



Road traffic façade treatment in Israel

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ABSTRACT

This paper outlines the program for façade treatment for traffic noise in Israel. The main principals of the program are: Façade treatment is only provided as part of a statutory plan for a new roadway or a substantial change to an existing road, monetary compensation is never given in lieu of treatment, the façade noise levels are determined by calculation only, using maximum potential noise-producing traffic conditions, the criteria for façade treatment are 64 dBA for residential buildings and 59 dBA for public buildings, the type of treatment is based on the amount the façade noise level exceeds the criterion. The average costs of façade treatments are 80,000 NIS (\$A25,000) for dwellings in multi-storey buildings, 210,000 NIS (\$A65,000) for single dwellings, 950,000 NIS (\$A300,000) for public buildings. Over the last 10 years, approximately 1,500 dwellings have been treated.

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1. INTRODUCTION

In recent years a number of arterial roads have been built in Israel adjacent to urban residential areas, many of which include high-rise buildings. The preferred noise treatment, where necessary, is either low-noise asphalt and/or noise barriers (up to a maximum height of 6 meters)/earth berms (up to a maximum height of 8 meters).

However, in many cases, because of the height of the buildings and their proximity to the road, these measures are insufficient for the upper floors and it is necessary to supplement the noise measures with facade treatment.



Figure 1 – Typical situation for façade treatment

It should be stressed that façade treatment is considered a supplementary noise control measure and not a principal noise measure. This is for two reasons: Firstly it is preferable to reach the required noise criteria outside of the building façade and then allow the residents to be able to open their windows and

still achieve a reasonable acoustic environment. Secondly, from the point of view of the road authority, it is preferable to restrict all the required works to within the statutory border of the road rather than deal with often hundreds of property owners who all have their demands and expectations.

A notable exception to this rule is the main Tel Aviv – Jerusalem highway that is being expanded at the moment. This road is considered of significant "scenic" value and so it was decided that the visual experience of the driver should not be disturbed by noise barriers and therefore, other than low-noise asphalt, façade treatment should be the primary noise treatment.

2. BACKGROUND

The façade treatment is always instituted as part of a statutory plan, i.e. a plan for a new road or for a significant change to an existing road.

It should be stressed that the façade treatment is in no way considered as compensation for the noise disturbance, for reducing the property value etc. but is exclusively considered as part of the statutory obligations, i.e. part of the overall noise treatment program for the road. As such, monetary compensation is never paid to the property owner in lieu of the required treatment.

Preferably the façade treatment is carried out simultaneously with the road construction so that the treatment is completed before the road is opened to traffic. But in some cases, due to bureaucratic complications, the façade treatment is carried out some time after the road has been opened to traffic.

It should be noted that in some cases it has been recommended that the treatment be carried out as part of the initial stage of the road construction, so that it can also provide some noise protection during the construction stage.

3. CRITERIA

3.1 Eligibility for Façade Treatment

In the late 1990's an inter-ministerial committee was set up to recommend criteria for traffic noise (1). The committee proposed that for residential dwellings, the criteria should be $Leq = 64$ dBA and $Leq = 59$ dBA for noise-sensitive public buildings (schools, hospitals etc.).

The criteria apply at a distance of 1 meter from the façade, under free-field conditions.

For residential dwellings, these criteria apply only to bedrooms, living rooms etc but not to service rooms such as bathrooms, laundries and kitchens. For public buildings the criteria apply only to rooms used for a noise-sensitive purpose, such as classrooms or hospital wards.

The criteria apply to traffic volumes and speeds that correspond to Level of Service "C" in both directions. The assumption being that these traffic conditions represents the maximum potential noise for the road.

3.2 Type of Façade Treatment

The type of façade treatment is determined by the amount the calculated noise level exceeds the criteria as set down by the inter-ministerial committee.

1. If the calculated noise level exceeds the criteria by **0-2 dBA**, the only requirement is that an air-conditioner should be installed.

The logic behind this is that if the noise is only slightly above the criteria, then closing the window will ensure an acceptable noise climate inside the room. However, the residents are denied the fresh air they would normally get from open windows so an air conditioner is provided to allow them an acceptable thermal climate in the rooms with windows closed.

2. If the calculated noise level exceeds the criteria by **2-5 dBA**, then hinged windows should replace sliding windows or doors and an air conditioner should be installed.

The logic behind this is that in almost all cases the weak point of the façade insulation is the openings (windows or doors) and by installing hinged windows or doors instead of sliding windows or doors, the façade insulation will be improved by up to 5 dBA.

It should be noted that, for functional reasons, the vast majority of property owners do not agree to the installation of hinged windows/doors, particularly in living rooms. They claim that they take up valuable space in the rooms, are less attractive etc. This has proved to be a significant problem in the façade treatment process. Obviously, a property owner cannot be forced to accept a particular window type against his will. On the other hand, if a sliding window is included as part of the treatment package, then the acoustic aims of the treatment program may not be met. A compromise has been

proposed in order not to make the whole façade treatment program meaningless. Initially only a hinged window is presented to the owner. If the owner refuses a hinged window then he may chose a sliding window on the condition that the new window provides improved noise insulation compared to the existing window. In addition, he signs a document to say that he understands that the sliding window that he has chosen is acoustically inferior to the window that he was offered, and after the façade treatment has been completed he will not have a claim regarding the noise conditions in the dwelling.

3. If the calculated noise level exceeds the criteria by more than **5 dBA**, then the façade treatment should be designed so that the noise level inside the dwelling is less than 40 dBA with windows closed.

In practice, even though the inter-ministerial criteria do not demand it, where there are internal roller shutters installed, the shutter is replaced with an exterior shutter.

It should be noted that the façade treatment is based on the approved building plan only, which is not always identical to the existing building. If a property owner has made changes to the dwelling without obtaining the required approval, then these changes are not eligible for façade treatment.

4. DETERMINING ELIGIBILITY FOR FAÇADE TREATMENT

The policy of the Authority is that the eligibility for façade treatment is determined by calculation only, as opposed to measurement. This ensures that the data and the process for determining the applicable noise level can be monitored and the predicted noise level is fixed and repeatable. This would not be the case if measurements were used.

Of course, another reason for using calculations is that the façade treatment often must be determined while the road construction has still not been completed.

Also, the façade treatment is always given based on the final stage of the road construction even though this may not be the current construction stage. Therefore, the final stage can only be assessed based on calculations.

The calculations are carried out using the FHWA Traffic Noise Model (TNM). All elements of the road and the surroundings are incorporated in the calculations, including the building envelope that acts as a barrier for some of the façade openings as well as for openings in adjacent buildings.

4.1 Calculation v Measurement

In early façade treatment projects, where the road had been completed before the façade treatment program was implemented, there was a requirement to carry out noise measurements in order to calibrate the noise prediction model. It was found that even though detailed traffic counts were made during the noise measurements (including traffic type and traffic speed) and the road and surroundings were carefully modeled, there were still sometimes significant deviations between the measurements and the calculations.

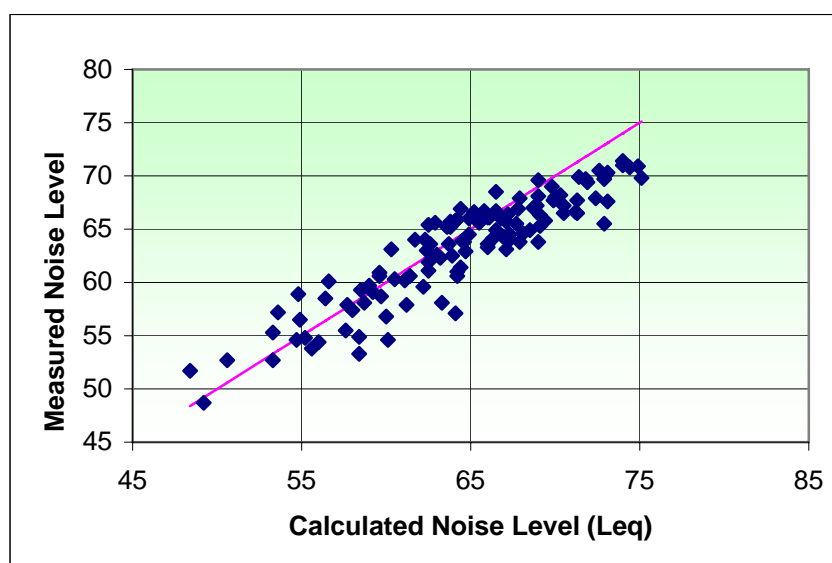


Figure 2 – Comparison between calculated and measured noise levels

Even though, it can be seen from Figure 2 that, in general, the calculated noise levels are greater than the measured noise levels (particularly at higher noise levels), these deviations suggested to the public that the system was not entirely accurate and reliable and, in cases where the predicted noise levels came close to the criteria, the resident demanded to be given "the benefit of the doubt" and included in the façade program.

5. INFRASTRUCTURE FOR IMPLEMENTING FAÇADE TREATMENT

5.1 Façade Treatment Authority

In order to implement the façade treatment program, a Façade Treatment Authority was set-up. This authority is a department within the National Roads Authority.

The Façade Treatment Authority includes a team of experts from a number of disciplines:

- An acoustic consultant who carries out the noise calculations.
- A surveyor who measures the roads (if dealing with an existing road), the surrounding environment (including noise barriers), the buildings (the location and height of openings, in particular).
- An air-conditioning engineer who determines the appropriate air conditioner to be installed.
- An electrical engineer who assesses the existing electricity layout of the dwelling to ensure that it is able to "carry" an air conditioner and designs changes where necessary (e.g. upgrade from 1 phase to 3 phase electricity).
- An architect who draws up relevant plans of the eligible dwelling to be presented to the property owner. These plans integrate the required treatment into the existing building conditions.
- A building inspector who supervises and approves the building works.

5.2 Façade Treatment Process

For each project the Authority initially sets the guidelines and policy for the façade treatment program for the particular plan. These guidelines are specific for each plan and must be approved by the Planning Authority. Although the basis of the guidelines is the same for each plan, there are often certain local conditions requiring that the guidelines be slightly adapted.

The first stage of the process requires establishing which dwellings are eligible for façade treatment and what is the appropriate treatment, based on the criteria given above in Section 3.

Then the Authority team visits the eligible dwelling to determine, whether the dwelling matches the approved building plan, whether air conditioners are installed, the state of the electricity etc.

Following the site visit, the plans of the dwelling are prepared by the architect, with the appropriate treatments and presented to the property owner (Figure 3.).

Experience has shown that many owners do not understand the plans. Therefore, a "showroom" has been set up at the Authority offices containing the various window and door types so that the owners can see the proposed building elements.

The property owner must approve the proposed treatments. However, if the owner refuses to approve the plan this is not considered a violation of the Statutory Plan and cannot hold-up the construction or the opening of the road.

The owner can choose between carrying out the work himself and having the Authority's contractor carry out the work. If the owner chooses to carry out the work himself, he must carry it out according to the architect's plan, at completion the work is inspected by the building supervisor and he receives the same payment as the Authority's contractor would have received.

If the owner does not accept the proposed treatment plan, he has the option of submitting an appeal to an Appeals Board. The Appeals Board includes a chairman (a retired judge), a representative of the public (usually an architect) and an acoustic consultant. Even though the members of the Appeals Board are selected and paid by the Authority they are an independent body and have demanded changes in the façade treatment plan, in some cases.

The owners still have the right to turn to the courts, but the existence of an Appeals Board has simplified the appeals process and reduced the number of legal claims to almost nil.

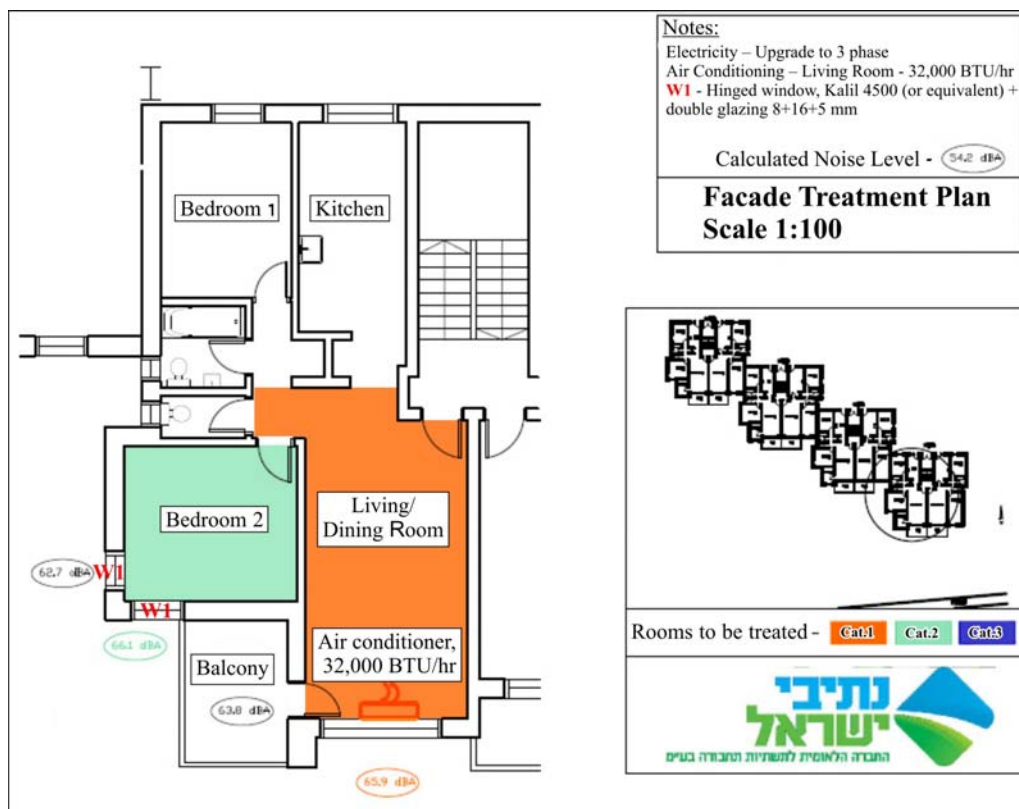


Figure 3 – Plan of dwelling including façade treatment details

6. FINAL REMARKS

Over the last 10 years, approximately 1,500 dwellings have been treated. Most of these have been apartments. But there have also been a significant number of private houses and public buildings.

The average costs of façade treatments are 80,000 NIS (\$A25,000) for dwellings in multi-storey buildings, 210,000 NIS (\$A65,000) for single dwellings, 950,000 NIS (\$A300,000) for public buildings.

REFERENCES

1. Criteria for noise from roads. Inter-ministerial committee for setting noise standards for roads, Feb. 1999.