

Comparative Acoustic Survey of Teatro Masini, Faenza: Insights from the 2020 and 2025 Investigations

Lamberto Tronchin (1)

Ruoran Yan (2) Kristian Jambrosic (3) Marko Horvat (4) Luca Battisti (5) Matteo Fadda (6) Adriano Farina (7) Cobi van Tonder (8)

(1) University of Bologna, Department of Architecture, lamberto.tronchin@unibo.it

(2) ruoran.yan2@unibo.it (3) kristian.jambrosic@fer.unizg.hr (4) marko.horvat@fer.unizg.hr (5) luca.battisti5@unibo.it

(6) matteo.fadda2@studio.unibo.it (7) adriano.farina3@unibo.it (8) cobi.vantonder@unibo.it

1. Introduction & Objectives

Teatro Masini is an 18th-century Italian opera house with ornate balconies and a shallow dome. After modest refurbishment post-2020, a new 2025 survey was conducted to detect acoustic shifts and test a wider measurement layout.

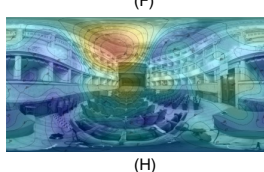
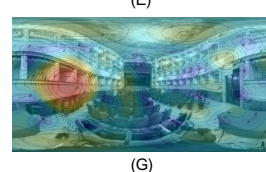
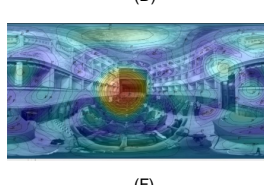
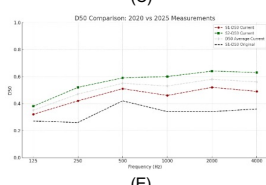
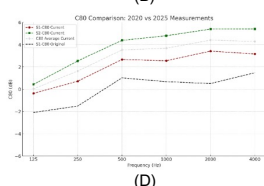
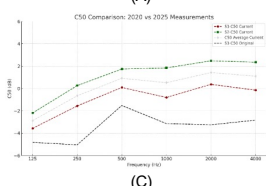
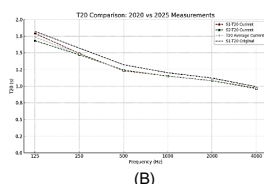
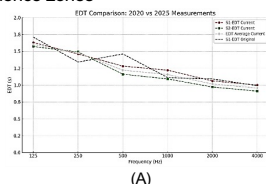
This study compares 2020 and 2025 acoustic data to:

- Assess the impact of renewed velvet and added source/receiver positions
- Examine changes in clarity, reverberation, and spatial reflections
- Demonstrate how high-channel arrays aid acoustic tuning in historic venues

4. Results – Acoustic Parameters & Reflection Mapping

Parameter Comparison (2020 vs 2025):

- EDT & T20 (A & B): Slight reduction (-0.15 to -0.20 s) in the mid-band, improving clarity without losing warmth
- C50 (C): Increased from < -1.5 dB to peaks of $+2.5$ dB (S2), enhancing speech intelligibility
- C80 (D): Now within the ideal 2–6 dB range, indicating improved musical clarity
- D50 (E): Values exceed 0.50 above 500 Hz, confirming improved articulation across audience zones



Mapping Highlights (EMG4 Array):

- Direct sound (F): Strong and centered along main axis
- Early reflections (G): Lateral returns from box fronts (~ 88 dB)
- Late reflections (H): Focused ceiling bounce enhances spatial height (~ 85 dB)

2. Architectural Background

Built between 1780 and 1787 by Giuseppe Pistocchi, Teatro Masini features:

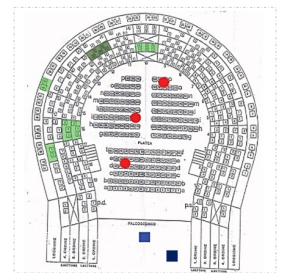
- A horseshoe-shaped plan with 4 stacked balconies and gallery
 - Rich neoclassical decoration: Doric columns, golden reliefs, statues
 - A flat dome enhancing early lateral reflections
 - Seating capacity: ~ 520 ; Volume: $2,330$ m³ (hall), $4,760$ m³ (flytower)
- Recent maintenance involved velvet panel renewal and minor box updates.



3. Measurement Setup

Measurements were carried out using the following setup:

- Sources: Two positions on stage — one at the proscenium (S1), one upstage (S2, added in 2025)
- Receivers: Multiple stalls and box positions, plus a new third-tier box (added in 2025)
- Microphones: Dummy head (KU-100), B-format (Ambeo), omnidirectional (B&K), EM64 spherical array
- Signal: 15-second exponential sine sweep (40 Hz–20 kHz)
- Conditions: Unoccupied hall, no scenery on stage



Impulse responses were processed in Aurora (Adobe Audition). The expanded 2025 layout enables direct comparison with 2020, while improving spatial coverage.

Source and receiver positions. New 2025 locations shown in dark green (receiver) and dark blue (source).

5. Conclusions & Recommendations

The 2025 survey shows subtle but significant improvements:

- Shorter decay improves clarity, especially for speech
- D50 and C50 reach thresholds suitable for spoken-word performance
- Lateral and ceiling reflections remain strong, preserving warmth and envelopment
- No major intervention is needed — optional drapery can optimize conditions for speech-heavy events