A Multi-Faith Chapel for a Noisy Downtown Location

Sound is affected by both absorption and reflection. Sounds echo off of hard surfaces like a ball bouncing off concrete. Soft, plush surfaces absorb sound like a ball flung at sand. In a worship space, it is imperative to control reverberation — sound echoing for several seconds. Too little and the sound has no sparkle. Too much and it is a jumble of sounds. The right balance requires heavy dense surfaces to reflect sound in all directions and as few soft, absorbent surfaces as possible. The congregation is the greatest absorber of sound.*

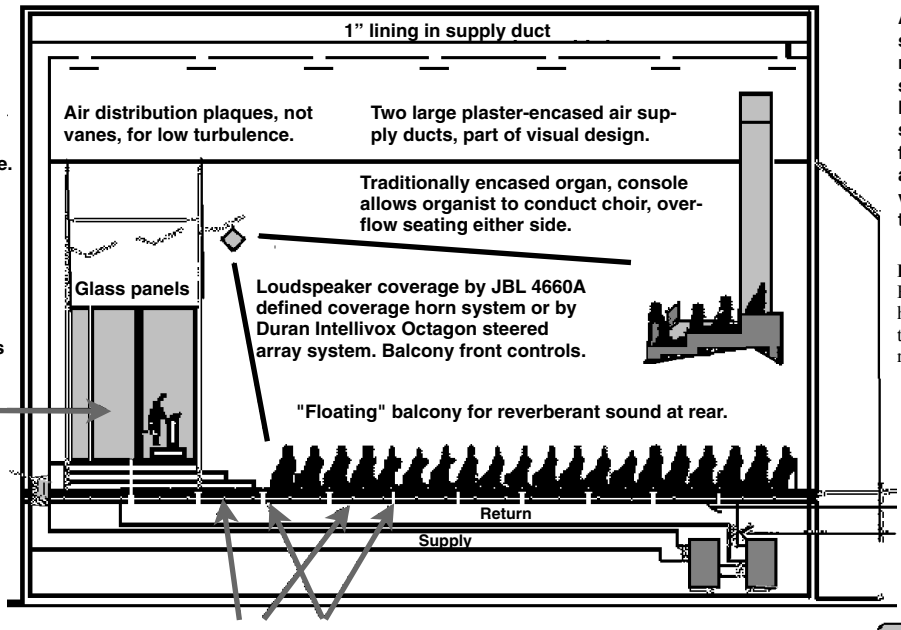
Ceiling
The heavy ceiling is suspended from the roof by hundreds of metal strips. It is coated with 1-1/2 inches of plaster. The plaster's density prevents the ceiling from vibrating. House lighting is embedded in the ceiling to avoid sound leakage.*

Walls
Instead of frame construction, walls are built of precast concrete panels. The extra mass helps cut building vibration and provides a stiff, hard base to reflect concert sound.*

The ventilation system is connected to the outside by a sound trap that channels air through narrow channels between perforated aluminum boxes of sound insulation. Ducts as large as house trailers collect air below the floor and move it under the vestibule to another sound trap and then to exterior grilles.*

Inverted V-shaped ceiling with apex angle slightly less than 90-degrees for added lateral diffusion.

Low air velocities for turbulence noise control and no dampers following silencers. 80 mpm worship space supply, 100 mpm return, and 120 mpm general spaces.



Short transepts either side of platform for religious objects storage.

75 mm hardwood panels on casters to change platform configuration for different users.

Silencers and resilient connections where supply ducts penetrate floor.

A vestibule or narthex provides a sound control lock to exterior noise with stairways on each side to the balcony. Overflow loudspeaker coverage and a TV screen for latecomers waiting for the proper point to enter the auditorium are options. The vestibule mirrors that of storage transepts.

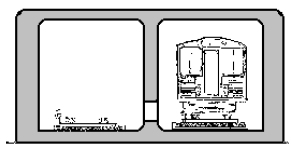
Doors
Heavy doors between the outside and hall are staggered to minimize direct transmission of sound into the auditorium or lobby. Doors have seals.*

Return air duct directly under concrete structural slab encased in plaster with 50 mm internal lining.

Return-air silencer

Rubber bearings
The auditorium rests on rubber bearings that absorb vibration from the tunnels. Bearings are 15 inches square, 7 inches high each and are composed of four layers of natural rubber sandwiched with 1/8-inch steel plates.*

Return air "mushrooms" lead to neoprene vertical ducts connecting to the large return-air ducts under the massive concrete slab forming the basement ceiling. The resilience of the neoprene avoids short-circuiting the isolation provided by the double-floor construction.



Rail tunnel
The underground rail tunnel has been capped with a massive slab of concrete supported on huge pylons. The cap runs under the auditorium like an underground bridge.*

All mechanical equipment located in the sound-isolated basement with mounting and connections as described in Chapter 8 of text.

Excavation for building extends down to floor of rail tunnel and is filled with gravel to support building. Gravel also located between cap slab of rail tunnel and basement floor concrete slab.

Muslim worship requires the platform panels to form an inner front wall cross the front of the auditorium with space for a niche, the mihrab, in front of which the imam stands for prayer. The lectern and its raised platform are in front of this inner front wall forming the minbar on which the imam addresses the congregation for his khutbah, a homily or sermon. In addition, all fixed seating is removed and stored elsewhere and prayer rugs cover the platform and main floor. The doors on the organ case and console are closed.

Orthodox Jewish worship requires the platform panels to be relocated along the length of the center aisle for the mechitza with women on one side, men on the other. The balcony may be used for additional seating for women or for a male choir, with doors on the organ case and console closed. The reading desk and its portable platform are at the front center of the fixed platform with men's seating between it and the front wall and on both sides. The lectern and its platform are near either corner in front of the front wall for the "drash" (homily).

This page was inspired by the 21 June 1998 edition of *The Seattle Times*, which describes the acoustical design features of Seattle's Benaroya Hall, home of the Seattle Symphony Orchestra. Thanks are due to illustrator Jeff Neumann, acoustician Cyril Harris, LMN Architects, and reporters David Miller, Karen Karabella, and Melinda Peregreen. Direct quotes and near-direct quotes are marked by an asterisk (*).