REPORT NO. DOT-TSC-FHWA-72-1
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MANUAL FOR HIGHWAY NOISE PREDICTION (APPENDIX B), AMENDMENT

OPERATIONAL HANDBOOK

R. Hinckley
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U.S. DEPARTMENT OF TRANSPORTATION
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Corrections to the Highway Noise Prediction (Appendix B) computer program are presented. The corrections address certain input case configurations. Also, the output statistical package has been modified.

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CONTENTS

BACKGROUND

Appendix B to the basic report, Manual for Highway Noise Prediction contains the programmer's manual and computer program listing. This report was issued in March 1972.

Copies of the report and computer program have been widely distributed. The Transportation Systems Center's experiences with the program as well as other users' experiences uncovered no initial problems. However, in November 1973 a user reported that certain input case configurations would cause program failures. The program has been modified to correct these problems which will be fully discussed in the next section.

The basic user's manual and overall program methodology and calculations remain unchanged. Also, the inputs and outputs remain the same.

It should be noted that the affected flow charts in Appendix B have not been updated at this time in order to expedite distribution of the program changes.

Also, included in this report is a list of the original computer program showing where the changes were made, as well as listing of the updated program.

Lastly, a sample problem run with the updated program is shown.

DISCUSSION

Through usage of the Highway Noise Program and from user feedback it has been found that certain input geometric configurations of roadways, barriers and receivers cause either program failure and/or invalid results. In general these failures will occur when the user has specified one of the configurations shown in figure 1. In addition it was found that several changes in the statistical calculations were required.

Enclosed is the information necessary to update the present version of the program to include those modifications that are required to handle the "problem" configurations:

1. Marked-up listing of the present version indicating where the modifications are to take place

2. List of modifications

3. Listing of the program as it should appear after updating.

INSTRUCTIONS FOR MODIFYING THE HIGHWAY NOISE PREDICTION PROGRAM

Enclosed is a listing of the updated program and a marked-up copy of the program to be modified. Modifications take three forms:

Inn - insert new cards here
Rnn - replace existing cards with new cards
Dnn - delete existing cards

where nn refers to the corresponding numbers on the enclosed list of corrections.

Also, due to some minor discrepancies among the various distributed versions, there are several areas of the program to be checked against the enclosed listing of the updated program. These are:

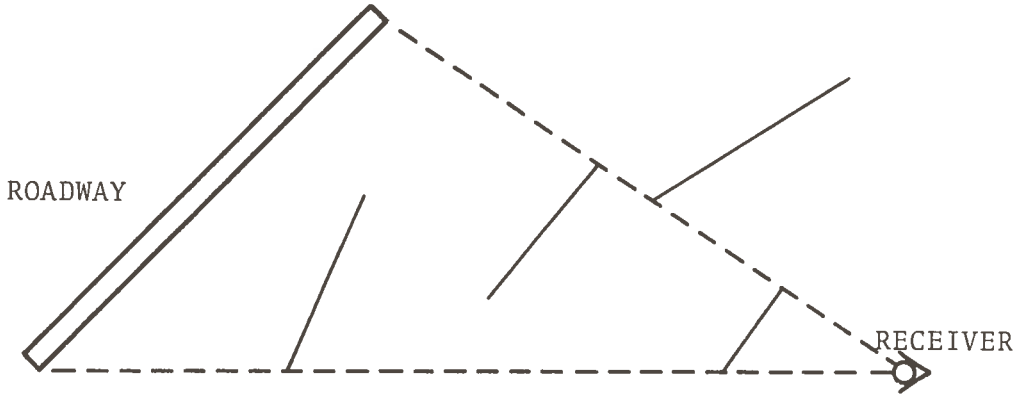
C1 - 4HZZ -- should be 2HZZ

C2 - 15A4 should be 15A2

C3 - 15A4 should be 15A2

C4 - ALP1(9,8) should be ALP1(14,8)

C5 - alphanumerics should be stored 4 characters per word.



Various Barrier Positions Relative to a Roadway and Receiver that Caused a Program Failure

Another Configuration that Will Cause a Program Failure

Figure 1

LIST OF CORRECTIONS

```
C       MAIN PROGRAM      9/74                                          R1

        DIMENSION SIG (4)                                               R2

        COMMON/DRIV4/CAP2                                               R3

        CAP2=0.0                                                        R4

        SIGL=4.35*SQRT(ALOG(1.0+CAP2/XLE(1)**2))                        I1

   56   XLNP=XLE(1)+2.56*SIGL                                           R5
        XL50=XLE(1)-SIGL**2/8.7                                         R5

        WRITE (IOUT, 2004)  XLE(1), XLNP, XL90, XL50, XL10              R6

        DATA BLNK/2H   /                                                R7

        DO 7 I=1,25                                                     R8
        IF(ALPHA(I).NE.BLNK)GO TO 13                                    R8
    7   CONTINUE

C       SUBROUTINES FOR TRAFFIC NOISE 9/74                              R9

        COMMON/INTER1/XLREF(1800)                                       R10

        INDEX=NR+10*(I-1)+10*5*(IF-1)+10*5+9+(IQ-1)                     R11
        XLREF(INDEX)=10.**((XLREF1-66.)/10.)                            R11

C       GEOMETRY ROUTINE 9/74                                           R12

        COMMON/DRIV4/CAP2                                               I3

        COMMON/INTER1/XLREF(1800)                                       R13

   10   CALL DEGEN (XR10,XR20,XRC, XB1, XB2, LOC)                       R14
        IF (LOC.NE.5)GO TO 11                                           R14
        CALL BLOCN (XR10, XR20, XRC, XB1, XB2, XK, LOC)                 R14
   11   IF (LOC.EQ.0) GO TO 12                                          R14

   12   CALL REPLCE (XB2, XB1)                                          R15

   17   CALL DEGEN (XR10, XR20, XRC, XG1, XG2, LOC)                     R16
        IF (LOC.NE.5) GO TO 1701                                        R16
        CALL BLOCN (XR10, XR20, XRC, XG1, XG2, XK, LOC)                 R16
1701    IF (LOC.EQ.0) GO TO 18                                          R16

        DN1=AMAG (XRC, XN1)                                             I4
```

```
      CALL DEGEN (XR1, XR2, XRCI, XRB1, XRB2, LOC)          R17.
      IF (LOC.NE.5) GO TO 79                                R17
      CALL BLOCN (XR1, XR2, XRCI, XRB1, XRB2, XK, LOC)      R17
   79 IF (LOC.EQ.0) GO TO 80                                R17

      CALL DEGEN (XRB3, XRB4, XRCI, XDB1, XDB2, LOC)        R18
      IF (LOC.NE.5) GO TO 96                                R18
      CALL BLOCN (XRB3, XRB4, XRCI, XDB1, XDB2, XK, LOC)    R18
   96 IF (LOC.NE.0) GO TO 110                               R18

      DN1I=AMAG(XRCI, XN1I)                                 I5

      CALL DEGEN (XRB3, XRB4, XRC, XDB1, XDB2, LOC)         R19
      IF (LOC.NE.5) GO TO 117                               R19
      CALL BLOCN (XRB3, XRB4, XRC, XDB1, XDB2, XJ, LOC)     R19
  117 IF (LOC.EQ.0) GO TO 140                               R19

      DN1I=AMAG(XRC,XN1I)                                   I6

      TT1=2.0*ANG1                                          R20
      TT2=2.0*ANG2
      TEM2=ABS ((SIN(TT2)+TT2-SIN(TT1)-TT1)/4./DIST**3)
      T3=0.0
      DO242 IF=1, NF
      IP=IF
      IF (IF.EQ.1) IP=5
      A=10**(-DN1*5.4E-5*2.35**(IP-5))
      T1=0.0
      DO240 IQ=1, NQ
      IF (NQS (MR, IQ).EQ.0) GO TO 240
      NQQ=NQS(MR, IQ)
      T2=0.0
      T4=0.0                                                R20
      DO235 I=1, NQQ
      INDEX=MR+10*(I-1)+10*5*(IF-1)+10*5*9*(IQ-1)
      T2=T2+VEXPH(MR,I,IQ)*XLREF(INDEX)
      IF (IF.EQ.1) T4=T4+VEXPH (MR, I, IQ)*XLREF (INDEX)**2
  235 CONTINUE
      T1=T1+FB(IF,IQ)*FG(IF)*CQ(IQ)*T2
      IF (IF.EQ.1) T3=T3+FB(IF,IQ)**2*FG(IF)**2*CQ(IQ)**4*T4

  240 CONTINUE
      XLE(IF)=XLE(IF)+ADST*T1*A
      IF (IF.EQ.1) CAP2=CAP2+TEM2*T3*A**2
  242 CONTINUE

C999  FORMAT (6H CODE=I3)                                   I6
```

```
      SUBROUTINE MOVE2(X1V,X2V,X3V,DELTA,IERR)
C MOVE AN ENDPOINT(2-DIMENSION)
      DIMENSION X1V(2),X2V(2),X3V(2)
      IERR=0
      TEMP=SQRT((X1V(1)-X3V(1))**2+(X1V(2)-X3V(2))**2)
      IF(TEMP.EQ.0.0) GO TO 3
      FCTR=DELTA/TEMP
      DO 2 I=1,2
      X2V(I)=X1V(I)+(X1V(I)-X3V(I))*FCTR
    2 CONTINUE
      RETURN
    3 IERR=4
      RETURN
      END
      FUNCTION TAN(X)
      TAN=SIN(X)/COS(X)
      RETURN
      END
      SUBROUTINE COLIN(X1V,X2V,X3V)
C CHECK WHETHER RECEIVER IS CO-LINEAR WITH ROADWAY SEGMENT
      DIMENSION X1V(2),X2V(2),X3V(2)
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 10
    5 ANG=ANGLE(X1V,X2V,X3V)
      IF(ANG.GE.2.6E-5) RETURN
   10 X3V(1)=X3V(1)+1.0
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 20
      ANG=ANGLE(X1V,X2V,X3V)
      IF(ANG.GE.2.6E-5) RETURN
   20 X3V(2)=X3V(2)+1.0
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 5
      RETURN
      END
      FUNCTION IAREA(X1V,X2V,X3V)
C FIND AREA OF TRIANGLE
      DIMENSION X1V(2),X2V(2),X3V(2)
      IAREA=1
      TERM1=X1V(1)*(X2V(2)-X3V(2))
      TERM2=X2V(1)*(X3V(2)-X1V(2))
      TERM3=X3V(1)*(X1V(2)-X2V(2))
      AREA=TERM1+TERM2+TERM3
      IF(AREA.LT.0.0) IAREA=-1
      IF(ABS(.5*AREA).LE.1.) IAREA=0
      RETURN
      END
      SUBROUTINE DEGEN(X1V,X2V,X3V,X4V,X5V,LOC)
```

I2

```
      COMMON/INOU/INPT,IOUT
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      LOC=5
      IF(IAREA(X4V,X1V,X3V).EQ.0) GO TO 10
      IF(IAREA(X4V,X2V,X3V).EQ.0) GO TO 40
      IF(IAREA(X5V,X1V,X3V).EQ.0) GO TO 45
      IF(IAREA(X5V,X2V,X3V).EQ.0) GO TO 45
      RETURN
   10 IAREA1=IAREA(X5V,X2V,X3V)
      IF(IAREA1.EQ.0) GO TO 30
      IAREA2=IAREA(X5V,X3V,X1V)
      IAREA3=IAREA(X5V,X1V,X2V)
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 55
   20 LOC=0
      RETURN
   30 LOC=30
      RETURN
   40 IAREA1=IAREA(X5V,X3V,X1V)
      IF(IAREA1.EQ.0) GO TO 30
      IAREA2=IAREA(X5V,X1V,X2V)
      IAREA3=IAREA(X5V,X2V,X3V)
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 55
      GO TO 20
   45 IAREA1=IAREA(X4V,X3V,X1V)
      IAREA2=IAREA(X4V,X1V,X2V)
      IAREA3=IAREA(X4V,X2V,X3V)
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 60
      GO TO 20
   55 CALL MOVE2(X4V,X4V,X5V,1.0,IERR)
      IF(IERR.EQ.4) WRITE(IOUT,1000)
      RETURN
   60 CALL MOVE2(X5V,X5V,X4V,1.0,IERR)
      IF(IERR.EQ.4) WRITE(IOUT,1000)
      RETURN
 1000 FORMAT(1H ,14HERROR IN MOVE2)
      END
```

MARKED-UP LISTING OF THE PRESENT VERSION OF
THE HIGHWAY NOISE PREDICTION PROGRAM

```
C   TRAFFIC NOISE PREDICTION MODEL
C   MAIN PROGRAM   12/14/71                                          R1
      DIMENSION SIG(4),XKAP(4)                                       R2
      DIMENSION XR1(3),XR2(3)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/INPT3/XRC(15),YRC(15),ZRC(15),NRC
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/DRIV3/CQ(4),XLE(9)
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON /STORE5/NQC(5)
      COMMON/DRIV4/XKA(5)                                            R3
      COMMON/STORE3/RX(10,11),RY(10,11),RZ(10,11),NRSM1(10)
      COMMON/GEO1/IBAR,ISEG,IGRA
      DATA LZ/2HZZ/                                                  C1
      INTEGER TITLE(15)
      EQUIVALENCE (RDIN(3),SIG(1))
    1 NQ=3
      NG=0
      NB=0
      CALL FILES
    5 READ(INPT,1005) (TITLE(I),I=1,15)
      IF(TITLE(1).EQ.LZ)GO TO 105
      WRITE(IOUT,2009)
      WRITE(IOUT,1005) (TITLE(I),I=1,15)
      CALL INPUT
      NF=RDIN(2)
      WRITE(IOUT,1002)(TITLE(I),I=1,15)
      WRITE(IOUT,1003)
      DO 11 I=1,NQ
      CQ(I)=EXP(.5*(SIG(I)*.23026)**2)
   11 CONTINUE
      DO 60 I=1,NRC
      DO 15 J=1,NF
      XLE(J)=0.
   15 CONTINUE
      DO 16 J=1,4                                                    R4
      XKA(J)=0.
   16 CONTINUE
      DO 50 M=1,NR
      DO 20 IQ=1,NQ
      NQC1=NQS(M,IQ)
      IF(NQC1.EQ.0)GO TO 20
      CALL INTER(M,IQ)
   20 CONTINUE
      XR1(1)=RX(M,1)
      XR1(2)=RY(M,1)
      XR1(3)=RZ(M,1)
      NLIM=NRSM1(M)+1
      DO 40 N=2,NLIM
      XR2(1)=RX(M,N)
      XR2(2)=RY(M,N)
      XR2(3)=RZ(M,N)
      CALL GEOMRY(XRC(I),YRC(I),ZRC(I),XR1,XR2,IERR,N)
      IF(IERR.EQ.1)GO TO 65
      IF(IERR.EQ.2)GO TO 70
      IF(IERR.EQ.3)GO TO 66
      IF(IERR.EQ.4)GO TO 60
```

```
      CALL REPLCE(XR2,XR1)
   40 CONTINUE
   50 CONTINUE                                                    I1
      DO 55 J=1,NF
      XLE(J)=100.*10.**ALOG10(XLE(J))
   55 CONTINUE
      IF(I.EQ.1) GO TO 155
      WRITE(IOUT,1003)
  155 WRITE(IOUT,1004) I,XRC(I),YRC(I),ZRC(I)
  156 IF(NF.EQ.1) GO TO 56
      WRITE(IOUT,2010)
      WRITE(IOUT,2001)
      WRITE(IOUT,2002) (XLE(II),II=2,NF)
   56 XLA=100.*10.0*ALOG10(XKA(1))                                }
      DO 59 J=2,4                                                 }
      XKAP(J)=XKA(J)/XKA(1)**J                                    } D1
   59 CONTINUE                                                    }
      SIGL=4.35*SQRT(ALOG(1.+XKAP(2)))                            }
      XLNP=XLA+2.56*SIGL                                          } R5
      XL50=XLA-SIGL**2/8.7                                        }
      XL10=XL50+1.28*SIGL
      XL90=XL50-1.28*SIGL
      WRITE(IOUT,2003)
      WRITE(IOUT,2004)XLA,XLNP,XL90,XL50,XL10                     R6
   60 CONTINUE
      GO TO 100
   65 WRITE(IOUT,1006)I,M,N,IBAR,ISEG
      GO TO 100
   66 WRITE(IOUT,1009)I,M,N
      GO TO 100
   70 WRITE(IOUT,1008)I,M,N,IGRA
  100 GO TO 5
  105 GO TO 1
 1002 FORMAT(//15A2)                                             C2
 1003 FORMAT(11HORECEIVER  10X,3HXRC9X,3HYRC9X,3HZRC)
 1004 FORMAT(4X,I3,5X,3F12.1)
 1005 FORMAT(15A2)                                               C3
 1006 FORMAT(44HOILLEGAL BARRIER INTERSECTS ROADWAY FOR REC I2,2X,2HR I2
     1,3HRS I2,2X,2HB I2,2X,3HBS I2)
 1008 FORMAT(49HOILLEGAL GROUND STRIP INTERSECTS ROADWAY FOR REC I2,2X,2
     1HR I2,3HRS I2,2X,4HAGS I2)
 1009 FORMAT(26HOTOO MANY REFLECTIONS,RCV ,I2,4H  R ,I2,4H  S ,I2)
 2001 FORMAT( 14X,2H635X,3H1254X,3H2504X,3H5003X,4H10003X,4H20003X,
     X 4H40003X,4H8000)
 2002 FORMAT(10X,8F7.1)
 2003 FORMAT(/10X,5HLE(A),5X,3HLNP,5X,3HL90,5X,3HL50,5X,3HL10)
 2004 FORMAT(8X,5F8.1//)
 2009 FORMAT(1H1,15X,24HTRAFFIC NOISE PREDICTION//)
 2010 FORMAT(/25X,22HOCTAVE BAND LEVELS (A))
      END
      SUBROUTINE FILES
      COMMON/INOU/INPT,IOUT
      INPT=5
      IOUT=6
      RETURN
      END
      SUBROUTINE INPUT
      COMMON/DRIV2/NQS(10,4),NF
      INTEGER ALPHA(25),ALP1(14,8),BLNK                          C4
      DIMENSION VTEMP(5)
      COMMON/STORE1/BX(10,5),BY(10,5),BZ(10,5),IBLAST(10),NBSM1(10)
```

```
      COMMON/STORE2/XXG1(10,2),YYG1(10,2),ZZG1(10,2),BGS(10),IDUM(10)
      COMMON/STORE3/RX(10,11),RY(10,11),RZ(10,11),NRSM1(10)
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/STORE5/NQC(5)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/INPT3/XRC(15),YRC(15),ZRC(15),NRC
      COMMON/XIN/ XINS(9),NINF
      DIMENSION RDN(15)
      EQUIVALENCE (RDIN(1),XNIGHT)
      DATA    IA/2HA /
      DATA    IG/2HG /
      DATA    IR/2HR /
      DATA    IT/2HT /
      DATA LAST/2HL /
      DATA BLNK/4H    /                                          R7
      DATA  ALP1                /4HRECE,4HIVER,4H HEI,4HGHT ,4HADJU,4HSTME,
     1          4HNT  ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     A                          4HNUMB,4HER O,4HF FR,4HEQUE,4HNCY ,4HBAND,
     2          4HS   ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     B                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR C,
     3          4HARS ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     C                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR CA,4HRS   ,
     4          4H    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     D                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR T,
     5          4HRUCK,4HS    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     E                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR TR,4HUCKS,
     6          4H    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     F                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR N,
     7          4HEW V,4HEHIC,4HLES ,4H(TYP,4HE 3 ,4HVEHI,4HCLES,4H)    ,
     G                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR NE,4HW VE,
     8          4HHICL,4HES   ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     /
      NINF=0
      DO 1 J=1,5
    1 NQC(J)=0
    5 READ(INPT,1000)IGO,I1,I2
      GO TO(10,20,30,36,40,50),IGO
C GARBAGE DATA....PROGRAM INITIALIZATION PARAMETERS
   10 WRITE(IOUT,2000)
   11 READ(INPT,1001) VALUE,IDN,ILAST,(ALPHA(I),I=1,25)
      RDN(IDN)=VALUE
      IF(ALPHA(1).NE.BLNK) GO TO 13                              R8
      WRITE(IOUT,2016) VALUE,IDN,(ALP1(I,IDN),I=1,9)
      GO TO 14                                                   14
   13 WRITE(IOUT,2001) VALUE,IDN,(ALPHA(I),I=1,25)
   14 IF(ILAST.NE.LAST) GO TO 11
      DO 12 J1=1,3
      J2=J1+2
      J3=2*J1+1
      J4=J1+6
      J5=2*J1+2
      RDIN(J2)=RDN(J3)
      RDIN(J4)=RDN(J5)
   12 CONTINUE
      RDIN(1)=RDN(1)
      RDIN(2)=RDN(2)
      IF(IDN.EQ.6) GO TO 5
      NINF=1
      READ(INPT,1006) (XINS(J1),J1=1,9)
```

C5

```
      WRITE(IOUT,2015) (XINS(J1),J1=1,9)
      GO TO 5
C
C
C VEHICLE DATA
C
   20 NR=I1
      DO 28 J=1,NR
      NSEC=1
      DO 21 K=1,NQ
   21 NQS(J,K)=0
   22 READ(INPT,1002) VEH,XMH,ITY,ILAST
      NQS(J,ITY)=NQS(J,ITY)+1
      NQC1=NQS(J,ITY)
      VEXPH(J,NQC1,ITY)=VEH/XMH/5280.
      XMPH(J,NQC1,ITY)=XMH
      IF(ILAST.NE.LAST)GO TO 22
C ROADWAY DATA SECTIONS
   24 READ(INPT,1003)RX(J,NSEC),RY(J,NSEC),RZ(J,NSEC),ILAST
      IF(ILAST.EQ.LAST)GO TO 25
      NSEC=NSEC+1
      GO TO 24
   25 IF(NSEC-1.NE.0)GO TO 26
      WRITE(IOUT,2010)
      CALL EXIT
   26 NRSM1(J)=NSEC-1
   28 CONTINUE
      GO TO 5
C BARRIER DATA SECTIONS
   30 NB=I1
      IF(NB.EQ.0)GO TO 5
      DO 35 J=1,NB
      NSEC=1
   31 READ(INPT,1003)BX(J,NSEC),BY(J,NSEC),BZ(J,NSEC),IBLAST(J)
      IF(IBLAST(J).EQ.IA.OR.IBLAST(J).EQ.IR)GO TO 32
      NSEC=NSEC+1
      GO TO 31
   32 IF(NSEC-1.NE.0)GO TO 33
      WRITE(IOUT,2011)
      CALL EXIT
   33 NBSM1(J)=NSEC-1
   35 CONTINUE
      GO TO 5
C ABSORBING GROUND STRIPS
   36 NG=I1
      IF(NG.EQ.0)GO TO 5
      DO 37 I=1,NG
      READ(INPT,1004)XXG1(I,1),YYG1(I,1),ZZG1(I,1),BGS(I)
      READ(INPT,1003)XXG1(I,2),YYG1(I,2),ZZG1(I,2),IDUM(I)
      IF(IDUM(I).EQ.IG)IDUM(I)=1
      IF(IDUM(I).EQ.IT)IDUM(I)=2
   37 CONTINUE
      GO TO 5
C RECEIVER DATA
   40 NRC=I1
      DO 41 I=1,NRC
      READ(INPT,1003)XRC(I),YRC(I),ZRC(I),IRDUM
      ZRC(I)=ZRC(I)+XNIGHT
   41 CONTINUE
      GO TO 5
C
```

```
   50 DO 65 J=1,NR
      WRITE(IOUT,2002)J
      DO 55 K=1,NQ
      NQC1=NQS(J,K)
      IF(NQC1.EQ.0) GO TO 55
      DO 54 I=1,NQC1
   54 VTEMP(I)=VEXPH(J,I,K)*XMPH(J,I,K)*5280.
      WRITE(IOUT,2004)K,(I,VTEMP(I),XMPH(J,I,K),I=1,NQC1)
   55 CONTINUE
      WRITE(IOUT,2013)
      WRITE(IOUT,2005)RX(J,1),RY(J,1),RZ(J,1)
      NSEC=NRSM1(J)+1
      DO 60 I=2,NSEC
      WRITE(IOUT,2006)I,RX(J,I),RY(J,I),RZ(J,I)
   60 CONTINUE
   65 CONTINUE
      IF(NB.EQ.0)GO TO 80
      DO 75 J=1,NB
      WRITE(IOUT,2007)J,IBLAST(J)
      WRITE(IOUT,2005)BX(J,1),BY(J,1),BZ(J,1)
      NSEC=NBSM1(J)+1
      DO 70 I=2,NSEC
      WRITE(IOUT,2006)I,BX(J,I),BY(J,I),BZ(J,I)
   70 CONTINUE
   75 CONTINUE
   80 IF(NG.EQ.0) GO TO 90
      DO 85 I=1,NG
      IF(IDUM(I).EQ.1)IDM=IG
      IF(IDUM(I).EQ.2)IDM=IT
      WRITE(IOUT,2012)I,IDM,XXG1(I,1),YYG1(I,1),ZZG1(I,1),
     1 BGS(I),XXG1(I,2),YYG1(I,2),ZZG1(I,2)
   85 CONTINUE
   90 WRITE(IOUT,2008)
      DO 95 I=1,NRC
      WRITE(IOUT,2006)I,XRC(I),YRC(I),ZRC(I)
   95 CONTINUE
      RETURN
 1000 FORMAT(3I5)
 1001 FORMAT(E10.0,I5,4X,A1,10X,25A2)
 1002 FORMAT(2E10.0,I5,5X,A1)
 1003 FORMAT(3E10.0,A1)
 1004 FORMAT(4E10.0)
 1006 FORMAT(9E5.0)
 2000 FORMAT(34HOPROGRAM INITIALIZATION PARAMETERS)
 2001 FORMAT(1X,E12.5,I10,5X,25A2)
 2002 FORMAT(10HOROADWAY  ,I3)
 2004 FORMAT(10HONUMBER OF13X,5HVEH/H8X,3HMPH/5H TYPE,I2,4H VEH/(3X,I2
     1,15X,2E13.4))
 2005 FORMAT(7HONUMBER,5X,1HX12X,1HY12X,1HZ/4X,1H1,2X,3E13.4)
 2006 FORMAT(3X,I2,2X,3E13.4)
 2007 FORMAT(10HOBARRIER  I3,2X,1H(A1,1H)10X,19HBARRIER COORD IN FT)
 2008 FORMAT(9HORECEIVER14X,20HRECEIVER COORD IN FT/7H NUMBER5X,1HX12X,1
     1HY12X,1HZ)
 2010 FORMAT(27HOINSUFFICIENT ROAD SECTIONS)
 2011 FORMAT(30HOINSUFFICIENT BARRIER SECTIONS)
 2012 FORMAT(18HOABSORBING STRIP  I3,2X,1H(A1,1H)//5H PT  7X,1HX12X,1HY1
     A2X,1HZ12X,5HWIDTH/4X,1H12X,4E13.4/4X,1H22X,3E13.4)
 2013 FORMAT(22X,18HSOURCE COORD IN FT)
 2015 FORMAT(5X,23HOPTIONAL NOISE SPECTRUM/5X,9F7.1)
 2016 FORMAT(1X,E12.5,I10,5X,14A4)
      END
```

```
C  SUBROUTINES FOR TRAFFIC NOISE    12/13/71                          R9
      SUBROUTINE INTER(NR,IQ)
      DIMENSION TL1(2,9,4),TL(72)
      EQUIVALENCE(TL(1),TL1(1,1,1))
      COMMON/XIN/ XINS(9),NINF
      COMMON/BLK2/NQ
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/INTER1/XLREF(10,5,9,4)                                    R10
      DATA TL(1), TL(2), TL(3), TL(4), TL(5), TL(6), TL(7), TL(8),
     1     TL(9),TL(10),TL(11),TL(12),TL(13),TL(14),TL(15),TL(16),
     2    TL(17),TL(18),TL(19),TL(20),TL(21),TL(22),TL(23),TL(24),
     3    TL(25),TL(26),TL(27),TL(28),TL(29),TL(30),TL(31),TL(32),
     4    TL(33),TL(34),TL(35),TL(36)/
     5  61.,75.,38.,48.,45.,57.,47.,62.,55.,66.,58.,70.,54.,72.,49.,63.,
     6  42.,57.,
     7  2*87.,2*60.,2*73.,2*78.,2*83.,2*82.,2*79.,2*74.,2*66./
      IF(NINF.LE.0) GO TO 1
      NINF=-1
      DO 13 J1=1,9
      J2=35+2*J1
      J3=36+2*J1
      J4=53+2*J1
      J5=54+2*J1
      TL(J2)=XINS(J1)
      TL(J3)=XINS(J1)
      TL(J4)=0.0
      TL(J5)=0.0
   13 CONTINUE
    1 NQQ=NQS(NR,IQ)
      CONS=ALOG10(70./30.)
      DO 10 IF=1,NF
      TEMP=TL1(2,IF,IQ)-TL1(1,IF,IQ)
      DO 10  I=1,NQQ
      XLREF1=TL1(1,IF,IQ)+TEMP*ALOG10(XMPH(NR,I,IQ)/30.)/CONS
      XLREF(NR,I,IF,IQ)=10.**((XLREF1-66.)/10.)                        R11
   10 CONTINUE
      RETURN
      END
      FUNCTION AMAG(X1V,X2V)
C FIND MAGNITUDE OF VECTOR
      DIMENSION X1V(3),X2V(3)
      AMAG=SQRT(DSQR(X1V,X2V))
      RETURN
      END
      FUNCTION ANGLE(X1V,X2V,X3V)
      DIMENSION X1V(3),X2V(3),X3V(3)
      D13=DSQR(X1V,X3V)
      D23=DSQR(X2V,X3V)
      ANGLE=1.5708
      IF(D13*D23.EQ.0.)RETURN
      D12=DSQR(X1V,X2V)
      ANGLE=ACOS((D23+D13-D12)/(SQRT(D13*D23)*2.))
      RETURN
      END
      FUNCTION BARFAC(KF,DELP)
C FIND BARRIER FACTOR
      IF(DELP.EQ.-0.2)GO TO 3
      IF(DELP.GE.12.5)GO TO 4
      IP=KF
      IF(KF.EQ.1)IP=5
```

```
      A=DELP*(2.**IP)/5.7
      IF(A.GE.78.5)GO TO 4
      IF(A.GT.0..AND.A.LT.78.5)GO TO 5
      IF(A.EQ.0.)GO TO 6
      IF(A.GT.-1.25.AND.A.LT.0.)GO TO 7
    3 BARFAC=1.0
      RETURN
    4 BARFAC=4.0E-3
      RETURN
    5 BARFAC=(TANH(SQRT(A))**2)/A/3.16
      RETURN
    6 BARFAC=.316
      RETURN
    7 A1=ABS(A)
      BARFAC=(TAN(SQRT(A1)))**2/A1/3.16
      RETURN
      END
      SUBROUTINE BLOCN(X1V,X2V,X3V,X4V,X5V,X6V,LOC)
C FIND RELATIVE LOCATION OF BARRIER
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2),X6V(2),XAV(2),XBV(2)
      LOC=KCUT(X1V,X3V,X4V,X5V)
      LOC=LOC+KCUT(X2V,X3V,X4V,X5V)*2
      IF(LOC.EQ.3)RETURN
      CALL TRI(X1V,X2V,X3V,X4V,XAV,KTRI)
      IF(LOC.EQ.0)GO TO 4
      IF(KTRI.EQ.1)GO TO 6
    2 CALL INTCPT(X1V,X2V,X3V,X5V,XBV)
      IF(LOC.EQ.4)GO TO 5
    3 X6V(1)=XBV(1)
      X6V(2)=XBV(2)
      RETURN
    4 IF(KTRI.EQ.0)RETURN
      LOC=4
      GO TO 2
    5 IF(KPOS(X1V,XAV,XBV).EQ.1)GO TO 3
    6 X6V(1)=XAV(1)
      X6V(2)=XAV(2)
      RETURN
      END
      FUNCTION DEL(X1V,X2V,X3V,X4V,HDIFF,DN1)
C FIND PATH LENGTH DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),XAV(3),XBV(3)
      CALL NRPT(X3V,X4V,X1V,XAV,DISTA)
      CALL NRPT(X3V,X4V,X2V,XBV,DISTB)
      DISTC=DSQR(XBV,XAV)
      DEL=SQRT((DISTA+DISTB)**2+DISTC)-DN1
      IF(HDIFF.GT.0.)DEL=-DEL
      RETURN
      END
      FUNCTION DSQR(X1V,X2V)
      DIMENSION  X1V(3),X2V(3)
      DSQR=0.0
      DO 10 I=1,3
   10 DSQR=(X1V(I)-X2V(I))**2+DSQR
      RETURN
      END
      SUBROUTINE ENDPT(X1V,X2V,X3V,X4V,X5V,X6V,KTRIG,IERR)
C FIND NEW ENDPOINT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3),X6V(3),XDUM(3)
      IERR=0
      KTRIG=0
```

```
      ITRIG=1
      CALL REPLCE(X1V,XDUM)
    1 CALL BLOCN(XDUM,X2V,X3V,X4V,X5V,X6V,LOC)
      IF(LOC.EQ.0) RETURN
      IF(LOC.NE.3) GO TO 2
      CALL REPLCE(X2V,X6V)
      GO TO 4
    2 X6V(3)=ZCOR(X1V,X2V,X6V)
      IF(ITRIG.EQ.0) GO TO 5
      IF(AMAG(X1V,X6V).GT.0.51) GO TO 5
      ITRIG=0
      DELTA=-0.51
      CALL MOVE(XDUM,XDUM,X2V,DELTA,IERR)
      GO TO 1
    5 DELTA=-0.5
      IF(LOC.EQ.1) GO TO 3
      CALL MOVE(X6V,X2V,X1V,DELTA,IERR)
      RETURN
    3 CALL MOVE(X6V,X6V,X1V,DELTA,IERR)
    4 KTRIG=1
      RETURN
      END
      FUNCTION HEIGHT(X1V,X2V,X3V,X4V)
C FIND HEIGHT DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),XI(3)
      CALL INTCPT(X1V,X2V,X3V,X4V,XI)
      HEIGHT=ZCOR(X1V,X2V,XI)-ZCOR(X3V,X4V,XI)
      RETURN
      END
      FUNCTION IEPS (X1V, X2V, X3V, X4V, DEL1)
C     CHECK ON PATH LENGTH DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3)
      IEPS =0
      DIST = AMAG (X1V,X2V)
      HDIFF = HEIGHT (X1V,X2V,X3V,X4V)
      DEL2 = DEL (X1V, X2V, X3V, X4V, HDIFF, DIST)
      DELM= (DEL1+DEL2)/2.
      IF((ABS(DEL2-DEL1) - 0.1-DELM/50.* (1.+DELM)) .GT.0.) IEPS=1
      RETURN
      END
      SUBROUTINE IMAGE(X1V,X2V,X3V,X4V)
C FIND IMAGE POINT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3)
      AX=X2V(1)-X1V(1)
      AY=X2V(2)-X1V(2)
      AXY=AX**2+AY**2
      RATIO=0.
      IF(AXY.EQ.0.)GO TO 10
      RATIO=(((X3V(2)-X2V(2))*AX-(X3V(1)-X2V(1))*AY)*2.0)/AXY
   10 X4V(1)=X3V(1)+AY*RATIO
      X4V(2)=X3V(2)-AX*RATIO
      X4V(3)=X3V(3)
      RETURN
      END
      SUBROUTINE INTCPT(X1V,X2V,X3V,X4V,X5V)
C FIND INTERCEPT OF TWO LINES IN A PLANE
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      AX=X2V(1)-X1V(1)
      AY=X2V(2)-X1V(2)
      BX=X4V(1)-X3V(1)
      BY=X4V(2)-X3V(2)
```

```
      C1=AY*X2V(1)-AX*X2V(2)
      C2=BY*X4V(1)-BX*X4V(2)
      D=AX*BY-AY*BX
      IF(D**2.LT.1.E-6)GO TO 2
      X5V(1)=(AX*C2-BX*C1)/D
      X5V(2)=(AY*C2-BY*C1)/D
      RETURN
    2 D=SQRT(AX**2+AY**2)
      X5V(1)=X1V(1)+(AX/D)*1.E+15
      X5V(2)=X1V(2)+(AY/D)*1.E+15
      RETURN
      END
      FUNCTION KCUT(X1V,X2V,X3V,X4V)
C DETERMINE IF TWO LINE SEGMENTS CROSS
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      KCUT=0
      CALL INTCPT(X1V,X2V,X3V,X4V,X5V)
      IF(KPOS(X1V,X2V,X5V).NE.1)RETURN
      IF(KPOS(X3V,X4V,X5V).EQ.1)KCUT=1
      RETURN
      END
      FUNCTION KPOS(X1V,X2V,X3V)
C FIND POSITION OF POINT ON LINE
      DIMENSION X1V(2),X2V(2),X3V(2)
      KPOS=1
      IF(((X3V(1)-X1V(1))*(X3V(1)-X2V(1))+(X3V(2)-X1V(2))*(X3V(2)-X2V(2)
     1)).GT.0.)KPOS=0
      RETURN
      END
      SUBROUTINE MIDP (X1V, X2V, X3V)
C     FIND CENTER POINT
      DIMENSION X1V(3), X2V(3), X3V(3)
      DO 10 I=1,3
   10 X3V(I) = (X1V(I)+X2V(I))/2.
      RETURN
      END
      SUBROUTINE NRPT(X1V,X2V,X3V,X4V,DIST)
C FIND NEAREST POINT TO LINE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),AV(3),BV(3)
      EQUIVALENCE (AV(1),AX),(AV(2),AY),(AV(3),AZ),(BV(1),BX),(BV(2),BY
     1),(BV(3),BZ)
      DO 5 I=1,3
      AV(I)=X2V(I)-X1V(I)
      BV(I)=X3V(I)-X1V(I)
    5 CONTINUE
      RATIO=0.
      TEMP=DSQR(X2V,X1V)
      IF(TEMP.NE.0.)RATIO=(AX*BX+AY*BY+AZ*BZ)/TEMP
      DO 10 I=1,3
      X4V(I)=X1V(I)+RATIO*AV(I)
   10 CONTINUE
      DIST=AMAG(X4V,X3V)
      IF(DIST.EQ.0.)DIST=1.
      RETURN
      END
      SUBROUTINE NR1(X1V,X2V,X3V,X4V,DIST,X5V,DN1)
C FIND NEAREST POINT TO LINE SEGMENT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3)
      IF(KPOS(X4V,X2V,X1V).EQ.1)GO TO 2
      IF(KPOS(X1V,X4V,X2V).EQ.1)GO TO 4
      CALL REPLCE(X4V,X5V)
```

```
      DN1=DIST
      RETURN
    2 CALL REPLCE(X1V,X5V)
      GO TO 6
    4 CALL REPLCE(X2V,X5V)
    6 DN1=AMAG(X5V,X3V)
      RETURN
      END
      SUBROUTINE REPLCE(X1V,X2V)
      DIMENSION X1V(3),X2V(3)
      X2V(1)=X1V(1)
      X2V(2)=X1V(2)
      X2V(3)=X1V(3)
      RETURN
      END
      SUBROUTINE SECTN(X1V,X2V,X3V,X4V,X5V,X6V,X7V)
C FIND EFFECTIVE BARRIER SECTION
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3),X6V(3),X7V(3)
      CALL INTCPT(X1V,X3V,X4V,X5V,X6V)
      X6V(3)=ZCOR(X4V,X5V,X6V)
      CALL INTCPT(X2V,X3V,X4V,X5V,X7V)
      X7V(3)=ZCOR(X4V,X5V,X7V)
      RETURN
      END
      SUBROUTINE TRI(X1V,X2V,X3V,X4V,X5V,KTRI)
C FIND IF POINT IN TRIANGLE AND LOCATE INTERCEPT
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      CALL INTCPT(X1V,X2V,X3V,X4V,X5V)
      KTRI=0
      IF(KPOS(X1V,X2V,X5V).EQ.0)RETURN
      IF(KPOS(X3V,X5V,X4V).EQ.1)KTRI=1
      RETURN
      END
      FUNCTION ZCOR(X1V,X2V,X3V)
C FIND Z COORDINATE
      DIMENSION X1V(3),X2V(3),X3V(3)
      TEM1=X2V(1)-X1V(1)
      TEM2=X2V(2)-X1V(2)
      TEM3=X2V(3)-X1V(3)
      IF(ABS(TEM1).GT.ABS(TEM2))GO TO 10
      ZCOR=X1V(3)+(X3V(2)-X1V(2))*TEM3/TEM2
      RETURN
   10 ZCOR=X1V(3)+(X3V(1)-X1V(1))*TEM3/TEM1
      RETURN
      END
      SUBROUTINE MOVE(X1V,X2V,X3V,DELTA,IERR)
C MOVE ENDPOINT OF ROAD
      DIMENSION X1V(3),X2V(3),X3V(3)
      IERR=0
      TEMP=AMAG(X1V,X3V)
      IF(TEMP.EQ.0.) GO TO 3
      FCTR=DELTA/TEMP
      DO 2 I=1,3
      X2V(I)=X1V(I)+(X1V(I)-X3V(I))*FCTR
    2 CONTINUE
      RETURN
    3 IERR=4
      RETURN
      END
      FUNCTION TAN(X)
      TAN=SIN(X)/COS(X)
```

```
      RETURN
      END
      FUNCTION ACOS(X)
      IF(X.EQ.0.0) GO TO 5
      ACOS=ATAN(SQRT(1.0-X*X)/X)
      IF(X.LT.0.0) ACOS=3.1416+ACOS
      RETURN
    5 ACOS=1.5708
      RETURN
      END
C  GEOMETRY ROUTINE   12/13/71
      SUBROUTINE GEOMRY(XR,YR,ZR,XR10,XR20,IERR,MR)
      DIMENSION XG1(3),XG2(3),XG3(3),XG4(3)
      DIMENSION B1(3,2,10),R1(3,2,10),RB1(3,2,10),TA1(3,2,10)
      DIMENSION KBCODE(10),KNUMB(10),KRNUMB(10),KRDNUM(10)
      DIMENSION KGCODE(10),BGT(10),IKIN(10)
      DIMENSION
     D DELP0(4),DELP1(4),DELP2(4),FB(9,4),DELR(4,10),FG(9),HGA(2),
     X XB1(3),XB2(3),XDB1(3),XDB2(3),XDB3(3),XDB4(3),
     X XRB1(3),XRB2(3),XRB3(3),XRB4(3),XRC(3),XRCI(3),
     X XR1(3),XR2(3),XR1I(3),XR2I(3),XP10(3),XR20(3),
     X XK(3),XKI(3),XJ(3),XNPT(3),XNPTI(3),XNPTJ(3),
     X XN1(3),XN2(3),XN1I(3),XIMG(3,10),XR2D(3),XR2G(3),
     X XLA(5,4),
     Z ZS(4)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/DRIV3/CQ(4),XLE(9)
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/STORE1/BX(10,5),BY(10,5),BZ(10,5),IBLAST(10),NBSM1(10)
      COMMON/STORE2/XXG1(10,2),YYG1(10,2),ZZG1(10,2),BGS(10),IDUM(10)
      COMMON/DRIV4/XKA(5)
      COMMON/GEO1/IBAR,ISEG,IGRA
      COMMON/INTER1/XLREF(10,5,9,4)
      EQUIVALENCE (RDIN(7),ZS(1))
      DATA   IR/2HR /
      DATA HGA(1),HGA(2)/10.,30./
      XRC(1)=XR
      XRC(2)=YR
      XRC(3)=ZR
      IERR=0
      CALL NRPT(XR10,XR20,XRC,XNPT,DIST)
      ANG1=ANGLE(XR10,XNPT,XRC)
C     ICODE=1
C     WRITE(IOUT,1000)ICODE,XR10,XR20,XRC,XNPT
C PRELIMINARY SELECTION OF BARRIERS
      NDIFF=0
      IF(NB.EQ.0) GO TO 16
      KBAR=0
      DO 15 IBAR=1,NB
      KAR=IBLAST(IBAR)
      XB1(1)=BX(IBAR,1)
      XB1(2)=BY(IBAR,1)
      XB1(3)=BZ(IBAR,1)
      NLIM=NBSM1(IBAR)+1
      DO 15 ISEG=2,NLIM
      XB2(1)=BX(IBAR,ISEG)
      XB2(2)=BY(IBAR,ISEG)
```

I2 R12 I3 D2 R13

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      XB2(3)=BZ(IBAR,ISEG)
      KBAR=KBAR+1
C     ICODE=2
C     WRITE(IOUT,1001)ICODE,KBAR,XB1,XB2
      IF(KCUT(XR10,XR20,XB1,XB2).NE.1)GO TO 10
      IERR=1
      RETURN
   10 CALL BLOCN(XR10,XR20,XRC,XB1,XB2,XK,LOC)
      IF(LOC.EQ.0)GO TO 11                                   } R14
      NDIFF=NDIFF+1
      KNUMB(NDIFF)=KBAR
      KBCODE(NDIFF)=LOC
      CALL REPLCE(XB1,B1(1,1,NDIFF))
      CALL REPLCE(XB2,B1(1,2,NDIFF))
   11 CALL REPLCE(XB2,XB1)                                   R15
   15 CONTINUE
C PRELIMINARY SELECTION OF STRIPS
   16 KGA=0
      IF(NG.EQ.0)GO TO 20
      DO 18 IGRA=1,NG
      XG1(1)=XXG1(IGRA,1)
      XG1(2)=YYG1(IGRA,1)
      XG1(3)=ZZG1(IGRA,1)
      XG2(1)=XXG1(IGRA,2)
      XG2(2)=YYG1(IGRA,2)
      XG2(3)=ZZG1(IGRA,2)
C     ICODE=3
C     WRITE(IOUT,1001)ICODE,IGRA,XG1,XG2
      IF(KCUT(XR10,XR20,XG1,XG2).NE.1)GO TO 17
      IERR=2
      RETURN
   17 CALL BLOCN(XR10,XR20,XRC,XG1,XG2,XK,LOC)               } R16
      IF(LOC.EQ.0)GO TO 18
      KGA=KGA+1
      KGCODE(KGA)=LOC
      CALL REPLCE(XG1,TA1(1,1,KGA))
      CALL REPLCE(XG2,TA1(1,2,KGA))
      BGT(KGA)=BGS(IGRA)
      IKIN(KGA)=IDUM(IGRA)
   18 CONTINUE
C DIFFRACTION OF DIRECT RAY
   20 CALL REPLCE(XR10,XR1)
   25 CALL REPLCE(XR20,XR2)
      DO 30 IQ=1,NQ
      DELPO(IQ)=-.2
   30 CONTINUE
C     ICODE=4
C     WRITE(IOUT,1000)ICODE,XR1,XR2
      IF(NDIFF.EQ.0)GO TO 71
      ITRIG=0
      DO 70 KDIFF=1,NDIFF
      KBAR=KNUMB(KDIFF)
      KCD=KBCODE(KDIFF)
      CALL REPLCE(B1(1,1,KDIFF),XB1)
      CALL REPLCE(B1(1,2,KDIFF),XB2)
C     ICODE=5
C     WRITE(IOUT,1001)ICODE,KBAR,XR1,XR2,XB1,XB2
      IF(KCD.EQ.3)GO TO 40
      CALL ENDPT(XR1,XR2,XRC,XB1,XB2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
      IF(KTRIG.EQ.0)GO TO 70
```

```
      GO TO 45
   40 CALL REPLCE(XR2,XK)
   45 MODD=0
C     ICODE=6
C     WRITE(IOUT,1001)ICODE,KCD,XR2,XK
      DO 60 IQ=1,NQ
      CALL NR1(XR1,XK,XRC,XNPT,DIST,XN1,DN1)
      ZN10=XN1(3)
      XN1(3)=ZN10+ZS(IQ)
      HDIFF=HEIGHT(XN1,XRC,XB1,XB2)
      IF(IQ.NE.1)GO TO 50
      IF(HDIFF.GT.20.)GO TO 70
   50 DELP=DEL(XN1,XRC,XB1,XB2,HDIFF,DN1)
      IF(DELP.GT.DELPO(IQ))GO TO 53
   52 IF(MODD.EQ.1)GO TO 65
      GO TO 70
   53 IF (IQ.NE.1) GO TO 59
      DR1 = AMAG(XRC,XR1)
      IF (ABS(DR1-DN1).LT.1.) GO TO 54
      HDIFA = HEIGHT (XR1,XRC,XB1,XB2)
      DELPA = DEL (XR1,XRC,XB1,XB2,HDIFA,DR1)
      DELM= (DELPA + DELP)/2.
C     ICODE=107
C     WRITE(IOUT,1000)ICODE,DELP,DELPA
      IF((ABS(DELPA-DELP)-0.1-DELM/50.*(1.+DELM)).LE.0.) GO TO 55
      CALL MIDP (XR1,XN1,XK)
C     ICODE=7
C     WRITE(IOUT,1000)ICODE,XR1,XN1,XK
      DELP = DELPA
   54 IF (IEPS(XK,XRC,XB1,XB2,DELP).EQ.0) GO TO 58
      CALL MIDP (XR1,XK,XK)
C     ICODE=8
C     WRITE(IOUT,1000)ICODE,XR1,XK
      GO TO 54
   55 DRK= AMAG (XRC,XK)
      IF (ABS(DRK-DN1).LT.1.) GO TO 58
   56 IF(IEPS (XK,XRC,XB1,XB2,DELP).EQ.0) GO TO 58
      CALL MIDP(XN1,XK,XK)
      GO TO 56
   58 IF (DELP.LE.DELPO(1)) GO TO 52
   59 DELPO (IQ) = DELP
C     ICODE=10
C     WRITE(IOUT,1000)ICODE,DELPO(1),DELPO(2)
      MODD=1
   60 CONTINUE
      IF(DELPO(2).LT.12.5)GO TO 65
      ITRIG=1
      IF(KCD.NE.3.OR.KCD.NE.2)GO TO 65
      CALL REPLCE(XR20,XR2)
      GO TO 66
   65 CALL REPLCE(XK,XR2)
   66 IF(ITRIG.EQ.1)GO TO 71
   70 CONTINUE
C     ICODE=11
C     WRITE(IOUT,1000)ICODE,XR2
   71 ANG=ANGLE(XR1,XR2,XRC)
      DELP=DELPO(1)
      FB(1,1)=BARFAC(1,DELP)
C     ICODE=12
C     WRITE(IOUT,1002)ICODE,FB(1,1)
      CALL REPLCE(XR2,XR2D)
```

I4

```
C GROUND ABSORPTION
   72 DO 73 KF=1,NF
      FG(KF)=1.
   73 CONTINUE
C     ICODE=13
C     WRITE(IOUT,1000)ICODE,XR1,XR2,XR2D
      IF(DELPO(1).GT.-0.2)GO TO 78
      IF(KGA.EQ.0)GO TO 78
      DO 77 IGRA=1,KGA
      LOC=KGCODE(IGRA)
      CALL REPLCE(TA1(1,1,IGRA),XG1)
      CALL REPLCE(TA1(1,2,IGRA),XG2)
      BG=BGT(IGRA)
      IKIND=IKIN(IGRA)
C     ICODE=14
C     WRITE(IOUT,1001)ICODE,LOC,XG1,XG2
      IF(LOC.EQ.3)GO TO 74
      CALL ENDPT(XR1,XR2,XRC,XG1,XG2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
      IF(KTPIG.EQ.0)GO TO 77
      GO TO 75
   74 CALL REPLCE(XR2,XK)
   75 CALL NR1(XR1,XK,XRC,XNPT,DIST,XN1,DN1)
      HDIFF=HEIGHT(XN1,XRC,XG1,XG2)
      IF(HDIFF.GT.HGA(IKIND))GO TO 77
      CALL SECTN(XR1,XK,XRC,XG1,XG2,XG3,XG4)
      DL=1.57/(1./BG+1./AMAG(XG3,XG4))
      DO 76 IK=1,NF
      PP=IK
      IF(IK.EQ.1)PP=5.
      IF(IKIND.EQ.1)A=(.0016*PP-0.0028)*DL
      IF(IKIND.EQ.2)A=2.**(PP/3.)/1310.*DL
      IF(A.GT.3.)A=3.
      FG(IK)=FG(IK)/10.**A
      IF(FG(IK).LT.1.E-3)FG(IK)=1.E-3
      CALL REPLCE(XK,XR2)
   76 CONTINUE
C     ICODE=15
C     WRITE(IOUT,1000)ICODE,FG(1),FG(9)
   77 CONTINUE
   78 CALL REPLCE(XR2,XR2G)
C PRELIMINARY SELECTION OF REFLECTORS
      NREF=0
      IF(NB.EQ.0)GO TO 91
      NRFDF=0
      KBAR=0
      DO 85 IBAR=1,NB
      KAR=IBLAST(IBAR)
      XRB1(1)=BX(IBAR,1)
      XRB1(2)=BY(IBAR,1)
      XRB1(3)=BZ(IBAR,1)
      NLIM=NBSM1(IBAR)+1
      DO 85 ISEG=2,NLIM
      XRB2(1)=BX(IBAR,ISEG)
      XRB2(2)=BY(IBAR,ISEG)
      XRB2(3)=BZ(IBAR,ISEG)
      KBAR=KBAR+1
C     ICODE=16
C     WRITE(IOUT,1001)ICODE,KBAR,XR1,XR2,XRB1,XRB2
      CALL IMAGE(XRB1,XRB2,XRC,XRCI)
      CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
```

```
C       ICODE=17
C       WRITE(IOUT,1000)ICODE,XPCI,XNPTI
        ANGIMG=ANGLE(XRB1,XRB2,XRCI)
        FCTR=(DIST*ANGIMG)/DISTI/ANG/FB(1,1)
        IF(FCTR.LT.0.1)GO TO 80
        NRFDF=NRFDF+1
        KRDNUM(NRFDF)=KBAR
        CALL REPLCE(XRB1,RB1(1,1,NRFDF))
        CALL REPLCE(XRB2,RB1(1,2,NRFDF))
C       ICODE=18
C       WRITE(IOUT,1001)ICODE,NRFDF,XRB1,XRB2
        IF(KAR.NE.IR)GO TO 80
        CALL PLOCN(XP1,XP2,XRCI,XRR1,XRR2,XK,LOC)
        IF(LOC.EQ.0)GO TO 80
        NREF=NREF+1
        KRNUMB(NREF)=KBAR
        CALL REPLCE(XRB1,R1(1,1,NREF))
        CALL REPLCE(XRB2,R1(1,2,NREF))
C       ICODE=19
C       WRITE(IOUT,1001)ICODE,NREF,XRB1,XRB2
   80 CALL REPLCE(XRB2,XRB1)
   85 CONTINUE
C BEGIN REFLECTOR PROBLEM
   91 IDXR=0
        IF(NREF.EQ.0)GO TO 180
        DO 175 KREF=1,NREF
        KBAR1=KRNUMB(KREF)
        CALL REPLCE(R1(1,1,KREF),XRB1)
        CALL REPLCE(R1(1,2,KREF),XRB2)
C       ICODE=20
C       WRITE(IOUT,1001)ICODE,KBAR1,XRB1,XRB2,XP1,XR2
        CALL IMAGE(XRB1,XRB2,XRC,XRCI)
        CALL ENDPT(XP1,XR2,XRCI,XRB1,XRB2,XK,KTRIG,IERR)
        IF(IERR.EQ.4) RETURN
C       ICODE=21
C       WRITE(IOUT,1001)ICODE,KTRIG,XRCI,XK
        IF(KTRIG.EQ.0)GO TO 175
        CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
        CALL NR1(XR1,XK,XRCI,XNPTI,DISTI,XN1I,DN1I)
C       ICODE=22
C       WRITE(IOUT,1000)ICODE,XNPTI,XN1I
        XN1I(3)=XN1I(3)+ZS(2)
        HDIFF=HEIGHT(XN1I,XPCI,XRB1,XRB2)
        IF(HDIFF.GT.-2.0)GO TO 175
        CALL REPLCE(XK,XP2)
        CALL SECTN(XR1,XR2,XRCI,XRB1,XRB2,XRB3,XRB4)
C       ICODE=23
C       WRITE(IOUT,1000)ICODE,XR1,XR2,XRB3,XRB4
        MDIFF=0
        DO 95 IQ=1,NQ
        DELP1(IQ)=-0.2
        DELP2(IQ)=-0.2
   95 CONTINUE
C DIFFRACTION BEFORE REFLECTION
        IF(NRFDF.EQ.0)GO TO 115
        DO 110 KRFDF=1,NRFDF
        KBAR2=KRDNUM(KRFDF)
        CALL REPLCE(RB1(1,1,KRFDF),XDB1)
        CALL REPLCE(RB1(1,2,KRFDF),XDB2)
C       ICODE=24
C       WRITE(IOUT,1001)ICODE,KBAR2,XDB1,XDB2
```

R17

```
      IF(KBAR2.EQ.KBAR1)GO TO 110
      CALL ELOCN(XRB3,XRB4,XRCI,XDB1,XDB2,XK,LOC)
      IF(LOC.NE.0)GO TO 110
      CALL ENDPT(XR1,XR2,XRCI,XDB1,XDB2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
C     ICODE=25
C     WRITE(IOUT,1001)ICODE,KTRIG,XK
      IF(KTRIG.EQ.0)GO TO 110
      CALL NR1(XR1,XK,XRCI,XNPTI,DISTI,XN1I,DN1I)
C     ICODE=26
C     WRITE(IOUT,1000)ICODE,XN1I
      ZN10=XN1I(3)
      XN1I(3)=ZN10+ZS(1)
      HDIFF=HEIGHT(XN1I,XRCI,XDB1,XDB2)
      IF(HDIFF.GT.20.0)GO TO 110
      CALL SECTN(XR1,XK,XRCI,XDB1,XDB2,XDB3,XDB4)
C     ICODE=27
C     WRITE(IOUT,1000)ICODE,XDB3,XDB4
      CALL NPPT(XDB3,XDB4,XRCI,XNPTJ,DISTJ)
      CALL NR1(XDB3,XDB4,XRCI,XNPTJ,DISTJ,XN2,DN2)
C     ICODE=127
C     WRITE(IOUT,1000)ICODE,XNPTJ,XN2,DISTJ,DN2
      HDIFF=HEIGHT(XN2,XRCI,XRB1,XRB2)
C     ICODE=227
C     WRITE(IOUT,1002)ICODE,HDIFF
      IF(HDIFF.GT.-2.0)GO TO 170
      DO 105 II=1,NQ
      IQ=NQ+1-II
      XN1I(3)=ZN10+ZS(IQ)
      HDIFF=HEIGHT(XN1I,XRCI,XDB1,XDB2)
      DELP=DEL(XN1I,XRCI,XDB1,XDB2,HDIFF,DN1I)
C     ICODE=327
C     WRITE(IOUT,1002)ICODE,DELP
      IF(DELP.GE.12.5.AND.IQ.EQ.2)GO TO 170
      IF(DELP.GT.DELP1(IQ))GO TO 100
      IF(IQ.EQ.1)GO TO 110
      GO TO 105
  100 MDIFF=1
      DELP1(IQ)=DELP
  105 CONTINUE
C     ICODE=28
C     WRITE(IOUT,1000)ICODE,DELP1(1),DELP1(2)
      CALL REPLCE(XK,XR2)
  110 CONTINUE
C     ICODE=29
C     WRITE(IOUT,1000)ICODE,XR2
C DIFFRACTION AFTER REFLECTION
      CALL IMAGE(XRB1,XRB2,XNPTI,XNPTJ)
      CALL IMAGE(XRB1,XRB2,XR1,XR1I)
  115 CALL IMAGE(XRB1,XRB2,XR2,XR2I)
C     ICODE=30
C     WRITE(IOUT,1000)ICODE,XR1I,XR2I,XNPTI
      IF(NRFDF.EQ.0)GO TO 145
      DO 140 KRFDF=1,NRFDF
      KBAR2=KRDNUM(KRFDF)
      CALL REPLCE(RB1(1,1,KRFDF),XDB1)
      CALL REPLCE(RB1(1,2,KRFDF),XDB2)
C     ICODE=31
C     WRITE(IOUT,1001)ICODE,KBAR2,XDB1,XDB2
      IF(KBAR2.EQ.KBAR1)GO TO 140
      CALL INTCPT(XRB1,XRB2,XRC,XR2I,XRB4)
```

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I5

```
      CALL BLOCN(XRB3,XRB4,XRC,XDB1,XDB2,XJ,LOC)
      IF(LOC.EQ.0)GO TO 140
      IF(LOC.EQ.3)GO TO 120
      CALL INTCPT(XR1I,XR2I,XRC,XJ,XKI)
      XKI(3)=ZCOR(XR1I,XR2I,XKI)
      DELTA=-0.5
      CALL MOVE(XKI,XKI,XR1I,DELTA,IERR)
      IF(IERR.EQ.4) RETURN
      IF(LOC.NE.1)GO TO 135
      GO TO 125
  120 CALL REPLCE(XR2I,XKI)
  125 CALL INTCPT(XR1I,XRC,XDB1,XDB2,XDB3)
C     ICODE=32
C     WRITE(IOUT,1001)ICODE,LOC,XJ,XKI,XDB3
      XDB3(3)=ZCOR(XDB1,XDB2,XDB3)
      HDIFF=HEIGHT(XR1I,XDB3,XRB1,XRB2)
      IF(HDIFF.GT.-2.0)GO TO 165
      CALL NR1(XR1I,XKI,XRC,XNPTJ,DISTI,XN1I,DN1I)
      ZN10=XN1I(3)
      DO 130 II=1,NQ
      IQ=NQ+1-II
      XN1I(3)=ZN10+ZS(IQ)
      HDIFF=HEIGHT(XN1I,XRC,XDB1,XDB2)
      IF(HDIFF.GT.20.0.AND.IQ.EQ.2)GO TO 140
      DELP=DEL(XN1I,XRC,XDB1,XDB2,HDIFF,DN1I)
      IF(HDIFF.EQ.1.AND.DELP.GT.-0.2)GO TO 165
      IF(DELP.LE.DELP2(IQ))GO TO 140
      DELP2(IQ)=DELP
  130 CONTINUE
C     ICODE=33
C     WRITE(IOUT,1000)ICODE,DELP2(1),DELP2(2)
      IF(DELP2(2).GE.12.5)GO TO 165
  135 CALL REPLCE(XKI,XR2I)
  140 CONTINUE
  145 CALL REPLCE(XR2I,XKI)
      IDXR=IDXR+1
C     ICODE=34
C     WRITE(IOUT,1001)ICODE,IDXR,XR2I
      IF(IDXR.LT.11)GO TO 150
      IERR=3
      RETURN
  150 DO 155 IQ=1,NQ
      DELR(IQ,IDXR)=AMAX1(DELP1(IQ),DELP2(IQ))
  155 CONTINUE
      DO 160 I=1,3
      XIMG(I,IDXR)=XRCI(I)
  160 CONTINUE
      GO TO 165
  165 CALL IMAGE(XRB1,XRB2,XKI,XK)
  170 CALL REPLCE(XK,XR2)
C     ICODE=35
C     WRITE(IOUT,1000)ICODE,XR2
  175 CONTINUE
C     ICODE=36
C     WRITE(IOUT,1000)ICODE,XR1,XR2
C BEGIN BARRIER FACTOR COMPUTATION
  180 NIMG=IDXR
      ANG=ANGLE(XR1,XR2,XRC)
      ADST=ANG/DIST
      IF(KPOS(XNPT,XR2,XR1).EQ.1)GO TO 190
      ANG2=ANG1-ANG
```

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```
      GO TO 195
  190 ANG2=ANG1+ANG
C CONTRIBUTION FROM DIRECT RAY
  195 DO 205 IQ=1,NQ
      IF(NQS(MR,IQ).EQ.0)GO TO 205
      DELP=DELPO(IQ)
      DO 200 KF=1,NF
      FB(KF,IQ)=BARFAC(KF,DELP)
  200 CONTINUE
C     ICODE=37
C     WRITE(IOUT,1002)ICODE,FB(1,IQ),FB(9,IQ)
  205 CONTINUE
C CONTRIBUTION FROM REFLECTIONS
      IF(NIMG.EQ.0)GO TO 230
      DO 225 KIMG=1,NIMG
      DO 210 I=1,3
      XRCI(I)=XIMG(I,KIMG)
  210 CONTINUE
      ANG1=ANGLE(XR1,XR2,XRCI)
      CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
      RATIO=(ANGI/DISTI)/ADST
      DO 220 IQ=1,NQ
      IF(NQS(MR,IQ).EQ.0)GO TO 220
      DELP=DELR(IQ,KIMG)
      DO 215 KF=1,NF
      FB(KF,IQ)=FB(KF,IQ)+BARFAC(KF,DELP)*RATIO
  215 CONTINUE
  220 CONTINUE
C     ICODE=38
C     WRITE(IOUT,1002)ICODE,FB(1,1),FB(1,2),FB(9,1),FB(9,2)
  225 CONTINUE
C COMPUTE MEAN ENERGY LEVEL
  230 CALL NR1(XR1,XR2,XRC,XNPT,DIST,XN1,DN1)
      DO 232 IQ=1,NQ
      NQQ=NQS(MR,IQ)
      IF(NQQ.EQ.0)GO TO 232
      DO 231 I=1,NQQ
      XLA(I,IQ)=0
  231 CONTINUE
  232 CONTINUE
      DO 242 IF=1,NF
      IP=IF
      IF(IF.EQ.1)IP=5
      A=10.**(-1.E-8*4.**IP*DN1)
      T1=0.
      DO 240 IQ=1,NQ
      IF(NQS(MR,IQ).EQ.0)GO TO 240
      NQQ=NQS(MR,IQ)
      T2=0.
      DO 235 I=1,NQQ
      T3=XLREF(MR,I,IF,IQ)*A*FB(IF,IQ)*FG(IF)
      T2=T2+VEXPH(MR,I,IQ)*T3
      IF(NF.GT.6.AND.IF.EQ.1)GO TO 235
      IF(NF.LE.6.AND.IF.NE.1)GO TO 235
      XLA(I,IQ)=XLA(I,IQ)+T3
  235 CONTINUE
      T1=T1+CQ(IQ)*T2
  240 CONTINUE
      XLE(IF)=XLE(IF)+ADST*T1
  242 CONTINUE
      SA1=SIN(ANG1)
```

R20

```
      SA2=SIN(ANG2)
      CA1=COS(ANG1)
      CA2=COS(ANG2)
      CPREV=ANG
      DO 246 N=1,4
      T1=0.
      DO 245 IQ=1,NQ
      IF(NQS(MR,IQ).EQ.0)GO TO 245
      NQQ=NQS(MR,IQ)
      T2=0.
      DO 244 I=1,NQQ
      T2=T2+VEXPH(MR,I,IQ)*XLA(I,IQ)**N
  244 CONTINUE
      T1=T1+CQ(IQ)**(N**2)*T2
  245 CONTINUE
      IT3=2*N-1
      T3=IT3
      XKA(N)=XKA(N)+T1/DIST**IT3*CPREV
      AFN=N
      CPREV=0.5/AFN*(SA2*CA2**IT3-SA1*CA1**IT3+T3*CPREV)
  246 CONTINUE
C     ICODE=39
C     WRITE(IOUT,1002)ICODE,XLE(1),XLE(9),CAP2
      ANG1=ABS(ANG2)
C     ICODE=40
C     WRITE(IOUT,1000)ICODE,XR2,XR2G,XR2D,XR20
      IF(DSQR(XR2,XR20).LT.1.)RETURN
      DELTA=1.
      CALL MOVE(XR2,XR1,XR10,DELTA,IERR)
      IF(IERR.EQ.4) RETURN
C     ICODE=41
C     WRITE(IOUT,1000)ICODE,XR1
      IF(DSQR(XR2,XR2G).LT.1.0)GO TO 247
      CALL REPLCE(XR2G,XR2)
      GO TO 91
  247 IF(DSQR(XR2,XR2D).LT.1.0)GO TO 25
      CALL REPLCE(XR2D,XR2)
      GO TO 72
C1000 FORMAT(6H0CODE I3,6F9.2/6F9.2)
C1001 FORMAT(6H0CODE I3,I4,6F9.2/6F9.2)
C1002 FORMAT(6H0CODE I3,6E12.2)
      END
```

I7

LISTING OF UPDATED VERSION OF THE
HIGHWAY NOISE PREDICTION PROGRAM
AS OF SEPTEMBER 1, 1974

```
C   TRAFFIC NOISE PREDICTION MODEL
C   MAIN PROGRAM    9/74
      DIMENSION SIG(4)
      DIMENSION XR1(3),XR2(3)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/INPT3/XRC(15),YRC(15),ZRC(15),NRC
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/DRIV3/CQ(4),XLE(9)
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON /STORE5/NQC(5)
      COMMON/DRIV4/CAP2
      COMMON/STORE3/RX(10,11),RY(10,11),RZ(10,11),NRSM1(10)
      COMMON/GEO1/IBAR,ISEG,IGRA
      DATA LZ/2HZZ/
      INTEGER TITLE(15)
      EQUIVALENCE (RDIN(3),SIG(1))
    1 NQ=3
      NG=0
      NB=0
      CALL FILES
    5 READ(INPT,1005) (TITLE(I),I=1,15)
      IF(TITLE(1).EQ.LZ)GO TO 105
      WRITE(IOUT,2009)
      WRITE(IOUT,1005) (TITLE(I),I=1,15)
      CALL INPUT
      NF=RDIN(2)
      WRITE(IOUT,1002)(TITLE(I),I=1,15)
      WRITE(IOUT,1003)
      DO 11 I=1,NQ
      CQ(I)=EXP(.5*(SIG(I)*.23026)**2)
   11 CONTINUE
      DO 60 I=1,NRC
      DO 15 J=1,NF
      XLE(J)=0.
   15 CONTINUE
      CAP2=0.0
      DO 50 M=1,NR
      DO 20 IQ=1,NQ
      NQC1=NQS(M,IQ)
      IF(NQC1.EQ.0) GO TO 20
      CALL INTER(M,IQ)
   20 CONTINUE
      XR1(1)=RX(M,1)
      XR1(2)=RY(M,1)
      XR1(3)=RZ(M,1)
      NLIM=NRSM1(M)+1
      DO 40 N=2,NLIM
      XR2(1)=RX(M,N)
      XR2(2)=RY(M,N)
      XR2(3)=RZ(M,N)
      CALL GEOMRY(XRC(I),YRC(I),ZRC(I),XR1,XR2,IERR,M)
      IF(IERR.EQ.1)GO TO 65
      IF(IERR.EQ.2)GO TO 70
      IF(IERR.EQ.3)GO TO 66
      IF(IERR.EQ.4)GO TO 60
      CALL REPLCE(XR2,XR1)
   40 CONTINUE
   50 CONTINUE
```

```
      SIGL=4.35*SQRT(ALOG(1.0+CAP2/XLE(1)**2))
      DO 55 J=1,NF
      XLE(J)=100.+10.*ALOG10(XLE(J))
   55 CONTINUE
      IF(I.EQ.1) GO TO 155
      WRITE(IOUT,1003)
  155 WRITE(IOUT,1004) I,XRC(I),YRC(I),ZRC(I)
  156 IF(NF.EQ.1) GO TO 56
      WRITE(IOUT,2010)
      WRITE(IOUT,2001)
      WRITE(IOUT,2002) (XLE(II),II=2,NF)
   56 XLNP=XLE(1)+2.56*SIGL
      XL50=XLE(1)-SIGL**2/8.7
      XL10=XL50+1.28*SIGL
      XL90=XL50-1.28*SIGL
      WRITE(IOUT,2003)
      WRITE(IOUT,2004)XLE(1),XLNP,XL90,XL50,XL10
   60 CONTINUE
      GO TO 100
   65 WRITE(IOUT,1006)I,M,N,IBAR,ISEG
      GO TO 100
   66 WRITE(IOUT,1009)I,M,N
      GO TO 100
   70 WRITE(IOUT,1008)I,M,N,IGRA
  100 GO TO 5
  105 CONTINUE
      CALL EXIT
 1002 FORMAT(//15A2)
 1003 FORMAT(11H RECEIVER  10X,3HXRC9X,3HYRC9X,3HZRC)
 1004 FORMAT(4X,I3,5X,3F12.1)
 1005 FORMAT(15A2)
 1006 FORMAT(44H ILLEGAL BARRIER INTERSECTS ROADWAY FOR REC I2,2X,2HR I2
     1,3HRS I2,2X,2HB I2,2X,3HBS I2)
 1008 FORMAT(49H ILLEGAL GROUND STRIP INTERSECTS ROADWAY FOR REC I2,2X,2
     1HR I2,3HRS I2,2X,4HAGS I2)
 1009 FORMAT(26H TOO MANY REFLECTIONS,RCV ,I2,4H  R ,I2,4H  S ,I2)
 2001 FORMAT( 14X,2H635X,3H1254X,3H2504X,3H5003X,4H10003X,4H20003X,
     X 4H40003X,4H8000)
 2002 FORMAT(10X,8F7.1)
 2003 FORMAT(/10X,5HLE(A),5X,3HLNP,5X,3HL90,5X,3HL50,5X,3HL10)
 2004 FORMAT(8X,5F8.1//)
 2009 FORMAT(1H1,15X,24HTRAFFIC NOISE PREDICTION//)
 2010 FORMAT(/25X,22HOCTAVE BAND LEVELS (A))
      END
      SUBROUTINE FILES
      COMMON/INOU/INPT,IOUT
      INPT=5
      IOUT=6
      RETURN
      END
      SUBROUTINE INPUT
      COMMON/DRIV2/NQS(10,4),NF
      INTEGER ALPHA(25),ALP1(14,8),BLNK
      DIMENSION VTEMP(5)
      COMMON/STORE1/BX(10,5),BY(10,5),BZ(10,5),IBLAST(10),NBSM1(10)
      COMMON/STORE2/XXG1(10,2),YYG1(10,2),ZZG1(10,2),BGS(10),IDUM(10)
      COMMON/STORE3/RX(10,11),RY(10,11),RZ(10,11),NRSM1(10)
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/STORE5/NQC(5)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
```

```
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/INPT3/XRC(15),YRC(15),ZRC(15),NRC
      COMMON/XIN/ XINS(9),NINF
      DIMENSION RDN(15)
      EQUIVALENCE (RDIN(1),XNIGHT)
      DATA    IA/2HA /
      DATA    IG/2HG /
      DATA    IR/2HR /
      DATA    IT/2HT /
      DATA LAST/2HL /
      DATA BLNK/2H  /
      DATA  ALP1                /4HRECE,4HIVER,4H HEI,4HGHT ,4HADJU,4HSTME,
     1           4HNT  ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     A                          4HNUMB,4HER O,4HF FR,4HEQUE,4HNCY ,4HBAND,
     2           4HS   ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     B                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR C,
     3           4HARS ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     C                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR CA,4HRS   ,
     4           4H    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     D                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR T,
     5           4HRUCK,4HS    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     E                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR TR,4HUCKS,
     6           4H    ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     ,
     F                          4HSTAN,4HDARD,4H DEV,4HIATI,4HON F,4HOR N,
     7           4HEW V,4HEHIC,4HLES ,4H(TYP,4HE 3 ,4HVEHI,4HCLES,4H)    ,
     G                          4HSOUR,4HCE H,4HEIGH,4HT FO,4HR NE,4HW VE,
     8           4HHICL,4HES   ,4H     ,4H     ,4H     ,4H     ,4H     ,4H     /
      NINF=0
      DO 1 J=1,5
    1 NQC(J)=0
    5 READ(INPT,1000)IGO,I1,I2
      GO TO(10,20,30,36,40,50),IGO
GARBAGE DATA....PROGRAM INITIALIZATION PARAMETERS
   10 WRITE(IOUT,2000)
   11 READ(INPT,1001) VALUE,IDN,ILAST,(ALPHA(I),I=1,25)
      RDN(IDN)=VALUE
      DO 7 I=1,25
      IF(ALPHA(I).NE.BLNK) GO TO 13
    7 CONTINUE
      WRITE(IOUT,2016) VALUE,IDN,(ALP1(I,IDN),I=1,14)
      GO TO 14
   13 WRITE(IOUT,2001) VALUE,IDN,(ALPHA(I),I=1,25)
   14 IF(ILAST.NE.LAST) GO TO 11
      DO 12 J1=1,3
      J2=J1+2
      J3=2*J1+1
      J4=J1+6
      J5=2*J1+2
      RDIN(J2)=RDN(J3)
      RDIN(J4)=RDN(J5)
   12 CONTINUE
      RDIN(1)=RDN(1)
      RDIN(2)=RDN(2)
      IF(IDN.EQ.6) GO TO 5
      NINF=1
      READ(INPT,1006) (XINS(J1),J1=1,9)
      WRITE(IOUT,2015) (XINS(J1),J1=1,9)
      GO TO 5
```

```
C VEHICLE DATA
   20 NR=I1
      DO 28 J=1,NR
      NSEC=1
      DO 21 K=1,NQ
   21 NQS(J,K)=0
   22 READ(INPT,1002) VEH,XMH,ITY,ILAST
      NQS(J,ITY)=NQS(J,ITY)+1
      NQC1=NQS(J,ITY)
      VEXPH(J,NQC1,ITY)=VEH/XMH/5280.
      XMPH(J,NQC1,ITY)=XMH
      IF(ILAST.NE.LAST)GO TO 22
C ROADWAY DATA SECTIONS
   24 READ(INPT,1003)RX(J,NSEC),RY(J,NSEC),RZ(J,NSEC),ILAST
      IF(ILAST.EQ.LAST)GO TO 25
      NSEC=NSEC+1
      GO TO 24
   25 IF(NSEC-1.NE.0)GO TO 26
      WRITE(IOUT,2010)
      CALL EXIT
   26 NRSM1(J)=NSEC-1
   28 CONTINUE
      GO TO 5
C BARRIER DATA SECTIONS
   30 NB=I1
      IF(NB.EQ.0)GO TO 5
      DO 35 J=1,NB
      NSEC=1
   31 READ(INPT,1003)BX(J,NSEC),BY(J,NSEC),BZ(J,NSEC),IBLAST(J)
      IF(IBLAST(J).EQ.IA.OR.IBLAST(J).EQ.IR)GO TO 32
      NSEC=NSEC+1
      GO TO 31
   32 IF(NSEC-1.NE.0)GO TO 33
      WRITE(IOUT,2011)
      CALL EXIT
   33 NBSM1(J)=NSEC-1
   35 CONTINUE
      GO TO 5
C ABSORBING GROUND STRIPS
   36 NG=I1
      IF(NG.EQ.0)GO TO 5
      DO 37 I=1,NG
      READ(INPT,1004)XXG1(I,1),YYG1(I,1),ZZG1(I,1),BGS(I)
      READ(INPT,1003)XXG1(I,2),YYG1(I,2),ZZG1(I,2),IDUM(I)
      IF(IDUM(I).EQ.IG)IDUM(I)=1
      IF(IDUM(I).EQ.IT)IDUM(I)=2
   37 CONTINUE
      GO TO 5
C RECEIVER DATA
   40 NRC=I1
      DO 41 I=1,NRC
      READ(INPT,1003)XRC(I),YRC(I),ZRC(I),IRDUM
      ZRC(I)=ZRC(I)+XNIGHT
   41 CONTINUE
      GO TO 5
C
   50 DO 65 J=1,NR
      WRITE(IOUT,2002)J
      DO 55 K=1,NQ
      NQC1=NQS(J,K)
```

```
      IF(NQC1.EQ.0) GO TO 55
      DO 54 I=1,NQC1
   54 VTEMP(I)=VEXPH(J,I,K)*XMPH(J,I,K)*5280.
      WRITE(IOUT,2004)K,(I,VTEMP(I),XMPH(J,I,K),I=1,NQC1)
   55 CONTINUE
      WRITE(IOUT,2013)
      WRITE(IOUT,2005)RX(J,1),RY(J,1),RZ(J,1)
      NSEC=NRSM1(J)+1
      DO 60 I=2,NSEC
      WRITE(IOUT,2006)I,RX(J,I),RY(J,I),RZ(J,I)
   60 CONTINUE
   65 CONTINUE
      IF(NB.EQ.0)GO TO 80
      DO 75 J=1,NB
      WRITE(IOUT,2007)J,IBLAST(J)
      WRITE(IOUT,2005)BX(J,1),BY(J,1),BZ(J,1)
      NSEC=NBSM1(J)+1
      DO 70 I=2,NSEC
      WRITE(IOUT,2006)I,BX(J,I),BY(J,I),BZ(J,I)
   70 CONTINUE
   75 CONTINUE
   80 IF(NG.EQ.0) GO TO 90
      DO 85 I=1,NG
      IF(IDUM(I).EQ.1)IDM=IG
      IF(IDUM(I).EQ.2)IDM=IT
      WRITE(IOUT,2012)I,IDM,XXG1(I,1),YYG1(I,1),ZZG1(I,1),
     1 BGS(I),XXG1(I,2),YYG1(I,2),ZZG1(I,2)
   85 CONTINUE
   90 WRITE(IOUT,2008)
      DO 95 I=1,NRC
      WRITE(IOUT,2006)I,XRC(I),YRC(I),ZRC(I)
   95 CONTINUE
      RETURN
 1000 FORMAT(3I5)
 1001 FORMAT(E10.0,I5,4X,A1,10X,25A2)
 1002 FORMAT(2E10.0,I5,5X,A1)
 1003 FORMAT(3E10.0,A1)
 1004 FORMAT(4E10.0)
 1006 FORMAT(9E5.0)
 2000 FORMAT(34H PROGRAM INITIALIZATION PARAMETERS)
 2001 FORMAT(1X,E12.5,I10,5X,25A2)
 2002 FORMAT(10H ROADWAY  ,I3)
 2004 FORMAT(10H NUMBER OF13X,5HVEH/H8X,3HMPH/5H TYPE,I2,4H VEH/(3X,I2
     1,15X,2E13.4))
 2005 FORMAT(7H NUMBER,5X,1HX12X,1HY12X,1HZ/4X,1H1,2X,3E13.4)
 2006 FORMAT(3X,I2,2X,3E13.4)
 2007 FORMAT(10H BARRIER  I3,2X,1H(A1,1H)10X,19HBARRIER COORD IN FT)
 2008 FORMAT(9H RECEIVER14X,20HRECEIVER COORD IN FT/7H NUMBER5X,1HX12X,1
     1HY12X,1HZ)
 2010 FORMAT(27H INSUFFICIENT ROAD SECTIONS)
 2011 FORMAT(30H INSUFFICIENT BARRIER SECTIONS)
 2012 FORMAT(18H ABSORBING STRIP  I3,2X,1H(A1,1H)//5H PT  7X,1HX12X,1HY1
     A2X,1HZ12X,5HWIDTH/4X,1H12X,4E13.4/4X,1H22X,3E13.4)
 2013 FORMAT(22X,18HSOURCE COORD IN FT)
 2015 FORMAT(5X,23HOPTIONAL NOISE SPECTRUM/5X,9F7.1)
 2016 FORMAT(1X,E12.5,I10,5X,14A4)
      END
  SUBROUTINES FOR TRAFFIC NOISE    9/74
      SUBROUTINE INTER(NR,IQ)
      DIMENSION TL1(2,9,4),TL(72)
      EQUIVALENCE(TL(1),TL1(1,1,1))
```

```
      COMMON/XIN/ XINS(9),NINF
      COMMON/BLK2/NQ
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/INTER1/XLREF(1800)
      DATA TL(1), TL(2), TL(3), TL(4), TL(5), TL(6), TL(7), TL(8),
     1     TL(9),TL(10),TL(11),TL(12),TL(13),TL(14),TL(15),TL(16),
     2    TL(17),TL(18),TL(19),TL(20),TL(21),TL(22),TL(23),TL(24),
     3    TL(25),TL(26),TL(27),TL(28),TL(29),TL(30),TL(31),TL(32),
     4    TL(33),TL(34),TL(35),TL(36)/
     5  61.,75.,38.,48.,45.,57.,47.,62.,55.,66.,58.,70.,54.,72.,49.,63.,
     6  42.,57.,
     7  2*87.,2*60.,2*73.,2*78.,2*83.,2*82.,2*79.,2*74.,2*66./
      IF(NINF.LE.0) GO TO 1
      NINF=-1
      DO 13 J1=1,9
      J2=35+2*J1
      J3=36+2*J1
      J4=53+2*J1
      J5=54+2*J1
      TL(J2)=XINS(J1)
      TL(J3)=XINS(J1)
      TL(J4)=0.0
      TL(J5)=0.0
   13 CONTINUE
    1 NQQ=NQS(NR,IQ)
      CONS=ALOG10(70./30.)
      DO 10 IF=1,NF
      TEMP=TL1(2,IF,IQ)-TL1(1,IF,IQ)
      DO 10  I=1,NQQ
      XLREF1=TL1(1,IF,IQ)+TEMP*ALOG10(XMPH(NR,I,IQ)/30.)/CONS
      INDEX=NR+10*(I-1)+10*5*(IF-1)+10*5*9*(IQ-1)
      XLREF(INDEX)=10.**((XLREF1-66.)/10.)
   10 CONTINUE
      RETURN
      END
      FUNCTION AMAG(X1V,X2V)
C FIND MAGNITUDE OF VECTOR
      DIMENSION X1V(3),X2V(3)
      AMAG=SQRT(DSQR(X1V,X2V))
      RETURN
      END
      FUNCTION ANGLE(X1V,X2V,X3V)
      DIMENSION X1V(3),X2V(3),X3V(3)
      D13=DSQR(X1V,X3V)
      D23=DSQR(X2V,X3V)
      ANGLE=1.5708
      IF(D13*D23.EQ.0.)RETURN
      D12=DSQR(X1V,X2V)
      ANGLE=ACOS((D23+D13-D12)/(SQRT(D13*D23)*2.))
      RETURN
      END
      FUNCTION BARFAC(KF,DELP)
C FIND BARRIER FACTOR
      IF(DELP.EQ.-0.2)GO TO 3
      IF(DELP.GE.12.5)GO TO 4
      IP=KF
      IF(KF.EQ.1)IP=5
      A=DELP*(2.**IP)/5.7
      IF(A.GE.78.5)GO TO 4
      IF(A.GT.0..AND.A.LT.78.5)GO TO 5
```

```
      IF(A.EQ.0.)GO TO 6
      IF(A.GT.-1.25.AND.A.LT.0.)GO TO 7
    3 BARFAC=1.0
      RETURN
    4 BARFAC=4.0E-3
      RETURN
    5 BARFAC=(TANH(SQRT(A))**2)/A/3.16
      RETURN
    6 BARFAC=.316
      RETURN
    7 A1=ABS(A)
      BARFAC=(TAN(SQRT(A1)))**2/A1/3.16
      RETURN
      END
      SUBROUTINE BLOCN(X1V,X2V,X3V,X4V,X5V,X6V,LOC)
C FIND RELATIVE LOCATION OF BARRIER
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2),X6V(2),XAV(2),XBV(2)
      LOC=KCUT(X1V,X3V,X4V,X5V)
      LOC=LOC+KCUT(X2V,X3V,X4V,X5V)*2
      IF(LOC.EQ.3)RETURN
      CALL TRI(X1V,X2V,X3V,X4V,XAV,KTRI)
      IF(LOC.EQ.0)GO TO 4
      IF(KTRI.EQ.1)GO TO 6
    2 CALL INTCPT(X1V,X2V,X3V,X5V,XBV)
      IF(LOC.EQ.4)GO TO 5
    3 X6V(1)=XBV(1)
      X6V(2)=XBV(2)
      RETURN
    4 IF(KTRI.EQ.0)RETURN
      LOC=4
      GO TO 2
    5 IF(KPOS(X1V,XAV,XBV).EQ.1)GO TO 3
    6 X6V(1)=XAV(1)
      X6V(2)=XAV(2)
      RETURN
      END
      FUNCTION DEL(X1V,X2V,X3V,X4V,HDIFF,DN1)
C FIND PATH LENGTH DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),XAV(3),XBV(3)
      CALL NRPT(X3V,X4V,X1V,XAV,DISTA)
      CALL NRPT(X3V,X4V,X2V,XBV,DISTB)
      DISTC=DSQR(XBV,XAV)
      DEL=SQRT((DISTA+DISTB)**2+DISTC)-DN1
      IF(HDIFF.GT.0.)DEL=-DEL
      RETURN
      END
      FUNCTION DSQR(X1V,X2V)
      DIMENSION  X1V(3),X2V(3)
      DSQR=0.0
      DO 10 I=1,3
   10 DSQR=(X1V(I)-X2V(I))**2+DSQR
      RETURN
      END
      SUBROUTINE ENDPT(X1V,X2V,X3V,X4V,X5V,X6V,KTRIG,IERR)
C FIND NEW ENDPOINT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3),X6V(3),XDUM(3)
      IERR=0
      KTRIG=0
      ITRIG=1
      CALL REPLCE(X1V,XDUM)
    1 CALL BLOCN(XDUM,X2V,X3V,X4V,X5V,X6V,LOC)
```

```
      IF(LOC.EQ.0) RETURN
      IF(LOC.NE.3) GO TO 2
      CALL REPLCE(X2V,X6V)
      GO TO 4
    2 X6V(3)=ZCOR(X1V,X2V,X6V)
      IF(ITRIG.EQ.0) GO TO 5
      IF(AMAG(X1V,X6V).GT.0.51) GO TO 5
      ITRIG=0
      DELTA=-0.51
      CALL MOVE(XDUM,XDUM,X2V,DELTA,IERR)
      GO TO 1
    5 DELTA=-0.5
      IF(LOC.EQ.1) GO TO 3
      CALL MOVE(X6V,X2V,X1V,DELTA,IERR)
      RETURN
    3 CALL MOVE(X6V,X6V,X1V,DELTA,IERR)
    4 KTRIG=1
      RETURN
      END
      FUNCTION HEIGHT(X1V,X2V,X3V,X4V)
C FIND HEIGHT DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),XI(3)
      CALL INTCPT(X1V,X2V,X3V,X4V,XI)
      HEIGHT=ZCOR(X1V,X2V,XI)-ZCOR(X3V,X4V,XI)
      RETURN
      END
      FUNCTION IEPS (X1V, X2V, X3V, X4V, DEL1)
C     CHECK ON PATH LENGTH DIFFERENCE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3)
      IEPS =0
      DIST = AMAG (X1V,X2V)
      HDIFF = HEIGHT (X1V,X2V,X3V,X4V)
      DEL2 = DEL (X1V, X2V, X3V, X4V, HDIFF, DIST)
      DELM= (DEL1+DEL2)/2.
      IF((ABS(DEL2-DEL1) - 0.1-DELM/50.* (1.+DELM)) .GT.0.) IEPS=1
      RETURN
      END
      SUBROUTINE IMAGE(X1V,X2V,X3V,X4V)
C FIND IMAGE POINT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3)
      AX=X2V(1)-X1V(1)
      AY=X2V(2)-X1V(2)
      AXY=AX**2+AY**2
      RATIO=0.
      IF(AXY.EQ.0.)GO TO 10
      RATIO=(((X3V(2)-X2V(2))*AX-(X3V(1)-X2V(1))*AY)*2.0)/AXY
   10 X4V(1)=X3V(1)+AY*RATIO
      X4V(2)=X3V(2)-AX*RATIO
      X4V(3)=X3V(3)
      RETURN
      END
      SUBROUTINE INTCPT(X1V,X2V,X3V,X4V,X5V)
C FIND INTERCEPT OF TWO LINES IN A PLANE
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      AX=X2V(1)-X1V(1)
      AY=X2V(2)-X1V(2)
      BX=X4V(1)-X3V(1)
      BY=X4V(2)-X3V(2)
      C1=AY*X2V(1)-AX*X2V(2)
      C2=BY*X4V(1)-BX*X4V(2)
      D=AX*BY-AY*BX
```

```
      IF(D**2.LT.1.E-6)GO TO 2
      X5V(1)=(AX*C2-BX*C1)/D
      X5V(2)=(AY*C2-BY*C1)/D
      RETURN
    2 D=SQRT(AX**2+AY**2)
      X5V(1)=X1V(1)+(AX/D)*1.E+15
      X5V(2)=X1V(2)+(AY/D)*1.E+15
      RETURN
      END
      FUNCTION KCUT(X1V,X2V,X3V,X4V)
C DETERMINE IF TWO LINE SEGMENTS CROSS
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      KCUT=0
      CALL INTCPT(X1V,X2V,X3V,X4V,X5V)
      IF(KPOS(X1V,X2V,X5V).NE.1)RETURN
      IF(KPOS(X3V,X4V,X5V).EQ.1)KCUT=1
      RETURN
      END
      FUNCTION KPOS(X1V,X2V,X3V)
C FIND POSITION OF POINT ON LINE
      DIMENSION X1V(2),X2V(2),X3V(2)
      KPOS=1
      IF(((X3V(1)-X1V(1))*(X3V(1)-X2V(1))+(X3V(2)-X1V(2))*(X3V(2)-X2V(2)
     1)).GT.0.)KPOS=0
      RETURN
      END
      SUBROUTINE MIDP (X1V, X2V, X3V)
C     FIND CENTER POINT
      DIMENSION X1V(3), X2V(3), X3V(3)
      DO 10 I=1,3
   10 X3V(I) = (X1V(I)+X2V(I))/2.
      RETURN
      END
      SUBROUTINE NRPT(X1V,X2V,X3V,X4V,DIST)
C FIND NEAREST POINT TO LINE
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),AV(3),BV(3)
      EQUIVALENCE (AV(1),AX),(AV(2),AY),(AV(3),AZ),(BV(1),BX),(BV(2),BY
     1),(BV(3),BZ)
      DO 5 I=1,3
      AV(I)=X2V(I)-X1V(I)
      BV(I)=X3V(I)-X1V(I)
    5 CONTINUE
      RATIO=0.
      TEMP=DSQR(X2V,X1V)
      IF(TEMP.NE.0.)RATIO=(AX*BX+AY*BY+AZ*BZ)/TEMP
      DO 10 I=1,3
      X4V(I)=X1V(I)+RATIO*AV(I)
   10 CONTINUE
      DIST=AMAG(X4V,X3V)
      IF(DIST.EQ.0.)DIST=1.
      RETURN
      END
      SUBROUTINE NR1(X1V,X2V,X3V,X4V,DIST,X5V,DN1)
C FIND NEAREST POINT TO LINE SEGMENT
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3)
      IF(KPOS(X4V,X2V,X1V).EQ.1)GO TO 2
      IF(KPOS(X1V,X4V,X2V).EQ.1)GO TO 4
      CALL REPLCE(X4V,X5V)
      DN1=DIST
      RETURN
    2 CALL REPLCE(X1V,X5V)
```

```
      GO TO 6
    4 CALL REPLCE(X2V,X5V)
    6 DN1=AMAG(X5V,X3V)
      RETURN
      END
      SUBROUTINE REPLCE(X1V,X2V)
      DIMENSION X1V(3),X2V(3)
      X2V(1)=X1V(1)
      X2V(2)=X1V(2)
      X2V(3)=X1V(3)
      RETURN
      END
      SUBROUTINE SECTN(X1V,X2V,X3V,X4V,X5V,X6V,X7V)
C FIND EFFECTIVE BARRIER SECTION
      DIMENSION X1V(3),X2V(3),X3V(3),X4V(3),X5V(3),X6V(3),X7V(3)
      CALL INTCPT(X1V,X3V,X4V,X5V,X6V)
      X6V(3)=ZCOR(X4V,X5V,X6V)
      CALL INTCPT(X2V,X3V,X4V,X5V,X7V)
      X7V(3)=ZCOR(X4V,X5V,X7V)
      RETURN
      END
      SUBROUTINE TRI(X1V,X2V,X3V,X4V,X5V,KTRI)
C FIND IF POINT IN TRIANGLE AND LOCATE INTERCEPT
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      CALL INTCPT(X1V,X2V,X3V,X4V,X5V)
      KTRI=0
      IF(KPOS(X1V,X2V,X5V).EQ.0)RETURN
      IF(KPOS(X3V,X5V,X4V).EQ.1)KTRI=1
      RETURN
      END
      FUNCTION ZCOR(X1V,X2V,X3V)
C FIND Z COORDINATE
      DIMENSION X1V(3),X2V(3),X3V(3)
      TEM1=X2V(1)-X1V(1)
      TEM2=X2V(2)-X1V(2)
      TEM3=X2V(3)-X1V(3)
      IF(ABS(TEM1).GT.ABS(TEM2))GO TO 10
      ZCOR=X1V(3)+(X3V(2)-X1V(2))*TEM3/TEM2
      RETURN
   10 ZCOR=X1V(3)+(X3V(1)-X1V(1))*TEM3/TEM1
      RETURN
      END
      SUBROUTINE MOVE(X1V,X2V,X3V,DELTA,IERR)
C MOVE ENDPOINT OF ROAD
      DIMENSION X1V(3),X2V(3),X3V(3)
      IERR=0
      TEMP=AMAG(X1V,X3V)
      IF(TEMP.EQ.0.) GO TO 3
      FCTR=DELTA/TEMP
      DO 2 I=1,3
      X2V(I)=X1V(I)+(X1V(I)-X3V(I))*FCTR
    2 CONTINUE
      RETURN
    3 IERR=4
      RETURN
      END
      SUBROUTINE MOVE2(X1V,X2V,X3V,DELTA,IERR)
C MOVE AN ENDPOINT(2-DIMENSION)
      DIMENSION X1V(2),X2V(2),X3V(2)
      IERR=0
      TEMP=SQRT((X1V(1)-X3V(1))**2+(X1V(2)-X3V(2))**2)
```

```
      IF(TEMP.EQ.0.0) GO TO 3
      FCTR=DELTA/TEMP
      DO 2 I=1,2
      X2V(I)=X1V(I)+(X1V(I)-X3V(I))*FCTR
    2 CONTINUE
      RETURN
    3 IERR=4
      RETURN
      END
      FUNCTION TAN(X)
      TAN=SIN(X)/COS(X)
      RETURN
      END
      SUBROUTINE COLIN(X1V,X2V,X3V)
C CHECK WHETHER RECEIVER IS CO-LINEAR WITH ROADWAY SEGMENT
      DIMENSION X1V(2),X2V(2),X3V(2)
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 10
    5 ANG=ANGLE(X1V,X2V,X3V)
      IF(ANG.GE.2.6E-5) RETURN
   10 X3V(1)=X3V(1)+1.0
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 20
      ANG=ANGLE(X1V,X2V,X3V)
      IF(ANG.GE.2.6E-5) RETURN
   20 X3V(2)=X3V(2)+1.0
      IF(IAREA(X1V,X2V,X3V).EQ.0) GO TO 5
      RETURN
      END
      FUNCTION IAREA(X1V,X2V,X3V)
C FIND AREA OF TRIANGLE
      DIMENSION X1V(2),X2V(2),X3V(2)
      IAREA=1
      TERM1=X1V(1)*(X2V(2)-X3V(2))
      TERM2=X2V(1)*(X3V(2)-X1V(2))
      TERM3=X3V(1)*(X1V(2)-X2V(2))
      AREA=TERM1+TERM2+TERM3
      IF(AREA.LT.0.0) IAREA=-1
      IF(ABS(.5*AREA).LE.1.) IAREA=0
      RETURN
      END
      SUBROUTINE DEGEN(X1V,X2V,X3V,X4V,X5V,LOC)
      COMMON/INOU/INPT,IOUT
      DIMENSION X1V(2),X2V(2),X3V(2),X4V(2),X5V(2)
      LOC=5
      IF(IAREA(X4V,X1V,X3V).EQ.0) GO TO 10
      IF(IAREA(X4V,X2V,X3V).EQ.0) GO TO 40
      IF(IAREA(X5V,X1V,X3V).EQ.0) GO TO 45
      IF(IAREA(X5V,X2V,X3V).EQ.0) GO TO 45
      RETURN
   10 IAREA1=IAREA(X5V,X2V,X3V)
      IF(IAREA1.EQ.0) GO TO 30
      IAREA2=IAREA(X5V,X3V,X1V)
      IAREA3=IAREA(X5V,X1V,X2V)
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 55
   20 LOC=0
      RETURN
   30 LOC=30
      RETURN
   40 IAREA1=IAREA(X5V,X3V,X1V)
      IF(IAREA1.EQ.0) GO TO 30
      IAREA2=IAREA(X5V,X1V,X2V)
      IAREA3=IAREA(X5V,X2V,X3V)
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```
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 55
      GO TO 20
   45 IAREA1=IAREA(X4V,X3V,X1V)
      IAREA2=IAREA(X4V,X1V,X2V)
      IAREA3=IAREA(X4V,X2V,X3V)
      IF(IAREA1.EQ.IAREA2.AND.IAREA1.EQ.IAREA3) GO TO 60
      GO TO 20
   55 CALL MOVE2(X4V,X4V,X5V,1.0,IERR)
      IF(IERR.EQ.4) WRITE(IOUT,1000)
      RETURN
   60 CALL MOVE2(X5V,X5V,X4V,1.0,IERR)
      IF(IERR.EQ.4) WRITE(IOUT,1000)
      RETURN
 1000 FORMAT(1H ,14HERROR IN MOVE2)
      END
C  GEOMETRY ROUTINE   9/74
      SUBROUTINE GEOMRY(XR,YR,ZR,XR10,XR20,IERR,MR)
      DIMENSION XG1(3),XG2(3),XG3(3),XG4(3)
      DIMENSION B1(3,2,10),R1(3,2,10),RB1(3,2,10),TA1(3,2,10)
      DIMENSION KBCODE(10),KNUMB(10),KRNUMB(10),KRDNUM(10)
      DIMENSION KGCODE(10),BGT(10),IKIN(10)
      DIMENSION
     D DELP0(4),DELP1(4),DELP2(4),FB(9,4),DELR(4,10),FG(9),HGA(2),
     X XB1(3),XB2(3),XDB1(3),XDB2(3),XDB3(3),XDB4(3),
     X XRB1(3),XRB2(3),XRB3(3),XRB4(3),XRC(3),XRCI(3),
     X XR1(3),XR2(3),XR1I(3),XR2I(3),XR10(3),XR20(3),
     X XK(3),XKI(3),XJ(3),XNPT(3),XNPTI(3),XNPTJ(3),
     X XN1(3),XN2(3),XN1I(3),XIMG(3,10),XR2D(3),XR2G(3),
     X XLA(5,4),
     Z ZS(4)
      COMMON/INOU/INPT,IOUT
      COMMON/BLK2/NQ
      COMMON/INPT1/RDIN(15)
      COMMON/INPT2/NR,NB,NG
      COMMON/DRIV2/NQS(10,4),NF
      COMMON/DRIV3/CQ(4),XLE(9)
      COMMON/DRIV4/CAP2
      COMMON/STORE4/XMPH(10,5,4),VEXPH(10,5,4)
      COMMON/STORE1/BX(10,5),BY(10,5),BZ(10,5),IBLAST(10),NBSM1(10)
      COMMON/STORE2/XXG1(10,2),YYG1(10,2),ZZG1(10,2),BGS(10),IDUM(10)
      COMMON/GEO1/IBAR,ISEG,IGPA
      COMMON/INTER1/XLREF(1800)
      EQUIVALENCE (PDIN(7),ZS(1))
      DATA   IR/2HR /
      DATA HGA(1),HGA(2)/10.,30./
      XRC(1)=XR
      XRC(2)=YR
      XRC(3)=ZR
      IERR=0
      CALL COLIN(XR10,XR20,XRC)
      CALL NRPT(XR10,XR20,XRC,XNPT,DIST)
      ANG1=ANGLE(XR10,XNPT,XRC)
      ICODE=1
      WRITE(IOUT,1000)ICODE,XR10,XR20,XRC,XNPT
  PRELIMINARY SELECTION OF BARRIERS
      NDIFF=0
      IF(NB.EQ.0) GO TO 16
      KBAR=0
      DO 15 IBAR=1,NB
      KAR=IBLAST(IBAR)
      XB1(1)=BX(IBAR,1)
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      XB1(2)=BY(IBAR,1)
      XB1(3)=BZ(IBAR,1)
      NLIM=NBSM1(IBAR)+1
      DO 15 ISEG=2,NLIM
      XB2(1)=BX(IBAR,ISEG)
      XB2(2)=BY(IBAR,ISEG)
      XB2(3)=BZ(IBAR,ISEG)
      KBAR=KBAR+1
C     ICODE=2
C     WRITE(IOUT,1001)ICODE,KBAR,XB1,XB2
      IF(KCUT(XR10,XR20,XB1,XB2).NE.1)GO TO 10
      IERR=1
      RETURN
   10 CALL DEGEN(XR10,XR20,XRC,XB1,XB2,LOC)
      IF(LOC.NE.5) GO TO 11
      CALL BLOCN(XR10,XR20,XRC,XB1,XB2,XK,LOC)
   11 IF(LOC.EQ.0)GO TO 12
      NDIFF=NDIFF+1
      KNUMB(NDIFF)=KBAR
      KBCODE(NDIFF)=LOC
      CALL REPLCE(XB1,B1(1,1,NDIFF))
      CALL REPLCE(XB2,B1(1,2,NDIFF))
   12 CALL REPLCE(XB2,XB1)
   15 CONTINUE
C PRELIMINARY SELECTION OF STRIPS
   16 KGA=0
      IF(NG.EQ.0)GO TO 20
      DO 18 IGRA=1,NG
      XG1(1)=XXG1(IGRA,1)
      XG1(2)=YYG1(IGRA,1)
      XG1(3)=ZZG1(IGRA,1)
      XG2(1)=XXG1(IGRA,2)
      XG2(2)=YYG1(IGRA,2)
      XG2(3)=ZZG1(IGRA,2)
C     ICODE=3
C     WRITE(IOUT,1001)ICODE,IGRA,XG1,XG2
      IF(KCUT(XR10,XR20,XG1,XG2).NE.1)GO TO 17
      IERR=2
      RETURN
   17 CALL DEGEN(XR10,XR20,XRC,XG1,XG2,LOC)
      IF(LOC.NE.5) GO TO 1701
      CALL BLOCN(XR10,XR20,XRC,XG1,XG2,XK,LOC)
 1701 IF(LOC.EQ.0)GO TO 18
      KGA=KGA+1
      KGCODE(KGA)=LOC
      CALL REPLCE(XG1,TA1(1,1,KGA))
      CALL REPLCE(XG2,TA1(1,2,KGA))
      BGT(KGA)=BGS(IGRA)
      IKIN(KGA)=IDUM(IGRA)
   18 CONTINUE
C DIFFRACTION OF DIRECT RAY
   20 CALL REPLCE(XR10,XR1)
   25 CALL REPLCE(XR20,XR2)
      DO 30 IQ=1,NQ
      DELPO(IQ)=-.2
   30 CONTINUE
C     ICODE=4
C     WRITE(IOUT,1000)ICODE,XR1,XR2
      IF(NDIFF.EQ.0)GO TO 71
      ITRIG=0
      DO 70 KDIFF=1,NDIFF
```

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      KBAR=KNUMB(KDIFF)
      KCD=KBCODE(KDIFF)
      CALL REPLCE(B1(1,1,KDIFF),XB1)
      CALL REPLCE(B1(1,2,KDIFF),XB2)
C     ICODE=5
C     WRITE(IOUT,1001)ICODE,KBAR,XR1,XR2,XB1,XB2
      IF(KCD.EQ.3)GO TO 40
      CALL ENDPT(XR1,XR2,XRC,XB1,XB2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
      IF(KTRIG.EQ.0)GO TO 70
      GO TO 45
   40 CALL REPLCE(XR2,XK)
   45 MODD=0
C     ICODE=6
C     WRITE(IOUT,1001)ICODE,KCD,XR2,XK
      DO 60 IQ=1,NQ
      CALL NR1(XR1,XK,XRC,XNPT,DIST,XN1,DN1)
      ZN10=XN1(3)
      XN1(3)=ZN10+ZS(IQ)
      DN1=AMAG(XRC,XN1)
      HDIFF=HEIGHT(XN1,XRC,XB1,XB2)
      IF(IQ.NE.1)GO TO 50
      IF(HDIFF.GT.20.)GO TO 70
   50 DELP=DEL(XN1,XRC,XB1,XB2,HDIFF,DN1)
      IF(DELP.GT.DELPO(IQ))GO TO 53
   52 IF(MODD.EQ.1)GO TO 65
      GO TO 70
   53 IF (IQ.NE.1) GO TO 59
      DR1 = AMAG(XRC,XR1)
      IF (ABS(DR1-DN1).LT.1.) GO TO 54
      HDIFA = HEIGHT (XR1,XRC,XB1,XB2)
      DELPA = DEL (XR1,XRC,XB1,XB2,HDIFA,DR1)
      DELM= (DELPA + DELP)/2.
C     ICODE=107
C     WRITE(IOUT,1000)ICODE,DELP,DELPA
      IF((ABS(DELPA-DELP)-0.1-DELM/50.*(1.+DELM)).LE.0.) GO TO 55
      CALL MIDP (XR1,XN1,XK)
C     ICODE=7
C     WRITE(IOUT,1000)ICODE,XR1,XN1,XK
      DELP = DELPA
   54 IF (IFPS(XK,XRC,XB1,XB2,DELP).EQ.0) GO TO 58
      CALL MIDP (XR1,XK,XK)
C     ICODE=8
C     WRITE(IOUT,1000)ICODE,XR1,XK
      GO TO 54
   55 DRK= AMAG (XRC,XK)
      IF (ABS(DRK-DN1).LT.1.) GO TO 58
   56 IF(IEPS (XK,XRC,XB1,XB2,DELP).EQ.0) GO TO 58
      CALL MIDP(XN1,XK,XK)
      GO TO 56
   58 IF (DELP.LE.DELPO(1)) GO TO 52
   59 DELPO (IQ) = DELP
C     ICODE=10
C     WRITE(IOUT,1000)ICODE,DELPO(1),DELPO(2)
      MODD=1
   60 CONTINUE
      IF(DELPO(2).LT.12.5)GO TO 65
      ITRIG=1
      IF(KCD.NE.3.OR.KCD.NE.2)GO TO 65
      CALL REPLCE(XR20,XR2)
      GO TO 66
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   65 CALL REPLCE(XK,XR2)
   66 IF(ITRIG.EQ.1)GO TO 71
   70 CONTINUE
C     ICODE=11
C     WRITE(IOUT,1000)ICODE,XR2
   71 ANG=ANGLE(XR1,XR2,XRC)
      DELP=DELPO(1)
      FB(1,1)=BARFAC(1,DELP)
C     ICODE=12
C     WRITE(IOUT,1002)ICODE,FB(1,1)
      CALL REPLCE(XR2,XR2D)
C GROUND ABSORPTION
   72 DO 73 KF=1,NF
      FG(KF)=1.
   73 CONTINUE
C     ICODE=13
C     WRITE(IOUT,1000)ICODE,XR1,XR2,XR2D
      IF(DELPO(1).GT.-0.2)GO TO 78
      IF(KGA.EQ.0)GO TO 78
      DO 77 IGRA=1,KGA
      LOC=KGCODE(IGRA)
      CALL REPLCE(TA1(1,1,IGRA),XG1)
      CALL REPLCE(TA1(1,2,IGRA),XG2)
      BG=BGT(IGRA)
      IKIND=IKIN(IGRA)
C     ICODE=14
C     WRITE(IOUT,1001)ICODE,LOC,XG1,XG2
      IF(LOC.EQ.3)GO TO 74
      CALL ENDPT(XR1,XR2,XRC,XG1,XG2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
      IF(KTRIG.EQ.0)GO TO 77
      GO TO 75
   74 CALL REPLCE(XR2,XK)
   75 CALL NR1(XR1,XK,XRC,XNPT,DIST,XN1,DN1)
      HDIFF=HEIGHT(XN1,XRC,XG1,XG2)
      IF(HDIFF.GT.HGA(IKIND))GO TO 77
      CALL SECTN(XR1,XK,XRC,XG1,XG2,XG3,XG4)
      DL=1.57/(1./BG+1./AMAG(XG3,XG4))
      DO 76 IK=1,NF
      PP=IK
      IF(IK.EQ.1)PP=5.
      IF(IKIND.EQ.1)A=(.0016*PP-0.0028)*DL
      IF(IKIND.EQ.2)A=2.**(PP/3.)/1310.*DL
      IF(A.GT.3.)A=3.
      FG(IK)=FG(IK)/10.**A
      IF(FG(IK).LT.1.E-3)FG(IK)=1.E-3
      CALL REPLCE(XK,XR2)
   76 CONTINUE
C     ICODE=15
C     WRITE(IOUT,1000)ICODE,FG(1),FG(9)
   77 CONTINUE
   78 CALL REPLCE(XR2,XR2G)
C PRELIMINARY SELECTION OF REFLECTORS
      NREF=0
      IF(NB.EQ.0)GO TO 91
      NREDF=0
      KBAR=0
      DO 85 IBAR=1,NB
      KAR=IBLAST(IBAR)
      XRB1(1)=BX(IBAR,1)
      XRB1(2)=BY(IBAR,1)
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      XRB1(3)=BZ(IBAR,1)
      NLIM=NBSM1(IBAR)+1
      DO 85 ISEG=2,NLIM
      XRB2(1)=BX(IBAR,ISEG)
      XRB2(2)=BY(IBAR,ISEG)
      XRB2(3)=BZ(IBAR,ISEG)
      KBAR=KBAR+1
C     ICODE=16
C     WRITE(IOUT,1001)ICODE,KBAR,XR1,XR2,XRB1,XRB2
      CALL IMAGE(XRB1,XRB2,XRC,XRCI)
      CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
C     ICODE=17
C     WRITE(IOUT,1000)ICODE,XRCI,XNPTI
      ANGIMG=ANGLE(XRB1,XRB2,XRCI)
      FCTR=(DIST*ANGIMG)/DISTI/ANG/FB(1,1)
      IF(FCTR.LT.0.1)GO TO 80
      NRFDF=NRFDF+1
      KRDNUM(NRFDF)=KBAR
      CALL REPLCE(XRB1,RB1(1,1,NRFDF))
      CALL REPLCE(XRB2,RB1(1,2,NRFDF))
C     ICODE=18
C     WRITE(IOUT,1001)ICODE,NRFDF,XRB1,XRB2
      IF(KAR.NE.IR)GO TO 80
      CALL DEGEN(XR1,XR2,XRCI,XRB1,XRB2,LOC)
      IF(LOC.NE.5) GO TO 79
      CALL RLOCN(XR1,XR2,XRCI,XRB1,XRB2,XK,LOC)
   79 IF(LOC.EQ.0)GO TO 80
      NREF=NREF+1
      KRNUMB(NREF)=KBAR
      CALL REPLCE(XRB1,R1(1,1,NREF))
      CALL REPLCE(XRB2,R1(1,2,NREF))
C     ICODE=19
C     WRITE(IOUT,1001)ICODE,NREF,XRB1,XRB2
   80 CALL REPLCE(XRB2,XRB1)
   85 CONTINUE
C BEGIN REFLECTOR PROBLEM
   91 IDXR=0
      IF(NREF.EQ.0)GO TO 180
      DO 175 KREF=1,NREF
      KBAR1=KRNUMB(KREF)
      CALL REPLCE(R1(1,1,KREF),XRB1)
      CALL REPLCE(R1(1,2,KREF),XRB2)
C     ICODE=20
C     WRITE(IOUT,1001)ICODE,KBAR1,XRB1,XRB2,XP1,XR2
      CALL IMAGE(XRB1,XRB2,XRC,XRCI)
      CALL ENDPT(XR1,XR2,XRCI,XRB1,XRB2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
C     ICODE=21
C     WRITE(IOUT,1001)ICODE,KTRIG,XRCI,XK
      IF(KTRIG.EQ.0)GO TO 175
      CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
      CALL NR1(XR1,XK,XRCI,XNPTI,DISTI,XN1I,DN1I)
C     ICODE=22
C     WRITE(IOUT,1000)ICODE,XNPTI,XN1I
      XN1I(3)=XN1I(3)+ZS(2)
      HDIFF=HEIGHT(XN1I,XRCI,XRB1,XRB2)
      IF(HDIFF.GT.-2.0)GO TO 175
      CALL REPLCE(XK,XR2)
      CALL SECTN(XR1,XR2,XRCI,XRB1,XRB2,XRB3,XRB4)
C     ICODE=23
C     WRITE(IOUT,1000)ICODE,XR1,XR2,XRB3,XRB4
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      MDIFF=0
      DO 95 IQ=1,NQ
      DELP1(IQ)=-0.2
      DELP2(IQ)=-0.2
   95 CONTINUE
C DIFFRACTION BEFORE REFLECTION
      IF(NRFDF.EQ.0)GO TO 115
      DO 110 KRFDF=1,NRFDF
      KBAR2=KRDNUM(KRFDF)
      CALL REPLCE(RB1(1,1,KRFDF),XDB1)
      CALL REPLCE(RB1(1,2,KRFDF),XDB2)
C     ICODE=24
C     WRITE(IOUT,1001)ICODE,KBAR2,XDB1,XDB2
      IF(KBAR2.EQ.KBAR1)GO TO 110
      CALL DEGEN(XRB3,XRB4,XRCI,XDB1,XDB2,LOC)
      IF(LOC.NE.5) GO TO 96
      CALL BLOCN(XRB3,XRB4,XRCI,XDB1,XDB2,XK,LOC)
   96 IF(LOC.NE.0)GO TO 110
      CALL ENDPT(XP1,XR2,XRCI,XDB1,XDB2,XK,KTRIG,IERR)
      IF(IERR.EQ.4) RETURN
C     ICODE=25
C     WRITE(IOUT,1001)ICODE,KTRIG,XK
      IF(KTRIG.EQ.0)GO TO 110
      CALL NR1(XR1,XK,XRCI,XNPTI,DISTI,XN1I,DN1I)
C     ICODE=26
C     WRITE(IOUT,1000)ICODE,XN1I
      ZN10=XN1I(3)
      XN1I(3)=ZN10+ZS(1)
      HDIFF=HEIGHT(XN1I,XRCI,XDB1,XDB2)
      IF(HDIFF.GT.20.0)GO TO 110
      CALL SECTN(XR1,XK,XRCI,XDB1,XDB2,XDB3,XDB4)
C     ICODE=27
C     WRITE(IOUT,1000)ICODE,XDB3,XDB4
      CALL NRPT(XDB3,XDB4,XRCI,XNPTJ,DISTJ)
      CALL NR1(XDB3,XDB4,XRCI,XNPTJ,DISTJ,XN2,DN2)
C     ICODE=127
C     WRITE(IOUT,1000)ICODE,XNPTJ,XN2,DISTJ,DN2
      HDIFF=HEIGHT(XN2,XRCI,XRB1,XRB2)
C     ICODE=227
C     WRITE(IOUT,1002)ICODE,HDIFF
      IF(HDIFF.GT.-2.0)GO TO 170
      DO 105 II=1,NQ
      IQ=NQ+1-II
      XN1I(3)=ZN10+ZS(IQ)
      DN1I=AMAG(XRCI,XN1I)
      HDIFF=HEIGHT(XN1I,XRCI,XDB1,XDB2)
      DELP=DEL(XN1I,XRCI,XDB1,XDB2,HDIFF,DN1I)
C     ICODE=327
C     WRITE(IOUT,1002)ICODE,DELP
      IF(DELP.GE.12.5.AND.IQ.EQ.2)GO TO 170
      IF(DELP.GT.DELP1(IQ))GO TO 100
      IF(IQ.EQ.1)GO TO 110
      GO TO 105
  100 MDIFF=1
      DELP1(IQ)=DELP
  105 CONTINUE
C     ICODE=28
C     WRITE(IOUT,1000)ICODE,DELP1(1),DELP1(2)
      CALL REPLCE(XK,XR2)
  110 CONTINUE
C     ICODE=29
```

```
C     WRITE(IOUT,1000)ICODE,XR2
C DIFFRACTION AFTER REFLECTION
      CALL IMAGE(XRB1,XRB2,XNPTI,XNPTJ)
      CALL IMAGE(XRB1,XRB2,XR1,XR1I)
  115 CALL IMAGE(XRB1,XRB2,XR2,XR2I)
C     ICODE=30
C     WRITE(IOUT,1000)ICODE,XR1I,XR2I,XNPTI
      IF(NRFDF.EQ.0)GO TO 145
      DO 140 KRFDF=1,NRFDF
      KBAR2=KRDNUM(KRFDF)
      CALL REPLCE(RB1(1,1,KRFDF),XDB1)
      CALL REPLCE(RB1(1,2,KRFDF),XDB2)
C     ICODE=31
C     WRITE(IOUT,1001)ICODE,KBAR2,XDB1,XDB2
      IF(KBAR2.EQ.KBAR1)GO TO 140
      CALL INTCPT(XRB1,XRB2,XRC,XR2I,XRB4)
      CALL DEGEN(XRB3,XRB4,XRC,XDB1,XDB2,LOC)
      IF(LOC.NE.5) GO TO 117
      CALL BLOCN(XRB3,XRB4,XRC,XDB1,XDB2,XJ,LOC)
  117 IF(LOC.EQ.0)GO TO 140
      IF(LOC.EQ.3)GO TO 120
      CALL INTCPT(XR1I,XR2I,XRC,XJ,XKI)
      XKI(3)=ZCOR(XR1I,XR2I,XKI)
      DELTA=-0.5
      CALL MOVE(XKI,XKI,XR1I,DELTA,IERR)
      IF(IERR.EQ.4) RETURN
      IF(LOC.NE.1)GO TO 135
      GO TO 125
  120 CALL REPLCE(XR2I,XKI)
  125 CALL INTCPT(XR1I,XRC,XDB1,XDB2,XDB3)
C     ICODE=32
C     WRITE(IOUT,1001)ICODE,LOC,XJ,XKI,XDB3
      XDB3(3)=ZCOR(XDB1,XDB2,XDB3)
      HDIFF=HEIGHT(XR1I,XDB3,XRB1,XRB2)
      IF(HDIFF.GT.-2.0)GO TO 165
      CALL NR1(XR1I,XKI,XRC,XNPTJ,DISTI,XN1I,DN1I)
      ZN10=XN1I(3)
      DO 130 II=1,NQ
      IQ=NQ+1-II
      XN1I(3)=ZN10+ZS(IQ)
      DN1I=AMAG(XRC,XN1I)
      HDIFF=HEIGHT(XN1I,XRC,XDB1,XDB2)
      IF(HDIFF.GT.20.0.AND.IQ.EQ.2)GO TO 140
      DELP=DEL(XN1I,XRC,XDB1,XDB2,HDIFF,DN1I)
      IF(HDIFF.EQ.1.AND.DELP.GT.-0.2)GO TO 165
      IF(DELP.LE.DELP2(IQ))GO TO 140
      DELP2(IQ)=DELP
  130 CONTINUE
C     ICODE=33
C     WRITE(IOUT,1000)ICODE,DELP2(1),DELP2(2)
      IF(DELP2(2).GE.12.5)GO TO 165
  135 CALL REPLCE(XKI,XR2I)
  140 CONTINUE
  145 CALL REPLCE(XR2I,XKI)
      IDXR=IDXR+1
C     ICODE=34
C     WRITE(IOUT,1001)ICODE,IDXR,XR2I
      IF(IDXR.LT.11)GO TO 150
      IERR=3
      RETURN
  150 DO 155 IQ=1,NQ
```

```
      DELR(IQ,IDXR)=AMAX1(DELP1(IQ),DELP2(IQ))
  155 CONTINUE
      DO 160 I=1,3
      XIMG(I,IDXR)=XRCI(I)
  160 CONTINUE
      GO TO 165
  165 CALL IMAGE(XRB1,XRB2,XKI,XK)
  170 CALL REPLCE(XK,XR2)
C     ICODE=35
C     WRITE(IOUT,1000)ICODE,XR2
  175 CONTINUE
C     ICODE=36
C     WRITE(IOUT,1000)ICODE,XR1,XR2
C BEGIN BARRIER FACTOR COMPUTATION
  180 NIMG=IDXR
      ANG=ANGLE(XR1,XR2,XRC)
      ADST=ANG/DIST
      IF(KPOS(XNPT,XR2,XR1),EQ,1)GO TO 190
      ANG2=ANG1-ANG
      GO TO 195
  190 ANG2=ANG1+ANG
C CONTRIBUTION FROM DIRECT RAY
  195 DO 205 IQ=1,NQ
      IF(NQS(MR,IQ),EQ,0)GO TO 205
      DELP=DELPO(IQ)
      DO 200 KF=1,NF
      FB(KF,IQ)=BARFAC(KF,DELP)
  200 CONTINUE
C     ICODE=37
C     WRITE(IOUT,1002)ICODE,FB(1,IQ),FB(9,IQ)
  205 CONTINUE
C CONTRIBUTION FROM REFLECTIONS
      IF(NIMG,EQ,0)GO TO 230
      DO 225 KIMG=1,NIMG
      DO 210 I=1,3
      XRCI(I)=XIMG(I,KIMG)
  210 CONTINUE
      ANGI=ANGLE(XR1,XR2,XRCI)
      CALL NRPT(XR1,XR2,XRCI,XNPTI,DISTI)
      RATIO=(ANGI/DISTI)/ADST
      DO 220 IQ=1,NQ
      IF(NQS(MR,IQ),EQ,0)GO TO 220
      DELP=DELR(IQ,KIMG)
      DO 215 KF=1,NF
      FB(KF,IQ)=FB(KF,IQ)+BARFAC(KF,DELP)*RATIO
  215 CONTINUE
  220 CONTINUE
C     ICODE=38
C     WRITE(IOUT,1002)ICODE,FB(1,1),FB(1,2),FB(9,1),FB(9,2)
  225 CONTINUE
C COMPUTE MEAN ENERGY LEVEL
  230 CALL NR1(XR1,XR2,XRC,XNPT,DIST,XN1,DN1)
      TT1=2,0*ANG1
      TT2=2,0*ANG2
      TEM2=ABS((SIN(TT2)+TT2-SIN(TT1)-TT1)/4,/DIST**3)
      T3=0,0
      DO 242 IF=1,NF
      IP=IF
      IF(IF,EQ,1) IP=5
C
C     A=10,**(-1,E-8*4,**IP*DN1)
```

```
C
      A=10.**(-DN1*5.4E-5*2.35**(IP-5))
      T1=0.0
      DO 240 IQ=1,NQ
      IF(NQS(MR,IQ).EQ.0) GO TO 240
      NQQ=NQS(MR,IQ)
      T2=0.0
      T4=0.0
      DO 235 I=1,NQQ
      INDEX=MR+10*(I-1)+10*5*(IF-1)+10*5*9*(IQ-1)
      T2=T2+VEXPH(MR,I,IQ)*XLREF(INDEX)
      IF(IF.EQ.1) T4=T4+VEXPH(MR,I,IQ)*XLREF(INDEX)**2
  235 CONTINUE
      T1=T1+FB(IF,IQ)*FG(IF)*CQ(IQ)*T2
      IF(IF.EQ.1) T3=T3+FB(IF,IQ)**2*FG(IF)**2*CQ(IQ)**4*T4
  240 CONTINUE
      XLE(IF)=XLE(IF)+ADST*T1*A
      IF(IF.EQ.1) CAP2=CAP2+TEM2*T3*A**2
  242 CONTINUE
C     ICODE=39
C     WRITE(IOUT,1002) ICODE,XLE(1),XLE(9),CAP2
      ANG1=ABS(ANG2)
C     ICODE=40
C     WRITE(IOUT,1000) ICODE,XR2,XR2G,XR2D,XR20
      IF(DSQR(XR2,XR20).LT.1.0) RETURN
      DELTA=1.0
      CALL MOVE(XR2,XR1,XR10,DELTA,IERR)
      IF(IERR.EQ.4) RETURN
C     ICODE=41
C     WRITE(IOUT,1000) ICODE,XR1
      IF(DSQR(XR2,XR2G).LT.1.0) GO TO 247
      CALL REPLCE(XR2G,XR2)
      GO TO 91
  247 IF(DSQR(XR2,XR2D).LT.1.0) GO TO 25
      CALL REPLCE(XR2D,XR2)
      GO TO 72
  999 FORMAT(6H CODE=I3)
 1000 FORMAT(6H CODE=I3,6F9.2/7F9.2)
 1001 FORMAT(6H CODE=I3,I4,6F9.2/6F9.2)
 1002 FORMAT(6H CODE=I3,6E13.4)
      END
```

SAMPLE PROBLEM RESULTS FROM UPDATED VERSION OF PROGRAM

TRAFFIC NOISE PREDICTION

```
SAMPLE PROBLEM 1
PROGRAM INITIALIZATION PARAMETERS
 0.50000E+01          1      RECEIVER HEIGHT ADJUSTMENT
 0.90000E+01          2      NUMBER OF FREQUENCY BANDS
 0.25000E+01          3      STANDARD DEVIATION FOR CARS
 0.00000E+00          4      SOURCE HEIGHT FOR CARS
 0.35000E+01          5      STANDARD DEVIATION FOR TRUCKS
 0.80000E+01          6      SOURCE HEIGHT FOR TRUCKS
 0.35000E+01          7      STANDARD DEVIATION FOR NEW VEHICLES
 0.00000E+00          8      SOURCE HEIGHT FOR NEW VEHICLES
    OPTIONAL NOISE SPECTRUM
      77.0   82.0   62.0   68.0   72.0   72.0   70.0   64.0   50.0
ROADWAY    1
NUMBER OF              VEH/H          MPH
TYPE 1 VEH
   1                   0.1350E+04     0.5000E+02
NUMBER OF              VEH/H          MPH
TYPE 2 VEH
   1                   0.7500E+02     0.5000E+02
                      SOURCE COORD IN FT
NUMBER      X             Y              Z
   1      0.0000E+00    0.6000E+01     0.0000E+00
   2      0.1000E+05    0.6000E+01     0.0000E+00
ROADWAY    2
NUMBER OF              VEH/H          MPH
TYPE 1 VEH
   1                   0.1250E+04     0.5000E+02
NUMBER OF              VEH/H          MPH
TYPE 2 VEH
   1                   0.5000E+02     0.5000E+02
                      SOURCE COORD IN FT
NUMBER      X             Y              Z
   1     -0.1000E+05    0.6000E+01     0.0000E+00
   2      0.0000E+00    0.6000E+01     0.0000E+00
ROADWAY    3
NUMBER OF              VEH/H          MPH
TYPE 1 VEH
   1                   0.1000E+03     0.4500E+02
NUMBER OF              VEH/H          MPH
TYPE 2 VEH
   1                   0.2500E+02     0.4500E+02
                      SOURCE COORD IN FT
NUMBER      X             Y              Z
   1     -0.1000E+05    0.5000E+04     0.0000E+00
   2      0.0000E+00    0.6000E+01     0.0000E+00
ROADWAY    4
NUMBER OF              VEH/H          MPH
TYPE 1 VEH
   1                   0.5000E+03     0.6000E+02
NUMBER OF              VEH/H          MPH
TYPE 2 VEH
   1                   0.5000E+02     0.6000E+02
                      SOURCE COORD IN FT
NUMBER      X             Y              Z
   1     -0.1000E+05   -0.6000E+01     0.0000E+00
   2      0.1000E+05   -0.6000E+01     0.0000E+00
BARRIER    1  (R)          BARRIER COORD IN FT
NUMBER      X             Y              Z
```

```
   1     -0.1000E+03   -0.2070E+02    0.2000E+02
   2      0.2000E+03   -0.2070E+02    0.2000E+02
BARRIER     2  (A)          BARRIER COORD IN FT
NUMBER      X               Y              Z
   1      0.1700E+03    0.2070E+02    0.6000E+01
   2      0.1000E+05    0.2070E+02    0.6000E+01
ABSORBING STRIP     1  (T)

PT          X               Y              Z              WIDTH
   1      0.0000E+00    0.5070E+02    0.0000E+00    0.5000E+02
   2     -0.2000E+03    0.1570E+03    0.0000E+00
RECEIVER                RECEIVER COORD IN FT
NUMBER      X               Y              Z
   1      0.0000E+00    0.1070E+03    0.5000E+01
   2      0.5000E+02    0.1070E+03    0.5000E+01
   3      0.1000E+03    0.1070E+03    0.5000E+01
   4      0.1500E+03    0.1070E+03    0.5000E+01
   5      0.2000E+03    0.1070E+03    0.5000E+01


SAMPLE PROBLEM 1
RECEIVER              XRC            YRC            ZRC
     1                0.0          100.0            5.0

                              OCTAVE BAND LEVELS (A)
              63      125      250      500     1000     2000     4000     8000
            49.1    61.2     66.0     71.0     70.5     68.2     61.9     53.1

          LE(A)      LNP      L90      L50      L10
            75.5     91.4     63.2     71.1     79.1


RECEIVER              XRC            YRC            ZRC
     2                50.0         100.0            5.0

                              OCTAVE BAND LEVELS (A)
              63      125      250      500     1000     2000     4000     8000
            48.7    60.8     65.6     70.6     70.2     67.9     61.6     52.8

          LE(A)      LNP      L90      L50      L10
            75.1     91.5     62.3     72.5     78.6


RECEIVER              XRC            YRC            ZRC
     3               100.0         100.0            5.0

                              OCTAVE BAND LEVELS (A)
              63      125      250      500     1000     2000     4000     8000
            47.9    60.1     64.9     70.0     69.7     67.4     61.4     52.6

          LE(A)      LNP      L90      L50      L10
            74.5     90.7     61.7     69.9     78.0


RECEIVER              XRC            YRC            ZRC
     4               150.0         100.0            5.0

                              OCTAVE BAND LEVELS (A)
              63      125      250      500     1000     2000     4000     8000
            46.8    59.0     63.9     69.0     68.9     66.6     60.8     51.8
```

LE(A)	LNP	L90	L50	L10
73.5	88.8	61.4	69.3	77.?

RECEIVER	XRC	YRC	ZRC
5	200.?	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	50?	1000	2000	4000	8000
45.9	58.1	43.1	68.2	68.2	65.9	60.3	51.1

LE(A)	LNP	L90	L50	L10
72.6	87.4	61.3	68.7	76.1

TRAFFIC NOISE PREDICTION

```
SAMPLE PROBLEM 2
ROADWAY     1
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.1350E+?4     0.5000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         0.7500E+?2     0.5000E+02
                             SOURCE COORD IN FT
NUMBER       X                 Y              Z
   1      0.0000E+00         ?.6070E+?1     0.0000E+00
   2      0.1200E+05         ?.6020E+?1     0.0000E+00
ROADWAY     2
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         0.1250E+?4     0.5000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.5070E+?2     0.5000E+02
                             SOURCE COORD IN FT
NUMBER       X                 Y              Z
   1     -0.1200E+05         ?.6070E+?1     0.0000E+00
   2      0.0000E+00         ?.6070E+?1     0.0000E+00
ROADWAY     3
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.1070E+?3     0.4500E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.2570E+?2     0.4500E+02
                             SOURCE COORD IN FT
NUMBER       X                 Y              Z
   1     -0.1200E+05         ?.5070E+?4     0.0000E+00
   2      0.0000E+00         ?.6070E+?1     0.0000E+00
ROADWAY     4
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.5070E+?3     0.6000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.5070E+?2     0.6000E+02
                             SOURCE COORD IN FT
NUMBER       X                 Y              Z
   1     -0.1200E+05        -?.6070E+?1     0.0000E+00
   2      0.1200E+05        -?.6070E+?1     0.0000E+00
BARRIER     1  (A)                 BARRIER COORD IN FT
NUMBER       X                 Y              Z
   1      0.1200E+03         ?.2070E+?2     0.6000E+01
   2      0.1200E+05         ?.2070E+?2     0.6000E+01
ABSORBING STRIP     1  (T)

PT           X                 Y              Z              WIDTH
   1      0.0000E+00         ?.5070E+?2     0.0000E+00     0.5000E+02
   2     -0.2000E+03         ?.1570E+?3     0.0000E+00
RECEIVER                     RECEIVER COORD IN FT
NUMBER       X                 Y              Z
   1      0.0000E+00         ?.1070E+?3     0.5000E+01
   2      0.5000E+02         ?.1070E+?3     0.5000E+01
```

3	0.1000E+03	0.1000E+03	0.5000E+01
4	0.1500E+03	0.1000E+03	0.5000E+01
5	0.2000E+03	0.1000E+03	0.5000E+01

SAMPLE PROBLEM 2

RECEIVER	XRC	YRC	ZRC
1	0.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
47.6	59.7	44.5	69.5	69.0	66.7	60.5	51.8

LE(A)	LNP	L90	L50	L10
74.2	89.5	62.1	69.8	77.6

RECEIVER	XRC	YRC	ZRC
2	50.3	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
47.1	59.2	44.0	69.2	68.6	66.3	60.2	51.3

LE(A)	LNP	L90	L50	L10
73.5	89.5	61.2	69.0	77.0

RECEIVER	XRC	YRC	ZRC
3	100.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
46.3	58.5	43.4	68.4	68.2	66.0	60.1	51.1

LE(A)	LNP	L90	L50	L10
72.9	88.7	60.6	68.5	76.4

RECEIVER	XRC	YRC	ZRC
4	150.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
45.4	57.6	42.5	67.7	67.7	65.5	59.8	50.7

LE(A)	LNP	L90	L50	L10
72.1	87.3	60.5	68.1	75.6

RECEIVER	XRC	YRC	ZRC
5	200.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
44.7	56.9	41.9	67.2	67.3	65.1	59.6	50.4

LE(A)	LNP	L90	L50	L10
71.5	86.5	60.1	67.6	75.1

TRAFFIC NOISE PREDICTION

```
SAMPLE PROBLEM 3
ROADWAY     1
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.13?0E+?4     0.5000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.75?0E+?2     0.5000E+02
                             SOURCE COORD IN FT
NUMBER       X                  Y              Z
   1      0.0000E+00         ?.60?0E+?1     0.0000E+0?
   2      0.1?00E+05         ?.60?0E+?1     0.0000E+0?
ROADWAY     2
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.12?0E+?4     0.5000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.50?0E+?2     0.5000E+02
                             SOURCE COORD IN FT
NUMBER       X                  Y              Z
   1     -0.1?00E+05         ?.60?0E+?1     0.0000E+0?
   2      0.0000E+03         ?.60?0E+?1     0.0000E+0?
ROADWAY     3
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.10?0E+?3     0.4500E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.25?0E+?2     0.4500E+02
                             SOURCE COORD IN FT
NUMBER       X                  Y              Z
   1     -0.1?00E+05         ?.50?0E+?4     0.0?00E+0?
   2      0.0000E+00         ?.60?0E+?1     0.0000E+0?
ROADWAY     4
NUMBER OF                    VEH/H          MPH
TYPE 1 VEH
   1                         ?.50?0E+?3     0.6000E+02
NUMBER OF                    VEH/H          MPH
TYPE 2 VEH
   1                         ?.50?0E+?2     0.6?00E+02
                             SOURCE COORD IN FT
NUMBER       X                  Y              Z
   1     -0.1?00E+05        -?.60?0E+?1     0.0000E+0?
   2      0.1?00E+05        -?.60?0E+?1     0.0000E+0?
BARRIER     1  (A)                BARRIER COORD IN FT
NUMBER       X                  Y              Z
   1      0.1?00E+03         ?.20?0E+?2     0.6?00E+01
   2      0.1?00E+05         ?.20?0E+?2     0.6000E+01
RECEIVER                     RECEIVER COORD IN FT
NUMBER       X                  Y              Z
   1.     0.0000E+00         ?.10?0E+?3     0.5000E+01
   2      0.5000E+02         ?.10?0E+?3     0.5000E+01
   3      0.1000E+03         ?.10?0E+?3     0.5000E+01
   4      0.1500E+03         ?.10?0E+?3     0.5000E+01
   5      0.2000E+03         ?.10?0E+?3     0.5000E+01


SAMPLE PROBLEM 3
```

RECEIVER	XRC	YRC	ZRC
1	0.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
47.8	60.0	64.9	69.9	69.6	67.3	61.2	52.7

LE(A)	LNP	L90	L50	L10
74.5	92.0	62.4	72.2	79.0

RECEIVER	XRC	YRC	ZRC
2	50.2	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
47.3	59.5	64.4	69.4	69.1	66.9	60.9	52.2

LE(A)	LNP	L90	L50	L10
73.9	89.5	61.9	69.7	77.5

RECEIVER	XRC	YRC	ZRC
3	100.2	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
46.5	58.7	63.6	68.7	68.6	66.4	60.5	51.7

LE(A)	LNP	L90	L50	L10
73.2	88.6	61.3	69.0	76.7

RECEIVER	XRC	YRC	ZRC
4	150.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
45.5	57.7	62.7	67.9	68.0	65.8	60.2	51.1

LE(A)	LNP	L90	L50	L10
72.3	87.2	61.2	68.5	75.9

RECEIVER	XRC	YRC	ZRC
5	200.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
44.8	57.1	62.1	67.3	67.5	65.4	59.9	50.7

LE(A)	LNP	L90	L50	L10
71.7	86.4	62.4	67.9	75.3

TRAFFIC NOISE PREDICTION

SAMPLE PROBLEM 4
ROADWAY 1

NUMBER OF TYPE 1 VEH	VEH/H	MPH
1	0.1350E+04	0.5000E+02
NUMBER OF TYPE 3 VEH	VEH/H	MPH
1	0.7500E+02	0.5000E+02

NUMBER	X	SOURCE COORD IN FT Y	Z
1	0.0000E+00	0.6000E+01	0.0000E+00
2	0.1000E+05	0.6000E+01	0.0000E+00

ROADWAY 2

NUMBER OF TYPE 1 VEH	VEH/H	MPH
1	0.1250E+04	0.5000E+02
NUMBER OF TYPE 3 VEH	VEH/H	MPH
1	0.5000E+02	0.5000E+02

NUMBER	X	SOURCE COORD IN FT Y	Z
1	-0.1000E+05	0.6000E+01	0.0000E+00
2	0.0000E+00	0.6000E+01	0.0000E+00

ROADWAY 3

NUMBER OF TYPE 1 VEH	VEH/H	MPH
1	0.1000E+03	0.4500E+02
NUMBER OF TYPE 3 VEH	VEH/H	MPH
1	0.2500E+02	0.4500E+02

NUMBER	X	SOURCE COORD IN FT Y	Z
1	-0.1000E+05	0.5000E+04	0.0000E+00
2	0.0000E+00	0.6000E+01	0.0000E+00

ROADWAY 4

NUMBER OF TYPE 1 VEH	VEH/H	MPH
1	0.5000E+03	0.6000E+02
NUMBER OF TYPE 3 VEH	VEH/H	MPH
1	0.5000E+02	0.6000E+02

NUMBER	X	SOURCE COORD IN FT Y	Z
1	-0.1000E+05	-0.6000E+01	0.0000E+00
2	0.1000E+05	-0.6000E+01	0.0000E+00

BARRIER 1 (A)

NUMBER	X	BARRIER COORD IN FT Y	Z
1	0.1000E+03	0.2000E+02	0.6000E+01
2	0.1300E+05	0.2000E+02	0.6000E+01

RECEIVER NUMBER	X	RECEIVER COORD IN FT Y	Z
1	0.0000E+00	0.1000E+03	0.5000E+01
2	0.5000E+02	0.1000E+03	0.5000E+01
3	0.1000E+03	0.1000E+03	0.5000E+01
4	0.1500E+03	0.1000E+03	0.5000E+01
5	0.2000E+03	0.1000E+03	0.5000E+01

SAMPLE PROBLEM 4

RECEIVER	XRC	YRC	ZRC
1	0.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
43.6	52.4	57.3	61.9	64.2	63.6	55.8	47.6

LE(A)	LNP	L90	L50	L10
68.9	78.3	62.5	67.3	72.0

RECEIVER	XRC	YRC	ZRC
2	50.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
43.0	51.9	56.7	61.2	63.5	62.9	55.1	46.9

LE(A)	LNP	L90	L50	L10
68.2	77.9	61.7	66.6	71.4

RECEIVER	XRC	YRC	ZRC
3	100.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
42.1	50.9	55.6	60.2	62.3	61.6	53.7	45.4

LE(A)	LNP	L90	L50	L10
67.7	76.8	60.4	65.3	70.2

RECEIVER	XRC	YRC	ZRC
4	150.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
41.0	49.6	54.1	58.4	60.5	59.7	51.6	43.1

LE(A)	LNP	L90	L50	L10
65.4	74.3	59.6	64.0	68.5

RECEIVER	XRC	YRC	ZRC
5	200.0	100.0	5.0

OCTAVE BAND LEVELS (A)

63	125	250	500	1000	2000	4000	8000
40.2	48.7	53.0	57.1	59.0	58.0	49.6	40.6

LE(A)	LNP	L90	L50	L10
64.1	71.6	59.4	63.1	66.9