

# Active Boom Noise Abatement in a Large Sport Utility Vehicle (SUV)

The ineffectiveness of sound absorbing material and even active noise cancellation (ANC) solutions implemented in modern vehicles, in absorbing the low-frequency standing waves in a large vehicle results in lingering of low-frequency noise, known as boom noise, inside such vehicles.

An active boom noise control solution which can be viewed as a low-frequency ‘active tuned acoustic damper’ is developed to add acoustic damping to the low-frequency standing waves inside the cabin of a large SUV to quiet its tonal persistent boom noise. The existing stock 8 inch subwoofer as well as one of the existing microphones built into the headliner of the vehicle were used in the active boom noise control solution.



Figure 1 Inside of the SUV

The effectiveness of the active boom noise control was first evaluated in the laboratory, by hitting the tailgate of the vehicle with an instrumented hammer and measuring the sound at various locations inside the cabin, without and

with control. One of the microphones placed on the headliner was used to provide the feedback signal. The FRFs of Figure 2 compare the pressure/force magnitudes measured at one location with the control off and on.

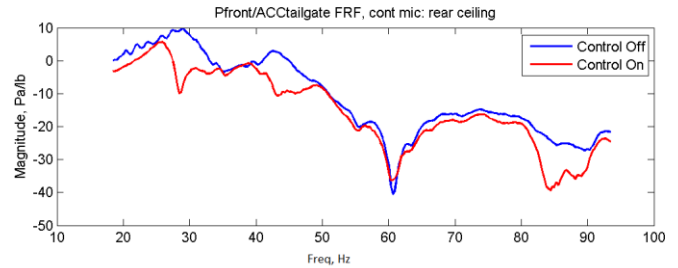


Figure 2 Measured frequency response functions, without control (blue trace) and with control (red trace) mapping the force perturbing the center of the tailgate to the pressure at the front of the cabin

Next, the road tests were done using the existing rear microphone as the feedback sensor. Figure 3, shows the power spectral densities (PSDs) of pressure measured at 3 locations by the rear, middle and driver side existing headliner microphones. The road tests were done on two different roads at two different speeds.

Comparison of the blue and red traces in Figures 2 and 3 points to the effectiveness of the active boom noise feedback control system absorbing the boom noise in the cabin.

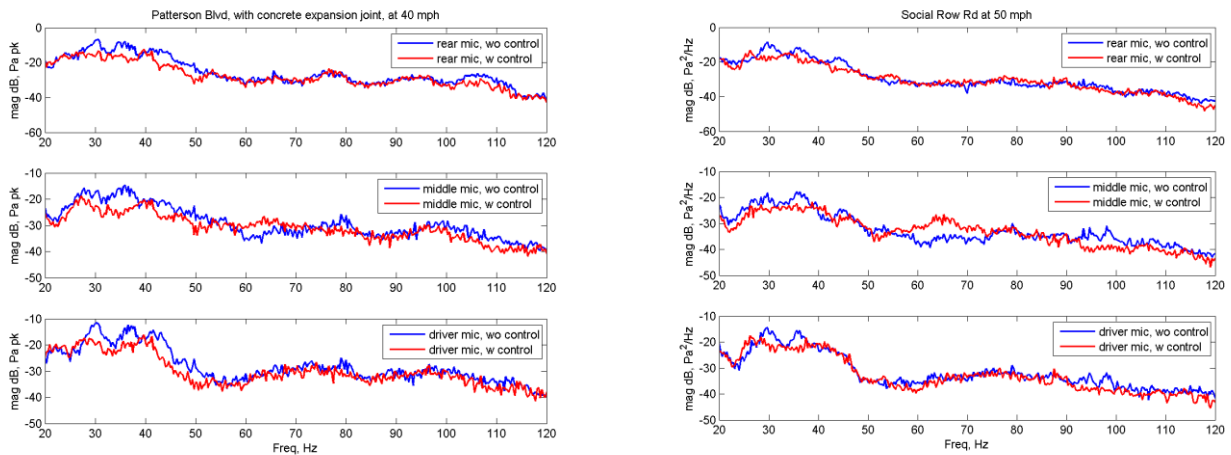


Figure 3 PSDs without control (blue traces) and with control (red traces) of pressure measured by the rear, middle, and front driver-side microphones