Noise and Air Quality Evaluation

Bedford 13953 - NH Route 101 Roadway Improvement Project

Bedford,
New Hampshire

Prepared for

Concord, New Hampshire

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1 Noise

1.1 Introduction

The purpose of this noise analysis is to evaluate the potential noise impacts associated with the NH Route 101 roadway improvement project in Bedford, New Hampshire. The noise analysis was conducted following the New Hampshire Department of Transportation's (NHDOT's) *Policy and Procedural Guidelines for the Assessment and Abatement of Highway Traffic Noise for Type I Highway Projects*[1] and the Federal Highway Administration's (FHWA's) guidelines.[2] The Project is considered a Type I project because it involves geometric changes along NH Route 101. NHDOT's procedures require that roadway noise levels associated with Type I projects be calculated, the results be compared to the noise abatement criteria, and, if noise impacts are identified, noise mitigation measures be evaluated to reduce sound level impacts in the study area. The following sections provide a description of the project, background information on roadway traffic noise, NHDOT's noise criteria and abatement policy, the noise analysis methodology, and results of the noise evaluation.

1.2 Project Description

The NHDOT is preparing roadway improvement plans along NH Route 101 from Wallace Road to NH Route 114, in Bedford, New Hampshire. The roadway improvements will provide two travel lanes in each direction, a center raised median with left-turn lanes at selected intersections, shoulders acceptable for bicycle travel, and sidewalks were appropriate. The posted speed limit along NH Route 101 is 40 miles per hour (mph) west of Old Bedford Road and 35 mph east of Old Bedford Road.

Land uses within the project study area are a mixture of commercial and residential properties. The limits of the Project are shown in **Figure 1**.

1 *Policy and Procedural Guidelines for the Assessment of and Abatement of Highway Traffic Noise for Type I Highway Projects*, April 2011.
2 *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, Title 23, Code of Federal Regulations, Part 772.

1.3 Noise Terminology

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities, such as sleep, work, or recreation. The individual human response to noise is subject to considerable variability since there are many emotional and physical factors that contribute to the differences in reaction to noise.

Sound (noise) is described in terms of loudness, frequency, and duration. Loudness is the sound pressure level measured on a logarithmic scale in units of decibels (dB). For community noise impact assessment, sound level frequency characteristics are based upon human hearing, using an A-weighted [dB(A)] frequency filter. The A-weighted filter is used because it approximates the way humans hear sound. Table 1 presents a list of common indoor and outdoor sound levels.

Table 1 Indoor and Outdoor Sound Levels

Outdoor Sound Levels	Sound Pressure (μPa)		Sound Level dB(A)	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

μPA MicroPascals describe pressure. The pressure level is what sound level monitors measure.
dB(A) A-weighted decibels describe pressure logarithmically with respect to 20 μPa (the reference pressure level).
Source: *Highway Noise Fundamentals*, Federal Highway Administration, September 1980.

Figure 1 Project Limits

0 900 1800 Feet

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Figure 1

Project Limits

Route 101 - Bedford, NH

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The most common way to account for the time varying nature of sound (duration) is through the equivalent sound level measurement, referred to as L_{eq}. The L_{eq} averages the background sound levels with short-term transient sound levels and provides a uniform method for comparing sound levels that vary over time. The FHWA's guidelines and criteria require the use of a one-hour L_{eq} for assessing highway noise impacts on different land uses. The loudness of traffic noise is related to traffic volumes, vehicle speeds, and numbers of trucks.

The following general relationships exist between hourly traffic noise levels and human perception:

- A 1 or 2 dB(A) increase is not perceptible to the average person.
- A 3 dB(A) increase is a doubling of acoustic energy, but is just barely perceptible to the human ear.
- A 10 dB(A) increase is a tenfold increase in acoustic energy, but is perceived as a doubling in loudness to the average person.

1.4 Noise Abatement Criteria

Traffic noise can adversely affect human activities, such as communication. FHWA has established Noise Abatement Criteria (NAC) to help protect the public health and welfare from excessive traffic noise. Recognizing that different areas are sensitive to noise in different ways, the NAC varies according to land use. The NAC are described in Table 2.

NHDOT endorses the FHWA's procedures and considers noise impacts to occur when existing or future sound levels approach (within 1 dB(A)) or exceed the NAC, or when future sound levels exceed the highest existing sound levels by 15 dB(A) or more. These guidance criteria are the recommended maximum levels for identifying locations that may be affected by highway noise.

Table 2 Noise Abatement Criteria (NAC), dB(A)

Activity Category	L_{eq}(h) [1]	Description of Activity Category
A	57 (Exterior)	Lands 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 purposes.
B [2]	67 (Exterior)	Residential.
C [2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E [2]	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in Categories A-D or F.
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.

Source: 23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*.

1 Leq (h) is an energy averaged, one hour, A-weighted noise level in decibels (dB(A)). The Leq(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

2 Includes undeveloped lands permitted for this Activity Category.

1.5 Methodology

The noise analysis evaluated the potential sound levels associated with vehicular traffic under both the Existing and Build conditions. Sound levels associated with roadway traffic were calculated using FHWA's Traffic Noise Model (TNM) Version 2.5.[3] An abbreviated approach was used in developing the terrain for the project area noise model which involved utilizing Google Earth to identify the elevations of the roads, receptor locations, and terrain features. Traffic inputs for NH Route 101, such as vehicular volume, truck percentage, and roadway speeds, were obtained from the NHDOT.

3 Traffic Noise Model 2.5 (TNM), Federal Highway Administration, February 2004.

The noise model evaluated traffic volume changes along NH Route 101 and the major intersecting side streets. The noise model was used to calculate the sound levels at the residential and commercial receptor locations adjacent to NH Route 101 within the project study area as shown in **Figures 2** through **4**. The sound levels calculated from the noise model were compared to NHDOT's noise impact criteria for compliance. For receptor locations that were identified to be impacted, noise mitigation, such as a noise barrier, were evaluated. A noise barrier must meet NHDOT's feasibility and reasonableness criteria in order to be constructed.

1.6 Results

The NH Route 101 roadway improvements will improve traffic flow and capacity within the project study area. The FHWA's TNM model was used to calculate sound levels associated with the project under both the Existing and Build conditions. The results of the noise analysis demonstrated that several of the residential and commercial receptor locations closest to NH Route 101 experience sound levels which exceed the NAC for Activity Category B (residential) or E (commercial) under the Existing and/or Build Conditions.

The Existing Condition sound levels ranged from 46 dB(A) to 69 dB(A) at the residential receptor locations and from 52 dB(A) to 70 dB(A) at the commercial receptor locations. Five residential receptor locations currently exceed the NHDOT's noise impact criteria of 66 dB(A). Under the Build Conditions, the residential receptor locations would experience sound levels ranging from 48 dB(A) to 69 dB(A) and the commercial receptors would experience sound levels ranging from 54 dB(A) to 71 dB(A). The noise analysis also demonstrates that the Project will not substantially increase the existing sound levels. The receptor locations are expected to experience increases of 0 dB(A) to 3 dB(A), as compared to the Existing Conditions. As noted previously, a sound level increase of 3 dB(A) is just barely perceptible to the human ear. However, these increases will result in seven residential receptors and one commercial receptor location under the Build Condition to experience sound levels that exceed NHDOT's noise impact criteria. All of the sound levels are presented in Table 1-3.

The following criteria must be met for a noise abatement measure to be advanced into a final design:

Feasibility

- Receptor locations must have predicted sound levels that result in noise impacts according to the NAC for the various land uses or experience an increase in sound levels of 15 dB(A) or greater.
- The noise abatement measure (noise barrier) must be able to be constructed given the existing geometry and taking into consideration cross streets, driveways, safety issues, environmental impacts, and other noise sources.
- The noise abatement measure must be able to provide effective sound level reductions. Every effort should be made to attain a 10 dB(A) (or greater) insertion loss at first row receptors. The construction of a noise barrier is not feasible if a 5 dB(A) noise reduction cannot be achieved for at least one impacted receptor.

Reasonableness

- The goal is to provide a 10 dB(A) noise reduction for at least one first row receptor location. However, the abatement measure must be able to provide at least a 7 dB(A) noise reduction for at least one benefited receptor.
- The noise abatement measure must be cost effective.
- The implementation of a noise abatement measure must be supported by the community.

Because NHDOT must balance its available funds and responsibilities, two mathematical formulas, called the Cost Effectiveness Index (CEI) and the Dimensional Effectiveness Index (DEI), are used as the primary factor when considering the reasonableness of construction of a noise barrier. A noise barrier with a CEI of $45,000 or less per benefited receptor or a DEI of 1,500 square feet or less per benefited receptor is considered cost effective. A noise barrier cost of $30 per square foot is used in the CEI calculation.

CEI = $$ / unit, where:

$$ = Total barrier cost, based upon a $30 per square foot cost.
unit = Number of benefited dwelling units in the study zone.

The CEI is calculated by dividing the noise barrier cost by the number of dwellings in the study zone that receive a 5 dB(A) insertion loss or greater. The noise barrier cost is determined by multiplying the square footage of the noise barrier from TNM by $30 per square foot.

The DEI is calculated by dividing the dividing the total protective surface area of a barrier by the number of dwellings in the study zone that receive a 5 dB(A) insertion loss or greater.

Figure 2 Noise Receptor Locations

0 300 600 Feet

LEGEND

- X.X-# - ACTIVITY CATEGORY B/C (RESIDENTIAL)
- X.X-# - ACTIVITY CATEGORY E (COMMERCIAL)
- X.X-# / X.X-# - IMPACTED LOCATION
- PROPOSED EDGE OF PAVEMENT

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Figure 2

Noise Receptor Locations

Route 101 - Bedford, NH

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Figure 3 Noise Receptor Locations

0 300 600 Feet

LEGEND

- X.X-# - ACTIVITY CATEGORY B/C (RESIDENTIAL)
- X.X-# - ACTIVITY CATEGORY E (COMMERCIAL)
- X.X-# / X.X-# - IMPACTED LOCATION
- PROPOSED EDGE OF PAVEMENT

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Figure 3

Noise Receptor Locations

Route 101 - Bedford, NH

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Figure 4 Noise Receptor Locations

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Table 3 Sound Levels, dB(A)

Receptor Location	Land Use Category	NHDOT Noise Criteria	Existing Sound Level	Build Sound Level	NHDOT Increase Criteria	Sound Level Increase
R.N-7	Residential	66	61	62	+10	1
R.N-9	Residential	66	65	66	+10	1
R.N-8	Residential	66	54	55	+10	1
R.N-10	Residential	66	68	69	+10	1
R.N-11	Residential	66	64	65	+10	1
R.N-13	Residential	66	60	60	+10	0
R.N-12	Residential	66	58	59	+10	1
R.N-4	Residential	66	60	61	+10	1
R.N-5	Residential	66	57	58	+10	1
R.N-6	Residential	66	53	54	+10	1
R.N-2	Residential	66	57	58	+10	1
R.N-1	Residential	66	57	58	+10	1
R.N-3	Residential	66	53	54	+10	1
R.S-1	Residential	66	60	61	+10	1
R.S-3	Residential	66	63	64	+10	1
C.S-1	Commercial	71	65	66	+10	1
C.N-1	Commercial	71	66	67	+10	1
C.S-2	Commercial	71	65	66	+10	1
C.S-3	Commercial	71	64	65	+10	1
C.S-4	Commercial	71	65	65	+10	0
C.S-5	Commercial	71	69	69	+10	0
C.N-2	Commercial	71	70	70	+10	0
C.S-6	Commercial	71	69	70	+10	1
C.N-3	Commercial	71	68	68	+10	0
C.N-4	Commercial	71	66	67	+10	1
C.N-6	Commercial	71	66	66	+10	0
R.N-14	Residential	66	63	64	+10	1
C.N-5	Commercial	71	63	64	+10	1
R.N-15	Residential	66	62	63	+10	1
R.N-16	Residential	66	60	62	+10	2
R.S-2	Residential	66	58	59	+10	1
C.S-7	Commercial	71	70	70	+10	0
C.S-8	Commercial	71	67	68	+10	1
C.S-11	Commercial	71	66	67	+10	1
C.S-12	Commercial	71	60	61	+10	1
C.S-13	Commercial	71	56	56	+10	1
C.S-14	Commercial	71	69	70	+10	1
C.S-10	Commercial	71	67	67	+10	0
C.N-7	Commercial	71	70	71	+10	1
C.N-8	Commercial	71	66	67	+10	1
Ball Field	Residential	66	53	54	+10	1
C.S-15	Commercial	71	69	70	+10	1
BYPC	Residential	66	65	65	+10	0
R.N-17	Residential	66	63	65	+10	2

Receptor Location	Land Use Category	NHDOT Noise Criteria	Existing Sound Level	Build Sound Level	NHDOT Increase Criteria	Sound Level Increase
C.N-10	Commercial	71	62	64	+10	2
R.N-18	Residential	66	56	58	+10	2
C.N-12	Commercial	71	54	56	+10	2
R.N-19	Residential	66	52	54	+10	2
C.N-13	Commercial	71	53	55	+10	2
C.N-11	Commercial	71	52	54	+10	2
R.N-20	Residential	66	53	54	+10	1
R.N-23	Residential	66	59	62	+10	3
R.N-24	Residential	66	56	58	+10	2
R.N-21	Residential	66	55	57	+10	2
R.N-22	Residential	66	53	55	+10	2
C.N-15	Commercial	71	68	69	+10	1
C.N-14	Commercial	71	62	64	+10	2
R.N-25	Residential	66	61	62	+10	1
Town Library	Commercial	71	62	63	+10	1
R.N-26	Residential	66	62	63	+10	1
R.N-27	Residential	66	65	66	+10	1
R.S-4	Residential	66	54	55	+10	1
R.S-5	Residential	66	54	56	+10	1
R.S-6	Residential	66	59	61	+10	2
R.S-7	Residential	66	64	65	+10	1
R.S-8	Residential	66	64	65	+10	1
R.S-9	Residential	66	52	53	+10	1
R.S-10	Residential	66	54	56	+10	2
R.S-11a	Residential	66	56	58	+10	2
R.S-12	Residential	66	52	53	+10	1
R.S-13	Residential	66	52	54	+10	2
R.S-14	Residential	66	56	59	+10	3
R.S-15	Residential	66	64	65	+10	1
R.S-16	Residential	66	51	53	+10	2
R.S-17	Residential	66	54	56	+10	2
R.S-18	Residential	66	63	64	+10	1
Town Hall	Commercial	71	62	63	+10	1
R.N-41	Residential	66	57	58	+10	1
R.N-28	Residential	66	54	56	+10	2
R.N-29	Residential	66	49	51	+10	2
R.N-30	Residential	66	47	49	+10	2
R.N-31	Residential	66	46	48	+10	2
C.N-16	Commercial	71	64	65	+10	1
R.S-19	Residential	66	61	63	+10	2
R.S-20	Residential	66	66	67	+10	1
R.S-21	Residential	66	57	58	+10	1
R.S-22	Residential	66	61	62	+10	1
R.S-23	Residential	66	60	61	+10	2

Receptor Location	Land Use Category	NHDOT Noise Criteria	Existing Sound Level	Build Sound Level	NHDOT Increase Criteria	Sound Level Increase
R.S-24	Residential	66	64	65	+10	1
R.S-25	Residential	66	54	56	+10	2
R.S-26	Residential	66	54	56	+10	2
R.S-27	Residential	66	54	56	+10	2
R.S-28	Residential	66	56	57	+10	1
R.S-29	Residential	66	64	65	+10	1
R.S-30	Residential	66	52	54	+10	2
R.S-31	Residential	66	53	55	+10	2
R.S-32	Residential	66	53	56	+10	3
R.S-33	Residential	66	58	61	+10	3
R.S-34	Residential	66	53	56	+10	3
R.S-35	Residential	66	58	61	+10	3
R.S-36	Residential	66	52	55	+10	3
R.S-37	Residential	66	53	56	+10	3
R.S-38	Residential	66	52	54	+10	2
R.S-39	Residential	66	53	55	+10	2
R.N-42	Residential	66	53	54	+10	1
R.S-41	Residential	66	49	51	+10	2
R.N-33	Residential	66	62	63	+10	1
R.N-34	Residential	66	69	69	+10	0
R.N-35	Residential	66	55	58	+10	3
R.N-36	Residential	66	68	68	+10	0
R.N-37	Residential	66	68	69	+10	1
R.N-38	Residential	66	58	61	+10	3
R.N-39	Residential	66	58	61	+10	3
R.N-40	Residential	66	62	63	+10	1
C.N-17	Commercial	71	66	67	+10	1
C.S-16	Commercial	71	59	60	+10	1
C.S-17	Commercial	71	67	68	+10	1
C.S-18	Commercial	71	64	65	+10	1
C.S-19	Commercial	71	54	55	+10	1
C.S-20	Commercial	71	70	71	+10	1
C.S-21	Commercial	71	67	67	+10	1
C.S-22	Commercial	71	61	62	+10	1
C.S-23	Commercial	71	58	59	+10	1
C.S-24	Commercial	71	63	64	+10	1
C.S-25	Commercial	71	56	57	+10	1
C.S-25	Commercial	71	56	57	+10	1
C.S-26	Commercial	71	57	58	+10	1
C.N-17	Commercial	71	64	64	+10	0
C.N-18	Commercial	71	62	62	+10	0
R.S-11b	Residential	66	64	65	+10	1
Gazebo	Residential	66	62	64	+10	2

Bold values exceed noise impact criteria of corresponding land use.

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The majority of receptor locations currently experience sound levels that are below NHDOT's noise impact criteria. The noise analysis identified the following impacted receptor locations:

- **R.N-9 (Build) and R.N-10 (Existing and Build)** – located on the north side of NH Route 101, just west of Wallace Road.
- **R.N-27 (Build)** – located on the north side of NH Route 101, just west of Meetinghouse Road.
- **R.S-20 (Existing and Build)** – located on the south side of NH Route 101, just west of Liberty Hill Road.
- **R.N-34 (Existing and Build), R.N-36 (Existing and Build), and R.N-37 (Existing and Build)** – located on the north side of NH Route 101 between Liberty Hill Road and Bedford Center Road.
- **C.S-20 (Build)** – located on the south side of NH Route 101, just east of Constitution Drive.

Receptor locations further away from the roadway would experience lower sound levels as sound waves dissipate with distance.

1.7 Noise Mitigation Guidelines

The noise analysis demonstrated that a total of seven residential receptor locations and one commercial receptor location within the Project area will experience Build Condition sound levels that exceed NHDOT's noise impact criteria. NHDOT's policy requires that the feasibility and reasonableness of noise mitigation be evaluated when noise impacts have been identified within a project area. This noise evaluation investigated the feasibility and reasonableness of constructing noise barriers within the Project area following NHDOT's guidance and procedures. NHDOT's guidance requires that potential noise mitigation measures meet acoustical, engineering, and cost considerations for constructing a noise barrier.

NHDOT and FHWA guidelines establish procedures to determine if a noise barrier is feasible and reasonable. The feasibility of noise abatement measures is based upon engineering and acoustical attributes. The engineering considerations include the existing roadway geometry, cross streets, driveways, safety issues, and other environmental impacts. The reasonableness of noise abatement measures is based upon its economic and social aspects. The costs of the noise abatement measures must be reasonable for the number of receptors receiving a benefit and the amount of noise reduction being achieved.

The implementation of an abatement alternative is considered cost effective if either the CEI or the DEI indicate that the alternative is reasonable. If both the CEI and DEI indicate that an alternative is unreasonable, then the alternative is not considered to be cost effective.

1.8 Noise Abatement Evaluation

An evaluation of four potential noise barriers located along NH Route 101 at the areas where there are impacted residential receptor locations was conducted. All four of these potential noise barriers were determined not to meet the NHDOT noise policy because they were not reasonable and would not be cost effective. Additionally, these noise barriers are not likely to be feasible due to the numerous curb cuts along the corridor and physical constraints such as limited space and wetlands. The following is a discussion of the specific noise barrier criteria:

Feasibility

- The noise barrier meets the acoustical requirement because receptor locations have predicted sound levels that exceed the NAC for residential and commercial land uses.
- Although three of the four possible noise barriers would provide a 5 dB(A) noise reduction for at least one impacted receptor, it is unlikely that barriers could be constructed given the topography and numerous curb-cuts along NH Route 101.

Reasonableness

- The noise barriers are not reasonable because they are not cost effective.
- All four of the possible noise barriers have CEIs and DEIs well above their respective criteria's of $45,000 or 1,500 square feet. Therefore, no noise barriers are recommended.
- Noise barriers are not recommended at any of the four impacted residential receptor locations within the project area. Table 4 summarizes the parameters of the noise barriers evaluated along NH Route 101. The four noise barrier evaluation locations and the adjacent benefited receptors are shown in Figures 5 through 7.

Table 4 Preliminary Noise Barrier Parameters

Noise Barrier Location	Benefited Residential Units	Barrier Length (feet)	Average Barrier Height (feet)	Barrier Cost ($)	Criteria CEI ($) / DEI (SF)	Cost Effective (< $45,000 / 1,500 SF)
Barrier-1, west of Wallace Rd	3	725	13	$ 282,750	$ 94,250 / 3,150 SF	No
Barrier-2, west of Meetinghouse Rd	0	600	24	$ 432,000	NA / NA	No
Barrier-3, west of Liberty Hill Rd	1	250	10	$ 75,000	$ 75,000 / 2,500 SF	No
Barrier-4, west of Bedford Center Rd	3	650	11	$ 214,500	$ 71,500 / 2,400 SF	No

Figure 5 Noise Barrier – Location 1

0 200 400 Feet

NOTE:
NOISE BARRIER NOT RECOMMENEDED

LEGEND
- X.X-# -x ACTIVITY CATEGORY B/C (RESIDENTIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-# -x ACTIVITY CATEGORY E (COMMERCIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-# -x / X.X-# -x IMPACTED LOCATION NOISE REDUCTION dBA (FROM BARRIER)
- PROPOSED EDGE OF PAVEMENT
- APPROXIMATE NOISE BARRIER EVALUATION LOCATION

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Figure 5

Noise Barrier Location 1

Route 101 - Bedford, NH

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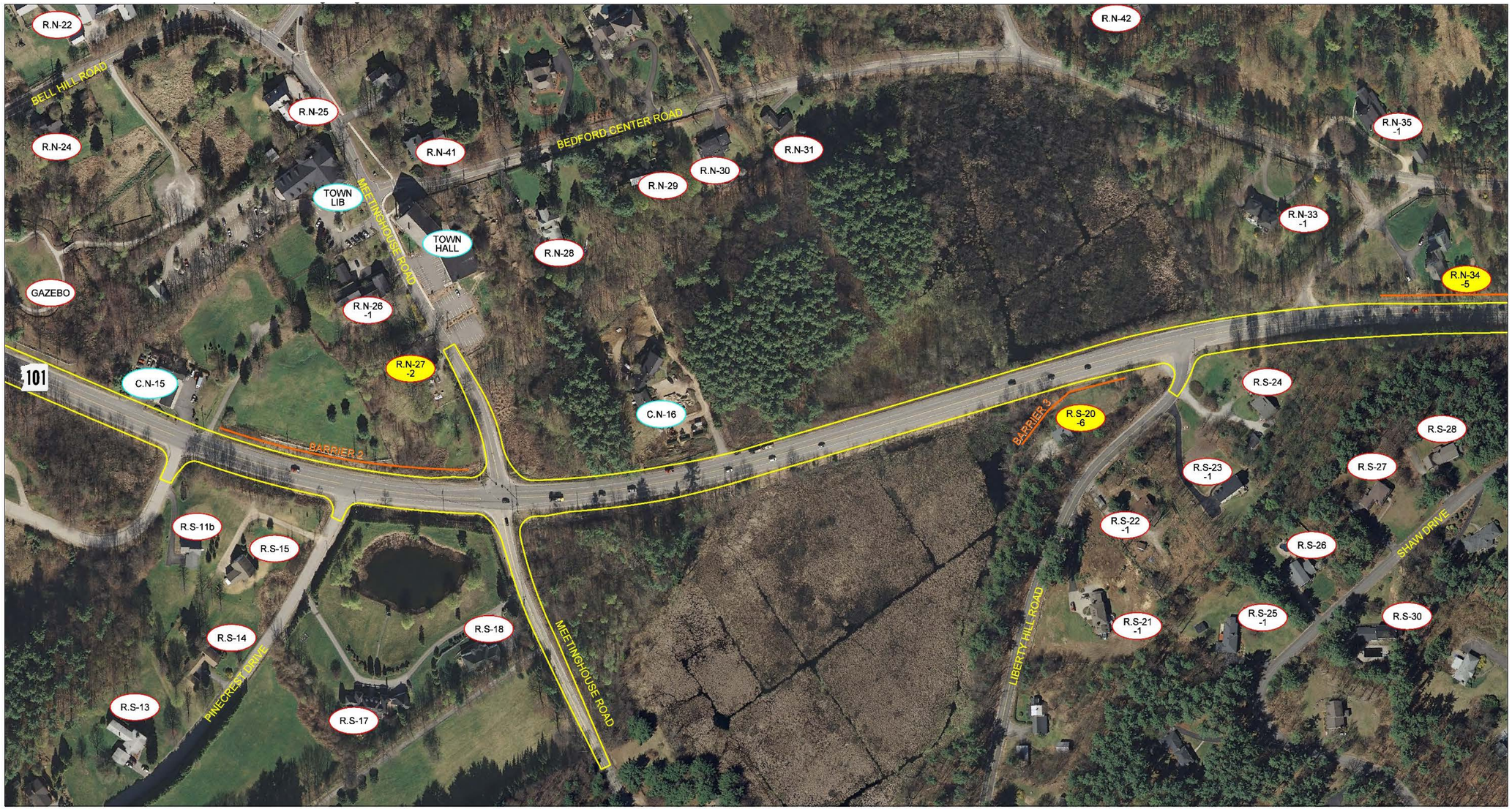
Figure 6 Noise Barrier – Location 2



0 200 400 Feet

LEGEND

- X.X-# -X - ACTIVITY CATEGORY B/C (RESIDENTIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-# -X - ACTIVITY CATEGORY E (COMMERCIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-# -X / X.X-# -X - IMPACTED LOCATION NOISE REDUCTION dBA (FROM BARRIER)
- PROPOSED EDGE OF PAVEMENT
- APPROXIMATE NOISE BARRIER EVALUATION LOCATION

Vanasse Hangen Brustlin, Inc.

Figure 6

Noise Barrier Locations 2 & 3

Route 101 - Bedford, NH

\\mawatr\TE\52390.01 Bedford 13953\tech\Report for DOT\Appendix\Bedford_101_Noise and Air Quality Report_072814.docx

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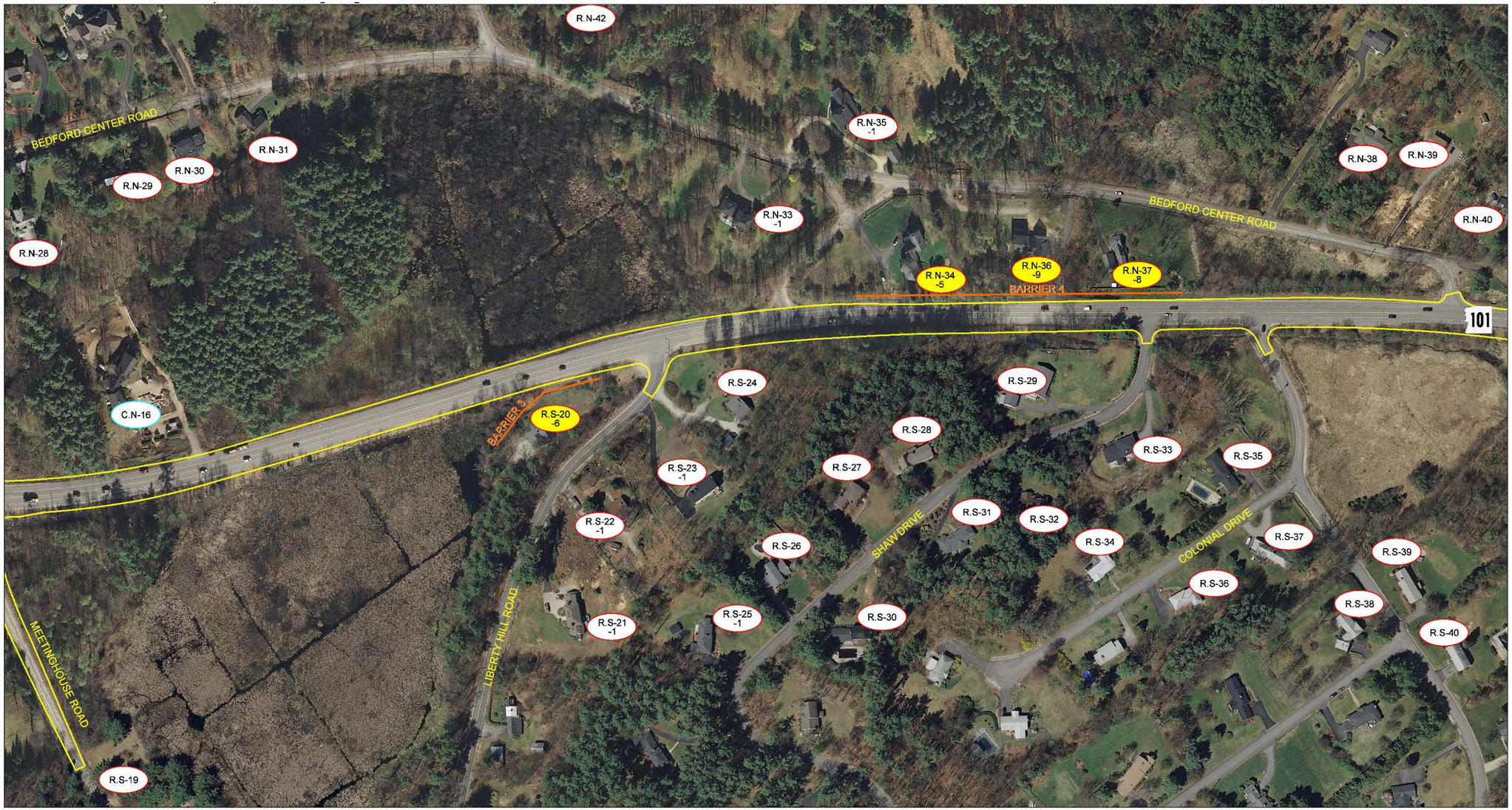
Figure 7 Noise Barrier – Location 3



0 200 400 Feet

LEGEND

- X.X-#/-x - ACTIVITY CATEGORY B/C (RESIDENTIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-#/-x - ACTIVITY CATEGORY E (COMMERCIAL) NOISE REDUCTION dBA (FROM BARRIER)
- X.X-#/-x X.X-#/-x - IMPACTED LOCATION NOISE REDUCTION dBA (FROM BARRIER)
- PROPOSED EDGE OF PAVEMENT
- APPROXIMATE NOISE BARRIER EVALUATION LOCATION

VHB Vanasse Hangen Brustlin, Inc.

Figure 7

Noise Barrier Locations 3 & 4

Route 101 - Bedford, NH

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1.9 Conclusion

The noise analysis evaluated sound levels associated with the NH Route 101 roadway improvement project in Bedford, New Hampshire. The results of the analysis demonstrate that seven residential receptor locations and one commercial receptor location will experience Build Condition sound levels that exceed NHDOT's noise impact criteria. The sound level increases from the Existing Conditions to the Build Conditions are small and will range from 0 dB(A) to 3 dB(A), which is not expected to be a noticeable change. Because the Build Condition sound levels do exceed one of the NHDOT's noise impact criteria, noise mitigation measures (noise barriers) were evaluated. However, the potential noise barriers did not meet the feasibility and reasonableness criteria. Although three of the four potential noise barriers did provide the minimum sound level reduction at one or more receptor locations, none of the potential noise barriers meet the NHDOT's cost effective policy. Therefore, no noise barriers are recommended for this project.

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2

Air Quality

2.1 Introduction

The purpose of this chapter is to evaluate the potential air quality impacts associated with the NH Route 101 roadway improvement project in Bedford, New Hampshire. The 1990 Clean Air Act Amendments (CAAA) require that a proposed project not cause any new violation of the National Ambient Air Quality Standards (NAAQS) for pollutants of concern, or increase the frequency or severity of any existing violations, or delay attainment of any NAAQS.

This air quality evaluation utilized the Federal Highway Administration's (FHWA's) carbon monoxide (CO) categorical hot-spot guidance presented in the February 12, 2014 memorandum. FHWA's guidance is based upon the transportation conformity rule 40 CFR 93.123(a)(3) and provides for a categorical hot-spot finding in place of doing a site specific CO hot-spot analysis to provide a project-level conformity determination for intersections that qualify.

The following sections discuss attainment status, the methodology, and the results.

2.2 Attainment Status

The EPA has set the NAAQS for air pollutants to protect the public health. The predominant source of pollution anticipated from the Proposed Project is carbon monoxide (CO) emissions from project-related motor vehicles and truck traffic.

CO is a colorless and odorless gas that is a product of incomplete combustion. CO is absorbed by the lungs and reacts with hemoglobin to reduce the oxygen carrying capacity of the blood. At low concentrations, CO has been shown to aggravate the symptoms of cardiovascular disease. The Bedford area is classified by EPA as an Attainment area for CO. Table 5 outlines the NAAQS for all of the pollutants regulated by the EPA.

Table 5 National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[1]	None	
	35 ppm (40 mg/m^3)	1-hour[1]	None	
Lead	0.15 ug/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 ug/m^3)	Annual (Arithmetic Mean)	Same as Primary	
Particulate Matter (PM_{10})	150 ug/m^3	24-hour[2]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15 ug/m^3	Annual (Arithmetic Mean)[3]	Same as Primary	
	35 ug/m^3	24-hour[4]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour[5]	Same as Primary	
	0.08 ppm (1997 std)	8-hour[6]	Same as Primary	
	0.12 ppm	1-hour (applied to limited areas)[7]		
Sulfur Dioxide	0.03 ppm	Annual	0.5 ppm	3-hour
	0.14 ppm	24-hour[1]		

1 Not to be exceeded more than once per year.
2 Not to be exceeded more than once per year on average over 3 years.
3 To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0µg/m^3.
4 To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).
5 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (Effective 60 days after publication in the Federal Register)
6 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
The 1997 standard—and the implementation rules for that standard—would remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
7 The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1.
As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the 8-hour ozone nonattainment Early Action Compact (EAC) Areas.

2.3 Methodology

The air quality evaluation followed the FHWA's CO categorical hot-spot guidance presented in the February 12, 2014 memorandum that follows the EPA 1992 CO modeling guidelines[4]. FHWA's guidance is based upon a demonstration that the project intersections have air quality modeling parameters, such as geometry, traffic, and emissions, that are lower than the air quality modeling parameters modeled in the guidance that demonstrated compliance with the NAAQS.

The FHWA's guidance modeled a multi-lane urbanized intersection with traffic operating at capacity using EPA's MOVES2010b and CAL3QHC models that demonstrated compliance with the NAAQS. The guidance indicates that you can rely on the FHWA's CO categorical hot-spot finding as part of their project-level conformity determination if a project's parameters fall within an acceptable range of modeled parameters. This can be demonstrated using the FHWA's CO categorical hot-spot guidance tool worksheets to evaluate the proposed project intersections.

The proposed project has a total of four signalized intersections all of which were evaluated using the guidance tool. These intersections include:

1. Route 101 and Wallace Road
2. Route 101 and Nashua Road
3. Route 101 and Old Meeting House Road
4. Route 101 and Old Bedford Road/Constitution Drive

These intersections were evaluated based upon year of analysis, grades, approach lanes, turning lanes, lane widths, travel speeds, traffic volumes, level of service, ambient temperature, background CO values, and the 8 hour persistence factor. The FHWA's CO categorical hot-spot guidance tool worksheets and intersection graphics are presented in the Air Appendix.

It should be pointed out that FHWA's CO categorical hot-spot guidance was designed to be applied to urban intersection projects in CO maintenance areas. However, this approach was determined to be applicable to the NH Route 101 roadway improvement project because all of the physical, emission, and traffic parameters were equal to or better than the example used in the FHWA's guidance.

4 U.S. Environmental Protection Agency, *Guideline for Modeling Carbon Monoxide from Roadway Intersections*, EPA-454/R-92-005, Office of Air Quality Planning and Standards, November, 1992.

2.4 Results

The air quality evaluation demonstrates that the proposed NH Route 101 roadway improvement project will not have any adverse air quality impacts, conforms to the Clean Air Act Amendments, and meets the National Ambient Air Quality Standards. The FHWA's CO categorical hot-spot guidance tool evaluated the signalized intersections in the study area. This tool demonstrates that all existing and future CO concentrations will be below the NAAQS.

The air quality evaluation demonstrates that the proposed Project conforms to the CAAA SIP because:

- No new violation of the NAAQS will be created,
- No increase in the frequency or severity of any existing violations will occur, and
- No delay in attainment of any NAAQS will result.

Therefore no air quality mitigation measures are required in support of this project.

Appendices

- **NOISE APPENDIX:**
  - Noise Monitoring Data
  - TNM Modeling Inputs / Results
  - TNM Results Summary

- **AIR QUALITY APPENDIX:**
  - FHWA's CO Categorical Hot Spot Guidance Tool Worksheets
  - Intersection Graphics

NOISE APPENDIX: Noise Monitoring Data

Summary			
Filename	14032501.LD0		
Serial Number	3707		
Model	SoundExpert™ LxT		
Firmware Version	2.205		
User	NBS		
Location	**Liberty Hill Rd - South**		
Job Description	**Route 101 Bedford**		
Note			
Measurement Description			
Start	2014/03/25 14:59:42		
Stop	2014/03/25 15:23:07		
Duration	0:23:25.1		
Run Time	0:23:25.1		
Pause	0:00:00.0		
Pre Calibration	2014/03/25 13:29:13		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT1L		
Microphone Correction	Off		
Integration Method	Exponential		
OBA Range	Normal		
OBA Bandwidth	1/1 Octave		
OBA Freq. Weighting	A Weighting		
OBA Max Spectrum	Bin Max		
Overload	122.4 dB		
	A	C	Z
Under Range Peak	78.6	75.6	80.6 dB
Under Range Limit	26.3	25.4	32.3 dB
Noise Floor	16.4	16.2	22.2 dB
Results			
LASeq	**68.4 dB**		
LASE	99.9 dB		
EAS	1.082 mPa²h		
LApeak (max)	2014/03/25 15:14:44	94.1 dB	
LASmax	2014/03/25 15:10:11	78.5 dB	
LASmin	2014/03/25 15:23:06	46.6 dB	
SEA	-99.9 dB		
LAS > 60.0 dB (Exceedence Counts / Duration)	18	1307.4 s	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-23:00**	**LNight 23:00-07:00**	**Lden**
	68.4	68.4	-99.9	68.4
LCSeq	73.7 dB			
LASeq	68.4 dB			
LCSeq - LASeq	5.3 dB			
LAIeq	69.2 dB			
LAeq	68.4 dB			
LAIeq - LAeq	0.8 dB			
# Overloads	0			
Overload Duration	0.0 s			
# OBA Overloads	0			
OBA Overload Duration	0.0 s			
Statistics				
LAS1.00	74.3 dB			
LAS5.00	71.7 dB			
LAS10.00	70.9 dB			
LAS15.00	70.4 dB			
LAS50.00	68.0 dB			
LAS90.00	60.6 dB			

Summary			
Filename	VHB.003		
Serial Number	2555		
Model	Model 831		
Firmware Version	2.201		
User	NBS		
Location	**Gazebo/Park #2**		
Job Description	**Route 101 Bedford**		
Note			
Measurement Description			
Start	2014/03/25 15:31:58		
Stop	2014/03/25 16:19:44		
Duration	0:47:45.8		
Run Time	0:47:45.8		
Pause	0:00:00.0		
Pre Calibration	2014/03/25 13:25:59		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRM831		
Microphone Correction	Off		
Integration Method	Linear		
OBA Range	Normal		
OBA Bandwidth	1/1 Octave		
OBA Freq. Weighting	A Weighting		
OBA Max Spectrum	Bin Max		
Gain	0.0 dB		
Overload	144.1 dB		
	A	C	Z
Under Range Peak	76.6	73.6	78.6 dB
Under Range Limit	26.3	26.7	32.3 dB
Noise Floor	17.2	17.5	22.8 dB
Results			
LAeq	**58.2 dB**		
LAE	92.7 dB		
EA	209.293 µPa²h		
LApeak (max)	2014/03/25 15:55:35	83.8 dB	
LASmax	2014/03/25 15:53:52	66.6 dB	
LASmin	2014/03/25 16:14:35	42.1 dB	
SEA	-99.9 dB		
LAS > 60.0 dB (Exceedence Counts / Duration)	37	909.7 s	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	
Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**
	58.2	58.2	-99.9	58.2
LCeq	66.1 dB			
LAeq	58.2 dB			
LCeq - LAeq	7.9 dB			
LAIeq	58.8 dB			
LAeq	58.2 dB			
LAIeq - LAeq	0.6 dB			
# Overloads	0			
Overload Duration	0.0 s			
# OBA Overloads	0			
OBA Overload Duration	0.0 s			
Statistics				
LAS1.00	63.5 dB			
LAS5.00	61.7 dB			
LAS10.00	60.9 dB			
LAS15.00	60.4 dB			
LAS50.00	57.5 dB			
LAS90.00	52.2 dB			

Summary			
Filename	VHB.002		
Serial Number	2555		
Model	Model 831		
Firmware Version	2.201		
User	NBS		
Location	**Gazebo/Park #1**		
Job Description	**Route 101 Bedford**		
Note			
Measurement Description			
Start	2014/03/25 14:15:15		
Stop	2014/03/25 15:30:50		
Duration	1:15:34.6		
Run Time	1:15:34.6		
Pause	0:00:00.0		
Pre Calibration	2014/03/25 13:25:59		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRM831		
Microphone Correction	Off		
Integration Method	Linear		
OBA Range	Normal		
OBA Bandwidth	1/1 Octave		
OBA Freq. Weighting	A Weighting		
OBA Max Spectrum	Bin Max		
Gain	0.0 dB		
Overload	144.1 dB		
	A	C	Z
Under Range Peak	76.6	73.6	78.6 dB
Under Range Limit	26.3	26.7	32.3 dB
Noise Floor	17.2	17.5	22.8 dB
Results			
LAeq	**58.6** dB		
LAE	95.2 dB		
EA	365.619 µPa²h		
LApeak (max)	2014/03/25 15:21:36	95.0 dB	
LASmax	2014/03/25 15:21:36	76.4 dB	
LASmin	2014/03/25 15:06:36	40.0 dB	
SEA	-99.9 dB		
LAS > 60.0 dB (Exceedence Counts / Duration)	69	1190.7 s	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-22:00**	**LNight 22:00-07:00**	**Lden**
	58.6	58.6	-99.9	58.6
LCeq	67.9 dB			
LAeq	58.6 dB			
LCeq - LAeq	9.3 dB			
LAIeq	61.0 dB			
LAeq	58.6 dB			
LAIeq - LAeq	2.4 dB			
# Overloads	0			
Overload Duration	0.0 s			
# OBA Overloads	0			
OBA Overload Duration	0.0 s			
Statistics				
LAS1.00	67.1 dB			
LAS5.00	61.7 dB			
LAS10.00	60.5 dB			
LAS15.00	60.0 dB			
LAS50.00	57.5 dB			
LAS90.00	52.8 dB			

Summary			
Filename	14032500.LD0		
Serial Number	3707		
Model	SoundExpert™ LxT		
Firmware Version	2.205		
User	NBS		
Location	**Bedford Center Rd - North**		
Job Description	**Route 101 Bedford**		
Note			
Measurement Description			
Start	2014/03/25 14:33:02		
Stop	2014/03/25 14:53:04		
Duration	0:20:01.9		
Run Time	0:20:01.9		
Pause	0:00:00.0		
Pre Calibration	2014/03/25 13:29:13		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT1L		
Microphone Correction	Off		
Integration Method	Exponential		
OBA Range	Normal		
OBA Bandwidth	1/1 Octave		
OBA Freq. Weighting	A Weighting		
OBA Max Spectrum	Bin Max		
Overload	122.4 dB		
	A	C	Z
Under Range Peak	78.6	75.6	80.6 dB
Under Range Limit	26.3	25.4	32.3 dB
Noise Floor	16.4	16.2	22.2 dB
Results			
LASeq	**61.3 dB**		
LASE	92.1 dB		
EAS	178.288 µPa²h		
LApeak (max)	2014/03/25 14:34:02	83.0 dB	
LASmax	2014/03/25 14:34:02	71.5 dB	
LASmin	2014/03/25 14:41:17	42.1 dB	
SEA	-99.9 dB		
LAS > 60.0 dB (Exceedence Counts / Duration)	23	869.6 s	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-23:00**	**LNight 23:00-07:00**	**Lden**
	61.3	61.3	-99.9	61.3
LCSeq	67.3 dB			
LASeq	61.3 dB			
LCSeq - LASeq	6.0 dB			
LAIeq	62.1 dB			
LAeq	61.3 dB			
LAIeq - LAeq	0.8 dB			
# Overloads	0			
Overload Duration	0.0 s			
# OBA Overloads	0			
OBA Overload Duration	0.0 s			
Statistics				
LAS1.00	66.9 dB			
LAS5.00	64.7 dB			
LAS10.00	63.9 dB			
LAS15.00	63.3 dB			
LAS50.00	60.6 dB			
LAS90.00	54.8 dB			

Summary			
Filename	14032503.LD0		
Serial Number	3707		
Model	SoundExpert™ LxT		
Firmware Version	2.205		
User	NBS		
Location	**Baseball Field**		
Job Description	**Route 101 Bedford**		
Note			
Measurement Description			
Start	2014/03/25 15:42:52		
Stop	2014/03/25 16:10:24		
Duration	0:27:31.3		
Run Time	0:27:31.3		
Pause	0:00:00.0		
Pre Calibration	2014/03/25 13:29:13		
Post Calibration	None		
Calibration Deviation	---		
Overall Settings			
RMS Weight	A Weighting		
Peak Weight	A Weighting		
Detector	Slow		
Preamp	PRMLxT1L		
Microphone Correction	Off		
Integration Method	Exponential		
OBA Range	Normal		
OBA Bandwidth	1/1 Octave		
OBA Freq. Weighting	A Weighting		
OBA Max Spectrum	Bin Max		
Overload	122.4 dB		
	A	C	Z
Under Range Peak	78.6	75.6	80.6 dB
Under Range Limit	26.3	25.4	32.3 dB
Noise Floor	16.4	16.2	22.2 dB
Results			
LASeq	**48.4 dB**		
LASE	80.6 dB		
EAS	12.724 µPa²h		
LApeak (max)	2014/03/25 15:43:08	79.5 dB	
LASmax	2014/03/25 15:57:18	60.7 dB	
LASmin	2014/03/25 16:05:21	42.3 dB	
SEA	-99.9 dB		
LAS > 60.0 dB (Exceedence Counts / Duration)	1	1.3 s	
LAS > 85.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 135.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 137.0 dB (Exceedence Counts / Duration)	0	0.0 s	
LApeak > 140.0 dB (Exceedence Counts / Duration)	0	0.0 s	

Community Noise	**Ldn**	**LDay 07:00-23:00**	**LNight 23:00-07:00**	**Lden**
	48.4	48.4	-99.9	48.4
LCSeq	60.6 dB			
LASeq	48.4 dB			
LCSeq - LASeq	12.2 dB			
LAIeq	49.7 dB			
LAeq	48.4 dB			
LAIeq - LAeq	1.3 dB			
# Overloads	0			
Overload Duration	0.0 s			
# OBA Overloads	0			
OBA Overload Duration	0.0 s			
Statistics				
LAS1.00	53.0 dB			
LAS5.00	51.1 dB			
LAS10.00	50.5 dB			
LAS15.00	50.0 dB			
LAS50.00	48.0 dB			
LAS90.00	44.8 dB			

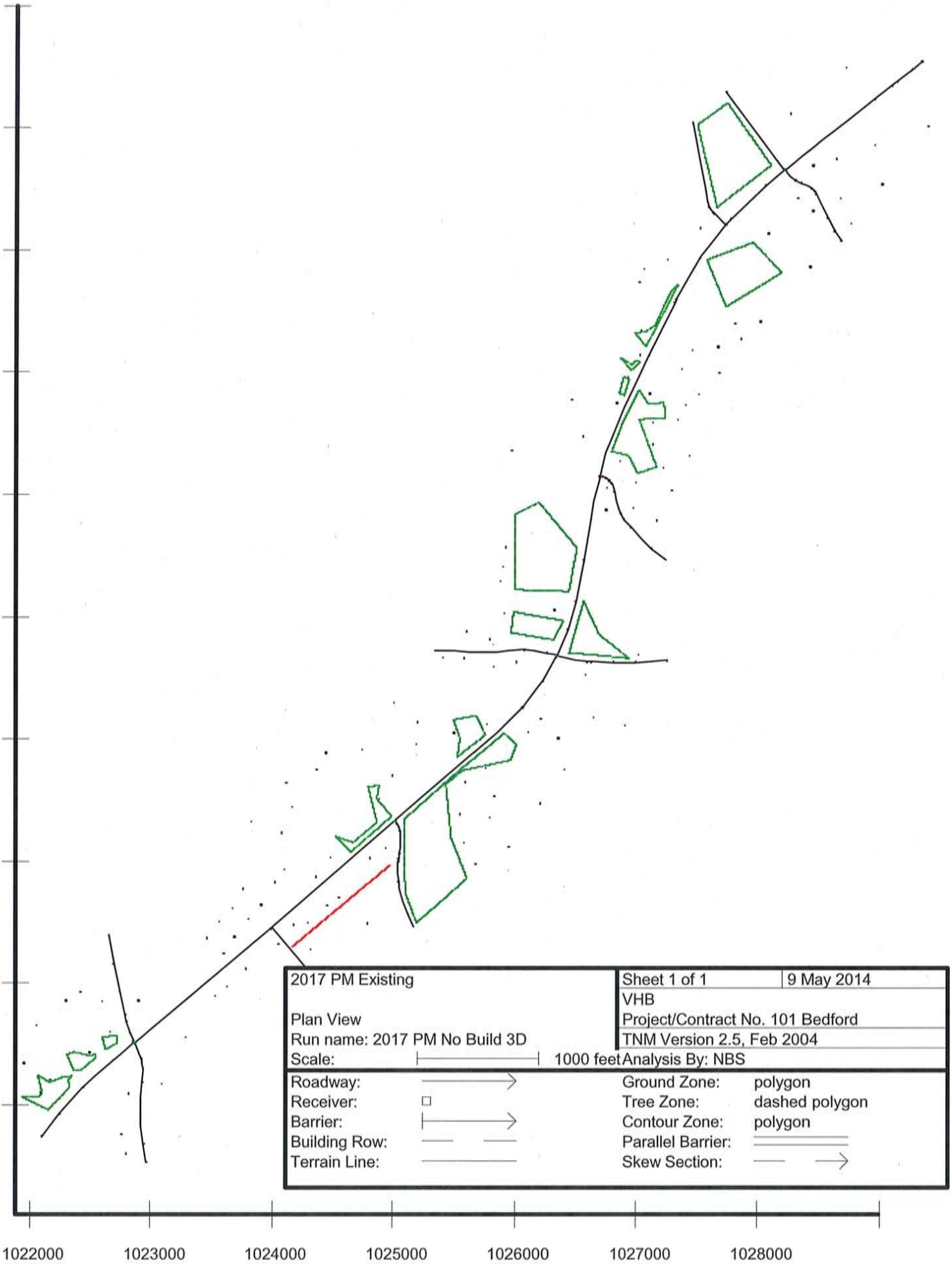
NOISE APPENDIX: Traffic Noise Model (TNM) Inputs / Results

NH Route 101 - Bedford, NH
Noise Monitoring Data
Date: March 25 2014
Weather: Partly Sunny 35 degrees with light winds.

Noise Monitoring Location	Unit	Time	Duration (minutes)	Sound Level (Leq) 2014 Monitored	2017 TNM	Delta
1.1 Gazebo / Park	LD-831	2:15 - 3:30 PM	75	58.6	61.9	3.3
1.2 Gazebo / Park	LD-831	3:30 - 4:20 PM	50	58.2	61.9	3.7
2.0 Bedford Center Rd - North	LD-LxT	2:30 - 2:50 PM	20	61.3	63.8	2.5
3.0 Liberty Hill Rd - South	LD-LxT	3:00 - 3:20 PM	20	68.4	68.8	0.4
4.0 Baseball Field	LD-LxT	3:40 - 4:05 PM	25	48.4	52.8	4.4

TNM results are slightly higher than the monitored results because TNM utilizes 2017 PM Peak hour volumes with free-flow conditions (posted speed limit). While the 2014 monitoring data experienced some lower speeds due to congestion at signals along the corridor.

>>> Calibration - OK


2017 PM Existing
Plan View
Run name: 2017 PM No Build 3D
Scale:
1000 feet
Sheet 1 of 1
9 May 2014
VHB
Project/Contract No. 101 Bedford
TNM Version 2.5, Feb 2004
Analysis By: NBS
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
0
1022000
1023000
1024000
1025000
1026000
1027000
1028000

VHB
NBS

9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2017 PM Existing
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

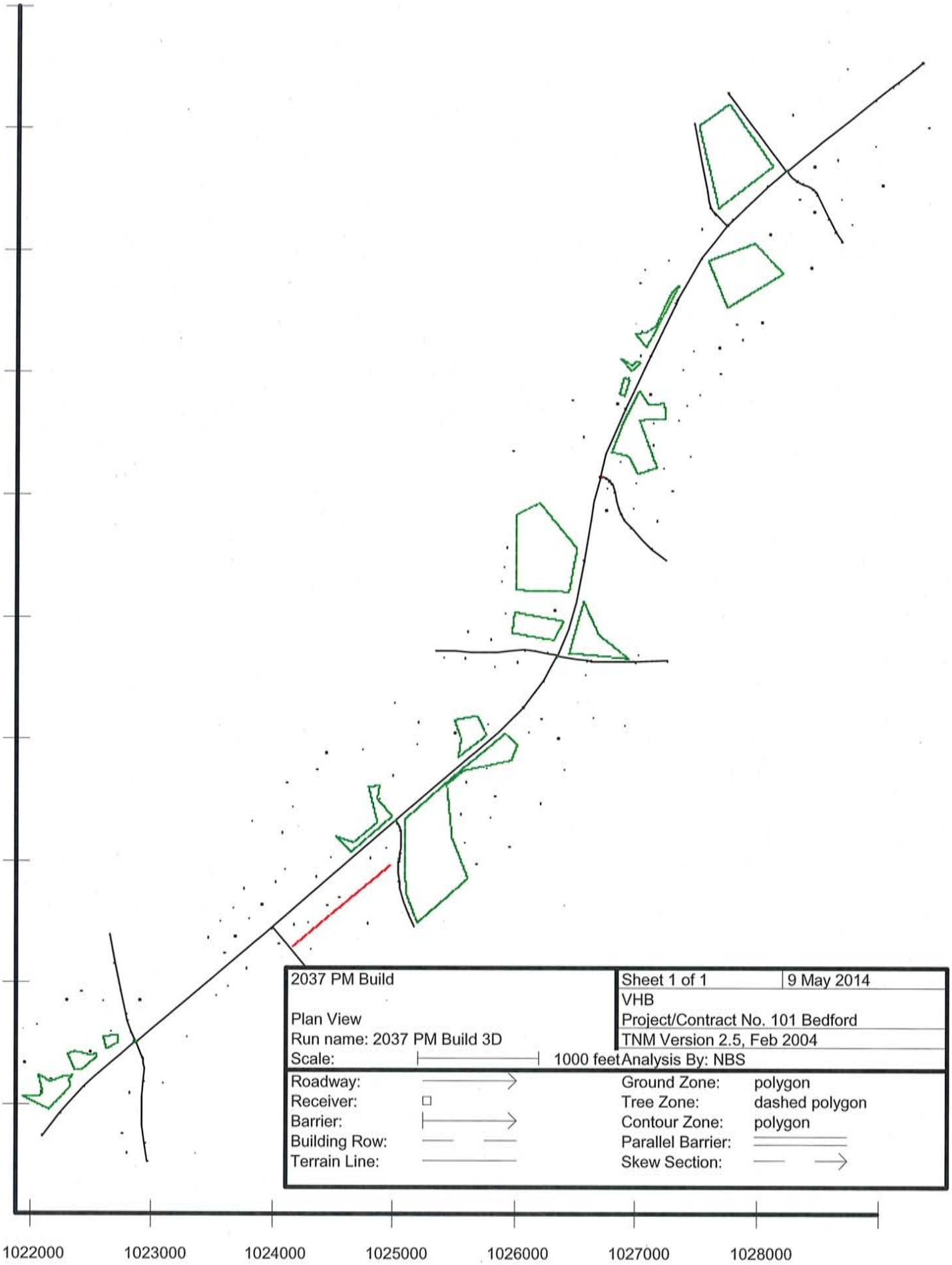
Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-7	1	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
R.N-9	2	1	0.0	65.4	66	65.4	15	----	65.4	0.0	8	-8.0
R.N-8	3	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.N-10	4	1	0.0	67.8	66	67.8	15	Snd Lvl	67.8	0.0	8	-8.0
R.N-11	5	1	0.0	63.9	66	63.9	15	----	63.9	0.0	8	-8.0
R.N-13	6	1	0.0	59.6	66	59.6	15	----	59.6	0.0	8	-8.0
R.N-12	7	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
R.N-4	8	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
R.N-5	9	1	0.0	56.7	66	56.7	15	----	56.7	0.0	8	-8.0
R.N-6	10	1	0.0	52.9	66	52.9	15	----	52.9	0.0	8	-8.0
R.N-2	11	1	0.0	56.7	66	56.7	15	----	56.7	0.0	8	-8.0
R.N-1	12	1	0.0	57.0	66	57.0	15	----	57.0	0.0	8	-8.0
R.N-3	13	1	0.0	52.9	66	52.9	15	----	52.9	0.0	8	-8.0
R.S-1	14	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
R.S-3	15	1	0.0	63.4	66	63.4	15	----	63.4	0.0	8	-8.0
C.S-1 Walgreens	17	1	0.0	65.2	71	65.2	15	----	65.2	0.0	8	-8.0
C.N-1 Harvest Market	19	1	0.0	66.0	71	66.0	15	----	66.0	0.0	8	-8.0
C.S-2 Shortys	21	1	0.0	65.3	71	65.3	15	----	65.3	0.0	8	-8.0
C.S-3 Modern Bride	23	1	0.0	63.6	71	63.6	15	----	63.6	0.0	8	-8.0
C.S-4 Fireplace Village	24	1	0.0	64.5	71	64.5	15	----	64.5	0.0	8	-8.0
C.S-5 Ethan Allen	26	1	0.0	68.5	71	68.5	15	----	68.5	0.0	8	-8.0
C.N-2 Culligan	28	1	0.0	69.6	71	69.6	15	----	69.6	0.0	8	-8.0
C.S-6 Family Health	31	1	0.0	69.0	71	69.0	15	----	69.0	0.0	8	-8.0

C.N-3	33	1	0.0	67.5	71	67.5	15	----	67.5	0.0	8	-8.0
C.N-4	34	1	0.0	66.2	71	66.2	15	----	66.2	0.0	8	-8.0
C.N-6	35	1	0.0	65.6	71	65.6	15	----	65.6	0.0	8	-8.0
R.N-14	36	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0
C.N-5	37	1	0.0	62.5	71	62.5	15	----	62.5	0.0	8	-8.0
R.N-15	38	1	0.0	62.0	66	62.0	15	----	62.0	0.0	8	-8.0
R.N-16	39	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
R.S-2	41	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
C.S-7 TD Bank	43	1	0.0	69.6	71	69.6	15	----	69.6	0.0	8	-8.0
C.S-8 Pizza Bella	44	1	0.0	66.7	71	66.7	15	----	66.7	0.0	8	-8.0
C.S-11	45	1	0.0	66.2	71	66.2	15	----	66.2	0.0	8	-8.0
C.S-12	46	1	0.0	59.9	71	59.9	15	----	59.9	0.0	8	-8.0
C.S-13	47	1	0.0	55.5	71	55.5	15	----	55.5	0.0	8	-8.0
C.S-14	48	1	0.0	69.3	71	69.3	15	----	69.3	0.0	8	-8.0
C.S-10	50	1	0.0	66.5	71	66.5	15	----	66.5	0.0	8	-8.0
C.N-7 Bedford Massage	52	1	0.0	70.0	71	70.0	15	----	70.0	0.0	8	-8.0
C.N-8	54	1	0.0	65.9	71	65.9	15	----	65.9	0.0	8	-8.0
Basesball Fields (M-4)	56	4	0.0	52.8	66	52.8	15	----	52.8	0.0	8	-8.0
C.S-15	58	1	0.0	68.7	71	68.7	15	----	68.7	0.0	8	-8.0
BYPC - Music School	60	2	0.0	64.8	66	64.8	15	----	64.8	0.0	8	-8.0
R.N-17 Vacant	62	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0
C.N-10	63	1	0.0	61.7	71	61.7	15	----	61.7	0.0	8	-8.0
R.N-18	64	1	0.0	56.1	66	56.1	15	----	56.1	0.0	8	-8.0
C.N-12	65	1	0.0	54.4	71	54.4	15	----	54.4	0.0	8	-8.0
R.N-19	67	1	0.0	51.9	66	51.9	15	----	51.9	0.0	8	-8.0
C.N-13	68	1	0.0	52.9	71	52.9	15	----	52.9	0.0	8	-8.0
C.N-11 Town Offices	70	1	0.0	52.4	71	52.4	15	----	52.4	0.0	8	-8.0
R.N-20	72	1	0.0	52.5	66	52.5	15	----	52.5	0.0	8	-8.0
R.N-23	73	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
R.N-24	74	1	0.0	55.8	66	55.8	15	----	55.8	0.0	8	-8.0
R.N-21	75	1	0.0	55.3	66	55.3	15	----	55.3	0.0	8	-8.0
R.N-22	77	1	0.0	52.8	66	52.8	15	----	52.8	0.0	8	-8.0
C.N-15 Mobil	78	1	0.0	68.1	71	68.1	15	----	68.1	0.0	8	-8.0
C.N-14	82	1	0.0	62.0	71	62.0	15	----	62.0	0.0	8	-8.0
R.N-25	84	1	0.0	61.0	66	61.0	15	----	61.0	0.0	8	-8.0
Town Library	85	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
R.N-26	87	1	0.0	61.9	66	61.9	15	----	61.9	0.0	8	-8.0
R.N-27	88	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
R.S-4	92	1	0.0	54.3	66	54.3	15	----	54.3	0.0	8	-8.0
R.S-5	93	1	0.0	54.2	66	54.2	15	----	54.2	0.0	8	-8.0

R.S-6	94	1	0.0	58.5	66	58.5	15	----	58.5	0.0	8	-8.0
R.S-7	95	1	0.0	64.2	66	64.2	15	----	64.2	0.0	8	-8.0
R.S-8	96	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
R.S-9	97	1	0.0	51.6	66	51.6	15	----	51.6	0.0	8	-8.0
R.S-10	98	1	0.0	53.9	66	53.9	15	----	53.9	0.0	8	-8.0
R.S-11a	99	1	0.0	56.1	66	56.1	15	----	56.1	0.0	8	-8.0
R.S-12	100	1	0.0	51.6	66	51.6	15	----	51.6	0.0	8	-8.0
R.S-13	101	1	0.0	51.9	66	51.9	15	----	51.9	0.0	8	-8.0
R.S-14	102	1	0.0	56.3	66	56.3	15	----	56.3	0.0	8	-8.0
R.S-15	103	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
R.S-16	104	1	0.0	50.9	66	50.9	15	----	50.9	0.0	8	-8.0
R.S-17	105	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.S-18	106	1	0.0	63.1	66	63.1	15	----	63.1	0.0	8	-8.0
Town Hall	107	1	0.0	61.9	66	61.9	15	----	61.9	0.0	8	-8.0
R.N-41	109	1	0.0	56.9	66	56.9	15	----	56.9	0.0	8	-8.0
R.N-28	111	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.N-29	112	1	0.0	49.1	66	49.1	15	----	49.1	0.0	8	-8.0
R.N-30	113	1	0.0	47.3	66	47.3	15	----	47.3	0.0	8	-8.0
R.N-31	114	1	0.0	46.2	66	46.2	15	----	46.2	0.0	8	-8.0
C.N-16	115	1	0.0	64.0	71	64.0	15	----	64.0	0.0	8	-8.0
R.S-19	116	1	0.0	61.1	66	61.1	15	----	61.1	0.0	8	-8.0
R.S-20	118	1	0.0	66.2	66	66.2	15	Snd Lvl	66.2	0.0	8	-8.0
R.S-21	119	1	0.0	56.6	66	56.6	15	----	56.6	0.0	8	-8.0
R.S-22	121	1	0.0	60.8	66	60.8	15	----	60.8	0.0	8	-8.0
R.S-23	122	1	0.0	59.8	66	59.8	15	----	59.8	0.0	8	-8.0
R.S-24	123	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
R.S-25	124	1	0.0	54.1	66	54.1	15	----	54.1	0.0	8	-8.0
R.S-26	125	1	0.0	54.4	66	54.4	15	----	54.4	0.0	8	-8.0
R.S-27	126	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.S-28	127	1	0.0	56.2	66	56.2	15	----	56.2	0.0	8	-8.0
R.S-29	128	1	0.0	64.1	66	64.1	15	----	64.1	0.0	8	-8.0
R.S-30	129	1	0.0	51.7	66	51.7	15	----	51.7	0.0	8	-8.0
R.S-31	130	1	0.0	52.6	66	52.6	15	----	52.6	0.0	8	-8.0
R.S-32	131	1	0.0	52.7	66	52.7	15	----	52.7	0.0	8	-8.0
R.S-33	132	1	0.0	58.1	66	58.1	15	----	58.1	0.0	8	-8.0
R.S-34	133	1	0.0	53.2	66	53.2	15	----	53.2	0.0	8	-8.0
R.S-35	134	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
R.S-36	135	1	0.0	52.4	66	52.4	15	----	52.4	0.0	8	-8.0
R.S-37	136	1	0.0	52.9	66	52.9	15	----	52.9	0.0	8	-8.0
R.S-38	137	1	0.0	52.4	66	52.4	15	----	52.4	0.0	8	-8.0

R.S-39	138	1	0.0	52.6	66	52.6	15	----	52.6	0.0	8	-8.0
R.S-40	139	1	0.0	52.5	66	52.5	15	----	52.5	0.0	8	-8.0
R.S-41	140	1	0.0	49.0	66	49.0	15	----	49.0	0.0	8	-8.0
R.N-33	142	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
R.N-34	143	1	0.0	68.6	66	68.6	15	Snd Lvl	68.6	0.0	8	-8.0
R.N-35	144	1	0.0	55.0	66	55.0	15	----	55.0	0.0	8	-8.0
R.N-36	145	1	0.0	67.9	66	67.9	15	Snd Lvl	67.9	0.0	8	-8.0
R.N-37	146	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0
R.N-38	147	1	0.0	58.4	66	58.4	15	----	58.4	0.0	8	-8.0
R.N-39	148	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
R.N-40	149	1	0.0	62.0	66	62.0	15	----	62.0	0.0	8	-8.0
C.N-17 Bedford Village Inn	151	1	0.0	66.1	71	66.1	15	----	66.1	0.0	8	-8.0
C.S-16	153	1	0.0	59.3	71	59.3	15	----	59.3	0.0	8	-8.0
C.S-17	154	1	0.0	67.2	71	67.2	15	----	67.2	0.0	8	-8.0
C.S-18	155	1	0.0	63.8	71	63.8	15	----	63.8	0.0	8	-8.0
C.S-19	156	1	0.0	54.0	71	54.0	15	----	54.0	0.0	8	-8.0
C.S-20	157	1	0.0	70.2	71	70.2	15	----	70.2	0.0	8	-8.0
C.S-21	158	1	0.0	66.5	71	66.5	15	----	66.5	0.0	8	-8.0
C.S-22	159	1	0.0	61.3	71	61.3	15	----	61.3	0.0	8	-8.0
C.S-23	160	1	0.0	58.1	71	58.1	15	----	58.1	0.0	8	-8.0
C.S-24	161	1	0.0	62.9	71	62.9	15	----	62.9	0.0	8	-8.0
C.S-25	162	1	0.0	56.3	71	56.3	15	----	56.3	0.0	8	-8.0
C.S-26	163	1	0.0	57.3	71	57.3	15	----	57.3	0.0	8	-8.0
C.N-17 Copper Door	164	1	0.0	63.6	71	63.6	15	----	63.6	0.0	8	-8.0
C.N-18 Liberty Mutual	165	1	0.0	61.5	71	61.5	15	----	61.5	0.0	8	-8.0
R.S-11b	167	1	0.0	64.3	66	64.3	10	----	64.3	0.0	8	-8.0
M-1 Gazebo / Park	170	1	0.0	61.9	66	61.9	10	----	61.9	0.0	8	-8.0
M-2 Bedford Center Rd - North	172	1	0.0	63.8	66	63.8	10	----	63.8	0.0	8	-8.0
M-3 Liberty Hill Rd - South	174	1	0.0	68.8	66	68.8	10	Snd Lvl	68.8	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	136	0.0	0.0	0.0
All Impacted	6	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0


2037 PM Build
Plan View
Run name: 2037 PM Build 3D
Scale:
1000 feet
Sheet 1 of 1
9 May 2014
VHB
Project/Contract No. 101 Bedford
TNM Version 2.5, Feb 2004
Analysis By: NBS
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
0
1022000
1023000
1024000
1025000
1026000
1027000
1028000

VHB
NBS

9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: INPUT HEIGHTS

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

ATMOSPHERICS: 68 deg F, 50% RH

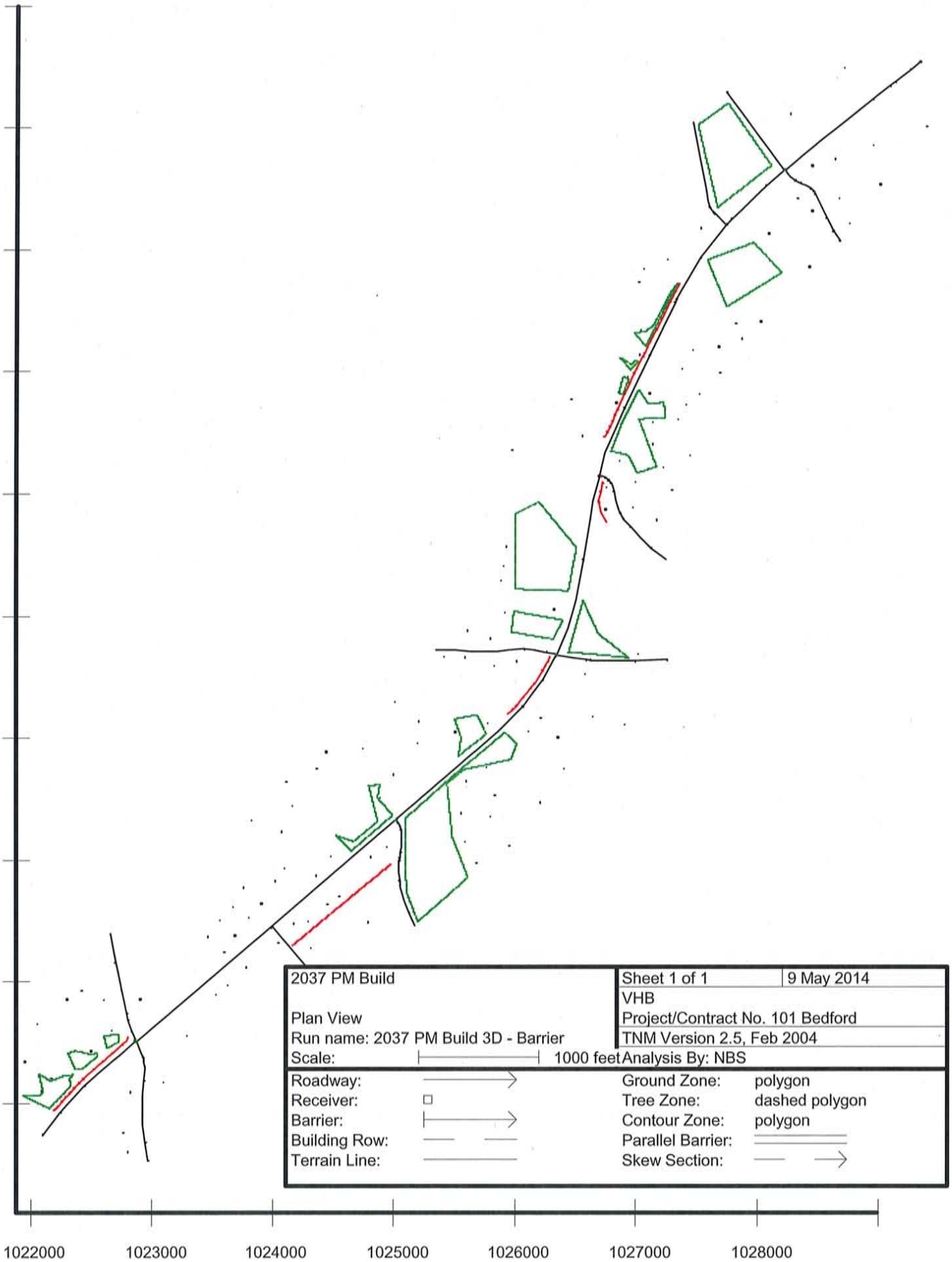
Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-7	1	1	0.0	62.0	66	62.0	15	----	62.0	0.0	8	-8.0
R.N-9	2	1	0.0	66.3	66	66.3	15	Snd Lvl	66.3	0.0	8	-8.0
R.N-8	3	1	0.0	54.9	66	54.9	15	----	54.9	0.0	8	-8.0
R.N-10	4	1	0.0	68.6	66	68.6	15	Snd Lvl	68.6	0.0	8	-8.0
R.N-11	5	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
R.N-13	6	1	0.0	60.4	66	60.4	15	----	60.4	0.0	8	-8.0
R.N-12	7	1	0.0	58.5	66	58.5	15	----	58.5	0.0	8	-8.0
R.N-4	8	1	0.0	61.1	66	61.1	15	----	61.1	0.0	8	-8.0
R.N-5	9	1	0.0	57.6	66	57.6	15	----	57.6	0.0	8	-8.0
R.N-6	10	1	0.0	53.8	66	53.8	15	----	53.8	0.0	8	-8.0
R.N-2	11	1	0.0	57.6	66	57.6	15	----	57.6	0.0	8	-8.0
R.N-1	12	1	0.0	57.9	66	57.9	15	----	57.9	0.0	8	-8.0
R.N-3	13	1	0.0	53.8	66	53.8	15	----	53.8	0.0	8	-8.0
R.S-1	14	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
R.S-3	15	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
C.S-1 Walgreens	17	1	0.0	66.2	71	66.2	15	----	66.2	0.0	8	-8.0
C.N-1 Harvest Market	19	1	0.0	66.8	71	66.8	15	----	66.8	0.0	8	-8.0
C.S-2 Shortys	21	1	0.0	66.1	71	66.1	15	----	66.1	0.0	8	-8.0
C.S-3 Modern Bride	23	1	0.0	64.5	71	64.5	15	----	64.5	0.0	8	-8.0
C.S-4 Fireplace Village	24	1	0.0	65.4	71	65.4	15	----	65.4	0.0	8	-8.0
C.S-5 Ethan Allen	26	1	0.0	69.4	71	69.4	15	----	69.4	0.0	8	-8.0
C.N-2 Culligan	28	1	0.0	70.4	71	70.4	15	----	70.4	0.0	8	-8.0
C.S-6 Family Health	31	1	0.0	69.6	71	69.6	15	----	69.6	0.0	8	-8.0

C.N-3	33	1	0.0	68.4	71	68.4	15	----	68.4	0.0	8	-8.0
C.N-4	34	1	0.0	67.0	71	67.0	15	----	67.0	0.0	8	-8.0
C.N-6	35	1	0.0	66.4	71	66.4	15	----	66.4	0.0	8	-8.0
R.N-14	36	1	0.0	64.1	66	64.1	15	----	64.1	0.0	8	-8.0
C.N-5	37	1	0.0	63.6	71	63.6	15	----	63.6	0.0	8	-8.0
R.N-15	38	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0
R.N-16	39	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
R.S-2	41	1	0.0	59.2	66	59.2	15	----	59.2	0.0	8	-8.0
C.S-7 TD Bank	43	1	0.0	70.3	71	70.3	15	----	70.3	0.0	8	-8.0
C.S-8 Pizza Bella	44	1	0.0	67.6	71	67.6	15	----	67.6	0.0	8	-8.0
C.S-11	45	1	0.0	67.1	71	67.1	15	----	67.1	0.0	8	-8.0
C.S-12	46	1	0.0	60.8	71	60.8	15	----	60.8	0.0	8	-8.0
C.S-13	47	1	0.0	56.1	71	56.1	15	----	56.1	0.0	8	-8.0
C.S-14	48	1	0.0	70.2	71	70.2	15	----	70.2	0.0	8	-8.0
C.S-10	50	1	0.0	67.3	71	67.3	15	----	67.3	0.0	8	-8.0
C.N-7 Bedford Massage	52	1	0.0	70.8	71	70.8	15	----	70.8	0.0	8	-8.0
C.N-8	54	1	0.0	66.6	71	66.6	15	----	66.6	0.0	8	-8.0
Basesball Fields (M-4)	56	4	0.0	53.9	66	53.9	15	----	53.9	0.0	8	-8.0
C.S-15	58	1	0.0	69.7	71	69.7	15	----	69.7	0.0	8	-8.0
BYPC - Music School	60	2	0.0	64.8	66	64.8	15	----	64.8	0.0	8	-8.0
R.N-17 Vacant	62	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
C.N-10	63	1	0.0	63.8	71	63.8	15	----	63.8	0.0	8	-8.0
R.N-18	64	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
C.N-12	65	1	0.0	56.0	71	56.0	15	----	56.0	0.0	8	-8.0
R.N-19	67	1	0.0	53.5	66	53.5	15	----	53.5	0.0	8	-8.0
C.N-13	68	1	0.0	54.8	71	54.8	15	----	54.8	0.0	8	-8.0
C.N-11 Town Offices	70	1	0.0	54.0	71	54.0	15	----	54.0	0.0	8	-8.0
R.N-20	72	1	0.0	54.3	66	54.3	15	----	54.3	0.0	8	-8.0
R.N-23	73	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
R.N-24	74	1	0.0	58.2	66	58.2	15	----	58.2	0.0	8	-8.0
R.N-21	75	1	0.0	57.3	66	57.3	15	----	57.3	0.0	8	-8.0
R.N-22	77	1	0.0	54.6	66	54.6	15	----	54.6	0.0	8	-8.0
C.N-15 Mobil	78	1	0.0	69.0	71	69.0	15	----	69.0	0.0	8	-8.0
C.N-14	82	1	0.0	64.4	71	64.4	15	----	64.4	0.0	8	-8.0
R.N-25	84	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
Town Library	85	1	0.0	63.1	66	63.1	15	----	63.1	0.0	8	-8.0
R.N-26	87	1	0.0	63.4	66	63.4	15	----	63.4	0.0	8	-8.0
R.N-27	88	1	0.0	66.0	66	66.0	15	Snd Lvl	66.0	0.0	8	-8.0
R.S-4	92	1	0.0	55.3	66	55.3	15	----	55.3	0.0	8	-8.0
R.S-5	93	1	0.0	55.5	66	55.5	15	----	55.5	0.0	8	-8.0

R.S-6	94	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
R.S-7	95	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
R.S-8	96	1	0.0	64.5	66	64.5	15	----	64.5	0.0	8	-8.0
R.S-9	97	1	0.0	52.9	66	52.9	15	----	52.9	0.0	8	-8.0
R.S-10	98	1	0.0	55.6	66	55.6	15	----	55.6	0.0	8	-8.0
R.S-11a	99	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
R.S-12	100	1	0.0	53.4	66	53.4	15	----	53.4	0.0	8	-8.0
R.S-13	101	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.S-14	102	1	0.0	59.1	66	59.1	15	----	59.1	0.0	8	-8.0
R.S-15	103	1	0.0	65.3	66	65.3	15	----	65.3	0.0	8	-8.0
R.S-16	104	1	0.0	52.6	66	52.6	15	----	52.6	0.0	8	-8.0
R.S-17	105	1	0.0	56.4	66	56.4	15	----	56.4	0.0	8	-8.0
R.S-18	106	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
Town Hall	107	1	0.0	62.7	66	62.7	15	----	62.7	0.0	8	-8.0
R.N-41	109	1	0.0	57.8	66	57.8	15	----	57.8	0.0	8	-8.0
R.N-28	111	1	0.0	55.9	66	55.9	15	----	55.9	0.0	8	-8.0
R.N-29	112	1	0.0	51.0	66	51.0	15	----	51.0	0.0	8	-8.0
R.N-30	113	1	0.0	49.1	66	49.1	15	----	49.1	0.0	8	-8.0
R.N-31	114	1	0.0	47.8	66	47.8	15	----	47.8	0.0	8	-8.0
C.N-16	115	1	0.0	64.9	71	64.9	15	----	64.9	0.0	8	-8.0
R.S-19	116	1	0.0	62.7	66	62.7	15	----	62.7	0.0	8	-8.0
R.S-20	118	1	0.0	67.2	66	67.2	15	Snd Lvl	67.2	0.0	8	-8.0
R.S-21	119	1	0.0	57.8	66	57.8	15	----	57.8	0.0	8	-8.0
R.S-22	121	1	0.0	61.9	66	61.9	15	----	61.9	0.0	8	-8.0
R.S-23	122	1	0.0	61.3	66	61.3	15	----	61.3	0.0	8	-8.0
R.S-24	123	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
R.S-25	124	1	0.0	55.8	66	55.8	15	----	55.8	0.0	8	-8.0
R.S-26	125	1	0.0	56.2	66	56.2	15	----	56.2	0.0	8	-8.0
R.S-27	126	1	0.0	55.5	66	55.5	15	----	55.5	0.0	8	-8.0
R.S-28	127	1	0.0	57.2	66	57.2	15	----	57.2	0.0	8	-8.0
R.S-29	128	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
R.S-30	129	1	0.0	53.8	66	53.8	15	----	53.8	0.0	8	-8.0
R.S-31	130	1	0.0	55.2	66	55.2	15	----	55.2	0.0	8	-8.0
R.S-32	131	1	0.0	55.7	66	55.7	15	----	55.7	0.0	8	-8.0
R.S-33	132	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
R.S-34	133	1	0.0	55.6	66	55.6	15	----	55.6	0.0	8	-8.0
R.S-35	134	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
R.S-36	135	1	0.0	54.5	66	54.5	15	----	54.5	0.0	8	-8.0
R.S-37	136	1	0.0	55.8	66	55.8	15	----	55.8	0.0	8	-8.0
R.S-38	137	1	0.0	54.3	66	54.3	15	----	54.3	0.0	8	-8.0

R.S-39	138	1	0.0	55.0	66	55.0	15	----	55.0	0.0	8	-8.0
R.S-40	139	1	0.0	54.1	66	54.1	15	----	54.1	0.0	8	-8.0
R.S-41	140	1	0.0	50.9	66	50.9	15	----	50.9	0.0	8	-8.0
R.N-33	142	1	0.0	63.0	66	63.0	15	----	63.0	0.0	8	-8.0
R.N-34	143	1	0.0	68.9	66	68.9	15	Snd Lvl	68.9	0.0	8	-8.0
R.N-35	144	1	0.0	57.9	66	57.9	15	----	57.9	0.0	8	-8.0
R.N-36	145	1	0.0	68.4	66	68.4	15	Snd Lvl	68.4	0.0	8	-8.0
R.N-37	146	1	0.0	69.0	66	69.0	15	Snd Lvl	69.0	0.0	8	-8.0
R.N-38	147	1	0.0	61.0	66	61.0	15	----	61.0	0.0	8	-8.0
R.N-39	148	1	0.0	60.6	66	60.6	15	----	60.6	0.0	8	-8.0
R.N-40	149	1	0.0	63.4	66	63.4	15	----	63.4	0.0	8	-8.0
C.N-17 Bedford Village Inn	151	1	0.0	67.0	71	67.0	15	----	67.0	0.0	8	-8.0
C.S-16	153	1	0.0	60.1	71	60.1	15	----	60.1	0.0	8	-8.0
C.S-17	154	1	0.0	68.1	71	68.1	15	----	68.1	0.0	8	-8.0
C.S-18	155	1	0.0	64.9	71	64.9	15	----	64.9	0.0	8	-8.0
C.S-19	156	1	0.0	55.1	71	55.1	15	----	55.1	0.0	8	-8.0
C.S-20	157	1	0.0	71.1	71	71.1	15	Snd Lvl	71.1	0.0	8	-8.0
C.S-21	158	1	0.0	67.4	71	67.4	15	----	67.4	0.0	8	-8.0
C.S-22	159	1	0.0	62.3	71	62.3	15	----	62.3	0.0	8	-8.0
C.S-23	160	1	0.0	59.2	71	59.2	15	----	59.2	0.0	8	-8.0
C.S-24	161	1	0.0	63.7	71	63.7	15	----	63.7	0.0	8	-8.0
C.S-25	162	1	0.0	57.2	71	57.2	15	----	57.2	0.0	8	-8.0
C.S-26	163	1	0.0	58.1	71	58.1	15	----	58.1	0.0	8	-8.0
C.N-17 Copper Door	164	1	0.0	64.4	71	64.4	15	----	64.4	0.0	8	-8.0
C.N-18 Liberty Mutual	165	1	0.0	62.3	71	62.3	15	----	62.3	0.0	8	-8.0
R.S-11b	167	1	0.0	65.2	66	65.2	10	----	65.2	0.0	8	-8.0
M-1 Gazebo / Park	170	1	0.0	64.0	66	64.0	10	----	64.0	0.0	8	-8.0
M-2 Bedford Center Rd - North	172	1	0.0	64.3	66	64.3	10	----	64.3	0.0	8	-8.0
M-3 Liberty Hill Rd - South	174	1	0.0	69.6	66	69.6	10	Snd Lvl	69.6	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	136	0.0	0.0	0.0
All Impacted	9	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0


2037 PM Build
Plan View
Run name: 2037 PM Build 3D - Barrier
Scale:
1000 feet
Sheet 1 of 1
9 May 2014
VHB
Project/Contract No. 101 Bedford
TNM Version 2.5, Feb 2004
Analysis By: NBS
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
0
1022000
1023000
1024000
1025000
1026000
1027000
1028000

VHB
NBS

9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-7	1	1	0.0	62.1	66	62.1	15	----	53.2	8.9	8	0.9
R.N-9	2	1	0.0	66.4	66	66.4	15	Snd Lvl	55.4	11.0	8	3.0
R.N-8	3	1	0.0	54.9	66	54.9	15	----	51.9	3.0	8	-5.0
R.N-10	4	1	0.0	68.7	66	68.7	15	Snd Lvl	66.0	2.7	8	-5.3
R.N-11	5	1	0.0	64.6	66	64.6	15	----	63.9	0.7	8	-7.3
R.N-13	6	1	0.0	60.4	66	60.4	15	----	59.5	0.9	8	-7.1
R.N-12	7	1	0.0	58.5	66	58.5	15	----	56.8	1.7	8	-6.3
R.N-4	8	1	0.0	61.1	66	61.1	15	----	55.6	5.5	8	-2.5
R.N-5	9	1	0.0	57.6	66	57.6	15	----	53.2	4.4	8	-3.6
R.N-6	10	1	0.0	53.8	66	53.8	15	----	50.8	3.0	8	-5.0
R.N-2	11	1	0.0	57.5	66	57.5	15	----	55.5	2.0	8	-6.0
R.N-1	12	1	0.0	57.9	66	57.9	15	----	56.4	1.5	8	-6.5
R.N-3	13	1	0.0	53.8	66	53.8	15	----	50.7	3.1	8	-4.9
R.S-1	14	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
R.S-3	15	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
C.S-1 Walgreens	17	1	0.0	66.2	71	66.2	15	----	66.2	0.0	8	-8.0
C.N-1 Harvest Market	19	1	0.0	66.8	71	66.8	15	----	66.7	0.1	8	-7.9
C.S-2 Shortys	21	1	0.0	66.1	71	66.1	15	----	66.1	0.0	8	-8.0
C.S-3 Modern Bride	23	1	0.0	64.5	71	64.5	15	----	64.5	0.0	8	-8.0
C.S-4 Fireplace Village	24	1	0.0	65.4	71	65.4	15	----	65.4	0.0	8	-8.0
C.S-5 Ethan Allen	26	1	0.0	69.4	71	69.4	15	----	69.4	0.0	8	-8.0
C.N-2 Culligan	28	1	0.0	70.4	71	70.4	15	----	70.4	0.0	8	-8.0
C.S-6 Family Health	31	1	0.0	69.6	71	69.6	15	----	69.6	0.0	8	-8.0

C.N-3	33	1	0.0	68.4	71	68.4	15	----	68.4	0.0	8	-8.0
C.N-4	34	1	0.0	67.0	71	67.0	15	----	67.0	0.0	8	-8.0
C.N-6	35	1	0.0	66.4	71	66.4	15	----	66.4	0.0	8	-8.0
R.N-14	36	1	0.0	64.1	66	64.1	15	----	64.1	0.0	8	-8.0
C.N-5	37	1	0.0	63.6	71	63.6	15	----	63.5	0.1	8	-7.9
R.N-15	38	1	0.0	63.2	66	63.2	15	----	63.2	0.0	8	-8.0
R.N-16	39	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
R.S-2	41	1	0.0	59.2	66	59.2	15	----	59.1	0.1	8	-7.9
C.S-7 TD Bank	43	1	0.0	70.3	71	70.3	15	----	70.3	0.0	8	-8.0
C.S-8 Pizza Bella	44	1	0.0	67.6	71	67.6	15	----	67.6	0.0	8	-8.0
C.S-11	45	1	0.0	67.1	71	67.1	15	----	67.1	0.0	8	-8.0
C.S-12	46	1	0.0	60.8	71	60.8	15	----	60.8	0.0	8	-8.0
C.S-13	47	1	0.0	56.1	71	56.1	15	----	56.1	0.0	8	-8.0
C.S-14	48	1	0.0	70.2	71	70.2	15	----	70.2	0.0	8	-8.0
C.S-10	50	1	0.0	67.3	71	67.3	15	----	67.3	0.0	8	-8.0
C.N-7 Bedford Massage	52	1	0.0	70.8	71	70.8	15	----	70.8	0.0	8	-8.0
C.N-8	54	1	0.0	66.6	71	66.6	15	----	66.6	0.0	8	-8.0
Basesball Fields (M-4)	56	4	0.0	53.9	66	53.9	15	----	53.9	0.0	8	-8.0
C.S-15	58	1	0.0	69.7	71	69.7	15	----	69.7	0.0	8	-8.0
BYPC - Music School	60	2	0.0	64.8	66	64.8	15	----	64.8	0.0	8	-8.0
R.N-17 Vacant	62	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
C.N-10	63	1	0.0	63.8	71	63.8	15	----	63.8	0.0	8	-8.0
R.N-18	64	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
C.N-12	65	1	0.0	56.1	71	56.1	15	----	56.0	0.1	8	-7.9
R.N-19	67	1	0.0	53.5	66	53.5	15	----	53.4	0.1	8	-7.9
C.N-13	68	1	0.0	54.8	71	54.8	15	----	54.7	0.1	8	-7.9
C.N-11 Town Offices	70	1	0.0	54.0	71	54.0	15	----	53.8	0.2	8	-7.8
R.N-20	72	1	0.0	54.4	66	54.4	15	----	54.2	0.2	8	-7.8
R.N-23	73	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
R.N-24	74	1	0.0	58.2	66	58.2	15	----	58.0	0.2	8	-7.8
R.N-21	75	1	0.0	57.3	66	57.3	15	----	57.2	0.1	8	-7.9
R.N-22	77	1	0.0	54.6	66	54.6	15	----	54.3	0.3	8	-7.7
C.N-15 Mobil	78	1	0.0	68.9	71	68.9	15	----	68.8	0.1	8	-7.9
C.N-14	82	1	0.0	64.4	71	64.4	15	----	64.4	0.0	8	-8.0
R.N-25	84	1	0.0	61.6	66	61.6	15	----	61.4	0.2	8	-7.8
Town Library	85	1	0.0	63.1	66	63.1	15	----	62.8	0.3	8	-7.7
R.N-26	87	1	0.0	63.4	66	63.4	15	----	62.2	1.2	8	-6.8
R.N-27	88	1	0.0	66.1	66	66.1	15	Snd Lvl	64.1	2.0	8	-6.0
R.S-4	92	1	0.0	55.3	66	55.3	15	----	55.3	0.0	8	-8.0
R.S-5	93	1	0.0	55.5	66	55.5	15	----	55.5	0.0	8	-8.0

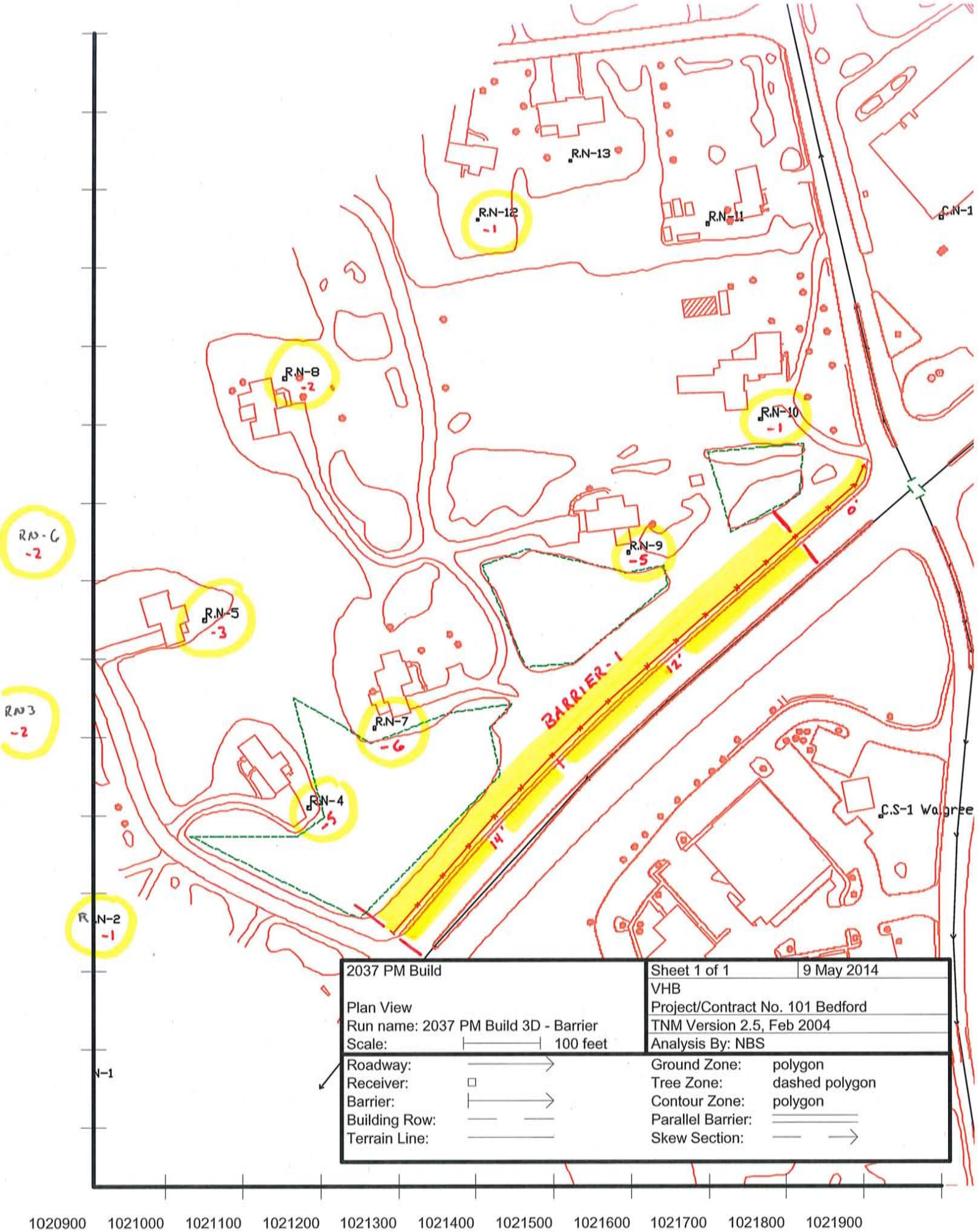
R.S-6	94	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
R.S-7	95	1	0.0	64.7	66	64.7	15	----	64.7	0.0	8	-8.0
R.S-8	96	1	0.0	64.5	66	64.5	15	----	64.4	0.1	8	-7.9
R.S-9	97	1	0.0	52.9	66	52.9	15	----	52.9	0.0	8	-8.0
R.S-10	98	1	0.0	55.6	66	55.6	15	----	55.5	0.1	8	-7.9
R.S-11a	99	1	0.0	57.7	66	57.7	15	----	57.7	0.0	8	-8.0
R.S-12	100	1	0.0	53.4	66	53.4	15	----	53.4	0.0	8	-8.0
R.S-13	101	1	0.0	54.0	66	54.0	15	----	54.0	0.0	8	-8.0
R.S-14	102	1	0.0	59.1	66	59.1	15	----	59.0	0.1	8	-7.9
R.S-15	103	1	0.0	65.3	66	65.3	15	----	65.3	0.0	8	-8.0
R.S-16	104	1	0.0	52.6	66	52.6	15	----	52.5	0.1	8	-7.9
R.S-17	105	1	0.0	56.4	66	56.4	15	----	56.3	0.1	8	-7.9
R.S-18	106	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
Town Hall	107	1	0.0	62.7	66	62.7	15	----	62.3	0.4	8	-7.6
R.N-41	109	1	0.0	57.8	66	57.8	15	----	57.6	0.2	8	-7.8
R.N-28	111	1	0.0	55.9	66	55.9	15	----	54.7	1.2	8	-6.8
R.N-29	112	1	0.0	51.0	66	51.0	15	----	50.5	0.5	8	-7.5
R.N-30	113	1	0.0	49.0	66	49.0	15	----	48.7	0.3	8	-7.7
R.N-31	114	1	0.0	47.7	66	47.7	15	----	47.2	0.5	8	-7.5
C.N-16	115	1	0.0	64.9	71	64.9	15	----	64.9	0.0	8	-8.0
R.S-19	116	1	0.0	62.7	66	62.7	15	----	62.7	0.0	8	-8.0
R.S-20	118	1	0.0	67.3	66	67.3	15	Snd Lvl	58.7	8.6	8	0.6
R.S-21	119	1	0.0	57.9	66	57.9	15	----	56.4	1.5	8	-6.5
R.S-22	121	1	0.0	61.9	66	61.9	15	----	59.7	2.2	8	-5.8
R.S-23	122	1	0.0	61.3	66	61.3	15	----	59.3	2.0	8	-6.0
R.S-24	123	1	0.0	65.2	66	65.2	15	----	64.7	0.5	8	-7.5
R.S-25	124	1	0.0	55.8	66	55.8	15	----	54.2	1.6	8	-6.4
R.S-26	125	1	0.0	56.2	66	56.2	15	----	54.5	1.7	8	-6.3
R.S-27	126	1	0.0	55.5	66	55.5	15	----	55.4	0.1	8	-7.9
R.S-28	127	1	0.0	57.2	66	57.2	15	----	57.2	0.0	8	-8.0
R.S-29	128	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
R.S-30	129	1	0.0	53.8	66	53.8	15	----	53.0	0.8	8	-7.2
R.S-31	130	1	0.0	55.2	66	55.2	15	----	55.2	0.0	8	-8.0
R.S-32	131	1	0.0	55.7	66	55.7	15	----	55.7	0.0	8	-8.0
R.S-33	132	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
R.S-34	133	1	0.0	55.6	66	55.6	15	----	55.6	0.0	8	-8.0
R.S-35	134	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
R.S-36	135	1	0.0	54.5	66	54.5	15	----	54.4	0.1	8	-7.9
R.S-37	136	1	0.0	55.8	66	55.8	15	----	55.7	0.1	8	-7.9
R.S-38	137	1	0.0	54.2	66	54.2	15	----	54.2	0.0	8	-8.0

R.S-39	138	1	0.0	55.0	66	55.0	15	----	55.0	0.0	8	-8.0
R.S-40	139	1	0.0	54.1	66	54.1	15	----	54.1	0.0	8	-8.0
R.S-41	140	1	0.0	51.0	66	51.0	15	----	49.9	1.1	8	-6.9
R.N-33	142	1	0.0	63.1	66	63.1	15	----	61.3	1.8	8	-6.2
R.N-34	143	1	0.0	69.2	66	69.2	15	Snd Lvl	53.9	15.3	8	7.3
R.N-35	144	1	0.0	58.0	66	58.0	15	----	54.4	3.6	8	-4.4
R.N-36	145	1	0.0	68.5	66	68.5	15	Snd Lvl	52.2	16.3	8	8.3
R.N-37	146	1	0.0	69.0	66	69.0	15	Snd Lvl	52.9	16.1	8	8.1
R.N-38	147	1	0.0	61.0	66	61.0	15	----	56.8	4.2	8	-3.8
R.N-39	148	1	0.0	60.7	66	60.7	15	----	57.7	3.0	8	-5.0
R.N-40	149	1	0.0	63.4	66	63.4	15	----	62.3	1.1	8	-6.9
C.N-17 Bedford Village Inn	151	1	0.0	67.0	71	67.0	15	----	67.0	0.0	8	-8.0
C.S-16	153	1	0.0	60.1	71	60.1	15	----	60.1	0.0	8	-8.0
C.S-17	154	1	0.0	68.1	71	68.1	15	----	68.1	0.0	8	-8.0
C.S-18	155	1	0.0	64.9	71	64.9	15	----	64.9	0.0	8	-8.0
C.S-19	156	1	0.0	55.1	71	55.1	15	----	55.1	0.0	8	-8.0
C.S-20	157	1	0.0	71.1	71	71.1	15	Snd Lvl	71.1	0.0	8	-8.0
C.S-21	158	1	0.0	67.4	71	67.4	15	----	67.4	0.0	8	-8.0
C.S-22	159	1	0.0	62.3	71	62.3	15	----	62.3	0.0	8	-8.0
C.S-23	160	1	0.0	59.2	71	59.2	15	----	59.2	0.0	8	-8.0
C.S-24	161	1	0.0	63.7	71	63.7	15	----	63.7	0.0	8	-8.0
C.S-25	162	1	0.0	57.2	71	57.2	15	----	57.2	0.0	8	-8.0
C.S-26	163	1	0.0	58.1	71	58.1	15	----	58.1	0.0	8	-8.0
C.N-17 Copper Door	164	1	0.0	64.4	71	64.4	15	----	64.4	0.0	8	-8.0
C.N-18 Liberty Mutual	165	1	0.0	62.3	71	62.3	15	----	62.3	0.0	8	-8.0
R.S-11b	167	1	0.0	65.2	66	65.2	10	----	65.2	0.0	8	-8.0
M-1 Gazebo / Park	170	1	0.0	64.0	66	64.0	10	----	63.9	0.1	8	-7.9
M-2 Bedford Center Rd - North	172	1	0.0	64.4	66	64.4	10	----	51.7	12.7	8	4.7
M-3 Liberty Hill Rd - South	174	1	0.0	69.7	66	69.7	10	Snd Lvl	65.9	3.8	8	-4.2

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	136	0.0	1.2	16.3
All Impacted	9	0.0	8.4	16.3
All that meet NR Goal	7	8.6	12.7	16.3

NH Route 101 - Bedford, NH
Barrier - Cost Effectiveness

Location	Barrier Length (ft)	Average Barrier Height (ft)	Barrier Area (SF)	Barrier Cost / SF	Barrier Cost	Benefited Receptors	Cost / Benefited Receptor	Cost Effective Index (CEI)	Barrier Recommended
Barrier-1 (w/o Wallace Rd)	725	13	9,425	$ 30.00	$ 282,750.00	3	$ 94,250.00	$ 45,000.00	No
Barrier-2 (w/o Meetinghouse Rd)	600	24	14,400	$ 30.00	$ 432,000.00	0	#DIV/0!	$ 45,000.00	No
Barrier-3 (w/o Liberty Hill Rd)	250	10	2,500	$ 30.00	$ 75,000.00	1	$ 75,000.00	$ 45,000.00	No
Barrier-4 (w/o Bedford Center Rd)	650	11	7,150	$ 30.00	$ 214,500.00	3	$ 71,500.00	$ 45,000.00	No



2037 PM Build		Sheet 1 of 1	9 May 2014
		VHB	
Plan View		Project/Contract No. 101 Bedford	
Run name: 2037 PM Build 3D - Barrier		TNM Version 2.5, Feb 2004	
Scale:	100 feet	Analysis By: NBS	

Roadway:		Ground Zone:	polygon
Receiver:		Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

VHB
NBS

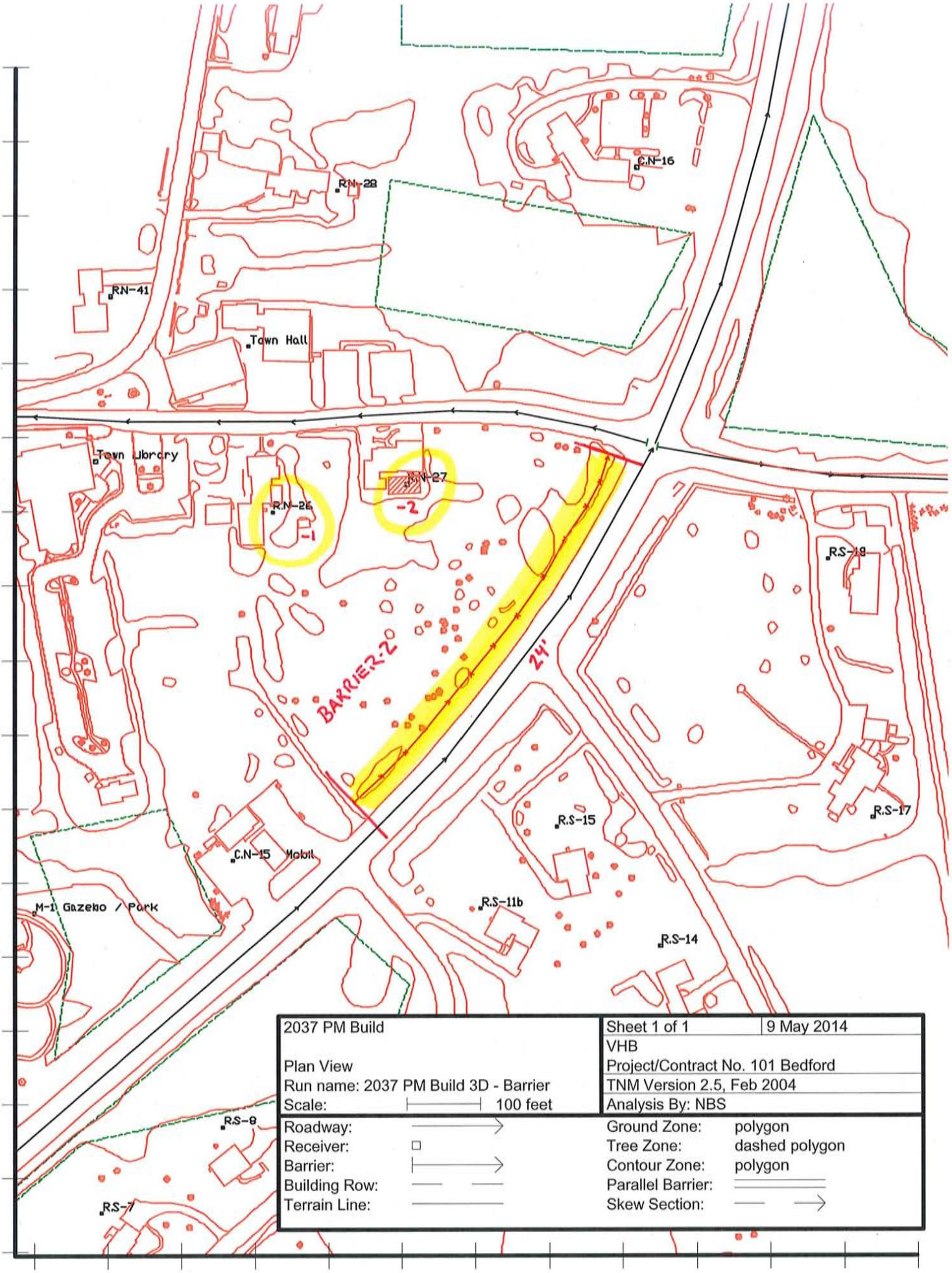
9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: Barrier-1 MIN
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-2	11	1	0.0	57.5	66	57.5	15	----	56.1	1.4	8	-6.6
R.N-3	13	1	0.0	53.8	66	53.8	15	----	52.1	1.7	8	-6.3
R.N-6	10	1	0.0	53.8	66	53.8	15	----	52.3	1.5	8	-6.5
R.N-5	9	1	0.0	57.6	66	57.6	15	----	55.1	2.5	8	-5.5
R.N-8	3	1	0.0	54.9	66	54.9	15	----	53.3	1.6	8	-6.4
R.N-12	7	1	0.0	58.5	66	58.5	15	----	57.7	0.8	8	-7.2
R.N-13	6	1	0.0	60.4	66	60.4	15	----	60.0	0.4	8	-7.6
R.N-11	5	1	0.0	64.6	66	64.6	15	----	64.3	0.3	8	-7.7
R.N-10	4	1	0.0	68.7	66	68.7	15	Snd Lvl	68.2	0.5	8	-7.5
R.N-9	2	1	0.0	66.4	66	66.4	15	Snd Lvl	61.9	4.5	8	-3.5
R.N-7	1	1	0.0	62.1	66	62.1	15	----	56.1	6.0	8	-2.0
R.N-4	8	1	0.0	61.1	66	61.1	15	----	56.6	4.5	8	-3.5

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	12	0.3	2.1	6.0
All Impacted	2	0.5	2.5	4.5
All that meet NR Goal	0	0.0	0.0	0.0


C.N-16
R.N-28
R.N-41
Town Hall
Town Library
R.N-27
R.N-26
-1
-2
R.S-18
BARRIER 2
24'
R.S-15
R.S-17
C.N-15 Mobil
M-1 Gazebo / Park
R.S-11b
R.S-14
R.S-9
R.S-7
2037 PM Build
Plan View
Run name: 2037 PM Build 3D - Barrier
Scale: 100 feet
Sheet 1 of 1
9 May 2014
VHB
Project/Contract No. 101 Bedford
TNM Version 2.5, Feb 2004
Analysis By: NBS
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
00 1024600 1024700 1024800 1024900 1025000 1025100 1025200 1025300 1025400 1025500 1025600 1025700

VHB
NBS

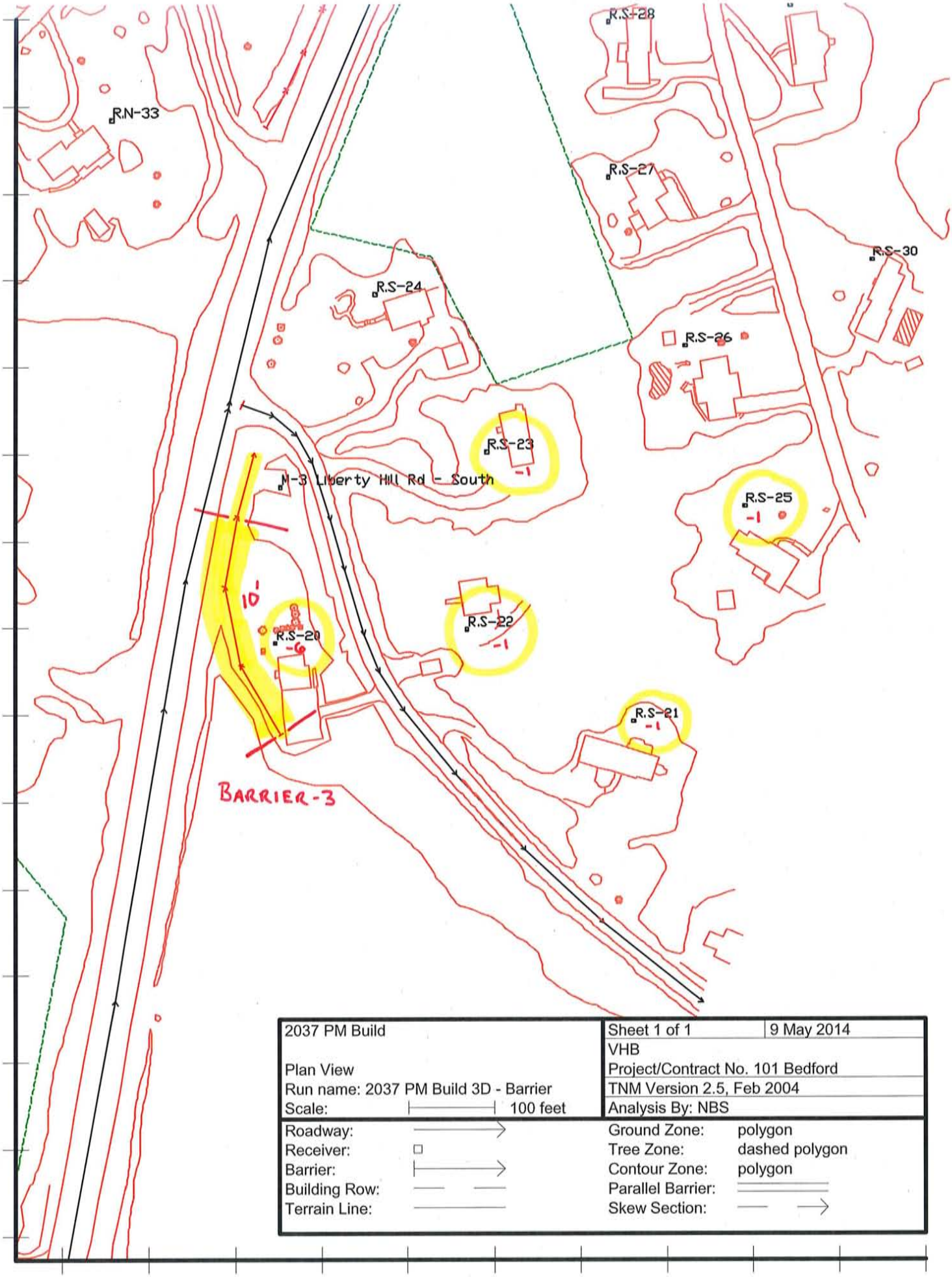
9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: Barrier-2 MAX
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-41	109	1	0.0	57.8	66	57.8	15	----	57.6	0.2	8	-7.8
Town Hall	107	1	0.0	62.7	66	62.7	15	----	62.3	0.4	8	-7.6
R.N-27	88	1	0.0	66.1	66	66.1	15	Snd Lvl	64.1	2.0	8	-6.0
R.N-26	87	1	0.0	63.4	66	63.4	15	----	62.2	1.2	8	-6.8
Town Library	85	1	0.0	63.1	66	63.1	15	----	62.8	0.3	8	-7.7
R.N-25	84	1	0.0	61.6	66	61.6	15	----	61.4	0.2	8	-7.8

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	6	0.2	0.7	2.0
All Impacted	1	2.0	2.0	2.0
All that meet NR Goal	0	0.0	0.0	0.0


R.S-28
R.N-33
R.S-27
R.S-30
R.S-24
R.S-26
R.S-23
-1
M-3 Liberty Hill Rd - South
R.S-25
-1
10'
R.S-22
-1
R.S-20
-6
R.S-21
-1
BARRIER-3
2037 PM Build
Plan View
Run name: 2037 PM Build 3D - Barrier
Scale: 100 feet
Sheet 1 of 1
9 May 2014
VHB
Project/Contract No. 101 Bedford
TNM Version 2.5, Feb 2004
Analysis By: NBS
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
25500
1025600
1025700
1025800
1025900
1026000
1026100
1026200
1026300
1026400
1026500

VHB
NBS

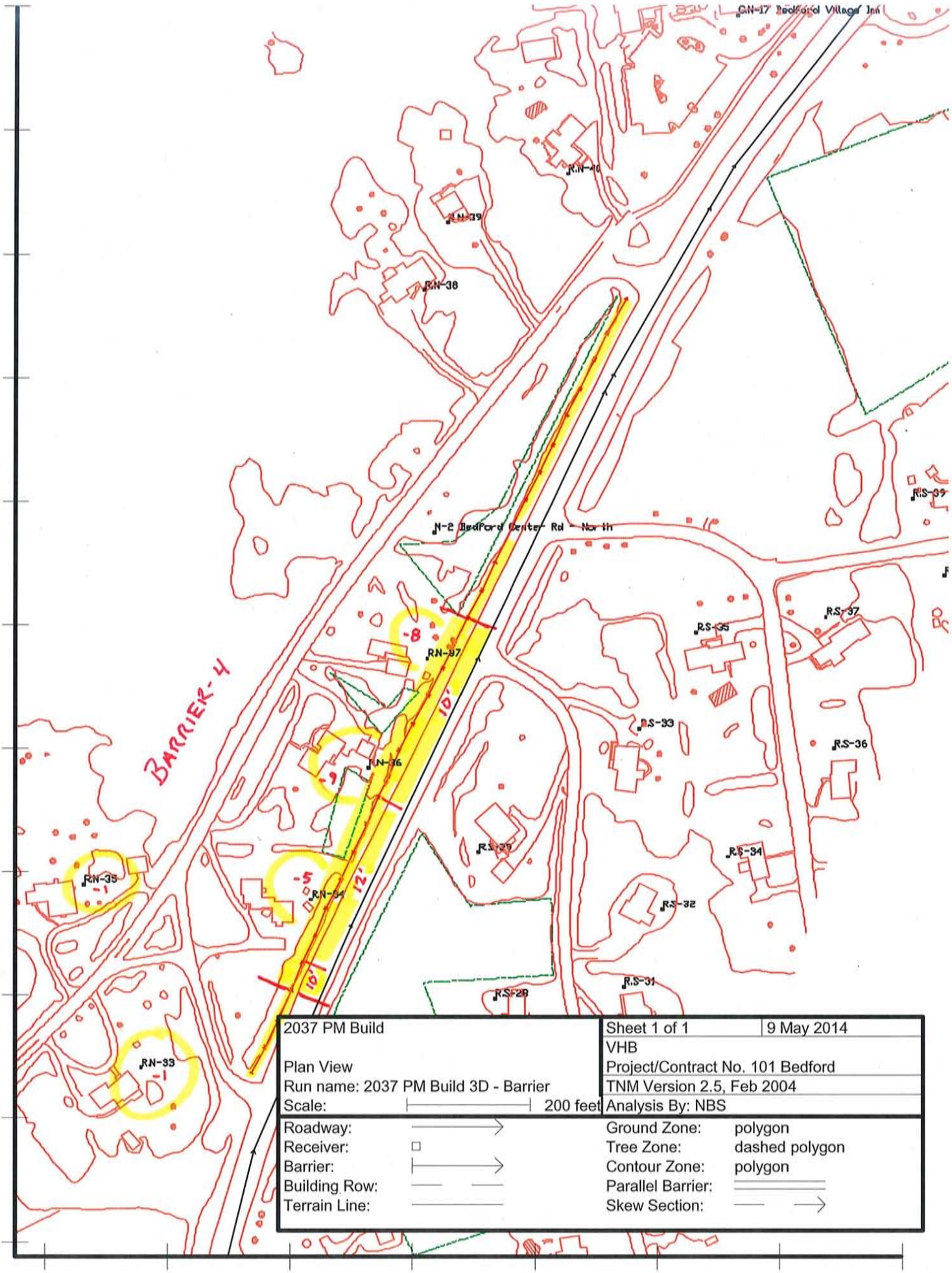
9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: Barrier-3 MIN
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier					With Barrier			
				LAeq1h		Increase over existing		Type Impact	Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.S-25	124	1	0.0	55.8	66	55.8	15	----	55.2	0.6	8	-7.4
R.S-23	122	1	0.0	61.3	66	61.3	15	----	60.7	0.6	8	-7.4
R.S-21	119	1	0.0	57.9	66	57.9	15	----	57.1	0.8	8	-7.2
R.S-22	121	1	0.0	61.9	66	61.9	15	----	60.6	1.3	8	-6.7
R.S-20	118	1	0.0	67.3	66	67.3	15	Snd Lvl	61.2	6.1	8	-1.9

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	5	0.6	1.9	6.1
All Impacted	1	6.1	6.1	6.1
All that meet NR Goal	0	0.0	0.0	0.0



2037 PM Build	Sheet 1 of 1 | 9 May 2014
	VHB
Plan View	Project/Contract No. 101 Bedford
Run name: 2037 PM Build 3D - Barrier	TNM Version 2.5, Feb 2004
Scale: 200 feet	Analysis By: NBS

Roadway:		Ground Zone:	polygon
Receiver:	□	Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

400 1025600 1025800 1026000 1026200 1026400 1026600 1026800

VHB
NBS

9 May 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 101 Bedford
RUN: 2037 PM Build
BARRIER DESIGN: Barrier-4 MIN

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver												
Name	No.	#DUs	Existing LAeq1h	No Barrier					With Barrier			
				LAeq1h		Increase over existing		Type Impact	Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R.N-37	146	1	0.0	69.0	66	69.0	15	Snd Lvl	60.8	8.2	8	0.2
R.N-36	145	1	0.0	68.5	66	68.5	15	Snd Lvl	59.8	8.7	8	0.7
R.N-34	143	1	0.0	69.2	66	69.2	15	Snd Lvl	64.7	4.5	8	-3.5
R.N-33	142	1	0.0	63.1	66	63.1	15	----	62.6	0.5	8	-7.5
R.N-40	149	1	0.0	63.4	66	63.4	15	----	63.4	0.0	8	-8.0
R.N-39	148	1	0.0	60.7	66	60.7	15	----	60.5	0.2	8	-7.8
R.N-38	147	1	0.0	61.0	66	61.0	15	----	60.7	0.3	8	-7.7
R.N-35	144	1	0.0	58.0	66	58.0	15	----	56.7	1.3	8	-6.7
R.S-41	140	1	0.0	51.0	66	51.0	15	----	50.7	0.3	8	-7.7

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	9	0.0	2.7	8.7
All Impacted	3	4.5	7.1	8.7
All that meet NR Goal	2	8.2	8.5	8.7

NOISE APPENDIX: TNM Results Summary

NH Route 101 - Bedford, NH
TNM Results Comparison

		Sound Levels (dBA)				
Receptor Location	Land Use Category	NHDOT Noise Criteria	2017 No Build	2037 Build	NHDOT Increase Criteria	Delta
R.N-7	Residential	66	61	62	+10	1
R.N-9	Residential	66	65	**66**	+10	1
R.N-8	Residential	66	54	55	+10	1
R.N-10	Residential	66	**68**	**69**	+10	1
R.N-11	Residential	66	64	65	+10	1
R.N-13	Residential	66	60	60	+10	0
R.N-12	Residential	66	58	59	+10	1
R.N-4	Residential	66	60	61	+10	1
R.N-5	Residential	66	57	58	+10	1
R.N-6	Residential	66	53	54	+10	1
R.N-2	Residential	66	57	58	+10	1
R.N-1	Residential	66	57	58	+10	1
R.N-3	Residential	66	53	54	+10	1
R.S-1	Residential	66	60	61	+10	1
R.S-3	Residential	66	63	64	+10	1
C.S-1	Commercial	71	65	66	+10	1
C.N-1	Commercial	71	66	67	+10	1
C.S-2	Commercial	71	65	66	+10	1
C.S-3	Commercial	71	64	65	+10	1
C.S-4	Commercial	71	65	65	+10	0
C.S-5	Commercial	71	69	69	+10	0
C.N-2	Commercial	71	70	70	+10	0
C.S-6	Commercial	71	69	70	+10	1
C.N-3	Commercial	71	68	68	+10	0
C.N-4	Commercial	71	66	67	+10	1
C.N-6	Commercial	71	66	66	+10	0
R.N-14	Residential	66	63	64	+10	1
C.N-5	Commercial	71	63	64	+10	1
R.N-15	Residential	66	62	63	+10	1
R.N-16	Residential	66	60	62	+10	2
R.S-2	Residential	66	58	59	+10	1
C.S-7	Commercial	71	70	70	+10	0
C.S-8	Commercial	71	67	68	+10	1
C.S-11	Commercial	71	66	67	+10	1
C.S-12	Commercial	71	60	61	+10	1
C.S-13	Commercial	71	56	56	+10	1
C.S-14	Commercial	71	69	70	+10	1
C.S-10	Commercial	71	67	67	+10	0
C.N-7	Commercial	71	70	71	+10	1
C.N-8	Commercial	71	66	67	+10	1
Baseball Fields (M-4)	Residential	66	53	54	+10	1
C.S-15	Commercial	71	69	70	+10	1
BYPC	Residential	66	65	65	+10	0
R.N-17	Residential	66	63	65	+10	2
C.N-10	Commercial	71	62	64	+10	2
R.N-18	Residential	66	56	58	+10	2
C.N-12	Commercial	71	54	56	+10	2
R.N-19	Residential	66	52	54	+10	2
C.N-13	Commercial	71	53	55	+10	2
C.N-11	Commercial	71	52	54	+10	2
R.N-20	Residential	66	53	54	+10	1
R.N-23	Residential	66	59	62	+10	3
R.N-24	Residential	66	56	58	+10	2
R.N-21	Residential	66	55	57	+10	2
R.N-22	Residential	66	53	55	+10	2
C.N-15	Commercial	71	68	69	+10	1
C.N-14	Commercial	71	62	64	+10	2
R.N-25	Residential	66	61	62	+10	1
Town Library	Commercial	71	62	63	+10	1
R.N-26	Residential	66	62	63	+10	1
R.N-27	Residential	66	65	**66**	+10	1
R.S-4	Residential	66	54	55	+10	1
R.S-5	Residential	66	54	56	+10	1
R.S-6	Residential	66	59	61	+10	2
R.S-7	Residential	66	64	65	+10	1
R.S-8	Residential	66	64	65	+10	1
R.S-9	Residential	66	52	53	+10	1
R.S-10	Residential	66	54	56	+10	2
R.S-11a	Residential	66	56	58	+10	2
R.S-12	Residential	66	52	53	+10	1
R.S-13	Residential	66	52	54	+10	2
R.S-14	Residential	66	56	59	+10	3
R.S-15	Residential	66	64	65	+10	1
R.S-16	Residential	66	51	53	+10	2
R.S-17	Residential	66	54	56	+10	2
R.S-18	Residential	66	63	64	+10	1
Town Hall	Commercial	71	62	63	+10	1
R.N-41	Residential	66	57	58	+10	1
R.N-28	Residential	66	54	56	+10	2
R.N-29	Residential	66	49	51	+10	2
R.N-30	Residential	66	47	49	+10	2
R.N-31	Residential	66	46	48	+10	2
C.N-16	Commercial	71	64	65	+10	1
R.S-19	Residential	66	61	63	+10	2
R.S-20	Residential	66	**66**	**67**	+10	1
R.S-21	Residential	66	57	58	+10	1
R.S-22	Residential	66	61	62	+10	1
R.S-23	Residential	66	60	61	+10	2
R.S-24	Residential	66	64	65	+10	1
R.S-25	Residential	66	54	56	+10	2
R.S-26	Residential	66	54	56	+10	2
R.S-27	Residential	66	54	56	+10	2
R.S-28	Residential	66	56	57	+10	1
R.S-29	Residential	66	64	65	+10	1
R.S-30	Residential	66	52	54	+10	2
R.S-31	Residential	66	53	55	+10	2
R.S-32	Residential	66	53	56	+10	3
R.S-33	Residential	66	58	61	+10	3
R.S-34	Residential	66	53	56	+10	3
R.S-35	Residential	66	58	61	+10	3
R.S-36	Residential	66	52	55	+10	3
R.S-37	Residential	66	53	56	+10	3
R.S-38	Residential	66	52	54	+10	2
R.S-39	Residential	66	53	55	+10	2
R.S-40	Residential	66	53	54	+10	1
R.S-41	Residential	66	49	51	+10	2
R.N-33	Residential	66	62	63	+10	1
R.N-34	Residential	66	**69**	**69**	+10	0
R.N-35	Residential	66	55	58	+10	3
R.N-36	Residential	66	**68**	**68**	+10	0
R.N-37	Residential	66	**68**	**69**	+10	1
R.N-38	Residential	66	58	61	+10	3
R.N-39	Residential	66	58	61	+10	3
R.N-40	Residential	66	62	63	+10	1
C.N-17	Commercial	71	66	67	+10	1
C.S-16	Commercial	71	59	60	+10	1
C.S-17	Commercial	71	67	68	+10	1
C.S-18	Commercial	71	64	65	+10	1
C.S-19	Commercial	71	54	55	+10	1
C.S-20	Commercial	71	70	**71**	+10	1
C.S-21	Commercial	71	67	67	+10	1
C.S-22	Commercial	71	61	62	+10	1
C.S-23	Commercial	71	58	59	+10	1
C.S-24	Commercial	71	63	64	+10	1
C.S-25	Commercial	71	56	57	+10	1
C.S-26	Commercial	71	57	58	+10	1
C.N-17	Commercial	71	64	64	+10	0
C.N-18	Commercial	71	62	62	+10	0
R.S-11b	Residential	66	64	65	+10	1
Gazebo / Park (M1)	Residential	66	62	64	+10	2
M-2 Bedford Center Rd - North	Residential	*66*	64	64	+10	*0*
M-3 Liberty Hill Rd - South	Residential	*66*	69	70	+10	*1*

XX - Residential land Use.
XX - Commercial Land Use.
XX - Monitoring Location only - does not represent a receptor location.

AIR QUALITY APPENDIX: FHWA's CO Categorical Hot-Spot Guidance Tool Worksheets

Air Quality
Transportation Conformity

Carbon Monoxide Categorical Hot-Spot Finding

Results

Urban Intersection

Project Description
Bedford Intersection 4 Route 101 and Wallace Road

Parameter	Entered value	Acceptable range	
Analysis Year	2017	≥ 2015	✓
Angle of cross streets for intersection (degrees)	90	90	✓
Maximum grade for intersection (%)	0	≤ 2	✓
Maximum grade (%) on cross street for intersection	0	0	✓
Number of through lanes			
Approach 1	2	≤ 4	✓
Approach 2	1	≤ 4	✓
Approach 3	2	≤ 4	✓
Approach 4	1	≤ 4	✓
Number of left turn lanes			
Approach 1	1	≤ 2	✓
Approach 2	2	≤ 2	✓
Approach 3	1	≤ 2	✓
Approach 4	2	≤ 2	✓
Lane width (ft)	12	12	✓
Median width (ft)	0	0	✓
Peak hour average approach speed (mph)			
Approach 1	40	≥ 25	✓
Approach 2	40	≥ 25	✓
Approach 3	40	≥ 25	✓
Approach 4	40	≥ 25	

			✔
Maximum approach volume (vph)			
Approach 1	1360	≤ 2640	✔
Approach 2	300	≤ 2640	✔
Approach 3	1035	≤ 2640	✔
Approach 4	320	≤ 2640	✔
Level of Service	D	A through E	✔
Ambient temperature (ºF)	20	≥ -10	✔
Heavy-duty trucks (%)	5	≥ 5	✔
1-hour background CO concentration (ppm)	2	≤ 29.5	✔
8-hour background CO concentration (ppm)	2	≤ 5.1	✔
Persistence Factor	0.7	≤ 0.7	✔

If all checks are green, the project parameters entered on the form are within the acceptable range to rely on FHWA's categorical finding for the intersection being analyzed for the project. All intersections requiring analysis must fall within the acceptable range for all the parameters in order to rely on the CO categorical hot-spot finding. Reliance on the CO categorical hot-spot finding is still subject to existing interagency consultation and the public involvement requirements under NEPA and the conformity rule (40 CFR 93.105) for this project.

If any of the checks are red, as indicted by the red X(s) above, one or more of the project parameters entered on the form fall outside the acceptable range to rely on the FHWA's categorical finding for the intersection being analyzed for this project. A project specific CO hot-spot analysis will be necessary to meet the requirements of 40 CFR 93.116(a) of the transportation conformity rule.

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Air Quality
Transportation Conformity

Carbon Monoxide Categorical Hot-Spot Finding

Results

Urban Intersection

Project Description
Bedford Intersection 3 Route 101 and Nashua Road

Parameter	Entered value	Acceptable range	
Analysis Year	2017	≥ 2015	✓
Angle of cross streets for intersection (degrees)	90	90	✓
Maximum grade for intersection (%)	0	≤ 2	✓
Maximum grade (%) on cross street for intersection	0	0	✓
Number of through lanes			
Approach 1	1	≤ 4	✓
Approach 2	0	≤ 4	✓
Approach 3	1	≤ 4	✓
Approach 4	0	≤ 4	✓
Number of left turn lanes			
Approach 1	1	≤ 2	✓
Approach 2	2	≤ 2	✓
Approach 3	1	≤ 2	✓
Approach 4	0	≤ 2	✓
Lane width (ft)	12	12	✓
Median width (ft)	0	0	✓
Peak hour average approach speed (mph)			
Approach 1	40	≥ 25	✓
Approach 2	40	≥ 25	✓
Approach 3	40	≥ 25	✓
Approach 4	40	≥ 25	

			✔
Maximum approach volume (vph)			
Approach 1	1270	≤ 2640	✔
Approach 2	155	≤ 2640	✔
Approach 3	1140	≤ 2640	✔
Approach 4	0	≤ 2640	✔
Level of Service	B	A through E	✔
Ambient temperature (ºF)	20	≥ -10	✔
Heavy-duty trucks (%)	5	≥ 5	✔
1-hour background CO concentration (ppm)	2	≤ 29.5	✔
8-hour background CO concentration (ppm)	2	≤ 5.1	✔
Persistence Factor	0.7	≤ 0.7	✔

If all checks are green, the project parameters entered on the form are within the acceptable range to rely on FHWA's categorical finding for the intersection being analyzed for the project. All intersections requiring analysis must fall within the acceptable range for all the parameters in order to rely on the CO categorical hot-spot finding. Reliance on the CO categorical hot-spot finding is still subject to existing interagency consultation and the public involvement requirements under NEPA and the conformity rule (40 CFR 93.105) for this project.

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Air Quality
Transportation Conformity

Carbon Monoxide Categorical Hot-Spot Finding

Results

Urban Intersection

Project Description
Bedford Intersection 2 Route 101 and Meetinghouse Road

Parameter	Entered value	Acceptable range	
Analysis Year	2017	≥ 2015	✓
Angle of cross streets for intersection (degrees)	90	90	✓
Maximum grade for intersection (%)	0	≤ 2	✓
Maximum grade (%) on cross street for intersection	0	0	✓
Number of through lanes			
Approach 1	1	≤ 4	✓
Approach 2	1	≤ 4	✓
Approach 3	1	≤ 4	✓
Approach 4	1	≤ 4	✓
Number of left turn lanes			
Approach 1	0	≤ 2	✓
Approach 2	0	≤ 2	✓
Approach 3	0	≤ 2	✓
Approach 4	0	≤ 2	✓
Lane width (ft)	12	12	✓
Median width (ft)	0	0	✓
Peak hour average approach speed (mph)			
Approach 1	40	≥ 25	✓
Approach 2	40	≥ 25	✓
Approach 3	40	≥ 25	✓
Approach 4	40	≥ 25	

			✔
Maximum approach volume (vph)			
Approach 1	1215	≤ 2640	✔
Approach 2	285	≤ 2640	✔
Approach 3	1105	≤ 2640	✔
Approach 4	255	≤ 2640	✔
Level of Service	E	A through E	✔
Ambient temperature (ºF)	20	≥ -10	✔
Heavy-duty trucks (%)	5	≥ 5	✔
1-hour background CO concentration (ppm)	2	≤ 29.5	✔
8-hour background CO concentration (ppm)	2	≤ 5.1	✔
Persistence Factor	0.7	≤ 0.7	✔

If all checks are green, the project parameters entered on the form are within the acceptable range to rely on FHWA's categorical finding for the intersection being analyzed for the project. All intersections requiring analysis must fall within the acceptable range for all the parameters in order to rely on the CO categorical hot-spot finding. Reliance on the CO categorical hot-spot finding is still subject to existing interagency consultation and the public involvement requirements under NEPA and the conformity rule (40 CFR 93.105) for this project.

If any of the checks are red, as indicted by the red X(s) above, one or more of the project parameters entered on the form fall outside the acceptable range to rely on the FHWA's categorical finding for the intersection being analyzed for this project. A project specific CO hot-spot analysis will be necessary to meet the requirements of 40 CFR 93.116(a) of the transportation conformity rule.

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Air Quality
Transportation Conformity

Carbon Monoxide Categorical Hot-Spot Finding

Results

Urban Intersection

Project Description
Bedford Intersection 1 Route 101 and Old Bedford Road

Parameter	Entered value	Acceptable range	
Analysis Year	2017	≥ 2015	✓
Angle of cross streets for intersection (degrees)	90	90	✓
Maximum grade for intersection (%)	0	≤ 2	✓
Maximum grade (%) on cross street for intersection	0	0	✓
Number of through lanes			
Approach 1	2	≤ 4	✓
Approach 2	1	≤ 4	✓
Approach 3	2	≤ 4	✓
Approach 4	1	≤ 4	✓
Number of left turn lanes			
Approach 1	1	≤ 2	✓
Approach 2	2	≤ 2	✓
Approach 3	1	≤ 2	✓
Approach 4	2	≤ 2	✓
Lane width (ft)	12	12	✓
Median width (ft)	0	0	✓
Peak hour average approach speed (mph)			
Approach 1	40	≥ 25	✓
Approach 2	40	≥ 25	✓
Approach 3	40	≥ 25	✓
Approach 4	40	≥ 25	

			✓
Maximum approach volume (vph)			
Approach 1	1460	≤ 2640	✓
Approach 2	420	≤ 2640	✓
Approach 3	1195	≤ 2640	✓
Approach 4	165	≤ 2640	✓
Level of Service	B	A through E	✓
Ambient temperature (ºF)	20	≥ -10	✓
Heavy-duty trucks (%)	5	≥ 5	✓
1-hour background CO concentration (ppm)	2	≤ 29.5	✓
8-hour background CO concentration (ppm)	2	≤ 5.1	✓
Persistence Factor	0.7	≤ 0.7	✓

If all checks are green, the project parameters entered on the form are within the acceptable range to rely on FHWA's categorical finding for the intersection being analyzed for the project. All intersections requiring analysis must fall within the acceptable range for all the parameters in order to rely on the CO categorical hot-spot finding. Reliance on the CO categorical hot-spot finding is still subject to existing interagency consultation and the public involvement requirements under NEPA and the conformity rule (40 CFR 93.105) for this project.

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AIR QUALITY APPENDIX: Intersection Graphics

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VHB Vanasse Hangen Brustlin, Inc.

Figure 1

Air Quality
Route 101/Wallace Road

Town of Bedford, NH

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Vanasse Hangen Brustlin, Inc.

Figure 2

Air Quality
Route 101/Nashua Road

Town of Bedford, NH

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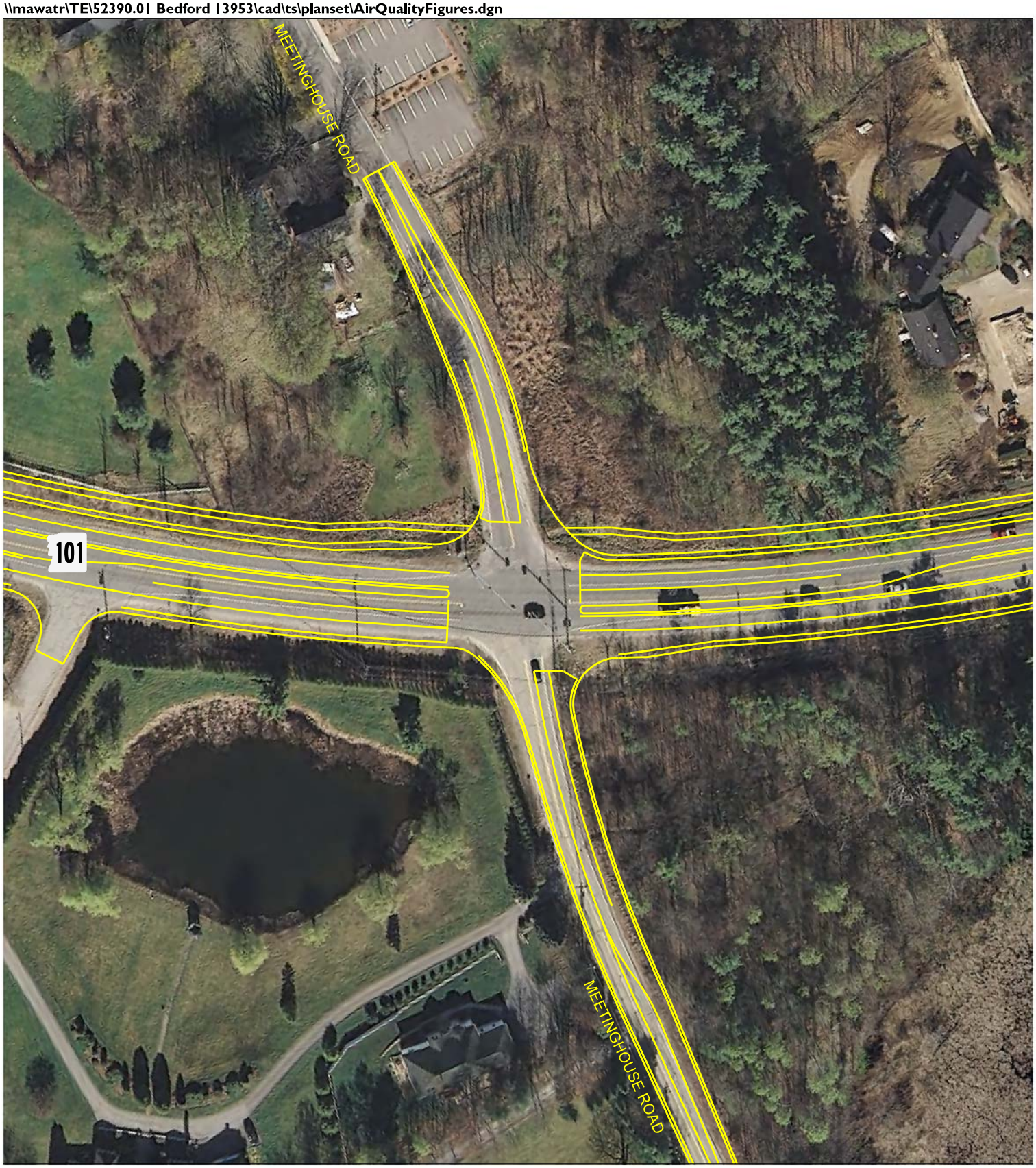

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Vanasse Hangen Brustlin, Inc.

Figure 3

Air Quality
Route 101/Meetinghouse Road

Town of Bedford, NH

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Figure 4

Air Quality
Route 101/Old Bedford Rd/Constitution Dr

Town of Bedford, NH