



The Review Of Residential, Commercial, And Industrial Project Related Environmental Impact Statements For Noise Concerns: A Brief Outline And Checksheet



THE REVIEW OF RESIDENTIAL, COMMERCIAL, AND
INDUSTRIAL PROJECT ENVIRONMENTAL IMPACT STATEMENTS
FOR NOISE CONCERNS: A BRIEF OUTLINE AND CHECKSHEET

By

Gale R. Hruska
Noise Control Specialist
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

PREFACE

Many projects, especially those involving Federal actions or Federal funding, require the submission of environmental impact statements (EIS's). To assist the people responsible for EIS preparation, many useful sources of information have been developed. However, almost no attention has been given to assisting the person who has to review one. It seems to be implied that the same material used in the preparation of the document is adequate for its review. Unfortunately, as people who have had to review EIS's know, this is not quite the case. The different perspectives of the preparer and the reviewer require that they approach the EIS from different directions. The EIS preparer strives to include sufficient information to provide a complete description of the noise impact of the project, while the reviewer must be able to ask the right questions to pinpoint any inadequacies.

In response to requests from both professional EIS reviewers and the public, the Region V Noise Program has assembled a list of concerns that it feels every EIS should address. This particular document is concerned with non-transportation related projects. It is our hope that, in spite of its brevity, it will be a basis from which a competent noise review can be effected.

CONTENTS

INTRODUCTION	A1 - A2
CHECKSHEET	B1 - B8
COMMENTARY ON CHECKSHEET CONCERNS	C1 - C12
REFERENCES	D1

INTRODUCTION

Anyone who reviews Environmental Impact Statements (EIS) for noise considerations is certain to discover that there is no single set of questions that can be used to judge EIS adequacy. The reasoning behind this conclusion is that each project (and the environment that the project either impacts or is impacted by) is unique. What is a major concern for one project can often have minimal impact on another. However, this is not to say that there is no systematic way to evaluate an EIS.

After reviewing many EIS's for noise impact, the Region V Noise Program has come to feel that there are five basic areas in which an EIS should provide information:

1. Site description
2. Project description
3. Existing and future noise levels
4. Noise impact caused by the project (or to the project)
5. Mitigation measures necessary to reduce noise impact to acceptable levels

To assist the reviewer on determining whether or not a non-transportation related EIS has adequately addressed these concerns, an EIS Review Checksheet has been prepared. The purpose of this exercise is not to set standards, but only to provide a systematic list of concerns that the well prepared EIS will address. Therefore, there is no discussion of quantitative aspects of environmental review. There are no tables, graphs, or equations for predicting how much noise will be produced or how serious the noise impact will be. If the reviewer wants to corroborate this type of information, he will have to go to the other sources, such as those given in the references.

The checksheet consists of six major questions relevant to the adequacy of the noise portion of the EIS. Associated with each question are a number of minor aspects which can be used to determine if the question is adequately addressed. It is suggested that the reviewer checkoff the minor aspects as he encounters them in the EIS. Those that are poorly discussed should be noted. For those aspects that are not discussed at all, the reviewer should determine if they are relevant to the particular project. Those that are not discussed but are relevant should be noted. After the adequacies and inadequacies of all of the minor aspects have been examined, the reviewer then uses the accumulated findings to determine how well he feels the major question has been answered, i.e. Has the EIS addressed the question adequately, adequately with reservations, or not adequately?

Those who are not familiar with environmental noise assessment may find the checksheet rather terse. For these people, a brief commentary dealing with each of the six basic questions has been included. Should one want to probe deeper into this subject, he must go the literature.

RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL PROJECT EIS REVIEW CHECKSHEET

Project _____

Date _____

(Note: If the project is primarily a noise receiver, go to Section A.
If the project is primarily a noise generator, go to Section B.

SECTION A - NOISE SENSITIVE PROJECTS

1. IS THE SCOPE OF THE PROJECT ADEQUATELY DESCRIBED?

- Adequate Adequate with reservations Not adequate
- Physical description of site
- Buildings, main use areas
- Remainder of site grounds
- Site usage
- Population involved: number of people, pertinent characteristics
- Hours of use
- Ultimate development plans
- Alternatives

2. IS AN ADEQUATE VISUAL DESCRIPTION OF THE SITE AND ITS ENVIRONMENT PROVIDED?

- Adequate Adequate with reservations Not adequate
- Type of visual overview
- Aerial photograph
- Drawn schematics
- Other
- None
- Adequate map scale: explicitly identified, reasonable size
- Project buildings and boundaries superimposed on site map

- Existing potential noise sources located and identified
 - Roads and highways
 - Railroad tracks and yards
 - Airports and flight path tracks
 - Recreational activities (parks, boating, race tracks, etc.)
 - Industrial noise sources
 - Commercial noise sources
 - Other

- Future developments located and identified

3. IS ADEQUATE QUALITATIVE AND QUANTITATIVE DATA ABOUT THE POTENTIAL NOISE SOURCES PROVIDED?

- Adequate Adequate with reservations Not adequate
- Roads: distances to site, traffic volumes, car-truck mix, speed limits
- Railroads: distances to site, day-night operations mix, train lengths, switching operations, parking of idling locomotives and refrigerator cars
- Airports: traffic volumes, distances to site, jet-nonjet mix, day-night mix, flight path descriptions, distance to site
- Recreational: usage patterns, distances to site
- Industrial: types of noise producing equipment, locations of equipment, distances to site, loading dock locations, parking locations, hours of operation
- Commercial: Noise sources, distances to site, loading dock locations, hours of operation
- Other

4. ARE ADEQUATE QUANTITATIVE NOISE PREDICTIONS PROVIDED?

- Adequate Adequate with reservations Not adequate
- Noise descriptors used
 - Day-night equivalent sound level L(dn)
 - Hourly equivalent sound level Leq(h)
 - Maximum A-Weighted levels L max
 - Other
- Predicted Noise levels at site provided
 - Noise levels from individual sources
 - Overall noise levels
- Ambient noise measurements provided
 - Adequate times of day
 - Adequate duration of measurements
- Predicted and measured noise levels agree with reviewer's corroborating calculations

5. IS THE NOISE IMPACT ADEQUATELY DISCUSSED?

- Adequate Adequate with reservations Not adequate
- Discussion of noise measures and their relation to impact
 - Definitions
 - Explanation of the relations between noise levels and degrees of hearing loss and annoyance
- Discussion of degree of impact on project
 - Number of people affected at various noise levels
 - Impact from individual sources
 - Combined impact from all sources

6. ARE MITIGATION MEASURES ADEQUATELY CONSIDERED?

- Adequate Adequate with reservations Not adequate
- Explicit documentation with regard to the need (or no need) for noise Mitigation measures
- Specific mitigation measures considered
- Barriers or earth berms
- Restrictions on the locations of noise sensitive activities
- Construction design measures: insulation, sealed windows, etc.
- Other
- Commitment to use of mitigation measures (if needed)

SECTION B - NOISE GENERATING PROJECTS

1. IS THE SCOPE TO THE PROJECT ADEQUATELY DESCRIBED?

- Adequate Adequate with reservations Not adequate
- Physical parameters relating to the project
 - Building construction: site layout, type of construction, etc.
 - Delineation of potential noise sources
 - Description of parking facilities
 - Description of truck routes and railroad tracks associated with facility
 - Description of loading and unloading areas
- Number of people involved at site and number of motor vehicles expected
- Projected hours of operation of site
- Ultimate development plans of project
- Alternatives to proposed project
- Construction activities

2. IS AN ADEQUATE VISUAL DESCRIPTION OF THE SITE AND ITS SURROUNDING ENVIRONMENT PROVIDED?

- Adequate Adequate with reservations Not adequate
- Type of visual description
 - Aerial photographs
 - Drawn schematics
 - Other
- Map scale adequate: reasonable size, explicitly given
- Project site
 - Site boundaries located and identified
 - Individual noise sources located and identified
 - Parking areas located
 - Loading-unloading areas located
- Surrounding area expected to be impacted by the project
 - Location of noise sensitive activities (school, parks, churches, residences, etc.)
 - Location of roads impacted by traffic to and from project
 - Location of land affected by site related railroad tracks and yards
- Zoning and land-use profiles of land surrounding project identified

3. IS ADEQUATE QUALITATIVE AND QUANTITATIVE DATA ABOUT THE POTENTIAL NOISE SOURCES PROVIDED?

- Adequate Adequate with reservations Not adequate
- Information on specific noise and vibration generators provided
 - Distances to boundary lines and affected noise sensitive sites
 - Expected hours of operation

- Typical noise levels produced by noise sources (including sources of information)
- Roads and highways: distances to residential and noise sensitive sites, traffic volumes before and after construction, car-truck mix before and after project
- Parking lots: locations, usage patterns, capacities, distances to affected sites
- Truck loading facilities: locations, day-night usage patterns, traffic volumes, types of vehicles, idling vehicle and refrigeration unit areas
- Railroad facilities: freight volumes, day-night operations usage, idling locomotive and refrigerator car areas, switching areas
- Construction activities: types noise sources, duration of construction phase of project, night operations
- Other

4. ARE ADEQUATE QUALITATIVE NOISE PREDICTIONS PROVIDED?

- Adequate Adequate with reservations Not adequate
- Noise descriptors used
 - Day-night equivalent sound level $L(dn)$
 - Hourly equivalent sound level $L_{eq}(h)$
 - Maximum sound level L_{max}
 - A-Weighted (dBA)
 - Octave bands (dB)
 - Other

-] Noise level predictions provided for individual noise sensitive sites
 -] Before project
 -] After project - from individual sources
 -] after project - overall level
 -] Construction noise levels
-] Noise level predictions provided at project boundary lines
 -] Before project
 -] After project - from individual sources
 -] After project - overall level
-] Ambient noise measurements provided
 -] At site boundaries
 -] At individual noise sensitive sites
 -] Taken at representative times of day
 -] Taken for adequate lengths of time
-] Predicted and measured noise levels agree with reviewer's corroborating calculations
-] Vibration problems considered

5. IS THE NOISE IMPACT ADEQUATELY DISCUSSED?

-] Adequate] Adequate with reservations] Not adequate
-] Discussion of noise measures and their relation to impact
 -] Definitions
 -] Explanation of the relations between noise levels and degrees of hearing loss and annoyance
-] Discussion of impact on population: number affected, degree of impact

- From individual noise sources
- From combined overall impact
- At individual noise sensitive sites
- At project boundary lines
- Construction noise impact discussed
- Vibration impact discussed
- Comments from public and other governmental agencies included and discussed

5. ARE MITIGATION MEASURES ADEQUATELY CONSIDERED?

- Adequate Adequate with reservations Not adequate
- Explicit documentation with regard to the need (or no need) for mitigation measures
- Specific measures considered
 - Project design considerations: quieted equipment, sealed windows, noise insensitive locations, etc.
 - Noise barriers or berms
 - Land use restrictions
 - Time use restrictions
 - Other
- Commitment to use of mitigation measures where needed

BRIEF COMMENTARY ON CHECKSHEET CONCERNS

Site specific construction projects can usually be partitioned into two classes relative to noise considerations. In the first class, there are those projects that are treated as noise receivers. This would include housing developments, schools, hospitals, apartment complexes, etc. The second category comprises those projects that are basically noise producers, examples of which are shopping centers, industrial parks, military facilities, and race tracks. The main concerns for the two projects classes turn out to be nearly the same; however the questions that must be answered to ascertain adequacy are often quite different. For this reason we have prepared a checksheet for each of the project types in which the main questions are identical but the supporting data required may be quite different.

1. IS THE SCOPE OF THE PROJECT ADEQUATELY DESCRIBED?

NOISE SENSITIVE PROJECTS: In most EIS's, the physical description of the proposed project is adequately described. The reviewer should focus on those project aspects that will help to minimize noise problems as well as those that could exacerbate the problems caused by noise intrusion from the surroundings. For example, if a residential development is backed up against a freeway, it is a bad situation and it should be noted. However, if there is a hill that shields the complex from the highway noise the situation is now good and this fact should be noted.

The EIS should provide data on site usage. How many people will be involved with the facility? Are any special noise sensitive groups, such as children, the elderly, hospital patients, etc., expected to utilize the facility? At what times will it be in use?

Information should be provided as to what is anticipated as the ultimate development of the project. The reviewer should investigate the possibility that while the proposed project might meet acceptable noise criteria, subsequent development might not. We have seen EIS's where developers have acknowledged the existence of noise problems on one segment of a project, but asked for a variance on noise requirements because an earlier portion of the project had already been completed. The reviewer should also consider the possibility of future off-site development which would cause the site to be impacted. The presence of large undeveloped tracts of land near the site of a housing project is an example of a situation which would give cause for concern, especially if the land was zoned other than residential.

NOISE GENERATING PROJECTS The project that generates noise as a by-product of its operations needs to be looked at as a collection of individual noise sources which add together to produce an overall impact. Its description should be complete enough so that it will be evident to the reviewer where and from what sources noise problems are likely to surface. In addition to particulars about the main use activities of the facility, attention must also be given to noise sources that are associated with supporting operations, such as parking facilities, truck routes, railroad tracks, and loading docks.

A complete description of the scope of the project includes estimates of the number of people involved at the facility, the amount of motor vehicle traffic expected to be generated as a result of the facility, and the hours the facility will be in operation. If alternate development plans are under consideration, a description of how they differ from the preferred alternative should be clearly presented.

Construction noise can often be a serious temporary problem. The EIS should provide a description of construction schedules, types of equipment to be used, and hauling routes. Finally, there should be a definite statement regarding the ultimate development plans for the project. The reviewer should examine the possibility of a scenario where the proposed project meets acceptable noise criteria, but a future expansion may not. Large vacant areas on the site map should cause one to consider this concern.

2. IS AN ADEQUATE VISUAL DESCRIPTION OF THE SITE AND ITS ENVIRONMENT PROVIDED?

An EIS should provide an overview of the site and its environment. A pictorial representation seems to be the best choice to meet this need. It should be of sufficient scale and clarity to provide unambiguous information about the concerns listed in the checksheet. It will be used in corroborating the EIS noise predictions and in pinpointing areas where noise problems could surface.

Although blueprints and other drawn graphics can provide much needed information, the aerial photograph is by far the most useful tool. It allows the reviewer an independent look at the site area. There have been many instances where the study of an aerial photograph has located potential noise problems that were not discussed in the EIS. Close scrutiny of this photograph should always be made if it is provided.

NOISE SENSITIVE PROJECTS For this situation, the most useful method of visualization would be to have a ground plan of the project structures and the site boundary lines superimposed over a map of the area. Noise sources that could potentially affect the project would be identified and a map scale would be included so that distances from the noise sources to the project could be determined.

NOISE GENERATING PROJECTS For this type of project, a site plan (to scale) having the locations of noise sources identified is needed. Additionally, the property boundary lines should be superimposed on the overall area map. The noise sensitive activities that could be affected by the project should also be identified. This information is needed to locate the noise sources relative to the noise affected areas in order that calculations of noise impact can be made. Vacant land within the project boundaries can also be identified by the reviewer as to its potential for future development.

3. IS ADEQUATE QUALITATIVE AND QUANTITATIVE DATA ABOUT THE POTENTIAL NOISE SOURCES PROVIDED?

NOISE SENSITIVE PROJECTS The EIS should supply sufficient data so that all of the potential noise sources in the vicinity of the project are described in enough detail to allow the reviewer to make his own calculations of noise levels. The particular information requested in this question should be sufficient for him to make corroborating calculations using the methods given in the references.

Construction noise problems are rare in this type of project. However, if the project is large enough, the reviewer may feel that the same type of information that is asked for in the next section is applicable here.

NOISE GENERATING PROJECTS In this situation the EIS needs to be concerned with three categories of noise generation: facility operations, transportation noise associated with the facility, and construction noise.

The noise from facility operations is often hard to characterize prior to construction because of the wide variety of often exotic noise sources that may be present. However, many manufacturers, especially those involved with air handling and conditioning equipment, provide noise specifications for their products. This information should be included in the EIS when it is available. Where octave band noise levels are given, they may easily be converted into the A-weighted noise levels that are used to assess impact. The sources of the noise levels information should be provided so that the reviewer can verify any noise levels that appear to be unreasonable. Estimates of the noise expected from untested equipment may be included in the EIS even though the degree of uncertainty in their true levels may be significant. A "best estimate" is better than no information at all; it will at least give the reviewer a "ball park value" as to what noise levels to expect.

Hours of operation of the facility are needed to estimate noise impact and should be included in the EIS. In certain situations, such as with drop-forge or punch-press facilities, ground transmitted vibrations can cause problems. The EIS should address this problem if it is applicable. Fortunately, the effects of vibration usually can be expected to die out very quickly as the distance from the source to the receiver is increased. Thus, most vibration sources will affect only those sites very near to the source, and will only pose problems to the surrounding community when they are located close to the property lines.

Railroad and motor vehicle traffic in and out of the facility can cause a significant noise problem, especially if the tracks or roads pass through residential areas. Information sufficiently detailed to allow estimates of this impact should be provided.

Construction activities can cause temporary noise problems. The most common complaints are those from truck hauling, earth moving equipment, and pile driving operations. It is especially important that hauling truck routes be identified, along with the expected traffic volumes, when residential development is located near the site.

4. ARE ADEQUATE QUANTITATIVE NOISE LEVEL PREDICTIONS PROVIDED?

Noise level predictions are usually given in one of three metrics: the maximum A-Weighted sound level (dBA), the hourly equivalent sound level $Leq(h)$, or the equivalent day-night sound level $L(dn)$. The A-Weighted sound level provides a measure of the instantaneous volume of a sound as it would be perceived by the human ear. The maximum A-Weighted level gives the loudest level that occurred during some particular period of time. A-Weighted levels can be used to characterize impact in situations where the sound is either of very short duration, or is a single event. However, if the noise level fluctuates over longer periods of time, an averaged sound level will correlate better with degree of impact. The hourly equivalent sound level is an energy-averaged sound level over a one hour period. $L(dn)$ is similar to $Leq(h)$ in that it is also an energy-averaged sound level. However, in this case the sound energy is averaged over a 24 hour period, with a 10 decibel penalty added to all noise occurring between the normal sleeping hours of 10 p.m. to 7 a.m. U.S. Environmental Protection Agency has correlated annoyance and hearing loss to $L(dn)$ values, which makes this metric useful in assessing noise impact.

How should noise levels be presented? When a wide impact is expected, noise contours can be superimposed on a site map. A noise contour is a line, together with a sound level, such that the land enclosed by the contour can be expected to experience noise levels as great or greater than the given sound level. It is analogous to a topographic map where points at a specific height are connected together to make an equal height contour, only in this case it is equal noise level points that are connected. If only a small area or only a few sites are affected, it is sufficient that a listing of sound levels be provided at representative points.

NOISE SENSITIVE PROJECTS Noise levels produced by the various noise sources can either be calculated or measured. If the levels are calculated, the EIS should provide, in addition to the overall level, the relative contributions of each noise source. This information is useful in determining where the major problems originate. Also, if the results of the reviewer's corroborating calculations disagree with the EIS values, the reviewer can pinpoint which source levels are in question.

Measurements of existing noise levels can be substituted for calculations in this situation, since the same noise sources affect the site both before and after project completion. The measurements should be taken at representative times of day and for long enough periods of time so as to obtain an accurate estimate of the noise environment. The reviewer should also be sure that measurements were taken during those times when the major noise sources were operating and producing maximum noise levels.

NOISE GENERATING PROJECTS In this type of project it is especially important to have noise predictions (or measurements) for the site prior to construction as well as for the period after the project is completed. The reason for this requirement is that the severity of noise impact is strongly dependent on what noise levels the people in the area are acclimated to.

Noise levels should be provided at the lot lines of the site as well as at the locations of individual noise sensitive activities. The lot line values are important in areas where vacant land borders the project site. They will permit a city to zone the vacant land so that future projects will be compatible with the noise from the present project.

It is much more difficult to accurately predict vibration levels than it is to predict airborne noise levels. For this reason we do not normally expect an EIS to provide quantitative vibration levels. However, we do expect at least a qualitative discussion of the problem. Is there machinery at the site capable of causing a major vibration impact? If so, does the EIS expect the vibrations to be great enough to be perceived by a person located at the property line or at one of the noise sensitive sites? If the answers to these questions are strongly affirmative, it may be necessary to require quantitative data.

Construction noise levels should be included if there is any likelihood of impact. This data can be obtained by actual measurement or it can be estimated by consulting the literature. Remember that truck hauling noise can affect people large distances from the site, so that expected levels along hauling routes should be included if this is a major activity.

5. IS THE NOISE IMPACT ADEQUATELY DISCUSSED?

A discussion of noise impact involves more than simply providing noise levels. The EIS should discuss how the noise measures used in the EIS relate to hearing loss and annoyance. General relations between noise levels and the degree of impact on people (e.g. noise levels vs percent of people annoyed) can be obtained from the literature and should be included. The annoyance aspects are most important since there are very few sites at which operations will be so loud as to cause physical hearing damage.

It should be noted that "the degree of impact" is a relative concept. If ambient noise levels are low to begin with, the impact of a project could be significant in spite of the fact that the new noise levels might not exceed normal standards. For example, consider a factory built in a rural area which originally experiences $L(dn)$ noise levels in the 40 decibel range. If the post-project levels turn out to be 10 dB greater, they would still be acceptable for most residential areas. To the people living in the area, however, the new levels would be subjectively twice as loud as they originally were.

For our considerations of noise impact, we generally feel that outdoor $L(dn)$ levels of 55dB or less are quite reasonable in residential areas, while levels above 65-70dB are definitely excessive. In term of identifiable changes in impact, a 3-4 dB increase in $L(dn)$ is noticeable, while increases greater than 7-8 dB are considered major.

Good sources for locating potential noise problems are letters from the public and from governmental agencies. They are usually printed in an appendix associated with public comments. The EIS should provide specific replies to their concerns.

NOISE SENSITIVE PROJECTS The reviewer must verify that the EIS relates the noise levels expected at the site to the requirements of the project, since site usage plays an important part in determining what noise levels are acceptable. For example, a convalescent home would require a quieter environment than could be tolerated by a housing development. The EIS should provide an analysis as to what degree the people at the site will be affected relative to these suggested maximum levels.

NOISE GENERATING PROJECTS The EIS should detail the impact on those noise and vibration sensitive sites affected by the project. Given the calculated noise and vibration levels, what will be their effect on the populace? Will ground vibrations be strong enough to cause structural damage? Questions such as these should be answered both at the specific noise sensitive sites previously mentioned and at the project boundaries. The boundary line considerations are important when there is vacant land adjacent to the project site that could be developed. Although it is usually evident, it is also good practice to identify which sources are the major contributors to the noise impact. This knowledge is needed in order to specify effective mitigation measures.

The impact of construction noise, although it is only temporary, can be substantial. In the immediate neighborhood of the site earth moving and pile driving activities can generate substantial annoyance. Hauling truck traffic can extend the impact to areas far beyond the project boundaries. The reviewer should ascertain that the EIS has assessed these impacts. Too often only a token effort is made.

ARE MITIGATION MEASURES ADEQUATELY CONSIDERED?

After all of the noise analysis has been presented it may become evident that mitigation efforts are warranted. The EIS should explicitly identify such situations, provide a discussion of applicable mitigation measures, and their benefits, and provide a clear-cut statement of the degree of commitment in implementing them. We see more than a few EIS's that simply dismiss mitigation with a wave of a hand and with unsupported statements that mitigation would be either too expensive or ineffective. It is possible that these conclusions are accurate, however, the EIS must provide supporting documentation.

The reviewer should view the inclusion of a well prepared mitigation chapter into the EIS as an indication of the project sponsor's commitment to minimize noise problems. This assumes, of course, that the sponsor has indicated that he intends to implement some of the measures.

NOISE SENSITIVE PROJECTS There are many ways that a developer can lessen the intrusive noise impact on his project. The choice of a quiet location to begin with is, of course, the best way. If this is not possible, there are design and construction practices that can ameliorate the problems.

"Soundproofing" buildings or constructing noise barriers can be effective. The adoption of land use codes by the local government can insure against future problems.

We see housing projects, in particular, where only a part of a project will experience excessive noise. It is not uncommon for the EIS to ask for an exemption from normal standards based on the fact that some other portion of the project has already been completed or that only a few people would be affected. The reviewer must use his own judgement as to whether such arguments are justified or whether they are simply a smoke screen to avoid further expense irregardless of the need for mitigation.

NOISE GENERATING PROJECTS Most (non-transportation) noise problems related to a project can be controlled by proper design considerations prior to the construction phase of the project. Choosing equipment locations with regard to noise considerations, providing mufflers for air handling machinery, vibration isolating heavy equipment, and using the facility itself as a noise barrier are examples of mitigation measures that can be designed into a site at a fraction of the cost that refitting would require. If the project is by nature one that the noise would be difficult to control (e.j. a racetrack or an amusement park), it is possible to minimize noise impact by restricting operating hours.

APPENDIX - REFERENCES

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3. Design Guide for Reducing Transportation Noise in and Around Buildings, D. Pallet, et al, Department of Commerce, National Bureau of Standards, Washington, D.C. 1978 Stock Number 003-003-01687-0
4. Department of Housing and Urban Development: Noise Abatement and Control Policy, USEPA, EPA 550/9-77-354, 1977
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