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Executive Summary

This Noise Study Report is a reevaluation of a report completed in January 2005 in support of the Final Environmental Impact Statement (FEIS) prepared for the project and signed May 5, 2005. After the FEIS, based on public comments, an additional noise wall was analyzed and found to be feasible and reasonable. It was added in the Record of Decision (ROD). Appendix A shows the summary noise wall table from the FEIS (as modified by the ROD).

This analysis found earlier walls are still feasible and reasonable. Exceptions include locations where post ROD engineering shifted ramps in such a way that the ramps occupy space where a wall had previously been planned. To help understand the changes from the FEIS/ROD, Table ES-1 lists the noise walls found to be feasible and reasonable in the ROD in the second column. The next column explains why a change occurred. The last column gives the current status with the updated analysis.

The total noise wall construction length at the time of the ROD was 4.9 miles. With this analysis it has increased to 7.3 miles. In some cases new receivers were identified and some walls formerly considered separately were combined in a way that abatement criteria are still met.

> *Statement of Likelihood*
> Based on the studies thus far accomplished, the Michigan Department of Transportation intends to install highway traffic noise abatement in the form of barriers listed in Table ES-1. The preliminary indications of likely abatement measures are based on preliminary design for barrier costs and noise reduction as reported in Section 5 of this document. If it subsequently develops during final design that these conditions have substantially changed, the abatement measures might not be provided. A final decision of the installation and aesthetics of the abatement measures will be made upon completion of the project's final design and the Context Sensitive Design process.

This updated analysis used a newer version of the Transportation Noise Model (TNM), Version 2.5, rather than Version 2.1. The newer version has been widely vetted and found to be more accurate than the earlier version. The horizontal and vertical clearance of the design has been refined since the FEIS, and traffic projections have changed, but not significantly. The speed limit is higher in the north end of the corridor than the previous 2005 analysis. This study conforms to the *MDOT Highway Noise Analysis and Abatement Handbook* (MDOT Noise Handbook), July 2011. The new policy includes changes on how dwelling unit equivalents (DUE) are calculated, as well as how "feasibility and reasonableness" are determined.

Table ES-1
Noise Wall Analysis Results

SEGMENT	WALLS APPROVED IN ROD	COMMENTS	WALLS APPROVED IN UPDATED ANALYSIS
1 8 Mile to Meyers	Wall 0 - NB1	Wall 0 – NB1 gets split by redesigned ramp to become Seg1 NB1 and NB2	Seg1 NB1
			Seg1 NB2
	Wall 1 - SB1	Wall 1 – SB 1 cannot be built due to redesigned ramp	
2 Meyers to 9 Mile	Wall 17 - NB Church & Wall 2 – NB1	Wall 17 – NB 1 and Wall 2 – NB 1 are combined into Seg2 NB1	Seg2 NB1
		Seg2 NB2 is a new wall added by updated analysis	Seg2 NB2
		Seg2 SB1 is a new wall added by updated analysis	Seg2 SB1
3 9 Mile to Woodward Heights		Seg3 NB 1 is a new wall added by updated analysis	Seg3 NB1
	Wall 3 – SB1	Wall 3 – SB 1 is lengthened	Seg3 SB1
4 Woodward Heights to I-696	Wall 4 - NB Church	Wall 4 - NB Church is lengthened	Seg4 NB1
	Wall - SB2	Wall SB 2 is lengthened	Seg4 SB2
5 1-696 to 11 Mile	Existing Walls	New walls replace existing walls	Seg5 NB5, NB6 & NB7
5a 11 Mile to Gardenia	Existing Walls	South ends of existing walls are removed as redesigned ramps shift south. Seg5a NB2 replaces much of an existing wall.	Seg5a NB2
6 Gardenia to 12 Mile		Seg6 NB1 is a new wall added by updated analysis	Seg6 NB1
	Wall 7 - SB1	Wall 7 - SB 1 is lengthened	Seg6 SB1
7 12 Mile to 14 mile	Wall 8 - NB1 & Wall 9 NB2	Walls almost same as before	Seg7 NB1 & Seg7 NB2
8 14 Mile to Rochester Road	Wall 10 – SB1	Wall same as before	Seg8 SB1
9 Rochester Road to Livernois	Wall 11 - NB1 & Wall 12 - NB2	Walls almost same as before	Seg9 NB1 & NB2
	Wall 13 - SB1 & Wall 14 – SB2	Walls almost same as before	Seg9 SB1 & SB2
10 Livernois to Wattles	Wall 15 - SB1	Wall same as before	Seg10 SB1
11a Wattles to Crooks		New wall added in updated analysis in section not covered by FEIS	Seg11a NB1
		New wall added in updated analysis in section not covered by FEIS	Seg11a SB1
11 Crooks to Coolidge Hwy	Wall 16 - SB1 & SB2, plus Wall 18 – SB3	Walls almost same as before	Seg11 SB1, SB2, SB3 &, SB4

Source: The Corradino Group of Michigan

1. Purpose of the Report

This Noise Study Report is a reevaluation of the noise analysis completed in January 2005 in support of the Final Environmental Impact Statement (FEIS) prepared for the I-75 Modernization project and signed in May 2005. After the FEIS, based on public comments and additional analysis, another noise wall was found to be feasible and reasonable. It was incorporated in the Record of Decision (ROD) signed in January 2006. The following sections describe how input data have changed and the new results to be carried forward to the design phase.

2. Project Description

I-75 is the main north-south roadway through Oakland County (Figure 1). It is currently experiencing congestion in the peak periods that is expected to get more severe and extend through greater portions of the day. A fourth lane will be added in each direction from M-102 (8 Mile Road) to South Boulevard. This lane will be a high occupancy vehicle (HOV) lane in the peak hours and a general purpose lane for the remaining hours. All of the bridges will be replaced, design geometrics will be modernized, and the drainage system will be upgraded.

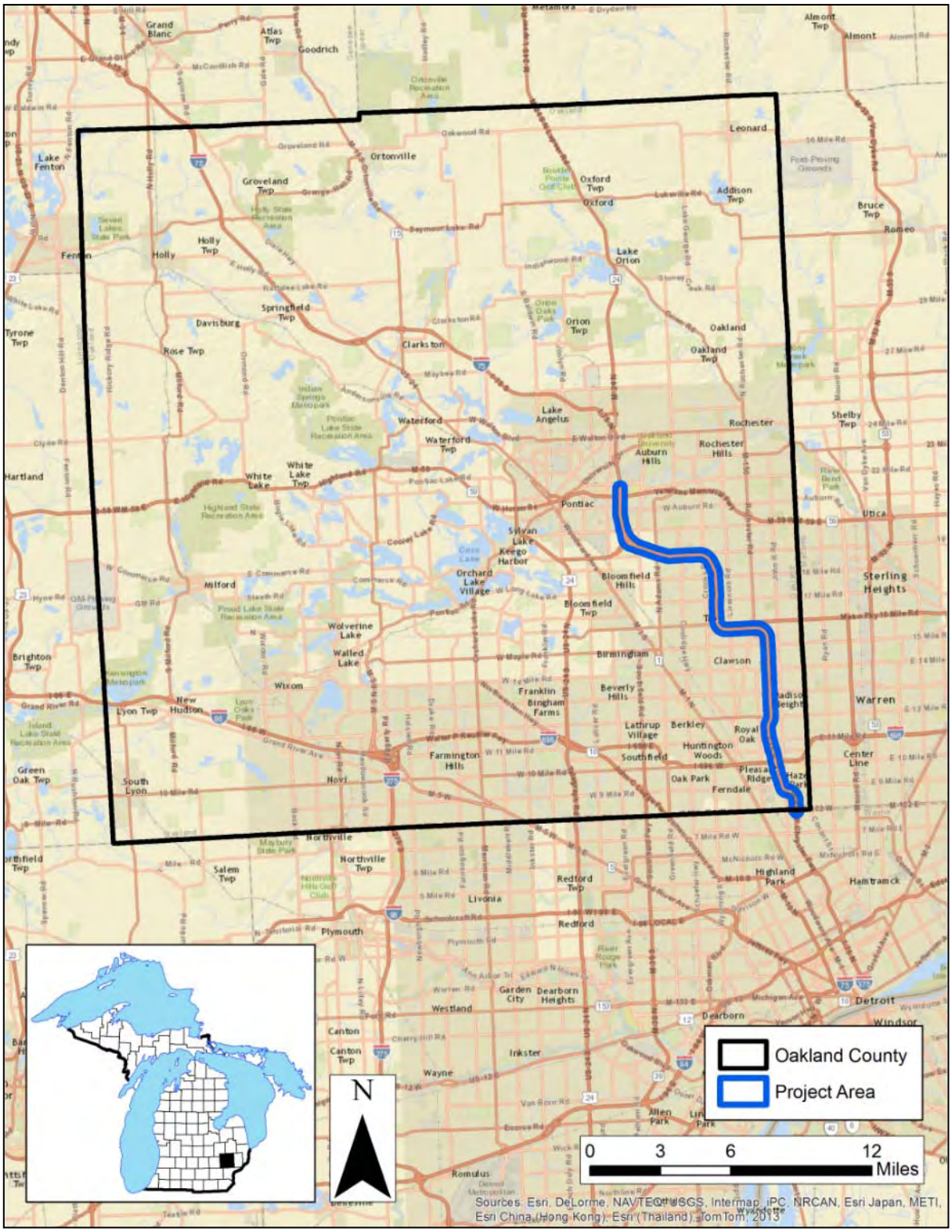
3. Traffic Noise Background

The TNM files from the 2005 Noise Study Report were used as a base. This analysis follows the guidance in the Federal Highway Administration's (FHWA's) *Highway Traffic Noise: Analysis and Abatement Guidance* (July 2010). Additionally, this analysis conforms to the *MDOT Highway Noise Analysis and Abatement Handbook* (MDOT Noise Handbook), July 2011. This policy includes revisions on how dwelling unit equivalents (DUE) are calculated, as well as how "feasibility and reasonableness" are determined.

Attention was given to the design changes that have occurred since the ROD. Updated designs that affect the noise analysis include shifts in ramp locations and the resultant changes in roadway elevations, minor roadway alignment shifts, and changes to the braided ramps north of I-696.

Noise measurements were made in conformance with FHWA guidance at 22 locations that represent the residences, schools, places of worship, and parks present within 500 feet of the proposed improvement. The locations generally represent worst case locations for all sensitive receptors, in what are considered noise sensitive areas.

Figure 1
Project Location



Source: The Corradino Group of Michigan and ESRI

Residences fall into land use category B for FHWA's Noise Abatement Criteria (NAC) (Table 1). The applicable noise criterion for this land use is 67 dB(A) in terms of the one-hour equivalent noise level, expressed as Leq (1h). The federal guidance on noise in 23 CFR Part 772 defines potential impacts in terms of noise levels approaching or exceeding the NAC. MDOT's Noise Handbook defines noise levels approaching as one decibel, and the effective value for impact analysis in Michigan for land use category B as 66 dB(A). The schools, places of worship, and parks fall into NAC land use category C, which is subject to the same NAC dB(A) criterion.

Table 1
FHWA Noise Abatement Criteria (NAC)[1]
Hourly A-Weighted Sound Level in Decibels (dB(A))

ACTIVITY CATEGORY	ACTIVITY CRITERIA[2]		EVALUATION LOCATION	ACTIVITY DESCRIPTION
	Leq(h)[3]	L10(h)[4]		
A	57	60	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 purpose.
B[5]	67	70	Exterior	Residential.
C[5]	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care 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	55	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[5]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in 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.

[1] MDOT defines a noise impact as a 10 dB(A) increase between the existing noise level to the design year predicted noise level OR a predicted design year noise level that is 1 dB(A) less than the levels shown in Table 1.

[2] Either Leq(h) or L10(h) (but not both) may be used on a project. MDOT uses Leq(h). The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.

[3] Leq is the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period, with Leq(h) being the hourly value of Leq.

[4] L10 is the sound level that is exceeded ten percent of the time (90th percentile) for the period under consideration, with L10 being the hourly value of L10.

[5] Includes undeveloped lands permitted for this activity category.

4. Methodology

Noise impacts were estimated using the FHWA required TNM2.5 modeling tool. In order to validate this model, ten common noise environments (CNE) were identified along the study corridor. Test measurements were taken in the field for at least two locations within each CNE. Exceptions to this rule were two locations where a CNE only had one isolated area of noise concern. CNEs were determined by changes in traffic and topography and were typically delimited by interchanges. Noise measurements were made and recorded on field sheets (Appendix B). Traffic was counted manually for local roads and one freeway direction, and by using videotape for the other freeway direction. Videotape was replayed and counted later. All counts were classified by vehicle type for use in the TNM2.5 validation runs. All but one modeled value for the 2014 validation runs were within 3 dBA of the measured values, validating the TNM2.5 model (see subsequent discussion of validation).

The validated TNM2.5 model was used to estimate future (2035) build noise levels, and a noise barrier analysis was performed. Barrier analysis results are discussed in Section 5.

4.1 Common Noise Environments

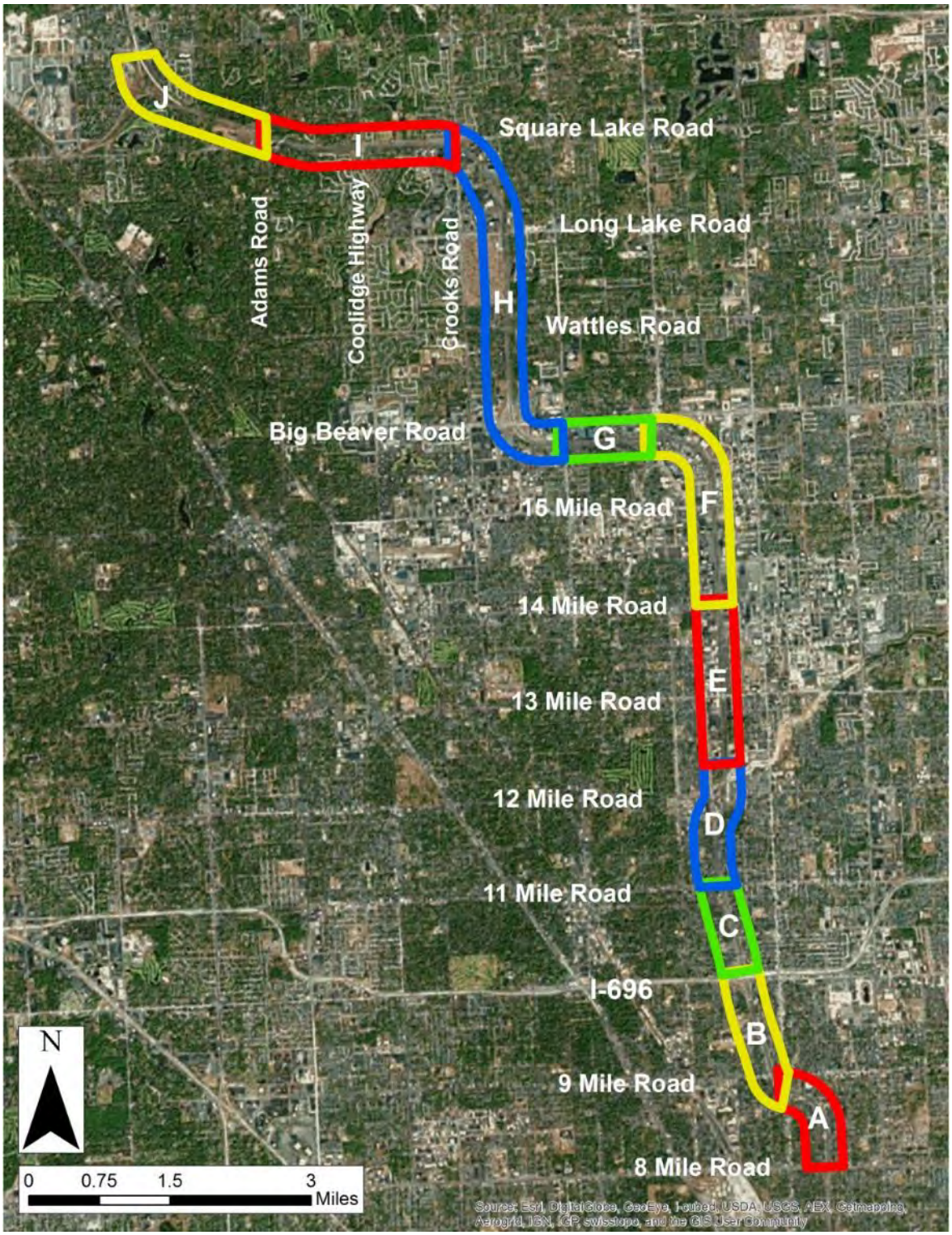
In most cases, the CNEs are so extensive geographically that the functioning of TNM2.5 suffers substantially if the whole CNE is included in a model run. To make the analysis manageable, the ten CNEs were broken into 16 segments. These shorter segments greatly reduced TNM2.5 run times. Table 2 describes each CNE and lists the measurement sites. Figures 2 through 9 illustrate the CNEs and measurement sites.

Table 2
Common Noise Environments

COMMON NOISE ENVIRONMENT	DESCRIPTION	MEASUREMENT SITES
A	8 Mile Road to 9 Mile Road	1,2
B	9 Mile Road to I-696	3,4,5,6
C	I-696 to 11 Mile Road	No measurements here due to geometry of future braided ramp.
D	11 Mile Rd to North of 12 Mile Rd	7,8,9
E	North of 12 Mile Rd to 14 Mile Rd	10
F	14 Mile Rd to Rochester Rd	13
G	Rochester Rd to Livernois Rd	14,15
H	Livernois Rd to Crooks Rd	18A,19,20,21
I	Crooks Road to Adams Road	24,25,26
J	Adams Rd to Square Lake	27,27A

Source: The Corradino Group of Michigan, Inc.

Figure 2
Common Noise Environments



Source: The Corradino Group of Michigan, Inc.

Figure 3
CNEs A and B

Source: The Corradino Group of Michigan, Inc.

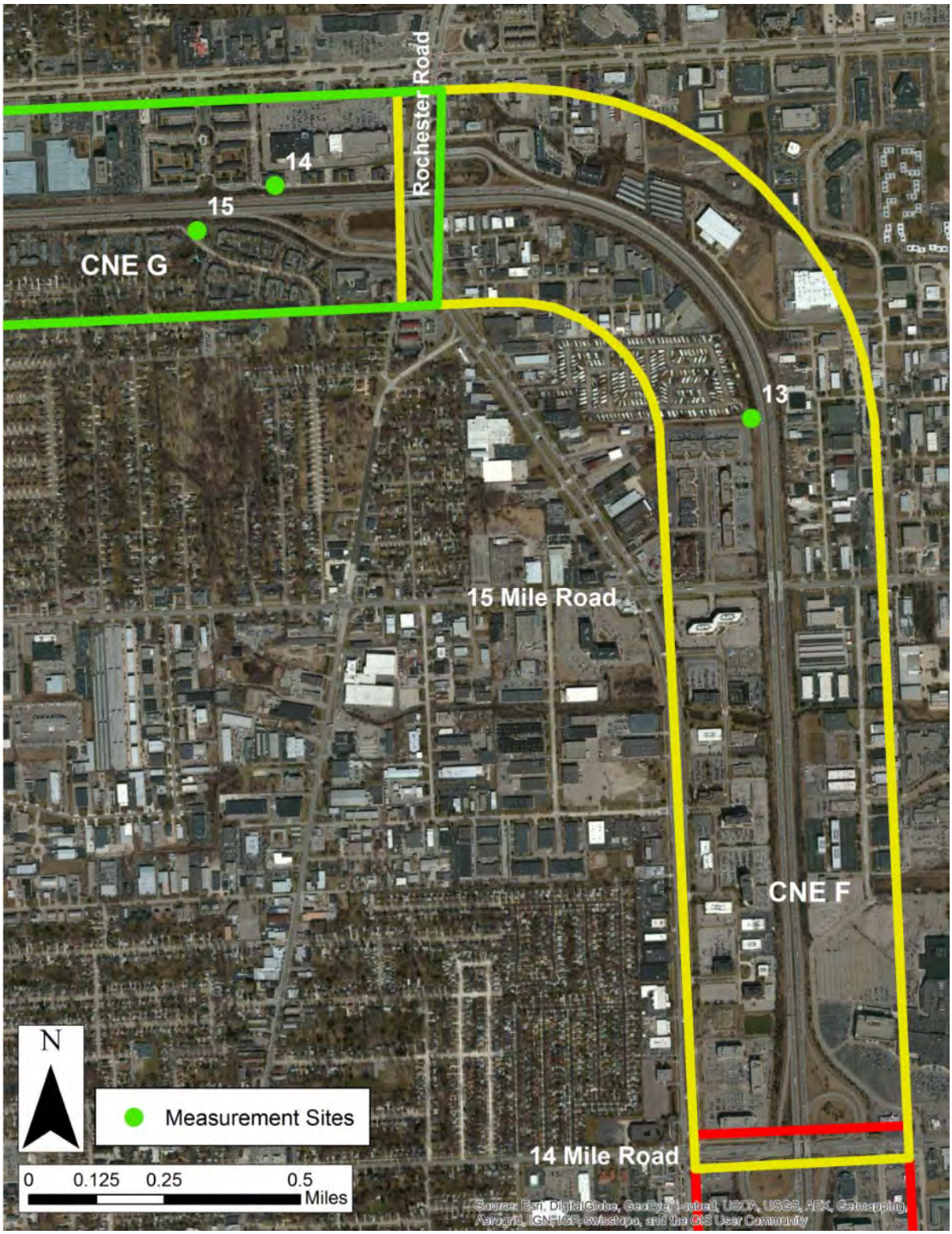
Figure 4
CNEs C and D

Source: The Corradino Group of Michigan, Inc.

Figure 5
CNE E

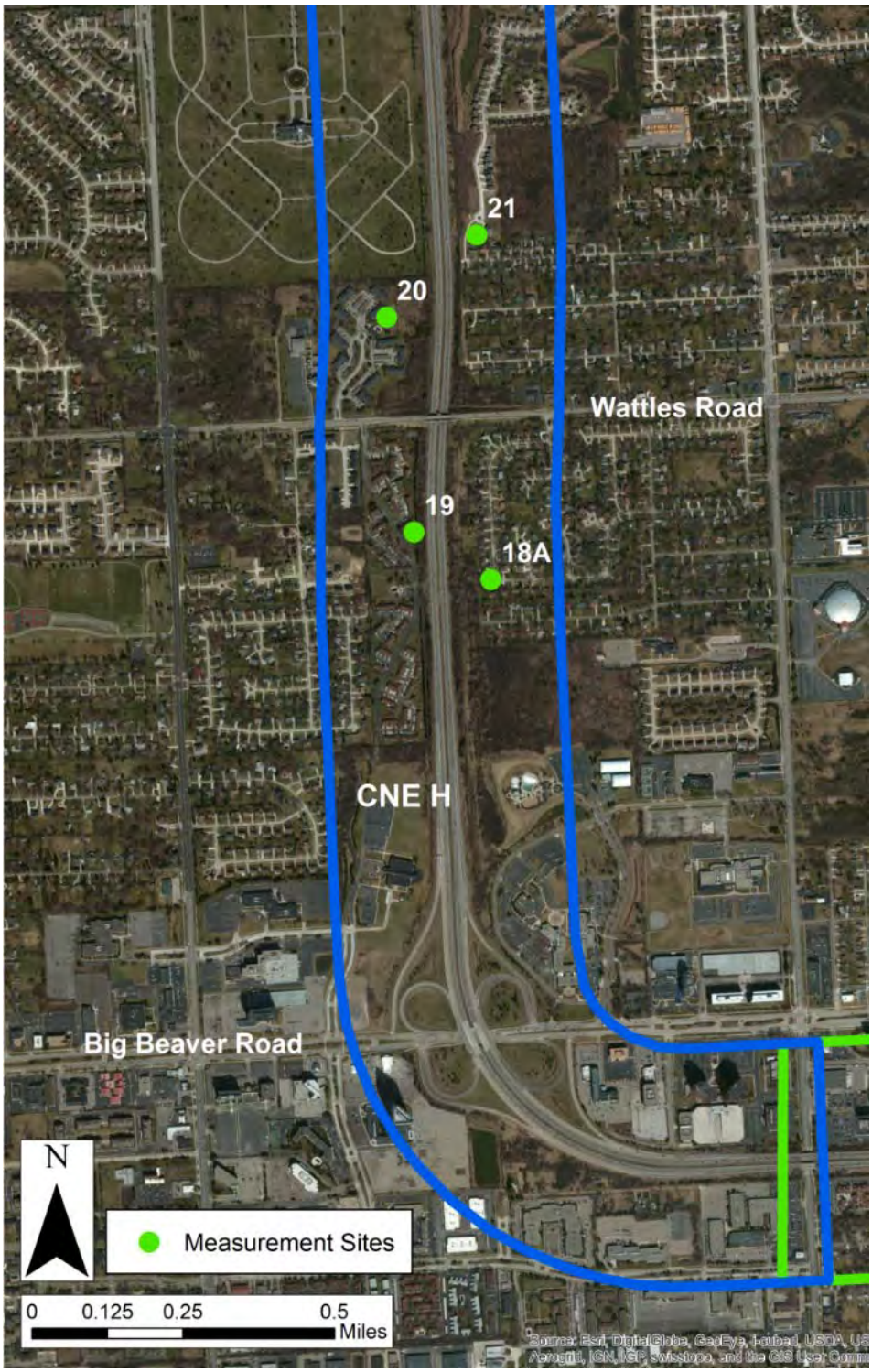
Source: The Corradino Group of Michigan, Inc.

Figure 6
CNEs F and G



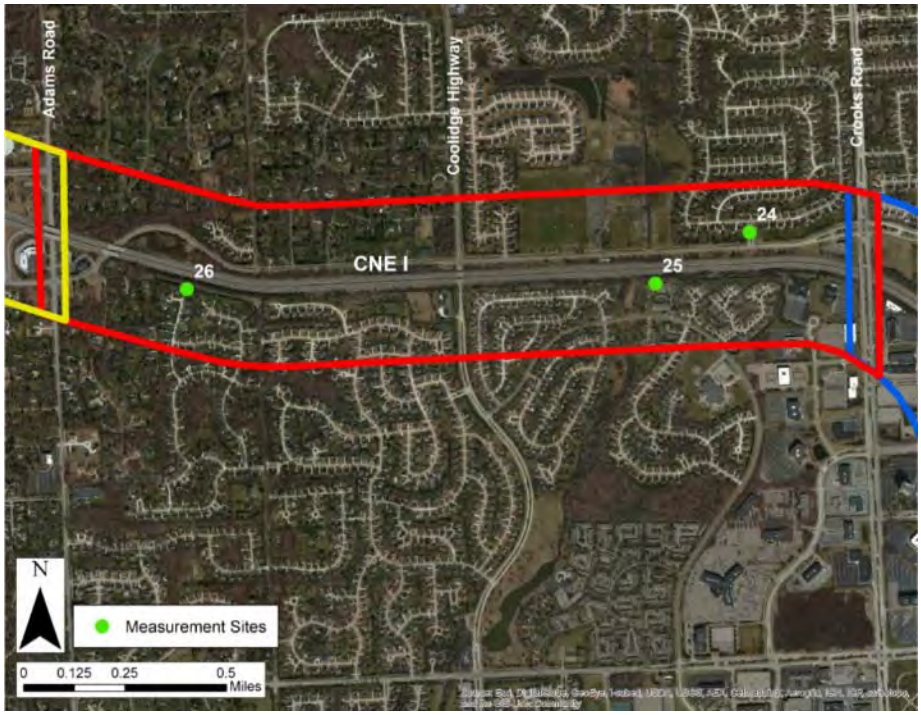
Source: The Corradino Group of Michigan, Inc.

Figure 7
CNE H



Source: The Corradino Group of Michigan, Inc.

Figure 8
CNE I



Source: The Corradino Group of Michigan, Inc.

Figure 9
CNE J

Source: The Corradino Group of Michigan, Inc.

4.2 Noise Measurements and TNM2.5 Validation

Fifteen-minute noise measurements and simultaneous traffic counts were conducted between May 27 and May 29, 2014. A Quest Noise Pro DLX noise meter was used with an exchange rate of 3, set on slow response, and A-weighting. A Quest QC-10/QC-20 Acoustic Calibrator emitting 114 dBA was used to calibrate the meter before and after the measurements (Appendix C). The setup height was five feet on a tripod set away from reflective surfaces. Leq (1h) and Lmax were recorded at each site. Table 3 shows the results of the field measurements and their relationship to the levels estimated by TNM2.5 using the traffic counts taken at the time of measurement. With the exception of site 21 all measurements were validated in the model. At site 21, the complex geometry and dense wooded area appear to have buffered the measurement, and the model predicted higher levels than recorded. The validation process highlighted the importance of geometry as model inputs, including elevations, topography, terrain lines, building rows and structures that often act as unrecognized local noise barriers.

Table 3
Validation Results

MEASUREMENT SITE	2014 MEASURED NOISE LEVEL dB(A)	2014 ESTIMATED NOISE LEVEL dB(A)	DIFFERENCE
27	65.0	66.9	1.9
27A	64.9	63.9	-1.0
26	67.4	69.8	2.4
25	71.6	73.2	1.6
24	63.2	63.1	-0.1
21	66.0	71.2	4.7
20	65.0	62.7	-2.3
19	69.6	71.4	1.8
18A	54.9	54.2	-0.7
14	72.3	74.8	2.5
15	73.3	75.0	1.7
13	69.8	72.1	2.3
10	71.3	73.1	1.8
9	73.9	75.4	1.5
7	68.9	70.5	1.6
8	67.5	66.1	-1.4
6	65.9	65.3	-0.6
5	68.4	68.7	0.3
4	67.7	69.3	1.6
3	69.8	72.1	2.3
2	67.5	70.2	2.7
1	66.4	68.9	2.5

Source: The Corradino Group of Michigan

4.3 Traffic for TNM2.5

The MDOT Noise Handbook and FHWA guidelines require the development of "worst-case traffic noise hour" conditions in modeling highway noise impacts. It also states that, "Under no circumstances should any speed below posted be used for noise modeling purposes, even if congestion and slower speeds are anticipated in the peak travel hour(s)." The corridor has a posted speed limit of 70 mph, with a limit of 60 mph for trucks. However, I-75 operates under congested conditions through much of the day. Noise levels are lower when vehicles are moving at slower speeds. Conversely, I-75 operates at the full posted speeds only at times of the day when traffic volumes are lower. As a consequence, research was performed to determine realistic "loudest hour" conditions.

The *Highway Capacity Manual* (HCM) published by the Transportation Research Board offers maximum capacities for different speeds under freeway conditions. At 70 mph the HCM indicates a total capacity of 1,200 passenger car equivalents per hour per lane. The presence of trucks reduces these volumes. As volumes build past this point speeds drop. Exhibit 11-3 of the *2010 Highway Capacity Manual* is below as Table 4.

Table 4
Highway Capacity Manual Freeway Speed/Volume Relationships

FREE FLOW SPEED	BREAKPOINT IN PASSENGER CARS/HOUR/LANE
75	1,000
70	1,200
65	1,400
60	1,600
55	1,800

Source: 2010 Highway Capacity Manual, Exhibit 11-3

Design hour traffic volumes forecast for 2035 for I-75 in almost all cases far exceeded the HCM value associated with 70 mph, indicating peak hour traffic will be much heavier than 1,200 vehicles per lane and will move much slower than 70 mph. Percentages for light, medium, and heavy commercial vehicles were also provided by the forecasting effort and were used as inputs to TNM2.5.

To conform to the MDOT Noise Handbook's guidance of using posted speeds and modeling the worst-case, TNM traffic inputs for the interstate mainline were set according to HCM volumes associated with the posted speed limit of 70 mph. Using the forecasted design hour volumes at 70 mph would over-predict noise levels.

With the HCM volume cap set at 1,200 vehicles per lane per hour, the percentage of commercial vehicles from the 2035 traffic forecast was applied to get the number of commercial vehicles in 2035. Traffic forecasting for 2035 did not include buses and motorcycles. The numbers used for these modes were based on the 2005 model runs and experience. Table 5

shows the multi-lane, one direction traffic used for the I-75 mainline. These volumes were used for both northbound and southbound mainlines.

Table 5
Mainline Traffic Volumes

VEHICLE TYPE	AMOUNT	SPEED
Auto	4,560	70
Med Truck	96	60
Heavy Truck	144	60
Buses	16	70
Motorcycle	16	70

Source: The Corradino Group of Michigan

Projected 2035 peak hour volume projections for ramps were available and used as TNM inputs after applying the provided percentages for commercial vehicles. These percentages were matched with the percentages for the corresponding mainline segment. Because service drive volumes forecasts were not available, inputs from the 2005 analysis were carried forward. Appendix D includes the traffic volumes used.

Horizontal and vertical roadway geometric data were drawn from the project's engineering reports. Elevations that were not available from the engineering reports were drawn from Google Earth.

4.4 Receivers and Dwelling Unit Equivalents

Single family homes within 500 feet of the project were entered individually as receivers in TNM2.5. For multi-family buildings receivers typically represented two to four units, depending on the layout of the buildings. Receivers were generally placed on the interstate side of the building in the front or rear of units, except in multifamily buildings where units face to one direction only. In these cases receivers were divided with one receiver facing the interstate and the other facing away from the interstate. Wherever possible, receivers were placed at the location of outdoor patios and balconies, reflecting areas of activity.

MDOT's Noise Handbook has a process for equating activity at schools, places of worship, and parks to dwelling units. The number of Dwelling Unit Equivalents (DUEs) was calculated for all impacted schools, places of worship, and parks. This process differs from the approach used in the work for the FEIS/ROD, as federal guidance changed.[1] Table 6 shows the results. Detailed tables showing DUE calculations are located in Appendix E.

[1] Pg. 39, Federal Highway Administration, *Highway Traffic Noise: Analysis and Abatement Guidance,* December 2011. "The highway agency highway traffic noise policy must also delineate how receptor units are determined for special land uses, such as parks, recreation areas, cemeteries, etc."

Table 6
Dwelling Unit Equivalents

SEGMENT	NAME	TYPE	DUEs
2	First Free Will Baptist Church	Place of Worship	10
2	Tabernacle Baptist	Place of Worship	14
2	United Oaks Elementary	School	22
2	Hazel Park Junior High	School	44
3	First Baptist	Place of Worship	7
4	Landmark Community Church	Place of Worship	30
4	Serenity Christian Church	Place of Worship	8
4	Roosevelt Elementary	School	8
5	Tabernacle of Praise	Place of Worship	7
6	New Beginning General Baptist	Place of Worship	7
10	Huber Park	Recreation Area	38
11	Firefighters Park	Recreation Area	36
12b	Heathers Club	Recreation Area	25

Source: The Corradino Group of Michigan

4.5 Federal and State Mitigation Guidance

Federal noise guidance is provided in federal regulations 23 CFR 772 and *Highway Traffic Noise: Analysis and Abatement Guidance*. Pursuant to that guidance MDOT issued its *MDOT Highway Noise Analysis and Abatement Handbook.* The latter identifies a noise impact as:

1. A 10 dB(A) increase from the existing noise level to the design year predicted level; or,

2. A predicted design year noise level that is 1 dB(A) less than the NAC levels as shown in Table 1.

The 10 dB(A) criterion is primarily for new freeway alignments where this new road introduces new noise.

Almost all receivers in this study fall into Activity Categories B or C, meaning a predicted noise level of 66 dB(A) indicates a noise impact. Commercial uses described in Activity Category E were determined to be non-sensitive to noise because of the desire to be seen by persons traveling on the interstate. Noise abatement measures block the view from the interstate.

MDOT's Noise Handbook states that for a noise wall to be feasible it must produce a noise reduction of at least 5 dB(A) for 75 percent of the impacted receivers. For a noise wall to be considered reasonable, it must cost less than $44,187 (2014) per benefitting receiver based on

a construction cost of $45 per square foot. The wall must also provide at least a 7 dB(A) noise reduction for 50 percent of the benefitting receivers. An additional goal is a 10 dB(A) noise reduction for at least one receiver.

Noise walls and berms can be considered for noise mitigation/abatement. Berms require a large area, but there is a lack of available right-of-way to accommodate the berms, therefore, recommendations are limited to noise walls.

5. Results

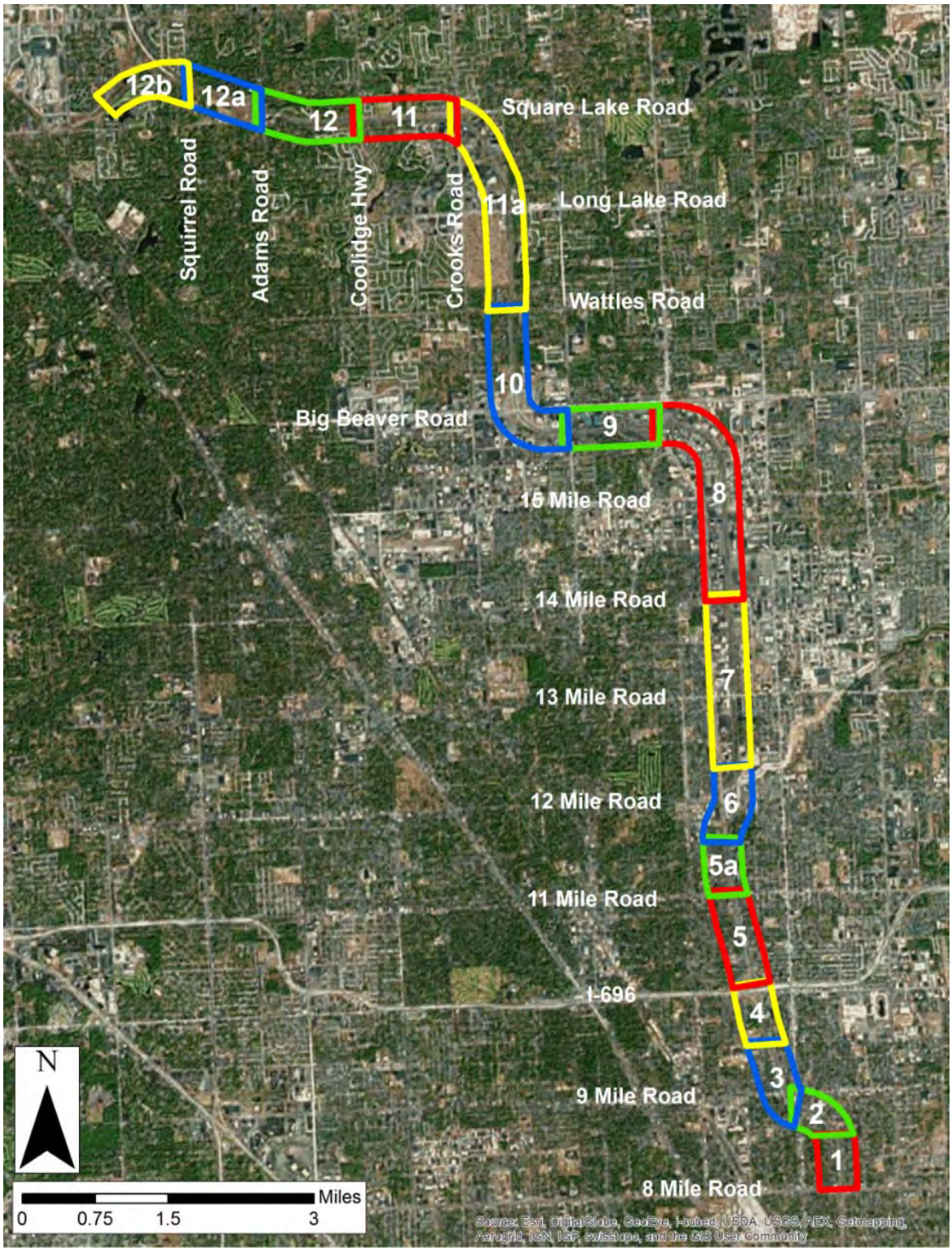
This study is a reevaluation of the noise analysis completed in 2005. Walls modeled in the original study were re-examined. Walls were modeled based on design changes that occurred since the 2005 analysis. In some cases previous walls were combined. Other previous walls were affected as redesigned ramps cut through the location where they were proposed. One new area was considered. At the time of the EIS, a Long Lake interchange was under consideration. The project was to have its own separate environmental documentation, so it was "gapped out" of the larger study. However, the Long Lake project was not completed, and the noise analysis was not conducted, so it is analyzed here.

This section details the analysis of each freeway segment, including noise wall feasibility and reasonableness. Appendix F has TNM2.5 sound level results output for the base condition without any walls. This allows for the determination of impacts and provides the basis for evaluating walls. Appendix G has the TNM2.5 output files that show the results of optimizing all the walls modeled and allows the tabulations that indicate if walls are considered feasible and reasonable. CNEs were subdivided for more efficient TNM2.5 model runs, resulting in 16 segments. Figure 10 details the segments used in modeling.

In several cases, the data for two noise walls in a CNE were combined for the feasible/reasonable test. When noise walls begin at the end of an overpass and a guardrail is present, the noise wall will be placed behind the guardrail. But such a wall would end where the guardrail ends. At that point a second wall would be positioned near the right-of-way line with the appropriate overlap. For a CNE evaluation, they are combined.

The first step in the analysis process is to identify impacts based on 2035 conditions. Receivers are referred to as impacted, not impacted, benefitting, and not benefitting. Once the analysis is undertaken and walls are modeled, values can change. The optimization process allows the modeler to test walls of various heights. Initially, the model is set up with a base wall height, estimated from experience and local conditions. The modeler can then input a number of other heights to test up and down to maximize the results for benefiting receivers and wall costs. This allows a benefit while holding the cost within the currently allowed limit of $44,187 (2014) per benefiting receiver, per guidelines.

Figure 10
TNM2.5 Segments



Source: The Corradino Group of Michigan, Inc.

5.1 Segment 1

Segment 1 begins at 8 Mile Road and ends at Meyers Avenue (Figure 11). Since the original analysis, this area has undergone design changes that shift the northbound on-ramp and southbound off-ramp associated with the 8 Mile Road interchange. This new geometry was inputted into TNM2.5. Three walls were modeled. A fourth wall had been included in the previous 2005 study, but was prohibited by the new design change that shifts the southbound off-ramp closer to 8 Mile Road. A new wall was not modeled there because only three impacted receivers would benefit. Two walls were modeled on the northbound side of I-75 that are feasible and reasonable. Wall Seg1 NB1 benefits 13 receivers at a cost of $26,079 per benefitting receiver (Table 7). Wall Seg1 NB2 benefits 15 receivers at a cost of $39,024 per benefitting receiver (Table 8).

Note that green shading in the tables generally means a wall meets a noise wall criterion, while red shading means it does not. A few exceptions are noted on individual tables and in the text.

One wall was modeled on the southbound side of I-75, but it is not feasible and reasonable as it benefits 8 receivers at a cost of $90,699 per benefitting receiver (Table 9). Figure 12 shows the walls modeled and the benefitting receivers. Walls Seg1 NB1 and NB2 are split by the new on ramp.

Figure 11
Segment 1 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 7
Wall Seg1 NB1

Impacted Receivers	9
Benefitting Receivers	13
# of Impacted with 5dB(A) reduction	9
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	7
% of Benefitting with 7dB(A) reduction	54%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 339,029
Cost per Benefitting Receiver	$26,079
Total Length	515
Average Height	14.64

Table 8
Wall Seg1 NB2

Impacted Receivers	10
Benefitting Receivers	15
# of Impacted with 5dB(A) reduction	10
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	9
% of Benefitting with 7dB(A) reduction	60%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 585,366
Cost per Benefitting Receiver	$39,024
Total Length	1057
Average Height	12.31

Table 9
Wall Seg1 SB1

Impacted Receivers	6
Benefitting Receivers	8
# of Impacted with 5dB(A) reduction	3
% of Impacted with 5dB(A) reduction	50%
# of Benefitting with 7dB(A) reduction	5
% of Benefitting with 7dB(A) reduction	63%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 725,593
Cost per Benefitting Receiver	$90,699
Total Length	1007
Average Height	16.00

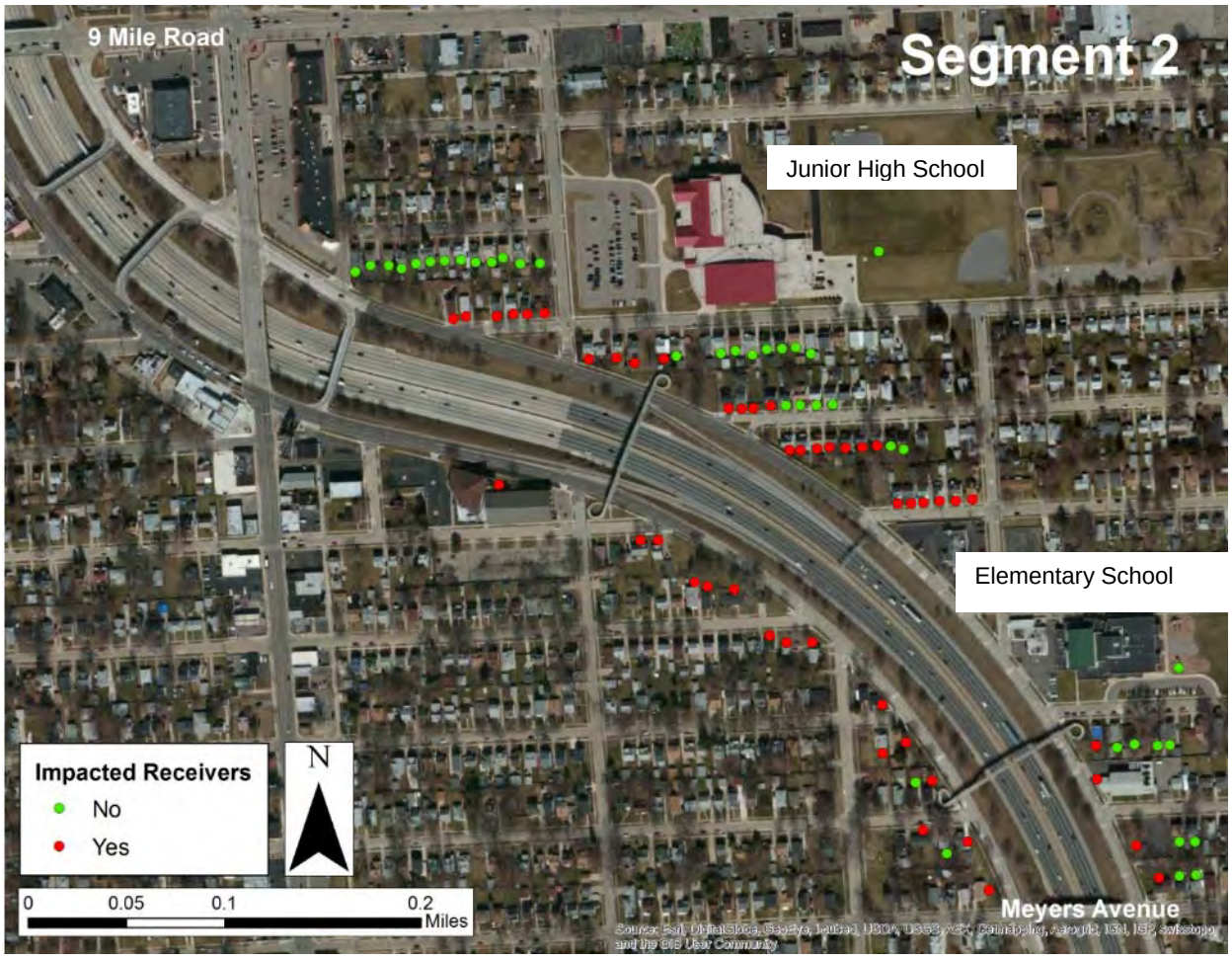
Figure 12
Segment 1 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.2 Segment 2

Segment 2 begins at Meyers Avenue and ends at 9 Mile Road (Figure 13). Two walls from the previous study were combined on the northbound side of I-75. NB Church and NB1 are now represented by Seg2 NB1. These walls were combined because an elementary school was built in the area between the two walls since the original 2005 analysis. This change allows the elementary school to benefit from a noise wall. A new junior high school was also opened in the area. It was modeled, however, it is not impacted by the highway noise (see green dot in Figure 13) and does not benefit from the walls. Another scenario was modeled on the northbound side of I-75. Wall Seg2 NB1 and Wall Seg2 NB2 were analyzed together because they serve the same CNE and are only separated because of the northbound off-ramp for 9 Mile Road. These walls are feasible and reasonable. Together they benefit 67 receivers at a cost of $20,932 per benefitting receiver (Table 10). One noise wall was modeled on the southbound side of I-75. Wall Seg2 SB1 benefits 16 receivers at a cost of $45,414 per benefitting receiver. This amount is within three percent of the MDOT criterion of $44,187, therefore, Wall Seg2 SB1 was determined to be feasible and reasonable (Table 11). Figure 14 shows the walls modeled and the benefitting receivers.

Figure 13
Segment 2 Impacted Receivers



Source: The Corradino Group of Michigan, Inc.

Table 10
Wall Seg2 NB1 and NB2

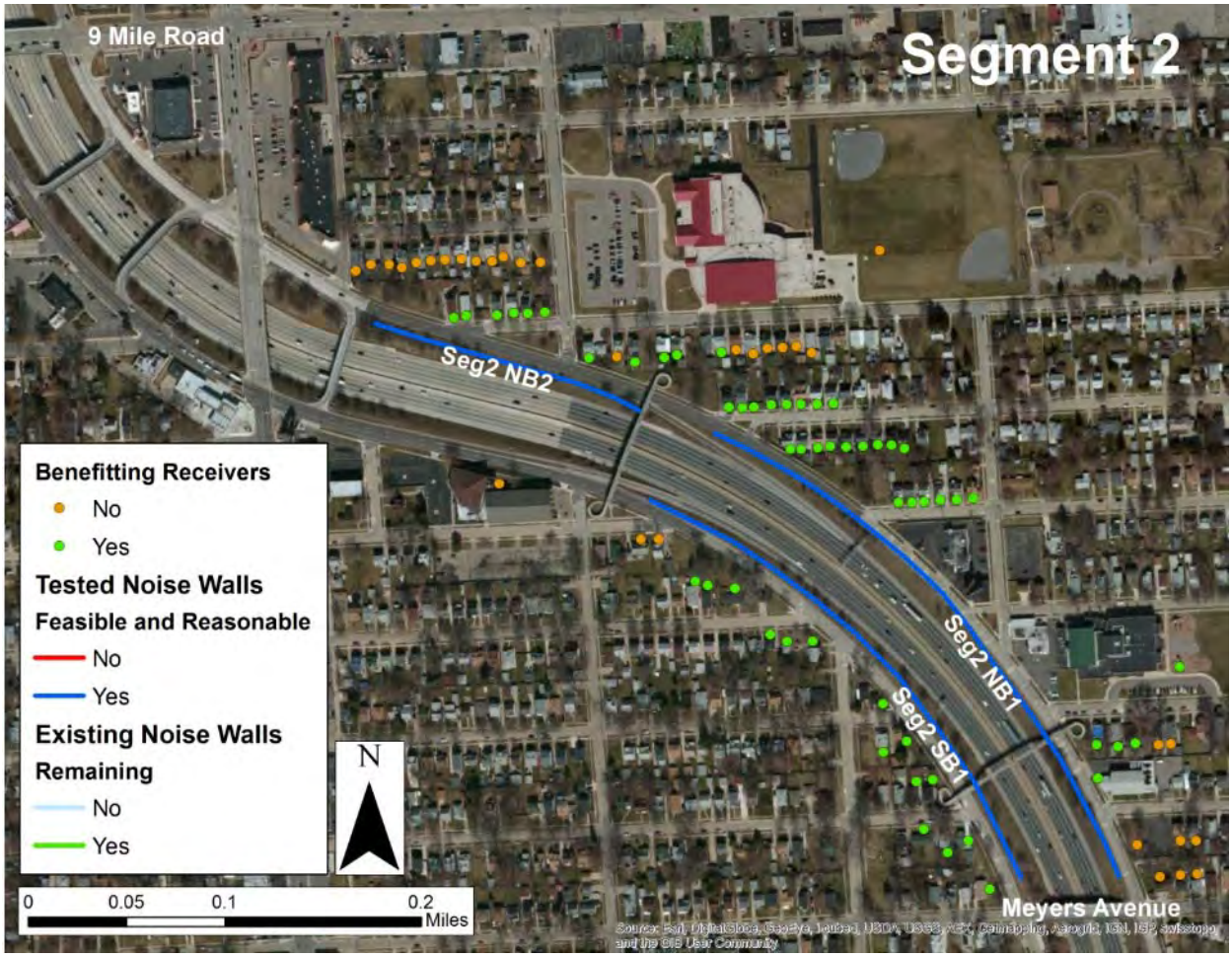
Impacted Receivers	39
Benefitting Receivers	67
# of Impacted with 5dB(A) reduction	36
% of Impacted with 5dB(A) reduction	92%
# of Benefitting with 7dB(A) reduction	34
% of Benefitting with 7dB(A) reduction	51%
# of Benefitting with 10 dB(A) reduction	2
Total Cost	$ 1,402,454
Cost per Benefitting Receiver	$20,932
Total Length	2578
Average Height	12.09

Table 11
Wall Seg2 SB1

Impacted Receivers	15
Benefitting Receivers	16
# of Impacted with 5dB(A) reduction	14
% of Impacted with 5dB(A) reduction	93%
# of Benefitting with 7dB(A) reduction	8
% of Benefitting with 7dB(A) reduction	50%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 726,6241
Cost per Benefitting Receiver	$45,414*
Total Length	1581
Average Height	9.77

*Wall is considered feasible and reasonable. See text.

Figure 14
Segment 2 Tested Noise Walls and Benefitting Receivers



Source: The Corradino Group of Michigan, Inc.

5.3 Segment 3

Segment 3 begins at 9 Mile Road and ends at Woodward Heights Boulevard (Figure 15). One wall was modeled on the northbound side of I-75. Wall Seg3 NB1 was analyzed previously but was found to not be feasible and reasonable. In this updated analysis it was found to be feasible and reasonable. Reasons for this change include changes in roadway elevations and traffic volumes, and the upgrade to the TNM2.5 software. Wall Seg3 NB1 benefits 23 receivers at a cost of $43,710 per benefitting receiver (Table 12). Wall Seg3 SB1 was also found to be feasible and reasonable. This wall is longer than what was previously proposed, thus benefitting more receivers. Wall Seg3 SB1 benefits 23 receivers at a cost of $24,456 per benefitting receiver (Table 13). Figure 16 shows the walls modeled and the benefitting receivers.

Figure 15
Segment 3 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 12
Wall Seg3 NB1

Impacted Receivers	20
Benefitting Receivers	23
# of Impacted with 5dB(A) reduction	19
% of Impacted with 5dB(A) reduction	95%
# of Benefitting with 7dB(A) reduction	18
% of Benefitting with 7dB(A) reduction	78%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 1,005,337
Cost per Benefitting Receiver	$43,710
Total Length	1322
Average Height	16.90

Table 13
Wall Seg3 SB1

Impacted Receivers	22
Benefitting Receivers	23
# of Impacted with 5dB(A) reduction	20
% of Impacted with 5dB(A) reduction	91%
# of Benefitting with 7dB(A) reduction	18
% of Benefitting with 7dB(A) reduction	78%
# of Benefitting with 10 dB(A) reduction	8
Total Cost	$ 562,491
Cost per Benefitting Receiver	$24,456
Total Length	911
Average Height	13.73

Figure 16
Segment 3 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.4 Segment 4

Segment 4 begins at Woodward Heights Boulevard and ends at I-696 (Figure 17). One wall was modeled on the northbound side of I-75. Wall Seg4 NB1 was found to be feasible and reasonable. It benefits 13 receivers at a cost of $42,444 per benefitting receiver (Table 14) and meets all criteria, except no receiver achieves a 10 dB(A) reduction. However, the church was determined to be close enough to the 10 dB(A) reduction as it is at 9 dB(A). Two walls were modeled on the southbound side of I-75. Wall Seg4 SB1 was found to not be feasible and reasonable (Table 15). Wall Seg4 SB2 was determined to be feasible and reasonable. It benefits 22 receivers at a cost of $42,067 (Table 16) and meets all criteria except that no receiver achieves a 10 dB(A) reduction. It was approved in the previous analysis because it benefited Roosevelt Elementary School. The decision here again considers the wall feasible and reasonable because of the protection to the school that is provided. Figure 18 shows the walls modeled and the benefitting receivers.

Figure 17
Segment 4 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 14
Wall Seg4 NB1

Impacted Receivers	13
Benefitting Receivers	13
# of Impacted with 5dB(A) reduction	12
% of Impacted with 5dB(A) reduction	92%
# of Benefitting with 7dB(A) reduction	11
% of Benefitting with 7dB(A) reduction	85%
# of Benefitting with 10 dB(A) reduction	0*
Total Cost	$ 551,769
Cost per Benefitting Receiver	$42,444
Total Length	816
Average Height	15.04

*Wall is considered feasible and reasonable. See text.

Table 15
Wall Seg4 SB1

Impacted Receivers	2
Benefitting Receivers	0
# of Impacted with 5dB(A) reduction	0
% of Impacted with 5dB(A) reduction	0%
# of Benefitting with 7dB(A) reduction	0
% of Benefitting with 7dB(A) reduction	N/A
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 209,242
Cost per Benefitting Receiver	N/A
Total Length	465
Average Height	10.00

Table 16
Wall Seg4 SB2

Impacted Receivers	14
Benefitting Receivers	22
# of Impacted with 5dB(A) reduction	13
% of Impacted with 5dB(A) reduction	93%
# of Benefitting with 7dB(A) reduction	12
% of Benefitting with 7dB(A) reduction	55%
# of Benefitting with 10 dB(A) reduction	0*
Total Cost	$ 925,466
Cost per Benefitting Receiver	$42,067
Total Length	1794
Average Height	13.80

Wall is considered feasible and reasonable. See text.

Figure 18
Segment 4 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.5 Segment 5

Segment 5 begins at I-696 and ends at 11 Mile Road (Figures 19 and 20). There are currently noise walls on both sides of the freeway in this segment. Existing walls on the southbound side of I-75 will remain, although the existing wall on the southbound side between I-696 and Lincoln was tested due to the new ramp configuration on the east side of I-75. However, all walls on the northbound side of I-75 will be removed, as this section is being completely redesigned. The new design involves a ramp structure that will elevate the ramp from westbound I-696 to I-75 north approximately 43 feet above the mainline. The elevation of this ramp will essentially block noise from the freeway for the homes on the northbound side of I-75. The result of this design is that noise walls built on the freeway side of the northbound service drive are not able to provide enough protection for any of the receivers to achieve a 5 dB(A) reduction, because most of the noise is being mitigated by the new ramp structure.

Several alternatives were modeled for this segment to ensure the results. The preferred alternative includes seven noise walls on the northbound side of I-75 (Figures 21 and 22). Wall Seg5 NB1 through Seg5 NB4 were found to not be feasible and reasonable (Table 17). They do not meet the criteria needed for noise walls. Wall Seg5 NB5 through Seg5 NB7 did not meet the feasible and reasonable criteria either. However, they are recommended due to the very high number of benefitting receivers (55), the high number of receivers (7) with a 10 dB(A) reduction, and the cost per benefitting receiver ($32,112) (Table 18). Walls Seg5 NB6 and NB7 are split by the new on ramp.

Southbound the existing wall on the west side of I-75 north of I-696 in Segment 5 protects a neighborhood in Royal Oak. Due to the height of the braid ramp (43 feet) TNM2.5 was run to see whether noise from the new ramp would pass over the existing west side wall, which had not been tested earlier. Analysis found impacted receivers behind the existing noise wall, concentrated on the two blocks north of Brockton Avenue. This area should be well protected by the existing wall (Figure 21). Another TNM2.5 run was made that modified the speed on the ramp to see whether that had any effect on impacts. Noise levels on the east side of I-75 went down, but there was no change on the west side. This means the impact is not coming from the ramp, but rather, from the traffic on the southbound service drive in that area. So, increasing the existing wall height will have no effect, as impacts do not result from changes to I-75.

The existing southbound wall north of Lincoln Avenue was incorporated in the TNM2.5 model run test noted above, but no impacts were found north of Lincoln Avenue.

Figure 19
Segment 5 Impacted Receivers
(Southern Section)

Source: The Corradino Group of Michigan, Inc.

Figure 20
Segment 5 Impacted Receivers
(Northern Section)

Source: The Corradino Group of Michigan, Inc.

Table 17
Wall Seg5 NB 1 through NB4

Impacted Receivers	18
Benefitting Receivers	0
# of Impacted with 5dB(A) reduction	0
% of Impacted with 5dB(A) reduction	0%*
# of Benefitting with 7dB(A) reduction	0
% of Benefitting with 7dB(A) reduction	N/A
# of Benefitting with 10 dB(A) reduction	0*
Total Cost	$ 641,827
Cost per Benefitting Receiver	N/A
Total Length	1551
Average Height	9.19

*Wall is considered feasible and reasonable. See text.

Table 18
Wall Seg 5 NB5 through NB7

Impacted Receivers	52
Benefitting Receivers	55
# of Impacted with 5dB(A) reduction	33
% of Impacted with 5dB(A) reduction	63%*
# of Benefitting with 7dB(A) reduction	24
% of Benefitting with 7dB(A) reduction	44%*
# of Benefitting with 10 dB(A) reduction	7
Total Cost	$ 1,766,167
Cost per Benefitting Receiver	$32,112
Total Length	2552
Average Height	15.37

*Wall is considered feasible and reasonable. See text.

Figure 21
Segment 5 Tested Noise Walls and Benefitting Receivers
(Southern Section)

Source: The Corradino Group of Michigan, Inc.

Figure 22
Segment 5 Tested Noise Walls and Benefitting Receivers
(Northern Section)

Source: The Corradino Group of Michigan, Inc.

5.6 Segment 5a

Segment 5a begins at 11 Mile Road and ends at Gardenia Avenue (Figure 23). This segment was not modeled in the previous analysis because there were no significant design changes. There are existing noise walls on both sides of the freeway. Both the northbound on-ramp and the southbound off-ramp have been shifted north approximately two blocks, requiring an analysis. Walls were modeled and maximized where possible to increase the number of benefitting receivers.

Wall Seg5a NB1 replaces the existing wall as closely as possible, but is not feasible and reasonable (Table 19). With the on-ramp shifting to the north, traffic will remain on the service drive farther. Wall Seg5a NB1 cannot block this service drive noise. Wall Seg5a NB2 replaces an existing noise wall, which is recommended for replacement. It does not meet all criteria, however, it is recommended due to the high number of benefitting receivers (51), four receivers achieving a noise reduction of 8 dB(A), and the low cost per benefitting receiver ($15,648) (Table 20). Wall Seg5a SB1 was modeled as a replacement of an existing wall, but it is not recommended because it is not feasible and reasonable (Table 21). Figure 24 shows the walls modeled and the benefitting receivers.

Figure 23
Segment 5a Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 19
Wall Seg5a NB1

Impacted Receivers	46
Benefitting Receivers	18
# of Impacted with 5dB(A) reduction	17
% of Impacted with 5dB(A) reduction	37%
# of Benefitting with 7dB(A) reduction	2
% of Benefitting with 7dB(A) reduction	11%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 721,606
Cost per Benefitting Receiver	$40,089
Total Length	1004
Average Height	16.00

Table 20
Wall Seg5a NB2

Impacted Receivers	34
Benefitting Receivers	51
# of Impacted with 5dB(A) reduction	26
% of Impacted with 5dB(A) reduction	76%
# of Benefitting with 7dB(A) reduction	16
% of Benefitting with 7dB(A) reduction	31%*
# of Benefitting with 10 dB(A) reduction	0*
Total Cost	$ 798,073
Cost per Benefitting Receiver	$15,648
Total Length	1234
Average Height	14.34

*Wall is considered feasible and reasonable. See text.

Table 21
Wall Seg5a SB1

Impacted Receivers	19
Benefitting Receivers	12
# of Impacted with 5dB(A) reduction	10
% of Impacted with 5dB(A) reduction	53%
# of Benefitting with 7dB(A) reduction	1
% of Benefitting with 7dB(A) reduction	8%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 814,802
Cost per Benefitting Receiver	$67,900
Total Length	862
Average Height	16.00

Figure 24
Segment 5a Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.7 Segment 6

Segment 6 begins at Gardenia Avenue and ends just north of 12 Mile Road (Figure 25). A design change at the 12 Mile Road Interchange required this segment to be rebuilt in TNM2.5. The primary change is the southbound off-ramp is shifted closer to the mainline. One wall was modeled on the northbound side of I-75. Wall Seg6 NB1 was found to be feasible and reasonable (Table 22). Two walls were modeled on the southbound side of I-75. Wall Seg6 SB1 was included in the previous study, but was lengthened in this analysis to benefit more receivers. This longer version is considered feasible and reasonable (Table 23). Wall Seg6 SB2 was again found to not be feasible and reasonable (Table 24). The sight distance requirement for the intersection of the service drive with Gardenia Avenue prevents this wall from being long enough to benefit enough receivers. Figure 26 shows the walls modeled and the benefitting receivers.

Figure 25
Segment 6 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 22
Wall Seg6 NB1

Impacted Receivers	18
Benefitting Receivers	26
# of Impacted with 5dB(A) reduction	14
% of Impacted with 5dB(A) reduction	78%
# of Benefitting with 7dB(A) reduction	13
% of Benefitting with 7dB(A) reduction	50%
# of Benefitting with 10 dB(A) reduction	2
Total Cost	$1,014,994
Cost per Benefitting Receiver	$39,038
Total Length	1821
Average Height	12.40

Table 23
Wall Seg6 SB1

Impacted Receivers	10
Benefitting Receivers	14
# of Impacted with 5dB(A) reduction	10
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	9
% of Benefitting with 7dB(A) reduction	64%
# of Benefitting with 10 dB(A) reduction	4
Total Cost	$ 570,743
Cost per Benefitting Receiver	$40,767
Total Length	653
Average Height	19.40

Table 24
Wall Seg6 SB2

Impacted Receivers	24
Benefitting Receivers	16
# of Impacted with 5dB(A) reduction	16
% of Impacted with 5dB(A) reduction	67%
# of Benefitting with 7dB(A) reduction	0
% of Benefitting with 7dB(A) reduction	0%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 364,788
Cost per Benefitting Receiver	$22,799
Total Length	676
Average Height	12.00

Figure 26
Segment 6 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.8 Segment 7

Segment 7 begins just north of 12 Mile Road and ends at 14 Mile Road (Figure 27). Two walls were modeled on the northbound side of I-75. Wall Seg7 NB1 and Seg7 NB2 were analyzed as one wall because they serve the same CNE. The reason there are two walls is that at the southern end of the segment, I-75 crosses over 13 Mile Road. From the end of the I-75 bridge the wall must be placed along the freeway where the guardrail is currently located. Where the guardrail ends the wall should be placed near the right-of-way line, if site conditions allow. The two walls should overlap by an amount four times the distance between them. The receivers were placed at units, rather than common outdoor activity areas, consistent with the previous analysis. Walls Seg7 NB1 and Seg7 NB2 are feasible and reasonable with 144 benefitting receivers at a cost of $19,407 per benefitting receiver (Table 25). Figure 28 shows the walls modeled and the benefitting receivers.

Figure 27
Segment 7 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 25
Walls Seg7 NB1 and NB2

Impacted Receivers	148
Benefitting Receivers	144
# of Impacted with 5dB(A) reduction	144
% of Impacted with 5dB(A) reduction	97%
# of Benefitting with 7dB(A) reduction	120
% of Benefitting with 7dB(A) reduction	83%
# of Benefitting with 10 dB(A) reduction	76
Total Cost	$ 2,794,569
Cost per Benefitting Receiver	$19,407
Total Length	3964
Average Height	15.67

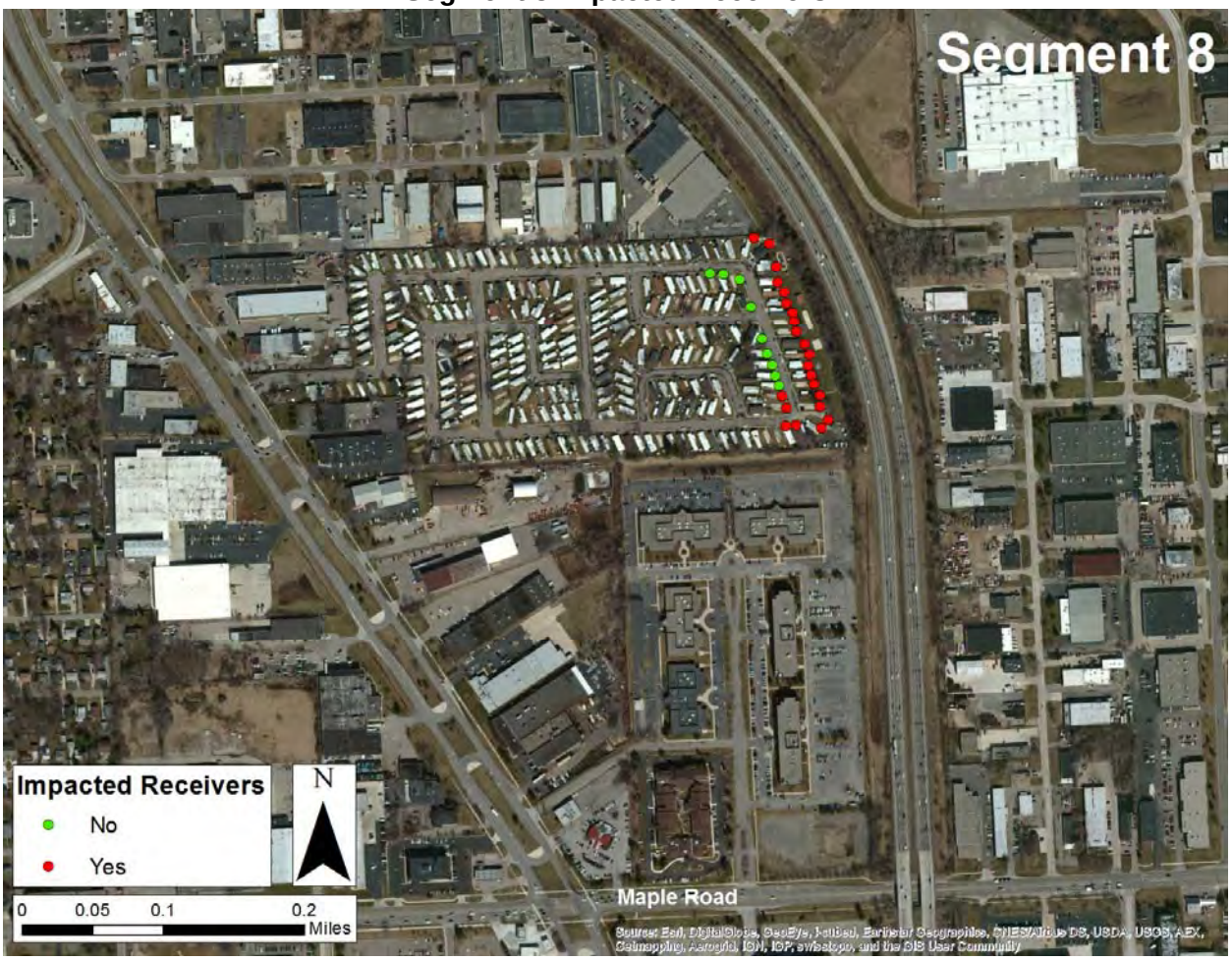
Figure 28
Segment 7 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.9 Segment 8

Segment 8 begins at 14 Mile Road and ends at Rochester Road. Only the section of I-75 between Maple Road and Rochester Road was modeled (Figure 29) because the commercial land uses between 14 Mile Road and Maple Road are not sensitive to highway noise. One wall was modeled on the southbound side of I-75. Wall Seg8 SB1 benefits 31 receivers at a cost of $24,861 per benefitting receiver, making it feasible and reasonable (Table 26). This was included in the previous analysis, but was lengthened slightly to benefit more receivers. Figure 30 shows the wall modeled and the benefitting receivers.

Figure 29
Segment 8 Impacted Receivers



Source: The Corradino Group of Michigan, Inc.

Table 26
Wall Seg8 SB1

Impacted Receivers	22
Benefitting Receivers	31
# of Impacted with 5dB(A) reduction	22
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	27
% of Benefitting with 7dB(A) reduction	87%
# of Benefitting with 10 dB(A) reduction	18
Total Cost	$770,701
Cost per Benefitting Receiver	$24,861
Total Length	1223
Average Height	14.00

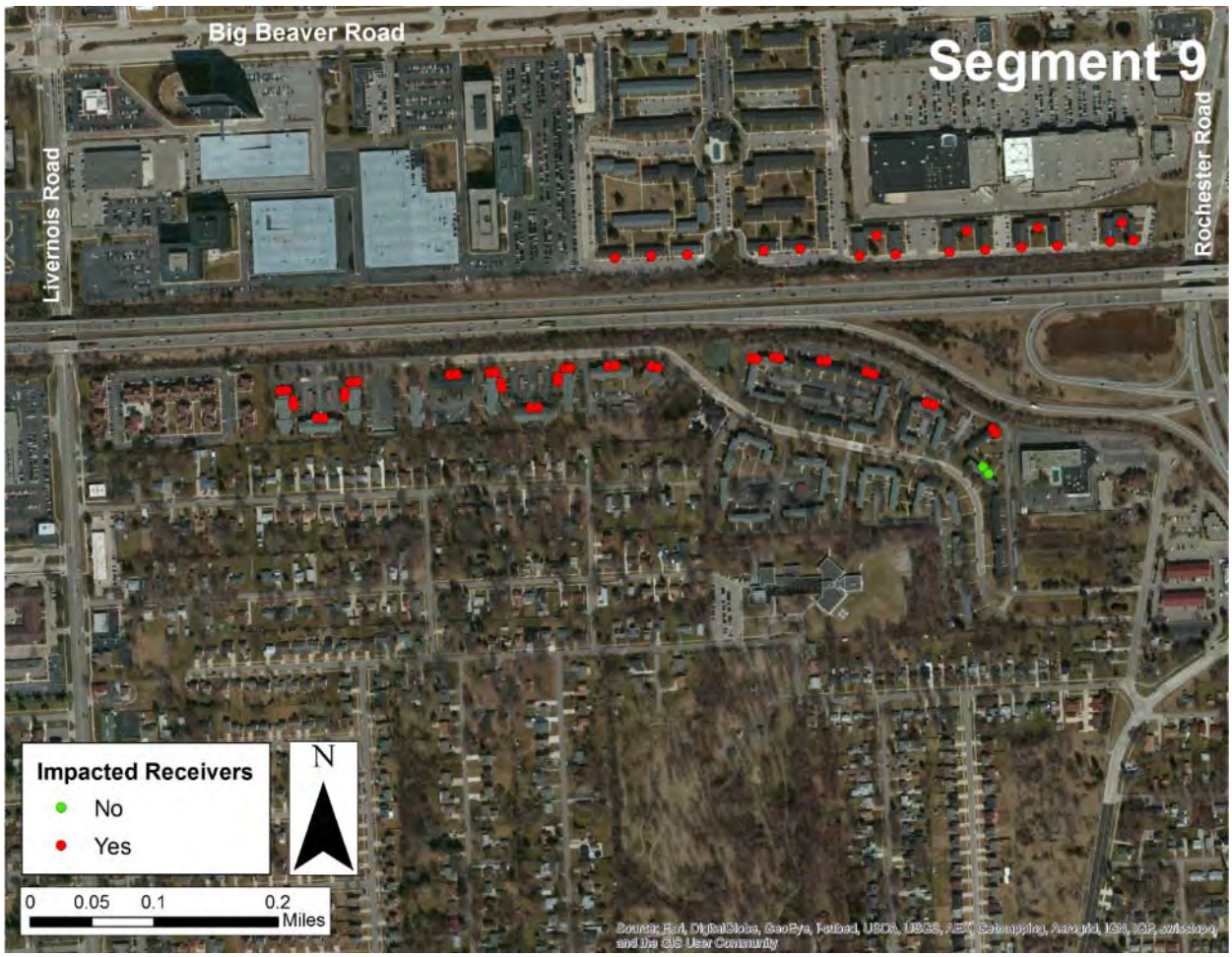
Figure 30
Segment 8 Tested Noise Wall and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.10 Segment 9

Segment 9 begins at Rochester Road and ends at Livernois Road (Figure 31.) Two walls were modeled on the northbound side of I-75 and two on the southbound side of I-75. In both, two walls were necessary due to the overpasses at both ends of the segment. Similar to the walls discussed in Segment 7, these walls are placed at the location of the guardrail where required and at the right-of-way line where it allows. Wall Seg9 NB1 and Seg9 NB2 benefit 45 receivers at a cost of $29,478 per benefitting receiver, making them feasible and reasonable (Table 27). Wall Seg9 SB1 and Seg9 SB2 benefit 135 receivers at a cost of $17,896 per benefitting receiver and are feasible and reasonable (Table 28). Figure 32 shows the walls modeled and the benefitting receivers.

Figure 31
Segment 9 Impacted Receivers



Source: The Corradino Group of Michigan, Inc.

Table 27
Wall Seg9 NB1 and NB2

Impacted Receivers	45
Benefitting Receivers	45
# of Impacted with 5dB(A) reduction	45
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	45
% of Benefitting with 7dB(A) reduction	100%
# of Benefitting with 10 dB(A) reduction	3
Total Cost	$ 1,326,493
Cost per Benefitting Receiver	$29,478
Total Length	2650
Average Height	11.12

Table 28
Wall Seg9 SB1 and SB2

Impacted Receivers	141
Benefitting Receivers	135
# of Impacted with 5dB(A) reduction	135
% of Impacted with 5dB(A) reduction	96%
# of Benefitting with 7dB(A) reduction	117
% of Benefitting with 7dB(A) reduction	87%
# of Benefitting with 10 dB(A) reduction	15
Total Cost	$ 2,415,935
Cost per Benefitting Receiver	$17,896
Total Length	3494
Average Height	15.35

Figure 32
Segment 9 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.11 Segment 10

Segment 10 begins at Livernois Road and ends at Wattles Road. Only the section immediately south of Wattles Road was modeled (Figure 33), because the commercial land uses from Livernois Road to the north end of the Big Beaver interchange are not sensitive to highway noise. One wall was modeled on the southbound side of I-75. Wall Seg10 SB1 benefits 80 receivers at a cost of $17,385 and is feasible and reasonable (Table 29). Figure 34 shows the wall modeled and the benefitting receivers.

Figure 33
Segment 10 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 29
Wall Seg10 SB1

Impacted Receivers	76
Benefitting Receivers	80
# of Impacted with 5dB(A) reduction	75
% of Impacted with 5dB(A) reduction	99%
# of Benefitting with 7dB(A) reduction	70
% of Benefitting with 7dB(A) reduction	88%
# of Benefitting with 10 dB(A) reduction	44
Total Cost	$ 1,390,790
Cost per Benefitting Receiver	$17,385
Total Length	2754
Average Height	11.22

Figure 34
Segment 10 Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.12 Segment 11a

Segment 11a begins at Wattles Road and ends at Long Lake Road (Figure 35). This segment was not included in the previous analysis because it was to be part of the Long Lake Road interchange project. Since the project was cancelled, this area was analyzed. One wall was modeled on the northbound side of I-75. Wall Seg11a NB1 serves the houses on Lange Drive, Carter Drive, and Paragon Drive at the south end. This wall benefits 17 receivers at a cost of $44,184 per benefitting receiver and is feasible and reasonable (Table 30). One wall was modeled on the southbound side of I-75. Wall Seg11a SB1 benefits 62 receivers at a cost of $15,766 per benefitting receiver and is feasible and reasonable (Table 31). Figure 36 shows the walls modeled and the benefitting receivers.

Figure 35
Segment 11a Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 30
Wall Seg11a NB1

Impacted Receivers	11
Benefitting Receivers	17
# of Impacted with 5dB(A) reduction	11
% of Impacted with 5dB(A) reduction	100%
# of Benefitting with 7dB(A) reduction	10
% of Benefitting with 7dB(A) reduction	59%
# of Benefitting with 10 dB(A) reduction	2
Total Cost	$ 751,135
Cost per Benefitting Receiver	$44,184
Total Length	1587
Average Height	10.54

Table 31
Wall Seg11a SB1

Impacted Receivers	34
Benefitting Receivers	62
# of Impacted with 5dB(A) reduction	26
% of Impacted with 5dB(A) reduction	76%
# of Benefitting with 7dB(A) reduction	40
% of Benefitting with 7dB(A) reduction	65%
# of Benefitting with 10 dB(A) reduction	6
Total Cost	$ 978,139
Cost per Benefitting Receiver	$15,776
Total Length	1207
Average Height	18.00

Figure 36
Segment 11a Tested Noise Walls and Benefitting Receivers

Source: The Corradino Group of Michigan, Inc.

5.13 Segment 11

Segment 11 begins at Long Lake Road and ends at Coolidge Highway. Only the area between Crooks Road and Coolidge Highway was modeled (Figure 37), because the commercial land uses between Long Lake Road and Crooks Road are not sensitive to highway noise. Three walls were modeled on the northbound side of I-75. None was found to be feasible or reasonable. Three different scenarios were modeled, but none could benefit enough receivers, even with 36 DUEs assigned to Firefighters Park (Tables 32-34). The primary reasons for this are the distance from the freeway, the lack of density, and the presence of Square Lake Road between the walls and the receivers. Four walls were modeled on the southbound side of I-75. Walls Segments 11 SB1 through SB4 were analyzed together because they serve a common noise environment. The walls were split because two had to be placed at the location of the guardrail and two near the right-of-way line. Together these walls benefit 100 receivers at a cost of $30,112, making all of them feasible and reasonable (Table 35). Figure 38 shows the walls modeled and the benefitting receivers.

Figure 37
Segment 11 Impacted Receivers

Source: The Corradino Group of Michigan, Inc.

Table 32
Wall Seg11 NB1

Impacted Receivers	9
Benefitting Receivers	3
# of Impacted with 5dB(A) reduction	3
% of Impacted with 5dB(A) reduction	33%
# of Benefitting with 7dB(A) reduction	0
% of Benefitting with 7dB(A) reduction	0%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 1,193,067
Cost per Benefitting Receiver	$397,689
Total Length	1893
Average Height	14.00

Table 33
Wall Seg11 NB 1 through NB3

Impacted Receivers	50
Benefitting Receivers	40
# of Impacted with 5dB(A) reduction	42
% of Impacted with 5dB(A) reduction	84%
# of Benefitting with 7dB(A) reduction	20
% of Benefitting with 7dB(A) reduction	50%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 1,887,078
Cost per Benefitting Receiver	$47,177
Total Length	4844
Average Height	8.65

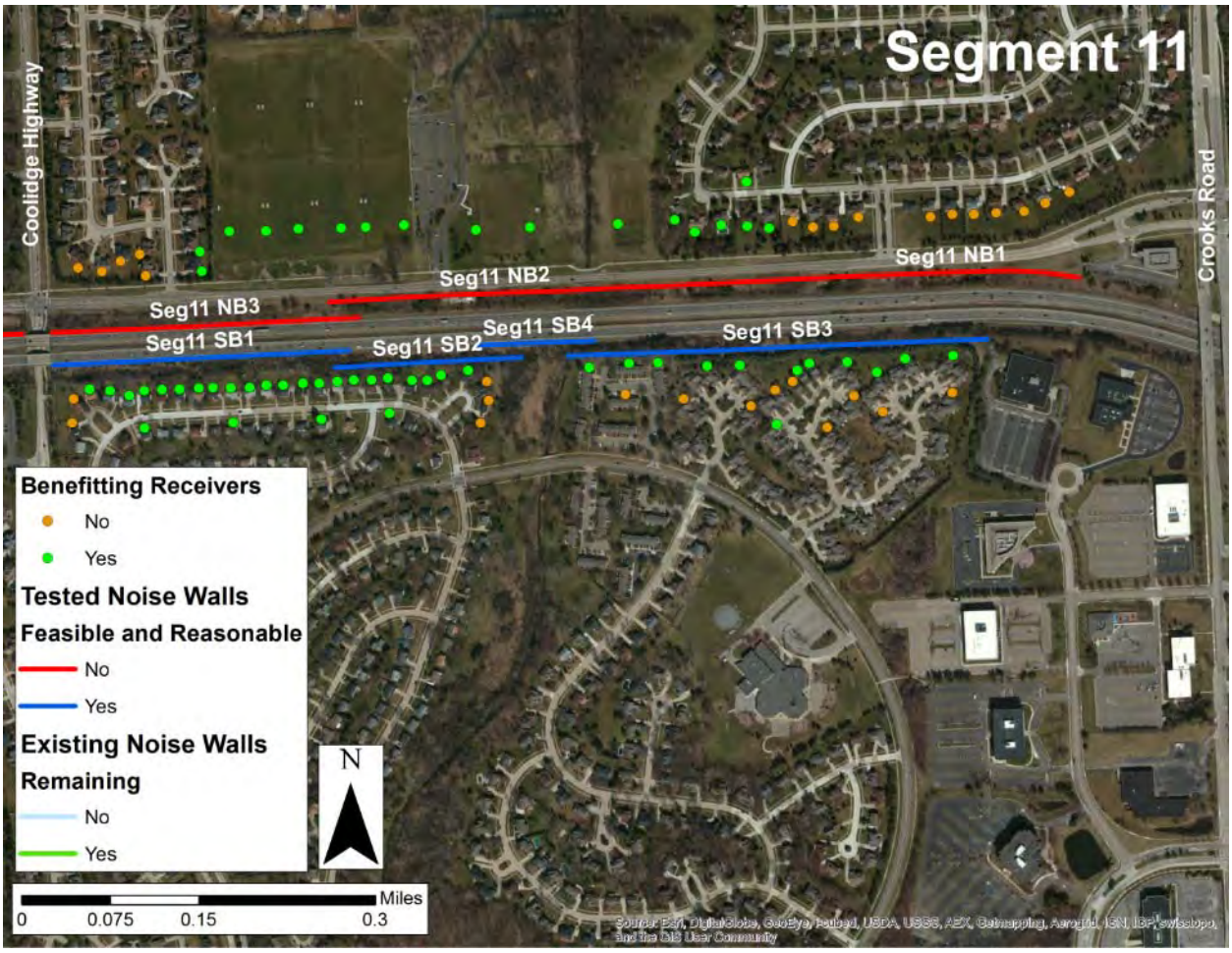
Table 34
Wall Seg1 NB2 and NB3

Impacted Receivers	41
Benefitting Receivers	35
# of Impacted with 5dB(A) reduction	34
% of Impacted with 5dB(A) reduction	83%
# of Benefitting with 7dB(A) reduction	20
% of Benefitting with 7dB(A) reduction	57%
# of Benefitting with 10 dB(A) reduction	0
Total Cost	$ 1,739,464
Cost per Benefitting Receiver	$49,699
Total Length	2951
Average Height	13.08

Table 35
Wall Seg11 SB1 through SB4

Impacted Receivers	87
Benefitting Receivers	100
# of Impacted with 5dB(A) reduction	86
% of Impacted with 5dB(A) reduction	99%
# of Benefitting with 7dB(A) reduction	70
% of Benefitting with 7dB(A) reduction	70%
# of Benefitting with 10 dB(A) reduction	37
Total Cost	$ 3,011,160
Cost per Benefitting Receiver	$30,112
Total Length	4567
Average Height	14.64

Figure 38
Segment 11 Tested Noise Walls and Benefitting Receivers

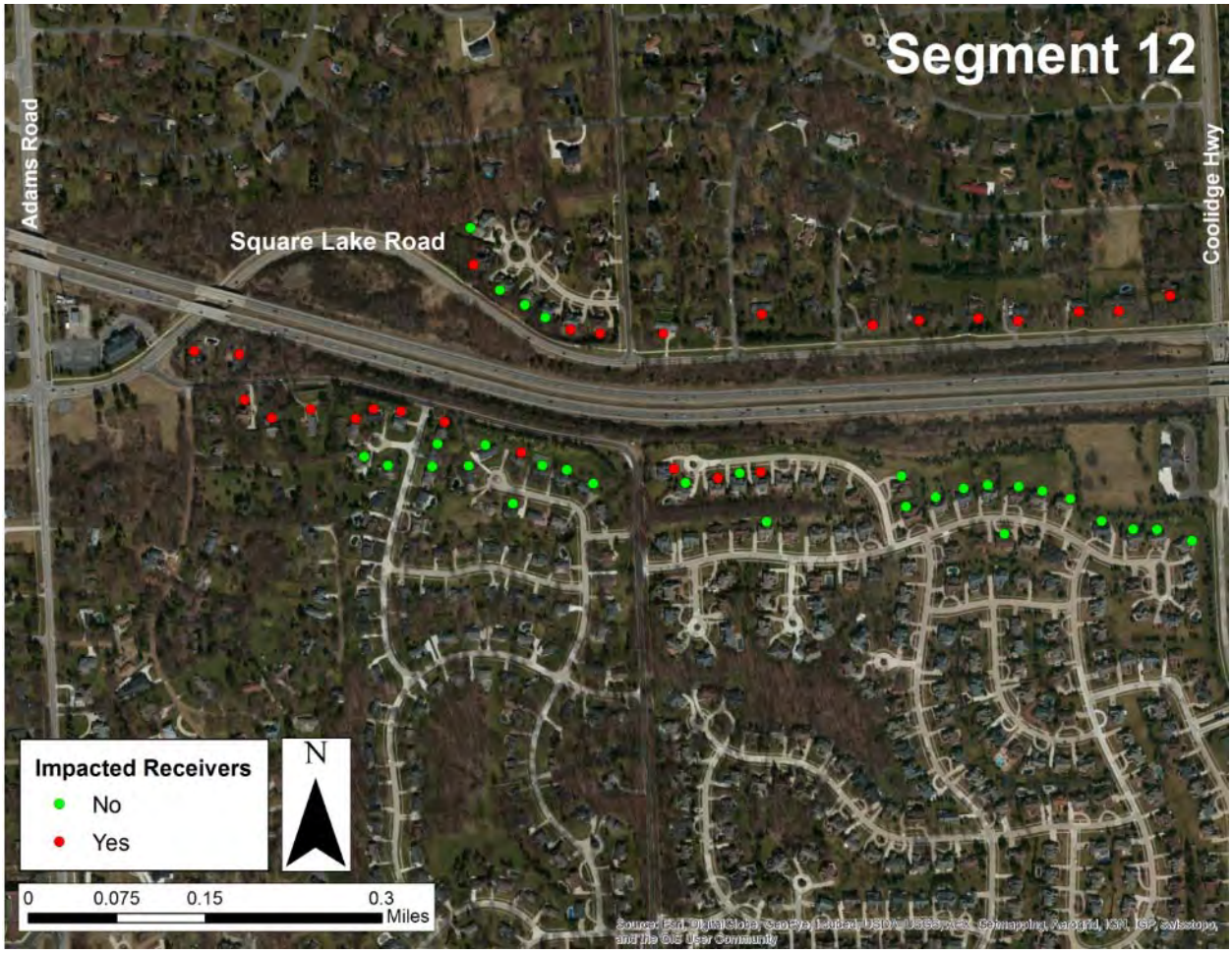


Source: The Corradino Group of Michigan, Inc.

5.14 Segment 12

Segment 12 begins at Coolidge Highway and ends at Adams Road (Figure 39). This segment was modeled previously, but no walls were modeled then because of the spread out nature of the small number of impacted receivers, indicating walls would not be reasonable. For the sake of completeness, walls were modeled in this updated analysis, but the earlier conclusion remains unchanged. Walls are not feasible and reasonable. Two walls were modeled on the northbound side of I-75. These walls were split because one had to be placed at the location of the guardrail near the Coolidge Highway overpass. Wall Seg12 NB1 and Seg12 NB2 are not feasible and reasonable (Table 36). Two walls were modeled on the southbound side of I-75. These walls were split because one wall had to be placed at the location of the guardrail near the Square Lake Road overpass. Wall Seg12 SB1 and Seg12 SB2 are not feasible and reasonable (Table 37). Figure 40 shows the walls modeled and the benefitting receivers.

Figure 39
Segment 12 Impacted Receivers



Source: The Corradino Group of Michigan, Inc.

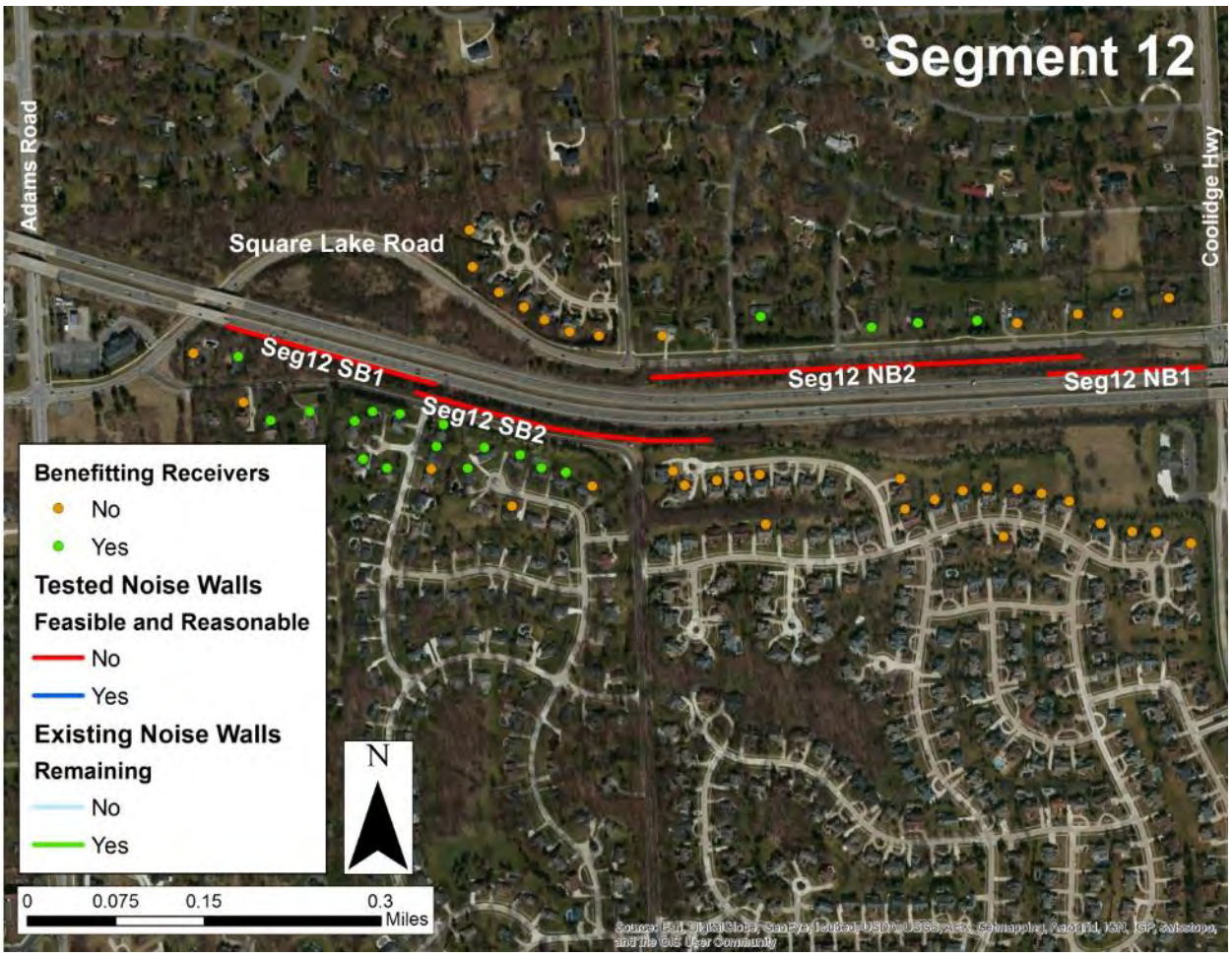
Table 36
Wall Seg12 NB1 and NB2

Impacted Receivers	10
Benefitting Receivers	4
# of Impacted with 5dB(A) reduction	4
% of Impacted with 5dB(A) reduction	40%
# of Benefitting with 7dB(A) reduction	1
% of Benefitting with 7dB(A) reduction	25%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 1,861,926
Cost per Benefitting Receiver	$465,482
Total Length	2584
Average Height	16.00

Table 37
Wall Seg12 SB1 and SB2

Impacted Receivers	10
Benefitting Receivers	15
# of Impacted with 5dB(A) reduction	8
% of Impacted with 5dB(A) reduction	80%
# of Benefitting with 7dB(A) reduction	10
% of Benefitting with 7dB(A) reduction	67%
# of Benefitting with 10 dB(A) reduction	1
Total Cost	$ 1,782,427
Cost per Benefitting Receiver	$118,828
Total Length	2327
Average Height	17.02

Figure 40
Segment 12 Tested Noise Walls and Benefitting Receivers



Source: The Corradino Group of Michigan, Inc.

5.15 Segment 12a

Segment 12a was created to model the Adams Woods community (Figure 41). This area was examined in the previous study. There was and still is an existing private wall built by that community along the freeway. The model for this segment includes the Adams Woods wall as part of the existing terrain. The modeling found only six impacted receivers. A new noise wall was not modeled in this location because of the few impacts.

Figure 41
Segment 12a Impacted Receivers

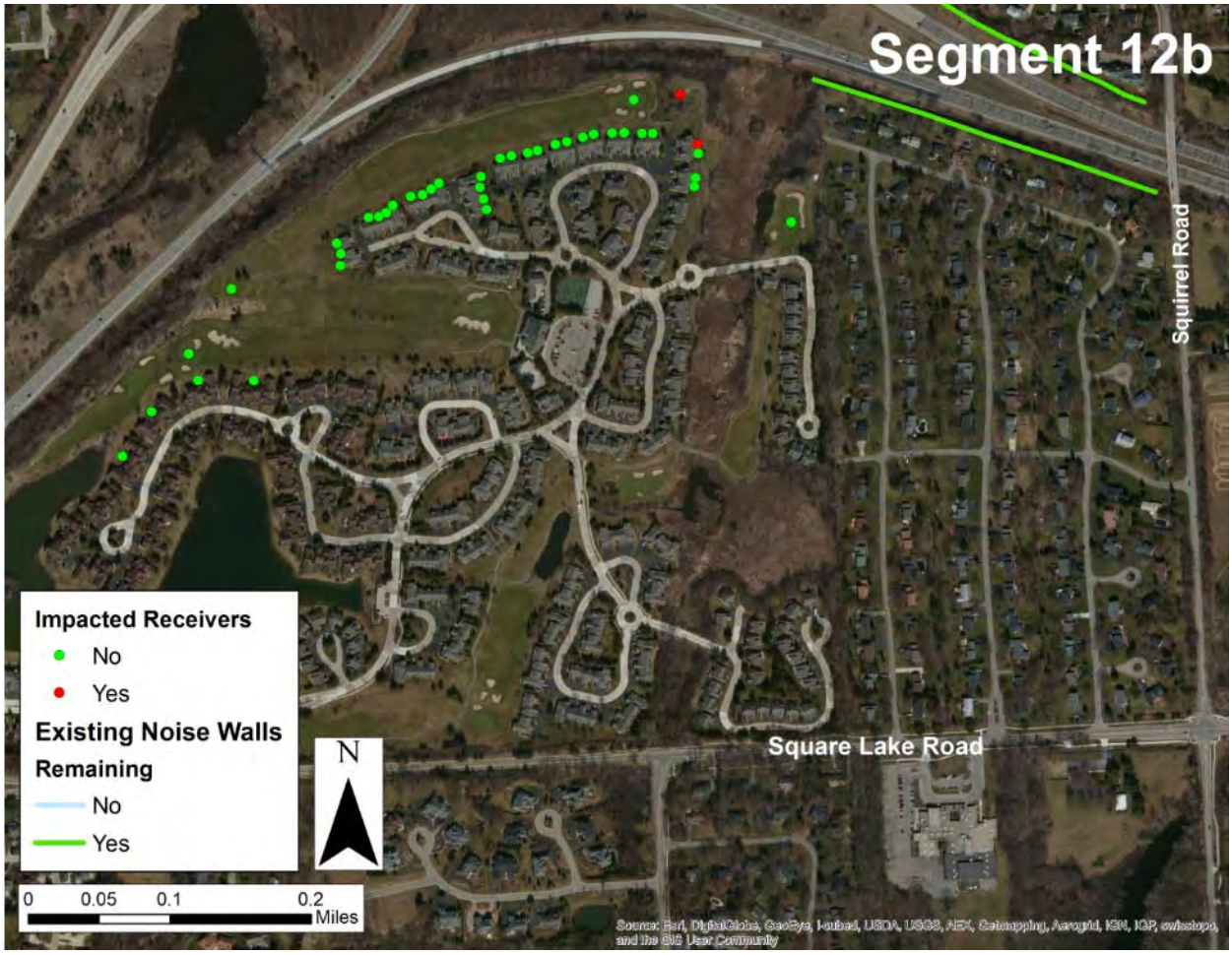
Source: The Corradino Group of Michigan, Inc.

5.16 Segment 12b

Segment 12b was created to model the area around the Heathers Condominiums (Figure 42). It was not included in the previous analysis since at that time no design changes were proposed. Since then the design has changed. The on-ramp from Square Lake Road to I-75 South is being shifted away from the Heathers Condominiums, and the northbound main line is being placed alongside the southbound mainline. The updated design also relocates the I-75 northbound exit ramp to Square Lake Road from the left side of the freeway to a traditional right-side exit.

A wall was not modeled here because there are only six impacted receivers in this area, five of which are assigned to an elevated tee box on the golf course. Only one dwelling unit is impacted.

Figure 42
Segment 12b Impacted Receivers



Source: The Corradino Group of Michigan, Inc.

6. Conclusions and Recommendations

This analysis found earlier walls are still feasible and reasonable. Exceptions include locations where post ROD engineering shifted ramps in such a way that the ramps occupy space where a wall had previously been planned. Table 38 shows the "old" wall name in the column titled "2005 Name." The next column shows the name assigned to the wall for this updated analysis and represents design horizon year 2035 conditions. The result of this analysis is that 30 noise walls are recommended for inclusion into the project. Sixteen other walls were modeled, but failed the feasibility/reasonability tests required for construction (Table 39). Detailed tables with X/Y coordinates, base elevations, and wall heights for engineering walls are included in Appendix H.

The total noise wall construction length at the time of the ROD was 4.9 miles. With this analysis it has increased to 7.3 miles. In some cases new receivers were identified and some walls formerly considered separately were combined in a way that abatement criteria are still met. Other walls proposed earlier were lengthened.

> *Statement of Likelihood*
> Based on the studies thus far accomplished, the Michigan Department of Transportation intends to install highway traffic noise abatement in the form of barriers listed in Table ES-1. The preliminary indications of likely abatement measures are based on preliminary design for barrier costs and noise reduction as reported in Section 5 of this document. If it subsequently develops during final design that these conditions have substantially changed, the abatement measures might not be provided. A final decision of the installation and aesthetics of the abatement measures will be made upon completion of the project's final design and the Context Sensitive Design process.

This updated analysis used a newer version of the Transportation Noise Model (TNM), Version 2.5, rather than Version 2.1. The newer version has been widely vetted and found to be more accurate than the earlier version. The horizontal and vertical clearance of the design has been refined since the FEIS, and traffic projections have changed, but not significantly. The speed limit is higher in the north end of the corridor than the previous analysis. This study conforms to the *MDOT Highway Noise Analysis and Abatement Handbook* (MDOT Noise Handbook), July 2011. The new policy includes changes on how dwelling unit equivalents (DUE) are calculated, as well as how "feasibility and reasonableness" are determined.

To help understand the changes from the FEIS/ROD, Table 40 lists the noise walls found to be feasible and reasonable in the ROD in the second column. The next column explains why a change occurred. The last column gives the current status with the updated analysis.

Table 38
Summary of Barrier Analysis Results
Walls Feasible and Reasonable

SEGMENT	2005 NAME	REEVALUATION NAME (2035)	LOCATION	LENGTH (FEET)	AVERAGE HEIGHT	COST ($2014)	BENIFITING RECEIVERS	COST PER BEN. RECEIVER.
1	Wall 0 - NB1	Seg1 NB1	8 Mile to Meyers Avenue	515	14.64	$339,029	13	$26,079
	Wall 0 - NB1	Seg1 NB2	8 Mile to Meyers Avenue	1057	12.31	$585,366	15	$39,024
2	Wall 17 - NB Church	Seg2 NB1	Meyers Avenue to 9 Mile	2578	12.09	$1,402,454	67	$20,932
	Wall 2 - NB1	Seg2 NB1	Meyers Avenue to 9 Mile					
		Seg2 NB2	Meyers Avenue to 9 Mile					
	None	Seg2 SB1	Meyers Avenue to 9 Mile	1581	9.77	$726,624	16	$45,414
3	None	Seg3 NB1	9 Mile to Woodward Heights	1322	16.90	$1,005,337	23	$43,710
	Wall 3 - SB1	Seg3 SB1	9 Mile to Woodward Heights	911	13.73	$562,491	23	$24,456
4	Wall 4 - NB Church	Seg4 NB1	Woodward Heights to I-696	816	15.04	$551,769	13	$42,444
	None	Seg4 SB2	Woodward Heights to I-696	1794	13.80	$925,466	22	$42,067
5	Existing walls	Seg5 NB5, NB6, & NB 7	I-696 to 11 Mile	2552	15.37	$1,766,167	55	$32,112
5a	None	Seg5a NB2	11 Mile to Gardenia Avenue	1234	14.34	$797,073	51	$15,629
6	None	Seg6 NB1	Gardenia to North of 12 Mile	1821	12.40	$1,014,994	26	$39,038
	Wall 7 - SB1	Seg6 SB1	Gardenia to North of 12 Mile	653	19.40	$570,743	14	$40,767
7	Wall 8 - NB1	Seg7 NB1	North of 12 Mile to 14 Mile	3964	15.67	$2,794,569	144	$19,407
	Wall 9 - NB2	Seg7 NB2	North of 12 Mile to 14 Mile					
8	Wall 10 - SB1	Seg8 SB1	14 Mile to Rochester Road	1223	14.00	$770,701	31	$24,861
9	Wall 11 - NB1	Seg9 NB1	Rochester Rd to Livernois	2650	11.12	$1,326,493	45	$29,478
	Wall 12 - NB2	Seg9 NB2						
	Wall 13 - SB1	Seg9 SB1	Rochester Rd to Livernois	3494	15.35	$2,415,935	135	$17,896
	Wall 14 - SB2	Seg9 SB2						
10	Wall 15 - SB1	Seg10 SB1	Livernois Rd to Wattles Rd	2754	11.22	$1,390,790	80	$17,385
11a	None	Seg11a NB1	Wattles Rd to Crooks Rd	1587	10.54	$751,135	17	$44,184
	None	Seg11a SB1	Wattles Rd to Crooks Rd	1207	18.00	$978,139	62	$15,776
11	Wall 16 - SB1 & SB2 & Wall 18 – SB3	Seg11 SB1, SB2, SB3, & SB4	Crooks Rd to Coolidge Hwy	4567	14.64	$3,011,160	100	$30,112

Source: The Corradino Group of Michigan

Table 39
Summary of Barrier Analysis Results
Walls NOT Feasible and Reasonable

SEGMENT	2005 NAME	REEVALUATION NAME (2035)	LOCATION	LENGTH (FEET)	AVERAGE HEIGHT	COST ($2014)	BENIFITING RECEIVERS	COST PER BEN. RECEIVER.
1	Wall 1 - SB1	Seg1 SB1	8 Mile to Meyers Avenue	1007	16.00	$725,593	8	$90,699
4	Seg 4 - SB1	Seg4 SB1	Woodward Heights to I-696	465	10.00	$209,242	0	N/A
5	Existing walls	Seg5 NB1, NB2, NB3, & NB4	I-696 to 11 Mile	1551	9.20	$641,824	0	N/A
5a	None	Seg5a NB1	11 Mile to Gardenia Avenue	1004	16.00	$721,606	18	$40,089
	None	Seg5a SB2	11 Mile to Gardenia Avenue	862	16.00	$814,802	12	$67,900
6	Seg 6 - SB2	Seg6 SB2	Gardenia to North of 12 Mile	676	12.00	$364,788	16	$22,799
11	Seg 11 - NB	Seg11 NB1, NB2, & NB3	Crooks Rd to Coolidge Hwy	3969	10.56	$1,887,078	40	$47,177
12	None	Seg12 NB1 & NB2	Coolidge Hwy to Adams Rd	2584	16.00	$1,861,926	4	$465,482
	None	Seg12 SB1 & SB2	Coolidge Hwy to Adams Rd	2327	17.02	$1,782,427	15	$118,828

Source: The Corradino Group of Michigan

Table 40
Noise Wall Analysis Results

SEGMENT	WALLS APPROVED IN ROD	COMMENTS	WALLS APPROVED IN UPDATED ANALYSIS
1 8 Mile to Meyers	Wall 0 - NB1	Wall 0 – NB1 gets split by redesigned ramp to become Seg1 NB1 and NB2	Seg1 NB1
			Seg1 NB2
	Wall 1 - SB1	Wall 1 – SB 1 cannot be built due to redesigned ramp	
2 Meyers to 9 Mile	Wall 17 - NB Church & Wall 2 – NB1	Wall 17 – NB 1 and Wall 2 – NB 1 are combined into Seg2 NB1	Seg2 NB1
		Seg2 NB2 is a new wall added by updated analysis	Seg2 NB2
		Seg2 SB1 is a new wall added by updated analysis	Seg2 SB1
3 9 Mile to Woodward Heights		Seg3 NB 1 is a new wall added by updated analysis	Seg3 NB1
	Wall 3 – SB1	Wall 3 – SB 1 is lengthened	Seg3 SB1
4 Woodward Heights to I-696	Wall 4 - NB Church	Wall 4 - NB Church is lengthened	Seg4 NB1
	Wall - SB2	Wall SB 2 is lengthened	Seg4 SB2
5 1-696 to 11 Mile	Existing Walls	New walls replace existing walls	Seg5 NB5, NB6 & NB7
5a 11 Mile to Gardenia	Existing Walls	South ends of existing walls are removed as redesigned ramps shift south. Seg5a NB2 replaces much of an existing wall.	Seg5a NB2
6 Gardenia to 12 Mile		Seg6 NB 1 is a new wall added by updated analysis	Seg6 NB1
	Wall 7 - SB1	Wall 7 - SB 1 is lengthened	Seg6 SB1
7 12 Mile to 14 mile	Wall 8 - NB1 & Wall 9 NB2	Walls almost same as before	Seg7 NB1 & Seg7 NB2
8 14 Mile to Rochester Road	Wall 10 – SB1	Wall same as before	Seg8 SB1
9 Rochester Road to Livernois	Wall 11 - NB1 & Wall 12 - NB2	Walls almost same as before	Seg9 NB1 & NB2
	Wall 13 - SB1 & Wall 14 – SB2	Walls almost same as before	Seg9 SB1 & SB2
10 Livernois to Wattles	Wall 15 - SB1	Wall same as before	Seg10 SB1
11a Wattles to Crooks		New wall added in updated analysis in section not covered by FEIS	Seg11a NB1
		New wall added in updated analysis in section not covered by FEIS	Seg11a SB1
11 Crooks to Coolidge Hwy	Wall 16 - SB1 & SB2, plus Wall 18 – SB3	Walls almost same as before	Seg11 SB1, SB2, SB3 &, SB4

Source: The Corradino Group of Michigan