

Building Envelope in Airport Regions: The influence of building envelope toward aircraft noise propagation

Personal Reflection

Throughout the research and design progress of this project, I have come to an understanding that while many researches on acoustic behavior of the building have been conducted, very few are related to the noise pollution cause by aviation activities. This lack in awareness of the impact of the annoyance cause by the aircraft seem to be the result in different in the amount population effected by the aircraft in comparison to other noise sources, such as traffic and industrial machine. This lack of awareness can be seen in the lack of proper instrument (software) to assessing and aiding the problem. For example, an urban acoustic simulation software often lack a proper noise database for aircraft, while an aircraft noise simulation often lack the ability to properly assess the ground condition of the flight path. Hence, throughout the research there are many uncertainties in the outcome of the research due to the lack of proper tool.

CATT-acoustic, a room geometry-based simulation, was chosen as the main simulation software for the project. While the software was mainly used for indoor space, it was chosen due to its availability and its gradual learning curve. While in doubt, with the help of the mentors, it possible to simulate an outdoor situation in a close room environment with a tweak in acoustic properties of the room boundaries. In addition, the results are surprisingly accurate when compared to the actual on-site measurement. While there are slightly different in the values per frequency, it is understandable, due to the absence of the certain element—such as wind and ambient noise—and due to the varies of spectrum of aircraft noise. As the program was used in an unconventional method, several limitation and error were found along the research progress, especially when dealing with small canyon and gap between old and new building façade, or when dealing with semi-transparent material, which give no result to an output of the simulation. Due to limited time frame, the actual problem of these error or limitation were still unidentified and less accurate methods were used for these specific cases. Further, investigation into the setting is required to identify the actual problem in this case.

The results of the initial experiments shown that aircraft is a very tricky noise source, when compared to other sources, due to its unique source position and directivity. Many design solutions which are effective against traffic noise show an opposite result when dealing with aircraft noise. For example, a flat roof which has better performance than gable roof in case of traffic noise shows an opposite effect in case of aircraft noise as more sound are being trap within the canyon. In addition, effectiveness of each design variation greatly depends on the position of the source and the surrounding context of the target building.

In addition to the acoustic aspect of the building, several feedbacks of the mentors are concerning the sustainability of the design and comfortability of the users. Furthermore, many acoustic guidelines seem to be emphasized on sealing technique and chunky construction system to exchange with reduction

of natural ventilation and lighting to achieve highest noise reduction value. This current approach is likely to decrease the comfort of the users while increase the energy consumption of the building, as it depends more on mechanical HVAC system to keep the building comfortable. Hence, an integral design approaches is incorporate into the aim of this project to create a more sustainable and comfortable building system for the user.

While many proposed shapes of building geometry shown a positive result in reducing outdoor noise pollution cause by the passing aircraft. Several questions regarding the actual application of each intervention remain. One, is the actual performance of the design on the real situation where wind and other noise sources are presented. As the proper simulation tool is still lacking, it is difficult to assess the actual performance of the design intervention within digital environment. The second question is regarding the affordability of each design solution. This is especially true in case of developing country which lack proper agencies who are assessing this problem seriously. Most of the people who live around airport and are affected by the aircraft noise are people with low-income who settle in this particular neighborhood due to the drop-in land value. The research also shows that it is quite difficult to find a universal solution to the annoyance cause by an aviation activity, as the problems occur all around the world under in different location with different context. This can be seen in case of Amsterdam and Bangkok. Two countries with same problem for all neighborhood within the airport region, however, under differences level in noise exposure, climate and living condition. Some solution, such as the winter garden that provide to be effective in the Dutch context may cause more problem in the tropical climate of Bangkok due to excessive sunlight. In addition, when dealing with aircraft noise annoyance a cumulative effort between different parties are required—these may include the residents, architects, urban planner and related government agencies. It is still difficult for many countries to come up with a proper solution, especially in the case of developing countries where proper coordination between different parties and knowledge on the issue are lacking. However, I do believe that in order to solve these problems more research is still required and hope this research project would act as a basic guideline and raise awareness of this growing issue.