URBAN MAPPING APPLICATIONS
CENSUS TRACTS TO OWNERSHIP PARCELS

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Introduction

Geoprocessing is a production mode function in Wyandotte County and Kansas City, Kansas. Geoprocessing applications utilize one or more of three geographic base files: ACG/DIME, parcel, and sanitary sewer network. The uses of these base files and their derivatives fall generally into three categories: computer mapping, base file for data, and analytic tool. A chart has been provided which categorizes the applications mentioned in this paper. This paper will provide a synopsis of the development of our local geoprocessing capabilities, discuss two recently initiated urban mapping applications (the Wyandotte County land data system and a parcel level land use system), and finally make some suggestions regarding the building of geographic data bases.

Development of Local Geoprocessing Activities

The nature of urban mapping applications in Wyandotte County is partly attributable to a decision by the Board of Public Utilities and Kansas City, Kansas in 1965 to begin the acquisition of large scale topographic base maps[1]. This base map series has been maintained with funds from a consortium of City, County, and public utility departments. The decision to acquire these maps was made without consideration of any geoprocessing capabilities that were to develop six years later.

URBAN MAPPING AND RELATED AUTOMATED APPLICATIONS
WYANDOTTE COUNTY AND KANSAS CITY, KANSAS

CATEGORY OF USAGE	GBF/DIME	PARCEL GBF	SANITARY SEWER GBF
Analytic Tool	- ADMATCH - Intersection matcher - Computation	- UNIMATCH* - Computation	- Capacity and flow modeling - "Address-to-pipe" linker* - Computation
Computer Mapping	- Choropleth - Dotmap - Network display - Incidence mapping	- Choropleth - Street right-of-way* - Parcel display with LANDS data* - Incidence mapping*	- Network display
Base File for Data	- Street inventory - Street sign inventory - Address file	- LANDS - Land use* - Zoning* - Address file	- Maintenance data* - Complaint data*

* Planned application

Local geoprocessing began with the development of a GBF/DIME file by the City in 1972. The DIME file was constructed from topographic base maps with a superimposed network. Street name and address information for each structure was acquired in the field by Post Office mail carriers and placed on the maps by planning department personnel. Once all DIME file coding was complete, the nodes were digitized. A system for added shape or "contour" points between the nodes for a single segment was developed and these points were also digitized. The result, after a great deal of editing, was a highly accurate DIME file with very precise coordinates.

The implementation of ADMATCH provided the ability to geocode and then summarize local data by geographic area. The first major geocoding application was a population migration study of Kansas City, Kansas. Post Office change-of-address records for a two-year period were geocoded to census tract and the summarized results used as the basis of the study. The study was a success and provided impetus for the development of additional capabilities.

Confidence in the quality and usefulness of the DIME file coupled with a lack of confidence in the integrity of local computerized land records prompted County officials to create the Base Mapping Program in 1973 and charge it with the development of a system for land ownership parcels.[2] Work began immediately with research into County records to determine and draw parcel boundaries on a set of topographic base maps. This endeavor proved to be a very time-consuming and exhausting task. Original estimated completion dates were grossly underestimated. Work on the maps, the coding of a basic parcel record, and initial digitizing of boundary points was not finished until mid-1978. It was during this time, however, that a computer mapping capability was developed.

The County acquired a plotter in late 1973 and development of computer graphic software began as a joint effort between the City and County.[3] Choropleth, dot map, and network mapping software was written and was soon being used by the City in a production environment. Local data files were routinely geocoded to census tract and summary data mapped. Several series of thematic maps were produced of both locally coded files and published 1970 census summary data. An in-

tersection matching program was written. An incident mapping program was written which plots the street network with street names from the DIME file and plots various symbols representing incidents. (Coordinates are assigned to address data by first assigning the data record to a DIME record and then using from and to address with from and to X and Y coordinates to interpolate along a segment. Parity is used to determine an offset from the segment either to the left or the right. Matched intersection data is identified and coordinates assigned around the intersection.) The incident mapping software has been particularly useful to the police department in the display of traffic accident and crime data.[4]

The computer mapping applications made an immediate positive impact on local officials. Computer generated maps were soon incorporated into reports and studies and it became standard procedure to geocode and map data from local files. With local urban mapping gaining momentum, the decision pending regarding the digitizing of parcels was made easier. It was decided that parcels would be digitized and furthermore that complete boundaries would be digitized rather than just centroids. A digitizer was acquired and a method of topologically encoding points was developed.[5] Some aspects of the method follow. Each parcel boundary point is encoded at digitizing time with the ordered list of parcels incident to the point. Node numbers are not used and complications attendant to their usage are avoided. Software for topologically editing the points similar to DIME topological editing is used to test the completeness and accuracy of the parcel points file. The software will produce ordered boundary lists for each parcel as well as DIME encoded parcel boundary segments. (All of the County has been digitized as of this writing and the coordinates and encoding are in the final stages of editing. It is expected that a current parcel map of Wyandotte County will be plotted by mid-1980.)

Construction of the sanitary sewer geographic base file[6] began in 1976. The file consists of node records which represent manholes, pump stations, treatment plants, etc., and segment records which represent pipes between nodes. The file will be used for record keeping of maintenance and complaint data, mapping, and for flow and capacity modeling. Present mapping applica-

tions plot map features from all three geographic base files. Segments and nodes are drawn from the sewer network file. Parcel boundaries are drawn from the parcel points file (with parcel addresses from the parcel file). Street names are determined and plotted from the DIME file. One of the important features of the sanitary sewer system is the linkage between the parcel file and the sewer network. Individual parcels which connect or would be connected to a particular pipe segment are coded to that segment record. This linkage will provide a two-way path between sewer network data and detailed parcel data. For example, sewer complaints by address can be address matched to a parcel and that parcel number used to determine pipe and manholes affected by the complaint. Going the other way, given a piece of sewer network for a modeling problem, it will be possible to extract detailed information about all parcels connected to that network.

Two major applications involving the parcel file have begun in the last eighteen months. One is a parcel level land use system and the other is the Wyandotte County land data system.

Parcel Level Land Use System

The City and the County both have an interest in parcel level land use data. The County's interest lies in the potential usage of the classifications in a computer assisted appraisal system, as a key in accessing both a real estate sales history file and data in the LANDS data base, and to help satisfy state reporting requirements regarding real estate assessment data. The City's interest lies in the use of the file by the Economic Development Department in working with existing and potential business, by the Physical Planning Department in neighborhood planning, and by the Water Pollution Control Department for sewer planning and as input to flow and capacity analysis programs.

The City and County are currently working with the USGS Program for Technical Assistance in the Analysis of Land Resources through the Ozark Regional Commission to select coding schemes, identify and evaluate data sources, and develop procedures for data collection. The results will be used initially to code a test area containing approximately fifteen square miles with five thousand parcels.

The selection of coding schemes will be done carefully. SIC (Standard Industrial Classification) codes are prevalent in economic and business data but are not very useful for non-business land uses. A land use coding scheme, such as the Bureau of Public Roads Standard Land Use Code (SLUC), covers a wide spectrum of land uses but is not used in economic data or business applications. It is likely that translation tables for SIC to SLUC and SLUC to SIC will be developed and both codes stored in the file.

It is felt that land use is most useful to local government when collected at the parcel level because it is only at that level that it can serve the operational needs. If it successfully serves the operational needs, then it at least stands a chance of being properly maintained.

LANDS - Wyandotte County Land Data System

When the parcel maps for the County were completed, the Base Mapping Program began matching the newly developed parcel numbers to existing real estate records and resolving differences in the two files. A new land data system has been designed to take advantage of the map-based parcel system. The design concept of LANDS[7] is centered around the ownership parcel. County land records organize themselves quite well by legal description and while various account numbering schemes, assessor's numbers, clerk's book and reference numbers, and other varied and assorted identification numbers for land records will come and go, the heart of the identity for any land record is its legal description. We have based our parcel numbers on legal descriptions.

LANDS will consolidate at least five separate computer systems dealing with land records in its initial implementation. It will eventually encompass all land record systems. The consolidation alone will solve many of the problems which currently exist in local land record keeping systems. The consolidation of systems, the new parcel base maps, and an automated mapping capability represents a massive jump in technology to those working on land data (many of whom were here when the records were manual!).

A parcel level mapping capability has been eagerly awaited for several years. Software and hardware

technology have been available to do the graphics but data other than for small test areas has not been available for practical applications. The next year will see many parcel level urban mapping applications emerge. In two years from now, it will reach a production mode level and a real time graphics capability will follow that.

Summary Remarks

The chronology of local geoprocessing development demonstrates a methodical approach to implementing geographic information systems. Each development followed successful applications of previous systems and was in response to a particular need. The complexity of the geographic base files and the applications increased as the level of involvement in geoprocessing escalated.

Although the scope of this paper did not allow for the development of specific methodology for building geographic base files and developing urban mapping applications, a few suggestions based on local experiences can be given.

1) Geographic base files should be designed utilizing data structures that conform to the natural structure of the phenomenon that is being represented, that is to say, it should be a virtual map. If the data structure is properly designed, then it can be edited for completeness and consistency; if not, it will have a short and inglorious life. The success of the DIME method lies in the ability to topologically edit a file so encoded. A properly designed data structure stands an excellent chance of being appropriate for applications which will arise in the future.
2) There is no short cut in building a geographic base file which will stand the test of time. Time, effort, and considerable resources must be expended to obtain a quality product with long term payoffs.
3) Application software should be written in a modular and generalized fashion so as to be useful in future applications. A glance at the chart provided demonstrates that many applications are listed for more than one base file.

Kansas City, Kansas and Wyandotte County have benefitted from the technology of geoprocessing and automated

cartography and are firmly committed to the utilization of those tools in the implementation of information systems to which they are applicable.

NOTES

[1] 655 sheets cover Wyandotte County at a scale of 1:1200. All planimetric features and two-foot contour intervals are produced using steriophotogrammetric methods. Kansas plane coordinates are indicated at 500 foot intervals. The maps are produced by M.J. Harden Associates of Kansas City, Missouri.

[2] Thomas M. Palmerlee and Ronald E. Domsch, "A Parcel Identification and Data System", Papers from the Eleventh Annual Conference of URISA, (1973), pp. 393-407.

[3] Ronald E. Domsch and Kenneth D. Mai, "Computer Mapping and its Impact on Kansas City, Kansas and Wyandotte County", Proceedings of the International Symposium on Computer-Assisted Cartography (Auto-Carto II), 1975, pp. 469-481.

[4] Rick Holloway, "Police Dispatch Reporting and Analysis System", Papers from the Fourteenth Annual Conference of URISA, (1976), pp. 115-126.

[5] Ronald E. Domsch, "A Topological Encoding of Points in a Cadastral Mapping System", Papers from the Fifteenth Annual Conference of URISA, (1977), pp. 176-184.

[6] Thomas M. Palmerlee and Jaye Brake, "Sanitary Sewer Computer File", Department of Information and Research Reports, 1978.

[7] Steve Hall, "The Wyandotte Land Data System - LANDS System Proposal", 1979.