Metacomet Development Project- Noise Analysis

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Submitted to:

Sage Environmental
301 Friendship
Providence, Rhode Island 02903

TABLE OF CONTENTS

1. Summary of Results

David Coate Consulting (DCC) conducted this noise study of the proposed Metacomet Development Project. Since the project is in the preliminary planning stage, detailed design details are not available at this time. However, a traffic study[1] has been conducted to project future vehicular traffic conditions associated with the development. In turn, the present study incorporates the results of the traffic study to determine the potential noise effects of increased traffic noise at residential receptor locations along Fort Street, Lyon Avenue, and Veterans Memorial.

The study shows that while increased traffic noise will be noticeable along certain roadways, the increase is below RIDOT noise guidelines. This project is not subject to RIDOT highway noise guidelines but is used here for informational purposes.

2. Introduction

The purpose of this report is to identify potential noise impacts associated with the proposed Metacomet Development Project in East Providence, Rhode Island. The project would consist of 890 residential units, 153,000 square feet of retail space, and a nine-hole golf course. Potential noise sources associated with the project include increased vehicular traffic, outdoor HVAC fan units, and other miscellaneous sources associated with increased human activity.

Since the project is in the preliminary planning stage, detailed design information including HVAC locations and data is not available. Traffic in the area is expected to increase substantially, and a traffic study has been conducted and the report analyzes expected changes in traffic noise levels in the residential areas adjacent to the project. As design information becomes available, this report can be updated as needed to include other potential non-traffic noise effects.

3. Project Location/Description

Figure 3.1 shows the proposed development plan for the Metacomet Development Project. Buffer areas are included in the plan to separate buildings and activities from the adjacent residential areas.

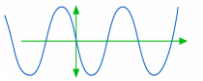
Figure 3.1 Metacomet Development Plan

4. Noise Metrics

4.1 Noise Metrics

The basic noise unit employed in this study is the A-weighted decibel (dBA). The decibel is a logarithmic scale used to measure the relative loudness of sounds. Figure 4.1 illustrates sound pressure levels in dBA of various sound sources between 0 dBA (threshold of hearing) and 140 dBA (threshold of pain).

An increase of 3 dBA in noise level can barely be perceived[2], while an increase of 5 dBA is readily noticeable and considered a substantial noise increase[3]. A 10 dBA increase corresponds to a subjective doubling of loudness. A relationship between changes in noise level and loudness is indicated in Table 4.1.



Common Outdoor Sound Levels	dB(A)	Common Indoor Sound Levels
		Rock Band
Jet flyover at 1000 ft	110	
	100	Inside Subway Train (New York)
Gas Lawnmower at 3 ft		
Diesel Truck at 50 ft Noisy Urban Daytime	90	Food blender at 3 ft Garbage Disposal at 3 ft
	80	Very loud Speech at 3 ft
Gas Lawnmower at 100 ft		
	70	
Commercial Area Heavy Traffic at 300 ft		Normal Speech at 3 ft
	60	Large Business Office Quiet Speech at 3 ft Dishwasher Next Room
	50	Small Theater, Large Conference Room (Background)
Quiet Urban Nighttime		
	40	
Quiet Suburban Nighttime		Library
	30	Bedroom at Night Concert Hall (Background)
Quiet Rural Nighttime		
	20	Broadcast and Recording Studio
	10	
	0	Threshold of Hearing

Figure 4.1 Sound Pressure Levels for Various Sound Sources

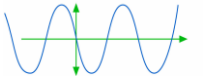


Table 4.1 Relationship Between Changes in Noise Level and Loudness

Increase (or Decrease) in Noise Level	Loudness Multiplied (or Divided) by
3 decibels	1.2
6 decibels	1.5
10 decibels	2
20 decibels	4

Since noise fluctuates from moment to moment, it is common practice to condense the noise level over a specified period of time into a single number called the Equivalent Noise Level (L_{eq}). Many surveys have shown that the L_{eq} properly predicts annoyance, and thus this metric is commonly used for noise measurements, prediction, and impact assessment.

The Day Night Average Sound Level (DNL) is a twenty-four hour average noise level with a 10-decibel upwards adjustment of nighttime noise levels to account for increased sensitivity to noise at night. The DNL metric has been used worldwide to assess human annoyance associated with noise.

The reader is referred to Appendix A for further discussion about noise descriptors and metrics.

4.2 Traffic Noise Level Thresholds

This project does not fall under the authority of Rhode Island Department of Transportation (RIDOT) traffic noise guidance since those criteria are for highway projects (either Type I or II) with federal funding. However, it is instructive to evaluate increased traffic noise associated with this project with RIDOT noise criteria since they take into account human annoyance associated with the cumulative effects of traffic noise.

The FHWA Noise Abatement Criteria[4] shown in Table 4.2 is used in determining traffic noise impacts on human activities. Noise impacts are defined by loudest hour equivalent noise levels (L_{eq}) approaching or exceeding these Noise Abatement Criteria values for the appropriate Activity Category. For example, the Noise Abatement Criterion for residential areas (Category B) is 67 dBA Leq. However, in 1993 the FHWA announced that "…all state highway agencies must establish a definition of 'approach' that is at least 1 dBA less than the FHWA Noise Abatement Criteria for use in identifying traffic noise impacts in traffic noise analyses."[5] Therefore, 66 dBA effectively became the Noise Abatement Criteria for the residential land use category.

In addition to the absolute NAC values, noise impact would also occur if the project would substantially increase the noise level at sensitive receptor locations. According to RIDOT's Noise Policy, a substantial increase is defined as an increase of 10 dBA or greater.

Table 4.2 FHWA Noise Abatement Criteria

Activity Category	L_{eq} for Loudest Traffic Hour	Description of Activity
A	57 (Exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	__	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

5. Traffic Noise Modeling

CADNA, the leading environmental noise modeling software application, was used to analyze traffic noise levels associated with this project. Annual Average Daily Traffic (AADT) data and vehicle speeds for existing and future conditions along Fort Street, Lyon Avenue, and Veterans Memorial. Table 5.1 shows this data. Truck traffic is prohibited on these roads, so these values include no trucks.

Table 5.1 Annual Average Daily Traffic and Speed

	Existing AADT	Future AADT	Speed (mph)
Fort Street	1150	2784	30
Lyon Avenue	1050	4254	34
Veterans Memorial	16500	29922	44

Figure 5.1 shows modeled existing (magenta) and future (purple) traffic noise contours at 65 DNL (dBA). This 65 DNL value is used by many Federal agencies including FAA, FWHA, STB, HUD and many state agencies to define human annoyance to noise. Depending on the specific vehicle classification by hour and other factors, 65 DNL is also often reasonably close to the loudest hour L_{eq}.

Figure 5.1 CADNA Modeled Existing and Future Traffic Noise Levels (65 DNL (dBA))

Figure 5.2 shows a zoomed in view of these contours for Fort Street.

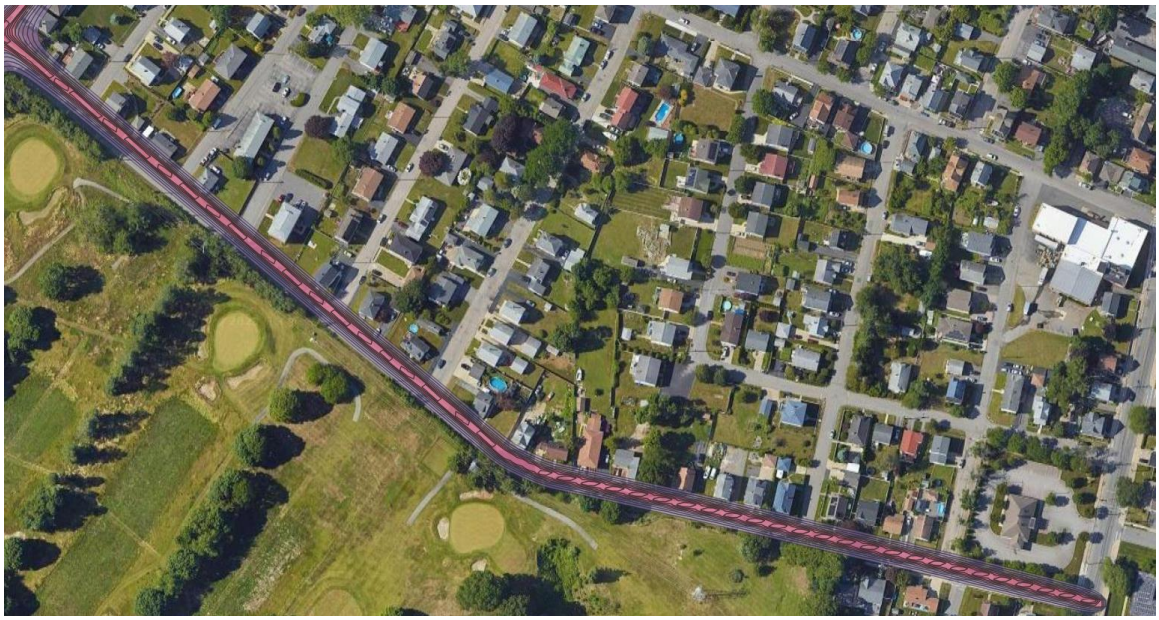


Figure 5.2 Fort Street Existing and Future Traffic Noise Levels (65 DNL (dBA))

Figure 5.3 shows a zoomed in view of the noise contours and residences along Lyon Avenue.

Figure 5.3 Lyon Avenue Existing and Future Traffic Noise Levels (65 DNL (dBA))

Figure 5.4 shows a zoomed in view of the noise contours and residences at the southern end of Veterans Memorial.

Figure 5.4 Veterans Memorial Existing and Future Traffic Noise Levels (65 DNL (dBA))

Table 5.2 shows the traffic noise modeling results for representative residential receptors along project-influenced roadways. Noise level increases along Fort Street and Lyon Avenue are greater than 3 dBA so these increases would be noticeable. The increase along Lyon Avenue would be very noticeable although all areas are below RIDOT's guideline of a 10 dBA increase. Future noise levels are also lower than FHWA's 66 dBA (1-hour L_{eq}) guideline (with the previously mentioned loudest hour caveat.). Consequently, even though future traffic noise levels would be noticeably higher than existing levels, project traffic noise levels would not exceed RIDOT thresholds.

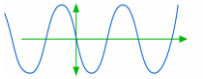
Table 5.2 Noise Modeling Results (DNL, dBA)

	Existing	Future	Increase (dB)
Fort Street	59.0	62.9	3.9
Lyon Avenue	57.9	63.8	5.9
Veterans Memorial	62.8	65.4	2.6

6. Construction Noise

Construction activities may increase short-term sound levels as a result of the use of heavy machinery. These increases may create a temporary adverse impact to nearby receptor locations.

Major sources of construction noise typically include pile drivers, jackhammers, trucks, cranes, and miscellaneous support equipment. Potential mitigation techniques for

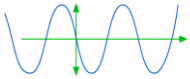


construction noise include limiting construction activity to daytime hours, ensuring that all diesel-powered equipment has effective mufflers, and erecting temporary noise barriers between construction operations and sensitive receptor locations. The use of alternative construction methods (e.g., using vibratory instead of impact pile drivers) could also reduce construction noise. Since detailed construction equipment and scenarios are not available at this phase of the project, specific mitigation measures have not been developed.

Typical construction noise levels associated with common highway construction equipment are shown in Table 6.1.

Table 6.1 Typical Construction Noise Levels

Equipment Type	Typical Maximum Noise Level in dBA at 50 feet
Dump Truck	88
Loader	86
Dozer	84
Grader	85
Vibratory Roller	82
Backhoe	85
Chain Trencher	85
Spreader	88
Paver	89
Water Truck	88
Pickup Truck	67
Backhoe/Skiploader	86
Forklift	86
Compactor	89
Pile Driver	85
Concrete Truck	88
Concrete Pump	82
Delivery Truck	80
Crane	83



Appendix A: Noise Descriptors and The Effects of Noise

Noise Descriptors

Noise is usually defined as sound that is undesirable because it interferes with speech communication and hearing, is intense enough to damage hearing, or is otherwise annoying. The characteristics of sound include parameters such as amplitude, frequency, and duration.

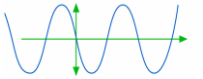
Sound can vary over an extremely large range of amplitudes. The decibel (dB) is the accepted standard unit for measuring the amplitude of sound because it accounts for these large variations in amplitude and reflects the way people perceive changes in sound amplitude. The decibel is based on a logarithmic scale which compresses the very large range of possible air pressure values into a more manageable scale.

Different sounds may have different frequency content. Frequency content of a sound refers to its tonal quality or pitch. When describing sound and its effect on a human population, A-weighted (dBA) sound levels are typically used to account for the response of the human ear. The term "A-weighted" refers to a filtering of the noise signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute (ANSI). The A-weighted noise level has been found to correlate well with people's judgements of the noisiness of different sounds and has been used for many years as a measure of community noise.

Community noise levels usually change continuously during the day. However, community noise typically exhibits a daily, weekly, and yearly pattern. To compare noise levels over different time periods, several descriptors have been developed. One descriptor, the equivalent sound level (L_{eq}), is the equivalent steady-state A-weighted sound level that would contain the same acoustical energy as the time-varying A-weighted sound level during the same time interval. The hourly L_{eq} is often used to describe traffic noise.

Another descriptor for noise is the statistical A-weighted noise level exceeded a given percentage of the time. For example, the L50 is the level exceeded 50 percent of the time and the L10 is the level exceeded 10 percent of the time.

The day-night average noise level (DNL or L_{dn}) was developed to evaluate the total daily community noise environment. The DNL is the time average of all A-weighted levels for a 24-hour period with a 10 dB upward adjustment added to the nighttime levels (2200 to 0700). This adjustment is an effort to account for the increased sensitivity to nighttime noise events. The DNL noise metric has been adopted by federal agencies including the Environmental Protection Agency (EPA), the Federal Aviation Administration (FAA), and the Housing and Urban Development (HUD) as the accepted unit for quantifying human annoyance to environmental noise.



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4. *Procedures for Abatement of Highway Noise and Construction Noise* Federal Highway Administration 23 CFR Part 772, Final Rule, effective 9 August 1992

5. Office of Environment and Planning, Memorandum HEP-41 December 1993

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