

# Golden Gate Parking Garage San Francisco

## SCOPE & SUCCESS

Vibro-Acoustics performed a **full system analysis** for the underground parking garage, meeting a strict noise criterion of 45 dBA.

### HIGHLIGHTS

- > Eliminated any noticeable garage fan noise in park setting
- > Overcame pressure drop limitations
- > Solved challenges involving tight space restrictions

### Improved Energy Efficiency

★★★★★

### Space

★★★★★

### Project Risk Minimization

★★★★★

### Noise Criteria

★★★★★

## OVERVIEW

**THE GOLDEN GATE PARK MUSIC CONCOURSE** underground parking garage is integrated tightly between the de Young Museum of Fine Art and the California Academy of Sciences, wrapping around the Music Concourse itself. This 800-car garage is virtually invisible within San Francisco's 1,000 acre Golden Gate Park.

The garage relies on two exhaust ventilation systems, each of which includes its own 200,000 CFM axial fan and smaller propeller fans to help with toxic fume buildup. In the early phase of the project, two 10 ft. long standard "low frequency" silencers were specified based on an acoustical analysis for noise control. These silencers were to be installed on both the intake and discharge sides of the fans to control noise within and outside of the garage.

## ⚠️ CHALLENGES

**AS A RESULT** of revisions to the fan rooms, the originally specified silencers became too large for the allocated space.

While a noise criterion of only 60 dBA was required inside the garage, the outdoor requirement presented a greater challenge. Based on an agreement to keep existing background noise levels from increasing near the exhaust discharges during the garage's peaks hours of operation, an outdoor noise criterion of 45 dBA was established. Concerned by the effect the garage and other noise sources may have on park events and wildlife, the local community put the project under close scrutiny with an aim to halt its construction.

**SOLUTION**

**Vibro-Acoustics partnered with the acoustical consultant and mechanical engineer to use the Integrated Systems Approach and redesign the noise control solution.**

**THE NEW SOLUTION MET THE REQUIRED NOISE CRITERIA** of 45 dBA (outdoor) and 60 dBA (indoor) and overcame the space and static pressure drop restrictions.

Acoustical louvers were installed to help reduce noise entering the garage, improving safety in the parking area. Absorption material was added in the fan rooms to control sound level buildup. For the exhaust fan intake, V-A provided dissipative silencers to reduce noise and ease fan airflow.

9 ft. axial cone silencers were selected to facilitate the airflow through the two systems. To address the noise in the underground tunnels, V-A provided a circular tunnel silencer design and used a culvert pipe casing to meet the structural requirements. These silencers were suitable for direct burial and prefabricated for low pressure drop, completing the attenuation required to meet the noise criterion.

Aerodynamics Losses for System Solution										
	in wg		63	125	250	500	1k	2k	4k	8k
Louver	0.55	IL	5	7	11	12	13	14	12	9
Mech Room	0.25									
Inlet Sil	1.3'	IL	14	25	40	43	55	42	23	15
Fan										
Cone Sil	0 <sup>2</sup>	IL	5	7	11	13	13	8	8	7
CD Silencer	0.65	IL	12	33	45	55	55	55	42	29
Tunnel & Shaft	0.6									
<b>Total PD</b>	<b>3.35</b>									

1. PD includes inlet losses due to extremely high air velocity.
2. Silencer internals designed to match fan characteristics, improving performance.



**Circular tunnel silencers were prefabricated for low pressure drop & underground application.**

