

POLITECNICO DI TORINO
FIRST SCHOOL OF ARCHITECTURE
Master of Science in Architecture Construction City
Honors theses

GREENERY SYSTEMS IN HISTORICAL URBAN CENTRES.

Soundscape Evaluation, Design Acoustic Proposals

by Ilaria Poma

Tutor: Arianna Astolfi

Co-tutors: Jian Kang, Yuliya Smyrnova

European cities are fast growing and noise pollution is becoming a major environmental problem. On the other hand, not too many green areas remain in cities, especially in city centres. Recently thanks to transaction from noise reduction to soundscapes creation, sound can be considered as a “source” and may be designed and planned. This thesis focuses on noise control in urban sites and takes part in the European HOSANNA project, a collaborative project under the Seventh Framework Programme, Theme 7, Sustainable Surface Transport. The innovative proposal consists in the use of vegetation on different urban surfaces to abate traffic noise.

Vegetation as sustainable element has gathered an increased attention for potential benefit in enhanced well-being of citizens and also for the resulting soundscape, with sounds and also aural visual interaction, useful for biodiversity. The main aim is reduction of road traffic noise in the city centre of European cities, characterized by historical constrained buildings. Two real case studies, a square and an urban courtyard, respectively placed in Italy and in England, have been evaluated. First in-situ measures have been carried out and then, for each case, different noise abatement schemes, based on the guidelines of HOSANNA program, have been proposed.

Acoustic simulations have been performed with the software CATT-Acoustic[®], then simulations have been repeated with two other software, namely CRR (Combined Ray-tracing and Radiosity) and Odeon[®], in order to verify the results and to study the applicability of the software for dealing with outdoor sound field propagation.

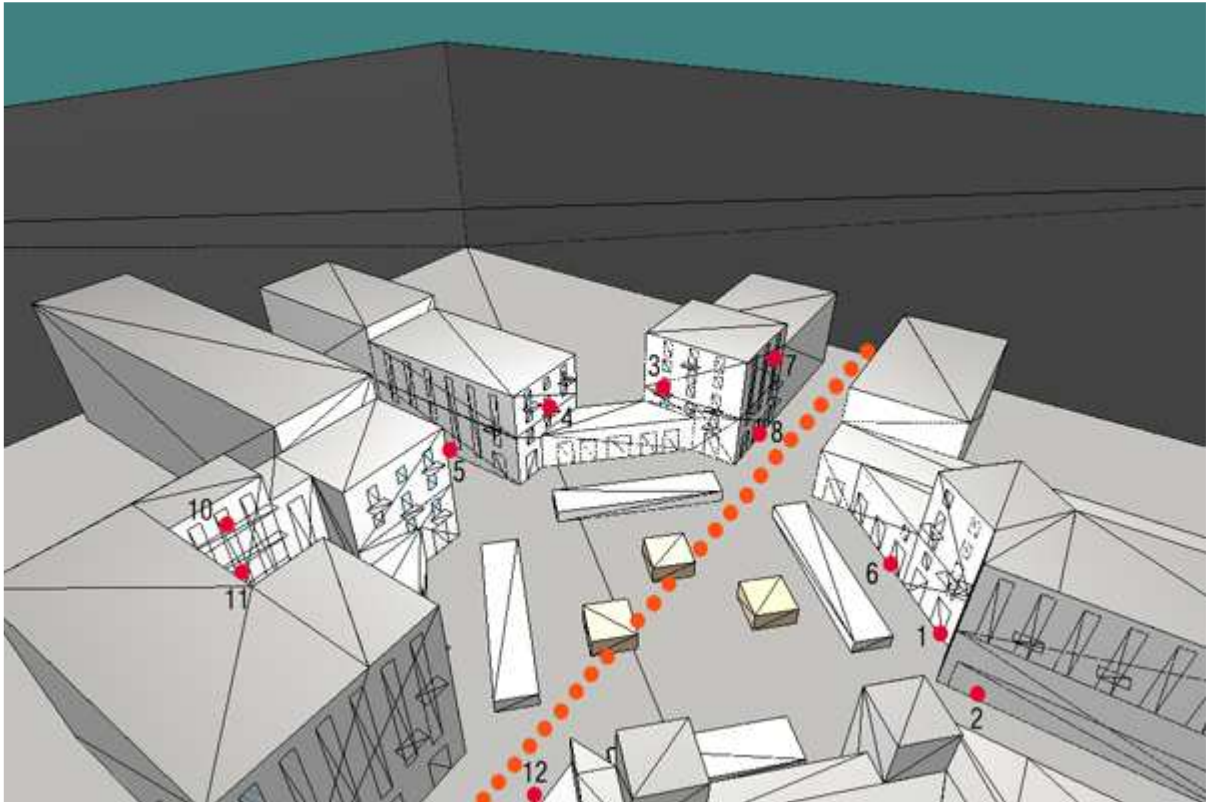


Figure 1. Case study 1: a square_Largo Saluzzo_Torino_Italy

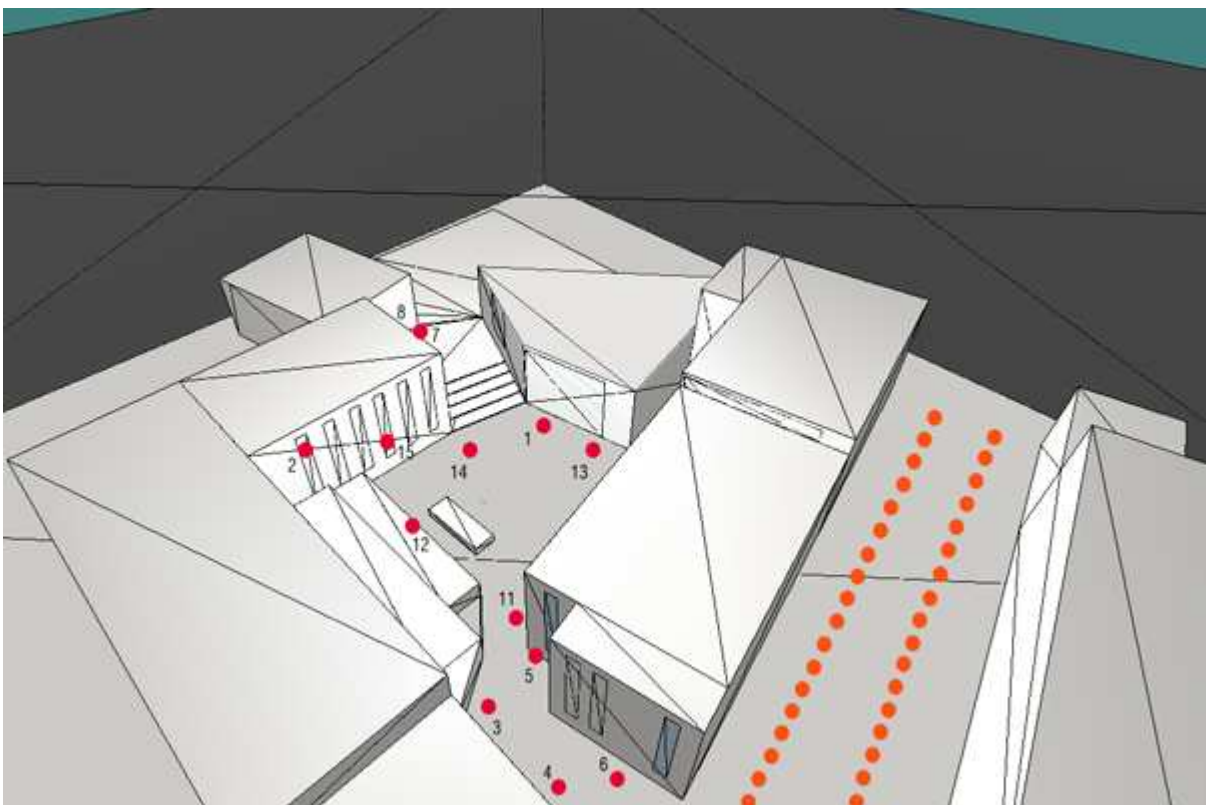


Figure 2. Case study 2: a courtyard_Leopold Square_Sheffield_United Kingdom

Different geometrical models, spaces sizes, types and amounts of vegetation have been evaluated, founding out that better results, in terms of traffic noise reduction, can be achieved by using green wall instead of climbing wall and that depending on size of a certain urban space amount or placement of vegetation can play an important role.

Effectiveness of various types of vegetation and their spatial distribution on the buildings facades to reduce traffic noise had been previously evaluated in laboratory, in accord to ISO/FDIS 17497-1¹. Both absorption and scattering have been evaluated with the method of Reverberation Chamber at the University of Sheffield, adopting a circular turntable with a 3 m diameter base plate.



Figure 3. The turntable with Ivy into the Reverberation Chamber of the University of Sheffield

Two types of vegetation have been proposed for both the places analyzed, vegetated wall and Ivy; green walls generally provide higher of about 1-2 dB(A) averaged noise reduction compared to the climbing wall. Higher insertion losses are achieved by those receivers which are generally located in the close proximity to the vegetation at lower ground.

While for the bigger place (the square), amount plays the more important role in terms of traffic noise reduction, for the smaller one (the courtyard), placement is the fundamental aspect to take in regard.

¹ ISO/FDIS 17497-1: Acoustics - Measurement of the sound scattering properties of surfaces – Part 1: Measurement of the random-incidence scattering coefficient in a reverberation room. 2000.

At last, simulations results demonstrate how vegetated wall affects also parameters related to intelligibility, such as Reverberation Time, EDT and Definition, more than Ivy. There is not a relation with the size, but different zones of the same place might have a different response to vegetation treatments in terms of affections to those parameters. Absorption and scattering result to be of fundamental importance in definition of these indexes and, in general, in the acoustic of places, also if they are outdoors.

Finally acoustics is not the only discipline involved in greenery systems issue, so also lighting, cooling and ventilation aspects, in addition to benefits-costs relations, have to be taken into account, in order to have an holistic point of view, as required from HOSANNA project, and in order to manage a complete process of design of a good urban soundscape.

For further information, e-mail:

Ilaria Poma: ilaria.poma@gmail.com