

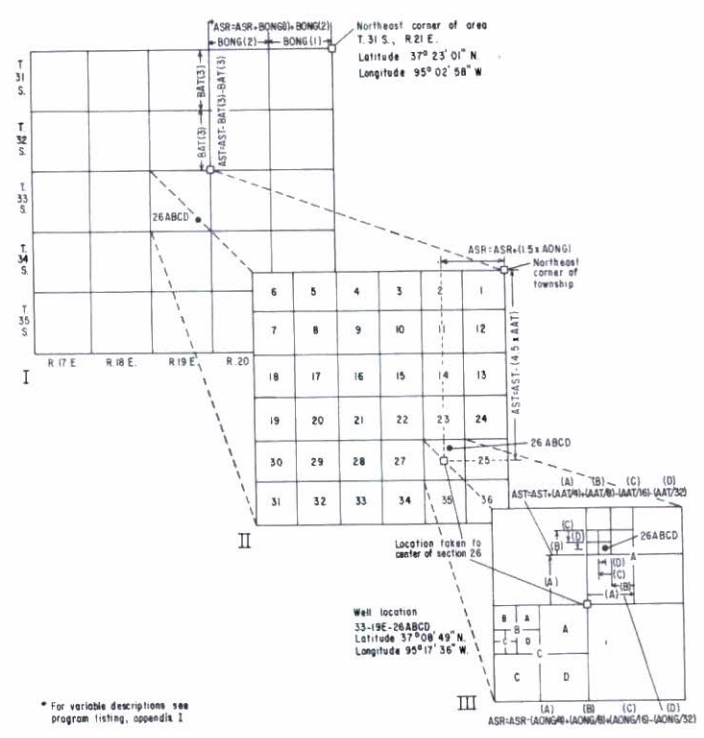
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# FORTRAN IV Program, KANS, for the Conversion of General Land Office Locations to Latitude and Longitude Coordinates

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By  
**Charles O. Morgan**  
**Jesse M. McNellis**



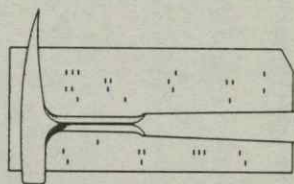
State Geological Survey  
The University of Kansas  
Lawrence, Kansas

Special Distribution Publication 42

1969

STATE GEOLOGICAL SURVEY OF KANSAS

Frank C. Foley, Director



FORTRAN IV Program, KANS, for the Conversion of General  
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Prepared as part of the cooperative program in Kansas conducted  
by the United States Geological Survey, the State Geological  
Survey of Kansas, and the Division of Water Resources of the  
Kansas State Board of Agriculture.

State Geological Survey  
The University of Kansas, Lawrence, Kansas

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FORTRAN IV Program, KANS, for the Conversion of General Land  
Office Locations to Latitude and Longitude Coordinates

By Charles O. Morgan<sup>1/</sup> and Jesse M. McNellis<sup>1/</sup>

ABSTRACT

General Land Office township and range locations are converted to latitude and longitude coordinates by a digital computer and a FORTRAN IV program. The conversions are within 10 seconds and usually within 5 seconds of a measured location, depending upon the reliability of the maps and the regularity of the sections. The basic program is designed for use in Kansas but has been adapted to other areas using General Land Office locations.

INTRODUCTION

The KANS program converts modified General Land Office township and range grid locations to latitude and longitude coordinates in Kansas. Minor modifications would adapt the program to other states using township and range designations. This program was developed by the authors as a part of the cooperative program between the U.S. Geological Survey and the State Geological Survey of Kansas. The program was tested on the IBM 7040 and the GE 635 at The University of Kansas Computation Center, Richard G. Hetherington, Director.

Townships in Kansas are numbered 1 through 35 South beginning at the Nebraska border. Ranges are numbered 1 through 25 East and 1 through 43 West beginning at the sixth principal meridian (fig. 1). For every 30 miles, or five townships, in a north-south direction, there is a range-correction line where displacement of ranges compensates for the earth's curvature. Township lines 1, 6, 11, 16, 21, 26, and 31 are range-correction lines. Figure 1 illustrates the displacement at the range-correction lines.

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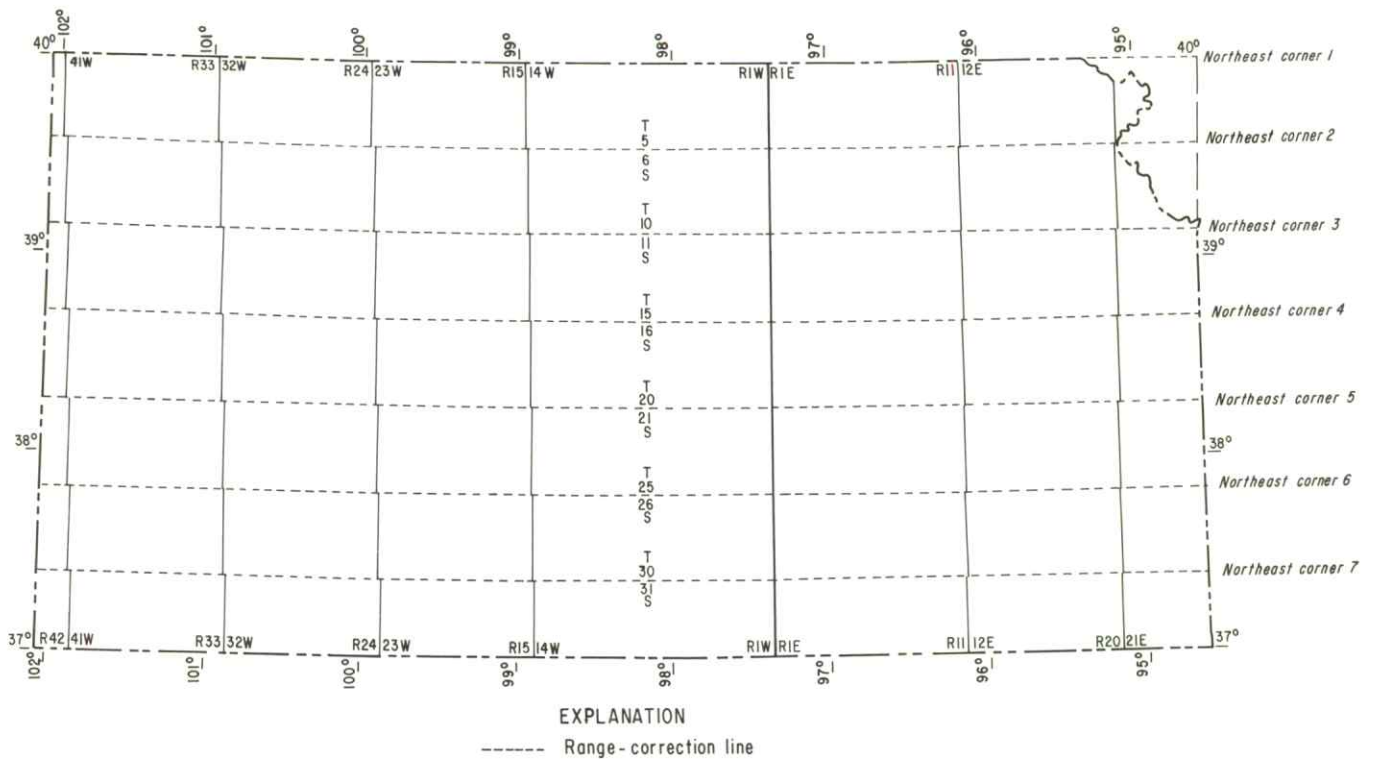


Figure 1.--Map of Kansas showing range-correction lines.

A total of 474 latitude and 474 longitude measurements are required for this conversion program to cover the entire State of Kansas. In addition, 481 factors along the seven east-west range-correction lines and 481 factors along the north-south lines are required. Seven more correction factors are needed in each direction to bound the 474 areas outlined by the latitude and longitude measurements.

#### PROGRAM EXPLANATION

Explanation of the FORTRAN IV KANS program is facilitated by referring to the program flow chart, the program listing, and the program control cards that are found in figure 2 and appendixes I and II, respectively.

Conversion of township and range locations to latitude and longitude coordinates requires the following:

- (1) The area or areas be bounded on the north and south by a set of range-correction lines; or cards numbered KAN 1690, KAN 1710, and KAN 1720 be modified to give the new north-south length of the area or areas, in town-

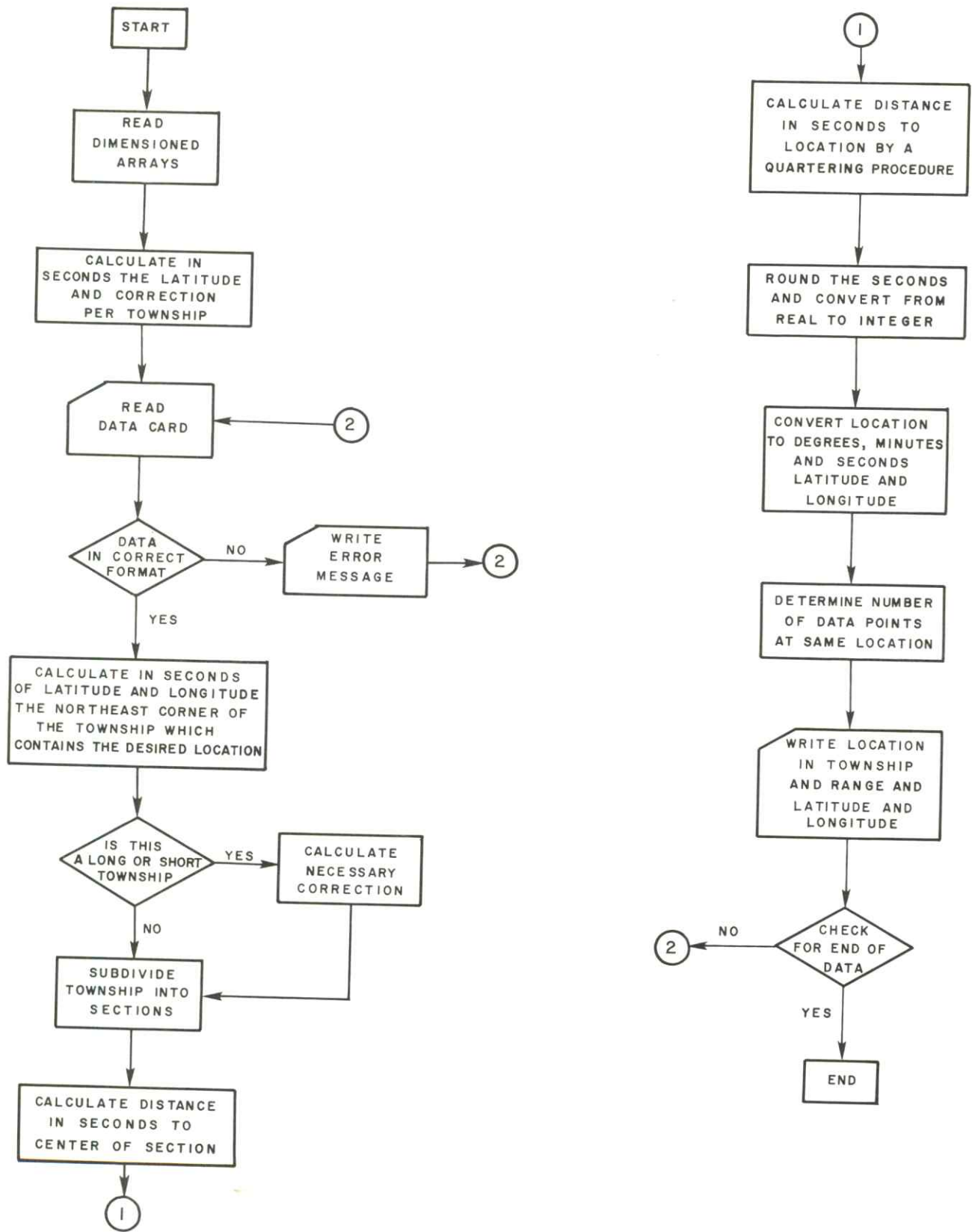


Figure 2.--Flow chart for FORTRAN IV KANS program.

ships. For example, the areas in the Kansas program consist of seven strips (fig. 1) running east to west that are five townships wide between range-correction lines, but the areas in the North Dakota version of the program consist of 36 east-west strips that are a single township wide.

- (2) The northeast corner of the area or areas be at the intersection of a range-correction (township) line and a range line (fig. 3).
- (3) The township and range location and the corresponding latitude and longitude coordinates of the northeast corner of the area or areas be determined.  
For Kansas there are seven range-correction lines (fig. 1); therefore, seven northeast corners are utilized. North Dakota uses the northeast corner of each range line, or a total of 36 corners.
- (4) The longitude between adjacent range lines from east to west along the upper range-correction line for Kansas or the range line for North Dakota (fig. 3) be measured in seconds.
- (5) The latitude between upper and lower range or range-correction lines from north to south (fig. 3) be measured in seconds. These measurements are correct for Kansas if cards KAN 1690, KAN 1710, and KAN 1720, which specify greater than one township, are not modified.
- (6) Two sets of correction factors that adjust the departures from parallelism in Kansas between the General Land Office grid system and the latitude-longitude coordinate system (fig. 4).
  - (a) Latitude correction factors -- at each township and range line intersection along the seven range-correction lines (481 intersections), the difference in seconds of latitude between each intersection and the northeast corner of the area being considered is recorded.
  - (b) Longitude correction factors -- the north-south range lines connecting range-correction lines may vary to the east or west at the south end of each set of five townships. This variation in seconds is recorded for each range line within the seven areas (481 lines).

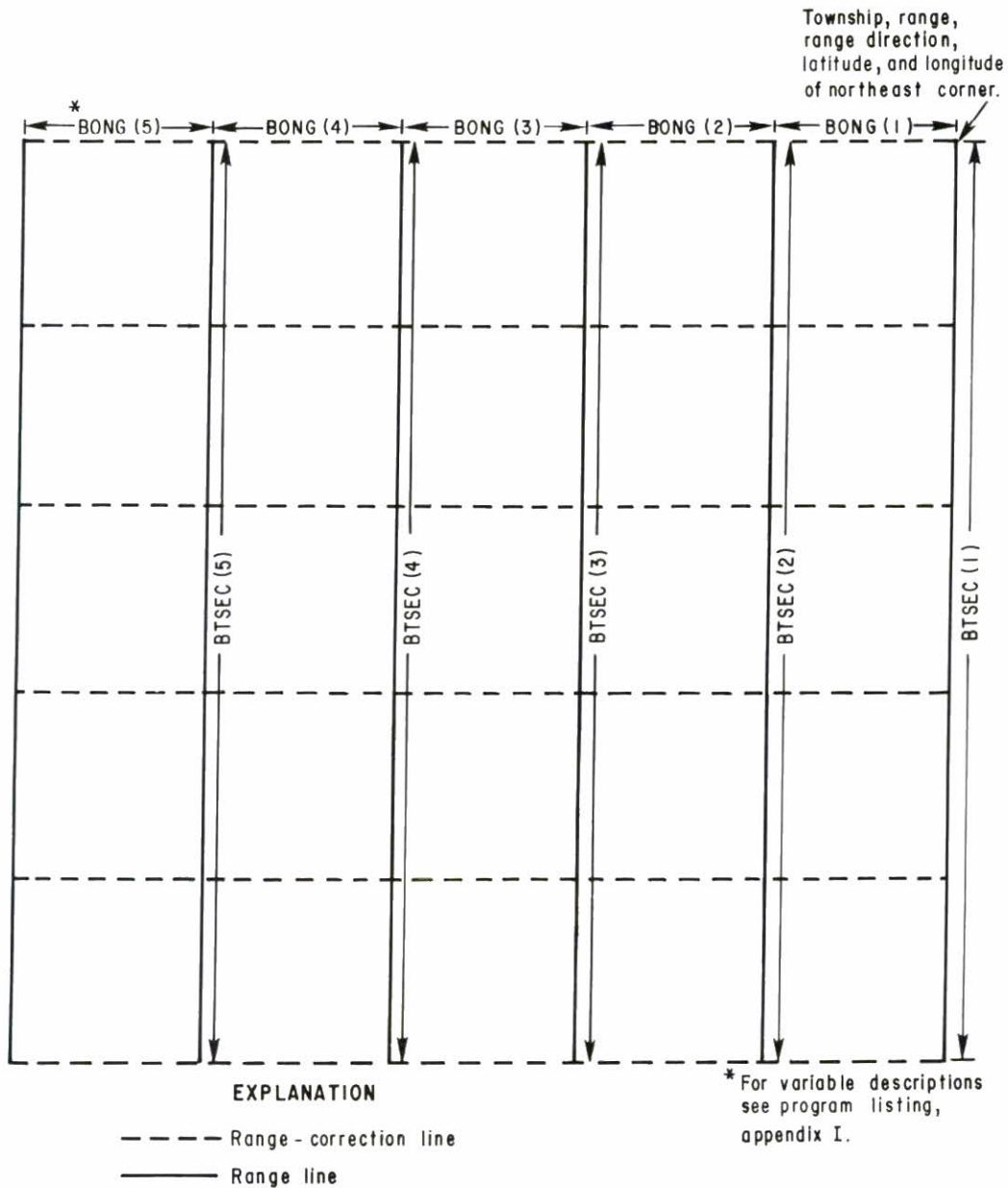


Figure 3.--Typical area showing the information needed to calculate latitude and longitude coordinates from township and range locations.

Within the program, subroutine ADJUST uses these factors to calculate corrections to the center of the fourth quarter section ( $2\frac{1}{2}$  acres) or to the center of the smallest division given in the location.

The conversion of a General Land Office location to latitude and longitude coordinates is calculated from the northeast corner of the area, as shown in figure 5. Kansas is divided into seven of these areas (fig. 1) traversing the State from east to west. The

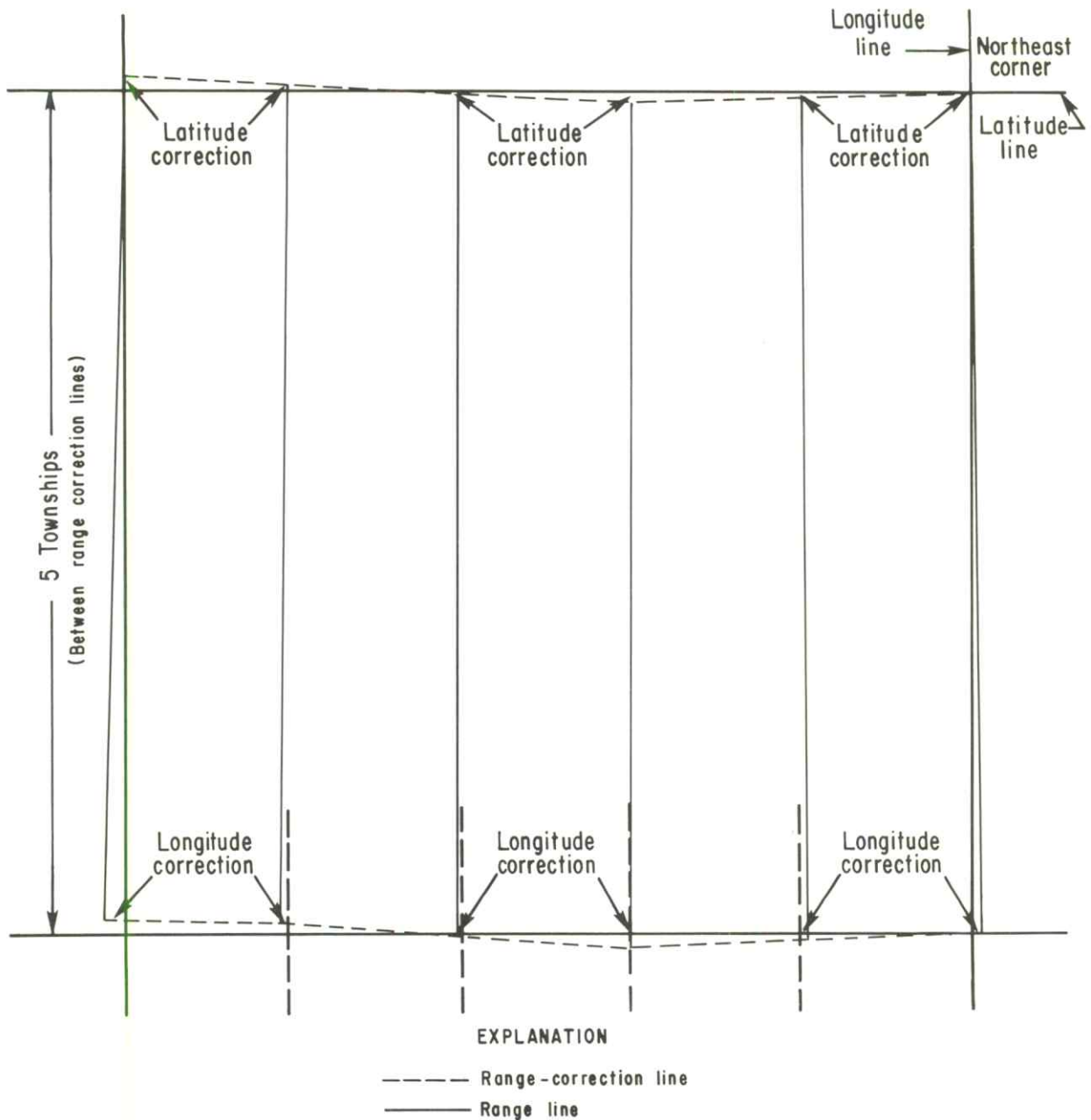


Figure 4.--Latitude and longitude corrections used in KANS program.

areas vary from 67 to 68 ranges in east-west length and from 4 to 5 townships in north-south width. The latitude and longitude degrees and minutes of the corners are considered to be the primary starting point for calculating coordinates within the designated areas. The latitude and longitude seconds of the primary point are included in the calculations for determining the coordinates of the datum location. From the primary point, the measured seconds of latitude are subtracted and the measured seconds of longitude are

added until the northeast corner of the township in which the datum point is located is reached (fig. 5I). If the location is only to the closest township and range, the latitude and longitude of the center of that township are determined and the calculations are concluded. However, if at least a section is given, calculations are continued.

The township where the datum point is located is subdivided into sections of equal size (fig. 5II). If the township is abnormally long or short in the longitude direction, as some are in Kansas because of correction sections on the west side of the township, adjustments are made. The five sections on the east are made equal to the average section width of the two townships either on the east or the west side of the long or short township. The section on the west has a longitude length equal to the total length of the long or short township minus the sum of the calculated longitude lengths of the five sections on the east. Correction factors to adjust latitude and longitude are included in all calculations. The seconds latitude and longitude are then calculated to the center of the designated section and added or subtracted from the previous total seconds.

If the General Land Office location is only to the nearest section, the calculations are concluded. However, if the location is designated to the 1st, 2nd, 3rd, or 4th quarter section, it is subdivided to the appropriate quarter (fig. 5III). The program then rounds the seconds to the nearest whole number.

If the seconds latitude and longitude fall between -1 and +60, the coordinates have been determined for the datum-point location. Otherwise, the seconds longitude are converted into minutes and degrees by a series of subtractions from the seconds and corresponding additions to minutes and degrees. The seconds latitude are converted into minutes and degrees by a series of additions to the seconds (since the seconds will be a minus number) and subtractions from the minutes and degrees. These calculations continue until the seconds fall between -1 and +60.

When more than one datum point is located at a single coordinate, and is so designated by serial numbers following the General Land Office location, that serial number will follow the final latitude and longitude coordinate. If no number is designated, a "1" will follow the coordinate. (See table 1 for examples of the General Land Office locations and the calculated latitudes and longitudes.)

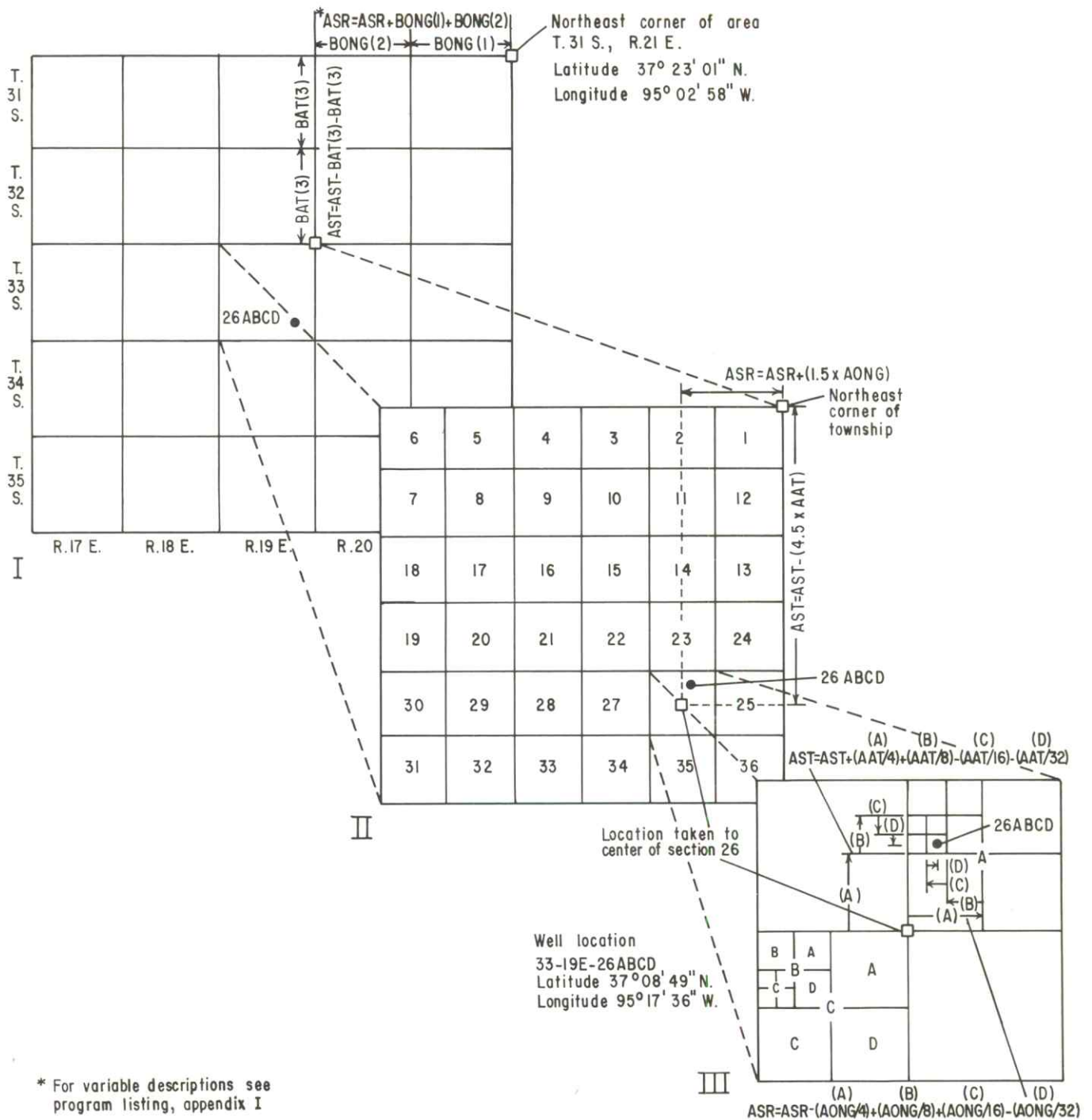


Figure 5.--Typical area showing the procedure for calculating the latitude and longitude of a township and range location (T. 33 S., R. 19 E., sec. 26, ABCD). I, location to northeast corner of township; II, location to center of section; III, location to designated quarter.

Table 1.--Program output

COUNTY	LAND OFFICE LOC.	LATITUDE	DIR.	LONGITUDE	SEQ.	AC.	NUMBER
CHEYENNE	5 38W 22ACB	39 36 25	N	101 34 24	1	2	27
CHEYENNE	5 42W 14CBC	39 36 58	N	102 0 36	1	2	28
CLOUD	5 3W 29BB	39 35 41	N	97 41 8	1	2	29
CLOUD	5 4W 2CCC	39 38 27	N	97 44 35	1	2	30
CLOUD	5 4W 4AAA	39 39 13	N	97 45 51	1	2	31
CLOUD	5 4W 7CC	39 37 38	N	97 49 1	1	2	32
CLOUD	5 4W 9AA	39 38 17	N	97 45 55	1	2	33
CLOUD	5 4W 11DD2	39 37 38	N	97 43 40	2	2	34
CLOUD	5 4W 12BC	39 38 4	N	97 43 23	1	2	35
CLOUD	5 4W 13AA	39 37 25	N	97 42 32	1	2	36
CLOUD	5 4W 19DD	39 35 54	N	97 48 11	1	2	37
CLOUD	5 4W 26BC	39 35 28	N	97 44 31	1	2	38
CLOUD	5 5W 2DC	39 38 30	N	97 50 42	1	2	39
CLOUD	8 4W 19CB	39 20 26	N	97 48 52	1	2	40
CLOUD	8 4W 30CBC	39 19 30	N	97 48 56	1	2	41
CLOUD	8 4W 31DDD	39 18 25	N	97 47 57	1	2	42
CLOUD	8 5W 9DDA	39 22 1	N	97 52 29	1	2	43
CLOUD	8 5W 10BBC	39 22 34	N	97 52 21	1	2	44
CLOUD	8 5W 10BCB	39 22 27	N	97 52 21	1	2	45
CLOUD	8 5W 11DCB	39 22 1	N	97 50 38	1	2	46
CLOUD	8 5W 13ADD	39 21 28	N	97 49 4	1	2	47
CLOUD	8 5W 22BAB	39 20 56	N	97 52 3	1	2	48
CLOUD	8 5W 22BDA	39 20 43	N	97 51 55	1	2	49
CLOUD	8 5W 25AA	39 20 0	N	97 49 8	1	2	50
CLOUD	8 5W 26DDD	39 19 18	N	97 50 12	1	2	51
CLOUD	8 5W 27 AB	39 20 0	N	97 51 42	1	2	52

## CONCLUDING REMARKS

Accuracy of the conversions depends upon several factors not controllable within the program: (1) the accuracy of the maps from which the latitude and longitude parameters are measured which, in turn, depends upon the scale of the map, the preciseness of the map survey, and the expansion or shrinkage of the map paper; (2) the accuracy of the measurements of the latitude and longitude parameters and the correction factors; and (3) the regularity of the General Land Office divisions.

If the base maps and the measurements of the latitude and longitude parameters are accurate and the General Land Office divisions are regular, coordinates will be calculated within one second latitude and longitude of the center of the smallest division. A second of latitude is approximately 100 feet and a second of longitude is approximately 80 feet in Kansas.

The program was checked by calculating the latitude and longitude of the 474 northeast corners measured along the upper edges of the seven strips or areas and adjusted on the basis of correction factors until agreement between measured and calculated points was reached. Also, the lower edge of each strip or area was checked with the upper edge of the strip below. The two preceding checks allowed a comparison of the nonparallelism of township and range lines with latitude and longitude lines.

General Land Office locations of 2,819 data points from various counties in Kansas were converted to latitude and longitude coordinates in 1.92 minutes on the central processor at a total job cost of \$21.58. Usable information is computer accessible from several tens of thousands of General Land Office locations in Kansas. The speed and accuracy of the conversion program obviously permits the tagging of these locations with latitude and longitude coordinates at nominal expense.

APPENDIXES

Appendix I.--Listing of FORTRAN IV statements in KANS program

CKANS0000	PROGRAM TO CONVERT T - R TO LAT-LONG COORDINATES	KAN 10
	DIMENSION BTSEC(600), BAT(600), BONG(600), ITTP(7), IRG(7), IWE(7)	KAN 20
	1, LTD(7), LTM(7), LTS(7), LND(7), LNM(7), LNS(7), IPX(7), AATDIF(6	KAN 30
	200)	KAN 40
	DIMENSION LT(7), LF(7), LC(3), IILT(600), TILT(600)	KAN 50
	COMMON NA(48)	KAN 60
	DATA IBLK/6H /	KAN 70
	-----	KAN 80
	KANS--PROGRAM TO CONVERT GENERAL LAND OFFICE LOCATIONS TO LATITUDE	KAN 90
	AND LONGITUDE COORDINATES.	KAN 100
		KAN 110
		KAN 120
	-----	KAN 130
	PROGRAMMED BY CHARLES O. MORGAN AND JESSE M. MCNELLIS	KAN 140
	KANSAS DISTRICT, WRD, USGS, LAWRENCE, KANSAS	KAN 150
	CONTROL MEASUREMENTS BY CARRIE REAVIS AND GLENDA RICHARDSON.	KAN 160
	DATE COMPLETED - 1965.	KAN 170
	LANGUAGE - FORTRAN IV.	KAN 180
	TESTED ON AN IBM 7040(32K) AND A GE 635(128K) AT THE UNIVERSITY	KAN 190
	OF KANSAS COMPUTATION CENTER.	KAN 200
	PROGRAM IS WRITTEN FOR KANSAS DATA--MINOR CHANGES CAN ADAPT THE	KAN 210
	PROGRAM FOR OTHER AREAS THAT HAVE A REGULAR GENERAL LAND OFFICE	KAN 220
	GRID SYSTEM. ALL INPUT CONTROL DATA (EXCEPT NA) MUST BE CHANGED	KAN 230
	FOR ANY AREA OTHER THAN KANSAS.	KAN 240
		KAN 250
	-----	KAN 260
	INPUT DATA ARE CARDS WITH GENERAL LAND OFFICE LOCATIONS, OUTPUT	KAN 270
	IS A LIST OF LOCATIONS AND LATITUDE-LONGITUDE COORDINATES	KAN 280
	-----	KAN 290
	-----	KAN 300
	EXPLANATION OF OUTPUT	KAN 310
	-----	KAN 320
	TABLE--LISTS (NOTE--CARD OUTPUT IN THE FORMAT OF THE WRD	KAN 330
	DATA CARDS MAY ALSO BE OBTAINED)	KAN 340
	1. COUNTY NAME OR OTHER IDENTIFICATION ON DATA CARD	KAN 350
	2. GENERAL LAND OFFICE LOCATION	KAN 360
	3. LATITUDE-LONGITUDE COORDINATES--INCLUDE	KAN 370
	SEQUENTIAL NUMBER (1 UNLESS OTHERWISE SPECIFIED	KAN 380
	IN THE GENERAL LAND OFFICE LOCATION) AND ARE	KAN 390
	ACCURATE TO WITHIN 10 SECONDS	KAN 400
	4. NUMBER SEQUENCE ON LISTING	KAN 410
		KAN 420
	-----	KAN 430
	EXPLANATION OF INPUT CONTROL CARDS	KAN 440
	-----	KAN 450
	- ALPHANUMERIC DECODING AID, THE NUMBERS 0 THROUGH 9, THE	KAN 460
	ALPHABET, A BLANK, THE PLUS, MINUS, PERIOD, LEFT PAREN,	KAN 470
	RIGHT PAREN, AND 6 ADDITIONAL SYMBOLS RESPECTIVELY.	KAN 480
	ONE CARD. NA ARRAY, FORMAT(48A1).	KAN 490
		KAN 500
	- LONGITUDE DISTANCE IN SECONDS OF EACH TOWNSHIP IN THE RANGE	KAN 510
	DIRECTION ALONG THE TOP OF EACH TIER, IN ARRAY BONG.	KAN 520
		KAN 530
	- LATITUDE DISTANCE IN SECONDS OF EACH TIER IN THE TOWNSHIP	KAN 540
	DIRECTION, IN ARRAY BTSEC. BONG, BTSEC ARE ENTERED BONG	KAN 550
	BTSEC, BONG BTSEC, ETC., 474 BONGS AND 474 BTSECS.	KAN 560
	60 CARDS. FORMAT(16F5.0).	KAN 570
		KAN 580
	- LATITUDE CORRECTION FACTORS, IN ARRAY AATDIF. ONE FOR	KAN 590

C	EACH BTSEC, TOTAL 481 ENTRIES. 25 CARDS. FORMAT(20F4.0).	KAN 600
C		KAN 610
C	- LONGITUDE CORRECTION FACTORS, IN ARRAY IILT. EACH IILT	KAN 620
C	IS THE DIFFERENCE BETWEEN BONG AND THE CORRESPONDING	KAN 630
C	DISTANCE IN SECONDS ALONG THE BOTTOM OF EACH TIER. ONE	KAN 640
C	FOR EACH BONG, TOTAL 481 ENTRIES. 19 CARDS. FORMAT(20I4).	KAN 650
C		KAN 660
C	- TOWNSHIP-RANGE AND LATITUDE-LONGITUDE OF THE NORTHEAST	KAN 670
C	CORNER OF EACH TIER. IN ARRAYS ITTP, IRG, IWE, LTD, LTM,	KAN 680
C	LTS, LND, LNM, LNS. SEVEN OF EACH. SEVEN CARDS.	KAN 690
C	FORMAT(I3, 1X, I3, A1, 2(I3, 2I2, 1X)).	KAN 700
C		KAN 710
C	- ITTP = TOWNSHIP	KAN 720
C	- IRG = RANGE	KAN 730
C	- IWE = RANGE DIRECTION	KAN 740
C	- LTD = DEGREES OF LATITUDE	KAN 750
C	- LTM = MINUTES OF LATITUDE	KAN 760
C	- LTS = SECONDS OF LATITUDE	KAN 770
C	- LND = DEGREES OF LONGITUDE	KAN 780
C	- LNM = MINUTES OF LONGITUDE	KAN 790
C	- LNS = SECONDS OF LONGITUDE	KAN 800
C		KAN 810
C	-----	KAN 820
C	PLACE CARD WITH Z PUNCHED IN FIRST COLUMN AFTER DATA TO TERMINATE	KAN 830
C	OPERATION OF PROGRAM.	KAN 840
C	-----	KAN 850
C	-----	KAN 860
C	THE PROGRAM IS SUCCESSFUL IN KANSAS. MINOR CHANGES HAVE BEEN	KAN 870
C	MADE IN THE PROGRAM TO MAKE IT USEFUL AND SUCCESSFUL	KAN 880
C	IN NORTH DAKOTA, COLORADO, AND NEBRASKA.	KAN 890
C		KAN 900
C	THERE IS A CORRECTION LINE EVERY 5 TOWNSHIPS IN KANSAS, THIS	KAN 910
C	MAY BE DIFFERENT IN OTHER STATES. THERE ARE 7 TIERS BOUNDED	KAN 920
C	BY THESE CORRECTION LINES. THE TOWNSHIP-RANGE AND CORRESPONDING	KAN 930
C	LATITUDE-LONGITUDE OF THE NORTHEAST CORNER OF EACH TIER	KAN 940
C	MUST BE KNOWN. THE DISTANCE IN SECONDS OF EACH TOWNSHIP IN THE	KAN 950
C	RANGE DIRECTION MUST BE KNOWN, AT THE TOP AND BOTTOM OF	KAN 960
C	EACH TIER. THE DISTANCE IN SECONDS OF EACH TIER IN THE TOWNSHIP	KAN 970
C	DIRECTION MUST BE KNOWN. THIS PERMITS STATE-WIDE USAGE OF THE	KAN 980
C	PROGRAM.	KAN 981
C	-----	KAN 990
C	-----	KAN1000
C		KAN1010
C	-----	KAN1020
C		KAN1030
C	READ IN DECODE ARRAY, NA.	KAN1040
C		KAN1050
C	-----	KAN1060
C		KAN1070
C	READ (5,1) (NA(I),I=1,48)	KAN1080
I	FORMAT (48A1)	KAN1090
C		KAN1100
C	-----	KAN1110
C		KAN1120
C	DIVID = NUMBER OF TOWNSHIPS IN THE LATITUDE (NORTH-SOUTH)	KAN1130
C	DIRECTION BETWEEN RANGE CORRECTION LINES	KAN1140
C	NT = NUMBER OF LATITUDE AND LONGITUDE DISTANCES TO BE READ	KAN1150
C	IPX = NUMBER WHERE THE LATITUDE AND LONGITUDE DISTANCES BEGIN	KAN1160
C	IN THE BONG AND BTSEC ARRAYS ALONG EACH OF THE RANGE STRIPS	KAN1170
C		KAN1180

C	-----	KAN1190
C	DIVID=5.	KAN1200
	NT=474	KAN1210
	KOUNT=0	KAN1220
	IPX(1)=1	KAN1230
	IPX(2)=68	KAN1240
	IPX(3)=135	KAN1250
	IPX(4)=203	KAN1260
	IPX(5)=271	KAN1270
	IPX(6)=339	KAN1280
	IPX(7)=407	KAN1290
		KAN1300
C	-----	KAN1310
C		KAN1320
C	READ IN THE LONGITUDE DISTANCE IN SECONDS BETWEEN THE NORTHEAST	KAN1330
C	CORNERS OF ADJACENT TOWNSHIPS FROM EAST TO WEST. (BONG)	KAN1340
C		KAN1350
C	READ IN THE LATITUDE DISTANCE IN SECONDS BETWEEN THE NORTH AND THE	KAN1360
C	SOUTH CORRECTION LINES, BEGINNING AT THE EAST EDGE OF THE AREA,	KAN1370
C	AND AT THE EAST EDGE OF EACH TOWNSHIP. (BTSEC)	KAN1380
C		KAN1390
C	-----	KAN1400
C		KAN1410
2	READ (5,2) (BONG(I),BTSEC(I),I=1,NT)	KAN1420
C	FORMAT (16F5.0)	KAN1430
C		KAN1440
C	-----	KAN1450
C		KAN1460
C	READ IN LATITUDE CORRECTION FACTORS (AATDIF) AND LONGITUDE	KAN1470
C	CORRECTION FACTORS (IILT).	KAN1480
C		KAN1490
C	-----	KAN1500
C		KAN1510
	MT=NT+7	KAN1520
3	READ (5,3) (AATDIF(I),I=1,MT)	KAN1530
C	FORMAT (20F4.0)	KAN1540
4	READ (5,4) (IILT(I),I=1,MT)	KAN1550
C	FORMAT (26I3)	KAN1560
C		KAN1570
C	-----	KAN1580
C		KAN1590
C	DETERMINE WIDTH IN SECONDS OF EACH TOWNSHIP IN THE LATITUDE	KAN1600
C	DIRECTION AND AMOUNT OF TILT IN SECONDS OF EACH TOWNSHIP IN	KAN1610
C	TOWNSHIPS 11 THROUGH 15 SOUTH, RANGES 1 THROUGH 43 WEST.	KAN1620
C		KAN1630
C	-----	KAN1640
C		KAN1650
5	DO 5 I=1,NT	KAN1660
	BAT(I)=BTSEC(I)/DIVID	KAN1670
	DO 6 I=1,MT	KAN1680
	IF (I.GT.412) TILT(I)=FLOAT(IILT(I))/4.	KAN1690
6	IF (I.LE.412) TILT(I)=FLOAT(IILT(I))/5.	KAN1700
C		KAN1710
C	-----	KAN1720
C		KAN1730
C	READ IN THE TOWNSHIP AND RANGE - LATITUDE AND LONGITUDE OF THE	KAN1740
C	NORTHEAST CORNER OF THE AREA -- THE CORNER MUST BE ON A RANGE	KAN1750
C	CORRECTION LINE.	KAN1760
C		KAN1770
C		KAN1780

```

C -----KAN1790
C KAN1800
7 DO 7 I=1,7 KAN1810
READ (5,8) ITTP(I),IRG(I),IWE(I),LTD(I),LTM(I),LTS(I),LND(I),LNM(I) KAN1820
),LNS(I) KAN1830
8 FORMAT (I3,1X,I3,A1,2(I3,2I2,1X)) KAN1840
DO 9 I=1,7 KAN1850
DO 9 J=1,37 KAN1860
9 IF (IWE(I).EQ.NA(J)) IWE(I)=J KAN1870
C KAN1880
C -----KAN1890
C KAN1900
C READ DATA CARD HAVING TOWNSHIP AND RANGE TO BE CONVERTED TO KAN1910
C LATITUDE AND LONGITUDE. KAN1920
C KAN1930
C -----KAN1940
C KAN1950
10 NLNE=0 KAN1960
WRITE (6,11) KAN1970
11 FORMAT (1H1) KAN1980
WRITE (6,12) KAN1990
12 FORMAT (1X,79(1H-),/) KAN2000
WRITE (6,13) KAN2010
13 FORMAT (80H COUNTY LAND OFFICE LOC. LATITUDE DIR. LOKAN2020
INGITUDE SEQ. AC. NUMBER ,/) KAN2030
WRITE (6,12) KAN2040
14 LC(1)=IBLK KAN2050
LC(2)=IBLK KAN2060
LC(3)=IBLK KAN2070
C KAN2080
C -----KAN2090
C KAN2100
C READ DATA SET--THIS AREA OF PROGRAM MUST BE CHANGED TO HANDLE DATA KAN2110
C PUNCHED IN OTHER FORMATS. KAN2120
C KAN2130
C -----KAN2140
C KAN2150
15 READ (5,15) (LT(I),I=1,7),L11,L12,L13,L14,(LC(I),I=1,3) KAN2160
FORMAT (11A1,3A6) KAN2170
IF (LT(1).EQ.NA(36)) GO TO 57 KAN2180
C KAN2190
C -----KAN2200
C KAN2210
C CHECK INPUT DATA FOR PROPER FORMAT (KANSAS SYSTEM OF NUMBERING KAN2220
C WATER WELLS) IF DATA IS NOT IN PROPER FORMAT, WRITE MESSAGE AND KAN2230
C CONTINUE TO NEXT DATA SET. KAN2240
C KAN2250
C -----KAN2260
C KAN2270
C DO 16 I=1,7 KAN2280
DO 16 J=1,48 KAN2290
16 IF (LT(I).EQ.NA(J)) LF(I)=J KAN2300
IF (LF(I).EQ.37) LF(I)=1 KAN2310
IF (LF(2).GT.10.OR.LF(4).GT.10.OR.LF(7).GT.10) GO TO 20 KAN2320
LTP=((LF(1)-1)*10)+LF(2)-1 KAN2330
LRG=((LF(3)-1)*10)+LF(4)-1 KAN2340
LWF=LT(5) KAN2350
NWE=LF(5) KAN2360
LSC=((LF(6)-1)*10)+LF(7)-1 KAN2370
IF (LTP.LE.35.AND.LTP.GE.1) GO TO 17 KAN2380

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	GO TO 20	KAN2390
17	IF (LRG.GE.1.AND.LRG.LE.25.AND.NWE.EQ.15) GO TO 18	KAN2400
	IF (LRG.GE.1.AND.LRG.LE.43.AND.NWE.EQ.33) GO TO 18	KAN2410
	GO TO 20	KAN2420
18	IKIC=0	KAN2430
	DO 19 I=15,48	KAN2440
	IF (L11.EQ.NA(I).AND.L11.NE.NA(37)) IKIC=1	KAN2450
	IF (L12.EQ.NA(I).AND.L12.NE.NA(37)) IKIC=1	KAN2460
	IF (L13.EQ.NA(I).AND.L13.NE.NA(37)) IKIC=1	KAN2470
19	IF (L14.EQ.NA(I).AND.L14.NE.NA(37)) IKIC=1	KAN2480
	IF (IKIC.EQ.0) GO TO 23	KAN2490
20	KOUNT=KOUNT+1	KAN2500
	WRITE (6,21) (LC(I),I=1,3),(LT(I),I=1,7),L11,L12,L13,L14,KOUNT	KAN2510
21	FORMAT (1X,3A6,2X,2A1,1X,3A1,1X,6A1,40X,15,5X,18)HERKOR IN LOCATION	KAN2520
	1 )	KAN2530
	WRITE (6,22)	KAN2540
22	FORMAT (1H )	KAN2550
	NLNE=NLNE+2	KAN2560
	GO TO 56	KAN2570
23	CUNG=0.	KAN2580
C		KAN2590
C	-----	KAN2600
C		KAN2610
C	CALCULATE RANGE STRIP WHERE BONG AND BTSEC ARRAYS WILL BE FOUND.	KAN2620
C		KAN2630
C	-----	KAN2640
C		KAN2650
	IX=((LTP-1)/5)+1	KAN2660
C		KAN2670
C	-----	KAN2680
C		KAN2690
C	CALCULATE LONGITUDE DISTANCE IN SECONDS FROM THE NORTHEAST CORNER	KAN2700
C	OF THE AREA TO THE NORTHEAST CORNER OF THE RANGE TO BE DETERMINED.	KAN2710
C		KAN2720
C	-----	KAN2730
C		KAN2740
	IRX=IRG(IX)	KAN2750
	AST=LTS(IX)	KAN2760
	ASR=LNS(IX)	KAN2770
	IY=IPX(IX)	KAN2780
	IF (NWE.EQ.15) GO TO 25	KAN2790
	IYY=IY+24	KAN2800
	DO 24 I=IY,IYY	KAN2810
24	ASR=ASR+BONG(I)	KAN2820
	IRX=1	KAN2830
	IY=IYY+1	KAN2840
25	IF (IRX.EQ.LRG) GO TO 26	KAN2850
	ASR=ASR+BONG(IY)	KAN2860
	IY=IY+1	KAN2870
	IF (NWE.EQ.33) IRX=IRX+1	KAN2880
	IF (NWE.EQ.15) IRX=IRX-1	KAN2890
	GO TO 25	KAN2900
26	IITL=IY+(IX-1)	KAN2910
	A1=AATDIF(IITL)	KAN2920
	A2=AATDIF(IITL+1)	KAN2930
	CALL ADJUST (A1,A2,LSC,L11,L12,L13,L14,AATDF)	KAN2940
	AST=AST+AATDF	KAN2950
	IDR=LND(IX)	KAN2960
	IMR=LN(IX)	KAN2970
	IDT=LTD(IX)	KAN2980

	IMT=LTM(IX)	KAN2990
	ITP=ITP(IX)	KAN3000
	T1=TILT(ITL)	KAN3010
	T2=TILT(ITL+1)	KAN3020
	CALL ADJUST (T1,T2,LSC,L11,L12,L13,L14,TILTF)	KAN3030
	I=IY	KAN3040
C		KAN3050
C	-----	KAN3060
C		KAN3070
C	CALCULATE LATITUDE DISTANCE IN SECONDS FROM THE NORTHEAST CORNER	KAN3080
C	OF THE RANGE COLUMN TO THE NORTHEAST CORNER OF THE TOWNSHIP TO BE	KAN3090
C	DETERMINED.	KAN3100
C		KAN3110
C	-----	KAN3120
C		KAN3130
	BATY=BAT(I)	KAN3140
	IF (IX.EQ.6.AND.NWE.EQ.33) BATY=BAT(I-68)	KAN3150
27	IF (ITP.EQ.LTP) GO TO 28	KAN3160
	AST=AST-BATY	KAN3170
	ASR=ASR+TILTF	KAN3180
	ITP=ITP+1	KAN3190
	GO TO 27	KAN3200
C		KAN3210
C	-----	KAN3220
C		KAN3230
C	SUBDIVIDE LATITUDE AND LONGITUDE TOWNSHIP LENGTHS INTO SECTION	KAN3240
C	LENGTHS AND CALCULATE THE DISTANCE IN SECONDS TO THE CENTER OF THE	KAN3250
C	SECTION.	KAN3260
C		KAN3270
C	-----	KAN3280
C		KAN3290
28	IF (LSC.LT.1) GO TO 43	KAN3300
	IF (IX.EQ.6.AND.NWE.EQ.33) GO TO 29	KAN3310
	AAT=BAT(I)/6.	KAN3320
	GO TO 30	KAN3330
29	AAT=BAT(I-68)/6.	KAN3340
	AAT1=(BAT(I)*5.)-(BAT(I-68)*5.)+AAT	KAN3350
30	IF (I.LE.2.OR.(I.GE.68.AND.I.LT.70).OR.(I.GE.135.AND.I.LT.137).OR.	KAN3360
	1(I.GE.203.AND.I.LT.205).OR.(I.GE.339.AND.I.LT.341).OR.(I.GE.407.AN	KAN3370
	2D.I.LT.409).OR.(I.GE.271.AND.I.LT.273)) GO TO 31	KAN3380
	IF (BONG(I).GE.(BONG(I-1)+6.).OR.BONG(I).LE.(BONG(I-1)-6.).AND.BON	KAN3390
	1G(I).GE.(BONG(I-2)+6.).OR.BONG(I).LE.(BONG(I-2)-6.)) GO TO 32	KAN3400
	GO TO 34	KAN3410
31	IF (BONG(I).GE.(BONG(I+1)+6.).OR.BONG(I).LE.(BONG(I+1)-6.).AND.BON	KAN3420
	1G(I).GE.(BONG(I+2)+6.).OR.BONG(I).LE.(BONG(I+2)-6.)) GO TO 33	KAN3430
	GO TO 34	KAN3440
32	CONG=(BONG(I)-((BONG(I-1)+BONG(I-2))/2.))+((BONG(I-1)+BONG(I-2))/1	KAN3450
	2.))	KAN3460
	AONG=(BONG(I)-CONG)/5.	KAN3470
	GO TO 35	KAN3480
33	CONG=(BONG(I)-((BONG(I+1)+BONG(I+2))/2.))+((BONG(I+1)+BONG(I+2))/1	KAN3490
	2.))	KAN3500
	AONG=(BONG(I)-CONG)/5.	KAN3510
	GO TO 35	KAN3520
34	AONG=BONG(I)/6.	KAN3530
35	IF (IX.EQ.6.AND.NWE.EQ.33) GO TO 37	KAN3540
36	IF (LSC.LE.6) AST=AST-(AAT/2.)	KAN3550
	GO TO 39	KAN3560
37	IF (LSC.LE.6.AND.LTP.EQ.26) GO TO 38	KAN3570
	AST=AST-(AAT1-AAT)	KAN3580

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GO TO 36
38 AST=AST-(AAT1/2.)
   AAT=AAT1
39 IF (LSC.GT.6.AND.LSC.LT.13) AST=AST-(1.5*AAT)
   IF (LSC.GT.12.AND.LSC.LT.19) AST=AST-(2.5*AAT)
   IF (LSC.GT.18.AND.LSC.LT.25) AST=AST-(3.5*AAT)
   IF (LSC.GT.24.AND.LSC.LT.31) AST=AST-(4.5*AAT)
   IF (LSC.GT.30) AST=AST-(5.5*AAT)
   IF (LSC.EQ.1.OR.LSC.EQ.12.OR.LSC.EQ.13.OR.LSC.EQ.24.OR.LSC.EQ.25)
1R.LSC.EQ.36) ASR=ASR+(AONG/2.)
   IF (LSC.EQ.2.OR.LSC.EQ.11.OR.LSC.EQ.14.OR.LSC.EQ.23.OR.LSC.EQ.26)
1R.LSC.EQ.35) ASR=ASR+(1.5*AONG)
   IF (LSC.EQ.3.OR.LSC.EQ.10.OR.LSC.EQ.15.OR.LSC.EQ.22.OR.LSC.EQ.27)
1R.LSC.EQ.34) ASR=ASR+(2.5*AONG)
   IF (LSC.EQ.4.OR.LSC.EQ.9.OR.LSC.EQ.16.OR.LSC.EQ.21.OR.LSC.EQ.28)
1.LSC.EQ.33) ASR=ASR+(3.5*AONG)
   IF (LSC.EQ.5.OR.LSC.EQ.8.OR.LSC.EQ.17.OR.LSC.EQ.20.OR.LSC.EQ.29)
1.LSC.EQ.32) ASR=ASR+(4.5*AONG)
   IF (CONG.EQ.0.) GO TO 40
   IF (LSC.EQ.6.OR.LSC.EQ.7.OR.LSC.EQ.18.OR.LSC.EQ.19.OR.LSC.EQ.30)
1.LSC.EQ.31) ASR=ASR+(5.*AONG)+(CONG/2.)
   IF (LSC.EQ.6.OR.LSC.EQ.7.OR.LSC.EQ.18.OR.LSC.EQ.19.OR.LSC.EQ.30)
1.LSC.EQ.31) AONG=CONG
   GO TO 41
40 IF (LSC.EQ.6.OR.LSC.EQ.7.OR.LSC.EQ.18.OR.LSC.EQ.19.OR.LSC.EQ.30)
1.LSC.EQ.31) ASR=ASR+(5.5*AONG)
C
C -----
C CALCULATE LATITUDE AND LONGITUDE DISTANCES IN SECONDS TO THE
C SPECIFIED QUARTER LOCATION IN THE SECTION.
C -----
C
41 IZZ=(LSC-1)/6
   ASR=ASR+(FLOAT(IZZ)*(TILTF/6.))+(TILTF/12.)
   DO 42 I=1,37
   IF (L11.EQ.NA(I)) L1=I
   IF (L12.EQ.NA(I)) L2=I
   IF (L13.EQ.NA(I)) L3=I
42 IF (L14.EQ.NA(I)) L4=I
   IF (L1.EQ.11.OR.L1.EQ.12) ASR=ASR-(TILTF/24.)
   IF (L1.EQ.13.OR.L1.EQ.14) ASR=ASR+(TILTF/24.)
   IF (L2.EQ.11.OR.L2.EQ.12) ASR=ASR-(TILTF/48.)
   IF (L2.EQ.13.OR.L2.EQ.14) ASR=ASR+(TILTF/48.)
   IF (L3.EQ.11.OR.L3.EQ.12) ASR=ASR-(TILTF/96.)
   IF (L3.EQ.13.OR.L3.EQ.14) ASR=ASR+(TILTF/96.)
   IF (L4.EQ.11.OR.L4.EQ.12) ASR=ASR-(TILTF/192.)
   IF (L4.EQ.13.OR.L4.EQ.14) ASR=ASR+(TILTF/192.)
   IF (L1.EQ.11.OR.L1.EQ.14) ASR=ASR-(AONG/4.)
   IF (L1.EQ.12.OR.L1.EQ.13) ASR=ASR+(AONG/4.)
   IF (L2.EQ.11.OR.L2.EQ.14) ASR=ASR-(AONG/8.)
   IF (L2.EQ.12.OR.L2.EQ.13) ASR=ASR+(AONG/8.)
   IF (L3.EQ.11.OR.L3.EQ.14) ASR=ASR-(AONG/16.)
   IF (L3.EQ.12.OR.L3.EQ.13) ASR=ASR+(AONG/16.)
   IF (L4.EQ.11.OR.L4.EQ.14) ASR=ASR-(AONG/32.)
   IF (L4.EQ.12.OR.L4.EQ.13) ASR=ASR+(AONG/32.)
   IF (L1.EQ.11.OR.L1.EQ.12) AST=AST+(AAT/4.)
   IF (L1.EQ.13.OR.L1.EQ.14) AST=AST-(AAT/4.)
   IF (L2.EQ.11.OR.L2.EQ.12) AST=AST+(AAT/8.)

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	IF (L2.EQ.13.OR.L2.EQ.14) AST=AST-(AAT/8.)	KAN4190
	IF (L3.EQ.11.OR.L3.EQ.12) AST=AST+(AAT/16.)	KAN4200
	IF (L3.EQ.13.OR.L3.EQ.14) AST=AST-(AAT/16.)	KAN4210
	IF (L4.EQ.11.OR.L4.EQ.12) AST=AST+(AAT/32.)	KAN4220
	IF (L4.EQ.13.OR.L4.EQ.14) AST=AST-(AAT/32.)	KAN4230
	GO TO 44	KAN4240
C		KAN4250
C	-----	KAN4260
C		KAN4270
C	IF SECTION NOT GIVEN, CALCULATE TO TOWNSHIP CENTER.	KAN4280
C		KAN4290
C	-----	KAN4300
C		KAN4310
43	AST=AST-(BAT(I)/2.)	KAN4320
	ASR=ASR+(BONG(I)/2.)+(TILTF/2.)	KAN4330
C		KAN4340
C	-----	KAN4350
C		KAN4360
C	ROUND THE SECONDS OF LATITUDE AND LONGITUDE AND CONVERT TO INTEGER	KAN4370
C	NUMBERS.	KAN4380
C		KAN4390
C	-----	KAN4400
C		KAN4410
44	IF (AST.GE.0.) GO TO 45	KAN4420
	KST=AST*(-100.)	KAN4430
	KKST=AST*(-1.)	KAN4440
	GO TO 46	KAN4450
45	KST=AST*100.	KAN4460
	KKST=AST	KAN4470
	KLST=KST-(KKST*100)	KAN4480
	IF (KLST.GE.50) AST=AST+1.0	KAN4490
	GO TO 47	KAN4500
46	KLST=KST-(KKST*100)	KAN4510
	IF (KLST.GE.50) AST=AST-1.0	KAN4520
47	IST=AST	KAN4530
	KSR=ASR*100.	KAN4540
	KKSR=ASR	KAN4550
	KLSR=KSR-(KKSR*100)	KAN4560
	IF (KLSR.GE.50) ASR=ASR+1.0	KAN4570
	ISR=ASR	KAN4580
C		KAN4590
C	-----	KAN4600
C		KAN4610
C	CONVERT THE LOCATION IN SECONDS TO DEGREES, MINUTES, AND SECONDS	KAN4620
C	OF LATITUDE AND LONGITUDE.	KAN4630
C		KAN4640
C	-----	KAN4650
C		KAN4660
48	IF (IST.GE.60) GO TO 49	KAN4670
	GO TO 50	KAN4680
49	IST=IST-60	KAN4690
	IMT=IMT+1	KAN4700
	GO TO 48	KAN4710
50	IF (IST.GE.0) GO TO 51	KAN4720
	IST=IST+60	KAN4730
	IMT=IMT-1	KAN4740
	GO TO 50	KAN4750
51	IF (IMT.GE.0) GO TO 52	KAN4760
	IMT=IMT+60	KAN4770
	IDT=IDT-1	KAN4780

	GO TO 51	KAN4790
52	IF (ISR.LT.60) GO TO 53	KAN4800
	ISR=ISR-60	KAN4810
	IMR=IMR+1	KAN4820
	GO TO 52	KAN4830
53	IF (IMR.LT.60) GO TO 54	KAN4840
	IMR=IMR-60	KAN4850
	IDR=IDR+1	KAN4860
	GO TO 53	KAN4870
C	-----	KAN4880
C		KAN4890
C	DETERMINE THE NUMBER OF WELLS AT ONE LOCATION.	KAN4900
C	-----	KAN4910
C		KAN4920
C		KAN4930
54	INO=1	KAN4940
C		KAN4950
	IMT=FLOAT(IMT)+.1	KAN5020
	IST=FLOAT(IST)+.1	KAN5030
	IMR=FLOAT(IMR)+.1	KAN5040
	ISR=FLOAT(ISR)+.1	KAN5050
	IF (L3.EQ.3.OR.L3.EQ.4.OR.L3.EQ.5) INO=L3-1	KAN5060
	IF (L4.GE.3.AND.L4.LE.5) INO=L4-1	KAN5070
	KOUNT=KOUNT+1	KAN5080
	NLNE=NLNE+2	KAN5090
C	-----	KAN5100
C		KAN5110
C		KAN5120
C	WRITE LOCATION IN TOWNSHIP AND RANGE, AND LATITUDE AND LONGITUDE.	KAN5130
C	-----	KAN5140
C		KAN5150
C		KAN5160
C		KAN5170
	WRITE (6,55) (LC(I),I=1,3),LTP,LRG,LWE,LSC,L11,L12,L13,L14,IDT,IMT	KAN5180
	1,IST,IDR,IMR,ISR,INO,KOUNT	KAN5190
55	FORMAT (1X,3A6,1X,2I3,A1,I3,4A1,3X,3I3,3H N,3X,I4,2I3,I4,4H 2,4	KAN5200
	1X,I5)	KAN5210
	WRITE (6,22)	KAN5220
56	IF (NLNE.GE.52) GO TO 10	KAN5230
	GO TO 14	KAN5240
57	CALL EXIT	KAN5250
	END	KAN5260-

CADJUST00	SUBROUTINE ADJUST	ADJ 10
	SUBROUTINE ADJUST (T1,T2,LS,L1,L2,L3,L4,TF)	ADJ 20
C	-----	ADJ 30
C		ADJ 40
C		ADJ 50
C	SUBROUTINE ADJUST--USED TO DETERMINE CORRECTION FACTORS, TO THE	ADJ 60
C	4TH QUARTER, FOR AATDIF (LATITUDE ADJUSTMENT) AND IILT (LONGITUDE	ADJ 70
C	ADJUSTMENT). AATDIF AND IILT ARE READ-IN AS CORRECTIONS AT	ADJ 80
C	TOWNSHIP CORNERS ALONG RANGE CORRECTION LINES. THIS SUBROUTINE	ADJ 90
C	SUBDIVIDES THESE VALUES AND DETERMINES CORRECTIONS AT THE LOCATION	ADJ 100
C	OF THE WELL.	ADJ 110
C	-----	ADJ 120
C		ADJ 130
C		ADJ 140
	DIMENSION N(4)	ADJ 150
	COMMON NA(48)	ADJ 160
	T3=T2-T1	ADJ 170
	IF (T3.EQ.0.) GO TO 9	ADJ 180
	DO 1 I=1,37	ADJ 190
	IF (L1.EQ.NA(I)) N(1)=I	ADJ 200
	IF (L2.EQ.NA(I)) N(2)=I	ADJ 210
	IF (L3.EQ.NA(I)) N(3)=I	ADJ 220
1	IF (L4.EQ.NA(I)) N(4)=I	ADJ 230
	SK=LS	ADJ 240
	IF (SK.LT.1.) GO TO 9	ADJ 250
	DO 2 I=1,3	ADJ 260
	IF (SK.GE.1..AND.SK.LE.6.) GO TO 3	ADJ 270
	SK=SK-6.	ADJ 280
	IF (SK.GE.1..AND.SK.LE.6.) GO TO 4	ADJ 290
2	SK=SK-6.	ADJ 300
	GO TO 9	ADJ 310
3	S1=(6.-(SK-1.))/6.	ADJ 320
	S2=1.-S1	ADJ 330
	GO TO 5	ADJ 340
4	S1=SK/6.	ADJ 350
	S2=1.-S1	ADJ 360
5	SCTL=T1*S1+T2*S2	ADJ 370
	DV=1.	ADJ 380
	DO 7 I=1,4	ADJ 390
	IF (N(I).GE.11.AND.N(I).LE.14) GO TO 6	ADJ 400
	GO TO 8	ADJ 410
6	DV=DV*2.	ADJ 420
	IF (N(I).EQ.11.OR.N(I).EQ.14) GO TO 7	ADJ 430
	SCTL=SCTL+(T3/(6.*DV))	ADJ 440
7	CONTINUE	ADJ 450
8	IF (N(1).GE.11.AND.N(1).LE.14) SCTL=SCTL+(T3/(12.*DV))	ADJ 460
	TF=SCTL	ADJ 470
	GO TO 10	ADJ 480
9	TF=T1	ADJ 490
10	RETURN	ADJ 500
	END	ADJ 510-

Appendix II.--Program control cards

NA ARRAY

0123456789ABCDEFGHIJKLMN0PQRSTUVWXYZ +-.(\*)\*/=, , \$

BONG AND BTSEC ARRAYS, RESPECTIVELY

475	1563	415	1563	175	1563	407	1563	406	1563	410	1563	398	1565	396	1565
409	1564	413	1564	402	1565	388	1565	409	1565	410	1564	404	1565	410	1565
399	1564	430	1564	398	1564	403	1564	414	1563	401	1562	403	1563	410	1563
405	1563	404	1563	404	1563	408	1565	405	1565	405	1566	402	1566	405	1566
405	1566	445	1566	405	1566	400	1567	406	1567	406	1566	408	1564	402	1563
404	1563	406	1561	408	1560	398	1560	403	1563	397	1562	406	1563	405	1562
402	1562	373	1562	403	1563	404	1564	404	1564	404	1564	400	1563	405	1564
403	1564	402	1564	406	1565	405	1565	402	1565	405	1565	407	1565	405	1564
406	1564	402	1565	404	1566	278	1574	398	1574	410	1574	410	1574	410	1573
402	1573	398	1570	408	1570	399	1571	405	1572	398	1572	404	1571	402	1570
403	1571	402	1570	404	1570	404	1570	450	1569	391	1568	402	1567	400	1566
414	1567	401	1564	400	1563	401	1565	398	1568	400	1568	410	1567	402	1567
400	1566	403	1566	402	1566	400	1566	402	1566	404	1566	397	1565	403	1565
407	1565	399	1566	398	1568	403	1568	405	1567	401	1568	400	1568	398	1567
405	1565	405	1565	398	1566	412	1566	392	1566	409	1565	401	1565	398	1565
411	1565	402	1565	391	1565	402	1565	400	1564	403	1562	403	1560	403	1561
404	1561	404	1561	401	1565	398	1566	402	1567	400	1567	390	1563	389	1563
398	1563	397	1562	409	1562	399	1562	399	1563	400	1562	399	1562	401	1562
397	1562	403	1562	399	1563	400	1563	399	1564	400	1564	397	1565	478	1566
395	1567	387	1568	403	1570	401	1569	402	1572	402	1574	400	1572	401	1570
402	1570	402	1569	401	1569	400	1568	400	1567	398	1567	398	1570	406	1570
394	1569	400	1569	401	1569	400	1569	394	1568	400	1567	400	1567	400	1568
400	1568	400	1568	400	1568	395	1570	400	1568	399	1566	404	1565	396	1563
399	1559	398	1556	399	1556	399	1556	398	1557	399	1557	401	1557	401	1558
399	1560	400	1561	400	1561	399	1561	400	1562	399	1559	401	1558	400	1557
403	1556	401	1555	400	1572	412	1571	397	1571	395	1571	390	1569	402	1568
404	1567	403	1566	404	1565	395	1565	395	1564	398	1563	401	1562	388	1562
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399	1569	397	1569	400	1567	404	1568	397	1569	399	1570	399	1569	398	1569
398	1570	400	1569	398	1569	400	1570	400	1571	400	1572	393	1571	398	1570
398	1572	398	1573	398	1573	391	1573	396	1575	396	1576	396	1574	396	1574
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399	1568	398	1570	397	1568	396	1568	397	1568	385	1569	397	1569	397	1569
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401	1580	390	1590	387	1588	391	1588	400	1586	397	1585	397	1584	396	1583
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404	1606	386	1605	394	1598	391	1592	391	1588	400	1584	390	1580	394	1581
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391 1558	391 1558	391 1556	393 1556	393 1561	393 1568	393 1569	393 1570
393 1572	392 1572	388 1569	392 1566	391 1561	390 1560	391 1562	391 1565
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390 1560	390 1561						

AATDIF ARRAY

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16	16	16	0	0	1	2	3	4	4	5	6	7	8	9	10	11	12	15	19
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26	26	16	6	6	6	6	5	4	3	2	1	1	0	-2	-4	-9	-9	-7	-4
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22																			

IILT ARRAY

C	0	0	0	0	-1	-10	-1	8	1	-11	-5	13	-2	3	2	-4	5	-2	4	8	-15	3	6	-2	-6	1
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0	1	-4	-5	-5	-2	-1	0	0	-4	-3	1	0														19

NORTHEAST CORNERS OF STRIPS 1 THROUGH 7 IN ARRAYS ITTP, IRG, IWE,  
LTD, LTM, LTS, LND, LNM, AND LNS

1	25E	400000	943538
6	25E	393357	943538
11	25E	390743	943453
16	25E	384140	943458
21	25E	381528	943616
26	25E	374910	943652
31	25E	372254	943652

DATA GROUP

538W22ACB	CHEYENNE
542W14CBC	CHEYENNE
5 3W29BB	CLOUD
5 4W 2CCC	CLOUD
5 4W 4AAA	CLOUD
5 4W 7CC	CLOUD
5 4W 9AA	CLOUD
5 4W11DD2	CLOUD
5 4W12BC	CLOUD
5 4W13AA	CLOUD
5 4W19DD	CLOUD
5 4W26BC	CLOUD
5 5W 2DC	CLOUD
8 4W19CB	CLOUD
8 4W30CBC	CLOUD
8 4W31DDD	CLOUD
8 5W 9DDA	CLOUD
8 5W10BBC	CLOUD
8 5W10BCB	CLOUD
8 5W11DCB	CLOUD
8 5W13ADD	CLOUD
8 5W22BAB	CLOUD
8 5W22BDA	CLOUD
8 5W25AA	CLOUD
8 5W26DDD	CLOUD
8 5W27AB	CLOUD

Z CARD

Z

Appendix III.--Program abstract

KANSAS GEOLOGICAL SURVEY COMPUTER PROGRAM  
THE UNIVERSITY OF KANSAS, LAWRENCE

PROGRAM ABSTRACT

Title (If subroutine state in title):

FORTRAN IV Program, KANS, for the Conversion of General Land Office Locations to  
Latitude and Longitude Coordinates

Date: 1965

Author, organization: Charles O. Morgan and Jesse M. McNellis  
U.S. Geological Survey, Water Resources Division

Direct inquiries to: Charles O. Morgan or Jesse M. McNellis

Name: \_\_\_\_\_ Address: U.S.G.S., WRD  
Box 768, Lawrence, Kansas 66044

Purpose/description: To convert General Land Office locations to latitude and longitude  
coordinates.

Mathematical method: See program listing.

Restrictions, range: Boundaries of Kansas

Computer manufacturer: GE, IBM Model: GE 635, IBM 7040, IBM 360/65

Programming language: FORTRAN IV

Memory required: 16 K Approximate running time: \_\_\_\_\_

Special peripheral equipment required: None

Remarks (special compilers or operating systems, required word lengths, number of successful runs, other machine versions, additional information useful for operation or modification of program) \_\_\_\_\_

Version available for North Dakota.

