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Washington, D.C. 20591

Airport Pavement Load Analysis

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September 1986

Final Report

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16. Abstract → This report describes the underlying theory and assumptions used in developing microcomputer software to determine and model the cumulative load distribution across any given airport pavement as a function of aircraft type and usage of the pavement.					
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PREFACE

This study was sponsored by the DOT/FAA Program Engineering and Maintenance Service (APM) and performed by Mr. Stephen Hall of Pailen-Johnson Associates, Inc. of Vienna, Virginia. Significant contributions were made by other PJA personnel, including Messrs. Claude Johnson, Al Premo, Robert Butler, and Michael Gandee.

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INTRODUCTION

In an effort to upgrade airport pavement design methods and evaluations based on nondestructive testing (NDT), the FAA identified the requirement to determine the lateral locations on particular pavements that have been subjected to the maximum cumulative loadings according to the mix of aircraft.

The objective of the study is to determine the cumulative load distribution across any given airport pavement based upon both theoretical considerations and the result of previous studies. A computer program is to be designed to model the distribution. The analysis section of the software will be structured to support operations that are unique on any given airport pavement and yet be flexible enough to allow the user to include new aircraft.

Critical to the design methodology, the prediction of the most likely failure locations, and the location of non-destructive test sites for civil aviation pavements is the determination of the lateral locations of the heaviest coverage of aircraft wheel paths. The following explanation of the design criteria is taken from FAA Report Number FAA-RD-74-36.¹

"In the design criteria, load repetitions are expressed in terms of coverages which represent the number of times a particular point on the pavement is expected to be stressed by a given number of aircraft operations (passes). The concept of coverages was first described in a letter entitled, "Design Curves for Less Than Capacity Operations," dated April 1949.²

A coverage caused by a particular aircraft type is a function of the number of passes, the number and spacing of wheels on the aircraft main landing gear, the width of the tire-contact area, and the lateral distribution of the

¹ FAA-RD-74-36, Field Survey and Analysis of Aircraft Distribution on Airport Pavements, February, 1975, by HoSang, Federal Aviation Administration, NTIS No. ADA-011-488.

² U.S. Army Engineer Waterways Experiment Station, CE, "Collection of Letter Reports on Flexible Pavement Design Curves", Miscellaneous Paper No. 4-61, June 1951, Vicksburg, MS.

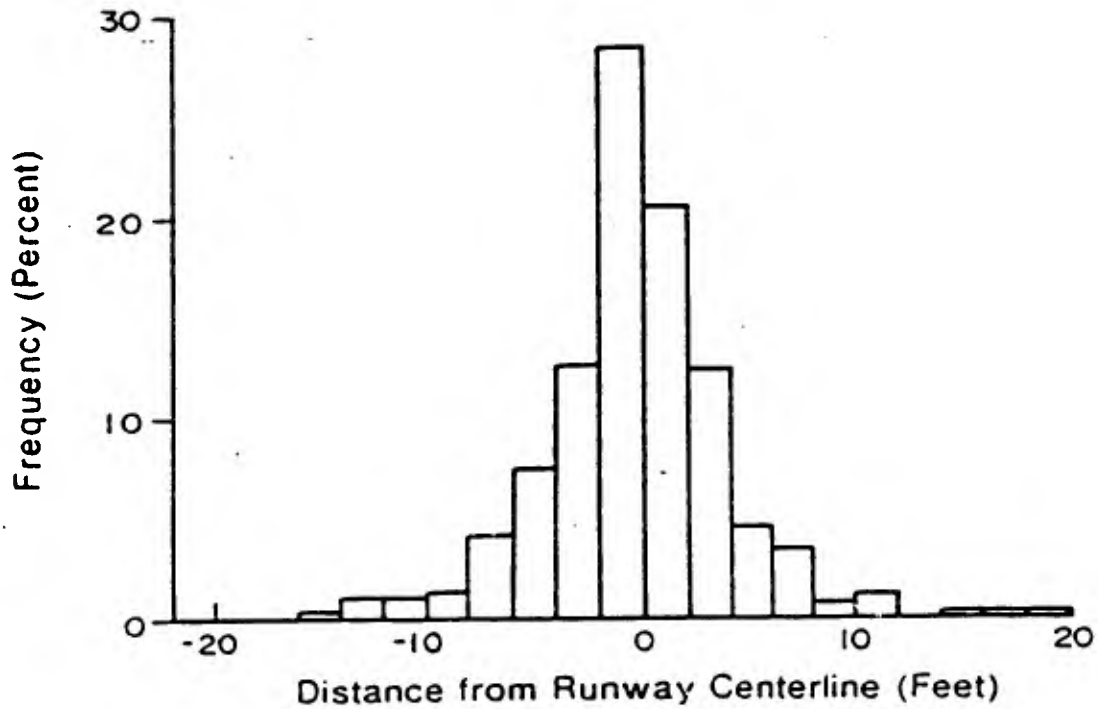
aircraft wheel-paths relative to the pavement centerline or guideline markings. The collective influence of these factors has been conveniently expressed in terms of derived pass-to-coverage (p/c) ratios based on observed lateral distribution patterns of aircraft wheel-paths."

The study presented by Victor HoSang in FAA-RD-74-36¹ was based upon a series of data collected at the following airports:

William B. Hartsfield Atlanta International Airport (ATL)
Chicago O'Hare International Airport (OPD)
Denver Stapleton International Airport (DEN)
Seattle-Tacoma International Airport (SEA)
Cleveland Hopkins International Airport (CLE)
Greater Buffalo International Airport (BUF)
Miami International Airport (MIA)
New Orleans International Airport (MSY)
Dallas-Fort. Worth Regional Airport (DFW).

The purpose of the study was to determine the distribution pattern of aircraft operations laterally across airport pavements from the runway or taxiway centerline. This was accomplished by placing sets of photoelectric transmitters and receivers across the pavements at fixed intervals as shown in Figure 1. For each operation, HoSang was able to determine the lateral position of a given aircraft from the centerline. Data were collected and sets of bar graphs were produced according to aircraft type, airport, type of operation, width of pavement and various other pavement conditions. Figure 2 shows a typical bar graph. Further analysis of the data led to the following conclusions:

- 1) Aircraft wheel paths conform to a theoretical normal distribution function as shown in Figure 3.
- 2) The effect of night operations, crosswinds, and wet pavement are negligible.

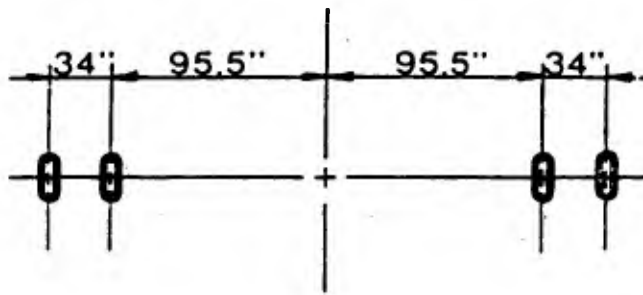


TYPICAL HISTOGRAM OF LATERAL DISTRIBUTION OF AIRCRAFT TRAFFIC ON RUNWAYS DURING TAKEOFFS
 (Actual data from Cleveland Hopkins International Airport Runway 23L)

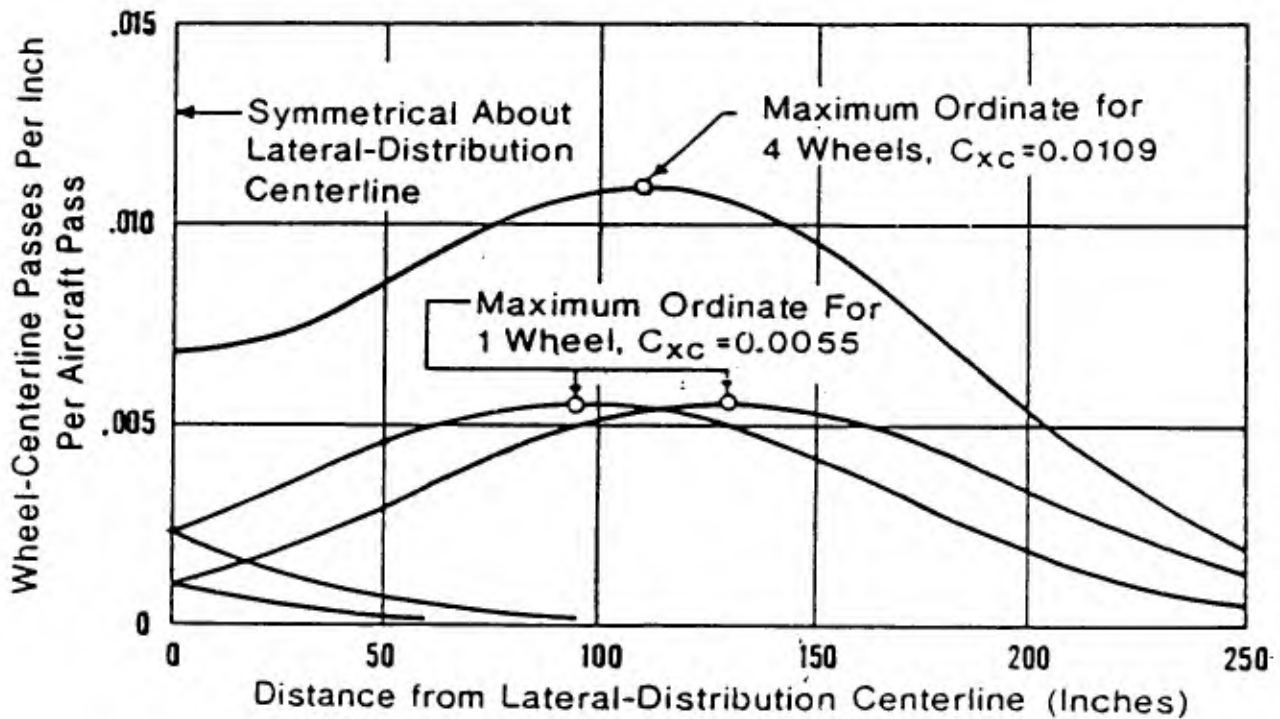
Source:

¹Hosang, p. 176

Figure 2



MAIN-GEAR CONFIGURATION
(Not To Scale)



(where C_{xc} = the maximum ordinate of the cumulative distribution of all wheels.)

Source:

¹ Hosang, p. 139

FIGURE 3

THEORETICAL NORMAL DISTRIBUTION
FOR BOEING 727 MAIN-GEAR
(FOR STANDARD DEVIATION OF 72 INCHES)

- 3) The offset of the aircraft centerline from the runway or taxiway centerline and the standard deviation of the normal distribution function were both empirically devised and are dependent upon the width of pavement and the type of operation. Table 1 summarizes these results.
- 4) There is no consistent correlation between either offset or standard deviation and the type of aircraft.

These conclusions were used to form the infrastructure and base algorithms for the Airport Pavement Load Analysis (APLA) program which is fully discussed in this report.

This report is divided into the following major sections:

- Section 1 - APLA Load Distribution Theory
- Section 2 - APLA Programming Considerations
- Section 3 - Conclusions and Recommendations

TABLE 1 SUMMARY OF AIRCRAFT DISTRIBUTION CHARACTERISTICS*

<u>PAVEMENT TYPE</u>	<u>PAVEMENT WIDTH, FT.</u>	<u>DISTRIBUTION CHARACTERISTICS</u>	
		<u>AVERAGE OFFSET, FT.¹</u>	<u>STANDARD DEVIATION, FT.</u>
<u>Runways</u>			
Landings	150	0.9 - 1.5 Left	7.0 - 10.3
	200	0.8 Right - 2.3 Left	9.0 - 11.2
Takeoffs	150	0.5 - 1.2 Left	6.0 - 8.3
	200	2.3 - 2.5 Left	7.5 - 8.2
<u>Taxiways</u>			
(Straight Sections)	75	2.1 Right	2.5 - 4.0
	100	3.2 Right	6.0
<u>Runway Exits</u>			
(High-Speed)	Varies	See Note ²	8.0 - 10.5

* Taken from FAA-RD-74-36, Executive Summary p. xxiv.

¹ Aircraft-centerline offset, measured relative to pavement centerline or guideline markings.

² Average offset was to the left or to the right of the guideline, depending upon the aircraft operational flow-pattern and exit configuration.

SECTION 1 - APLA LOAD DISTRIBUTION THEORY

In order to analyze the total cumulative load on a given airport pavement, an appropriate statistical distribution is calculated which is weighted according to the loads (weights) on individual aircraft landing gears and the frequencies of operations of the various aircraft types. FAA design criteria for airport pavements take into account load repetitions expressed in terms of the number of times (coverages) that a point on the pavement is expected to be stressed per aircraft pass or operation, based upon the observed lateral distribution of aircraft wheel paths on pavement. Conversely, the pass-to-coverage (p/c) ratio is a common method of expressing the average number of passes required to stress (cover) a particular point on the pavement.

The APLA analysis is based upon two concepts. The first is that the observed lateral distributions of aircraft wheel paths on pavement conform to a theoretical normal distribution as shown by the results of the empirical studies in Report No. FAA-RD-74-36, "Field Survey and Analysis of Aircraft Distribution on Airport Pavements". The calculations therefore use the normal distribution function for each landing gear:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\bar{x}}{\sigma}\right)^2}$$

where, $f(x)$ = normal distribution or frequency function; the magnitude of the normal distribution at point x expressed as gear centerline passes per inch per aircraft pass.

σ = standard deviation of the normal distribution function

x = the random variable; distance from the runway or taxiway centerline to the point where $f(x)$ is calculated.

\bar{x} = mean random variable; distance from the runway or taxiway centerline to the midpoint of the landing gear.

As pointed out in Report No. FAA-RD-74-36 (p. 137), coverage can be redefined as the maximum number of wheel passes at the point of maximum accumulation of occurrence of passes. In the case of the present analysis, because of the close spatial proximity of the wheels on any given landing gear and the large number of iterations inherent in the analysis, gear rather than wheel centerlines are used so $f(x)$ is expressed in terms of gear centerline passes (coverages) per inch per aircraft pass.

As established by the results in Report No. FAA-74-36, a correlation exists between the pavement width and both the standard deviation and the offset from the pavement centerline associated with take-offs, landings, and taxi operations. A difference in both the standard deviation and offset was also observed between take-off and landing operations. However, because the number of landings equals the number of take-offs, the two values for both the standard deviation and the offset can be averaged. In addition, over the range of all airports studied, there was no consistent correlation between aircraft type and either the standard deviation or the pavement centerline offset.

In light of the foregoing conclusions the normal distribution function is modified to:

$$f(x) = \frac{1}{\sigma_a \sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{x - (\bar{x} - x_0)}{\sigma_a} \right)^2}$$

for each type of pavement where all variables are the same as in the previous equation with the following modifications:

σ_a = average standard deviation

x_0 = average offset of the aircraft fuselage from the runway or taxiway centerline

Both the average standard deviation and the average offset are assigned according to values listed in the program (derived from averages of data in

Report No. FAA-RD-74-36) or the user may choose to use data specific to his airport if it is included in Report No. FAA-RD-74-36.

The second concept is that a quantitative measure of the load of an individual aircraft on airport pavement can be obtained from the products of the frequency function, the weight (m_i) on each landing gear, and the number of operations (passes, P_i) per year, summed for left or right landing gears of the individual aircraft (n). Since not all pavements are subjected to a bidirectional mode of operations, the magnitude and location of the cumulative distribution function for all landing gears will be dependent upon the percentage of operations (%) for a given direction of the pavement:

$$wf(x) = \sum_{i=1}^n \% P_i m_i f(x)_i$$

The resultant units of this weighted frequency function, $wf(x)$, are: (kilopasses/year) X (kilopounds) X (gear centerline passes/inch year) which reduces to megapound-coverages (gear centerline passes) per inch per year.

Therefore one direction or the other must be defined as the direction of perspective of the analysis. For example, if a pavement is oriented NE-SW, the user must define the direction of the perspective of the analysis as either NE or SW and input the percentage of operations in that direction.

The total cumulative load per year, $tf(x)$, on any pavement then is the sum of the individual weighted frequency functions for all aircraft (N),

$$tf(x) = \sum_{i=1}^N wf(x)_i$$

which is also expressed in megapound-coverages per inch per year.

The magnitude of this total cumulative load is the comparative quantitative measure of cumulative load on airport pavement and requires the following input for every aircraft used in each analysis:

- o wing and center gear locations
- o load per landing gear
- o frequency of operations per year

In addition, every analysis requires:

- o the compass orientation of the pavement
- o the percentage of operations in the defined compass direction
- o average standard deviation
- o average offset from pavement centerline

Figure 4 is a graphical representation of how the load distributions of three different types of aircraft combined to produce a total cumulative load distribution. The curves depict the cumulative loads generated by the gears of the individual aircraft as well as the total cumulative load from the gears of all aircraft. It should be noted that the standard deviation and centerline offset are the averages for a 150 foot wide runway and that the compass orientation of the runway is toward the north with 25% of the operations in this direction. The figure, however, shows the cumulative load on the pavement from all operations, i.e., 25% of the operations in the north direction and 75% of the operations in the south direction.

DATA FILE: COMLOT-150' RUNWAY
STANDARD DEVIATION = 90.48001 INCHES

DATE: MAY 5, 1986
COMPOSITE OFFSET = -11.88 INCHES

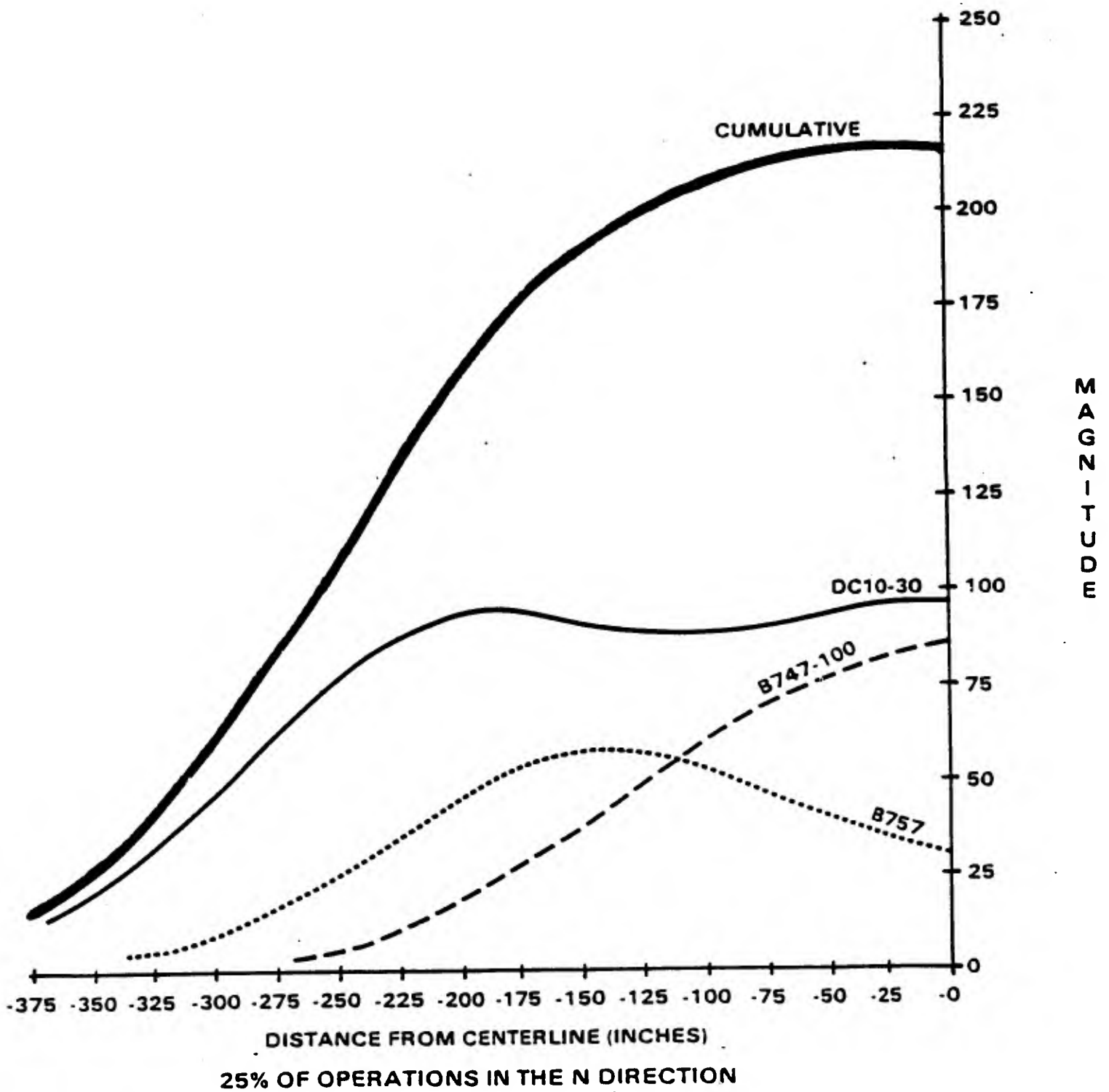
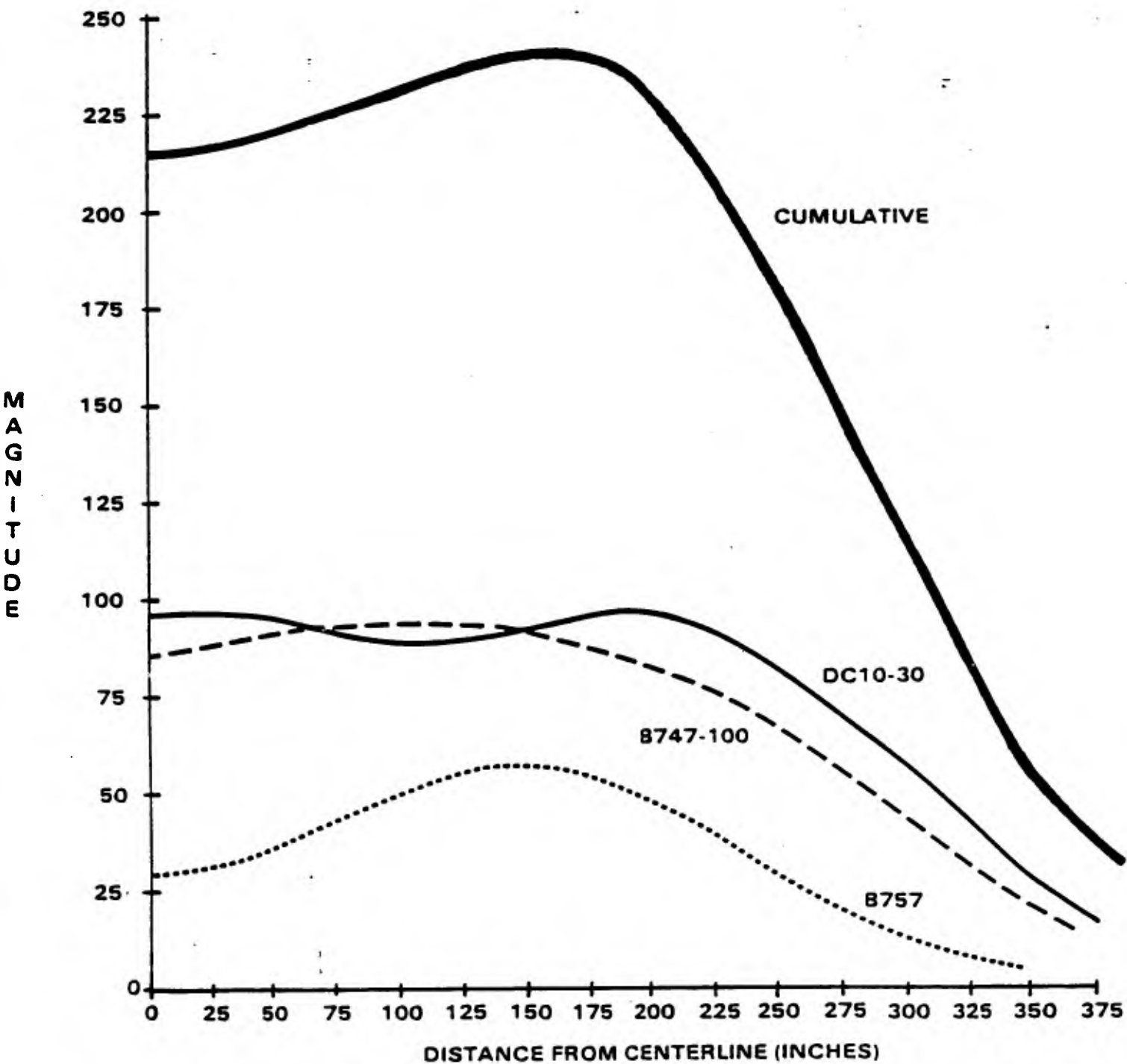


Figure 4

AIRPORT PAVEMENT LOAD ANALYSIS



25% OF OPERATIONS IN THE N DIRECTION

Figure 4 (Continued)

AIRPORT PAVEMENT LOAD ANALYSIS

SECTION 2 - APLA PROGRAMMING CONSIDERATIONS

The Airport Pavement Load Analysis (APLA) program was developed to determine a comparative quantitative measure of cumulative loads, how the cumulative loads vary with distance from the pavement centerline, and the locations of maximum cumulative loads on airport pavement according to any given mix of aircraft.

APLA was written in IBM BASIC version 3.0 and compiled with the IBM BASIC Compiler Version 2.00. The resulting APLA system executes on any IBM PC compatible hardware. The APLA Systems Manual is included as Appendix A and contains a detailed explanation of the system initialization, program files, data files, and system operation. A listing of the APLA system BASIC source code is included as Appendix B.

The following is a discussion of the capabilities of the APLA system. For the details involving the screen displays, reference to Appendix A should be made.

Aircraft Data File

The APLA system maintains a permanent data file of relevant aircraft data. These data include aircraft gear distances from the aircraft centerline and either weights per gear, or in the case of aircraft with single or single tandem wing gears, a gross weight from which the weight per wing gear is calculated by the program. The program also allows the user to edit the aircraft data file by adding new aircraft data, deleting an aircraft, or modifying any existing data. A good source of the required data is FAA Advisory Circular 150/5325-5B, "Aircraft Data"³.

Basically aircraft have three types of landing gear configurations:

- o A single set of wing gears such as the B727
- o A double set of wing gears such as the B747
- o A single set of wing gears and a center gear such as the DC10-30

³ AC NO: 150/5325-5B, Aircraft Data, July 1975, by Vitale, TAD-443.1.

Figure 5 shows "Aircraft Data" of Boeing B727, B747 and DC-10 aircraft with the three different configurations. The spacing between wing gears is given as the value "F" and for aircraft with a single set of wing gears, the maximum takeoff weight is input to calculate the load imposed by each wing gear. The total wing gear load is calculated as 95% of the gross takeoff weight⁴, i.e. the load per wing gear is 47.5% of the gross takeoff weight. The user may choose to input another weight based upon known average loads of the aircraft if they are well established.

For aircraft with a double set of wing gears or a set of wing gears and a center gear, the load on the wing landing gears is determined by using landing gear loading on pavement curves from the airplane characteristics reports published by the manufacturer of the individual aircraft.⁵ Figure 6 is an example of such a curve for the DC10-30 from reference 5a. The maximum takeoff weight of 555,000 pounds yields 97,000 pounds on the center gear and 444,000 pounds on the wing gears (or 222,000 pounds on each wing gear). The inner wing gear spacing for aircraft with a double set of wing gears can also be obtained from the airplane characteristics reports.

APLA also has the option of providing both a screen listing and a printout of the entire current aircraft data file.

Airport Data Files

Input data for any individual APLA analysis are contained in a data file created by the user. Since the APLA analysis calculates the magnitude of the cumulative load per year, the user should input the following data for each runway or taxiway analyzed in any given year:

- o data file name
- o width of runway or taxiway

⁴ AC 150/5320-6C, Airport Pavement Design and Evaluation, December 1978, p. 29.

MODEL	MAXIMUM TAKEOFF WEIGHT	MAXIMUM LANDING WEIGHT	A	B	C	D	E	F	G	J	K	M	N	P	TURN RADIUS
100	160,000 LB 72,600 KG	142,500 LB 64,700 KG	108'0" 32.92M	133'2" 40.59M	34'0" 10.36M	53'3" 16.23M	68'4" 20.93M	18'9" 5.72M	9'4" 2.84M	42'9" 13.07M	10'4" 3.14M	14'4" 4.37M	8'3" 2.51M	12'0" 3.66M	72'0" 21.9M
200	190,500 LB 86,500 KG	154,500 LB 70,100 KG	108'0" 32.92M	153'2" 46.68M	34'0" 10.36M	63'3" 19.28M	78'4" 23.88M	18'9" 5.72M	9'4" 2.84M	42'9" 13.07M	10'4" 3.14M	16'11" 5.16M	8'0" 2.44M	12'0" 3.66M	82'0" 25.0M

NOTE: 727-200 HAS OPTIONAL MAXIMUM TAKEOFF WEIGHT OF 207,500 LB (94,200 KG).
LANDING 160,000 LB (72,600 KG).

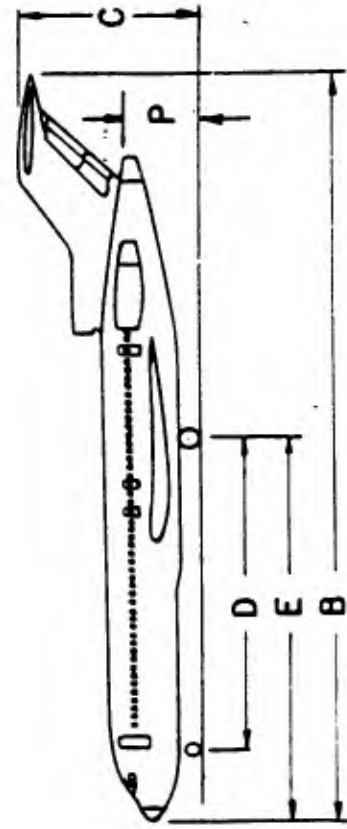
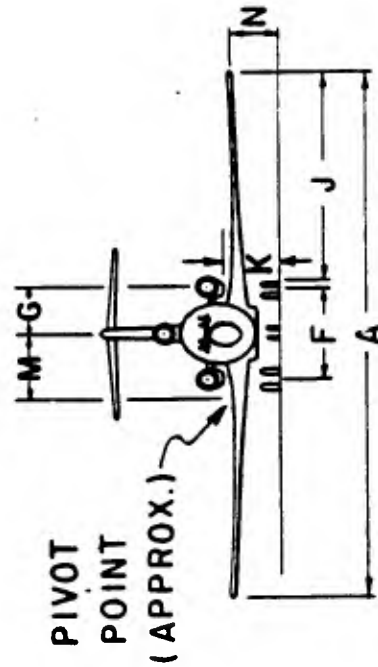


Figure 5 BOEING 727

MODEL	MAXIMUM TAKEOFF WEIGHT	MAXIMUM LANDING WEIGHT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	TURN RADIUS
100	710,000 LB 322,300 KG	564,000 LB 256,000 KG	195'8" 59.64M	231'10" 70.40M	64'3" 19.58M	84'0" 25.60M	109'5" 33.37M	36'1" 11.00M	39'9" 12.10M	69'10" 21.28M	77'6" 23.60M	3'9" 1.14M	6'0" 1.82M	50'0" 15.24M	17'7" 5.36M	168'0" 51.21M	
SP	560,000 LB 299,600 KG	450,000 LB 204,300 KG	195'8" 59.64M	184'9" 56.31M	65'10" 20.06M	67'4" 20.52M	92'9" 28.27M	36'1" 11.00M	39'2" 11.94M	69'6" 21.18M	77'6" 23.60M	3'7" 1.10M	5'7" 1.71M	40'0" 12.19M	17'2" 5.23M	138'0" 42.06M	

NOTES: 747-100 HAS OPTIONAL MAXIMUM TAKEOFF WEIGHT OF 735,000 LB. (333,700 KG).
 -200 " " " " 820,000 LB. (372,300 KG).
 -200 " " LANDING " " 630,000 LB. (286,000 KG).
 ALL OTHER 747-200 PARAMETERS SAME AS SHOWN FOR 747-100 ABOVE.

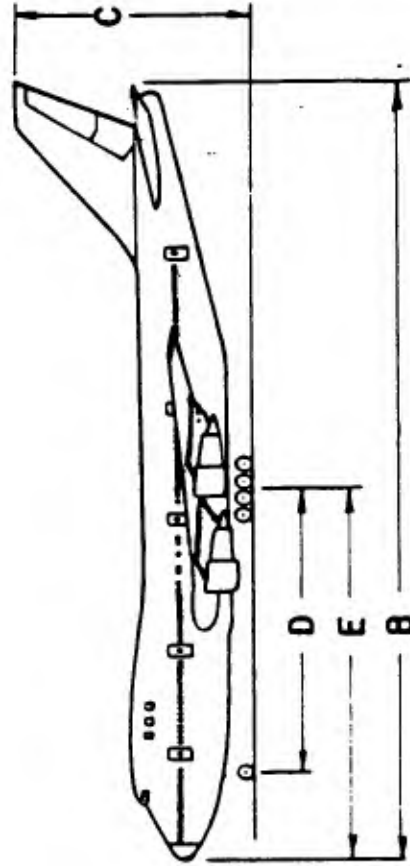
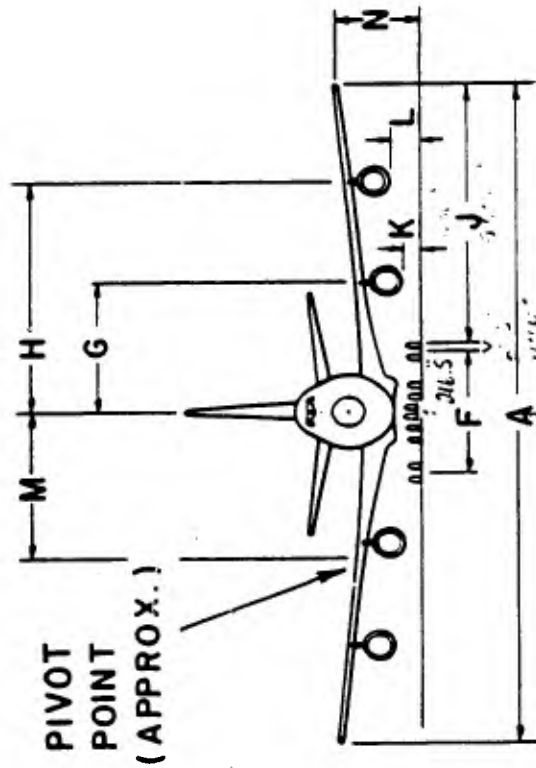


Figure 5 BOEING 747
(Continued)

SERIES	MAXIMUM TAKEOFF WEIGHT	MAXIMUM LANDING WEIGHT	A	B	C	D	E	F	G	J	K	M	N	P	TURN RADIUS
10 ✓	430,000 LB 195,048 KG	367,500 LB 164,884 KG	155.4" 47.55M	182.13" 55.55M	57.6" 17.53M	72.4.6" 22.06M	100.4" 30.56M	35.0" 10.67M	30.11" 9.42M	57.4" 17.45M	2.10" 0.86M	39.0" 11.9M	14.6" 4.42M	29.9" 9.07M	121.8" 37.1M
30,40 ✓	555,000 LB 251,748 KG	403,000 LB 182,801 KG	165.4" 50.39M	181.7" 55.35M	57.7" 17.55M	72.4.6" 22.06M	100.4" 30.56M	35.0" 10.67M	30.11" 9.42M	62.4" 18.97M	2.11" 0.89M	37.2.4" 11.3M	14.6" 4.42M	29.11" 9.12M	125.4" 38.2M

- NOTES: 1. CENTERLINE MAIN LANDING GEAR ON SERIES 30, 40 ONLY.
 2. SERIES 40 HAS LENGTH (B) OF 182.13" (55.55M).
 3. ALL VERTICAL DIMENSIONS SHOWN ARE NOMINAL CLEARANCE, MAXIMUM RANGE WEIGHT AND NOMINAL CENTER OF GRAVITY.

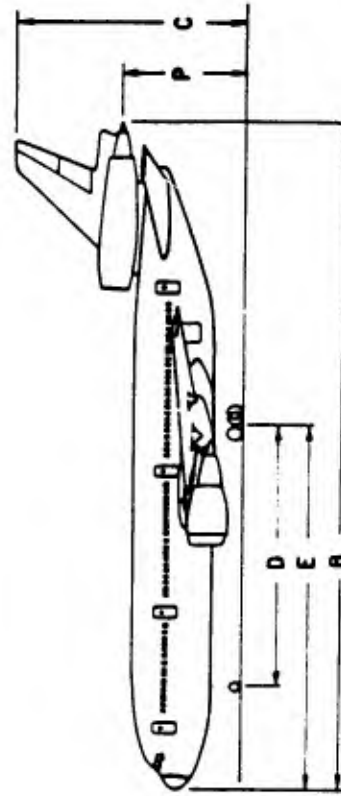
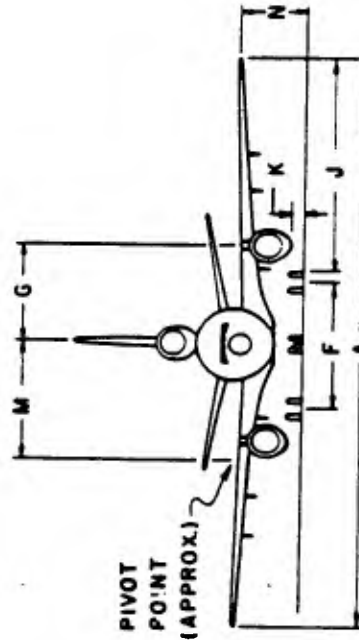


Figure 5 McDonnell-Douglas DC-10

(Continued)

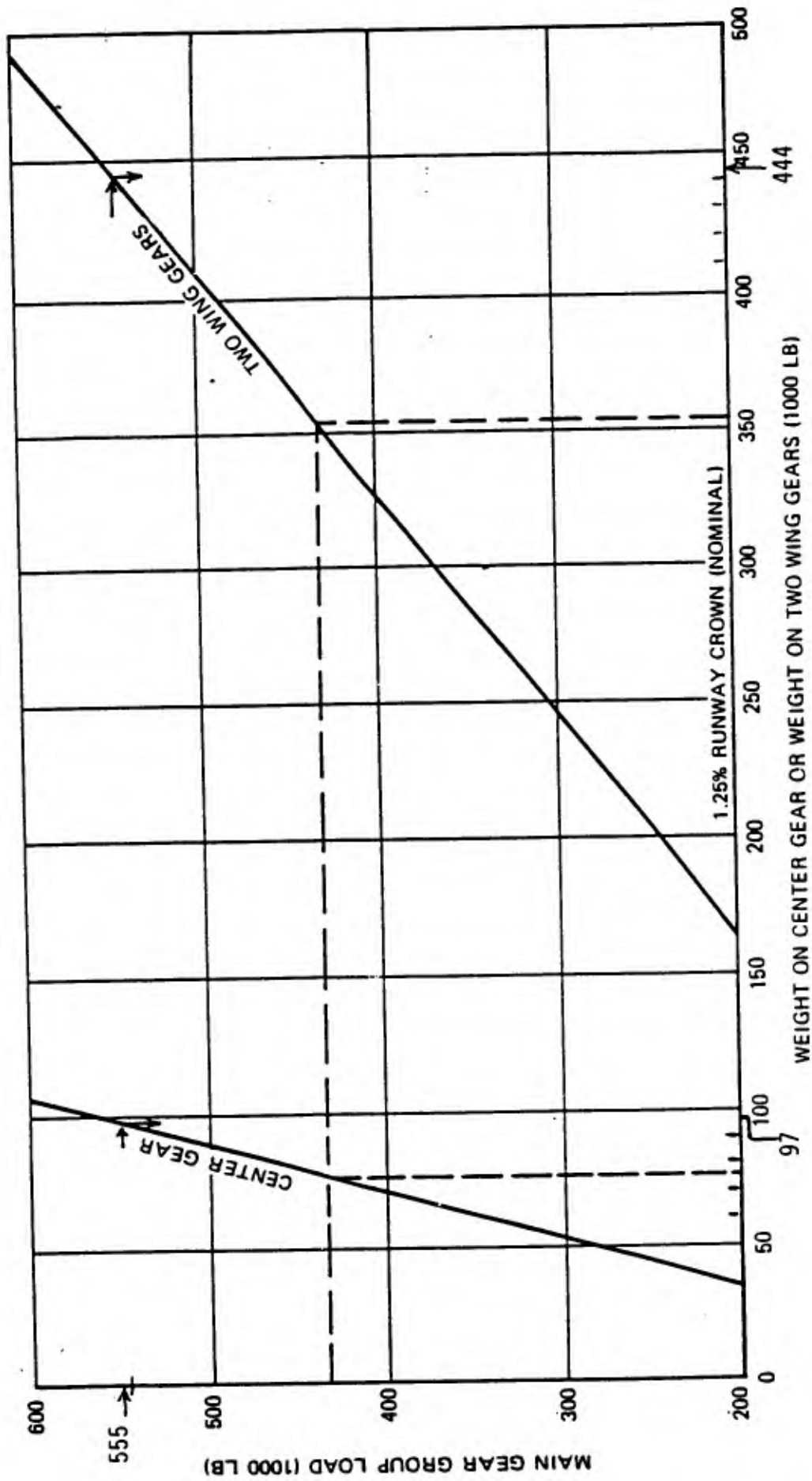


Figure 6 CENTER GEAR AND WING GEAR LOADING ON PAVEMENT
MODEL DC-10 SERIES 30, 30CF, 40 AND 40CF

- o average standard deviation of the normal distribution of operations on the runway or taxiway pavement
- o average offset of operations from the runway or taxiway centerline
- o compass orientation of the analysis
- o percentage of operations in the compass direction
- o number of operations per year of each aircraft type

The airport data from HoSang¹, has been reduced and included in the data file as default information for the user. Figure 7 shows these data. It is recommended that unless the user has more precise data, that indicated default values for the standard deviation and offset of the indicated runways and taxiways be used.

Figure 8 shows the contents of the airport data file "O'Hare" supplied with APLA. This data file was prepared using the "FAA Statistical Handbook of Aviation" for 1983.⁶ An approximation of the number of operations for 1983 was made by dividing the total number of each type of the more common aircraft types by the total number of aircarrier operations at O'Hare. A bidirectional mode of operations was assumed so that the percentage of operations in the NW direction is 50%. This is a "test" data file used to demonstrate the APLA program.

Once an airport data file is created, it is automatically saved on diskette until the user deletes it. APLA also allows a listing of the contents of any airport data file and a list of all existing data files.

Any airport data file may also be edited. The file can be renamed, deleted, or modified.

⁶ FAA Statistical Handbook of Aviation, Calendar Year 1983.

AVERAGES FOR ALL AIRPORTS STUDIED

150' RUNWAYS		200' RUNWAYS	
OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
-11.88	90.48	-18.96	104.76
75' TAXIWAYS		100' TAXIWAYS	
OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
29.64	42.84	38.40	70.80

CROSSWIND CONDITIONS FOR 150' RUNWAYS

AIRPORT	>5 KTS. FROM THE RIGHT		>5 KTS. FROM THE LEFT	
	OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
DEN	-39.78	110.76	16.14	97.68
ORD	-21.84	66.72	-24.90	87.30

Figure 7

Standard deviations and centerline offsets averaged from
FAA-RD-74-36, Figure 6

AIRPORT PAVEMENT LOAD ANALYSIS

DATA FILE: O'HARE - 150' RUNWAY

DATE: MARCH 24, 1986

50 % OF OPERATIONS IN THE NW DIRECTION

STANDARD DEVIATION = 90.48 INCHES

OFFSET = -11.88 INCHES

AIRCRAFT	OPERATION FREQUENCY (1000'S/ YEAR)	INNER GEAR DISTANCE (INCHES)	GROSS WEIGHT (KLBS.)	WEIGHT/ INNER GEAR (KLBS.)	OUTER GEAR DISTANCE (INCHES)	WEIGHT/ OUTER GEAR (KLBS.)
A300	6.198	189.0	302.000			
B707-320	4.375	132.5	312.000			
B727-200	204.535	112.5	190.500			
B737-200	63.439	103.0	115.500			
B747-100	26.615	75.0		168.625	216.5	168.625
B757	2.734	144.0	231.000			
B767	8.932	183.0	317.000			
DC 6	6.927	148.0	104.000			
DC 8-61	24.245	125.0	329.000			
DC 9-30	101.538	98.0	108.000			
DC10-30	28.256	0.0		97.000	210.0	222.000
L-188	6.745	187.0	116.000			
L-382	2.005	85.5	155.000			
L1011	21.146	216.0	430.000			

Figure 8

Sample airport data file supplied with APLA

Analyses

The results of APLA are generated in several ways:

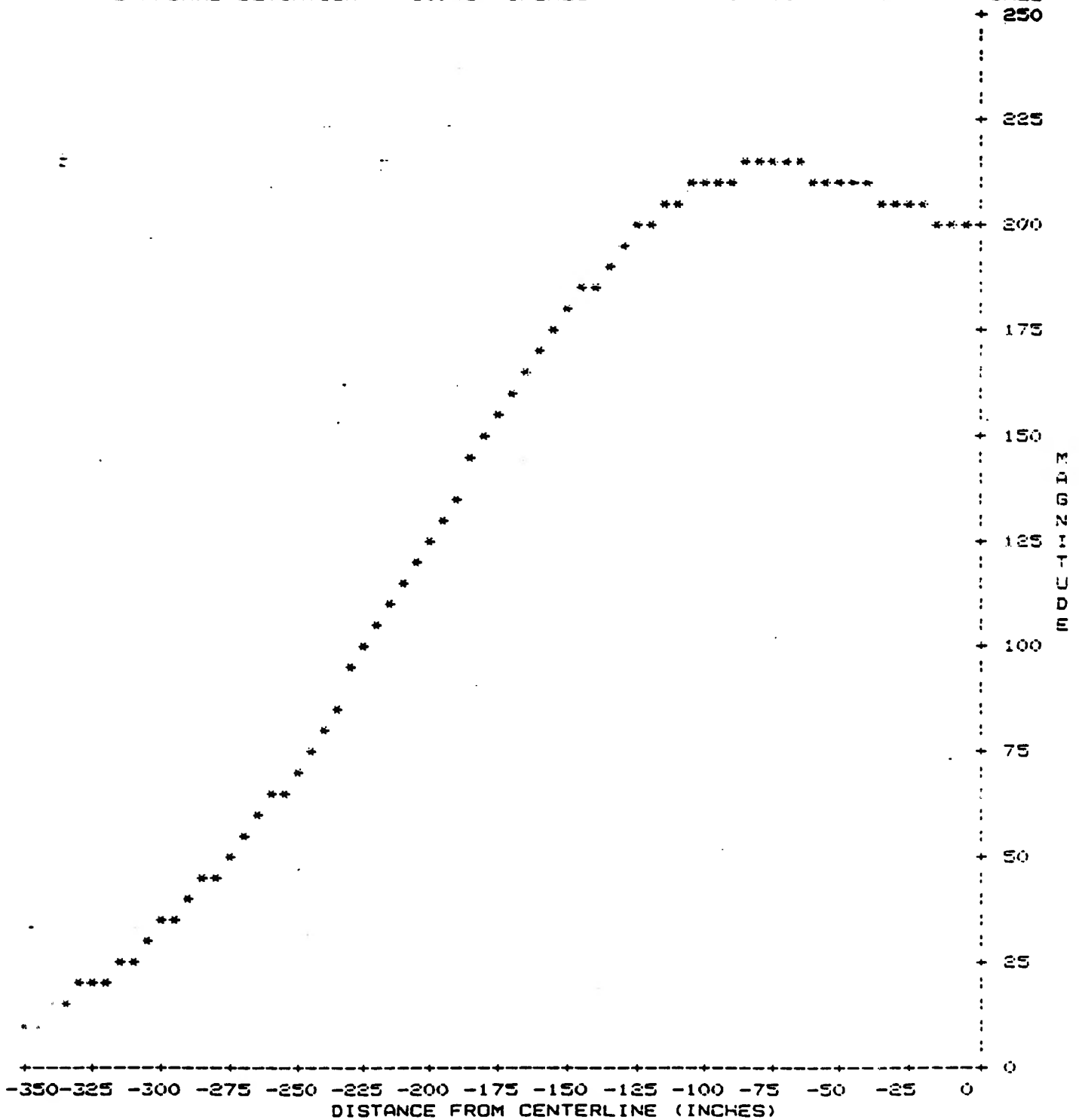
- o The location and magnitude of the positions of maximum cumulative load
- o The location and magnitude of the load distribution across the pavement every five (5) inches
- o A graphical representation of the entire load distribution

Figure 9 is an example of the graphical results of an APLA analysis using the O'Hare data file. Although twenty (20) inches is unrealistically small for the standard deviation, Figure 10 exaggerates how a smaller standard deviation increases the magnitude and attenuates the location of the load maxima.

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 90.48 INCHES

DATE: JULY 4, 1986
OFFSET = -11.88

INCHES



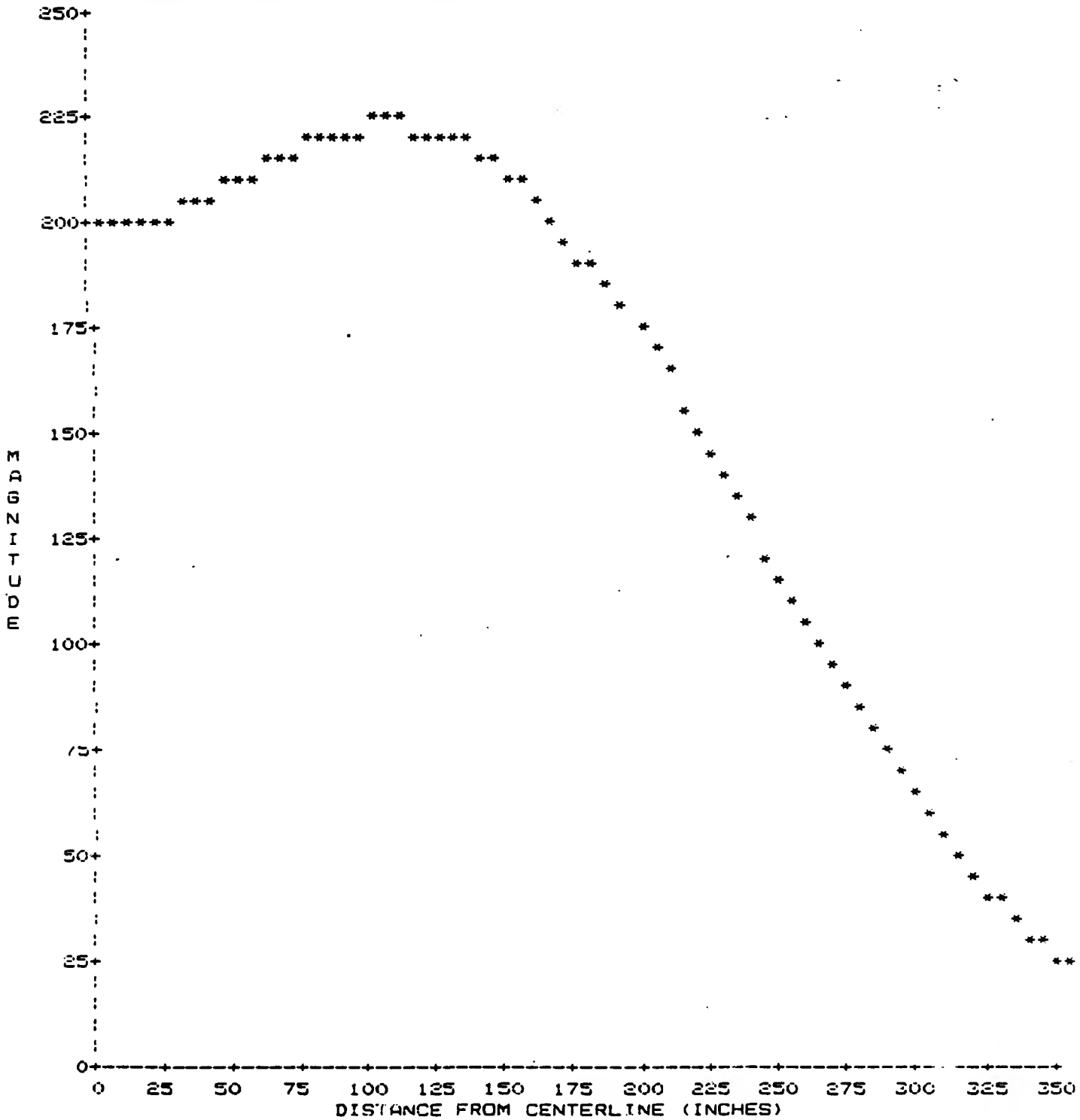
50 % OF OPERATIONS IN THE NW DIRECTION

Figure 9

Example of the graphical results of an APLA analysis using the O'Hare data file

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 90.48 INCHES

DATE: JULY 4, 1986
OFFSET = -11.88 INCHES

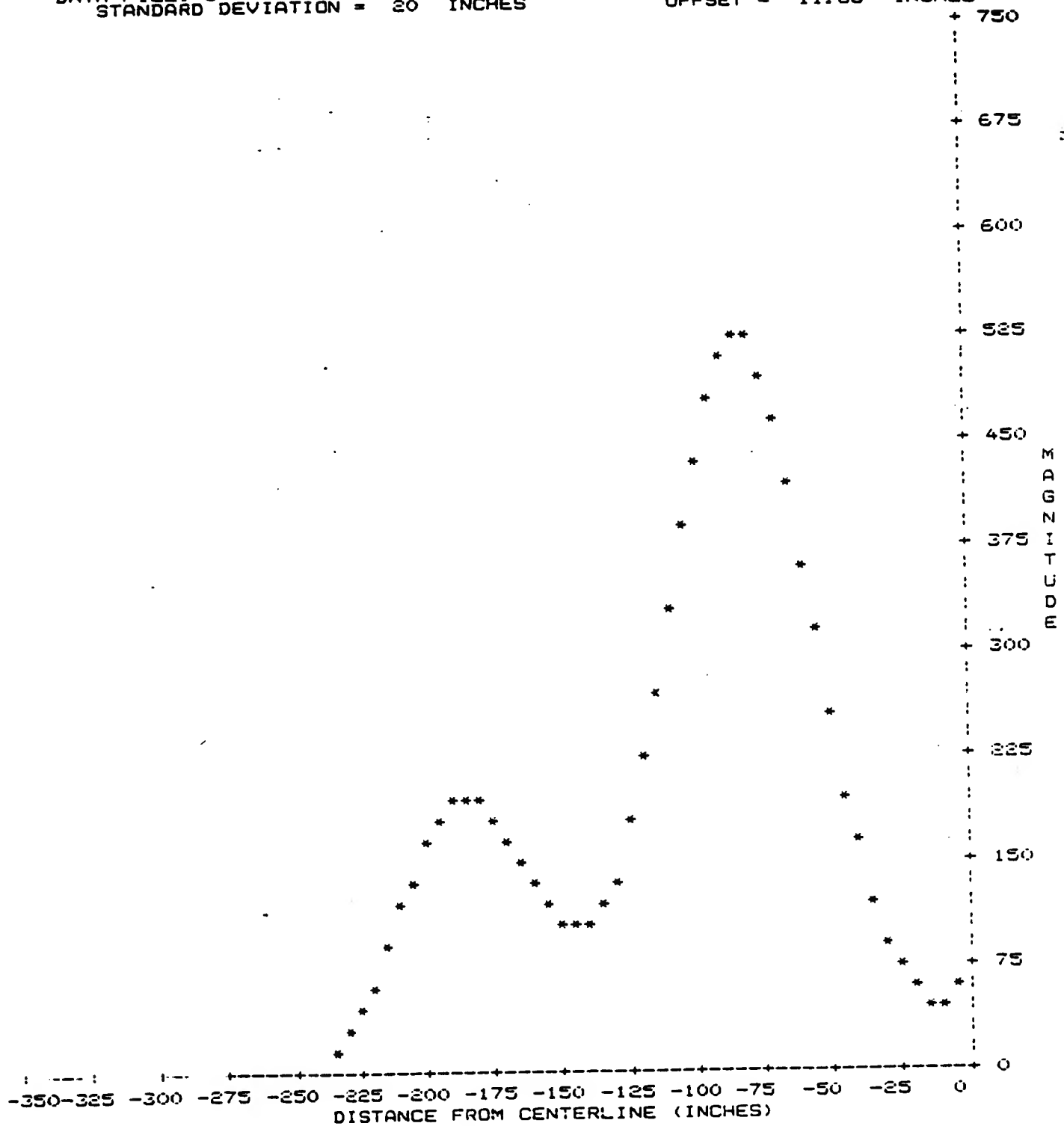


50 % OF OPERATIONS IN THE NW DIRECTION

Figure 9 (Continued)

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 20 INCHES

DATE: _____
OFFSET = -11.88 INCHES



50 % OF OPERATIONS IN THE NW DIRECTION

Figure 10

Graphical results of an APLA analysis using the O'Hare data file showing the effects of reducing the standard deviation

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 20 INCHES

DATE:
OFFSET = -11.88 INCHES

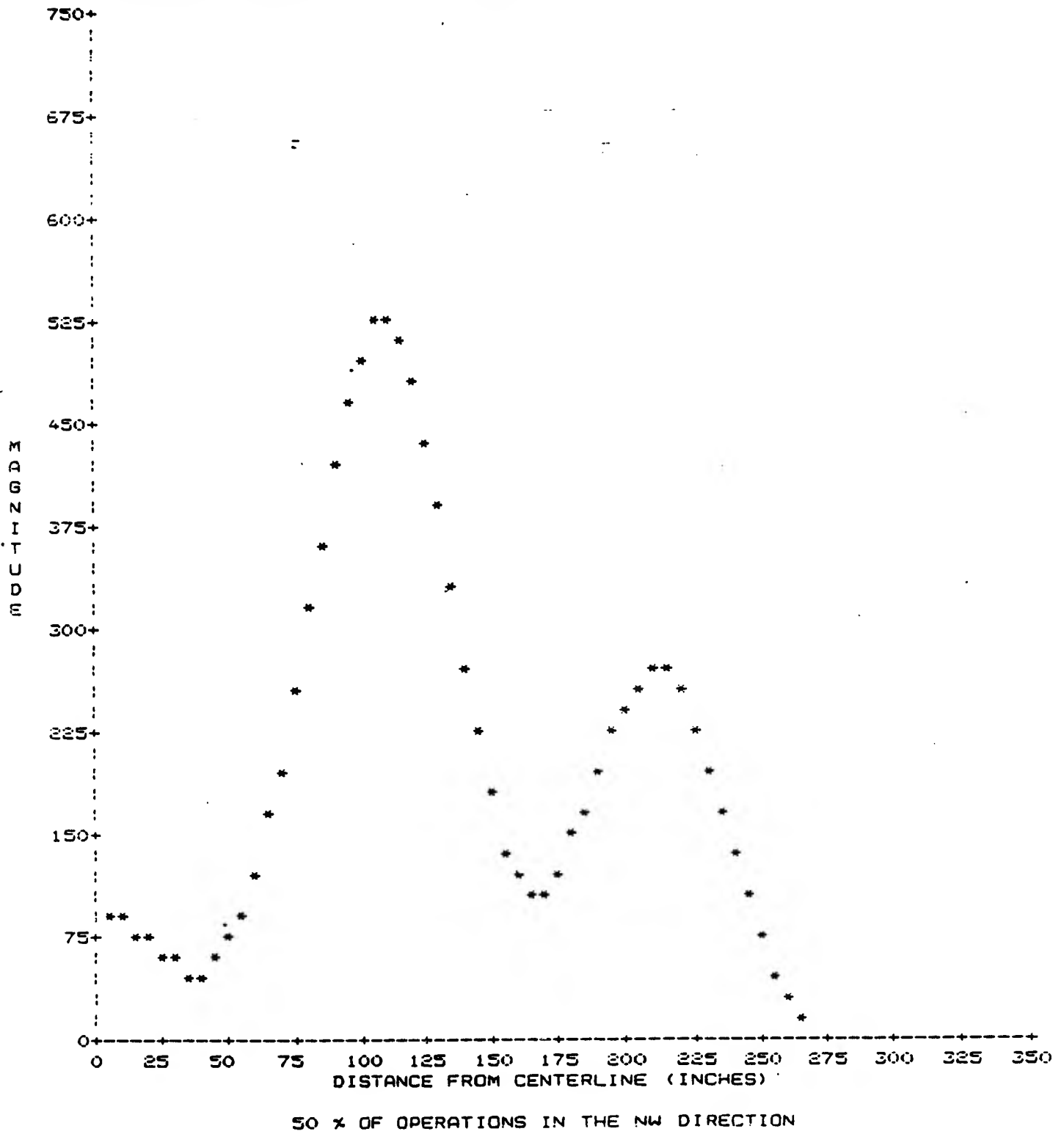


Figure 10 (Continued)

SECTION 3 - CONCLUSIONS

The most important conclusion is that APLA analysis can provide the results of a quantitative comparative measure of the cumulative load on any given airport pavement based on the mix of aircraft operations. The analysis is important because it produces the cumulative load across the entire pavement based upon the actual gear locations of the aircraft involved. Calculation of the load magnitude every five inches allows the user to examine how the cumulative loads vary across the pavement and how the maximum loads compare to the entire load distribution.

By contrast, the commonly accepted pavement design methodology is based upon the number of annual departures equivalent to a design aircraft, i.e. the aircraft that requires the greatest thickness of pavement. This approach is a "worst case" scenario whereby the annual departures assigned to the design aircraft are calculated as if all aircraft had the same landing gear configuration as the design aircraft and therefore the total load was exerted on the pavement at the location of the wheels of the design aircraft.⁴ From these data, the pavement thickness is determined based upon the predicted annual departures of the design aircraft over a twenty year period.

As previously noted, APLA uses actual loads and wheel configurations of the forecasted aircraft in determining the pavement loads. This approach generates data which are key to:

- o The determination of pavement design criteria
- o The prediction of lateral locations of primary fatigue
- o The location of non-destructive test (NDT) sites

SECTION 4 — RECOMENDATIONS

In its present configuration, APLA computes and presents the cumulative load distribution across a given pavement in both tabular and graphical form. The analysis, though complete, is structured such that several enhancements could be readily incorporated. It is therefore recommended that the following items be considered for future study.

1. The APLA analysis should be expanded to differentiate between the lateral load distributions at the middle and at the ends of the runways based upon data from HoSang¹.
2. A study should be performed to determine how the magnitude of the APLA cumulative load compares to the current pavement design analysis so that the APLA program can be used as further input to design methodologies especially in terms of more accurately determining thicknesses laterally across pavements.
3. A study to determine when and where a given pavement will first fail based upon APLA should be conducted. Current pavement design procedures calculate required thicknesses of pavement for a 20 year life expectancy at the location of the wing gears of the design aircraft. The proposed study should assess how the location of maximum load calculated by APLA corresponds to the wing gear location of the design aircraft and when failure will occur based upon the cumulative repetitions of the traffic mix.

It is recommended that copies of the APLA program be used periodically for runways and taxiways at major airports to obtain any changes in the cumulative load distributions.

APPENDIX A -- AIRPORT PAVEMENT LOAD ANALYSIS SYSTEMS DOCUMENTATION

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1.0 INTRODUCTION

APLA has been developed to determine a comparative quantitative measure of cumulative loads, how the cumulative loads vary with distance from the pavement centerline, and the locations of maximum cumulative loads on airport pavement according to any given mix of aircraft. The results of this analytical procedure are useful for applications such as:

- o The prediction of lateral locations of primary fatigue
- o The determination of pavement design criteria
- o The location of non-destructive test (NDT) points.

2.0 SYSTEM THEORY

In order to analyze the total cumulative load on a given airport pavement, an appropriate statistical distribution is calculated which is weighted according to the loads (weights) on individual aircraft landing gears and the frequencies of operations of the various aircraft types. FAA design criteria for airport pavements take into account load repetitions expressed in terms of the number of times (coverages) that a point on the pavement is expected to be stressed per aircraft pass or operation, based upon the observed lateral distribution of aircraft wheel paths on pavement. Conversely, the pass-to-coverage (p/c) ratio is a common method of expressing the average number of passes required to stress (cover) a particular point on the pavement.

The APLA analysis is based upon two concepts. The first is that the observed lateral distributions of aircraft wheel paths on pavement conform to a theoretical normal distribution as shown by the results of the empirical studies in Report No. FAA-RD-74-36, "Field Survey and Analysis of Aircraft Distribution on Airport Pavements". The calculations therefore use the normal distribution function for each landing gear:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\bar{x}}{\sigma}\right)^2}$$

where, $f(x)$ = normal distribution or frequency function; the magnitude of the normal distribution at point x expressed as gear centerline passes per inch per aircraft pass.

σ = standard deviation of the normal distribution function

x = the random variable; distance from the runway or taxiway centerline to the point where $f(x)$ is calculated.

\bar{x} = mean random variable; distance from the runway or taxiway centerline to the midpoint of the landing gear.

As pointed out in Report No. FAA-RD-74-36 (p. 137), coverage can be redefined as the maximum number of wheel passes at the point of maximum accumulation of occurrence of passes. In the case of the present analysis, because of the close spatial proximity of the wheels on any given landing gear and the large number of iterations inherent in the analysis, gear rather than wheel centerlines are used so $f(x)$ is expressed in terms of gear centerline passes (coverages) per inch per aircraft pass.

As established by the results in Report No. FAA-74-36, a correlation exists between the pavement width and both the standard deviation and the offset from the pavement centerline associated with take-offs, landings, and taxi operations. A difference in both the standard deviation and offset was also observed between take-off and landing operations. However, because the number of landings equals the number of take-offs, the two values for both the standard deviation and the offset can be averaged. In addition, over the range of all airports studied, there was no consistent correlation between aircraft type and either the standard deviation or the pavement centerline offset.

In light of the foregoing conclusions the normal distribution function is modified to:

$$f(x) = \frac{1}{\sigma_a \sqrt{2\pi}} \cdot e^{-\frac{1}{2} \left(\frac{x - (\bar{x} - x_o)}{\sigma_a} \right)^2}$$

for each type of pavement where all variables are the same as in the previous equation with the following modifications:

σ_a = average standard deviation

x_o = average offset of the aircraft fuselage from the runway or taxiway centerline

Both the average standard deviation and the average offset are assigned according to values listed in the program (derived from averages of data in

Report No. FAA-RD-74-36) or the user may choose to use data specific to his airport if it is included in Report No. FAA-RD-74-36.

The second concept is that a quantitative measure of the load of an individual aircraft on airport pavement can be obtained from the products of the frequency function, the weight (mi) on each landing gear, and the number of operations (passes, Pi) per year, summed for left or right landing gears of the individual aircraft (n). Since not all pavements are subjected to a bidirectional mode of operations, the magnitude and location of the cumulative distribution function for all landing gears will be dependent upon the percentage of operations (%) for a given direction of the pavement:

$$wf(x) = \sum_{i=1}^n \% P_i m_i f(x)_i$$

The resultant units of this weighted frequency function, wf(x), are: (kilopasses/year) X (kilopounds) X (gear centerline passes/inch year) which reduces to megapound-coverages (gear centerline passes) per inch per year.

Therefore one direction or the other must be defined as the direction of perspective of the analysis. For example, if a pavement is oriented NE-SW, the user must define the direction of the perspective of the analysis as either NE or SW and input the percentage of operations in that direction.

The total cumulative load per year, tf(x), on any pavement then is the sum of the individual weighted frequency functions for all aircraft (N),

$$tf(x) = \sum_{i=1}^N wf(x)_i$$

which is also expressed in megapound-coverages per inch per year.

The magnitude of this total cumulative load is the comparative quantitative measure of cumulative load on airport pavement and requires the following input for every aircraft used in each analysis:

- o wing and center gear locations .
- o load per landing gear
- o frequency of operations per year

In addition, every analysis requires:

- o the compass orientation of the pavement
- o the percentage of operations in the defined compass direction
- o average standard deviation
- o average offset from pavement centerline

The data base structure and maintainability are explained under separate headings.

An additional future outcome of this analysis could be implemented by comparing various empirical measurements with the magnitude of the total cumulative load. For example, by comparing moduli of elasticity measurements with $tf(x)$, a mathematical relationship may evolve whereby the modulus of elasticity could be calculated at any given lateral location on an airport pavement from its $tf(x)$ value adjusted to account for significant variables such as pavement composition and climate.

3.0 SYSTEM REQUIREMENTS

The following are the minimum necessary requirements for the APLA system.

A) **HARDWARE**

- o An IBM PC, XT, AT or compatible microcomputer
- o 64K Random Access Memory (RAM)
- o Two disk drives (floppies and/or hard disk) each with 360 bytes minimum
- o Compatible printer (no special features)

B) **OPERATING SYSTEM**

- o PC-DOS or MS-DOS which must be added to APLA diskette A as described in Section 6.J

C) **SOFTWARE**

- o APLA diskettes A and B

4.0 PROGRAM FILES

The APLA system is composed of the following program files, written in BASIC, which operate interdependently to produce the modeling results:

- o APLA.BAS -- Introduction
- o APLA2. BAS -- Primary options menu
- o DATSORT.BAS -- Aircraft data file editor
- o LIST1.BAS -- Aircraft data file listing and printout
- o ANALYSIS.BAS -- Airport data file creation, editing, listing and
 printout. Total cumulative load calculations
 and report and graph generation.

Listings of each program are included in Appendix A.

5.0 DATA FILES

The system maintains one independent and a set of dependent random access data files. The independent data file, AIRCRAFT.DAT, and three of the dependent data files, are accessed during any single analysis. AIRCRAFT.DAT, residing on diskette A, contains gear location and weight per gear data for most of the heavier (>90,000 lbs.) commercial aircraft.

The user names and creates, or selects the airport data file which contains the frequency of operations per year for the heavier aircraft that operate on the particular airport runway or taxiway that is to be analyzed. This airport data file along with the other airport data files are maintained in the DATFILS directory on diskette B.

DATE.DAT, residing on diskette A, and FILELIST.DAT, residing on diskette B, are supplemental data files. DATE.DAT contains only the current date entered at the beginning of an APLA analysis and FILELIST.DAT contains a current list of airport data files in the DATFILS directory on diskette B.

5.1 Data File Structure

The following pages describe each data file structure field by field, showing field name, field type (C=character, N=numeric), field width, and field description.

5.1.1

All records in the AIRCRAFT.DAT file have the following configuration:

Structure for file: AIRCRAFT.DAT

Number of Records: 00033

Date of last update: 01/08/86

Independent data file

FLD	NAME	TYPE	WIDTH	DESCRIPTION
001	BUF.LG\$	N	4	Number of landing gears
002	BUF.A\$	C	10	Aircraft designator
003	BUF.B\$	N	4	Inner gear location
004	BUF.GW\$	N	4	Gross weight
005	BUF.C\$	N	4	Weight/inner gear
006	BUF.D\$	N	4	Outer gear location
007	BUF.E\$	N	4	Weight/outer gear
TOTAL			34	

5.1.2

The first record in an airport data file, such as O'HARE.DAT, has the structure of the following record 00001 while the remaining records have the structure of the second following group.

Structure for file: O'HARE.DAT (example of an airport data file)

Number of records: 00012

Date of last update: 01/08/86

Dependent data file

RECORD 00001

FLD	NAME	TYPE	WIDTH	DESCRIPTION
001	BUF.PF\$	N	4	Percentage of operations in the given direction
002	BUF.DIR\$	C	2	Given direction of perspective
003	BUF.OS\$	N	4	Offset from centerline
004	BUF.SD\$	N	4	Standard deviation
005	BUF.TYP\$	C	20	Type of pavement facility
006	BUF.CW\$	C	2	Code for crosswind conditions
TOTAL			36	

RECORDS 00002 - 00011

FLD	NAME	TYPE	WIDTH	DESCRIPTION
001	BUF.LG\$	N	4	Number of landing gears
002	BUF.AD\$	C	10	Aircraft designator
003	BUF.FREQ\$	N	4	Frequency of operations
004	BUF.B\$	N	4	Inner gear location
005	BUF.GW\$	N	4	Gross weight
006	BUF.C\$	N	4	Weight/inner gear
007	BUF.D\$	N	4	Outer gear location
008	BUF.E\$	N	4	Weight/out gear
TOTAL			38	

5.1.3

Structure for file: DATE.DAT
Number of records: 00001
Date of last update: 03/21/86
RECORD 00001

FLD	NAME	TYPE	WIDTH	DESCRIPTION
001	BUF.PDATE\$	C	17	Date of current APLA
analysis				
TOTAL			17	

5.1.4

Structure for file: FILELIST.DAT
Number of records: 00002
Date of last update: 01/08/86
RECORD 00001-00002

FLD	NAME	TYPE	WIDTH	DESCRIPTION
001	BUF.FILENAM\$	C	8	Name of airport data file
TOTAL			8	

6.0 SYSTEM INITIALIZATION

The first time that the system is used, DOS should be copied onto APLA diskette A if the user has in IBM PC. This is accomplished by inserting the user's DOS diskette into drive A, turning on the microcomputer and inserting APLA diskette A into drive B. After A> appears on the screen, enter: COPY COMMAND.COM B:. APLA diskette A should now be configured.

Back-up copies of the APLA diskette A should be made at this time using the DOS commands, FORMAT and DISKCOPY, taking care to format the blank back-up diskette and then copying the APLA diskette A onto the back-up diskette. The original APLA diskette A should then be stored away.

Once the hardware is booted (turned on) i.e. A> appears on the screen, the user simply inserts the back-up program diskette, A, into drive A, the data file diskette, B, into drive B, and enters "APLA".

If an XT or an AT is being used, turn on the microcomputer and insert APLA diskette A into drive B, after C> appears on the screen. Then enter:

```
MD APLA
CD APLA
COPY B:*.*
```

This creates an APLA subdirectory under which the contents of APLA diskette A are copied. After all files are copied, replace APLA diskette A in drive B with APLA diskette B and store the original APLA diskette away.

Once the XT or AT is turned on, i.e. C> appears on the screen, then enter:

```
CD APLA
APLA
```

7.0 INITIAL SCREEN

The system is operational when the initial screen (Fig. 1) is displayed. Simply enter the date and the main menu will appear. The date may be entered in any format desired, up to 17 characters in length, and then the main menu will be activated.

```

      A          PPPPPP          LL          A
    A  A        PP  PP        LL          A  A
  A  A  A      PP  PP        LL          A  A  A
AAAAAAA      P P P P P      LL          AAAAAAA
  A          PP           LL          A          A
 A          PP           LL          A          A
A          PP           LLLLLL        A          A

```

AIRPORT PAVEMENT LOAD ANALYSIS

Software developed by PAILEN-JOHNSON ASSOC., INC.

PLEASE ENTER TODAY'S DATE:
(MAXIMUM 17 CHARACTERS)

CAPS LOCK SHOULD BE ON

Figure 1

APLA INTRODUCTION/DATE SCREEN

8.0 MAIN MENU

From the main menu (Fig. 2) select one of the four options discussed in the following sections.

AIRPORT PAVEMENT LOAD ANALYSIS

```
*****  
*  
*   Welcome to APLA, a program designed to analyze the   *  
*   distribution of aircraft load on airport pavement   *  
*   according to the frequency of traffic.               *  
*  
*****
```

MAIN MENU

ENTER DESIRED OPTION:

L: TO LIST THE AIRCRAFT DATA FILE.

E: TO EDIT THE AIRCRAFT DATA.

A: TO RUN ANALYSES.

Q: TO EXIT.

WAITING?

Figure 2

MAIN MENU SCREEN

9.0 AIRCRAFT DATA FILE LISTING

Entering "L" routes control to this section.

The aircraft data listing menu (Fig. 3) allows listings and printouts of either the entire aircraft data file or only the aircraft in the data file. Whenever a printout is selected the following statement is displayed on the screen:

"Wait until printout is complete. Then press any key to continue."

When the flashing cursor reappears any key may be pressed to continue.

9.1 Aircraft Listing and Printout

Entering "A" will produce a screen listing and entering "B" will produce a hard copy of aircraft in the aircraft data file (Fig. 4).

9.2 Entire Aircraft Data File Listing and Printout

Entering "L" will produce a screen listing and "P" will produce a hard copy of the entire aircraft data file contents. Figure 5 shows the contents of the data file supplied with the program. Note that three types of aircraft are listed according to their landing gear configuration relative to the aircraft centerline.

- o aircraft with only one set of wing gears — the inner gear distance from centerline is the distance between the center of the wing gear and the fuselage centerline. The load per gear is calculated from the gross weight.

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                    X
X          DATA LISTING                          X
X                                                    X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

ENTER:

A: TO SEE A LIST OF AIRCRAFT IN THE CURRENT DATA FILE.

B: TO OBTAIN A PRINTOUT OF AIRCRAFT IN THE CURRENT DATA FILE

L: TO SEE A LIST OF THE ENTIRE DATA FILE

P: TO OBTAIN A PRINTOUT OF THE ENTIRE DATA FILE

R: TO RETURN TO THE MAIN MENU

WAITING?

Figure 3

DATA LISTING

Figure

RECORD #	AIRCRAFT DESIGNATOR	RECORD #	AIRCRAFT DESIGNATOR
1	A300	17	DC 6
2	B707-120	18	DC 8
3	B707-320	19	DC 8-50
4	B707320B	20	DC 8-61
5	B720	21	DC 8-62
6	B727-100	22	DC 8-63
7	B727-200	23	DC 9-10
8	B737-100	24	DC 9-20
9	B737-200	25	DC 9-30
10	B747-100	26	DC 9-40
11	B747-SP	27	DC 9-50
12	B757	28	DC10-10
13	B767	29	DC10-30
14	CONCORDE	30	L-188
15	CV880	31	L-382
16	CV990	32	L1011

PRESS ANY KEY TO CONTINUE

Figure 4

AIRCRAFT DESIGNATOR FILE

AIRCRAFT DESIGNATOR	INNER GEAR DISTANCE FROM CENTERLINE (INCHES)	GROSS WEIGHT (KLBS.)	WEIGHT/ INNER GEAR (KLBS.)	OUTER GEAR DISTANCE FROM CENTERLINE (INCHES)	WEIGHT/ OUTER GEAR (KLBS.)
A300	189.0	302.000			
B707-120	132.5	257.000			
B707-320	132.5	312.000			
B707320B	132.5	327.000			
B720	131.5	231.000			
B727-100	112.5	160.000			
B727-200	112.5	190.500			
B737-100	103.0	100.000			
B737-200	103.0	115.500			
B747-100	75.0		168.625	216.5	168.625
B747-SP	75.0		133.000	216.5	133.000
B757	144.0	231.000			
B767	183.0	317.000			
CONCORDE	152.0	400.000			
CV880	113.0	184.500			
CV990	119.5	246.200			
DC 6	148.0	104.000			
DC 8	125.0	315.000			
DC 8-50	125.0	325.000			
DC 8-61	125.0	328.000			
DC 8-62	125.0	350.000			
DC 8-63	125.0	355.000			
DC 9-10	98.0	90.700			
DC 9-20	98.0	100.000			
DC 9-30	98.0	108.000			
DC 9-40	98.0	114.000			
DC 9-50	98.0	121.000			
DC10-10	210.0	430.000			
DC10-30	0.0		97.000	210.0	222.000
L-188	187.0	116.000			
L-382	85.5	155.000			
L1011	216.0	430.000			

Figure 5

AIRCRAFT WHEEL GEAR CONFIGURATION

- o aircraft with two sets of wing gears — indicated by inner gear distance from centerline, a weight/inner gear, an outer gear distance from centerline and a weight/outer gear.

- o aircraft with one set of wing gears and a body gear — indicated by a zero inner gear distance from centerline and a weight/inner gear for the body gear and an outer gear distance from centerline and a weight/outer gear for the wing gear.

The weights are listed as KLBS which represents thousands of pounds.

Entering "R" will return control to the main menu.

10.0 AIRCRAFT DATA FILE EDITOR

Aircraft data file editing should be done with the following considerations in mind:

- o Any parameter changes will naturally affect the results of analyses and therefore should be implemented with a high level of certainty.
- o Lists of changes should be examined so that mistakes can be corrected. After completion of any edit mode the user will be prompted as to whether a list of changes is desired.
- o To optimize execution time of the analysis the aircraft data file should not include data for extraneous aircraft.
- o Once an aircraft is deleted, the data for that aircraft is erased from the file. However, original data can be re-entered by reading it from a listing of the original aircraft data file using the back-up diskette or Figure 5.
- o Changes to the aircraft data file require a short wait to be sorted and written to diskette. Therefore, for editing efficiency, all editing (additions, deletions and modifications) can be done before sorting. In other words, when the user is prompted as to whether more changes are desired, a "Y" response should be given until all editing is complete.

Entering "E" from the main menu directs control to this section.

Figure 6 shows the aircraft data file editor menu from which the indicated options can be selected.

```
*****
*
*                AIRCRAFT                *
*            DATA FILE EDITOR            *
*
*****
```

ENTER DESIRED OPTION:

A: TO ADD NEW DATA

D: TO DELETE DATA

M: TO MODIFY DATA

L: TO LIST THE DATA FILE

R: TO RETURN TO THE MAIN MENU

WAITING

Figure 6 .

AIRCRAFT DATA FILE EDITOR

10.1 Aircraft Data Addition

This mode is only for adding aircraft not already included in the aircraft data file. Aircraft data may be obtained from FAA Advisory Circular 150/5325-5B or manufacturers specifications.

Entering an "A" from the editor menu will display:

```
-----  
: ENTER AIRCRAFT DESIGNATORS AS NO MORE THAN 10 CHARACTERS,      :  
: OR ENTER THE 'RETURN' KEY ONLY WHEN DATA ADDITION IS FINISHED.  :  
:                                                                    :  
: AIRCRAFT DESIGNATOR?                                           :  
:                                                                    :  
: IS THIS CORRECT (Y/N)?                                         :  
-----
```

The designators should be entered as combinations of letters and numbers separated by a hyphen, if needed, with a total length no greater than 10, such as B707-120. Entry should always begin in the first space.

If the aircraft already exists in the data file then the display will read:

```
-----  
: THIS AIRCRAFT IS ALREADY IN DATA FILE. IF YOU WISH TO CHANGE ITS  :  
: PARAMETERS THIS MUST BE DONE UNDER THE SECTION: 'TO MODIFY DATA'. :  
: PLEASE CONTINUE TO ENTER NEW DATA OR ENTER THE 'RETURN' KEY TO   :  
: TERMINATE ADDITION OF DATA.                                       :  
-----
```

As long as the aircraft is new to the data file and the designator is entered properly, the display reads:

```

: ENTER:
:
: 1: IF THIS AIRCRAFT HAS ONLY ONE SET OF WING GEARS. (i.e.MOST
: AIRCRAFT)
:
: 2: IF THIS AIRCRAFT HAS TWO SETS OF WING GEARS. (i.e. B747)
:
: 3: IF THIS AIRCRAFT HAS ONE SET OF WING GEARS AND A CENTER
: GEAR. (i.e. DC10-30)

```

A "1" will yield the following prompts and examples of input:

```

: GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?
: FEET? 12.5
: INCHES? 1
: GROSS WEIGHT (THOUSANDS OF LBS.; 10.000 to 999.999 KLBS)? 70.500

```

Note that 12.5,1 equals 12.5 feet, 1 inch or 151 inches from the center of the right landing gear to the center of the left landing gear. Note that an entry of 12,7 would likewise be equivalent to 151 inches between landing gears. A gross weight of 70.500 equals 70,500 lbs. Note that values can be carried out to three decimal places or the decimal and terminal zeros can be omitted.

A "2" yields the prompt:

```

: INNER GEAR LOCATION (FEET, INCHES APART)?
: FEET?
: INCHES?
: WEIGHT/INNER GEAR (THOUSANDS OF LBS.; 10.000 to 999.999 KLBS)?
: OUTER GEAR LOCATION (FEET, INCHES APART)?
: FEET?
: INCHES?
: WEIGHT/OUTER GEAR (THOUSANDS OF LBS.; 10.000 to 999.999 KLBS)?

```

A "3" yields:

```
-----  
: WING GEAR LOCATION (FEET, INCHES APART)? :  
: FEET? :  
: INCHES? :  
: WEIGHT/BODY GEAR (THOUSANDS OF LBS.; 10.000 to 999.999 KLBS)? :  
: WEIGHT/WING GEAR (THOUSANDS OF LBS.; 10.000 to 999.999 KLBS)? :  
-----
```

To terminate addition of data the return key should be entered when the next aircraft designator is called for.

Then the screen displays:

```
-----  
: DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE? (Y/N) :  
-----
```

Entering a "Y" will produce a screen listing of all data added and then the following prompt appears (which is the same as if an "N" had been entered):

```
-----  
: ENTER: :  
: 1: TO RETURN TO THE EDITOR MENU :  
: 2: TO ABORT THESE CHANGES :  
: 3: TO MODIFY THE CHANGES :  
-----
```

If there are mistakes or desired changes in the data added, a reply of "3" will direct control to the modification mode (see section 10.3).

A reply of "1" returns control to the editor menu whereas a reply of "2" aborts all editing completed during the current session and then returns control to the editor menu.

10.2 Aircraft Data Deletion

Entering a "D" from the aircraft data file editor menu routes control to the deletion mode. In this mode, an aircraft and all of its data parameters are erased from the aircraft data file. The first prompt displayed is:

```
-----  
: ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO :  
: DELETE, AS NO MORE THAN 10 CHARACTERS, OR ENTER THE 'RETURN' KEY :  
: ONLY WHEN DATA DELETION IS FINISHED. :  
: : :  
: AIRCRAFT DESIGNATOR? :  
-----
```

The aircraft designator must be entered exactly as it appears on the aircraft data file listing (section 9.1). The following warnings will be displayed if either the designator is not an exact match or the user attempts to delete an aircraft that is not in the data file; or the aircraft has already been deleted, respectively:

```
-----  
: THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE :  
: 'RETURN' KEY TO TERMINATE DELETION OF DATA. :  
: : :  
: THIS AIRCRAFT HAS ALREADY BEEN DELETED. :  
-----
```

After termination of the deletion mode (<CR> in reply to the designator prompt), the user is queried as to whether a list of changes is desired:

```
-----  
: DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE? (Y/N) :  
-----
```

Then the following query appears:

```
-----  
: ARE THESE DELETIONS CORRECT? (Y/N) :  
-----
```

This gives the user a chance to omit deletions made in error by displaying a list of deletions and allowing the user to input the aircraft designators which were deleted in error. Then the following screen appears which allows two of the same options as in the addition mode (Section 10.1):

```
-----  
: ENTER: :  
: 1: TO RETURN TO THE EDITOR MENU :  
: 2: TO ABORT THESE CHANGES :  
-----
```

10.3 Aircraft Data Modification

Entering an "M" from the aircraft data file editor menu routes control to the modification mode. In this mode, any data parameter of aircraft in the data file can be altered. The first prompt is:

```
-----  
: ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO :  
: MODIFY, AS NO MORE THAN 10 CHARACTERS, OR ENTER THE 'RETURN' KEY :  
: ONLY WHEN DATA MODIFICATION IS FINISHED. :  
: : :  
: AIRCRAFT DESIGNATOR? :  
-----
```

Again the designator must be entered exactly as it appears on the aircraft data file listing.

Figure 7 shows examples of the displays for the three different aircraft. Any parameter may be changed.

AIRCRAFT DESIGNATOR	GEAR DISTANCE FROM CENTERLINE	GROSS WEIGHT
B727-100	112.5	160.000

ENTER:

- 1: TO CHANGE AIRCRAFT DESIGNATOR
- 2: TO CHANGE GEAR LOCATION
- 3: TO CHANGE GROSS WEIGHT
- 4: TO MODIFY ANOTHER AIRCRAFT
- 5: TO RETURN

WAITING

AIRCRAFT DESIGNATOR	WING GEAR DISTANCE FROM CENTERLINE	WEIGHT/BODY GEAR	WEIGHT/WING GEAR
DC10-30	210	97	222

ENTER:

- 1: TO CHANGE AIRCRAFT DESIGNATOR
- 2: TO CHANGE WING GEAR LOCATION
- 3: TO CHANGE WEIGHT/BODY GEAR
- 4: TO CHANGE WEIGHT/WING GEAR
- 5: TO MODIFY ANOTHER AIRCRAFT
- 6: TO RETURN

WAITING

AIRCRAFT DESIGNATOR	INNER GEAR DISTANCE FROM CENTERLINE	WEIGHT/ INNER GEAR	OUTER GEAR DISTANCE FROM CENTERLINE	WEIGHT/ OUTER GEAR
B747-100	75.0	168.625	216.5	168.625

ENTER:

- 1: TO CHANGE AIRCRAFT DESIGNATOR
- 2: TO CHANGE INNER GEAR LOCATION
- 3: TO CHANGE WEIGHT/INNER GEAR
- 4: TO CHANGE OUTER GEAR LOCATION
- 5: TO CHANGE WEIGHT/OUTER GEAR
- 6: TO MODIFY ANOTHER AIRCRAFT
- 7: TO RETURN

WAITING

Figure 7

SAMPLE AIRCRAFT CONFIGURATION

After termination of the modification mode (<CR> in response to the designator prompt), the remaining prompts are the same as in the addition mode.

10.4 Aircraft Data File Listing

Entering an "L" from the editor menu allows a list of the current aircraft data file to be viewed on the screen. Since this list always includes any changes made in editing, the user must wait for sorting each time he lists the data file after an edit mode. However, the user must only wait for sorting one time if he requests a list of changes after all editing is complete.

10.5 Return

Entering an "R" from the editor menu will return control to the main menu. Whenever either a list of the data file or a return to the main menu is requested after any editing the following message appears first:

```
-----  
:                               :  
:          SORTING, PLEASE WAIT.          :  
-----
```

11.0 INITIAL MENU

Entering an "A" from the main menu will produce the initial menu (Fig. 8) for analyses and airport data file editing.

11.1 List of Airport Data Files

Entering an "L" from the initial menu will produce a screen listing of all the airport data files that currently exist on diskette B. Figure 9 is an example.

The data file names are listed in three columns in alphabetical order.

The data file, O'HARE, is an approximation for a major runway at O'HARE airport for 1983 based upon the 1983 total operations at O'Hare and the composition of the major carriers' fleets. The data file, TEST, is a short fictitious file for testing the program operation.

Entering an "N" will return control to the initial menu and a "Y" will produce a listing of the airport data file and then returns control to the initial menu.

11.2 Analysis and Airport Data

Entering an "A" from the initial menu produces the following screen:

```
-----  
:                                     :  
:           AIRPORT DATA FILE ENTRY :  
: ENTER:                               :  
: 1:  IF THIS AN EXISTING FILE         :  
: 2:  IF THIS IS A NEW FILE TO BE CREATED :  
: 3:  TO RETURN TO THE INITIAL MENU     :  
: WAITING                               :  
-----
```

```
*****
*
*              INITIAL MENU              *
*
*****
```

INSERT THE AIRPORT DATA DISKETTE IN DRIVE B:

ENTER DESIRED SELECTION:

L: TO LIST THE EXISTING AIRPORT DATA FILES

A: TO ENTER AIRPORT DATA AND RUN ANALYSES

R: TO RETURN TO MAIN MENU

WAITING?

Figure 8

INITIAL MENU

AIRPORT DATA FILES

O'HARE

TEST

DO YOU WANT A PRINTOUT OF THIS LIST (Y/N)?

Figure 9
AIRPORT DATA FILE

Entering a "1" or a "2" then produces the prompt:

```
-----  
:   ENTER THE NAME OF THE AIRPORT DATA FILE, (8 CHARACTERS MAXIMUM):?   :  
-----
```

11.2.1 Existing Airport Data Files

If an existing airport data file is being recalled (i.e., a "1" has been entered in response to the airport data file entry screen), the name of the file must be entered exactly as it is listed. When the file name is entered the following screen appears:

```
-----  
:                               CURRENT DATA FILE OPERATIONS                               :  
:                               ENTER:                                                       :  
:   L:  TO LIST CONTENTS OF THE AIRPORT DATA FILE                                         :  
:   P:  FOR A PRINTOUT OF THE AIRPORT DATA FILE CONTENTS                                  :  
:   E:  TO EDIT THE AIRPORT DATA FILE                                                       :  
:   D:  TO DELETE THE AIRPORT DATA FILE                                                     :  
:   N:  TO RENAME THE AIRPORT DATA FILE                                                     :  
:   A:  FOR ANALYSIS                                                                           :  
:   R:  TO RETURN TO THE INITIAL MENU                                                         :  
:                               WAITING?                                                       :  
-----
```

11.2.2 New Airport Data File

Entering a "2" as a response to the airport data file entry screen allows the user to name the airport data file to be created. Since analyses will probably be performed on individual pavements for a given time period, the user will probably want to name the file according to a pavement identifier and the year.

For example, DCAR3285 could refer to runway DCAR32 and 85 to the year, 1985, that the data parameters apply to.

After the name of the new data file is entered the following screen, shown with example input, appears:

```

:                                     NEW DATA FILE CREATION                                     :
: INPUT THE DIRECTION OF THE PAVEMENT ANALYSIS AND THE AVERAGE % OF OPERATIONS IN THAT DIRECTION. :
: ENTER ONE OF THE DIRECTIONS: N, S, E, W, NE, NW, SE, SW? N :
: ENTER THE % OF OPERATIONS IN THIS DIRECTION: 50 :
: ENTER THE LETTER FOR THE TYPE OF PAVEMENT: :
:   A: 150' RUNWAY           B: 200' RUNWAY           C: 75' TAXIWAY :
:   D: 100' TAXIWAY         E: OTHER                 :A :
: THE EMPIRICALLY DERIVED AVERAGES FOR A 150' RUNWAY ARE: :
: OFFSET= -11.88 :
: STANDARD DEVIATION= 90.48001 :
: DO YOU WANT TO RETAIN THESE VALUES (Y/N) ? N :
: ENTER THE MEAN OFFSET FROM THE CENTERLINE (INCHES) OR A 'T' TO :
: SEE A TABLE OF VALUES: :
: ENTER THE AVERAGE STANDARD DEVIATION (INCHES): :
: ENTER AIRCRAFT DESIGNATORS AS NO MORE THAN 10 CHARACTERS. :
: ENTER AIRCRAFT OPERATIONS FOR EACH AIRCRAFT AS THOUSAND OF :
: OPERATIONS/YEAR. :
: AIRCRAFT DESIGNATOR? (OR ENTER THE RETURN KEY WHEN DATA ADDITION :
: IS FINISHED) :
: AIRCRAFT OPERATIONS (THOUSAND OF OPERATIONS PER YEAR)? :

```

The direction of perspective refers to the longitudinal direction along which the user is viewing the cross-section of the pavement.

Offset is the average position of the aircraft relative to the runway or taxiway centerline such that a negative number is to the left of centerline and a positive number to the right. Figure 10 shows the table listed when the user inputs a 'T' response to the mean offset prompt. Although the effects of

AVERAGES FOR ALL AIRPORTS STUDIED

150' RUNWAYS		200' RUNWAYS	
OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
-11.88	90.48	-18.96	104.76

75' TAXIWAYS		100' TAXIWAYS	
OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
29.64	42.84	38.40	70.80

ENTER ANY KEY TO CONTINUE

CROSSWIND CONDITIONS FOR 150' RUNWAYS

AIRPORT	>5 KTS. FROM THE RIGHT		>5 KTS. FROM THE LEFT	
	OFFSET (INCHES)	STD. DEV. (INCHES)	OFFSET (INCHES)	STD. DEV. (INCHES)
DEN	-39.78	110.76	16.14	97.68
ORD	-21.84	66.72	-24.90	87.30

ENTER THE MEAN OFFSET FROM THE CENTERLINE (INCHES):

Figure 10

AIRPORT RUNWAY/TAXIWAY DATA

crosswinds were considered minor in Report No. FAA-74-36 they are reported here to give the user the option of implementing the effects on the values of the standard deviation and the offset.

Aircraft designators are then correctly entered along with the number of operations for each aircraft in thousands/year (e.g., 1.25=1,250 operations/year).

After all data is entered and <CR> is entered in response to the aircraft designator prompt the following screen appears:

```
-----  
: ENTER      1: TO SAVE THIS FILE           :  
:            2: TO ENTER ADDITIONAL DATA  :  
:            3: TO ABORT                   :  
: WAITING?                                     :  
-----
```

Entering a "1" will save the data file to diskette B and then returns control to the current data file operations screen (Section 11.2.1); A "2" allows additional data to be added to the current airport data file; and a "3" deletes the entire data file and returns control to the initial menu (Section 11.0).

11.2.3 Data File Listing and Printout

Entering an "L" produces a screen listing; a "P" produces a printout of the current airport data file. Figure 11 shows the data file, O'HARE, supplied with the system. The frequencies of operations are the number of operations for each aircraft in thousands/year and are recorded to the third decimal place (e.g., 6.198=6,198).

11.2.4 Airport Data File Editor

Entering an "E" produces the airport data file editor menu (Figure 12).

DATA FILE:O'HARE - 150' RUNWAY

50 % OF OPERATIONS IN THE NW DIRECTION

STANDARD DEVIATION = 90.48 INCHES

OFFSET = -11.88 INCHES

AIRCRAFT DESIGNATOR	FREQUENCY OF OPERATIONS (THOUSANDS/YEAR)
A300	6.198
B707-320	4.375
B727-200	204.535
B737-200	63.439
B747-100	26.615
B757	2.734
B767	8.932
DC 6	6.927
DC 8-61	24.245
DC 9-30	101.538
DC10-30	28.256
L-188	6.745
L-382	2.005
L1011	21.146

Figure 11

O'HARE DATA FILE

```
*****  
*                                     *  
*               AIRPORT               *  
*           DATA FILE EDITOR          *  
*                                     *  
*****
```

ENTER:

A: TO ADD AIRPORT DATA

M: TO MODIFY AIRPORT DATA

D: TO DELETE AIRPORT DATA

R: TO RETURN TO THE PREVIOUS PAGE

WAITING?

Figure 12

AIRPORT DATA FILE EDITOR

The airport data file editor operates much in the same way as the previously described aircraft data file editor.

11.2.4.1 Addition of Airport Data

Entering an "A" allows addition of airport data and the following prompt appears:

```
-----  
:   ENTER AIRCRAFT DESIGNATORS AS NO MORE THAN 10 CHARACTERS.   :  
:   ENTER AIRCRAFT FREQUENCY FOR EACH AIRCRAFT AS THOUSANDS OF   :  
:   OPERATIONS/YEAR                                             :  
:   :                                                               :  
:   AIRCRAFT DESIGNATOR? (OR ENTER THE RETURN KEY WHEN DATA ADDITION :  
:   IS FINISHED)                                               :  
-----
```

Aircraft designators must be entered according to the following criteria:

- o Ten characters or less
- o No characters other than letters, numbers, and hyphen
- o The aircraft must not already exist in the currently recalled airport data file.
- o The aircraft must already exist in the aircraft data file and the designation must be entered exactly as it appears in the aircraft data file.
- o The recalled data file cannot contain more than 250 aircraft.

After the designator is entered properly the screen displays:

```
-----  
: AIRCRAFT FREQUENCY (THOUSANDS OF OPERATIONS PER YEAR) :  
-----
```

Number of operations must be between 0 and 1,000,000 and entered as thousands of operations with up to 3 decimal places (e.g., 100.252=100,252).

After termination of data addition by entering the return key after the next aircraft designator is called for, the remaining prompts are the same as those in the aircraft data file editor:

```
-----  
: DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE? (Y/N) :  
: DO YOU WISH TO MODIFY THESE CHANGES? (Y/N) :  
: DO YOU WISH TO MAKE ANY MORE CHANGES? (Y/N) :  
-----
```

The responses also yield the same results.

11.2.4.2 Deletion of Airport Data

Entering a "D" from the airport data file editor menu allows the user to delete aircraft from the current data file by responding with the prompt:

```
-----  
: ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO :  
: DELETE, AS NO MORE THAN 10 CHARACTERS. ENTER 'RETURN' TO TERMINATE :  
: DELETION OF DATA. :  
: :  
: AIRCRAFT DESIGNATOR? :  
-----
```

Again the designator must be entered exactly as it appears on the aircraft data file listing and the remaining prompts are the same as in the deletion mode of the aircraft data file editor.

11.2.4.3 Modification of Airport Data

Entering an "M" from the airport data file editor menu allows modification of data with the initial screen of:

```
DATA FILE: O'HARE - 150' RUNWAY
50% OPERATIONS IN THE NW DIRECTION
STANDARD DEVIATION = 90.48 INCHES      OFFSET = -11.88 INCHES
ENTER:  1: TO CHANGE THE % OF OPERATIONS
        2: TO CHANGE THE DIRECTION
        3: TO CHANGE THE MEAN OFFSET
        4: TO CHANGE THE STANDARD DEVIATION
        5: TO CHANGE THE TYPE OF PAVEMENT
        6: TO CHANGE AIRCRAFT PARAMETERS
        7: TO RETURN
WAITING?
```

Entering numbers 1 through 5 allows changing of the above listed parameters whereas a 7 displays the same prompts as in the other editing modes:

```
DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE? (Y/N)
DO YOU WISH TO MODIFY THESE CHANGES? (Y/N)
DO YOU WISH TO MAKE ANY MORE CHANGES? (Y/N)
```

Entering a 6 first displays a list of the data file (Figure 11) and then displays the following:

```
ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO
MODIFY, AS NO MORE THAN 10 CHARACTERS. ENTER THE 'RETURN' KEY TO
TERMINATE DATA MODIFICATION.
AIRCRAFT DESIGNATOR?
```

For example, if DC10-30 is entered the following screen response appears allowing any parameter to be changed:

```
-----  
: AIRCRAFT          NUMBER OF OPERATIONS          :  
: DESIGNATOR        (THOUSANDS/YEAR)             :  
: DC10-30           28.256                       :  
:                                                           :  
: ENTER:                                                 :  
:                                                           :  
: 1: TO CHANGE AIRCRAFT DESIGNATOR                 :  
: 2: TO CHANGE NUMBER OF OPERATIONS                :  
: 3: TO MODIFY ANOTHER AIRCRAFT                   :  
: 4: TO RETURN                                      :  
:                                                           :  
: WAITING?                                           :  
-----
```

Entering a "4" returns control to the three terminal prompts common to all editor return queries as described previously.

11.2.5 Airport Data File Deletion

Entering a "D" allows the entire data file to be deleted. This is especially useful for eliminating obsolete data or a data file entered in error.

11.2.6 Renaming the Airport Data File

Entering an "N" allows the user to rename the current airport data file in case of a typographical error or a more appropriate name is required.

11.2.7 Analysis

Entering an "A" allows the analysis of the current airport data file with the following screen display:

pavement centerline in report form (Figure 13). Individual sigma refers to the standard deviation used in the normal distribution calculations.

A listing of the airport data file contents and relevant aircraft data are also provided as a record of the analytical parameters (Figure 14).

11.2.7.2 Entire Load Distribution

An "E" or a "T" response will produce a report of the entire load distribution showing the magnitude of the load for every 5 inch interval from the runway or taxiway centerline (Figure 15).

If the maximum load distribution has not been produced, then a listing of the airport and aircraft data parameters are also provided.

11.2.7.3 Load Distribution Plot

A "G" response will first produce the prompt:

```
-----  
: MAKE SURE YOU ADVANCE THE PRINTER HEAD TO THE TOP OF THE NEXT PAGE. :  
: : :  
: THEN ENTER ANY KEY TO CONTINUE. :  
-----
```

This allows the graph to be produced all on two pages and will work on any printer with both standard paper sizes.

An "S" response directs the load distribution plot to the screen.

Figure 16 shows the results of the O'HARE data file where magnitude is in (mega operations-pounds) x gear centerline passes per inch per year. The plot is the best visual representation for comparing both absolute and relative loads.

The analysis menu then reappears.

AIRPORT PAVEMENT LOAD ANALYSIS

DATA FILE: O'HARE - 150' RUNWAY

DATE: MARCH 24, 1986

50 % OF OPERATIONS IN THE NW DIRECTION

STANDARD DEVIATION = 90.48 INCHES

OFFSET = -11.88 INCHES

DISTANCE FROM CENTERLINE (INCHES)	LOAD MAXIMA (MEGA LB.- GEAR CL. PASSES/INCH/YEAR)
-100	216.0132
110	225.3409

Figure 13

ANALYSIS OF O'HARE RUNWAY

AIRPORT PAVEMENT LOAD ANALYSIS

DATA FILE: O'HARE - 150' RUNWAY

DATE: MARCH 24, 1986

50 % OF OPERATIONS IN THE NW DIRECTION

STANDARD DEVIATION = 90.48 INCHES

OFFSET = -11.88 INCHES

AIRCRAFT	OPERATION FREQUENCY (1000'S/ YEAR)	INNER GEAR DISTANCE (INCHES)	GROSS WEIGHT (KLBS.)	WEIGHT/ INNER GEAR (KLBS.)	OUTER GEAR DISTANCE (INCHES)	WEIGHT/ OUTER GEAR (KLBS.)
A300	6.198	189.0	302.000			
8707-320	4.375	132.5	312.000			
8727-200	204.535	112.5	190.500			
8737-200	63.439	103.0	115.500			
8747-100	26.615	75.0		168.625	216.5	168.625
8757	2.734	144.0	231.000			
8767	8.932	183.0	317.000			
DC 6	6.927	148.0	104.000			
DC 8-61	24.245	125.0	329.000			
DC 9-30	101.538	98.0	108.000			
DC10-30	28.256	0.0		97.000	210.0	222.000
L-188	6.745	187.0	116.000			
L-382	2.005	85.5	155.000			
L1011	21.146	216.0	430.000			

Figure 14

O'HARE ANALYSIS

AIRPORT PAVEMENT LOAD ANALYSIS

DATA FILE: O'HARE - 150' RUNWAY

DATE: MARCH 24, 1986

50 % OF OPERATIONS IN THE NW DIRECTION

STANDARD DEVIATION = 90.48 INCHES

OFFSET = -11.88 INCHES

DISTANCE FROM CENTERLINE (INCHES)	MAGNITUDE (MEGA LBS.-GEAR CL. PASSES/INCH/YEAR)	DISTANCE FROM CENTERLINE (INCHES)	MAGNITUDE (MEGA LBS.-GEAR CL. PASSES/INCH/YEAR)
-400	7.383637	5	200.5776
-395	8.335396	10	201.0386
-390	9.385902	15	201.7002
-385	10.54212	20	202.5537
-380	11.81109	25	203.5873
-375	13.1999	30	204.7852
-370	14.71564	35	206.129
-365	16.36529	40	207.5967
-360	18.15571	45	209.1641
-355	20.09354	50	210.8049
-350	22.18518	55	212.4905
-345	24.43664	60	214.1913
-340	26.85351	65	215.8766
-335	29.44088	70	217.5152
-330	32.20326	75	219.0755
-325	35.14449	80	220.5266
-320	38.26764	85	221.8381
-315	41.57497	90	222.9811
-310	45.06784	95	223.9275
-305	48.74663	100	224.6518
-300	52.61066	105	225.13
-295	56.65807	110	225.3409
-290	60.88591	115	225.2656
-285	65.28994	120	224.8881
-280	69.86456	125	224.1953
-275	74.60294	130	223.1768
-270	79.49677	135	221.8257
-265	84.53635	140	220.1376
-260	89.71063	145	218.1113
-255	95.00711	150	215.7484
-250	100.4118	155	213.0533
-245	105.9094	160	210.0331
-240	111.4832	165	206.6973
-235	117.1153	170	203.0576
-230	122.7866	175	199.128
-225	128.4767	180	194.9243
-220	134.1644	185	190.4639
-215	139.8274	190	185.7657
-210	145.443	195	180.8499
-205	150.9877	200	175.7375
-200	156.4377	205	170.4505
-195	161.7691	210	165.0114
-190	166.9581	215	159.4429
-185	171.9811	220	153.7682
-180	176.8151	225	148.0101
-175	181.4383	230	142.1915
-170	185.8295	235	136.3348

Figure 15

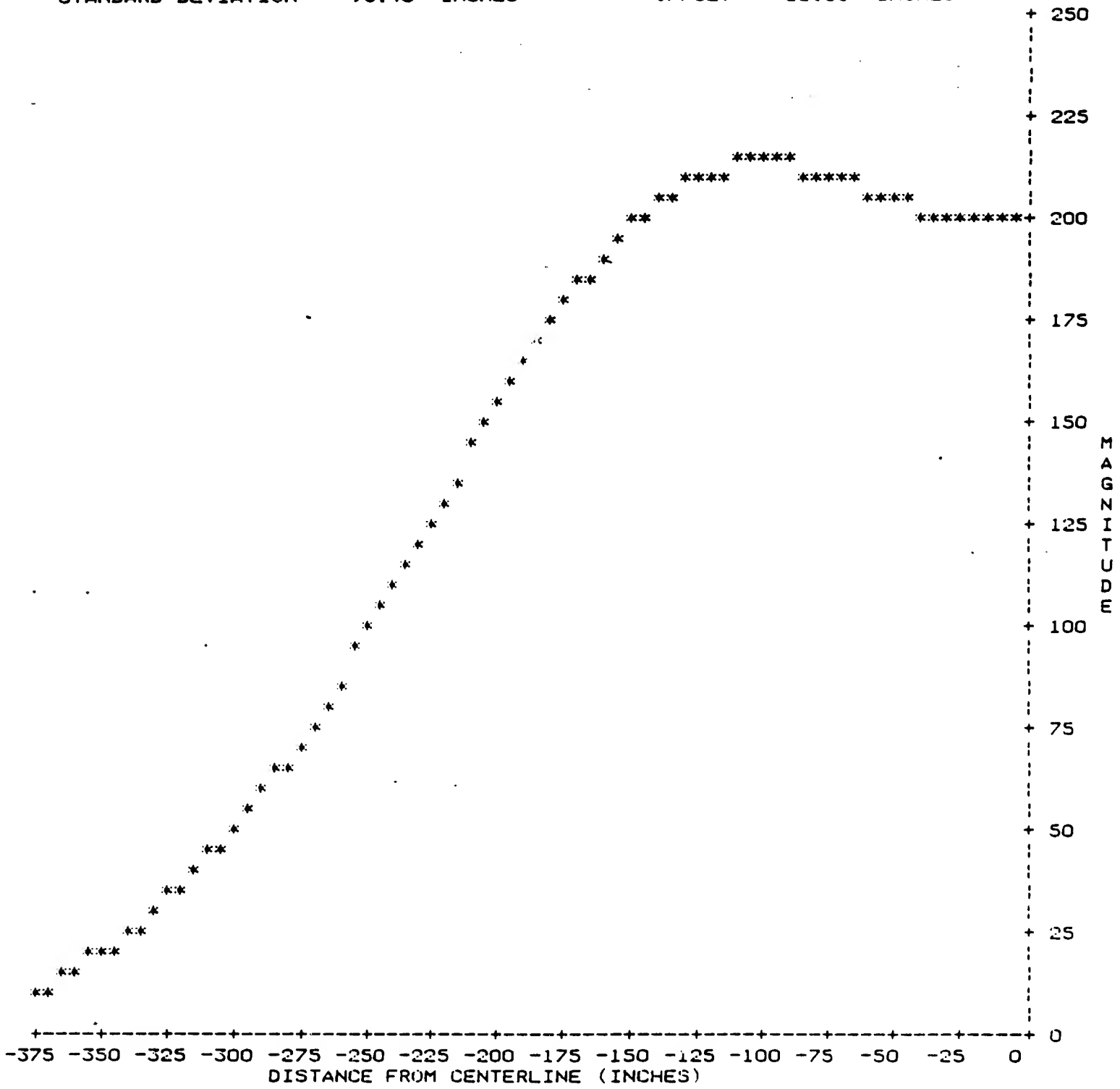
O'HARE LOAD DISTRIBUTION

-165	189.9692	240	130.4619
-160	193.8395	245	124.5942
-155	197.4243	250	118.7522
-150	200.7097	255	112.9554
-145	203.6846	260	107.2227
-140	206.3399	265	101.5715
-135	208.6697	270	96.0183
-130	210.6711	275	90.57835
-125	212.3442	280	85.26564
-120	213.6922	285	80.0928
-115	214.7218	290	75.07116
-110	215.4427	295	70.21072
-105	215.8673	300	65.5201
-100	216.0132	305	61.00656
-95	215.8973	310	56.67605
-90	215.5432	315	52.53311
-85	214.9737	320	48.58113
-80	214.2157	325	44.82215
-75	213.2972	330	41.25703
-70	212.2479	335	37.88567
-65	211.0987	340	34.70661
-60	209.8809	345	31.71762
-55	208.6263	350	28.91548
-50	207.3662	355	26.29616
-45	206.1313	360	23.85487
-40	204.9511	365	21.58616
-35	203.8537	370	19.48402
-30	202.8649	375	17.54195
-25	202.0083	380	15.75305
-20	201.3047	385	14.11012
-15	200.7717	390	12.60575
-10	200.4237	395	11.23234
-5	200.2713	400	9.982236
0	200.3214		

Figure 15 (Continued)
O'HARE LOAD DISTRIBUTION

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 90.48 INCHES

DATE: MARCH 24, 1986
OFFSET = -11.88 INCHES

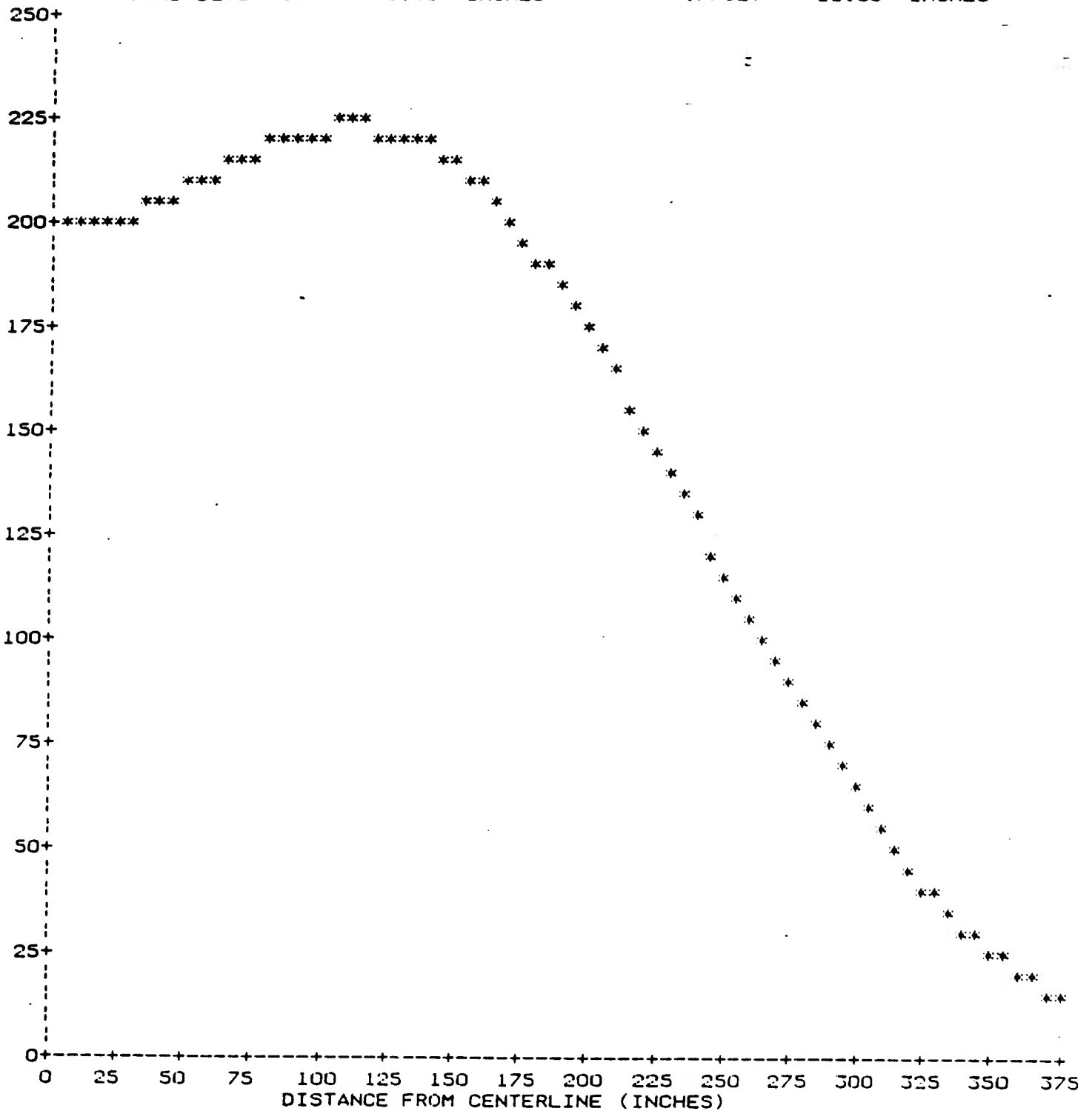


50 % OF OPERATIONS IN THE NW DIRECTION

Figure 16
O'HARE LOAD GRAPH
A-52

DATA FILE: O'HARE - 150' RUNWAY
STANDARD DEVIATION = 90.48 INCHES

DATE: MARCH 24, 1986
OFFSET = -11.88 INCHES



50 % OF OPERATIONS IN THE NW DIRECTION

Figure 16 (Continued)

O'HARE LOAD GRAPH

11.2.7.4 Exit

A "R" response returns the initial menu from which another "R" response returns the main menu and an "E" response will then exit the program.

APPENDIX B -- APLA SYSTEM SOURCE CODE LISTING

```

10 '*****
20 '   PROGRAM "APLA"
30 '   MAIN MENU
40 '*****
50 KEY OFF
60 COLOR 10,0
70 CLS
80 PRINT "
90 PRINT "
100 PRINT "
110 PRINT "
120 PRINT "
130 PRINT "
140 PRINT "
150 PRINT
160 PRINT "
170 PRINT
180 PRINT "
190 LOCATE 23,28
200 PRINT "CAPS LOCK SHOULD BE ON"
210 LOCATE 18,22
220 PRINT "(MAXIMUM 17 CHARACTERS)"
230 LOCATE 17,20
240 LINE INPUT "PLEASE ENTER TODAY'S DATE: ";PDATE$
250 IF LEN(PDATE$)<17 THEN PDATE$=PDATE$+STRING$(17-LEN(PDATE$),32)
260 IF LEN(PDATE$)>17 THEN CLS: PRINT "INPUT ONLY 17 CHARACTERS OR LESS.":GOTO
230
270 IF ASC(MID$(PDATE$,1,1))=32 THEN CLS: PRINT "ENTRY MUST BEGIN IN THE FIRST
SPACE": GOTO 230
280 OPEN "R",3,"DATE.DAT",17
290 FIELD 3, 17 AS BUF.PDATE$
300 LSET BUF.PDATE$=PDATE$
310 PUT 3,1
320 CLOSE #3
330 CHAIN "APLA2"

```

```

      A          PPPPPP          LL          A
    A A          PP PP          LL          A A
  A A          PP PP          LL          A A
AAAAAA          PFFFFFF          LL          AAAAAA
  A          A          PP          LL          A          A
    A          A          PP          LL          A          A
  A          A          PP          LLLLLL          A          A

```

AIRPORT PAVEMENT LOAD ANALYSIS

Software developed by PAILEN-JOHNSON ASSOC., INC."

```

10 '***** APLA2 *****
20 COLOR 10,0
30 CLS
40 PRINT "                AIRPORT PAVEMENT LOAD ANALYSIS
50 PRINT
60 PRINT " *****
70 PRINT " *
80 PRINT " *      Welcome to APLA, a program designed to analyze the
90 PRINT " *      distribution of aircraft load on airport pavement
100 PRINT " *      according to the frequency of traffic.
110 PRINT " *
120 PRINT " *****
130 PRINT
140 PRINT "                MAIN MENU": PRINT
150 PRINT "ENTER DESIRED OPTION:": PRINT
160 PRINT "L: TO LIST THE AIRCRAFT DATA FILE.": PRINT
170 PRINT "E: TO EDIT THE AIRCRAFT DATA.": PRINT
180 PRINT "A: TO RUN ANALYSES.": PRINT
190 PRINT "Q: TO EXIT.": PRINT
200 INPUT "WAITING"; Q$
210 IF Q$="" THEN 240
220 TEST$="QEAL"
230 IF INSTR(TEST$,Q$)<>0 AND Q$<>"" THEN 300
240 CLS
250 PRINT "INVALID ENTRY. BE SURE CAPS LOCK IS ON."
260 PRINT "ENTER ANY KEY TO CONTINUE."
270 Z$=INKEY$: IF Z$="" THEN 270
280 IF ASC(Z$)=13 THEN 270
290 GOTO 30
300 IF Q$="L" THEN CHAIN "LIST1"
310 IF Q$="E" THEN CHAIN "DATSORT"
320 IF Q$="A" THEN CHAIN "ANALYSIS"
330 IF Q$="Q" THEN CLS: PRINT "END OF SESSION.....": END
340 GOTO 30

```



```

500 PRINT ""
510 PRINT "ENTER:"
520 PRINT ""
530 PRINT "A: TO SEE A LIST OF AIRCRAFT IN THE CURRENT DATA FILE."
540 PRINT ""
550 PRINT "B: TO OBTAIN A PRINTOUT OF AIRCRAFT IN THE CURRENT DATA FILE"
560 PRINT ""
570 PRINT "L: TO SEE A LIST OF THE ENTIRE DATA FILE"
580 PRINT ""
590 PRINT "P: TO OBTAIN A PRINTOUT OF THE ENTIRE DATA FILE"
600 PRINT ""
610 PRINT "R: TO RETURN TO THE MAIN MENU"
620 PRINT ""
630 INPUT "WAITING"; Q$
640 IF Q$="" THEN 670
650 TEST$="PRABL"
660 IF INSTR(TEST$,Q$)<>0 AND Q$<>"" THEN 730
670 CLS
680 PRINT "INVALID ENTRY. BE SURE THE CAPS LOCK IS ON."
690 PRINT "ENTER ANY KEY TO CONTINUE."
700 Z$=INKEY$: IF Z$="" THEN 700
710 IF ASC(Z$)=13 THEN 700
720 GOTO 420
730 IF Q$="R" THEN CLOSE: CHAIN "APLA2"
740 '*****
750 'LISTING AND PRINTING OF DATA FILE
760 '*****
770 S=1 'counter for allowing only one screen to be viewed at a time
780 FOR J=1 TO 250
790 IF D$(J)="&lllll" THEN 1140
800 IF J=1 AND Q$="B" OR J=1 AND Q$="P" THEN 940
810 IF J=1 THEN 900
820 IF J<>1 AND Q$="B" THEN 1020
830 IF J<>1 AND Q$="P" THEN 1090
840 IF J<>S*18 THEN 1010
850 WHILE INKEY$<>""
860 WEND
870 PRINT "ENTER ANY KEY TO CONTINUE" 'allowing one page at a time
880 Z$=INKEY$: IF Z$="" THEN 880
890 S=S+1
900 CLS
910 IF Q$="A" AND D$(J+K)="&lllll" AND J=K+1 THEN 420
920 IF Q$="A" THEN PRINT "", " AIRCRAFT", "", "", " AIRCRAFT": PRINT "RECORD
#", "DESIGNATOR", "", "RECORD #", "DESIGNATOR": GOTO 1020
930 IF Q$="L" THEN PRINT AAA$: PRINT BBB$: PRINT CCC$: PRINT DDD$: PRINT "":
GOTO 1060
940 CLS: PRINT "WAIT UNTIL PRINTOUT IS COMPLETE. THEN ENTER ANY KEY TO
CONTINUE."
950 IF Q$="P" THEN 990
960 LPRINT "", " AIRCRAFT", "", "", " AIRCRAFT"
970 LPRINT "RECORD #", "DESIGNATOR", "", "RECORD #", "DESIGNATOR"
980 LPRINT "": GOTO 1020
990 LPRINT AAA$: LPRINT BBB$: LPRINT CCC$: LPRINT DDD$
1000 LPRINT "": GOTO 1090

```

```

1010 IF Q$="L" THEN 1060
1020 IF D$(J+K)="&&&&&&" THEN 1120
1030 IF Q$="B" THEN 1080
1040 IF K=S*18 THEN KK=1
1050 PRINT J, D$(J), "", J+K-KK, D$(J+K-KK): GOTO 1110
1060 IF LG (J)=1 THEN PRINT USING EE$;D$(J);E(J);GW(J): GOTO 1110
1070 IF LG (J)<>1 THEN PRINT USING EE$;D$(J);E(J);L(J);M(J);N(J): GOTO 1110
1080 LPRINT J, D$(J), "", J+K, D$(J+K): GOTO 1110
1090 IF LG (J)=1 THEN LPRINT USING EE$;D$(J);E(J);GW(J): GOTO 1110
1100 IF LG (J)<>1 THEN LPRINT USING EE$;D$(J);E(J);L(J);M(J);N(J)
1110 NEXT J
1120 IF J<>K+1 AND Q$="A" THEN PRINT "", "", "", J+K-1, D$(J+K-1)
1130 IF J<>K+1 AND Q$="B" THEN LPRINT J, D$(J)
1140 IF Q$="B" OR Q$="P" THEN LPRINT "": LPRINT ""
1150 WHILE INKEY$<>""
1160 WEND
1170 PRINT "ENTER ANY KEY TO CONTINUE."
1180 Z$=INKEY$: IF Z$="" THEN 1180
1190 GOTO 420
1200 '***** ERROR TRAPS *****
1210 CLS
1220 PRINT "YOU DO NOT HAVE A PRINTER OR IT IS NOT TURNED ON."
1230 PRINT
1240 RESUME 430

```

```

10 '*****
20 '* PROGRAM "DATSORT" - SORTS AND MERGES SINGULARLY AFTER ALL EDITING *
30 '* EDITS AND SORTS Aircraft Data into "AIRCRAFT.DAT" *
40 '*****
50 'STRINGS= BUF.A$, BUF.B$, BUF.C$, BUF.D$, BUF.E$, BUF.GW$,X$,D$,F$,G$,Q$,Z$,
60 ' AAA$, BBB$, CCC$, EEE$, A$, B$, C$, E$, AA$, BB$, EE$,QQ$,ZQ$
70 'INTEGERS= X, Y, I, J, P, T, Z, K, A, D, M, XX, EDITTYPE, FIRSTPASS, NOADD,
FLAG, MFLAG
80 'SINGLE PRECISIONS= E, L, M, N, LG, GW, M1,M2,E1,E2
90 '
100 'WRITTEN BY STEPHEN T. HALL AT PJA FOR THE FAA
110 '
120 '*****
130 COLOR 10,0
140 DIM D$(250), E(250), L(250), M(250), N(250), F$(250), G$(250), FLAG(250),
LG(250), GW(250), MFLAG(250), E1(250), E2(250), M1(250), M2(250)
150 A$=" AIRCRAFT INNER GEAR WEIGHT/ OUTER GEAR
WEIGHT/"
160 B$="DESIGNATOR DISTANCE FROM INNER GEAR DISTANCE FROM OUTER
GEAR"
170 C$=" CENTERLINE CENTERLINE"
180 E$="\ \ ###.# ###.### ###.# ###.###
190 AA$=" AIRCRAFT GEAR DISTANCE GROSS"
200 BB$="DESIGNATOR FROM CENTERLINE WEIGHT"
210 EE$="\ \ ###.# ###.###
220 AAA$=" AIRCRAFT INNER GEAR GROSS WEIGHT/ OUTER GEAR
WEIGHT/"
230 BBB$="DESIGNATOR DISTANCE FROM WEIGHT INNER GEAR DISTANCE FROM
OUTER GEAR"
240 CCC$=" CENTERLINE CENTERLINE"
250 DDD$=" (INCHES) (KLBS.) (KLBS.) (INCHES)
(KLBS.)"
260 EEE$="\ \ ###.# ###.### ###.#
###.###"
270 GOTO 480
280 LINE INPUT "IS THIS CORRECT (Y/N)? ";Z$
290 IF Z$="Y" OR Z$="N" THEN RETURN
300 PRINT "YOU MUST ENTER A 'Y' OR AN 'N'."
310 GOTO 280
320 REDO=0
330 FOR A=1 TO LEN(M1$)
340 IF ASC(MID$(M1$,A,1))<46 OR ASC(MID$(M1$,A,1))>57 OR ASC(MID$(M1$,A,1))=47
THEN 420
350 NEXT A
360 RETURN
370 REDO=0
380 FOR A=1 TO LEN(M2$)
390 IF ASC(MID$(M2$,A,1))<46 OR ASC(MID$(M2$,A,1))>57 OR ASC(MID$(M2$,A,1))=47
THEN 420
400 NEXT A
410 RETURN
420 REDO=2
430 PRINT "YOU HAVE ENTERED A WRONG KEY. TRY AGAIN."
440 RETURN

```

```

450 '*****
460 ' EXISTING AIRCRAFT DATA FILE READ INTO MEMORY
470 '*****
480 OPEN "R",1,"AIRCRAFT.DAT",80
490 FIELD 1, 4 AS BUF.G$, 10 AS BUF.A$, 4 AS BUF.B$, 4 AS BUF.GW$, 4 AS
BUF.C$, 4 AS BUF.D$, 4 AS BUF.E$, 46 AS X$
500 X=1
510 GET 1,X
520 IF BUF.A$="&&&&&" THEN 560
530 LG(X)=CVS(BUF.G$) : D$(X)=BUF.A$ : E(X)=CVS(BUF.B$) : L(X)=CVS(BUF.C$) :
M(X)=CVS(BUF.D$) : N(X)=CVS(BUF.E$) : GW(X)=CVS(BUF.GW$) : MFLAG(X)=0
540 X=X+1
550 GOTO 510
560 P=X-1
570 XX=X
580 FIRSTPASS=1
590 IF QQ$="L" THEN GOSUB 4730
600 '*****
610 ' MENU
620 '*****
630 CLS
640 PRINT "", "*****"
650 PRINT "", "*"
660 PRINT "", "*" AIRCRAFT "*"
670 PRINT "", "*" DATA FILE EDITOR "*"
680 PRINT "", "*"
690 PRINT "", "*****"
700 PRINT "": PRINT ""
710 PRINT "ENTER DESIRED OPTION:": PRINT ""
720 PRINT "A: TO ADD NEW DATA": PRINT ""
730 PRINT "D: TO DELETE DATA": PRINT ""
740 PRINT "M: TO MODIFY DATA": PRINT ""
750 PRINT "L: TO LIST THE DATA FILE": PRINT ""
760 PRINT "R: TO RETURN TO THE MAIN MENU": PRINT ""
770 LINE INPUT "WAITING ";QQ$
780 IF QQ$="" THEN 810
790 TEST$="ADMRL"
800 IF INSTR(TEST$,QQ$)<>0 AND QQ$<>"" THEN 830
810 GOSUB 5170
820 GOTO 630
830 IF QQ$="A" THEN GOSUB 920
840 IF QQ$="D" THEN GOSUB 2020
850 IF QQ$="M" THEN GOSUB 2380
860 IF QQ$="L" THEN GOSUB 4650: GOTO 500
870 IF QQ$="R" THEN GOSUB 4650: CLOSE: CHAIN "APLA2"
880 GOTO 630
890 '*****
900 ' ADDITION OF NEW DATA.
910 '*****
920 EDITTYPE=0
930 NOADD=XX
940 FOR I=XX TO 250
950 CLS
960 PRINT "ENTER AIRCRAFT DESIGNATORS AS NO MORE THAN 10 CHARACTERS,"

```

```

970 PRINT "OR ENTER THE 'RETURN' KEY ONLY WHEN DATA ADDITION IS FINISHED.":
PRINT ""
980 PRINT ""
990 IF I=250 THEN PRINT "THIS IS YOUR LAST ALLOWABLE DATA ENTRY. DATA FILE WILL
THEN BE FULL. PLEASE QUIT AFTER THIS ENTRY AND DELETE SOME OLD DATA IF YOU WISH
TO ADD MORE NEW DATA.": PRINT ""
1000 LINE INPUT "AIRCRAFT DESIGNATOR? "; D$(I)
1010 IF D$(I)="" AND REDES<>1 THEN 1980
1020 IF D$(I)="" AND REDES=1 THEN D$(X)=F$(D): RETURN
1030 IF LEN(D$(I))<10 THEN D$(I)=D$(I)+STRING$(10-LEN(D$(I)),32)
1040 IF LEN(D$(I))>10 THEN CLS: PRINT "INPUT ONLY 10 CHARACTERS OR LESS.":GOTO
1000
1050 IF ASC(MID$(D$(I),1,1))=32 THEN CLS: PRINT "ENTRY MUST BEGIN IN THE FIRST
SPACE": GOTO 1000
1060 FOR A=1 TO 10
1070 IF ASC(MID$(D$(I),A,1))=32 OR ASC(MID$(D$(I),A,1))=45 OR
ASC(MID$(D$(I),A,1))>47 AND ASC(MID$(D$(I),A,1))<58 OR ASC(MID$(D$(I),A,1))>64
AND ASC(MID$(D$(I),A,1))<91 THEN 1090 ELSE 1080
1080 CLS: PRINT "AIRCRAFT DESIGNATORS MUST BE A COMBINATION OF LETTERS AND
NUMBERS, ONLY.": GOTO 1000
1090 NEXT A
1100 IF REDES=1 THEN RETURN
1110 IF I=1 THEN 1200
1120 FOR Y=1 TO I-1
1130 IF D$(Y)=D$(I) AND FLAG(Y)=-1 THEN D$(Y)="????? ": GOTO 1190
1140 IF D$(Y)<>D$(I) THEN 1190
1150 CLS
1160 PRINT "THIS AIRCRAFT IS ALREADY IN THE DATA FILE. IF YOU WISH TO CHANGE
ITS PARAMETERS THIS MUST BE DONE UNDER THE SECTION: 'TO MODIFY DATA'. PLEASE
CONTINUE TO ENTER NEW DATA OR ENTER THE 'RETURN' KEY TO TERMINATE ADDITION OF
DATA."
1170 PRINT ""
1180 GOTO 1000
1190 NEXT Y
1200 GOSUB 280
1210 IF Z$="N" THEN 1000
1220 PRINT "": PRINT ""
1230 PRINT "ENTER:": PRINT ""
1240 PRINT "1: IF THIS AIRCRAFT HAS ONLY ONE SET OF WING GEARS. (i.e. MOST
AIRCRAFT)"
1250 PRINT "2: IF THIS AIRCRAFT HAS TWO SETS OF WING GEARS. (i.e. B747)"
1260 PRINT "3: IF THIS AIRCRAFT HAS ONE SET OF WING GEARS AND A CENTER GEAR.
(i.e. DC10-30)
1270 LINE INPUT "WAITING ";Z$
1280 IF Z$="1" OR Z$="2" OR Z$="3" THEN 1310
1290 GOSUB 5170
1300 GOTO 1220
1310 LG(I)=VAL(Z$)
1320 ON LG(I) GOTO 1810, 1530, 1330
1330 PRINT "WING GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
1340 LINE INPUT "FEET? "; M1$
1350 GOSUB 320
1360 IF REDO=2 THEN 1340
1370 LINE INPUT "INCHES? "; M2$

```

```

1380 GOSUB 370
1390 IF REDO=2 THEN 1370
1400 M(I)=(12*VAL(M1$)+VAL(M2$))/2
1410 E(I)=0
1420 IF M(I)<301 AND M(I)>0 THEN 1430 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1330
1430 LINE INPUT"WEIGHT/BODY GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
1440 GOSUB 370
1450 IF REDO=2 THEN 1430
1460 L(I)=VAL(M2$)
1470 IF L(I)<10^3 AND L(I)=>10 THEN 1480 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1430
1480 LINE INPUT"WEIGHT/WING GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
1490 GOSUB 370
1500 IF REDO=2 THEN 1480
1510 N(I)=VAL(M2$)
1520 IF N(I)<10^3 AND N(I)=>10 THEN 1950 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1480
1530 PRINT "INNER GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)? "
1540 LINE INPUT "FEET? "; M1$
1550 GOSUB 320
1560 IF REDO=2 THEN 1540
1570 LINE INPUT "INCHES? "; M2$
1580 GOSUB 370
1590 IF REDO=2 THEN 1570
1600 E(I)=(12*VAL(M1$)+VAL(M2$))/2
1610 IF E(I)<301 AND E(I)>0 THEN 1620 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1530
1620 LINE INPUT"WEIGHT/INNER GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
1630 GOSUB 370
1640 IF REDO=2 THEN 1620
1650 L(I)=VAL(M2$)
1660 IF L(I)<10^3 AND L(I)=>10 THEN 1670 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1620
1670 PRINT"OUTER GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
1680 LINE INPUT "FEET? "; M1$
1690 GOSUB 320
1700 IF REDO=2 THEN 1680
1710 LINE INPUT "INCHES? "; M2$
1720 GOSUB 370
1730 IF REDO=2 THEN 1710
1740 M(I)=(12*VAL(M1$)+VAL(M2$))/2
1750 IF M(I)<301 AND M(I)>0 THEN 1760 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1670
1760 LINE INPUT"WEIGHT/OUTER GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
1770 GOSUB 370
1780 IF REDO=2 THEN 1760
1790 N(I)=VAL(M2$)
1800 IF N(I)<10^3 AND N(I)=>10 THEN 1950 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1760

```

```

1810 PRINT"GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)? "
1820 LINE INPUT "FEET? "; M1$
1830 GOSUB 320
1840 IF REDO=2 THEN 1820
1850 LINE INPUT "INCHES? "; M2$
1860 GOSUB 370
1870 IF REDO=2 THEN 1850
1880 E(I)=(12*VAL(M1$)+VAL(M2$))/2
1890 IF E(I)<301 AND E(I)>0 THEN 1900 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 1810
1900 LINE INPUT"GROSS WEIGHT(THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)? ";M2$
1910 GOSUB 370
1920 IF REDO=2 THEN 1900
1930 GW(I)=VAL(M2$)
1940 IF GW(I)<10^3 AND GW(I)=>10 THEN 1950 ELSE PRINT "OUT OF RANGE. TRY
AGAIN.": GOTO 1900
1950 P=I: XX=XX+1
1960 PRINT ""
1970 CLS: NEXT I
1980 IF I=1 OR NOADD=I THEN 630 ELSE FIRSTPASS=2: GOTO 3880
1990 '*****
2000 '   DELETION OF DATA
2010 '*****
2020 EDITTYPE=1
2030 IF P=0 THEN PRINT "DATA FILE IS EMPTY. DATA MUST BE ENTERED.": PRINT "":
GOTO 930
2040 FOR D=1 TO P
2050 CLS
2060 PRINT "ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO
DELETE, AS NO MORE THAN 10 CHARACTERS, OR ENTER THE RETURN KEY ONLY WHEN DATA
DELETION IS FINISHED.":PRINT ""
2070 LINE INPUT "AIRCRAFT DESIGNATOR? ";F$(D): PRINT ""
2080 IF F$(D)="" THEN D=D-1: GOTO 2340
2090 IF LEN(F$(D))<10 THEN F$(D)=F$(D)+STRING$(10-LEN(F$(D)),32)
2100 FOR X=1 TO P
2110 IF F$(D)<>D$(X) THEN 2150
2120 IF FLAG(X)=-1 THEN PRINT "THIS AIRCRAFT HAS ALREADY BEEN DELETED.":PRINT
"": GOTO 2070
2130 FLAG(X)=-1
2140 GOTO 2170
2150 NEXT X
2160 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO TERMINATE DELETION OF DATA.": PRINT "": GOTO 2070
2170 NEXT D
2180 IF EDITTYPE<>3 THEN 2340
2190 FOR J=1 TO P
2200 CLS
2210 PRINT "ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU DO NOT WANT
TO DELETE, AS NO MORE THAN 10 CHARACTERS, OR ENTER THE RETURN KEY ONLY WHEN
FINISHED.":PRINT ""
2220 LINE INPUT "AIRCRAFT DESIGNATOR? ";G$(J)
2230 IF G$(J)="" THEN 2330
2240 IF LEN(G$(J))<10 THEN G$(J)=G$(J)+STRING$(10-LEN(G$(J)),32)
2250 FOR X=1 TO P

```

```

2260 IF G$(J)<>D$(X) THEN 2300
2270 IF FLAG(X)<>-1 THEN PRINT "THIS AIRCRAFT IS CURRENTLY IN THE DATA
FILE.":PRINT "": GOTO 2220
2280 FLAG(X)=+1
2290 GOTO 2320
2300 NEXT X
2310 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO RETURN TO THE EDITOR MENU.": PRINT "": GOTO 2220
2320 NEXT J
2330 IF EDITTYPE=3 THEN RETURN
2340 IF D=0 THEN 630 ELSE FIRSTPASS=2: GOTO 3880
2350 '*****
2360 ' MODIFICATION OF DATA
2370 '*****
2380 CLS
2390 IF P=0 THEN PRINT "DATA FILE IS EMPTY. DATA MUST BE ENTERED.": PRINT "":
GOTO 930
2400 PRINT "ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO
MODIFY, AS NO MORE THAN 10 CHARACTERS, OR ENTER THE RETURN KEY ONLY WHEN DATA
MODIFICATION IS FINISHED.":PRINT ""
2410 EDITTYPE=2
2420 FOR D=1 TO 250
2430 LINE INPUT "AIRCRAFT DESIGNATOR? ";F$(D)
2440 IF F$(D)="" THEN D=D-1: GOTO 3840
2450 IF LEN(F$(D))<10 THEN F$(D)=F$(D)+STRING$(10-LEN(F$(D)),32)
2460 FOR X=1 TO P
2470 IF F$(D)=D$(X) AND FLAG(X)<>-1 THEN 2500
2480 NEXT X
2490 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO TERMINATE DATA MODIFICATION.": PRINT "": GOTO 2430
2500 MFLAG(X)=+1
2510 IF LG(X)=1 THEN 3470
2520 IF LG(X)=2 THEN 2960
2530 CLS
2540 PRINT " AIRCRAFT WING GEAR DISTANCE WEIGHT/BODY GEAR WEIGHT/WING
GEAR"
2550 PRINT "DESIGNATOR", " FROM CENTERLINE"
2560 PRINT
2570 PRINT SPC(1) D$(X) SPC(13) M(X) SPC(14) L(X) SPC(13) N(X): PRINT ""
2580 PRINT "ENTER.": PRINT ""
2590 PRINT "1: TO CHANGE AIRCRAFT DESIGNATOR": PRINT ""
2600 PRINT "2: TO CHANGE WING GEAR LOCATION": PRINT ""
2610 PRINT "3: TO CHANGE WEIGHT/BODY GEAR": PRINT ""
2620 PRINT "4: TO CHANGE WEIGHT/WING GEAR": PRINT ""
2630 PRINT "5: TO MODIFY ANOTHER AIRCRAFT": PRINT ""
2640 PRINT "6: TO RETURN": PRINT ""
2650 LINE INPUT "WAITING ";Z$
2660 IF Z$="1" OR Z$="2" OR Z$="3" OR Z$="4" OR Z$="5" OR Z$="6" THEN 2690
2670 GOSUB 5170
2680 GOTO 2540
2690 Q=VAL(Z$)
2700 ON Q GOTO 2710, 2770, 2860, 2910, 3830, 3840
2710 LINE INPUT "AIRCRAFT DESIGNATOR? "; D$(X)
2720 I=X

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2730 REDES=1
2740 GOSUB 1020
2750 REDES=0
2760 GOTO 2530
2770 PRINT"WING GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
2780 LINE INPUT "FEET? "; M1$
2790 GOSUB 320
2800 IF REDO=2 THEN 2780
2810 LINE INPUT "INCHES? "; M2$
2820 GOSUB 370
2830 IF REDO=2 THEN 2810
2840 M(X)=(12*VAL(M1$)+VAL(M2$))/2
2850 IF M(X)<301 AND M(X)>0 THEN 2530 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 2770
2860 LINE INPUT "WEIGHT/BODY GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
2870 GOSUB 370
2880 IF REDO=2 THEN 2860
2890 L(X)=VAL(M2$)
2900 IF L(X)<10^3 AND L(X)=>10 THEN 2530 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 2860
2910 LINE INPUT "WEIGHT/WING GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
2920 GOSUB 370
2930 IF REDO=2 THEN 2910
2940 N(X)=VAL(M2$)
2950 IF N(X)<10^3 AND N(X)=>10 THEN 2530 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 2910
2960 CLS
2970 PRINT A$: PRINT B$: PRINT C$
2980 PRINT USING E$;D$(X); E(X); L(X); M(X); N(X): PRINT "": PRINT""
2990 PRINT "ENTER:": PRINT ""
3000 PRINT "1: TO CHANGE AIRCRAFT DESIGNATOR": PRINT ""
3010 PRINT "2: TO CHANGE INNER GEAR LOCATION": PRINT ""
3020 PRINT "3: TO CHANGE WEIGHT/INNER GEAR": PRINT ""
3030 PRINT "4: TO CHANGE OUTER GEAR LOCATION": PRINT ""
3040 PRINT "5: TO CHANGE WEIGHT/OUTER GEAR": PRINT ""
3050 PRINT "6: TO MODIFY ANOTHER AIRCRAFT": PRINT ""
3060 PRINT "7: TO RETURN": PRINT ""
3070 LINE INPUT "WAITING ";Z$
3080 IF Z$="1" OR Z$="2" OR Z$="3" OR Z$="4" OR Z$="5" OR Z$="6" OR Z$="7" THEN
3110
3090 GOSUB 5170
3100 GOTO 2970
3110 Q=VAL(Z$)
3120 ON Q GOTO 3130, 3190, 3280, 3330, 3420, 3830, 3840
3130 LINE INPUT "AIRCRAFT DESIGNATOR? "; D$(X)
3140 I=X
3150 REDES=1
3160 GOSUB 1020
3170 REDES=0
3180 GOTO 2530
3190 PRINT "INNER GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
3200 LINE INPUT "FEET? "; M1$

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3210 GOSUB 320
3220 IF REDO=2 THEN 3200
3230 LINE INPUT "INCHES? "; M2$
3240 GOSUB 370
3250 IF REDO=2 THEN 3230
3260 E(X)=(12*VAL(M1$)+VAL(M2$))/2
3270 IF E(X)<301 AND E(X)>0 THEN 2960 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 3190
3280 LINE INPUT "WEIGHT/INNER GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999
KLBS.)? ";M2$
3290 GOSUB 370
3300 IF REDO=2 THEN 3280
3310 L(X)=VAL(M2$)
3320 IF L(X)<10^3 AND L(X)=>10 THEN 2960 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 3280
3330 PRINT "OUTER GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
3340 LINE INPUT "FEET? "; M1$
3350 GOSUB 320
3360 IF REDO=2 THEN 3340
3370 LINE INPUT "INCHES? "; M2$
3380 GOSUB 370
3390 IF REDO=2 THEN 3370
3400 M(X)=(12*VAL(M1$)+VAL(M2$))/2
3410 IF M(X)<301 AND M(X)>0 THEN 2960 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 3330
3420 LINE INPUT "WEIGHT/OUTER GEAR (THOUSANDS OF LBS.; 10.000 TO 999.999
KLBS.)? ";M2$
3430 GOSUB 370
3440 IF REDO=2 THEN 3420
3450 N(X)=VAL(M2$)
3460 IF N(X)<10^3 AND N(X)=>10 THEN 2960 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 3420
3470 CLS
3480 PRINT AA$: PRINT BB$
3490 PRINT
3500 PRINT USING EE$; D$(X); E(X); GW(X): PRINT ""
3510 PRINT "ENTER: ": PRINT ""
3520 PRINT "1: TO CHANGE AIRCRAFT DESIGNATOR": PRINT ""
3530 PRINT "2: TO CHANGE GEAR LOCATION": PRINT ""
3540 PRINT "3: TO CHANGE GROSS WEIGHT": PRINT ""
3550 PRINT "4: TO MODIFY ANOTHER AIRCRAFT": PRINT ""
3560 PRINT "5: TO RETURN": PRINT ""
3570 LINE INPUT "WAITING ";Z$
3580 IF Z$="1" OR Z$="2" OR Z$="3" OR Z$="4" OR Z$="5" THEN 3610
3590 GOSUB 5170
3600 GOTO 3480
3610 Q=VAL(Z$)
3620 ON Q GOTO 3630, 3690, 3780, 3830, 3840
3630 LINE INPUT "AIRCRAFT DESIGNATOR? "; D$(X)
3640 I=X
3650 REDES=1
3660 GOSUB 1020
3670 REDES=0
3680 GOTO 3470

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```

3690 PRINT"GEAR LOCATION (FEET, INCHES APART; MAXIMUM 50 FEET)?"
3700 LINE INPUT "FEET? "; M1$
3710 GOSUB 320
3720 IF REDO=2 THEN 3700
3730 LINE INPUT "INCHES? "; M2$
3740 GOSUB 370
3750 IF REDO=2 THEN 3730
3760 E(X)=(12*VAL(M1$)+VAL(M2$))/2
3770 IF E(X)<301 AND E(X)>0 THEN 3470 ELSE PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 3690
3780 LINE INPUT "GROSS WEIGHT (THOUSANDS OF LBS.; 10.000 TO 999.999 KLBS.)?
";M2$
3790 GOSUB 370
3800 IF REDO=2 THEN 3780
3810 GW(X)=VAL(M2$)
3820 IF GW(X)<10^3 AND GW(X)=>10 THEN 3470 ELSE PRINT "OUT OF RANGE. TRY
AGAIN.": GOTO 3780
3830 NEXT D
3840 IF D=0 THEN 630 ELSE FIRSTPASS=2
3850 '*****
3860 ' LIST OF CHANGES
3870 '*****
3880 CLS
3890 INPUT "DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE?
(Y/N)";Q$
3900 IF Q$="N" THEN 4400
3910 IF Q$="Y" THEN CLS: GOTO 3940
3920 GOSUB 5170
3930 GOTO 3880
3940 IF EDITTYPE=0 THEN PRINT "DATA ADDED": PRINT ""
3950 IF EDITTYPE=1 THEN PRINT "DATA TO BE DELETED": PRINT ""
3960 IF EDITTYPE=2 THEN PRINT "DATA MODIFIED": PRINT ""
3970 PRINT AAA$: PRINT BBB$: PRINT CCC$
3980 S=1
3990 PRINT ""
4000 IF EDITTYPE=0 THEN 4030
4010 IF EDITTYPE=1 THEN 4280
4020 IF EDITTYPE=2 THEN 4160
4030 FOR J=NOADD TO P+1
4040 IF D$(J)=" " THEN 4400
4050 IF LG(J)=1 THEN PRINT USING EE$;D$(J); E(J); GW(J)
4060 IF LG(J)=2 OR LG(J)=3 THEN PRINT USING EEE$;D$(J); E(J); L(J); M(J); N(J)
4070 IF S<>17 THEN 4140
4080 WHILE INKEY$<>" "
4090 WEND
4100 PRINT "ENTER ANY KEY TO CONTINUE"
4110 Z$=INKEY$: IF Z$=" " THEN 4110
4120 CLS: PRINT AAA$: PRINT BBB$: PRINT CCC$
4130 S=0
4140 S=S+1
4150 NEXT J
4160 FOR J=1 TO P+1
4170 IF D$(J)=" " THEN 4400
4180 IF MFLAG(J)=+1 AND LG(J)=1 THEN PRINT USING EE$;D$(J);E(J);GW(J): S=S+1

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4190     IF      MFLAG(J)=+1      AND      LG(J)<>1      THEN      PRINT      USING
EEE$;D$(J);E(J);L(J);M(J);N(J):S=S+1
4200 IF S<>17 THEN 4270
4210 WHILE INKEY$<>""
4220 WEND
4230 PRINT "ENTER ANY KEY TO CONTINUE"
4240 Z$=INKEY$: IF Z$="" THEN 4240
4250 CLS: PRINT AA$: PRINT BBB$: PRINT CCC$
4260 S=0
4270 NEXT J
4280 FOR J=1 TO P+1
4290 IF D$(J)="" THEN 4400
4300 IF FLAG(J)=-1 AND LG(J)=1 AND D$(J)<>"?????" " THEN PRINT USING
EE$;D$(J); E(J); GW(J): S=S+1
4310 IF FLAG(J)=-1 AND LG(J)<>1 AND D$(J)<>"?????" " THEN PRINT USING
EEE$;D$(J); E(J); L(J); M(J); N(J): S=S+1
4320 IF S<>17 THEN 4390
4330 WHILE INKEY$<>""
4340 WEND
4350 PRINT "ENTER ANY KEY TO CONTINUE"
4360 Z$=INKEY$: IF Z$="" THEN 4360
4370 CLS: PRINT AA$: PRINT BBB$: PRINT CCC$
4380 S=0
4390 NEXT J
4400 PRINT ""
4410 IF EDITTYPE=1 THEN LINE INPUT "ARE THESE DELETIONS CORRECT? (Y/N) "; Q$
ELSE 4470
4420 IF Q$="Y" OR Q$="N" THEN 4450
4430 GOSUB 5170
4440 GOTO 4400
4450 IF Q$="Y" THEN 4470
4460 IF Q$="N" THEN EDITTYPE=3: GOSUB 2180
4470 PRINT ""
4480 PRINT SPACE$(10) "ENTER:"
4490 PRINT SPACE$(10) "1: TO RETURN TO THE EDITOR MENU"
4500 PRINT SPACE$(10) "2: TO ABORT THESE CHANGES"
4510 IF EDITTYPE=0 OR EDITTYPE=2 THEN PRINT SPACE$(10) "3: TO MODIFY THE
CHANGES"
4520 LINE INPUT "WAITING "; ZQ$
4530 IF EDITTYPE=0 AND ZQ$="3" OR EDITTYPE=2 AND ZQ$="3" THEN 2380
4540 IF ZQ$="1" THEN RETURN
4550 IF ZQ$<>"2" THEN 4620
4560 IF EDITTYPE<>1 THEN 500
4570 FOR J=1 TO P+1
4580 IF D$(J)="" THEN 500
4590 IF FLAG(J)=-1 THEN FLAG(J)=+1
4600 NEXT J
4610 GOTO 500
4620 GOSUB 5170
4630 GOTO 4470
4640 '***** MERGE AND SORT *****
4650 CLS
4660 IF FIRSTPASS=1 THEN RETURN
4670 PRINT "SORTING, PLEASE WAIT."

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5190 PRINT "ENTER ANY KEY TO CONTINUE."  
5200 Z$=INKEY$: IF Z$="" THEN 5200  
5210 IF ASC(Z$)=13 THEN 5200  
5220 RETURN
```

```

10 '*****
20 'SUBPROGRAM "ANALYSIS": AIRPORT DATA FILE MANAGEMENT AND ANALYSIS
30 '
40 '*****
50 ' ADDITIONAL VARIABLES'
60 ' STRINGS= APDAT$, FILENAM$, FILENAM2$, DES$, BUF.AD$, BUF.FREQ$,
QQ$, ZQ$, QNUM$, BUF.Y$, FIL$, XQ$, BUF.PTFRQ$, BUF.DIR$, DIR$, M2$, OFFSET$, TEST$, BUF.-
OS$, BUF.SD$, BUF.TYP$, TYPE$, TYP$, PRT$, PDATE$
70 ' INTEGERS= MODE,
ACTOT, XX, P, T, NOADD, LGC, SD, FXFLAG, IX, PFLAG, FILTOT, Q, TTOT, FFLAG, PTFLAG, F, OSFLG
80 ' SINGLE PRECISIONS= FREQ!, EC, LC, NC, PTFRQ, OFFSET, PF
90 ' DOUBLE PRECISIONS= FX#, YSUM, ZSUM, SD
100 COLOR 10,0
110 OPEN "R",3,"DATE.DAT",17
120 FIELD 3, 17 AS BUF.PDATE$
130 GET 3,1
140 PDATE$=BUF.PDATE$
150 CLOSE #3
160 ON ERROR GOTO 10780
170 GOTO 300
180 REDO=0
190 FOR A=1 TO LEN(M2$)
200 IF OSFLG=1 THEN IF ASC(MID$(M2$,A,1))<45 OR ASC(MID$(M2$,A,1))>57 OR
ASC(MID$(M2$,A,1))=47 THEN 240
210 IF ASC(MID$(M2$,A,1))<46 OR ASC(MID$(M2$,A,1))>57 OR ASC(MID$(M2$,A,1))=47
THEN 240
220 NEXT A
230 RETURN
240 REDO=2
250 PRINT "YOU HAVE ENTERED A WRONG KEY. TRY AGAIN."
260 RETURN
270 '*****
280 'THE FOLLOWING SECTION READS AND STORES INTO MEMORY THE AIRCRAFT DATA FILE
290 '*****
300 AAA$=" AIRCRAFT NUMBER OF OPERATIONS"
310 BBB$=" DESIGNATOR (THOUSANDS/YEAR)"
320 EE$=" \ \ ###.###"
330 DEFINT F
340 DIM D$(250), E(250), L(250), M(250), N(250), F$(250), G$(250), FLAG(250),
LG(250), GW(250), MFLAG(250), DES$(250), FREQ!(250), LC(250),
YSUM(162), ILG(250), IE(250), IL(250), IM(250), IN(250), IGW(250), FFLAG(1000), FIL$(-
1000), YYMAX(6), PFLAG(160)
341 ' SEE COMMENTS IN "LIST1" FOR DESCRIPTION OF VARIABLES
350 TTLE1$="DISTANCE FROM : MAGNITUDE : DISTANCE FROM :
MAGNITUDE"
360 TTLE6$=" CENTERLINE : (MEGA LBS.-GEAR CL. : CENTERLINE : (MEGA
LBS.-GEAR CL. "
370 TTLE3$="DISTANCE FROM LOAD MAXIMA "
380 TTLE7$=" (INCHES) : PASSES/INCH/YEAR) : (INCHES) :
PASSES/INCH/YEAR"
390 TTLE2$=" CENTERLINE (MEGA LB.- GEAR CL."
400 TTLE4$=" (INCHES) PASSES/INCH/YEAR)"
410 TTLE8$="DISTANCE FROM MAGNITUDE"
420 TL1$=" OPERATION INNER GROSS WEIGHT/ OUTER
WEIGHT/"

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430   TL2$=" AIRCRAFT   FREQUENCY   GEAR       WEIGHT   INNER   GEAR
      OUTER "
440   TL3$="           (1000'S/   DISTANCE           GEAR       DISTANCE
      GEAR"
450   TL4$="           YEAR)     (INCHES)    (KLBS.)   (KLBS.)   (INCHES)
      (KLBS.)"
460   EE1$="\          \   ###.###   ###.#           ###.###   ###.#
      ###.###"
470   EE1$="\          \   ###.###   ###.#   ###.###"
480   OPEN "R",1,"AIRCRAFT.DAT",80
490   FIELD 1, 4 AS BUF.G$, 10 AS BUF.A$, 4 AS BUF.B$, 4 AS BUF.GW$, 4 AS
      BUF.C$, 4 AS BUF.D$, 4 AS BUF.E$, 46 AS X$
500   X=1
510   GET 1,X
520   IF BUF.A$="&&&&&" THEN 560
530   ILG(X)=CVS(BUF.G$) : D$(X)=BUF.A$ : IE(X)=CVS(BUF.B$) : IL(X)=CVS(BUF.C$)
      : IM(X)=CVS(BUF.D$) : IN(X)=CVS(BUF.E$) : IGW(X)=CVS(BUF.GW$) : MFLAG(X)=0
540   X=X+1
550   GOTO 510
560   ACTOT=X-1
570   '*****
580   '           INITIAL MENU
590   '*****
600   CLS
610   CLOSE
620   RESTORE
630   DATA 0,"",",",0,"",",",1,0,0,0
640   READ PFLAG,QNUM$,QQ$,Q,Q$,XQ$,FIRSTPASS,PTFLAG,DATENTQ,OSFLG
650   PRINT "", "*****"
660   PRINT "", "*"
670   PRINT "", "*"           INITIAL MENU
680   PRINT "", "*"
690   PRINT "", "*****"
700   PRINT "": PRINT "": PRINT ""
710   PRINT "INSERT THE AIRPORT DATA DISKETTE IN DRIVE B:"
720   PRINT "": PRINT "": PRINT ""
730   PRINT "ENTER DESIRED SELECTION:": PRINT ""
740   PRINT "L: TO LIST THE EXISTING AIRPORT DATA FILES": PRINT ""
750   PRINT "A: TO ENTER AIRPORT DATA AND RUN ANALYSES": PRINT ""
760   PRINT "R: TO RETURN TO MAIN MENU": PRINT ""
770   INPUT "WAITING"; Q$
780   TEST$="LAR"
790   IF INSTR(TEST$,Q$)<>0 AND Q$<>"" THEN 830
800   CLS
810   GOSUB 11570
820   GOTO 600
830   IF Q$="L" THEN GOSUB 1130: GOTO 600
840   IF Q$="R" THEN CHAIN "APLA2"
850   '***** DATA FILE ENTRY *****
860   CLS
870   FIRSTPASS=1
880   LOCATE 3,30
890   PRINT "AIRPORT DATA FILE ENTRY"
900   LOCATE 10,1

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910 PRINT "ENTER:" : PRINT ""
920 PRINT "      1: IF THIS IS AN EXISTING FILE"
930 PRINT "      2: IF THIS IS A NEW FILE TO BE CREATED"
940 PRINT "      3: TO RETURN TO THE INITIAL MENU"
950 PRINT "": INPUT "WAITING "; QNUM$
960 IF QNUM$="1" OR QNUM$="2" THEN 1010
970 IF QNUM$="3" THEN 600
980 CLS
990 GOSUB 11570
1000 GOTO 860
1010 LOCATE 20,1
1020 LINE INPUT "ENTER THE NAME OF THE AIRPORT DATA FILE ( 8 CHARACTERS MAXIMUM
):"; FILENAM$
1030 IF FILENAM$="" THEN 860
1040 IF LEN(FILENAM$)<8 THEN FILENAM$=FILENAM$+STRING$(8-LEN(FILENAM$),32)
1050 IF LEN(FILENAM$)>8 THEN 1010
1060 OPEN "R",2,"B:\DATFILS\"+FILENAM$+".DAT",80
1070 FIELD 2, 4 AS BUF.PF$, 2 AS BUF.DIR$, 4 AS BUF.OS$, 4 AS BUF.SD$, 20 AS
BUF.TYP$, 2 AS BUF.CW$, 44 AS X$
1080 IF LOF(2)>0 AND QNUM$="2" THEN CLS: CLOSE: PRINT "THIS DATA FILE ALREADY
EXISTS.": GOTO 880
1090 IF LOF(2)=0 AND QNUM$="1" THEN CLS: PRINT "THIS DATA FILE DOES NOT
EXIST.":CLOSE: KILL "B:\DATFILS\"+FILENAM$+".DAT": GOTO 880
1100 IF QNUM$="1" THEN 3330
1110 IF QNUM$="2" THEN 1690
1120 '***** WRITES NEW FILENAME TO FILELIST.DAT *****
1130 OPEN "R",1,"B:FILELIST.DAT",8
1140 FIELD 1, 8 AS BUF.Y$
1150 IF LOF(1)=0 AND FIRSTPASS<>2 THEN CLS: PRINT "NEW DISKETTE. PLEASE CREATE
DATA FILE(S).": GOTO 870
1160 IF LOF(1)=0 AND FIRSTPASS=2 THEN QNUM$="2": X=1: GOTO 1230
1170 X=1
1180 GET 1,X
1190 IF BUF.Y$="&2&&&&&&&&&" THEN 1230
1200 FIL$(X)=BUF.Y$
1210 X=X+1
1220 GOTO 1180
1230 IF QNUM$="2" THEN FIL$(X)=FILENAM$: FILTOT=X: GOSUB 11380: CLOSE #1:
RETURN
1240 FILTOT=X-1
1250 ' ***** AIRPORT DATA FILE LIST *****
1260 S=1
1270 FOR J=1 TO FILTOT STEP 3
1280 IF J=1 THEN 1350
1290 IF J<S*17 THEN 1390
1300 WHILE INKEY$<>""
1310 WEND
1320 PRINT "": PRINT "": PRINT "ENTER ANY KEY TO CONTINUE"
1330 Z$=INKEY$: IF Z$="" THEN 1330
1340 S=S+1
1350 CLS: LOCATE 2,25
1360 PRINT "AIRPORT DATA FILES"
1370 LOCATE 3,25
1380 FOR I=1 TO 18:PRINT CHR$(205);:NEXT I: PRINT " ": PRINT " "

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1390 IF FILTOT=J+1 THEN PRINT TAB(10) FIL$(J) TAB(30) FIL$(J+1): GOTO 1430
1400 IF FILTOT=J THEN PRINT TAB(10) FIL$(J): GOTO 1430
1410 PRINT TAB(10) FIL$(J) TAB(30) FIL$(J+1) TAB(50) FIL$(J+2)
1420 NEXT J
1430 PRINT "": INPUT "DO YOU WANT A PRINTOUT OF THIS LIST? (Y/N)"; Z$
1440 IF Z$="Y" THEN 1490
1450 IF Z$="N" THEN 1660
1460 CLS
1470 GOSUB 11570
1480 GOTO 1260
1490 FOR J=1 TO FILTOT STEP 3
1500 IF J<>1 THEN 1600
1510 CLS: PRINT "BE SURE TO ADVANCE THE PRINTER HEAD TO THE TOP OF THE NEXT
PAGE."
1520 WHILE INKEY$<>""
1530 WEND
1540 PRINT "THEN ENTER ANY KEY TO CONTINUE"
1550 Z$=INKEY$: IF Z$="" THEN 1550
1560 LPRINT TAB(25) "AIRPORT DATA FILES"
1570 LPRINT TAB(25)
1580 FOR I=1 TO 18:LPRINT CHR$(95);:NEXT I
1590 FOR I=1 TO 4:LPRINT " ": NEXT I: GOTO 1620
1600 IF FILTOT=J+1 THEN 1640
1610 IF FILTOT=J THEN 1650
1620 LPRINT TAB(10) FIL$(J) TAB(30) FIL$(J+1) TAB(50) FIL$(J+2)
1630 NEXT J
1640 LPRINT TAB(10) FIL$(J) TAB(30) FIL$(J+1): GOTO 1660
1650 LPRINT TAB(10) FIL$(J)
1660 CLOSE #1
1670 RETURN
1680 '***** CREATION OF NEW DATA FILE *****
1690 XX=1
1700 EDITTYPE=4
1710 CLS: LOCATE 3,10
1720 PRINT "NEW DATA FILE CREATION"
1730 LOCATE 10,1
1740 PRINT "INPUT THE DIRECTION OF THE PAVEMENT ANALYSIS AND THE AVERAGE %
OF OPERATIONS IN THAT DIRECTION."
1750 PRINT
1760 LINE INPUT "ENTER ONE OF THE DIRECTIONS: N,S,E,W,NE,NW,SE,SW? "; DIR$
1770 IF DIR$<>"N" AND DIR$<>"S" AND DIR$<>"E" AND DIR$<>"W" AND DIR$<>"NE" AND
DIR$<>"NW" AND DIR$<>"SE" AND DIR$<>"SW" THEN CLS: PRINT "WRONG ENTRY. ENTER
ONE OF THE GIVEN DIRECTIONS ONLY.": GOTO 1730
1780 IF PTFLAG=1 THEN RETURN
1790 PRINT
1800 LINE INPUT "ENTER THE % OF OPERATIONS IN THIS DIRECTION: "; M2$
1810 GOSUB 180
1820 IF REDO=2 THEN 1800
1830 PTFRQ=VAL(M2$)
1840 IF PTFRQ>100 OR PTFRQ<=0 THEN CLS: PRINT "OUT OF RANGE. TRY AGAIN.": GOTO
1800
1850 IF PTFLAG=1 THEN RETURN
1860 PRINT

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1870 LINE INPUT "ENTER THE LETTER FOR THE TYPE OF PAVEMENT:
           A: 150' RUNWAY           B: 200' RUNWAY           C: 75' TAXIWAY
           D: 100' TAXIWAY         E: OTHER           : ";TYPE$
1880 TEST$="ABCDE"
1890 IF INSTR(TEST$,TYPE$)<>0 AND TYPE$<>"" THEN 1930
1900 PRINT
1910 PRINT "YOU MUST ENTER AN A, B, C, D, OR E. TRY AGAIN."
1920 GOTO 1860
1930 IF PTFLAG=+1 THEN RETURN
1940 IF TYPE$="A" THEN OFFSET=-11.88: SD=90.48001: TYP$="150' RUNWAY"
1950 IF TYPE$="B" THEN OFFSET=-18.96: SD=104.76: TYP$="200' RUNWAY"
1960 IF TYPE$="C" THEN OFFSET=29.64: SD=42.84: TYP$="75' TAXIWAY"
1970 IF TYPE$="D" THEN OFFSET=38.4: SD=70.8: TYP$="100' TAXIWAY"
1980 IF TYPE$="E" THEN 2060
1990 PRINT
2000 PRINT "THE EMPIRICALLY DERIVED AVERAGES FOR A "TYP$" ARE: "
2010 PRINT "OFFSET= "OFFSET
2020 PRINT "STANDARD DEVIATION="SD
2030 PRINT
2040 INPUT "DO YOU WANT TO RETAIN THESE VALUES (Y/N) ";Q$
2050 IF Q$="N" THEN 2110 ELSE 2630
2060 PRINT
2070 LINE INPUT "ENTER THE PAVEMENT TYPE (NO MORE THAN 20 CHARACTERS): ";TYP$
2080 IF TYP$="" THEN 1860
2090 IF LEN(TYP$)>20 THEN 2060
2100 TYPE$=TYP$
2110 PRINT: LINE INPUT "ENTER THE MEAN OFFSET FROM THE CENTERLINE (INCHES) OR A
'T' TO SEE A TABLE OF VALUES: ";M2$
2120 IF M2$<>"T" THEN 2500
2130 CLS
2140 LOCATE 3,20
2150 PRINT "AVERAGES FOR ALL AIRPORTS STUDIED"
2160 LOCATE 4,20
2170 FOR Z=1 TO 33: PRINT CHR$(205);: NEXT Z
2180 PRINT "           150' RUNWAYS           200' RUNWAYS"
2190 PRINT
2200 PRINT "           OFFSET      STD. DEV.           OFFSET      STD. DEV."
2210 PRINT "           (INCHES)    (INCHES)           (INCHES)    (INCHES)"
2220 PRINT
2230 PRINT "           -11.88      90.48           -18.96      104.76"
2240 FOR Z= 1 TO 2: PRINT: NEXT
2250 PRINT "           75' TAXIWAYS           100' TAXIWAYS"
2260 PRINT
2270 PRINT "           OFFSET      STD. DEV.           OFFSET      STD. DEV."
2280 PRINT "           (INCHES)    (INCHES)           (INCHES)    (INCHES)"
2290 PRINT
2300 PRINT "           29.64      42.84           38.40      70.80"
2310 FOR Z= 1 TO 3: PRINT: NEXT
2320 WHILE INKEY$<>""
2330 WEND
2340 PRINT "ENTER ANY KEY TO CONTINUE"
2350 Q$=INKEY$: IF Q$="" THEN 2350
2360 CLS
2370 PRINT SPC(18) "CROSSWIND CONDITIONS FOR 150' RUNWAYS"

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2380 PRINT SPC(18);
2390 FOR Z=1 TO 37: PRINT CHR$(205);: NEXT Z
2400 PRINT "          >5 KTS. FROM THE RIGHT          >5 KTS. FROM THE LEFT"
2410 PRINT
2420 PRINT "AIRPORT      OFFSET      STD. DEV.          OFFSET      STD. DEV."
2430 PRINT "          (INCHES)    (INCHES)          (INCHES)    (INCHES)"
2440 PRINT
2450 PRINT " DEN          -39.78      110.76          16.14      97.68"
2460 PRINT
2470 PRINT " ORD          -21.84      66.72          -24.90     87.30"
2480 PRINT
2490 LINE INPUT "ENTER THE MEAN OFFSET FROM THE CENTERLINE (INCHES): ";M2$
2500 OSFLG=1
2510 GOSUB 180
2520 OSFLG=0
2530 IF REDO=2 THEN 2110
2540 OFFSET=VAL(M2$)
2550 IF OFFSET>100 OR OFFSET<-100 THEN CLS: PRINT "OUT OF RANGE. TRY AGAIN.":
GOTO 2110
2560 IF PTFLAG=1 THEN RETURN
2570 PRINT: LINE INPUT "ENTER THE AVERAGE STANDARD DEVIATION (INCHES): ";M2$
2580 GOSUB 180
2590 IF REDO=2 THEN 2570
2600 SD=VAL(M2$)
2610 IF SD>150 OR SD<11.5 THEN CLS: PRINT "OUT OF RANGE. TRY AGAIN.": GOTO
2570
2620 IF PTFLAG=1 THEN RETURN
2630 PRINT
2640 PRINT "ENTER AIRCRAFT DESIGNATORS AS NO MORE THAN 10 CHARACTERS."
2650 PRINT "ENTER AIRCRAFT OPERATIONS FOR EACH AIRCRAFT AS THOUSANDS OF
OPERATIONS/YEAR."
2660 FOR I=XX TO ACTOT
2670 PRINT
2680 LINE INPUT "AIRCRAFT DESIGNATOR? (OR ENTER THE RETURN KEY WHEN DATA
ADDITION IS FINISHED) "; DES$(I)
2690 IF DES$(I)="" AND REDES<>1 THEN 3080
2700 IF DES$(I)="" AND REDES=1 THEN DES$(X)=F$(D): RETURN
2710 IF LEN(DES$(I))<10 THEN DES$(I)=DES$(I)+STRING$(10-LEN(DES$(I)),32)
2720 IF LEN(DES$(I))>10 THEN CLS: PRINT "INPUT ONLY 10 CHARACTERS OR
LESS.":GOTO 2670
2730 IF ASC(MID$(D$(I),1,1))=32 THEN CLS: PRINT "ENTRY MUST BEGIN IN THE FIRST
SPACE": GOTO 2670
2740 FOR A=1 TO 10
2750 IF ASC(MID$(DES$(I),A,1))=32 OR ASC(MID$(DES$(I),A,1))=45 OR
ASC(MID$(DES$(I),A,1))>47 AND ASC(MID$(DES$(I),A,1))<58 OR
ASC(MID$(DES$(I),A,1))>64 AND ASC(MID$(DES$(I),A,1))<91 THEN 2770 ELSE 2760
2760 CLS: PRINT "AIRCRAFT DESIGNATORS MUST BE A COMBINATION OF LETTERS,
NUMBERS, AND HYPHENS ONLY.": GOTO 2670
2770 NEXT A
2780 FOR JJ=1 TO ACTOT
2790 IF D$(JJ)=DES$(I) THEN 2820
2800 NEXT JJ
2810 CLS:PRINT "THIS AIRCRAFT IS EITHER NOT IN THE CURRENT AIRCRAFT DATA FILE
AND MUST BE ADDED WHILE IN THE EDITOR (SEE THE MAIN MENU) OR THE DESIGNATION
IS NOT THE SAME.": GOTO 2670

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2820 IF I=1 THEN 2860
2830 FOR J=1 TO I-1
2840 IF DES$(J)=DES$(I) AND FLAG(J)<>-1 THEN CLS: PRINT "THIS AIRCRAFT IS
ALREADY IN THE CURRENT AIRPORT DATA FILE." : GOTO 2670
2850 NEXT J
2860 IF REDES=1 THEN RETURN
2870 PRINT " "
2880 LINE INPUT "AIRCRAFT OPERATIONS (THOUSANDS OF OPERATIONS PER YEAR)? ";
M2$
2890 GOSUB 180
2900 IF REDO=2 THEN 2880
2910 FREQ!(I)=VAL(M2$)
2920 IF FREQ!(I)<10^3 OR FREQ!(I)>0 THEN 2930 ELSE PRINT "OUT OF RANGE. TRY
AGAIN.": GOTO 2870
2930 CLS
2940 LG(I)=ILG(JJ)
2950 E(I)=IE(JJ)
2960 L(I)=IL(JJ)
2970 M(I)=IM(JJ)
2980 N(I)=IN(JJ)
2990 GW(I)=IGW(JJ)
3000 XX=XX+1
3010 NEXT I
3020 PRINT "DATA HAS BEEN INPUT FOR ALL AIRCRAFT IN THE CURRENT AIRCRAFT DATA
FILE.": PRINT "ADDITIONAL AIRCRAFT DATA MUST FIRST BE ADDED ACCORDING TO THE
EDITOR CALLED FROM THE MAIN MENU."
3030 PRINT "OPERATION FREQUENCIES CAN THEN BE ADDED BY RETURNING TO THE
ANALYSIS SECTION, NAMING THE AIRPORT DATA FILE AS AN EXISTING FILE, AND
MODIFYING THE FILE."
3040 WHILE INKEY$<>""
3050 WEND
3060 PRINT "ENTER ANY KEY TO CONTINUE."
3070 Z$=INKEY$: IF Z$="" THEN 3070
3080 P=I-1
3090 IF I<>1 THEN 3190
3100 IF EDITTYPE=0 THEN RETURN
3110 PRINT ""
3120 INPUT "NO ENTRIES MADE. DO YOU WANT TO ABORT THIS DATA FILE CREATION?
(Y/N)"; XQ$
3130 IF XQ$="Y" THEN 4150
3140 IF XQ$="N" THEN 2670
3150 CLS
3160 GOSUB 11570
3170 CLS
3180 GOTO 3110
3190 IF EDITTYPE=0 THEN RETURN
3200 CLS: LOCATE 7,10
3210 PRINT "ENTER 1: TO SAVE THIS DATA FILE"
3220 PRINT " 2: TO ENTER ADDITIONAL DATA"
3230 PRINT " 3: TO ABORT"
3240 INPUT "WAITING"; DATENTQ
3250 ON DATENTQ GOTO 3290, 2670, 4150
3260 CLS
3270 GOSUB 11570
3280 GOTO 3200

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```

3290 FIRSTPASS=2
3300 GOSUB 1130
3310 GOTO 3670
3320 '***** EXISTING AIRPORT DATA READ INTO MEMORY *****
3330 GET 2,1
3340 PTFRQ=CVS(BUF.PF$)
3350 DIR$=BUF.DIR$
3360 OFFSET=CVS(BUF.OS$)
3370 SD=CVS(BUF.SD$)
3380 TYPE$=BUF.TYP$
3390 IF TYPE$="A"          " THEN TYP$="150' RUNWAY"
3400 IF TYPE$="B"          " THEN TYP$="200' RUNWAY"
3410 IF TYPE$="C"          " THEN TYP$="75' TAXIWAY"
3420 IF TYPE$="D"          " THEN TYP$="100' TAXIWAY"
3430 TEST$="A              B                      C                      D
      "
3440 IF INSTR(TEST$,TYPE$)=0 THEN TYP$=TYPE$
3450 CW$=BUF.CW$
3460 X=1
3470 FIELD 2, 4 AS BUF.G$, 10 AS BUF.AD$, 4 AS BUF.FREQ$, 4 AS BUF.B$, 4 AS
BUF.GW$, 4 AS BUF.C$, 4 AS BUF.D$, 4 AS BUF.E$, 42 AS X$
3480 GET 2,X+1
3490 IF CVS(BUF.FREQ$)=0 THEN 3590
3500 DES$(X)=BUF.AD$: FREQ!(X)=CVS(BUF.FREQ$): MFLAG(X)=0
3510 LG(X)=CVS(BUF.G$)
3520 E(X)=CVS(BUF.B$)
3530 L(X)=CVS(BUF.C$)
3540 M(X)=CVS(BUF.D$)
3550 N(X)=CVS(BUF.E$)
3560 GW(X)=CVS(BUF.GW$)
3570 X=X+1
3580 GOTO 3480
3590 P=X-1
3600 XX=X
3610 FIRSTPASS=1
3620 IF QQ$="L" OR QQ$="P" THEN GOSUB 7110
3630 IF QQ$="A" THEN 7510
3640 '*****
3650 '          MENU
3660 '*****
3670 CLS
3680 LOCATE 5,20
3690 PRINT "CURRENT DATA FILE OPERATIONS"
3700 LOCATE 6,20
3710 PRINT "-----"
3720 LOCATE 8,30
3730 PRINT "ENTER:": PRINT ""
3740 PRINT "          L: TO LIST CONTENTS OF THE AIRPORT DATA FILE":
PRINT ""
3750 PRINT "          P: FOR A PRINTOUT OF THE AIRPORT DATA FILE
CONTENTS": PRINT ""
3760 PRINT "          E: TO EDIT THE AIRPORT DATA FILE": PRINT ""
3770 PRINT "          D: TO DELETE THE AIRPORT DATA FILE": PRINT ""
3780 PRINT "          N: TO RENAME THE AIRPORT DATA FILE": PRINT ""

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```

3790 PRINT "                A: FOR ANALYSIS": PRINT ""
3800 PRINT "                R: TO RETURN TO THE INITIAL MENU": PRINT ""
3810 INPUT "                WAITING"; QQ$
3820 TEST$="ADENLPR"
3830 IF INSTR(TEST$,QQ$)<>0 AND QQ$<>"" THEN 3870
3840 CLS
3850 GOSUB 11570
3860 GOTO 3670
3870 IF QQ$="L" OR QQ$="P" THEN GOSUB 6730: GOTO 3330
3880 IF QQ$="D" THEN 4100
3890 IF QQ$="E" THEN 4400
3900 IF QQ$="A" THEN GOSUB 6730: GOTO 3330
3910 IF QQ$="N" THEN 3960
3920 IF QQ$="R" AND FIRSTPASS=2 THEN GOSUB 6730: GOTO 600
3930 IF QQ$="R" AND FIRSTPASS=1 THEN 600
3940 GOTO 3670
3950 '***** DATA FILE RENAME AND DELETE *****
3960 CLS: LINE INPUT "ENTER THE NEW NAME OF THE AIRPORT DATA FILE :
                (8 CHARACTERS MAXIMUM) "; FILENAM2$

3970 IF FILENAM2$="" THEN 3670
3980 IF LEN(FILENAM2$)<8 THEN FILENAM2$=FILENAM2$+STRING$(8-LEN(FILENAM2$),32)
3990 IF LEN(FILENAM2$)>8 THEN 3960
4000 IF FILENAM2$=FILENAM$ THEN CLS: PRINT "": PRINT "THIS IS THE EXISTING FILE
NAME.": GOTO 3680
4010 OPEN "R",3,"B:\DATFILS\"+FILENAM2$+".DAT",80
4020 IF LOF(3)>0 THEN CLOSE #3: CLS: PRINT "": PRINT "THIS DATA FILE ALREADY
EXISTS.": GOTO 3680
4030 CLOSE : KILL "B:\DATFILS\"+FILENAM2$+".DAT"
4040 NAME "B:\DATFILS\"+FILENAM$+".DAT" AS "B:\DATFILS\"+FILENAM2$+".DAT"
4050 GOSUB 4170
4060 FILENAM$=FILENAM2$
4070 OPEN "R",2,"B:\DATFILS\"+FILENAM$+".DAT",80
4080 FIELD 2,4 AS BUF.PF$, 2 AS BUF.DIR$, 4 AS BUF.OS$, 4 AS BUF.SD$, 20 AS
BUF.TYP$, 2 AS BUF.CW$, 44 AS X$
4090 GOTO 3670
4100 PRINT "": INPUT "ARE YOU SURE?(Y/N)";Q$
4110 IF Q$="Y" THEN 4150
4120 IF Q$="N" THEN 3670
4130 GOSUB 11570
4140 GOTO 4100
4150 CLOSE: KILL "B:\DATFILS\"+FILENAM$+".DAT"
4160 IF DATENTQ=3 OR XQ$="Y" THEN 600
4170 OPEN "R",1,"B:FILELIST.DAT",8
4180 FIELD 1,8 AS BUF.Y$
4190 A=1
4200 AA=0
4210 GET 1,A
4220 IF BUF.Y$="&&&&&&&&" THEN 4280
4230 FIL$(A)=BUF.Y$
4240 IF FILENAM$=BUF.Y$ THEN FIL$(A)=FILENAM2$: IF QQ$="D" OR QQ$="X" THEN
FFLAG(A)=-1: AA=AA+1
4250 A=A+1
4260 GOTO 4210
4270 CLS: PRINT "FILE NOT FOUND. REENTER FILENAME. ": GOTO 610

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4280 FILTOT=A-AA
4290 TTOT=A-AA
4300 GOSUB 11390
4310 CLOSE #1
4320 IF QQ$="N" THEN RETURN
4330 IF QQ$<>"X" THEN 600
4340 WHILE INKEY$<>" "
4350 WEND
4360 CLS: LOCATE 7,3: PRINT "THE DATA DISK IN DRIVE B IS FULL. YOU MUST EITHER
DELETE SOME OBSOLETE AIRPORT DATA FILES OR REPLACE THE DISK IN DRIVE B WITH A
BLANK DISK.", "", "ENTER ANY KEY TO CONTINUE."
4370 Z$=INKEY$: IF Z$="" THEN 4370
4380 GOTO 600
4390 '***** EDITOR *****
4400 CLS
4410 PRINT "", "*****"
4420 PRINT "", "*"
4430 PRINT "", "*" AIRPORT
4440 PRINT "", "*" DATA FILE EDITOR
4450 PRINT "", "*"
4460 PRINT "", "*****"
4470 LOCATE 8,1
4480 PRINT "ENTER:": PRINT ""
4490 PRINT "A: TO ADD AIRPORT DATA": PRINT ""
4500 PRINT "M: TO MODIFY AIRPORT DATA": PRINT ""
4510 PRINT "D: TO DELETE AIRPORT DATA": PRINT ""
4520 PRINT "R: TO RETURN TO THE PREVIOUS PAGE": PRINT ""
4530 INPUT "WAITING"; Q$
4540 TEST$="AMDR"
4550 IF INSTR(TEST$,Q$)<>0 AND Q$<>" " THEN 4590
4560 CLS
4570 GOSUB 11570
4580 GOTO 4400
4590 IF Q$="A" THEN GOSUB 4670
4600 IF Q$="M" THEN GOSUB 5100
4610 IF Q$="D" THEN GOSUB 4750
4620 IF Q$="R" THEN 3670
4630 GOTO 4400
4640 '*****
4650 ' ADDITION OF NEW DATA.
4660 '*****
4670 CLS
4680 EDITTYPE=0
4690 NOADD=XX
4700 GOSUB 2640
4710 IF I=1 OR NOADD=I THEN 4400 ELSE FIRSTPASS=2: GOTO 5950
4720 '*****
4730 ' DELETION OF DATA
4740 '*****
4750 IF P=0 THEN PRINT "DATA FILE IS EMPTY. DATA MUST BE ENTERED.": PRINT "":
GOTO 4680
4760 EDITTYPE=1
4770 FOR D=1 TO P
4780 CLS

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4790 PRINT "ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO
DELETE, AS NO MORE THAN 10 CHARACTERS. ENTER 'RETURN' TO TERMINATE
DELETION OF DATA.": PRINT ""
4800 LINE INPUT "AIRCRAFT DESIGNATOR? ";F$(D): PRINT ""
4810 IF F$(D)="" THEN D=D-1: GOTO 5060
4820 IF LEN(F$(D))<10 THEN F$(D)=F$(D)+STRING$(10-LEN(F$(D)),32)
4830 FOR X=1 TO P
4840 IF F$(D)<>DES$(X) THEN 4880
4850 IF FLAG(X)=-1 THEN PRINT "THIS AIRCRAFT HAS ALREADY BEEN DELETED.":PRINT
"": GOTO 4800
4860 FLAG(X)=-1
4870 GOTO 4900
4880 NEXT X
4890 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO TERMINATE DELETION OF DATA.": PRINT "": GOTO 4800
4900 NEXT D
4910 IF EDITTYPE<>3 THEN 5060 ELSE CLS
4920 PRINT "ENTER THE DESIGNATOR, OF THE AIRCRAFT THAT YOU DO NOT WANT TO
DELETE, AS NO MORE THAN 10 CHARACTERS. ENTER THE 'RETURN' KEY TO
TERMINATE REENTERING DATA.": PRINT ""
4930 FOR J=1 TO P
4940 LINE INPUT "AIRCRAFT DESIGNATOR? ";G$(J)
4950 IF G$(J)="" THEN 5050
4960 IF LEN(G$(J))<10 THEN G$(J)=G$(J)+STRING$(10-LEN(G$(J)),32)
4970 FOR X=1 TO P
4980 IF G$(J)<>DES$(X) THEN 5020
4990 IF FLAG(X)<>-1 THEN PRINT "THIS AIRCRAFT IS CURRENTLY IN THE DATA
FILE.":PRINT "": GOTO 4940
5000 FLAG(X)=+1
5010 GOTO 5040
5020 NEXT X
5030 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO TERMINATE REENTERING DATA.": PRINT "": GOTO 4940
5040 NEXT J
5050 IF EDITTYPE=3 THEN 6650
5060 IF D=0 THEN 4400 ELSE FIRSTPASS=2: GOTO 5950
5070 '*****
5080 ' MODIFICATION OF DATA
5090 '*****
5100 CLS
5110 IF P=0 THEN PRINT "DATA FILE IS EMPTY. DATA MUST BE ENTERED.": PRINT "":
GOTO 4680
5120 EDITTYPE=2
5130 LOCATE 2,10
5140 PRINT "DATA FILE: "FILENAM$" - "TYP$: PRINT ""
5150 PRINT TAB(21) PTFRQ;"% OPERATIONS IN THE ";DIR$;" DIRECTION"
5160 PRINT
5170 PRINT TAB(5) "STANDARD DEVIATION = "SD" INCHES OFFSET =
"OFFSET" INCHES"
5180 PRINT
5190 PRINT " ENTER: 1: TO CHANGE THE % OF OPERATIONS
5200 PRINT " 2: TO CHANGE THE DIRECTION"
5210 PRINT " 3: TO CHANGE THE MEAN OFFSET"
5220 PRINT " 4: TO CHANGE THE STANDARD DEVIATION"

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5230 PRINT "          5: TO CHANGE THE TYPE OF PAVEMENT"
5240 PRINT "          6: TO CHANGE AIRCRAFT PARAMETERS"
5250 PRINT "          7: TO RETURN"
5260 INPUT "WAITING";Q
5270 ON Q GOTO 5330, 5310,5350,5370,5390,5520,5910
5280 CLS
5290 GOSUB 11570
5300 GOTO 5100
5310 PTFLAG=+1: GOSUB 1760
5320 GOTO 5100
5330 PTFLAG=+1: GOSUB 1800
5340 GOTO 5100
5350 PTFLAG=+1: GOSUB 2110
5360 GOTO 5100
5370 PTFLAG=+1: GOSUB 2570
5380 GOTO 5100
5390 PTFLAG=+1: GOSUB 1860
5400 IF TYPE$="A" THEN TYP$="150' RUNWAY"
5410 IF TYPE$="B" THEN TYP$="200' RUNWAY"
5420 IF TYPE$="C" THEN TYP$="75' TAXIWAY"
5430 IF TYPE$="D" THEN TYP$="100' TAXIWAY"
5440 IF TYPE$<>"E" THEN 5100
5450 PRINT
5460 LINE INPUT "ENTER THE PAVEMENT TYPE (NO MORE THAN 20 CHARACTERS): ";M2$
5470 IF M2$="" THEN 5100
5480 IF LEN(M2$)>20 THEN 5460
5490 TYP$=M2$
5500 TYPE$=TYP$
5510 GOTO 5100
5520 QQ$="L"
5530 GOSUB 7110
5540 QQ$="E"
5550 PRINT "ENTER THE AIRCRAFT DESIGNATOR, OF THE AIRCRAFT THAT YOU WANT TO
MODIFY, AS NO MORE THAN 10 CHARACTERS. ENTER THE 'RETURN' KEY TO
TERMINATE DATA MODIFICATION.": PRINT ""
5560 FOR D=1 TO 250
5570 INPUT "AIRCRAFT DESIGNATOR";F$(D)
5580 IF F$(D)="" THEN D=D-1: GOTO 5910
5590 IF LEN(F$(D))<10 THEN F$(D)=F$(D)+STRING$(10-LEN(F$(D)),32)
5600 FOR X=1 TO P
5610 IF F$(D)=DES$(X) AND FLAG(X)<>-1 THEN 5640
5620 NEXT X
5630 PRINT "THIS AIRCRAFT IS NOT IN THE DATA FILE. TRY AGAIN OR ENTER THE
'RETURN' KEY TO TERMINATE DATA MODIFICATION.": PRINT "": GOTO 5570
5640 MFLAG(X)=+1
5650 CLS
5660 PRINT AAA$
5670 PRINT BBB$
5680 PRINT USING EE$;DES$(X);FREQ!(X): PRINT ""
5690 PRINT "ENTER:": PRINT ""
5700 PRINT "1: TO CHANGE AIRCRAFT DESIGNATOR": PRINT ""
5710 PRINT "2: TO CHANGE NUMBER OF OPERATIONS": PRINT ""
5720 PRINT "3: TO MODIFY ANOTHER AIRCRAFT": PRINT ""
5730 PRINT "4: TO RETURN": PRINT ""

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5740 INPUT "WAITING": Q
5750 ON Q GOTO 5790, 5850, 5900, 5910
5760 CLS
5770 GOSUB 11570
5780 GOTO 5650
5790 LINE INPUT "AIRCRAFT DESIGNATOR? "; DES$(X)
5800 I=X
5810 REDES=1
5820 GOSUB 2700
5830 REDES=0
5840 GOTO 5650
5850 LINE INPUT "AIRCRAFT OPERATIONS (THOUSANDS OF OPERATIONS PER YEAR)? ";
M2$
5860 GOSUB 180
5870 IF REDO=2 THEN 5850
5880 FREQ!(X)=VAL(M2$)
5890 IF FREQ!(X)<10^3 AND FREQ!(X)>0 THEN 5650 ELSE PRINT "OUT OF RANGE. TRY
AGAIN.": GOTO 5850
5900 NEXT D
5910 IF D=0 AND PTFLAG=0 THEN 4400 ELSE FIRSTPASS=2
5920'*****
5930' LIST OF CHANGES
5940'*****
5950 CLS
5960 INPUT "DO YOU WANT TO SEE A LIST OF THE CHANGES THAT YOU JUST MADE? (Y/N)
"; Z$
5970 IF Z$="N" THEN 6510
5980 IF Z$="Y" THEN CLS: GOTO 6010
5990 GOSUB 11570
6000 GOTO 5950
6010 IF EDITTYPE=0 THEN PRINT "DATA ADDED": PRINT ""
6020 IF EDITTYPE=1 THEN PRINT "DATA TO BE DELETED": PRINT ""
6030 IF EDITTYPE=2 THEN PRINT "DATA MODIFIED": PRINT ""
6040 LOCATE 3,30
6050 PRINT "DATA FILE: "FILENAM$ - "TYP$: PRINT ""
6060 IF PTFLAG=+1 THEN PRINT TAB(21) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;"
DIRECTION": PRINT: PRINT TAB(5) "STANDARD DEVIATION = "SD" INCHES" SPC(10)
"OFFSET = "OFFSET" INCHES"
6070 PRINT
6080 IF D=0 AND EDITTYPE<>0 THEN 6590
6090 PRINT AAA$: PRINT BBB$
6100 S=1
6110 PRINT ""
6120 IF EDITTYPE=0 THEN 6150
6130 IF EDITTYPE=1 THEN 6400
6140 IF EDITTYPE=2 THEN 6280
6150 FOR J=NOADD TO P+1
6160 IF DES$(J)="" THEN 6510
6170 PRINT USING EE$;DES$(J); FREQ!(J)
6180 IF S<>14 THEN 6250
6190 WHILE INKEY$<>""
6200 WEND
6210 PRINT "ENTER ANY KEY TO CONTINUE"
6220 Z$=INKEY$: IF Z$="" THEN 6220
6230 CLS: PRINT AAA$: PRINT BBB$

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6240 S=0
6250 S=S+1
6260 NEXT J
6270 GOTO 6580
6280 FOR J=1 TO P+1
6290 IF DES$(J)="" THEN 6510
6300 IF MFLAG(J)=+1 THEN PRINT USING EE$;DES$(J);FREQ!(J): S=S+1
6310 IF S<>14 THEN 6380
6320 WHILE INKEY$<>""
6330 WEND
6340 PRINT "ENTER ANY KEY TO CONTINUE"
6350 Z$=INKEY$: IF Z$="" THEN 6350
6360 CLS: PRINT AAA$: PRINT BBB$
6370 S=0
6380 NEXT J
6390 GOTO 6510
6400 FOR J=1 TO P+1
6410 IF DES$(J)="" THEN 6510
6420 IF FLAG(J)=-1 THEN PRINT USING EE$;DES$(J); FREQ!(J): S=S+1
6430 IF S<>14 THEN 6500
6440 WHILE INKEY$<>""
6450 WEND
6460 PRINT "ENTER ANY KEY TO CONTINUE"
6470 Z$=INKEY$: IF Z$="" THEN 6470
6480 CLS: PRINT AAA$: PRINT BBB$
6490 S=0
6500 NEXT J
6510 PRINT ""
6520 Z$=""
6530 IF EDITTYPE=1 THEN INPUT "ARE THESE DELETIONS CORRECT? (Y/N) ";Z$ ELSE
6580
6540 IF Z$="Y" THEN 6650
6550 IF Z$="N" THEN EDITTYPE=3: GOTO 4910
6560 GOSUB 11570
6570 GOTO 6510
6580 PRINT
6590 INPUT "DO YOU WISH TO MODIFY THESE CHANGES? (Y/N)"; Z$
6600 IF Z$="N" THEN 6650
6610 IF Z$="Y" THEN 5100
6620 GOSUB 11570
6630 PRINT
6640 GOTO 6590
6650 PRINT
6660 INPUT "DO YOU WISH TO MAKE ANY MORE CHANGES? (Y/N)"; ZQ$
6670 IF ZQ$="N" THEN 6730
6680 IF ZQ$="Y" THEN RETURN
6690 GOSUB 11570
6700 PRINT
6710 GOTO 6650
6720 '***** MERGE AND SORT *****
6730 CLS
6740 IF FIRSTPASS=1 THEN RETURN
6750 PRINT "SORTING, PLEASE WAIT."
6760 T=P

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7250 PRINT TAB(21) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
7260 PRINT
7270 PRINT TAB(10) "STANDARD DEVIATION = "SD" INCHES                OFFSET =
"OFFSET" INCHES"
7280 PRINT
7290 PRINT AAA$
7300 PRINT BBB$
7310 PRINT "": GOTO 7420
7320 CLS: PRINT "WAIT UNTIL PRINTOUT IS COMPLETE. THEN ENTER ANY KEY TO
CONTINUE."
7330 LPRINT TAB(25) "DATA FILE:"FILENAM$ - "TYP$: LPRINT ""
7340 LPRINT TAB(21) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
7350 LPRINT
7360 LPRINT TAB(10) "STANDARD DEVIATION = "SD" INCHES" SPC(10) "OFFSET =
"OFFSET" INCHES"
7370 LPRINT
7380 LPRINT AAA$
7390 LPRINT BBB$
7400 LPRINT ""
7410 IF FLAG(X)<>-1 THEN LPRINT USING EE$;DES$(X);FREQ!(X): GOTO 7430
7420 IF FLAG(X)<>-1 THEN PRINT USING EE$;DES$(X);FREQ!(X)
7430 NEXT X
7440 PRINT
7450 WHILE INKEY$<>""
7460 WEND
7470 PRINT "ENTER ANY KEY TO CONTINUE"
7480 Z$=INKEY$: IF Z$="" THEN 7480
7490 RETURN
7500 '***** ANALYSIS *****
7510 CLS
7520 S=1: M=1: ZSUM=0: YMAX(1)=0: YMAX=0: GFLAG=0
7530 LOCATE 3,30
7540 PRINT CHR$(201);:FOR A=1 TO 10:PRINT CHR$(205);:NEXT:PRINT CHR$(187)
7550 LOCATE 4,30
7560 PRINT CHR$(186);" ANALYSIS ";CHR$(186)
7570 LOCATE 5,30
7580 PRINT CHR$(200);:FOR A= 1 TO 10:PRINT CHR$(205);:NEXT:PRINT CHR$(188)
7590 LOCATE 7,15
7600 LINE INPUT "IS THIS ANALYSIS READY TO BE RUN (Y/N)? ";Q$
7610 IF Q$="N" THEN 3670
7620 IF Q$="Y" THEN 7660
7630 CLS
7640 GOSUB 11570
7650 GOTO 7510
7660 LOCATE 10,11
7670 PRINT "PLEASE WAIT. ANALYSIS WILL TAKE A FEW MINUTES"
7680 FOR Z=1 TO 2
7690 IF Z=1 THEN PF=PTFRQ/100
7700 IF Z=2 THEN OFFSET=-OFFSET: PF=(100-PTFRQ)/100
7710 FOR X=1 TO P
7720 IF LG(X)=1 THEN EC(1)=-E(X): EC(2)=E(X): LC(X)=GW(X)*.475
7730 IF LG(X)=2 THEN EC(1)=-E(X): EC(2)=E(X): LC(X)=L(X): EC(3)=M(X)
7740 IF LG(X)=3 THEN EC(1)=-M(X): EC(2)=0: LC(X)=L(X): EC(3)=M(X)
7750 FOR IX=0 TO 160

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7760 FOR Y=1 TO 3
7770 IF LG(X)=1 AND Y=3 THEN 7830
7780 IF LG(X)=2 AND Y=3 THEN LC(X)=N(X)
7790 IF LG(X)=3 AND Y=1 OR LG(X)=3 AND Y=3 THEN LC(X)=N(X)
7800
FX#(Y)=PF*FREQ!(X)*LC(X)*(1/(SD*2.5066283#))*EXP(-.5*(((5*(IX-80))-(EC(Y)+OFF-
SET))/SD)^2))
7810 YSUM(IX)=YSUM(IX)+FX#(Y)
7820 NEXT Y
7830 'IF YSUM(IX)=ZSUM OR YSUM(IX)=0 THEN 7360
7840 IF YSUM(IX)=ZSUM OR YSUM(IX)=0 THEN 7940
7850 IF Z=1 THEN 7930
7860 IF X<>P THEN 7910
7870 IF YSUM(IX)>YMAX THEN YMAX=YSUM(IX)
7880 IF YSUM(IX)>ZSUM THEN YYMAX(M)=YSUM(IX): DIST(M)=(5*IX)-400
7890 IF YSUM(IX)<YYMAX(M) THEN M=M+1
7900 IF M>10 THEN CLS:PRINT "UNREASONABLE NUMBER OF MAXIMA. YOU MUST CHOOSE A
LARGER, MORE REALISTIC STANDARD DEVIATION OR RETAIN THE PRESET VALUE.": GOTO
7520
7910 ZSUM=YSUM(IX)
7920 IF IX=0 THEN YYMAX(1)=YSUM(0): DIST(1)=-400
7930 NEXT IX
7940 NEXT X
7950 NEXT Z
7960 BEEP
7970 OFFSET=-OFFSET
7980 YMAX1=YMAX
7990 '***** ANALYSIS MENU *****
8000 CLS
8010 YMAX=YMAX1
8020 LOCATE 3,20
8030 PRINT "ANALYSIS MENU"
8040 LOCATE 7,1
8050 PRINT "": PRINT "ENTER:": PRINT ""
8060 PRINT "L: TO LIST THE POINTS OF MAXIMUM LOAD": PRINT ""
8070 PRINT "P: TO OBTAIN A PRINTOUT OF THE POINTS OF MAXIMUM LOAD": PRINT ""
8080 PRINT "E: TO LIST THE ENTIRE LOAD DISTRIBUTION": PRINT ""
8090 PRINT "T: TO OBTAIN A PRINTOUT OF THE ENTIRE LOAD DISTRIBUTION": PRINT ""
8100 PRINT "G: TO OBTAIN A PRINTED GRAPH OF THE ANALYSIS": PRINT ""
8110 PRINT "S: TO OBTAIN A SCREEN GRAPH OF THE ANALYSIS": PRINT ""
8120 PRINT "R: TO RETURN TO THE INITIAL MENU": PRINT ""
8130 INPUT "WAITING"; AQ$
8140 TEST$="LPETGRS"
8150 IF INSTR(TEST$,AQ$)<>0 AND AQ$<>"" THEN 8190
8160 CLS
8170 GOSUB 11570
8180 GOTO 8000
8190 IF AQ$="R" THEN CLEAR: CLOSE: GOTO 300
8200 IF AQ$="L" THEN 9380
8210 IF AQ$="P" THEN 8950
8220 IF AQ$="G" OR AQ$="S" THEN 9700
8230 '***** TOTAL LOAD DISTRIBUTION *****
8240 S=1
8250 FOR IX=0 TO 160

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8260 IF IX=0 THEN 8340
8270 IF IX<>0 AND AQ$="T" THEN 8650
8280 IF IX<S*13 THEN 8410
8290 WHILE INKEY$<>""
8300 WEND
8310 PRINT "ENTER ANY KEY TO CONTINUE"
8320 Z$=INKEY$: IF Z$="" THEN 8320
8330 S=S+1
8340 CLS
8350 IF AQ$="T" THEN 8430
8360 PRINT SPACE$(5) "DATA FILE: "; FILENAM$ - "TYP$ SPACE$(10) "DATE: ";
PDATE$
8370 PRINT ""
8380 PRINT TAB(17) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
8390 PRINT
8400 PRINT TTLE8$: PRINT TTLE2$; SPACE$(10) "STD. DEV. = "SD" INCHES":PRINT
TTLE4$; SPACE$(11) "OFFSET = "OFFSET" INCHES": PRINT ""
8410 PRINT TAB(5) (5*IX)-400 TAB(22) YSUM(IX)
8420 GOTO 8670
8430 PRINT "MAKE SURE YOU ADVANCE THE PRINTER HEAD TO THE TOP OF THE NEXT
PAGE."
8440 WHILE INKEY$<>""
8450 WEND
8460 PRINT "THEN ENTER ANY KEY TO CONTINUE."
8470 Z$=INKEY$: IF Z$="" THEN 8470
8480 PRINT ""
8490 PRINT "WAIT UNTIL PRINTOUT IS COMPLETE. THEN ENTER ANY KEY TO CONTINUE."
8500 LPRINT TAB(21) CHR$(44);:FOR A=1 TO 32:LPRINT CHR$(45);:NEXT:LPRINT
CHR$(44)
8510 LPRINT TAB(21) CHR$(124);" AIRPORT PAVEMENT LOAD ANALYSIS ";CHR$(124)
8520 LPRINT TAB(21) CHR$(124);:FOR A=1 TO 32:LPRINT CHR$(95);:NEXT:LPRINT
CHR$(124)
8530 LPRINT ""
8540 LPRINT SPACE$(5) "DATA FILE: "; FILENAM$ - "TYP$ SPACE$(10) "DATE: ";
PDATE$
8550 LPRINT ""
8560 LPRINT TAB(17) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
8570 LPRINT ""
8580 LPRINT TAB(9) "STANDARD DEVIATION : "SD" INCHES" SPC(10) "OFFSET =
"OFFSET" INCHES"
8590 LPRINT ""
8600 LPRINT TTLE1$
8610 LPRINT TTLE6$
8620 LPRINT TTLE7$
8630
                                                                                                                                                                LPRINT
"-----;-----;-----;-----"
8640 LPRINT TAB(15);";";TAB(39);";";TAB(55);";"
8650 IF IX=80 THEN LPRINT TAB(5) (5*IX)-400 TAB(22) YSUM(IX): GOTO 8680
8660 LPRINT TAB(5) (5*IX)-400 TAB(22) YSUM(IX) TAB(45) (5*IX)+5 TAB(61)
YSUM(IX+81)
8670 NEXT IX
8680 IF PFLAG=1 OR AQ$="E" THEN 8890
8690 FOR I=1 TO 6: LPRINT CHR$(10): NEXT I
8700 LPRINT

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8710 LPRINT TAB(21) CHR$(44);:FOR A=1 TO 32:LPRINT CHR$(45);:NEXT:LPRINT
CHR$(44)
8720 LPRINT TAB(21) CHR$(124);" AIRPORT PAVEMENT LOAD ANALYSIS ";CHR$(124)
8730 LPRINT TAB(21) CHR$(124);:FOR A=1 TO 32:LPRINT CHR$(95);:NEXT:LPRINT
CHR$(124)
8740 LPRINT ""
8750 LPRINT SPACES(5) "DATA FILE: "; FILENAM$ - "TYP$ SPACES(10) "DATE: ";
PDATE$
8760 LPRINT ""
8770 LPRINT TAB(17) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
8780 LPRINT
8790 LPRINT TAB(9) "STANDARD DEVIATION = "SD" INCHES" SPC(10) "OFFSET =
"OFFSET" INCHES"
8800 LPRINT
8810 LPRINT TL1$: LPRINT TL2$: LPRINT TL3$: LPRINT TL4$
8820 LPRINT ""
8830 FOR J=1 TO P
8840 IF LG (J)=1 THEN LPRINT USING EE1$;DES$(J);FREQ!(J);E(J);GW(J): GOTO 8860
8850 IF LG (J)<>1 THEN LPRINT USING EEE1$;DES$(J);FREQ!(J);E(J);L(J);M(J);N(J)
8860 NEXT J
8870 LPRINT "": LPRINT ""
8880 PFLAG=1
8890 WHILE INKEY$<>""
8900 WEND
8910 PRINT "": PRINT "ENTER ANY KEY TO CONTINUE."
8920 Z$=INKEY$: IF Z$="" THEN 8920
8930 GOTO 8000
8940 '***** PRINTOUT OF MAXIMA *****
8950 I=10
8960 PRT$=SPACES(I)
8970 CLS
8980 PRINT "MAKE SURE YOU ADVANCE THE PRINTER HEAD TO THE JP OF THE NEXT
PAGE."
8990 WHILE INKEY$<>""
9000 WEND
9010 PRINT "THEN ENTER ANY KEY TO CONTINUE."
9020 Z$=INKEY$: IF Z$="" THEN 9020
9030 LOCATE 10,1
9040 PRINT "AFTER PRINTOUT OF THE FIRST PAGE IS COMPLETE, ADVANCE THE PRINTER
HEAD TO THE TOP OF THE FOLLOWING PAGE."
9050 PRINT "THEN ENTER ANY KEY TO CONTINUE."
9060 FOR J=1 TO 3
9070 LPRINT CHR$(10)
9080 NEXT J
9090 LPRINT TAB(21) CHR$(44);:FOR A=1 TO 32:LPRINT CHR$(45);:NEXT:LPRINT
CHR$(44)
9100 LPRINT TAB(21) CHR$(124);" AIRPORT PAVEMENT LOAD ANALYSIS ";CHR$(124)
9110 LPRINT TAB(21) CHR$(124);:FOR A=1 TO 32:LPRINT CHR$(95);:NEXT:LPRINT
CHR$(124)
9120 LPRINT "": LPRINT ""
9130 LPRINT SPACES(5) "DATA FILE: "; FILENAM$ - "TYP$ SPACES(10) "DATE: ";
PDATE$
9140 LPRINT ""
9150 LPRINT TAB(17) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"

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9160 LPRINT
9170 LPRINT ""
9180 LPRINT TAB(9) "STANDARD DEVIATION = "SD" INCHES" SPC(10) "OFFSET =
"OFFSET" INCHES"
9190 FOR J=1 TO 3
9200 LPRINT CHR$(10)
9210 NEXT J
9220 PRT$=SPACE$(17)
9230 LPRINT PRT$;TTLE3$
9240 LPRINT PRT$;TTLE2$
9250 LPRINT PRT$;TTLE4$
9260 LPRINT ""
9270 LPRINT ""
9280 FOR X=1 TO M
9290 IF YYMAX(X)=0 THEN 9330
9300 PRT$=SPACE$(24-LEN(STR$(DIST(X))))
9310 LPRINT PRT$;DIST(X) SPACE$(15) YYMAX(X)
9320 NEXT X
9330 WHILE INKEY$<>""
9340 WEND
9350 Z$=INKEY$: IF Z$="" THEN 9350
9360 IF PFLAG=1 THEN 8000 ELSE 8700
9370 '***** LIST OF MAXIMA *****
9380 I=10
9390 PRT$=SPACE$(I)
9400 CLS: LOCATE 1,21
9410 PRINT CHR$(201);:FOR A=1 TO 32:PRINT CHR$(205);:NEXT:PRINT CHR$(187)
9420 LOCATE 2,21
9430 PRINT CHR$(186);" AIRPORT PAVEMENT LOAD ANALYSIS ";CHR$(186)
9440 LOCATE 3,21
9450 PRINT CHR$(200);:FOR A= 1 TO 32:PRINT CHR$(205);:NEXT:PRINT CHR$(188)
9460 LOCATE 5,1
9470 PRINT SPACE$(5) "DATA FILE: "; FILENAM$ - "TYP$ SPACE$(10) "DATE: ";
PDATE$
9480 LOCATE 7,1
9490 PRINT TAB(17) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;" DIRECTION"
9500 LOCATE 9,1
9510 PRINT TAB(9) "STANDARD DEVIATION = "SD" INCHES" SPC(10) "OFFSET =
"OFFSET" INCHES"
9520 LOCATE 12,1
9530 PRINT SPC(17);TTLE3$
9540 PRINT SPC(17);TTLE2$
9550 PRINT SPC(17);TTLE4$
9560 PRINT ""
9570 PRINT ""
9580 FOR X=1 TO M
9590 IF YYMAX(X)=0 THEN 9630
9600 PRT$=SPACE$(24-LEN(STR$(DIST(X))))
9610 PRINT PRT$;DIST(X) SPACE$(15) YYMAX(X)
9620 NEXT X
9630 PRINT "": PRINT ""
9640 WHILE INKEY$<>""
9650 WEND
9660 PRINT TAB(10) "ENTER ANY KEY TO CONTINUE" 'allowing one page at a time

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9670 Z$=INKEY$: IF Z$="" THEN 9670
9680 GOTO 8000
9690 '***** SETS SCALING FACTOR FOR GRAPH *****
9700 IF GFLAG=0 THEN 9740
9710 FOR IX=5 TO 155
9720 PFLAG(IX)=0
9730 NEXT IX
9740 F=250
9750 IF YMAX<F THEN 9780
9760 F=F+250
9770 GOTO 9750
9780 IF YMAX=>50 THEN 9820
9790 FOR F=5 TO 50 STEP 5
9800 IF YMAX<F THEN 9820
9810 NEXT F
9820 YMAX=CSNG(F)
9830 IF AQ$="G" THEN R=1
9840 IF AQ$="S" THEN R=2
9850 I=CSNG((CINT(YMAX/5))/(10/R))
9860 CLS
9870 IF AQ$="S" THEN 9930
9880 PRINT "MAKE SURE YOU ADVANCE THE PRINTER HEAD TO THE TOP OF THE NEXT
PAGE."
9890 PRINT "THEN ENTER ANY KEY TO CONTINUE."
9900 WHILE INKEY$<>""
9910 WEND
9920 Z$=INKEY$: IF Z$="" THEN 9920
9930 LOCATE 10,1
9940 IF AQ$="S" THEN PRINT SPACES$(5) "DATA FILE: "; FILENAM$ - "TYP$
SPACES$(10) "DATE: "; PDATE$
9950 IF AQ$="S" THEN PRINT TAB(9) "STANDARD DEVIATION = "SD" INCHES" SPC(10)
"OFFSET = "OFFSET" INCHES": PRINT
9960 IF AQ$="S" THEN PRINT TAB(21) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;"
DIRECTION": PRINT : PRINT
9970 PRINT "PLEASE WAIT FOR GRAPH TO BE COMPLETED."
9980 PRINT "THEN ENTER ANY KEY TO CONTINUE."
9990 FOR A=1 TO 2
10000 IF A=1 THEN PAGE=0 'controls initial plotting position
10010 IF A=2 THEN PAGE=76: IF AQ$="S" THEN CLS
10020 YMAX=CSNG(F)
10030 Z=YMAX
10040 IF AQ$="G" THEN LPRINT SPACES$(5) "DATA FILE: "; FILENAM$ - "TYP$
SPACES$(10) "DATE: "; PDATE$
10050 IF AQ$="G" THEN LPRINT TAB(9) "STANDARD DEVIATION = "SD" INCHES" SPC(10)
"OFFSET = "OFFSET" INCHES"
10060 '*****PRINTS GRAPH FROM TOP DOWN *****
10070 P$=SPACES$(71)
10080 SS$="MAGNITUDE "
10090 S=1
10100 'Y loop graphs, line by line
10110 FOR Y=Z TO 0 STEP -1
10120 Y=CSNG((CINT(Y*10))/10)
10130 ' sets plotting points, "*"
10140 FOR IX=5+PAGE TO 79+PAGE

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10150 IF Y>YSUM(IX) THEN 10220
10160 IF A=1 THEN ZZ=+3
10170 IF A=2 THEN ZZ=80
10180 IF IX-ZZ>71 THEN 10220
10190 IF PFLAG(IX)=+1 THEN MID$(P$,IX-ZZ,1)=" ": GOTO 10220
10200 MID$(P$,IX-ZZ,1)="*"
10210 PFLAG(IX)=+1
10220 NEXT IX
10230 ' sets vertical "MAGNITUDE" label
10240 IF Y>(Z-((20-(R^3-2*R))*(I/R))) OR Y<(Z-((31+(R^3-2*R))*(I/R))) THEN
Pl$=SPACE$(1): GOTO 10280
10250 Pl$=MID$(SS$,S,1)
10260 S=S+1
10270 ' sets ordinate values
10280 IF Y>YMAX THEN 10420
10290 IF Y=0 THEN 10490
10300 YMAX=CSNG((CINT(YMAX*10))/10)
10310 Y$=STR$(YMAX)
10320 II=5-LEN(Y$)
10330 Y=VAL(Y$)
10340 P2$=SPACE$(II)
10350 'P$="*"s, "+"=axis, Y$=#s, P2$=blanks, Pl$="magnitude"
10360 IF AQ$="G" AND A=1 THEN LPRINT P$;"+";Y$;P2$;Pl$
10370 IF AQ$="S" AND A=1 THEN PRINT P$;"+";Y$;P2$;Pl$
10380 IF AQ$="G" AND A=2 THEN LPRINT Pl$;P2$;Y$;"+";P$
10390 IF AQ$="S" AND A=2 THEN PRINT Pl$;P2$;Y$;"+";P$
10400 YMAX=YMAX-(5*I)
10410 GOTO 10470
10420 P2$=SPACE$(5)
10430 IF AQ$="G" AND A=1 THEN LPRINT P$;":";P2$;Pl$
10440 IF AQ$="S" AND A=1 THEN PRINT P$;":";P2$;Pl$
10450 IF AQ$="G" AND A=2 THEN LPRINT Pl$;P2$;":";P$
10460 IF AQ$="S" AND A=2 THEN PRINT Pl$;P2$;":";P$
10470 NEXT Y
10480 '*****DRAWX X-AXIS *****
10490 S=1
10500 Q=70: P$=SPACE$(71): Pl$=SPACE$(72): Z$="-350 ": II=5
10510 IF A=1 THEN MID$(Pl$,1,5)=Z$
10520 IF A=2 THEN MID$(Pl$,1,1)="0"
10530 FOR X=1 TO Q
10540 IF X=S*5 THEN 10560
10550 MID$(P$,X,1)="-": GOTO 10620
10560 MID$(P$,X,1)="+"
10570 IF AQ$="S" THEN S=S-5
10580 IF A=1 THEN X$=STR$((X*5)+VAL(Z$)): MID$(Pl$,X-II+5,5)=X$:
X=(VAL(X$)-VAL(Z$))/5
10590 IF A=2 THEN X$=STR$(X*5): MID$(Pl$,X-1,5)=X$: X=VAL(X$)/5
10600 IF AQ$="S" THEN S=S+5
10610 S=S+1
10620 NEXT X
10630 IF AQ$="G" AND A=1 THEN LPRINT " +";P$;"0": LPRINT Pl$
10640 IF AQ$="S" AND A=1 THEN PRINT " +";P$;"0": PRINT SPC(5);Pl$;
10650 IF AQ$="G" AND A=2 THEN LPRINT " 0+";P$: LPRINT " ";Pl$
10660 IF AQ$="S" AND A=2 THEN PRINT " 0+";P$; PRINT SPC(8) Pl$;

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10670 IF AQS="G" THEN LPRINT TAB(25) "DISTANCE FROM CENTERLINE (INCHES)":LPRINT
10680 IF AQS="G" THEN LPRINT TAB(21) PTFRQ;"% OF OPERATIONS IN THE ";DIR$;"
DIRECTION"
10690 IF AQS="G" THEN FOR J=1 TO 6: LPRINT CHR$(10): NEXT J: GOTO 10730
10700 WHILE INKEY$<>""
10710 WEND
10720 Z$=INKEY$: IF Z$="" THEN 10720
10730 NEXT A
10740 IF AQS="G" THEN GFLAG=1
10750 IF AQS="S" THEN GFLAG=2: GOTO 8000
10760 IF PFLAG=1 THEN 8000 ELSE 8700
10770 '*****ERROR TRAPS *****
10780 IF ERR=61 OR ERR=9 THEN QQS="X": RESUME 4150
10790 IF ERR<>71 THEN 10870
10800 CLS
10810 LOCATE 7,3
10820 PRINT "THE DISK DRIVE DOOR IS OPEN OR A DISK IS NOT IN THE DRIVE.", "PLACE
THE CORRECT DISK IN THE DRIVE AND ENTER ANY KEY TO CONTINUE."
10830 WHILE INKEY$<>""
10840 WEND
10850 Z$=INKEY$: IF Z$="" THEN 10850
10860 RESUME
10870 IF ERR<>67 THEN 10900
10880 MKDIR "B:DATFILS"
10890 RESUME
10900 IF ERR<>76 THEN 10930
10910 MKDIR "B:DATFILS"
10920 RESUME
10930 IF ERR<>57 THEN 10970
10940 CLS
10950 PRINT "THE NEW DISKETTE MUST FIRST BE FORMATTED."
10960 RESUME 610
10970 IF ERR<>27 THEN 11080
10980 CLS
10990 PRINT "THE PRINTER IS NOT TURNED ON OR IS OUT OF PAPER."
11000 PRINT "ENTER ANY KEY TO CONTINUE"
11010 WHILE INKEY$<>""
11020 WEND
11030 Z$=INKEY$: IF Z$="" THEN 11030
11040 IF QS="L" THEN RESUME 1660
11050 IF QQS="P" THEN RESUME 7490
11060 IF AQS="P" OR AQS="T" OR AQS="G" THEN RESUME 8000
11070 RESUME
11080 IF ERR<>24 THEN 11190
11090 CLS
11100 PRINT "YOU DO NOT HAVE A PRINTER OR IT IS EITHER NOT TURNED ON OR OUT OF
PAPER."
11110 PRINT "ENTER ANY KEY TO CONTINUE"
11120 WHILE INKEY$<>""
11130 WEND
11140 Z$=INKEY$: IF Z$="" THEN 11140
11150 IF QS="L" THEN RESUME 1660
11160 IF QQS="P" THEN RESUME 7490
11170 IF AQS="P" OR AQS="T" OR AQS="G" THEN RESUME 8000

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11180 RESUME
11190 IF ERR<>25 THEN 11300
11200 CLS
11210 PRINT "THE PRINTER IS OFF LINE."
11220 PRINT "ENTER ANY KEY TO CONTINUE"
11230 WHILE INKEY$<>""
11240 WEND
11250 Z$=INKEY$: IF Z$="" THEN 11250
11260 IF Q$="L" THEN RESUME 1660
11270 IF QQ$="P" THEN RESUME 7490
11280 IF AQ$="P" OR AQ$="T" OR AQ$="G" THEN RESUME 8000
11290 RESUME
11300 CLS
11310 PRINT "ERROR NUMBER: ";ERR;". CHECK BASIC MANUAL."
11320 PRINT "ENTER ANY KEY TO CONTINUE"
11330 WHILE INKEY$<>""
11340 WEND
11350 Z$=INKEY$: IF Z$="" THEN 11350
11360 RESUME NEXT
11370 '*****SORTING FILELIST.DAT*****
11380 TTOT=FILTOT
11390 FOR J=1 TO FILTOT-1
11400 IF FFLAG(J)=-1 THEN 11420
11410 IF FIL$(J)>FIL$(J+1) THEN SWAP FIL$(J),FIL$(J+1): SWAP
FFLAG(J),FFLAG(J+1):Z=J.
11420 NEXT J
11430 IF Z>1 THEN FILTOT=Z: Z=0: GOTO 11390
11440 '***** WRITING TO FILELIST.DAT*****
11450 K=1
11460 FOR J=1 TO TTOT
11470 IF FIL$(J)="" OR FIL$(J)="&&&&&&&&" THEN 11520
11480 IF FFLAG(J)=-1 THEN FFLAG(J)=0: GOTO 11520
11490 LSET BUF.Y$=FIL$(J)
11500 PUT 1,K
11510 K=K+1
11520 NEXT J
11530 LSET BUF.Y$="&&&&&&&&"
11540 PUT 1,K
11550 RETURN
11560 '***** SUB FOR WRONG KEY ENTRY *****
11570 PRINT
11580 PRINT "INVALID ENTRY. BE SURE CAPS LOCK IS ON."
11590 PRINT "ENTER ANY KEY TO CONTINUE."
11600 Z$=INKEY$: IF Z$="" THEN 11600
11610 IF ASC(Z$)=13 THEN 11600
11620 RETURN

```

APPENDIC C - REFERENCES

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 - c. Boeing 747, Airplane Characteristics - Airport Planning, DG-58327, Revision B, December 1982.
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