FRA-270-30.0

NOISE IMPACT ASSESSMENT

Columbus, Ohio

Prepared by

ms consultants, inc.
4150 Belden Village Street, N.W.
Canton, Ohio

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Noise Analysis

I. INTRODUCTION

A. General Summary and Conclusions

Highway generated noise levels resulting from proposed improvements to I - 270 between the I-270/I-670/US 62 interchange and Dempsey Road were estimated using a PC version of the Federal Highway Administration (FHWA) approved predictive model STAMINA 2.0/OPTIMA. Existing noise levels were also estimated using the predictive model. The proposed improvements include mainline and collect/distributor lane additions, and modification of the existing interchanges at Morse Road and SR 161. The I-270/Morse Road interchange modification includes new ramps connecting to Stelzer Road and continuing west to Sunbury Road (Connector Road). Modification of the I-270/SR 161 interchange extends eastward on SR 161 to provide a proper tie-in with the proposed SR 161 (New Albany Bypass) project.

A conceptual highway and receiver configuration was modelled to estimate existing and future noise contours. This configuration was also utilized to evaluate the potential effectiveness of noise barriers for the abatement of predicted impacts. Future (Design Year 2015) noise levels, as Leq(h), were predicted to range from approximately 73 - 75 dBA (A-weighted decibels) at 100 feet from the proposed near lane centerline to 63 - 65 dBA at 500 feet. This was an increase of 3.8 - 4.5 dBA above predicted existing levels.

Predicted noise levels were compared to FHWA Noise Abatement Criteria (NAC) of 67 dBA (Leq(h)) for Category B activities. The results of the analysis indicated that noise levels currently exceed the FHWA NAC for many receiver locations within 360 feet of the I-270 centerline. Receivers between 100 to 200 feet of the mainline were predicted to be experiencing Leq(h)s of between 69 to 73 dBA. Noise levels at these receiver locations were predicted to increase 4 to 6 dBA with the proposed improvement by the Design Year (2015).

A conceptual noise barrier 14 feet in height was shown to provide reductions in noise levels of 5.4 decibels at a distance of 200 feet and 4.0 decibels at 400 feet from the proposed near lane centerline. The majority of first row receivers in the study area were located between

200 and 400 feet of the proposed near lane. This barrier reduced noise levels at approximately 70% of the first row receivers to below the FHWA NAC. Residential receivers exceeding the 67 dBA design level did so by less than 0.5 decibels. A noise barrier 16 feet in height brought all protected receivers to below 67 dBA.

Noise sensitive receivers within the study area include Royal Manor School, Wilder Elementary School, the Northeast Career Center, and five churches. These receivers are located from 500 to over 2000 feet from I-270. Maximum increases predicted as a result of the proposed improvements was 3 decibels at one location. Noise levels were not predicted to exceed NAC for any sensitive receivers.

B. Purpose of the Analysis

The purpose of this analysis was to evaluate potential impacts related to highway generated noise resulting from the proposed improvements to I-270 in accordance with 23 CFR Part 772, "Procedures for Abatement of Highway Traffic and Construction Noise." The analysis addressed the feasibility of abatement measures where required to reduce levels to or below FHWA NAC levels.

C. Description of the Proposed Project

1. Location

The proposed project is located in Franklin County, Ohio and passes through portions of the cities of Columbus and Gahanna, and unincorporated areas of Blendon and Mifflin Townships (Figure 1). The project involves a portion of the northeast section of the I-270 outerbelt surrounding central Columbus.

2. Scope

Existing I-270 is a limited access, six-lane facility with interchanges at I-670/US 62, Morse Road, and SR 161 in the study area. North and South bound lane groups (three 12' lanes each direction) are separated by a 52' median. The proposed project includes the modification of the existing interchanges at Morse Road and SR 161 and the addition of up to three lanes in each direction on the mainline. The added lanes would be constructed outside the existing lanes preserving the 52' median for possible future lane additions. The proposed typical section for the maximum build condition is shown in Figure 2.

Modifications to the Morse Road Interchange include a new connection to Stelzer Road (continuing west to Sunbury Road) and improvement of Morse Road from Stelzer to Appian Way as shown in Figure 3. Also illustrated in this figure are improvements to the SR 161 interchange. The proposed work includes reconfiguration of the ramps and improvements to SR 161 east through the SR 161/Sunbury Road interchange to connect with the proposed relocation of SR 161 (New Albany Bypass).

3. Estimated Completion

Due to the scale of the complete project, phased construction has been proposed. The initial project is expected to include the Morse/Stelzer interchange ("Project No. 1") with construction anticipated in 1994. The identification and timing of subsequent projects are shown on Figure 4.

II. EXISTING NOISE ENVIRONMENT

A. Description of Study Area

The study area adjacent to the I-270 beltway is composed mostly of established residential neighborhoods and undeveloped land. Commercial development is present in the I-270/Morse Road and SR 161/Sunbury interchange areas. Vacant lands have been subjected to increasing development pressure with both single and multi-family residential and major commercial development underway throughout the corridor. Existing land uses, including those areas currently under development are illustrated in Figure 5. Many "first-row" receivers, both residential and commercial, are located within 250 feet of the existing highway centerline or approximately 200 feet from the near lane. The average distance of all first row receivers to the near lane was 265 feet. The majority of all first row receivers are within 400 feet of the near lane.

Noise sensitive receivers within the study area include Royal Manor School, Wilder Elementary School, the Northeast Career Center, Northland Church of the Nazarene, Capitol City Baptist Church, St. Andrew's Methodist Church, and St. Luke Lutheran Church. Other schools, churches, and other noise sensitive receivers in the general area are 2000 feet or farther from the proposed improvement.

Land uses are primarily subjected to highway generated noise from I-270 and the major arterial streets serving the area. Traffic on Morse Road, SR 161, Stelzer Road, and Sunbury

Road affects the existing noise environment for land uses adjacent to these facilities. In addition to roads, the other major transportation facility in the area is the Port Columbus International Airport located southeast of the I-670/US 62/I-270 interchange. Although aircraft noise was occasionally noticeable during field reconnaissance, it was not a significant aspect of the ambient noise condition during the observation period.

B. Existing Traffic

Existing (1991) Average Daily Traffic (ADT) volumes for I-270 and the arterial system are shown on Figure 6. The Peak Hour (PM) traffic volumes are shown on Figure 7. The I-270 PM Peak Hour Volume (9685 vph) was used for the analysis. Traffic was split equally between the north and southbound lane groups. Truck traffic was assumed to be 2% of the peak hour volume and all were specified as "Heavy Trucks" in the model.

C. Ambient Noise

The noise descriptor 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 that period. Table 1 indicates the noise levels of various activities and locations which may help in understanding noise magnitude and the following discussions.

Ambient (existing) noise levels were predicted utilizing STAMINA 2.0 Highway Noise Prediction Model. Ambient noise monitoring was not performed. Three highway and receiver configurations were modelled. The noise prediction model procedures, assumptions, and input parameters utilized are more fully discussed in Section III. B. Predicted existing noise levels for these configurations are shown in Table 2. Predicted existing noise levels at specified receiver distances are shown on Figure 8.

Ambient noise levels for receivers generally closest to the I-270 mainline, approximately 200 feet, were predicted to range from 69.3 to 73.3 decibels. The 67 decibel contour was approximately 220 to 290 feet from the near lane (280 to 350 feet from the highway centerline). The location of the 67 decibel contour varies due to the roadway's vertical alignment and typical section relative to the receiver. The shielding effects of intervening structures, terrain, and dense vegetation in some areas, may also result in the 67 decibel contour being closer to the mainline than predicted by the model.

Table 1. Common Indoor and Outdor Noise Levels

COMMON OUTDOOR NOISE LEVELS	NOISE LEVEL (dBA)	COMMON INDOOR NOISE LEVELS
	110	Rock Band
Jet Flyover at 1000 ft		
	100	Inside Subway Train (New York)
Gas Lawn Mower at 3 ft		
Diesel Truck at 50 ft	90	Food Blender at 3 ft
Noisy Urban Daytime	80	Garbage Disposal at 3 ft Shouting at 3 ft
Gas Lawn Mower at 100 ft	70	Vacuum Cleaner at 10 ft
Commercial Area		Normal Speech at 3 ft
Heavy Traffic at 300 ft	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Small Theatre, Large Conference Room (Background)
Quiet Suburban Nighttime		Library
	30	Bedroom at Night Concert Hall (Background)
Quiet Rural Nighttime		
	20	
		Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

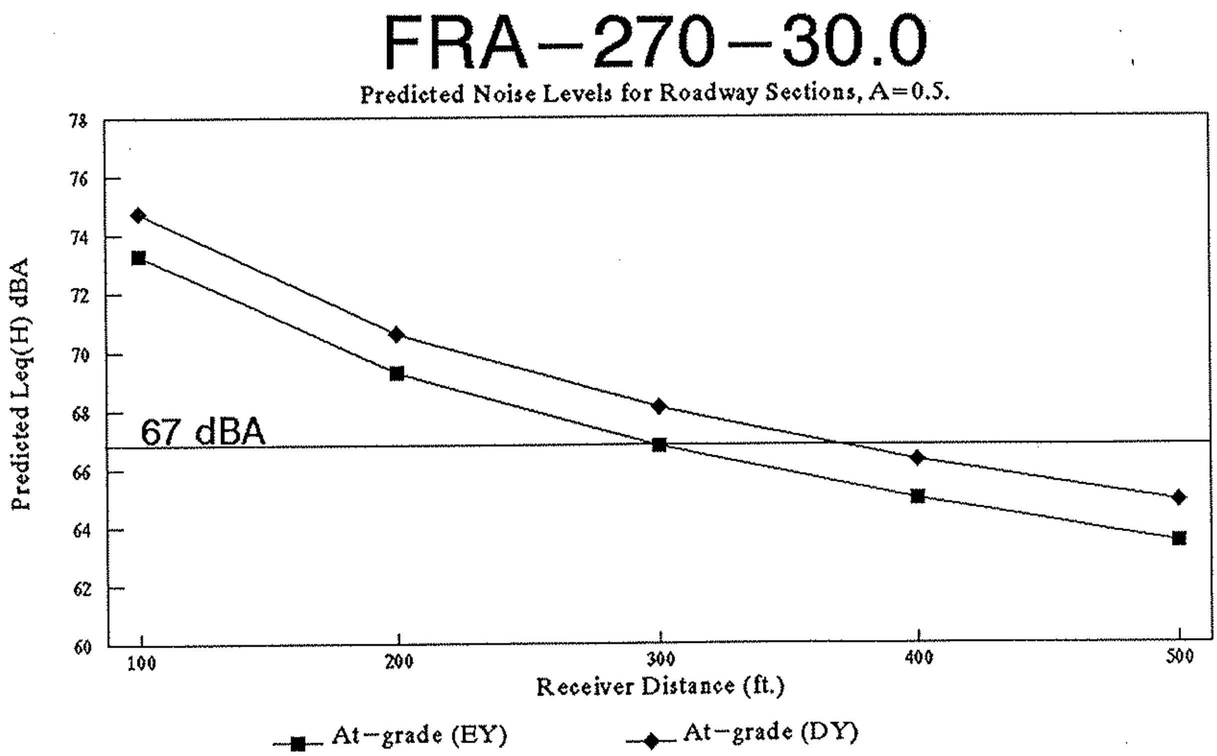
TABLE 2. FRA-270-30.0 Predicted Noise Levels for Typical Roadway Sections

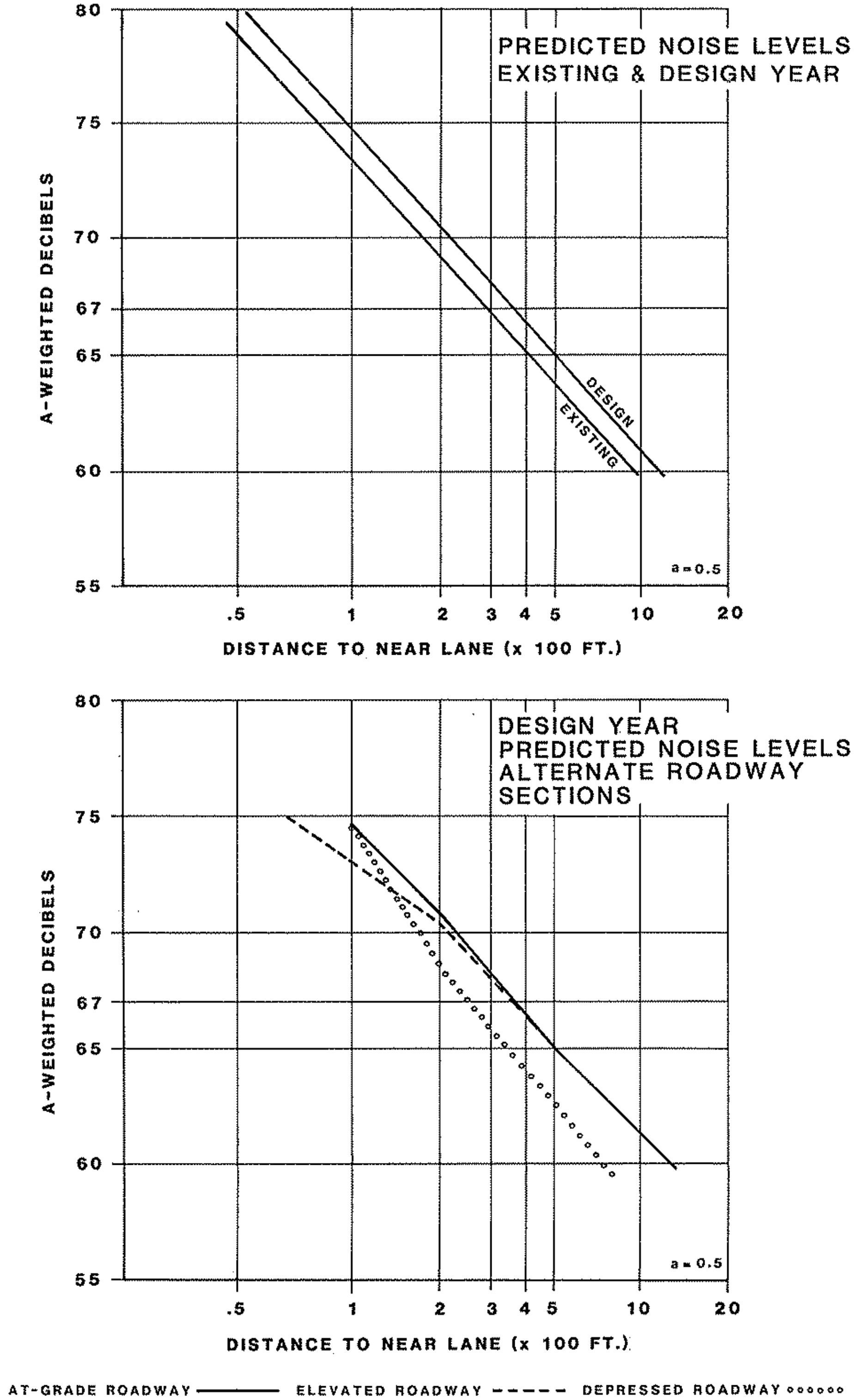
a=0.5

YEAR	TYPICAL ROADWAY SECTION	Leq (dBA) @ RECEIVER DISTANCE (ft.)* 100	200	300	400	500
EXISTING (1991)	CUT	73.2	67.5	64.8	62.8	61.3
	ELEVATED	71.6	69.1	66.8	65	63.5
	AT-GRADE	73.3	69.3	66.8	65	63.5
DESIGN (2015)	CUT	74.6	68.5	66	64.3	63
	ELEVATED	73.1	70.4	68.1	66.3	64.9
	AT-GRADE	74.7	70.6	68.1	66.3	64.9

* Distance from equivalent near lane group.

FIGURE 8.




PREDICTED NOISE LEVELS
EXISTING & DESIGN YEAR
A-WEIGHTED DECIBELS
80
75
70
67
65
60
55
DESIGN
EXISTING
a=0.5
.5
1
2
3
4
5
10
20
DISTANCE TO NEAR LANE (x 100 FT.)
DESIGN YEAR
PREDICTED NOISE LEVELS
ALTERNATE ROADWAY
SECTIONS
A-WEIGHTED DECIBELS
80
75
70
67
65
60
55
a=0.5
.5
1
2
3
4
5
10
20
DISTANCE TO NEAR LANE (x 100 FT.)
AT-GRADE ROADWAY
ELEVATED ROADWAY
DEPRESSED ROADWAY

III. PREDICTED NOISE FROM IMPROVEMENT

A. Design Year Traffic

Design Year (2015) Average Daily Traffic (ADT) volumes for the interstate system are shown on Figure 9. The AM and PM Design Hour traffic volumes for I-270 are shown on Figures 10 and 11. The highest Design Hour volume on the interstate was the southbound section from the New Crossroad to the US 62/I-270 interchange (AM Design Hour Volume = 7717). This volume was applied to both the north and southbound lanes and used in the analyses. Of the total Design Hour volume, 2% were considered to be "Heavy Trucks". I-270 operates generally at Level of Service E under existing traffic conditions. For the purpose of this analysis, No Build traffic volumes were assumed to be the same as existing volumes.

B. Discussion of Prediction Methodology

Noise levels were predicted utilizing a PC version of the STAMINA 2.0 Highway Noise Prediction Model. The model considers three dimensional roadway, receiver, and barrier information to predict A-weighted sound levels at specified receiver locations. Sound energy mean emission levels (A-weighted sound level at 50 feet) for vehicle types (automobiles, medium trucks, and heavy trucks) are adjusted by the model based on traffic volume, vehicle speed, and location relative to identified receivers and barriers. All traffic was assumed to be automobiles and heavy trucks.

C. Procedures

The following procedure was used for the prediction of both existing (ambient) and future noise levels. A conceptual highway/receiver configuration of the I-270 mainline was used to develop noise contours. In this configuration five receivers were placed at 100 foot intervals beginning at 100 feet from the near lane centerline. Typical at-grade, depressed, and elevated roadway sections were modelled. Receiver height was set at 6 feet above ground elevation. Traffic was split equally between the north and southbound lane groups of I-270 and placed on the outside (C/D) lanes in each direction. No shielding factors were applied to account for intervening structures, e. g., buildings, dense vegetation, crossroad structures between the roadway and the receivers. Because areas adjacent to the facility and generally vegetated to varying degrees, an attenuation factor ("alpha") of 0.5 was used in the analyses. This factor results in sound levels decreasing by 4.5 decibels per doubling distance. Sound levels over a "hard" site (a=0.0) would decrease at a rate of approximately 3 decibels per doubling distance.

In combination with an at-grade section, this roadway and traffic configuration resulted in the "worse case" condition and was used for the subsequent evaluation of noise impact. (See Table 2.) Additional roadway configurations evaluated to determine the worse case are described in the Appendix. The Appendix also contains samples of the STAMINA 2.0/OPTIMA computer output. Figures 12 and 13 illustrate the roadway/receiver configuration for the existing and proposed highway.

D. Predicted Noise Levels

Predicted Design Year (2015) noise levels are shown in Table 2. Construction of the proposed improvements will place the near lane (outside CD lane) up to 62 feet closer to receivers adjacent to maximum build (12 lane) sections. Predicted noise levels for many of the closest receivers, approximately 100 feet from the proposed near lane, ranged from 73.1 to 74.7 dBA.

Receivers presently 100 feet from the near lane would be 38 feet from the proposed near lane. Noise levels for these receivers increased 7.3 decibels over predicted existing levels of 73.3 dBA. Other first row receivers, currently 200 to 300 feet from the existing near lane, were predicted to have noise level increases of 3.5 to 2.7 decibels above existing predicted levels of 69.3 and 66.8 dBA respectively. It was noted that some receivers located 100 feet from the existing near lane may be displaced by proposed right-of-way acquisition.

The 67 dBA contour was approximately 260 to 360 feet from the near lane (380 to 480 feet from the I-270 centerline). This represented a shift in the 67 dBA contour of up to 120 feet in the worse case configuration.

E. Predicted Noise Contours

Predicted worse case noise contours are illustrated on Figure 14 (Map Pocket). Shown are the locations of the 65, 70, and 75 dBA contours. The FHWA-NAC 67 dBA contour is also shown.

Figure 15 indicates the predicted Existing and Design Year Leq(H) at intervals of 50 feet from the existing near lane. This information is also shown on Figure 16 A-J which indicates the location of the first row receivers.

IV. Impact Assessment

A. Predicted Noise Impacts

Predicted Design Year noise levels were compared to predicted Existing Year levels and to FHWA Noise Abatement Criteria (23 CFR Part 772) for Category B and C land use activities (see Table 3). Noise impact was defined as the perceived, measurable change in the noise environment relative to these reference levels.

Table 3.

FHWA NOISE ABATEMENT CRITERIA

(23 CFR Part 772)
Hourly A-Weighted Sound Level - decibels (dBA)

Activity Category	Leq(h)	Description of Activity Category
A	57 (Ext.)	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	67 (Ext.)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Ext.)	Developed lands, properties, or activities not included in Categories A or B above.
D	----	Undeveloped lands.
E	52 (Int.)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Only first row receivers, i.e., those with no intervening structures between their location and the highway, were evaluated. Receivers were identified as impacted if Design Year levels exceeded existing levels by more than 5 dBA, or if predicted levels were at or above the FHWA-NAC Leq(h) of 67 dBA. The assessment was based upon the worse case roadway, traffic, and receiver configurations, i.e., at-grade section, maximum build condition (12 lanes), and no shielding or barrier affects.

The results of the assessment are tabulated in Table 4. (Table 4 also contains a summary of the noise barrier analysis. These data are discussed in Section V.) Note that commercial land use activities would normally be considered Category C with a design level of 72 dBA. Since most of the development in the study area is Category B, only the 67 dBA contour data is presented. The magnitude of impact to Category C receivers were, however, based on the 72 dBA design level.

Predicted Leq(h), shown on Table 4, were estimated based upon the following:

Distance	Predicted Leq (dBA)	
c-l extg.	"EY"	"DY"
near lane	1991	2015
75 - 125	73	81
125 - 175	72	76
175 - 225	69	73
225 - 275	68	71
275 - 325	67	70
325 - 375	66	69
375 - 425	65	68
425 - 475	65	67
475 -	64	66

Table 4. FRA−270−30.0 NOISE IMPACT SUMMARY (See NOTES)
SECTION 1: Agler to McCutcheon

RECEIVER DATA							IMPACT SUMMARY				BARRIER SUMMARY		
							Predicted Leq(h) dBA					Approx.	DY
Sect'n No.	Rec. No.	Receiver Type	Lt./Rt. Mainline	Distances CL	Ext'g NL	Prop. NL	EY 1991	DY 2015	Incr./ Decr.	DY Above NAC	Barr. ID#	Reduction w/Barrier	Leq(h) w/Barrier
1	1	RES	Right	400	340	278	66	69	3	2	A	−4.5	64.5
1	2	COMM	Right	405	345	283	66	69	3	–	A	−4.5	64.5
1	3	MULTI	Right	400	340	278	66	69	3	2	A	−4.5	64.5
1	4	MULTI	Right	400	340	278	66	69	3	2	A	−5.4	63.6
1	5	COMM	Right	330	270	208	68	71	3	–	A	−5.4	65.6
1	6	MULTI	Right	410	350	288	66	69	3	2	A	−4.5	64.5
1	7	MULTI	Right	535	475	413	64	66	2	–	A	−4	62
1	8	MULTI	Right	460	400	338	65	68	3	1	A	−4.5	63.5
1	9	MULTI	Right	460	400	338	65	68	3	1	A	−4.5	63.5
1	10	MULTI	Right	460	400	338	65	68	3	1	A	−4.5	63.5
1	11	MULTI	Right	460	400	338	65	68	3	1	A	−4.5	63.5
1	12	MULTI	Right	345	285	223	67	70	3	3	A	−5.4	64.6
1	13	MULTI	Right	330	270	208	68	71	3	4	A	−5.4	65.6
1	14	MULTI	Right	345	285	223	67	70	3	3	A	−5.4	64.6
1	15	MULTI	Right	280	220	158	69	73	4	6	A	−8.6	64.4
1	16	MULTI	Right	300	240	178	68	71	3	4	A	−5.4	65.6
1	17	MULTI	Right	375	315	253	67	70	3	3	A	−4.5	65.5
1	18	MULTI	Right	380	320	258	67	70	3	3	A	−4.5	65.5
1	19	RES	Right	285	225	163	68	71	3	4	A	−5.4	65.6
1	20	RES	Right	200	140	78	72	76	4	9	A	−8.6	67.4
1	21	RES	Right	200	140	78	72	76	4	9	A	−8.6	67.4
1	22	RES	Right	280	220	158	69	73	4	6	A	−5.4	67.6
1	23	RES	Right	275	215	153	69	73	4	6	A	−5.4	67.6
1	24	RES	Right	195	135	73	72	Take	n/a	n/a	A	n/a	n/a
1	25	RES	Right	200	140	78	72	76	4	9	A	−8.6	67.4
1	26	RES	Right	290	230	168	68	71	3	4	A	−5.4	65.6
1	27	RES	Left	250	190	128	69	73	4	6	NONE	n/a	73
1	28	COMM	Left	190	130	68	72	Take	n/a	n/a	NONE	n/a	n/a
1	29	COMM	Left	210	150	88	72	76	4	4	NONE	n/a	76
1	30	RES	Left	365	305	243	67	70	3	3	NONE	n/a	70
1	31	RES	Right	330	270	208	68	71	3	4	A	−5.4	65.6
1	32	RES	Right	280	220	158	69	73	4	6	A	−5.4	67.6
1	33	RES	Right	240	180	118	69	73	4	6	A	−8.6	64.4
1	34	RES	Right	200	140	78	72	76	4	9	A	−8.6	67.4
1	35	RES	Right	200	140	78	72	76	4	9	A	−8.6	67.4
1	36	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	37	RES	Right	215	155	93	72	76	4	9	A	−8.6	67.4
1	38	RES	Right	215	155	93	72	76	4	9	A	−8.6	67.4
1	39	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	40	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	41	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	42	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	43	RES	Right	225	165	103	72	76	4	9	A	−8.6	67.4
1	44	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	45	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	46	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	47	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	48	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	49	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	50	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	51	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	52	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	53	RES	Right	225	165	103	72	76	4	9	A	−8.6	67.4
1	54	RES	Right	225	165	103	72	76	4	9	A	−8.6	67.4
1	55	RES	Right	240	180	118	69	73	4	6	A	−8.6	64.4
1	56	RES	Right	220	160	98	72	76	4	9	A	−8.6	67.4
1	57	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	58	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	59	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	60	RES	Right	230	170	108	72	76	4	9	A	−8.6	67.4
1	61	RES	Right	235	175	113	69	73	4	6	A	−8.6	64.4
1	62	RES	Right	215	155	93	72	76	4	9	A	−8.6	67.4

Table 4. (cont.) FRA-270-30.0 NOISE IMPACT SUMMARY
SECTION 2: McCutcheon to Morse

RECEIVER DATA							IMPACT SUMMARY						
							Predicted Leq(h) dBA					Approx.	DY
Sect'n No.	Rec. No.	Receiver Type	Lt./Rt. Mainline	Distances CL	Ext'g NL	Prop. NL	EY 1991	DY 2015	Incr./ Decr.	DY Above NAC	Barr. ID#	Reduction w/Barrier	Leq(h) w/Barrier
2	63	RES	Right	170	110	48	73	Take	n/a	n/a	NONE	n/a	n/a
2	64	RES	Left	200	140	78	72	76	4	9	NONE	n/a	76
2	65	RES	Right	520	460	398	65	67	2	0	NONE	n/a	67
2	66	RES	Right	530	470	408	65	67	2	0	NONE	n/a	67
2	67	RES	Right	540	480	418	64	66	2	–	NONE	n/a	66
2	68	RES	Right	535	475	413	64	66	2	–	NONE	n/a	66
2	69	RES	Right	565	505	443	64	66	2	–	NONE	n/a	66
2	70	RES	Right	585	525	463	64	66	2	–	NONE	n/a	66
2	71	RES	Right	585	525	463	64	66	2	–	NONE	n/a	66
2	72	RES	Right	560	500	438	64	66	2	–	NONE	n/a	66
2	73	RES	Right	475	415	353	65	68	3	1	NONE	n/a	68
2	74	RES	Right	460	400	338	65	68	3	1	NONE	n/a	68
2	75	RES	Right	445	385	323	65	68	3	1	NONE	n/a	68
2	76	RES	Right	400	340	278	66	69	3	2	NONE	n/a	69
2	77	RES	Right	245	185	123	69	73	4	6	B	-8.6	64.4
2	78	MULTI	Right	250	190	128	69	73	4	6	B	-8.6	64.4
2	79	MULTI	Right	350	290	228	67	70	3	3	B	-5.4	64.6
2	80	MULTI	Right	260	200	138	69	73	4	6	B	-8.6	64.4
2	81	RES	Right	350	290	228	67	70	3	3	B	-5.4	64.6
2	82	MULTI	Right	260	200	138	69	73	4	6	B	-8.6	64.4
2	83	MULTI	Right	245	185	123	69	73	4	6	B	-8.6	64.4
2	84	RES	Right	350	290	228	67	70	3	3	B	-5.4	64.6
2	85	RES	Right	350	290	228	67	70	3	3	B	-5.4	64.6
2	86	MULTI	Right	245	185	123	69	73	4	6	B	-8.6	64.4
2	87	RES	Right	345	285	223	67	70	3	3	B	-5.4	64.6
2	88	RES	Right	280	220	158	69	73	4	6	B	-5.4	67.6
2	89	RES	Right	235	175	113	69	73	4	6	B	-8.6	64.4
2	90	RES	Right	275	215	153	69	73	4	6	B	-5.4	67.6
2	91	RES	Right	170	110	48	73	Take	n/a	n/a	B	n/a	n/a
2	92	RES	Right	190	130	68	72	Take	n/a	n/a	B	n/a	n/a
2	93	RES	Right	200	140	78	72	76	4	9	B	-8.6	67.4
2	94	RES	Right	205	145	83	72	76	4	9	B	-8.6	67.4
2	95	RES	Right	270	210	148	69	73	4	6	B	-8.6	64.4
2	96	RES	Right	255	195	133	69	73	4	6	B	-8.6	64.4
2	97	RES	Right	195	135	73	72	Take	n/a	n/a	B	n/a	n/a
2	98	RES	Right	155	95	33	73	Take	n/a	n/a	B	n/a	n/a
2	99	RES	Right	185	125	63	73	Take	n/a	n/a	B	n/a	n/a
2	100	RES	Right	255	195	133	69	73	4	6	B	-8.6	64.4
2	101	RES	Right	260	200	138	69	73	4	6	B	-8.6	64.4
2	102	RES	Right	195	135	73	72	Take	n/a	n/a	B	n/a	n/a
2	103	RES	Right	180	120	58	73	Take	n/a	n/a	B	n/a	n/a
2	104	RES	Right	190	130	68	72	Take	n/a	n/a	B	n/a	n/a
2	105	RES	Right	180	120	58	73	Take	n/a	n/a	B	n/a	n/a
2	106	RES	Right	185	125	63	73	Take	n/a	n/a	B	n/a	n/a
2	107	RES	Right	225	165	103	72	76	4	9	B	-8.6	67.4
2	108	COM/IND	Right	250	190	128	69	73	4	1	NONE	n/a	73
2	109	COM/IND	Right	490	430	368	65	67	2	–	NONE	n/a	67
2	110	SEM-PUB	Left	1160	1100	1038	<64	<64	n/a	–	NONE	n/a	<64
2	111	RES	Left	950	890	828	<64	<64	n/a	–	NONE	n/a	<64

Table 4. (cont.) FRA–270–30.0 NOISE IMPACT SUMMARY
SECTION 3: Morse to Sunbury

RECEIVER DATA							IMPACT SUMMARY						
							Predicted Leq(h) dBA					Approx.	DY
Sect'n	Rec.	Receiver	Lt./Rt.	Distances			EY	DY	Incr./	DY Above	Barr.	Reduction	Leq(h)
No.	No.	Type	Mainline	CL	Ext'g NL	Prop. NL	1991	2015	Decr.	NAC	ID#	w/Barrier	w/Barrier
3	112	MULTI	Right	550	490	428	64	66	2	–	C	–4	62
3	113	MULTI	Right	450	390	328	65	68	3	1	C	–4.5	63.5
3	114	MULTI	Right	350	290	228	67	70	3	3	C	–5.4	64.6
3	115	MULTI	Right	320	260	198	68	71	3	4	C	–5.4	65.6
3	116	MULTI	Right	295	235	173	68	71	3	4	C	–5.4	65.6
3	117	MULTI	Right	270	210	148	69	73	4	6	C	–8.6	64.4
3	118	MULTI	Right	240	180	118	69	73	4	6	C	–8.6	64.4
3	119	MULTI	Right	235	175	113	69	73	4	6	C	–8.6	64.4
3	120	MULTI	Right	405	345	283	66	69	3	2	C	–4.5	64.5
3	121	MULTI	Right	300	240	178	68	71	3	4	C	–5.4	65.6
3	122	MULTI	Right	410	350	288	66	69	3	2	C	–4.5	64.5
3	123	COMM	Left	550	490	428	64	66	2	–	NONE	n/a	66
3	124	COMM	Left	400	340	278	66	69	3	–	NONE	n/a	69
3	125	COMM	Left	325	265	203	68	71	3	–	NONE	n/a	71
3	126	COMM	Left	460	400	338	65	68	3	–	NONE	n/a	68
3	127	COMM	Left	260	200	138	69	73	4	1	NONE	n/a	73
3	128	COMM	Left	320	260	198	68	71	3	–	NONE	n/a	71
3	129	COMM	Left	300	240	178	68	71	3	–	NONE	n/a	71
3	130	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	131	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	132	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	133	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	134	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	135	RES	Left	750	690	628	<64	64	1	–	D	–3.5	60.5
3	136	RES	Left	650	590	528	<64	65	1	–	D	–3.5	61.5
3	137	RES	Left	540	480	418	64	66	2	–	D	–4	62

Table 4. (cont.) FRA–270–30.0 NOISE IMPACT SUMMARY
SECTION 4: Sunbury to SR 161

RECEIVER DATA							IMPACT SUMMARY						
							Predicted Leq(h) dBA					Approx.	DY
Sect'n No.	Rec. No.	Receiver Type	Lt./Rt. Mainline	Distances CL	Ext'g NL	Prop. NL	EY 1991	DY 2015	Incr./ Decr.	DY Above NAC	Barr. ID#	Reduction w/Barrier	Leq(h) w/Barrier
4	138	RES	Left	350	290	228	67	70	3	3	D	–5.4	64.6
4	139	CHURCH	Left	480	420	358	65	68	3	1	D	–4	64
4	140	RES	Left	350	290	228	67	70	3	3	D	–5.4	64.6
4	141	RES	Left	330	270	208	68	71	3	4	D	–5.4	65.6
4	142	RES	Left	320	260	198	68	71	3	4	D	–5.4	65.6
4	143	RES	Left	370	310	248	67	70	3	3	D	–5.4	64.6
4	144	RES	Left	255	195	133	69	73	4	6	D	–8.6	64.4
4	145	RES	Left	245	185	123	69	73	4	6	D	–8.6	64.4
4	146	RES	Left	245	185	123	69	73	4	6	D	–8.6	64.4
4	147	RES	Left	240	180	118	69	73	4	6	D	–8.6	64.4
4	148	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	149	CHURCH	Right	730	670	608	<64	64	1	–	NONE	n/a	64
4	150	RES	Right	475	415	353	65	68	3	1	E	–4	64
4	151	(8) RES	Right	545	485	423	64	66	2	–	E	–4	62
4	152	RES	Right	710	650	588	<64	64	1	–	NONE	n/a	64
4	153	RES	Right	720	660	598	<64	64	1	–	NONE	n/a	64
4	154	RES	Right	700	640	578	<64	64	1	–	NONE	n/a	64
4	155	RES	Left	210	150	88	72	76	4	9	D	–8.6	67.4
4	156	RES	Left	210	150	88	72	76	4	9	D	–8.6	67.4
4	157	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	158	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	159	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	160	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	161	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	162	RES	Left	225	165	103	72	76	4	9	D	–8.6	67.4
4	163	RES	Left	225	165	103	72	76	4	9	D	–8.6	67.4
4	164	RES	Left	230	170	108	72	76	4	9	D	–8.6	67.4
4	165	RES	Left	235	175	113	69	73	4	6	D	–8.6	64.4
4	166	RES	Left	250	190	128	69	73	4	6	D	–8.6	64.4
4	167	MULTI	Left	215	155	93	72	76	4	9	D	–8.6	67.4
4	168	MULTI	Left	240	180	118	69	73	4	6	D	–8.6	64.4
4	169	MULTI	Left	295	235	173	68	71	3	4	D	–5.4	65.6
4	170	MULTI	Left	340	280	218	67	70	3	3	D	–5.4	64.6
4	171	MULTI	Left	185	125	63	73	Take	n/a	n/a	D	n/a	n/a
4	172	MULTI	Left	255	195	133	69	73	4	6	D	–8.6	64.4
4	173	MULTI	Left	275	215	153	69	73	4	6	D	–5.4	67.6
4	174	MULTI	Left	310	250	188	68	71	3	4	D	–5.4	65.6
4	175	MULTI	Left	270	210	148	69	73	4	6	D	–8.6	64.4
4	176	MULTI	Left	265	205	143	69	73	4	6	D	–8.6	64.4
4	177	MULTI	Left	415	355	293	66	69	3	2	D	–4.5	64.5
4	178	MULTI	Left	315	255	193	68	71	3	4	D	–5.4	65.6
4	179	MULTI	Left	500	440	378	65	67	2	0	D	–4	63
4	180	MULTI	Left	540	480	418	64	66	2	–	D	–4	62
4	181	MULTI	Left	595	535	473	64	66	2	–	D	–3.5	62.5
4	182	MULTI	Left	655	595	533	<64	65	n/a	–	D	–3.5	61.5
4	183	MULTI	Left	710	650	588	<64	64	n/a	–	D	–3.5	60.5
4	184	MULTI	Left	860	800	738	<64	<64	n/a	–	NONE	n/a	n/a

Table 4. (cont.) FRA–270–30.0 NOISE IMPACT SUMMARY
SECTION 5: SR 161 to Dempsey

RECEIVER DATA							IMPACT SUMMARY						
							Predicted Leq(h) dBA					Approx.	DY
Sect'n No.	Rec. No.	Receiver Type	Lt./Rt. Mainline	Distances CL	Ext'g NL	Prop. NL	EY 1991	DY 2015	Incr./ Decr.	DY Above NAC	Barr. ID#	Reduction w/Barrier	Leq(h) w/Barrier
5	185	MULTI	Left	945	885	823	<64	<64	n/a	–	NONE	n/a	n/a
5	186	MULTI	Left	835	775	713	<64	<64	n/a	–	NONE	n/a	n/a
5	187	MULTI	Left	890	830	768	<64	<64	n/a	–	NONE	n/a	n/a
5	188	COMM	Right	760	700	638	<64	<64	n/a	–	NONE	n/a	n/a
5	189	RES	Right	750	690	628	<64	64	n/a	–	F	-3.5	60.5
5	190	RES	Right	490	430	368	65	67	2	0	F	-4	63
5	191	RES	Right	425	365	303	66	69	3	2	F	-4.5	64.5
5	192	RES	Right	410	350	288	66	69	3	2	F	-4.5	64.5
5	193	RES	Right	405	345	283	66	69	3	2	F	-4.5	64.5
5	194	RES	Right	325	265	203	68	71	3	4	F	-5.4	65.6
5	195	RES	Right	270	210	148	69	73	4	6	F	-8.6	64.4
5	196	RES	Right	250	190	128	69	73	4	6	F	-8.6	64.4
5	197	RES	Right	265	205	143	69	73	4	6	F	-8.6	64.4
5	198	RES	Right	335	275	213	67	70	3	3	F	-5.4	64.6
5	199	RES	Right	430	370	308	66	69	3	2	F	-4.5	64.5
5	200	RES	Right	370	310	248	67	70	3	3	F	-5.4	64.6
5	201	RES	Right	330	270	208	68	71	3	4	F	-5.4	65.6
5	202	RES	Right	310	250	188	68	71	3	4	F	-5.4	65.6
5	203	RES	Right	310	250	188	68	71	3	4	F	-5.4	65.6
5	204	RES	Right	330	270	208	68	71	3	4	F	-5.4	65.6
5	205	RES	Left	335	275	213	67	70	3	3	G	-5.4	64.6
5	206	RES	Left	200	140	78	72	76	4	9	G	-8.6	67.4
5	207	RES	Left	255	195	133	69	73	4	6	G	-8.6	64.4
5	208	RES	Left	250	190	128	69	73	4	6	G	-8.6	64.4
5	209	RES	Left	270	210	148	69	73	4	6	G	-8.6	64.4
5	210	RES	Left	290	230	168	68	71	3	4	G	-5.4	65.6
5	211	RES	Left	290	230	168	68	71	3	4	G	-5.4	65.6
5	212	RES	Left	265	205	143	69	73	4	6	G	-8.6	64.4
5	213	RES	Left	270	210	148	69	73	4	6	G	-8.6	64.4
5	214	RES	Left	260	200	138	69	73	4	6	G	-8.6	64.4
5	215	RES	Left	240	180	118	69	73	4	6	G	-8.6	64.4
5	216	RES	Left	200	140	78	72	76	4	9	G	-8.6	67.4
5	217	RES	Left	220	160	98	72	76	4	9	G	-8.6	67.4
5	218	RES	Left	300	240	178	68	71	3	4	G	-5.4	65.6
5	219	RES	Left	300	240	178	68	71	3	4	G	-5.4	65.6
5	220	RES	Left	230	170	108	72	76	4	9	G	-8.6	67.4
5	221	RES	Left	210	150	88	72	76	4	9	G	-8.6	67.4
5	222	RES	Left	225	165	103	72	76	4	9	G	-8.6	67.4
5	223	RES	Left	370	310	248	67	70	3	3	G	-5.4	64.6
5	224	RES	Left	350	290	228	67	70	3	3	G	-5.4	64.6
5	225	RES	Left	320	260	198	68	71	3	4	G	-5.4	65.6

Table 4. (cont.) FRA-270-30.0 NOISE IMPACT SUMMARY
SECTION 5: SR 161 to Dempsey, cont.

RECEIVER DATA							IMPACT SUMMARY						
				Distances			Predicted Leq(h) dBA					Approx.	DY
Sect'n No.	Rec. No.	Receiver Type	Lt./Rt. Mainline	CL	Ext'g NL	Prop. NL	EY 1991	DY 2015	Incr./ Decr.	DY Above NAC	Barr. ID#	Reduction w/Barrier	Leq(h) w/Barrier
5	226	RES	Left	290	230	168	68	71	3	4	G	-5.4	65.6
5	227	RES	Left	275	215	153	69	73	4	6	G	-5.4	67.6
5	228	RES	Left	235	175	113	69	73	4	6	G	-8.6	64.4
5	229	RES	Left	225	165	103	72	76	4	9	G	-8.6	67.4
5	230	RES	Left	175	115	53	73	Take	n/a	n/a	G	n/a	n/a
5	231	RES	Left	225	165	103	72	76	4	9	G	-8.6	67.4
5	232	RES	Left	220	160	98	72	76	4	9	G	-8.6	67.4
5	233	RES	Left	310	250	188	68	71	3	4	G	-5.4	65.6
5	234	RES	Left	250	190	128	69	73	4	6	G	-8.6	64.4
5	235	RES	Left	225	165	103	72	76	4	9	G	-8.6	67.4
5	236	RES	Left	250	190	128	69	73	4	6	G	-8.6	64.4
5	237	RES	Left	340	280	218	67	70	3	3	G	-5.4	64.6
5	238	RES	Left	330	270	208	68	71	3	4	G	-5.4	65.6
5	239	RES	Left	250	190	128	69	73	4	6	G	-8.6	64.4
5	240	RES	Left	220	160	98	72	76	4	9	G	-8.6	67.4
5	241	RES	Left	245	185	123	69	73	4	6	G	-8.6	64.4
5	242	RES	Left	320	260	198	68	71	3	4	G	-5.4	65.6
5	243	RES	Left	290	230	168	68	71	3	4	G	-5.4	65.6
5	244	RES	Left	230	170	108	72	76	4	9	G	-8.6	67.4
5	245	RES	Left	210	150	88	72	76	4	9	G	-8.6	67.4
5	246	RES	Left	220	160	98	72	76	4	9	G	-8.6	67.4
5	247	RES	Left	235	175	113	69	73	4	6	G	-8.6	64.4
5	248	RES	Left	240	180	118	69	73	4	6	G	-8.6	64.4
5	249	RES	Left	230	170	108	72	76	4	9	G	-8.6	67.4
5	250	RES	Left	210	150	88	72	76	4	9	G	-8.6	67.4
5	251	RES	Left	215	155	93	72	76	4	9	G	-8.6	67.4
5	252	RES	Right	300	240	178	68	71	3	4	F	-5.4	65.6
5	253	RES	Right	345	285	223	67	70	3	3	F	-5.4	64.6
5	254	SCHOOL	Right	650	590	528	<64	65	n/a	-	F	-3.5	61.5
5	255	MULTI	Right	200	140	78	72	76	4	9	F	-8.6	67.4
5	256	MULTI	Right	315	255	193	68	71	3	4	F	-5.4	65.6
5	257	MULTI	Right	240	180	118	69	73	4	6	F	-8.6	64.4
5	258	MULTI	Right	220	160	98	72	76	4	9	F	-8.6	67.4
5	259	MULTI	Right	285	225	163	68	71	3	4	F	-5.4	65.6
5	260	MULTI	Right	265	205	143	69	73	4	6	F	-8.6	64.4
5	261	MULTI	Right	380	320	258	67	70	3	3	F	-4.5	65.5
5	262	RES	Right	270	210	148	69	73	4	6	F	-8.6	64.4
5	263	RES	Right	240	180	118	69	73	4	6	F	-8.6	64.4
5	264	RES	Right	230	170	108	72	76	4	9	F	-8.6	67.4
5	265	RES	Right	230	170	108	72	76	4	9	F	-8.6	67.4
5	266	RES	Right	270	210	148	69	73	4	6	F	-8.6	64.4
5	267	RES	Right	290	230	168	68	71	3	4	F	-5.4	65.6
5	268	RES	Right	320	260	198	68	71	3	4	F	-5.4	65.6
5	269	RES	Right	370	310	248	67	70	3	3	F	-5.4	64.6
5	270	RES	Right	320	260	198	68	71	3	4	F	-5.4	65.6
5	271	RES	Right	260	200	138	69	73	4	6	F	-8.6	64.4
5	272	RES	Right	255	195	133	69	73	4	6	F	-8.6	64.4
5	273	RES	Right	350	290	228	67	70	3	3	F	-5.4	64.6
5	274	RES	Right	380	320	258	67	70	3	3	F	-4.5	65.5
Averages (All SECTIONS)				317	265	209			3	4		-5.3	

NOTES:

1. Refer to Figures 16 A – J for receiver locations.
2. EY and DY Leq(h) estimated from STAMINA 2.0 output for receiver distances of 100, 200, 300, 400, and 500 ft. from existing or proposed NL.
3. Receivers <75' to proposed NL assumed TAKES.
4. Potential barrier reductions generalized based on OPTIMA calculated Insertion Loss for receivers at 100, 200, 300, 400, and 500 ft. from proposed NL.
5. FHWA-NAC Category B = 67 dBA; Category C = 72 dBA.
6. Receiver No. 151 represents multiple residential structures.
7. "MULTI" are multiple family residential structures.
8. "Lt./Rt." = West/East of mainline

Only one receiver was located closer than 100 feet to the existing near lane. Receivers at 100 feet experienced an increase of 7.3 decibels, a minor noise impact. Eight (8) receivers were affected by increases of 5 decibels or more but, all were assumed to be displaced by proposed R/W acquisition.

Noise levels for receivers located 150 feet and further from the existing near lane were predicted to increase a maximum of 4.5 decibels. The majority of first row receivers were located between 200 and 400 feet. Noise levels were predicted to increase 3.3 to 2.5 decibels at these locations. The average increase for all first row receivers was 3 decibels. These receivers were not considered to be impacted by <u>increases</u> in highway generated noise levels resulting from the proposed improvement.

The 67 dBA level occurred at 350 feet from the highway centerline (290 feet from the existing near lane) in the Existing Year. Approximately 184 receivers (67% of all first row receivers) were located within this contour. This contour was predicted to occur at a maximum of 480 feet from the I-270 centerline (approximately 420 feet from the existing near lane) in the Design Year analysis. A total of 225 (82%) Category B receivers were predicted to be above 67 dBA in the Design Year. Ten of the 14 Category C receivers were predicted to exceed 72 dBA. Receivers exceeded the appropriate NAC by an average of 4 decibels by Deign Year.

The noise impact assessment was based upon the worse case conditions. Some receivers identified as impacted by increases of 5 decibels or greater, or with predicted Leq(h) exceeding 67 dBA may not be affected. In addition, receivers located adjacent to elevated or depressed roadway sections, and those adjacent to 8 or 10 lane sections will experience noise levels lower than those predicted by this assessment methodology.

I-270 operates generally at Level of Service E under existing traffic conditions. For the purpose of this analysis, Design Year No Build traffic volumes were assumed to be the same as existing volumes. Therefore, predicted No Build noise levels were unchanged from predicted Existing Year noise levels.

The proposed improvements are for an existing facility. Relocation of this facility was not considered feasible. Therefore, other build alternatives considered were essentially limited to collector/distributor lane additions, interchange modifications, and other geometric improvements to the existing facility. The noise analysis and impact assessment was based upon the maximum build and worse case condition. Refinement of the alternatives during detailed design may reduce the number of receivers impacted and the magnitude of impacts at some locations.

An assessment of noise impacts related to the Connector Road was not conducted. This area is, at present, essentially undeveloped and contains only one receiver; a commercial/industrial activity. Commercial development planned for the area is based in part upon anticipated construction of the Connector Road.

C. Construction Noise

Increased noise levels will occur during the construction period. However, impacts will be temporary and not excessive. Construction equipment will consist of bulldozers, front-end loaders, graders, scraper trucks, and air compressors. This equipment will operate intermittently and will produce noise in the range of 70 to 98 dBA at a distance of 50 feet. No barriers or shields are planned for the construction period, although equipment will be muffled as normal.

V. PROPOSED ABATEMENT MEASURES

In locations where predicted Design Year noise levels increased by 5 decibels over existing predicted levels, or where FHWA-NAC (67 dBA) were exceeded, highway noise attenuation was investigated. Relocation or major modification of the existing alignment was not considered feasible. Some of the receivers impacted may be displaced through right-of-way acquisition. The number of impacted receivers has been adjusted based upon the current preliminary R/W plans. It was also assumed that receivers located within 75 feet of the proposed near lane would be displaced. Additional receivers may be displaced as final roadway plans are developed.

The feasibility and effectiveness of noise barriers in attenuating predicted highway generated noise impacts was evaluated. For this analysis a "conceptual" noise wall was placed between I-270 and impacted receiver locations. Noise barriers are generally most effective when placed as close as possible to the receiver or the source. Barrier effectiveness diminishes as the receiver's distance from the barrier increases or to the end of the barrier decreases. The maximum distance of the modelled noise barrier was 50 feet from the proposed (worse case configuration) near lane centerline. See Figure 17.

STAMINA 2.0 was used to predict A-weighted sound levels at representative receiver locations with the barrier in place. The Barrier Cost Reduction (BCR) subroutine of OPTIMA was utilized to evaluate barrier performance. Using acoustic data supplied by STAMINA 2.0, BCR assists in the evaluation of alternative barrier heights and construction materials to maximize cost effectiveness. Metal, concrete, masonry, or wood noise walls or earthen berms may be specified.

A total of seven barrier sections, ranging in length from 1900 to 6000 feet, were modelled. Barriers were not placed adjacent to commercial (Category C) receivers where those receivers comprised the predominant first row land use activity. These receivers were not significantly impacted by increased noise levels, nor did the predicted levels generally exceed the FHWA-NAC of 72 dBA. In addition, these activities are typically highway oriented businesses relying, in part, on their visibility from the interstate.

Barriers of 12, 14, 16, and 18 feet were evaluated. Barrier performance, measured as "insertion loss", for each are listed in Table 5. A minimum barrier height of 14 feet was required to reduce noise levels at most first row receivers to 67 dBA or lower. Based upon these data the 14' barrier was considered to be the most cost effective.

Insertion loss with the 14' barrier ranged from an 8.6 decibel reduction for receivers at 100 feet from the near lane to 4.0 decibels for those at 400 feet. The average distance of all first row receivers to the proposed near lane was 209 feet. The barriers reduced predicted noise levels an average of 5.3 decibels for all receivers. Preliminary barrier locations and predicted Design Year noise contours with the barriers in place are illustrated on Figure 18 (Map Pocket).

The 67 dBA contour was approximately 70 feet from the near lane, roughly 15 to 20 feet outside the "typical" proposed R/W. With this configuration, the 67 dBA contour was predicted to be within approximately 50 feet of the proposed R/W for all receivers 100 feet or greater from the barrier ends. Barrier end points typically occur at crossroads and interchange locations. Receivers near these locations may not experience predicted reduction due to overriding effects of crossroad traffic generated noise.

The results of the conceptual barrier analysis are summarized with the impact assessment results in Table 4. Preliminary cost estimates for each barrier section are shown in Table 6 along with estimated cost per receiver for each. The estimate was based upon a cost of $10 per square foot for a typical metal noise wall.

Table 5. FRA-27-30.0 PREDICTED BARRIER INSERTION LOSS

RECEIVER	DIST. (ft.)	ALTERNATE BARRIER HEIGHT 12'	14'	16'	18'
1	100	7.0	8.6	10.0	11.3
2	200	4.2	5.5	6.7	7.8
3	300	3.4	4.5	5.6	6.7
4	400	3.0	4.0	5.0	6.0
5	500	2.6	3.6	4.6	5.5

Table 6. FRA-270-30.0 SUMMARY OF CONCEPTUAL 14 FT. NOISE BARRIERS

BARRIER ID	LOCATION Station		Station		LENGTH (ft)	EST. COST	NO. REC'RS	COST/ REC'R.
A	1492	to	1444	Lt.	4800	$672,000	58	$11,586
B	1420	to	1385	Lt.	3500	$490,000	31	$15,806
C	1355	to	1336	Lt.	1900	$266,000	11	$24,182
D	1330	to	1270	Rt.	6000	$840,000	48	$17,500
E	1309	to	1289	Lt.	2000	$280,000	12	$23,333
F	1256	to	1215	Lt.	4100	$574,000	39	$14,718
G	1250	to	1215	Rt.	3500	$490,000	47	$10,426
					25800	$3,612,000	246	$14,683

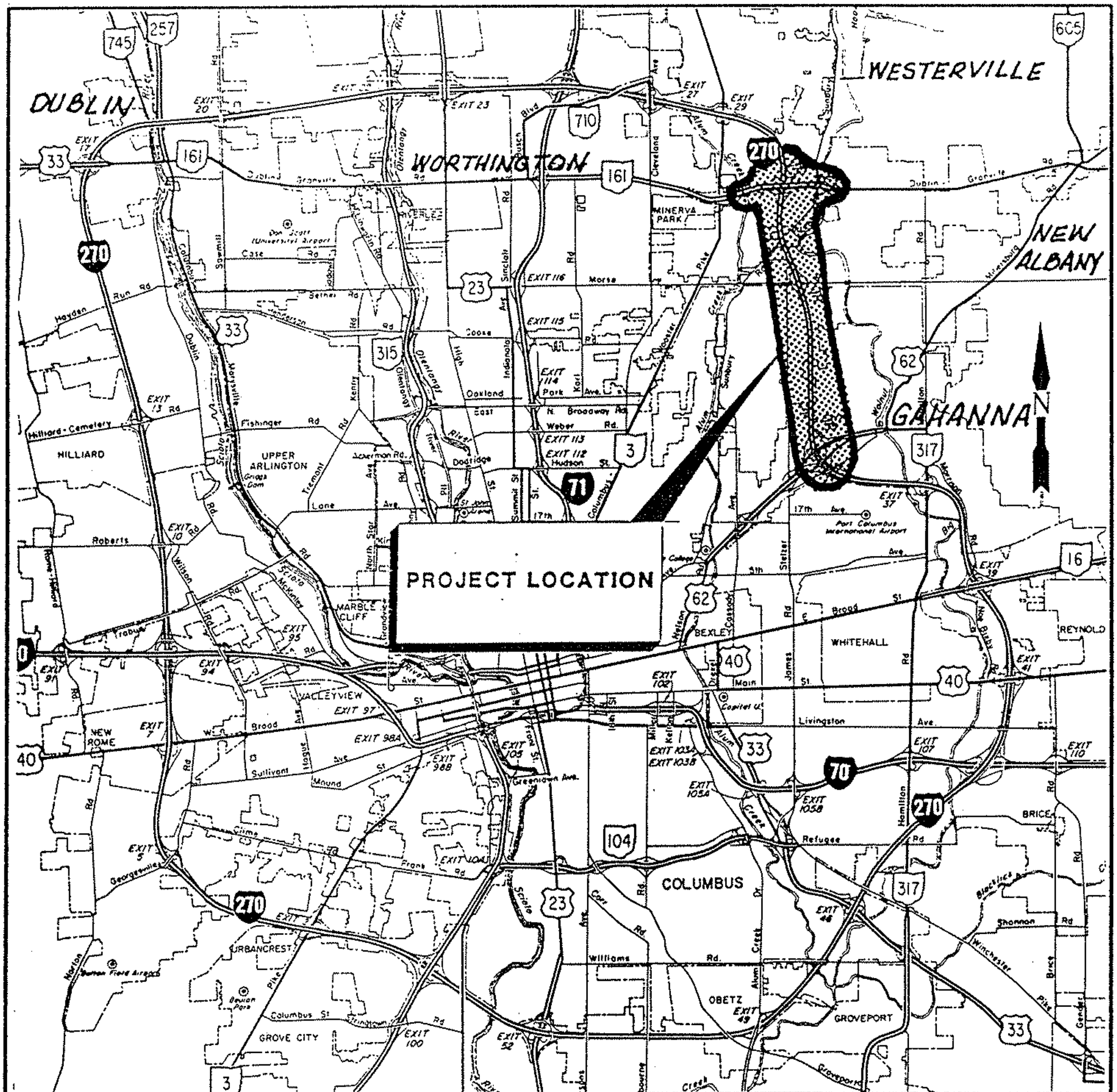
Note: Cost based on $10 per S.F.

The barrier analyses conducted for this study were preliminary and addressed impacts for a generalized worse case scenario. Barrier heights may be adjusted at some locations where the roadway is depressed or elevated relative to the receivers or where actual typical sections and traffic volumes are different from those modelled. Detailed barrier evaluation and design will be conducted during the final design phase. Barrier location and cost-effectiveness will be evaluated and alternative barrier types will be assessed on the basis of costs, aesthetics, safety, and public input.

FRA–270–30.0

NOISE IMPACT ASSESSMENT

FIGURES



FRA-270-30.00

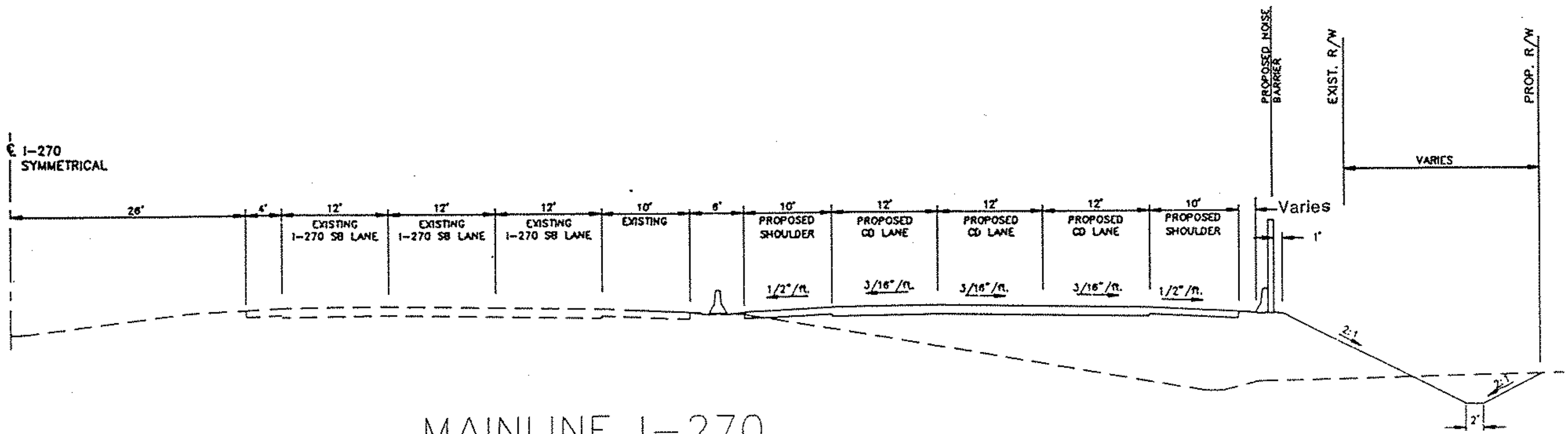
Columbus, Ohio

Figure 1

PROJECT LOCATION MAP

Prepared by

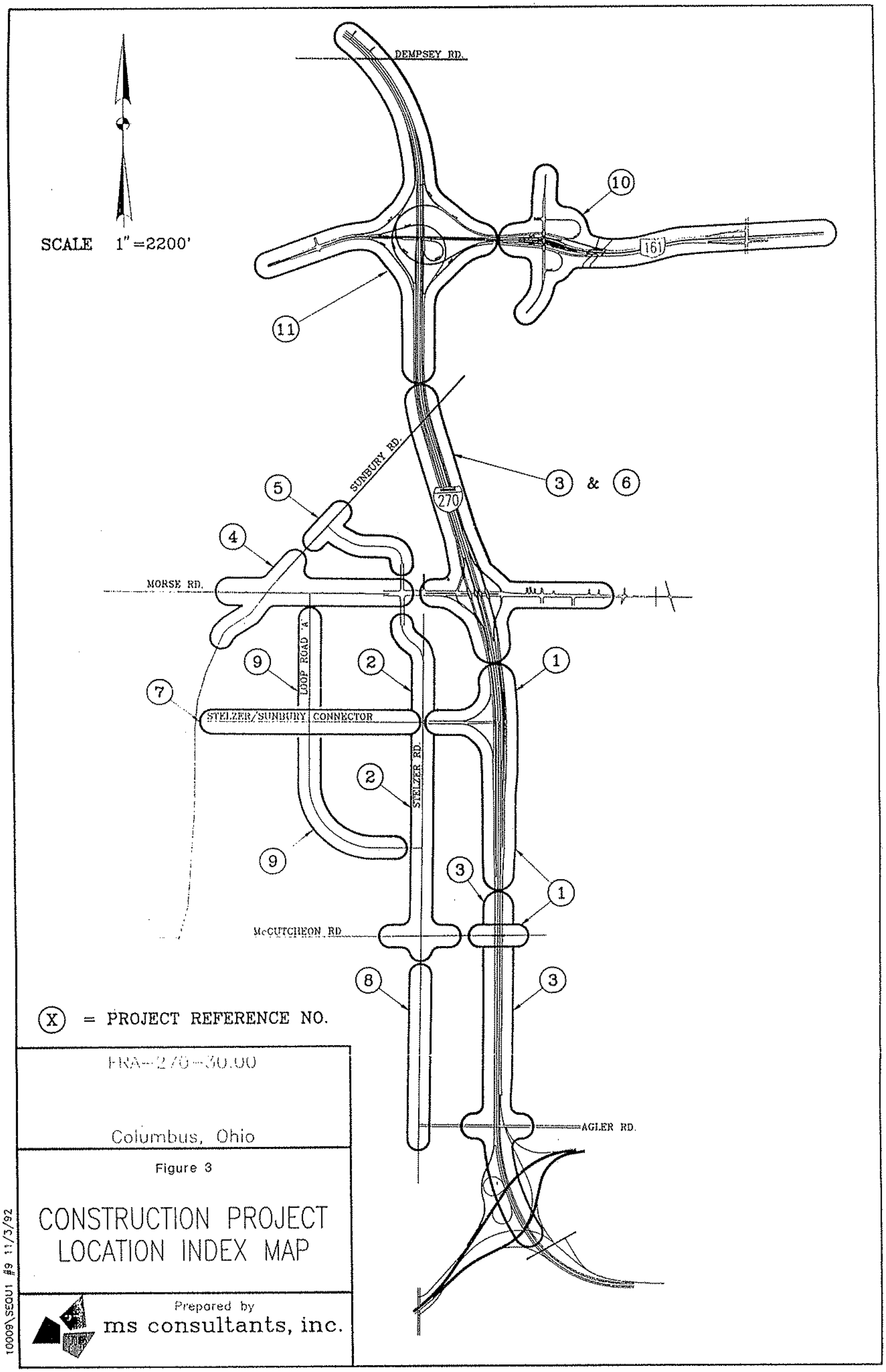
ms consultants, inc.



MAINLINE I-270
NORMAL CD SECTION
(SHOWN AT STA. 1290+00)

FRA-270-30.00
TYPICAL SECTION
Prepared by
ms consultants, inc.

Figure 2



FRA-270-30.00

Columbus, Ohio

Figure 3

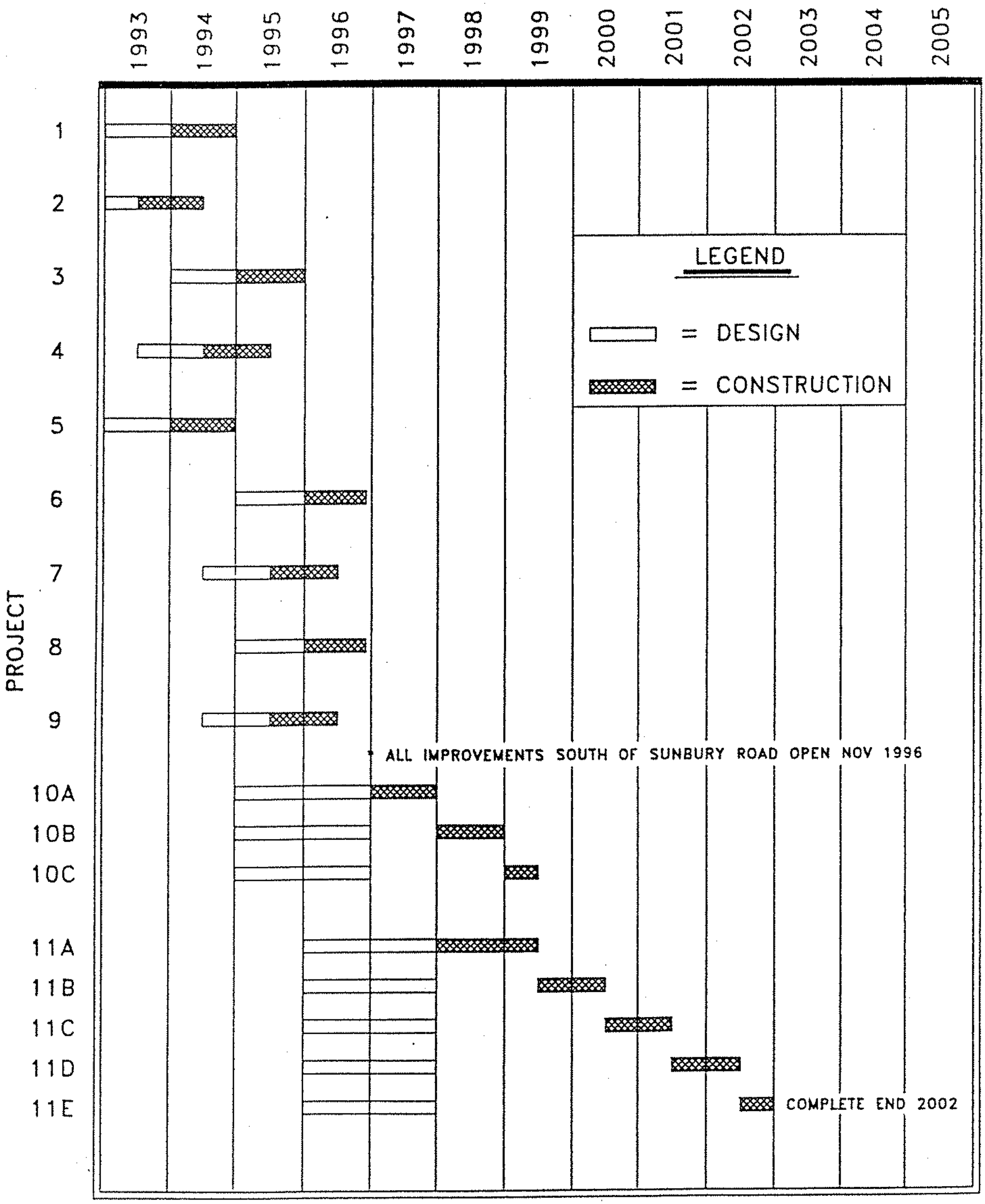
CONSTRUCTION PROJECT LOCATION INDEX MAP

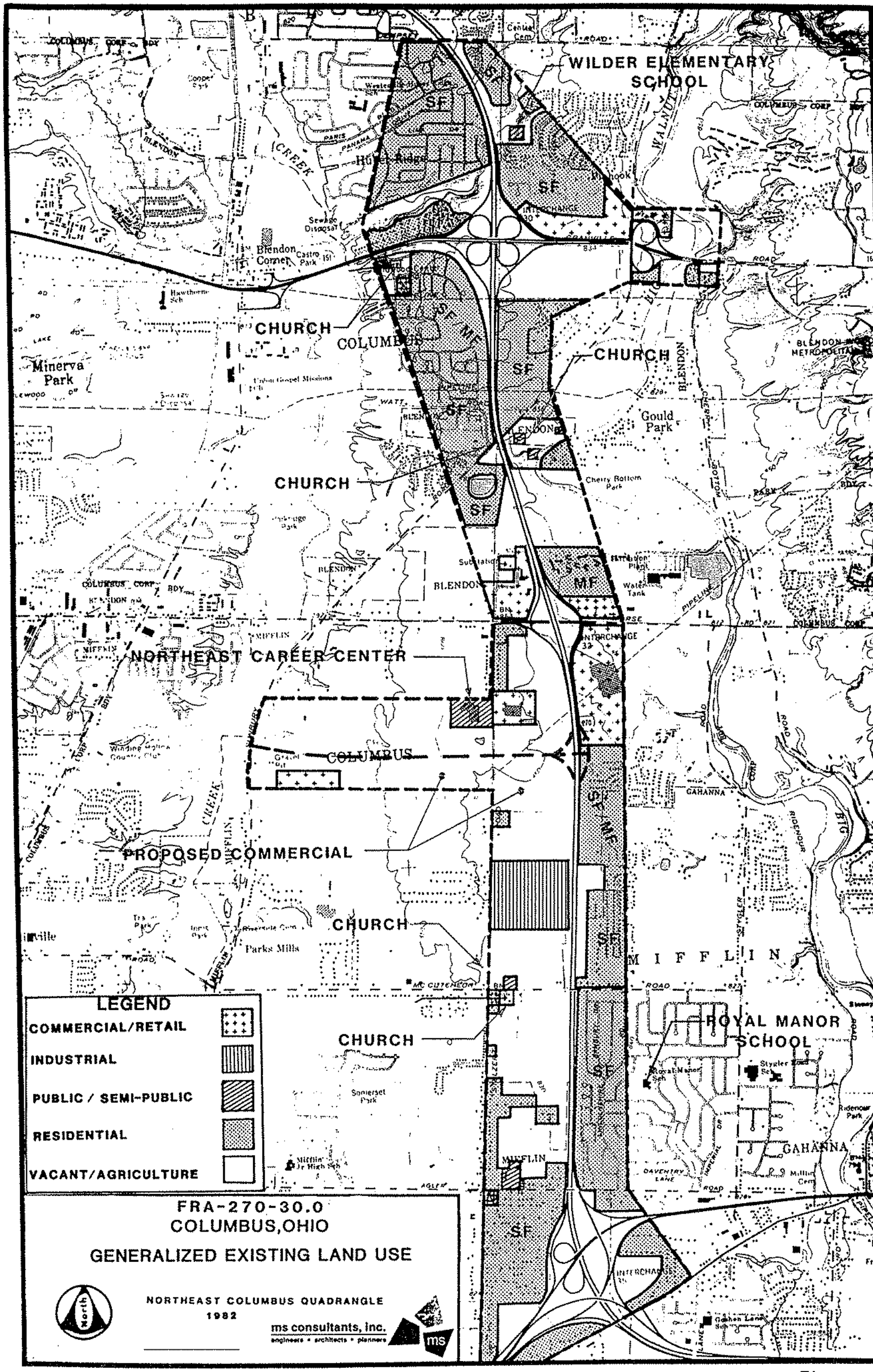
Prepared by ms consultants, inc.

10009\SEQU1 #9 11/3/92

Figure 4

FRA-270-30.0
PROJECT SCHEDULE





WILDER ELEMENTARY SCHOOL
CHURCH
COLUMBUS
CHURCH
CHURCH
SF
SF
SF-MF
SF
SF
SF
MF
SF-MF
SF
SF
SF
Minerva Park
Gould Park
Blendon Corner
NORTHEAST CAREER CENTER
COLUMBUS
PROPOSED COMMERCIAL
CHURCH
Parks Mills
MIFFLIN
ROYAL MANOR SCHOOL
CHURCH
GAHANNA
MIFFLIN
LEGEND
COMMERCIAL/RETAIL
INDUSTRIAL
PUBLIC / SEMI-PUBLIC
RESIDENTIAL
VACANT/AGRICULTURE
FRA-270-30.0
COLUMBUS,OHIO
GENERALIZED EXISTING LAND USE
NORTHEAST COLUMBUS QUADRANGLE
1982
North
ms consultants, inc.
engineers • architects • planners

Figure 5

INTERCHANGE JUSTIFICATION STUDY
I-270 SOUTH OF MORSE
Columbus, Ohio

1991
AVERAGE DAILY TRAFFIC

Prepared by
ms consultants, inc.
Columbus, Ohio

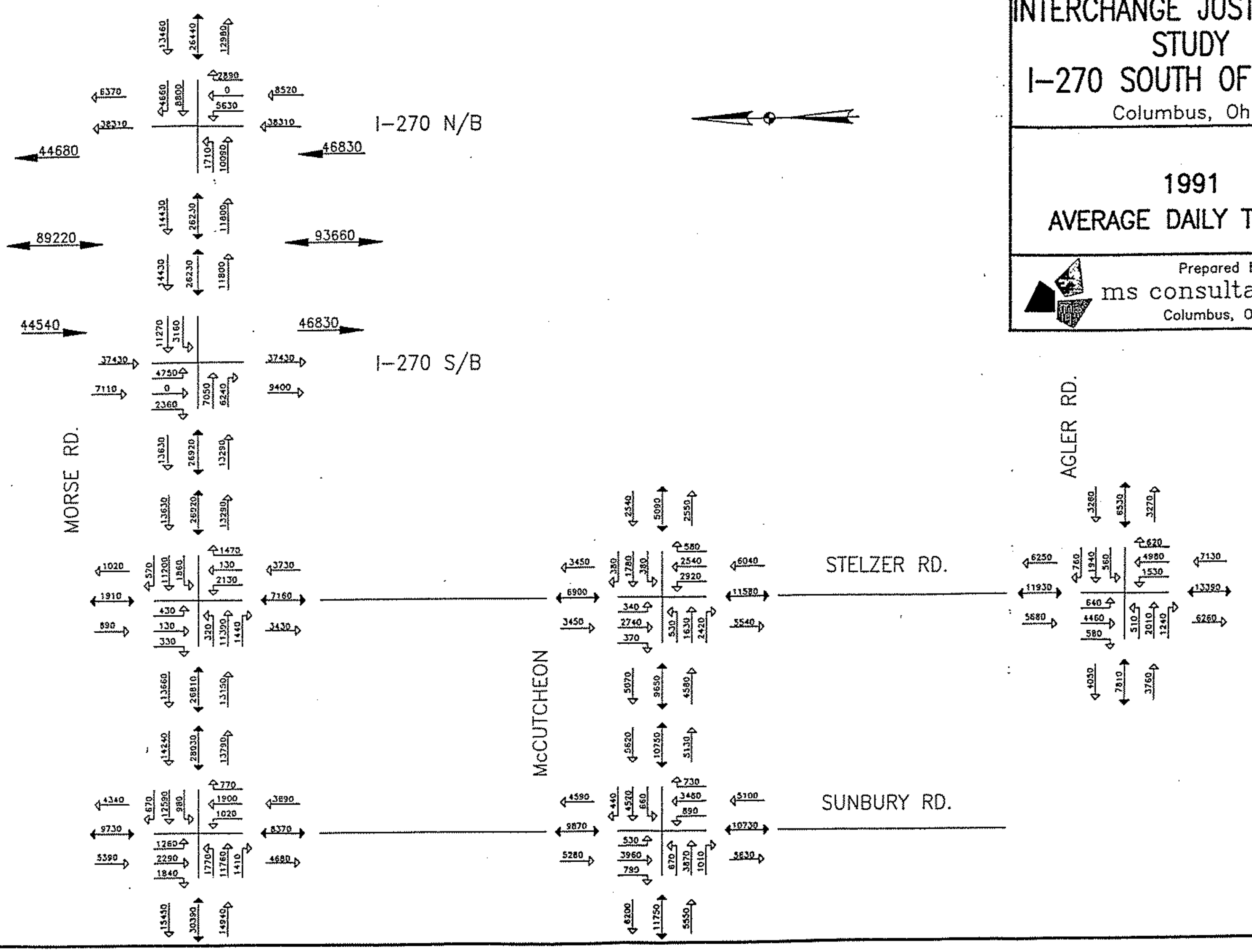


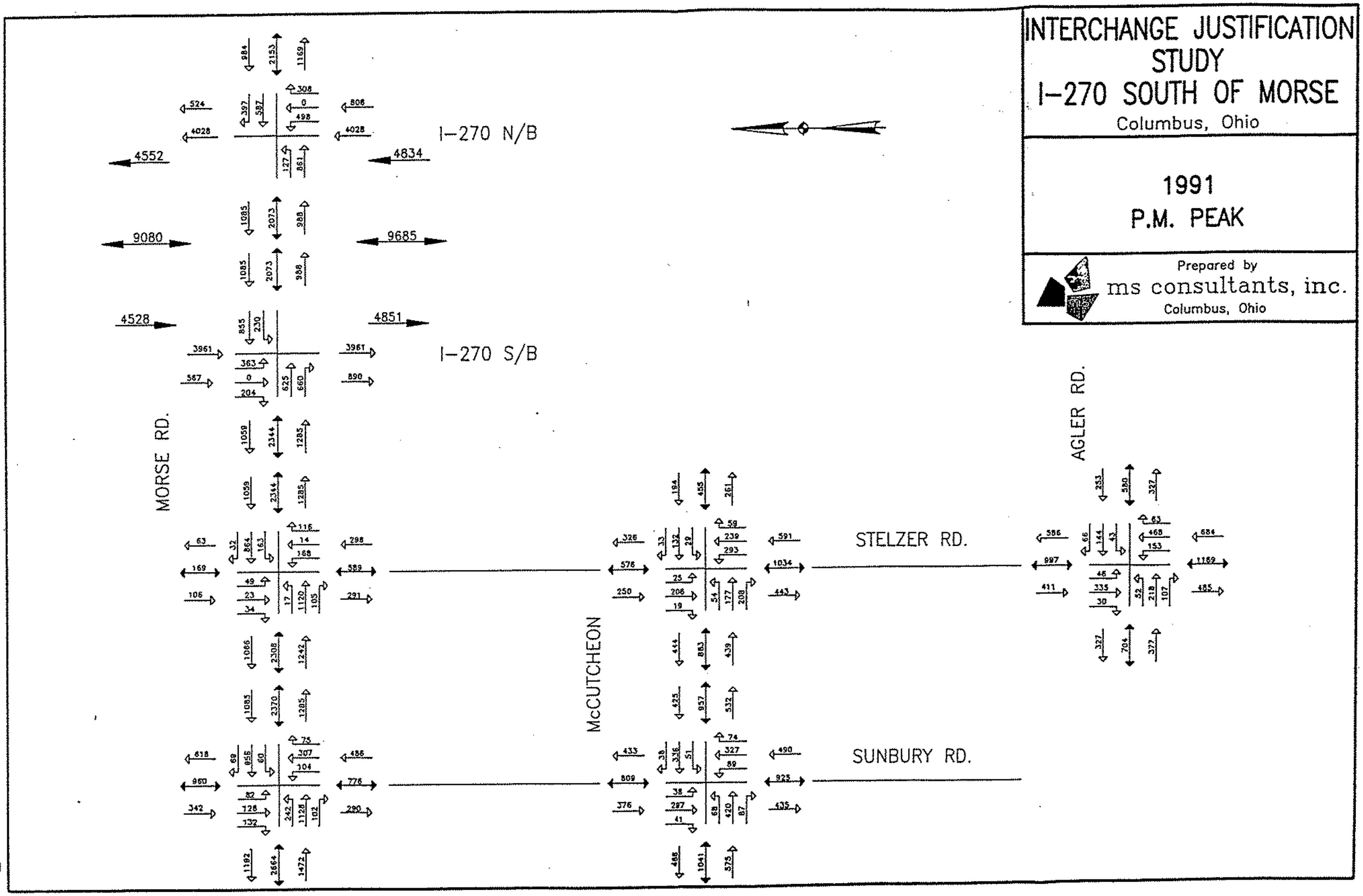
Figure 6

51215VB1 #9 2/3/92

INTERCHANGE JUSTIFICATION STUDY
I-270 SOUTH OF MORSE
Columbus, Ohio

1991
P.M. PEAK

Prepared by
ms consultants, inc.
Columbus, Ohio



51215VB1 #9 2/3/92

Figure 7

I-270
NORTHEAST OUTERBELT INTERCHANGE ACCESS STUDY
Columbus, Ohio

Figure 9

2015 DESIGN YEAR AVERAGE DAILY TRAFFIC INTERSTATE SYSTEM

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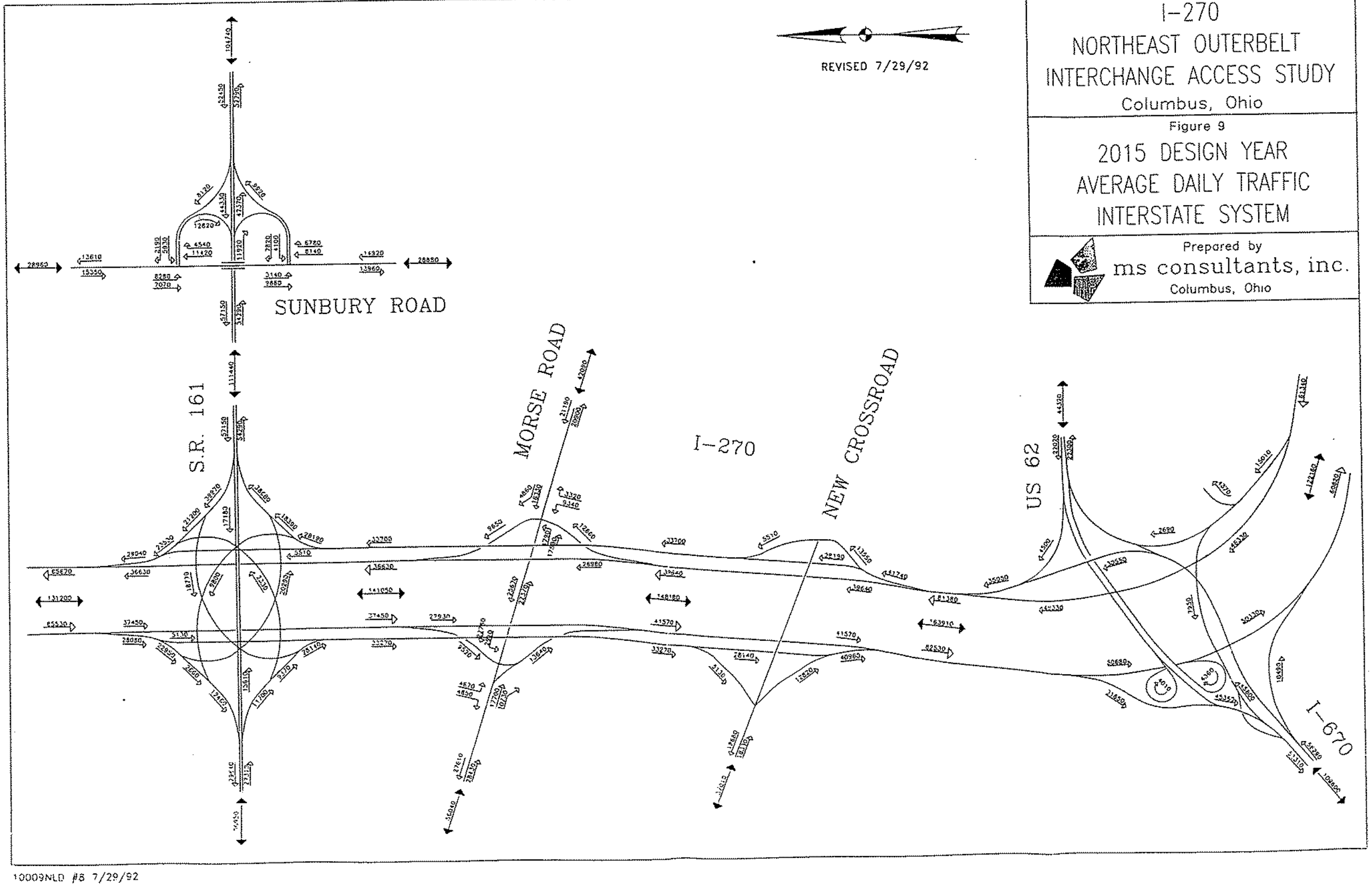
ms consultants, inc.
Columbus, Ohio



FRA–270–30.00

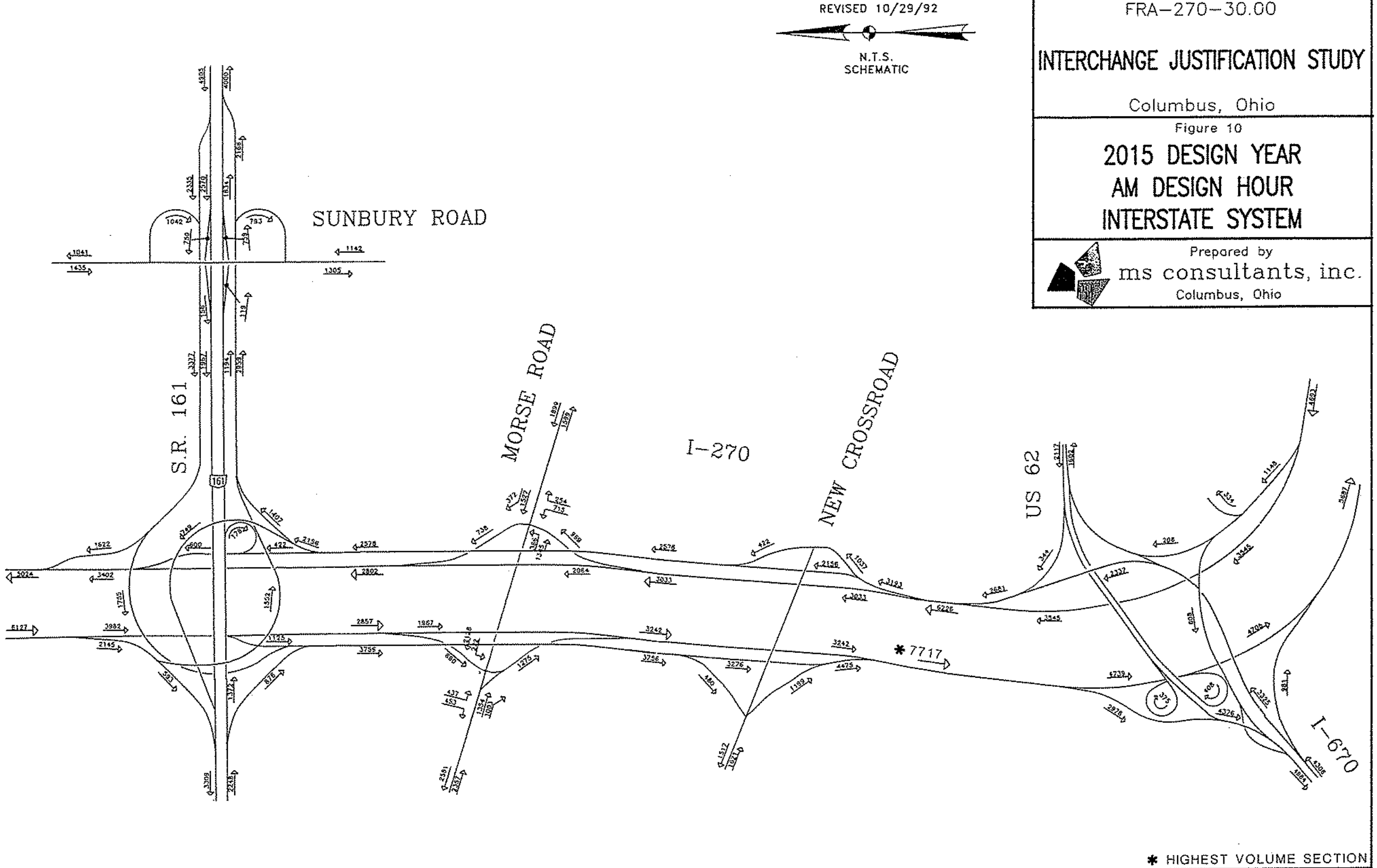
INTERCHANGE JUSTIFICATION STUDY

Columbus, Ohio

Figure 10

2015 DESIGN YEAR AM DESIGN HOUR INTERSTATE SYSTEM

Prepared by
ms consultants, inc.
Columbus, Ohio



10009ARE #8 10/29/92

FRA-270-30.00

INTERCHANGE JUSTIFICATION STUDY

Columbus, Ohio

Figure 11

2015 DESIGN YEAR PM DESIGN HOUR INTERSTATE SYSTEM

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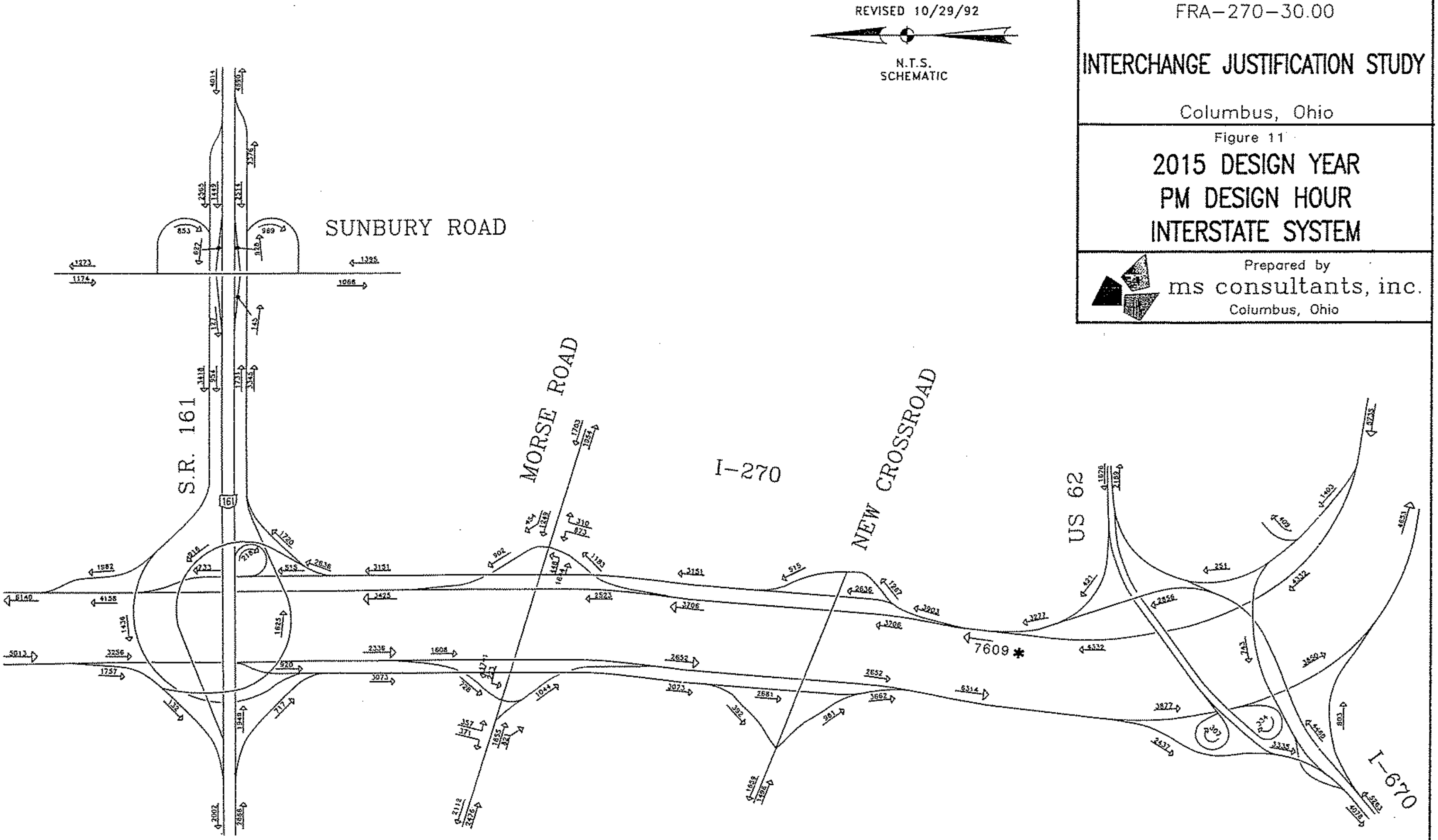
ms consultants, inc.
Columbus, Ohio

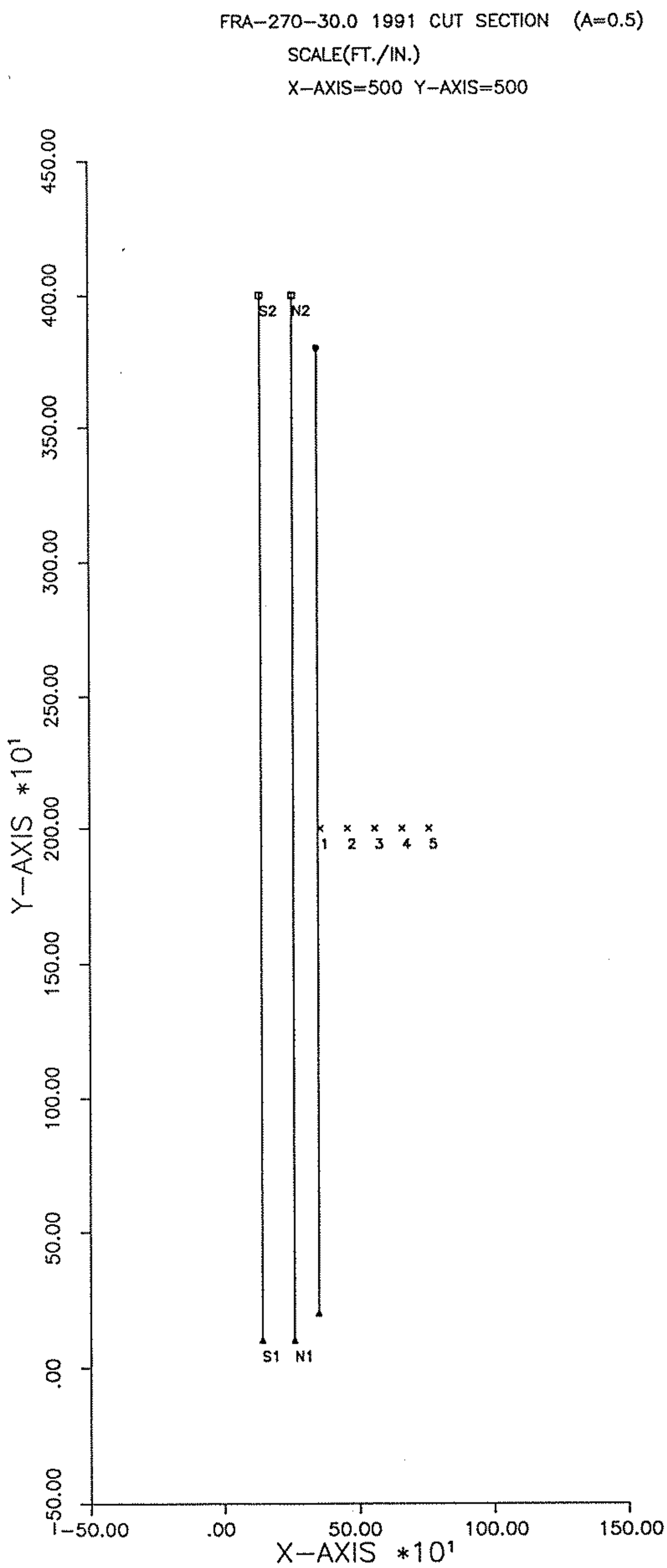
REVISED 10/29/92



* HIGHEST VOLUME SECTION

10009ART #8 10/29/92

Figure 12



FRA-270-30.0 1991 CUT SECTION (A=0.5)
SCALE(FT./IN.)
X-AXIS=500 Y-AXIS=500
S2
N2
S1
N1
1
2
3
4
5
Y-AXIS *10¹
X-AXIS *10¹
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
.00
-50.00
-50.00
.00
50.00
100.00
150.00

Figure 13

FRA-270-30.0 2015 CUT SECTION (A=0.5)
SCALE(FT./IN.)
X-AXIS=500 Y-AXIS=500

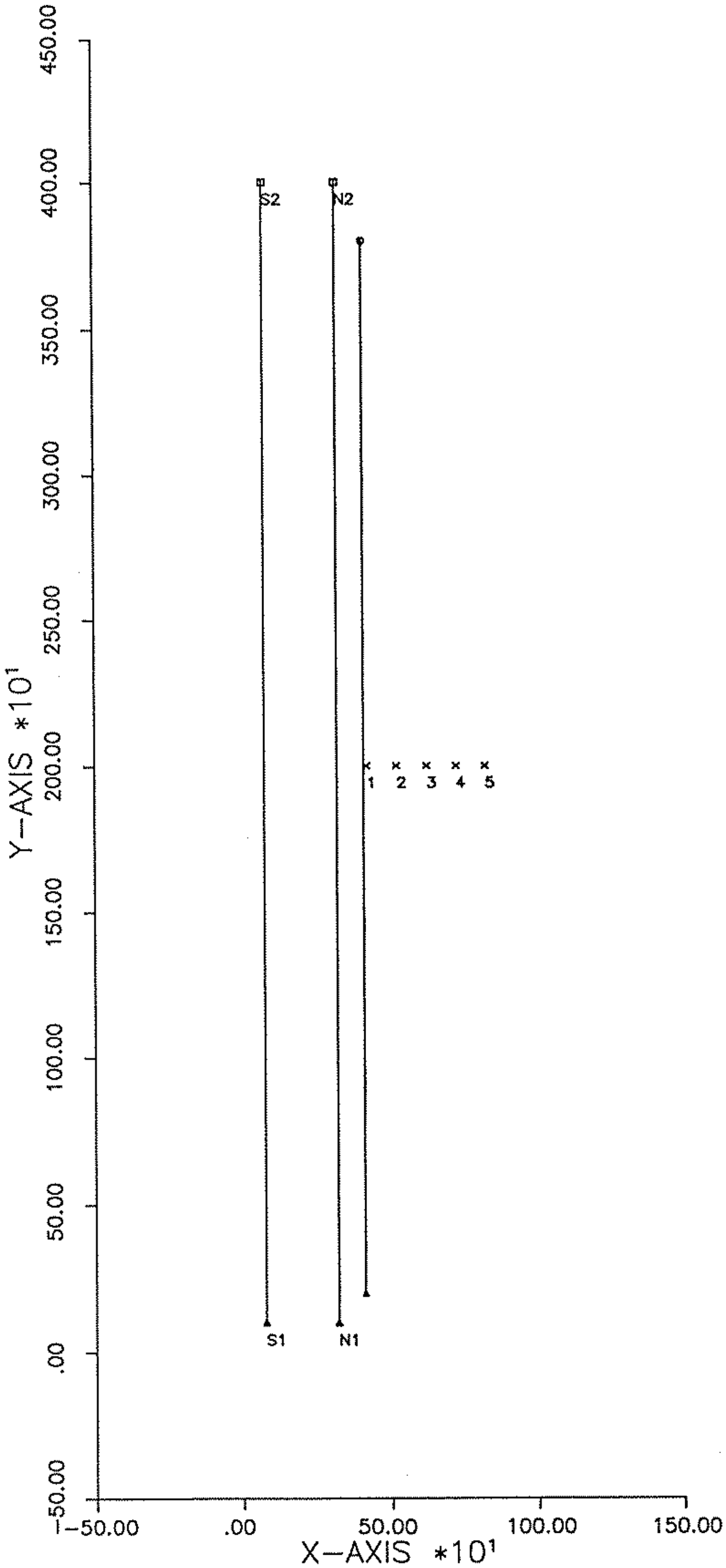
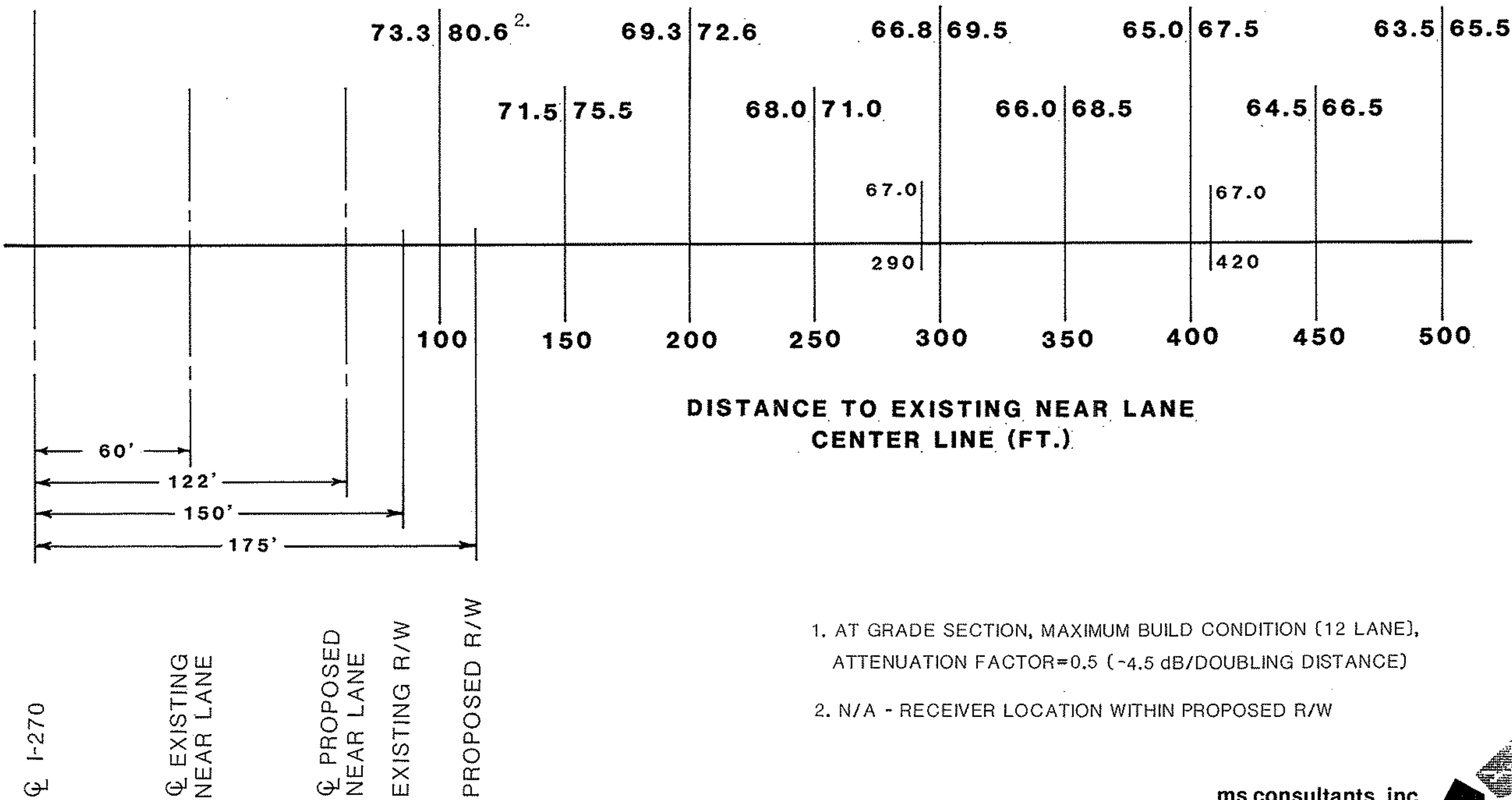


Figure 15

PREDICTED EXISTING / DESIGN YEAR NOISE LEVELS (Leq(H) dBA)[1]

1991 | 2015



1. AT GRADE SECTION, MAXIMUM BUILD CONDITION (12 LANE), ATTENUATION FACTOR=0.5 (~4.5 dB/DOUBLING DISTANCE)

2. N/A - RECEIVER LOCATION WITHIN PROPOSED R/W

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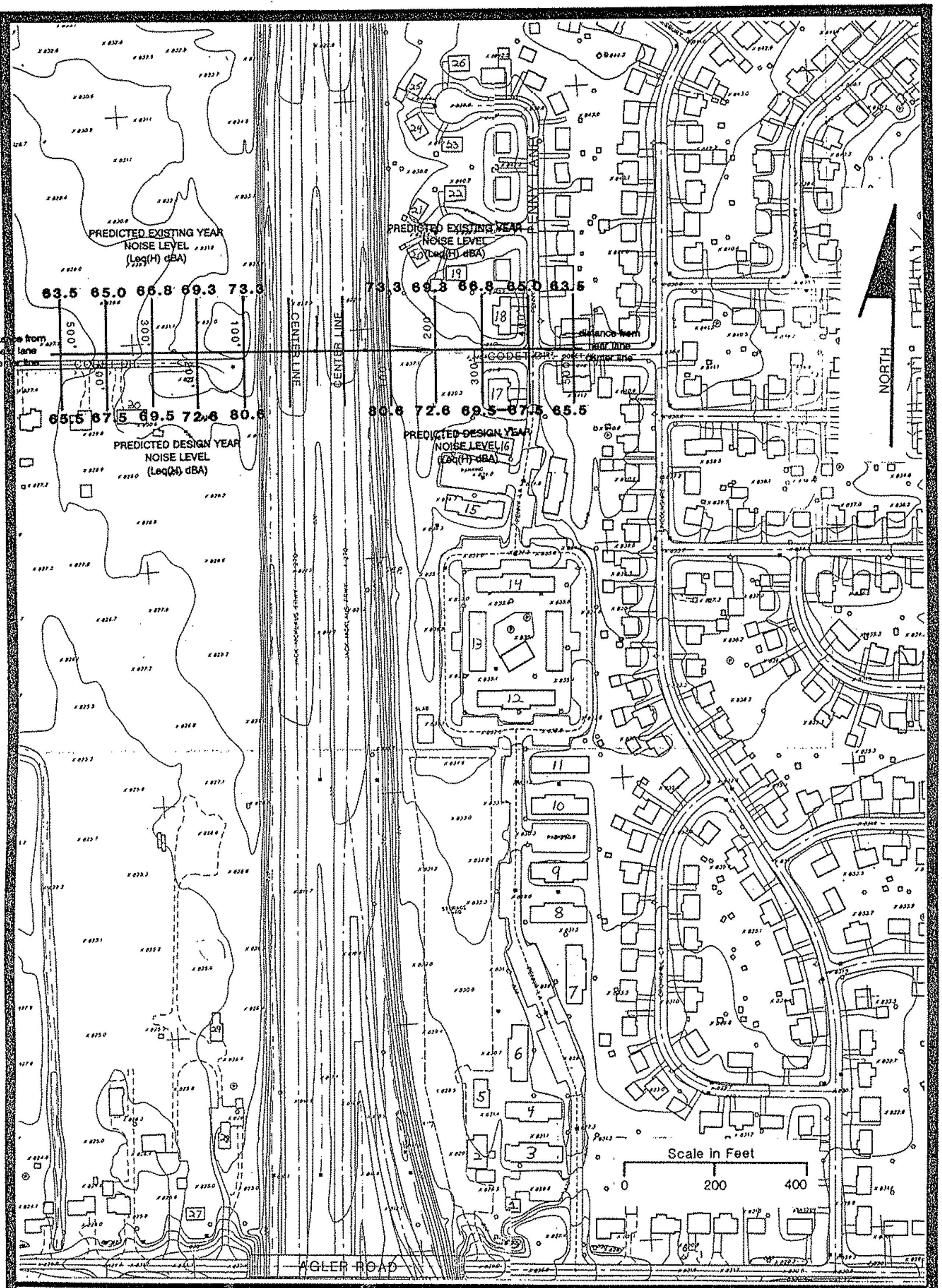


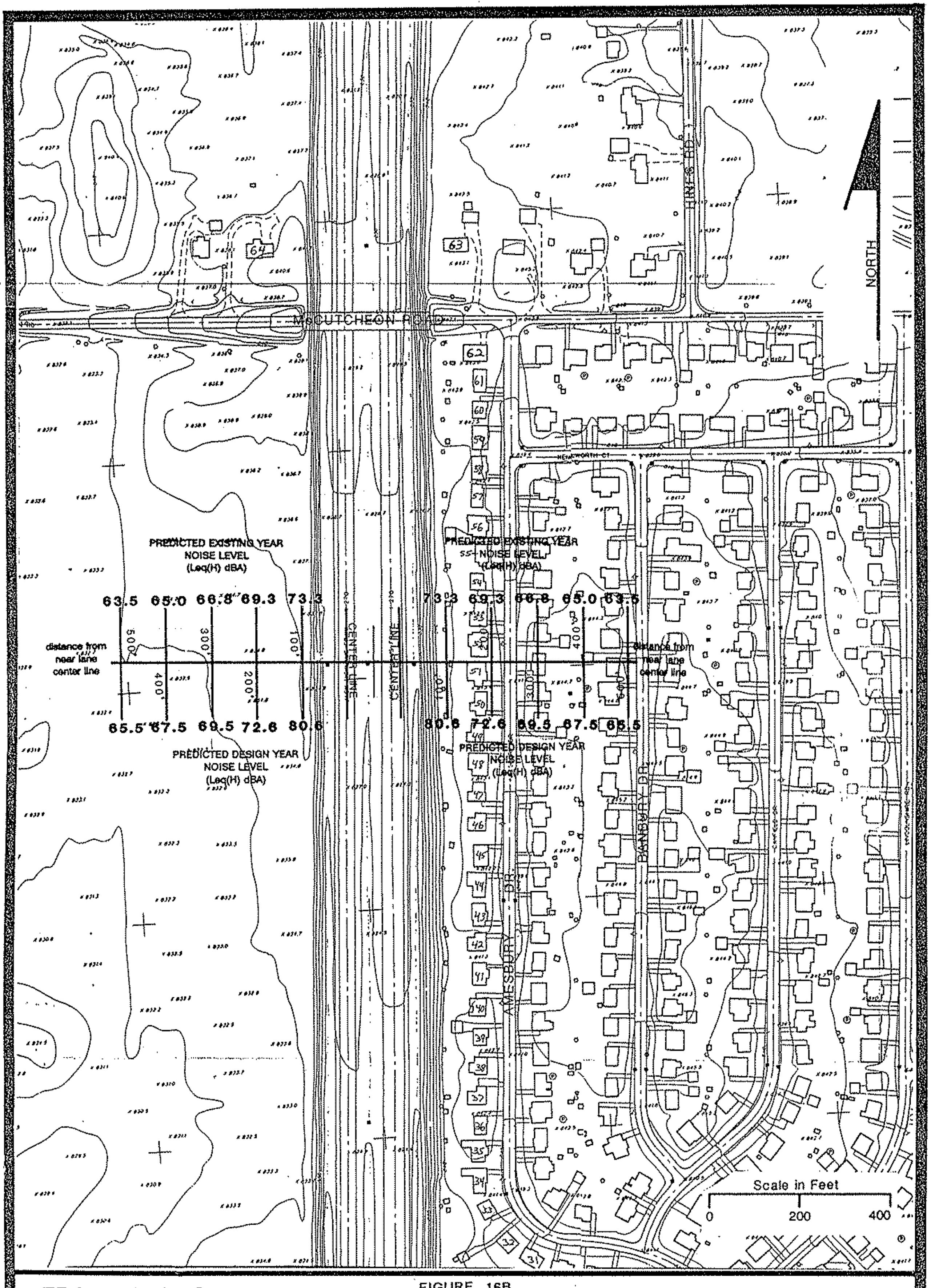
FRA-270-30.0

FIGURE 16A

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



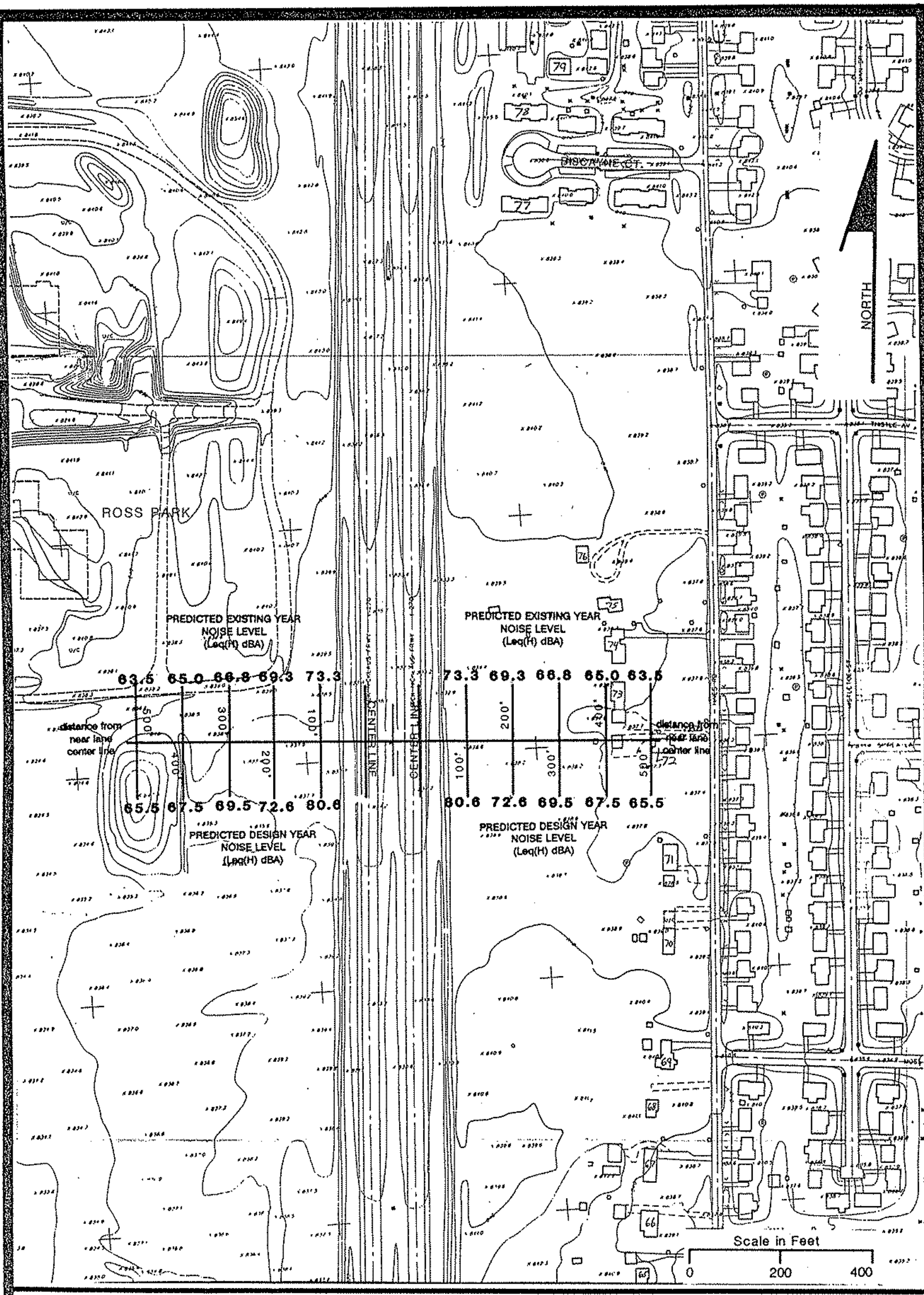
FRA-270-30.0

FIGURE 16B

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



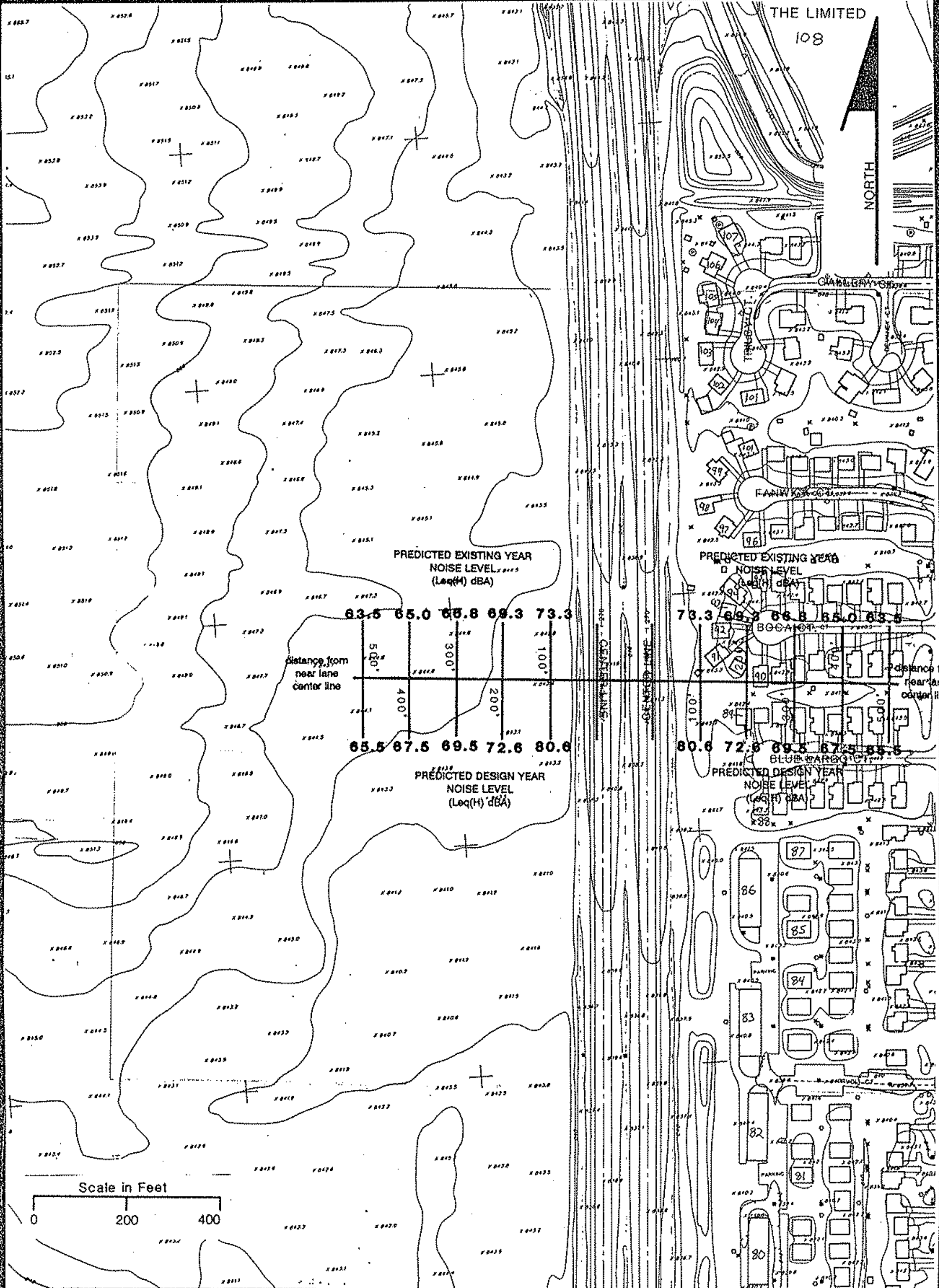
FRA-270-30.0

FIGURE 16C

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



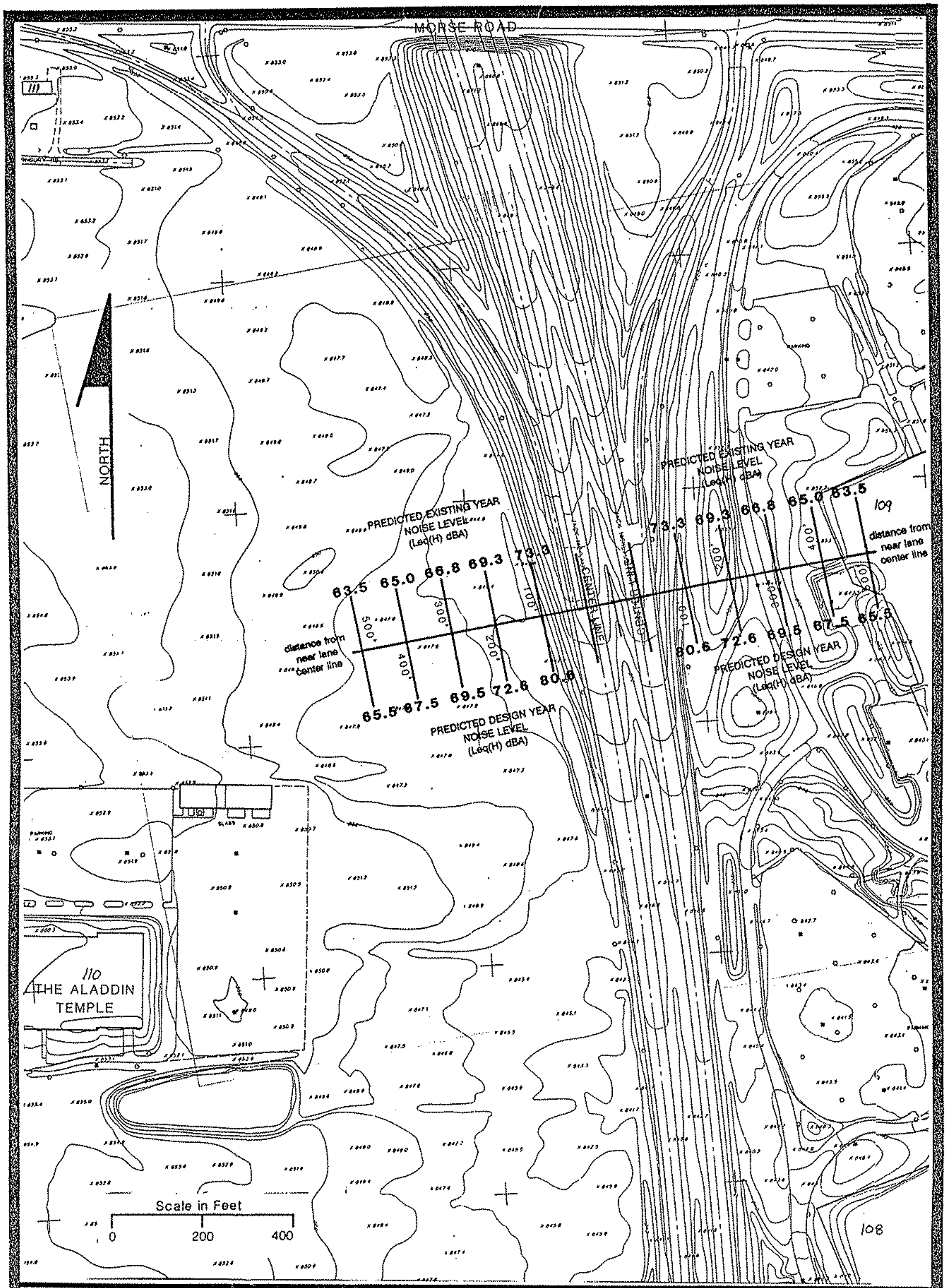
FRA-270-30.0

FIGURE 16D

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



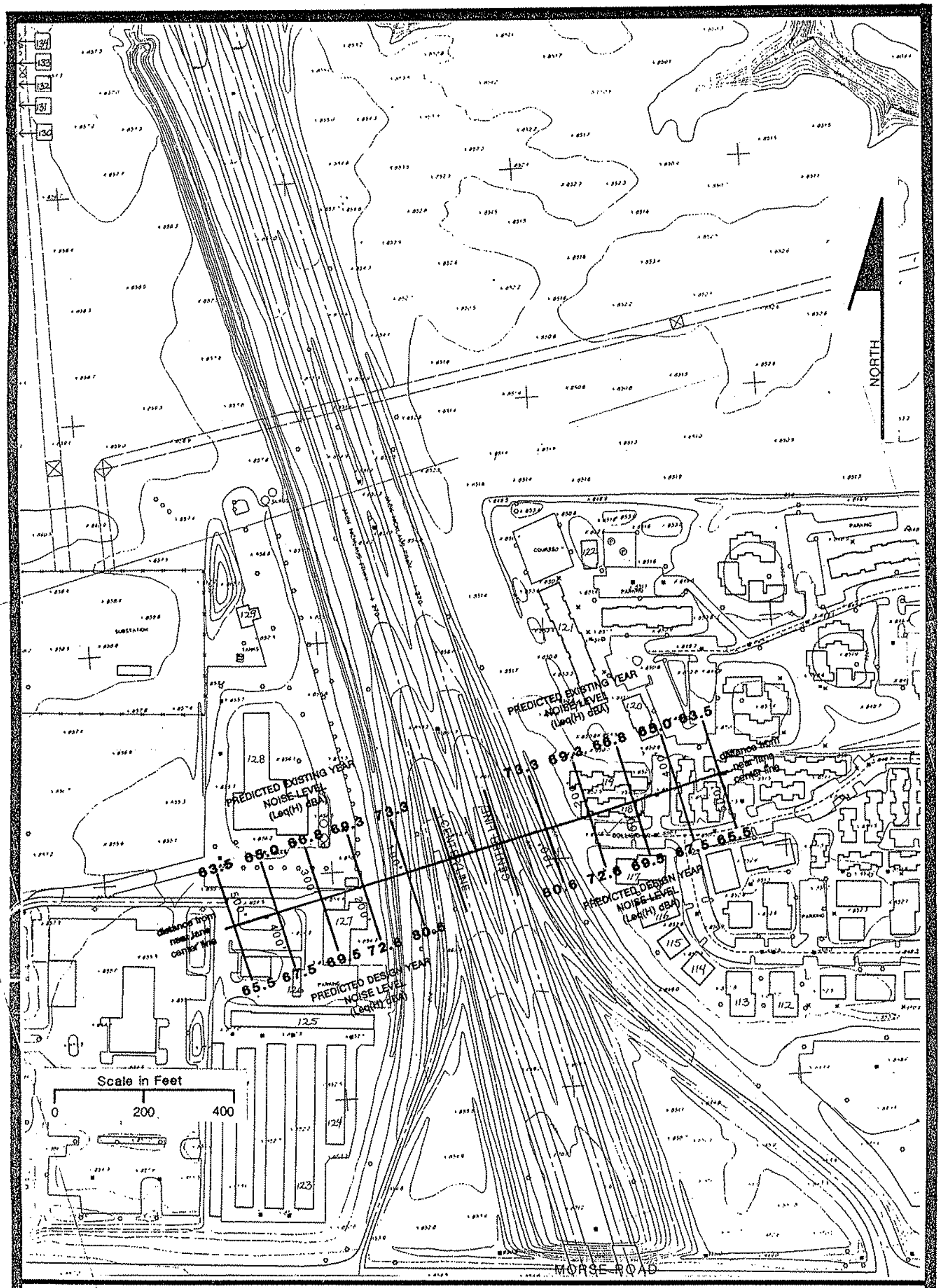
FRA-270-30.0

FIGURE 16E

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



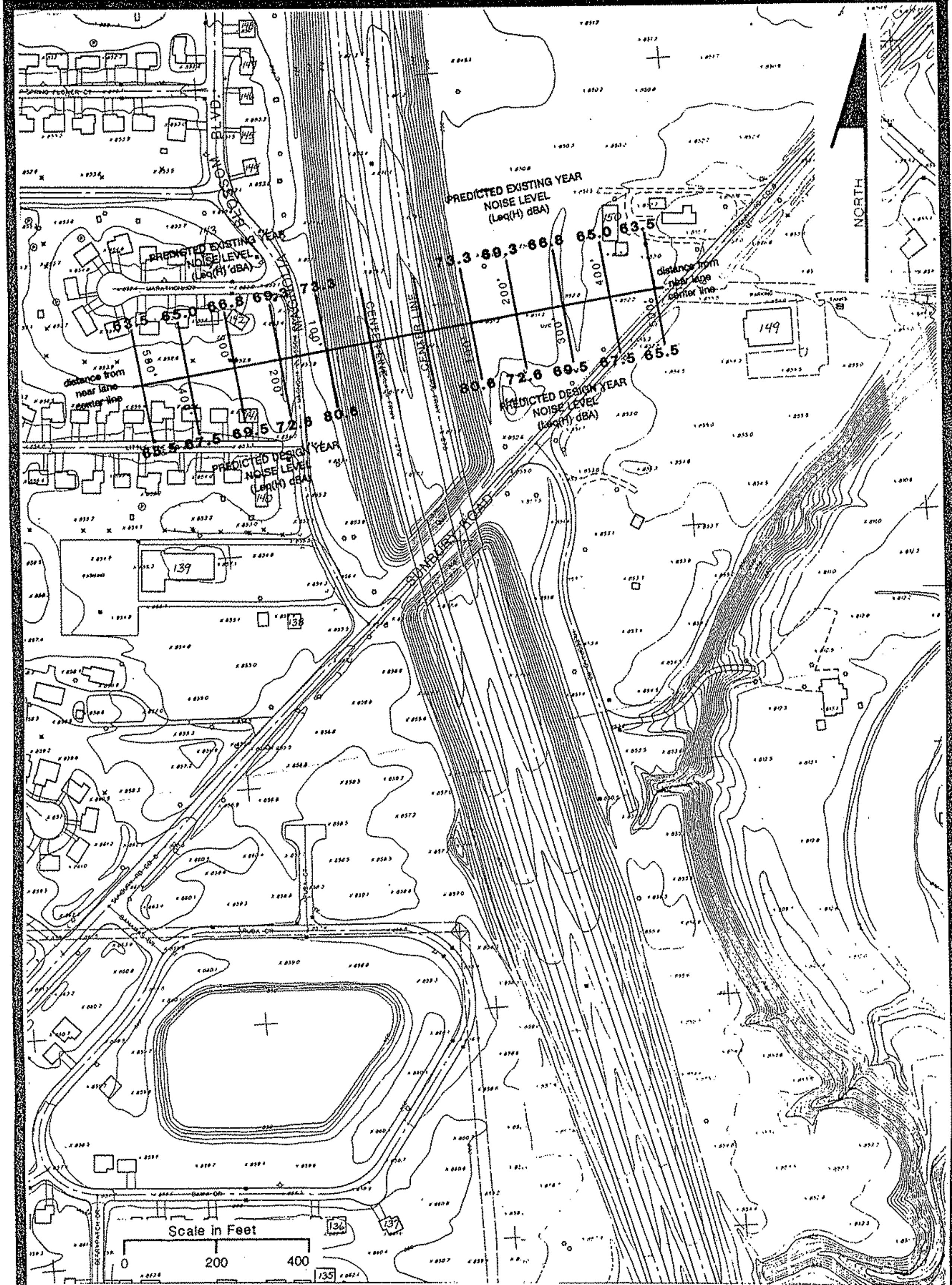
FRA-270-30.0

FIGURE 16F

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



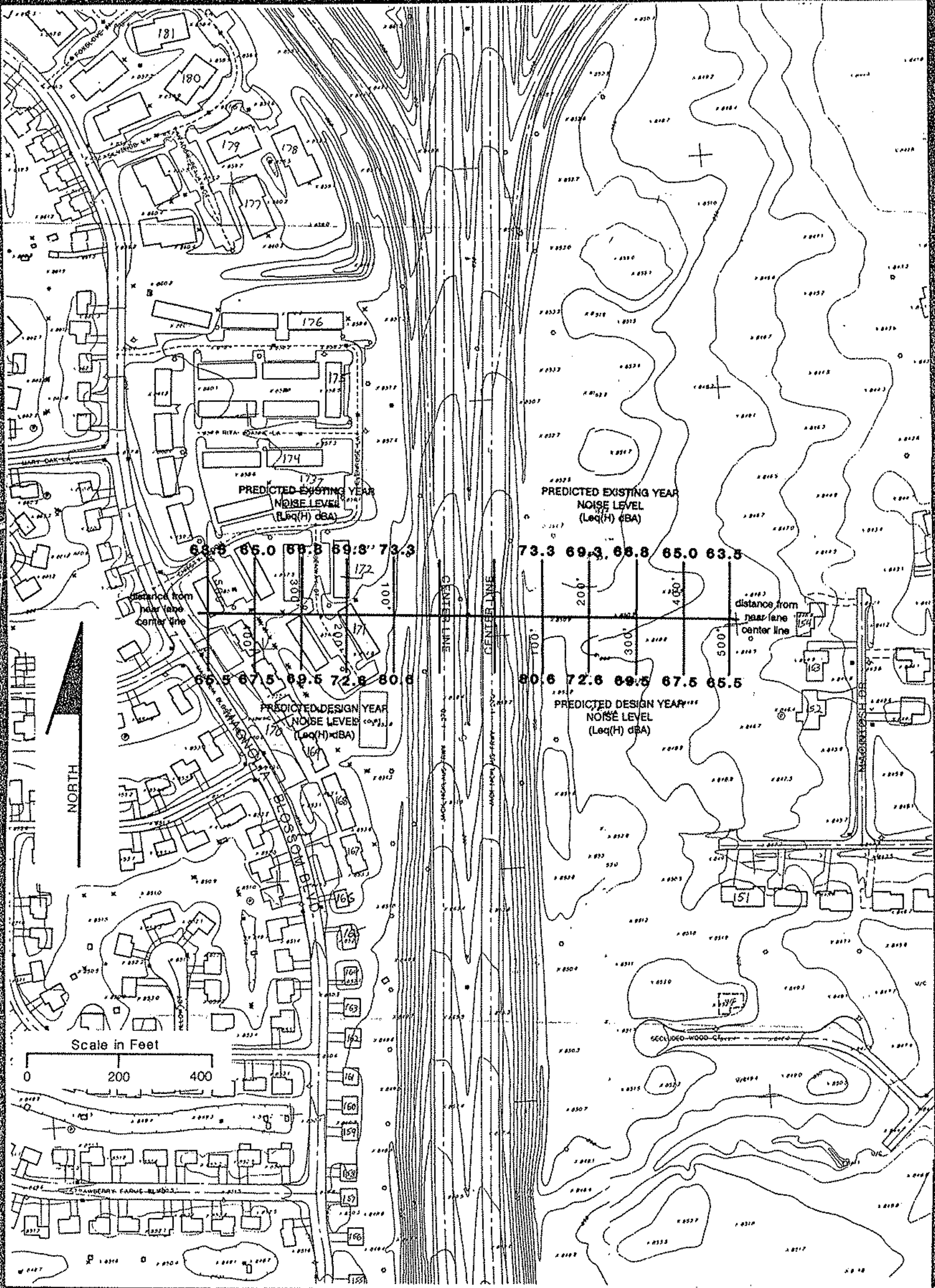
FRA-270-30.0

FIGURE 16G

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, Inc.
engineers • architects • planners



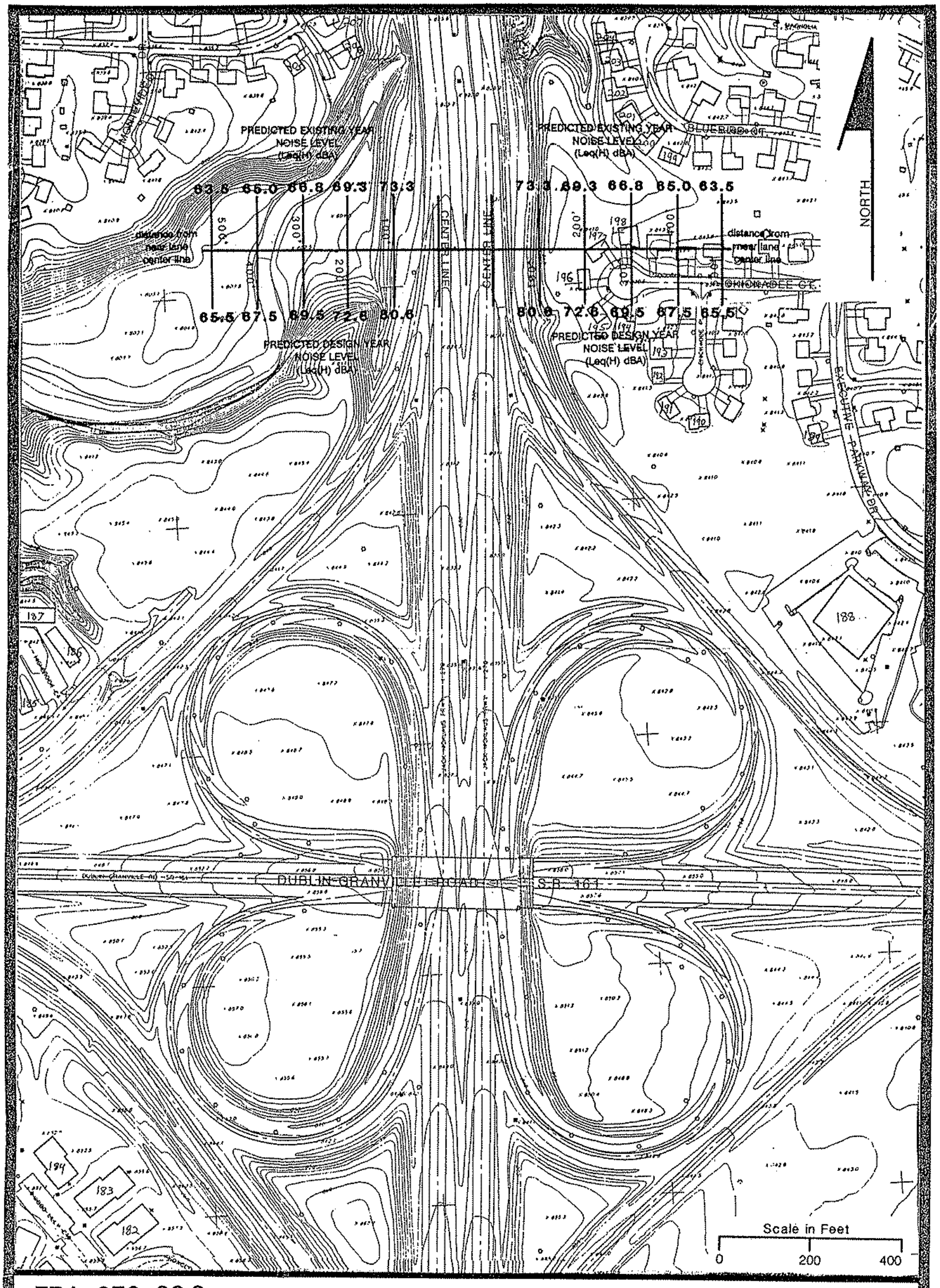
FRA-270-30.0

FIGURE 16H

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners



FRA-270-30.0

FIGURE 16I

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

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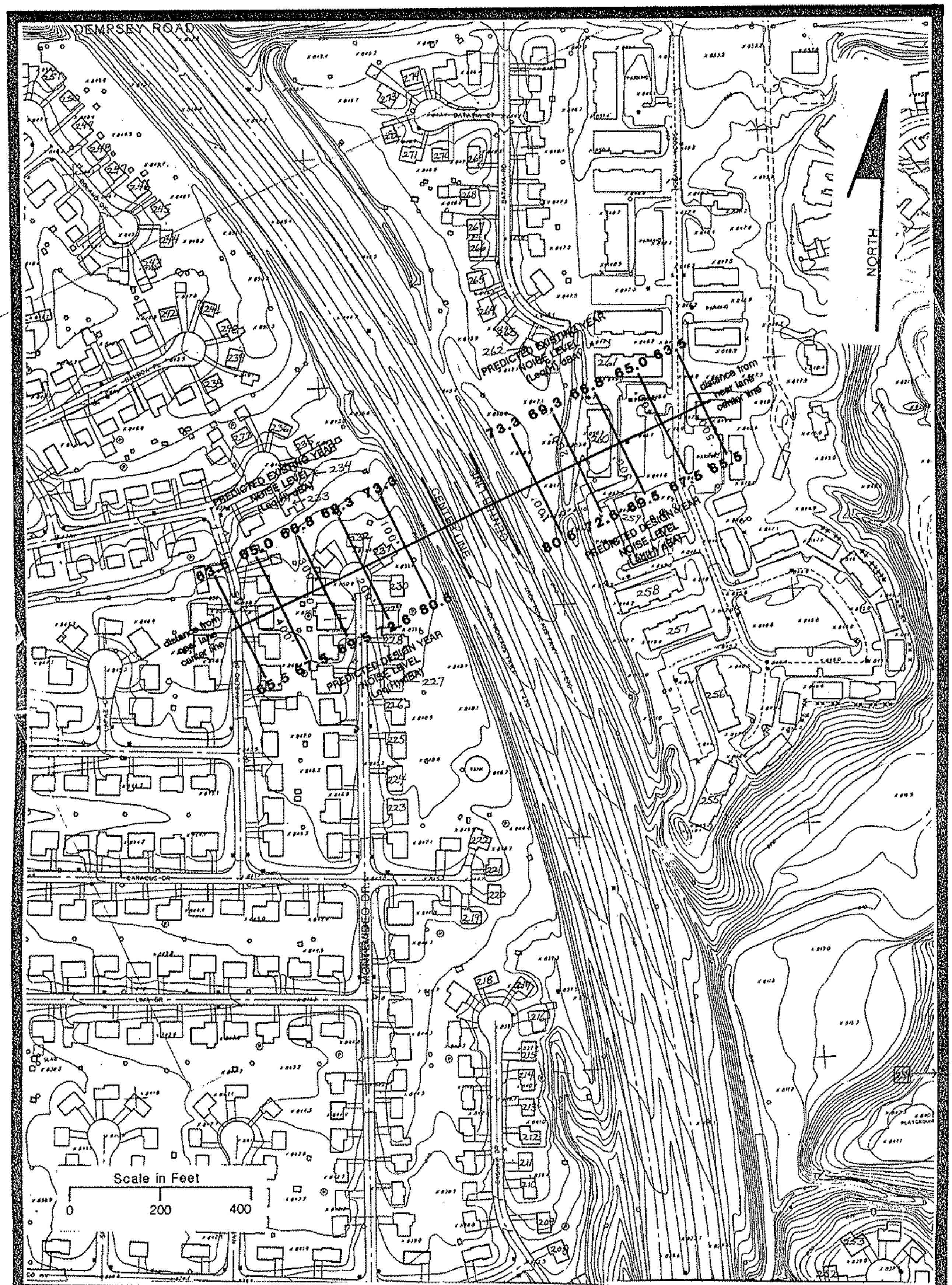
engineers • architects • planners



FRA-270-30.0

FIGURE 16J

WORSE CASE NOISE LEVELS

NOISE IMPACT ASSESSMENT

ms consultants, inc.
engineers • architects • planners

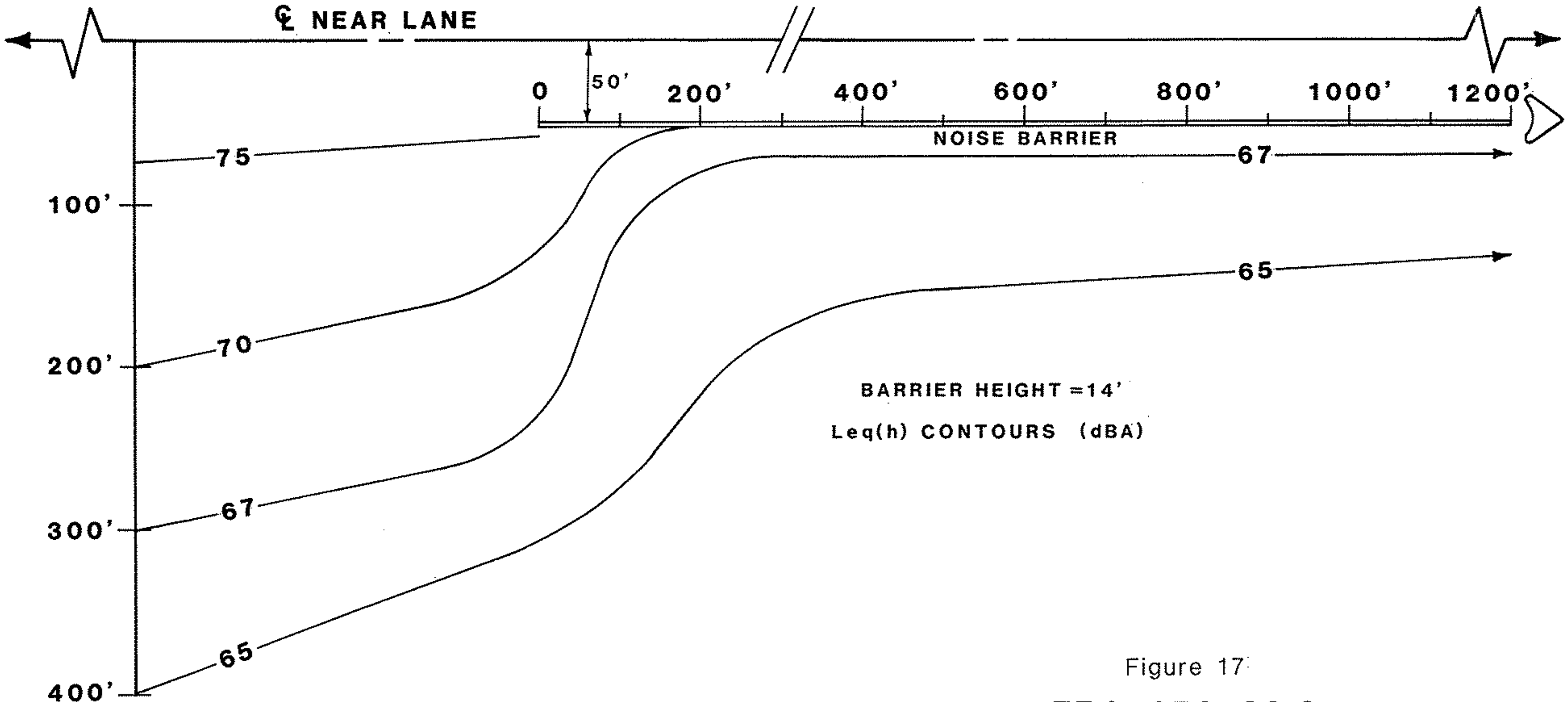


Figure 17

FRA-270-30.0
TYPICAL NOISE CONTOURS WITH BARRIERS

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FRA–270–30.0

NOISE IMPACT ASSESSMENT

APPENDIX

FRA-270-30.0

STAMINA 2.0/OPTIMA Output Files

Roadways: At-Grade
Elevated
Depressed

Alpha Factor = 0.5 All cases

Roadway/Receiver Plot Design Year

Roadway/Receiver Plot Existing Year

Sample Profile Plots Design Year

```
1                 STAMINA 2.0/BCR
            FHWA VERSION 3 (MARCH 1983)
           TRAFFIC NOISE PREDICTION MODEL
           IBM-PC VERSION 1.40
           (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
           SERIAL NUMBER 6309
           SOLD TO MOSURE & SYRAKIS COMPANY
           RUN BEGAN ON 10/20/92 AT 09:55:54

   (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )

 FRA-270-30.0 1991 CUT SECTION  (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

      HEIGHT      CODE         DESCRIPTION
        .00         1      RECEIVER HEIGHT ADJUSTMENT
       1.00         2      A-WEIGHTED SOUND LEVEL ONLY
        .00         3      HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
       8.00         4      HEIGHT ADJUSTMENT FOR HEAVY TRUCKS   (HT)
       2.30         5      HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS  (MT)

0ROADWAY   1     SOUTH BOUND LANE GROUP

                     VEHICLE TYPE   VEHICLES/HOUR     SPEED
                          CARS           4850.          55.
                          HT              100.          55.
                          MT                0.          55.
0                       ------------COORDINATES-------------
                              X           Y           Z    GRADE
 S1                         140.        100.         25.     0
 S2                         140.       4000.         25.     0

0ROADWAY   2     NORTH BOUND LANE GROUP

                     VEHICLE TYPE   VEHICLES/HOUR     SPEED
                          CARS           4850.          55.
                          HT              100.          55.
                          MT                0.          55.
0                       ------------COORDINATES-------------
                              X           Y           Z    GRADE
 N1                         260.        100.         25.     0
 N2                         260.       4000.         25.     0

 BARRIER   1   TYPE(A)     TOP OF CUT

            ---------COORDINATES----------
                X         Y        Z        Z0      DELZ        P
 C1           350.      200.      40.      25.        2.        3
 C2           350.     3800.      40.      25.

 TYPICAL RECEIVERS

                       ------------COORDINATES-------------
                              X           Y           Z
 1                          360.       2000.         46.
 2                          460.       2000.         46.
 3                          560.       2000.         46.
 4                          660.       2000.         46.
 5                          760.       2000.         46.

  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5  .5  .5  .5  .5
  2 *  .5  .5  .5  .5  .5

  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0  .0  .0  .0  .0
  2 *  .0  .0  .0  .0  .0

 RECEIVER    LEQ(H)   L10
 1             73.2   76.3

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1         1
            66.9
    2         1
```

72.0

RECEIVER LEQ(H) L10
2 67.5 70.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

ROADWAY	SEGMENT
1	1
	64.2
2	1
	64.8

RECEIVER LEQ(H) L10
3 64.8 67.2

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	61.9
2	1
	61.6

RECEIVER LEQ(H) L10
4 62.8 65.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	60.0
2	1
	59.6

RECEIVER LEQ(H) L10
5 61.3 63.6

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	58.6
2	1
	58.0

```
1                    STAMINA 2.0/BCR
              FHWA VERSION 3 (MARCH 1983)
             TRAFFIC NOISE PREDICTION MODEL
             IBM-PC VERSION 1.40
             (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
             SERIAL NUMBER 6309
             SOLD TO MOSURE & SYRAKIS COMPANY
             RUN BEGAN ON 10/20/92 AT 09:56:01


   (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )


 FRA-270-30.0 1991 ELEVATED SECTION  (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

      HEIGHT      CODE          DESCRIPTION
        .00         1      RECEIVER HEIGHT ADJUSTMENT
       1.00         2      A-WEIGHTED SOUND LEVEL ONLY
        .00         3      HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
       8.00         4      HEIGHT ADJUSTMENT FOR HEAVY TRUCKS    (HT)
       2.30         5      HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS   (MT)


0ROADWAY   1      SOUTH BOUND LANE GROUP


                              VEHICLE TYPE   VEHICLES/HOUR      SPEED
                                   CARS            4850.          55.
                                   HT               100.          55.
                                   MT                 0.          55.
0                               ------------COORDINATES-------------
                                         X            Y           Z     GRADE
 S1                                    140.         100.         80.      0
 S2                                    140.        4000.         80.      0


0ROADWAY   2      NORTH BOUND LANE GROUP


                              VEHICLE TYPE   VEHICLES/HOUR      SPEED
                                   CARS            4850.          55.
                                   HT               100.          55.
                                   MT                 0.          55.
0                               ------------COORDINATES-------------
                                         X            Y           Z     GRADE
 N1                                    260.         100.         80.      0
 N2                                    260.        4000.         80.      0


 BARRIER   1   TYPE(A)      TOP OF FILL

                ---------COORDINATES----------
                      X          Y           Z          Z0        DELZ          P
 F1                 290.       200.         75.        65.          2.          3
 F2                 290.      3800.         75.        65.


 TYPICAL RECEIVERS


                               ------------COORDINATES-------------
                                         X            Y           Z
 1                                     360.        2000.         65.
 2                                     460.        2000.         65.
 3                                     560.        2000.         65.
 4                                     660.        2000.         65.
 5                                     760.        2000.         65.


  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5  .5  .5  .5  .5
  2 *  .5  .5  .5  .5  .5


  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0  .0  .0  .0  .0
  2 *  .0  .0  .0  .0  .0


 RECEIVER      LEQ(H)    L10
 1               71.6   75.0

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1          1
             64.0
    2          1
```

70.8

```
RECEIVER    LEQ(H)   L10
2            69.1   71.7

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

ROADWAY  SEGMENT

   1        1
          64.0
   2        1
          67.5

RECEIVER    LEQ(H)   L10
3            66.8   69.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

ROADWAY  SEGMENT

   1        1
          62.4
   2        1
          64.8

RECEIVER    LEQ(H)   L10
4            65.0   67.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

ROADWAY  SEGMENT

   1        1
          60.9
   2        1
          62.8

RECEIVER    LEQ(H)   L10
5            63.5   65.3

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

ROADWAY  SEGMENT

   1        1
          59.6
   2        1
          61.2
```

```
1                STAMINA 2.0/BCR
           FHWA VERSION 3 (MARCH 1983)
          TRAFFIC NOISE PREDICTION MODEL
          IBM-PC VERSION 1.40
          (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
          SERIAL NUMBER 6309
          SOLD TO MOSURE & SYRAKIS COMPANY
          RUN BEGAN ON 10/20/92 AT 09:56:05

   (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )

 FRA-270-30.0 1991 AT-GRADE SECTION  (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

      HEIGHT      CODE        DESCRIPTION
         .00        1     RECEIVER HEIGHT ADJUSTMENT
        1.00        2     A-WEIGHTED SOUND LEVEL ONLY
         .00        3     HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
        8.00        4     HEIGHT ADJUSTMENT FOR HEAVY TRUCKS   (HT)
        2.30        5     HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS  (MT)

0ROADWAY   1     SOUTH BOUND LANE GROUP

                          VEHICLE TYPE  VEHICLES/HOUR    SPEED
                              CARS           4850.         55.
                              HT              100.         55.
                              MT                0.         55.
0                           ------------COORDINATES-------------
                                 X          Y            Z    GRADE
 S1                            140.       100.          40.     0
 S2                            140.      4000.          40.     0

0ROADWAY   2     NORTH BOUND LANE GROUP

                          VEHICLE TYPE  VEHICLES/HOUR    SPEED
                              CARS           4850.         55.
                              HT              100.         55.
                              MT                0.         55.
0                           ------------COORDINATES-------------
                                 X          Y            Z    GRADE
 N1                            260.       100.          40.     0
 N2                            260.      4000.          40.     0

 TYPICAL RECEIVERS

                           ------------COORDINATES-------------
                                 X          Y            Z
 1                             360.      2000.          46.
 2                             460.      2000.          46.
 3                             560.      2000.          46.
 4                             660.      2000.          46.
 5                             760.      2000.          46.

  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5  .5  .5  .5  .5
  2 *  .5  .5  .5  .5  .5

  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0  .0  .0  .0  .0
  2 *  .0  .0  .0  .0  .0

 RECEIVER    LEQ(H)   L10
 1             73.3   76.4

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1         1
            66.9
    2         1
            72.2

 RECEIVER    LEQ(H)   L10
 2             69.3   71.8

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA
```

ROADWAY SEGMENT

```
   1        1
          64.4
   2        1
          67.6
```

RECEIVER LEQ(H) L10

```
3           66.8   69.0
```

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

```
   1        1
          62.4
   2        1
          64.8
```

RECEIVER LEQ(H) L10

```
4           65.0   67.0
```

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

```
   1        1
          60.9
   2        1
          62.8
```

RECEIVER LEQ(H) L10

```
5           63.5   65.3
```

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

```
   1        1
          59.6
   2        1
          61.2
```

```
1               STAMINA 2.0/BCR
            FHWA VERSION 3 (MARCH 1983)
           TRAFFIC NOISE PREDICTION MODEL
           IBM-PC VERSION 1.40
           (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
           SERIAL NUMBER 6309
           SOLD TO MOSURE & SYRAKIS COMPANY
           RUN BEGAN ON 10/20/92 AT 09:56:08

    (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )

 FRA-270-30.0 2015 CUT SECTION  (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

      HEIGHT      CODE         DESCRIPTION
         .00        1     RECEIVER HEIGHT ADJUSTMENT
        1.00        2     A-WEIGHTED SOUND LEVEL ONLY
         .00        3     HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
        8.00        4     HEIGHT ADJUSTMENT FOR HEAVY TRUCKS   (HT)
        2.30        5     HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS  (MT)

0ROADWAY   1     SOUTH BOUND LANE GROUP

                     VEHICLE TYPE  VEHICLES/HOUR    SPEED
                          CARS           7700.        55.
                          HT              150.        55.
                          MT                0.        55.
0                     ------------COORDINATES-------------
                           X            Y           Z     GRADE
 S1                       78.         100.         25.      0
 S2                       78.        4000.         25.      0

0ROADWAY   2     NORTH BOUND LANE GROUP

                     VEHICLE TYPE  VEHICLES/HOUR    SPEED
                          CARS           7700.        55.
                          HT              150.        55.
                          MT                0.        55.
0                     ------------COORDINATES-------------
                           X            Y           Z     GRADE
 N1                      322.         100.         25.      0
 N2                      322.        4000.         25.      0

 BARRIER   1   TYPE(A)     TOP OF CUT

           ---------COORDINATES----------
                X         Y          Z        Z0       DELZ        P
 C1           412.      200.       40.       25.         2.        3
 C2           412.     3800.       40.       25.

 TYPICAL RECEIVERS

                     ------------COORDINATES-------------
                           X            Y           Z
 1                       422.        2000.         46.
 2                       522.        2000.         46.
 3                       622.        2000.         46.
 4                       722.        2000.         46.
 5                       822.        2000.         46.

  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5  .5  .5  .5  .5
  2 *  .5  .5  .5  .5  .5

  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0  .0  .0  .0  .0
  2 *  .0  .0  .0  .0  .0

 RECEIVER     LEQ(H)   L10
 1              74.6   77.5

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1         1
            65.8
    2         1
```

74.0

RECEIVER LEQ(H) L10
2 68.5 70.9

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

1 1
64.0
2 1
66.7

RECEIVER LEQ(H) L10
3 66.0 68.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

1 1
62.5
2 1
63.5

RECEIVER LEQ(H) L10
4 64.3 66.2

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

1 1
61.2
2 1
61.4

RECEIVER LEQ(H) L10
5 63.0 64.8

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY SEGMENT

1 1
60.1
2 1
59.9

```
1              STAMINA 2.0/BCR
           FHWA VERSION 3 (MARCH 1983)
          TRAFFIC NOISE PREDICTION MODEL
          IBM-PC VERSION 1.40
          (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
          SERIAL NUMBER 6309
          SOLD TO MOSURE & SYRAKIS COMPANY
          RUN BEGAN ON 10/20/92 AT 09:56:52

   (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )

 FRA-270-30.0 2015 ELEVATED SECTION (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

       HEIGHT      CODE        DESCRIPTION
         .00         1      RECEIVER HEIGHT ADJUSTMENT
        1.00         2      A-WEIGHTED SOUND LEVEL ONLY
         .00         3      HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
        8.00         4      HEIGHT ADJUSTMENT FOR HEAVY TRUCKS   (HT)
        2.30         5      HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS  (MT)

0ROADWAY   1     SOUTH BOUND LANE GROUP

                          VEHICLE TYPE   VEHICLES/HOUR     SPEED
                              CARS            7700.          55.
                              HT               150.          55.
                              MT                 0.          55.
0                           ------------COORDINATES-------------
                                 X          Y           Z     GRADE
 S1                             78.       100.         80.      0
 S2                             78.      4000.         80.      0

0ROADWAY   2     NORTH BOUND LANE GROUP

                          VEHICLE TYPE   VEHICLES/HOUR     SPEED
                              CARS            7700.          55.
                              HT               150.          55.
                              MT                 0.          55.
0                           ------------COORDINATES-------------
                                 X          Y           Z     GRADE
 N1                            322.       100.         80.      0
 N2                            322.      4000.         80.      0

 BARRIER   1   TYPE(A)      TOP OF FILL

              ---------COORDINATES----------
                   X         Y          Z        ZO      DELZ         P
 F1              352.      200.        75.       65.        2.         3
 F2              352.     3800.        75.       65.

 TYPICAL RECEIVERS

                         ------------COORDINATES-------------
                                 X          Y           Z
 1                             422.      2000.         65.
 2                             522.      2000.         65.
 3                             622.      2000.         65.
 4                             722.      2000.         65.
 5                             822.      2000.         65.

  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5  .5  .5  .5  .5
  2 *  .5  .5  .5  .5  .5

  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0  .0  .0  .0  .0
  2 *  .0  .0  .0  .0  .0

 RECEIVER     LEQ(H)   L10
 1              73.1   76.4

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1        1
           62.5
    2        1
```

72.7

RECEIVER LEQ(H) L10
2 70.4 72.8

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	63.5
2	1
	69.4

RECEIVER LEQ(H) L10
3 68.1 70.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	62.5
2	1
	66.7

RECEIVER LEQ(H) L10
4 66.3 68.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	61.2
2	1
	64.7

RECEIVER LEQ(H) L10
5 64.9 66.5

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	60.1
2	1
	63.1

```
1                STAMINA 2.0/BCR
           FHWA VERSION 3 (MARCH 1983)
          TRAFFIC NOISE PREDICTION MODEL
          IBM-PC VERSION 1.40
          (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
          SERIAL NUMBER 6309
          SOLD TO MOSURE & SYRAKIS COMPANY
          RUN BEGAN ON 10/20/92 AT 09:56:16

   (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )

 FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5)
0PROGRAM INITIALIZATION PARAMETERS

      HEIGHT      CODE          DESCRIPTION
        .00         1       RECEIVER HEIGHT ADJUSTMENT
       1.00         2       A-WEIGHTED SOUND LEVEL ONLY
        .00         3       HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
       8.00         4       HEIGHT ADJUSTMENT FOR HEAVY TRUCKS   (HT)
       2.30         5       HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS  (MT)

0ROADWAY   1     SOUTH BOUND LANE GROUP

                          VEHICLE TYPE  VEHICLES/HOUR    SPEED
                              CARS           7700.         55.
                               HT             150.         55.
                               MT               0.         55.
0                           ------------COORDINATES-------------
                                   X          Y           Z     GRADE
 S1                               78.       100.         40.      0
 S2                               78.      4000.         40.      0

0ROADWAY   2     NORTH BOUND LANE GROUP

                          VEHICLE TYPE  VEHICLES/HOUR    SPEED
                              CARS           7700.         55.
                               HT             150.         55.
                               MT               0.         55.
0                           ------------COORDINATES-------------
                                   X          Y           Z     GRADE
 N1                              322.       100.         40.      0
 N2                              322.      4000.         40.      0

 TYPICAL RECEIVERS

                           ------------COORDINATES-------------
                                   X          Y           Z
 1                               422.      2000.         46.
 2                               522.      2000.         46.
 3                               622.      2000.         46.
 4                               722.      2000.         46.
 5                               822.      2000.         46.

  ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .5   .5   .5   .5   .5
  2 *  .5   .5   .5   .5   .5

  SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

  1 *  .0   .0   .0   .0   .0
  2 *  .0   .0   .0   .0   .0

 RECEIVER    LEQ(H)   L10
 1             74.7   77.6

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA

 ROADWAY  SEGMENT

    1         1
            65.8
    2         1
            74.1

 RECEIVER    LEQ(H)   L10
 2             70.6   72.8

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING   40.0 DBA
```

ROADWAY SEGMENT

ROADWAY	SEGMENT
1	1
	64.0
2	1
	69.5

RECEIVER	LEQ(H)	L10
3	68.1	70.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	62.5
2	1
	66.7

RECEIVER	LEQ(H)	L10
4	66.3	68.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	61.2
2	1
	64.7

RECEIVER	LEQ(H)	L10
5	64.9	66.5

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 40.0 DBA

ROADWAY	SEGMENT
1	1
	60.1
2	1
	63.1

```
                P R O G R A M   O P T I M A
                ****************************

          BARRIER OPTIMIZATION PROGRAM USING
          PARTIAL SOUND ENERGIES COMPUTED BY THE
          STAMINA/BCR PROGRAM
              FHWA VERSION 3 -- MARCH 1983

          IBM-PC VERSION 1.40
          (C) COPYRIGHT 1987, TRINITY CONSULTANTS, INC.
          SERIAL NUMBER 6309
          SOLD TO MOSURE & SYRAKIS COMPANY
          RUN BEGAN ON 03/10/93 AT 14:26:43



     PROBLEM TITLE
     *************

FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER   SUM2.


     RECEIVER AND BARRIER IDENTIFIERS
     AS OBTAINED FROM BCR INPUT FILE
     ***********************************

 RECEIVER IDENTIFIERS  (NUMBER IN SYSTEM =   5)

1          2          3          4          5

 BARRIER IDENTIFIERS  (NUMBER IN SYSTEM =   1)

B1


     BARRIER TYPE SELECTION
     **********************

          THE FOLLOWING CODES ARE USED TO DESIGNATE MATERIAL TYPES
          (CONSTRUCTION COSTS -- DATE : 1980)

           1 FH-BERM  2 FH-MASON 3 FH-WOOD  4 FH-CONC  5 FH-STEEL

 ENTER TYPE NUMBER (1-5) FOR EACH BARRIER ELEMENT. (LIST DIRECTED)
             5


     RECEIVER SPECIFICATIONS
     ***********************

     NUMBER OF PEOPLE REPRESENTED AND EXTERIOR
     DESIGN NOISE LEVEL FOR EACH RECEIVER

 FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER


     SUMMARY OF BARRIER AND RECEIVER DATA
     ************************************

 BARR ELE      ID          TYPE
        1      B1          FH-STEEL

  REC NO.      REC ID        PEOPLE        DNL
        1      1                4.         67.
        2      2                4.         67.
        3      3                4.         67.
        4      4                4.         67.
        5      5                4.         67.

            EFFECTIVENESS/COST RATIO AND BARRIER HEIGHT MATRICES
            ****************************************************

 BARRIER SECTION        EFFECTIVENESS/COST               CORRESPONDING
  NO  IDENT                   RATIO                   BARRIER HEIGHTS(IN FT)

 HEIGHT INDEX   1   2    3    4    5    6    7    8   1  2  3  4  5  6  7  8


   1  B1        *  25.  24.  23.  21.  18.  16.  15.  0. 8.10.12.14.16.18.20.

 HEIGHT INDEX   1   2    3    4    5    6    7    8   1  2  3  4  5  6  7  8
```

BARRIER HEIGHT SELECTION FOR NOISE LEVEL AND COST CALCULATION
****

FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER

ALTERNATE BARRIER HT. ANALYSIS

BARRIER HEIGHT INDEX FOR EACH BARRIER SECTION
5
CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
14.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	1	65.9	74.5	8.6
2	2	64.6	70.0	5.5
3	3	63.3	67.8	4.5
4	4	62.2	66.2	4.0
5	5	61.2	64.8	3.6

BARRIER TYPE	COST
FH-BERM	0.
FH-MASON	0.
FH-WOOD	0.
FH-CONC	0.
FH-STEEL	565200.

****

BARRIER COST = $ 565200.

BARRIER HEIGHT SELECTION FOR NOISE LEVEL AND COST CALCULATION
****

FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER

BARRIER HT. = 16'

BARRIER HEIGHT INDEX FOR EACH BARRIER SECTION
6
CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
16.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	1	64.5	74.5	10.0
2	2	63.4	70.0	6.7
3	3	62.2	67.8	5.6
4	4	61.2	66.2	5.0
5	5	60.2	64.8	4.6

BARRIER TYPE	COST
FH-BERM	0.
FH-MASON	0.
FH-WOOD	0.
FH-CONC	0.
FH-STEEL	703300.

****

BARRIER COST = $ 703300.

BARRIER HEIGHT SELECTION FOR NOISE LEVEL AND COST CALCULATION
****

FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER

BARRIER HT. = 12'

BARRIER HEIGHT INDEX FOR EACH BARRIER SECTION
4
CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
12.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	1	67.5	74.5	7.0
2	2	65.8	70.0	4.2
3	3	64.4	67.8	3.4
4	4	63.2	66.2	3.0
5	5	62.2	64.8	2.6

BARRIER TYPE	COST
FH-BERM	0.
FH-MASON	0.
FH-WOOD	0.
FH-CONC	0.
FH-STEEL	469300.

****

BARRIER COST = $ 469300.

BARRIER HEIGHT SELECTION FOR NOISE LEVEL AND COST CALCULATION
****

FRA-270-30.0 2015 AT-GRADE SECTION (A=0.5) W/BARRIER

BARRIER HT. = 18'

BARRIER HEIGHT INDEX FOR EACH BARRIER SECTION
7
CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
18.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	1	63.2	74.5	11.3
2	2	62.2	70.0	7.8
3	3	61.1	67.8	6.7
4	4	60.2	66.2	6.0
5	5	59.3	64.8	5.5

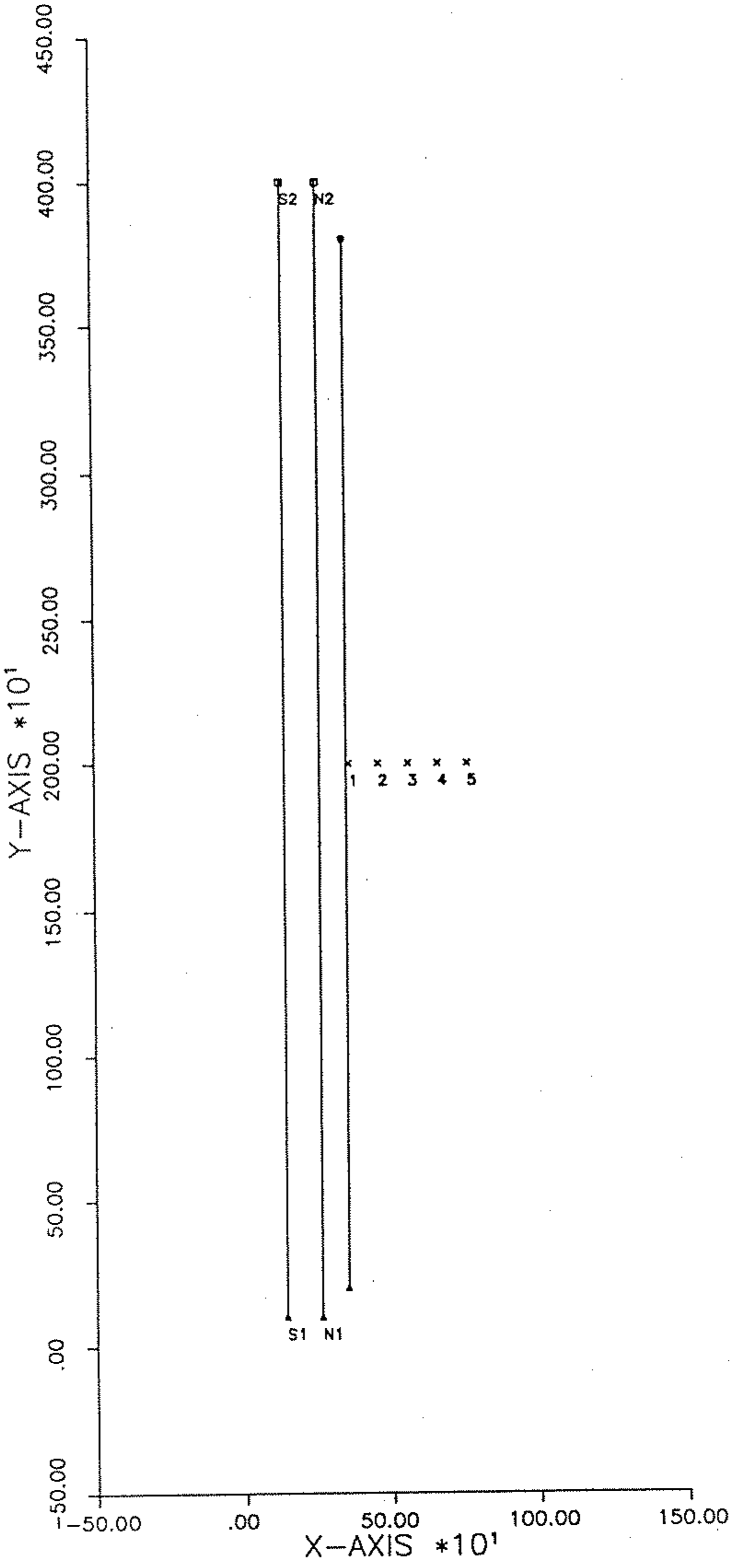
BARRIER TYPE	COST
FH-BERM	0.
FH-MASON	0.
FH-WOOD	0.
FH-CONC	0.
FH-STEEL	883700.

****

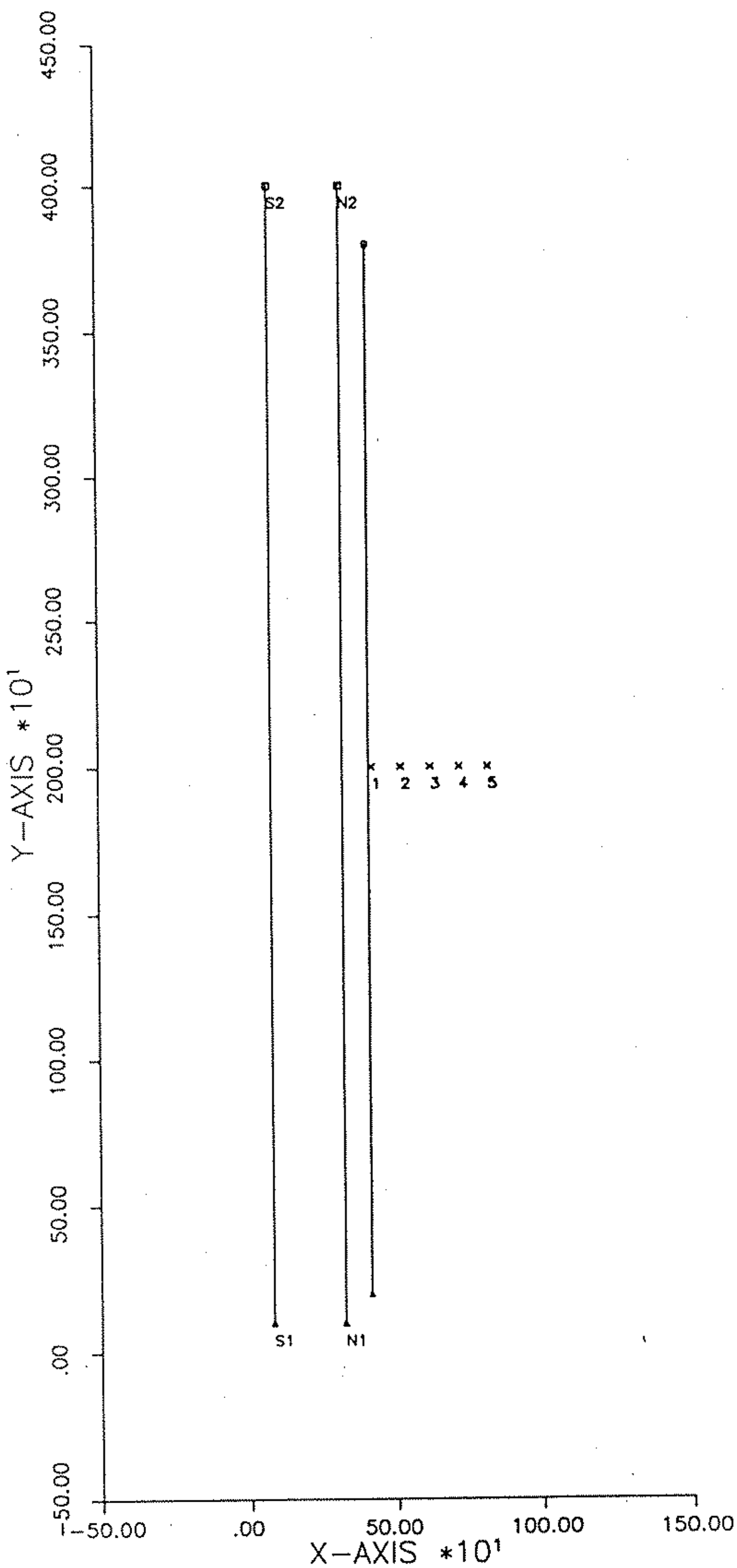
BARRIER COST = $ 883700.

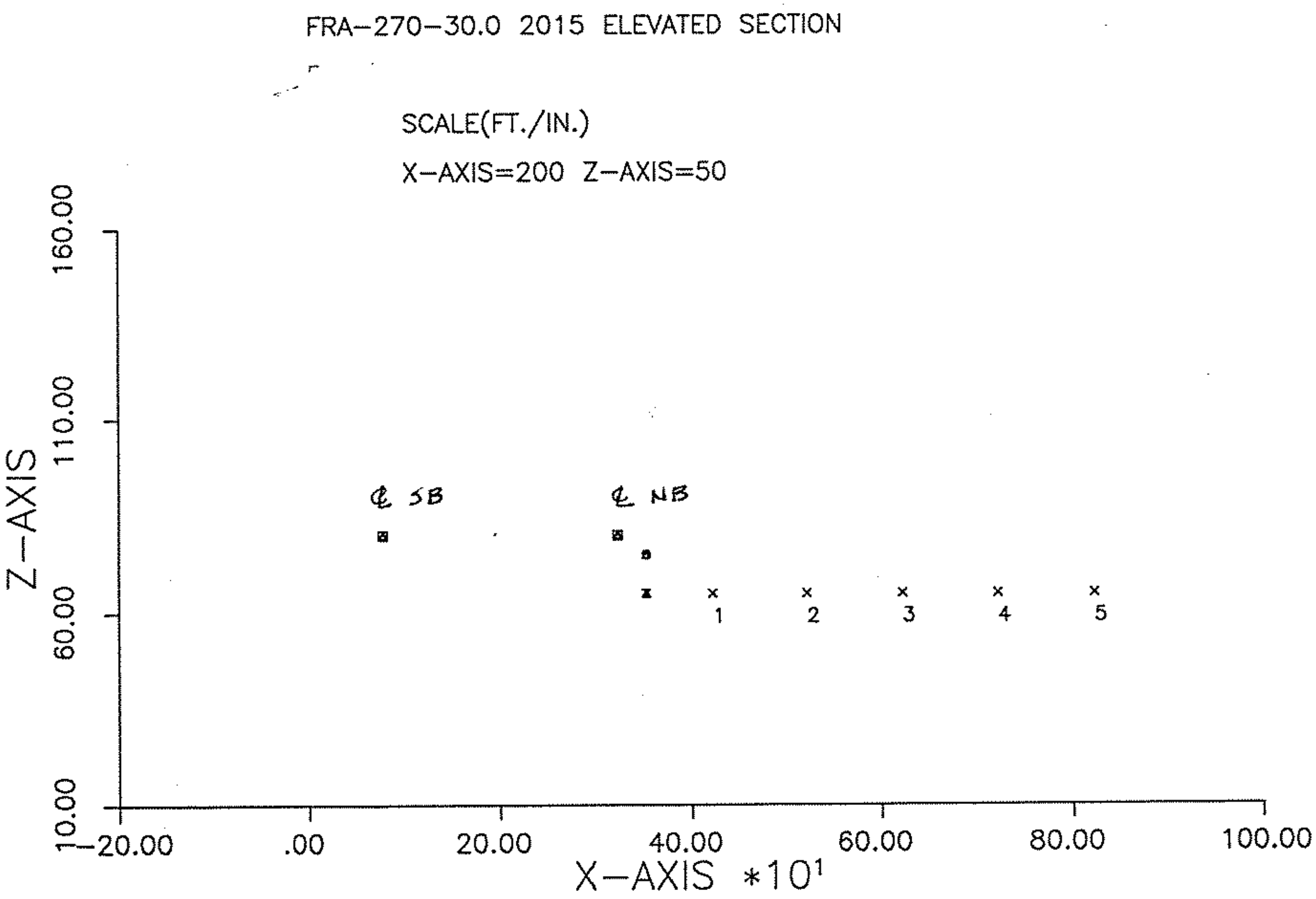
END OF ALL CASES

FRA-270-30.0 1991 CUT SECTION (A=0.5)
SCALE(FT./IN.)
X-AXIS=500 Y-AXIS=500



FRA-270-30.0 2015 CUT SECTION (A=0.5)
SCALE(FT./IN.)
X-AXIS=500 Y-AXIS=500

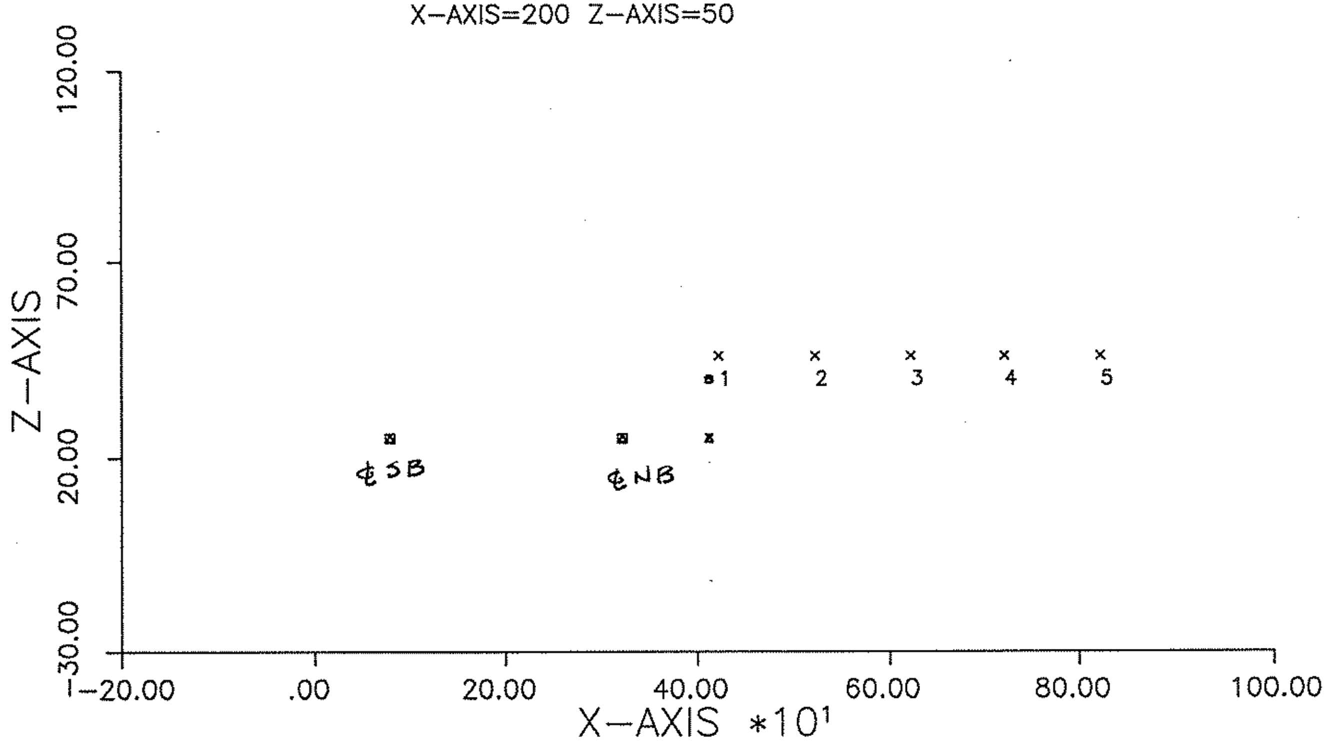



FRA-270-30.0 2015 ELEVATED SECTION
SCALE(FT./IN.)
X-AXIS=200 Z-AXIS=50
Z-AXIS
160.00
110.00
60.00
10.00
-20.00
.00
20.00
40.00
60.00
80.00
100.00
X-AXIS *10¹
℄ SB
℄ NB
1
2
3
4
5

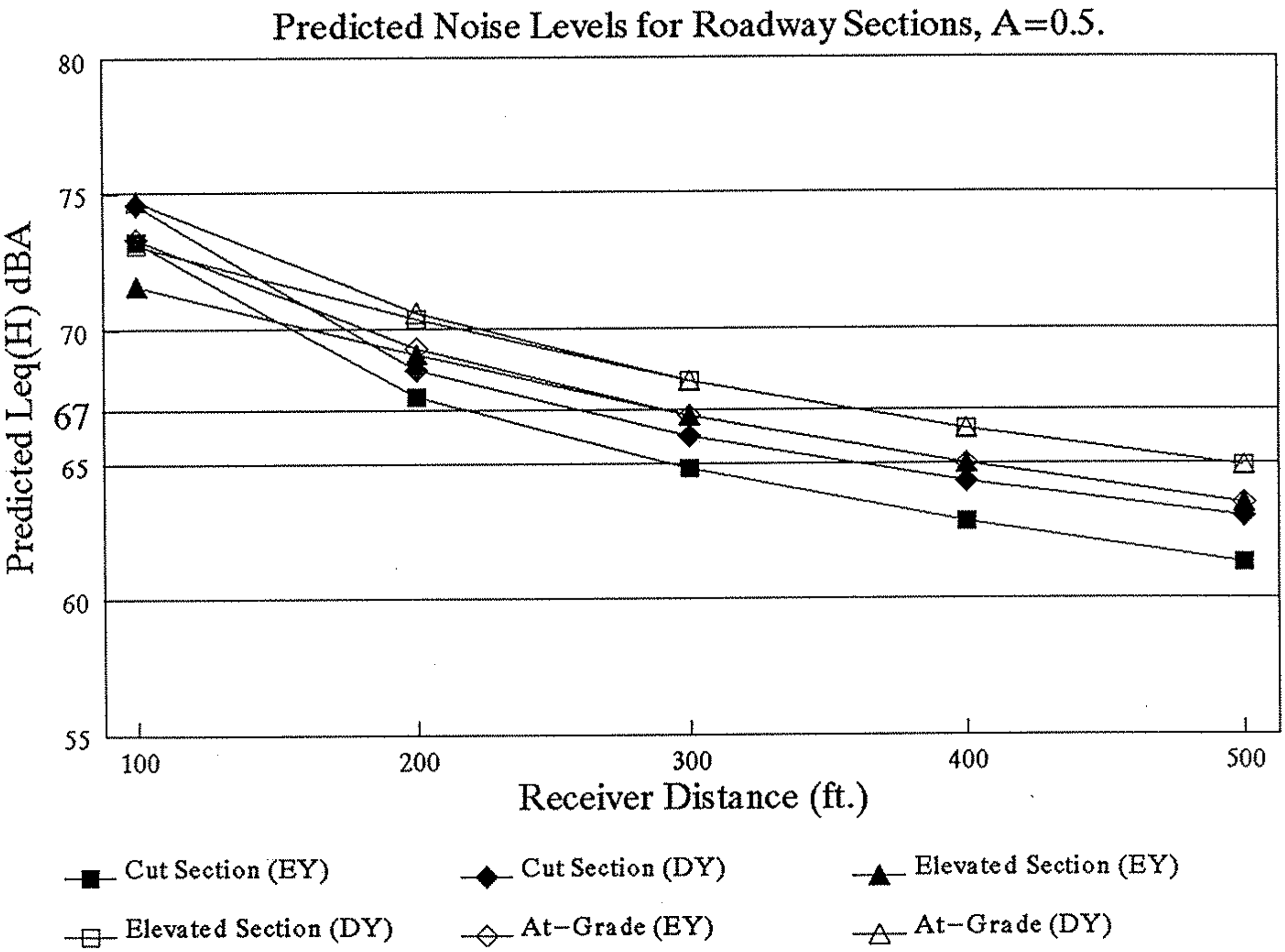
FRA-270-30.0 2015 CUT SECTION

SCALE(FT./IN.)

X-AXIS=200 Z-AXIS=50



FRA-270-30.0



Predicted Noise Levels for Roadway Sections, A=0.5.
80
75
70
67
65
60
55
Predicted Leq(H) dBA
100
200
300
400
500
Receiver Distance (ft.)
Cut Section (EY)
Cut Section (DY)
Elevated Section (EY)
Elevated Section (DY)
At-Grade (EY)
At-Grade (DY)

FRA-270-30.0

ALTERNATE ROADWAY AND ALPHA FACTOR DATA

Alternate Roadway Configurations (Two vs. Four Roadways)

Alternate Alpha Factor Evaluation ("Hard" vs. "Soft" Site)

ALTERNATE ROADWAY CONFIGURATION ANALYSIS

The effect of alternate roadway configurations was evaluated to determine the appropriate worse case scenario for assessing project noise impacts. Due to the width of the proposed typical section, which contains up to 12 lanes, two alternate roadway layouts were modelled. Additionally, both were modelled with and without the conceptual barrier. Results of these analyses are summarized on the following page.

The following roadway parameters were defined:

Alternate "DYL": Two roadways, representing northbound and southbound lane groups respectively. Maximum Design Hour traffic for any interstate section was placed on the approximate centerline of the outside lane in each direction. Distance between these roadways was 244 feet.

Alternate "DYLB": Same configuration as "DYL" with 14' barrier placed 50 feet from the near lane centerline.

Alternate "DYL4": Four roadways were modelled, two in each travel direction. Traffic was divided equally among all four roadways. The roadways were located on the outside C/D lane and the outside mainline lane of each lane group. Distance between the "C/D" and "Mainline" roadways was 62 feet. The "Mainline" roadways were separated by 120 feet. The "C/D" roadways were in the same location as the roadways specified in Alternates DYL and DYLB.

Alternate "DYL4B": Same configuration as "DYL4" with barrier placed 50 feet from the near lane centerline.

All alternatives were modelled as at-grade, straight and level sections. Receiver distances to the nearest lane were unchanged. Alpha factor at 0.5.

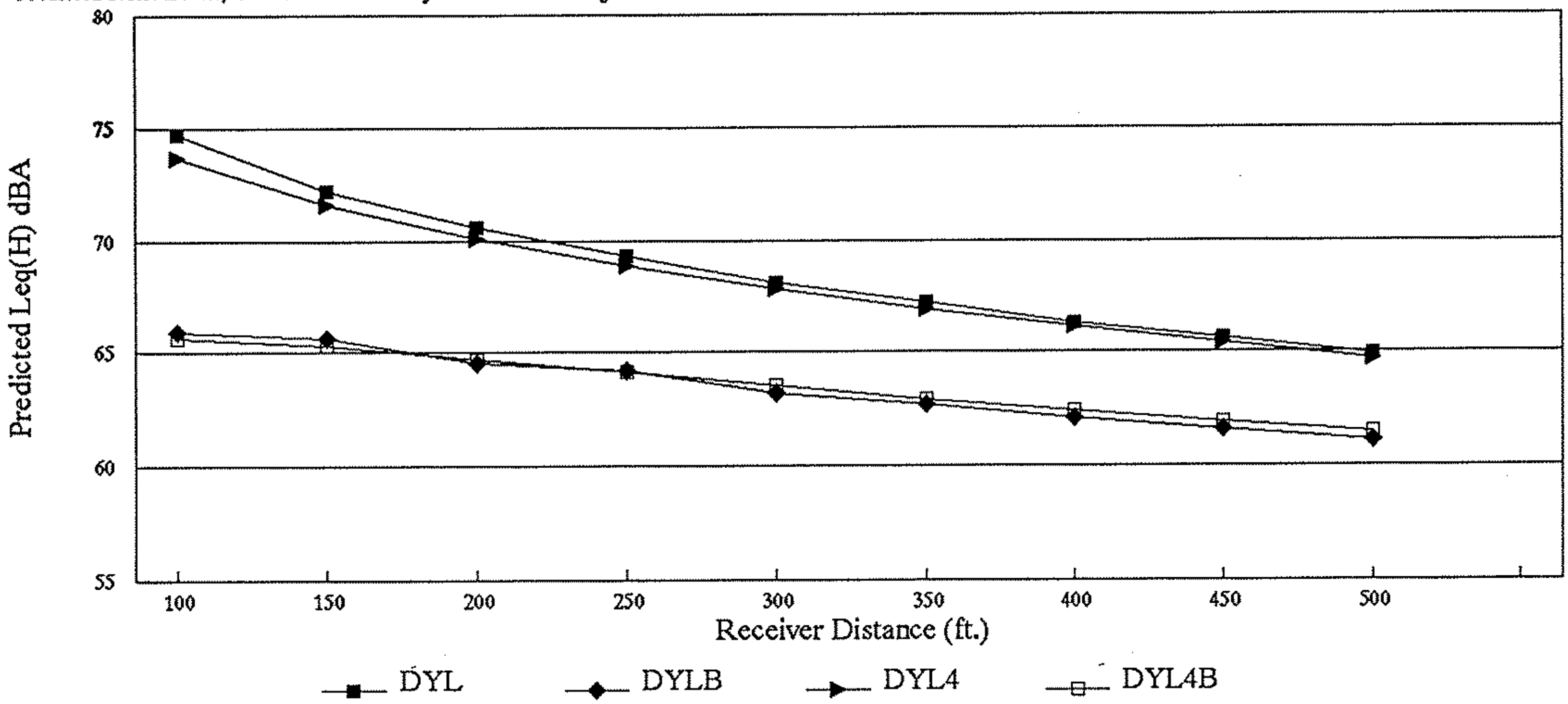
This analysis indicated that Alternates "DYL" and "DYLB" resulted in the highest predicted noise levels at all receiver locations. The two roadway configuration was utilized for the noise impact assessment.

FRA−270−30.0 Predicted Noise Levels for Typical At−grade Section; Two vs. Four Roadway Altemate Configurations.

MODELED CONFIG.	NO. RDWYS	BARRIER	ALPHA FACTOR	Leq (dBA) @ RECEIVER DISTANCE (ft.) 100	150	200	250	300	350	400	450	500
DYL	2	NO	0.5	74.7	72.2	70.6	69.3	68.1	67.2	66.3	65.6	64.9
DYLB	2	YES	0.5	65.9	65.6	64.5	64.2	63.2	62.7	62.1	61.6	61.1
DYL4	4	NO	0.5	73.7	71.6	70.1	68.9	67.8	66.9	66.1	65.4	64.7
DYL4B	4	YES	0.5	65.6	65.3	64.7	64.1	63.5	62.9	62.4	61.9	61.5

FRA−270−30.0

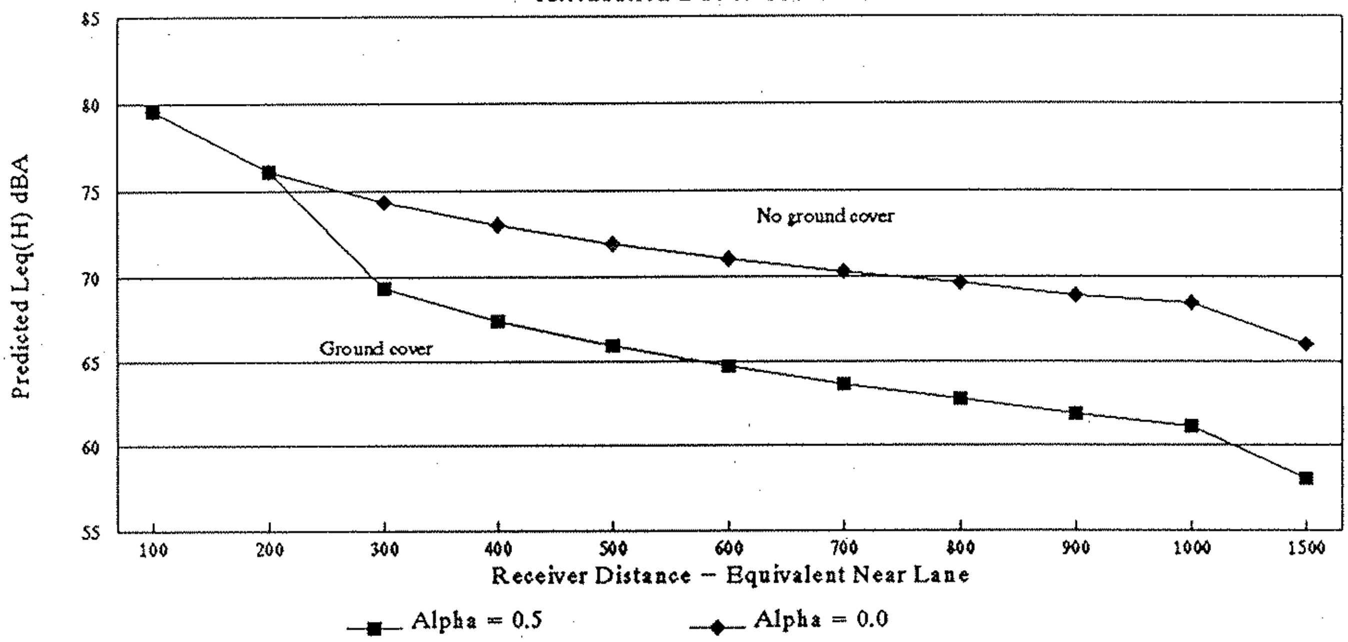
Predicted Noise Levels, Generalized Roadway and Barrier Configurations.



Design Year Condition. Receiver distance to centerline near lane.

FRA-270-30.0

Attenuation Due to Ground Cover



FRA-270-30.0 Predicted Noise Levels for Typical Roadway Sections

a=0.0

YEAR	TYPICAL ROADWAY SECTION	Leq (dBA) @RECEIVER DISTANCE (ft.)* 100	200	300	400	500
EXISTING (1991)	CUT	76.2	67.2	64.9	63.1	61.7
	ELEVATED	72.9	71.1	70.6	69.5	68.5
	AT-GRADE	76.3	73.6	71.8	70.5	69.4
DESIGN (2015)	CUT	77.6	68.9	66.5	64.8	63.4
	ELEVATED	74.4	72.6	72.1	70.7	69.7
	AT-GRADE	77.7	74.9	73.2	71.9	70.9

* Distance from equivalent near lane group.

FRA-270-30.0

Predicted Noise Levels for Roadway Sections, A=0.0.