
20 dB	“Four times” (or ¼) as loud

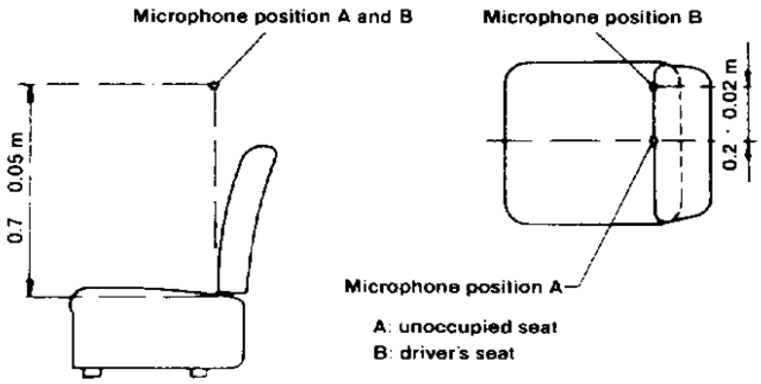
True only for the same sound!

Noise Testing: Wayside

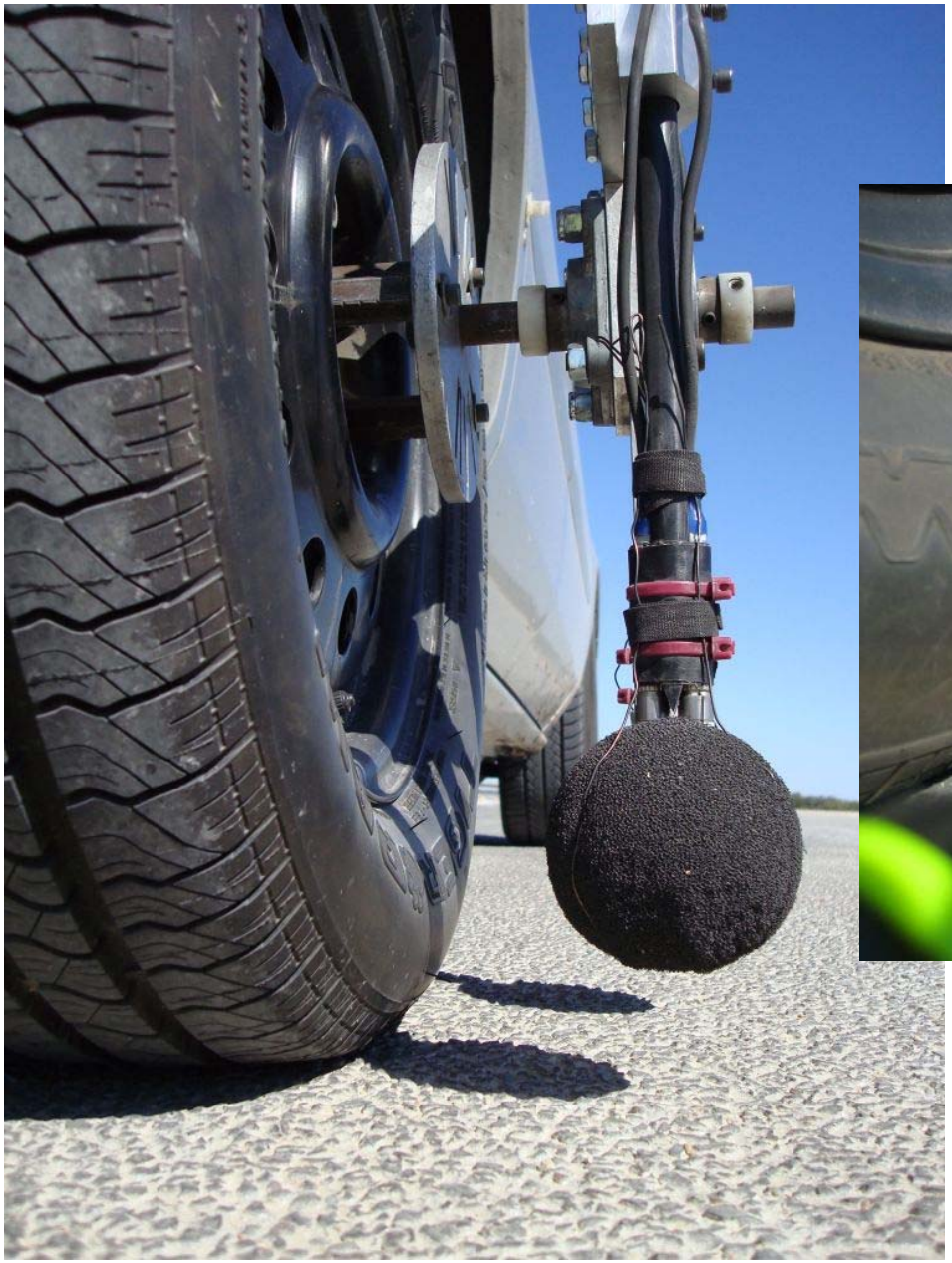
- Measures noise “roadside” of the traveling public or under controlled conditions using a test vehicle

Noise Testing: In Vehicle

SAE J1477 and ISO 5128



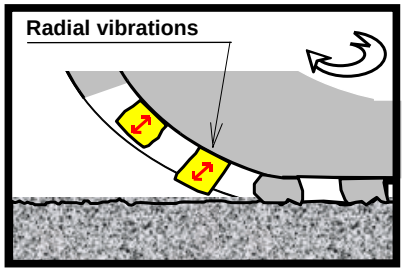
Noise Testing: OBSI



AASHTO TP 76

Generation Mechanisms – Hammer

- Highway texture and tread block induce radial vibrations of the tread block and the tire carcass
- Like a rubber hammer
- Important at low & mid frequencies

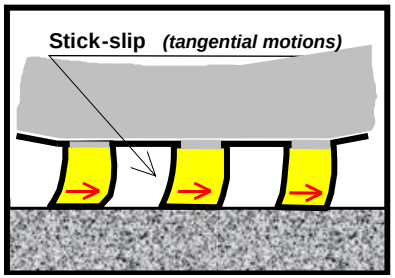


Make impacts soft and random

Source: Purdue SQDH, Ulf Sandberg

Generation Mechanisms – Squeaker

- "Stick-slip" between tread blocks and surface creates tangential motion
- Causes squeaks and squeals – high frequency
- Like a squeaky sneaker on a basketball court

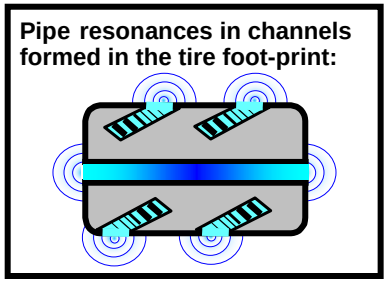


Source: Purdue SQDH, Ulf Sandberg

Increase local friction and increase surface roughness

Amplification Mechanisms – Organ Pipe

- Channels in tire footprint act like organ pipes, amplifying source
- Radiate sound out from channel
- Mid-frequency effect

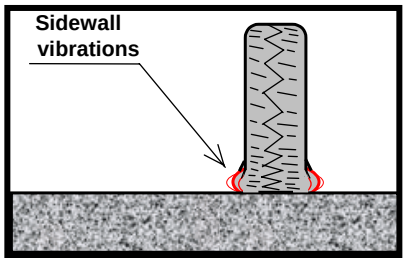


Change void geometries

Source: Purdue SQDH, Ulf Sandberg

Amplification Mechanisms – Pie Plate

- Vibrations of sidewall amplify noise source
- Radiates sound to the side (sideline radiation)
- Depends on tire construction



Reduce positive texture

Source: Purdue SQDH, Ulf Sandberg