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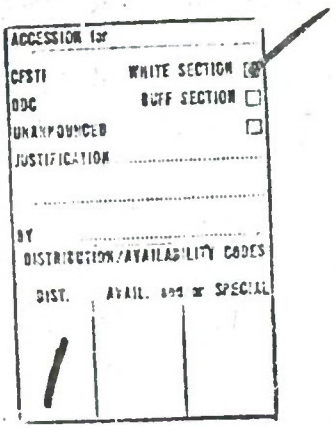
TECHNICAL REPORT 4070

AN IMPROVED COMPUTER PROGRAM TO CALCULATE THE AVERAGE BLAST IMPULSE LOADS ACTING ON A WALL OF A CUBICLE

STUART LEVY

MAY 1970

PICATINNY ARSENAL
DOVER, NEW JERSEY



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TECHNICAL REPORT 4070

AN IMPROVED COMPUTER PROGRAM TO CALCULATE THE AVERAGE BLAST IMPULSE LOADS ACTING ON A WALL OF A CUBICLE

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MAY 1970

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PICATINNY ARSENAL
DOVER, NEW JERSEY

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ACKNOWLEDGMENT

This report and computer program were prepared with the advice of Richard Rindner of the Process Engineering Laboratory, Picatinny Arsenal and Norval Dobbs of Ammann and Whitney, Consulting Engineers, New York, who originally developed the program under a project funded by the Armed Forces Explosive Safety Board.

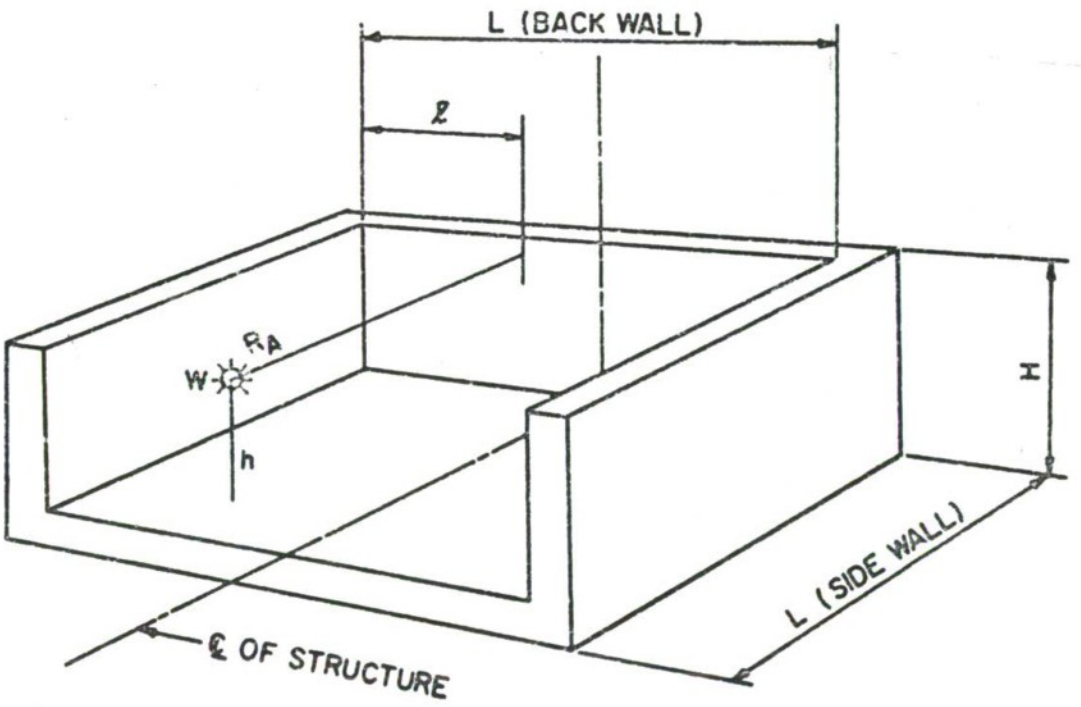


FIGURE 1

CUBICLE PARAMETERS

SUMMARY

An improved computer program was devised to calculate the average blast impulse loads acting on a wall of a cubicle when an explosive charge is detonated within the cubicle. It was formulated by the AED's Process Engineering Laboratory in connection with the Safety Design Criteria Program.

PROGRAM DESCRIPTION

The original computer program was to calculate data points for the construction of impulse charts in regulatory Department of Defense publication Technical Manual 5-1300, "Structures to Prevent the Effects of Accidental Explosion." This original program was prepared by Ammann & Whitney, a consulting engineering firm in New York City, dated June 1969, under contract to Picatinny Arsenal.

The input to the program was simplified. Instead of a possible five data cards per problem only two data cards were required. Two subroutines were added to calculate geometrical ratios and to specify the grid system needed in the problem solution. The output was modified to echo the input and give a clear print-out of the reflected impulse on each wall and the total impulse acting on the wall in question. This program is suitable for use by an engineer with little or no computer background.

The program can be used as a supplement to TM 5-1300. It eliminates the necessity of interpolation or extrapolation from the impulse charts in the manual and can save many hours of tedious hand calculations by completing multiple impulse calculations in a few minutes.

Step-by-step procedures are given for specifying the computer input. Sample input sheets, problem solutions by computer and impulse charts of TM 5-1300 are in Appendix A.

The program prints the solution of each problem on a separate page. The output consists of the title, input data, and the calculated impulse for each reflecting surface and total impulse load.

The computer program is written in Fortran IV and has been run on an IBM 360, Model 65. A copy of the Fortran coding and required input data is in Appendix B.

Limitation

Because of the limitations of the test data used to develop this computer program, extrapolation beyond this range may give inaccurate results. However, to overcome this, the restrictions of the geometrical ratios mentioned on Pages 4-12 of TM 5-1300 are incorporated in the computed program.

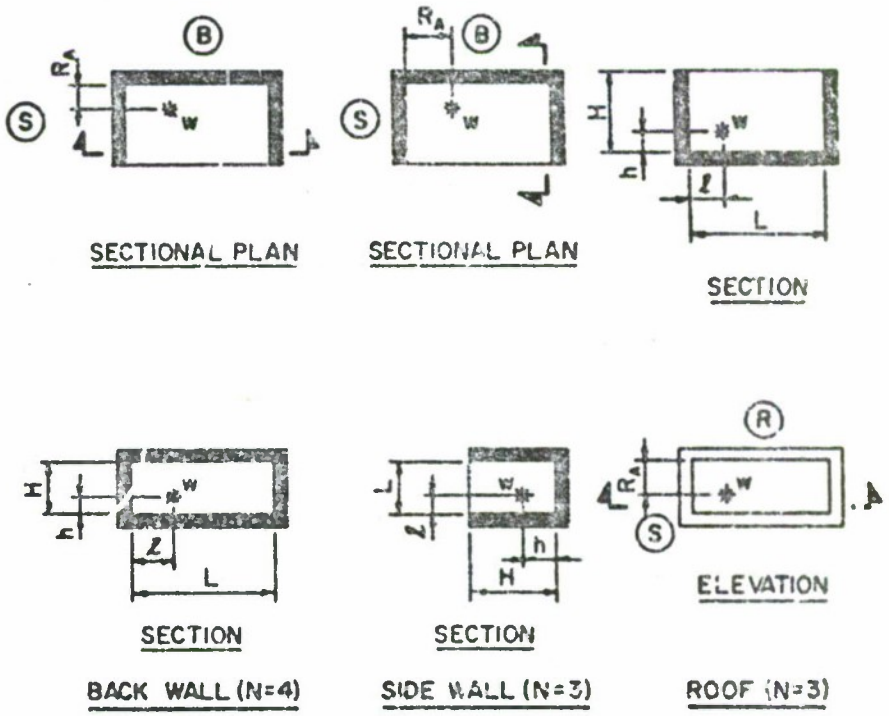


FIGURE 2

THREE WALL CUBICLE WITH ROOF

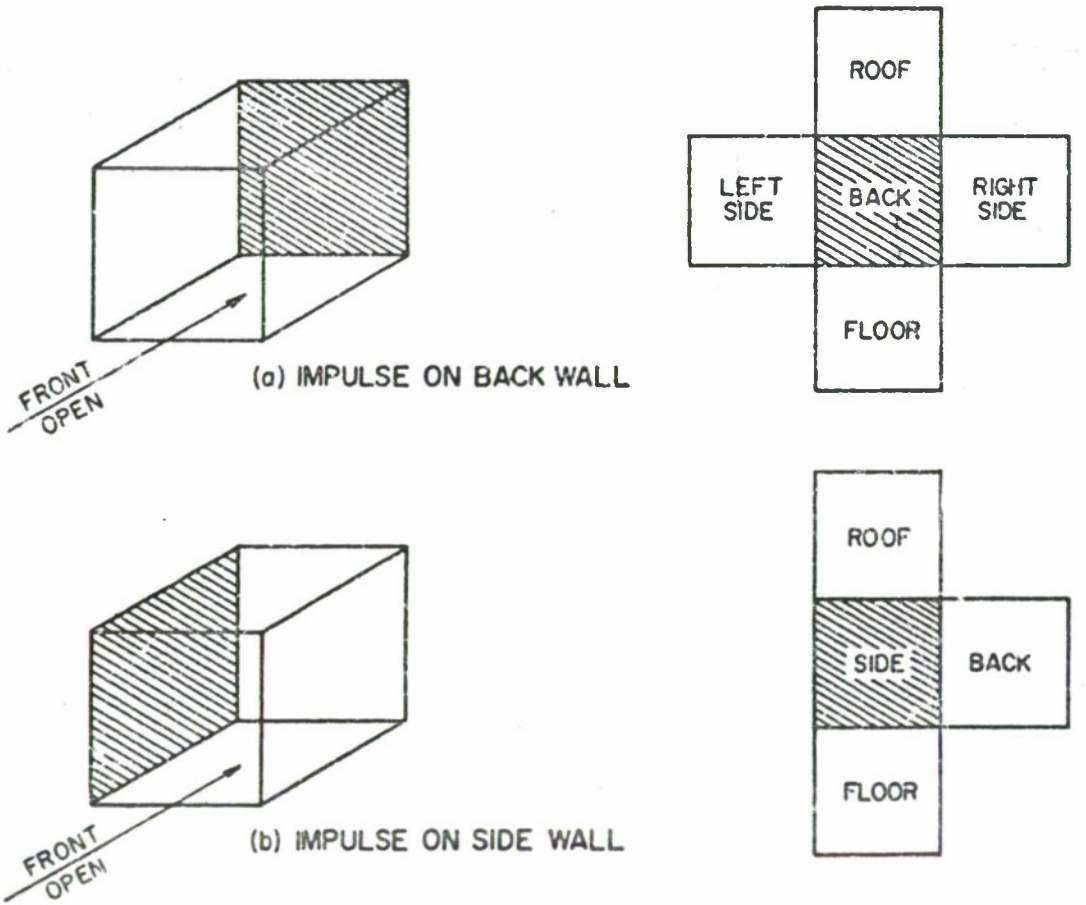


FIGURE 3

REFLECTING SURFACES - 3 WALL CUBICLE WITH ROOF

TABLE 1

INPUT DEFINITIONS AND FIELD SPECIFICATIONS

	Column	Symbol	Description
Card No. 1	1-68		Problem title
Card No. 2	1-10	RA	Distance from center of charge to wall in question (ft.) (Decimal point required.)
Card No. 2	11-20	W	Explosive charge weight (lbs.) (Decimal point required.)
Card No. 2	21-30	H	Height of the wall in question (ft.) (Decimal point required.)
Card No. 2	31-40	L	Length of loaded wall (ft.) (Decimal point required.)
Card No. 2	41-50	h	Height of charge above floor (ft.) (Decimal point required.)
Card No. 2	51-60	l	Minimum distance between the charge to and an adjacent wall (ft.) (Decimal point required.)
Card No. 2	61-70		Leave blank
Card No. 2	71		FLOOR - Insert 1 if present
	72		ROOF - Insert 1 if present
	73		LEFT SIDE - Insert 1 if present
	74		RIGHT SIDE- Insert 1 if present

STEP-BY-STEP PROCEDURE FOR PROGRAM INPUT

To utilize the program, it is necessary to fill out the information required by the two data cards on the input form (Figure 4). The data should be key-punched and inserted in its proper place in the input deck. It should be noted that the required input data in Appendix B must precede this data.

The input parameters are given by the input sheet (Figure 4) and are defined in meaning and card column position in Table 1 and illustrated in Figures 1-3.

TABLE 2

COMPARISON OF COMPUTER RESULTS WITH MANUAL CALCULATIONS

Impulse - PSI - MS

Problem	Manual	Computer	Difference	% Difference
A5	1000	958	42	4.2
A6	8500	8651	151	1.78
A8	117	112	5	4.24

As indicated in Table 2, the difference between the manual and computer calculations is only a few percent. This difference may be accounted for by the smoothing of the impulse curves contained in the manual. The computers results should be more accurate than the manual charts since the calculation are direct and numerical interpolation is used instead of visual.

Appendix A shows the details of the manual and computer calculations.

CARD NO. 1

PROBLEM IDENTIFICATION (TITLE CARD)	
1	60

CARD NO. 2

1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 72 73 74			
							REFLECTION CODE			
DIST. OF CHARGE FROM WALL	CHARGE WEIGHT	WALL HEIGHT	WALL LENGTH	HEIGHT OF CHARGE ABOVE FLOOR	MIN. DIST. OF CHARGE TO ADJ. WALL		FLOOR	ROOF	LEFT SIDE	RIGHT SIDE
R_A Ft.	W Lbs.	H Ft.	L Ft.	h Ft.	ℓ Ft.					

FIGURE 4

INPUT SHEET

Filling Out the Input Form

These procedures should be followed in filling out the input form.

1. Fill in Title or Problem Identification Card.

2. Sketch the structure and charge location as shown in Figure 1 and 2.

3. Enter RA, W, H, L. h, 1. (Units are in feet and ibs; a decimal point must be supplied after each number.)

4. Enter a "1" or "zero" (no decimal point) in the appropriate column of the reflection code of the input sheet. If the reflection surface (floor, roof, left side wall or right side wall) is present enter a 1, otherwise indicate the absence of the surface by a zero. Sketching the cubicle and unfolding the view (Figure 3) will help determine the reflecting surface. Detailed instructions follow.

Specifying Reflection Code

In performing its calculations, the program considers the effect of reflection of the original blast impulse from surfaces at right angles and in contact with the wall whose impulse load is being computed. Figure 3 illustrates a method for determining the reflecting surfaces of a three-wall cubicle with roof. Figure 3(a) shows how to specify the reflection code on the input sheet (Figure 4) when it is desired to calculate the impulse load on the back wall. By unfolding the walls of the cubicle, keeping the back wall in the center, it is noted that there are four reflecting surfaces at right angles and in contact with the back wall: the floor, roof and two side walls. There the presence of these reflecting surfaces are indicated on the input sheet by putting a 1 in each of the columns labeled Floor, Roof, Left Side, Right Side. The reflection code of Figure 4 would be 1111. Sample Problem A6 (Appendix A) has the same configuration of Figure 4 except that it lacks a roof; its reflection code is 1011.

Sometimes the wall in question is not the back wall. In order to use the input form, the cubicle should be rotated so that the wall occupies the same position as the back wall. The solution will be the same as a back wall problem.

In Sample Problem A8, (Appendix A) it is required to calculate the impulse load on the roof of a cubicle. The cubicle is rotated 90° so that the roof becomes the back wall, the floor the front wall, and the front wall the roof. This configuration will then be the same as Figure 3(a). The input sheet should then be filled out accordingly.

Figure 3(b) shows an unfolded view of the same cubicle used as an aid in calculating the impulse on a side wall. The three reflecting surfaces are the roof, back wall and floor. In specifying the input code, the cubicle is rotated 90° so that the side wall is treated as a back wall and vice versa. The reflection code of Figure 4 (input sheet) would be 1110. Sample Problem A5 (Appendix A) shows the calculation of the impulse loading on a side wall of a cubicle similar to Figure 4 except that Sample Problem A5 lacks a roof; its reflection code is 1010.

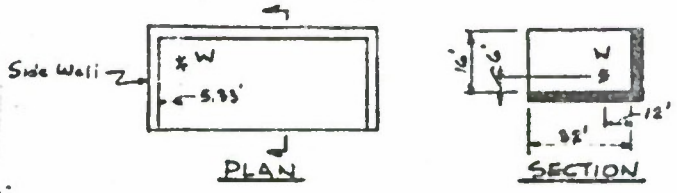
APPENDICES

APPENDIX A

Sample Problems

Example A-5 CLOSE-IN BLAST LOADS

Required: Average scaled impulse on the side wall of a three wall cubicle from an explosive charge of 245#. The cubicle is fully vented.



Solution:

Step 1 - $h = 16$ ft. $L = 32$ ft. $W = 245$ lbs. } For definition of terms see Fig. 4-15 - Side wall of three wall cubicle ($N = 2$)
$H = 6$ ft. $l = 12$ ft. $R_A = 5.33$ ft. }

Step 2 - $\frac{h}{H} = 0.375$ $\frac{l}{L} = 0.375$ $\frac{L}{R_A} = 6.00$ $\frac{L}{H} = 2.00$

$$Z_A = \frac{R_A}{W^{\frac{1}{3}}} = \frac{5.33}{(245)^{\frac{1}{3}}} = 0.85 \text{ ft/lb}^{\frac{1}{3}}$$

Interpolation is required for Z_A, $\frac{L}{H}$, $\frac{l}{L}$ & $\frac{h}{H}$.

Step 3 - Determine & tabulate the values of $\bar{I}_b$ from Figures 4-28 thru 4-42 (see Table 4-16 for $N = 2$) for: $L/R_A = 6.00$, $Z_A = 0.85$ (interpolate or interpolate) and for values given for $\frac{L}{H}$, $\frac{l}{L}$ and $\frac{h}{H}$. See Table A-1.

Step 4-a. Plot $\bar{I}_b$ versus $\frac{L}{H}$ for the values of $\frac{l}{L}$ and constant $\frac{h}{H}$. Figure A-3

b. Determine $\bar{I}_b$ for $\frac{L}{H} = 2.00$, $\frac{h}{H} = 0.375$ & various $\frac{l}{L}$ ratios by entering Figure A-3a with $\frac{L}{H} = 2.00$

$\frac{l}{L}$	$\bar{I}_b$
0.10	240
0.25	210
0.50	190
0.75	170

c. Repeat above steps for $\frac{h}{H} = 0.33, 0.50$ & 0.75 by entering Figures A-3b thru A-3d with $\frac{L}{H} = 2.00$. Tabulate results

TABLE A-1

TABULATION OF $\bar{i}_b$ FOR $L/R_A=6, Z_A=0.85$ AND VARIOUS L/H, ℓ/L AND h/H RATIOS

h/H	0.15				0.25				0.50				0.75		
ℓ/L \ L/H	.10	.25	.50	.75	.10	.25	.50	.75	.10	.25	.50	.75	.25	.50	.75
0.75	135	125	105	95	135	110	90	72	130	90	75	65	77	67	58
1.50	210	183	165	150	205	165	140	125	180	130	108	95	115	95	80
3.00	280	255	225	200	270	240	225	200	260	200	170	145	170	145	130
6.00	310	280	245	225	320	285	265	245	310	280	250	230	260	250	230
Figure	4-28	4-29	4-30	4-31	4-32	4-33	4-34	4-35	4-36	4-37	4-38	4-39	4-40	4-41	4-42

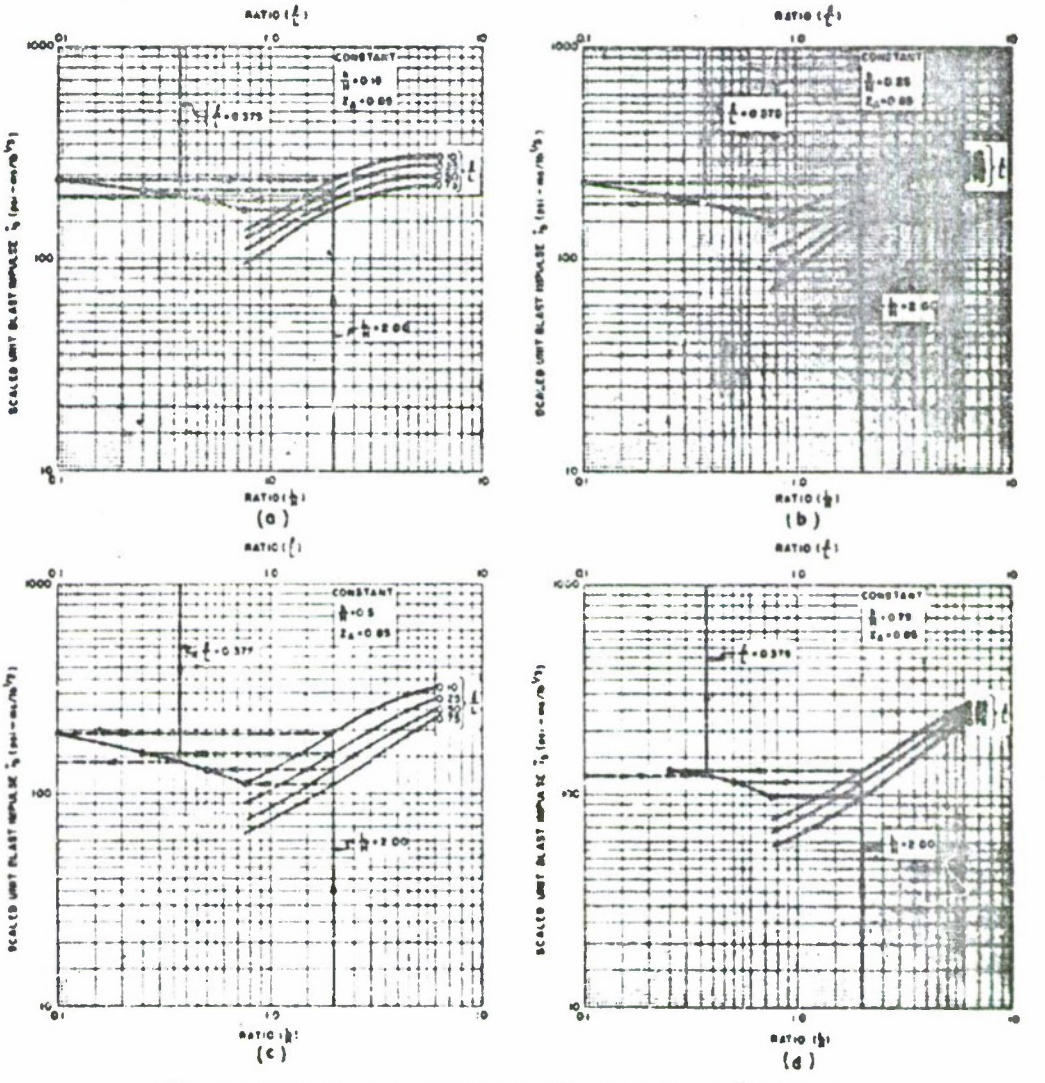


FIG. A-3 INTERPOLATION OF SCALED IMPULSE FOR L/H and ℓ/L RATIOS

d. On each h/H chart, plot $\bar{i}_b$ (Steps 4b & 4c) versus ℓ/L (upper abscissa of Figures A-3a thru A-3d)

e. Determine $\bar{i}_b$ for $\frac{\ell}{L} = 0.375$ on each h/H chart by entering Figures A-3a thru A-3d with $\frac{\ell}{L} = 2.375$ & reading curves plotted in Step 4d.

$\frac{h}{H}$	$\bar{I}_b$	
0.15	197	Figure A-3a
0.25	185	Figure A-3b
0.50	140	Figure A-3c
0.75	123	Figure A-3d

f. Plot $\bar{i}_b$ (Step 4e) versus $\frac{h}{H}$. Figure A-4

Step 5 - For $\frac{h}{H} = 0.375$ read $\bar{i}_b = 160$ psi-ms/lb$^{1/3}$ on Figure A-4.

$$i_b = 160(245)^{1/3} = 1000 \text{ psi-ms}$$

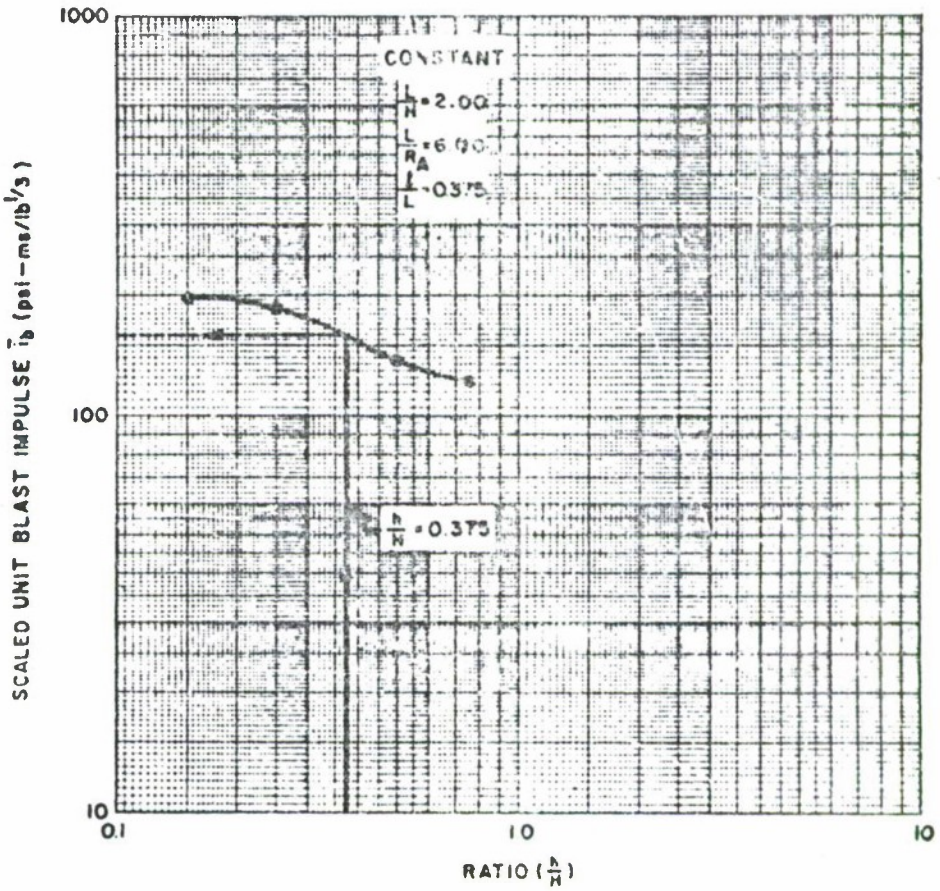


FIG. A-4 INTERPOLATION OF SCALED IMPULSE FOR h/H RATIOS

CARD NO. 1

PROBLEM IDENTIFICATION (TITLE CARD)	
1 PROBLEM A5	60

CARD NO. 2

1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 72 73 74			
							REFLECTION CODE			
DIST. OF CHARGE FROM WALL	CHARGE WEIGHT	WALL HEIGHT	WALL LENGTH	HEIGHT OF CHARGE ABOVE FLOOR	MIN. DIST. OF CHARGE TO ADJ. WALL		FLOOR	ROOF	LEFT SIDE	RIGHT SIDE
R_A Ft.	W Lbs.	H Ft.	L Ft.	h Ft.	ℓ Ft.					
5.33	245.	16.	32.	6.	12.		1	0	1	0

FIGURE 4

INPUT SHEET

PROBLEM A5

INPUT

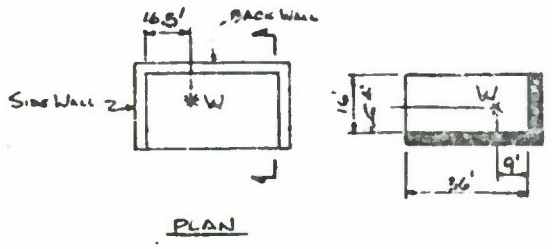
DISTANCE OF CHARGE FROM BLAST WALL	FT.	5.33
CHARGE WEIGHT	LBS.	245.00
BLAST WALL HEIGHT	FT.	16.00
BLAST WALL LENGTH	FT.	32.00
HEIGHT OF CHARGE ABOVE GROUND	FT.	6.00
MIN. DIST. BETWEEN CHARGE & ADJ. WALL	FT.	12.00
REFLECTION CODE		1 0 1 0

OUTPUT

REFLECTING SURFACE	IMPULSE PSI-MS
FLOOR	632.75
LEFT SIDE WALL	326.40
TOTAL	958.15

Example A-6 CLOSE-IN BLAST LOADS

Required: Average scaled impulse on the back wall of a three wall cubicle from an explosive charge of 4500#. The cubicle is fully vented.



PLAN

Solution:

Step 1 - $H = 16$ ft. $L = 36$ ft. $W = 4500$ lbs. $h = 4$ ft. $\ell = 9$ ft. $R_A = 16.5$ ft. } For definition of terms see Fig. 4-15 Back wall of three wall cubicle (No 3)

Step 2 - $\frac{h}{H} = 0.25$ $\frac{\ell}{L} = 0.25$ $\frac{L}{R_A} = 2.18$ $\frac{L}{H} = 2.25$

$$Z_A = \frac{R_A}{W^{\frac{1}{3}}} = \frac{16.5}{(4500)^{\frac{1}{3}}} = 1.00 \text{ ft/lb}^{\frac{1}{3}}$$

Interpolation is required for $\frac{L}{H}$

Step 3 - Determine the values of $\bar{i}_b$ from Figure 4-47 (determined from Fig. 4-16 for N = 3, $\frac{h}{H} = 0.25$, $\frac{\ell}{L} = 0.25$) for $\frac{L}{H}$ ratios of 0.75, 1.50, 3.00 & 6.00.

$\frac{L}{H}$	$\bar{i}_b$
0.75	365
1.50	480
3.00	530
6.00	570

Step 4 - Plot $\bar{i}_b$ versus $\frac{L}{H}$ Figure A-5

Step 5 - For $\frac{L}{H} = 2.25$ read $\bar{i}_b = 515$ psi-ms/lb$^{\frac{1}{3}}$ on Figure A-5.

$$ib = 515(4500)^{1/3} = 8500 \text{ psi-ms}$$

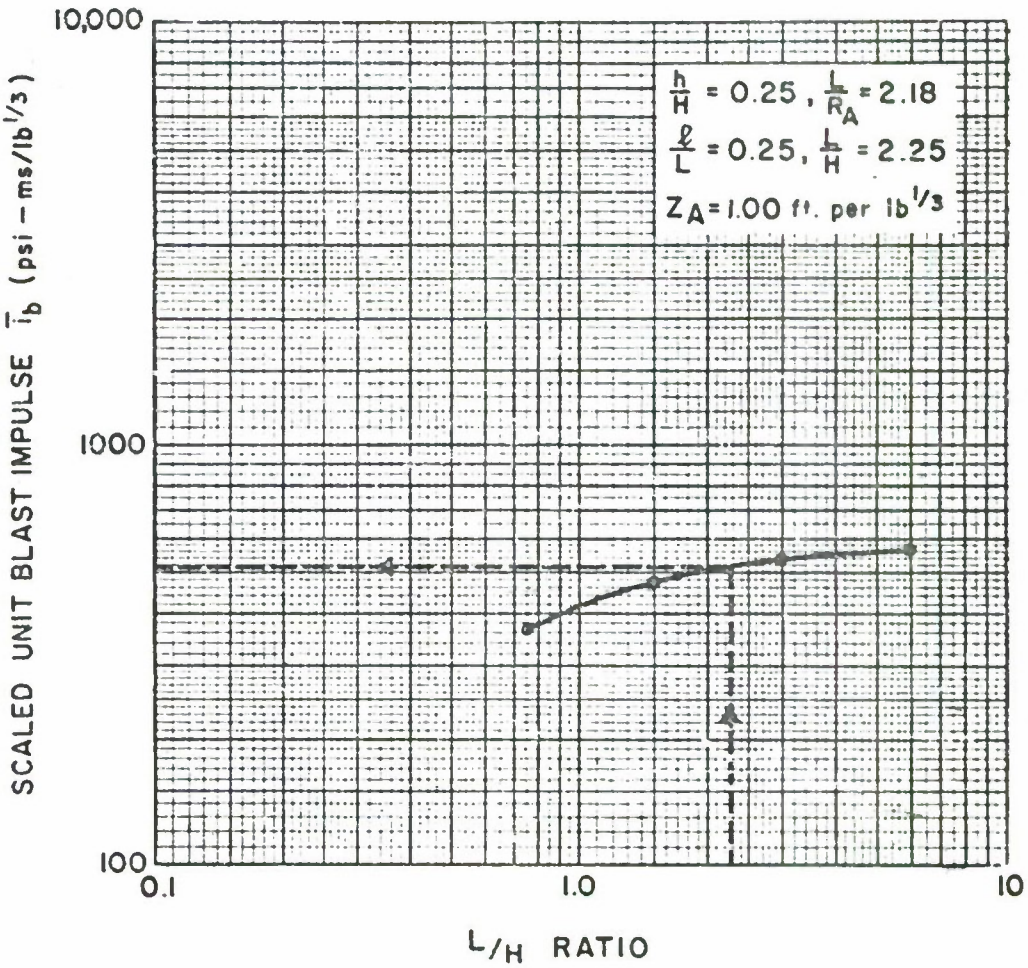


FIG. A-5 INTERPOLATION OF SCALED IMPULSE FOR $\frac{L}{H}$ RATIOS

CARD NO. 1

PROBLEM IDENTIFICATION (TITLE CARD)	
1 PROBLEM A6	63

CARD NO. 2

1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 72 73 74
DIST. OF CHARGE FROM WALL	CHARGE WEIGHT	WALL HEIGHT	WALL LENGTH	HEIGHT OF CHARGE ABOVE FLOOR	MIN. DIST. OF CHARGE TO ADJ. WALL		REFLECTION CODE: FLOOR / ROOF / LEFT SIDE / RIGHT SIDE
R_A Ft.	W Lbs.	H Ft.	L Ft.	h Ft.	ℓ Ft.		
16.5	4500.	16.	36.	4.	9.		1 / 0 / 1 / 1

FIGURE 4

INPUT SHEET

PROBLEM A6

INPUT

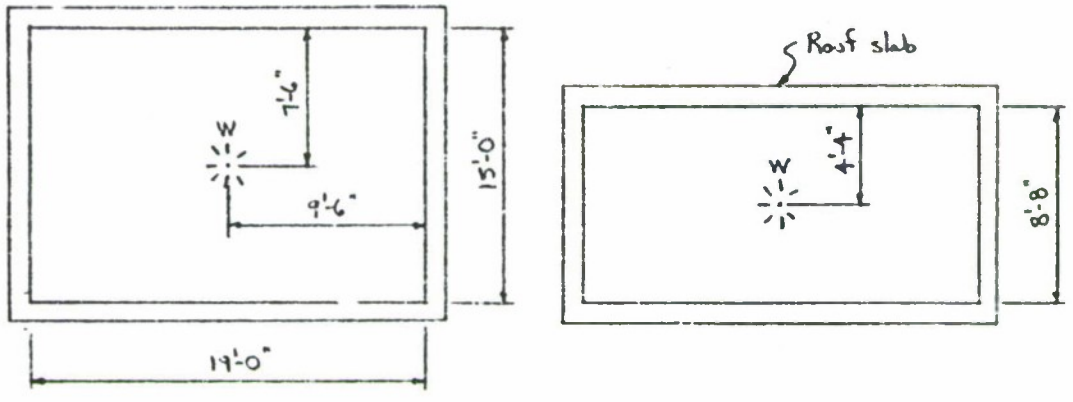
DISTANCE OF CHARGE FROM BLAST WALL	FT.	16.50
CHARGE WEIGHT	LBS.	4500.00
BLAST WALL HEIGHT	FT.	16.00
BLAST WALL LENGTH	FT.	36.00
HEIGHT OF CHARGE ABOVE GROUND	FT.	5.00
MIN. DIST. BETWEEN CHARGE & ADJ. WALL	FT.	9.00
REFLECTION CODE		1 0 1 1

OUTPUT

REFLECTING SURFACE	IMPULSE PSI-MS
FLOOR	4340.05
LEFT SIDE WALL	2744.60
RIGHT SIDE WALL	1566.15
TOTAL	8650.79

Example A-8 CLOSE-IN BLAST LOADS

Required: Average scaled impulse and maximum mean pressure on the roof slab of an enclosed cubicle with a small venting area from an explosive charge of 3#. The cubicle dimensions are as shown below.



Plan Elevation

Fig A-7

Solution

Step 1- $H = 15$ ft. $L = 19$ ft $W = 3$# $\}$ For definition of terms see Figure 4-15 - Four walls cubicle with roof (No. 4)

$h = 7.5$ ft $l = 9.5$ ft $R_A = 4.33$ ft $\}$

Step 2- $\frac{h}{H} = 0.50$ $\frac{l}{L} = 0.50$ $\frac{L}{R_A} = 4.39$ $\frac{L}{H} = 1.27$

$$Z_A = \frac{R_A}{W^{\frac{1}{3}}} = \frac{4.33}{(3)^{\frac{1}{3}}} = 3.00 \text{ ft/lb}^{\frac{1}{3}}$$

Interpolation is required for $\frac{L}{H}$.

Step 3- Determine the value of I_b from Figure 4-62 (From Figure 4-6 for No. 4, $\frac{h}{H} = 0.50$ & $\frac{l}{L} = 0.50$) for $\frac{L}{H}$ ratios of 0.75, 1.50, 3.00 and 6.00.

Problem A-6 CLOSE-IN BLAST LOADS

Problem: Determine the average scaled impulse and maximum mean pressure on the wall of an enclosed cubicle from a contained, partially vented explosion.

Procedure:

Step 1 - Select from Figure 4-15 the structural configuration which will define the number (N) and location of effective reflecting surfaces for the wall of the structure in question. Determine the charge weight W, and as defined by the structural configuration chosen above, the charge location parameters (R_A, i, ℓ) and the structural parameters (L, H).

Step 2 - Calculate chart parameters $\frac{h}{H}$, $\frac{\ell}{L}$, $\frac{L}{R_A}$, $\frac{L}{H}$ and scaled distance Z_A.

$$Z_A = \frac{R_A}{W^{\frac{1}{3}}}$$

Steps 3, 4 & 5 - Following the procedure outlined in Problem 5, determine $\bar{i}_r$ conforming to the above parameters.

Step 6 - Calculate charge-volume ratio $\left(\frac{W}{V}\right)$

Step 7 - For calculated $\frac{W}{V}$, read p_{rm} from Figure 4-65

$\frac{L}{H}$	$\bar{I}_b$
0.75	74
1.50	87
3.00	112
6.00	171

Step 4 - Plot $\bar{I}_b$ versus $\frac{L}{H}$. Figure A-8

Step 5 - For $\frac{L}{H} = 1.27$ read $\bar{I}_b = 81$ psi-ms/lb$^{\frac{1}{3}}$ on Figure A-8

$$Ib = 81(3)^{1/3} = 117 \text{ psi-ms}$$

Step 6 - Calculate charge-volume ratio $\left(\frac{W}{V}\right)$

$$\frac{W}{V} = \frac{3}{19(15)8.67} = 0.00121 \text{ lb/ft}^3$$

Step 7 - For $\frac{W}{V} = 0.00121$ lb/ft^3 read $p_{so} = 19$ psi on Figure 4-65

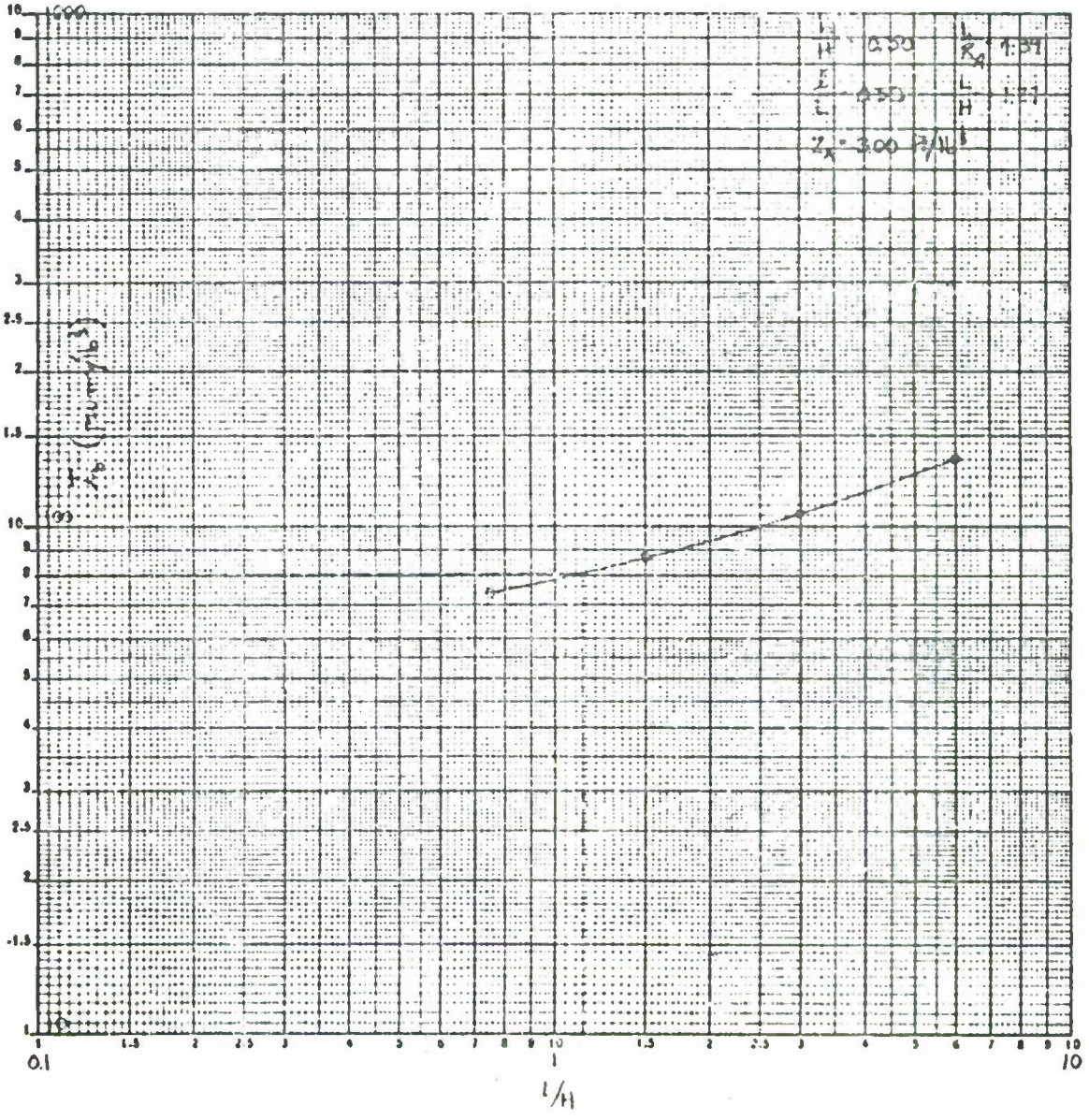


Fig. A-8 Interpolation of Scale Impulse for $\frac{L}{H}$ Ratios

CARD NO. 1

PROBLEM IDENTIFICATION (TITLE CARD)
1 PROBLEM A8

CARD NO. 2

1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 72 73 74			
							REFLECTION CODE			
DIST. OF CHARGE FROM WALL	CHARGE WEIGHT	WALL HEIGHT	WALL LENGTH	HEIGHT OF CHARGE ABOVE FLOOR	MIN. DIST. OF CHARGE TO ADJ. WALL		FLOOR	ROOF	SIDE LEFT	SIDE RIGHT
R_A Ft.	W Lbs.	H Ft.	L Ft.	h Ft.	ℓ Ft.					
4.33	3.	15.	19.	7.5	9.5		1	1	1	1

FIGURE 4

INPUT SHEET

PROBLEM A8

INPUT

DISTANCE OF CHARGE FROM BLAST WALL	FT.	4.33
CHARGE WEIGHT	LBS.	3.00
BLAST WALL HEIGHT	FT.	15.00
BLAST WALL LENGTH	FT.	19.00
HEIGHT OF CHARGE ABOVE GROUND	FT.	7.50
MIN. DIST. BETWEEN CHARGE & ADJ. WALL	FT.	9.50
REFLECTION CODE		1 1 1 1

OUT PUT

REFLECTING SURFACE	IMPULSE PSI-MS
FLOOR	29.93
ROOF	29.93
LEFT SIDE WALL	26.09
RIGHT SIDE WALL	26.09
TOTAL	112.03

APPENDIX B

Fortran Coding, Compilation and Required Input Data

```
                      CPICAT01                                                                  PICA0010
                C     PICATINNY STUDIES FOR REFLECTING IMPULSE                                  PICA0020
0001                  DIMENSION PZ(16,16),PR(16,16),PA(18,6),PCR(18,6),PSQZ(16),PSQ(16),PICA0030
                     1PRZ(16),PR(16),PIPZ(16),PIR(16),ZN(30),ALPLAN(30),      HCON(12),PHPICA0040
                     2AAR(30),SNOAM(13GL,ZPLAN(30,30),APRAL(30,1),AZZ(30,1),AP1IR(30,1), PICA0050
                     3ZPSE(30,30),          ANG2(30,30),ANG1(30,30),PCON(17),PAA(30),PECR)PICA0060
                     4301,CRAL(30,30),DSRLAN(30,30),DCEL(30,30),PRAL(30,30),            PICA0070
                     5      ZZ(30,30),ANS(4),   PIIR(30,30),SIMP(30,30),SUM(30),SIMPAVE(30)PICA0080
                     6,SVE(30),SPEIR(30),SPI(30),CINAV(30),ZTN(12)                        PICA0090
0002                  DIMENSION ICODE(4),HDG(17)
0003                  ZTN(1)=0.35                                                          PICA0140
0004                  ZTN(2)=0.435                                                         PICA0150
0005                  ZTN(3)=0.6                                                           PICA0160
0006                  ZTN(4)=0.69                                                          PICA0170
0007                  ZTN(5)=0.77                                                          PICA0180
0008                  ZTN(6)=0.91                                                          PICA0190
0009                  ZTN(7)=1.1                                                           PICA0200
0010                  ZTN(8)=1.48                                                          PICA0210
0011                  ZTN(9)=1.7                                                           PICA0220
0012                  ZTN(10)=2.7                                                          PICA0230
0013                  ZTN(11)=5.1                                                          PICA0240
0014                  ZTN(12)=7.3                                                          PICA0250
0015                  HCON(1)=0.0625                                                       PICA0360
0016                  HCON(2)=0.125                                                        PICA0370
0017                  HCON(3)=0.25                                                         PICA0380
0018                  HCON(4)=0.375                                                        PICA0390
0019                  HCON(5)=0.5                                                          PICA0400
0020                  HCON(6)=0.75                                                         PICA0410
0021                  HCON(7)=1.0                                                          PICA0420
0022                  HCON(8)=1.5                                                          PICA0430
0023                  HCON(9)=2.0                                                          PICA0440
0024                  HCON(10)=3.0                                                         PICA0450
0025                  HCON(11)=4.0                                                         PICA0460
0026                  HCON(12)=5.0                                                         PICA0470
0027                  PCON(1)=3.7                                                          PICA0480
0028                  PCON(2)=9.8                                                          PICA0490
0029                  PCON(3)=22.1                                                         PICA0500
0030                  PCON(4)=58.8                                                         PICA0510
0031                  PCON(5)=132.0                                                        PICA0520
0032                  PCON(6)=200.0                                                        PICA0530
0033                  PCON(7)=300.0                                                        PICA0540
0034                  PCON(8)=400.0                                                        PICA0550
0035                  PCON(9)=500.0                                                        PICA0560
0036                  PCON(10)=700.0                                                       PICA0570
0037                  PCON(11)=1000.0                                                      PICA0580
0038                  PCON(12)=1500.0                                                      PICA0590
0039                  PCON(13)=2000.0                                                      PICA0600
0040                  PCON(14)=3000.0                                                      PICA0610
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0041          PCON(15)=4000.0                                                  PICA0620
0042          PCON(16)=5000.0                                                  PICA0630
0043          PCON(17)=7000.0                                                  PICA0640
0044          NWALL =4
0045          READ ( 5     ,903)N1,((PZ(I,J),PH(I,J),J=1,N1),I=1,12)          PI
0046          READ ( 5     ,903)N2,((PA(I,J),PCR(I,J),J=1,N2),I=1,18)         PICA0660
0047          READ ( 5     ,903)N4,(PSCZ(I),PSC(I),I=1,N4)                    PICA0670
0048          READ ( 5     ,903)N5,(PRZ(I),PR(I),I=1,N5)                      PICA0680
0049          READ ( 5     ,903)N6,(PIPZ(I),PIP(I),I=1,N6)                    PICA0690
0050        1 READ(5,901)(HDG(I),I=1,17)
0051      901 FORMAT(17A4)
0052          WRITE (6     ,902)                                              PICA0750
0053          WRITE(6,804)(HDG(I),I=1,17)
0054      804 FORMAT(1X,17A4)
0055          READ(5,917)R,W,H,EL,HLIT,ELLIT,(ICODE(I),I=1,4)
0056      917 FORMAT(6F10.0,10X,4I1)
0057          WRITE(6,924)R,W,H
0058      924 FORMAT(    ///50X,5HINPUT,///,10X,
                1 45HDISTANCE OF CHARGE FROM BLAST WALL          FT.,10X,F10.2//10X,
                2 45HCHARGE WEIGHT                               LBS.,10X,F10.2,//10X,
                3 45HBLAST WALL HEIGHT                           FT.,10X,F10.2)
0059          WRITE(6,925)EL,HLIT,ELLIT,(ICODE(I),I=1,4)
0060      925 FORMAT(//10X,
                1 45HBLAST WALL LENGTH                           FT.,10X,F10.2,//10X,
                2 45HHEIGHT OF CHARGE ABOVE GROUND               FT.,10X,F10.2,//10X,
                3 45HMIN. DIST. BETWEEN CHARGE & ADJ. WALL       FT.,10X,F10.2,//10X,
                4 45HREFLECTION CODE                              ,8X,4(2X,I1))
0061          WRITE(6,926)
0062      926 FORMAT(////50X,6HOUTPUT///10X,20HREFLECTING SURFACE
                1 25X, 15HIMPULSE PSI-MS ///)
0063          NC=1                                                             PICA0790
0064          TOTAL=0.0                                                        PICA0800
0065        2 CONTINUE
0066          ZA=R/W**0.333333
0067          CALL RATIO(R,EL,ELLIT,H,HLIT,ZBZA,RLL,HH,RLH)
0068          IF(NC.EQ.2.OR.NC.EQ.4)GO TO 923
0069          CALL GRID(H,HLIT,NSPH,NOZLP)
0070          CALL GRID(EL,ELLIT,NSPL,NLTOL)
0071          IF(NSPH.LT.4)NSPH=4
0072          IF(NSPL.LT.4)NSPL=4
0073      923 CONTINUE
0074          NLI=NSPL+1-NLTOL
0075          ZB=ZBZA*ZA                                                       PICA0880
0076          HHH=2.0*ZB/RLH                                                   PICA0890
0077          HBAR=HH*2.0*ZB/RLH                                               PICA0900
0078          IF(HBAR-0.062514,5,5                                             PICA0910
0079        4 WRITE (6     ,912)
0080          GO TO 8                                                          PICA0930
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0011          5 IF(HBAR-15.016,6,7                                          PICA0960
0012          7 WRITE (6      ,916)
0013            GO TO 8                                                     PICA0960
0014          6 SPL=NSPL                                                    PICA0970
0015            SPH=NSPH                                                    PICA0980
0016            SMA=2.0*PI/SPL                                              PICA0990
0017            SMB=2.0*PI/(RLH*SPH)                                        PICA1000
0018            DO 3 I=1,NLI                                                PICA1010
0019            A=I                                                         PICA1020
0020            ZN(I)=SQRT((2.0**2+((A-1.0)*SMA)**2)                        PICA1030
0021            DO 1000 J=1,12                                              PICA1040
0022            IF(HBAR-HCON(J))1001,1001,1002                              PICA1050
0023       1001 IF(ZN(I)-ZTN(J))1003,1005,1005                              PICA1060
0024       1003 ZMM=ZN(I)                                                   PICA1070
0025            CALL HBA(HBAR,PZ(1,1),PH(1,1),ZMM,PHBAR1,N1,NLI,HCON(1))    PICA1080
0026            IF(PHBAR1-0.01)1006,1006,1007                               PICA1090
0027       1007 PHBAR1=0.01                                                 PICA1100
0028            GO TO 1006                                                  PICA1110
0029       1002 IF(HBAR-5.0)1000,1000,1004                                  PICA1120
0030       1004 ZMM=7.3                                                     PICA1130
0031            GO TO 1009                                                  PICA1140
0032       1000 CONTINUE                                                    PICA1150
0033       1005 ZMM=ZN(I)                                                   PICA1160
0034       1006 CALL HBA(HBAR,PZ(1,1),PH(1,1),ZMM,PHBAR1,N1,NLI,HCON(1))   PICA1170
0035       1009 IF(PHBAR1-HHH)2,3,9                                         PICA1180
0036          9 PHBAR1=HHH                                                  PICA1190
0037          3 PHBAR(I)=PHBAR1                                             PICA1200
0038         47 DO 46 I=1,NLI                                               PICA1210
0039         46 RHBAR(I)=PHBAR(I)*R(M/12,0*PI)                              PICA1220
                FIND ZPLAN                                                  PICA1230
0040            NN=2                                                        PICA1240
0041            NN=NSPH+1                                                   PICA1250
0042            DO 63 I=1,NLI                                               PICA1260
0043            ZPLAN(I,1)=SQRT(ZN(I)**2+HBAR**2)                           PICA1270
0044            DO 48 J=2,NN                                                PICA1280
0045            A=J-1                                                       PICA1290
0046            ZOOPL=SQRT(ZN(I)**2+(HBAR+A*SMB)**2)                        PICA1300
0047            TEST=0.02*ZOOPL                                             PICA1310
0048            DO 2000 K=1,12                                              PICA1320
0049            IF(HBAR-HCON(K))2001,2001,3000                              PICA1330
0050       2001 IF(ZN(I)-ZTN(K))2003,2005,2005                              PICA1340
0051       2003 ZPLAN(I,J)=ZOOPL                                            PICA1350
0052            GO TO 48                                                    PICA1360
0053       2002 IF(HBAR-5.0)2000,2000,2004                                  PICA1370
0054       2004 IF(ZN(I)-7.31)2003,2005,2005                                PICA1380
0055       2000 CONTINUE                                                    PICA1390
0056       2005 ZM=ZN(I)                                                    PICA1400
0057         61 CALL HBA(HBAR,PZ(1,1),PH(1,1),ZM,PHBAR1,N1,NLI,HCON(1))    PICA1410
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0128            HOL=PHBAR1-B*SMB                                                PICA1420
0129            IF(HOL)208,209,209                                              PICA1430
0130      209   ZPLAN(I,JI=SQRT(ZM**2+HBAR**2)                                  PICA1440
0131            GO TO 49                                                        PICA1450
0132      208   ZSTART=SQRT(ZDOPL**2-HBAR**2)                                   PICA1460
0133       62   CALL NRAIMBAR,PZ(1,1),PHI(1,1),ZSTART,PHBAR1,N1,NL1,HCON(1))    PICA1470
0134            IF(PHBAR1-2.01211,211,212                                       PICA1480
0135      212   B5MB=B*SMB                                                      PICA1490
0136            IF(PHBAR1-B5MB)220,221,221                                      PICA1500
0137      220   PHBAR1=2.0                                                      PICA1510
0138            GO TO 222                                                       PICA1520
0139      221   PHBAR1=BSMB                                                     PICA1530
0140      222   ZM=SQRT(ZDOPL**2-(HBAR*PHBAR1)**2)                              PICA1540
0141            GO TO 209                                                       PICA1550
0142      211   ZNEW=SQRT(ZSTART**2+(PHBAR1*HBAR)**2)                           PICA1560
0143            IF(ZDOPL-ZNEW)58,59,60                                          PICA1570
0144       58   ZDIT=ZNEW-ZDOPL                                                 PICA1580
0145            IF(ZDIT-TEST)59,59,200                                          PICA1590
0146      200   ZSTART=0.999*ZSTART                                             PICA1600
0147            GO TO 62                                                        PICA1610
0148       59   ZM=ZSTART                                                       PICA1620
0149            GO TO 209                                                       PICA1630
0150       60   ZDIT=ZDOPL-ZNEW                                                 PICA1640
0151            IF(ZDIT-TEST)59,59,210                                          PICA1650
0152      210   ZSTART=1.0003*ZSTART                                            PICA1660
0153            GO TO 62                                                        PICA1670
0154       48   CONTINUE                                                        PICA1680
0155       63   CONTINUE                                                        PICA1690
0156            DO 65 I=1,NLI                                                   PICA1700
0157            DO 64 J=1,NN                                                    PICA1710
0158            ZPLA=ZPLAN(I,J)                                                 PICA1720
0159            IF(ZPLA-16.01214,214,215                                        PICA1730
0160      215   ZPLA=16.0                                                       PICA1740
0161      214   CALL LAGINT(PSOZ(1),PSO(1),ZPLA,ZPSO,N4)                        PICA1750
0162       64   ZPS(I,JI=ZPSO                                                   PICA1760
0163       65   CONTINUE                                                        PICA1770
0164            DO 66 I=1,NLI                                                   PICA1780
0165            DO 67 J=1,NN                                                    PICA1790
0166            ANG2(I,JI=0.0                                                   PICA1800
0167       67   ANG1(I,JI=ATAN(SQRT(1.0-(HBAR/ZPLAN(I,JI)**2)/(HBAR/ZPLAN(I,JI)*PICA1810
                 17.2956                                                        PICA1820
0168       66   CONTINUE                                                        PICA1830
0169            MM=1                                                            PICA1840
0170            MMM=0                                                           PICA1850
0171      102   DO 81 I=1,NLI                                                   PICA1860
0172            IF(MMM-21205,206,205                                            PICA1870
0173      206   ALPLAN(I)=ATAN(SQRT(1.0-(ZA/ZN(I))**2)/(ZA/ZN(I)))*57.2956      PICA1880
0174      205   DO 68 J=1,NN                                                    PICA1890
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0175            IF(MM-1)100,100,101                                     PICA1900
0176        101 IF(MM-11)201,201,202                                    PICA1910
0177        201 ANG=ANG2(I,J)                                           PICA1920
0178            GO TO 182                                               PICA1930
0179        202 ANG=ALPLAN(I)                                           PICA1940
0180            GO TO 182                                               PICA1950
0181        100 ANG=ANG1(I,J)                                           PICA1960
0182        182 IF(ANG+40.9)92,83,83                                    PICA1970
0183         83 IF(ZPS(I,J)-22.1)84,85,85                               PICA1980
0184         85 DO 86 LN=1,N2                                           PICA1990
0185            PAA(LN)=PA(18,LN)                                       PICA2000
0186         86 PPCR(LN)=PCR(18,LN)                                     PICA2010
0187            CALL LAG(PAA(1),PPCR(1),ANG,CRAL1,N2)                   PICA2020
0188            CRAL(I,J)=CRAL1                                         PICA2030
0189            GO TO 68                                                PICA2040
0190         84 IF(ANG-52.5)87,85,85                                    PICA2050
0191         87 IF(ZPS(I,J)-9.8)88,89,89                                PICA2060
0192         89 CRAL(I,J)=3.0                                           PICA2070
0193            GO TO 68                                                PICA2080
0194         88 CRAL(I,J)=2.6                                           PICA2090
0195            GO TO 68                                                PICA2100
0196         82 IF(ZPS(I,J)-3.7)69,70,71                                PICA2110
0197         69 WRITE (6,927)                                           PICA2120
0198         70 K=1                                                     PICA2130
0199            GO TO 72                                                PICA2140
0200         71 DO 73 L=2,17                                            PICA2150
0201            IF(ZPS(I,J)-PCON(L))74,75,76                            PICA2160
0202         74 MK=L                                                    PICA2170
0203            GO TO 77                                                PICA2180
0204         75 K=L                                                     PICA2190
0205            GO TO 72                                                PICA2200
0206         76 IF(ZPS(I,J)-7000.0)73,213,78                            PICA2210
0207         73 CONTINUE                                                PICA2220
0208         78 WRITE (6,914)
0209        213 K=17                                                    PICA2240
0210         72 DO 79 KK=1,N2                                           PICA2250
0211            PAA(KK)=PA(K,KK)                                        PICA2260
0212         79 PPCR(KK)=PCR(K,KK)                                      PICA2270
0213            CALL LAG(PAA(1),PPCR(1),ANG,CRAL1,N2)                   PICA2280
0214            CRAL(I,J)=CRAL1                                         PICA2290
0215            GO TO 68                                                PICA2300
0216         77 DIFP=PCON(L)-ZPS(I,J)                                   PICA2310
0217            DO 80 KK=1,N2                                           PICA2320
0218            PPCR(KK)=PCR(MK,KK)-(PCR(MK,KK)-PCR(MK-1,KK))*DIFP/(PCON(MK)-PCONPICA2330
               1(MK-1))                                                 PICA2340
0219         80 PAA(KK)=PA(MK,KK)                                       PICA2350
0220            CALL LAG(PAA(1),PPCR(1),ANG,CRAL1,N2)                   PICA2360
0221            CRAL(I,J)=CRAL1                                         PICA2370
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0222          68 CONTINUE                                                    PICA2380
0223          81 CONTINUE                                                    PICA2390
0224             MMM=KMM+1                                                   PICA2400
0225             IF(MMM-1)103,103,104                                        PICA2410
0226         104 IF(MMM-2)103,203,207                                        PICA2420
0227         103 DO 91 I=1,NLI                                               PICA2430
0228             DO 90 J=1,NN                                                PICA2440
0229             PSPLAN(I,JI=CRAL(I,JI*ZPSI(I,JI                             PICA2450
0230          90 ZPSI(I,JI=PSPLAN(I,JI                                       PICA2460
0231          91 CONTINUE                                                    PICA2470
0232             DO 92 I=1,NLI                                               PICA2480
0233             DO 93 J=1,NN                                                PICA2490
0234             B=J-1                                                       PICA2500
0235             DOPL(I,JI=SQRT(ZN(I)**2+IHBAR*B*SMBI**2)                    PICA2510
0236          93 ANG2(I,JI=ATAN(SQRT(1.0-(ZN(I)/DOPL(I,J))**2)/(ZN(I)/DOPL(I,J)))*5PICA2520
                 17.2956                                                     PICA2530
0237          92 CONTINUE                                                    PICA2540
0238             KM=2                                                        PICA2550
0239             GO TO 102                                                   PICA2560
0240         203 DO 105 I=1,NLI                                              PICA2570
0241             DO 106 J=1,NN                                               PICA2580
0242             PRA(I,JI=PSPLAN(I,JI*CRAL(I,JI                              PICA2590
0243             PRA=PRA(I,JI                                                PICA2600
0244             CALL LAGINT(PRI(I,PRZ(I,PRA,PRZZ,N5I                        PICA2610
0245             ZZ(I,JI=PRZZ                                                PICA2620
0246             CALL LAGINT(PIRZ(I,PIR(I,PRZZ,PIRR,N6I                      PICA2630
0247         106 PIR(I,JI=PIRR                                               PICA2640
0248         105 CONTINUE                                                    PICA2650
0249             GO TO 102                                                   PICA2660
0250         207 DO 305 I=1,NLI                                              PICA2670
0251             APRA(I,JI=PSPLAN(I,JI*CRAL(I,JI                             PICA2680
0252             APRA=APRA(I,JI                                              PICA2690
0253             CALL LAGINT(PRI(I,PRZ(I,APRA,APRZZ,N5I                      PICA2700
0254             AZZ(I,JI=APRZZ                                              PICA2710
0255             CALL LAGINT(PIRZ(I,PIR(I,APRZZ,APIRR,N6I                    PICA2720
0256             APIR(I,JI=APIRR                                             PICA2730
0257         305 CONTINUE                                                    PICA2740
0258             NSTOP=NN-1                                                  PICA2750
0259             DO 107 I=1,NLI                                              PICA2760
0260             SUM(I=PIR(I,JI-PIR(I,NNI                                    PICA2770
0261             DO 108 J=2,NSTOP,2                                          PICA2780
0262         108 SUM(I=SUM(I+PIR(I,JI*4.0+PIR(I,J+1I*2.0                     PICA2790
0263         107 SIMPAY(I=SUM(I/(3.0*SPII                                    PICA2800
0264             DO 109 I=1,NLI                                              PICA2810
0265             DO 110 J=1,NN                                               PICA2820
0266             B=J-1                                                       PICA2830
0267             SVC JI=B*SMB                                                PICA2840
0269         110 SPIR(I,JI=PIR(I,JI                                          PICA2850
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0269                SBAR=PHBAR(I)                                                  PICA2860
0270                CALL LAG1(SVII),SPIIRII,SBAR,SPINT,NN)                         PICA2870
0271                SPI(I)=SPINT                                                   PICA2880
0272                SIMPAV(I)=SIMPAV(I)+(APIIR(I,1)-PIIR(I,1)+APIIR(I,1)-SPI(I)*RHBAHPICA2890
                   1(I)/2.0                                                        PICA2900
0273            109 CONTINUE                                                       PICA2910
0274                IF(NLTOL-1)120,121,121                                         PICA2920
0275            120 DO 114 I=1,NLI                                                 PICA2930
0276            114 FINAV(I)=SIMPAV(I)                                             PICA2940
0277                GO TO 115                                                      PICA2950
0278            121 N=NLTOL+1                                                      PICA2960
0279                DO 111 I=1,NLTOL                                               PICA2970
0280                J=I+1                                                          PICA2980
0281                NK=N-I                                                         PICA2990
0282            111 FINAV(NK)=SIMPAV(J)                                            PICA3000
0283                DO 112 I=1,NLI                                                 PICA3010
0284                NK=NLTOL+I                                                     PICA3020
0285            112 FINAV(NK)=SIMPAV(I)                                            PICA3030
0286            115 NOVI=NLTOL+NLI                                                 PICA3040
0287                FISUM=FINAV(1)+FINAV(NOVI)                                     PICA3050
0288                NSTOP=NOVI-1                                                   PICA3060
0289                DO 113 I=2,NSTOP,2                                             PICA3070
0290            113 FISUM=FISUM+FINAV(I)*4.0+FINAV(I+1)*2.0                        PICA3080
0291                ANSENC(I)=FISUM/(3.0*SPL)                                      PICA3090
0292                I=NC
0293                IF(CODE(I).EQ.0)GO TO 936
0294                ANS(I)=ANS(I)*666.333333
0295                GO TO(928,929,930,931),I
0296            928 WRITE(6,932)ANS(I)
0297            932 FORMAT(10X,5HFLOOR,40X,F10.2/)
0298                GO TO 927
0299            929 WRITE(6,933)ANS(I)
0300            933 FORMAT(10X,5HROOF ,40X,F10.2/)
0301                GO TO 927
0302            930 WRITE(6,937)ANS(I)
0303            937 FORMAT(10X,14HLEFT SIDE WALL,31X,F10.2/)
0304                GO TO 927
0305            931 WRITE(6,934)ANS(I)
0306            934 FORMAT(10X,15HRIGHT SIDE WALL,30X,F10.2/)
0307            927 CONTINUE
0308                TOTAL=TOTAL+ANSENC(I)                                          PICA3100
0309            936 CONTINUE
0310                IF(M.EQ.6)WRITE(6,939)TOTAL
0311            939 FORMAT(50X,5HTOTAL,F10.2)
0312              8 IF(NWALL-NC(I),I,116                                           PICA3130
0313            116 NC=NC+1                                                        PICA3140
0314                GO TO(10,11,12,11),NC
0315             11 HLET=H-HLET
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0316                GO TO 10
0317             12 SAVE=H
0318                HLIT=HLIT
0319                H=EL
0320                EL=SAVE
0321                SAVE=HLIT
0322                HLIT=ELLIT
0323                ELLIT=SAVE
0324             10 CONTINUE
0325                GO TO 2
0326            801 FORMAT(4H ZA=,F10.3)                                        PICA3150
0327            802 FORMAT(1H1)                                                 PICA3160
0328            803 FORMAT(2I5,2F10.3)                                          PICA3170
0329            902 FORMAT(4F10.3,4I5,A4,A4,A2)                                 PICA3180
0330            903 FORMAT(I5/(6F10.3))
0331            904 FORMAT(2I5)
0332            905 FORMAT(47H HBARLIT SMALLER THAN 0.0625 OR BIGGER THAN 5.0)   PICA3220
0333            906 FORMAT(7F10.3)                                              PICA3230
0334            907 FORMAT(43H PSO SMALLER THAN 3.7, USED PSO=3.7               )PICA3240
0335            908 FORMAT(29H AVERAGE REFLECTED IMPULSE OF, I5,11H WALL(S) IS,F10.2) PICA3250
0336            909 FORMAT(25H HEIGHTS OF MACH STEM ARE, 4F10.5/(7F10.5))       PICA3260
0337            910 FORMAT(29H AVERAGE REFLECTED IMPULSE IS, F10.2)             PICA3270
0338            911 FORMAT(7H ZB/ZA=,F10.3,6X,7H I/I  =,F10.3,6X,7H H/H  =,F10.3,/ PICA3280
                    17H L/H   =,F10.3,6X,7H NSPL =,I10,6X,7H NSPH =,I10,/       PICA3290
                    27H NLI   =,I10,6X,7H NLTOL=,I10)                           PICA3300
                912 FORMAT(41H HBAR LESS THAN 0.0625, SKIP TO NEXT CASE)        PICA3310
0339            913 FORMAT(3A4,A2)                                              PICA3320
0340            914 FORMAT(43H PSO BIGGER THAN 7000.0, USED PSO=7000.0          )PICA3330
0341            915 FORMAT(7F10.4)                                              PICA3340
0342            916 FORMAT(47H HBAR LARGER THAN 15.0, SKIP TO NEXT CASE)        PICA3350
0343                END                                                         PICA3360
0344                                                                            PICA3370
                                                                                PICA3380
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0001          SUBROUTINE HBA(HBAR,PZ,PH,ZN,PHBAR1,N1,NL1,HCON)                  0010
0002          DIMENSION PZZ(16),PHH(16),PZ(16,16),PH(16,16),HCON(12)            0020
0003          IF(HBAR-0.0625)5,6,7                                              0040
0004        5 WRITE (6,905)                                                     0050
0005          RETURN                                                            0060
0006        6 K=1                                                               0070
0007          GO TO 8                                                           0080
0008        7 IF(HBAR-0.125)9,10,11                                             0090
0009        9 MK=1                                                              0100
0010          GO TO 12                                                          0110
0011       10 K=2                                                             0120
0012          GO TO 8                                                           0130
0013       11 IF(HBAR-0.25)13,14,15                                           0140
0014       13 MK=2                                                            0150
0015          GO TO 12                                                          0160
0016       14 K=3                                                             0170
0017          GO TO 8                                                           0180
0018       15 IF(HBAR-0.375)16,17,18                                          0190
0019       16 MK=3                                                            0200
0020          GO TO 12                                                          0210
0021       17 K=4                                                             0220
0022          GO TO 8                                                           0230
0023       18 IF(HBAR-0.5)19,20,21                                            0240
0024       19 MK=4                                                            0250
0025          GO TO 12                                                          0260
0026       20 K=5                                                             0270
0027          GO TO 8                                                           0280
0028       21 IF(HBAR-0.75)22,23,24                                           0290
0029       22 MK=5                                                            0300
0030          GO TO 12                                                          0310
0031       23 K=6                                                             0320
0032          GO TO 8                                                           0330
0033       24 IF(HBAR-1.0)25,26,27                                            0340
0034       25 MK=6                                                            0350
0035          GO TO 12                                                          0360
0036       26 K=7                                                             0370
0037          GO TO 8                                                           0380
0038       27 IF(HBAR-1.5)28,29,30                                            0390
0039       28 MK=7                                                            0400
0040          GO TO 12                                                          0410
0041       29 K=8                                                             0420
0042          GO TO 8                                                           0430
0043       30 IF(HBAR-2.0)31,32,33                                            0440
0044       31 MK=8                                                            0450
0045          GO TO 12                                                          0460
0046       32 K=9                                                             0470
0047          GO TO 8                                                           0480
0048       33 IF(HBAR-3.0)34,35,36                                            0490
```

```
0049          34 MK=9                                                          0500
0050             GO TO 12                                                      0510
0051          35 K=10                                                          0520
0052             GO TO 9.                                                      0530
0053          36 IF(HBAR-4.0137,38,39                                          0540
0054          37 MK=10                                                         0550
0055             GO TO 12                                                      0560
0056          38 K=11                                                          0570
0057             GO TO 8                                                       0580
0058          39 IF(HBAR-5.0140,41,41                                          0590
0059          40 MK=11                                                         0600
0060             GO TO 12                                                      0610
0061          41 K=12                                                          0620
0062           8 DO 42 L=1,N1                                                  0630
0063             PZZ(L)=PZ(K,L)                                               0640
0064          42 PHH(L)=PH(K,L)                                               0650
0065             CALL LAGINT(PZZ(1),PHH(1),ZN,PHBAR1,N11                      0660
0066             RETURN                                                       0670
0067          12 DIFH=HBAR-HCON(MK)                                           0680
0068             DO 44 L=1,N1                                                 0690
0069             PZZ(L)=PZ(MK,L)+(PZ(MK+1,L)-PZ(MK,L))*DIFH/(HCON(MK+1)-HCON(MK))  0700
0070          44 PHH(L)=PH(MK,L)                                              0710
0071             CALL LAGINT(PZZ(1),PHH(1),ZN,PHBAR1,N11                      0720
0072             RETURN                                                       0730
0073         905 FORMAT(47H HBAR(1) SMALLER THAN 0.0625 OR BIGGER THAN 5.01   0740
0074         906 FORMAT(36H HBAR BIGGER THAN 5.0, USED HBAR=5.01              0750
0075             END                                                          0760
```

```
FORTRAN IV G LEVEL 1, MOD 2          LAGINT          DATE = 69342          15/42/41          PAGE 0001

0001                SUBROUTINE LAGINT(XLOG,FLOG,XOLOG,FO,N)                                    0010
0002                DIMENSION X(16),P(16),F(16),XLOG(16),FLOG(16)                              0020
0003                DO 1030 M=1,N                                                              0040
0004                X(M)=ALOG(XLOG(M))                                                         0050
0005                F(M)=ALOG(FLOG(M))                                                         0060
0006           1030 CONTINUE                                                                   0070
0007                XO=ALOG(XOLOG)                                                             0090
0008                DO 1010 M1=1,N                                                             0090
0009                P(M1)=1                                                                    0100
0010                DO 1010 M=1,N                                                              0110
0011                IF(M-M1)1009,1010,1009                                                     0120
0012           1009 P(M1)=P(M1)*(XO-X(M))/(X(M1)-X(M))                                         0130
0013           1010 CONTINUE                                                                   0140
0014                FO=0.0                                                                     0150
0015                DO 1020 M=1,N                                                              0160
0016           1020 FO=FO+P(M)*F(M)                                                            0170
0017                IF(FO-88.)100,100,101                                                      0180
0018           101  FO=7H.                                                                    0190
0019           100  FO=2.71828**FO                                                            0200
0020                RETURN                                                                     0190
0021                END                                                                        0200
```

```
FORTRAN IV G LEVEL 1, MOD 2          LAG          DATE = 69342          15/42/41          PAGE 0001

0001                SUBROUTINE LAG(X,F,XC,FC,N)                                    0010
0002                DIMENSION X(30),P(30),F(30)                                    0020
0003                DO 1010 M=1,N                                                  0040
0004                P(M)=1                                                         0050
0005                DO 1010 M1=1,N                                                 0060
0006                IF(M1-M)1009,1010,1009                                         0070
0007           1009 P(M)=P(M)*(XC-X(M1))/(X(M)-X(M1))                              0080
0008           1010 CONTINUE                                                       0090
0009                FC=0.0                                                         0100
0010                DO 1020 M1=1,N                                                 0110
0011           1020 FC=FC+P(M1)*F(M1)                                              0120
0012                RETURN
0013                END
```

```
FORTRAN IV G LEVEL 1, MOD 2          RATIO          DATE = 69342          15/42/41          PAGE 0001

0001          SUBROUTINE RATIOIR,EL,ELLIT,H,HLIT,ZBZA,RLL,RH,RLH)
0002          ZBZA=.5*(EL/R)
0003          RLL=ELLIT/EL
0004          RH=HLIT/H
0005          RLH=EL/H
0006          IF(RLL.LT.0.1)RLL=0.1
0007          IF(RLL.GT.0.75)RLL=0.75
0008          IF(RH.LT.0.15)RH=0.15
0009          IF(RH.GT.0.75)RH=0.75
0010          IF(RLH.GT.6.)RLH=6.
0011          IF(RLH.GT.6.)ZBZA=0.5*(6.*H/R)
0012          RETURN
0013          END
```

```
FORTRAN IV G LEVEL 1, MOD 2          GRID          DATE = 69342      15/42/41          PAGE 0001

0001          SUBROUTINE GRID(A,ALIT,NA,L)
              C     DETERMINES NUMBER OF VERTICAL AND HORIZONTAL LINES FOR GRID
0002          DIMENSION XX(50)
0003          Z=AMIN1(ALIT,A-ALIT)
0004          DO 21 I=2,20,2
0005          SAVE=1.E+5
0006          NA=I
0007          K=I
0008          SPWTH=A/I
0009          DO 30 J=1,I
0010          XJ=J
0011          X=XJ*SPWTH
0012          XX(J)=ABS(Z-XL
0013          K=J
0014          ANS=AMIN1(XX(JL,SAVE)
0015          SAVE=ANS
0016          IF(XX(J)-0,2120,20,31
0017       31 XXX=ABS(SAVE-XX(JI
0018          IF(SAVE-XXX)21,30,30
0019       30 CONTINUE
0020       21 CONTINUE
0021       20 CONTINUE
0022          IF(NA.NE.20)GO TO 23
0023          DO 22 I=1,K
0024          L=I
0025          IF(ANS-XX(I))22,23,22
0026       22 CONTINUE
0027       23 CONTINUE
0028          IF(NA.NE.20)L=K
0029          RETURN
0030          END
```

REQUIRED INPUT DATA

FORMAT (I5/(6F10.8))

CARD NUMBER						
2	12					
3	0.35	0.012	0.405	0.03	0.69	0.07
4	0.55	0.1	0.730	0.2	0.93	0.40
5	1.07	0.5	1.19	0.7	1.30	1.0
6	1.37	1.30	1.4x	1.6	1.45	2.0
7	0.435	0.012	0.50	0.03	0.62	0.07
8	0.705	0.1	0.995	0.2	1.24	0.40
9	1.33	0.5	1.45	0.7	1.65	1.0
10	1.77	1.30	1.84	1.6	1.90	2.0
11	0.6	0.012	0.655	0.03	0.8	0.07
12	0.9	0.1	1.2	0.2	1.59	0.40
13	1.7	0.5	1.88	0.7	2.1	1.0
14	2.25	1.30	2.36	1.6	2.5	2.0
15	0.69	0.012	0.74	0.03	0.95	0.07
16	1.09	0.1	1.43	0.2	1.89	0.40
17	2.04	0.5	2.3	0.7	2.6	1.0
18	2.76	1.30	2.95	1.6	3.1	2.0
19	0.77	0.012	0.9	0.03	1.11	0.07
20	1.26	0.1	1.63	0.2	2.14	0.40
21	2.33	0.5	2.67	0.7	3.05	1.0
22	3.25	1.30	3.50	1.6	3.7	2.0
23	0.81	0.012	1.0	0.03	1.4	0.07
24	1.6	0.1	2.1	0.2	2.9	0.40
25	3.1	0.5	3.55	0.7	4.1	1.0
26	4.3	1.30	4.6	1.6	4.9	2.0
27	1.1	0.012	1.25	0.03	1.65	0.07
28	1.9	0.1	2.55	0.2	3.4	0.40
29	3.7	0.5	4.15	0.7	4.75	1.0
30	5.1	1.30	5.55	1.6	6.0	2.0
31	1.48	0.012	1.7	0.03	2.25	0.07
32	2.60	0.1	3.45	0.2	4.6	0.40
33	5.0	0.5	5.7	0.7	6.6	1.0
34	7.0	1.30	7.5	1.6	8.0	2.0
35	1.7	0.012	2.02	0.03	2.6	0.07
36	2.95	0.1	4.0	0.2	5.3	0.40
37	5.95	0.5	6.75	0.7	7.8	1.0
38	8.6	1.30	9.3	1.6	9.9	2.0
39	2.7	0.012	3.15	0.03	4.0	0.07
40	4.6	0.1	6.0	0.2	7.7	0.40
41	8.3	0.5	9.4	0.7	10.7	1.0
42	11.3	1.30	13.0	1.6	13.4	2.0
43	5.1	0.012	5.7	0.03	6.6	0.07
44	7.1	0.1	9.3	0.2	12.1	0.40
45	10.8	0.5	12.1	0.7	13.6	1.0
46	15.0	1.30	16.0	1.6	17.2	2.0
47	7.3	0.012	7.8	0.03	9.0	0.07
48	9.45	0.1	10.7	0.2	12.4	0.40
49	14.2	0.5	14.45	0.7	16.0	1.0
50	17.25	1.30	18.5	1.6	20.1	2.0
51	4					
52	0.	2.2	15.	2.1	30.	2.1
53	40.	2.2	0.	2.48	15.	2.48
54	30.	2.48	40.	2.68	0.	3.1
55	15.	3.08	30.	2.93	40.	3.45
56	0.	4.16	15.	4.14	30.	3.72
57	40.	4.5	0.	5.3A	35.	5.2
58	30.	4.77	40.	5.1	0.	6.15

CARD NUMBER						
59	15.	5.9	30.	5.6	40.	5.45
60	0.	6.7	15.	6.46	30.	6.18
61	40.	6.0	0.	7.24	15.	7.0
62	30.	6.7	40.	6.56	0.	7.6
63	15.	7.3	30.	7.0	40.	6.96
64	0.	6.0	15.	7.7	30.	7.45
65	40.	7.28	0.	8.4	15.	8.1
66	30.	7.85	40.	7.66	0.	8.74
67	15.	8.46	30.	8.18	40.	8.0
68	0.	9.0	15.	8.7	30.	8.43
69	40.	8.25	0.	9.6	15.	9.3
70	30.	9.07	40.	8.96	0.	10.3
71	15.	10.0	30.	9.75	40.	9.56
72	0.	11.	15.	10.7	30.	10.43
73	40.	10.25	0.	11.97	15.	11.68
74	30.	11.4	40.	11.2	40.5	3.65
75	55.	2.85	70.	2.05	90.	1.0
76	16					
77	0.136	6900.	0.177	5580.	0.252	4640.
78	0.379	3240.	0.505	2340.	0.757	1320.
79	1.262	505.	1.770	322.	2.525	162.
80	3.780	55.	5.05	26.8	7.57	10.9
81	12.62	4.1	17.70	2.6	25.25	1.7
82	50.5	0.71				
83	16					
84	0.136	82500.	0.177	67600.	0.252	50000.
85	0.379	31500.	0.505	21450.	0.757	11420.
86	1.262	4650.	1.770	2240.	2.525	925.
87	3.780	240.	5.05	87.5	7.57	28.2
88	12.62	9.4	17.70	5.7	25.25	3.5
89	50.5	1.44				
90	16					
91	0.136	4350.	0.177	3620.	0.252	2600.
92	0.379	1505.	0.505	1080.	0.757	550.
93	1.262	244.	1.770	150.	2.525	90.
94	3.780	51.	5.05	34.	7.57	20.
95	12.62	10.8	17.70	7.5	25.25	5.2
96	50.5	2.7				

**** E N D O F D A T A ****

/*

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13. ABSTRACT

An improved computer program was formulated to calculate the average blast impulse loads acting on a wall of a cubicle when an explosive charge is detonated within the cubicle. It was devised by the Ammunition Engineering Directorate's Process Engineering Laboratory in connection with the Safety Design Criteria Program and it simplifies an earlier computer program used to calculate data points for the construction of impulse charts in Technical Manual 5-1300, "Structures to Prevent the Effects of Accidental Explosion."

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Improved Computer Program						
Fortran IV						
Average blast impulse load						
Cubicle wall						
Technical Manual 5-1300						
Impulse charts						
Step-by-step procedure						