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DEVELOPMENT OF A SMALL AREA
POPULATION AND HOUSING ESTIMATING SYSTEM
FOR THE CITY OF OMAHA

A Thesis
Presented to the
Department of Geography
and the
Faculty of the Graduate College
University of Nebraska

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
University of Nebraska at Omaha

by
Stephen Warren Kinzy

December 1977

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THESIS ACCEPTANCE

Accepted for the faculty of the Graduate College, University of
Nebraska, in partial fulfillment of the requirements for the degree
Master of Arts, University of Nebraska at Omaha.

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CHAPTER I

INTRODUCTION

Purpose

The need for population housing information describing the conditions of our urban areas has become critical for city and county governments in their attempts to deal with such problems as urban growth, inner city decay and redevelopment, location of public facilities, and allocation of city services. No longer can the decennial census inventories be used as the only source of urban information. City and county governments must develop methods of estimating population and housing characteristics between census enumerations that can provide accurate, timely and meaningful information concerning the urban community. This information must then be made available to local decision makers so that they can respond to the needs of their jurisdictions based upon current data about the area's condition and trends.

Estimates for geographic subareas are essential to understanding the internal distribution of population and housing characteristics within cities and their changing patterns over time. The actions of local government in responding to urban problems must be sensitive to changing conditions within specific neighborhoods; thus the need for current estimates by subarea is critical.

The urban geographer can make an important contribution to the development and implementation of population and housing estimating

procedures within local government. The essential question is the quantification of "where," which the geographer is eminently well qualified to answer. The study of the spatial arrangement and distribution of occurrences is at the core of geographic research. Today the skills of the geographer can be applied to help local government respond in an effective way to the problems of our cities.

Research Problem

In order to respond to the need for population and housing estimates within geographic subareas, this study will attempt to develop a model for the preparation of annual census tract estimates for the City of Omaha, utilizing the DIME (Dual Independent Map Encoding) Geographic Base File System (see Definitions) and local government/utility company files. Research conducted by the Municipal Information Division of the Omaha City Planning Department between 1975 and 1977 will provide the basis for the study, although an attempt will be made to consolidate and evaluate the results of that research, concluding with the formulation of a general purpose method for estimating population and housing characteristics.

The formulation of population and housing estimates for jurisdictions and geographic subareas is not a new approach but the use of computer technology to help prepare estimates is. The computer can be utilized not only to increase the efficiency of preparing estimates but also to provide the user with a high degree of flexibility in the aggregation and geographic manipulation of local information. The geographic restrictions as to which administrative areas are used for estimating

purposes can be removed, thus providing current population and housing estimates directly into any number of geographic subareas. It is the purpose of this study to determine if automated geocoding techniques and computer technology can be used to produce accurate and timely population and housing estimates for geographic subareas.

Organization

In order to resolve the research problem, the study is organized into four chapters:

Chapter I - Introduction

Chapter II - Evaluates alternative methods of preparing small area estimates including mathematical techniques, Component Methods, the Composite Method, Symptomatic Series Methods, and the Housing Unit Methods. The determinants for selecting appropriate methods are also discussed.

Chapter III - Describes the ICES (Intercensal Estimating System) model designed to prepare a census tract estimate for the City of Omaha, utilizing a Modified Housing Unit Method. The specific quantitative procedures are defined and the model tested.

Chapter IV - Evaluates the results of the model's estimates against other sources. The study concludes with an analysis of potential use of the ICES model for development of a general purpose estimating methodology for geographic subareas.

Definition of Terms

The following definitions are divided into two categories: General Terms and Data Item Definitions for the population and housing estimates (U.S. Bureau of the Census, 1970, pp.73-136).

General Terms

ADMATCH: The acronym for Address Matching, a United States Census Bureau computer program designed to address match local data file records to GBF/DIME File records.

CENSUS TRACT: A statistical subdivision of a Standard Metropolitan Statistical Area (SMSA). Census tract boundaries are determined jointly by a local committee and the U.S. Census Bureau. Tracts are initially designed to be relatively homogenous with respect to population characteristics, economic status, and living conditions. A typical tract has about 4,000 to 5,000 residents.

DATA BASE: A non-redundant collection of interrelated data items.

ESTIMATE: An approximation of current population and housing characteristics.

GBF/DIME: The acronym for Geographic Base File/Dual Independent Map Encoding, a computer system designed to handle geographic data. DIME represents a specific type of geographic base file created by the U.S. Census Bureau.

GEOCODING: A procedure for the location of an object or event in space.

INTERCENSAL: Between census enumerations (defined in its broadest sense).

INVENTORY: A total count or enumeration. With respect to population and housing, an inventory is made as a result of a decennial census or a special census taken at one point in time by the U.S. Census Bureau, state or local government.

PROJECTION: An anticipation of future population or housing counts.

SYSTEM: A process made up of sets of components that work together for the overall objectives of the whole.

Data Item Definitions

I. DEMOGRAPHIC ESTIMATES

- A. Total population: All persons living within a predefined area at the time of the census enumeration or estimate.
 - 1. Minority population: Includes all persons not considered White, such as Blacks, Indians and Orientals.
 - a. Black populations: Persons classified as Negro or Black.
 - b. Other minority populations: Persons classified as Indian or Oriental.
 - 2. Elderly population: Those persons 65 years of age and over.

II. HOUSEHOLD ESTIMATES

- A. Household: An occupied housing unit.
- B. Group quarters population: All persons who do not reside in a household are regarded as living in group quarters. These include persons living in institutions, rooming houses, military barracks, and college dormitories.
- C. Persons per household: The average number of persons contained within households for a specific area.

III. HOUSING ESTIMATES

- A. Housing unit: A house, an apartment, a group of rooms or single room occupied or intended for occupancy as separate living quarters. Both occupied and vacant housing units are included in the housing inventory, except mobile homes are included only if they are occupied.
 - 1. Housing type: The structural status of housing units.
 - a. Single family housing unit: A structure containing only one housing unit (for the purpose of ICES estimates this category also includes mobile homes and condominiums). A structure is defined as a separate building that either has open space on all four sides (detached) or is separated by dividing walls that extend from ground to roof (attached).
 - b. Multi-family housing unit: A structure containing two or more housing units (all public housing is included within this category).

2. Housing tenure: The occupancy status of housing units.

- a. Owner occupied housing: A housing unit is owner occupied if the owner or co-owner lives in the unit, even if it is mortgaged.
- b. Renter occupied housing: A housing unit is renter occupied if the unit is rented for cash rent and was not being owned or bought.
- c. Vacant housing: A housing unit is considered vacant if no one is living in it, unless its occupants are only temporarily absent.

Review of the Literature

The literature currently available in regard to population and housing estimating generally falls into two categories: methodological works and studies of specific procedures. Additionally, the literature is further stratified into works regarding national, state, county, and jurisdictional estimates and those regarding subjurisdiction estimates. Unfortunately, studies regarding subjurisdictional or small area estimation represent the smallest category of available literature. This is due to three main reasons:

- 1. The complexity of preparing small area estimates
- 2. The general lack of resources for methodological testing
- 3. Limited source data for estimate evaluation other than decennial census material.

For the purpose of this study two works are of particular importance: Peter Morrison's Demographic Information for Cities: A Manual for Estimates and Projecting Local Population Characteristics and the San Diego Comprehensive Planning Organization's (CPO) Population and Housing Estimating Systems. Peter Morrison's study was prepared for the United

States Department of Housing and Urban Development to serve as a manual for analysts responsible for preparing estimates and forecasts of local population characteristics (Morrison, 1971, p. iii). The study analyzes alternative estimating and forecasting methods from the viewpoint of procedure and performance, and presents numerous examples that describe the actual application of these techniques within local government. This reference is a particularly invaluable one because it provides the reader with a scholarly catalogue of small area estimating methods, application procedures, and performance standards, and is exceedingly well documented.

The San Diego report is an extraordinarily well written and precise review of alternative estimating methodologies and their utility within local government. This report, unlike Morrison's, was written to recommend a specific estimating system for the San Diego region; in its preparation a comprehensive review was made of both existing estimates and local data sources. It is interesting to note that, as a result of this highly professional study, the Comprehensive Planning Organization implemented the suggested recommendations and today has one of the finest subarea estimating systems in the United States. (Note: The San Diego system is modeled after the Housing Unit Method discussed in chapter II.)

In addition to these two works, a number of other articles can be found in the Bibliography that evaluate the accuracy of and describe the implementation procedures of various subarea estimating methods.

Background

Traditional Sources of Population and Housing Information

Population and housing information required by local government, business, the academic community, has traditionally been derived from one primary source: The United States Decennial Census of Population and Housing. The Census provides a tremendous amount of statistical information regarding population and housing characteristics for a variety of geographical areas (see figure I). The importance of census information is that the data produced are nationally standardized by definition and geography. Thus, census data concerning Boston will be comparable to that of Los Angeles, Houston, and Omaha. The Census also provides the only small area statistics generally available from the federal government, namely, the census tract and block statistics for the nation's urban areas (SMSA's - Standard and Metropolitan Statistical Areas). Unfortunately, the Census is only taken every ten years (although in 1985 a mid-decade census will be taken for the first time), with the statistical data generally released within two years from the date of the Census. Because of these time constraints, census data at best can only provide an historical image of local conditions, for it rapidly loses any real usefulness as time progresses.

In order to provide current information to supplement Census statistics, state, regional and local information should be obtained. Most state governments prepare county level estimates and some conduct census surveys to provide small area statistics (Kansas, California, etc.). Additionally, regional Councils of Government normally prepare

AREA

STANDARD METROPOLITAN STATISTICAL AREA (SMSA) AND COMPONENT AREAS

POPULATION

At least 50,000

CENSUS TRACT

Average 4,000

BLOCK GROUP

Average 1,000

BLOCK

Average 100

AREA

STANDARD METROPOLITAN
STATISTICAL AREA (SMSA)
AND COMPONENT AREAS

POPULATION

At least 50,000

Central City

Urbanized Area
(Shaded Area)

County

Place :

Minor Civil Division

CENSUS TRACT

Average 4,000

BLOCK GROUP

Average 1,000

BLOCK

Average 100

Figure 1. Census Geography

county and jurisdictional estimates, and occasionally small area estimates. Local governments are also beginning to realize the need for small area estimates, especially with the advent of the 1974 Housing and Community Development Act and other federal grant programs which require updated population and housing information to be included as part of the grant applications. Within the local government environment, a wide variety of data suitable for preparing estimates is generally available as byproducts of the regulatory function of government (taxation, permit issuing, vital statistics, etc.). To utilize this information, local governments are now starting to establish methods and systems by which local data can be transformed, either by definition or geography, into information that can be combined with other sources to produce the needed estimates.

Estimates for the City of Omaha

The Municipal Information Division of the Omaha City Planning Department has recently established an annual population and housing estimating system that utilizes a wide variety of local data and the DIME Geographic Base File System to prepare census tract estimates. The Intercensal Estimating System (ICES) was developed in response to the need for updated population and housing characteristics for the 1976 Housing and Community Development Block Grant Application. The system was designed and implemented within the five months of July through November 1975, during which estimates of 20 characteristics for 89 Omaha census tracts were prepared. During the first part of 1976, the 1975 methodology was reviewed and refined; the January 1,

1976 estimates of 20 characteristics for 100 Omaha census tracts were subsequently prepared. Based upon this experience, the ICES approach appears capable of providing population and housing estimates for almost any administrative area within the urban environment.

CHAPTER II

ALTERNATIVE METHODOLOGY

A variety of estimating techniques has been developed in order to meet the need for intercensal population and housing statistics. These techniques can generally be broken down into two approaches:

1. Field survey
2. Analytical techniques

Field surveys involve gathering of data directly from the population. The best example of a comprehensive field survey is the decennial census enumeration in which enumerators interview every household within the community or more recently (1970 Census) where census questionnaires are mailed to every household. Field surveys of this type are very costly because they require tremendous resources (people, forms, tabulations and data processing equipment, transportation or postage, etc.). The cost of field surveys generally makes this approach prohibitive to anyone other than the U.S. Census Bureau and a few commercial directory companies. Local governments in cooperation with the U.S. Census Bureau sometimes conduct special censuses but these are expensive (roughly \$.30 per capita), laborious and time consuming.

On the other hand, analytical techniques provide local government with a relatively inexpensive way to prepare estimates. Analytical, or non-survey, techniques involve establishing a relationship between the appropriate symptomatic data and the statistics to be estimated, in order

to calculate intercensal population and housing statistics. Symptomatic data such as vital statistics, building and demolition permits, utility connections, automobile registrations, and so forth are available within most local jurisdictions. Local symptomatic data can be geocoded to small analysis areas such as census tracts by manually aggregating the data or through the use of automated geocoding techniques (Kinzy, 1977). Because analytical techniques have greater potential and broader applicability within local government, this chapter will be limited to an examination of intercensal estimates for census tracts using non-survey techniques.

Mathematical Techniques

Mathematical methods offer the simplest approach for estimating population characteristics by census tract. An attempt is made to fit a mathematical trend to past census figures in order to establish a trend line relationship. Mathematical techniques assume that population characteristics follow a fixed trend formulated from previous experience. This trend usually can be expressed either mathematically or graphically. Past change is generally expressed as a mathematical function of time. The estimating function is then extrapolated beyond the last enumeration. Three different mathematical techniques exist for estimating intercensal population data:

1. The Arithmetic Method
2. The Geometric Method
3. The Apportionment Method

This discussion of these techniques is based upon information contained

in the two sources: Population Forecasting Methods, a U.S. Department of Commerce, Bureau of Public Roads publication (1964), and The Methods and Materials of Demography by Shyrock, Siegal, and associates (1971).

Arithmetic Method

The Arithmetic Method extrapolates past absolute changes in population characteristics to the current data. In its simplest form, the past decennial census figures are merely extrapolated to the present time. For example, if population increased from 0 to 100 people between 1960 and 1970, a 1975 estimate would be calculated by adding ten people per year until 1975. The 1975 population would then be 150 people. This can be expressed mathematically as follows:

1.
$$\begin{array}{r} 1970 \text{ Population} \\ - \text{ } 1960 \text{ Population} \\ \hline 1960-1970 \text{ Population change} \end{array}$$
2.
$$\frac{1960-1970 \text{ Population change}}{10 \text{ (number of years)}} = \text{Annual change}$$
3.
$$\text{Annual change} \times 5 \text{ (years)} = 1970-1975 \text{ Population change}$$
4.
$$\begin{array}{r} 1970 \text{ Population} \\ + \text{ } 1970-1975 \text{ Population change} \\ \hline 1975 \text{ Population} \end{array}$$

Geometric Method

The Geometric Method of intercensal population estimation is essentially identical to the Arithmetic Method except that it uses percent change instead of absolute change. For instance, if the 1970 population is 75 and the 1960 population is 50, then the 1975 population is calculated by dividing the population change of 25 by the 1960 population of 50 to obtain the rate of change (50.0 percent) between 1960 and 1970.

The rate of change is then used to calculate the amount of change between 1970 and 1975 (approximately 19) which is added to the 1970 population to obtain the 1975 population estimate of 94.

1.
$$\frac{1970 \text{ Population} - 1960 \text{ Population}}{1960-1970 \text{ Population change}}$$
2.
$$\frac{1960-1970 \text{ Population change}}{1960 \text{ Population}} = 1960-1970 \text{ Rate of change (\%)}$$
3.
$$\frac{1970 \text{ Population} \times 1960-1970 \text{ Rate of change}}{\text{Amount of change in 10 years}}$$
4.
$$\frac{5 \text{ Years}}{10 \text{ Years}} = .5 \text{ (Time factor)}$$
5.
$$\frac{\text{Amount of change in 10 years} \times \text{Time factor}}{1970-1975 \text{ Amount of change}}$$
6.
$$\frac{1970 \text{ Population} + 1970-1975 \text{ Amount of change}}{1975 \text{ Population}}$$

Apportionment Method

The Apportionment Method involves distributing an estimated intercensal population for a county among its various component census tracts. The Apportionment Method is approximately equal to the other mathematical methods discussed above when the Arithmetic and Geometric methods are adjusted to an independent estimate of county population.

For example, assume the 1975 population estimate for a county is 200 people. The 1960 population was 100 and the 1970 population was 150 for the county. A particular census tract within this county in 1960 had a population of 10, or 10 percent of the county population, and in 1970 had a population of 25, or 16.7 percent of the county

population. The 1975 population of this particular census tract, using the Geometric Method, would be calculated by estimating the change in 1960 and 1970 population shares (6.7 percent). The rate of change is then used to calculate the population share for 1975 (45 people). Utilizing this method each census tract is given its pro rata share of the county population for the intercensal data. The percentage shares of all census tracts must be equal to 100 percent when added together. A certain amount of data adjustment may be necessary in order to obtain a 100 percent distribution.

1.
$$\frac{\text{1960 (or 1970) Census tract population}}{\text{1960 (or 1970) County population}} = \text{1960 (or 1970) Population share (\%)}$$
2.
$$\begin{array}{r} \text{1970 Population share (\%)} \\ - \text{1960 Population share (\%)} \\ \hline \text{1960-1970 Change in population share (\%)} \end{array}$$
3.
$$\frac{\text{1960-1970 Change in population share (\%)}}{\text{1960 Population share (\%)}} = \text{1960-1970 Rate of change (\%)}$$
4.
$$\begin{array}{r} \text{1970 Population share (\%)} \\ \times \frac{\text{1960-1970 Rate of change (\%)}}{\text{Amount of change (\%)}} \end{array}$$
5.
$$\frac{\text{5 Years}}{\text{10 Years}} = .5 \text{ (Time factor)}$$
6.
$$\begin{array}{r} \text{Amount of change (\%)} \\ \times \text{Time factor} \\ \hline \text{1970-1975 Change in population share (\%)} \end{array}$$
7.
$$\begin{array}{r} \text{1970 Population share (\%)} \\ + \frac{\text{1970-1975 Change in population share (\%)}}{\text{1975 Population share (\%)}} \end{array}$$
8.
$$\begin{array}{r} \text{1975 County population} \\ \times \frac{\text{(Census tract) Population share (\%)}}{\text{1975 Census tract population}} \end{array}$$

Evaluation of Mathematical Techniques

The main advantages of the mathematical techniques are that they are relatively easy to apply and understand. Although methodologically simple, mathematical procedures are generally suitable for short-range estimates (less than three years). These methods are also suited to areas that have experienced relatively consistent population changes in the past and where no extreme fluctuations are anticipated in the immediate future.

The disadvantages of mathematical techniques become apparent when the estimates are made at longer time intervals. The factors which produce the changes in population characteristics over time (i.e. birth, death, net migration) do not remain constant over extended periods of time. These techniques are insensitive to such consideration.

In his study on intercensal census tract population estimates, Robert Schmitt found that Arithmetic projections were subject to an average error of 25.3 percent and a median error of 22.0 percent. Geometric projections were subject to an average error of 25.6 percent and a median error of 15.6 percent over a ten-year period. The Apportionment, or Ratio, Method experienced an average error of 27.9 percent and a median error of 21.5 percent (Schmitt, 1956). In light of the above discussion, it is doubtful whether mathematical techniques would normally be appropriate for the preparation of intercensal census tract estimates. The insensitivity of these techniques renders them ineffective for long-range estimates. Because of the disadvantages of these techniques, they are seldom used to produce estimates, except in those circumstances where time limitations dictate immediate results.

Component Methods

Accurate population estimates can be made if the factors which directly affect population change are known. Natural change data (i.e. births minus deaths) are usually available at the census tract level. On the other hand, net migration is extremely difficult to monitor for small areas. Nevertheless, it is possible to estimate net migration by using symptomatic data in the absence of actual data on migration. Symptomatic data, such as school enrollment, must be available on a continuing basis in order to estimate migration. To meet this need, the U.S. Bureau of the Census developed Component Methods I and II in order to estimate the net migration component of population change (U.S. Bureau of the Census, 1949; U.S. Bureau of the Census, 1966B). These two methods of population estimation employ school enrollment data to estimate net migration.

Component Method I

Component Method I relies on the assumption that the migration rate of school age children can be estimated as the difference between the percentage change in the population segment which is of school age and the general population figure for the United States. The United States figure supposedly represents the effect of change due to all factors with the exception of internal migration. The migration rate for total population of the local area is then assumed to be identical to that of the school age population. This migration rate is then applied to the total population of the area at the last census date, plus one-half of the births occurring in the intercensal period, in

order to derive the estimate of net migration. The U. S. Census Bureau has supplanted Component Method I with Component Method II because of the greater realistic nature of its assumptions and its more logical procedure in estimating net migration.

Component Method II

The Component Method II initially begins the same as Component Method I in that natural increase is calculated from published vital statistics. The Component Method II's main feature is that net migration is calculated for net civilian population. This procedure relies on the assumed relationship of the movement of school age children and adults. The Component Method II procedure estimates net migration for school age children with the expected number based upon the age specific survivors for the last decennial census. The difference between the actual and expected school age population reflects school age migration which can be converted into a migration rate. The school age migration rate is then transformed into a migration rate for the whole population. The final estimated rates are then applied to the civilian population to derive the migration estimate (Shyrock, Siegal and Associates, 1971).

The Component Method II procedure is based upon the following two assumptions:

1. That the ratio of the population of elementary school age children (usually $7\frac{1}{2}$ to $15\frac{1}{2}$ years) to the number enrolled in the elementary grades is stable for the estimating period
2. That the ratio of the net migration for the total population to the school age population closely corresponds to that for the

gross inner-city migrants in the United States for the same period. The validity of both assumptions relies on past census statistical relationships with current data (After Shyrock, Siegal and Associates, 1971)

Evaluation of the Component Methods

The Component Method I has been discarded by the U. S. Census Bureau as a means of population estimation. It has not produced accurate results on past tests (Zitter and Shyrock, 1974). Additionally, this method does not lend itself to a small area analysis because of the inappropriate assumptions that net migration of school age children is equivalent to that of the total population, and that the fertility trend in the local area is the same as that of the nation as a whole.

The Component Method II is generally not used for census tract population estimates due to the extreme sensitivity of net migration within census tracts. The accuracy of this Component Method is reduced by the differences between the relationship of the migration of school age children and the migration of total population. The validity of this assumption at the census tract level is subject to question, because the migration patterns of certain groups in the population (single men and women, married couples without children, college students and institutional population) are not identical to those of school age children. A significant proportion of the population in these groups within a census tract can cause gross errors in census tract population estimates. It therefore appears that both Component Methods are not particularly well suited for census tract population estimation (Zitter and Shyrock, 1974).

Composite Method

In 1959 Donald Brogue and Beverly Duncan introduced the Composite Method, which prepares independent estimates of population for several different age groups from which a total estimate can be gained by summing the independent estimates (Morrison, 1971). This method relies on the fact that symptomatic indicators are generally more sensitive within specific age ranges. Although Composite Method procedures utilize a wide variety of input data, such as vital statistics, social service and school enrollment data, the process typically involves the following general steps:

1. Estimate the current population 45 years of age and over by dividing age-sex-race specific death rates into related death records for the residents of the study area
2. Estimate the number of females in the child bearing ages (18 to 44 years) by using the general fertility ratio by age and race of mother
3. Compute the number of males by applying a sex ratio to the female population by age and race
4. Estimate the population 5 to 18 years of age using current school enrollment figures, which are multiplied by the previous ratio of children in this age range to children actually enrolled in school
5. Estimate the population under five years old using the race specific general fertility ratio, which is the ratio of children under 5 to females 18 to 24 years of age

6. Check the figure gained by Steps 4 and 5 with the figures derived from Component Method II.
7. Sum the estimates gained in Steps 1 through 5 to yield the total population estimate for the area (After Morrison, 1971)

The Composite Method, because of its great sensitivity, has proven to be an accurate estimating technique for large areas, usually county level or higher (Shyrock, Siegal and Associates, 1971, p. 768). Another advantage of the Composite Method is that the procedure yields age-specific data.

While the Composite Method has not been tested at the census tract level, it tends to be prone to errors as the population of the study area declines. In sparsely populated areas, a disproportionate number of births, deaths, and school enrollment figures may exist in certain age categories. These fluctuations may create inaccurate results. Furthermore, this method is rather laborious to perform and requires a detailed data base as compared to other procedures, and thus is probably impractical for census tract estimating.

Symptomatic Series Methods

The Symptomatic Series Methods as developed by Robert C. Schmitt and his associates rely on data that reflect changes in population (Schmitt, 1954; Schmitt, 1956; Schmitt, 1966). Data such as vital statistics, school attendance and public utility hook-ups directly relate to population change. The relationship between population and symptomatic data can be measured with the use of regression analysis. Based upon the association of symptomatic data to decennial census data, regression

analysis provides a mechanism by which periodically collected symptomatic data can be used to estimate population directly. Regression methods assume that a stable linear relationship exists between population change and symptomatic data change.

This mathematical relationship can be expressed by the following equation:

$$Y = a + bx$$

where, Y = census tract population (dependent variable)

a = Y axis intersect

b = regression coefficient

x = symptomatic data (independent variable)

Three types of methods exist for predicting population through the use of symptomatic variables:

1. The Censal Ratio Method
2. The Ratio Correlation Method
3. The Proration Method

Censal Ratio Method

The Censal Ratio Method provides a simple framework for estimating population based on a highly related symptomatic variable. The symptomatic variable must be available both on an annual basis for population estimation and for previous decennial census years. A partial list of typical symptomatic variables would include:

1. The number of utility hook-ups
2. School enrollment data
3. The number of building permits

4. Vital statistics
5. The number of auto registrations

The Censal Ratio procedure is usually applied in the following manner:

1. Compute the ratio of the symptomatic variable to total population over a period of several census decades for each census tract. The ratios, in order to be predictable, should be stable or linearly consistent
2. Extrapolate these ratios to the desired estimation date
3. Multiply the symptomatic variable for the estimation date by the reciprocal of the censal ratio. This multiplication will yield the estimated census tract population
4. Sum the census tract estimates gained through the use of this method to check against overall estimates for the parent area. Adjustments should then be made as required.

As alluded to previously, the censal ratio must remain fairly stable or change in a consistent fashion, if an accurate estimate is to be made from the last census data. Certain types of symptomatic data will not be well suited for population measurement. Each city must determine for itself which are the best indicators based upon correlation analysis.

Ratio Correlation Method

A more elaborate procedure to estimate population by census tract is the Ratio Correlation Method. This method entails relating change through a multiple regression equation. These variables are assumed to be linked to one another over time. The Method basically involves

distributing proportionately the total parent area population among its census tracts. The statistic obtained from regression analysis is the change in a census tract's share of a known parent population.

More specifically, the dependent variable in the regression equation represents the ratio of the census tract's share of total population in 1970 to its corresponding share in 1960. The independent variables such as births, deaths, elementary school enrollment, and auto registrations are similarly expressed as a ratio of census tract's share of the independent variable in 1970 to its corresponding share in 1960. The census tracts should then be stratified into two groups:

1. Those who exceed their past share of parent area population
2. Those which did not surpass their past share of the parent area population

Regression analysis is applied to both of these stratified groups in order to acquire the two regression equations. The estimated change in the share ratios for individual census tracts is gained by substituting the 1970 through 1975 share ratios for the independent variables. This change in the share ratio is multiplied by the original share ratio of 1970 to obtain the estimated 1975 share. Finally, this estimated 1975 share is multiplied by the estimated 1975 parent area population to gain the census tract population. The percentage shares of all census tracts should sum to 100 percent.

The Ratio Correlation Method assumes that a statistical relationship exists between the dependent and independent variables during the census periods. The degree of statistical relationship can be measured by the multiple correlation coefficient. A high coefficient over the

past two census periods would indicate that the degree of correlation is remaining stable and consistent, and thus the equation should yield reasonably accurate estimates (Morrison, 1971, p. 142).

Proration Method

The Proration Method is very similar to the Appropriation Method and the Censal Ratio Method. All three methods involve the distribution of an estimated total parent area population among its component parts. The main difference in the Proration Method versus the other methods is that the Proration Method gains its results directly from symptomatic data. An example of the Proration Method procedure will clarify this difference.

Using the Proration Method, the estimated parent area population is distributed among the census tracts according to the proportion of the tract by tract distribution of symptomatic data. For instance, a census tract containing five percent of the city's residential water meters is also assumed to have a corresponding share of the city's population. The estimated parent area population is multiplied by the symptomatic share of a variable to yield the population figure for the particular census tract.

Evaluation of the Symptomatic Series Methods

The main advantage of the Censal Ratio Method is its simplicity in application. The accuracy of estimates derived, however, depends upon the consistency and accuracy of the symptomatic data. If the data is accurate and consistently related, the results gained should adequately measure population change within census tracts. Other complications can

still arise even if the relationship is consistent. If the overall population estimate for the parent area is inaccurate, the census tract estimate will also be inaccurate. The accuracy of the technique depends upon the variables used within the estimating procedure. Using vital statistics, it was found that over a ten-year period the average error was 15.4 percent and the median error was 10 percent (Schmitt, 1956, p. 377).

Utilizing a multiple correlation coefficient to measure the relationship between symptomatic data and population change, the Ratio Correlation Method has proven to be accurate. It was determined that the mean percent deviation using this method was only 9.9 percent, bettering the Censal Ratio Method and the extrapolation procedures for estimating populations of minor civil divisions (Schmitt and Grier, 1966). Because of its use of regression analysis, the Ratio Correlation Method has proven to be one of the more promising techniques for census tract population estimating.

The final estimation technique under the Symptomatic Series Methods category is the Proration Method. This Method depends entirely on the accuracy of the symptomatic data as it relates to population. A one to one correspondence is not likely using symptomatic variables. However, it was found that population allocated by vital statistics was only subject to an average error of 10.6 percent and a median error of 5.9 percent (Schmitt, 1956, p. 377). This Method proved to be the most accurate of those tested in this particular paper. The simplicity of this technique and its application make it desirable but correlation analysis should be performed to insure the reliability of the symptomatic variables.

Housing Unit Methods

Housing Unit Methods utilize utility data, residential building and demolition permits, or a combination of these, to measure changes in population. An estimate of current occupied housing stock is a basic prerequisite for estimating current population within each census tract. Housing Unit Methods assume that population can be measured from changes in the number of occupied housing units and persons per household since the base year. The U. S. Census of Housing data from 1970 is updated through the use of building and demolition permits which directly reflect changes in the total number of housing units. Once a proper vacancy rate for the area is estimated by field survey, extrapolation of 1960 to 1970 vacancy rates or other procedures, the estimated population is derived by multiplying the number of persons per household by the number of occupied housing units. Group quarters population must then be added to the household population to arrive at a total population count. Of the Housing Unit Methods available for deriving population estimates, the three most common are:

1. The Building and Demolition Permit Method
2. The Utility Method
3. The Combination Method (Morrison, 1971, p. 138; San Diego Comprehensive Planning Organization, 1971)

Building and Demolition Permit Method

This Method derives population estimates through the use of building permits and demolition permits records. Accurate permit files must be available by census tract in order to apply this technique. The basic

procedure can be outlined as follows:

1. Find the total number of housing units by census tracts from the 1970 U.S. Census of Population, Census Tract Report
2. Add to these figures the number of building permits (housing units constructed within the census tract since the last census). These figures should be checked against a real estate file or a certificate of occupancy to insure that the structure was actually built
3. Subtract from this figure the number of housing units demolished by using demolition permits. This will yield a total number of housing units by census tract for the desired intercensal period
4. Calculate the number of vacant housing units in order to find the number of occupied dwelling units. The vacancy rate can be found by taking a field survey using 1970 rates or other reliable procedures. The number of vacant units must be subtracted from the total number of housing units to obtain the number of occupied dwelling units.
5. Multiply the number of occupied units by the number of persons per household to find the total household population. The number of persons per household is usually found by either extrapolating the 1960-1970 census trend or applying the 1970 figure.
6. Add to the total household population the total number of people living in group quarters. This will yield the total population within each census tract (After San Diego Comprehensive Planning Organization, 1971)

Utility Method

The Utility Method assumes that the number of utility hook-ups directly reflects the number of occupied dwelling units. A one to one relationship is believed to exist between public utility hook-ups and the number of occupied housing units. Certain adjustments can be made by figuring a ratio of hook-ups to the total number of occupied housing units in 1970. This ratio can then be applied to the current public utility hook-up count in order to correct for any over and under counts. The procedure for calculating population through the use of the Utility Method is as follows:

1. Calculate the ratio of the number of utility hook-ups to the number of occupied housing units for the base year if possible
2. Apply this ratio to the current number of utility hook-ups. This will yield the number of occupied dwelling units
3. Follow Steps 5 and 6 which are discussed under the Building Permit Method section (After Starsinic and Zitter, 1968)

Combination Method

The Combination Method uses both demolition and building permits and utility data to derive population figures. The basic procedure is much the same as that of the Housing Unit Methods discussed previously. However, vacancy rates are handled in a different manner as described below. The procedure using the Combination Method is as follows:

1. Find the total number of housing units by census tract from the 1970 U. S. Census of Population, Census Tract Report
2. Subtract the number of demolition permits from the number of

building permits and then add or subtract this figure from the total 1970 number of housing units. This will yield the total number of housing units in 1975

3. Calculate the ratio of the number of utility hook-ups to the number of occupied housing in the base year
4. Apply this ratio to the current number of utility hook-ups. This will yield the number of occupied dwelling units
5. Subtract the total number of housing units (Step 2) by the total number of occupied housing units (Step 4) for each census tract. The remainder is the number of vacant housing units. Check this figure against the 1970 census figure to test its reasonableness
6. Proceed to estimate population in a similar manner as the other two methods described above

This Method derives the number of vacant housing units as a residual. This residual is a good check on the reasonability of the estimating system.

Evaluation of the Housing Unit Methods

The Housing Unit Methods have made a creditable showing in tests conducted so far (Starsinic and Zitter, 1968, pp. 475-484; U. S. Bureau of the Census, 1969), although the accuracy of these Methods varies according to the quality of the input data. Building permit data for instance may not necessarily be representative of actual construction, for more permits are normally taken out than result in building activity. The issuance of Certificates of Occupancy or the recording of final building inspections helps to eliminate this problem. Utility company records

are also subject to error if master meter connections (meters that serve more than one dwelling unit) are not adjusted for. Another problem is that generally the assignment of building, demolition and utility records to census tracts is a manual operation. When dealing with thousands of records, this process can be tedious, time-consuming and error prone. With the use of local data files and a geographic base file, much of the manual geographic coding can be eliminated.

The largest amount of errors seemingly occurs in estimation of the number of occupied housing units, and not from the size of households (Starsinic and Zitter, 1968, p. 481). More refinements are needed in local data files in order to lower the amount of error in the number of occupied households. Results of empirical studies indicate that the Utility Method is generally more accurate than the Building Permit Method for estimation of the number of occupied housing units. This can be mainly attributed to the inaccuracies in the number of building and demolition permits. In addition, estimation of vacancy rates poses difficulties, but the use of the Combination Method to derive the number of vacant units as a residual appears to be a logical process to obtain vacancy rates.

The Housing Unit Methods' popularity and suitability for small area analysis is described in the survey done by the U.S. Bureau of the Census (U. S. Bureau of the Census, 1970, p. 5). Over seventy percent of the local agencies which make population estimates use one of the Housing Unit Methods. This speaks well for the broad applicability of these Methods.

Selecting the Appropriate Method

As we have seen in our review of the various estimating techniques, many studies have been conducted in order to assess the accuracy of alternative estimating systems. These studies have helped eliminate the least accurate methods. Unfortunately, the more accurate alternatives are difficult to compare because of methodological differences. A Rand Corporation Study written by Peter Morrison concluded that, of these more accurate methods, no specific technique has consistently demonstrated greater accuracy than another (Morrison, 1971, p. 26). Thus the decision regarding which method should be utilized is generally reached upon answering the following four questions:

1. What data items are required?
2. For which geographic areas are estimates to be prepared?
3. What is the status and quality of local data bases?
4. What resources are available to conduct the estimates?

The first question to be answered involves the data items to be estimated and the desired level of accuracy of the estimates. Generally the data items to be estimated are predetermined, as they represent specific input requirements for federal grant applications, local modeling systems, or administrative/legislative requests. Once a determination has been made as to which data items are required, the specific estimating techniques to be used in producing the estimates are narrowed. For example, if age-specific population estimates are required, then only the techniques which produce age-specific estimates should be used. If total population estimates are needed, a broader range of techniques can be utilized. Once the data items have been selected and the estimating

techniques generally narrowed, the final choice of a specific technique should be based upon the level of accuracy that can be achieved. It would generally be expected that the level of accuracy to be obtained by the estimates would be as high as possible, although the achievement of that accuracy is largely dependent upon the inherent methodological bias of the technique and the use of the technique within the local government.

The second question regards the geographic delineation of the estimates and affects both the choice of the methodology and the procedures that are used to apply the method. Assuming that small area estimates are required, a determination must be made as to which administrative areas are used. If mathematical techniques are utilized, then data must be available for consistent geographical areas over time, which generally necessitates the use of census tracts. If methods which require the use of current local data are utilized, the geographic areas should be defined by the street network for simplicity in geocoding. The DIME Geographic Base File system now makes it possible to efficiently geocode large numbers of local records and assign them to any number of geographic areas, but this assumes that an operational GBF/DIME File is available and that local geographic codes are assigned to the file by street segment. If a geographic base file does not exist, this virtually eliminates the use of some techniques, without substantial amounts of clerical help.

The third determination or question to be answered concerns the availability, extent, and quality of the local "data base" to be used. Not only must data required by the estimating procedure be available, but it must also be definitionally consistent with the estimating methodology,

be in proper format (geographically and statistically), and be of suitable quality to achieve an acceptable level of accuracy. The attainment of local primary data within the above constraints becomes a major determinant in the choice of an appropriate estimating technique, for if the required primary data cannot be procured, then the specific technique requiring this data cannot be applied within the local environment.

The final question affecting the choice of estimating methodology is related to the extent of local resources (manpower and data processing), and the time constraints placed upon the system. The answer to this question most directly affects the choice of the technique and the accuracy of the estimates to be prepared. For no matter how complete the local data base may be or how numerous the techniques that could potentially be utilized, local resources and time constraints will in the final analysis determine which technique will be used and how accurately the technique can be applied.

CHAPTER III

THE ICES (INTERCENSAL ESTIMATING SYSTEM) MODEL

Based upon the previous review of the alternative estimating methodology and selection criteria, chapter III deals with the development of the ICES population and housing estimating model for the City of Omaha. The criteria governing the model's design are evaluated in regard to data item, geographic, data base, and local resource considerations. The overall ICES methodology is then examined and its specific procedures described. The model is tested and population and housing estimates of Omaha census tracts are presented.

Design Criteria

This section of chapter III provides an analysis of the questions asked in the previous chapter regarding the selection of estimating methodology. The framework for the overall ICES design is based upon the answers to those questions with respect to the Omaha environment. It is important to remember that, regardless of the estimating method selected for use, the method must be modified to fit the given situation. In regard to the ICES program, the following items influenced the overall design and implementation of the system.

Data Item Considerations

The data items to be estimated were predetermined by the specific input requirements of the 1976 Housing and Community Development Block

Grant Application, as defined by the United States Department of Housing and Urban Development. The items required for that program included:

- I. Demographic estimates
 - A. Total population
 - 1. Minority population
 - a. Black population
 - b. Other minority population
 - 2. Elderly population
- II. Household estimates
 - A. Households
 - B. Group quarters population
 - C. Persons per household
- III. Housing estimates
 - A. Housing units
 - 1. Housing type
 - a. Single family housing
 - b. Multi-family housing
 - 2. Housing tenure
 - a. Owner occupied
 - b. Renter occupied
 - c. Vacant

Since the required data items were classified into three categories: demographic, household, and housing estimates, the estimating method to be used had to be capable of producing a rather wide range of population and housing related characteristics. In general this eliminated methods that produced only population estimates, although it should be recognized

that such techniques can be used to later verify the population estimate derived from the method initially employed. A modified Housing Unit Method appeared to have the most potential for preparing the estimates required. This finding was further substantiated by the other criteria.

Geographic Considerations

The data items specified for the Housing and Community Development Block Grant Application were to be provided according to individual census tract. For the purpose of the 1975 estimates required by the Application, 1970 census tracts were utilized (see figure 2), and estimates were prepared for 89 of the 95 Douglas County census tracts. For the 1976 estimates, 1980 census tracts were utilized. (During 1976 the local Statistical Areas Committee and the Census Bureau had officially approved 1980 tracts. See figure 3) This increased the number of tracts in Douglas County from 95 to 104 and the number of tracts for which estimates were required by the Application from 89 to 100.

The most important geographic consideration to influence the choice of an estimating procedure was the availability of an updated GBF/DIME File for the Omaha area. The GBF/DIME system as previously defined is a computer system designed to handle geographic data. A simplified version of the information contained on the DIME File can be seen in figure 4. The primary application of the DIME system has been, and continues to be, in geocoding, the process of assigning spatially related information to geographic areas. The fundamental reason for the creation of DIME by the Census Bureau was to automate 1970 Census geocoding procedures. Through the use of DIME technology

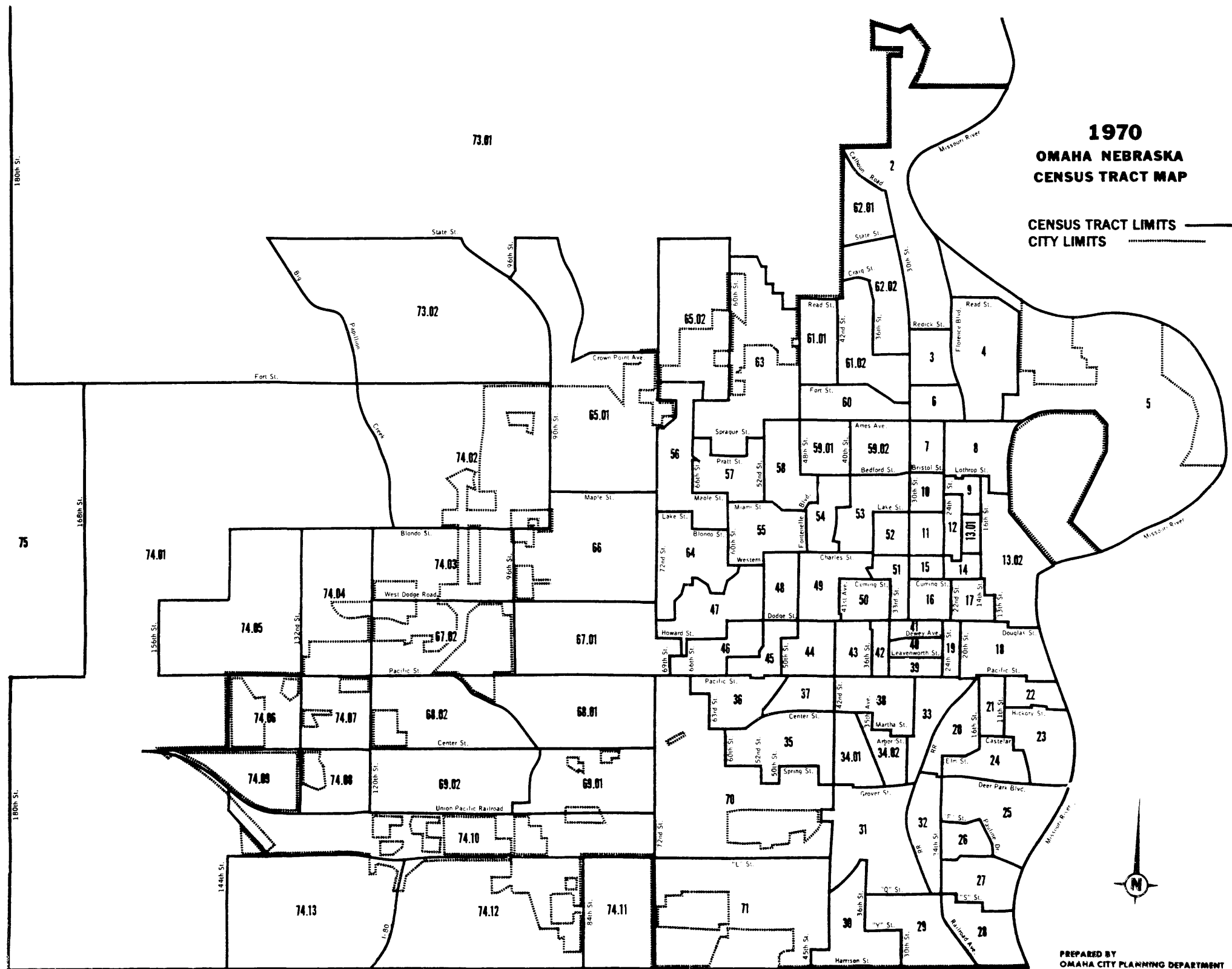


Figure 2. 1970 Omaha Nebraska Census Tract Map

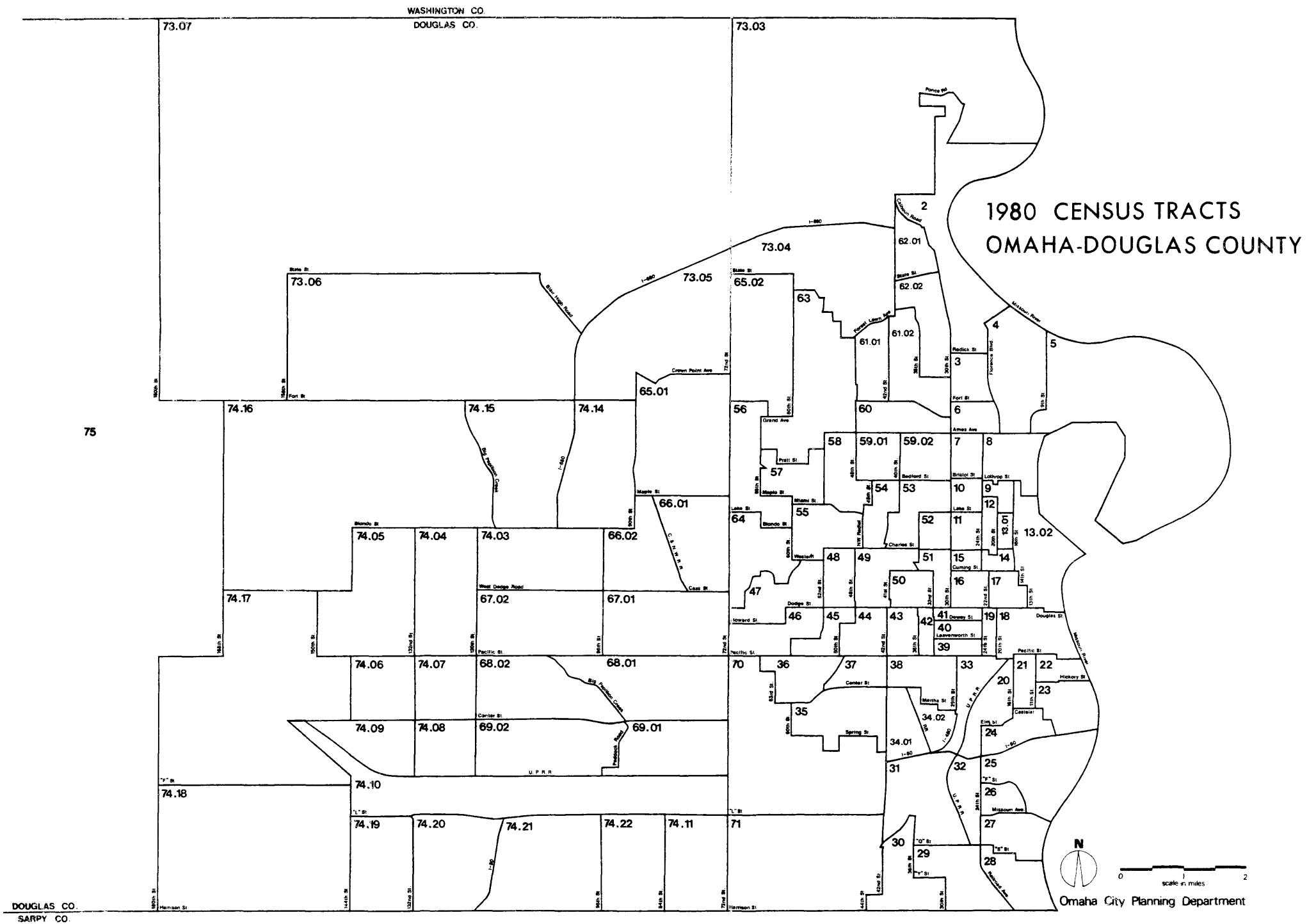
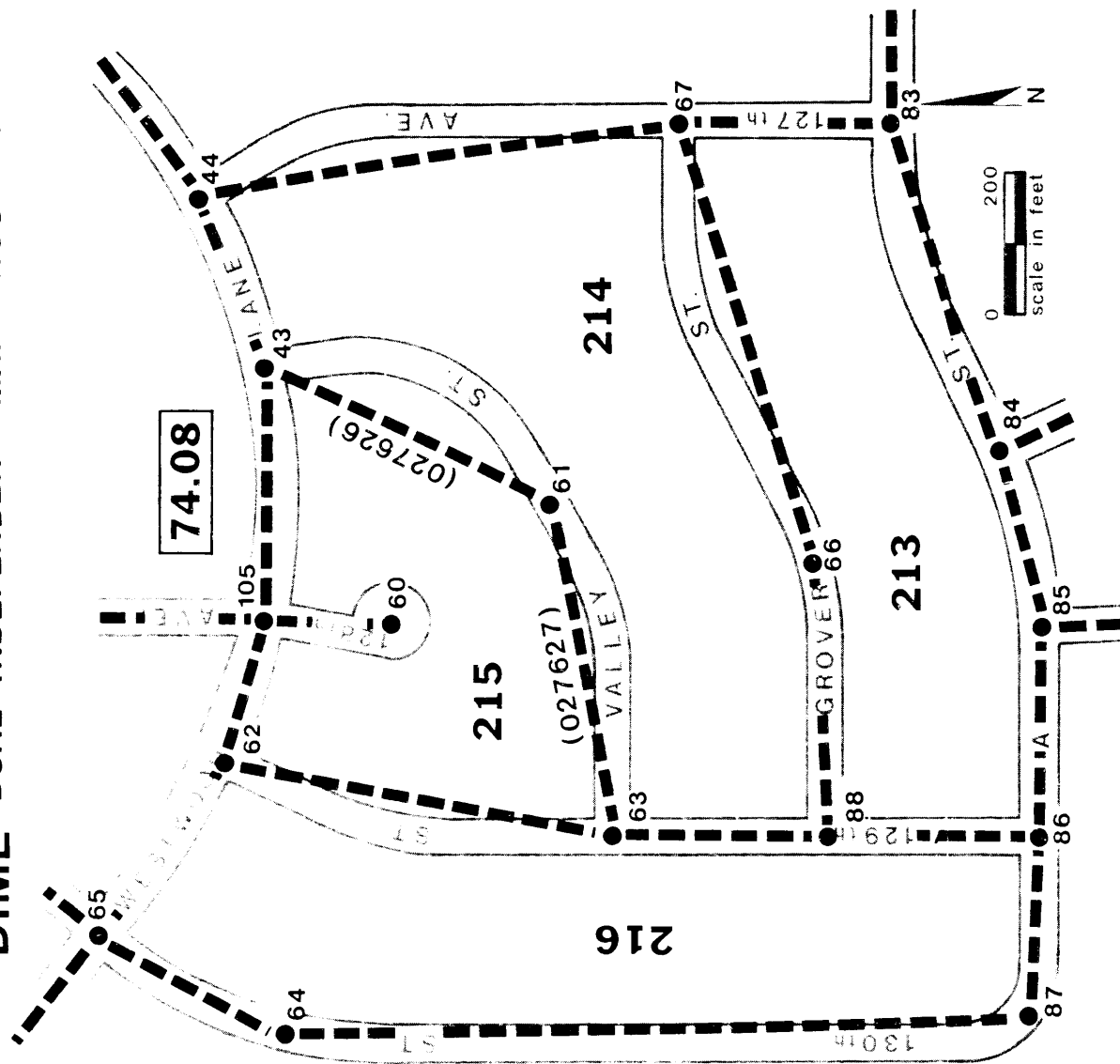


Figure 3. 1980 Census Tracts. Omaha - Douglas County

DIME DUAL INDEPENDENT MAP ENCODING



ACG/DIME Geocoding Worksheet

Record Number	Segment Name And Description	From Node	To Node	Left Block Face			Right Block Face		
				Address Low	Address High	Tract	Address Low	Address High	Tract
027626	Valley Street	43	61	12801	12849	214	12800	12848	215
027627	Valley Street	61	63	12851	12899	214	12850	12898	215
017758	Grover Street	67	66	12751	12823	213	12750	12822	214
017759	Grover Street	66	88	12825	12899	213	12824	12898	214
010221	South 127th Ave.	44	67	3351	3473	212	3350	3498	214
010222	South 127th Ave.	67	83	3475	3599	212	3500	3598	213

Figure 4. DIME - Dual Independent Map Encoding

millions of census questionnaires were tabulated into census geography. In addition to the Census Bureau's use of DIME, local governments are beginning to utilize the system to increase their geocoding efficiency hundreds of times, and to break down the geographic barriers that have isolated and restricted the use of important local information. DIME provides local users with the ability to geographically code large data bases easily and efficiently. Thus many of the problems in obtaining local data that are inherent in some of the more accurate estimating methods are eliminated. Data files containing thousands of records can now be geographically coded to any administrative area defined by the street network, such as traffic zones, fire and police cruiser districts, and subdivisions, etc. Once these areas are coded to the DIME File, local data can then be matched to them by address, utilizing the ADMATCH (address matching) program. (Note: ADMATCH is potentially capable of matching every address to the proper geographic area, although in practice errors exist in both the DIME File and in local file addresses that make a 100 percent match impossible. With relatively correct files, 85 to 95 percent of all addresses should successfully match. The remaining 5 to 15 percent (rejects) must then be manually geocoded. With continuing refinements to both the Geographic Base File and the address fields of local files, most of these rejects can eventually be eliminated.

Data Base Considerations

The availability, extent, and quality of the local "data base" seemed to be consistent with the input requirements of a modified Housing

Unit Method. The following list displays the primary data sources utilized as part of the 1976 ICES design:

1. 1970 Census tract statistics -- U. S. Census Bureau
2. 1976 Douglas County Real Property File -- Douglas County Government
3. 1970-1976 Omaha Building and Wrecking Permits -- Omaha Housing and Community Development Department
4. 1976 Omaha Public Power District Residential Customer File -- Omaha Public Power District
5. 1976 Northwestern Bell Telephone Company Residential Customer File -- Northwestern Bell Telephone Company
6. 1976 Omaha Public Schools Student Census File -- Omaha Public Schools
7. 1969-1976 Vital Statistics -- Omaha-Douglas County Health Department
8. 1974 Profiles of Change -- R. L. Polk Company
9. 1976 Public Housing Inventory -- Omaha Housing Authority
10. 1976 Mobile Home File (Douglas County Auto Registration File) -- Douglas County Government

It is important to realize that the ICES program is the first local application program to extensively utilize a wide variety of local files. As a result many definitional and format problems were encountered in its initial establishment. These will be discussed further in the section on ICES design. In spite of these data preparation difficulties, an adequate amount of primary source data was obtained at the census tract level to meet the necessary data requirements for the Housing

Unit Method utilized within ICES.

Local Resource Considerations

Of the four considerations described in chapter II, local resources and time constraints had the most individual bearing on the final design of the estimating system. ICES was designed, and 1975 estimates produced, within five months of 1975. The program required a full-time staff of three and spent approximately \$10,000 on data processing for preparation of both the 1975 and 1976 estimates. As this program was the first major attempt to produce small area estimates for the City of Ohama, and the first time that the local data base and Geographic Base File had been utilized for estimating, the need for refinement of the system became apparent. Due to the time constraints on the first year's program, these refinements were not incorporated into the system until 1976. In 1976 an evaluation was made of the 1975 estimates, which resulted in a number of modifications being made to the system. For example, it was anticipated that the 1975 estimates would be made almost entirely from local data files, but because of definition and programming difficulties, a few potential sources could not be utilized within the 1975 time constraints. Thus, less reliable methods (interpolation of census trends) were utilized to correct some of the deficiencies in the local data. This mixture of interpolation and local resources did produce reasonable 1975 estimates, although it was realized that a higher level of accuracy could be achieved with the use of local data exclusively. During 1976 many of the problems experienced during 1975 were resolved and a number of special studies were conducted to refine the system. This resulted in the use of

more local data and the attainment of higher estimate accuracy.

The 1975 and 1976 experiences demonstrate the need for an adequate level of manpower and funding within reasonable time constraints to evaluate, test, and refine estimating methodology. Many of the problems encountered in 1975 could have been eliminated with better data base documentation to evaluate local data sources. Fortunately, the choice of a modified Housing Unit Method allowed for the use of a variety of mathematical techniques to compensate for the lack of local data for the 1975 estimates. The 1976 system refinements allowed these mathematical techniques to be replaced with local data, thus increasing the estimate's accuracy without substantially changing the methodology.

ICES Design

The purpose of this section of chapter III is to describe the Housing Unit Method modified for use within the Omaha environment. As previously described in chapter II the traditional Housing Unit Method consists of six steps:

1. Tabulating the total number of housing units by census tract from the 1970 United States Census of Population and Housing Census Tract Report
2. Adding to these figures according to census tract the number of housing units constructed since the last census
3. Subtracting the number of housing units demolished since the last census, according to census tract
4. Determining the number of vacant housing units by census tract for the date of the estimate. Subtracting the number of vacant

units from total housing units to obtain the number of occupied units

5. Multiplying the number of occupied units by the number of persons per household to obtain household population
6. Adding to the household population the number of persons living in group quarters to obtain total census tract population

Housing Estimates

During the creation of the 1975 estimates the above procedure was closely followed, utilizing whenever possible local data. The procedure relies heavily upon census statistics from the most current census. Once the census data base is established, local information is used to determine both the number of new units constructed since the census as well as those units demolished. To derive this information two sources of data were available: Omaha's building and demolition permits and the Douglas County Real Property File. Upon examination it was found that the permit data could not be used directly because:

1. Permits were not available in computer readable form during the entire 1970 to 1975 period, but only since 1973
2. Building and demolition permits only indicate the intention to carry out an activity and not necessarily the completion of that activity. Due to the lack of an efficient mechanism for verifying the execution of building or demolition activity, the permits did not appear to be an entirely accurate means of determining housing unit change

The Douglas County Real Property File proved to be a more valuable

source of housing unit information than did the permits. The Property File contains records on all parcels (property) within Douglas County. Associated with these records is a wealth of information regarding property ownership, tax assessment, tax billing, legal description, property address, etc. The File also includes the following items which are of specific importance in determining housing unit change:

1. Property class, enabling single and multi-family residential property to be identified
2. Improvement value, identifying the existence of a structure on the property

To produce housing unit change since 1970, a copy of the 1971 Real Property File (which reflected 1970 information) was compared to the 1975 Real Property File (which reflected 1974 information up to December 31, 1974) for residential property that had experienced a change in improvement status, either from no improvements on the property to an improved value (construction) or from an improved value to no improvements (demolitions). Because the multi-family records on the Property File did not identify the number of housing units within a multi-family structure, building and demolition permits containing the number of units were used to supplement the property data. The final product of this process was a computer tape that contained 1970 to 1975 change in improvement status for single and multi-family housing units. This tape was matched to the DIME File to geocode the records according to census tract, thus producing a tabulation of single and multi-family housing unit change. This information was then added to the 1970 housing counts to obtain a January 1, 1975 estimate.

In 1976 it was determined that both the efficiency and accuracy of single and multi-family housing counts could be improved by calculating 1976 single family housing counts directly from the Douglas County Real Property File (property ownership could also be tabulated at the same time). This eliminated the need for steps 1 and 2 of the Housing Unit Method, by producing an actual housing inventory for 1976. Two separate procedures were required to determine single family units and multi-family units. The 1976 single family housing estimate was derived from the 1976 Real Property File (which reflects 1975 data up to December 31, 1975), geocoded to census tracts using DIME. Secondly, a multi-family housing unit inventory was obtained from a correlation of the 1975 multi-family housing estimate (updated with building and demolition permits to 1976), and 1974 R. L. Polk Company's Profiles of Change multi-family data updated with permits to 1976. The decision as to which source would be used was made after a comparison of both figures with total housing unit and occupancy information.

Utilizing the above procedures a 1976 housing unit inventory was made according to type of housing unit. In addition, the number of owner occupied units was established from the single family inventory by selecting all residential property qualified for Nebraska's Homestead Exemption for owner occupied housing and all residential property not identified by homestead exemption where the address of the property matches the address of the owner. In addition to the owner occupied estimate, a vacant housing estimate was obtained by subtracting the number of occupied housing units (described in the next portion of this chapter) from the total housing estimate. Given the number of owner occupied and

vacant housing units, renter housing units were calculated as a residual using the following formula:

$$\begin{array}{r} \text{Total housing unit estimate} \\ - \text{Owner occupied housing unit estimate} \\ - \text{Vacant housing unit estimate} \\ \hline \text{Renter housing unit estimate} \end{array}$$

Household Estimates

The method of obtaining the number of occupied housing units and thus the number of vacant housing units was designed to utilize customer files from both the Omaha Public Power District (OPPD) and Northwestern Bell Telephone Company. In order to calculate the ratio of utility customers to occupied housing units, an attempt was made to procure 1970 utility files to compare against the household count from the Census. Unfortunately, it was discovered that 1970 files were unavailable from either source because of the self-liquidating nature of the files (historical reference is lost with file updating and maintenance activity). Because the ratio of utility customers to occupied housing units could not be calculated, the assumption was made that the number of active electric and telephone customers would be equal to the number of actual occupied housing units. Through the use of two independent files it was hoped that a close numerical relationship would substantiate this assumption.

For the purpose of the 1975 estimates only the Omaha Public Power District file was available for use within the time constraints of the 1975 program. After processing the file and generating a set of vacancy rates, they were found to be excessive. Upon further investigation, OPPD discovered a logic problem in the program used to prepare its file, thus

a sizeable number of records had been omitted. Due to the time restrictions placed on the program, it was not possible to repeat the ADMATCH; thus an alternative strategy was developed. Without local source data to directly obtain the 1975 occupied housing estimate, a 1975 vacancy rate had to be established from interpolating Census trends at the census tract level.

In 1976 both the OPPD and Telephone Company files were available, and the previous programming problem had been resolved. Customer addresses were geocoded to census tracts using DIME and the resultant totals subtracted from the total housing count to obtain vacancy rates. Two vacancy rates were obtained: one from the OPPD file and one from the Telephone Company file. The variance between the two rates was calculated and the differences evaluated (Causes of the differences were public housing, mobile homes, master meters, low telephone usage, etc.). Once the differences were resolved and a single vacancy rate arrived at, it was then possible to calculate the 1976 occupied housing unit estimate.

Upon arriving at a household estimate for each census tract, it was then necessary to calculate a household population and a group quarters population, which can be added together to obtain a total population estimate. The calculation of household population is done by multiplying the number of households by a persons per household rate, because of time limitation. During 1976 a survey was made of group quarters facilities that resulted in: 1) identifying all major group quarters facilities, and 2) obtaining an accurate and updated count of group quarters population. Because of the limited number of group quarters population (8,955 for 1976) this procedure was relatively easy to undertake; persons per

household rates were much more difficult. The persons per household rates used for the 1975 estimates were interpolated from Census trends. Recognizing that this technique was not sensitive to rapidly changing social conditions, a new approach was sought for 1976.

The persons per household procedure that was finally utilized is designed after A Model for Estimating Household Size in the San Diego Region (San Diego Comprehensive Planning Organization, 1974). The model is a multiple linear regression equation that utilizes symptomatic independent variables to arrive at a persons per household dependent variable. The key in developing the model is to obtain local symptomatic data for both 1970, to establish the equation, and for 1976, to calculate the estimate. The input requirements that were finally selected are:

- 1) percentage of K-9 school enrollment to occupied housing units, 2) percentage of single family housing units to total housing units, and 3) average births per occupied housing units. Not only was this data required for 1970 and 1976, it was also required by census tract. Single family housing units were already available by census tract, as was the birth data from Vital Statistics Division, Omaha - Douglas County Health Department. School enrollment proved to be more difficult to acquire and geocode to census tract, because the Omaha area is divided into five school districts (Omaha, Ralston, District 66, Millard and the parochial) with only one having school census statistics in computer readable form (Omaha). Once all the information was acquired and geocoded to census tracts, a 1970 equation was established and applied to the 1976 data to arrive at a 1976 persons per household rate. This rate is then used in the following formula to obtain the 1976 total population estimate:

$$X = (a \times b) + c$$

where, X = total population

a = household estimate

b = persons per household rate

c = group quarters population

Demographic Estimates

Once a total population estimate is made, it can provide the basis for a number of other population characteristics. The two characteristics that were required for the Block Application were minority and elderly population; therefore these will be discussed at this point. In 1975 due to time limitations the 1970 ratios of minority and elderly population were directly applied to the 1975 total population estimate. This technique is only successful in areas of population stability or where the population group is immobile, as is generally the case with the elderly population. However, in the case of minority population, the technique can be misleading. In Omaha the minority population is concentrated within a few specific census tracts which have historically lost population. When a constant minority population ratio is applied to these tracts, the result is a decline in the minority population. Because this technique did not allow for migration, it was not acceptable for the 1976 estimates.

In 1976 sources of symptomatic minority statistics were evaluated, with only two providing acceptable data: Vital Statistics (minority births and deaths) and School Census statistics (minority school enrollment). From this information a multiple linear regression equation was calculated for 1970 and 1976. The input data used was: 1) average

minority births, 2) average minority deaths, and 3) minority school enrollment. Upon calculation of the equation it was found that multicollinearity existed between minority births and minority school enrollment; thus the two variables were considered statistically identical, and one was necessarily eliminated from the equation. The model was therefore constricted to the two variables: average minority deaths and minority school enrollment, with successful results. From this equation a total minority population estimate was established. Black and other minority statistics were calculated from the total minority population estimate, based upon their proportional relationship to total minority student population in the school census file.

Elderly population proved to be the most difficult 1976 estimate to ascertain because of the lack of local symptomatic data on elderly population. The only data that was readily available was the death statistics of persons 65 years of age and over. Because of the lack of statistics, a dual method was established, utilizing the death statistics as part of a single factor regression equation and interpolation of elderly population trends from decennial census tract statistics. Once both sets of data were calculated, an evaluation was made of each result to determine the most reasonable estimate.

ICES Methodology

This section of chapter III details the specific procedures of the ICES methodology. It is presented in outline form to provide a step by step sequence of the preparation of the 1976 estimates.

Work Element A: 1976 HOUSING ESTIMATES

Work Activities

1. Tabulation of the total number of single family housing units

- a. Creation of a tape from the Douglas County Real Property File containing the records of all residentially classed (single family) improved property
- b. ADMATCH of this tape with the DIME file to geocode the records to census tract. The results of this activity were:

Number of records processed	78,062
Total rejects	6,480
Total records matched	71,582
Match rate	91.70 %
Percent of DIME file updated at	
time of ADMATCH	70 %
Computer time (CPU minutes)	6.92

(Note: The single family housing tape ADMATCHed here is a constricted tape representing only that area within Interstates I-80 and I-680, thus the number of records processed does not equal the total number of single family housing units.)

- c. The ADMATCH rejects were reviewed and manually geocoded

These records were then added to the matched records to establish the single family housing count

- d. Creation of a printout from the Douglas County Auto Registration File containing the records of all mobile homes within the Omaha area
- e. The 1,593 mobile home records were manually geocoded to mobile home parks and then to census tracts
- f. The mobile home tract totals were added to the single family housing count (Activity 1c) to arrive at a single family housing count consistent with the ICES definition

2. Tabulation of the total number of multi-family housing units

- a. Creation of a printout from Omaha's Building and Wrecking Permit file of all multi-family permit activity for 1974 and 1975
- b. Geocode the permits to census tract
- c. Creation of a list by census tract of the 1975 ICES multi-family housing counts (Note: The 1975 ICES numbers were obtained by adding the number of multi-family building permits less the number of multi-family wrecking permits between 1970 and 1975 to the 1970 Census counts.)
- d. Creation of a list by census tract of the 1974 multi-family units tabulated by the R. L. Polk Company in Profiles of Change
- e. Update of both the 1975 ICES and the 1974 R. L. Polk multi-family counts to January 1, 1976, using the data created in Activity 2a

- f. Creation of a list by census tract of all public housing owned by the City of Omaha. This information was obtained from the Omaha Housing Authority, and was added into the multi-family housing counts where applicable in order to be consistent with the ICES definition
 - g. Evaluation of the data from Activities 2e and 2f on a census tract basis to determine the most reasonable number
(Note: This process generally involved the use of both multi-family counts to calculate two total housing counts, which were compared to the occupancy information produced in Work Element B. This comparison produced two vacancy rates which were evaluated against census trends and other sources to arrive at a reasonable multi-family estimate)
3. Calculation of the total number of housing units
- This activity is accomplished by simply adding the 1976 single family housing unit estimate to the 1976 multi-family housing unit estimate by census tract.

Work Element B: 1976 HOUSING TENURE AND HOUSEHOLD ESTIMATES

Work Activities

- 1. Tabulation of owner occupied housing units
 - a. Creation of a printout from the single family housing tape (created in Activity 1a of Work Element A) that identifies all residential property qualified for Nebraska's Homestead Exemption for owner occupied housing and all residential property not identified by homestead exemption where the

address of the property matches the address of the owner.

This information was already geocoded to census tracts
in Activity 1b and 1c of Work Element A

2. Tabulation of household (occupied housing units) estimate

- a. Creation of two files containing all active residential
(single and multi-family) customers of the Omaha Public
Power District and Northwestern Bell Telephone Company
- b. ADMATCH both files against the DIME File to geocode the
records to census tract. The results of this activity
were:

1976 Omaha Public Power District Customer File

Number of records processed	115,783
Total rejects	18,448
Total records matched	97,335
Match rate	84.07 %
Percent of DIME file updated at time of ADMATCH	70 %
Computer time (CPU minutes)	6.20

1976 Northwestern Bell Customer File

Number of records processed	126,024
Total rejects	21,729
Total records matched	104,295
Match rate	82.67 %
Percent of DIME file updated at time of ADMATCH	70 %
Computer time (CPU minutes)	7.23

(Note: The difference in the total number of records processed in the two files is due to the Northwestern Bell file containing some Sarpy County records.)

- c. The ADMATCH rejects were reviewed and manually geocoded. These records were then added to the matched records to establish total census tract counts for both files
- d. Evaluation of both files as part of Activity 2g in Work Element A to determine the most reasonable number. (Note: It was generally found that in the older parts of the City the OPPD data was more reliable, whereas in the suburbs the Telephone Company data was more acceptable.)

3. Calculation of vacant housing unit estimate

To produce the number of vacant housing units the following formula was used for each census tract:

$$\begin{array}{r} \text{Total housing unit estimate} \\ - \text{Household estimate} \\ \hline \text{Vacant housing unit estimate} \end{array}$$

4. Calculation of renter occupied housing unit estimate

Renter occupied housing units are calculated as a residual using the following formula:

$$\begin{array}{r} \text{Owner occupied housing unit estimate} \\ + \text{Vacant housing unit estimate} \\ - \text{Total housing unit estimate} \\ \hline \text{Renter occupied housing unit estimate} \end{array}$$

Work Element C: DEMOGRAPHIC ESTIMATES AND RATES

Work Activities

1. Survey of group quarters population

- a. Identification of group quarters facilities by census tract
 - b. Telephone survey of facilities to determine occupancy
 - c. Tabulation of survey results by census tract
2. Persons per household regression model
- a. To determine the 1976 persons per household rate by census tract a regression model was designed after A Model for Estimating Household Size in the San Diego Region (Comprehensive Planning Organization, 1974). The input requirements for the model were:
 - 1970 Persons per household rate
 - Percentage of K-9 school enrollment to occupied housing units (1970)
 - Percentage of single family housing units to total housing units (1970)
 - 1969-1971 Average births per occupied housing unit (1970)

A multiple linear regression equation was calculated from the above information:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3$$

where, Y = persons per household (dependent variable)

a = 1.480044 (Y axis)

b_1 = 1.658 (regression coefficient)

x_1 = percentage of K-9 school enrollment

b_2 = .879 (regression coefficient)

x_2 = percentage of single family housing

b_3 = -.359 (regression coefficient)

x_3 = births per occupied housing unit

The significant statistics from the equation were:

.970269 multiple correlation coefficient

.941422 coefficient of multiple determination

.058578 unaccounted variance (see appendix A)

- b. Creation of the three independent variables for 1976 from local data:

- Percentage of K-9 enrollment from school census files geocoded to census tract. Sources: Omaha, Ralston, District 66, Millard Public Schools (Note: This information also included private schools.)
- Percentage of single family housing from Activity 1, Work Element A
- Births per occupied housing unit from Vital Statistics, Omaha--Douglas County Health Department

- c. Calculation of 1976 persons per household rate from the regression equation created in Activity 2a and the three 1976 independent variables from Activity 2b, Work Element C

3. Calculation of total population

Total population was calculated using the following formula for each census tract:

$$X = (a \times b) + c$$

where, X = 1976 population estimate

a = 1976 occupied housing units (households)

b = 1976 persons per household

c = 1976 group quarters population estimate

4. Minority population regression model

- a. To determine the 1976 population by census tract a regression model was designed. The input requirements for the model were:

- 1970 Minority population
- 1969-1971 Average minority deaths (1970)
- 1970 Minority population ages 5 to 19

A multiple linear regression equation was calculated from the above information:

$$Y = a + b_1x_1 + b_2x_2$$

where, Y = minority population (dependent variable)

a = 36.817511 (Y axis)

b_1 = 43.420 (regression coefficient)

x_1 = minority deaths

b_2 = 2.078 (regression coefficient)

x_2 = minority student population

The significant statistics from the equation were:

- .939901 multiple correlation coefficient
- .937414 coefficient of multiple determination
- .062586 unaccounted variance (see appendix B)

- b. Creation of the two independent variables for 1976 from local data:

- Minority deaths from Vital Statistics, Omaha-Douglas County Health Department
- Minority student population by place of residence.

Sources: Omaha, Ralston, District 66, Millard Public
Schools

- c. Calculation of 1976 minority population estimate from the regression equation created in Activity 4a and the two 1976 independent variables from Activity 4b, Work Element C
5. Calculation of black and other minority population
 - a. Calculation of a ratio of black and other minority students to the total minority student population from the 1976 School Census files by census tract
 - b. Calculate total black and other minority population by applying the ratio from Activity 5a to total minority population
6. Calculation of elderly population
 - a. To determine 1976 elderly population by census tract, a single factor regression analysis was made, with 1970 death statistics of persons 65 years old and over and with 1970 total elderly population. Source: Omaha-Douglas County Health Department. The results of this analysis demonstrated a highly positive correlation coefficient of .930. Death statistics for 1976 were then substituted into the regression equation, and a 1976 estimate was derived. (see appendix C)
 - b. Interpolation of elderly population trends was performed using the 1950, 1960, and 1970 census tract statistics to derive 1976 estimates
 - c. Evaluation of both techniques to determine the most reasonable estimate

The population and housing estimates produced as a result of the ICES methodology can be found in appendix D.

CHAPTER IV

EVALUATION AND CONCLUSION

We have thus far discussed local government's critical need for subarea population and housing estimates, which information is prerequisite to any intelligent response to urban problems. That these estimates must be current and reliable is obvious. It was suggested that, through the use of automated geocoding techniques and computer technology, these estimates could be prepared for a variety of geographic subareas. A wide range of alternative estimating techniques were described and analyzed, from which a specific methodology was selected for testing. Utilizing a modified Housing Unit Method, a model (ICES - Intercensal Estimating System) was constructed that incorporated the use of local data bases and the DIME Geographical Base File System. The model's design over a two-year period was discussed, as well as the specific methodology that was used to prepare 1976 census tract estimates for the City of Omaha.

In order to assess the success of the model in preparing small area estimates, this chapter will provide both a quantitative and a methodological evaluation of the ICES model. Furthermore, a conclusion will be provided that lists the significant results of this analysis and proposes a general purpose estimating methodology.

Quantitative Evaluation

This portion of the evaluation reviews the results of the 1976 estimates against other estimates prepared for approximately the same time period. It should be stressed that the only true test of an estimating methodology is a comparison with a 100% enumeration of the area at the same point in time. Unfortunately an inventory of this type is conducted only at the beginning of each decade. Without statistics of this type, it is difficult to evaluate an estimating methodology. One may, however, arrive at a reasonably objective analysis of a given method by comparing its results with those derived from other methods. As attempt is made to compare the ICES estimates with other estimates made for the Omaha-Douglas County area.

Sources of Comparison

There are currently six organizations that prepare estimates for the Omaha area. These organizations utilize a variety of methods, geographic areas, and estimating dates, in preparation of their statistics. In order to provide a basis upon which the estimates may be evaluated, the following discussion will briefly summarize the various estimating techniques used by the organizations.

1. Organization: Bureau of Business Research (BBR) - University of Nebraska at Lincoln

Date of Estimate: July 1, 1976

Geographic Areas: State, counties

Methods: Cohort-Survival, County Shares

Characteristics: Total population by sex and age

Source: Nebraska Population Estimates, 1977

The Bureau of Business Research prepares state and county estimates on an annual basis as part of their involvement with the U. S. Bureau of the Census' Federal-State Cooperative Program for Local Population Estimates. BBR utilizes two separate methods for preparation of state and county estimates:

The methods used to produce population estimates by age for Nebraska differed for the state and the counties. The state-level age estimates were based on a cohort-survival method, whereas the county shares method was used to allocate the state-level age groups to counties. (BBR, 1977, p. 36)

2. Organization: U. S. Bureau of the Census - Washington, D.C.

Date of Estimate: July 1, 1975

Geographic Areas: States, counties, minor civil divisions

Method: Administrative Records Method

Characteristics: Population, per capita income

Source: "1973 (Revised) and 1975 Population Estimates and 1972 (Revised) and 1974 Per Capita Income Estimates for Counties, Incorporated Places, and Selected Minor Civil Divisions in Nebraska", Current Population Reports, 1977

The Census Bureau's methodology used to prepare the July 1, 1975 estimates is a component procedure known as the Administrative Records Method, that estimates each component of population change separately (births, deaths, net migration). The natural change components, births and deaths, are derived from Vital Statistics data. Migration data is obtained from Federal income tax returns. This method of computing population estimates has proven to be rather successful, with only 5.9 percent variance between the estimates and special census counts taken

for 86 areas nationwide.

3. Organization: Metropolitan Area Planning Agency (MAPA) - Omaha

Date of Estimate: July 1, 1976

Geographic Areas: Counties, jurisdictions

Method: Housing Unit Building and Demolition Permits Method

Characteristics: Population, persons per household

Source: MAPA Region Facts, 1977

MAPA has produced jurisdictional level estimates for their five-county planning region, utilizing

. . . building and demolition permit data supplied by local jurisdictions. Adjustments are then made for vacancy rates, household size trends and changes in group quarters residents.
(MAPA, 1977, page 1)

4. Organization: Center for Applied Urban Research (CAUR) -
University of Nebraska at Omaha

Date of Estimate: December 31, 1976

Geographic Areas: Six subareas of the Omaha urban area

Method: Housing Unit Building and Demolition Permits Method

Characteristics: Population, median family income

Source: "Population Estimates of Omaha and its Six Subareas",
1977

The Center for Applied Urban Research prepares estimates for six subareas of the City of Omaha (including Boys Town and Ralston). The subareas are aggregates of census tracts, although they do not follow tract boundaries exactly (see figure 5). The 1976 population estimates were made, utilizing the Housing Unit Building and Demolition Permits Method; permits were

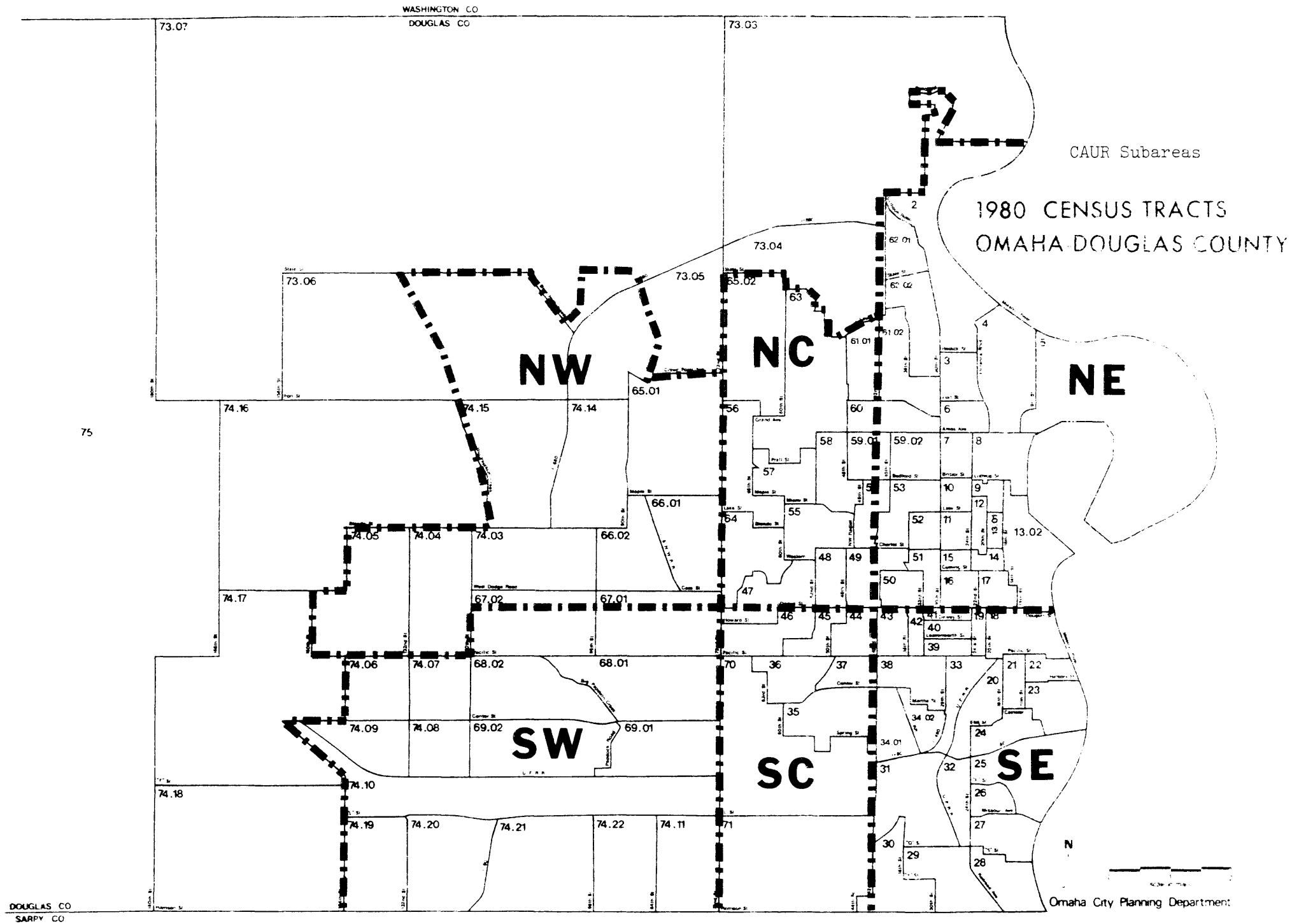


Figure 5. CAUR Subareas

tabulated according to subarea. A 6 percent single family and 10 percent multi-family vacancy rate were assumed to be constant, along with an annual decline of 0.01 percent in the persons per household rate.

5. Organization: Omaha World Herald

Date of Estimate: September, 1976

Geographic Areas: Thirteen subareas of the Omaha SMSA

Method: 2,000 Household Survey

Characteristics: Households (HH), HH income, HH labor force,
HH age, HH education, HH family composition,
HH size, housing tenure, housing value

Source: 1976 - 1977 Consumer Preference Study, 1977

As part of an ongoing market survey program, the Omaha World Herald annually estimates household characteristics for the Omaha SMSA. A 2,000 household survey was taken by telephone and inflated to represent 100 percent of all households. At a 95 percent confidence level, the sampling tolerance for 1 percent of 2,000 households is 0.4 of 1 percent. The subareas utilized in the survey are only grossly related to census tracts (see figure 6).

6. Organization: Omaha City Planning Department

Date of Estimate: January 1, 1976

Geographic Areas: Census tracts within the Omaha urban area

Method: ICES Housing Unit Inventory Method

Characteristics: Population by race, elderly population,
households, group quarter population,
persons per household, housing units by
type and tenure

Source: ICES '76 Intercensal Estimating System January 1,
1976 Population and Housing Estimates, 1977

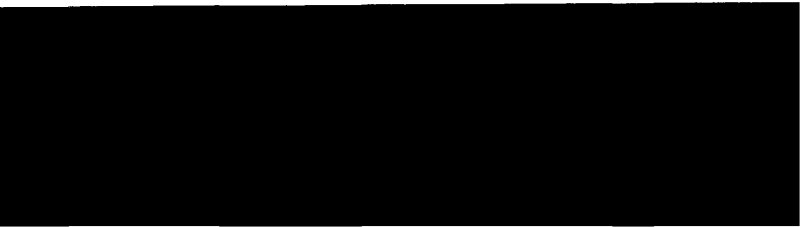


Figure 6. World Herald Subareas

Estimate Comparison

Without a census enumeration or a special census to provide the basis from which the accuracy of the above estimates can be measured, it is impossible to determine which method is in fact the most accurate. Subsequently, it will be the purpose of this section of chapter IV to simply compare the ICES estimates to the other sources, with the assumption that consistency of the ICES and the other estimates will demonstrate the reasonableness of the ICES model. An attempt will then be made to objectively describe some of the reasons for the differences in the estimates.

Three general areas of difference exist between the six sets of estimates: geographic, time, and the type of characteristics determined. The geographic differences happen to be the most profound, for the six estimates include four county estimates, two jurisdictional estimates, and three small area estimates of three different areas. Because the ICES estimates are by census tract, it is possible to compare them with the other two small area estimates (see figures 5 and 6), although certain differences will exist because the areal boundaries are not identical. At the jurisdictional level the ICES estimates can be adjusted to approximate both Omaha's corporate limits and Omaha's zoning jurisdiction limits (an extension three miles from Omaha's corporate limits within Douglas County), but again the geographical areas will not coincide exactly. Finally, the ICES model does not provide estimates at the county level. At the current time it is not possible to utilize the ICES model beyond the Omaha urbanized area because both the DIME File and most of the data files do not extend beyond this point. Thus for

the purpose of this comparison only small area and jurisdictional estimates will be utilized.

Estimates from the six sources also differ in the point in time for which they were prepared. Two were prepared for July 1, 1976; one for July 1, 1975; and one each for January 1, 1976; September 1976; and December 31, 1976. In a growing community such as Omaha, this difference in time has an effect upon the symptomatic data used as source material, and thus upon the estimates. In order to accurately compare the estimates an adjustment must be made for this time difference.

The third difference affecting the direct comparison of various estimates is the difference in the specific characteristics being estimated. Not only is it necessary that the characteristics being compared be identical; they must also be defined in the same way. Therefore, for the purpose of this analysis only the following characteristics can be compared: population, household, persons per household.

Population Comparison

The comparison of the various population estimates can be made at two geographic levels: 1) within Omaha's corporate limits, and 2) within CAUR's subareas. The jurisdictional comparison discussed first involves four estimates: those produced by MAPA, the Census Bureau, CAUR, and ICES. In order to allow for the time difference, actual population figures are not compared directly, but rather a standardized annual growth rate is calculated from the following formulas:

1. 1976 Estimate
 - 1970 Census count
 1970-1976 Amount of change

2.
$$\frac{\text{Number of months between April 1, 1970 (Census date) and the date of the Estimate}}{12 \text{ (months in a year)}} = \text{Time factor}$$
3.
$$\frac{1970-1976 \text{ Amount of change}}{\text{Time factor}} = \text{Amount of annual change}$$
4.
$$\frac{\text{Amount of annual change}}{1970 \text{ Census count}} = \text{Percent of annual change (growth rate)}$$

The comparison of the four population estimates using this formula is summarized in table I (see also figure 7).

TABLE I

COMPARISON OF POPULATION ESTIMATES FOR THE CITY OF OMAHA

Organization Date of Estimate	Time factor	Population estimate	Change	Annual change	Growth rate(%)
U. S. Census Bureau July 1, 1975	5.3	371,455	17,066	3,220	.91
MAPA July 1, 1976	6.1	368,733	14,344	2,351	.66
CAUR* December 31, 1976	6.8	396,504	42,115	6,193	1.75
ICES January 1, 1976	5.8	367,281	12,892	2,223	.63
1970 Census (Actual Count) April 1, 1970	. . .	354,389

*Adjusted for Boys Town and Ralston

The variations in the annual change between ICES and the other estimates ranged from the 128 persons with the MAPA estimate to 3,970 with the CAUR estimate. The Census Bureau estimates were within 997 persons of the ICES estimate. The largest variation, seen with the CAUR estimate, is

OMAHA POPULATION ESTIMATE COMPARISON

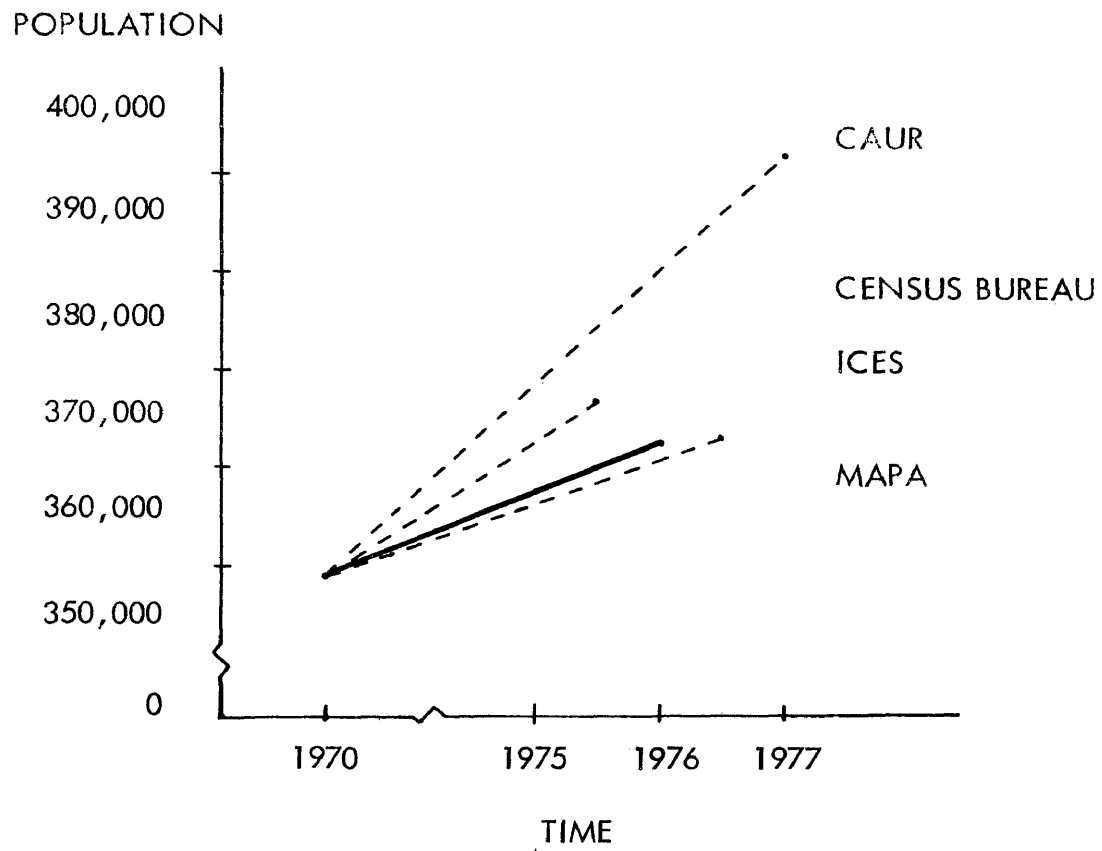


FIGURE 7.

probably due to four factors:

1. Differences in geographic definition
2. CAUR's use of constant vacancy and persons per household rates to calculate the subarea estimates and thus the jurisdictional estimates
3. The exaggeration of the 1970 Census data in certain areas of Omaha. As a result of a detailed examination of certain census tracts in the northeastern part of Omaha, it was discovered that substantial overcounting of multi-family units occurred in 1970. The use of the 1970 data as a base for the preparation of estimates would thus result in some exaggerations
4. The use of inaccurate permit data. As was previously described, there are a number of problems inherent in the use of permit data for the Omaha area (see chapter III). Thus if precautions are not taken, this data can produce misleading results. This argument can be substantiated by comparing the CAUR estimate with the MAPA estimate, which also is based on permit data (a 3,842 person variation exists)

The more moderate differences between the ICES estimate and the Census Bureau's estimate can be explained by:

1. Differences in geographic definition
2. Basic methodological differences. The Census Bureau's Administrative Records Method calculates population directly, whereas the ICES population estimate is indirectly calculated from household data
3. The inability to establish a 1970 ratio of utility data (representing the number of households) to actual household data for the ICES estimate (see chapter III). The assumption that the number of utility customers equals the number of households would seem to undercount

some households and thus produce a smaller population estimate

4. The exaggeration of certain 1970 Census data. As explained previously, this situation would also affect the Census Bureau's population estimates based upon the 1970 Census counts

The MAPA jurisdictional estimate is fairly consistent with the ICES estimate; therefore both estimation methods seem to be reasonable in producing comparable statistics at the jurisdictional level.

The second comparison of population estimates involves evaluating the ICES tract estimates within CAUR's subareas. It should again be emphasized that this comparison is limited by inherent differences in geographic definition (see figure 5). Utilizing the same evaluation technique for normalizing the time factor, the comparison is made in table II.

In describing the variations by subarea it should be remembered from the jurisdictional comparison that the CAUR estimate was the most diverse of the four estimates; probable reasons for this have been previously suggested. One may assume that the estimates at the subarea level may be influenced by these same factors. The variations in annual change by subarea range from 1,304 persons in the northeast subarea, to 113 persons in the northwest subarea. Overall the greatest difference between the ICES and CAUR subarea estimates was seen in the older parts of Omaha where both the 1970 Census errors and fluctuation from the vacancy and persons per household rates (assumed constant) would be the greatest. For the western suburban areas the differences between the two estimates was minimal. The subarea analysis seems to substantiate the four probable reasons for differences between the ICES and CAUR estimates that were discussed previously.

TABLE II
COMPARISON OF CAUR AND ICES SUBAREA ESTIMATES

Subarea	1970 Population	1976 Estimate*	Change	Annual change	Growth rate (%)
CAUR ANNUAL POPULATION CHANGE SINCE 1970					
Northeast	80,959	76,358	-4,601	-677	- .84
Southeast	78,630	74,322	-4,308	-634	- .81
North Central	69,500	72,964	3,464	509	.73
South Central	40,374	43,285	2,911	428	1.06
Northwest	40,794	51,753	10,959	1,612	3.95
Southwest	64,462	83,548	19,086	2,807	4.35
TOTAL	374,719	402,230	27,511	4,046	1.08
ICES ANNUAL POPULATION CHANGE SINCE 1970					
Northeast	80,959	69,472	-11,487	-1,981	-2.45
Southeast	78,630	69,406	- 9,224	-1,590	-2.02
North Central	69,500	67,368	- 2,132	- 368	- .53
South Central	40,374	40,283	- 91	- 13	- .03
Northwest	40,794	50,798	10,004	1,725	4.23
Southwest	64,462	82,769	18,307	3,156	4.90
TOTAL	374,719	380,096	5,377	927	.25

*The ICES estimate is adjusted for Boys Town and Ralston

Household Comparison

A comparison of household estimates can be made by evaluating the Omaha World Herald's 1976 household estimates by subarea. Because the World Herald does not prepare a population estimate, and because the ICES estimates are the only other published source of household estimates, the only possible comparison that can be made between these two sources is on the basis of households. In calculating the household comparisons the same procedures were used that were utilized above: 1) establishing geographic similarity between the subareas (see figure 6), and 2) calculating the annual growth rate to normalize the time factor. It should be mentioned that establishing geographic similarity between the ICES and World Herald estimates was a greater problem than it had been for the CAUR estimates, because of the distinct variation between the World Herald subareas and Omaha census tracts. The statistics included in table III provide a general comparison.

The comparison of household change shows the variance between the annual change of the two estimates to be fairly small, ranging from 51 households in subarea I to 552 households in subarea D. The overall difference between the two estimates is only 321 households. While there are differences between the two estimates for all the subareas, the most distinct differences between the estimates are found in the older sections of town. The World Herald survey was based upon 1970 census household relationships; thus the same errors that affected the CAUR estimates also have an impact here. In addition many of the reasons given for the differences between ICES and other population estimates would also seem to influence the variation in household estimates.

TABLE III
COMPARISON OF WORLD HERALD AND ICES SUBAREA ESTIMATES

Subarea	1970 Households	1976 Estimate*	Change	Annual change	Growth rate (%)
WORLD HERALD ANNUAL HOUSEHOLD CHANGE SINCE 1970					
A	20,610	17,091	- 3,519	- 550	- 2.67
D	23,555	15,440	- 8,115	-1,268	- 5.38
E	11,161	12,333	1,172	183	1.64
F	15,243	17,091	1,848	289	1.89
G	21,461	25,493	4,032	630	2.94
H	6,592	12,527	5,935	927	14.07
I	11,418	18,257	6,839	1,069	9.36
J	10,606	18,742	8,136	1,271	11.98
TOTAL	120,646	136,974	16,328	2,551	2.12
ICES ANNUAL HOUSEHOLD CHANGE SINCE 1970					
A	20,610	19,599	- 1,011	- 174	- .85
D	23,555	19,405	- 4,150	- 716	- 3.04
E	11,161	11,394	233	40	.36
F	15,243	14,355	- 888	- 153	- 1.00
G	21,461	23,280	1,819	314	1.46
H	6,592	10,633	4,041	697	10.57
I	11,418	17,912	6,494	1,120	9.81
J	10,606	17,003	6,397	1,103	10.40
TOTAL	120,646	133,581	12,935	2,230	1.85

*The ICES estimate is adjusted for Carter Lake, Ralston, and Boys Town

Persons Per Household Comparison

Persons per household is the only remaining characteristic which can serve as a common basis for a comparison of the various estimates. This comparison can only be made for the Omaha corporate limits, as the ICES model is the only one to calculate persons per household estimates by census tracts. In addition to the ICES estimate, both CAUR and MAPA have prepared persons per household estimates; in both cases only one persons per household rate was established for the City of Omaha and then applied as a constant to obtain the estimate. The estimates prepared for 1976 are:

1. ICES: 2.89 Persons per household
2. MAPA: 2.83 Persons per household
3. CAUR*: 3.00 Persons per household

* Calculated using CAUR's assumption of a 0.1 persons per household decline per year for the period from 1970 through 1976 (CAUR, 1977)

From this comparison it is easy to understand why the CAUR population estimate was so high in comparison with both the MAPA and the ICES estimates. While all three estimates assume a decline in the persons per household rate since 1970, the MAPA estimate shows the largest decline but still is within 0.06 of the ICES estimate. With the exception of the ICES estimate, which was calculated as the result of a persons per household regression model (see chapter III), the other estimates were made using a mathematical trend method.

Methodological Evaluation

Within this portion of chapter IV a methodological evaluation will be made of the ICES model and the three general categories of estimates available from the model: 1) housing estimates, 2) household estimates, and 3) demographic estimates. This section will qualitatively review the specific ICES methods and work activities used to prepare 1976 estimates.

Housing Estimates

The tabulation of housing estimates by type and tenure for Omaha census tracts utilized the Douglas County Real Property File, Omaha building and wrecking permits, R. L. Polk Company's Profiles of Change, and occupied housing data from utility files. While this method has proved to be reasonably successful, certain work activities require refinement. The estimation of the number of housing units directly from local data files is a substantial improvement over determining housing unit change, although the accuracy and reliability of the data files takes on additional importance.

The Douglas County Real Property File proved to be an excellent source for both the single family and owner occupied housing estimates. However, the tabulation of multi-family housing should be improved. The current method for establishing a multi-family inventory (through the use of 1970 Census data or Polk data updated with permits) still requires the use of secondary census tract data. As a result, housing estimates are still tied geographically to census tracts. In order for housing estimates to be made for other geographic areas (e.g. cruiser districts,

transportation zones), a new source of data on multi-family units must be found that provides an inventory by address of the number of multi-family units within a structure. A logical way to obtain this data would involve the Douglas County Assessor's Office, which would code this data to the Real Property File. It could then be processed along with the existing single family information to obtain total housing counts directly from one source. Permit information should also be refined by consistently recording final inspections to provide an additional check on housing activity.

The process by which housing tenure is calculated has also proved to be reasonably accurate. From the owner occupied and total housing units calculated above, and the number of occupied housing units (see next section), vacancy and renter occupied units can be easily calculated as residuals.

Household Estimates

As was discussed in chapter III, occupied housing units were identified from residential customer files of both the Omaha Public Power District and Northwestern Bell Telephone Company. The use of these two files has provided an invaluable source of information on the number of households, although the lack of historical information needed to calculate the ratio of utility customers to actual households remains a problem. Until a census enumeration can be taken to provide this information, some further accuracy could be imparted to the present method by matching the two files to each other according to address. This would ensure an accurate accounting of all possible households from both files. This

would also eliminate the present procedure of grossly evaluating both files to determine the most reasonable data.

The survey of group quarters population proved to be extremely successful. As a result of this survey a mechanism has been established within the ICES method to prepare this data annually. The only improvement that could be made to the survey would be the identification of additional non-institutional facilities.

The use of the persons per household regression model to calculate persons per household rates by census tract also proved to be highly successful. The independent variables used within the model (school enrollment, single family housing, average births) proved to be strongly correlated to persons per household, explaining 94 percent of the variance. The only problems that existed with the model involved obtaining school enrollment for census tracts. The area for which estimates were prepared encompassed four school districts (Omaha, Ralston, District 66, Millard), only one of which (Omaha) had automated files. Thus the tabulation of school enrollment data for the suburban tracts was difficult. In addition to improving this situation, the model could perhaps be perfected by testing additional independent variables to account for some of the unaccounted variance. The model could also be stratified by areas of homogeneity and then tested in order to determine whether its accuracy could be improved.

Demographic Estimates

In addition to total population the ICES model produced minority and elderly population estimates. Once the number of households, persons

per household rate, and group quarters population were tabulated, the calculation of total population was relatively simple. However, arriving at a minority population estimate was more difficult. As described in chapter III, a minority population regression model was produced that utilized minority student population and minority deaths as independent variables. The variables were strongly correlated to minority population and explained 94 percent of the variance. As with the persons per household model, the largest problem involved obtaining the necessary symptomatic data. The model could also be improved by testing additional independent variables and stratifying the data. The use of Black and other minority students to total minority student ratios in order to calculate that segment of the total population appears to be an appropriate method, given the limited local data base. Without question the ICES method of elderly population estimation needs refinement; the lack of current data on the elderly population presents a major obstacle. Future estimations might be based on elderly counts obtained directly from Social Security files; an elderly population regression model might also be created and employed.

Conclusion

In order to review the essential elements of this study, this final section of chapter IV will be structured into three parts. First, a summary of the most important findings of the study will be presented. The second part is a brief discussion of the use of ICES as a general purpose estimating methodology. The last part of this section will be a resolution of the research problem presented at the beginning of this work.

Findings

1. Prior to selecting an estimating method, an evaluation should be made of data items, geographic requirements, the local data base, and local resources.

Once this evaluation is completed, selection of a specific methodology will be facilitated. The ICES model was developed in response to these four considerations within the Omaha environment, and thus cannot be directly transferred to another area. However, the basic design of the system should be compatible within most local governments. The point to be emphasized is that the above four considerations will dictate the specific estimating methodology within the context of an overall system design.

2. The general Housing Unit methodology is most suited to the needs of local government, because it provides a wide range of population and housing estimates utilizing local data files.

Despite the availability of a large number of estimating methods (see chapter II), the Housing Unit Methods are generally most applicable to the needs of local government, because the problems facing local administrators require both housing and demographic data (urban development and redevelopment, crime, transportation, sewage treatment, etc.). Additionally, the Federal government is beginning to require both housing and population data as part of grant applications. The Housing Unit Methods are well suited to local government for they utilize data bases that are already in existence within the local environment (permits, property files, school census files, etc.) to produce the needed information.

3. The GBF/DIME File and automated geocoding techniques enable large data bases to be used to obtain information suitable for estimating.

The DIME system has allowed certain data bases to be used for the first time, because large files that contain thousands of records can now be accurately and efficiently geocoded in minutes rather than weeks. It should be understood that these capabilities are only available with an updated and correct DIME File. If DIME is not implemented within local government, the ability to geocode large data bases is lost and less accurate estimating methods must necessarily be used.

One important aspect of automated geocoding and aggregate data analysis is that a high level of confidentiality can be maintained over individual records, while permitting public use of aggregate statistics. This capability enables the planner or researcher to have access to a wide range of information that was previously not available. Privacy and confidentiality can be maintained without sacrificing information required for decision making.

4. The use of DIME as part of the ICES model will allow estimates to be prepared for many administrative areas.

The ICES model can be described as a Housing Unit Inventory Method, because it utilizes local data files that generally represent 100% of an occurrence (property file, residential customer files, school census files, etc.). Because this Method does not use an "add-on" approach (census count plus housing activity), it is not tied to census geography. This enables local users to attach many different local codes (transportation zones, market areas, subdivisions, etc.) to DIME and to then use the ICES model to calculate population and housing estimates for these areas. Thus DIME and ICES can remove many of the geographic barriers that have isolated the effective use of estimates.

5. The ICES model is capable of producing reasonably accurate estimates.

As was mentioned at the beginning of this chapter, the 1976 ICES estimates cannot be absolutely evaluated for accuracy, because of the lack of a Census enumeration with which to compare the estimates. However, some assessment of the ICES method was possible by comparing its estimates with those produced by other sources. This analysis showed the ICES estimates to be well within reasonable limits. Furthermore, certain limitations inherent in the other estimates were not characteristic of the ICES methodology.

6. The cost of producing the ICES estimates was well within reasonable limits.

Two financial cost elements should be identified when evaluating the ICES system: the first being developmental costs, and the second, requirements for system maintenance. Developmental costs include those activities required to: establish procedures; procure the necessary computer files and programs; geocode the files; prepare, test and execute the regression models; conduct surveys; and produce the final estimates. On-going costs incurred in preparing estimates beyond initial system development are substantially lower as the process is basically a repetition of previous procedures. (Note: The development and maintenance of the GBF/DIME File and local data bases is not included in ICES funding.)

The ICES program as developed in the Omaha environment was funded entirely by the Community Development Block Grant. The development of ICES in 1975 represented an approximate investment of \$22,000, of which \$6,000 (27%) was required for data processing and \$16,000 (73%) for

manpower (two man years). The 1976 ongoing cost of the program was \$10,000 (a 55% reduction of the 1975 cost), of which \$4,000 (40%) was required for data processing and \$6,000 (60%) was required for manpower (six man months). The 1975 cost of the program represented 11% of the administrative cost of the Grant (\$200,000) whereas the 1976 expenditure was 5% of the administrative cost. It is anticipated that continued annual cost will remain at the 5% figure. It is important to realize that the Community Development Block Grant solely funds Omaha's estimating program, though the use of the estimates is city wide.

The Use of ICES as a General Purpose Estimating Model

As was mentioned in the findings, ICES can be summarized as a Housing Unit Inventory Method that incorporates automated geocoding technology to prepare population and housing estimates. The essential components of the model are the GBF/DIME File and the local data base. The DIME File provides a tremendous degree of geographic flexibility in the tabulation of local data files and thus is capable of producing estimates for any geographic area that can be defined to the File. Regardless of the DIME File's accuracy, estimates cannot be produced in the absence of a local data base in computer readable form. Not only must local data files contain, either directly or indirectly, the characteristic to be estimated, they also must possess a geographic identifier (address) that will enable individual records to be geographically coded. The ICES model simply combines DIME technology and local data files into a specific methodology to produce the required estimates.

ICES had demonstrated that reasonably accurate estimates can be prepared by geographic subarea without the constraints of census geography. This geographic independence thus allows the ICES methodology to be utilized in part or totally to produce estimates for other administrative areas. In producing the population and housing estimates described within this study, three basic categories of data were tabulated:

- 1) Inventory data
 - Housing counts
 - Household counts
 - Owner occupied housing
 - Group quarters population
- 2) Residual data (calculated data)
 - Vacant housing
 - Renter housing
 - Total population
- 3) Regression model data
 - Persons per household
 - Minority population
 - Elderly population

The ICES methodology allowed for data to be obtained independently of geographic considerations and used either directly, as inventory data or independent variables for the regression models, or indirectly to create other data items as residuals. Utilizing this approach a wide range of other characteristics could also be computed if the information were available from the local data base.

The basic ICES design allows for a great deal of adaptibility and consequently could be modified to meet the data needs of many local governments other than Omaha. The concept simply requires the selection of both the data items and geography required for local purposes; obtaining the local data files that contain the needed information; and

then geocoding that information to the appropriate geographic areas. Once the data is available by geographic subarea, the use of one of the estimating methods mentioned in chapter II can be used to calculate the required estimates. For the purposes of population and housing estimation, a Housing Unit Method modified to use inventory data is probably the most acceptable.

Resolution of the Research Problem

As previously stated, the purpose of this work was to determine if:

. . . automated geocoding techniques and computer technology can be used to produce accurate and timely population and housing estimates for geographic subareas.

To resolve this problem the ICES model was presented as the means by which population and housing estimates can be derived from local data files. The key element of the ICES model is the use of the GBF/DIME system and automated geocoding techniques. With the use of DIME and a modified Housing Unit Method, information from local data files was utilized to directly inventory population and housing characteristics, thus eliminating the need for historical census information tied to census geography.

By utilizing the Housing Unit Inventory Method and the GBF/DIME system, ICES was tested by the City of Omaha to produce 1976 census tract estimates. When compared to other estimates, the ICES estimates were found to produce reasonably accurate results. In addition they were the only Omaha estimates to produce 16 characteristics for 100 geographic subareas.

Because the DIME File is capable of being coded to represent many

different geographic subareas, and because the ICES model allows for a great deal of geographic independence, this approach can indeed be used to provide accurate and timely estimates for any number of geographic subareas.

APPENDIX A

PERSONS PER HOUSEHOLD REGRESSION MODEL

```

      * * * MULTIPLE LINEAR REGRESSION * * *
ENTER NUMBER OF INDEPENDENT VARIABLES IN THE FORM XX [RET]
? 3
ENTER COLUMN NUMBERS OF THE INDEPENDENT VARIABLES IN
THE FORM XX,XX,... ETC. [RET]
? 2,3,4
ENTER COLUMN NUMBER OF DEPENDENT VARIABLE IN THE FORM XX [RET]
? 1

VARIABLE MEAN STANDARD CORRELATION REGRESSION STD. ERROR COMPUTED
NO. DEVIATION X VS Y COEFFICIENT OF REG. COEF T VALUE
2 .611 .266 .937 1.658 .118 13.998
3 .707 .257 .846 .879 .096 9.174
4 .061 .023 .561 -.359 .986 -.365
DEPENDENT
1 3.094 .637
INTERCEPT 1.480044
MULTIPLE CORRELATION COEFFICIENT .970269
STANDARD ERROR OF ESTIMATE .156785
SUM OF SQUARES ATTRIBUTABLE TO REGRESSION 35.555062
DEGREES OF FREEDOM ASSOCIATED WITH SSAR 3.
MEAN SQUARE OF SSAR 11.851687
SUM OF SQUARES OF DEVIATIONS FROM REGRESSION 2.212335
DEGREES OF FREEDOM ASSOCIATED WITH SDR 90.
MEAN SQUARE OF SDR .024582
F-VALUE 482.138472
WANT TABLE OF RESIDUALS (YES OR NO)
? NO
WANT TO PERFORM ANOTHER MULTIPLE LINEAR REGRESSION (YES OR NO)
? NO

```

* * * * *

Variable

1	Person per Household
2	% School Enrollment
3	% Single Family Housing
4	Births per Occupied Housing

Computed using ITS STAT Software

APPENDIX B

MINORITY POPULATION REGRESSION MODEL

```

      * * * MULTIPLE LINEAR REGRESSION * * *
ENTER NUMBER OF INDEPENDENT VARIABLES IN THE FORM XX [RET]
? 2
ENTER COLUMN NUMBERS OF THE INDEPENDENT VARIABLES IN
THE FORM XX,XX,... ETC. [RET]
? 2,5
ENTER COLUMN NUMBER OF DEPENDENT VARIABLE IN THE FORM XX [RET]
? 1

VARIABLE MEAN STANDARD CORRELATION REGRESSION STD. ERROR COMPUTED
NO. DEVIATION X VS Y COEFFICIENT OF REG.COEF T VALUE
  2    3.355    7.611    .882    43.420    6.192    7.013
  5   100.485   206.665    .906    2.078    .228    9.114
DEPENDENT
  1   391.305   770.506
INTERCEPT                                36.817511
MULTIPLE CORRELATION COEFFICIENT            .939901
STANDARD ERROR OF ESTIMATE                  265.931569
SUM OF SQUARES ATTRIBUTABLE TO REGRESSION  49299646.992580
DEGREES OF FREEDOM ASSOCIATED WITH SSAR      2.
MEAN SQUARE OF SSAR                         24649823.496290
SUM OF SQUARES OF DEVIATIONS FROM REGRESSION 6506203.154779
DEGREES OF FREEDOM ASSOCIATED WITH SSDR      92.
MEAN SQUARE OF SSDR                         70719.599508
F-VALUE                                     348.557170
WANT TABLE OF RESIDUALS (YES OR NO)
? NO
WANT TO PERFORM ANOTHER MULTIPLE LINEAR REGRESSION (YES OR NO)
? NO

```

* * * * *

Variable

- | | |
|---|----------------------------|
| 1 | Total Minority Population |
| 2 | Minority Deaths |
| 3 | Minority School Enrollment |

Computed using ITS STAT Software

APPENDIX C

ELDERLY POPULATION REGRESSION

* * * SIMPLE ONE-VARIABLE REGRESSION * * *

SPECIFY THE DEPENDENT VARIABLE IN THE FORM XX [RET]
 ? 1
 SPECIFY THE INDEPENDENT VARIABLE IN THE FORM XX [RET]
 ? 2

INTERCEPT.....	12.727
REGRESSION COEFFICIENT.....	17.772
STD. ERROR OF REG. COEF.726
COMPUTED T-VALUE.....	24.478
CORRELATION COEFFICIENT.....	.930
STANDARD ERROR OF ESTIMATE...	92.875

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARIATION	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REGRESSION	1	5168373.050	5168373.050	599.176
DEVIATION FROM REGRESSION	93	802199.097	8625.797	
TOTAL	94	5970572.147		

WANT TO PRINT TABLE OF RESIDUALS (YES OR NO)
 ? NO
 WANT TO PERFORM ANOTHER REGRESSION (YES OR NO)
 ? NO

* * * * *

Variable	
1	Elderly Population
2	Elderly Deaths

Computed using ITS STAT Software

APPENDIX D

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

1. Total Population
2. Elderly Population
3. Minority Population
4. Black Population
5. Other Minority Population
6. Households
7. Household Population
8. Persons Per Household
9. Group Quarters
10. Total Housing
11. Single Family Housing
12. Mobile Homes
13. Public Housing
14. Multi-Family Housing
15. Owner Housing
16. Renter Housing
17. Vacant Housing
18. Vacancy Rate

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 TOTAL POPULATION	CENSUS TRACT (1980)	1976 TOTAL POPULATION	CENSUS TRACT (1980)	1976 TOTAL POPULATION
2	5,197	35	5,042	66.01	8,881
3	3,056	36	5,627	66.02	5,916
4	3,179	37	3,379	67.01	4,644
5	1,249	38	4,701	67.02	4,220
6	3,426	39	2,261	68.01	6,633
7	2,725	40	2,579	68.02	3,895
8	3,100	41	1,026	69.01	7,104
9	1,311	42	1,602	69.02	8,562
10	2,030	43	2,785	70	10,381
11	2,080	44	2,172	71	7,309
12	1,861	45	3,870	73.03	1,651
13.01	891	46	2,503	73.04	1,555
13.02	755	47	2,624	73.05	3,244
14	405	48	5,028	73.06	1,408
15	875	49	5,239	73.07	*
16	2,338	50	4,031	74.03	4,035
17	819	51	3,157	74.04	4,402
18	1,101	52	3,097	74.05	*
19	2,170	53	3,052	74.06	5,346
20	3,009	54	4,404	74.07	3,954
21	2,582	55	6,150	74.08	5,320
22	2,275	56	4,896	74.09	1,547
23	2,339	57	5,223	74.10	135
24	3,288	58	5,249	74.11	*
25	2,754	59.01	3,513	74.14	12,824
26	2,112	59.02	3,625	74.15	5,681
27	2,159	60	5,476	74.16	1,773
28	3,407	61.01	3,287	74.17	2,556
29	4,797	61.02	5,366	74.18	2,698
30	6,966	62.01	540	74.19	4,920
31	3,842	62.02	5,831	74.20	5,731
32	2,162	63	9,827	74.21	9,428
33	2,573	64	6,136	74.22	6,029
34.01	4,170	65.01	7,226	75	*
34.02	2,746	65.02	5,792	Census Tract Total	387,847

*Census Tracts outside
Omaha's jurisdiction

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 ELDERLY POPULATION	CENSUS TRACT (1980)	1976 ELDERLY POPULATION	CENSUS TRACT (1980)	1976 ELDERLY POPULATION
2	961	35	479	66.01	639
3	403	36	979	66.02	426
4	388	37	628	67.01	488
5	144	38	968	67.02	165
6	572	39	436	68.01	451
7	330	40	601	68.02	171
8	195	41	281	69.01	178
9	138	42	264	69.02	163
10	319	43	685	70	509
11	324	44	397	71	490
12	227	45	968	73.03	127
13.01	102	46	310	73.04	51
13.02	164	47	391	73.05	117
14	36	48	830	73.06	32
15	97	49	702	73.07	*
16	339	50	629	74.03	101
17	278	51	391	74.04	70
18	238	52	217	74.05	*
19	623	53	299	74.06	53
20	506	54	603	74.07	67
21	460	55	1,236	74.08	37
22	507	56	896	74.09	11
23	220	57	684	74.10	4
24	697	58	709	74.11	*
25	394	59.01	439	74.14	218
26	270	59.02	323	74.15	97
27	408	60	1,040	74.16	30
28	433	61.01	108	74.17	66
29	652	61.02	317	74.18	54
30	766	62.01	53	74.19	167
31	400	62.02	717	74.20	172
32	381	63	865	74.21	66
33	365	64	522	74.22	42
34.01	338	65.01	455	75	*
34.02	335	65.02	168	Census Tract Total	37,862

*Census Tracts outside
Omaha's jurisdiction

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 MINORITY POPULATION	CENSUS TRACT (1980)	1976 MINORITY POPULATION	CENSUS TRACT (1980)	1976 MINORITY POPULATION
2	263	35	45	66.01	68
3	1,218	36	78	66.02	48
4	122	37	53	67.01	0
5	51	38	97	67.02	60
6	1,900	39	122	68.01	80
7	2,676	40	113	68.02	56
8	2,742	41	86	69.01	74
9	1,285	42	49	69.02	56
10	1,990	43	72	70	107
11	2,039	44	64	71	140
12	1,824	45	97	73.03	41
13.01	702	46	49	73.04	53
13.02	277	47	43	73.05	86
14	211	48	113	73.06	50
15	657	49	259	73.07	*
16	90	50	89	74.03	99
17	231	51	1,318	74.04	78
18	86	52	2,736	74.05	*
19	142	53	1,663	74.06	93
20	99	54	1,428	74.07	64
21	95	55	107	74.08	83
22	86	56	59	74.09	56
23	86	57	199	74.10	0
24	56	58	892	74.11	*
25	70	59.01	1,893	74.14	190
26	57	59.02	2,580	74.15	117
27	68	60	1,697	74.16	12
28	161	61.01	1,007	74.17	42
29	1,551	61.02	1,272	74.18	24
30	124	62.01	43	74.19	40
31	53	62.02	614	74.20	34
32	43	63	1,376	74.21	17
33	109	64	66	74.22	80
34.01	76	65.01	120	75	*
34.02	43	65.02	267	Census Tract Total	43,917

*Census Tracts outside
Omaha's jurisdiction

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 BLACK POPULATION	CENSUS TRACT (1980)	1976 BLACK POPULATION	CENSUS TRACT (1980)	1976 BLACK POPULATION
2	244	35	0	66.01	34
3	1,192	36	0	66.02	21
4	95	37	0	67.01	0
5	8	38	36	67.02	11
6	1,859	39	0	68.01	15
7	2,655	40	15	68.02	0
8	2,715	41	29	69.01	27
9	1,281	42	0	69.02	44
10	1,981	43	14	70	16
11	2,009	44	21	71	43
12	1,803	45	26	73.03	24
13.01	661	46	8	73.04	40
13.02	236	47	14	73.05	56
14	181	48	29	73.06	40
15	584	49	214	73.07	*
16	7	50	39	74.03	86
17	0	51	1,248	74.04	31
18	0	52	2,721	74.05	*
19	0	53	1,591	74.06	33
20	0	54	1,393	74.07	30
21	7	55	75	74.08	45
22	20	56	44	74.09	31
23	61	57	189	74.10	0
24	6	58	848	74.11	*
25	0	59.01	1,890	74.14	122
26	0	59.02	2,547	74.15	75
27	26	60	1,670	74.16	6
28	143	61.01	975	74.17	24
29	1,459	61.02	1,249	74.18	12
30	97	62.01	43	74.19	20
31	0	62.02	588	74.20	20
32	43	63	1,326	74.21	7
33	8	64	47	74.22	49
34.01	16	65.01	84	75	*
34.02	0	65.02	218	Census Tract Total	39,501

*Census Tracts outside
Omaha's jurisdiction

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 OTHER MINORITY POPULATION	CENSUS TRACT (1980)	1976 OTHER MINORITY POPULATION	CENSUS TRACT (1980)	1976 OTHER MINORITY POPULATION
2	19	35	45	66.01	34
3	26	36	78	66.02	27
4	27	37	53	67.01	0
5	43	38	61	67.02	49
6	41	39	122	68.01	65
7	21	40	98	68.02	56
8	27	41	57	69.01	47
9	4	42	49	69.02	12
10	9	43	58	70	91
11	30	44	43	71	97
12	21	45	71	73.03	17
13.01	41	46	41	73.04	13
13.02	41	47	29	73.05	30
14	30	48	84	73.06	10
15	73	49	45	73.07	*
16	83	50	50	74.03	13
17	231	51	70	74.04	47
18	86	52	15	74.05	*
19	142	53	72	74.06	60
20	99	54	35	74.07	34
21	88	55	32	74.08	38
22	66	56	15	74.09	25
23	25	57	10	74.10	0
24	50	58	44	74.11	*
25	70	59.01	3	74.14	68
26	57	59.02	33	74.15	42
27	42	60	27	74.16	6
28	18	61.01	32	74.17	18
29	92	61.02	23	74.18	12
30	27	62.01	0	74.19	20
31	53	62.02	26	74.20	14
32	0	63	50	74.21	10
33	101	64	19	74.22	31
34.01	60	65.01	36	75	*
34.02	43	65.02	49	Census Tract Total	4,416

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

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CENSUS TRACT (1980)	1976 HOUSEHOLDS	CENSUS TRACT (1980)	1976 HOUSEHOLDS	CENSUS TRACT (1980)	1976 HOUSEHOLDS
2	1,657	35	1,852	66.01	2,938
3	939	36	2,008	66.02	1,986
4	1,062	37	1,098	67.01	1,626
5	407	38	1,711	67.02	1,540
6	1,061	39	1,050	68.01	2,183
7	917	40	1,244	68.02	1,186
8	949	41	578	69.01	1,921
9	466	42	836	69.02	2,458
10	730	43	1,440	70	3,498
11	776	44	804	71	2,087
12	715	45	1,468	73.03	487
13.01	335	46	866	73.04	438
13.02	289	47	812	73.05	1,067
14	204	48	2,266	73.06	599
15	296	49	2,268	73.07	*
16	491	50	1,851	74.03	1,500
17	414	51	1,218	74.04	1,287
18	234	52	1,001	74.05	*
19	1,280	53	929	74.06	1,533
20	1,126	54	1,350	74.07	1,292
21	1,053	55	2,241	74.08	1,551
22	594	56	1,742	74.09	437
23	840	57	1,909	74.10	35
24	1,250	58	1,952	74.11	*
25	959	59.01	1,053	74.14	4,029
26	711	59.02	1,162	74.15	2,219
27	775	60	1,606	74.16	539
28	1,240	61.01	903	74.17	777
29	1,576	61.02	1,594	74.18	820
30	2,265	62.01	204	74.19	1,482
31	1,295	62.02	1,709	74.20	1,692
32	941	63	3,229	74.21	3,041
33	838	64	2,012	74.22	1,945
34.01	1,522	65.01	2,180	75	*
34.02	903	65.02	1,536	Census Tract Total	130,985

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

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CENSUS TRACT (1980)	1976 HOUSEHOLD POPULATION	CENSUS TRACT (1980)	1976 HOUSEHOLD POPULATION	CENSUS TRACT (1980)	1976 HOUSEHOLD POPULATION
2	5,087	35	5,040	66.01	8,667
3	3,042	36	5,622	66.02	5,859
4	3,175	37	3,338	67.01	4,406
5	1,249	38	4,055	67.02	4,220
6	3,257	39	2,258	68.01	6,484
7	2,714	40	2,152	68.02	3,890
8	3,094	41	890	69.01	7,088
9	1,286	42	1,572	69.02	8,554
10	2,029	43	2,635	70	9,969
11	2,080	44	2,002	71	7,221
12	1,859	45	3,861	73.03	1,651
13.01	891	46	2,503	73.04	1,555
13.02	725	47	2,615	73.05	3,244
14	404	48	5,008	73.06	1,408
15	847	49	4,899	73.07	*
16	840	50	3,795	74.03	4,035
17	679	51	3,130	74.04	4,402
18	393	52	3,093	74.05	*
19	2,150	53	3,001	74.06	5,320
20	2,995	54	4,280	74.07	3,954
21	2,548	55	6,140	74.08	5,320
22	1,634	56	4,756	74.09	1,547
23	2,276	57	5,192	74.10	135
24	3,288	58	5,114	74.11	*
25	2,752	59.01	3,454	74.14	12,812
26	2,112	59.02	3,625	74.15	5,681
27	2,131	60	5,059	74.16	1,773
28	3,398	61.01	3,287	74.17	2,556
29	4,775	61.02	5,356	74.18	2,698
30	6,954	62.01	539	74.19	4,920
31	3,833	62.02	5,674	74.20	5,617
32	2,155	63	9,622	74.21	9,427
33	2,422	64	6,116	74.22	6,029
34.01	4,170	65.01	7,150	75	*
34.02	2,736	65.02	5,637	Census Tract Total	378,892

*Census Tracts outside
Omaha's jurisdiction

ICES - JANUARY 1, 1976
POPULATION AND HOUSING ESTIMATES

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CENSUS TRACT (1980)	1976 PERSONS PER HOUSEHOLD	CENSUS TRACT (1980)	1976 PERSONS PER HOUSEHOLD	CENSUS TRACT (1980)	1976 PERSONS PER HOUSEHOLD
2	3.07	35	2.72	66.01	2.95
3	3.24	36	2.80	66.02	2.95
4	2.99	37	3.04	67.01	2.71
5	3.07	38	2.37	67.02	2.74
6	3.07	39	2.15	68.01	2.97
7	2.96	40	1.73	68.02	3.28
8	3.26	41	1.54	69.01	3.69
9	2.76	42	1.88	69.02	3.48
10	2.78	43	1.83	70	2.85
11	2.68	44	2.49	71	3.46
12	2.60	45	2.63	73.03	3.39
13.01	2.66	46	2.89	73.04	3.55
13.02	2.51	47	3.22	73.05	3.04
14	1.98	48	2.21	73.06	2.35
15	2.86	49	2.16	73.07	*
16	1.71	50	2.05	74.03	2.69
17	1.64	51	2.57	74.04	3.42
18	1.68	52	3.09	74.05	*
19	1.68	53	3.23	74.06	3.47
20	2.66	54	3.17	74.07	3.06
21	2.42	55	2.74	74.08	3.43
22	2.75	56	2.73	74.09	3.54
23	2.71	57	2.72	74.10	3.86
24	2.63	58	2.62	74.11	*
25	2.87	59.01	3.28	74.14	3.18
26	2.97	59.02	3.12	74.15	2.56
27	2.75	60	3.15	74.16	3.29
28	2.74	61.01	3.64	74.17	3.29
29	3.03	61.02	3.36	74.18	3.29
30	3.07	62.01	2.64	74.19	3.32
31	2.96	62.02	3.32	74.20	3.32
32	2.29	63	2.98	74.21	3.10
33	2.89	64	3.04	74.22	3.10
34.01	2.74	65.01	3.28	75	*
34.02	3.03	65.02	3.67	Census Tract Total	2.89 Average

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 GROUP QUARTERS	CENSUS TRACT (1980)	1976 GROUP QUARTERS	CENSUS TRACT (1980)	1976 GROUP QUARTERS
2	110	35	2	66.01	214
3	14	36	5	66.02	57
4	4	37	41	67.01	238
5	0	38	646	67.02	0
6	169	39	3	68.01	149
7	11	40	427	68.02	5
8	6	41	136	69.01	16
9	25	42	30	69.02	8
10	1	43	150	70	412
11	0	44	170	71	88
12	2	45	9	73.03	0
13.01	0	46	0	73.04	0
13.02	30	47	9	73.05	0
14	1	48	20	73.06	0
15	28	49	340	73.07	*
16	1,498	50	236	74.03	0
17	140	51	27	74.04	0
18	708	52	4	74.05	*
19	20	53	51	74.06	26
20	14	54	124	74.07	0
21	34	55	10	74.08	0
22	641	56	140	74.09	0
23	63	57	31	74.10	0
24	0	58	135	74.11	*
25	2	59.01	59	74.14	12
26	0	59.02	0	74.15	0
27	28	60	417	74.16	0
28	9	61.01	0	74.17	0
29	22	61.02	10	74.18	0
30	12	62.01	1	74.19	0
31	9	62.02	157	74.20	114
32	7	63	205	74.21	1
33	151	64	20	74.22	0
34.01	0	65.01	76	75	*
34.02	10	65.02	155	Census Tract Total	8,955

*Census Tracts outside Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 TOTAL HOUSING	CENSUS TRACT (1980)	1976 TOTAL HOUSING	CENSUS TRACT (1980)	1976 TOTAL HOUSING
2	1,767	35	1,853	66.01	3,028
3	980	36	2,037	66.02	2,149
4	1,142	37	1,148	67.01	1,650
5	423	38	1,942	67.02	1,724
6	1,184	39	1,247	68.01	2,269
7	957	40	1,505	68.02	1,194
8	1,041	41	618	69.01	1,965
9	527	42	841	69.02	2,505
10	777	43	1,475	70	3,719
11	838	44	861	71	2,233
12	762	45	1,473	73.03	562
13.01	385	46	873	73.04	438
13.02	325	47	852	73.05	1,158
14	240	48	2,325	73.06	731
15	328	49	2,590	73.07	*
16	511	50	2,114	74.03	1,580
17	477	51	1,304	74.04	1,475
18	277	52	1,097	74.05	*
19	1,366	53	993	74.06	1,740
20	1,190	54	1,429	74.07	1,393
21	1,054	55	2,278	74.08	1,654
22	594	56	1,861	74.09	441
23	858	57	1,992	74.10	39
24	1,338	58	1,971	74.11	*
25	1,024	59.01	1,105	74.14	4,263
26	726	59.02	1,259	74.15	2,687
27	829	60	1,741	74.16	592
28	1,262	61.01	922	74.17	895
29	1,594	61.02	1,704	74.18	953
30	2,399	62.01	210	74.19	1,623
31	1,320	62.02	1,735	74.20	1,713
32	1,054	63	3,433	74.21	3,421
33	928	64	2,132	74.22	2,411
34.01	1,563	65.01	2,256	75	*
34.02	928	65.02	1,586	Census Tract Total	139,935

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 SINGLE FAMILY HOUSING	CENSUS TRACT (1980)	1976 SINGLE FAMILY HOUSING	CENSUS TRACT (1980)	1976 SINGLE FAMIL' HOUSING
2	1,615	35	1,488	66.01	1,936
3	829	36	1,864	66.02	925
4	1,104	37	1,097	67.01	1,193
5	398	38	738	67.02	998
6	868	39	313	68.01	1,577
7	697	40	146	68.02	1,062
8	762	41	8	69.01	1,674
9	298	42	187	69.02	1,948
10	489	43	303	70	2,372
11	518	44	567	71	1,970
12	249	45	951	73.03	560
13.01	208	46	666	73.04	438
13.02	189	47	792	73.05	678
14	39	48	835	73.06	321
15	254	49	879	73.07	*
16	56	50	534	74.03	746
17	44	51	614	74.04	1,064
18	17	52	497	74.05	*
19	130	53	916	74.06	1,250
20	843	54	1,129	74.07	903
21	599	55	1,889	74.08	1,246
22	364	56	1,496	74.09	366
23	575	57	1,500	74.10	32
24	931	58	1,367	74.11	*
25	875	59.01	993	74.14	2,794
26	574	59.02	1,146	74.15	1,149
27	663	60	1,541	74.16	592
28	1,017	61.01	787	74.17	895
29	1,040	61.02	1,560	74.18	787
30	2,256	62.01	138	74.19	1,225
31	1,126	62.02	1,644	74.20	1,361
32	439	63	2,488	74.21	1,238
33	663	64	1,946	74.22	814
34.01	1,108	65.01	1,901	75	*
34.02	803	65.02	1,424	Census Tract Total	93,098

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 MOBILE HOMES	CENSUS TRACT (1980)	1976 MOBILE HOMES	CENSUS TRACT (1980)	1976 MOBILE HOMES
2		35	2	66.01	65
3	1	36	1	66.02	
4	464	37	38	67.01	1
5	1	38	1	67.02	
6	1	39	3	68.01	
7		40		68.02	1
8		41		69.01	1
9		42		69.02	4
10		43	4	70	251
11		44	1	71	18
12		45	2	73.03	3
13.01		46	1	73.04	104
13.02	1	47		73.05	5
14		48		73.06	197
15		49	1	73.07	*
16	1	50		74.03	125
17	1	51		74.04	2
18		52		74.05	*
19		53		74.06	2
20	1	54	1	74.07	1
21	1	55		74.08	1
22		56	2	74.09	1
23	1	57	4	74.10	
24	1	58	1	74.11	*
25	2	59.01		74.14	1
26		59.02	1	74.15	
27		60		74.16	143
28	2	61.01		74.17	2
29		61.02		74.18	1
30	2	62.01	1	74.19	78
31		62.02	6	74.20	1
32		63	3	74.21	1
33	1	64	2	74.22	18
34.01		65.01	5	75	*
34.02	5	65.02		Census Tract Total	1593

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 PUBLIC HOUSING	CENSUS TRACT (1980)	1976 PUBLIC HOUSING	CENSUS TRACT (1980)	1976 PUBLIC HOUSING
2		35		66.01	
3		36		66.02	
4		37		67.01	
5		38	223	67.02	
6	107	39		68.01	
7	118	40	208	68.02	
8		41		69.01	
9		42		69.02	
10	175	43		70	
11	143	44		71	
12	446	45		73.03	
13.01		46		73.04	
13.02		47		73.05	
14	110	48	105	73.06	
15		49		73.07	*
16		50		74.03	
17	121	51		74.04	
18		52	388	74.05	*
19		53		74.06	
20		54		74.07	
21	144	55		74.08	
22		56		74.09	
23		57	144	74.10	
24		58		74.11	*
25		59.01		74.14	
26		59.02		74.15	
27		60		74.16	
28		61.01		74.17	
29	386	61.02		74.18	
30		62.01		74.19	
31		62.02		74.20	
32	225	63		74.21	
33		64		74.22	
34.01		65.01		75	*
34.02		65.02		Census Tract Total	3,043

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 MULTI-FAMILY HOUSING	CENSUS TRACT (1980)	1976 MULTI-FAMILY HOUSING	CENSUS TRACT (1980)	1976 MULTI-FAMILY HOUSING
2	152	35	365	66.01	1,092
3	151	36	173	66.02	1,224
4	38	37	51	67.01	457
5	25	38	1,204	67.02	726
6	316	39	934	68.01	692
7	260	40	1,359	68.02	132
8	279	41	610	69.01	291
9	229	42	654	69.02	557
10	288	43	1,172	70	1,347
11	320	44	294	71	263
12	513	45	522	73.03	2
13.01	177	46	207	73.04	0
13.02	136	47	60	73.05	480
14	201	48	1,490	73.06	410
15	74	49	1,711	73.07	*
16	455	50	1,580	74.03	834
17	433	51	690	74.04	411
18	260	52	600	74.05	*
19	1,236	53	77	74.06	490
20	347	54	300	74.07	490
21	455	55	389	74.08	408
22	230	56	365	74.09	75
23	283	57	492	74.10	7
24	407	58	604	74.11	*
25	149	59.01	112	74.14	1,469
26	152	59.02	113	74.15	1,538
27	166	60	200	74.16	0
28	245	61.01	135	74.17	0
29	554	61.02	144	74.18	166
30	143	62.01	72	74.19	398
31	194	62.02	91	74.20	352
32	615	63	945	74.21	2,183
33	265	64	186	74.22	1,597
34.01	455	65.01	355	75	*
34.02	125	65.02	162	Census Tract Total	46,837

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

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CENSUS TRACT (1980)	1976 OWNER HOUSING	CENSUS TRACT (1980)	1976 OWNER HOUSING	CENSUS TRACT (1980)	1976 OWNER HOUSING
2	1,380	35	1,319	66.01	1,678
3	574	36	1,613	66.02	793
4	928	37	996	67.01	1,050
5	217	38	584	67.02	886
6	593	39	200	68.01	1,423
7	424	40	100	68.02	1,004
8	509	41	2	69.01	1,553
9	212	42	128	69.02	1,843
10	354	43	193	70	2,072
11	315	44	470	71	1,588
12	160	45	811	73.03	422
13.01	115	46	584	73.04	378
13.02	132	47	702	73.05	607
14	14	48	709	73.06	260
15	146	49	623	73.07	*
16	20	50	399	74.03	670
17	12	51	359	74.04	970
18	10	52	288	74.05	*
19	70	53	513	74.06	1,083
20	605	54	765	74.07	804
21	396	55	1,598	74.08	1,140
22	267	56	1,224	74.09	356
23	437	57	1,202	74.10	26
24	686	58	1,131	74.11	*
25	684	59.01	640	74.14	2,617
26	437	59.02	720	74.15	1,015
27	477	60	1,078	74.16	539
28	821	61.01	578	74.17	751
29	817	61.02	1,199	74.18	694
30	1,943	62.01	130	74.19	1,134
31	935	62.02	1,344	74.20	1,240
32	320	63	2,101	74.21	1,159
33	469	64	1,574	74.22	743
34.01	912	65.01	1,584	75	*
34.02	689	65.02	1,262	Census Tract Total	76,301

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

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RELIMINARY

CENSUS TRACT (1980)	1976 RENTER HOUSING	CENSUS TRACT (1980)	1976 RENTER HOUSING	CENSUS TRACT (1980)	1976 RENTER HOUSING
2	277	35	533	66.01	1,260
3	365	36	395	66.02	1,193
4	134	37	102	67.01	576
5	190	38	1,127	67.02	654
6	468	39	850	68.01	760
7	493	40	1,144	68.02	182
8	440	41	576	69.01	368
9	254	42	708	69.02	615
10	376	43	1,247	70	1,426
11	461	44	334	71	499
12	555	45	657	73.03	65
13.01	220	46	282	73.04	60
13.02	157	47	110	73.05	460
14	190	48	1,557	73.06	339
15	150	49	1,645	73.07	*
16	471	50	1,452	74.03	830
17	402	51	859	74.04	317
18	224	52	713	74.05	*
19	1,210	53	416	74.06	450
20	521	54	585	74.07	488
21	657	55	643	74.08	411
22	327	56	518	74.09	81
23	403	57	707	74.10	9
24	564	58	821	74.11	*
25	275	59.01	413	74.14	1,412
26	274	59.02	442	74.15	1,204
27	298	60	528	74.16	0
28	419	61.01	325	74.17	26
29	759	61.02	395	74.18	126
30	322	62.01	74	74.19	348
31	360	62.02	365	74.20	452
32	621	63	1,128	74.21	1,882
33	369	64	438	74.22	1,202
34.01	610	65.01	596	75	*
34.02	214	65.02	274	Census Tract Total	54,684

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 VACANT HOUSING	CENSUS TRACT (1980)	1976 VACANT HOUSING	CENSUS TRACT (1980)	1976 VACANT HOUSING
2	110	35	1	66.01	90
3	41	36	29	66.02	163
4	80	37	50	67.01	24
5	16	38	231	67.02	184
6	123	39	197	68.01	86
7	40	40	261	68.02	8
8	92	41	40	69.01	44
9	61	42	5	69.02	47
10	47	43	35	70	221
11	62	44	57	71	146
12	47	45	5	73.03	75
13.01	50	46	7	73.04	0
13.02	36	47	40	73.05	91
14	36	48	59	73.06	132
15	32	49	322	73.07	*
16	20	50	263	74.03	80
17	63	51	86	74.04	188
18	43	52	96	74.05	*
19	86	53	64	74.06	207
20	64	54	79	74.07	101
21	1	55	37	74.08	103
22	0	56	119	74.09	4
23	18	57	83	74.10	4
24	88	58	19	74.11	*
25	65	59.01	52	74.14	234
26	15	59.02	97	74.15	468
27	54	60	135	74.16	53
28	22	61.01	19	74.17	118
29	18	61.02	110	74.18	133
30	134	62.01	6	74.19	141
31	25	62.02	26	74.20	21
32	113	63	204	74.21	380
33	90	64	120	74.22	466
34.01	41	65.01	76	75	*
34.02	25	65.02	50	Census Tract Total	8,950

*Census Tracts outside
Omaha's jurisdiction

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POPULATION AND HOUSING ESTIMATES

CENSUS TRACT (1980)	1976 VACANCY RATE	CENSUS TRACT (1980)	1976 VACANCY RATE	CENSUS TRACT (1980)	1976 VACANCY RATE
2	6.23	35	.05	66.01	2.97
3	4.18	36	1.42	66.02	7.58
4	7.01	37	4.36	67.01	1.45
5	3.79	38	11.89	67.02	10.67
6	10.39	39	15.80	68.01	3.79
7	4.18	40	17.34	68.02	.67
8	8.84	41	6.47	69.01	2.24
9	11.57	42	.59	69.02	1.88
10	6.05	43	2.37	70	5.94
11	7.40	44	6.62	71	6.54
12	6.17	45	.34	73.03	13.35
13.01	12.99	46	.80	73.04	.00
13.02	11.08	47	4.69	73.05	7.86
14	15.00	48	2.54	73.06	18.06
15	9.76	49	12.43	73.07	*
16	3.91	50	12.44	74.03	5.06
17	13.21	51	6.60	74.04	12.75
18	15.52	52	8.75	74.05	*
19	6.30	53	6.45	74.06	11.90
20	5.38	54	5.53	74.07	7.25
21	.09	55	1.62	74.08	6.23
22	.00	56	6.39	74.09	.91
23	2.10	57	4.17	74.10	10.26
24	6.58	58	.96	74.11	*
25	6.35	59.01	4.71	74.14	5.49
26	2.07	59.02	7.70	74.15	17.42
27	6.51	60	7.75	74.16	8.95
28	1.74	61.01	2.06	74.17	13.18
29	1.13	61.02	6.46	74.18	13.96
30	5.92	62.01	2.86	74.19	8.69
31	1.89	62.02	1.50	74.20	1.23
32	10.72	63	5.94	74.21	11.11
33	9.70	64	5.63	74.22	19.33
34.01	2.62	65.01	3.37	75	*
34.02	2.69	65.02	3.15	Census Tract Total	6.40 Average

*Census Tracts outside
Omaha's jurisdiction

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