Orchestra Pit Acoustics – From Bayreuth to Broadway

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Abstract: The challenge for contemporary opera house and theatre acousticians is to provide a pit design that functions not only for the Italian and French operas, but Wagnerian opera and contemporary compositions as well. The pit must promote hearing between sections and projection into the hall, while maintaining as comfortable an environment as possible.

The earliest orchestra pit designs for European opera houses were open “bath tub” pits holding few musicians on a single level. As the art form evolved, opera demanded larger orchestras with a wider range of instruments. The position of the orchestra in front of the vocalists was workable acoustically as long as the opera house was low in volume and had limited seating capacity. Vocalists were required to project over the pit orchestra, often demanding prodigious vocal strength and stamina.

Opera Pits remained essentially unchanged until 1876 when Wagner’s Bayreuth pit redefined the musician/vocalist orientation by extending the orchestra pit well below the stage edge, and covering the front of the orchestra with a hood to create the “mystical abyss.”

Our approach to pit design, based on over 20 years of experience, is rooted in providing flexibility, tunability, and support for the artists performing there. The key aspect of this flexibility is pit design that provides several acoustical environments designed to adjust specifically for different styles of opera and musical theater. The treatment of the pit, acoustically as well as visually and environmentally, must support the pit orchestra.

Key criteria include:

1. Adequate space per musician, ranging from 18 to 20 square feet (1.67 to 1.85 square meters). Broadway orchestras actually require more area per musician due to the contemporary instruments such as trap sets, synthesizers, and extensive percussion, but thankfully have smaller orchestras.
2. If the pit extends under the stage, then it must be sized adequately to hold at least two rows of musicians at a minimum (8 feet or 2.4 meters).
3. In addition, the area the under the stage should be maximized both in width and depth to allow additional volume around the musicians in order to temper and reduce the levels of loudness in the pit. Reversible portable hanging panels, reflective on one side and sound absorptive on the other, can be placed around the area occupied by the musicians, leaving a “decompression” area beyond.
4. We find it important to provide sound absorptive panels that can be positioned at the music director’s discretion at the underside of the pit overhang and along wall surfaces. These serve to control sound levels and help balance brass and percussion to strings and woodwinds. Diffusion panels at the pit rail are often useful.
5. Pit surfaces should be wood (or at least gypsum board), furred out on blocking – but never raw concrete or block.
6. When a large “bath tub” style pit will be required occasionally for a very large opera or ballet orchestra, the pit can be expanded using removable platforms in the seating area. This is economical as it avoids the purchase of an additional pit lift, but can affect seat count and complicate subscription ticket sales.
7. Multiple lifts provide the most flexibility for varying orchestra size. However, the lift width should not be narrower than 12 feet (3.6 meters) on the center line to allow for two stands (four rows) of musicians and varying lift heights.
8. For added flexibility in multi-use pit designs, we have provided adjustable height pit platforms, instead of a fixed slab, under the stage overhang. This allows the music director and scenic designer additional flexibility in setting the orchestra acoustically and integrating any scenic elements into the pit area.

Our experience has shown that musicians cannot produce exceptional music in a dark, poorly ventilated and overly loud pit. They often have difficulty in hearing one another in crowded conditions under the stage overhang. However, hall management is often loath to lose audience seats if a larger pit is provided. There is also the issue of minimizing the distances that singers have to project over the pit to the audience, and the different acoustical requirements of Italian, French and Wagnerian opera and the various styles of ballet and musical theater.

Our designs (see Figure 1 below) address these concerns by providing the most flexible, adaptable pit possible, with multiple options on sound absorption, diffusion and volume through the use of a variety of acoustical devices.
FIGURE 1: Pit design for maximum flexibility