NEW ACADEMY OF MUSIC IN THE SUBURBS OF ATHENS: ARCHITECTURAL LANGUAGE AND ACOUSTICAL SOLUTIONS

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1 INTRODUCTION

The present study introduces the New Academy of Music, an educational project set to be implemented in Kifissia, Athens. Envisioned as a hub for the community, the academy is designed with spaces that are functional, encompassing both indoor and outdoor areas.
The proposed solution comprises two zones, namely, a public one where musical and cultural activities are hosted, and a more private zone dedicated to instruction/tutoring activities as well as administrative functions.
The teaching zone consists of small and large classrooms for musical instruments, theoretical courses, percussion instruments, group classes, orchestra, choir, and studios for rehearsal and recordings. The cultural zone includes a chamber music auditorium of 350 seats, foyer, dressing rooms, an exhibition room, a small amateur radio station, and an outdoor multipurpose theatre for 550 persons. An open air cafeteria functions as a conceivable boundary between the two zones.

Table 1. Project Identity

Title	New Academy of Music in the suburbs of Athens
Architect	Aikaterini Bousia Alexaki
Supervised by	Tasis Papaioannou (Design Advisor) Dimitrios Karydis (Urban Design Advisor) Alexandra Sotiropoulou, Giannis Karagiannis (Acoustics Advisors)
Date	2015

2 SPATIAL ARRANGEMENT OF ROOMS

2.1 Building Program and Classrooms' Arrangement

After determining the building program, the arrangement of the classrooms has been defined by acoustical criteria. It was necessary to create a proper zoning to eliminate the disturbing noise from traffic, music practice and other noise. It was important to place together the rooms with low noise potential, such as theory classrooms, and maintain distance from disturbing traffic routes around the building[1]. Most classrooms dedicated to the teaching of classical instruments and theoretical courses have been placed at the most private and protected area, to reduce external noise. The classes for percussion and louder instruments, as well as the group classes for children, choirs and orchestra, have been placed in a specially designed underground level, to protect the rest of the building and surrounding residential areas from high noise levels.
The auditorium has been placed, along with other uses more open to the public, at the most public zone, neighboring a park and enhancing accessibility via public transport. All classrooms and the auditorium are accessed by double doors to eliminate the disturbance from the circulation spaces to teaching and practice spaces.
The building was designed to meet the ideal values for sound insulation, reverberation time and internal ambient noise. However, this paper focuses on the shape and reverberation time of the

classrooms and the auditorium that have been designed according to architectural and acoustical criteria.

Table 2. Building Program - Teaching Zone

	Room Type	Unit Size (m^2)	Total Size (m^2)
14	Small teaching rooms for voice and instrumetns	25	350
4	Big teaching rooms for instruments, voice and chamber music	50	200
3	Teaching rooms for Theory (Groups)	50	150
1	Teaching room for percussion	50	50
3	Recording studios – electrical instruments	50	150
1	Room for children group activities	75	75
1	Orchestra rehearsal room	250	250
1	Choir rehearsal room	90	90

Table 3. Building Program - Cultural Zone

	Room Type	Unit Size (m^2)	Total Size (m^2)
1	Auditorium	450	450
1	Foyer - lobby	300	300
4	Group dressing rooms	55	220
2	Private dressing rooms	20	40
1	Multipurpose room	230	230
1	Radio Station room	25	25
1	Open air theater	-	-
2	Control rooms	25	50

Figure 1: Architectural Model of the Academy, scale 1:200, July 2015.

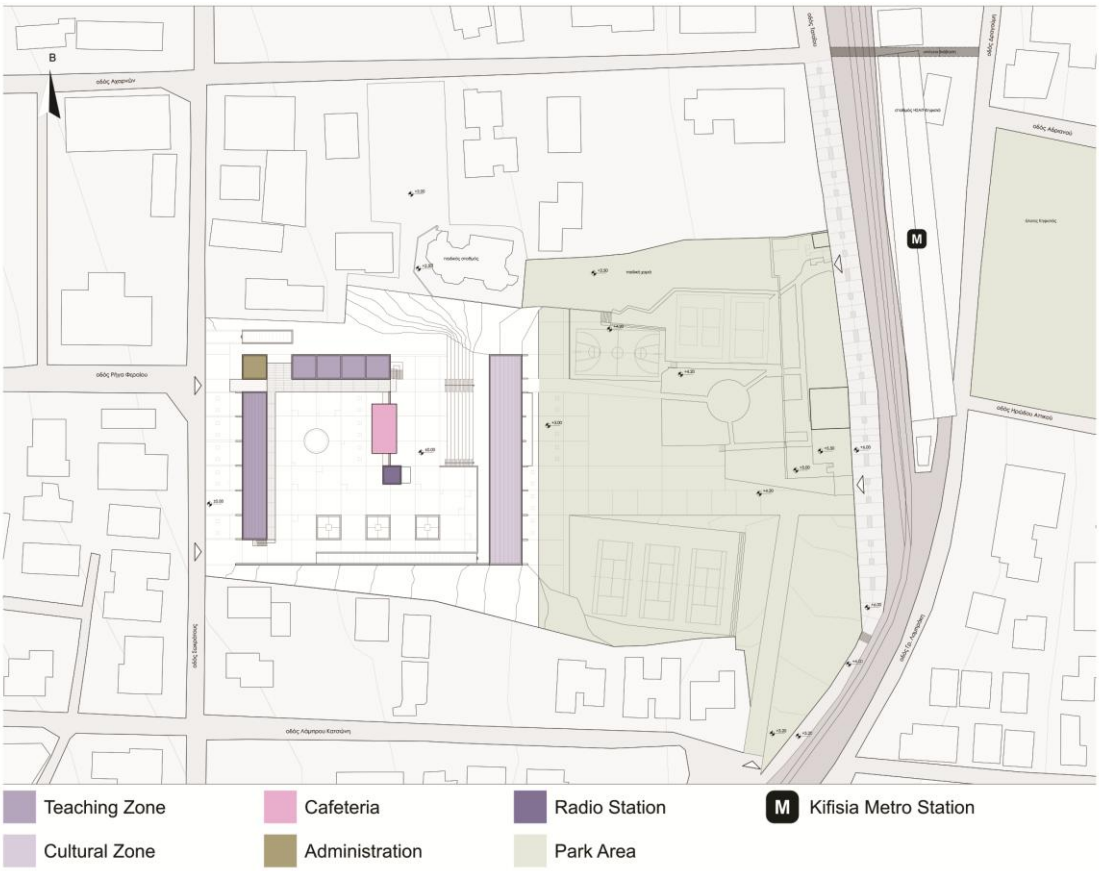


Figure 2: Masterplan

3 ROOM ACOUSTICAL DESIGN

3.1 The acoustic design of the auditorium

Table 4. Basic features of the auditorium

Use	Chamber music - speech
Capacity	350 pax
Length	28 m.
Width	15,85 m.
Height (min./max.)	3,5 m. / 8 m.
Volume	2390 m^3
Target RT (500, 1000 Hz) (occupied hall)	1.2

The auditorium acoustics have been pivotal to the design decisions since the very start of the project's architectural synthesis. The auditorium was crafted with a dual-purpose design to cater to both chamber music and lectures. In light of this dual functionality, a target Reverberation Time (RT) of 1.20 s was selected for the project, balancing the acoustics for both musical performances and spoken presentations[2].
The shape that was selected for the auditorium was the classic shoe box that has been considered the most suitable for the combination of the architectural synthesis and the acoustical solution.

Morphologically, the shape follows the grid of the whole synthesis, based on a rhythm that symbolically repeats itself in the whole project. Acoustically the rectangular shape is versatile, accommodating a range of music genres and also meeting the acoustical specifications for clear speech. The narrow width of the auditorium ensures that all the members of the audience will be relatively close to the side walls, receiving lateral sound reflections shortly after the direct sound[3]. This combination of the direct and reflected sound gives the music the desirable definition.
The volume of the auditorium was defined with the use of the simplified Reverberation Time formula according to C.W. Kosten (1966) and the Sabine model.

$$RT = (0.16V) / S_A\alpha_{eq}$$

where RT: target Reverberation Time [s]
V: optimal room volume [m^3]
S_A: equivalent audience area [m^2]
α_{eq}: equivalent sound absorption coefficient (1.07 for full-room at mid frequencies.)

The volume of the auditorium was defined by the target Reverberation Time and the maximum capacity of the room:

$V = RT.S_A.\alpha_{eq} / 0.16 = 2390\ m^2$

where RT = 1.2 s.
$S_A = 255\ m^2$ [1]

The selected materials serve for diffusing and reflecting the sound while also contributing to an aesthetically pleasing architectural environment that aligns with the building's emphasis on clarity and simplicity.
The entire design is based on the use of exposed concrete, wood, metal and glass. The auditorium roof is a waffle slab, a choice that allows sound diffusion. The walls are covered with wooden diffusion panels. Sound reflectors are hanging from the ceiling. They can be rotated to reflect sound for speech, or turn horizontally/vertically to contribute to the diffusion for music.
The seating is elevated to allow direct sound projection and to ensure the visual contact of the audience with the stage.

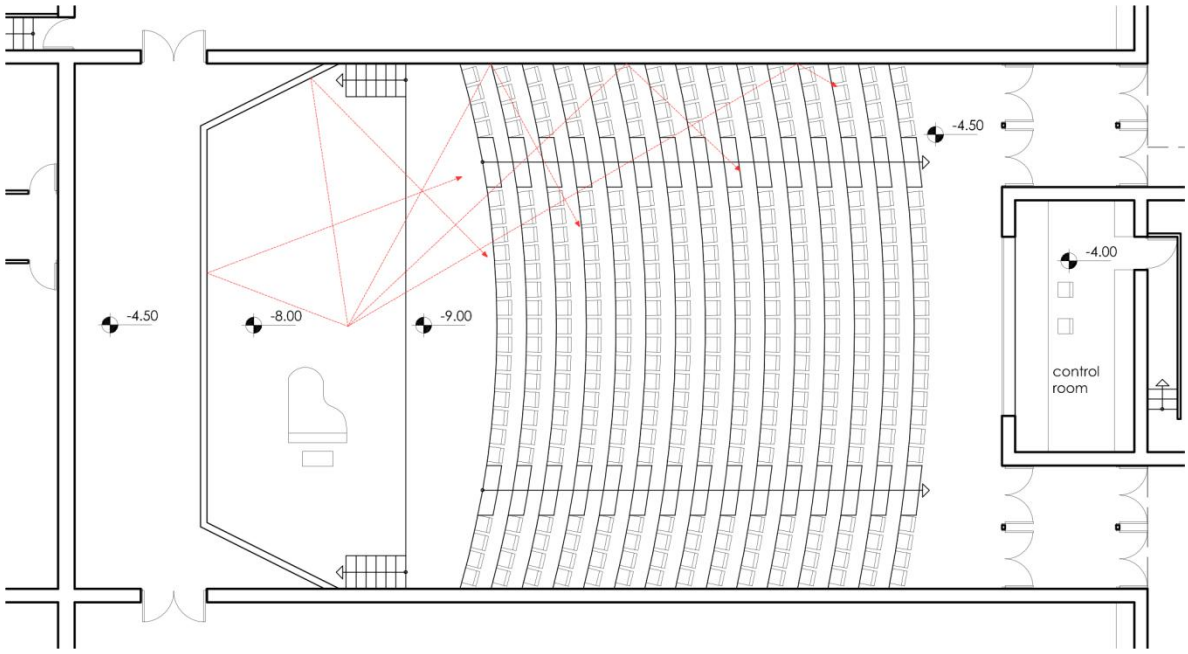
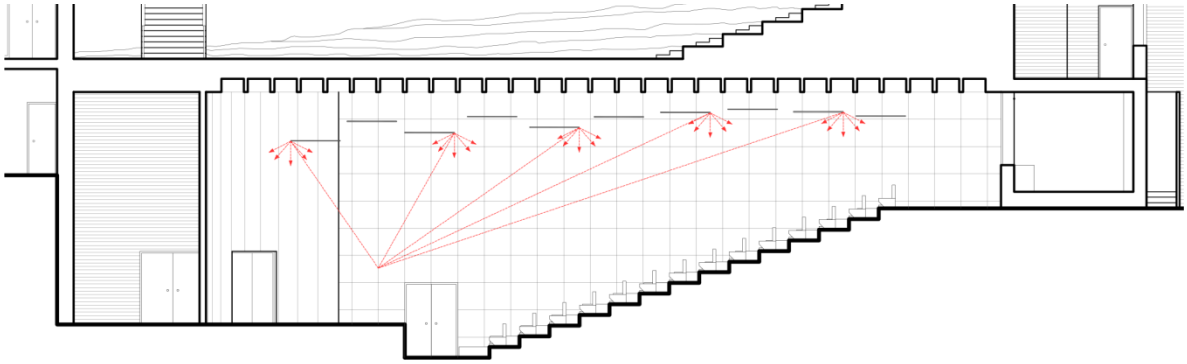


Figure 3: Auditorium plan view

[1] The S_A has been estimated for 50 choir members (50x0.5=25m^2), 20 orchestra members (20x1,5=30 m^2) and an audience of 200m^2

A.



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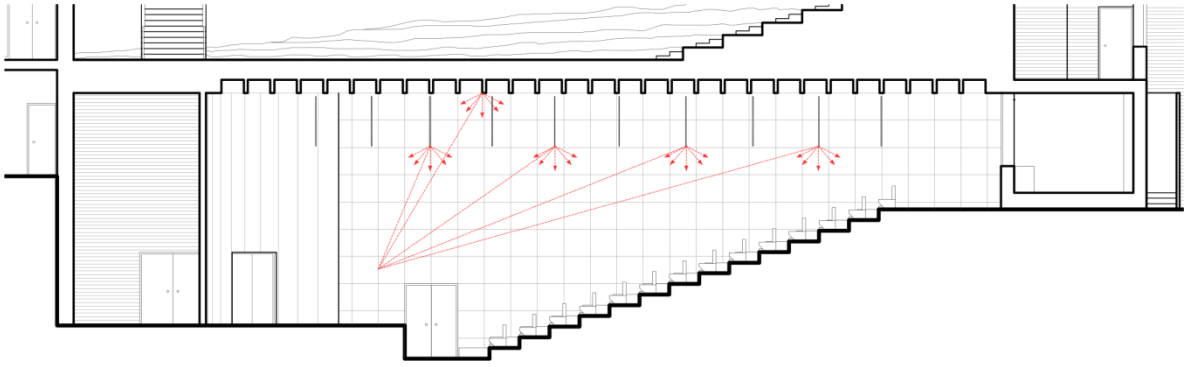

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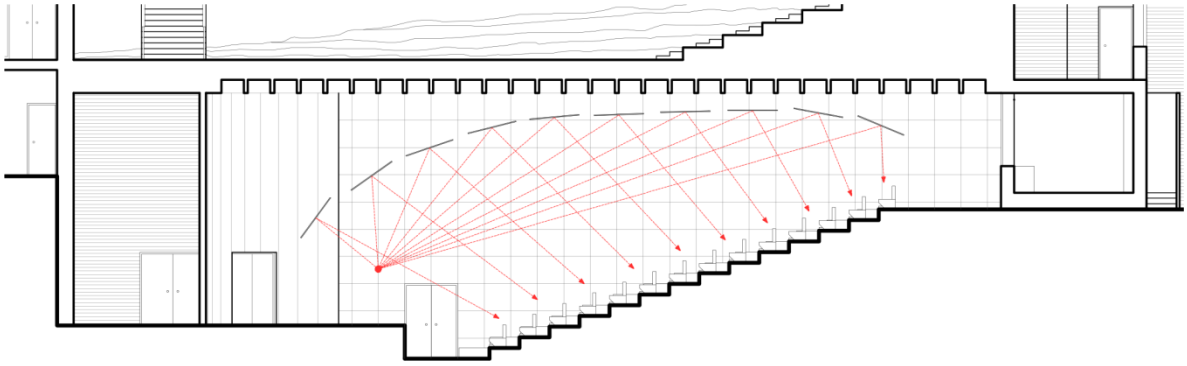

Figure 4: Auditorium Section. A. Music, B. Music, C. Speech

A.

B.

C.

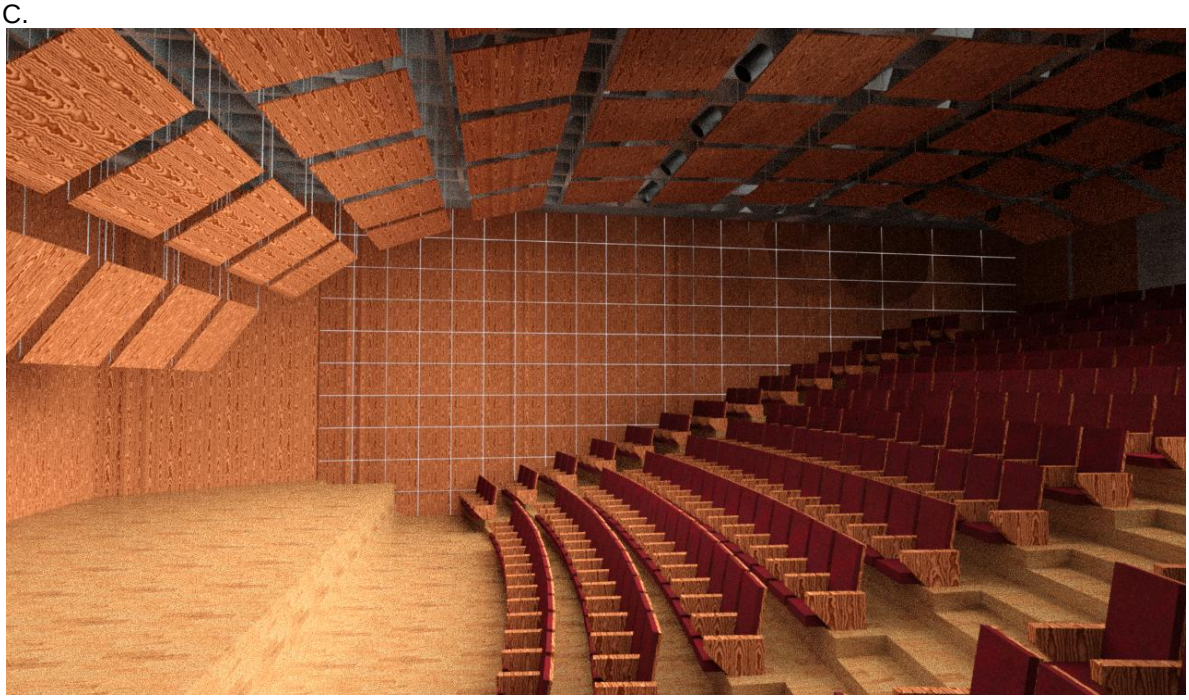

Figure 5: Auditorium 3d Model. A. Music, B. Music, C. Speech

3.2 Design of the music classrooms

The classrooms for musical instrument and voice teaching and practicing have been located at the south of the building complex. The smaller classrooms are at the ground level and the bigger classrooms at the first floor. The objective of the acoustical design of the music classrooms is to assure sound insulation and provide the right RT for clear speech communication and for music teaching and practice.

The acoustics of the classrooms will be flexible as the target RT may vary depending on different instruments, the number of musicians and the purpose of practice. The flexible RT will allow the students to practice different music genres and discover how to control the clarity, the balance and the loudness of their performance.

The shape of the classrooms follows the grid of the whole project. To prevent acoustical issues from parallel walls, smaller classrooms have a trapezoidal layout, and larger ones have an inclined roof[4]. The music rooms are designed to be used by solo instrumentalists or small music ensembles. They are expected to receive the greatest level of usage, as students may use them up to 40 hours per week[5]. Variable acoustics allow students to practice in different conditions according to the needs of teaching and their personal preferences. The target RT of the classrooms ranges from 0.4 to 0.9 seconds. Flexible acoustics in all classrooms are achieved through mobile diffusive and absorptive panels, allowing for a tailored acoustic experience. Sound absorbing materials are used to eliminate flutter echo and to avoid uncomfortably loud sound power especially in the smaller classrooms.

Table 5. Basic features of the teaching classes modules

A. Small Classrooms

Use	Teaching / practice of musical instruments
Length	5.8 m
Width (min./max.)	2.94/4.45 m
Height	3.45 m
Volume	74 m^3
RT	Variable

B. Large Classrooms

Use	Teaching / practice of musical instruments
Length	7.4 m
Width	7.2 m
Height (min./max.)	4.3/5.9 m
Volume	272 m^3
RT	Variable

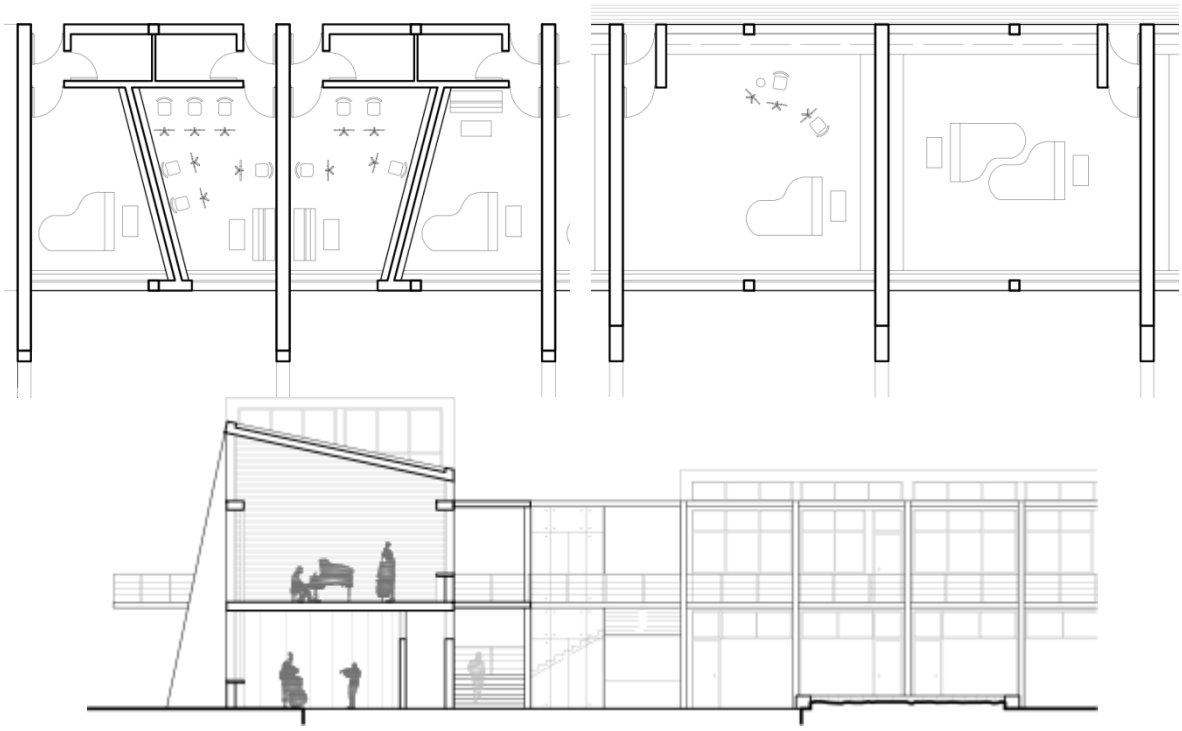

Figure 6: Plan and section of small and large classroom modules.

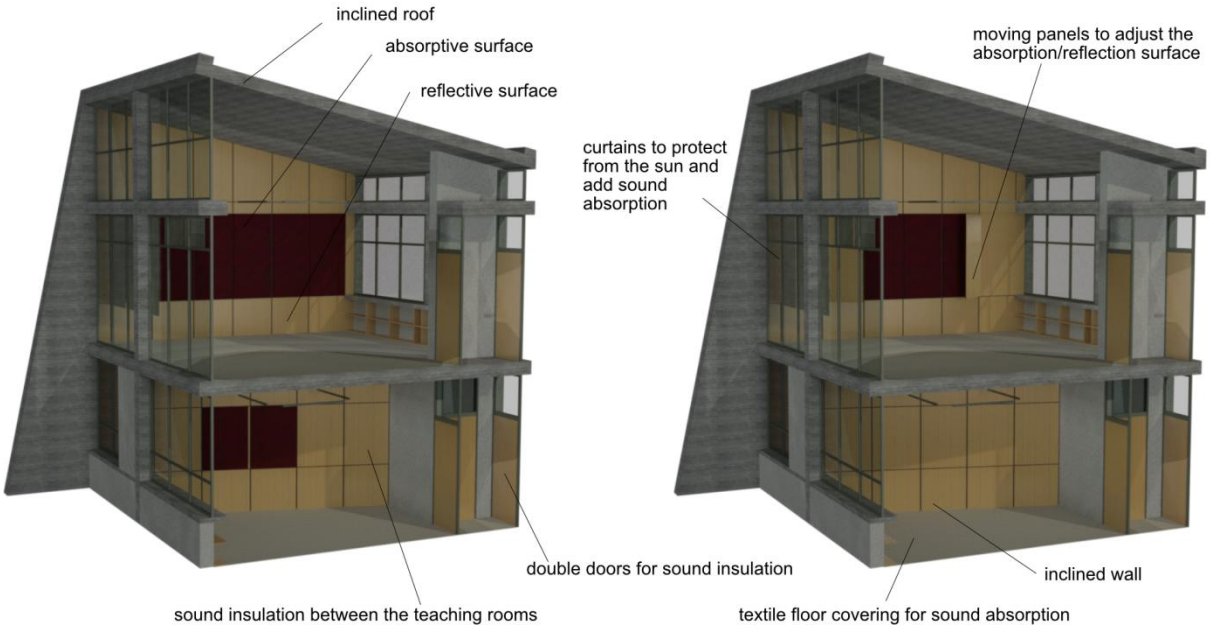

Figure 7: Classroom module 3d model

3.3 Conclusions

The design of the New Music Academy was based on a set of architectural and acoustic parameters. The acoustics of the spaces and the ideal reverberation time were decisive for the compositional decisions that determined the shape of the rooms, their volume and the choice of materials. The architectural composition aims to create an educational environment that will allow the users to enjoy the process and have the best results in their practice and performance.

4 REFERENCES

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Acknowledgements

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