N-96-01
II-A-141

IBM 360/SYSTEM BATCH VERSION OF HIGHWAY CONSTRUCTION NOISE MODEL

October 1981

Office of Noise Abatement & Control
U. S. Environmental Protection Agency
Washington, D. C. 20460

N-96-01
II-A-141

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA 550/9-81-314-C	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE IBM 360 / System Batch Version of Highway Construction Noise Model		5. REPORT DATE June 1981 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Kenneth J. Plotkin		8. PERFORMING ORGANIZATION REPORT NO. WR 81-22
9. PERFORMING ORGANIZATION NAME AND ADDRESS Wyle Laboratories/Wyle Research 2361 Jefferson Davis Highway, #404 Arlington, Virginia 22202		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. DOT-FH-11-9455
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency, Office of Noise Abatement & Control (ANR-471) Washington, D.C. 20460, and	U.S. Department of Transportation, Federal Highway Administration, Washington, D.C. 20590	13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Completed under an Interagency Agreement jointly sponsored by both EPA (Office of Noise Abatement and Control) and FHWA.

16. ABSTRACT

This study investigated the noise associated with highway construction activities. It involved the identification and examination of: highway construction activities, noise characteristics associated with highway construction activities, availability of highway construction noise abatement measures, demonstration of construction site noise abatement measures, and development of a computer-based model for use as a tool to predict the noise impact of construction activities and to plan mitigation measures. The model was developed for use on the FHWA computer (IBM 360).

A total of seven reports were prepared in this study and have been released for public distribution.

This report provides additional information to the Part B report on the highway construction noise model installed at DOT's Transportation Computer Center on an IBM 360 computer. It delineates the differences between the version of the model as installed on the IBM 360 and the two models (HINPUT and HICNOM) operating on the Wyle Computer (PDP-11). The report has additional user's manual information for use on the IBM 360, a programmer's manual describing changes in going from the PDP-11 to the IBM 360, and a maintenance manual.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Highway Noise Model Construction Noise Model		

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

IBM 360/SYSTEM BATCH VERSION OF HIGHWAY CONSTRUCTION NOISE MODEL

October 1981

Office of Noise Abatement & Control
U. S. Environmental Protection Agency
Washington, D. C. 20460

FORWARD

This study was jointly sponsored, through an Interagency Agreement (IAG), by the Office of Noise Abatement and Control (ONAC), U.S. Environmental Protection Agency (EPA), and the Federal Highway Administration (FHWA), U.S. Department of Transportation (DOT). The study was conducted by Wyle Laboratories under contract to FHWA Contract No. DOT-FH-11-9455. Wyle Research of El Segundo, California, and Wyle Research of Arlington, Virginia, performed the study.

The object of the study was to investigate and study the noise associated with highway construction activities. The study involved the identification and examination of: highway construction activities, noise characteristics associated with highway construction activities, availability of highway construction noise abatement measures, demonstration of construction site noise abatement measures, and development of a computer-based model for use as a tool to predict the noise impact of construction activities and to plan mitigation measures. The model was developed for use on the FHWA computer (IBM 360).

The principal project officers for Wyle Laboratories on this project were Mr. William Fuller of Wyle Research in El Segundo and Dr. Kenneth Plotkin of Wyle Research of Arlington, Virginia.

The government project managers for the study were Mr. Fred Romano of FHWA, and Mr. Roger Heymann of EPA/ONAC.

The various technical reports completed by Wyle under this contract and submitted to FHWA have been released for public distribution by EPA.

PREFACE

This study involved a comprehensive review of the environmental noise associated with highway construction activities. A total of seven reports have been released for public distribution. These reports are:

1. Analysis and Abatement of Highway Construction Noise, EPA 550/9-81-314-A, September 1981.
2. A Model for the Prediction of Highway Construction Noise, EPA 550/9-81-314-B, September 1981.
3. IBM 360/System Batch Version of Highway Construction Noise Model, EPA 550/9-81-314-C, September 1981.
4. Appendix A, Highway Construction Noise Field Measurements, Site 1: I-201 (California), EPA 550/9-81-314-D, September 1981.
5. Appendix B, Highway Construction Noise Field Measurements, Site 2: I-205 (Oregon), EPA 550/9-81-314-E, September 1981.
6. Appendix C, Highway Construction Noise Field Measurements, Site 3: I-95/I-395 (Maryland), EPA 550/9-81-314-F, September 1981.
7. Appendix D, Highway Construction Noise Field Measurements, Site 4: I-75 (Florida), EPA 550/9-81-314-G, September 1981.

The first two reports (Part A and Part B) might be considered the principal reports since they are relatively self-contained units on this study's efforts, the engineering studies and the computer model, respectively. In this regard, if there is to be a limited purchase of the reports, one might consider obtaining either or both of Part A and Part B, and obtaining the other reports as additional informational needs arise.

- The first report (Part A) contains all of the information from the engineering study phase of the project. It gives information on highway construction procedures, highway construction site noise characteristics, available abatement measures, and results from field demonstrations on noise abatement.

- The second report (Part B) presents a complete description of the highway noise prediction model. The report contains a description of the model's formulation and construction, a description of the program, and a user's manual.

- The third report (Part C) provides additional information to the Part B report on the highway construction noise model installed at DOT's Transportation Computer Center on an IBM 360 computer. It delineates the differences between the version of the model as installed on the IBM 360 and the two models (HINPUT and HICNOM) operating on the Wyle Computer (PDP-11). The report has additional user's manual information for use on the IBM 360, a programmer's manual describing changes in going from the PDP-11 to the IBM 360, and a maintenance manual.

- Reports 4, 5, 6, and 7 (Part D through Part G) contain field data gathered at the field demonstrations at highway construction sites in: Route I-201, California; I-205, Oregon; I-95/I-395, Maryland; and I-75, Florida. They contain noise data on single and multiple pieces of equipment, provide general description of highway site activities, and activity analyses of equipment.

ACKNOWLEDGMENT

The Author would like to thank Mr. Lynn Runt, of the Federal Highway Administration, for his invaluable assistance and guidance in the installation of this computer program on the TCC system.

TABLE OF CONTENTS

1.0 INTRODUCTION

This note describes HICNOM, the highway construction noise model as installed on the IBM 360 system at the Transportation Computing Center. A complete description of the model may be found in Wyle Research Report WR80-58, "A Model for the Prediction of Highway Construction Noise". This note is an addendum to that report, and presents the differences between the IBM 360 version and the earlier PDP-11 version. Three sections are presented here: a user's manual (Section 2.0), describing the operation of this model on the 360 system, a programmer's manual (Section 3.0), describing changes in the code which were made, and a maintenance manual (Section 4.0). The differences between the two versions are primarily due to language restrictions and system conventions. The one major difference between the two versions is that this is a batch version, while the program as described in WR80-58 is conversational. This conversion was made because of the lack of ready availability of a conversational system for this installation. The conversational program is fully documented in WR 80-58, and this capability can be restored if a suitable system becomes available. As with the conversational version, the batch version consists of two programs: HINPUT, which transforms construction activity oriented input data into acoustic source quantities, and HICNOM, which performs the acoustical calculations. The programs are run sequentially, with HICNOM reading a data file created by HINPUT.

2.0 USER'S MANUAL

2.1 Hardware Requirements

The program is written in IBM Fortran IV and is configured to run on a 360 system with 100K bytes of memory. (HINPUT requires 64K program space and HICNOM requires 72K.) Input is from a card reader on unit 5. Output is to a line printer on unit 6. A read/write file, in 80 character card format, is on unit 2. HINPUT writes onto unit 2, and HICNOM reads the resultant data from unit 2. These logical units may be the physical devices noted or may be disc files (or equivalent) with corresponding format. All I/O is within an 80 character wide format.

2.2 Input Data Requirements

The following data are required:

- Cartesian coordinates of receiver locations.
- Excess attenuation, expressed as dB per doubling of distance.
- Names of the equipment at the site. Table 2 of WR80-58 is a list of equipment types and models built into the program.
- Coordinates defining source geometries.
- Coordinates defining barrier locations.

Additional information which may be needed is speed and volume data for haul operations, the nature of turnaround loops, activity level data, and source data for equipment defined by the user. Units are specified by the data base. The default units are distances in feet, speeds in mph, capacity in cubic yards, duty cycle time in hours, frequency in Hz.

2.2.2 Input Data Format

The input data is prepared as a card deck. A description of the specific data required on each card, the variable names within HINPUT, and formats are given below. Examples are presented at the end of this section.

Title (TITLE) - An 80 character title card. The first character is reserved for carriage control. (20A4)

Number of receivers (NOBS) – A number up to 10. (I3)

Coordinates of receiver locations (OBSPTS) - X, Y, Z, locations of each receiver, one card per receiver. Z corresponds to the actual elevation of the receiver, i.e., ground elevation plus receiver height above the ground. There must be NOBS cards. (3F10.2)

Value of excess ground attenuation (EXATT) - The ground attenuation, expressed as dB per doubling of distance. A value of 1 to 1.5 is typical of construction sites. (F10.2)

Source type, model, and type of geometry (SRCNAM, MODEL, IGEOM) - The source name is one of the types given in Table 2 of WR80-58. The name must be spelled exactly as shown and must begin in column 1. To specify a new type, enter USER DEFINED. The model is one of the choices in Table 2 . To create a new model, enter 0. To specify a previous user-created model, enter -1, -2, etc., to specify "last new model of this type", "next to last new model of this type", etc. The total number of models of a given type (highest value in Table 1 plus user-created models) must not exceed ten. Note that the model number for USER DEFINED is always 0 the first time, and zero or negative thereafter. The type of geometry is 1, 2, or 3, to specify a point, line, or area, respectively. The input value of IGEOM is used only for those geometries specified as having alternates in Table 1 of WR80-58, plus USER DEFINED. It is ignored otherwise; a blank is acceptable where IGEOM is not required. (4A4, 2I5)

Following the source type card, data are provided describing the activity of this source. The sequence is repeated for each source present. Up to 10 point, 6 line, and 5 area sources are permitted. They may be presented in any convenient order. Providing a blank source type card (only the first four columns need be blank) indicates there are no more sources.

Number of hours worked per day (HOURS) - Enter the number of hours worked per day. A full day is 8 hours. (This is a default value; it may be changed. See the maintenance manual.) Working at less than full efficiency reduces this; for example, if there is a 75-percent use factor, enter 6. Entering a negative value indicates that the program is to compute the use factor so as to match the production rate to the last equipment with a production rate. Equipment for which a production rate exists are indicated in Table 1 of WR80-58. To avoid errors, group equipment together. For example, in a load and haul operation, first specify the activity level for either the trucks or the loader, then enter the other with a negative number for hours worked. Note that a negative input can be used to specify separate activities with the same net production. (F10.2)

If the equipment specified operates at a point, the following are required:

Coordinates of source location (XPTSRC) - X, Y, Z, location of source. Z corresponds to the elevation of the ground at the source. (3F10.2)

If a new piece of equipment is being defined which operates at a point (either by a USER DEFINED type or a 0 model number), the following card is required:

L_{max}, Δ, capacity, cycle time, acoustic height, and frequency (EQUIP, IFREQ) - L_{max} and Δ are as defined in Section 2.2.1 of WR80-58. The capacity is the capacity per cycle (cubic yards), and cycle time is in hours. Acoustic height is as defined in Section 2.1.5 of WR80-58, and frequency is the effective frequency for barrier calculations. The last two quantities do not matter if there are no barriers. (5F10.2, I10)

If the equipment specified operates over an area, the following cards are required:

Number of centerline points (NCLPTS) - A number up to 20. It must be at least 2 to be meaningful. Entering a 0 or negative number indicates that the last previous area is to be reused. This option is useful in cases where different equipment types use the same area; for example, compactors and a water truck in a fill area. (I3)

Coordinates of points and width (XCLPTS, WIDTH) - X, Y, Z, of each centerline point, and the width of the area at that point. Z corresponds to the ground elevation. There must be NCLPTS cards. (4F10.2)

If a new piece of equipment is being defined, a card must be inserted here giving L_{max}, Δ, capacity, cycle time, acoustic height, and frequency, exactly as described above for new point source equipment.

Number of pieces of equipment (EN) - The number of identical pieces of equipment operating in this area. It is common for several identical pieces of equipment to work in a given area. (F5.0)

If the equipment specified operates on a line, the following cards are required

Number of points defining line (NLNPTS) - Up to 20 points may be used. There must be at least two to be meaningful. However, if a return loop is to be generated (see discussion below), the program will create additional points, so that the input NLNPTS must be less than 20. No more than 6 points should be specified if a loop is to be created by the program. Entering a zero or negative value means use the input points for last previous line source, as described above for areas. (I3)

Coordinates of line points - X, Y, Z, of points defining the line source. Z corresponds to the ground elevation. If a return loop is to be created, the last point is the loading/unloading point and the next to last point must be at least 2.5 times the loop radius away from it. There must be NLNPTS cards. (3F10.2)

Line source equipment may be either haul or non-haul, as described in Section 2.2.1 of WR80-58. If user-created non-haul equipment has been specified, a card must be inserted here giving L_{max}, Δ, capacity, cycle time, acoustic height, and frequency, exactly as described above for new point source equipment.

If user-created haul equipment has been specified, the following card must be inserted:

L_o, V_{ref}, slope, V_{crit}, capacity, acoustic height, and frequency (HAULEQ, IFREQ) - L_o, V_{ref}, slope, and V_{crit} are as defined in Equation (12) of WR80-58. Capacity, acoustic height, and frequency are as described earlier for point and area sources. (6F10.2, I10)

The following cards are required for haul equipment:

Speed on each segment (SPEED) - The speeds on the road segments. If n line points were specified, n - 1 speeds will be required. These are the average speeds on each segment. If program-generated acceleration and deceleration profiles are to be specified, the speeds need only be approach and departure speeds; however, n - 1 values must still appear. Up to 8 speeds are placed on each card; sufficient cards must be present to accommodate n - 1 values. (8F10.2)

Vehicles per hour (VOL) - This card is required only if a positive value of HOURS was specified for this equipment. The volume is the one-way flow per hour. (F10.2)

Loop radius, loop type, stopping point, deceleration point (RAD, ILOOP, ISTOP, IDEC) - A loop type of 1 through 7 specifies that a loop as defined in Figure 3 of WR80-58 is to be generated by the program. Enter the radius in feet. The radius is required only for types 1 through 6. Blanks may be entered otherwise. Entering a zero or negative type indicates straight-through traffic on the input line with no program-generated loop. A value greater than 7 will be treated as 7. ISTOP and IDEC are required only if a zero or negative value of ILOOP is specified; they are ignored otherwise. If the haul operation is straight through (i.e., no program generated loops) ISTOP and IDEC identify the indices of the haul road points where vehicles stop (usually for loading or unloading) and where deceleration begins, respectively. The deceleration point must precede the stopping point, and by a distance consistent with the approach speed and deceleration rate. Specifying a zero or negative stopping point indicates no stopping point, and cruise is presumed at the speeds previously input. Specifying a stopping point and a zero or negative deceleration point indicates that the program is to generate acceleration and deceleration profiles which extend sufficiently far so as to match the input speeds; new speeds are created for the segments involved. Specifying positive deceleration and stopping points indicates that actual average speeds have been input, and no kinematics are to be generated by the program. Blanks may be used in place of zeros. (F10.2, 315)

This sequence of cards is repeated, with appropriate options, for each piece of equipment. A blank card denotes the end of construction activity data, as noted earlier. The remaining data input describes barriers.

Number of barriers (NBAR) - A number up to 3. (I3)

For each barrier (up to NBAR), the following cards are required

Number of points (NBPTS) - A number up to 5, specifying how many coordinate points define the barrier. (I3)

Coordinates of barrier points (BARPTS) - X, Y, Z, of the points defining the top edge of the barrier. NBPTS cards must appear. It should be kept in mind that shielding is computed only for the first barrier encountered for each source/receiver pair; this should be considered when entering data for multiple barriers. The program was also designed to handle straightforward barrier arrangements. Complex shapes which intercept a particular line-of-sight more than once may cause erroneous results. (3F10.2)

Figures 1, 2, and 3 are sample input data files. They correspond to the three example cases presented in WR80-58.

Figure 1 is a cut area with two identical load and haul operations. In each, two bulldozers push earth toward a loader, which loads tandem trailer dump trucks. Four receiver positions are specified. The first and third receivers input were site

```
 I210 CUT AREA, RECEIVERS C3,C4,C6,C7
  4
      -500.      -610.        0.
      -460.      -300.        0.
      -200.       300.        0.
         0.         0.        0.
         1.
LOADER                5     1
         8.
      -110.       -65.        0.
TRUCKS                3
        -1.
  3
      -900.      -105.        0.
      -450.      -105.        0.
      -120.       -25.        0.
        35.        35.
       100.     1
LOADER                5     1
        -1.
      -390.      -355.        0.
TRUCKS                3
        -1.
  3
     -1000.      -105.        0.
      -850.      -105.        0.
      -410.      -340.        0.
        35.        35.
       150.     5
BULLDOZER             3     2
         8.
  2
       -30.       -80.        0.
        15.      -200.        0.
BULLDOZER             3     2
         8.
  2
       -50.       -80.        0.
       -25.      -220.        0.
BULLDOZER             3     2
         8.
  2
      -355.      -400.        0.
      -200.      -490.        0.
BULLDOZER             3     2
         8.
  2
      -355.      -410.        0.
      -285.      -550.        0.

  0
```

Figure 1. HINPUT Input Data, Cut Area.

```
 I210 FILL AREA, RECEIVERS F6,F7,F8
  3
        0.         0.         4.
        0.        70.         4.
      -50.       340.         4.
        1.
TRUCKS              3
        8.
  4
      350.       270.         0.
     -340.       260.         0.
     -340.       120.         0.
      350.       120.         0.
       30.        20.        10.
       55.
        0.     0     0     0
BULLDOZER           3     3
        8.
  2
     -290.       140.         0.        80.
      450.       140.         0.        80.
   1.

  0
```

Figure 2. HINPUT Input Data, Fill Area.

```
  BARRIER EXAMPLE CASE
   3
        0.        100.          4.
        0.       -100.          4.
      100.          0.          4.
        1.
LOADER                   2    1
        8.
        0.          0.          0.
TRUCKS                   2
       -1.
  2
     -500.          0.          0.
        0.          0.          0.
       30.
       25.    7

  2
  2
     -100.         50.         15.
       50.         50.         15.
  3
     -100.        -50.         15.
        0.        -50.         15.
       50.        -50.         15.
```

Figure 3. HINPUT Input Data, Barrier Example.

boundary measurement points, while the second and fourth were each close to one of the loading operations. The equipment inputs are the loader, trucks, and bulldozers at one load operation, followed by the same at the other. Note that balance-to-the-last is specified (negative hours worked) for both loader and trucks at the second load operation. This is because both operations were known to have the same production rate, even though they were not directly connected. The intervening bulldozer data were irrelevant to the stored production rate, since bulldozers do not have production defined in this model.

Program-generated return loops were specified for both haul operations. Three road points were sufficient to describe each approach, with the last corresponding to the loading point. The speeds input are the approach cruise speeds.

Figure 2 corresponds to the fill area for this same operation. The trucks passed to one side of the fill area, turned around, and returned parallel to the approach but about 140 feet from it. They slowed through the area. A bulldozer working over an 80-foot-wide area spread the dumped earth. The first two receivers are near the dump/spread operation. The third is near the haul road approach.

Figure 3 shows a hypothetical operation with barriers. The two barriers are symmetric about the haul/load operation. They are physically identical, but are specified with different numbers of points. A straight in-and-out return loop is specified; the 25-foot radius given is irrelevant. Two of the receivers are shielded by the barriers, and one is not.

2.3 Running the Programs

The programs are run in a batch mode on the IBM 360 system. The runs may be submitted as card decks. HINPUT is run with data sets described in Section 2.2 as the card input on logical unit 5. An output file is created on unit 2; this must be a card punch if only card input is used. The output data is used directly as card input on unit 2 to HICNOM. Output from HICNOM is to the line printer, unit 6.

The programs are currently installed as card image files on the TCC system. The file on unit 2 is a disc file. Only a JCL card deck and the HINPUT input data are physically required. Figures 4 and 5 are the JCL decks required to run the programs. The disc files on which HINPUT and HICNOM are stored are shown on the FORT cards in Figures 4 and 5. The account and user ID information on the JOB card must be changed to represent the user's account. These JCL sets generate source listings of the programs; the option NOSOURCE should be added to the EXEC card to suppress this if not desired. In the card decks shown, unit 2 file is DATA01. Prior to running HINPUT, there must be no old file named DATA01. Figures 6 shows the JCL required to clear an existing unit 2 file. Figure 7 shows JCL to print DATA01. A run sequence to clear DATA01, run HINPUT, print DATA01, and run HICNOM would consist of submitting the decks in the order 6, 4, 7, 5. This sequence considers DATA01 to be a scratch file not to be preserved. A single deck may be submitted, stacking the decks in this order with only one JOB card at the beginning, and one set of //, blank at the end. Following completion of the HINPUT run, HICNOM is submitted.

2.4 Program Output

2.4.1 HINPUT Outputs

Figures 8 through 10 are the unit 2 data outputs generated by HINPUT, corresponding to the data sets shown in Figures 1 through 3. The data files contain the input data converted to acoustical quantities. Data are presented in the order receiver data, point source data, line source data, area source data, barrier data, and excess attenuation. The quantities created and the FORTRAN formats for the data items are:

- Title line.
- Number of Receivers: I3.
- Receiver coordinates (X, Y, Z): 3F10.2 for each.
- Number of point sources: I3.
- Source location (X,Y,Z), effective emission level, and nominal frequency: 4F10.2, I10 for each. Note that the Z value has the effective acoustic height added to the input Z.

```
//LD03LR3D JOB (0124,FHRS),'LD004LR PLOTKIN',CLASS=X,TIME=4
//   EXEC FORTGCLG,PARM.FORT=NOLIST,REGION=150K
//FORT.SYSIN DD DSN=LD.LD03XX01.RS41.HINPUT.SOURCE,
//   UNIT=3330,VOL=SER=LR0001,DISP=SHR
/*
//GO.FT02F001 DD DSN=LD.LD03XX01.RS41.DATA01,UNIT=3330,VOL=SER=LR0001,
//   DISP=(NEW,KEEP),SPACE=(TRK,(5,1),RLSE),
//   DCB=(RECFM=FB,LRECL=80,BLKSIZE=6400)
//GO.FT05F001 DD *

(Insert data deck here)

//
  Blank
```

Figure 4. JCL and Data Deck to Run HINPUT

```
//LD03LR3D JOB (0124,FHRS),'LD004LR PLOTKIN',CLASS=X,TIME=4
//   EXEC FORTGCLG,PARM.FORT=NOLIST,REGION=150K
//FORT.SYSIN DD DSN=LD.LD03XX01.RS41.HICNOM.SOURCE,
// UNIT=3330,VOL=SER=LR0001,DISP=SHR
/*
//GO.FT02F001 DD DSN=LD.LD03XX01.RS41.DATA01,UNIT=3330,VOL=SER=LR0001,
//   DISP=(OLD,KEEP)
//GO.FT06F001 DD SYSOUT=A,DCB=(RECFM=UA,BLKSIZE=133)
//
  Blank
```

Figure 5. JCL to Run HICNOM

```
//LD03LR3D JOB (0124,FHRS),'LD004LR PLOTKIN',CLASS=X,TIME=4
//SCRATCH EXEC PGM=IEHPROGM
//SYSPRINT DD SYSOUT=A
//DISK DD UNIT=3330,VOL=SER=LR0001,DISP=OLD
//SYSIN DD *
  SCRATCH DSNAME=LD.LD03XX01.RS41.DATA01,VOL=3330=LR0001
/*
//
  Blank
```

Figure 6. JCL to Scratch Unit 2 Data File DATA01.

```
//LD03LR3D JOB (0124,FHRS),'LD004LR PLOTKIN',CLASS=X,TIME=4
//S2 EXEC PGM=IEBGENER,REGION=80K
//SYSPRINT DD SYSOUT=A
//SYSIN DD *
//SYSUT1 DD DSN=LD.LD03XX01.RS41.DAT01,UNIT=3330,VOL=SER=LR0001,
//   DISP=SHR
//SYSUT2 DD SYSOUT=A,DCB=(RECFM=U,BLKSIZE=133)
/*
  Blank
```

Figure 7. JCL to Print Unit 2 Data File DATA01

```
I210 CUT AREA, RECEIVERS C3,C4,C6,C7
 4              RECEIEVERS
   -500.00    -110.00       0.0
   -460.00    -300.00       0.0
   -700.00     300.00       0.0
      0.0        0.0        0.0
 2              POINT SOURCES
   -110.00     -65.00       6.00       80.00          500            LOADER  1
   -390.00    -355.00       6.00       80.00          500            LOADER  2
 6              LINE SOURCES
10      500            TRUCKS  1
   -900.00    -105.00       6.00       86.00 0.0003241
   -450.00    -105.00       6.00       86.00 0.0003241
   -354.22     -81.78       6.00       86.00 0.0001624
   -229.29     124.46       6.00       85.22 0.0001771
   -167.12     169.37       6.00       84.13 0.0002010
    -91.79     157.91       6.00       87.64 0.0002385
    -46.37      95.74       6.00       80.34 0.0003103
    -57.83      19.91       6.00       72.69 0.0007502
   -120.00     -25.00       6.00       86.00 0.0004232
   -354.22     -81.76       6.00        0.0  0.0
11      500            TRUCKS  2
  -1000.00    -105.00       6.00       85.00 0.0003241
   -850.00    -105.00       6.00       85.00 0.0003241
   -728.87    -169.69       6.00       86.00 0.0001652
   -586.08    -125.22       6.00       84.40 0.0001947
   -471.65    -137.02       6.00       82.10 0.0002537
   -398.20    -225.57       6.00       74.45 0.0006120
   -410.00    -340.00       6.00       86.00 0.0006126
   -498.54    -413.45       6.00       86.00 0.0002537
   -612.93    -401.65       6.00       86.00 0.0001947
   -686.43    -313.10       6.00       86.00 0.0001652
   -728.87    -169.69       6.00        0.0  0.0
 2      500            BULLDOZER   1
    -30.00     -80.00       6.00       83.00 0.0078027
     15.00    -200.00       6.00        0.0  0.0
 2      500            BULLDOZER   2
    -50.00     -80.00       6.00       83.00 0.0070316
    -25.00    -220.00       6.00        0.0  0.0
 2      500            BULLDOZER   3
   -355.00    -400.00       6.00       83.00 0.0055793
   -200.00    -450.00       6.00        0.0  0.0
 2      500            BULLDOZER   4
   -355.00    -410.00       6.00       83.00 0.0063888
   -285.00    -550.00       6.00        0.0  0.0
0               AREA SOURCES
0               BARRIERS
     1.00
```

Figure 8. HINPUT Output Data File, Cut Area.

```
I210 FILL AREA, RECEIVERS F6,F7,F8
 3           RECEIEVERS
    0.0         0.0          4.00
    0.0        70.00         4.00
  -50.00      340.00         4.00
 0           POINT SOURCES
 1           LINE SOURCES
 4    500           TRUCKS  1
   350.00     270.00         6.00        86.00 0.0003464
  -340.00     260.00         6.00        86.00 0.0003464
  -340.00     120.00         6.00        86.00 0.0010393
   350.00     120.00         6.00         0.0  0.0
 1           AREA SOURCES
 2    500           BULLDOZER     1
  -290.00     140.00         6.00        80.00       83.00
   450.00     140.00         6.00        80.00        0.0
 0           BARRIERS
     1.00
```

Figure 9. HINPUT Output Data File, Fill Area.

```
BARRIER EXAMPLE CASE
 3           RECEIEVERS
    0.0       100.00       4.00
    0.0      -100.00       4.00
  100.00        0.0        4.00
 1           POINT SOURCES
    0.0         0.0        6.00      76.00        500          LOADF
 1           LINE SOURCES
 3    500           TRUCKS  1
 -500.00        0.0        6.00      75.39 0.0003710
    0.0         0.0        6.00      81.00 0.0003710
 -500.00        0.0        6.00       0.0  0.0
 0           AREA SOURCES
 2           BARRIERS
 2           POINTS
 -100.00      50.00      15.00
   50.00      50.00      15.00
 3           POINTS
 -100.00     -50.00      15.00
    0.0      -50.00      15.00
   50.00     -50.00      15.00
    1.00
```

Figure 10. HINPUT Output Data File, Barrier Example.

- Number of line sources: I3
- For each line source, the following:
  - Number of points and nominal frequency: I3, I7.
  - Point coordinates (X, Y, Z), vehicle passby level ($L_{eq(e)}$), and source density (N): 4F10.2, F10.7 for each. The coordinate points printed in Figures 8 and 10 are the loop points created by the program, as requested in Figures 1 and 3. The emission levels and source densities (vehicles per unit distance) correspond to the segment beginning at the point on the same line; there is one fewer of these than there are points.
- Number of area sources: I3.
- For each area source, the following:
  - Number of points and nominal frequency: I3, I7.
  - Center point coordinates (X,Y, Z), width, and effective source emission level: 5F10.2. There is one fewer emission level than there are points.
- Number of barriers: I3.
- For each barrier, the following:
  - Number of points: I3.
  - Coordinates (X, Y, Z), of points: 3F10.2.
- Excess attenuation: F10.2.

Various identifying information is also printed in the data files. Their formats may be seen in the program listings. Their main intent is to make the data file readable. The source names (input names plus an appended ordinal) are read by HICNOM and used to annotate its output. Experienced users of this model can modify this file to make minor changes, rather than reenter all the data through HINPUT, when analyzing alternate scenarios at a given site.

2.4.3 HICNOM Outputs

Figures 11 through 13 are the HICNOM outputs corresponding to the three examples. The outputs consist of two parts: the total noise level at each receiver point, and the contribution of each source component to the noise at each receiver.

3210 CUT AREA, RECEIVERS C2,C4,C6,C7

RECEIVER NUMBER	LEQ
1	71.7
2	77.7
3	67.7
4	77.6

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER: 1

INDEX	INTENSITY	LEVEL	SOURCE
1	0.234737E+07	63.7	LOADER 1
2	0.183014E+07	62.6	LOADER 2
101	0.222030E+06	53.5	TRUCKS 1
201	0.524353E+05	47.2	TRUCKS 1
301	0.387177E+05	45.9	TRUCKS 1
401	0.573591E+04	35.3	TRUCKS 1
501	0.525100E+04	37.2	TRUCKS 1
601	0.447421E+04	36.5	TRUCKS 1
701	0.395720E+04	36.0	TRUCKS 1
801	0.203713E+04	33.1	TRUCKS 1
901	0.117152E+06	50.7	TRUCKS 1
102	0.471742E+05	46.7	TRUCKS 2
202	0.655355E+05	48.2	TRUCKS 2
302	0.477425E+05	46.8	TRUCKS 2
402	0.313777E+05	45.0	TRUCKS 2
502	0.308463E+05	44.9	TRUCKS 2
602	0.230734E+05	43.6	TRUCKS 2
702	0.724359E+06	58.6	TRUCKS 2
802	0.403019E+06	56.1	TRUCKS 2
902	0.150431E+06	51.8	TRUCKS 2
1002	0.700156E+05	48.5	TRUCKS 2
103	0.470204E+06	56.7	BULLDOZER 1
104	0.498271E+06	57.0	BULLDOZER 2
105	0.362039E+07	65.6	BULLDOZER 3
106	0.590771E+07	67.7	BULLDOZER 4

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER: 2

INDEX	INTENSITY	LEVEL	SOURCE
1	0.231170E+06	53.4	LOADER 1
2	0.260271E+08	74.2	LOADER 2
101	0.116149E+07	60.7	TRUCKS 1
201	0.474575E+06	56.7	TRUCKS 1
301	0.177362E+06	52.5	TRUCKS 1
401	0.194592E+05	42.9	TRUCKS 1

Figure 11. HICNOM Output, Cut Area.

501	0.370127E+05	45.7	TRUCKS 1
601	0.110700E+05	40.4	TRUCKS 1
701	0.991491E+04	40.0	TRUCKS 1
801	0.562761E+04	37.5	TRUCKS 1
901	0.578225E+06	57.6	TRUCKS 1
102	0.901897E+05	49.5	TRUCKS 2
202	0.176735E+06	52.5	TRUCKS 2
302	0.233854E+06	53.7	TRUCKS 2
402	0.300600E+06	54.8	TRUCKS 2
502	0.523969E+05	53.0	TRUCKS 2
602	0.114542E+07	60.6	TRUCKS 2
702	0.104305E+08	70.2	TRUCKS 2
802	0.100631E+07	60.0	TRUCKS 2
902	0.354253E+06	55.5	TRUCKS 2
1002	0.220225E+06	53.4	TRUCKS 2
103	0.101191E+07	60.1	BULLDOZER 1
104	0.118429E+07	60.7	BULLDOZER 2
105	0.671517E+07	68.3	BULLDOZER 3
106	0.673942E+07	68.3	BULLDOZER 4

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER: 3

INDEX	INTENSITY	LEVEL	SOURCE
1	0.902906E+06	59.6	LOADER 1
2	0.224955E+06	53.5	LOADER 2
101	0.172419E+06	52.4	TRUCKS 1
201	0.789105E+05	49.0	TRUCKS 1
301	0.312663E+06	55.0	TRUCKS 1
401	0.335013E+06	55.3	TRUCKS 1
501	0.293798E+06	54.7	TRUCKS 1
601	0.113623E+06	50.6	TRUCKS 1
701	0.455303E+05	46.6	TRUCKS 1
801	0.137715E+05	41.4	TRUCKS 1
901	0.408737E+06	56.1	TRUCKS 1
102	0.276985E+05	44.4	TRUCKS 2
202	0.335570E+05	45.3	TRUCKS 2
302	0.260057E+05	44.2	TRUCKS 2
402	0.237137E+05	43.7	TRUCKS 2
502	0.186934E+05	42.7	TRUCKS 2
602	0.562600E+04	37.5	TRUCKS 2
702	0.553980E+05	47.4	TRUCKS 2
802	0.184250E+05	42.7	TRUCKS 2
902	0.139477E+05	41.4	TRUCKS 2
1002	0.191716E+05	42.8	TRUCKS 2
103	0.104139E+07	60.2	BULLDOZER 1
104	0.105541E+07	60.2	BULLDOZER 2
105	0.360112E+06	55.6	BULLDOZER 3
106	0.321594E+06	55.1	BULLDOZER 4

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER: 4

INDEX	INTENSITY	LEVEL	SOURCE
1	0.112012E+08	70.5	LOADER 1
2	0.409370E+05	55.1	LOADER 2
101	0.150197E+06	51.8	TRUCKS 1
201	0.237496E+05	43.7	TRUCKS 1

Figure 11 (continued)

301	0.249626E+06	54.2	TRUCKS	1
401	0.108435E+05	50.4	TRUCKS	1
501	0.144579E+06	51.6	TRUCKS	1
601	0.310037E+06	54.9	TRUCKS	1
701	0.965229E+06	55.8	TRUCKS	1
801	0.319069E+06	55.0	TRUCKS	1
901	0.146270E+07	61.7	TRUCKS	1
102	0.212339E+05	43.3	TRUCKS	2
202	0.274037E+05	44.4	TRUCKS	2
302	0.231439E+05	43.5	TRUCKS	2
402	0.277204E+05	43.8	TRUCKS	2
502	0.251419E+05	44.0	TRUCKS	2
602	0.945164E+04	39.8	TRUCKS	2
702	0.895509E+05	49.5	TRUCKS	2
802	0.256091E+05	44.1	TRUCKS	2
902	0.164704E+05	42.7	TRUCKS	2
1002	0.177651E+05	42.5	TRUCKS	2
103	0.224233E+08	73.5	BULLDOZER	1
104	0.178787E+08	72.5	BULLDOZER	2
105	0.819350E+06	59.1	BULLDOZER	3
106	0.663645E+05	56.2	BULLDOZER	4

Figure 11 (concluded).

```
I210 FILL AREA, RECEIVERS F6,F7,F8

RECEIVER NUMBER          LEQ


          1              73.8
          2              79.0
          3              72.8

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  1

INDEX   INTENSITY     LEVEL      SOURCE

  101   0.130051E+07  61.1    TRUCKS  1
  201   0.160519E+06  52.1    TRUCKS  1
  301   0.144165E+03  71.6    TRUCKS  1
10101   0.783700E+07  68.9    BULLDOZER    1

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  2

INDEX   INTENSITY     LEVEL      SOURCE

  101   0.221592E+07  63.5    TRUCKS  1
  201   0.190697E+06  52.8    TRUCKS  1
  301   0.511801E+03  77.1    TRUCKS  1
10101   0.256984E+08  74.1    BULLDOZER    1

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  3

INDEX   INTENSITY     LEVEL      SOURCE

  101   0.944712E+07  69.8    TRUCKS  1
  201   0.241757E+06  53.8    TRUCKS  1
  301   0.536960E+07  67.3    TRUCKS  1
10101   0.420217E+07  66.2    BULLDOZER    1
```

Figure 12. HICNOM Output, Fill Area.

```
BARRIER EXAMPLE CASE

RECEIVER NUMBER          LEQ


         1               58.9
         2               58.9
         3               69.4

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  1

INDEX   INTENSITY     LEVEL      SOURCE

   1    0.472858E+06  56.7    LOADER  1
 101    0.638069E+05  48.0    TRUCKS  1
 201    0.232203E+06  53.7    TRUCKS  1

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  2

INDEX   INTENSITY     LEVEL      SOURCE

   1    0.472858E+06  56.7    LOADER  1
 101    0.638069E+05  48.0    TRUCKS  1
 201    0.232203E+06  53.7    TRUCKS  1

COMPONENT CONTRIBUTIONS FOR RECEIVER NUMBER:  3

INDEX   INTENSITY     LEVEL      SOURCE

   1    0.789336E+07  69.0    LOADER  1
 101    0.173479E+06  52.4    TRUCKS  1
 201    0.531313E+06  58.0    TRUCKS  1
```

Figure 13. HICNOM Output, Barrier Example.

The component contribution for each receiver consists of a source identifying index, an intensity quantity, the sound pressure level due to that source, and the name of that source as read from the unit 2 file. The intensity quantity is $10^{L/10}$, where L is the sound level. The identifying index may be decoded as follows:

- Point sources have one or two digits, line sources three or four, and area sources five.
- The last two digits are the sequential number of the source, in the order it appears in the intermediate data file. Separate counts, from 1, exist for points, lines, and areas.
- For line and area sources, the next two digits identify the source segment, in the order they appear in the data file. Separate counts exist for each source. The level corresponds to that segment only.
- Area sources are identified by a 1 in the fifth digit (leading digit if present).

Note that the order of each source component list corresponds exactly to the order in which the components appear in the data file read by HICNOM.

3.0 PROGRAMMER'S MANUAL

The programs are written in IBM FORTRAN IV, as described in "IBM System/360 and System/370 FORTRAN IV Language", Order No. GC28-6515-10. The following changes were made:

1. The programs were re-structured as batch jobs. This effected I/O statements only. HINPUT reads from unit 5 and writes onto unit 2. HICNOM reads from 2 and writes onto 6. Error messages from subroutines are written onto 6.

2. File open and close statements have been deleted. Files are controlled by JCL, as described in Section 2.

3. DO loop parameters have been modified to conform with the restriction of IBM FORTRAN that only constants or scalar variables are allowed. For example,

   ```
   DO 9 I = 1, NCLPTS (N) -1
   ```

   has been changed to

   ```
   IMAX = NCLPTS (N) -1
   DO 9 I = 1, IMAX
   ```

   The new parameters such as IMAX are not defined in the variable dictionaries; they are local quantities and self-explanatory.

4. Literal constants are introduced through DATA statements only. For example,

   ```
   WRITE (1, 112) NBAR, 'BARR', 'IERS'
   ```

   has been replaced by

   ```
   DIMENSION BARLIT (2)
   :
   DATA BARLIT/'BARR', 'IERS'/
   :
   WRITE (2, 112) NBAR, BARLIT
   ```

   The new variable names are self evident in the DATA statements, and are not included in the variable dictionaries.

5. All data statements for quantities in COMMON blocks are placed in BLOCK DATA routines.

6. The name statements, PROGRAM HINPUT and PROGRAM HICNOM, have been deleted. The programs are identified as MAIN by the system. The names DATA1 and DATA2 have been eliminated from the BLOCK DATA subroutines; there are, however, still two such routines. The shorter one (DATA1) must be linked with HICNOM.

7. All fixed point variables are I * 4, the standard default for IBM FORTRAN.

The following extensions from ANS FORTRAN are still present in the programs:

1. Apostrophes are used to define literal strings.
2. Two variables are declared LOGICAL * 1 in subroutine DECODE.
3. Two four dimensional arrays are used in HICNOM: STRIPL and STRIPR.

These extensions are valid on the IBM 360, and provided significant convenience in writing the program.

In addition to language and system changes, HICNOM has been modified to read the source names created by HINPUT, and prints these with the source component contributions. The new output has been described in Section 2.

4.0 MAINTENANCE MANUAL

Program maintenance is virtually identical to that described in WR80-58. The only differences are that DATA statements for quantities in COMMON blocks /CONSTS/ and UNITS/ are contained only in BLOCK DATA DATA1, and that this routine is linked with HICNOM as well as HINPUT.

When obtaining listings of the programs for maintenance review, it should be noted that the compiler on the TCC system deletes consecutive comment cards beyond a certain number, and generates a severity 0 diagnostic warning. The source listings obtained from running JCL in Figures 4 and 5 will therefore not contain complete annotation and dictionaries. To obtain full listings, the original source files must be printed. This may be accomplished by running a JCL deck similar to that shown in Figure 7, replacing DATA01 with HINPUT.SOURCE or HICNOM.SOURCE.