

**THE EVALUATION OF HONEY COMB
HIGHWAY SOUND BARRIER
I-280 SECTION 8B**

HARRISON, NEW JERSEY

**BY
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16. Abstract The purpose of this study was to determine the insertion loss of a traffic noise barrier erected along I-280 in Harrison, N.J. This barrier was constructed of a phenolic-impregnated paper honeycomb core faced with aluminum panels on both sides, a type not previously used in New Jersey. Noise data was recorded both before and after barrier construction, from several microphones placed at two locations at a site adjacent to the highway. These microphones were placed at 5, 11.5, and 18 feet above the pavement of a dead-end street, at 75 and 150 feet from the center of the near lane. The highest microphone was at I-280 pavement level, since the road was elevated along the entire portion on which the barrier was built. Also recorded were traffic counts by type of vehicle for both eastbound and westbound traffic, and traffic speeds for westbound traffic only. The noise data was reduced to obtain large samples of Leq's for each microphone position. These were analyzed statistically using a non-parametric method to find the insertion loss for each position, along with 95% confidence limits. It was found that the barrier was moderately successful in reducing traffic noise, for the conditions of the study. For comparison purposes, small samples were randomly selected from the full-size samples and analyzed using the same method. It was found that the small sample results did not approximate those from the large samples to an acceptable degree.					
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DEFINITIONS

dB - The abbreviation for decibel, a measurement of sound level. A noise whose level is increased by 10dB is perceived as being twice as loud as the original. Conversely, if the level were reduced by 10dB it would be perceived as being one-half as loud as the original.

Confidence Level - The percentage of the time that a particular statistically determined quantity is expected to be found between its confidence limits. A 95% confidence level indicates that a particular insertion loss lies between the specified confidence limits 95% of the time, and outside them 5% of the time.

Confidence Limits - The upper and lower limits between which a statistically determined quantity will be found. For example, an insertion loss of 7.3 +0.9, -0.5 dB indicates that the insertion loss lies between 6.8 dB and 8.2 dB.

Insertion Loss - The reduction in sound level resulting from the construction (insertion) of a noise barrier between the source and the receiver. This quantity is determined by measurements taken on the receiver side of the barrier. It is not a perceived quantity.

L_{eq} - An L_{eq} is the equivalent sound level for a specified period. During any period of measurement of traffic noise, the sound level varies continuously. The L_{eq} is a convenient means for determining and expressing the "overall" sound level resulting from the analysis of these variations.

Non-parametric - A method of statistical analysis which does not depend upon the particular known distribution of the data, and in fact does not require that the data conform to some known distribution.

SUMMARY AND CONCLUSIONS

Traffic noise data was collected adjacent to I-280 westbound at Jersey Street in Harrison, New Jersey, in order to determine the insertion loss of a noise barrier erected in this area. The data consisted of six-minute tape-recorded samples taken simultaneously at a reference point five feet above the noise barrier and at two field locations, Location 1 at 75 feet from the center of the near lane and Location 2 at 150 feet from the center of the near lane. Microphone heights at these locations were 5 feet, 11.5 feet, and 18 feet above street level. I-280 is elevated in this locale, so the highest field microphone was actually at the grade of the roadway. Figures 1 and 2, pages 6 and 7 show the details of this arrangement.

Data was collected both before and after the construction of the barrier. However, the Reference - Location 1 data was not recorded simultaneously with the Reference - Location 2 data, due to equipment limitations. A count of light, medium, and heavy vehicles was made for each six-minute observation, along with a minimum of ten radar speed readings of westbound traffic.

Prior to the commencement of field work, it was decided to use statistical techniques in analyzing the data to obtain insertion losses, the analysis to be accomplished at the 95% confidence level. Accordingly, it was planned to obtain samples of 50 or more observations at each microphone, if feasible, to maximize the accuracy of the results. In general, it was possible to do this.

The noise data was reduced to obtain an L_{eq} for each six-minute observation, yielding a set of data for each microphone at each location, for both "before" and "after" conditions. All data sets were tested for normality, the results being that not all sets could be accepted as being normally distributed. Thus, the medians rather than the means were used in performing the statistical analysis. The lack of normality and the fact that the "after" Reference L_{eq} 's were significantly higher

than those recorded before barrier construction, made it difficult to directly compare the two sets of measurements. As the first step in overcoming this difficulty, the difference in medians between the "before" and "after" Reference data sets were added to the "before" Reference data for each location. For the Location 1 Reference data 2.2 was added to each datum, and for Location 2 the figure was 2.0. The "modified before" and the original "after" data sets were then compared using non-parametric method. The result was that in both cases the hypothesis that the "modified before" and the original "after" data sets were from the same population was accepted.

These same constants were applied to the Location 1 and Location 2 field microphone "before" data, thereby increasing the difference in medians between the modified "before" and "after" data sets for each microphone position at each location. Each of these differences was taken as a first estimate of insertion loss at the particular microphone position. To test the accuracy of the first estimate for each position, the difference in each case was added to the "after" data set, thereby increasing the value of each datum. This "modified after" data set was then tested to see if it was from the same population as the "modified before" set (which had been modified to account for the increase in the median noise level at the Reference position). In some cases an adjustment of the estimate was necessary, so that a "best fit" could be obtained.

The constants applied to each of the "after" data sets to obtain the "best fit" are assumed to be the insertion losses at the 95% confidence level. These ranged from 5.7 dB to 8.3 dB, with confidence limits from -1.3 to +1.5. Table 6, page 22 lists insertion losses and confidence limits by microphone position.

It may be concluded that for the distances and heights tested, the barrier is moderately effective in reducing traffic noise.

RECOMMENDATIONS

The statistical findings of this study have shown that the barrier is effective in reducing noise from traffic of all types. It should be noted however, that the barrier was placed atop a concrete parapet at the edge of an elevated highway. The highest field microphones were level with the bottom of the parapet (I-280 pavement grade) so that insertion loss above this point is unknown (See Figure 2, page 7). It is reasonable to believe that the effect of the barrier would be substantially reduced for receivers at higher elevations, and would therefore provide inadequate protection for second - and third - story residents.

An inspection of the barrier was performed on June 14, 1983, the details of which can be found on pages 10 and 11. Although the barrier seemed to be structurally sound, the neoprene seal between the bottom panel and the parapet (See Figure 4, page 12) had deteriorated badly in places, leaving large gaps which no doubt reduced the effectiveness of the system. Therefore, this type of barrier can be recommended for initial installation or retrofit only if the seal design and/or materials are modified to insure that the seal will remain functional.

Concerning data collection, it should be noted that there was a wide range of traffic counts per observation within each vehicle classification, and also for the average speed per observation (See Table 1, page 10). Furthermore, the traffic mix often varied considerably throughout the day. These factors necessitated obtaining large samples of relatively long observations in order to take into account as much of this variation as possible. It is therefore recommended that for under conditions such as those encountered in this study, large samples of 50-75 observations of five minutes each be obtained, in order to insure an accurate determination of insertion loss and meaningful confidence limits. See the sections on Data Analysis and Results and Discussion for details which support this recommendation.

INTRODUCTION

The primary objective of this study was to determine the insertion loss of the honeycomb noise barrier, which had not been previously used in New Jersey. Secondary objectives were to determine the continued effectiveness of the barrier by visual inspection of the structure and seals, and to recommend improvements and/or solutions should they be required as a result of the inspection.

The decision to construct a traffic noise barrier along the north (westbound) side of I-280 in Harrison was a result of the need to provide some noise abatement for the people living adjacent to the highway in this completely urbanized municipality. The problem became one of "retrodesign" since the roadway is elevated on bridges or on embankment held by retaining walls throughout the residential area. Hence the barrier would necessarily be placed on top of the parapet along this section of roadway and would have to be compatible with existing wall and bridge design both in method of construction and loading. The honeycomb barrier produced by Cameo, Los Angeles, California met these needs and was approved for use, with the requirement that it be evaluated for its effectiveness as a condition of approval.

The barrier as constructed is 7' - 4" high, mounted on a 2' - 8" concrete parapet, to give an effective height of 10 feet. It consists of a 2.5"-thick phenolic impregnated paper honeycomb core, faced on either side by .063" aluminum panels. The top and bottom of the core are sealed by aluminum channel, so that the core is completely enclosed. The panels are supported by steel H-beams placed vertically on ten-foot centers, as shown in Figure 4, page 12, with a neoprene seal between the panel bottom and the parapet. A total of 3,830 linear feet of this barrier was installed, at a cost of \$456,000.

The soundness of this design is discussed in the section on Data Collection.

STUDY PROCEDURES

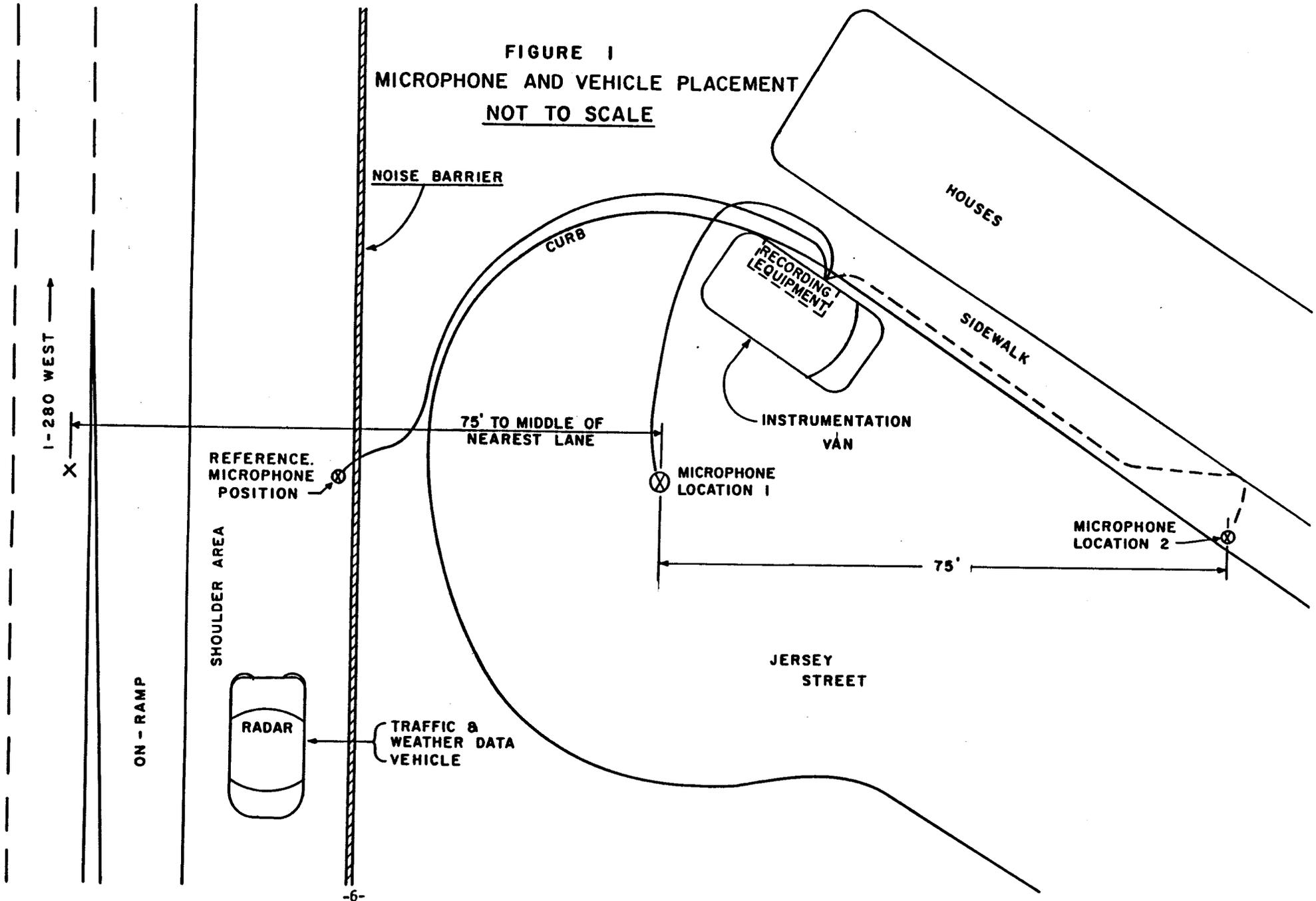
DATA COLLECTION

The data collection operation was designed to yield traffic noise data and traffic counts for both the "before" and "after" barrier construction conditions. Microphone locations were at the barrier (Reference), 75 feet from the center of the near lane (Location 1), and 150 feet from the center of the near lane (Location 2). The Reference microphone height was 15 feet above the I-280 pavement (5 feet above the top of the barrier) while the microphones at Locations 1 and 2 were at 5 feet, 11.5 feet, and 18 feet above the pavement on Jersey Street. The uppermost microphone was level with the I-280 pavement. See Figures 1, 2, and 3, pages 6, 7, and 8 for diagrams of microphone locations, and recording equipment layout.

Since this study was being conducted in the totally urbanized municipality of Harrison, field microphone locations were necessarily a compromise between data collection requirements, minimization of the effects of ambient noise, equipment set-up time, available parking for the equipment van, and non-interference with local vehicular and pedestrian traffic. Cables from the microphones transmitted the traffic noise signals to two tape recorders so that data from four microphones was recorded simultaneously. In this way two series of observations were recorded for the "before" condition, one for the Reference - Location 1 combination and the other for Reference - Location 2. Once the barrier was constructed the same arrangements were used to obtain the "after" data.

Complete traffic counts were made for the duration of each sample of traffic noise. These counts were categorized by eastbound and westbound vehicles, and further subdivided into light vehicles, medium trucks, and heavy trucks. Also at this time a minimum of ten random radar speed readings were recorded for westbound traffic only (the side on which the microphones were placed). Wind

FIGURE 1
MICROPHONE AND VEHICLE PLACEMENT
NOT TO SCALE



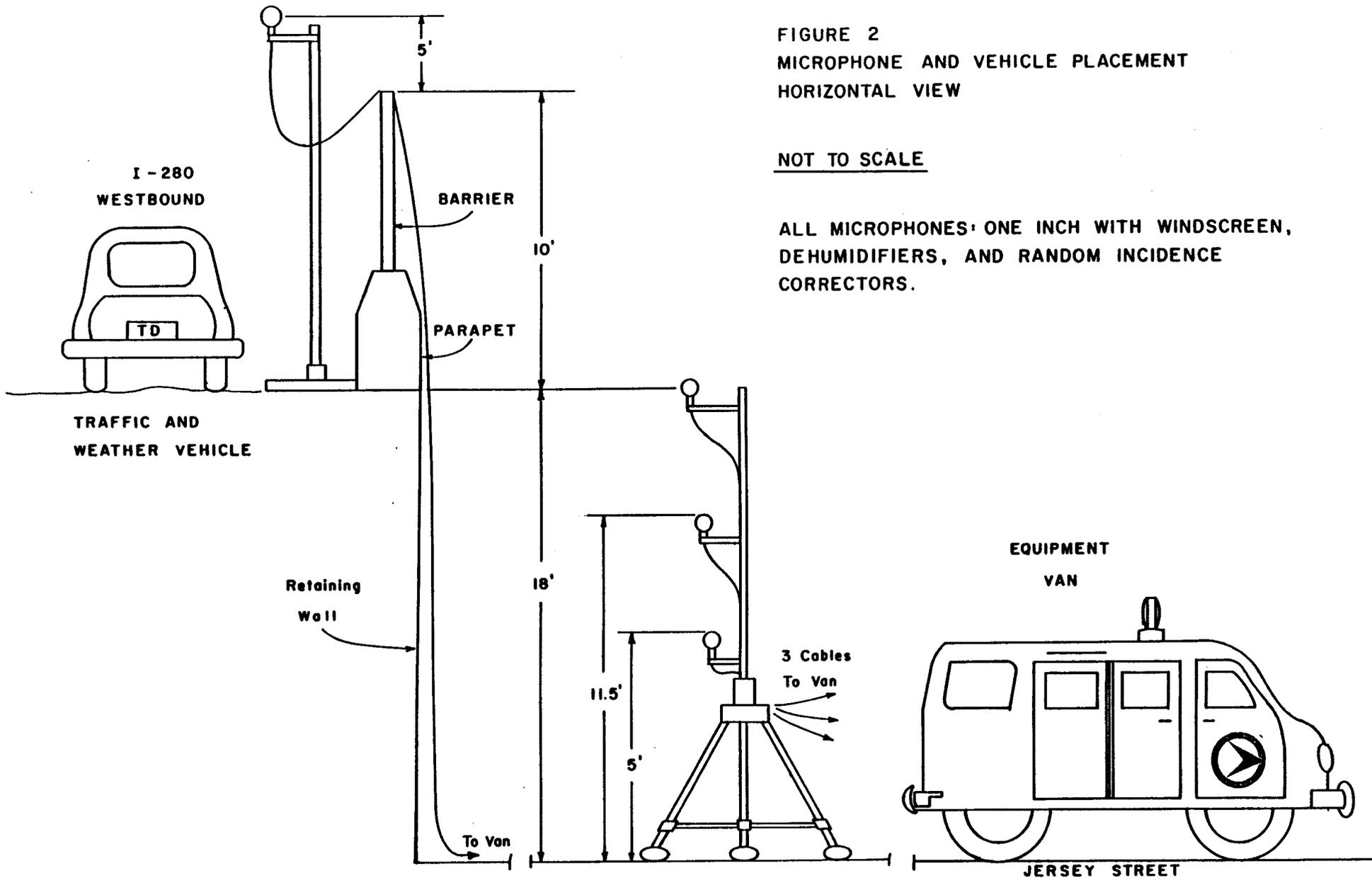


FIGURE 2
MICROPHONE AND VEHICLE PLACEMENT
HORIZONTAL VIEW

NOT TO SCALE

ALL MICROPHONES: ONE INCH WITH WINDSCREEN,
DEHUMIDIFIERS, AND RANDOM INCIDENCE
CORRECTORS.

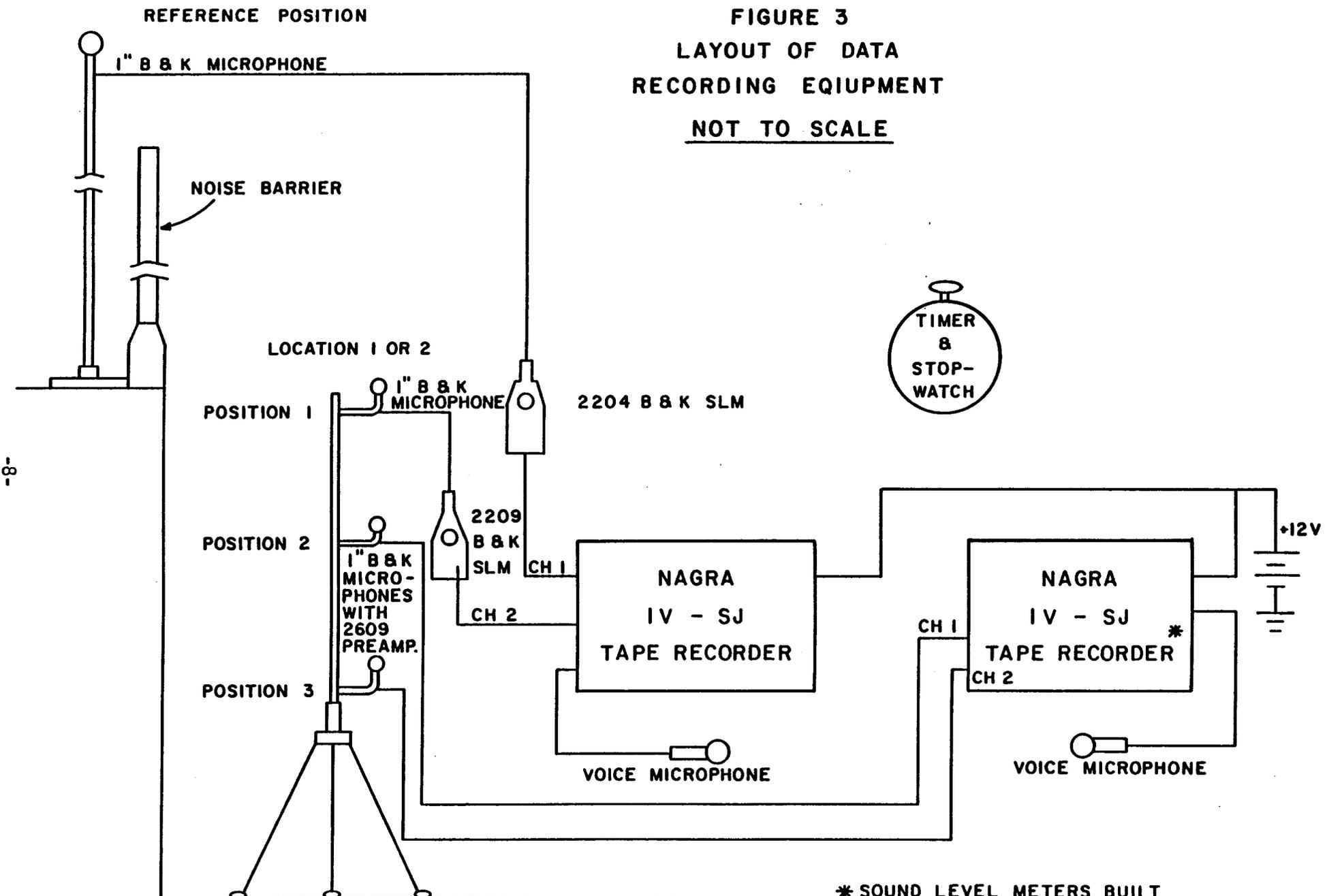


FIGURE 3
LAYOUT OF DATA
RECORDING EQUIPMENT
NOT TO SCALE

* SOUND LEVEL METERS BUILT INTO TAPE RECORDER.

speed and temperature were also recorded about every twenty minutes, primarily to determine the feasibility of continuing sampling under doubtful weather conditions. No data was collected when wind speed exceeded 10 mph or when the roadway was wet. All data was collected on weekdays at off-peak hours. No attempt was made to collect "after" data on dates, days, or at times corresponding to those used for the "before" data collection.

Previous experience in traffic noise sampling in metropolitan New Jersey had shown that contamination by noise from aircraft, locally operated trucks, heavy equipment, and other sources resulted in approximately 25% of the observations being discarded, and a like percentage being heavily edited. It was assumed that these conditions would occur at this site as well, especially since it was less than three miles from Newark International Airport. Preliminary visits to the site supported this assumption, and showed that traffic volume and mix varied greatly from one five-minute observation to another. It was therefore decided to try to obtain at least 100 observations for each microphone in order to be reasonably certain of having 50 observations once the data was reduced. The large samples were needed to insure a high level of accuracy in the statistical analysis, and to take into account the expected wide range of traffic speeds and counts. As can be seen from Table I below, these expectations were well-founded. Observations were to be of six-minute duration nominally, to be later shortened to 5 minutes -20 seconds in the reduction process. Detailed notes on extraneous noise were kept to facilitate the editing process. See Appendix I, pages 28 and 29 for a detailed description of the data collection routine.

TABLE 1
MAXIMUM AND MINIMUM SPEEDS AND TRAFFIC COUNTS
PER OBSERVATION*

Microphone Location	Westbound-Near Lanes			Eastbound-Far Lanes			
	Speed ⁺ MPH	Light Vehicles	Medium Trucks	Heavy Trucks	Light Vehicles	Medium Trucks	Heavy Trucks
1 Before	46-61	43-84	2-12	5-22	37-107	0-11	2-25
1 After	45-58	51-128	3-16	7-29	44-113	0-12	4-20
2 Before	46-56	42-114	1-14	7-26	41-84	0-10	3-19
2 After	45-61	54-128	3-17	5-29	44-122	1-15	3-64

*All entries are rounded from reduced data.

+Speed was recorded for westbound (near side) traffic only.

Recording tapes were nominally 45 minutes long. This allowed for recording seven six-minute observations on each channel simultaneously, while leaving adequate time for calibration signals, voice announcements, and extra-long observations (which sometimes were necessary due to prolonged interference from non-highway generated noise).

The actual method of data analysis was undetermined at the start of data collection. However, it was assumed that before-and-after comparisons would be made using either regression analysis or sample means in order to find the insertion loss at each microphone position.

The final aspect of data collection was the visual inspection of the barrier performed on June 14, 1983, almost two years after its construction. This was accomplished by walking the entire length of the barrier on the highway side. The sections on ramps were inspected the same way. In addition, the receiver side was

inspected for approximately two-thirds of its length, the remaining portion being inaccessible due to foliage and fences.

The barrier appeared to be structurally sound throughout with no deterioration in strength or rigidity. The finish had not deteriorated noticeably. However, the neoprene seal was in very poor condition in many places. (See Figure 4, page 12 for construction details.) Deficiencies included cracks, pieces broken out of the seal, all or part of the seal pulled out of the panel leaving large gaps, and sections where the seal did not meet the top of the parapet. These deficiencies were most prevalent over the easternmost third of the barrier.

DATA REDUCTION

Data reduction served two purposes. The first was to edit out the non-highway noise from each observation; the second was to obtain an L_{eq} for each of the edited observations. This work was accomplished using the equipment shown in Figure 5, page 13. Only one channel could be reduced at a time, and in general, each channel had to be played back twice. The first run was used to check the calibration signals at the beginning and end of each channel; the voice announcements at the beginning, end, and between observations; and most important - which portions of each observation were to be edited out so that a sample of 5m - 20s of traffic noise could be obtained.

Central to obtaining and recording all of this information was the graph produced by the 2305 Bruel & Kjaer Graphic Level Recorder. Information coming over the monitor speaker (calibration signal, noise, voice announcements) was noted on the graph as it was produced continuously by the machine. Since the graph paper was fed at a known set speed, the graph could be used as a timing index for the second run-through of the same observations, at which time the extraneous noise was edited out and (ideally) seven observations of the desired

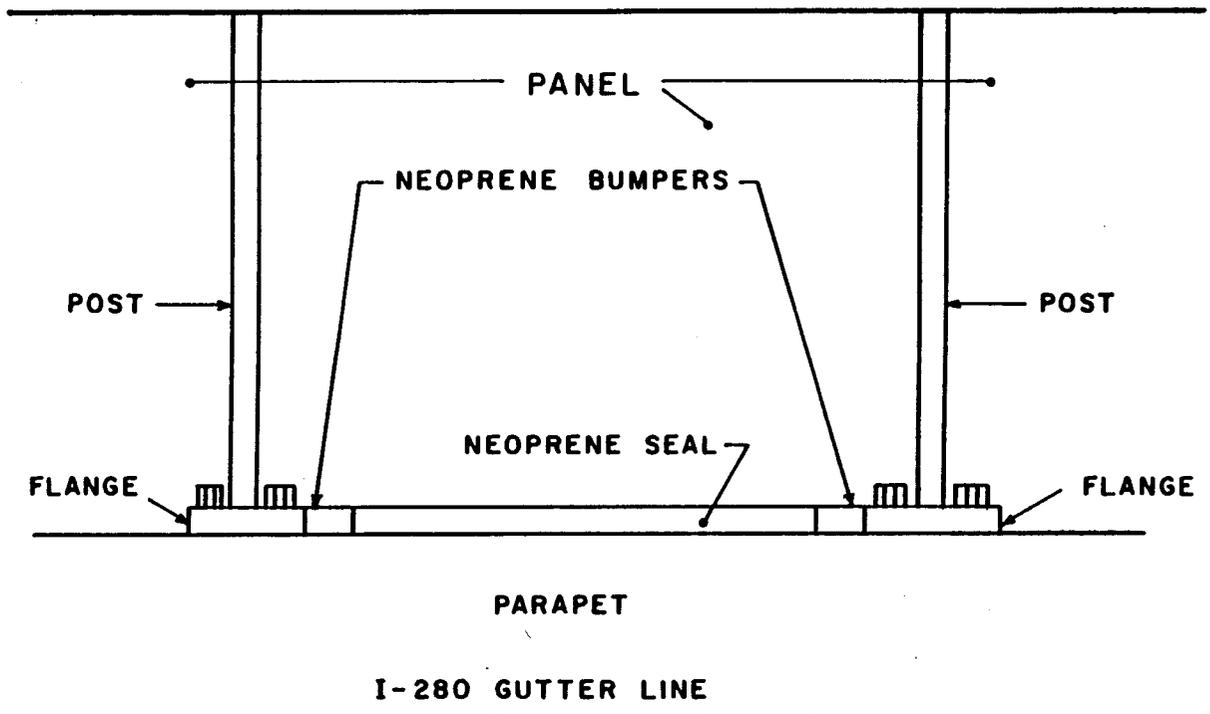


FIGURE 4
BARRIER DETAILS
NOT TO SCALE

-12-

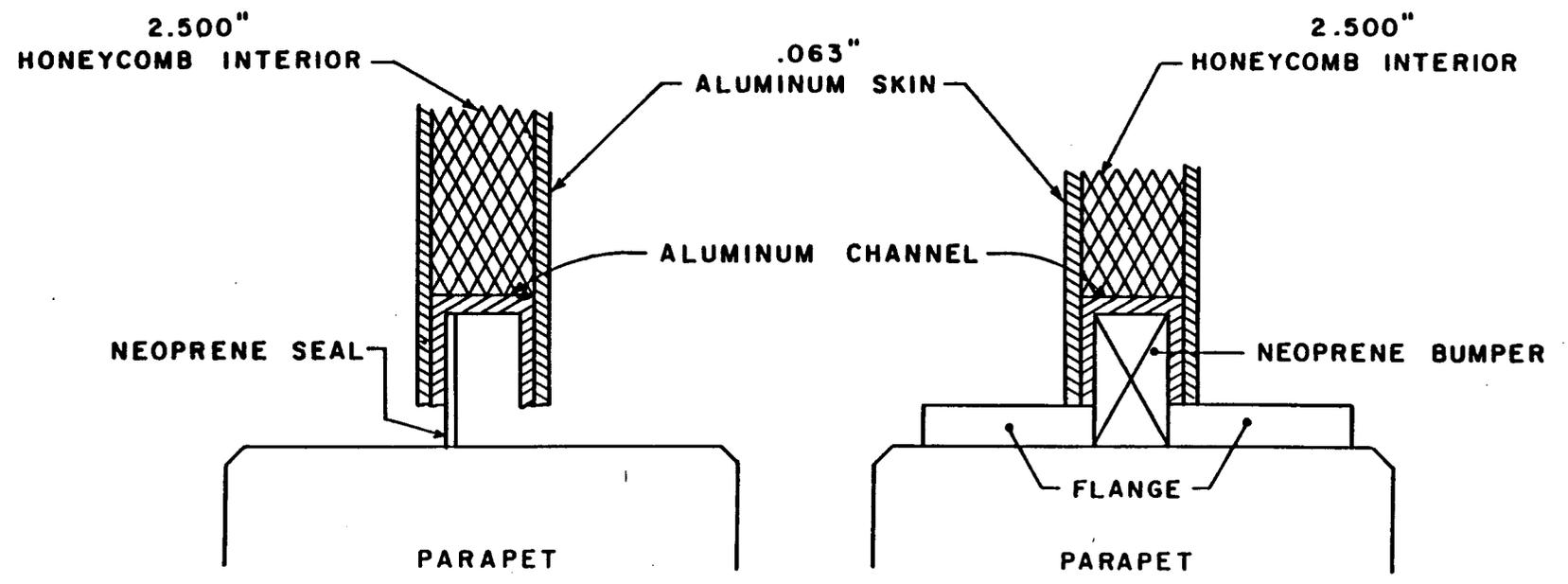
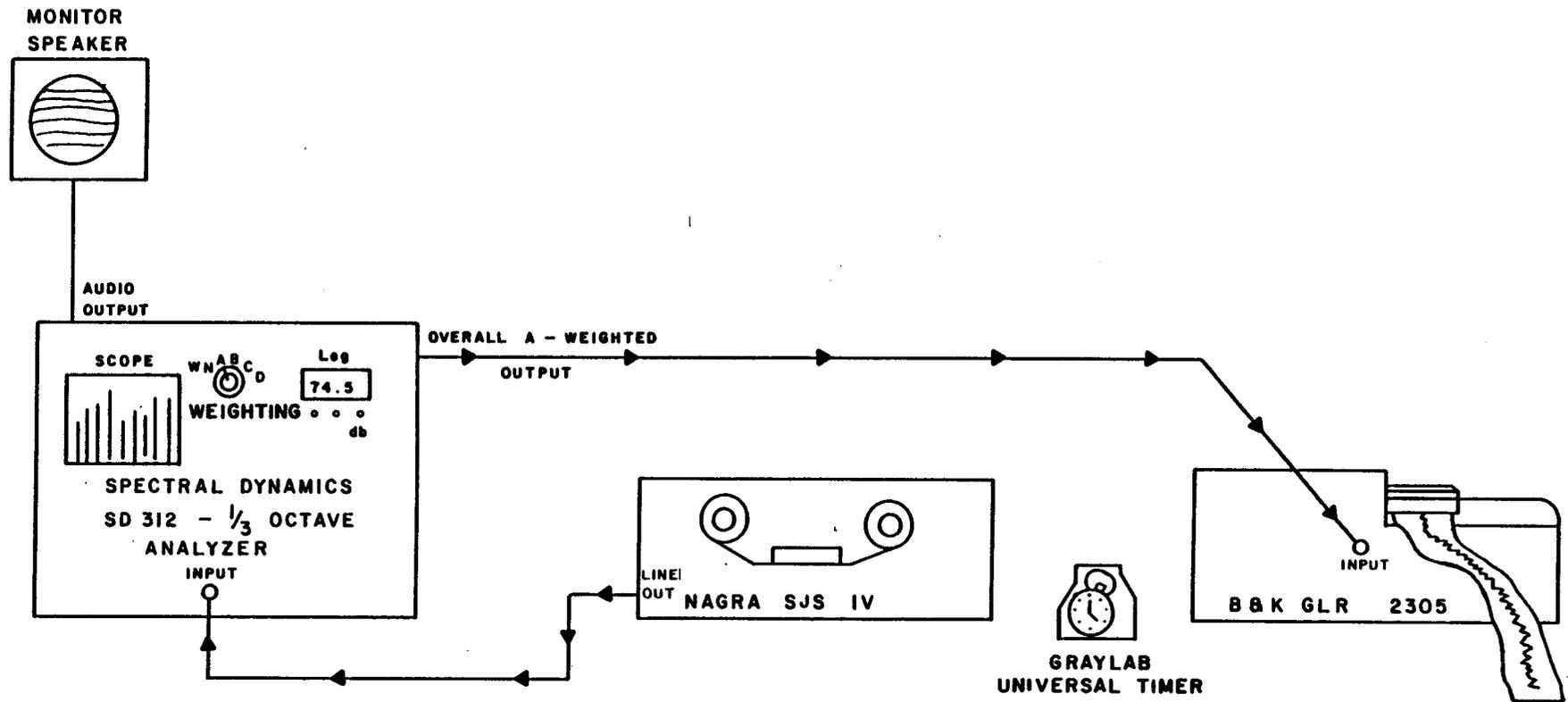


FIGURE 5
DATA REDUCTION EQUIPMENT



length were obtained from the tape. During this second playback the traffic noise was A-weighted and an L_{eq} obtained for each 5m - 20s of "clean" noise.

As expected, a large number of the observations were so contaminated with non-highway noise that they could not be edited and were therefore discarded. Table 2 below lists the number of usable observations for each microphone position for both the "before" and "after" conditions.

TABLE 2
NUMBER OF USABLE OBSERVATIONS
OBTAINED FROM DATA REDUCTION PROCESS

Microphone Position	Location 1		Location 2	
	Before	After	Before	After
Reference	62	154	91	143
1 (18.0 ft.)	61	81	67	36
2 (11.5 ft.)	11	57	58	31
3 (5.0 ft.)	10	43	28	84

As can be seen the goal of 50 observations was not always realized, primarily due to contamination by extraneous noise. However, the small sample sizes for Location 1, Positions 2 and 3 - "before" - were due to a tape recorder breakdown which occurred at the beginning of the study. Data collection continued for the other two microphone positions while this machine was being repaired. Budget and personnel limitations prevented obtaining the full complement of observations once the unit was back in service.

A detailed description of data reduction operations can be found in Appendix II, pages 30 and 31.

Also included in data reduction was the preparation of traffic data, which was accomplished after the noise data had been reduced. As already explained, much of the noise data was discarded because of contamination by non-highway noise, so that as a first step in reducing the traffic data, it was necessary to be

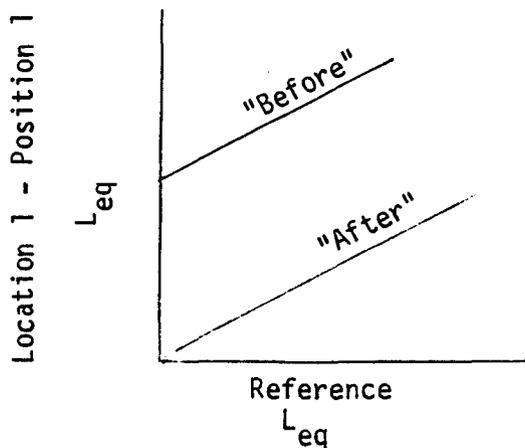
certain that an L_{eq} for a 5m - 20s noise observation had been obtained for at least one of the four microphone positions from which noise had been recorded simultaneously during data collection (e.g., Reference and Location 1, Positions 1, 2, and 3). For those observations meeting this criterion, an average speed was determined from the 10 or more radar readings taken during the original (six-minute) observation, and the traffic counts were reduced proportionately to agree with the 5m - 20s (edited) noise observation. Appendices III-VI, pages 33 - 44 contain the reduced noise and traffic data.

DATA ANALYSIS

The fundamental purpose of the data analysis was to determine barrier insertion loss, with confidence limits, at the 95% confidence level. This required a statistical method of comparison between the "before" and "after" data which would be "universal" in that it could be applied to the pairs of data sets from each of the microphones (e.g., Location 1 - Position 1 "before" and Location 1 -Position 1 "after"). The most desirable case would have been to have a linear relationship between the Reference L_{eq} 's and those from the field microphones, with the "before" and "after" regression lines parallel, as shown in Figure 6, below.

FIGURE 6

IDEALIZED RELATIONSHIP BETWEEN REFERENCE AND FIELD L_{eq} 'S



Obviously the insertion loss at this microphone position is the difference in L_{eq} 's at any point along the lines. Unfortunately, this very desirable situation did not occur. In attempting to find "best fit" regression lines it was found that first, there was no "universal" relationship and second, that in each case the "before" and "after" regression lines were not parallel but diverging. Furthermore, one or both of the regression lines was curvilinear.

Another very desirable condition would have been for all data sets to have been normally distributed. This would have facilitated tests of significance and subsequent determinations of insertion loss for each microphone position. Using the SAS UNIVARIATE¹ procedure, all 16 data sets were tested for normality with the result that seven of these could not be considered normal. This included all four data sets from Location 1 "after" (Reference and three field microphone positions) which effectively eliminated any calculation of insertion loss based on normality for that location.

Since no direct, simple method appeared satisfactory, it was decided to use a non-paramatic technique. Consequently, the Wilcoxon rank-sum test was selected and used to determine whether or not particular pairs of data sets were from the same population. (e.g., Location 1, Position 1 "before" and Location 1, Position 1 "after"). Briefly, this test assigns ordinal numbers (ranks) to the data points (L_{eq} 's) from the combined sets of data being compared ("before" and "after"), starting with rank 1 for the algebraically smallest value. The sum of the ranks of the smaller sample or the "before" sample is called W_1 , which is approximately normally distributed.² This sum is used in the formula

$$z = \frac{W_1 - m_w}{\sigma_w}$$

¹Reference (7), pp. 472-430.

²Reference (3), pp. 174-184.

where m = the mean of the combined samples,

σ_w = the standard deviation of the combined samples, and z is approximately normally distributed.

Clearly, if W_1 is very close to or equal to m_w , $|z|$ is very small. When $|z|$ is small there is a very high probability that W_1 is within the approximately normal distribution of W_1 's, or from another standpoint - that there is a very high probability that the two samples being tested are from the same population.

Ideally, if two sets of data are in fact from the same population they will either have to coincide, or differ throughout by a constant. It was obvious from the initial inspection of the pairs of data sets that they did not coincide. Therefore, if they proved to be from the same population - except for differing by a constant - that constant could be considered to be a first estimate of the insertion loss associated with the particular pair of "before" and "after" data sets. On the other hand, if the data sets were shown to be from different populations, but could be made to appear to be from the same one by adding a constant to all of the data points of one set, then again that constant could be taken as a first estimate of insertion loss. Thus inferences drawn from the test results led in a logical sequence to determining the actual insertion losses and confidence limits.³

For each set of data from the Reference microphone, there were three sets from the corresponding field microphones (e.g., Reference and Location 1 - Microphone Positions 1, 2, and 3). Each of the field microphone data sets were compared to the appropriate Reference data set using the Wilcoxon test to determine if the Reference and field data sets were from different populations. In all cases, for both locations and for both the "before" and "after" conditions, the field microphone data was shown to be from a population different from that of the Reference data.

³Reference (4), pp. 68-75.

The next step was to test the "before" and "after" Reference data for each field location, since the difference in medians was rather small in both cases. Table 3 below shows the medians for all microphone locations.

TABLE 3

MEDIAN Leq'S FOR BOTH MICROPHONE LOCATIONS:
BEFORE AND AFTER BARRIER CONSTRUCTION

Microphone Position	Microphone Height Above Pavement	Location 1		Location 2	
		Before	After	Before	After
Ref.	15.0 Ft.	75.4	77.6	75.6	77.6
1	18.0 Ft.	68.0	62.7	64.6	58.3
2	11.5 Ft.	66.7	62.5	63.5	59.5
3	5.0 Ft.	65.0	61.3	62.8	58.2

The test supported the hypothesis that the L_{eq} 's from the "after" Reference microphone were from a different population from those from the "before" Reference microphone for both locations. This was reasonable considering that the generally higher "after" levels were due to a considerable increase in traffic.

At this point a histogram was obtained for each of the four Reference data sets. These were examined to see if, by applying a constant to the data, the data sets in each pair (i.e., Reference "before" and "after" - Location 1 and Reference "before and "after" - Location 2) could be made to appear as if they had come from the same population. The histograms showed this to be feasible in that by adding a constant to the "before" data in each case, the distributions could be made to more nearly coincide with the "after" data. These constants were by no means arbitrary but were in fact the differences between the "before" and "after" medians for each pair of data sets. Thus constants of 2.2 and 2.0 were added to the "before" Reference data for Location 1 and Location 2 respectively. The rank-sum test was again applied and now showed that the "before" and "after" pairs were from the

same population. The constant 2.0 was later changed to 2.1 to give the best possible fit.

The results of this test demonstrated the increases in "after" Reference noise levels due to overall increases in traffic could be taken into account statistically, and without resorting to any manipulation of traffic data per se. This was just as well, since there appeared to be no relationship between changes in mix and speed, and increases in levels. Based on the statistical results then, it was reasonable that equal adjustments were warranted for the (field) Location 1 and Location 2 data sets. This adjustment moved the "before" medians upwards so that the "before" differences were greater than previously.

Histograms were now obtained to see if it was reasonable to adjust the "after" field data upwards in order to have it test as being from the same population as the "before" field data, for each field microphone position. The histograms showed that this appeared to be a justified approach so each of the six "after" data sets was adjusted upward to approximate the "before" sets. The initial adjustment in each case was the difference in medians between the adjusted "before" data (adjusted upward to account for the increased "after" traffic), and the original "after" data. Again the rank-sum test was applied, and in every case the corresponding "before" and "after" data sets proved to be from the same population.

The next logical step was to modify the initial adjustment so as to minimize z thereby obtaining the most accurate estimate of the "true" difference between the "before" and "after" data sets for each field microphone position.⁴ This difference was considered to be the insertion loss in each case, listed in Table 6, page 22.

⁴Reference (1), pp. 317-320.

Confidence limits were obtained using an approximation procedure which applies to large samples.⁵ This technique has three basic steps:

1. Form a table of differences between each "before" and each "after" data point (L_{eq}). If there are m "before" points and n "after" points, there are mn differences;
2. Order these differences algebraically from lowest to highest;
3. Using the formula for large sample approximation, determine the integer which is used to locate the confidence limits in the table of ordered differences. If, for instance, the integer were 25, the lower and upper confidence limits would be the 25th difference from the lower and upper ends of the difference table.

This method is directly associated with the Wilcoxon rank-sum test to determine confidence limits.

SMALL SAMPLE ANALYSIS

In an attempt to demonstrate the increased accuracy resulting from using large samples, small samples were tested and the results compared. To perform this demonstration, samples of 7 L_{eq} 's were randomly selected from each of the eight data sets for Location 1 (Reference plus 3 field positions; "before" and "after"). The rank-sum test was used in the way already described for the full data sets. Table 4 below gives a comparison of the medians determined for each of the samples compared. Table 5, immediately following, shows the insertion loss confidence limits resulting from the large and small samples. These will be discussed in the next section.

⁵Reference (4), pp. 78-81.

TABLE 4

COMPARISON OF MEDIAN L_{eq} 'S LARGE AND SMALL
SAMPLES FOR MICROPHONE LOCATION 1

Microphone Position	Before				After			
	Sample Size	Median L_{eq}	Sample Size	Median L_{eq}	Sample Size	Median L_{eq}	Sample Size	Median L_{eq}
Ref.	62	75.4	7	76.8	154	77.6	7	77.1
1	61	68.0	7	68.7	81	62.7	7	62.9
2	11	66.7	7	66.7	57	62.5	7	59.5
3	10	65.0	7	64.7	43	61.3	7	56.6

TABLE 5

COMPARISON OF INSERTION LOSSES AND 95% CONFIDENCE LIMITS
FOR LARGE AND SMALL SAMPLES: LOCATION 1

Microphone Position	Insertion Loss With 95% Confidence Limits	
	Large Sample	Small Sample
1	7.3, +0.9, -0.5	5.7, +2.7, -1.8
2	6.5, +1.3, -1.0	10.2, +1.5, -1.6
3	5.7, +1.5, -1.3	8.4, +1.5, -1.8

RESULTS AND DISCUSSION

Table 6 below shows the insertion losses and 95% confidence limits for the six field microphone positions.

TABLE 6
INSERTION LOSSES IN dB, WITH 95% CONFIDENCE LIMITS

Microphone Position	Microphone Height	Location 1	Location 2
1	18.0 Ft.	7.3, +0.9, -0.5	8.3, +0.8, -1.0
2	11.5 Ft.	6.5, +1.3, -1.0	6.0, +0.5, -0.7
3	5.0 Ft.	5.7, +1.5, -1.3	6.2, +0.9, -1.0

The rank-sum test was applied to the insertion losses and those from Location 1 were found to be from the same population as those from Location 2. This rather unexpected result can be explained by examining the field microphone locations in relation to noise generators, barriers and reflectors other than those associated with the highway.

Figure 6, page 23 shows both field microphone locations, which as already noted were the best compromise for the highly urbanized setting. The microphones at Location 1 have a 175° field of view of the highway while those at Location 2 have only a 75° field of view. Thus, even though Location 1 was far more deeply in the shadow of the barrier and would therefore be expected to have higher insertion losses than Location 2, it was exposed to the noise from each vehicle for a much longer period. As an approximation consider a vehicle travelling at 55 mph in the near lane. It would be in the field of view of Location 1 for at least 12 seconds (1000 ft. minimum) as compared to being in the field of view of Location 2 for about 3 seconds (230 feet). This would tend to result in relatively higher levels at Location 1 and consequently a "lowered" insertion loss.

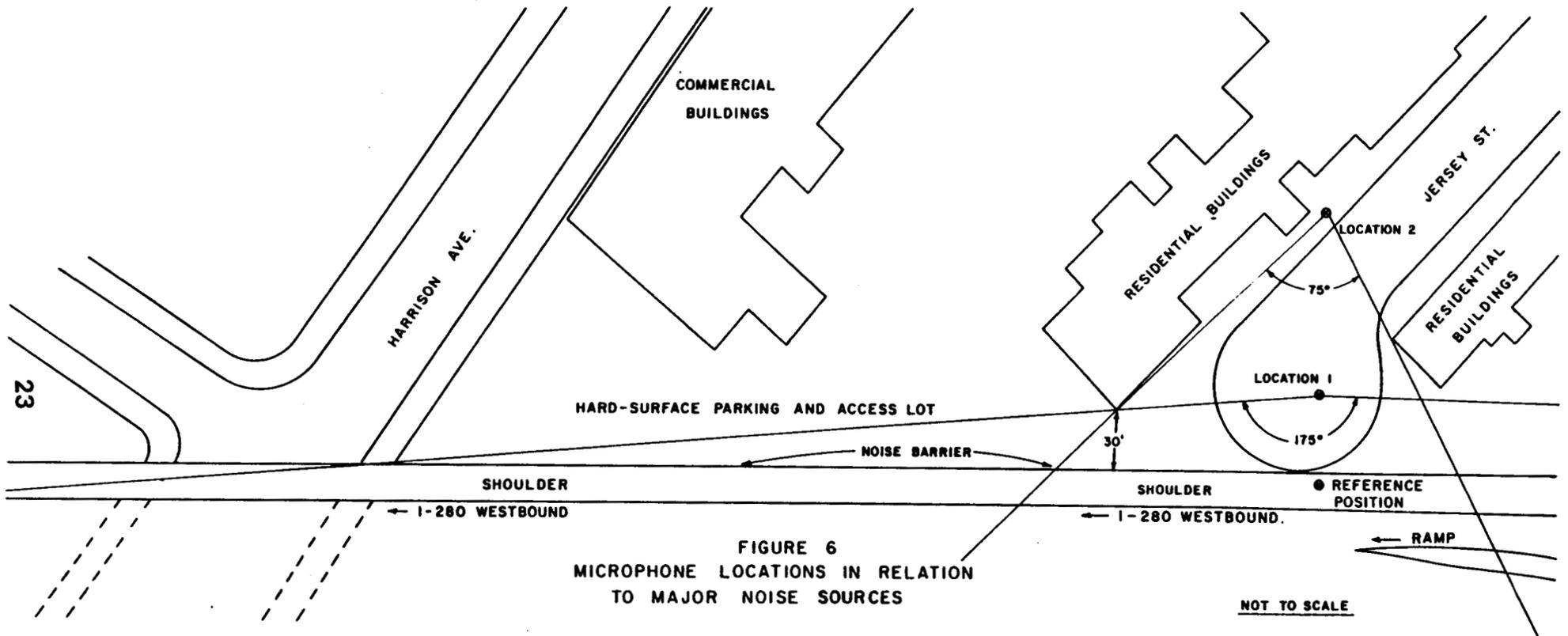


FIGURE 6
MICROPHONE LOCATIONS IN RELATION
TO MAJOR NOISE SOURCES

NOT TO SCALE

Also, far more apparent at Location 1 was traffic noise from Harrison Avenue. This is the heavily travelled main thoroughfare in Harrison, used by both local and through traffic consisting of all types of vehicles and municipal equipment. Location 1 was exposed to noise from this road via a hard-surfaced (and therefore noise-reflective) driveway access lot which was 30 feet wide (from highway retaining wall to nearest building) at its narrowest point. Furthermore, the concrete retaining wall did nothing to attenuate any noise travelling this path. Although Location 1 was about 380 feet from Harrison Avenue, it is not unreasonable to assume that some of the noise from this area contributed to the levels at those microphones. Location 2 was protected from this noise by the virtually continuous front of two- and three-story commercial and industrial buildings on Harrison Avenue and Jersey Street.

As explained earlier, a comparison between the results of using small samples and large samples was made, using the same technique each time. Table 5, page 21, shows the much narrower confidence intervals obtained from the larger samples, which is to be expected.

It is obvious from the table that the insertion losses are quite different for the two sets of samples. These insertion losses are actually the constants added to the L_{eq} of each observation of the "after" sample in order to have it coincide with the "before" sample as closely as possible, as explained in the Data Analysis section. Had the differences in medians been used without trying to find a "best fit" between the "before" and "after" data for each case, the small-sample insertion losses would have been closer to those calculated from the full-size samples (by coincidence), but still would have not been acceptable. The confidence limits would also have been different in this case; they would have been worse. Thus, the overall result of using small samples would be the same as their usefulness in determining insertion losses was concerned.

IMPLEMENTATION

The data collection, data reduction, and data analysis techniques used in this study are suitable for application elsewhere. Collection of a large sample is statistically sound irrespective of there being no a priori knowledge of the distribution.⁶ Furthermore, the comparison of results from large and small samples in Table 5, page 21 shows the practicality of this approach. However, it must be kept in mind that the period for which the sample is obtained affects the correctness of the insertion loss finally obtained. For instance, the equipment used for data reduction updates the data under consideration every 0.5 second which in effect yields a sample of 640 for an observation of 5m - 20s. This is a very large sample and is certainly representative of the time period in which it was taken, but it is not necessarily representative of the next consecutive 5m - 20s observation. Examination of the reduced data has shown that differences in the range of 2.0 -7.0 dB are common within any one (nominal) hour of observations. Also, the differences between the highest and lowest L_{eq} 's range from 4.3 - 13.9 dB for the "before" data and 10.3 -31.3 dB, for the "after" depending upon microphone position. Obviously neither a large number of observations for a short period nor a small number of observations for a long period is likely to represent the range of data actually encountered.

The data reduction technique is likewise applicable to other studies. By utilizing the B & K Graphic Level Recorder, a monitor speaker, and the field notes made during each observation editing can be accomplished with a high degree of accuracy. Because of the considerable difficulty in obtaining uncontaminated observations of traffic noise, data collection could become extremely prolonged.

⁶Reference (6), pp. 69, 70.

However, the editing process allows for the removal of extraneous noise so that field time is reduced to a minimum.

Last, the Wilcoxon rank-sum test provides a simple, broadly applicable method for determining not only if a significant change has occurred between "before" and "after" conditions, but for a method of quantizing the change as well. This test has associated with it a means for estimating the median of the differences between the "before" and "after" data, which in this study was equivalent to estimating the insertion loss.⁷ Also, associated with this test is a method for determining the confidence interval⁸ for the actual insertion loss (as determined from the "best fit" application of the rank-sum test described earlier). Obviously the fact that an initial estimate of insertion loss (or any before-after change) can be determined easily along with the confidence limits, makes the Wilcoxon rank-sum test an excellent choice for analyzing data from other studies.

⁷Reference (4), pp. 75-77.

⁸ibid, pp. 78-81.

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APPENDIX I
DATA COLLECTION PROCEDURE

Figures 1, 2, and 3 on pages 6, 7, and 8 show the equipment layout used for data collection. A three-person crew was necessary for this part of the project. The procedure was as follows:

1. The instrumentation van was positioned so that only one 100-foot cable was needed to reach any field microphone;
2. The tripod, cables, microphones, and mast for the microphones at Location 1 (or Location 2) were positioned and connected;
3. Simultaneously the tape recorders, voice microphones, timers, sound level meters, and ancillary items were set up in the instrumentation van;
4. A preliminary announcement consisting of the tape number, date, location, job site name, "before" or "after" barrier construction and signal weighting was recorded on each channel of each tape;
5. A pistonphone calibration signal was recorded for each channel used for field microphones, followed by an announcement for the start of Observation 1;
6. The traffic and weather vehicle was positioned along the I-280 shoulder, and safety cones set up. The four-way flashers and a flashing roof light were used whenever the vehicle was in position;
7. The Reference microphone was set up and calibrated, as was the radar unit;
8. An initial wind speed and temperature reading were obtained and recorded;
9. The equipment operator was informed of the weather data and the readiness of the traffic data crew;
10. The equipment operator gave the starting signal to the traffic data crew via walkie-talkie and then started the tape recorders and the timer. The traffic crew counted three classes of vehicles: light, medium trucks, and heavy

trucks, for both the eastbound and westbound roadways. At least ten radar speed readings for westbound (near-side) traffic were recorded during each observation. Observations were nominally six-minutes minimum but often they were longer to allow for portions containing extraneous noise (planes, trains, etc.) to be edited out during data reduction;

11. The equipment operator entered pertinent information such as meter settings, starting time and duration of each observation, etc. on forms provided for this purpose. He also noted any unusual noise such as that from planes or trains which might have to be edited out when the observation was reduced, to obtain an L_{eq} for traffic noise only;
12. At the end of the observation the operator stopped the recorders and the timer and signalled the traffic data crew to stop. He then recorded the end of the observation and the start of the next one on the tape;
13. Upon being given the ready signal from the traffic data crew, the operator signalled the start of the next observation, repeating the applicable preceding steps.

Because of equipment limitations, it was possible to record data from no more than four microphones simultaneously. Therefore, noise from the Reference and the three Location 1 microphones was recorded first and when an adequate number of observations were obtained, the noise from the Reference - Location 2 combination was recorded. This was done for both the "before" and "after" conditions, resulting in sixteen sets of data.

APPENDIX II

DATA REDUCTION PROCEDURE

Data reduction was accomplished by one person. Editing of tapes was done by the same person throughout the entire data reduction process in order to ensure uniformity of results. Types of extraneous noise edited from the tapes included that from aircraft, trains, municipal equipment and vehicles, private and commercial vehicles, pedestrians, and general neighborhood noises. The routine was as follows:

1. The data reduction equipment was set up as shown in Figure 5, page 13;
2. All controls were set for proper readings, levels, speeds, etc.;
3. The tape was started on playback and the graphic level recorder pen set at the appropriate level to record the calibration signal. The 1/3-octave band analyzer was checked for the correct L_{eq} . The calibration signal was checked for uniform level;
4. The voice announcement following calibration signal was checked for necessary information (tape number, date, observation number, etc.) and to ascertain that it agreed with field notes. This information was written on the graph at start of the first observation;
5. The graph of the first observation on the channel was recorded. By consulting the field notes and listening to the monitor speaker it was possible to determine where extraneous noises occurred during the observation. The type of noise and the start and stop of each occurrence were marked on the graph;
6. At the end of the observation the voice announcement was checked, the start of the next observation indicated on the graph, and reduction proceeded as before;
7. At the end of the last observation the tape was checked for final voice

announcement and calibration signal. The tape was then rewound to the start of the first observation;

8. The tape was rerun on the same channel, using the graph and a timer to obtain 5m - 20s of traffic noise for each observation, where available. Observations not meeting this requirement were discarded;
9. The L_{eq} 's for all observations having 5m - 20s of traffic noise were recorded;
10. At the end of the last observation the tape was rewound and Steps 3 - 10 were repeated for the second channel.

The speed of the westbound traffic was determined by averaging the radar readings taken during the observation. A minimum of 10 readings were taken each time. All traffic counts were prorated from the actual count obtained during the observation. For instance, a light vehicle count of 198 for a six-minute observation was prorated by taking $\frac{5m - 20s}{6m} \times 198 = \frac{320s}{360s} \times 198 = \frac{8}{9} \times 198 = 176.0$

Prorated counts were reported to the nearest tenth.

EXPLANATION OF COLUMN HEADINGS

FOR

APPENDICES III- VI

- OBS - Total number of usable observations to this point
- DATE - Date observation was recorded
- OBSNO - Sequential observation number for the particular date
- REF - L_{eq} for the particular observation from the Reference microphone
- LxP1 - L_{eq} for the particular observation at Location x, Position 1
- LxP2 - Same as above for Position 2
- LxP3 - Same as above for Position 3
- SPD - The average speed of westbound traffic for the particular observation, determined from at least 10 observations
- WBL - The number of light vehicles travelling in the westbound lanes during the observation, prorated for 5m - 20s from the original count
- WBM - Same as above for westbound medium trucks
- WBH - Same as above for westbound heavy trucks
- EBL - Same as above for eastbound light vehicles
- EBM - Same as above for eastbound medium trucks
- EBH - Same as above for eastbound heavy trucks

APPENDIX III
I-280 LOCATION 1-BEFORE BARRIER CONSTRUCTION

OBS	DATE	OBSNO	REF	L1P1	L1P2	L1P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH
1	3/11/81	1	75.7	68.4	.	.	52.5	65.8	5.3	19.6	64.9	5.3	8.0
2	3/11/81	2	75.4	68.4	.	.	54.6	56.9	9.8	9.8	44.4	3.6	8.9
3	3/11/81	3	75.7	68.1	.	.	53.6	42.7	6.2	9.8	62.2	2.7	17.8
4	3/11/81	5	76.3	70.4	.	.	52.8	67.6	8.9	9.8	50.7	4.4	11.6
5	3/11/81	6	76.2	70.7	.	.	50.8	60.4	7.1	19.6	46.2	4.4	16.0
6	3/12/81	1	75.2	68.2	.	.	51.5	64.9	5.3	12.4	60.4	4.4	11.6
7	3/12/81	2	74.6	66.8	.	.	51.7	72.0	6.2	16.0	59.6	4.4	12.4
8	3/12/81	3	76.1	68.0	.	.	50.4	61.3	3.6	9.8	49.8	0.9	6.2
9	3/12/81	4	74.8	68.7	.	.	52.1	52.4	8.9	9.8	53.3	2.7	11.6
10	3/12/81	5	76.7	.	.	.	50.7	59.6	4.4	18.7	62.2	5.3	8.9
11	3/12/81	6	.	67.1	.	.	52.0	57.8	10.7	12.4	52.4	3.6	12.4
12	3/12/81	7	75.5	68.0	.	.	55.5	81.8	8.9	5.3	56.9	3.6	9.8
13	3/12/81	9	76.3	69.4	.	.	55.3	54.2	5.3	11.6	53.3	2.7	13.3
14	3/12/81	10	74.4	68.0	.	.	50.2	49.8	11.6	6.2	59.6	2.7	3.6
15	3/12/81	11	76.9	69.6	.	.	49.6	64.0	5.3	14.2	67.6	1.8	10.7
16	3/12/81	12	73.8	67.7	.	.	52.7	73.8	8.9	9.8	40.0	1.8	11.6
17	3/18/81	1	74.5	67.6	.	.	49.9	59.6	8.0	10.7	64.9	8.0	8.9
18	3/18/81	2	75.0	67.2	.	.	52.1	55.1	11.6	10.7	65.8	4.4	14.2
19	3/18/81	3	76.8	69.8	.	.	50.7	49.8	3.6	8.9	67.6	5.3	19.6
20	3/18/81	4	74.7	66.9	.	.	57.0	53.3	4.4	8.0	58.7	6.2	16.9
21	3/18/81	5	74.5	67.7	.	.	48.8	69.3	2.7	7.1	93.3	7.1	17.8
22	3/18/81	6	75.1	68.7	.	.	49.6	49.8	6.2	12.4	72.0	4.4	24.9
23	3/19/81	1	73.9	65.7	.	.	54.0	53.3	3.6	9.8	37.3	4.4	10.7
24	3/19/81	2	.	69.7	.	.	57.2	56.9	9.8	20.4	48.9	3.6	8.9
25	3/19/81	3	74.1	66.6	.	.	51.4	51.6	5.3	9.8	56.9	4.4	9.8
26	3/19/81	4	76.2	69.9	.	.	51.4	68.4	12.4	17.8	70.2	1.8	8.9
27	3/19/81	5	.	67.8	.	.	56.5	50.3	5.3	14.5	59.4	2.3	11.4
28	3/19/81	6	75.3	68.0	.	.	61.2	69.3	5.3	11.6	51.6	3.6	16.9
29	3/19/81	7	75.7	67.9	.	.	52.0	46.0	9.3	10.0	52.7	6.7	7.3
30	3/19/81	8	74.0	68.2	.	.	52.7	67.0	3.8	13.7	45.0	7.6	4.6
31	3/19/81	9	76.5	.	.	.	53.9	58.7	3.9	16.9	46.2	2.7	6.2
32	3/19/81	10	78.4	69.7	.	.	47.1	54.9	6.9	16.8	54.1	3.0	7.6
33	3/19/81	11	78.4	71.4	.	.	55.4	84.4	8.9	13.3	49.8	1.8	12.4
34	3/19/81	12	76.9	68.7	.	.	47.9	56.0	11.6	9.8	54.2	3.6	7.1
35	3/20/81	1	.	70.4	.	.	54.4	51.6	6.2	12.4	71.1	4.4	9.8
36	3/20/81	2	76.7	70.4	.	.	52.2	63.1	8.9	14.2	66.7	0.0	12.4
37	3/20/81	3	77.7	.	.	.	52.5	48.9	6.2	15.1	64.0	3.6	15.1
38	3/20/81	4	76.9	68.8	.	.	51.1	56.0	11.6	15.1	53.3	6.2	11.6
39	3/20/81	5	76.1	.	.	.	52.3	50.7	4.4	16.0	54.2	4.4	15.1
40	3/20/81	6	76.6	.	.	.	51.1	65.8	4.4	14.2	56.9	5.3	10.7
41	3/20/81	7	76.9	70.9	.	.	49.7	71.1	2.7	17.8	50.7	10.7	15.1
42	3/20/81	8	76.8	69.2	.	.	50.3	49.6	6.9	16.3	58.4	5.6	10.7
43	3/20/81	9	73.9	66.7	.	.	49.0	51.6	8.9	11.6	46.2	2.7	7.1
44	3/20/81	11	78.1	71.9	.	.	50.7	53.3	11.6	22.2	48.0	3.6	14.2
45	3/24/81	1	72.9	64.3	.	.	54.7	54.5	7.8	6.0	60.5	3.5	14.7
46	3/24/81	2	74.1	66.4	.	.	52.9	57.1	4.3	10.4	58.8	5.2	13.0
47	3/24/81	3	77.6	69.9	.	.	47.6	59.6	7.1	20.4	61.3	0.9	10.7
48	3/24/81	4	73.2	65.7	.	.	48.0	59.5	5.2	15.6	37.2	3.7	2.2
49	3/24/81	5	76.9	70.9	.	.	45.7	60.0	6.7	19.3	106.7	10.6	14.0
50	3/24/81	7	73.5	65.6	.	.	50.4	58.0	2.7	11.3	62.0	6.0	18.0

APPENDIX III
I-280 LOCATION 1-BEFORE BARRIER CONSTRUCTION

CBS	DATE	OBSNO	REF	L1P1	L1P2	L1P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH
51	3/24/81	8	74.1	67.1	.	.	49.6	70.2	5.3	12.4	47.1	3.6	7.1
52	3/24/81	9	71.4	.	.	.	49.0	54.1	4.6	9.1	50.3	7.6	8.4
53	3/24/81	10	74.6	66.9	.	.	52.4	58.7	3.0	13.7	50.3	5.3	7.6
54	3/24/81	11	76.4	68.1	.	.	45.8	84.4	8.0	14.2	52.4	5.3	8.9
55	3/24/81	12	74.9	67.8	.	.	52.6	77.9	8.2	18.0	58.2	5.7	16.4
56	3/26/81	1	73.8	66.9	65.7	63.8	50.3	57.9	4.3	9.6	45.0	4.3	13.0
57	3/26/81	2	75.3	68.6	66.7	64.7	51.8	66.3	9.1	9.9	56.4	5.3	11.4
58	3/26/81	3	73.6	65.6	64.6	62.5	47.2	61.3	1.8	22.2	52.4	3.6	11.6
59	3/26/81	4	73.4	66.2	65.1	63.0	55.1	54.2	8.2	9.0	49.2	5.7	12.3
60	3/26/81	5	.	69.4	67.9	65.9	50.3	48.0	5.3	15.1	64.9	5.3	21.3
61	3/26/81	6	77.0	70.1	68.3	65.6	49.8	66.7	8.9	13.3	58.7	3.6	10.7
62	3/26/81	7	75.9	65.9	65.5	63.9	54.1	44.3	9.8	9.0	52.5	7.4	8.2
63	3/26/81	8	74.0	63.4	67.8	66.3	50.1	64.9	7.8	13.0	59.7	2.6	6.0
64	3/26/81	9	73.5	63.6	66.2	.	52.5	49.3	6.9	6.0	57.9	4.3	7.8
65	3/26/81	10	77.2	67.0	68.9	66.9	52.2	55.4	12.1	13.0	56.2	4.3	6.9
66	3/26/81	11	74.7	64.7	.	.	48.8	59.1	6.6	4.9	51.7	2.5	13.1
67	3/26/81	12	75.1	65.2	67.1	65.2	53.4	83.6	11.6	11.6	57.8	9.8	9.8

APPENDIX IV
I-280 LOCATION 1-AFTER BARRIER CONSTRUCTION

CBS DATE	CBSNO	REF	LIP1	LIP2	LIP3	SPC	WBL	WBM	WBH	EBL	EBM	EBH	
1	10/5/81	1	76.7	62.6	.	.	51.3	56.0	8.9	13.3	63.1	0.9	12.4
2	10/5/81	2	75.4	61.6	.	.	51.5	50.7	8.0	11.5	65.8	3.6	10.7
3	10/5/81	3	77.6	62.8	.	.	51.6	72.0	7.1	12.4	81.8	3.6	10.7
4	10/5/81	4	78.0	64.0	.	.	50.2	65.8	7.1	18.6	56.0	5.3	8.9
5	10/5/81	5	77.6	64.1	.	.	53.1	78.2	4.4	15.1	67.6	2.7	12.4
6	10/5/81	6	79.0	64.6	.	.	51.9	72.0	3.6	14.2	68.4	3.6	11.5
7	10/5/81	7	76.5	63.6	.	.	54.8	61.5	6.6	11.0	59.5	4.2	15.3
8	10/5/81	8	77.7	63.6	.	.	51.7	99.6	7.1	17.8	87.1	3.6	10.7
9	10/5/81	9	79.7	65.0	.	.	51.4	80.0	7.1	16.9	88.0	3.6	12.4
10	10/5/81	10	77.1	62.3	.	.	53.0	102.2	4.4	11.5	98.7	0.2	11.5
11	10/5/81	11	79.2	64.7	.	.	55.7	124.6	11.1	14.5	80.2	3.4	7.7
12	10/13/81	1	77.2	62.0	.	.	55.8	65.8	10.7	11.5	69.3	0.0	16.0
13	10/13/81	2	76.7	60.7	.	.	53.8	73.8	8.9	16.0	78.2	2.7	13.3
14	10/13/81	3	75.4	61.1	.	.	50.4	65.8	4.4	12.4	69.3	5.3	15.1
15	10/13/81	4	77.0	62.1	.	.	51.1	58.7	10.7	15.1	61.3	2.7	16.0
16	10/13/81	5	76.9	59.7	.	.	54.8	53.3	6.2	15.1	75.6	8.9	9.8
17	10/13/81	7	75.4	60.8	.	.	49.9	59.5	2.7	9.8	49.8	6.2	5.3
18	10/13/81	8	77.7	62.1	.	.	54.6	70.2	6.2	12.4	72.0	3.6	13.3
19	10/13/81	9	78.8	.	.	.	52.6	70.2	8.0	14.2	63.1	6.2	14.2
20	10/13/81	10	78.2	63.7	.	.	53.1	69.3	9.8	19.5	72.0	6.2	15.1
21	10/13/81	11	76.5	62.8	.	.	56.9	74.7	10.7	12.4	62.2	6.2	6.2
22	10/13/81	12	76.7	62.3	.	.	52.1	92.4	9.8	13.3	60.4	5.3	8.9
23	10/13/81	13	76.2	61.4	.	.	52.8	79.1	5.3	17.8	48.9	5.3	10.7
24	10/13/81	14	78.6	69.8	.	.	51.9	69.3	14.2	16.9	62.2	6.2	11.5
25	10/13/81	15	76.8	61.4	.	.	53.1	112.9	5.3	15.1	74.7	8.0	8.9
26	10/13/81	16	76.1	62.0	.	.	54.6	97.8	6.2	11.5	65.8	3.6	11.5
27	10/13/81	17	77.6	62.1	.	.	53.6	101.3	3.6	16.0	105.8	6.2	6.2
28	10/14/81	1	77.1	.	.	.	53.3	66.7	9.3	15.1	76.4	8.9	14.2
29	10/14/81	2	78.3	63.3	.	.	48.7	75.6	6.2	21.3	71.1	2.7	12.4
30	10/14/81	3	78.6	.	.	.	49.1	60.4	5.3	13.3	77.3	4.4	11.5
31	10/14/81	4	76.6	61.9	.	.	55.4	55.1	8.9	16.0	63.1	4.4	10.7
32	10/14/81	5	77.4	60.8	.	.	49.2	58.7	8.0	11.5	73.8	7.1	10.7
33	10/14/81	6	77.4	62.6	.	.	53.1	77.3	7.1	20.4	82.7	5.3	10.7
34	10/14/81	7	75.7	61.5	.	.	51.1	74.7	6.2	9.8	79.1	3.6	19.5
35	10/14/81	8	75.5	60.4	.	.	53.2	73.8	7.1	7.1	71.1	4.4	12.4
36	10/14/81	9	75.7	.	.	.	52.9	73.8	7.1	15.1	71.1	6.2	13.3
37	10/14/81	10	78.1	62.7	.	.	53.1	76.4	8.0	11.5	69.3	3.6	8.9
38	10/14/81	11	77.1	.	.	.	56.4	77.3	3.6	16.9	66.7	8.0	12.4
39	10/14/81	12	77.4	.	.	.	51.4	97.8	8.9	15.1	64.9	4.4	10.7
40	10/14/81	13	79.6	64.0	.	.	52.8	78.2	5.3	22.2	59.5	5.3	17.8
41	10/14/81	14	75.6	.	.	.	52.5	76.4	10.7	13.3	72.0	8.0	4.4
42	10/14/81	15	78.9	63.7	.	.	52.3	104.9	12.4	15.1	79.1	5.3	15.1
43	10/14/81	16	76.4	60.6	.	.	50.6	119.1	10.7	15.1	66.7	4.4	8.9
44	10/14/81	17	77.7	62.7	.	.	51.1	92.4	6.2	16.9	94.2	5.3	12.4
45	10/14/81	18	76.8	62.0	.	.	52.1	112.9	8.0	14.2	94.2	4.4	17.8
46	10/15/81	1	85.7	59.7	.	.	54.1	81.8	5.3	10.7	69.3	4.4	14.2
47	10/15/81	2	77.5	63.9	.	.	54.6	67.6	5.3	17.8	65.8	0.9	12.4
48	10/15/81	3	78.9	64.0	.	.	51.2	61.3	6.2	18.6	54.2	3.6	19.5
49	10/15/81	4	77.2	64.8	.	.	54.0	79.1	8.0	15.1	94.2	8.9	13.3
50	10/15/81	5	.	63.4	.	.	53.8	64.9	4.4	10.7	65.8	8.0	16.0

APPENDIX IV
I-280 LOCATION 1-AFTER BARRIER CONSTRUCTION

OBS	DATE	CBSNO	REF	LIP1	LIP2	LIP3	SPD	WBL	WBM	WBH	EEL	EEM	EBH
51	10/15/81	6	77.4	61.4	.	.	51.9	81.8	11.5	17.8	66.7	2.7	10.7
52	10/15/81	7	77.4	62.3	.	.	56.0	71.1	4.4	14.2	67.6	4.4	10.7
53	10/15/81	8	77.1	63.8	.	.	55.2	89.8	3.6	11.5	64.0	10.7	12.4
54	10/15/81	11	77.0	61.9	.	.	55.3	95.1	8.9	13.3	82.7	6.2	8.9
55	10/15/81	12	79.3	63.4	.	.	53.2	95.6	7.7	17.1	75.9	8.5	4.3
56	10/15/81	13	76.4	.	.	.	56.4	79.6	7.8	10.4	84.8	5.2	11.2
57	10/15/81	14	77.4	.	.	.	53.3	126.2	11.5	22.2	105.8	4.4	13.3
58	10/20/81	1	77.8	63.9	.	.	50.0	74.7	10.4	9.8	69.3	3.6	9.8
59	10/20/81	2	77.7	65.1	.	.	52.1	75.6	8.9	14.2	66.7	8.0	8.9
60	10/20/81	3	77.2	63.4	.	.	50.6	72.0	8.0	13.3	64.0	5.3	11.5
61	10/20/81	4	74.9	61.5	.	.	52.7	62.2	7.1	9.8	56.9	2.7	15.1
62	10/20/81	5	76.2	.	.	.	52.1	64.0	2.7	13.3	72.9	8.0	7.1
63	10/20/81	6	75.1	62.5	.	.	53.2	64.9	7.1	12.4	72.0	6.2	8.0
64	10/20/81	7	80.9	67.4	.	.	52.4	61.3	7.1	22.2	52.4	6.2	8.9
65	10/20/81	8	88.3	73.9	.	.	54.6	80.9	6.2	9.8	69.3	7.1	11.5
66	10/20/81	9	88.1	73.9	.	.	50.0	64.0	8.9	16.0	53.3	5.3	14.2
67	10/20/81	10	.	73.1	.	.	52.5	68.4	5.3	13.3	66.7	9.8	10.7
68	10/20/81	11	87.7	74.0	.	.	51.6	72.0	8.0	16.9	67.6	4.4	10.7
69	10/20/81	12	.	75.8	.	.	51.8	66.7	8.9	21.3	48.0	8.0	6.2
70	10/20/81	14	.	74.7	.	.	52.4	79.1	7.1	12.4	70.2	3.6	8.0
71	10/21/81	1	76.8	62.3	.	.	53.6	72.0	8.9	16.0	68.4	7.1	14.2
72	10/21/81	2	77.1	62.7	.	.	54.9	64.9	9.8	13.3	69.3	9.8	11.5
73	10/21/81	3	78.4	62.7	.	.	51.6	77.3	13.3	16.0	63.1	3.6	9.8
74	10/21/81	4	76.0	61.2	.	.	55.4	53.3	5.3	14.2	74.7	3.6	13.3
75	10/21/81	5	77.4	61.8	.	.	51.5	78.2	8.9	12.4	56.9	4.4	9.8
76	10/21/81	6	77.9	62.3	.	.	53.3	64.0	8.9	12.4	63.1	3.6	18.0
77	10/21/81	7	77.6	62.9	.	.	49.0	68.4	10.7	14.2	78.2	2.7	11.5
78	10/21/81	8	79.8	65.3	.	.	54.5	76.4	8.9	22.2	64.9	4.4	11.5
79	10/21/81	9	77.1	62.9	.	.	53.3	88.0	8.9	11.5	58.7	9.8	12.4
80	10/21/81	10	77.3	62.5	.	.	57.9	80.0	7.1	7.1	64.9	2.7	9.8
81	10/21/81	11	77.5	62.7	.	.	54.5	70.2	7.1	12.4	78.2	5.3	14.2
82	10/21/81	12	76.5	62.2	.	.	50.3	92.4	8.0	10.7	73.8	4.4	9.8
83	10/21/81	13	76.4	61.7	.	.	52.2	87.1	6.2	10.7	74.7	9.8	5.3
84	10/21/81	14	77.6	62.5	.	.	51.7	125.3	8.9	24.9	102.2	2.7	8.9
85	10/22/81	1	78.8	.	.	.	53.1	72.0	8.0	13.3	46.2	3.6	10.7
86	10/22/81	2	78.8	68.0	.	.	55.0	90.7	8.9	18.6	79.1	6.2	18.6
87	10/22/81	3	80.7	56.1	.	.	53.8	77.3	8.0	22.2	50.7	4.4	13.3
88	10/22/81	4	77.1	57.7	.	.	52.2	66.7	7.1	14.2	64.9	2.7	6.2
89	10/22/81	5	77.0	65.9	.	.	53.6	80.0	11.5	16.9	55.1	7.1	18.6
90	10/22/81	6	76.0	.	.	.	51.4	75.6	6.2	13.3	58.7	8.9	5.3
91	10/22/81	7	78.5	.	.	.	51.0	60.4	9.8	20.4	64.0	7.1	10.7
92	10/22/81	8	77.7	.	.	.	52.6	73.8	4.4	9.8	81.8	4.4	14.2
93	10/22/81	9	77.4	61.9	.	.	55.8	87.1	6.2	14.2	59.5	2.7	9.8
94	10/22/81	11	78.1	62.8	.	.	54.2	76.4	7.1	16.9	68.4	7.1	15.1
95	10/22/81	12	77.8	62.5	.	.	53.1	88.0	7.1	21.3	64.0	5.3	6.2
96	10/22/81	13	76.2	.	.	.	53.5	90.7	11.5	9.8	71.1	5.3	7.1
97	10/22/81	14	78.3	.	.	.	52.6	78.2	10.7	13.3	64.0	3.6	13.3
98	12/3/81	2	68.5	.	.	55.6	44.9	64.0	8.9	16.9	57.8	7.1	9.8
99	12/3/81	4	77.6	.	66.8	62.8	52.1	67.6	5.3	14.2	72.0	6.2	8.0
100	12/3/81	5	78.0	.	64.1	60.4	49.7	88.5	7.9	11.8	56.1	10.3	13.4

APPENDIX IV
I-280 LCCATIGN 1-AFTER BARRIER CONSTRUCTION

OBS DATE	CBSNC	REF	L1P1	L1P2	L1P3	SPC	WEL	WBM	WBF	EEL	EBM	EEH	
101	12/3/81	6	77.0	.	65.7	61.6	48.1	77.3	5.3	18.7	73.8	8.0	9.8
102	12/3/81	7	77.0	.	64.7	60.3	48.1	78.2	6.2	8.9	69.3	7.1	8.0
103	12/3/81	8	75.6	.	63.0	60.4	54.5	108.4	7.1	8.9	101.3	4.4	8.0
104	12/3/81	9	78.9	.	64.5	61.9	46.2	117.3	8.0	14.2	93.3	6.2	13.3
105	12/14/81	1	77.3	.	61.6	59.0	51.1	88.9	6.2	14.2	72.9	3.6	8.0
106	12/14/81	3	79.7	.	63.9	61.2	50.5	65.8	5.3	19.6	66.7	7.1	20.4
107	12/14/81	4	79.4	.	62.6	59.2	51.1	53.6	6.0	19.3	66.2	4.5	12.6
108	12/14/81	5	79.2	.	63.1	60.4	46.2	72.0	3.6	20.4	65.3	8.0	8.9
109	12/14/81	6	76.6	.	61.2	58.6	53.6	80.9	7.1	14.2	72.0	7.1	10.7
110	12/14/81	7	78.5	.	63.0	.	51.6	71.1	7.1	20.4	64.0	5.3	11.6
111	12/14/81	11	80.4	.	64.1	60.5	51.4	78.2	7.1	15.1	62.2	3.6	13.3
112	12/14/81	12	78.2	.	63.3	.	54.1	79.1	10.7	15.1	73.8	3.6	12.4
113	12/17/81	1	77.9	.	.	63.7	51.0	81.8	6.2	16.0	82.7	5.3	17.8
114	12/17/81	3	77.3	.	.	.	52.7	82.7	7.1	10.7	72.0	2.7	16.0
115	12/17/81	4	78.3	.	.	62.9	48.1	89.8	3.6	14.2	76.4	8.0	11.6
116	12/17/81	5	77.2	.	.	63.8	49.3	81.8	7.1	20.4	71.1	6.2	13.3
117	12/17/81	6	75.6	.	.	62.3	49.0	68.4	8.0	18.7	80.9	8.0	12.4
118	12/17/81	7	77.9	.	.	65.9	49.1	90.7	5.3	16.0	80.0	4.4	14.2
119	12/17/81	8	80.3	.	62.8	62.7	51.0	87.0	6.8	14.5	65.7	2.6	13.6
120	12/17/81	9	81.5	.	66.8	66.5	50.2	96.0	10.9	12.4	55.1	8.0	8.0
121	12/17/81	10	77.2	.	61.0	60.9	49.1	71.1	7.1	18.7	62.2	6.2	8.0
122	12/17/81	11	79.0	.	61.6	61.6	51.4	94.2	12.4	12.4	60.4	3.6	10.7
123	12/17/81	12	76.7	.	59.7	59.7	53.8	90.7	8.0	15.1	64.0	6.2	13.3
124	12/17/81	13	78.0	.	63.9	64.5	48.9	88.0	8.9	14.2	72.0	5.3	15.1
125	12/21/81	1	78.6	.	.	.	52.9	78.2	8.9	10.7	84.4	11.6	10.7
126	12/21/81	2	78.9	.	63.0	63.5	54.1	76.4	8.0	13.3	82.7	3.6	15.1
127	12/21/81	4	79.3	.	.	.	52.6	80.0	8.0	22.2	74.7	7.1	16.0
128	12/21/81	5	77.6	.	.	.	50.6	82.7	10.7	8.0	61.3	7.1	10.7
129	12/21/81	6	.	.	62.1	62.7	50.8	78.2	4.4	13.3	64.9	4.4	16.9
130	12/21/81	7	78.6	.	61.9	63.1	51.7	69.3	7.1	16.0	64.0	5.3	10.7
131	12/21/81	8	77.7	.	62.3	62.5	51.5	82.3	9.1	15.2	66.3	7.6	13.7
132	12/21/81	9	75.5	.	59.8	59.9	49.6	66.7	3.6	10.7	71.1	2.7	6.2
133	12/21/81	10	78.2	.	61.7	62.3	50.9	84.4	11.6	18.7	84.4	1.8	8.0
134	12/21/81	11	78.7	.	63.0	63.7	50.2	74.7	9.8	16.0	60.4	5.3	12.4
135	12/21/81	12	77.1	.	61.1	61.4	51.6	88.9	8.0	10.7	78.2	5.3	15.1
136	12/21/81	13	77.1	.	.	.	47.9	99.6	6.2	12.4	70.2	4.4	12.4
137	12/21/81	14	78.3	.	61.2	62.0	50.8	91.6	8.9	14.2	77.3	7.1	6.2
138	4/19/82	1	78.3	.	.	.	52.1	83.6	12.4	12.4	79.1	10.7	13.3
139	4/19/82	2	75.6	.	50.2	.	53.9	70.2	5.3	13.3	44.4	3.6	9.8
140	4/19/82	3	.	.	50.2	.	50.7	79.1	7.1	16.9	87.1	10.7	10.7
141	4/19/82	4	77.6	.	50.4	52.1	53.0	73.8	11.6	11.6	65.8	8.0	14.2
142	4/19/82	5	75.3	.	50.2	.	55.6	88.9	8.9	8.0	64.0	8.0	7.1
143	5/3/82	1	78.7	.	.	.	52.1	72.0	7.1	13.3	68.4	4.4	13.3
144	5/3/82	2	77.2	.	.	.	49.6	61.3	10.7	19.1	81.8	5.3	15.1
145	5/3/82	3	82.1	.	66.0	.	49.0	77.3	9.8	14.2	71.1	2.7	16.0
146	5/3/82	4	79.6	.	.	.	47.7	74.7	14.2	16.9	81.8	6.2	9.8
147	5/3/82	5	78.5	.	.	.	53.3	74.7	8.2	11.5	76.3	6.6	15.6
148	5/3/82	6	79.4	.	.	.	49.7	73.8	5.7	14.8	77.1	4.1	15.6
149	5/3/82	7	80.1	.	.	.	50.6	79.6	9.0	14.8	70.6	4.9	7.4
150	5/3/82	8	76.7	.	.	.	53.2	94.6	9.2	10.0	66.1	0.7	12.1

APPENDIX IV
I-280 LOCATION 1-AFTER BARRIER CONSTRUCTION

CBS	DATE	CBSNC	REF	L1P1	L1P2	L1P3	SPC	WBL	WBM	WBH	EEL	EBM	EBH
151	5/3/82	9	77.9	.	52.5	.	46.9	108.4	11.6	16.0	95.1	2.7	16.0
152	5/3/82	10	76.1	.	.	.	52.4	104.9	6.2	8.9	112.9	5.3	9.8
153	5/3/82	11	78.0	.	.	.	51.9	97.8	6.2	13.3	87.1	10.7	8.0
154	5/3/82	12	77.1	.	.	.	50.5	114.7	7.1	24.8	108.7	8.0	15.1
155	5/4/82	1	78.9	.	.	.	49.5	76.4	6.2	16.9	66.7	3.6	11.6
156	5/4/82	2	76.7	.	.	.	51.2	76.4	5.3	9.8	73.8	11.6	13.3
157	5/4/82	3	77.4	.	62.5	.	56.3	58.9	8.5	16.2	70.0	10.2	13.7
158	5/4/82	4	76.5	.	.	.	51.2	76.4	8.9	12.4	74.7	3.6	15.1
159	5/4/82	5	77.0	.	.	.	50.4	80.0	8.9	12.4	90.7	6.2	13.3
160	5/4/82	7	77.7	.	63.0	.	51.4	82.7	10.7	18.7	93.3	6.2	16.0
161	5/4/82	13	.	.	.	.	50.5	101.3	9.8	11.6	74.7	8.0	7.1
162	5/4/82	14	.	.	62.3	.	50.9	81.1	12.8	17.9	71.7	6.0	16.2
163	5/4/82	15	.	.	62.9	.	49.9	128.0	10.7	16.0	101.3	8.9	11.6
164	5/4/82	16	.	.	61.3	48.8	51.0	113.8	10.9	17.5	110.5	9.8	7.1
165	5/5/82	1	.	.	60.0	.	52.8	55.1	8.0	16.9	76.4	3.6	16.0
166	5/5/82	2	.	.	61.2	.	50.1	73.8	5.3	19.6	83.6	8.0	8.9
167	5/5/82	3	.	.	62.2	59.8	51.9	57.8	10.7	11.6	76.4	10.7	12.4
168	5/5/82	4	.	.	61.9	.	49.8	67.6	16.0	19.6	76.4	5.3	13.3
169	5/5/82	5	.	.	63.4	.	51.0	118.2	9.8	16.9	91.6	10.7	12.4
170	5/5/82	12	.	.	59.8	.	52.2	73.8	8.0	12.4	81.8	3.6	8.9
171	5/5/82	13	.	.	62.2	60.3	49.3	104.0	3.6	24.9	72.0	3.6	15.6
172	5/5/82	14	.	.	61.3	58.7	49.4	86.2	8.0	16.0	92.4	6.2	8.9
173	5/6/82	2	.	.	.	60.6	52.5	78.2	7.1	13.3	68.4	6.2	14.2
174	5/6/82	3	.	.	60.9	58.0	49.9	78.2	5.3	15.1	84.4	12.4	12.4
175	5/6/82	4	.	.	.	.	53.8	76.3	6.6	13.9	85.3	6.6	10.7
176	5/6/82	5	.	.	64.0	61.3	51.1	85.3	9.4	25.6	75.9	6.0	17.9
177	5/6/82	7	.	.	62.6	.	50.9	79.4	4.3	29.0	101.5	3.4	9.4
178	5/6/82	8	.	.	62.6	.	49.9	92.2	5.1	18.8	71.7	4.3	12.8
179	5/6/82	9	.	.	64.5	61.9	49.5	77.0	5.3	17.5	80.8	10.7	13.7
180	5/6/82	10	.	.	63.0	59.7	48.5	90.5	6.8	17.1	71.7	6.0	9.4
181	5/6/82	11	.	.	61.6	.	48.7	88.0	8.0	12.4	83.6	6.2	4.4
182	5/6/82	13	.	.	62.9	.	49.6	110.9	12.8	17.1	75.1	9.4	7.7
183	5/6/82	14	.	.	64.1	.	50.6	92.4	8.0	23.1	85.3	4.4	17.8

APPENDIX V
I-280 LOCATION 2-BEFORE BARRIER CONSTRUCTION

OBS	DATE	OBSNO	REF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH	
1	4/7/81	1		72.3	61.3	61.3	51.3	54.2	50.5	7.1	10.7	59.7	2.1	6.4
2	4/7/81	2		74.7	.	62.8	52.5	44.7	56.0	7.1	10.7	45.3	5.3	10.7
3	4/7/81	3		75.4	63.2	.	.	47.7	54.4	5.5	17.2	69.5	4.8	8.3
4	4/7/81	4		76.8	65.3	64.7	63.9	45.1	56.0	8.0	21.3	71.1	5.3	8.9
5	4/7/81	5		72.3	61.4	59.9	59.6	47.6	61.3	6.2	6.2	42.7	1.8	12.4
6	4/7/81	6		72.9	.	.	.	49.3	56.0	8.0	13.3	61.3	1.8	8.0
7	4/7/81	7		75.6	64.4	63.5	62.9	51.2	78.2	8.0	11.6	59.6	5.3	9.8
8	4/7/81	8		75.3	64.9	63.9	65.2	48.9	65.8	5.3	11.6	63.1	7.1	9.8
9	4/7/81	9		75.6	63.3	60.3	60.0	51.2	73.8	9.8	12.4	58.7	6.2	16.0
10	4/7/81	10		76.1	65.0	63.5	63.0	52.3	79.1	4.4	13.3	40.9	6.2	8.9
11	4/7/81	11		75.6	.	.	61.8	51.2	96.9	10.7	11.6	65.8	5.3	8.9
12	4/7/81	12		.	.	64.5	64.3	49.8	113.8	11.6	25.8	81.8	5.3	11.6
13	4/8/81	1		77.3	.	.	.	51.0	73.8	8.9	21.3	62.2	6.2	7.1
14	4/8/81	2		73.7	64.2	63.0	59.9	51.2	68.4	8.0	6.2	68.4	2.7	15.1
15	4/8/81	3		75.7	65.8	64.9	63.5	50.9	70.9	8.4	17.5	68.6	3.0	12.2
16	4/8/81	4		75.4	65.6	64.1	.	51.3	41.8	4.4	23.1	43.6	1.8	7.1
17	4/8/81	5		76.1	.	.	.	50.6	54.2	7.1	13.3	51.6	1.8	3.6
18	4/8/81	6		76.4	66.9	64.3	64.8	51.3	64.0	12.4	15.1	57.8	6.2	13.3
19	4/8/81	7		75.3	64.5	63.9	.	52.4	58.7	8.9	14.2	73.8	5.3	10.7
20	4/8/81	9		75.0	.	63.2	.	47.1	64.9	11.6	11.6	64.0	4.4	5.3
21	4/8/81	10		75.5	.	63.9	.	48.2	59.6	8.9	10.7	59.6	1.8	11.6
22	4/8/81	11		77.2	.	65.1	.	51.5	69.3	8.0	12.4	58.7	2.7	4.4
23	4/8/81	12		74.5	65.6	63.4	.	54.9	74.7	9.8	8.9	48.0	4.4	13.3
24	4/10/81	1		76.5	64.4	63.1	62.5	52.9	63.1	8.5	11.1	53.8	6.0	12.8
25	4/10/81	2		77.2	.	.	.	50.3	68.3	9.5	18.2	67.5	7.8	16.4
26	4/10/81	3		74.4	63.9	63.6	63.5	51.5	74.7	5.3	6.2	71.1	3.6	15.1
27	4/10/81	4		75.6	64.2	62.9	63.0	52.8	72.9	7.1	13.3	74.7	6.2	8.9
28	4/10/81	5		77.2	66.4	64.5	63.2	56.4	57.8	3.6	11.6	32.7	9.8	14.2
29	4/10/81	6		77.4	66.4	65.3	64.9	45.3	72.9	8.9	15.1	58.7	5.3	8.9
30	4/10/81	7		75.6	.	64.0	62.6	47.0	73.0	4.1	16.4	70.6	6.6	10.7
31	4/10/81	8		75.5	63.9	62.5	62.1	53.6	69.3	1.8	14.2	57.8	8.9	9.8
32	4/10/81	9		.	.	.	64.4	49.9	58.7	7.1	8.9	58.7	3.6	16.0
33	4/10/81	10		74.8	64.4	63.5	63.2	53.6	76.4	7.1	9.8	66.7	3.6	6.2
34	4/10/81	11		73.0	62.3	61.6	60.0	51.2	61.3	10.7	11.6	54.2	5.3	4.4
35	4/10/81	12		75.7	65.2	.	.	50.7	85.3	6.2	10.7	61.3	4.4	7.1
36	4/13/81	1		76.6	.	67.0	.	52.5	51.6	6.2	6.2	64.0	4.4	15.1
37	4/13/81	2		74.4	62.6	61.5	61.0	50.6	48.0	9.8	11.6	46.2	3.6	7.1
38	4/13/81	3		73.1	63.4	61.2	61.2	48.9	56.0	8.9	16.0	45.3	2.7	10.7
39	4/13/81	4		75.0	62.3	62.2	61.9	54.0	74.7	5.3	15.1	55.1	4.4	8.9
40	4/13/81	5		75.8	.	64.2	63.4	47.3	57.8	5.3	12.4	50.7	3.6	6.2
41	4/13/81	6		76.9	62.3	61.8	61.2	51.1	67.6	7.1	16.0	57.8	4.4	8.0
42	4/16/81	1		76.0	65.3	64.2	.	52.3	53.8	3.4	11.1	70.8	3.4	7.7
43	4/16/81	2		74.1	64.0	63.2	.	52.9	66.7	3.6	12.4	58.7	3.6	11.6
44	4/16/81	3		77.4	66.3	64.7	.	50.1	86.9	5.3	13.0	61.0	2.3	13.0
45	4/16/81	4		76.4	66.2	64.9	.	55.2	79.1	10.7	11.6	42.7	3.6	8.0
46	4/16/81	5		75.3	65.3	63.9	.	47.1	78.2	4.4	12.4	60.4	4.4	10.7
47	4/16/81	6		76.5	66.3	65.0	.	50.1	76.4	5.3	13.3	66.7	7.1	8.9
48	4/22/81	1		76.3	65.6	62.7	.	52.0	53.3	5.3	14.7	62.7	9.3	8.7
49	4/22/81	2		76.2	.	.	.	51.0	52.6	4.3	7.8	59.7	0.0	14.2
50	4/22/81	3		75.6	64.1	62.0	.	51.6	71.1	8.9	12.4	54.2	3.6	17.8

APPENDIX V
I-280 LOCATION 2-BEFORE BARRIER CONSTRUCTION

OBS	DATE	OBSNO	REF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	FBL	FBM	EBH
51	4/22/81	4	77.2	66.4	66.2	.	53.5	70.2	8.0	8.9	63.1	5.3	17.8
52	4/22/81	5	76.3	65.2	62.8	.	50.2	51.6	8.0	21.3	71.1	3.6	11.6
53	4/22/81	6	75.9	64.6	63.2	.	50.6	64.0	3.6	13.3	67.6	5.3	13.3
54	4/22/81	7	76.5	64.2	63.3	.	46.8	60.0	6.0	14.0	56.7	6.0	9.3
55	4/22/81	8	76.9	.	64.2	.	55.3	56.0	10.7	16.0	52.4	8.9	7.1
56	4/28/81	2	75.5	63.9	62.1	.	52.3	64.0	1.6	9.8	83.7	4.1	9.8
57	4/28/81	3	74.3	62.5	60.5	.	54.7	45.0	4.3	12.1	60.5	5.2	14.7
58	4/28/81	4	74.8	.	61.2	.	46.4	63.1	7.1	9.8	47.1	4.4	10.7
59	4/28/81	5	75.5	64.6	62.7	.	46.8	64.0	2.7	15.1	50.7	2.7	2.7
60	4/28/81	6	74.5	.	.	.	48.3	75.6	3.6	17.6	81.8	8.0	14.2
61	4/28/81	7	74.1	.	.	.	53.6	68.4	7.9	12.3	58.7	5.3	9.6
62	4/28/81	8	76.8	.	.	.	56.5	81.3	8.6	10.4	45.0	8.6	9.5
63	4/28/81	9	74.3	64.8	63.5	.	50.5	71.1	10.7	12.4	47.1	6.2	7.1
64	4/29/81	1	75.1	64.6	63.2	.	52.2	64.9	7.1	11.6	41.8	5.3	18.7
65	4/29/81	2	76.4	.	.	.	49.9	51.6	8.9	8.9	65.8	5.3	12.4
66	4/29/81	3	73.6	65.1	.	.	48.4	48.9	5.3	9.8	65.8	4.4	6.2
67	4/29/81	4	75.2	65.3	.	.	51.6	63.1	3.6	14.2	66.7	3.6	8.0
68	4/29/81	5	74.8	65.7	63.5	.	52.4	49.8	10.7	12.4	61.3	4.4	13.3
69	4/29/81	6	75.7	66.3	65.0	.	52.3	60.4	7.1	10.7	61.3	5.3	14.2
70	4/29/81	7	76.3	65.7	64.7	.	49.5	64.8	4.9	9.0	53.3	4.1	7.4
71	4/29/81	8	73.2	.	.	.	49.9	59.1	9.0	12.3	70.6	6.6	10.7
72	4/29/81	9	76.2	.	.	.	54.8	70.2	5.3	8.9	53.3	3.6	9.8
73	4/29/81	10	76.2	.	.	.	52.0	54.2	8.2	15.6	55.0	2.5	7.4
74	4/29/81	11	76.7	.	.	.	49.9	57.8	10.7	19.6	62.2	5.3	13.3
75	4/29/81	12	75.7	64.6	64.0	.	50.8	64.9	10.7	12.4	43.6	1.8	8.0
76	4/30/81	1	78.8	68.2	.	.	53.2	55.6	9.1	13.0	64.8	6.9	8.4
77	4/30/81	2	76.0	65.2	63.5	.	52.0	44.7	2.7	10.0	46.7	4.0	10.0
78	4/30/81	3	74.6	61.9	60.5	.	54.2	83.6	14.2	14.2	67.6	3.6	16.0
79	4/30/81	4	77.0	65.1	.	.	54.4	67.0	10.7	12.2	61.7	2.3	9.9
80	4/30/81	5	75.2	63.9	.	.	54.0	63.1	2.7	20.4	50.7	2.7	8.9
81	4/30/81	6	75.3	64.4	.	.	50.6	51.6	8.9	16.9	56.9	3.6	8.0
82	4/30/81	7	76.4	63.9	.	.	54.1	62.2	6.2	14.2	48.9	1.8	6.2
83	4/30/81	8	77.8	67.1	.	.	54.1	63.1	13.3	14.2	53.3	4.4	7.1
84	4/30/81	9	76.9	.	.	.	53.3	76.4	4.4	13.3	52.4	1.8	8.9
85	4/30/81	10	77.1	64.8	.	.	54.0	56.0	8.9	8.9	61.3	8.9	11.6
86	4/30/81	11	75.7	64.2	.	.	50.2	66.7	5.3	12.4	64.9	4.4	7.1
87	4/30/81	12	74.8	63.0	.	.	52.0	75.6	8.0	14.2	62.2	9.8	8.9
88	4/30/81	13	74.6	63.5	.	.	53.7	83.6	8.9	7.1	63.1	4.4	7.1
89	4/30/81	14	76.2	63.7	.	.	52.5	72.9	3.6	14.2	56.9	2.7	13.3
90	4/30/81	15	76.4	66.5	.	.	53.1	80.9	6.2	7.1	69.3	9.8	8.9
91	4/30/81	16	75.1	63.4	.	.	54.6	80.9	0.9	12.4	70.2	8.0	7.1
92	4/30/81	17	75.6	63.9	.	.	52.6	76.4	3.6	10.7	79.1	5.3	8.0
93	4/30/81	18	76.9	64.2	.	.	52.7	76.4	9.8	9.8	75.6	7.1	10.7

APPENDIX VI
I-280 LOCATION 2-AFTER BARRIER CONSTRUCTION

OBS	DATE	OBSNO	REF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH	
1	10/29/81	1		78.8	.	.	54.4	68.4	5.3	8.0	33.6	5.3	15.1	
2	10/29/81	2		79.4	.	60.3	58.7	50.2	65.5	5.3	20.6	70.9	5.3	15.2
3	10/29/81	3		77.4	56.3	.	52.3	88.0	8.9	18.6	75.6	4.4	11.5	
4	10/29/81	4		77.5	55.7	58.6	57.8	53.1	84.4	8.0	18.6	76.4	5.3	13.3
5	10/29/81	7		77.4	56.7	59.7	.	55.0	64.0	10.7	12.4	60.4	5.3	13.3
6	10/29/81	9		75.9	55.1	58.4	57.4	53.4	74.7	6.2	11.5	82.7	6.2	14.2
7	10/29/81	10		77.0	54.2	.	.	51.4	91.6	8.0	16.0	65.8	2.7	9.8
8	10/29/81	11		76.7	.	.	.	50.6	103.1	5.3	11.5	88.0	1.8	18.6
9	10/29/81	12		75.5	55.7	60.3	59.3	53.2	92.4	5.3	8.9	69.3	8.0	11.5
10	10/29/81	13		78.3	56.9	60.0	.	51.6	90.7	12.4	19.5	88.9	3.6	12.4
11	10/29/81	14		76.4	56.5	.	.	54.9	84.4	3.6	16.0	96.9	3.6	6.2
12	10/30/81	1		77.4	.	.	.	52.9	74.7	8.0	8.9	77.3	5.3	13.3
13	10/30/81	2		76.5	.	.	.	53.6	87.1	8.0	6.2	65.8	4.4	14.2
14	10/30/81	5		74.6	54.1	.	56.1	54.2	95.1	12.4	8.9	81.8	7.1	11.5
15	10/30/81	6		78.2	56.7	59.9	59.6	50.0	86.2	7.1	21.3	87.1	4.4	12.4
16	10/30/81	7		80.5	58.1	61.2	.	51.9	90.7	7.1	23.1	85.3	4.4	7.1
17	11/2/81	1		77.5	57.0	59.2	59.3	52.0	62.4	6.3	17.4	45.8	4.7	12.6
18	11/2/81	2		77.5	56.9	60.0	59.7	50.4	62.2	2.7	20.4	63.1	5.3	8.9
19	11/2/81	3		76.4	54.4	57.6	57.1	52.8	66.7	4.4	9.8	71.1	6.2	10.7
20	11/2/81	4		76.7	.	.	.	49.8	74.7	6.2	13.3	73.8	8.9	12.4
21	11/2/81	5		76.0	55.1	59.1	58.5	53.9	66.7	8.0	11.5	64.9	8.9	13.3
22	11/2/81	6		77.2	.	.	.	53.8	62.2	7.1	14.2	64.9	6.2	15.1
23	11/2/81	7		.	.	59.7	60.4	52.2	81.8	5.3	14.2	67.6	5.3	10.7
24	11/2/81	8		76.7	.	.	.	52.6	93.3	8.9	10.7	63.1	4.4	7.1
25	11/2/81	9		78.7	62.0	61.4	57.4	51.2	81.8	6.2	18.6	71.1	5.3	16.0
26	11/2/81	10		78.0	60.6	61.9	57.0	50.2	70.2	8.0	11.5	56.0	6.2	16.0
27	11/2/81	11		.	61.3	60.0	55.6	53.7	66.7	8.9	14.2	68.4	3.6	11.5
28	11/2/81	13		77.5	61.1	.	56.3	50.9	72.0	5.3	19.5	69.3	6.2	10.7
29	11/2/81	14		76.6	61.2	61.4	56.3	50.6	94.2	10.7	16.0	69.3	1.8	13.3
30	11/4/81	1		78.3	.	.	.	51.8	66.7	8.0	16.0	67.6	4.4	17.8
31	11/4/82	2		78.6	.	.	.	53.9	67.6	8.0	11.5	70.2	8.9	11.5
32	11/4/81	3		79.8	.	.	.	51.7	66.4	10.3	11.1	58.5	4.0	9.5
33	11/4/81	4		78.5	.	.	.	53.2	78.2	8.0	16.9	86.2	5.3	14.2
34	11/4/81	5		74.8	57.3	.	52.2	55.1	71.1	5.3	10.7	72.0	4.4	8.0
35	11/4/81	6		77.6	.	.	.	47.9	56.9	13.3	20.4	54.2	5.3	13.3
36	11/4/81	7		77.7	59.5	59.0	55.0	51.0	67.7	7.4	16.2	59.6	10.3	11.0
37	11/4/81	8		76.6	.	.	53.7	51.8	65.8	5.3	8.9	63.1	6.2	2.7
38	11/4/81	9		76.9	61.0	.	55.7	51.4	69.3	6.2	10.7	67.6	7.1	16.9
39	11/4/81	10		75.9	58.6	.	.	51.4	64.9	7.1	8.9	61.3	4.4	9.8
40	11/4/81	11		78.1	.	.	.	52.1	64.0	7.1	8.9	85.3	8.0	9.8
41	11/4/81	12		78.5	.	59.3	55.5	50.7	92.4	10.7	15.1	87.1	8.0	7.1
42	11/4/81	13		79.4	.	.	55.8	51.2	97.8	9.8	20.4	56.0	5.3	10.7
43	11/4/81	14		78.5	.	.	.	48.8	85.3	8.9	15.1	64.0	6.2	12.4
44	11/4/81	15		77.7	60.7	59.5	56.6	50.7	110.1	8.5	17.1	99.0	9.4	11.1
45	11/4/81	16		79.8	.	.	.	49.7	87.1	9.8	19.5	78.2	6.2	10.7
46	11/5/81	1		77.0	64.4	59.0	.	52.7	71.4	5.7	13.1	69.7	3.3	10.7
47	11/5/81	2		76.4	.	.	.	52.2	64.9	7.1	14.2	61.3	5.3	8.0
48	11/5/81	3		78.0	59.1	58.2	54.9	54.2	66.7	12.4	18.7	68.4	5.3	15.1
49	11/5/81	4		76.9	.	.	.	53.7	67.6	9.8	15.1	56.0	9.8	12.4
50	11/5/81	6		77.3	59.4	59.5	56.6	52.3	75.6	7.1	22.2	76.4	3.6	8.9

APPENDIX VI
I-280 LOCATION 2-AFTER BARRIER CONSTRUCTION

OBS	DATE	OBSNO	FEF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH
51	11/5/81	7	78.7	59.7	59.1	57.0	50.5	68.4	12.4	17.8	68.4	15.1	7.1
52	11/5/81	8	79.7	.	.	56.6	51.0	69.3	11.5	13.3	73.8	7.1	16.9
53	11/5/81	11	78.8	.	.	55.0	51.0	56.9	9.8	16.9	78.2	7.1	8.9
54	11/5/81	12	77.5	.	.	.	53.5	69.9	5.1	11.8	61.8	2.9	10.3
55	11/5/81	13	.	60.1	60.8	56.7	53.6	86.2	9.8	23.1	75.6	3.6	11.6
56	11/5/81	15	79.3	.	.	.	52.6	95.1	5.3	12.4	70.2	8.0	3.3
57	11/5/81	16	79.0	.	.	.	53.8	98.7	7.1	18.7	88.0	4.4	15.1
58	11/13/81	1	66.6	.	.	.	50.1	62.2	4.4	20.4	121.8	12.4	13.3
59	11/13/81	2	67.9	.	.	.	51.7	82.7	8.0	12.4	72.0	10.7	8.9
60	11/13/81	3	68.0	58.6	58.3	.	50.4	73.8	9.8	18.7	98.9	5.3	13.3
61	11/13/81	4	67.1	58.4	57.7	54.4	51.5	78.2	6.2	12.4	70.2	4.4	18.7
62	11/13/81	5	66.9	58.2	.	.	51.5	88.0	6.2	16.9	71.1	4.4	14.2
63	11/13/81	6	.	58.7	56.3	55.0	50.9	79.1	6.2	15.1	80.0	6.2	9.8
64	11/13/81	7	67.6	59.1	57.0	56.4	54.7	103.1	3.6	23.1	82.7	6.2	16.9
65	11/13/81	8	77.0	57.3	56.8	54.4	52.3	96.9	10.7	14.2	75.6	1.8	9.8
66	11/13/81	9	77.2	.	.	.	51.9	97.8	8.9	14.2	81.8	3.6	64.0
67	11/13/81	10	76.8	.	.	.	53.1	89.8	9.8	9.8	67.6	6.2	13.3
68	11/13/81	11	77.2	.	60.6	.	49.7	90.3	8.2	17.2	89.4	4.1	13.9
69	11/13/81	13	80.4	.	.	.	53.0	108.4	10.7	27.6	103.1	2.7	14.2
70	11/24/81	1	78.6	.	.	56.2	49.6	83.6	8.0	15.1	72.0	8.0	17.8
71	11/24/81	2	78.5	.	.	.	52.0	81.8	8.0	16.0	64.0	8.0	64.0
72	11/24/81	3	78.5	.	.	.	52.8	61.3	8.0	9.8	77.3	7.1	20.4
73	11/24/81	4	80.4	.	.	.	49.1	66.7	10.7	13.3	64.9	1.8	12.4
74	11/24/81	5	77.7	.	.	.	52.9	78.2	8.0	15.1	49.8	4.4	18.7
75	11/24/81	6	80.7	.	.	57.7	48.8	58.7	9.8	23.1	75.6	8.9	6.2
76	11/24/81	7	78.1	.	.	57.4	51.2	88.9	9.3	14.2	66.7	3.6	10.7
77	12/3/81	1	76.8	.	.	.	53.4	84.4	3.6	22.2	66.7	5.3	6.2
78	12/3/81	2	68.5	.	.	79.9	44.9	64.0	8.9	16.9	57.8	7.1	9.8
79	12/3/81	3	67.2	.	.	.	50.6	63.1	8.0	12.4	69.3	8.9	8.0
80	12/3/81	4	77.6	.	.	50.6	52.1	67.6	5.3	14.2	72.0	6.2	8.0
81	12/3/81	5	78.0	.	.	.	49.7	88.5	7.9	11.8	56.1	10.3	13.4
82	12/3/81	6	77.0	.	.	.	48.1	77.3	5.3	18.7	73.8	8.0	9.8
83	12/3/81	7	77.0	.	.	48.6	48.1	78.2	6.2	8.9	69.3	7.1	8.0
84	12/3/81	8	75.6	.	.	49.8	54.5	108.4	7.1	8.9	101.3	4.4	8.0
85	12/3/81	9	78.9	.	.	50.8	46.2	117.3	8.0	14.2	93.3	6.2	13.3
86	12/14/81	1	77.3	.	.	58.0	51.1	88.9	6.2	14.2	72.9	3.6	8.0
87	12/14/81	2	78.5	.	.	.	49.8	67.6	3.6	16.9	52.4	5.3	10.7
88	12/14/81	3	79.7	.	.	.	50.5	65.8	5.3	19.6	66.7	7.1	20.4
89	12/14/81	4	79.4	.	.	60.8	51.1	53.6	6.0	19.3	66.2	4.5	12.6
90	12/14/81	5	79.2	.	.	59.1	46.2	72.0	3.6	20.4	69.3	8.0	8.9
91	12/14/81	6	76.6	.	.	57.4	53.6	80.9	7.1	14.2	72.0	7.1	10.7
92	12/14/81	7	78.5	.	.	60.3	51.6	71.1	7.1	20.4	64.0	5.3	11.6
93	12/14/81	8	76.2	.	.	.	51.8	64.0	6.2	15.1	70.2	4.4	16.0
94	12/14/81	9	79.0	.	.	.	51.0	77.3	9.8	5.3	62.2	9.8	20.4
95	12/14/81	10	78.5	.	.	.	50.1	101.3	16.9	22.2	75.6	3.6	4.4
96	12/14/81	11	80.4	.	.	60.7	51.4	78.2	7.1	15.1	62.2	3.6	13.3
97	12/14/81	12	78.2	.	.	59.4	54.1	79.1	10.7	15.1	73.8	3.6	12.4
98	12/14/81	13	78.2	.	.	.	54.0	100.5	7.1	15.1	69.3	5.3	14.2
99	12/14/81	14	77.3	.	.	.	51.3	91.6	8.0	8.0	76.4	1.8	13.3
100	12/17/81	1	77.9	.	.	58.2	51.0	81.8	6.2	16.0	82.7	5.3	17.8

APPENDIX VI
I-280 LOCATION 2-AFTER BARRIER CONSTRUCTION

OBS	DATE	OBSNO	REF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH
101	12/17/81	2	79.2	.	.	.	49.5	72.9	8.9	14.2	75.6	5.3	18.7
102	12/17/81	3	77.3	.	.	58.2	52.7	82.7	7.1	10.7	72.0	2.7	16.0
103	12/17/81	4	78.3	.	.	59.0	48.1	89.8	3.6	14.2	76.4	8.0	11.6
104	12/17/81	5	77.2	.	.	59.5	49.3	81.8	7.1	20.4	71.1	6.2	13.3
105	12/17/81	6	75.6	.	.	57.7	49.0	68.4	8.0	18.7	80.9	8.0	12.4
106	12/17/81	7	77.9	.	.	60.4	49.1	90.7	5.3	16.0	80.0	4.4	14.2
107	12/17/81	8	80.3	.	.	60.2	51.0	87.0	6.8	14.5	65.7	2.6	13.6
108	12/17/81	9	81.5	.	.	63.1	50.2	96.0	10.9	12.4	55.1	8.0	8.0
109	12/17/81	10	77.2	.	.	58.0	49.1	71.1	7.1	18.7	62.2	6.2	8.0
110	12/17/81	11	79.0	.	.	.	51.4	94.2	12.4	12.4	60.4	3.6	10.7
111	12/17/81	12	76.7	.	.	57.0	53.8	90.7	8.0	15.1	64.0	6.2	13.3
112	12/17/81	13	78.0	.	.	60.0	48.9	88.0	8.9	14.2	72.0	5.3	15.1
113	12/17/81	14	77.1	.	.	.	55.4	64.9	4.4	16.0	67.6	8.9	11.6
114	12/21/81	1	78.6	.	.	.	52.9	78.2	8.9	10.7	84.4	11.6	10.7
115	12/21/81	2	78.9	.	.	60.9	54.1	76.4	8.0	13.3	82.7	3.6	15.1
116	12/21/81	4	79.3	.	.	.	52.6	80.0	8.0	22.2	74.7	7.1	16.0
117	12/21/81	5	77.6	.	.	.	50.6	82.7	10.7	8.0	61.3	7.1	10.7
118	12/21/81	6	.	.	.	61.3	50.8	78.2	4.4	13.3	64.9	4.4	16.9
119	12/21/81	7	78.6	.	.	.	51.7	69.3	7.1	16.0	64.0	5.3	10.7
120	12/21/81	8	77.7	.	.	59.3	51.5	82.3	9.1	15.2	66.3	7.6	13.7
121	12/21/81	9	75.5	.	.	58.2	49.6	66.7	3.6	10.7	71.1	2.7	6.2
122	12/21/81	10	78.2	.	.	59.9	50.9	84.4	11.6	18.7	84.4	1.8	8.0
123	12/21/81	11	78.7	.	.	.	50.2	74.7	9.8	16.0	60.4	5.3	12.4
124	12/21/81	12	77.1	.	.	58.9	51.6	88.9	8.0	10.7	78.2	5.3	15.1
125	12/21/81	13	77.1	.	.	60.0	47.9	99.6	6.2	12.4	70.2	4.4	12.4
126	12/21/81	14	78.3	.	.	59.8	50.8	91.6	8.9	14.2	77.3	7.1	6.2
127	4/19/82	1	78.3	.	.	.	52.1	83.6	12.4	12.4	79.1	10.7	13.3
128	4/19/82	2	75.6	.	.	.	53.9	70.2	5.3	13.3	44.4	3.6	9.8
129	4/19/82	4	77.6	.	.	.	53.0	73.8	11.6	11.6	65.8	8.0	14.2
130	4/19/82	5	75.3	.	.	.	55.6	88.9	8.9	8.0	64.0	8.0	7.1
131	5/3/82	1	78.7	.	.	59.9	52.1	72.0	7.1	13.3	68.4	4.4	13.3
132	5/3/82	2	77.2	.	.	.	49.6	61.3	10.7	19.1	81.8	5.3	15.1
133	5/3/82	3	82.1	.	.	.	49.0	77.3	9.8	14.2	71.1	2.7	16.0
134	5/3/82	4	78.6	.	.	.	47.7	74.7	14.2	16.9	81.8	6.2	9.8
135	5/3/82	5	78.5	.	.	.	53.3	74.7	8.2	11.5	76.3	6.6	15.6
136	5/3/82	6	79.4	.	.	.	49.7	73.8	5.7	14.8	77.1	4.1	15.6
137	5/3/82	7	80.1	.	.	.	50.6	79.6	9.0	14.8	70.6	4.9	7.4
138	5/3/82	8	76.7	.	.	59.0	53.2	94.6	9.2	10.0	66.1	0.7	12.1
139	5/3/82	9	77.9	.	.	.	46.9	108.4	11.6	16.0	95.1	2.7	16.0
140	5/3/82	10	76.1	.	.	.	52.4	104.9	6.2	8.9	112.9	5.3	9.8
141	5/3/82	11	78.0	.	.	.	51.9	97.8	6.2	13.3	87.1	10.7	8.0
142	5/3/82	12	77.1	.	.	.	50.5	114.7	7.1	24.8	108.7	8.0	15.1
143	5/4/82	1	78.9	.	.	.	49.5	76.4	6.2	16.9	66.7	3.6	11.6
144	5/4/82	2	76.7	.	.	.	51.2	76.4	5.3	9.8	73.8	11.6	13.3
145	5/4/82	3	77.4	.	.	58.6	56.3	58.9	8.5	16.2	70.0	10.2	13.7
146	5/4/82	4	76.5	.	.	60.2	51.2	76.4	8.9	12.4	74.7	3.6	15.1
147	5/4/82	5	77.0	.	.	.	50.4	80.0	8.9	12.4	90.7	6.2	13.3
148	5/4/82	7	77.7	.	.	.	51.4	82.7	10.7	18.7	93.3	6.2	16.0
149	5/4/82	13	.	.	.	59.3	50.5	101.3	9.8	11.6	74.7	8.0	7.1
150	5/4/82	14	.	.	.	58.3	50.9	81.1	12.8	17.9	71.7	6.0	16.2

APPENDIX VI
I-280 LOCATION 2-AFTER BARRIER CONSTRUCTION

OBS	DATE	OBSNO	FEF	L2P1	L2P2	L2P3	SPD	WBL	WBM	WBH	EBL	EBM	EBH
151	5/4/82	15	.	.	.	58.8	49.9	128.0	10.7	16.0	101.3	8.9	11.6
152	5/4/82	16	.	.	.	57.5	51.0	113.8	10.9	17.5	110.5	9.8	7.1
153	5/5/82	14	.	.	.	58.4	49.4	86.2	8.0	16.0	92.4	6.2	8.9
154	5/6/82	3	.	.	.	57.6	49.9	78.2	5.3	15.1	84.4	12.4	12.4
155	5/6/82	4	.	.	.	57.9	53.8	76.3	6.6	13.9	85.3	6.6	10.7
156	5/6/82	5	.	.	.	60.6	51.1	85.3	9.4	25.6	75.9	6.0	17.9
157	5/6/82	7	.	.	.	60.2	50.9	79.4	4.3	29.0	101.5	3.4	9.4
158	5/6/82	9	.	.	.	62.3	49.5	77.0	5.3	17.5	80.8	10.7	13.7
159	5/6/82	10	.	.	.	60.1	49.5	90.5	6.8	17.1	71.1	6.0	9.4
160	5/6/82	11	.	.	.	58.8	48.7	88.0	8.0	12.4	83.6	6.2	4.4
161	5/6/82	14	.	.	.	60.9	50.6	92.4	8.0	23.1	85.3	4.4	17.8

APPENDIX VII

MAJOR ITEMS OF DATA COLLECTION EQUIPMENT

- 1 - 2204 B & K sound level meter
- 1 - 2209 B & K sound level meter
- 2 - 4220 B & K pistonphones
- 2 - Model IV - SJ NAGRA tape recorders
- 4 - 1" B & K microphones with preamps, input stages, random incidence correctors,
windscreens, dessicators
- 1 - MPH K-55 radar
- 1 - Set headphones
- 3 - Walkie-talkies
- 1 - Stop watch
- 2 - Microphone masts with bases

MAJOR ITEMS OF DATA REDUCTION EQUIPMENT

- 1 - B & K 2305 Graphic Level Recorder
- 1 - Nagra IV-SJ Tape Recorder
- 1 - Spectral Dynamics SD312-22 1/3-octave Analyzer
- 1 - Gray Lab Universal Timer
- 1 - Misco Monitor Speaker