Draft

Noise Technical Report

Blue Water Bridge Plaza

St. Clair County, MI

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Noise Technical Report

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(Because of the large file sizes of these figures, they are available on CD by request.)

Noise Technical Report

1.0 PURPOSE

In conformance with the National Environmental Policy Act, the Federal Highway Administration's (FHWA) *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, and related Federal and Michigan laws and regulations, this report discusses the noise impact of the Blue Water Bridge Plaza project.

The noise analysis presents the existing and future acoustical environment at various receptors located throughout the study area. The determination of noise abatement measures and locations is in compliance with Title 23, Code of Federal Regulation (CFR), Part 772, and the Michigan Department of Transportation's (MDOT's) Highway Traffic Noise Analysis and Abatement Policy[1].

2.0 TRAFFIC NOISE

Sound is a form of vibration that causes pressure variations in elastic media such as air and water. Noise is defined as unwanted and disruptive sound. The ear is sensitive to this pressure variation and perceives it as sound. The intensity of these pressure variations causes the ear to discern different levels of loudness. These pressure differences are most commonly measured in decibels.

The decibel (dB) is the unit of measurement for sound. The decibel scale audible to humans spans approximately 140 dB. A level of zero decibels corresponds to the lower limit of audibility, while 140 decibels produces a sensation more akin to pain than sound. The decibel scale is a logarithmic representation of the actual sound pressure variations. Therefore, a 26 percent change in the energy level only changes the sound level one dB. The human ear would not detect this change except in an acoustical laboratory. A doubling of the energy level would result in a three-dB increase, which would be barely perceptible in the natural environment. A tripling in energy sound level would result in a clearly noticeable change of five-dB in the sound level. A change of ten times the energy level would result in a ten-dB change in the sound level. This would be perceived as a doubling (or halving) of the apparent loudness.

The human ear has a non-linear sensitivity to noise. To account for this in noise measurements, electronic weighting scales are used to define the relative loudness of different frequencies. The "A" weighting scale is widely used in environmental work because it closely resembles the non-linearity of human hearing. Therefore, the unit of measurement for an A-weighted noise level is dBA.

Traffic noise is not constant. It varies as each vehicle passes a point. The time-varying characteristics of environmental noise are analyzed statistically to determine the duration and intensity of noise exposure. In an urban environment, noise is made up of two distinct parts. One is ambient or background noise. Wind noise and distant traffic noise make up the acoustical environment surrounding the project. These sounds are not readily recognized, but combine to produce a non-irritating ambient sound level. This background sound level varies throughout the day, being lowest at night and highest during the day.

The other component of urban noise is intermittent and louder than the background noise. Transportation noise and local industrial noise are examples of this type of noise. It is for these reasons that environmental noise is analyzed statistically.

The statistical descriptor used for traffic noise is L_{eq}. L_{eq} is the constant, average sound level, which over a period of time contains the same amount of sound energy as the varying levels of the traffic noise. The L_{eq} correlates reasonably well the effects of noise on people. It is also easily measurable with integrating sound level meters. The time period for traffic noise is 1-hour. Therefore, the unit of measure for traffic noise is L_{eq}(1h) dBA.

Highway noise sources have been divided into five types of vehicles; automobiles (A), medium trucks (MT), heavy trucks (HT), Buses (B) and Motorcycles (M). Each vehicle type is defined as follows:

- Automobiles – all vehicles with two axles and four tires, includes passenger vehicles and light trucks, less than 10,000 pounds.
- Medium trucks – all vehicles having two axles and six tires, vehicle weight between 10,000 and 26,000 pounds.
- Heavy trucks – all vehicles having three or more axles, vehicle weight greater than 26,000 pounds.
- Buses – all vehicles designed to carry more than nine passengers.
- Motorcycles – all vehicles with two or three tires and an open-air driver/passenger compartment.

Noise levels produced by highway vehicles can be attributed to three major categories:

- Running gear and accessories (tires, drive train, fan and other auxiliary equipment)
- Engine (intake and exhaust noise, radiation from engine casing)
- Aerodynamic and body noise

Tires are the dominant noise source at speeds greater than 50 mph for trucks and automobiles. Tire sound levels increase with vehicle speed but also depend upon road surface, vehicle weight, tread design and wear. Change in any of these can vary noise levels. At lower speeds, especially in trucks and buses, the dominant noise source is the engine and related accessories.

3.0 PROJECT DESCRIPTION

The Michigan Department of Transportation (MDOT) is studying potential improvements to the United States Border Crossing Plaza at the Blue Water Bridge in Port Huron, Michigan. The general location of the project is shown on Figure 1. Several federal agencies inspect trucks, cars, passengers, and cargo on the plaza, which is owned and operated by MDOT. The Blue Water Bridge is the second busiest commercial border crossing between the United States and Canada and is the fourth busiest overall between the two countries.

Lengthy backups of commercial and passenger vehicles waiting to enter the United States at the Blue Water Bridge are common. During weekday afternoon peaks these traffic backups routinely exceed three miles in length. They interfere with local traffic using Highway 402 in Canada and are of great concern to Canadian officials.

The purpose of the study is to develop improvements to the Blue Water Bridge Plaza which will include, but not be limited to the following:

- Accommodate projected 30-year traffic growth and potential future facility needs.
- Minimize backups on Highway 402 and I-94/69.
- Accommodate the latest inspection technologies and procedures.
- Improve facility security.
- Reduce weave movements on the bridge, plaza, and I-94/69.


Lake Huron
Saginaw Bay
Location of Blue Water Bridge Plaza Study Port Huron, Michigan
Bay City
Midland
Saginaw Township North
Saginaw
Flint
Owosso
Port Huron
To London
To Grand Rapids
Lansing
Okemos
To Chicago/ Indianapolis
Waterford
Shelby
Pontiac
Troy
Harrison
Clinton
St. Clair Shores
Novi
Detroit
Lake St. Clair
Grosse Pointe Park
Ann Arbor
To Chicago
Canton
Jackson
Ypsilanti
Wayne
Southgate
River Rouge
To Toronto
Windsor
Ontario, Canada
Tronton
Woodhaven
Monroe
Adrian
Lake Erie
To Toledo
Location Map
Project: Blue Water Bridge Plaza Study
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W
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ENGINEERS PLANNERS ECONOMISTS
Wilbur Smith Associates
MDOT
Michigan Department of Transportation

Figure 1

Alternatives being considered include the No-Build and three build alternatives; the City East Alternative (formerly PA-2), City West Alternative (formerly PA-4) and the Township Alternative (formerly PA-3). The City East and West Alternatives are in the City of Port Huron. The Township Alternative is located in Port Huron Township.

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No-Build Alternative The No-Build Alternative would not involve any changes to the existing plaza configuration or ramps, nor would it include any improvements to the Black River Bridge or the I-94/I-69 Corridor. The Alternative would include continued maintenance and technology improvements as space allows, over the next 25 years. Accommodation of all of the required facilities for Customs and Border Protection (CBP) would not be possible on the existing plaza and substantial gridlock would occur on the plaza as new facilities are introduced and the limited existing parking and queuing space is reduced. There would be no expansion of the existing plaza footprint.

City East Alternative This alternative would bring most of the plaza down to street level expanding north and south of the existing plaza. Pine Grove Avenue would be re-routed to the east of the existing plaza, between Hancock Street and Scott Avenue. I-94/69 would be widened from 4 lanes to 6 lanes beginning west of the Lapeer Connector to the Plaza. The Lapeer Connector and Water Street interchanges would be rebuilt along with proposed improvements at the M-25/Hancock Street intersections and at the following intersections along Pine Grove Avenue: Scott Avenue, 10th Avenue/Elmwood Street, and Hancock Street. A new Welcome Center would be constructed along I-69/94 in Port Huron Township. The City East Alternative is superimposed on an aerial photo of the study area, Figure 2.

City West (Preferred) Alternative This alternative expands the existing plaza to the north and south within the City of Port Huron bringing most of the existing elevated plaza down the street level. The City West Alternative would require the relocation of Pine Grove Avenue to the west between 10th Avenue and Hancock Street. Heading north from 10th Avenue, the relocated Pine Grove Avenue would wrap around the south and west sides of the new plaza. The relocated Pine Grove Avenue would then turn back east and connect with the existing Pine Grove Avenue at approximately Riverview Street. This alternative would also include expansion of the Black River Bridge from four lanes to nine lanes, reconstruction of the Water Street interchange, reconstruction of the Lapeer Connector interchange, and a new Welcome Center along I-69/94 in Port Huron Township. West of the Black River, the City East and City West Alternatives are the same. There would also be improvements at the Pine Grove/10th Street intersection and new traffic signals or roundabouts at key locations along the relocated Pine Grove Avenue. The City West Alternative is superimposed on an aerial photo of the study area, Figure 3.

Township Alternative This alternative would create a new plaza approximately 1.5 miles west of the current facility, on undeveloped land in Port Huron Township. South of the new plaza I-94/69 would be widened from 4 lanes to 6 lanes beginning near

Lapeer Street. The I-94/69 lanes would become a walled secure route to take vehicles between the new plaza and the Blue Water Bridge. The M-25 Connector would be extended to provide a local access road parallel to the secured I-94/69 corridor with improved access to the Lapeer Connector and Water Street. The current plaza footprint would be unchanged and would be revised to serve as the Duty Free Shop. Improvements are also proposed for the M-25/Hancock Street intersections and the following intersections along Pine Grove Avenue; Scott Avenue at 10th Avenue and Hancock Street. The Township Alternative is superimposed on an aerial photo of the study area, Figure 4.

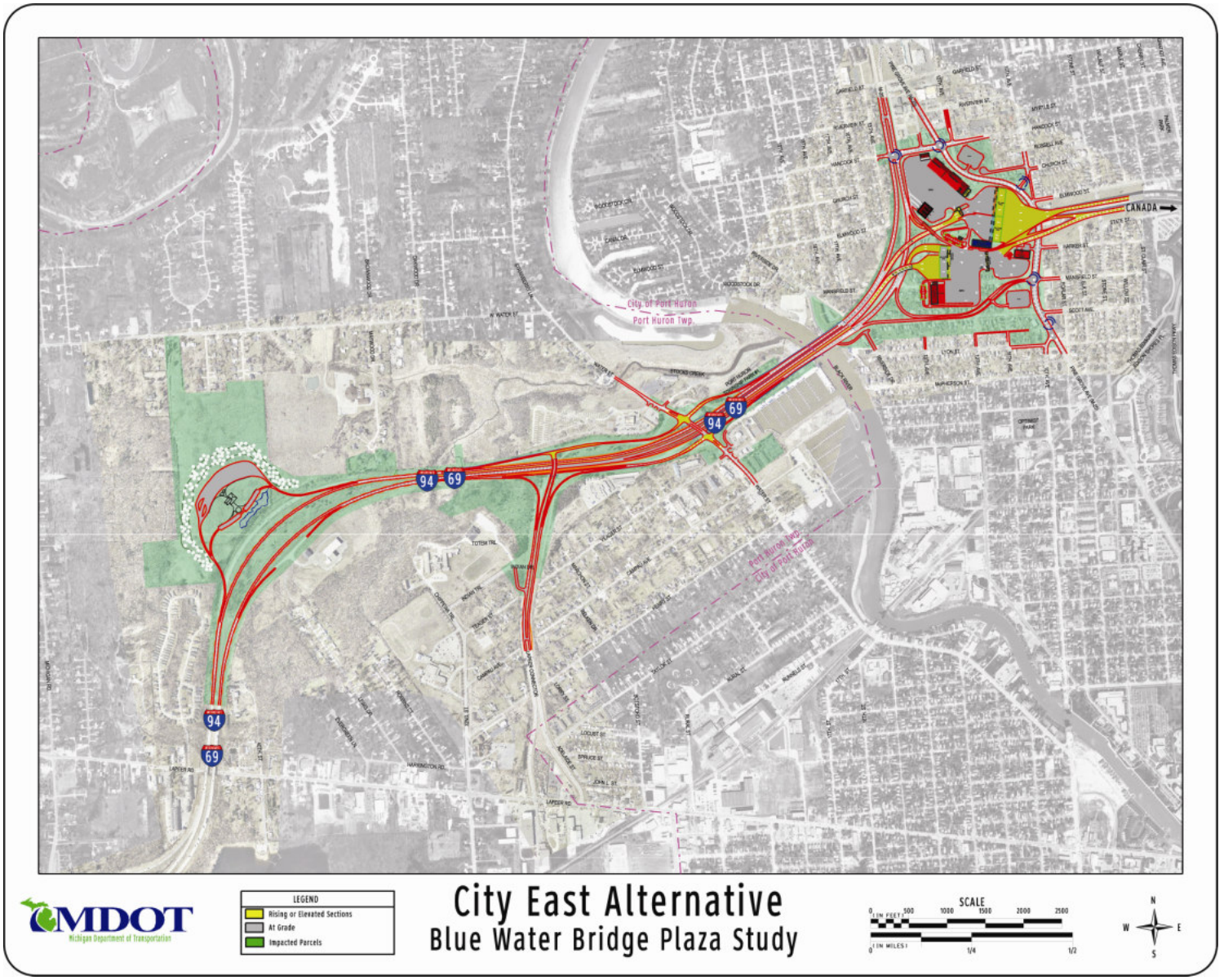
CANADA
City of Port Huron
Port Huron Twp.
94
69
LEGEND
Rising or Elevated Sections
At Grade
Impacted Parcels
City East Alternative
Blue Water Bridge Plaza Study
SCALE
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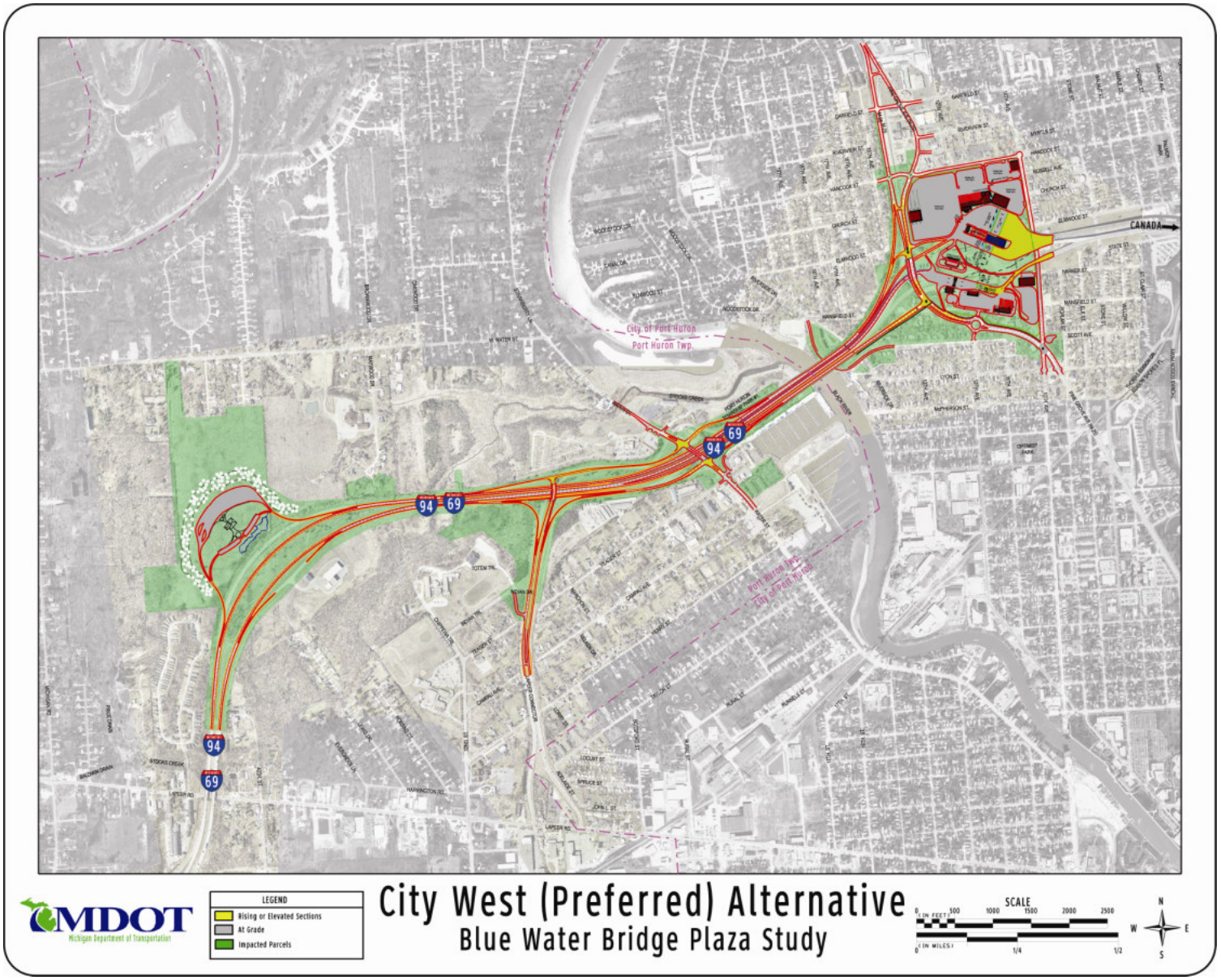
Figure 2


CANADA
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City West (Preferred) Alternative
Blue Water Bridge Plaza Study
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Figure 3

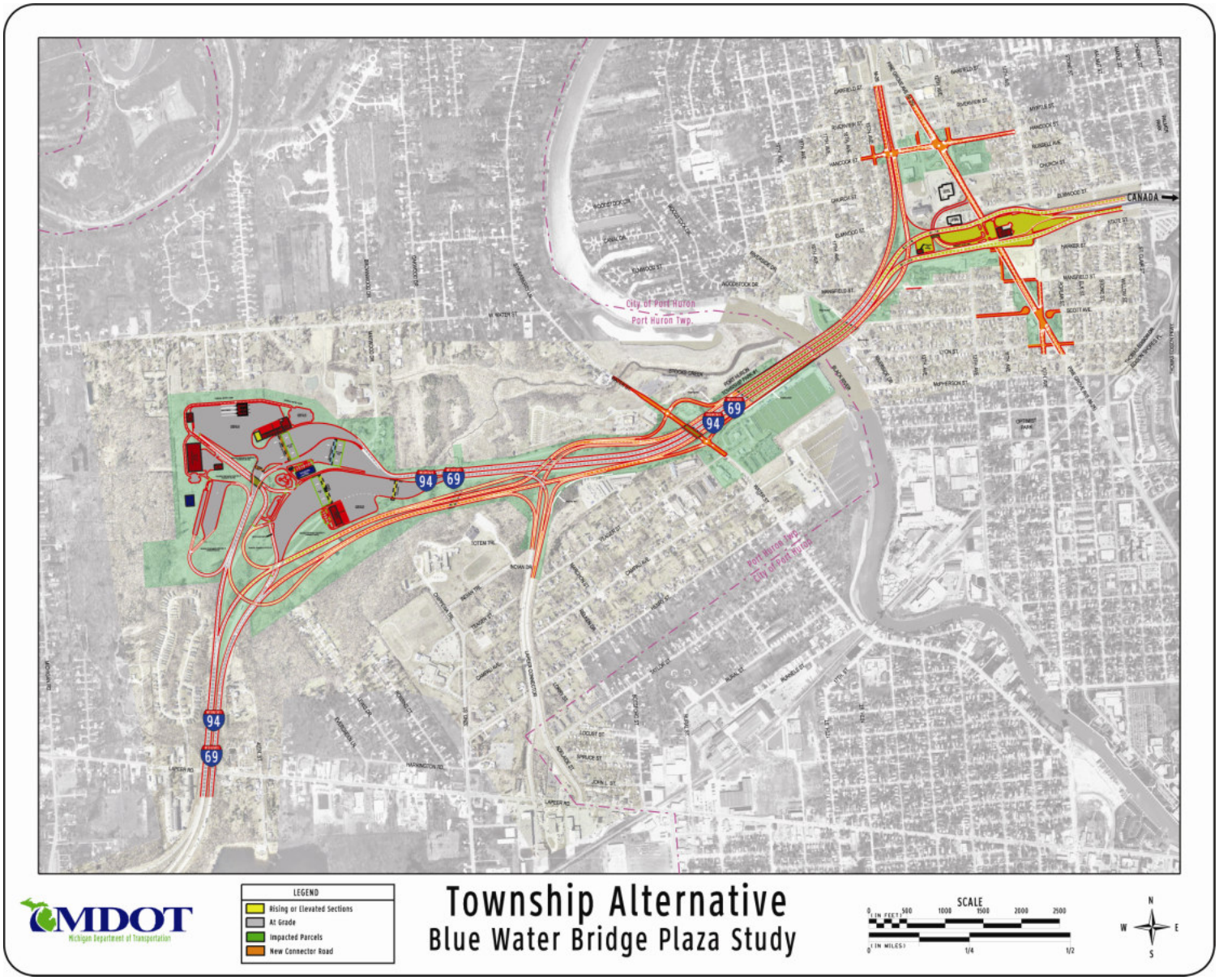
CANADA
City of Port Huron
Port Huron Twp.
94
69
LEGEND
Rising or Elevated Sections
At Grade
Impacted Parcels
New Connector Road
MDOT
Michigan Department of Transportation
Township Alternative
Blue Water Bridge Plaza Study
SCALE
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Figure 4

4.0 AFFECTED ENVIRONMENT

4.1 Noise Abatement Criteria

The FHWA's Noise Abatement Criteria (NAC) and MDOT's Highway Traffic Noise Analysis and Abatement Policy for implementing the NAC, were used in the analysis of the acoustic impact of the proposed highway project. The NAC, which is presented in the Code of Federal Regulations, Title 23 Part 772, revised April, 2005, provides procedures whereby the acoustic impact of the proposed action can be assessed, and the needs for abatement measures can be determined. The NAC for the various land uses are presented in Table 1. The noise level descriptor used is the equivalent sound level, L_{eq}, defined as the steady state sound level which, in a stated time period (usually one hour) contains the same sound energy as the actual time-varying sound. The term $L_{eq}(h)$ or "hourly L_{eq}" is used to describe the L_{eq} in an hour's time.

Noise abatement measures will be considered when the predicted noise levels approach or exceed those values shown for the appropriate activity category in Table 1, or when the predicted traffic noise levels substantially exceed the existing noise levels. "Approach" is defined as being within 1 dBA less than the noise levels shown in Table 1. The MDOT has defined an increase over existing noise levels of 10 dBA or more as being "substantial".

Table 1
Noise Abatement Criteria
Hourly A-Weighted Sound Level-Decibels (dBA)

Activity Category	$L_{eq}(1h)$	Description of Activity Category / Land Uses
A	57 dBA (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 lands are to continue to serve their intended purpose.
B	67 dBA (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 dBA (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Source: Code of Federal Regulations, Title 23 Part 772, Revised April 2005

4.2 Existing Noise Levels

Land use in the study area is a mixture of residential, commercial and vacant lands. In the vicinity of Lapeer Street the land use is primarily commercial with a few residences scattered in amongst the commercial properties. Just north of Lapeer Steer a permanent trailer home development abuts the southbound lanes of I-94/69. The lands abutting I-

94/69, except for one small residential development north of the east west leg of the corridor, are primarily undeveloped from north of the trailer home community to the Lapeer Connector on both sides of the corridor. Three schools and associated playfields exist south of the I-94/69 corridor and west of the Lapeer Connector with the closest school being 600 feet to the south of the corridor. North of the I-94/69 corridor from the Lapeer Connector to the Black River are two Township Parks, the Michigan Welcome Center and two commercial establishments. South of the corridor in this same general area are commercial establishments, a hotel and a marina. Land use north and west of the corridor from the Black River to the northern terminus along the M-25 Connector is residential. Land east of the Black River and south the plaza is residential except for commercial developments along Pine Grove Avenue.

Existing noise level measurements were conducted on July 28, 2004 at 14 representative sites in the study area: one park, one school, and 12 residences. The measurements were made in accordance with FHWA guidelines using an integrating sound level analyzer meeting ANSI and IEC Type 1 specifications. Noise measurements were conducted for a period of ten to twenty minutes at each site. Traffic counts were taken at each site, concurrent with the noise measurements when traffic was visible form the site. The data collected at the 14 sites are presented in Table 2. The location of the field sites are shown in Appendix A on Figures 5 through 11.

4.3 Comparison of Field Data vs. Modeled Traffic Counts

The FHWA Traffic Noise Model® (TNM) Version 2.5[2] was used to model the field measurements, using the traffic count information, to determine the applicability of the model to the specific project environment. The following parameters were used in this model to calculate an hourly $L_{eq}(1h)$ at a specific receiver location:

- Distance between roadway and receiver;
- Relative elevations of roadway and receiver;
- Hourly traffic volume in light-duty (two axles, four tires), medium-duty (two axles, six tires), and heavy-duty (three or more axles) vehicles;
- Vehicle speed;
- Roadway grade;
- Topographic features, including retaining walls and berms; and
- Noise source height of the vehicles.

Comparing the modeled noise levels to the measured noise levels confirms the applicability of the computer model to the specific project. Traffic counts concurrent with the noise measurements were taken at nine (9) of the 14 measurement sites. The traffic data from these nine (9) sites was used in the model. All nine (9) modeled sites compared within 0-3 dB of the measured levels. This represents reasonable correlation since the human ear can barely distinguish a 3 dBA change in the $L_{eq}(1h)$ noise level in the urban environment. The site by site comparison is presented in Table 3.

Table 2
Measured Existing Noise Levels
Blue Water Bridge Plaza
St. Clair County, MI

Field Site #	Site Description and Distance From Edge of Shoulder	Date	Start Time	Duration	Traffic[1)]					Noise Level, dBA $L_{eq}(1h)$
					Direction	Auto	Med Truck	Heavy Truck	Speed mph	
152	Condominiums, 2005 – 2009 Riverside Dr., 125' north of I-94	07/28/04	8:05	20 min.	EB & WB	638	19	116	55	66
132	Vacant lot in front of 2423 15th Ave., 53' west of M-25	07/28/04	8:39	20 min.	EB & WB	635	20	17	45	69
107	Residence, 2402 10th Ave., 155' north of Plaza	07/28/04	9:17	20 min.	No Counts - Traffic not moving					63
87	Residence, 1713 Mansfield St. 97' south of I-94	07/28/04	9:55	20 min.	EB & WB	576	22	122	55	63
81	Residence, 1662 Mansfield St., 320' south of I-94	07/28/04	10:27	20 min.	EB	429	11	56	55	55
70	Residence, 1642 Scott Ave., 652' south of I-94	07/28/04	11:35	10 min.	No Counts - No traffic					54
64	Residence, 1920 Riverside Dr., 142' south of I-94	07/28/04	12:10	20 min.	EB	413	10	64	45	63
51	Port Huron TWP. Park #1, 280' north of I-94	07/28/04	12:53	20 min.	EB & WB	863	22	97	55	60
17	Residence, 2793 Maywood Dr., 422' north of I-94	07/28/04	13:26	20 min.	No Counts - No traffic					51
22	Residence, 2911 Eastland Dr., 1692' north of I-94	07/28/04	14:02	10 min.	No Counts - No traffic					42
45	Residence, 2603 Yeager St., 105' East of Lapeer Connector	07/28/04	14:33	20 min.	NB & SB Lapeer	246	9	5	45	61
42	Chippewa Middle School, 902' south of I-94	07/28/04	15:06	20 min.	No Counts - Traffic not visible					51
7	Residence, 2810 Lewis Dr., 510' south of I-94	07/28/04	15:33	20 min.	EB & WB	700	20	124	55	53
26	Mobile Home, 49 Pine Needle Trail, 148' west of I-94	07/28/04	16:06	20 min.	EB & WB	713	21	134	55	66

1) Autos defined as 2-axle, 4-tire; medium trucks as 2-axle, 6-tire; heavy trucks as 3 or more axles.

Source: HNTB Corporation, July, 2004

Table 3
Comparison Of Measured And Modeled Noise Levels
Blue Water Bridge Plaza
St. Clair County, MI

Field Site[1)]	Noise Level, dBA L_{eq}(1h)		Difference in Noise Level, dBA L_{eq}(1h) (Modeled Minus Measured)
	Measured	Modeled	
152	66	69	3
132	69	67	-2
87	63	66	3
81	55	57	2
64	63	65	2
51	60	62	2
45	61	59	-2
7	53	56	3
26	66	66	0

1) Sites 107, 70, 17, 22, and 42 were not modeled, no traffic counts.
Source: HNTB, July, 2004

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Noise Impact Prediction

The traffic noise prediction program, TNM v. 2.5, was used to model existing and future peak hour 2030 traffic noise levels within the study area. TNM v. 2.5 input and output files have been provided to MDOT on a CD. One hundred eighty (180) representative receiver locations are numbered, 1 through 176 (plus four (4) additional receivers numbered 79A, 80A, 120A and 130A) on Figures 5 through 11 in Appendix A. These receivers were selected to model the representative noise impacts at two (2) churches (one with a pre-school), three (3) schools with playfields, two (2) parks (50 RV spots in one park), one (1) hotel/motel, 52 commercial properties, and 422 residences which include apartments and trailer homes adjacent to the proposed project. The results of the computer modeling are presented in Table 4.

Future No-Build traffic noise levels within the corridor would approach or exceed the NAC for Activity Category B properties at 101 residences, one (1) hotel/motel and Township Park #1 and at five (5) Activity Category C commercial establishments.

Design hour 2030 noise levels adjacent to the City East Alternative would approach or exceed the NAC for Activity Category B locations at 71 residences, one (1) hotel/motel and Township Park #1 and at three (3) Activity Category C commercial establishments. None of the noise receivers would be exposed to noise levels that “substantially exceed existing” noise levels.

The City West Alternative would cause 2030 design hour noise levels to approach or exceed the NAC for Activity Category B properties at 48 residences, one (1) hotel/motel and Township Park #1 and at three (3) Activity Category C commercial establishments. None of the noise receivers would be exposed to noise levels that "substantially exceed existing" noise levels.

Future 2030 design hour noise levels adjacent to the Township Alternative would approach or exceed the NAC for Activity Category B locations at 52 residences and 14 RV spots in Township Park #2. None of the noise receivers would be exposed to noise levels that "substantially exceed existing" noise levels.

The security walls adjacent to I-94/69 from the proposed Township Alternative Customs Plaza to the east could increase the noise levels for Receivers 42 – 70 and 79 - 114. A parallel barrier analysis, using the two dimensional parallel barrier analysis tools within TNM v. 2.5, was performed at three locations between the Black River and the Customs Plaza. Based on this analysis the concrete security fences could raise noise levels 3 to 8 decibels above the results of the more detailed three dimensional TNM modeling. The increases vary substantially and are a function of the height of the security fences, and relative elevation differences between the roadways and the Receivers.

Table 4
Design Hour Noise Levels, dBA L_{eq}(1h)
Blue Water Bridge Plaza
St. Clair County, MI

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
1	Res.	1	67	***67***	***69***	***69***	***69***	***67***
2	Comm.	1	72	67	69	69	69	67
3	Res.	1	67	***68***	***70***	***70***	***70***	***68***
4	Res.	1	67	***68***	***69***	***71***	***71***	***67***
5	Comm.	1	72	***72***	***74***	***76***	***76***	69
6	Res.	1	67	59	61	62	62	59
7	Res.	1	67	58	60	61	61	58
8	Comm.	1	72	62	64	66	66	TBA
9	Playfield	1	67	50	52	53	53	50
10	Playfield	1	67	50	52	53	53	50
11	School	1	67	49	51	52	52	48
12	Res.	1	67	58	60	62	62	TBA
13	Res.	1	67	60	62	64	64	TBA
14	Res.	1	67	64	***66***	TBA	TBA	TBA
15	Res.	1	67	***67***	***69***	TBA	TBA	TBA

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
16	Res.	1	67	***66***	***68***	TBA	TBA	TBA
17	Res.	1	72	61	62	64	64	TBA
18	Res.	1	67	58	60	62	62	TBA
19	Res.	1	67	57	59	61	61	TBA
20	Pre-school	1	67	53	55	56	56	52
21	Church	1	67	52	54	56	56	53
22	Res.	2	67	48	50	50	50	55
23	Res.	2	67	47	49	50	50	56
24	Res.	1	67	46	48	49	49	52
25	Trailer Home	3	67	63	65	***67***	***67***	62
26	Trailer Home	4	67	***68***	***70***	***72***	***72***	***66***
27	Trailer Home	4	67	64	***66***	***68***	***68***	63
28	Trailer Home	8	67	59	61	62	62	59
29	Trailer Home	6	67	65	***67***	***70***	***70***	***66***
30	Trailer Home	7	67	64	***66***	***68***	***68***	***66***
31	Trailer Home	14	67	58	59	61	61	59
32	Trailer Home	6	67	***70***	***72***	***73***	***73***	***72***
33	Trailer Home	6	67	63	65	***66***	***66***	64
34	Trailer Home	2	67	***69***	***70***	***69***	***69***	***69***
35	Trailer Home	1	67	***67***	***69***	***67***	***67***	***66***
36	Trailer Home	6	67	60	62	62	62	61
37	Comm.	1	72	65	67	65	65	64
38	Comm.	2	72	68	70	69	69	67
39	Comm.	1	72	70	***71***	***72***	***72***	70
40	Comm.	1	72	69	***71***	***73***	***73***	70
41	Comm.	1	72	66	68	70	70	66
42	School	1	67	54	56	59	59	54
43	Playfield	1	67	50	52	53	53	49
44	School	1	67	57	59	63	63	57
45	Res.	6	67	62	63	64	64	61
46	Res.	3	67	56	57	58	58	53
47	Res.	5	67	57	58	59	59	54
48	Res.	3	67	59	60	60	60	55
49	Res.	4	67	61	62	62	62	56
50	Hotel	1	67	***68***	***69***	***69***	***69***	62
51	Park	1	67	***66***	***67***	***67***	***67***	58
52	Comm.	1	72	66	67	65	65	61

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
53	Comm.	1	72	63	64	61	61	61
54	RV Park	9	67	61	62	59	59	62
55	RV Park	14	67	62	63	62	62	***66***
56	RV Park	11	67	58	59	58	58	58
57	RV Park	2	67	60	61	61	61	60
58	RV Park	4	67	57	58	58	58	56
59	RV Park	4	67	55	57	57	57	53
60	RV Park	4	67	58	59	59	59	55
61	RV Park	2	67	63	64	64	64	59
62	Res.	2	67	63	64	59	58	59
63	Res.	2	67	62	63	62	59	57
64	Res.	1	67	***67***	***69***	TBA	TBA	***67***
65	Res.	2	67	65	***66***	65	TBA	61
66	Res.	2	67	62	64	63	TBA	58
67	Res.	7	67	60	61	61	58	54
68	Res.	4	67	60	61	TBA	58	55
69	Res.	6	67	56	58	57	55	51
70	Res.	4	67	56	58	TBA	56	53
71	Res.	11	67	53	55	55	54	49
72	Res.	3	67	53	54	55	55	49
73	Res.	6	67	54	55	57	59	51
74	Res.	10	67	52	54	54	54	50
75	Res.	2	67	56	57	58	61	55
76	Res.	3	67	54	55	56	56	53
77	Res.	5	67	56	57	57	56	56
78	Res.	2	67	60	60	62	TBA	60
79	Res.	2	67	64	65	TBA	TBA	63
79A	Res.	3	67	***68***	***70***	TBA	TBA	TBA
80	Res.	4	67	60	62	TBA	TBA	57
80A	Res.	2	67	***72***	***74***	TBA	TBA	TBA
81	Res.	2	67	60	62	TBA	TBA	57
82	Res.	11	67	56	57	TBA	TBA	51
83	Res.	9	67	58	59	TBA	TBA	52
84	Res.	5	67	58	59	TBA	TBA	54
85	Res.	4	67	55	56	TBA	TBA	52
86	Comm.	3	72	67	67	TBA	TBA	TBA
87	Res.	1	67	***67***	***69***	TBA	TBA	***69***

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
88	Res.	2	67	***67***	***68***	TBA	TBA	65
89	Comm.	1	72	70	***71***	TBA	TBA	62
90	Res.	3	67	62	63	TBA	TBA	57
91	Res.	6	67	60	62	TBA	TBA	53
92	Res.	4	67	60	61	TBA	TBA	53
93	Res.	1	67	61	62	TBA	TBA	54
94	Comm.	1	72	63	64	TBA	TBA	58
95	Res.	6	67	61	62	TBA	TBA	58
96	Res.	5	67	63	64	***66***	64	63
97	Res.	8	67	58	59	61	60	57
98	Res.	3	67	59	61	60	60	57
99	Res.	8	67	57	58	58	57	54
100	Res.	8	67	56	58	57	57	54
101	Res.	4	67	56	58	58	57	55
102	Res.	2	67	62	63	61	60	60
103	Res.	3	67	60	62	61	56	59
104	Res.	11	67	55	57	56	55	53
105	Res.	10	67	60	61	59	58	56
106	Res.	5	67	57	59	59	59	56
107	Res.	3	67	62	64	***66***	64	63
108	Church	1	67	62	64	TBA	TBA	62
109	Res.	2	67	59	61	TBA	TBA	57
110	Res.	7	67	58	60	TBA	TBA	55
111	Res.	4	67	64	65	TBA	TBA	59
112	Comm.	1	72	65	65	TBA	TBA	64
113	Comm.	1	72	61	62	TBA	TBA	60
114	Comm.	1	72	64	65	TBA	TBA	64
115	Res.	1	67	***67***	***68***	***69***	63	***70***
116	Res.	1	67	***67***	***68***	***70***	64	***70***
117	Res.	2	67	***67***	***68***	***69***	64	***70***
118	Res.	3	67	***66***	***67***	***69***	64	***69***
119	Res.	2	67	***68***	***69***	***70***	65	***71***
120	Res.	1	67	***67***	***68***	***70***	65	***70***
120A	Res.	1	67	***66***	***67***	TBA	TBA	TBA
121	Res.	1	67	58	59	60	57	60
122	Res.	1	67	58	59	61	58	61
123	Res.	1	67	58	59	60	57	61

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
124	Res.	2	67	58	59	61	58	61
125	Res.	1	67	59	60	61	59	62
126	Res.	2	67	59	60	61	58	61
127	Res.	2	67	59	60	61	58	61
128	Res.	1	67	59	60	61	57	61
129	Res.	2	67	61	63	61	58	61
130A	Res.	1	67	***66***	***68***	TBA	TBA	TBA
130	Res.	3	67	***68***	***69***	***69***	64	***69***
131	Res.	3	67	***69***	***70***	***70***	64	***70***
132	Res.	1	67	***69***	***70***	***70***	63	***70***
133	Res.	2	67	60	61	61	58	61
134	Res.	3	67	60	61	61	59	61
135	Res.	2	67	60	62	61	59	61
136	Res.	1	67	61	62	61	60	61
137	Res.	2	67	61	62	62	60	62
138	Res.	2	67	62	63	62	59	62
139	Res.	3	67	61	62	61	60	60
140	Res.	1	67	***67***	***69***	***69***	63	***69***
141	Res.	3	67	63	64	61	63	62
142	Res.	3	67	61	62	60	61	59
143	Res.	2	67	59	60	58	60	56
144	Res.	3	67	57	59	56	58	53
145	Res.	3	67	61	62	59	62	57
146	Res.	1	67	***70***	***72***	***69***	***71***	***69***
147	Res.	3	67	65	***66***	64	***66***	61
148	Res.	2	67	65	***67***	65	65	61
149	Res.	1	67	***73***	***75***	***73***	***69***	***70***
150	Res.	2	67	65	***67***	65	65	59
151	Res.	1	67	***72***	***73***	***73***	***69***	***69***
152	Apts.	24	67	***72***	***73***	TBA	TBA	TBA
153	Comm.	1	72	66	67	TBA	TBA	TBA
154	Comm.	1	72	65	67	TBA	TBA	TBA
155	Comm.	1	72	65	66	TBA	62	TBA
156	Comm.	1	72	66	66	TBA	57	TBA
157	Comm.	1	72	60	62	61	TBA	61
158	Comm.	1	72	60	63	62	TBA	62
159	Comm.	1	72	63	65	TBA	TBA	TBA

Receiver Number[1)]	Land Use Type[2)]	# units represented	FHWA/ MDOT Noise Abatement Criterion	Modeled Noise Level, L_{eq}(1h) (dBA)				
				Existing Noise Levels (2004) with Traffic Model Volumes	No Build (2030)	City East Build (2030)	City West Build (2030)	Town-ship Build (2030)
160	Comm.	1	72	64	65	TBA	TBA	TBA
161	Comm.	1	72	***71***	***71***	TBA	TBA	TBA
162	Comm.	1	72	63	63	TBA	TBA	62
163	Comm.	1	72	65	65	TBA	TBA	64
164	Comm.	1	72	66	67	TBA	TBA	65
165	Comm.	1	72	68	67	TBA	TBA	TBA
166	Comm.	1	72	62	62	TBA	TBA	61
167	Comm.	1	72	61	61	TBA	TBA	60
168	Comm.	1	72	59	60	TBA	TBA	58
169	Comm.	1	72	67	66	TBA	TBA	TBA
170	Comm.	4	72	68	68	TBA	TBA	68
171	Comm.	1	72	64	65	TBA	TBA	TBA
172	Comm.	3	72	64	65	66	65	64
173	Comm.	1	72	64	66	TBA	TBA	TBA
174	Comm.	1	72	64	65	65	65	TBA
175	Comm.	4	72	67	68	70	TBA	TBA
176	Comm.	2	72	59	60	62	60	TBA

1) Receiver locations are presented in Appendix A on Figures 5-11
2) Res-Residential, Comm-Commercial, Apts – Apartments
67 Noise levels that approach or exceed the NAC
TBA Properties to be acquired as part of proposed improvements.

5.3 Mitigation Measures

MDOT has criteria for determining where noise abatement should be provided. These criteria are summarized as follows:

- Where negative noise impacts are expected to occur, noise abatement will be considered and will be implemented if found feasible and reasonable for existing developments, and future developments were approved before the date of public knowledge. After the date of public knowledge, MDOT will not be responsible for providing noise abatement for new developments. The provision of noise abatement for new developments becomes the responsibility of local governments and private developers.
- All sites will be considered. However, it is generally known that commercial and industrial sites prefer that there be no interference with the view to their establishments. Therefore, when commercial and residential sites expected to convert to a commercial or industrial land use (e.g., some of the residential units have converted to commercial/industrial, or the area has been rezoned commercial)

are found to be reasonable and feasible, they will be asked if they want noise abatement. If they do not want it, it will not be provided.

- Planned Development - A planned, designed, and programmed development where a building permit has been issued.
- Date of Public Knowledge - The date that the proposed projects final environmental analysis and documentation (i.e., Categorical Exclusion [CE], Finding of No Significant Impact [FONSI], or Record of Decision [ROD]) was approved by FHWA.
- Feasible - This refers to engineering considerations, such as can a noise barrier be built given the topography of the location; can a substantial noise reduction be achieved given certain access, drainage, safety, or maintenance requirements; are other noise sources present in the area? While every reasonable effort should be made to obtain a substantial noise reduction, a noise abatement measure is not feasible if it cannot achieve at least a 5 dBA noise reduction.
- Substantial Noise Reduction - A 10 dBA L_{eq}(1h) sound level reduction for at least one receptor.
- Reasonable - Noise mitigation will be considered reasonable if the comparative construction cost will be $38,060[3] or less (in 2007 dollars) per benefiting dwelling unit. Additionally, the local jurisdiction(s) must have entered into the required agreements with MDOT regarding maintenance, land use policy, and funding participation. A majority of the affected residents must be in favor of abatement.
- If during final design, the project cost becomes not reasonable (construction costs exceed the total benefited amount of $38,060 per unit), the local jurisdiction(s) will be asked if they wish to increase their financial participation in the noise abatement project to cover the excess cost per dwelling unit (the amount over $38,060 per unit), or have noise abatement dropped from further consideration.
- Where an extreme noise impact is identified (80 dBA Leq(1h) or greater), special consideration may be warranted. These sites will be considered on an individual basis.

Within the framework of MDOT's criteria, various methods were reviewed to mitigate the noise impact of the proposed improvements. Among those considered were reduction of speed limits, restriction of truck traffic to specific times of the day, a total prohibition of trucks, alteration of horizontal and vertical alignments, property acquisition for construction of noise barriers or berms, acquisition of property to create buffer zones to prevent development that could be adversely impacted, noise insulation of public use or nonprofit institutional structures and in certain circumstances, residential structures, the use of berms, and the use of sound barriers.

Reductions of speed limits, although acoustically beneficial, are seldom practical unless the design speed of the proposed roadway is also reduced. Restriction or prohibition of trucks is counter to the project purpose and need. Design criteria and recommended termini for the proposed project preclude substantial horizontal and vertical alignment shifts that would produce noticeable changes in the projected acoustical environment. The construction of noise berms is neither feasible nor reasonable because of the amount of space that would be required. Therefore, only the construction of noise barriers was reviewed.

Mitigation of the reflected noise in the area of the security fences could be accomplished with absorptive facings on the roadway side of the security fences. Depending on the absorption coefficient of the materials and the area covered it is possible that the noise increases created by the parallel barriers could be reduced from a range of 3 to 8 decibels to a range of 1 to 3 decibels.

Noise barriers were analyzed at six (6) locations within the project limits. Two (2) noise barriers were analyzed for the City East Alternative, one (1) for the City West Alternative and three (3) were analyzed for the Township Alternative. The location of the noise barriers are identified in Appendix A on Figures 7, 8, 9 and 10. The noise barriers were modeled for the City East and Township Alternatives west of M-25 between Hancock Street and the Black River (Barrier Numbers 1 and 5), west of M-25 between Garfield Street and Hancock Street (Barrier Numbers 2 and 6). The City West Alternative had a noise barrier modeled for the residential area west of M-25 between Elmwood Street and the Black River (Barrier Numbers 3).

Noise Barrier 4, which is located west of I-94/69 and north of Lapeer Street, was analyzed for the Township Alternative. No noise barrier was modeled in this area for the City East and Township Alternatives since the location of I-94/69 in this area is not being changed and no additional capacity is being provided.

The results of the barrier analysis, including barrier location, future L_{eq}(1h) noise levels without and with a barrier, barrier length and height, estimated cost, the number of residential units benefited, the noise reduction provided by the barrier and the cost per residential unit are presented in Table 5. All of the noise barriers analyzed meet MDOT's feasibility criteria. However, only five (5) noise barriers (Noise Barriers 1, 2, 4, 5, and 6) meet MDOT's definition for reasonableness.

There are other areas along the I-94/69 corridor were individual receptors exceed the NAC, such as Receivers 1, 3 and 4 which extend along the right-of-way for approximately 1,400 feet. However, it is impossible to design a barrier for single receptors that would meet MDOT's cost criteria of $38,060. There are additional locations along the improved local streets in Port Huron were receptors exceed the NAC. In these areas, local cross streets and driveway access prohibit the construction of feasible noise barriers.

The 66 dBA L_{eq}(1h) setback distance along the I-94/I-69/M-25 corridor would be 380 feet for the City East and City West Alternatives and 270 feet for the Township Alternative. The setback distance indicates that noise levels within the distance shown, measured perpendicular to the centerline of the nearest lane of the final design project in either direction, is 66 dBA or greater. This setback distance was developed to assist local planning authorities in developing land use control over the remaining undeveloped lands along the project in order to prevent further development of incompatible land use.

Table 5
ACOUSTICAL MITIGATION
NOISE BARRIER LOCATIONS ANALYZED
Blue Water Bridge Plaza
Port Huron, MI

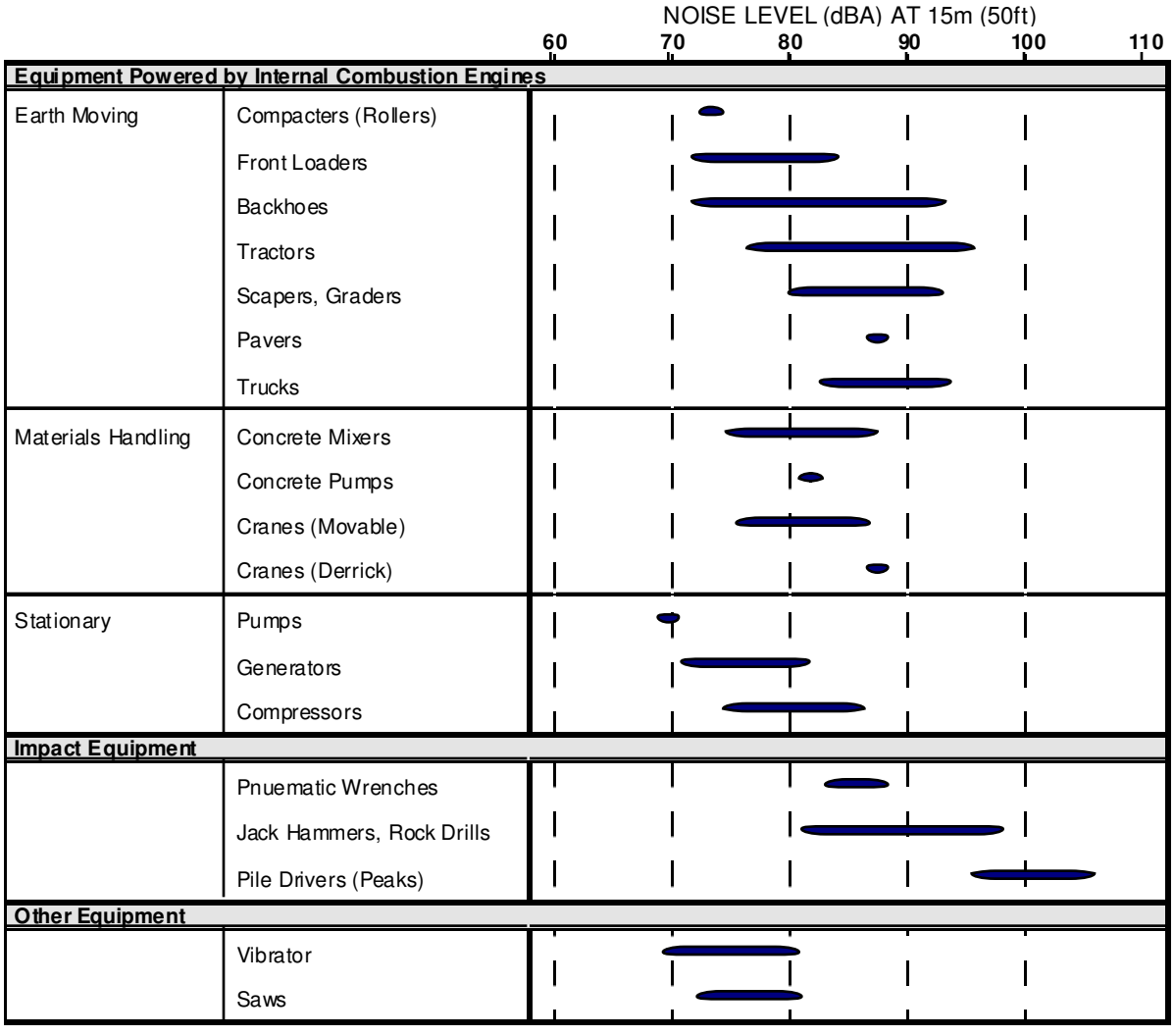
Barrier Number	Locations	Existing L_{eq}(1h) Noise Levels, dBA	Range of Future L_{eq}(1h) Noise Levels, dBA		Noise Reduction (dB)	Barrier Characteristics		Cost[1)]	Number of Units Attenuated	Cost/ Unit	Feasible and Reasonable
			w/o Barrier	Barrier		Length (ft)	Height (ft)				
	City East										
1	West of M-25, between Hancock Street and Black River	59 - 73	61 - 73	52 - 61	5-13	2510	12-18	$1,591,739	44	$36,176	Yes
2	West of M-25, between Garfield Street and Hancock Street	58 - 68	61 - 70	55 - 62	5-11	865	15	$547,011	16	$34,188	Yes
	City West										
3	West of M-25 between Elmwood St and Black River	65-73	65 - 71	60 - 64	5-10	1,023	12-15	$591,629	8	$73,954	No
	Township										
4	West of I-94/69, north of Lapeer Street	59 – 70	64 – 72	59 – 61	5 – 11	1,838	12 - 18	$1,143,844	40	$28,596	Yes
5	West of M-25, between Hancock Street and Black River	59 – 73	56 - 70	51 – 63	5 – 13	2,488	12 - 15	$1,520,707	40	$38,018	Yes
6	West of M-25, between Garfield Street and Hancock Street	58 – 68	61 - 71	55 – 60	5 – 11	865	15	$547,011	18	$30,390	Yes

1) Based on $25.50 per square foot and an additional cost of $250.00 per foot^3

5.4 Construction Noise

The major construction elements of this project are expected to be demolition, hauling, grading, paving, and bridge construction. General construction noise impacts for passersby and those individuals living or working near the project can be expected particularly from demolition, earth moving and paving operations. Table 6 lists some typical peak operating noise levels at a distance of 15 m (50 feet), grouping construction equipment according to mobility and operating characteristics. Considering the relatively short-term nature of construction noise, impacts are not expected to be substantial. The transmission loss characteristics of nearby structures are believed to be sufficient to moderate the effects of intrusive construction noise.

TABLE 6
CONSTRUCTION EQUIPMENT SOUND LEVELS



SOURCE: U.S. Report to the President and Congress on Noise, February, 1972.

Construction noise on this project should be controlled by measures including but not limited to the following:[4]

- The construction contract specifications should require that the contractor adhere with all Federal, state, and local noise abatement and control requirements.
- Construction activity in the vicinity of residences should be limited to the hours between 7:00 am and 7:00 pm or as specified by local requirements.
- A responsive communication process should be established with local residents. A telephone number should be posted at the construction site for inquiries concerning project activity.
- Construction equipment should be in good repair and fitted with "manufacturer recommended" mufflers.
- Equipment such as generators, which may be used during the nighttime hours, should be enclosed.
- Local or state jurisdictions should monitor construction noise and advise the contractor of any violation of maximum allowable noise levels.

6.0 CONCLUSION

MDOT policy is to install the feasible and reasonable noise barriers associated with transportation improvements. However, as shown in Table 5, there are no feasible or reasonable noise barriers associated with the preferred (City West) Alternative. The noise barriers proposed west of M-25, between Garfield Street and Hancock Street and between Hancock Street and the Black River, are feasible and reasonable for either the City East or the Township Alternatives, while the noise barrier west of I-94/69 and north of Lapeer Street is feasible and reasonable only for Township Alternative. If final design results in substantial changes in roadway design from modeled conditions, noise abatement measures will be reviewed.

During the public comment period on the DEIS, comments on noise concerns will be solicited at public meetings from local residents, and officials of the jurisdiction(s) affected by the project. These comments will be used to draft the final environmental document. A final decision on the installation of abatement measures will be made upon completion of the project design and the public involvement process.

7.0 REFERENCES

1 Michigan Department of Transportation's (MDOT's) Commission Policy 10136, Noise Abatement, July 31, 2003.

2 Michael C. Lau, Cynthia S. Y. Lee, Gregg G. Judith L. Rochat, Eric R. Boeker, and Gregg C. Fleming. FHWA Traffic Noise Model® Users Guide (Version 2.5 Addendum). Federal Highway Administration, April 2004.

3 E-mail correspondence dated June 7, 2007, Thomas Hanf, MDOT, to John Jaeckel, HNTB updating noise barrier units costs and cost per benefiting unit criteria.

4 E-mail correspondence dated June 14, 2007, Thomas Hanf, MDOT, to John Jaeckel, HNTB regarding construction noise control.