

A C C E S S

OBTAINING DIGITAL MAP DATA
FROM THE KANSAS CARTOGRAPHIC DATABASE

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Introduction

Collection of digital or "computerized" map data from the U.S. Geological Survey (USGS) series of 7.5-minute "quadrangle" or "topographic" map sheets began at the Kansas Geological Survey (KGS) in the spring of 1981. In the intervening ten years, an ever-changing collection of student employees has labored to "digitize" - convert to computer form - the basic map features from all 1,570 quadrangle maps in the state. (A complete list of available features and coverages within the state is provided in Appendix A).

From this digitized data, a set of 2,379 cartographic databases has been constructed¹ such that each database models (with full topological structure) a "county patch" area. The county patch is defined as the portion of a county which lies within a single USGS quadrangle map area. The county patch areas subdivide the map data into disjoint (non-overlapping) subsets which cover the entire state. More importantly, they segment the vast amount of data into databases of a more workable size. In addition, county patch subdivision provides simple extraction of map data based on county, quadrangle, or county patch inclusion, by restricting the set of databases for feature selection.

The collection of county patch map databases constructed at the KGS, formerly called the Kansas Data Base or KDB, is now known as the "Kansas Cartographic Database" or "KCD". Containing only map data that has been generated locally, the KCD actually consists of more than 2,500 separate map databases and comprises more than 10,000 individual files which combined require in excess of 200 megabytes of disk storage.

Only a single copy of the KCD exists at the KGS, because of the large storage requirements. KCD databases are accessed directly by Automated Cartography staff to add, change, and correct, map features, or to select and retrieve data for analysis, display, and production. Allowing KGS staff to have concurrent access to the KCD for direct extraction of data would seriously complicate operations and software functions.

¹ Computer mapping operations at the KGS are performed with the Geodata Interactive Management Map Analysis and Production or GIMMAP ('jim-'map) system, a software package written in-house to support digital map data collection; map database construction; feature, symbology, and legend creation and editing; reference system conversion (geographic, projected, legal); concatenation of adjacent map areas; network and polygon analysis; intelligent feature retrieval; transfer of digital map data; and point symbol generation, line annotation, and preparation of color separations for publication-quality map products.

To provide (virtually) direct access to all KCD map data without sacrificing the security and integrity of the KCD, a new program² has been written. The ACCESS program makes KCD data available to all KGS users without requiring them to interpret GIMMAP data structures in the binary files of map databases. ACCESS creates a (tape) file containing fixed-length, ASCII records of features from the KCD. The selected features may be restricted to an area ranging from a small part of a single county to the entire state. Users may select the set of features to be included by specifying a list of as many as fifteen feature code ranges (low-high).

The output file is structured (data is grouped) by selected area, and, within map area, features are grouped by feature type. All features are uniquely numbered (within the output file), and the count of features in a group is included at the beginning of the group. The number of points in each line of a group is listed at the beginning of the points describing the path of the line. The output format from the ACCESS program is described completely in "Output (Tape) File Format", below.

² The ACCESS program was actually constructed from routines taken from the MAPGEN program through a process of simplification and modification.

Naming Databases in the KCD

The USGS quadrangle map areas form a matrix or grid covering the state. Individual maps or map areas in this grid may be uniquely identified by various arbitrary schemes. Since it is necessary to refer to quadrangle maps (which have unique names) and county patches uniquely, a system for identifying quadrangle map areas was developed at the Kansas Geological Survey (KGS). Combined with county identifiers, the system identifies each county patch in Kansas with a unique name.

Quadrangle areas are identified uniquely by the combination of a row number and a column number for the position of each map area in the grid covering Kansas. Row and column numbers both begin at one for the quadrangle map³ that contains the southwest corner of Kansas, the map whose southwest corner is at 36.875 degrees of north latitude and 102.125 degrees west longitude. Row numbers increase to the north while column numbers increase to the east. There are twenty-six rows and sixty-one columns covering Kansas, as shown in Fig. 1, below. The Lawrence West quadrangle map, in row 17, column 55, contains the Kansas Geological Survey.

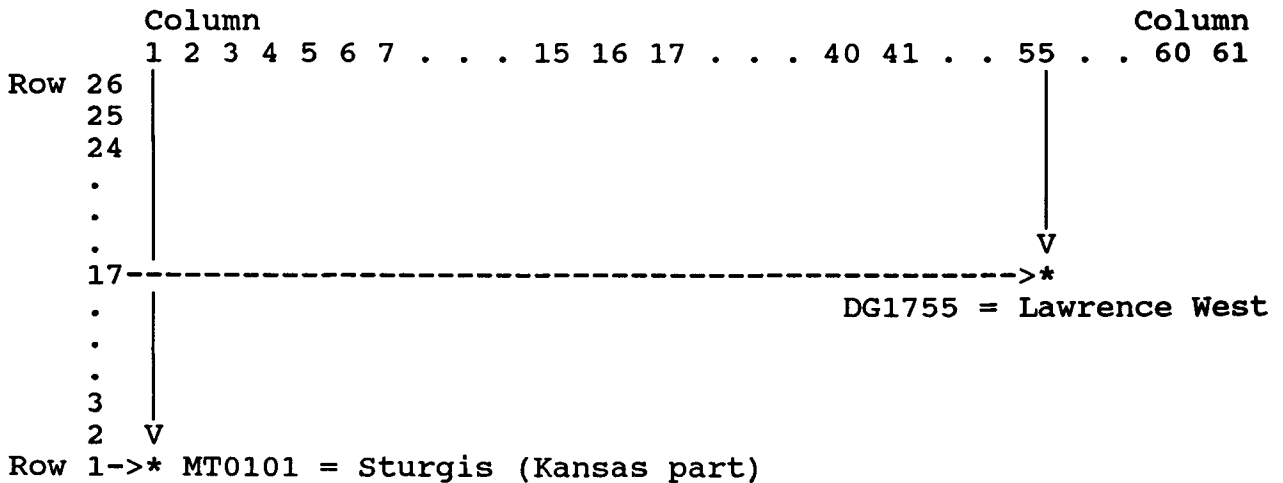


Figure 1: Row and Column Numbers in the Kansas Quadrangle Grid

The boundary lines of the 105 counties in Kansas serve to divide the grid of quadrangle map areas into county patches. Thus, the addition of the (unique) identifier for the county containing a patch, to the row and column numbers of the quadrangle map area in which it lies, completes the unique county patch "base name".

³ The Sturgis 7.5' quadrangle map.

The county identifier in this case is the two-letter abbreviation of the county name, as used on license plates in the state. The name for the county patch containing the Kansas Geological Survey is "DG1755", where DG = Douglas county. Row 17 and column 55 of the Kansas map grid identify the Lawrence West quadrangle, whose southwest corner is at 38.875 degrees north latitude, and 95.375 degrees west longitude. The list of two-letter abbreviations for Kansas counties is provided in Appendix B.

At the KGS, the county patch "base name" is attached to all files containing map data in the county patch area. Appending a single letter to the base name, representing the "layer" or general data type such as B = basic or H = hydrographic, further distinguishes databases by basic data type. This allows multiple databases for an area to exist with a common base name, so that large data sets may be segmented by feature type to promote efficient processing. As an example of base names and layers, the county patch database containing the KGS and other basic features is named "DG1755B".

Files associated with a base are named by appending characters to the base name (+ layer) for the county patch. For example, the "Arc" file, containing line and isolated point features, for the database above would be named "DG1755B_AW", where "A" identifies an Arc file, and "W" indicates a "Working" copy, rather than the (optional) back-up or "S"ave copy. Selection of data with ACCESS is determined by a list of Arc files stored in the Arc filenames file, which may be created by the recipient of the data.

The ACCESS Program

The ACCESS program has been written to increase KGS access to KCD map data. The ACCESS program will be used to create a tape file of ASCII data containing point and arc features, with locations represented in geographic (longitude, latitude) reference. The form of the output file is simple, as described below. However, one characteristic of this form is that the file does not contain the explicit topological relationships that exist in the original GIMMAP databases. These can be reconstructed by the destination system, usually ARC/INFO. ACCESS will be used to generate a tape file containing all KCD features for the state, and may possibly be used to create files with subsets of data by area or type.

The area covered by the output from ACCESS is the union of areas covered by the input, county patch databases. The base names are actually inferred from the Arc filenames for the bases, which are taken from the Arc filenames file. An example, showing the list of Arc files and map of quadrangles covering Douglas county, is shown in Figure 2, below. Each county patch database in the list is opened by ACCESS and searched for arcs that were selected by up to fifteen feature code ranges. Within the group of arcs for a county patch, arcs are further grouped by feature codes so that feature code records appear only once for a given feature within a county patch group.

	Column				
		54	55	56	57
Row					
DG1554B_AW	18				
DG1555B_AW					
DG1556B_AW					
DG1557B_AW					
DG1654B_AW					
DG1655B_AW	17				
DG1656B_AW					
DG1657B_AW					
DG1754B_AW					
DG1755B_AW					
DG1756B_AW	16				
DG1757B_AW					
DG1854B_AW					
DG1855B_AW					
DG1856B_AW	15				

Figure 2: Quads and County Patch Arcfiles for Douglas County

Output (Tape) File Format

All output records from the ACCESS program are a fixed length of ten bytes (10B). There are five classes of records, each having one or two specific record types as defined below. The records for each class must have the specified content and all records must appear in the specified order. Formatting for each record type is shown below the content, with the letter "A" for alphanumeric or character data, and the letter "I" for integer data. The number following the letter (A or I) is the maximum size of, or number of positions reserved for, the value. Leading blanks in integer values are interpreted as zeros.

1. Arcs are grouped by the county patch database of their origin. Each county patch group begins with two records called the county patch records. The first record contains the two-letter county abbreviation for the patch, and the row and column numbers that uniquely locate the quadrangle map containing the patch. The second contains the number of feature code groups for the patch and the total number of arcs taken from the county patch.

The county patch records (one set for each county patch):

- a. county abbreviation , quad row , quad column
(A2) (I4) (I4)
- b. number of feature code groups and arcs in the base
(I4) (I6)

2. Within county patches, arcs are grouped by feature codes. Grouping the arcs for each selected feature code, (isolated points or line arcs), reduces the size of the output file, because the feature code information is included only once within each database group. At the beginning of a feature code group are two feature code records. The first contains the feature code and number of arcs in that code group. The second contains a unique (within this file) "Global" number for the first arc in the group. Thus, the first arc in the file, taken from the first database in the list has a Global number of one. Global numbers are increased by one for each subsequent arc. The maximum Global number is 999,999.

The feature code records (one set for each code group):

- (a) group feature code , # of arcs in the group
(I4) (I6)
- (b) Global # of the first arc in the group
(I10)

3. Following the feature code records for isolated points (arcs with feature codes less than 2000), are isolated point records, one for each isolated point arc in the group. Each isolated point record consists of the location of the point feature in the special form of representation for geographic (longitude and latitude) reference, for ACCESS output, (see explanation in Appendix C).

The isolated point record (one for each arc in the group):

```

longitude , latitude
(I1,I2,I2) (I1,I2,I2) (see format in Appendix C)

```

4. Following the feature code records for a group of line arcs (feature code above 1999), is an arc header record and a set of point records, for each arc in the group. The arc header record contains the number of points defining the arc (maximum of 5,000) and the Global number of the arc (maximum of 999,999). The number of points may be used to control the input of the point records. The set of point records for an arc, consists of (at least) the endpoints of the arc and all interior points, in the proper order to define the arc path. Each point record for a line arc contains the location of a single point, using the special ACCESS form for geographic (longitude and latitude) reference (see Appendix C).

The arc header record (one for each line arc in the group):

```

# of arc points , Global number
(I4) (I6)

```

The point records (one for each interior point in the arc):

```

longitude , latitude (start node)
" , " (first interior point)
" , "
. , .
. , .
. , . (last interior point)
longitude , latitude (end node)
(I1,I2,I2) (I1,I2,I2) (see Appendix C)

```

5. Following the arcs from the last county patch database in the Arc filenames list file, a special record containing all blanks is added to the output file. When this blank record is read by a program, the program will be expecting a county patch record, and thus, a blank county abbreviation will be read along with a row and column number equal to zero. This condition is used to signal the end of the file.

Tape File Characteristics and Content

The tape file for output from ACCESS is created with fixed length records of 10 bytes each. These records are packed into physical blocks of 32,500 bytes on the tape, to minimize wasted space for the inter-record tape gaps by minimizing the number of physical records. Mounting the tape and copying from the tape on the Data General require proper specification of these characteristics.

The tape content will include all requested features, packed in order of the base names specified in the Arc filenames list file, and grouped by database. Features within the database groups are further grouped by arc feature codes. These feature code groups appear in the ACCESS output file in an order that is determined by the order of the features in the Arc file of each base.

Sample output from the ACCESS program is listed in Appendix D for a single county patch database, DG1856B, which contains the basic features from the Douglas county part of the (Midland) quadrangle map, located at row 18 and column 56 of the Kansas grid.

Retrieving and Plotting ACCESS Data

Map features may be extracted from the ACCESS output file on the basis of area or feature type. Since the features are grouped by county patch base, extraction of data from the ACCESS file can be restricted to those patches which lie in the desired counties as indicated by the two-letter county abbreviations in the county patch record at the beginning of each group. Data from unwanted counties may simply be skipped (read and not used) by following the file format rules described in this document.

The county patch records also contain the row and column numbers for the patch. These numbers provide a rough means of extracting data by geographic (longitude and latitude) area, by "windowing" on a geographic rectangle, and ignoring data groups outside the minimum and maximum row and columns of the area. More detailed windowing may be performed by the user's software to "clip" data outside a more refined boundary within the geographic window.

Selection of features by type is supported by the inclusion of the feature code in the first record of each group of arcs of a common feature code. All selected arcs within each county patch database group are in turn grouped according to feature code so that any selected code occurs only one time in the (county patch) group. User software can cause selection of features based on ranges of feature codes to include only those features which are desired, and no others.

The KCD data, provided by the ACCESS program, is referenced in a special form (described in Appendix C) of geographic or longitude and latitude coordinates. Point locations are as accurate as the original KCD data, and are generally the most accurate locations available for Kansas. These features may be used for making maps in which other plot files, generated by the Automated Cartography group, are to be overlaid, provided that the reference systems are compatible. That is, geographic locations must be projected into X-Y space by the same or equivalent software as that used by GIMMAP for map data projection. In addition, if any mathematical transformations such as translation, rotation, or scaling are to be used, they must parallel transformations performed on the data by Automated Cartography, if the plots are to match properly.

APPENDIX A

MAP DATA COVERAGE BY FEATURE CODE

The following sixteen pages contain counts of all features in the KCD that have been digitized and edited, and are available⁴ for use in analysis or mapping. This list is a summary for each of the 105 counties in Kansas (and a summary for the entire state at the end), with features ordered by feature codes (which define the feature type) as used by Automated Cartography at the KGS. A list of feature codes is available.

These listings consist of four columns, each containing a 4-digit feature code, followed by the count of all arcs of that feature code that exist in the county patch databases for that county. Each of the county lists is headed by an entry that contains the two-digit county abbreviation and the county name, which may run over to the next line. The columns of output are ordered from left to right. That is, reading begins with the left-most column from top to bottom, followed by the second column from the left, again from top to bottom, and so on. The first column on a page follows the last column of the previous page.

A list of the counts of all features from the KCD, county patch databases exists, and may be examined upon request. It is also possible to create additional copies of this report. All of the features represented by these counts, that is, all map features in the KCD, may be extracted and made available for use via the ACCESS program.

Note: For the most part, these features will be accurately located and should correctly model the USGS quadrangle map source documents. However, map data compiled by humans, no matter by what technology, are far from perfect. Omissions and errors of various kinds are expected to be found⁵.

⁴ The counts and the features they represent are accurate as of the writing of this report, July of 1991.

⁵ When errors are found by users of the ACCESS program, they should be reported so that the affected features in the databases as well as the erroneous data in the affected files from ACCESS can be corrected.

AL = Allen

FC	Count
1111	555
1112	20
1211	1
1243	1
2111	82
2112	28
2212	15
2219	12
2223	5
2259	5
2269	8
2293	2
2310	35
2320	13
2410	369
2411	83
2420	158
2421	1978
4110	266
4120	279
4121	3777
4140	15
4141	523
4320	191
4330	21
4364	1

AN = Anderson

FC	Count
1111	630
1112	20
1210	9
1243	1
2111	43
2112	33
2141	1
2181	267
2212	17
2219	13
2222	1
2223	14
2262	1
2263	1
2269	6
2282	2
2310	32
2320	13
2410	607
2411	23

2420	290
2421	1986
4110	434
4111	54
4121	4830
4141	285
4320	214
4330	21
4364	5

AT = Atchison

FC	Count
1111	482
1112	20
1211	7
1212	1
1222	1
1263	1
2111	48
2112	35
2212	7
2213	3
2219	16
2222	3
2223	13
2229	3
2289	3
2293	2
2310	22
2320	19
2410	72
2420	16
4110	34
4120	5
4241	1
4310	8
4320	71
4330	18
4342	1
4366	4

BA = Barber

FC	Count
1111	1200
1112	53
1233	1
2111	93
2112	99
2212	16
2219	3

2223	10
2263	1
2310	42
2320	19
2410	60
2420	207
4110	66
4310	30
4320	82
4330	38
4363	1

BB = Bourbon

FC	Count
1111	704
1112	24
1210	1
1243	1
2111	41
2112	32
2141	141
2181	23
2212	14
2219	12
2223	34
2262	1
2263	4
2269	5
2310	31
2320	15
2410	258
2411	39
2420	90
2421	1974
4110	454
4120	5
4121	4500
4141	266
4150	2
4230	1
4310	54
4320	212
4330	40
4364	1

BR = Brown

FC	Count
1111	601
1112	25
1243	1

2111	45
2112	51
2212	22
2219	3
2222	2
2223	5
2293	1
2310	29
2320	13
2410	87
2420	24
4110	10
4120	6
4310	11
4320	53
4330	21
4364	1

BT = Barton

FC	Count
1111	925
1112	36
1253	1
2111	64
2112	48
2212	32
2213	7
2219	8
2223	25
2224	5
2234	157
2244	109
2262	8
2287	4
2310	51
2320	27
2410	35
2420	151
2421	5
2430	4
4110	16
4120	4
4130	2
4140	4
4150	8
4320	30
4330	24
4355	12
4356	5
4365	4
4373	15
4376	9

BU = Butler

FC	Count
1111	1438
1112	54
1210	37
1253	1
2111	223
2112	142
2181	445
2212	14
2213	1
2219	4
2223	25
2261	11
2262	1
2263	5
2271	18
2273	3
2282	6
2289	9
2310	64
2320	46
2410	1099
2411	139
2420	531
2421	5877
4110	393
4120	499
4121	6369
4140	52
4141	129
4320	336
4330	37
4365	2
9999	1

CA = Clark

FC	Count
1111	1037
1112	48
1233	1
1999	1
2111	96
2112	154
2212	29
2219	2
2223	4
2310	12
2320	6
2410	67
2420	159
3180	307

3185	3
3190	195
3195	6
3200	198
3205	14
3210	124
3215	2
3220	135
3225	5
3230	170
3235	3
3240	84
3250	57
3260	5
4110	21
4120	201
4140	63
4150	2
4310	29
4320	164
4330	23
4340	1
4341	1
4353	2
4363	1
4374	2

CD = Cloud

FC	Count
1111	763
1112	35
1211	1
1243	1
2111	97
2112	62
2212	16
2213	3
2223	13
2263	2
2293	2
2310	43
2320	18
2330	4
2410	253
2420	512
4110	307
4120	76
4320	101
4330	25
4364	1

CF = Coffey

FC	Count
1111	701
1112	24
1200	16
1233	1
2111	84
2112	32
2141	3
2212	6
2213	3
2219	1
2223	4
2266	12
2282	10
2286	20
2293	3
2310	14
2320	7
2410	441
2411	216
2420	143
2421	2031
2450	3
4110	74
4111	188
4121	5416
4131	3
4141	298
4145	147
4150	91
4151	7
4320	194
4330	16
4363	2

CK = Cherokee

FC	Count
1111	625
1112	25
1243	1
2111	36
2112	33
2212	70
2213	11
2219	9
2223	14
2262	3
2269	2
2289	3
2293	2
2310	128
2320	55
2410	232

2411	116
2420	154
2421	1704
4110	261
4120	95
4121	5509
4141	78
4310	99
4320	125
4330	20
4364	1

CL = Cowley

FC	Count
1111	1139
1112	48
1252	1
1253	1
2111	89
2112	87
2212	20
2219	7
2223	12
2263	1
2272	1
2282	10
2293	3
2310	77
2320	38
2410	300
2420	131
2421	1
4110	508
4120	435
4121	2
4310	25
4320	88
4330	30
4345	1
4365	6

CM = Comanche

FC	Count
1111	833
1112	35
1223	1
2111	48
2112	54
2212	15
2223	4

2262 2
 2310 10
 2320 4
 2410 93
 2420 107
 4110 13
 4120 4
 4310 7
 4320 26
 4330 26
 4362 1

CN = Cheyenne

FC	Count
1111	1075
1112	36
1233	1
2111	55
2112	59
2212	11
2223	13
2310	8
2320	4
2410	15
2420	92
4110	31
4310	20
4320	23
4330	205
4354	25
4363	1

CQ = Chautauqua

FC	Count
1111	679
1112	25
1210	12
1233	1
2111	104
2112	36
2181	255
2212	9
2213	3
2219	2
2223	4
2293	2
2310	15
2320	9
2410	386
2411	4

2420 425
 2421 2025
 4110 549
 4120 29
 4121 3587
 4310 61
 4320 144
 4330 25
 4363 4

CR = Crawford

FC	Count
1111	640
1112	24
1233	1
1252	1
2111	42
2112	32
2181	62
2212	60
2213	8
2219	7
2222	1
2223	36
2262	4
2263	8
2272	2
2279	8
2282	4
2289	4
2310	94
2320	49
2410	82
2411	37
2420	68
2421	1981
4110	28
4120	1
4121	3875
4141	8
4310	43
4320	259
4330	44
4345	1
4363	2

CS = Chase

FC	Count
1111	782
1112	34

1223 1
 2111 77
 2112 59
 2212 6
 2213 1
 2219 4
 2223 10
 2263 3
 2271 6
 2281 2
 2310 16
 2320 16
 2410 285
 2411 32
 2420 71
 2421 35
 4110 486
 4120 79
 4320 79
 4330 25
 4362 2

CY = Clay

FC	Count
1111	689
1112	24
1211	1
1243	1
2111	63
2112	43
2212	5
2213	3
2223	14
2293	2
2310	16
2320	6
2410	279
2420	325
4110	247
4120	76
4140	2
4145	8
4150	32
4151	7
4320	76
4330	16
4364	4

DC = Decatur

FC	Count
----	-------

1111 925
 1112 36
 1233 1
 2111 72
 2112 79
 2152 2
 2212 21
 2223 8
 2310 15
 2320 4
 2410 34
 2420 366
 4110 4
 4120 115
 4140 12
 4310 14
 4320 83
 4330 25
 4341 9
 4354 29
 4363 1

DG = Douglas

FC	Count
1111	474
1112	14
1114	32
1210	16
1211	1
1273	1
1520	4
1560	6
2111	48
2112	31
2113	1
2115	3
2120	6
2154	1
2181	249
2212	41
2213	3
2223	4
2224	4
2244	4
2261	24
2262	2
2271	15
2272	3
2282	2
2283	3
2310	18
2320	12
2350	1
2360	3
2410	247

2411 113
 2420 61
 2421 1259
 2430 4
 2450 2
 2460 1
 2511 10
 2512 5
 3090 7
 3100 6
 4110 97
 4120 67
 4121 2373
 4141 7
 4150 1
 4320 211
 4330 15
 4360 1
 4367 2

2112 33
 2115 2
 2212 10
 2219 2
 2223 13
 2293 2
 2310 14
 2320 10
 2410 47
 2420 21
 4110 60
 4120 6
 4310 32
 4320 31
 4330 18
 4363 1

2223 3
 2310 18
 2320 5
 2410 396
 2411 10
 2420 433
 2421 2493
 2450 22
 4110 413
 4111 53
 4121 4314
 4141 24
 4320 229
 4330 19
 4362 1

2212 5
 2213 9
 2223 25
 2263 1
 2266 23
 2286 32
 2293 3
 2310 28
 2320 14
 2410 26
 2420 92
 4110 12
 4120 12
 4320 21
 4330 16
 4363 1

 EL = Ellis

 ED = Edwards

 FI = Finney

 DK = Dickison

FC Count
 1111 894
 1112 36
 1243 1
 2111 53
 2112 53
 2212 13
 2213 20
 2222 5
 2223 15
 2266 15
 2286 30
 2293 9
 2310 58
 2320 31
 2410 102
 2420 67
 4110 30
 4120 4
 4320 28
 4330 26
 4364 1

FC Count
 1111 665
 1112 34
 1233 1
 2111 48
 2112 36
 2212 21
 2223 1
 2262 1
 2310 10
 2320 8
 2410 14
 2420 31
 4110 22
 4320 28
 4330 21
 4355 6
 4363 1
 4373 7

FC Count
 1111 925
 1112 36
 1253 1
 2111 178
 2112 120
 2212 14
 2266 22
 2286 36
 2293 5
 2310 14
 2320 7
 2410 393
 2411 5
 2420 614
 2421 3353
 4110 372
 4120 891
 4121 471
 4140 710
 4141 65
 4320 225
 4330 26
 4365 2

FC Count
 1111 1350
 1112 56
 1114 50
 1210 13
 1253 1
 2111 138
 2112 108
 2181 173
 2212 33
 2213 14
 2262 6
 2310 28
 2320 17
 2410 86
 2411 37
 2420 327
 2421 877
 2430 6
 2460 5
 4110 23
 4120 2
 4121 185
 4140 2
 4141 1022
 4150 108
 4230 2
 4320 133
 4330 39
 4353 29
 4365 5

 EK = Elk

 EW = Ellsworth

 DP = Doniphan

FC Count
 1111 415
 1112 16
 1233 1
 2111 37

FC Count
 1111 708
 1112 24
 1210 9
 1223 1
 2111 104
 2112 30
 2181 267
 2213 1
 2219 1
 2222 9

FC Count
 1111 770
 1112 36
 1222 1
 1233 1
 2111 48
 2112 34

 FO = Ford

FC	Count
1111	1145
1112	51
1253	1
2111	75
2112	64
2212	48
2213	3
2219	1
2223	2
2262	3
2282	4
2310	31
2320	20
2410	27
2420	180
4110	14
4120	2
4320	37
4330	30
4353	13
4365	5
4373	4
4374	4
7777	2
9999	1

FR = Franklin

FC	Count
1111	630
1112	20
1253	1
1520	3
1560	4
2111	42
2112	28
2113	57
2120	6
2181	20
2212	8
2223	23
2229	1
2263	2
2266	16
2282	14
2286	36
2310	30
2320	29
2410	177
2411	41
2420	78
2421	1781
4110	155
4120	3

4121	4267
4141	53
4320	299
4330	27
4342	1
4365	7
7777	4
9999	1

GE = Geary

FC	Count
1111	409
1112	15
1121	24
1232	1
1253	1
2111	56
2112	34
2113	128
2115	3
2141	33
2142	49
2143	27
2212	13
2213	2
2219	6
2222	3
2223	28
2229	2
2263	8
2266	27
2269	4
2273	1
2279	3
2286	48
2289	2
2293	3
2310	7
2320	5
2410	82
2420	16
4110	161
4120	27
4320	114
4330	19
4343	1
4365	1

GH = Graham

FC	Count
----	-------

1111	927
1112	36
1233	1
2111	86
2112	92
2212	27
2223	3
2234	45
2293	2
2310	7
2410	133
2411	1
2420	494
2421	21
4110	10
4120	97
4121	72
4140	49
4141	19
4320	99
4330	24
4341	2
4354	53
4362	1
4363	1

GL = Greel
ey

FC	Count
1111	807
1112	30
1223	1
2111	56
2112	40
2213	12
2310	6
2420	59
4310	4
4320	47
4330	113
4351	6
4362	2

GO = Gove

FC	Count
1111	1105
1112	42
1213	1
2111	75
2112	68
2152	3

2212	4
2213	5
2223	10
2266	26
2281	4
2286	44
2293	16
2310	13
2320	4
2410	32
2420	169
4320	68
4330	195
4341	9
4354	35
4360	1
4361	1

GT = Grant

FC	Count
1111	600
1112	25
1243	1
2111	45
2112	41
2212	7
2213	2
2219	2
2223	2
2310	13
2320	10
2420	29
4120	7
4140	6
4320	43
4330	90
4364	1

GW = Green
wood

FC	Count
1111	1216
1112	38
1243	1
1430	2
2111	100
2112	66
2113	18
2181	94
2212	7
2213	13

2219 1
 2223 13
 2224 2
 2234 8
 2244 41
 2263 4
 2310 52
 2320 15
 2410 469
 2411 146
 2420 151
 2421 4644
 4110 860
 4120 179
 4121 6839
 4140 7
 4141 587
 4150 32
 4320 360
 4330 65
 4364 1

 GY = Gray

FC Count
 1111 910
 1112 40
 1233 1
 2111 61
 2112 56
 2212 15
 2213 8
 2223 2
 2310 19
 2320 11
 2410 6
 2420 58
 4120 1
 4140 7
 4320 39
 4330 31
 4363 1

 HG = Hodge
 man

FC Count
 1111 890
 1112 35
 1223 1
 2111 58
 2112 47
 2212 20

2262 4
 2310 8
 2320 4
 2410 42
 2420 121
 4110 11
 4130 2
 4320 32
 4330 24
 4353 21
 4362 1

 HM = Hamil
 ton

FC Count
 1111 1061
 1112 47
 1233 1
 2111 79
 2112 62
 2212 7
 2213 4
 2219 4
 2310 8
 2320 5
 2410 15
 2420 119
 4110 102
 4120 70
 4140 69
 4310 21
 4320 47
 4330 88
 4353 20
 4363 4

 HP = Harpe
 r

FC Count
 1111 832
 1112 36
 1233 1
 2111 59
 2112 83
 2212 6
 2213 4
 2219 4
 2222 3
 2223 13
 2293 1
 2310 39
 2320 22

2410 50
 2420 240
 2421 22
 4110 31
 4120 157
 4121 20
 4140 54
 4141 8
 4310 20
 4320 70
 4330 25
 4363 1

 HS = Haske
 ll

FC Count
 1111 600
 1112 25
 1120 30
 1233 1
 1310 212
 1320 5
 1330 351
 1510 1
 1520 1
 1530 1
 1541 3
 1560 3
 2111 39
 2112 36
 2120 3
 2212 63
 2214 2
 2219 2
 2223 17
 2224 3
 2234 504
 2310 14
 2320 5
 2360 2
 2420 2
 2511 3
 2520 20
 3280 1
 3290 17
 3300 20
 4120 15
 4140 62
 4320 36
 4330 163
 4340 2
 4363 1

 HV = Harve

Y
 FC Count
 1111 567
 1112 24
 1253 1
 2111 69
 2112 59
 2212 9
 2213 10
 2262 10
 2266 10
 2267 6
 2282 11
 2286 26
 2287 15
 2293 5
 2310 28
 2320 29
 2410 103
 2411 10
 2420 47
 2421 12
 4110 9
 4120 117
 4121 18
 4141 2
 4320 91
 4330 15
 4352 3
 4365 1
 **** 1

 JA = Jacks
 on

FC Count
 1111 699
 1112 28
 1211 1
 1243 1
 2111 73
 2112 51
 2212 8
 2213 6
 2223 15
 2293 2
 2310 18
 2320 7
 2410 130
 2420 37
 4110 6
 4120 3
 4320 88
 4330 24
 4364 2

 JF = Jeffe
 rson

FC	Count
1111	584
1112	21
1114	57
1115	18
1223	1
2111	44
2112	32
2115	6
2146	3
2212	10
2213	3
2219	4
2223	27
2262	1
2263	1
2282	2
2283	2
2289	2
2293	2
2310	8
2320	6
2410	80
2420	32
4110	24
4120	35
4320	86
4330	18
4362	1

 JO = Johns
 on

FC	Count
1111	516
1112	18
1263	1
2111	58
2112	27
2212	10
2213	44
2219	8
2223	4
2253	15
2261	26
2262	24
2263	38
2266	47
2269	14
2271	2

2272	17
2273	16
2276	6
2279	11
2281	40
2282	53
2283	40
2286	79
2289	2
2310	37
2320	31
2410	83
2411	46
2420	60
2421	585
4110	52
4120	11
4121	1271
4310	82
4320	230
4330	34
4341	1
4342	16
4343	4
4344	20
4345	17
4346	12
4366	4

 JW = Jewel
 l

FC	Count
1111	925
1112	36
1233	1
2111	70
2112	76
2212	7
2213	4
2219	4
2223	18
2293	2
2310	40
2320	13
2410	226
2420	805
2430	2
4110	100
4120	185
4140	79
4150	43
4310	30
4320	71
4330	32
4363	1

 KE = Kearn
 y

FC	Count
1111	911
1112	40
1233	1
2111	64
2112	71
2212	7
2213	7
2310	5
2320	4
2410	29
2420	64
2421	1
4110	31
4120	7
4130	3
4140	61
4141	1
4320	58
4330	73
4353	13
4363	4

 KM = Kingm
 an

FC	Count
1111	891
1112	35
1211	1
1243	1
2111	85
2112	67
2212	3
2213	8
2219	3
2223	8
2262	6
2272	1
2282	8
2289	2
2310	52
2320	26
2410	132
2420	120
4110	522
4120	238
4140	8
4150	1
4210	1
4320	89

 4330 18
 4360 2
 4364 2
 7777 1

 KW = Kiowa

FC	Count
1111	754
1112	30
1233	1
2111	48
2112	34
2212	18
2310	17
2320	11
2410	33
2420	87
4320	25
4330	15
4355	11
4363	1
4373	4
4374	8

 LA = Labet
 te

FC	Count
1111	679
1112	24
1210	6
1211	3
1220	2
1230	1
1233	1
1240	2
1252	1
2111	86
2112	43
2181	265
2212	31
2213	1
2219	4
2223	7
2263	1
2272	2
2293	3
2310	94
2320	44
2410	256
2411	9
2420	317

2421 3087
2430 13
2431 2
2450 1
4110 283
4120 25
4121 5637
4130 2
4140 4
4141 48
4150 2
4310 28
4320 211
4330 26
4345 1
4363 2
9999 5

LC = Lincoln

FC Count
1111 769
1112 36
1233 1
2111 51
2112 42
2213 5
2223 18
2286 6
2293 3
2310 34
2320 13
2410 57
2420 94
4110 63
4120 2
4320 21
4330 20
4363 1

LE = Lane

FC Count
1111 745
1112 30
1233 1
2111 53
2112 40
2213 19
2223 2
2310 18
2320 8

2410 7
2420 70
4320 28
4330 20
4351 10
4363 1

LG = Logan

FC Count

1111 1105
1112 42
1233 1
2111 71
2112 63
2212 23
2213 8
2219 2
2223 2
2224 1
2272 1
2281 4
2310 13
2320 6
2410 15
2420 146
4140 2
4320 68
4330 198
4341 3
4354 19
4363 4

LN = Linn

FC Count

1111 667
1112 24
1211 1
1223 1
2111 41
2112 32
2212 10
2219 2
2223 29
2262 5
2310 16
2320 8
2410 128
2411 3
2420 29
2421 341

4110 21
4120 141
4121 968
4141 50
4310 16
4320 93
4330 23
4362 1

LV = Leavenworth

FC Count

1111 514
1112 17
1210 18
1242 1
1263 1
2111 32
2112 52
2142 8
2181 199
2212 4
2213 1
2219 9
2223 17
2271 6
2272 1
2279 1
2281 2
2289 3
2293 5
2310 24
2320 15
2330 1
2410 342
2411 193
2420 30
2421 1656
4110 55
4120 12
4121 4264
4141 46
4310 15
4320 162
4330 20
4340 6
4344 5
4366 5

LY = Lyon

FC Count

1111 925
1112 36
1263 1
1300 39
2111 68
2112 67
2212 12
2213 8
2219 7
2223 15
2261 27
2262 4
2263 2
2266 14
2271 23
2281 28
2286 14
2293 7
2310 22
2320 28
2410 103
2420 55
4110 72
4120 1
4320 102
4330 22
4366 1

MC = Mitchell

FC Count

1111 745
1112 30
1243 1
2111 78
2112 73
2212 4
2219 8
2223 17
2293 3
2310 27
2320 12
2410 59
2420 120
4110 36
4120 22
4320 96
4330 20
4364 2

ME = Meade

FC Count

1111 1030
 1112 48
 1233 1
 2111 89
 2112 66
 2212 14
 2222 2
 2223 9
 2310 13
 2320 7
 2410 16
 2420 74
 4110 20
 4120 1
 4310 15
 4320 60
 4330 24
 4353 13
 4363 1

 MG = Montg
 omery

FC Count
 1111 676
 1112 24
 1242 1
 1253 1
 2111 88
 2112 35
 2212 47
 2213 4
 2219 8
 2222 1
 2223 4
 2262 14
 2263 3
 2269 3
 2272 1
 2282 3
 2289 7
 2293 1
 2310 57
 2320 42
 2410 328
 2411 29
 2420 297
 2421 1929
 4110 195
 4120 96
 4121 4479
 4141 35
 4310 49
 4320 167
 4330 22
 4344 2

4365 1

 MI = Miami

FC Count
 1111 651
 1112 24
 1243 1
 2111 41
 2112 28
 2212 6
 2219 14
 2223 11
 2263 1
 2269 8
 2283 3
 2286 2
 2310 30
 2320 25
 2410 53
 2411 50
 2420 38
 2421 1792
 2450 1
 4110 36
 4120 8
 4121 3337
 4141 1
 4150 12
 4310 44
 4320 183
 4330 31
 4364 4

 MN = Mario
 n

FC Count
 1010 14
 1020 12
 1111 1005
 1112 40
 1211 2
 1233 1
 2111 180
 2112 102
 2212 26
 2213 5
 2219 5
 2222 31
 2223 59
 2262 1
 2310 32

2320 22
 2410 569
 2411 132
 2420 311
 2421 2718
 4110 92
 4120 265
 4121 1092
 4140 16
 4141 114
 4150 10
 4320 235
 4330 25
 4341 10
 4342 3
 4343 2
 4360 1

 MP = McPhe
 rson

FC Count
 1111 949
 1112 41
 1253 1
 2111 70
 2112 49
 2212 14
 2213 13
 2219 1
 2222 3
 2223 8
 2263 15
 2266 34
 2282 12
 2283 6
 2286 42
 2289 12
 2293 2
 2310 46
 2320 27
 2410 63
 2420 104
 4110 29
 4120 6
 4320 31
 4330 50
 4352 10
 4365 4

 MR = Morri
 s

FC Count

1111 719
 1112 30
 1233 1
 2111 51
 2112 34
 2212 14
 2213 8
 2219 1
 2223 11
 2293 1
 2310 21
 2320 12
 2410 85
 2420 60
 2421 2
 4110 22
 4120 17
 4320 30
 4330 17
 4363 2

 MS = Marsh
 all

FC Count
 1111 925
 1112 36
 1211 2
 1243 1
 2111 62
 2112 86
 2154 1
 2212 21
 2213 2
 2219 2
 2223 23
 2262 1
 2282 4
 2293 2
 2310 47
 2320 14
 2410 739
 2420 300
 4110 360
 4120 85
 4130 1
 4140 2
 4310 29
 4320 79
 4330 31
 4364 1

 MT = Morto
 n

FC	Count
1111	781
1112	30
1210	1
1211	1
1230	1
1233	1
2111	48
2112	36
2212	10
2213	18
2219	3
2263	2
2310	7
2320	3
2420	124
2421	267
4121	25
4140	20
4141	159
4310	37
4320	25
4330	111
4341	1
4343	2
4353	36
4363	2

 NM = Nemaha

FC	Count
1111	745
1112	30
1233	1
2111	48
2112	72
2212	11
2219	1
2223	20
2293	5
2310	17
2320	8
2410	690
2420	115
4110	23
4120	23
4310	15
4320	64
4330	24
4363	1

 NO = Neoshoo

FC	Count
1111	605
1112	20
1233	1
1252	1
2111	69
2112	24
2212	8
2213	1
2219	13
2223	16
2263	1
2269	1
2272	2
2273	2
2293	3
2310	39
2320	13
2410	78
2411	95
2420	36
2421	2271
4110	40
4111	27
4120	21
4121	4662
4141	41
4320	276
4330	31
4345	1
4363	2

 NS = Ness

FC	Count
1111	1108
1112	42
1233	1
2111	173
2112	129
2212	5
2222	1
2223	16
2310	22
2320	10
2410	159
2411	1
2420	937
2421	2864
4120	93
4121	412
4140	305
4141	1047
4210	1

4320	218
4330	24
4363	1

NT = Norton

FC	Count
1111	925
1112	36
1243	1
2111	50
2112	82
2212	25
2219	3
2222	2
2223	11
2262	1
2293	3
2310	23
2320	11
2410	173
2420	505
2421	4
2520	2
4120	114
4140	50
4150	24
4310	19
4320	60
4330	25
4341	9
4354	1
4364	1

OB = Osborne

FC	Count
1111	925
1112	36
1233	1
2111	101
2112	84
2212	10
2213	6
2219	7
2223	3
2262	2
2310	30
2320	13
2410	76
2420	102
4110	28

4120	5
4320	113
4330	27
4363	1

OS = Osage

FC	Count
1111	770
1112	28
1212	1
1233	1
1500	226
1520	1
1560	8
2111	104
2112	32
2113	159
2115	19
2120	20
2130	1
2150	1
2212	30
2213	6
2214	8
2219	6
2223	18
2234	88
2244	29
2262	9
2263	6
2266	6
2269	6
2271	4
2282	12
2286	10
2293	2
2310	46
2320	29
2410	471
2411	99
2420	184
2421	2656
2500	3
4110	148
4111	6
4120	155
4121	1910
4141	29
4150	37
4320	157
4330	16
4341	2
4342	3
4343	8
4360	1

5000 109
5001 1
9002 1

4310 71
4320 161
4330 31
4364 2

4355 13
4364 2
4373 4

4363 1

RC = Rice

OT = Ottawa
a

PN = Pawne
e

PT = Potta
watomie

FC Count

FC Count
1111 757
1112 33
1211 1
1233 1
2111 53
2112 43
2212 5
2213 9
2223 3
2286 7
2293 4
2310 41
2320 15
2410 52
2420 111
4110 98
4120 5
4320 31
4330 24
4363 2

FC Count
1111 810
1112 38
1211 3
1212 2
1243 1
2111 59
2112 41
2212 23
2213 2
2223 3
2262 1
2293 2
2310 17
2320 8
2410 22
2420 113
4110 32
4320 35
4330 38
4341 3
4355 11
4364 1
4373 3

FC Count
1111 850
1112 24
1223 1
2111 78
2112 41
2212 6
2213 12
2223 25
2272 2
2310 17
2320 15
2410 295
2420 142
2421 3
4110 215
4120 120
4121 5
4320 230
4330 25
4362 1
4366 2

1111 775
1112 36
1243 1
2111 53
2112 42
2212 5
2213 11
2219 4
2293 2
2310 60
2320 20
2410 36
2420 74
4110 19
4320 30
4330 21
4355 9
4364 1
4373 3

RH = Rush

PL = Phillip
s

PR = Pratt

RA = Rawli
ns

FC Count

FC Count
1111 930
1112 36
1210 10
1243 1
2000 1
2111 113
2112 124
2141 1
2181 308
2212 23
2223 7
2293 1
2310 23
2320 9
2410 200
2420 731
2421 3565
4110 2
4120 22
4121 2359
4141 2147

FC Count
1111 746
1112 30
1113 11
1243 1
2111 70
2112 57
2212 19
2213 5
2223 5
2310 33
2320 15
2410 14
2420 48
2450 2
4110 9
4320 69
4330 24

FC Count
1111 1105
1112 42
1233 1
2111 66
2112 84
2212 10
2213 2
2223 8
2310 12
2320 5
2410 47
2420 360
4120 54
4140 36
4150 1
4310 22
4320 52
4330 131
4341 2
4354 28

1111 746
1112 30
1233 1
2111 50
2112 45
2212 2
2222 4
2223 13
2310 19
2320 10
2410 35
2420 155
4110 3
4320 28
4330 20
4355 1
4363 1
4373 1
4376 1
9999 1

RL = Riley

FC	Count
1111	647
1112	24
1115	20
1210	8
1211	2
1263	1
2111	128
2112	45
2113	47
2115	3
2141	32
2142	46
2181	373
2212	11
2213	1
2219	11
2223	21
2263	8
2273	13
2279	2
2283	4
2286	4
2310	17
2320	9
2410	393
2411	747
2420	161
2421	1355
4110	227
4120	116
4121	2094
4320	312
4330	23
4360	1
4366	2
9999	1

RN = Reno	
FC	Count
1111	1317
1112	56
1232	1
1263	1
2001	7
2111	122
2112	107
2212	9
2213	22
2219	1
2223	16
2230	15

2240	3
2263	4
2269	4
2282	2
2289	17
2310	75
2320	59
2410	134
2411	1
2420	89
2421	3
4110	140
4120	146
4121	1
4141	20
4150	20
4320	131
4330	35
4343	1
4352	7
4355	19
4366	1
4373	3

RO = Rooks	
FC	Count
1111	928
1112	36
1233	1
2111	94
2112	85
2212	17
2223	7
2262	5
2293	2
2310	15
2320	8
2410	106
2420	161
4110	38
4120	3
4150	7
4320	111
4330	39
4363	1

RP = Republic	
FC	Count
1111	745
1112	30

1211	1
1233	1
2111	66
2112	72
2212	33
2223	7
2262	17
2293	4
2310	45
2320	19
2410	291
2420	570
2430	45
4110	275
4120	128
4140	18
4310	27
4320	81
4330	24
4363	2

RS = Russe	
11	
FC	Count
1111	925
1112	36
1243	1
2111	62
2112	54
2212	16
2213	4
2219	2
2223	10
2263	1
2266	23
2286	35
2293	6
2310	26
2320	10
2410	77
2420	78
4110	31
4150	16
4320	36
4330	51
4364	1

SA = Saline	
FC	Count
1111	765
1112	35

1263	1
2111	56
2112	43
2212	4
2213	6
2219	3
2223	7
2262	6
2266	31
2267	3
2269	6
2282	12
2286	63
2287	7
2310	73
2320	41
2410	45
2420	78
4110	86
4320	35
4330	26
4366	2

SC = Scott	
FC	Count
1111	745
1112	30
1243	1
2111	52
2112	40
2212	9
2213	9
2223	3
2310	17
2320	10
2410	1
2420	35
4120	3
4140	2
4320	43
4330	21
4351	10
4364	1

SD = Sheridan	
FC	Count
1111	925
1112	36
1223	1
2111	91

2112 79
 2152 4
 2212 20
 2223 18
 2262 2
 2293 4
 2310 9
 2320 1
 2410 34
 2411 7
 2420 296
 2421 21
 4120 78
 4140 4
 4141 85
 4320 118
 4330 20
 4340 3
 4341 1
 4354 30
 4363 1

SF = Staff
 ord

FC Count

1111 820
 1112 33
 1233 1
 1520 1
 2000 1
 2001 80
 2111 68
 2112 71
 2212 22
 2213 3
 2223 1
 2230 64
 2240 35
 2293 1
 2310 22
 2320 11
 2410 45
 2420 61
 2421 3
 4110 39
 4120 95
 4121 23
 4140 19
 4141 51
 4320 69
 4330 30
 4363 6
 4373 14

SG = Sedgw
 ick

FC Count

1111 1054
 1112 44
 1210 3
 1283 1
 2111 109
 2112 95
 2212 2
 2213 3
 2219 6
 2223 24
 2261 26
 2262 19
 2263 31
 2266 34
 2267 51
 2271 23
 2272 14
 2273 5
 2276 2
 2279 2
 2282 37
 2283 44
 2286 69
 2287 29
 2289 2
 2293 6
 2310 99
 2320 73
 2410 127
 2411 4
 2420 234
 2421 12
 4110 135
 4120 561
 4121 6
 4130 14
 4141 24
 4150 2
 4320 119
 4330 28
 4342 1
 4344 2
 4352 9
 4368 15

SH = Sherm
 an

FC Count

1111 1108
 1112 41
 1243 1

2111 99
 2112 58
 2213 3
 2223 5
 2266 16
 2286 44
 2293 4
 2310 9
 2320 3
 2410 9
 2420 134
 4310 19
 4320 73
 4330 209
 4354 20
 4364 1

SM = Smith

FC Count

1111 925
 1112 36
 1243 1
 2111 72
 2112 69
 2212 21
 2219 1
 2223 11
 2229 2
 2262 4
 2293 3
 2310 21
 2320 9
 2410 154
 2420 826
 2421 9
 4110 37
 4120 220
 4140 62
 4141 9
 4310 19
 4320 70
 4330 48
 4364 1

SN = Shawn
 ee

FC Count

1111 594
 1112 24
 1114 46
 1115 10

1284 1
 2111 90
 2112 30
 2113 23
 2115 1
 2146 2
 2212 18
 2213 3
 2222 3
 2223 6
 2261 20
 2262 20
 2266 20
 2267 9
 2269 27
 2271 23
 2272 15
 2276 4
 2281 9
 2282 28
 2286 38
 2287 14
 2289 26
 2310 42
 2320 30
 2410 147
 2411 98
 2420 22
 2421 1473
 4110 81
 4111 1
 4120 27
 4121 2846
 4141 22
 4150 15
 4320 240
 4330 39
 4368 6

ST = Stant
 on

FC Count

1111 720
 1112 30
 1233 1
 2111 56
 2112 37
 2212 7
 2213 2
 2219 3
 2310 8
 2320 5
 2420 61
 4110 2
 4120 6
 4140 7

4310 14
4320 41
4330 100
4340 1
4353 3
4360 1
4363 1

SU = Sumner

FC Count

1111 1234
1112 55
1243 1
2111 93
2112 116
2212 50
2213 10
2219 2
2222 2
2223 24
2261 20
2262 10
2271 15
2281 3
2293 3
2310 89
2320 55
2410 102
2420 195
2421 2
4110 82
4120 429
4141 35
4310 30
4320 99
4330 30
4360 1
4364 1

SV = Stevens

FC Count

1111 759
1112 30
1243 1
2111 65
2112 55
2212 5
2213 3
2219 11
2220 1

2310 12
2320 5
2420 19
2421 96
4121 36
4140 3
4141 478
4310 10
4320 61
4330 109
4340 1
4353 5
4364 1

SW = Seward

FC Count

1111 670
1112 29
1253 1
2111 40
2112 54
2212 19
2219 3
2223 3
2272 1
2310 10
2320 3
2410 6
2420 6
4110 7
4120 1
4310 12
4320 37
4330 22
4353 11
4354 1
4365 1

TH = Thomas

FC Count

1111 1106
1112 42
1243 1
2111 86
2112 88
2212 24
2223 8
2261 10
2266 10
2273 6

2281 28
2286 14
2293 2
2310 20
2420 398
4110 12
4120 63
4130 20
4140 120
4320 87
4330 286
4340 1
4341 6
4343 5
4364 2

TR = Trego

FC Count

1111 925
1112 36
1233 1
2111 61
2112 54
2212 12
2213 2
2222 1
2223 2
2266 21
2272 1
2286 38
2293 4
2310 12
2320 7
2410 85
2420 106
4110 76
4150 16
4320 44
4330 101
4341 2
4354 2
4363 2

WA = Wallace

FC Count

1110 54
1111 957
1112 36
1120 5
1223 1

1310 92
1410 2
2111 66
2112 55
2212 14
2213 7
2219 2
2223 2
2310 8
2320 8
2410 24
2420 165
4310 5
4320 41
4330 293
4341 1
4351 11
4354 20
4360 1
4362 1

WB = Wabau
nsee

FC Count

1111 842
1112 25
1223 1
2111 58
2112 43
2212 1
2213 6
2223 26
2263 2
2266 26
2271 1
2286 34
2293 7
2310 11
2320 13
2410 135
2420 125
4110 165
4120 61
4320 172
4330 34
4362 1

WH = Wichita

FC Count

1111 745
1112 30

1233 1
 2111 48
 2112 39
 2213 11
 2293 1
 2310 7
 2320 3
 2420 43
 4320 40
 4330 18
 4351 8
 4363 1

WL = Wilson

FC Count

1111 605
 1112 20
 1243 1
 2111 123
 2112 24
 2212 15
 2213 15
 2219 2
 2223 14
 2262 4
 2263 5
 2282 13
 2283 4
 2289 4
 2310 35
 2320 21
 2410 234
 2411 13
 2420 345
 2421 1962
 4110 258
 4120 75
 4121 3760
 4141 124
 4320 187
 4330 12
 4364 1

WO = Woods

FC Count

1111 555
 1112 20
 1210 7
 1233 1
 2111 88

2112 30
 2181 242
 2212 14
 2293 2
 2310 28
 2320 14
 2410 305
 2411 29
 2420 338
 2421 1864
 4110 174
 4111 4
 4120 17
 4121 4229
 4141 206
 4150 21
 4320 198
 4330 16
 4363 2
 7777 1
 9999 1

WS = Washi

ngton
 FC Count

1111 927
 1112 35
 1210 19
 2111 93
 2112 115
 2181 192
 2212 5
 2213 8
 2219 2
 2223 31
 2282 4
 2293 5
 2310 45
 2320 15
 2410 481
 2411 74
 2420 473
 2421 3166
 3001 1
 4001 97
 4110 121
 4120 52
 4121 3175
 4141 42
 4310 62
 4320 146
 4330 25
 4363 1

WY = Wyand
 otte

FC Count

1111 192
 1112 8
 1210 12
 1280 1
 2111 39
 2112 39
 2181 137
 2212 10
 2213 14
 2219 1
 2251 14
 2261 65
 2262 8
 2263 9
 2266 6
 2271 28
 2272 21
 2273 24
 2276 7
 2279 6
 2281 26
 2282 4
 2286 6
 2289 10
 2310 9
 2320 23
 2410 61
 2411 10
 2420 78
 2421 429
 4110 56
 4120 6
 4121 921
 4141 2
 4310 19
 4320 94
 4330 10
 4342 2
 4343 4
 4368 30

KS = KANSAS

Statewide Totals

FC	Count	2150	1	3185	3	4376	10
		2152	9	3190	195	5000	109
1010	14	2154	2	3195	6	5001	1
1020	12	2181	3571	3200	198	7777	8
1110	54	2212	1615	3205	14	9002	1
1111	86020	2213	503	3210	124	9999	11
1112	3400	2214	10	3215	2		
1113	11	2219	295	3220	135		
1114	185	2220	1	3225	5		
1115	48	2222	77	3230	170		
1120	35	2223	1139	3235	3		
1121	24	2224	15	3240	84		
1200	16	2229	8	3250	57		
1210	181	2230	79	3260	5		
1211	29	2234	802	3280	1		
1212	4	2240	38	3290	17		
1213	1	2244	183	3300	20		
1220	2	2251	14	4001	97		
1222	2	2253	15	4110	11262		
1223	11	2259	5	4111	333		
1230	2	2261	229	4120	7425		
1232	2	2262	210	4121	103936		
1233	41	2263	170	4130	44		
1240	2	2266	439	4131	3		
1242	2	2267	69	4140	1932		
1243	28	2269	94	4141	8190		
1252	4	2271	164	4145	155		
1253	12	2272	85	4150	503		
1263	7	2273	70	4151	14		
1273	1	2276	19	4210	2		
1280	1	2279	33	4230	3		
1283	1	2281	146	4241	1		
1284	1	2282	257	4310	1167		
1300	39	2283	106	4320	11286		
1310	304	2286	777	4330	4773		
1320	5	2287	69	4340	15		
1330	351	2289	108	4341	62		
1410	2	2293	174	4342	27		
1430	2	2310	3058	4343	27		
1500	226	2320	1664	4344	29		
1510	1	2330	5	4345	21		
1520	10	2350	1	4346	12		
1530	1	2360	5	4351	45		
1541	3	2410	16378	4352	29		
1560	21	2411	2692	4353	166		
1999	1	2420	19513	4354	263		
2000	2	2421	68195	4355	82		
2001	87	2430	74	4356	5		
2111	7719	2431	2	4360	10		
2112	6122	2450	31	4361	1		
2113	433	2460	6	4362	13		
2115	37	2500	3	4363	68		
2120	35	2511	13	4364	44		
2130	1	2512	5	4365	39		
2141	211	2520	22	4366	21		
2142	103	3001	1	4367	2		
2143	27	3090	7	4368	51		
2146	5	3100	6	4373	58		
2150	1	3180	307	4374	14		

APPENDIX B

KANSAS 2-LETTER COUNTY ABBREVIATION CODES

AL = ALLEN	GL = GREELEY	OB = OSBORNE
AN = ANDERSON	GW = GREENWOOD	OT = OTTAWA
AT = ATCHISON	HM = HAMILTON	PN = PAWNEE
BA = BARBER	HP = HARPER	PL = PHILLIPS
BT = BARTON	HV = HARVEY	PT = POTTAWATOMIE
BB = BOURBON	HS = HASKELL	PR = PRATT
BR = BROWN	HG = HODGEMAN	RA = RAWLINS
BU = BUTLER	JA = JACKSON	RN = RENO
CS = CHASE	JF = JEFFERSON	RP = REPUBLIC
CQ = CHAUTAUQUA	JW = JEWELL	RC = RICE
CK = CHEROKEE	JO = JOHNSON	RL = RILEY
CN = CHEYENNE	KE = KEARNY	RO = ROOKS
CA = CLARK	KM = KINGMAN	RH = RUSH
CY = CLAY	KW = KIOWA	RS = RUSSELL
CD = CLOUD	LA = LABETTE	SA = SALINE
CF = COFFEY	LE = LANE	SC = SCOTT
CM = COMANCHE	LV = LEAVENWORTH	SG = SEDGWICK
CL = COWLEY	LC = LINCOLN	SW = SEWARD
CR = CRAWFORD	LN = LINN	SN = SHAWNEE
DC = DECATUR	LG = LOGAN	SD = SHERIDAN
DK = DICKINSON	LY = LYON	SH = SHERMAN
DP = DONIPHAN	MN = MARION	SM = SMITH
DG = DOUGLAS	MS = MARSHALL	SF = STAFFORD
ED = EDWARDS	MP = MCPHERSON	ST = STANTON
EK = ELK	ME = MEADE	SV = STEVENS
EL = ELLIS	MI = MIAMI	SU = SUMNER
EW = ELLSWORTH	MC = MITCHELL	TH = THOMAS
FI = FINNEY	MG = MONTGOMERY	TR = TREGO
FO = FORD	MR = MORRIS	WB = WABAUNSEE
FR = FRANKLIN	MT = MORTON	WA = WALLACE
GE = GEARY	NM = NEMAHA	WS = WASHINGTON
GO = GOVE	NO = NEOSHO	WH = WICHITA
GH = GRAHAM	NS = NESS	WL = WILSON
GT = GRANT	NT = NORTON	WO = WOODSON
GY = GRAY	OS = OSAGE	WY = WYANDOTTE

APPENDIX C

LOCATION REPRESENTATION AND INTERPRETATION FOR OUTPUT FROM THE ACCESS PROGRAM

In an effort to reduce the size of output files from the ACCESS program, a special form for representing locations has been used. In particular, using the straightforward ASCII representation with decimal degrees of longitude and latitude would require some 22 bytes per location. Given that there are nearly 10,000,000 points in the whole of the KCD and that the original intent of the ACCESS program is to create a tape file of the entire KCD, requiring 22 bytes per location could not produce the desired result, namely a (single) tape containing the KCD. Such a file would require more than 300 megabytes, well over the limit of a tape, even using the maximum recording density and physical block size. Instead, the simple coding of the geographic locations described below has been adopted to obtain the desired result.

Each point location represents a single longitude and latitude pair relative to a fixed reference point for the quadrangle in which the county patch lies. The fixed reference point for each quadrangle is the southwest corner of the quadrangle area. The location of this reference point is calculated from the row and column numbers given in the county patch record:

Given: Row = rr Column = cc

Find: the location of the southwest corner of the quadrangle map area at row rr and column cc in the KGS/GIMMAP grid for USGS 7.5' quadrangle maps (see Figure 1, above). The location of this county patch reference point is specified in decimal degrees west longitude (LONSW) and north latitude (LATSW), with the longitude signed negative, by the following equations:

$$\text{LONSW} = -102.125 + (\text{cc} - 1) * 0.125$$

$$\text{LATSW} = 36.875 + (\text{rr} - 1) * 0.125$$

Within each (county patch) group of arcs in the ACCESS output file, geographic locations for isolated points and points defining paths of lines are relative displacements from the reference point of the quadrangle map containing the county patch. Each relative location consists of at most ten digits for the longitude and latitude. The first five places (some digits may be blank) contain the change in longitude from the reference point. The second five places contain the change in latitude relative to the reference point.

These relative values for longitude and latitude represent distance from the southwest corner reference point in minutes, seconds, and hundredths of a second of longitude and latitude. Each consists of three parts:

(a) the first digit represents whole minutes of displacement from the reference corner, which, since the area is restricted to the 7.5' quadrangle map, must range from 0 to 7.

(b) the second and third places hold one or two digits, which represent the number of whole seconds of displacement from the reference corner, ranging from 0 to 59.

(c) the fourth and fifth places hold one or two digits, which represent the number of hundredths of a second of displacement from the reference corner, ranging from 0 to 99.

Using these representations, point locations are specified within 1/100th of a second of arc. This is the approximate equivalent of 0.0005 inches on the (1:24,000) quadrangle map, and about one foot on the earth's surface, effectively maintaining KCD accuracy.

The relative longitude and latitude values are positive offsets to be added to the location of the reference point. Calculation of the reference point longitude (LONSW) and latitude (LATSW) from the row and column numbers (found in the county patch records) of the quadrangle map has been illustrated above.

Conversion from relative longitude (ABCDE) and latitude (abcde) of a location output by ACCESS to geographic reference is as follows:

Given:	<u>Point to be Converted</u>	<u>SW Reference Point</u>
	relative longitude = ABCDE	longitude = LONSW
	relative latitude = abcde	latitude = LATSW

Then, the longitude (LONPT) of the point is:

$$\text{LONPT} = \text{LONSW} + \text{A}/60 + ((10*\text{B} + \text{C}) + (10*\text{D} + \text{E})/100)/3600$$

And the latitude of the point (LATPT) is:

$$\text{LATPT} = \text{LATSW} + \text{a}/60 + ((10*\text{b} + \text{c}) + (10*\text{d} + \text{e})/100)/3600$$

Note: All arithmetic operations and operands in this conversion must be REAL (floating-point), blanks are interpreted as zeros.

APPENDIX D

SAMPLE ACCESS OUTPUT FROM BASE DG1856B

The following 6 pages contain sample output of the ACCESS program. This listing contains output for all (basic) features, taken from the county patch database DG1856B, the Douglas county part of the Midland quadrangle map. The exact format of the data in this file is described above under "Output (Tape) File Format" (page 5). The area of coverage was specified by creating an Arc filenames list in a file for input to ACCESS. This list contained the single entry: DG1856B_AW. As with the feature code count data listed in columns in Appendix A, this output is read column by column, left to right, and top to bottom. The first column of successive pages follows the last column of the previous page.

dg 18 56	240 914678	0382714075	15757132 4
31 211	2407305455	2 28	1576913216
4330 1	241280 2 4	1 03305437	1578413220
1	1329323918	1 05202826	158 713219
30 1	2398423885	10 29	15846132 0
0 0 123894	3468723874	0382714075	1591313152
0 0 022997	3473214627	0511412935	2 05613028
0 0 022041	348 505421	0533212710	2 18612922
0 0 02 780	348290 166	0547412568	2 3 512827
0 0 014827	2212 14	0559612390	2 44212713
0 0 013590	18	0578212080	2 63012548
0 0 011882	2 18	0591611768	2 72912452
0 0 005931	135900 2 4	1 0 711426	2 82312370
0 0 004530	134160 198	1 0321 713	2 9 812289
0 0 002944	7 19	1 03305437	2 99412220
0 0 0018 4	0 01515876	3 30	210 512190
0 0 00 732	0 519156 1	1 05202826	210 612176
0 0 00 0 0	0117615226	1 05801685	210 112166
0 7630 0 0	01776149 2	1 05701478	2 99812156
017150 0 0	01948148 1	3 31	2101212135
025890 0 0	0207714748	241280 2 4	2109312043
036550 0 0	023 214679	221490 2 6	2128211833
049790 0 0	5 20	135900 2 4	2144211651
1 2150 0 0	3482801895	2223 2	2154011528
114560 0 0	347 201826	32	2162911443
134520 0 0	3436801547	2 32	2167311388
152340 0 0	3397301220	344860 9 7	2178811252
2 5230 0 0	3386301131	348250 8 8	2186711184
221390 0 0	8 21	2 33	219 111126
239820 0 0	3386301131	3386301131	2192411094
254200 0 0	335440 875	344860 9 7	2193811073
318 50 0 0	333370 717	2224 4	2193411051
337580 0 0	331380 542	34	2192611047
348340 0 0	328550 376	2 34	219 911039
348320 0 7	326970 3 0	02827239 2	2188911038
2112 1	323960 221	02834238 3	2185011042
2	322770 191	4 35	2179211062
14 2	2 22	02834238 3	2159711136
030170 0 3	134160 198	0284023285	2134111223
0299801243	132290 2 3	0286321494	2107911311
0299502316	4 23	0285321125	2 82811397
0294103364	322770 191	2 36	2 57511481
0293004633	315 40 195	0285321125	2 46511517
0291105951	3 8190 196	028682 541	2 41211545
029 811390	241280 2 4	3 37	2 39811561
0289912724	2 24	028682 541	2 39311577
0289313998	132290 2 3	0289514947	2 392117 3
02878150 2	1 4610 212	0289814676	2 38811814
028672 383	3 25	4120 9	2 39412110
0283922091	023 214679	38	15 39
0283523217	0256014672	58 38	1495805355
02827239 2	0289814676	2 39412110	1499305297
1111 15	2 26	2 217121 5	1516805060
3	1 0510 215	15989121 9	1526204766
0289814676	1 4610 212	15797121 1	1532404517
0294105442	5 27	1578412374	153 004135
030220 168	0289814676	1578112631	1528503971
134160 198	0307814624	1576012945	1522003765
1339905442	0335414519	1575113127	1501903391
1342514638	0349414443	1575313176	149 103187

1462802886	1502413872	3148923877	2512023876
1433102658	1565013314	3234123874	3 46123879
1387502424	15691121 0	3371423876	3 81223881
1353702210	1567912076	3458223873	2 65
135 402152	1566912066	3468723874	3 81223881
20 40	14816123 2	3 50	3124123878
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