POPULATION AND ECONOMIC PROJECTIONS FOR TRAFFIC ZONES WITH LIMITED HISTORICAL DATA

BY

THOMAS J. LLOYD

APPROVED BY:

Robert E. Mercer
Chairman, Thesis Committee

William Imperatore
Professor of Geography

Tom Bohannon
Associate Professor of Mathematical Sciences

William Imperatore
Chairman, Department of Geography

Joyce V. Lawrence
Dean of the Graduate School

POPULATION AND ECONOMIC PROJECTIONS FOR TRAFFIC ZONES WITH LIMITED HISTORICAL DATA

A THESIS

PRESENTED to

the FACULTY of the DEPARTMENT OF GEOGRAPHY

APPALACHIAN STATE UNIVERSITY

IN PARTIAL FULFILLMENT

of the REQUIREMENTS for the DEGREE

MASTER OF ARTS

BY

THOMAS J. LLOYD

September 1980

ABSTRACT

Determination of the future urban transportation system needs relies heavily on the location and amount of population, housing, income, and employment. In order to develop a comprehensive transportation plan for the Fayetteville Urban Area, detailed trip data out of, into, and through the area are required. These data are derived from land use, and socio-economic data, and are classified into traffic zones, or areas of similar vehicular origins and destinations. The traffic zone is a relatively new concept of which historical data is either non-existent or limited. Thus, the purpose of this thesis is to devise a step-by-step methodology which will render traffic zone, population, and economic data based on limited data.

A combination of regression techniques, ratios, percentages, and the compound interest model was used in this procedure. Each category of data was projected separately for 1985 and 2005.

The methodology used is statistically accurate and applicable to similar kinds of transportation studies although when dealing with projections into the future only time will show validity.

ACKNOWLEDGEMENTS

I would like to express my appreciation to the many friends, teachers, and associates who by their suggestions and advice made this study possible. I especially want to thank the members of my thesis committee, Drs. Reiman, Imperatore, and Bohannon who assisted me through many months of planning and execution of this study. My deep thanks to Jena Gibson, B. J. Cashwell, and Margaret Davis for many hours of proof-reading and typing. Lastly, my deepest thanks go to my wife and parents who painstakingly stood by and struggled with me through the months of work it took to produce this study.

Thomas J. Lloyd

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

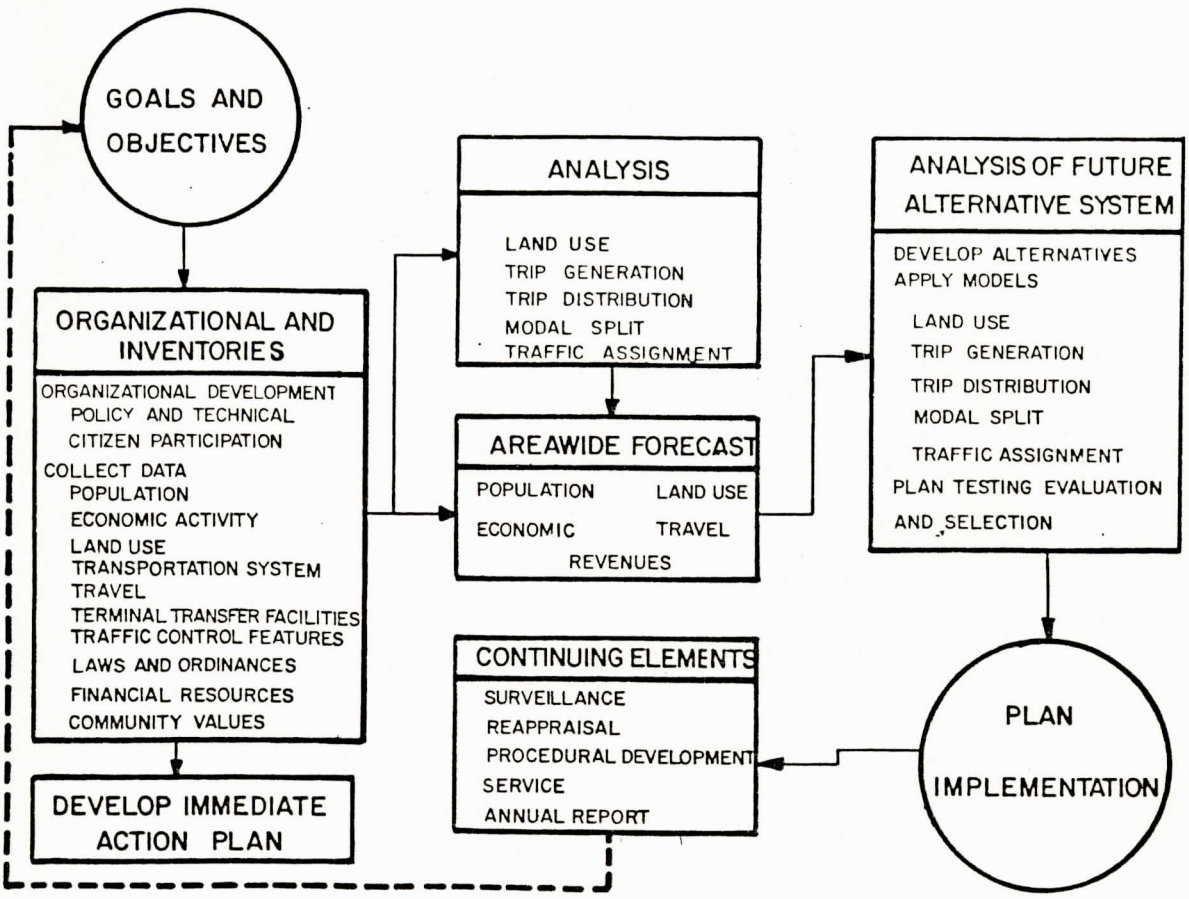
CHAPTER I

INTRODUCTION

The urban street system occupies 25 to 30 percent of the total developed land in an urban area.[1] Today's complex urban society requires extensive travel to fulfill the needs of its population and to support economic activity. The ability to estimate future travel needs requires not only a thorough understanding of existing travel--why it occurs and what affects it--but also the trend of change this travel has exhibited in the past.

In order to estimate future travel demands of an urban area, the variables which will affect this travel must be determined. Conventional techniques of travel forecasting generally involve the development of a series of sub-models which describe travel in terms of its major components: (1) trip generation, (2) trip distribution, and (3) transportation systems.[2] All of these sub-models are interrelated and must be considered holistically.

The sub-models for travel forecasting use as their data base population and economic projections for the design year. These projections are the variables which the North Carolina Department of Transportation uses, at this time, to determine trip generation in a specific year. A diagram of the transportation planning process is shown in Figure 1.1. This flow chart portrays the importance of population and economic forecasts in the urban transportation planning process.



THE CONTINUING URBAN TRANSPORTATION PLANNING PROCESS

Source: North Carolina Department of Transportation, Division of Highways, Transportation Planning and Plan Reevaluation, 1980, p.1.

FIGURE 1.1

Because of this relatively new and uncommon scale of data gathering and analysis, problems may arise in collection. Therefore it is the intent of this thesis to demonstrate a reliable and relatively quick series of procedural steps to analyze and project population and economic data at the traffic zone level using limited historical data. The Cumberland County-Fayetteville, North Carolina Urban Area is used as the target area of this study (Figure 1.2).[3]

Definition of Terms

It is appropriate at this point to define certain terms and concepts. Table 1 gives a breakdown of relevant terminology and definitions.

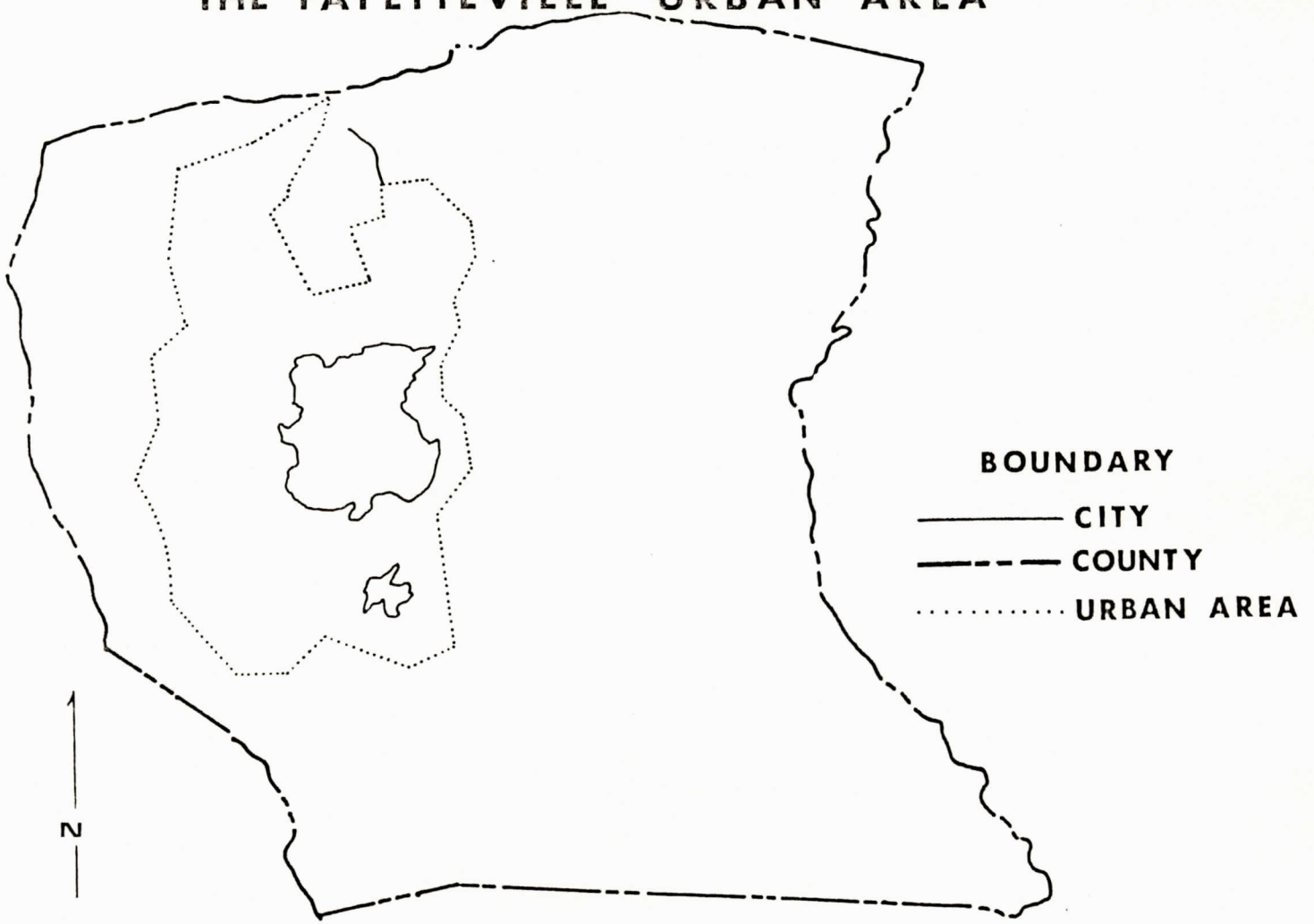

THE FAYETTEVILLE URBAN AREA
BOUNDARY
CITY
COUNTY
URBAN AREA
N

Figure 1.2

Table 1

DEFINITION OF TERMS

TERM	DEFINITION
O. D. Zone	The smallest, geographic area of homogeneous type, and number, of traffic generators and attractors used in transportation planning. (Figure 1.4)
Economic Projection	Dwelling unit, employment, and mean family income projections.
Planning Districts	A grouping of census tracts and O. D. zones, the boundary of which coincides with census tract boundaries. (Figure 1.5)
Group Quarters	Living arrangements for institutional inmates or for other groups containing five or more persons not related to the person in charge.
Cumberland County Joint Planning Board Standard Projections	A combination of various state agencies' population and economic forecasts considered to be the most accurate depiction of future Cumberland County.
Linear Regression Model	The linear regression model referred to in this study can be mathematically represented as: $y = ax + b$ where a is the slope of the line and b is the y-intercept
Compound Interest Model	The compound interest model can be mathematically represented as: $FV = PV(1 + i)N$ where FV = Future Value, PV = Present Value, i = Percent interest per period, N = Compounding Period

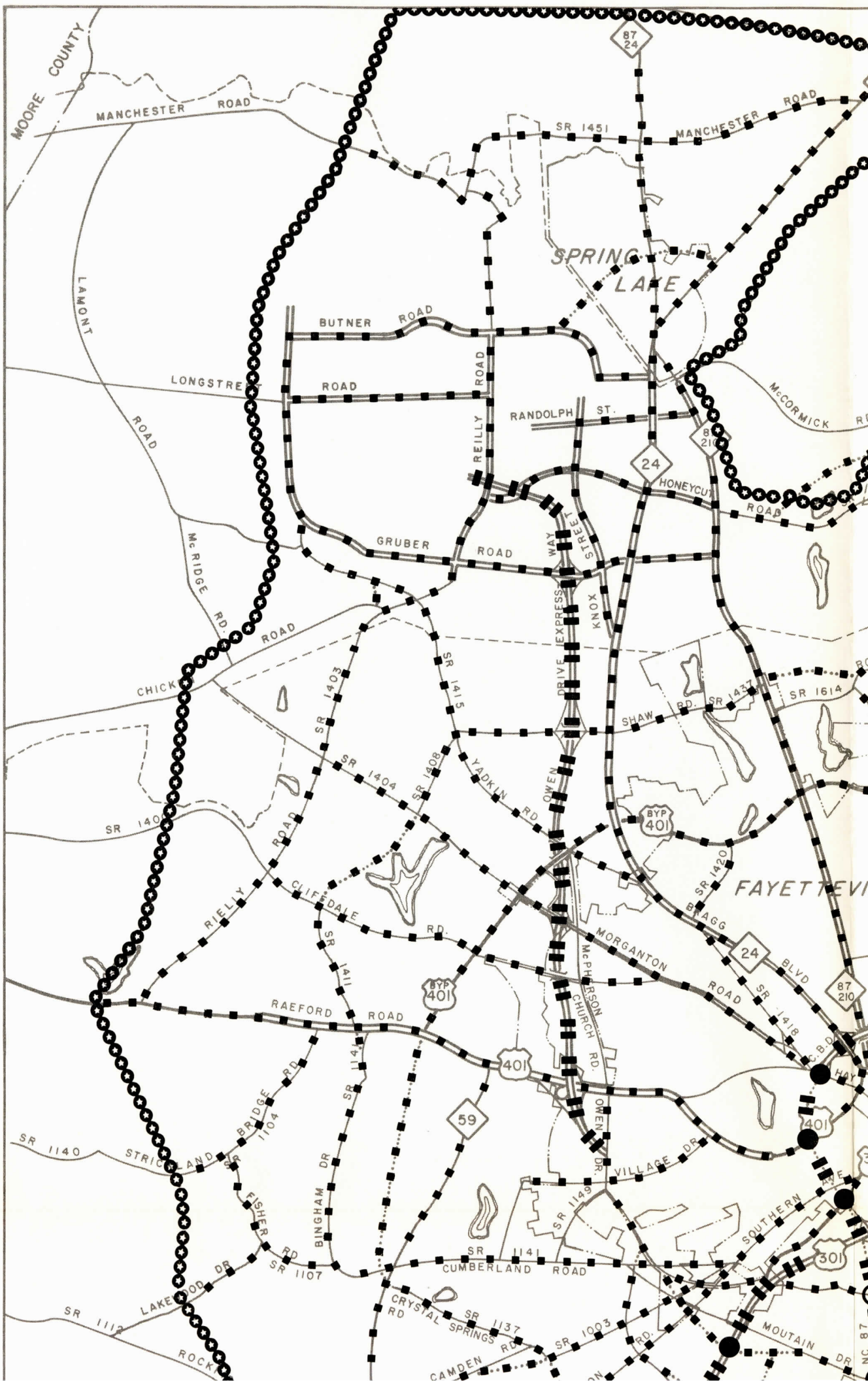
The Study Area

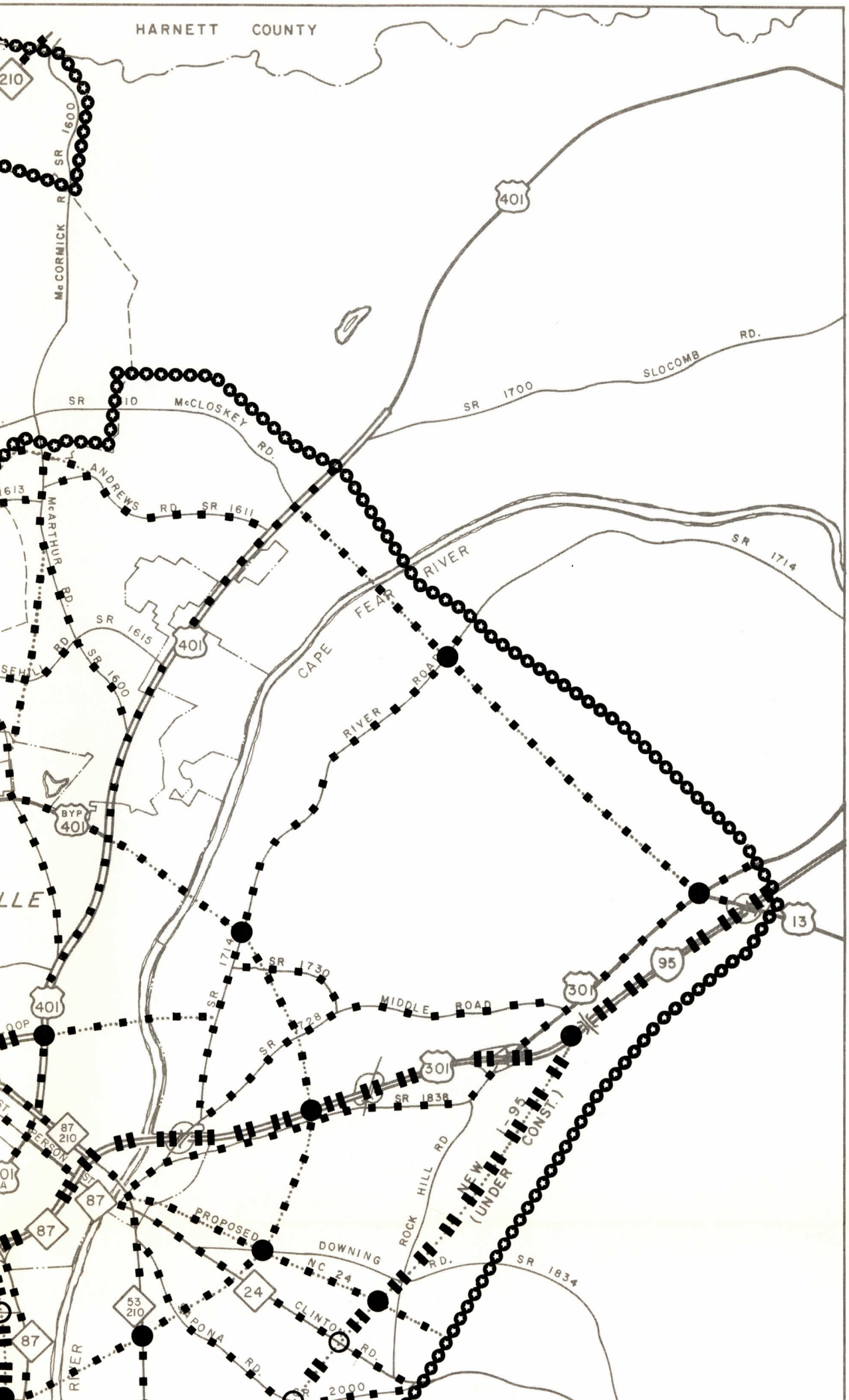
Cumberland County lies within the Atlantic Coastal Plain physiographic region. This area is characterized as having a slightly rolling to flat terrain.[4] The altitude ranges from less than 80 to 486 feet above sea level. The average approximate precipitation is 46 inches per year.[5] The county encompasses 661 square miles of land.

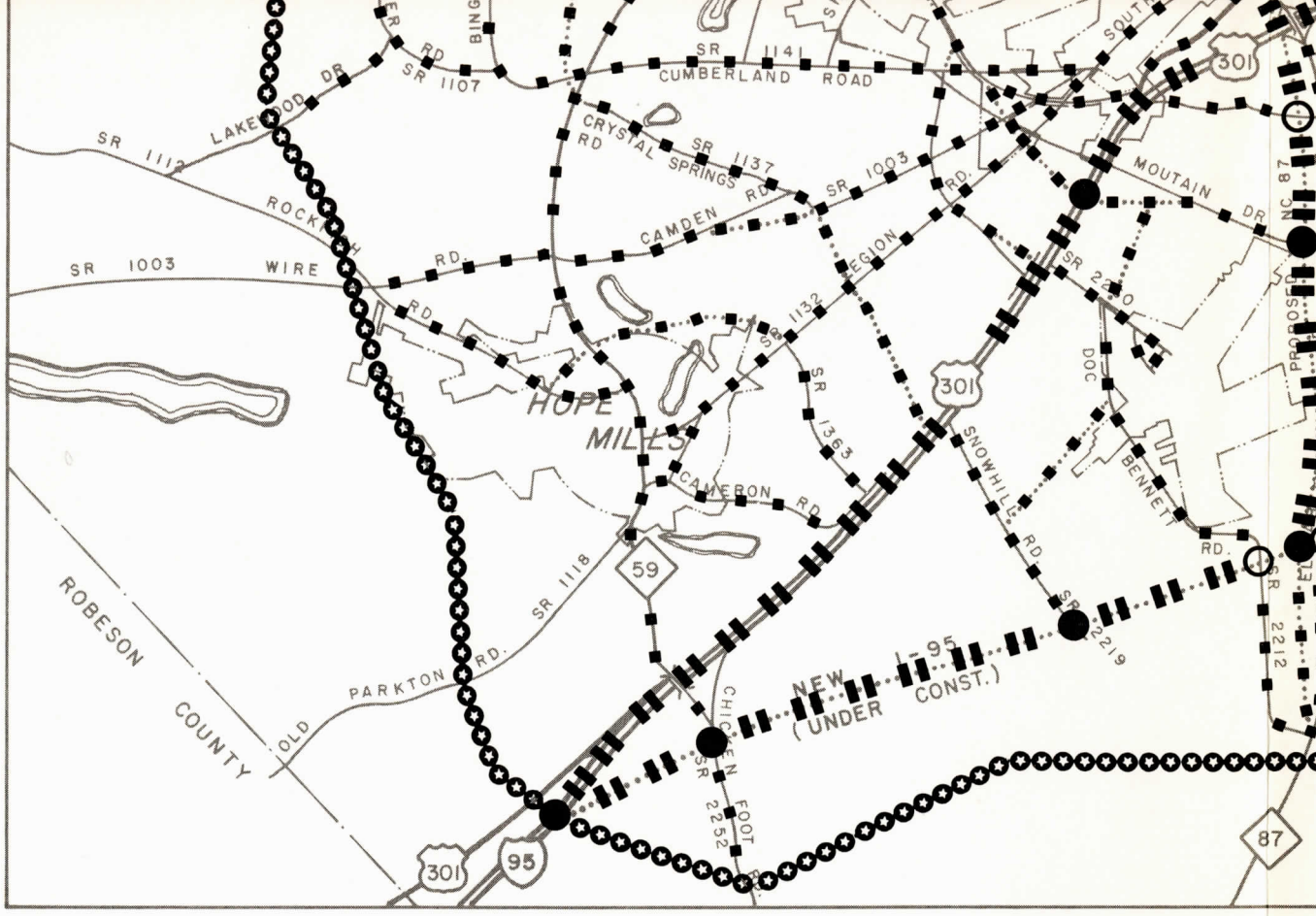
A comprehensive transportation study for the Fayetteville Urban Area was completed in 1962 which resulted in a "Thoroughfare Plan" that was officially approved by the state and affected local governments during the same year[6] (Figure 1.3). Amendments to the Plan were approved in 1968.

In 1977, the Planning and Research Branch of the Division of Highways of the North Carolina Department of Transportation, in cooperation with the Cumberland County Joint Planning Board, published the Fayetteville Urban Area Transportation Study, Technical Report 4.[7] This report outlined the planning area and subdivided this area into the current traffic zones used in the Thoroughfare Plan (Figure 1.4).

The planning area boundary, termed the external corridor, is laid out to include all of the land area which may potentially become urbanized during the design period. (The design period in this case was 25 years.) It should be kept in mind that these traffic zones are the basic areal unit of land used in the generation of models to determine trip origin and destination in forecasting travel.


MOORE COUNTY
MANCHESTER ROAD
LAMONT
SR 1451
SPRING LAKE
BUTNER ROAD
LONGSTREET ROAD
REILLY ROAD
RANDOLPH ST.
McCORMICK
HONEYCUTT ROAD
GRUBER ROAD
McRIDGE RD.
EXPRESS WAY
KNOX STREET
DRIVE
SR 1403
SR 1415
SR 1437
SR 1614
SHAW RD.
SR 1404
SR 1408
YADKIN RD.
OWEN
BYP 401
SR 1420
FAYETTEVI
BRAGG BLVD
CLIFFDALE RD.
SR 1411
MORGANTON ROAD
McPHERSON CHURCH RD.
SR 1418
RAEFORD ROAD
401
59
SR 1140
STRICKLAND BRIDGE RD.
SR 1104
SR 1147
FISHER RD.
SR 1107
BINGHAM DR.
OWEN DR.
VILLAGE DR.
SR 1149
SR 1141
CUMBERLAND ROAD
SOUTHERN
301
LAKEWOOD DR.
SR 1112
CRYSTAL SPRINGS RD.
SR 1137
SR 1003
CAMDEN RD.
MOUTAIN DR.


HARNETT COUNTY
210
McCORMICK RD.
SR 1600
401
SR 1700
SLOCOMB RD.
SR 1610
McCLOSKEY RD.
ANDREWS RD.
SR 1611
McARTHUR RD.
SR 1615
SR 1600
CAPE FEAR RIVER
SR 1714
RIVER ROAD
BYP 401
401
SR 1730
SR 1714
MIDDLE ROAD
SR 1728
301
95
13
SR 1838
NEW (UNDER CONST.) I-95
ROCK HILL RD
87
210
87
PROPOSED
DOWNING RD.
NC 24
SR 1834
24
53
210
87
CLINTON RD.
SR 2000



FAYETTEVILLE URBAN AREA THOROUGHFA

CURRENT THOROUGHFARE CORDON LINE (PLANNING BOUNDARY)

	EXISTING	PROPOSE
FREEWAYS		
OTHERS		

0 1 2

ROX. SCALE: IN MILES

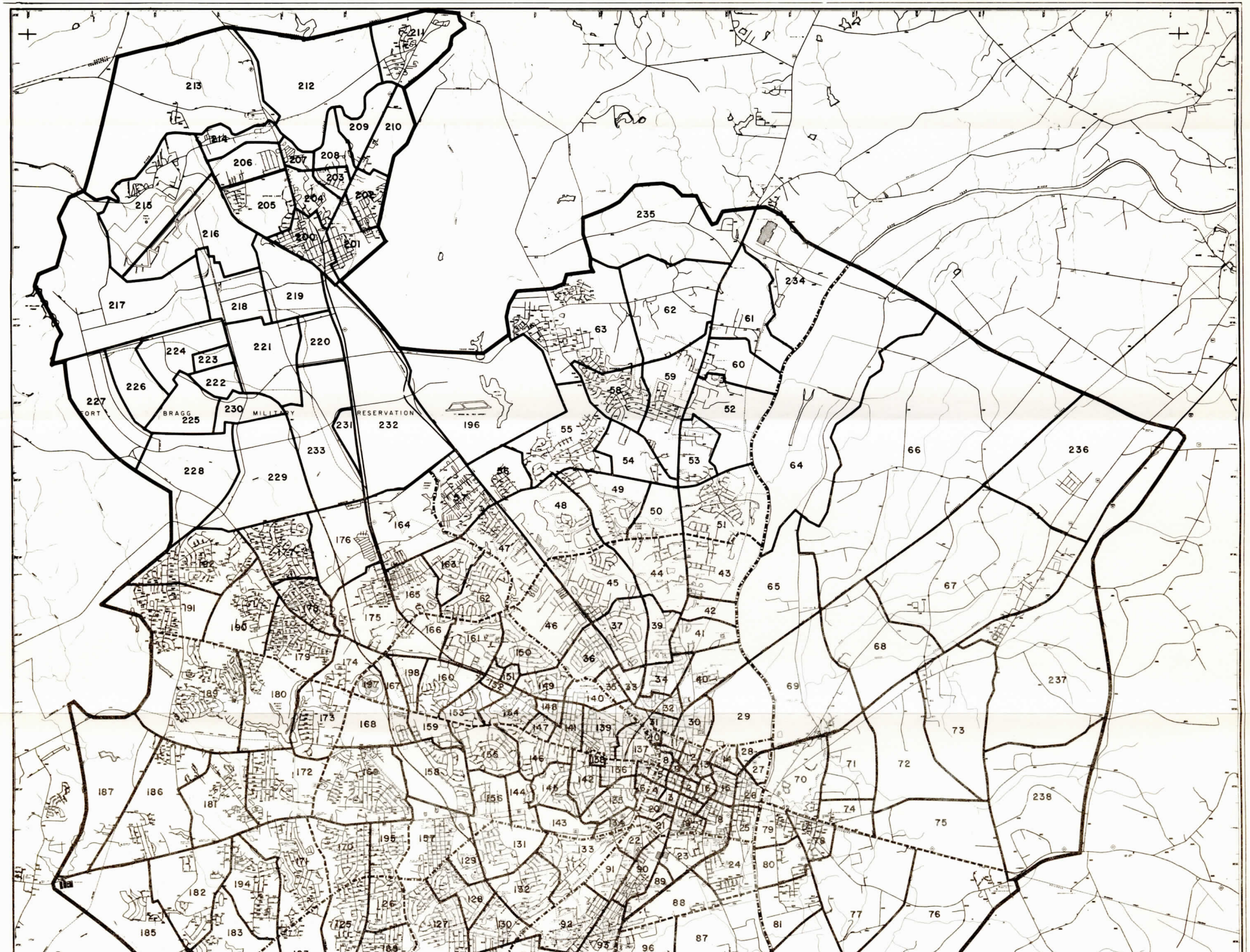
FIGURE 1.3

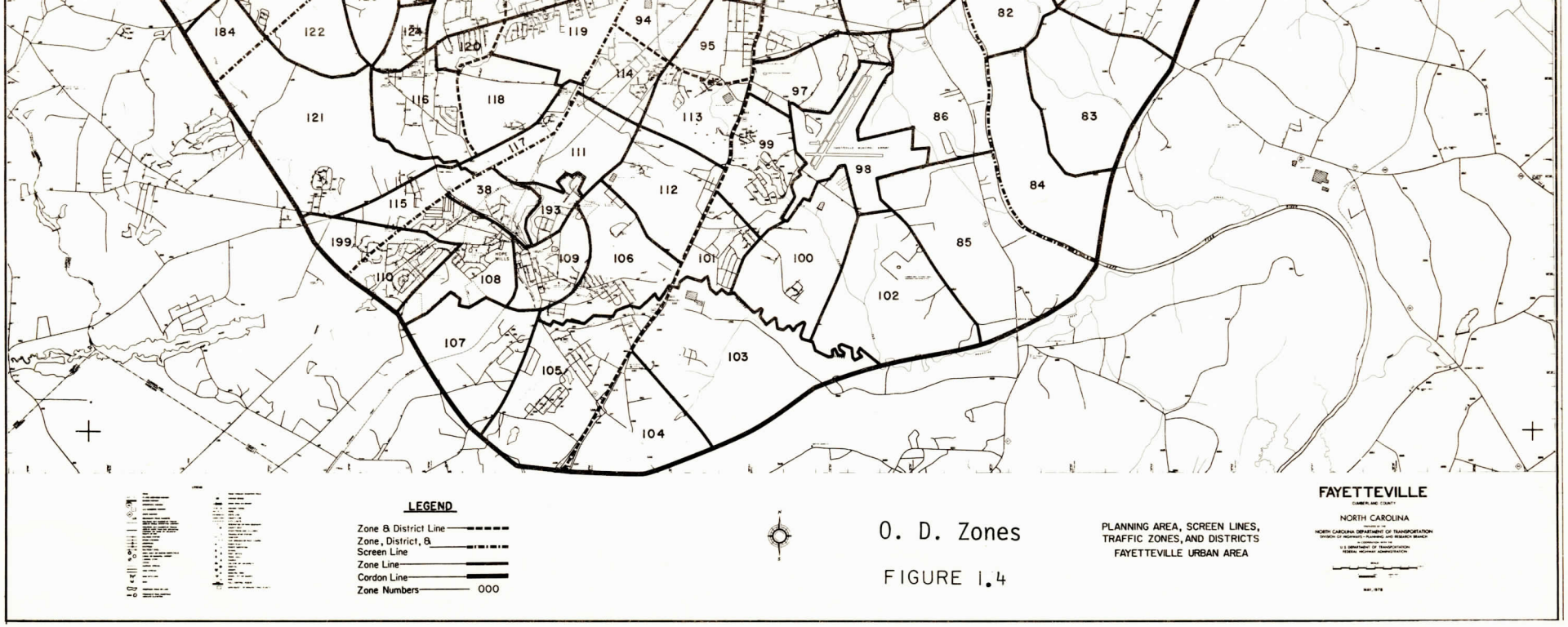
RE PLAN: MAJOR THOROUGHFARES

D

INTERCHANGES

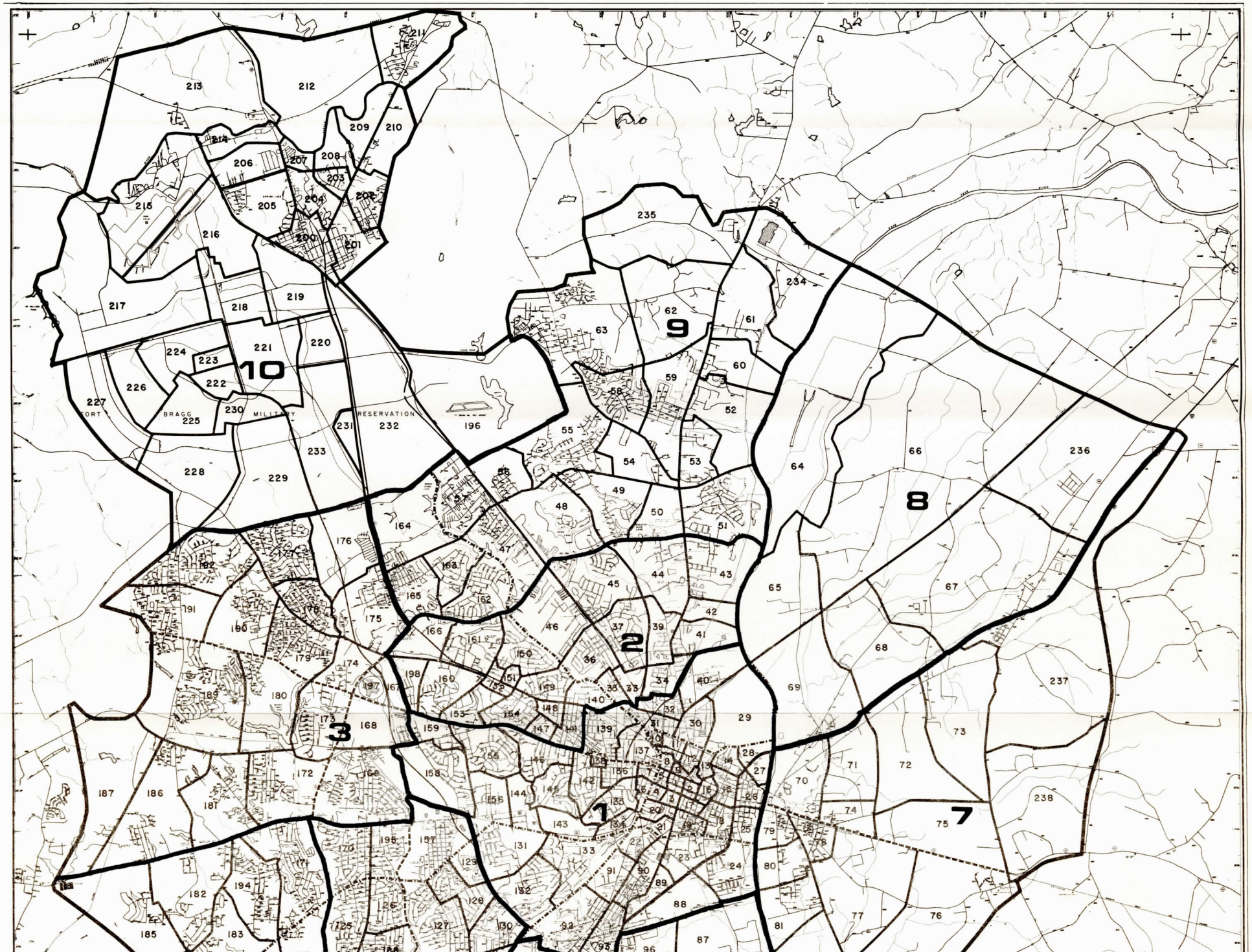
GRADE SEPARATIONS

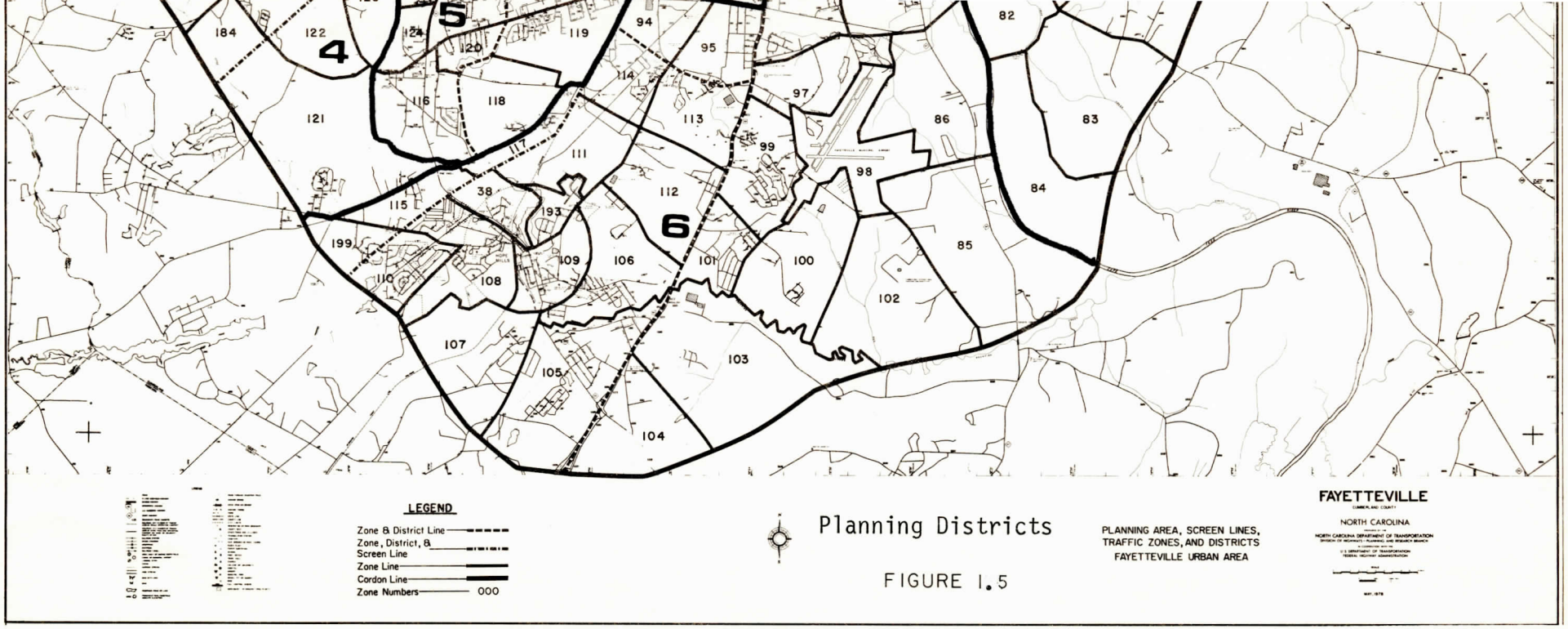

FORT BRAGG MILITARY RESERVATION



O. D. Zones

FIGURE 1.4


FORT BRAGG MILITARY RESERVATION
1
2
3
7
8
9
10



LEGEND

Zone & District Line

Zone, District, & Screen Line

Zone Line

Cordon Line

Zone Numbers 000

Planning Districts

FIGURE I.5

PLANNING AREA, SCREEN LINES, TRAFFIC ZONES, AND DISTRICTS FAYETTEVILLE URBAN AREA

FAYETTEVILLE

CUMBERLAND COUNTY

NORTH CAROLINA

Need for the Study

Since the urban street system is permanent, and expensive to construct and maintain, much care and foresight are needed in its development.[8] It is for this reason that thoroughfare planning has taken a major role in the planning of North Carolina's urban street system.[9]

Thoroughfare planning is the process used by public officials to assure the development of the most appropriate street system to meet existing and future travel desires within the urban area.[10] The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with changing traffic demands.[11] With the advent of thoroughfare planning, much needless time and expense can be alleviated.

The underlying theme of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety.[12] The location of present and future population, commercial, and industrial enterprises affects major street and highway locations. In order to develop a comprehensive transportation plan for an urban area, detailed trip data are required concerning trips being made into, out of, and through the area. These data are derived from land use and socio-economic data which are used to predict future economic conditions.[13]

Socio-economic data (population and economic data) for travel forecast model development are categorized into four data sets. They

are: dwelling units, population, employment, and income. Information on these data sets must be obtained at the traffic zone level in order to observe their effect on origins and destinations of travel within the urban area boundary. It is because of this concept of origins and destinations of vehicular travel that traffic zones are commonly referred to as "O. D. zones." The term O. D. zone will henceforth be used in reference to traffic zones.

The data source for the four data sets listed above is available in publications of the U.S. Census Bureau at the county and census tract level. A problem arises, however, when trying to obtain data at the urban areas or O. D. zone scale, as there are no official organizations which gather data at these levels. It is also unfortunate that most urban area and O. D. zone boundaries do not coincide with census tract or block boundaries.

Because of the lack of official data collected at either the urban area or O. D. zone level, most planning organizations are faced with two choices of data collection: (1) conduct O. D. zone surveys, or (2) use censal data to step down to the O. D. zone level. Obviously, the second choice appears to be the least expensive and time consuming. The only problem with choice (2) is that many planners lack either the expensive, sophisticated computer equipment or the requisite expertise in mathematics and statistics. Also, in many cases, such as the Fayetteville-Cumberland County urban area, O. D. zones have just recently been designated and mapped, so there is a lack of historical data at that level.

It seems, therefore, that unless a local planning agency can afford compiling numerous costly surveys, it must use the available census data.[14] This thesis intends to demonstrate a method of projecting population and economic data at the county level, in which census data can be used, for allocations down to the O. D. zone level using simple, yet accurate, statistical techniques.

Review of the Literature

A review of pertinent literature revealed four basic categories of population projection techniques. The first of these deals with graphical or mathematical techniques. These techniques are included in the broad category of trend based methods.[15] These methods use census data and reconcile, up to the target year, the results of absolute and/or percentage changes for all previous years. These percentages are then used in the projection of postcensal estimates. The data base for these types of analyses is available for states and counties on an annual basis through the Federal-State Cooperative Program for Local Population Estimates.[16] A problem arises when the planner desires to perform population estimates on a scale smaller than county, because it has been assumed by most experts that the smaller the area, the greater error to be expected.[17] This assumption is based on the belief that at the local level migration is a large and variable element in population change. The advantage of these types of analyses is that they are better suited for short term projections which have had relatively constant changes over time in the size of their population, and for which no marked erratic or rapid changes are foreseen. The weakness of such methods of

projection is that they are founded on the assumption that "the factors and conditions which affect population and economic growth or decline will remain unchanged and will have the same affects in the future."[18]

The second category of population and economic projections is based on relationship of growth in one area to growth in other areas (ratio methods). These types of projections assume that growth in one area or community is usually closely related to, or affected by, economic and population changes in the economic region or state.[19] If logically-founded projections for the region or state are available, the projections for the community can be derived directly therefrom.

The main disadvantage of these types of techniques is that the ratio method, based upon a forecast for a large area, is subject to all the errors, incorrect assumptions, and inaccuracies in that forecast. This, in essence, means that not only will errors occur in the actual forecast of the larger region or state, but also in the assumption that the same factors which influence the larger region will also influence the local community. There is no assurance that assumptions made for the larger area will be valid for the smaller community. As stated before, though, when an area is relatively stable in growth and change, these methods are reliable if the smaller community parallels the larger region or state.

The third category of projections is referred to as component methods. These methods study separately several factors, such as

births, deaths, and net migration, which affect the future size of the population. The theory behind component analysis is that more accurate estimates can be obtained by analyzing separate components of an area than analyzing the area as a whole.

The main disadvantage of these methods is that a great deal of data concerning birth rates, death rates, in and out migration need to be readily available to the community planner.[20] In many cases this is not possible; many small communities do not have the manpower to collect data needed for these techniques.

Another disadvantage of these methods is that they are very time consuming. Most small community planning agencies cannot afford to finance a long, detailed study which is needed in order to use these methods properly.

The last category of population and economic projections is forecast data derived directly from specific estimates of future employment. These methods are not generally used for transportation studies because "they assume that the volume of employment in an area on a future date can be forecast from consideration of certain economic factors alone, without taking into account the probable size of the future population."[21]

Given constraints of time and money, the logical methods of population projections over a short period of time would be found in the

trend based methods which are in fact the most common methods used on the smaller scale.[22] Simply stated, trend based methods extend an historical rate of growth for the total population into the future. These techniques use straight lines, geometric and logistic causes to extrapolate a population trend of the past into the future. When the projections are void of specific characteristics of population, such as age and sex, the mathematical trend analysis methods are the quickest and least expensive.

Hypothesis

The hypothesis of this thesis is as follows:

> Reliable population and economic projections can be calculated at the O. D. zone level, despite a limited data base, by means of trend based projection methods.

FOOTNOTES

[1] North Carolina Department of Transportation, Thoroughfare Planning and Research Branch, "Thoroughfare Planning Principles," Raleigh, 1978, p. 1 (mimeographed).

[2] Marion Robert Poole, Urban Travel Forecasting, Report to the North Carolina Department of Transportation, May, 1977, p. 2.

[3] Division of Highways of the North Carolina Department of Transportation, Report on the Origin-Destination Study and Development of Travel Forecast Models, Fayetteville Urban Transportation Study, No. 2, July, 1975, p. 1.

[4] Cumberland County Joint Planning Board, Report on the Economy, Environment, and Government of Cumberland County, North Carolina, 1975, p. 4.

[5] Ibid

[6] Cumberland County Joint Planning Board, Fayetteville Urban Area Annual Report, July 1977, p. 4.

[7] Division of Highways of the North Carolina Department of Transportation, Report on the Capacity-Deficiency Analysis and Development and Analysis of Alternatives, Fayetteville Urban Area Transportation Study, Technical Report No. 4, 1977, p. 2.

[8] North Carolina Department of Transportation, Thoroughfare Planning and Research Branch, Thoroughfare Planning Principles, p. 1.

[9] North Carolina Department of Transportation, Thoroughfare Planning and Research Branch, Thoroughfare Planning Principles, p. 1.

[10] Ibid.

[11] Ibid.

[12] Ibid, p. 4.

[13] Division of Highways of the North Carolina Department of Transportation, Report on the Origin-Destination Study, p. 1.

[14] J. Pegram, "Origin-Destination Surveys," Seminar given at Transportation Planning and Plan Reevaluation, Raleigh, North Carolina, January 21, 1980.

[15] United States Department of Transportation, Federal Highway Administration, A Report on Forecasting and Estimating Methods, June, 1964, p. 18.

[16] North Carolina Department of Transportation, Thoroughfare Planning and Research Branch, Thoroughfare Planning Principles, p. 3.

[17] United States Department of Commerce, Bureau of the Census, Guide for Local Area Population Projections, Technical Report No. 39, July, 1977, p. 5.

[18] North Carolina Department of Transportation, Thoroughfare Planning and Research Branch, Thoroughfare Planning Principles, p. 27.

[19] Ibid.

[20] Ibid.

[21] United States Department of Commerce, Bureau of the Census, Guide for Local Area Population Projections, p. 5.

[22] Andrew M. Isserman, The Accuracy of Population Projections for Subcounty Areas, Journal of the American Institute of Planners, Vol. 43, No. 3 (July, 1977), pp. 247-259.

CHAPTER II

METHODOLOGY AND PROCEDURE

This study involves making population, dwelling unit, income, and employment projections for Origin-Destination (O. D.) zones within the Fayetteville Transportation Study Area. The study area was delimited through a cooperative agreement by federal, state, and local officials in 1965, which delineated an area for the purpose of data collection for a transportation study. The urban area included the City of Fayetteville, the Town of Hope Mills, the Fort Bragg Military Reservation, and the Town of Spring Lake.

1985 Population Projections

Population Projections were based on a combination of past population trends, past ratios of urban area population to county-wide population, past ratios of planning district population to urban area population, available vacant residential land, and the Land Use Policies Plan.[1]

During the first stage of analysis, linear regression was used to project population on the county level. Regression was also used to obtain the percent of county-wide population accounted for by the urban area. By regressing this percent with time, it was determined that the urban area would account for 87 percent of the county population in 1985.

The second stage involved the calculation of an average yearly growth rate for the county population for the years 1977 to 1979. This rate was then used to project urban population on a yearly basis.

The final stage of analysis involved the use of ratios to allocate population from the urban area to each planning district, and from each planning district to the O. D. zones.

A detailed discussion of the methodology follows:

Step I	Population data were obtained for 1976, 1977, and 1978 at the O. D. zone, planning district, and census tract levels. County population data was available for the above years plus 1980, 1990, and 2000 in the Cumberland County Joint Planning Board Standard Projections.
Step II	An average yearly growth rate was calculated for the time period 1977-1979 at the county level through analysis of the data in Step I.
Step III	The derived growth rate/year was used to obtain a population projection for 1985 using 1977 as the base year. This was performed at the planning district and O. D. zone levels. This also rendered an urban area population projection for 1985.
Step IV	Linear regression was performed on the Standard Projections to obtain a 1985 county-wide projection.
Step V	A ratio of urban population to county population was derived for 1976, 1977, and 1978. These ratios were then used to project the 1985 urban area population to county population ratio through simple linear regression.
Step VI	A second urban area population projection was obtained by multiplying the ratio found in Step V by the county-wide population projection for 1985 found in Step IV.
Step VII	The two 1985 population projections for the urban area derived in Steps III and VI were compared and found to be statistically significant at the .01 level.

Step VIII Minor adjustments were made at the O. D. zone level based on Community Development Plans for revitalization, the Cumberland County Land Use Policies Plan, and the Commercial Areas Plan for Cumberland County.[2]

1985 Dwelling Unit Projections

The projection of dwelling units for the study area involved two primary mathematical procedures. The first procedure was an analysis of the yearly growth rate. The compound interest model was used for this stage of projection for the years 1970 through 1978 for the county. The derived growth rate was then used to project urban area dwelling units using 1977 as the base year.

The second projection technique was trend analysis using simple linear regression. This was used to interpolate the county Standard Projections. The resultant dwelling unit total was then multiplied by 87 percent (the degree to which the urban area accounted for the total county-wide dwelling units) to obtain a 1985 urban area dwelling unit total. This number was then compared to the projection derived through the use of the compound interest model and was found to be numerically equal.

Ratios were used to allocate dwelling units to planning districts and O. D. zones. Vacant land availability was also analyzed during the allocation process to insure sufficient space for additional dwelling units.

A detailed description of the methodology for dwelling unit projections follows:

Step I — Data for 1976, 1977, and 1978 dwelling unit totals by planning district, census tract, and O. D. zones were obtained from the Cumberland County Joint Planning Board.

Step II — A yearly dwelling unit growth rate was calculated for each planning district for the years 1976 through 1978 and also 1970 through 1978 period using a compound interest model.

Step III — The above growth rates were used to project a 1985 dwelling unit total at the urban area level by projecting each planning district separately and summing these totals to arrive at the urban area total.

Step IV — The Cumberland County Joint Planning Board Standard Projections found in Table 2 were used to interpolate a 1985 county-wide dwelling unit projection. Simple linear regression was performed to accomplish this.

Step V — The county-wide projection obtained in Step IV was compared to the urban area total obtained in Step III. The urban area was found to account for 87 percent of the county-wide housing.

Step VI — A ratio of urban area dwelling units to the county-wide dwelling unit total was obtained for 1976 through 1978.

Step VII — Linear Regression was performed on the ratios obtained in Step VI to project a 1985 ratio between urban area housing and county-wide housing. This ratio coincided with the 1985 urban area population to 1985 county-wide population ratio.

Step VIII — A ratio of the 1985 urban area housing total to the 1985 county-wide total was also obtained by comparing Steps III and IV. This ratio also corresponded with ratio in Step VII, thus validating the results.

Step IX — Minor adjustments were made at the O. D. zone level based on Community Development plans, current building trends, and available vacant land zoned residential.

Step X — A persons per household total was calculated as follows:

$$\frac{\text{1985 Urban Area Population total}}{\text{1985 Urban Area dwelling unit total}} = 3.1$$

TABLE 2

CUMBERLAND COUNTY

JOINT PLANNING BOARD

STANDARD PROJECTION SERIES

Category	1980	1990	2000
County Population	256,036	309,360	353,555
County-wide Housing	79,268	109,314	145,496
County Per Capita Income	6,249	9,405	12,561
Fayetteville Per Capita Income	7,061	10,772	14,445
County Employment	74,895	94,695	115,036

1985 Mean Family Income

To be consistent with data used in the Cumberland County Joint Planning Board Standard Projections (Table 2) data were converted to 1977 dollars. Also, because the Standard Projections were given as per capita income, each projection had to be multiplied by a person per household total to obtain mean family income for the county in 1980 and 1990.

Interpolation by means of linear regression was performed on the Standard Projections in order to obtain the 1985 county-wide mean family income total. From this total, yearly growth rates were computed and applied to the planning districts and O. D. zones.

An in-depth analysis of the methodological procedures used to project mean family income for the urban area follows:

Step I — 1977 mean family income totals were obtained for all O. D. zones, census tracts, and planning districts in the urban area from the Cumberland County Joint Planning Board.

Step II — The Cumberland County Joint Planning Board Standard Projections were regressed to interpolate 1985 county-wide and city-wide per capita income totals.

Step III — The projected 1985 per capita income figures found in Step II were converted from 1976 to 1977 dollars by multiplying both by 1.06.[3]

Step IV — Because it has already been established that 87 percent of the 1985 county-wide housing and population was accounted for by the urban area, and because the Standard Projections give city-wide and county-wide per capita income, an urban area per capita income figure was developed from the Standard Projections as follows:

(.87 x 1985 city-wide per capita income total)

+

(.13 x 1985 county-wide per capita income total)

Step V — The 1985 urban area per capita income total, obtained in Step IV above, was converted to mean family income by multiplying per capita income by the 1985 urban area population per household total found in Step X of 1985 Dwelling Unit Projections.

Step VI — A ratio between 1977 planning district mean family income and 1977 urban area mean family income was found as follows:

$$\frac{\text{1977 Planning District Mean Family Income}}{\text{1977 Urban Area Mean Family Income}}$$

Step VII — The ratio found in Step VI was then used to obtain a 1985 planning district mean family income figure. This was performed as follows:

$$\frac{\text{1977 Planning District Mean Family Income}}{\text{1977 Urban Area Mean Family Income}} \times \text{1985 Urban Area Mean Family Income}$$

Step VIII — The same procedure was used in calculating each O. D. zone mean family income for 1985.

$$\frac{\text{1977 O. D. Zone Mean Family Income}}{\text{1977 Planning District Mean Family Income}} \times \text{1985 Planning District Mean Family Income}$$

This step demonstrates the relationship of each O. D. zone income to its corresponding planning district total income. The ratio was assumed to remain constant between 1977 and 1985.

1985 Employment Projections

Employment, because of the amount and nature of the existing data, was the most time consuming and most difficult category to project. A

combination of regression techniques, ratio analysis, growth rate analysis, and factoring was used to arrive at the 1985 projections.

The six employment groups used in this study are as follows:

GROUP I - Agriculture, mining, construction, manufacturing, transportation, utilities, and communications.

GROUP II - Wholesale and retail trade.

GROUP III - Auto dealers, service stations, eating and drinking establishments.

GROUP IV - Finance, insurance, real estate, and government.

GROUP V - Services.

GROUP VI - School.

Because the North Carolina Department of Transportation and the North Carolina Employment Security Commission categorize government and school employment into different groups, Category C which included Groups IV, V, and school employment was formed to include both. Thus, by forming a new category to include Groups IV and V of the Employment Security Commission's classification system, and Groups IV, V, and school employment of the Department of Transportation's classification system, a method was obtained to form a category which included the same employment found in both classification systems. School employment is categorized in Group V of the Employment Security Commission's classification system. This new category was then used to obtain a ratio between it and the total county employment to be used for projection procedures. (Refer to Table 3 for Categories A through C.)

TABLE 3

1977 EMPLOYMENT SECURITY COMMISSION

COUNTY EMPLOYMENT ESTIMATES

I	II	III	IV	V	School
16,940	15,800		21,380	6,270	Included in Group IV
			27,650		
CATEGORY A	CATEGORY B		CATEGORY C		

* These estimates are given by Group I, II, III, IV, and V, and also by categories which are combinations of groups.

TABLE 4

1977 PLANNING BOARD ESTIMATES

FOR THE URBAN AREA

I	II	III	IV	V	School
	70% Group II & III 1977 County	47% Group III & II 1977 County	14.96% Group IV, V & Sch. 1977 County	49.6% Group IV, V & Sch 1977 County	15% Group IV, V & Sch 1977 County
12,146	11,070	7,469	4,139	13,722	4,168
	18,539			22,029	
CATEGORY A	CATEGORY B		CATEGORY C		

* This table depicts the percent of 1977 county employment accounted for by the urban area employment for each group.

TABLE 5

1977 PERCENT COUNTY EMPLOYMENT

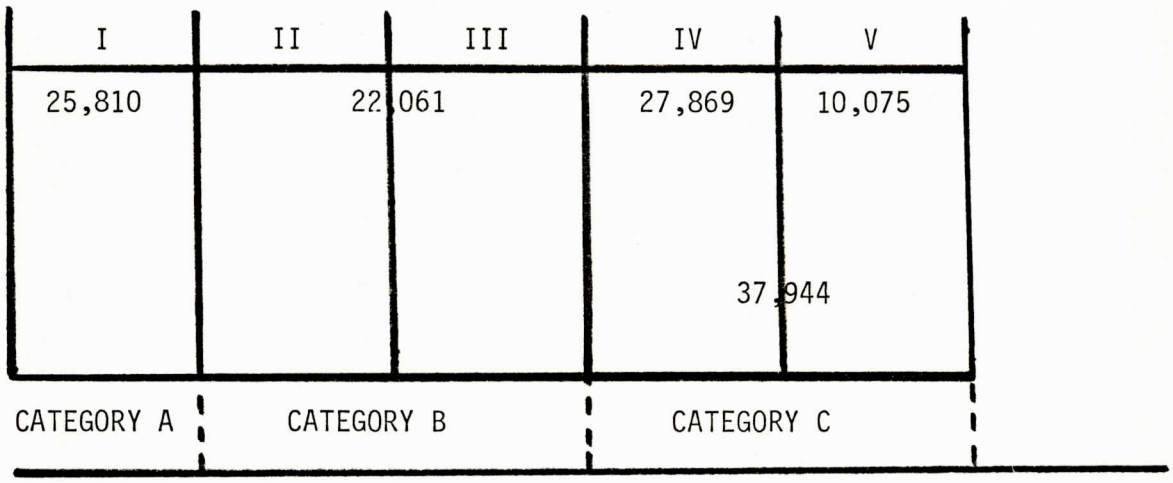
ACCOUNTED FOR BY THE URBAN AREA

I	II	III	IV	V	School
71.1% Group I 1977 County	117% of Category B, 1977 County		14.69%	49.6% 79.67% of Category C, 1977 County	15.074%

* This table shows the relationship between 1977 county employment and the percent to which these categories were accounted for by the urban area.

TABLE 6

1985 COUNTY ESTIMATES BASED ON
THE EMPLOYMENT SECURITY COMMISSION



*These estimates are given by groups and previously defined combinations of groups.

TABLE 7

1985 PLANNING BOARD ESTIMATES FOR URBAN AREA

I	II	III	IV	V	School
	15,456	10,428	5,680	18,830	5,721
18,506	25	878	18.78% of 30,230	62.29% of 30,230 79.67% of Category C	18.92% of 30,230

*This table shows the 1985 Planning Board estimates for the Urban Area, and also the percent of Category C accounted for by Groups IV, V, and School.

Because of the nature of traffic generation and attraction characteristics, all Fort Bragg employment was listed under Group V, not Group IV employment.

Following is a detailed breakdown of steps taken to analyze current, and project future, employment:

Step I — County-wide employment figures by group were obtained for the years 1970 to 1978 from the North Carolina Employment Security Commission.[4] These figures were given in the form of yearly averages. Adjustments had to be made with respect to the various types of employment included in the six groups described in the text. Groups II and III were combined to form Category B; Groups IV, V, and school combined to form Category C.

Step II — The Cumberland County Joint Planning Board Standard Projections provided projected county-wide employment for 1980, 1990, and 2000. Linear regression was performed to interpolate the 1985 county-wide employment total.

Step III — Linear regression was performed on the new categories described in Step I above for the years 1970, 1974, and 1978 to arrive at a 1985 county-wide projection for each group. Fort Bragg employment was factored out during this stage.

Step IV — The projected employment for each category in Step III above was then summed to produce an aggregate total for 1985 county-wide employment.

Step V — The county-wide employment projections obtained in Steps II and III above were compared and found to be significant at the .02 confidence level.

* Note: — The remaining steps allocate the projected county-wide employment to each particular planning district and O. D. zone. Refer to Tables 3 through 9 for Steps VI through XIX.

Step VI — Below are the groupings of employment into three major categories. The percent of 1977 county-wide employment accounted for by the following was determined:

TABLE 8

1985-2005
Increase in Employment
Actual and Percent of Total

I	II	III	IV	V	School	
8,922	5,933	3,757	2,611	7,514	2,570	= 31,307
28.5%	19%	12%	8.3%	24%	8.2%	= 100%

TABLE 9

1985-2005
1/2 Employment Increase
by Group

I	II	III	IV	V	School	
4461	2,966	1879	1305	3757	1285	= 15,653

a) Group I
b) Groups II and III combined
c) Groups IV, V, and school combined

Step VII — The percent of Category B, at the county level, accounted for by the Group II employment, for the year 1977 was calculated. This also provided the Group III percentage.

Step VIII — The percent of county employment accounted for by the urban area was calculated for all three categories as follows:

a) The ratio between Group II urban area employment to Category B (Group I and Group II employment) employment at county level for 1977 was calculated.

b) The ratio between Group III urban area employment in 1977 to Category B employment at the county level for 1977 was calculated.

Step IX

a) The ratio between 1977 Group IV urban area employment and 1977 county-wide employment for Category C (Groups IV, V, and school) was calculated.

b) The ratio between 1977 Group V urban area employment and 1977 county-wide employment for Category C was calculated.

c) The ratio between 1977 urban area school employment and 1977 county-wide employment for Category C was calculated.

Step X — By regressing the ratio of urban area employment to county-wide employment for the years 1970 through 1978 it was found that 90 percent of 1985 county-wide employment was accounted for by the 1985 urban area. Thus, urban area total employment was obtained by multiplying the result of Step II by .90.

Step XI — The 1985 county-wide employment for Category C was calculated. This was obtained by summing the percentages found in Steps IXa, IXb, and IXc and multiplying that sum by the 1985 projected county employment found in Step II.

Step XII — The 1985 urban area employment for Group IV was obtained by multiplying the 1985 county-wide Group IV employment by Step IXa.

Step XIII — The 1985 urban area employment for Group V was obtained by multiplying the 1985 county-wide Group V employment by Step IXb.

Step XIV — The 1985 urban area employment for school was obtained by multiplying the 1985 county-wide school employment by Step IXc.

Thus, Step X + Step XI + Step XII yielded the same percentage as Step IXa + IXb + IXc.

Step XV — The ratio between 1977 planning district employment totals to 1977 urban area employment totals for each group was calculated as follows:

$$\frac{\text{1977 Planning District I Employment for Group I}}{\text{1977 Urban Area Employment}}$$

Step XVI — The above ratio was used to obtain 1985 planning district total.

i.e., Step XV x 1985 urban area total

Step XVII — Once the 1985 employment totals for each group were calculated at the urban area level for each planning district, the growth rate for each planning district between 1977 and 1985 was computed and found to be 1.28/yr.

Step XVIII — The growth rate obtained in Step XVII was used to obtain projected employment at the O. D. zone level, i.e., the 1977 O. D. zone employment for each group was multiplied by a growth rate of 1.28/yr. Fort Bragg was then readded to planning district 10b.

Step XIX — Minor adjustments were made based on vacant land availability and general land use familiarity within the urban area.

POPULATION AND DWELLING UNIT PROJECTIONS FOR 2005

As a first stage, vacant residential land was tabulated for the urban area on the planning district and O. D. zone level. Residential acreage was used to support the 1985 housing projections and was subtracted from the total vacant land to obtain net available residential land for 2005.

The second stage of analysis, actual extrapolation, was performed on the Standard Projections using simple linear regression and a compound interest model based on yearly growth rates. Through regression and annual trend analysis, it was found that the 2005 urban area would account for approximately 85 percent of the total county population. Hence, a county projection was obtained for population and housing and subsequently multiplied by .85, resulting in an urban area projection for population and dwelling units.

The third stage involved allocation procedures using a simple ratio method of comparison between dwelling unit totals for each planning district in 1985 and the urban area for that same year. This ratio was then applied to the 2005 urban area total to achieve 2005 planning district totals. The same method of ratio analysis was performed on each O. D. zone in comparison with subsequent planning districts in which they were located. Also, building permit trends were analyzed and used as a guideline in this allocation process.

A detailed, step-by-step outline of the projection and allocation methodology for 2005 population and dwelling units follows:

Step I — Vacant land was tabulated by O. D. zone.

Step II — Regression was performed on the Cumberland County Joint Planning Board Standard Projections to obtain the 2005 county-wide dwelling unit projection. Fort Bragg was held constant from 1985 through 2005.

Step III — Population per household obtained through the Cumberland County Joint Planning Board Standard Projections was regressed for the years 1980 through 2000 and projected to be 2.44 in the year 2005.

Step IV — The 2005 county-wide dwelling unit projection was multiplied by 85 percent to obtain the 2005 urban area dwelling unit total.

Step V — From the 1985 and 2005 urban area totals, a growth rate using the compound interest model was established.

Step VI — The growth rate/year found in Step V was used to derive the 2005 O. D. zone dwelling unit projections using 1985 as the base year.

Step VII — The C.H.N.M.B. Plan for proposed downtown revitalization was used to allocate additional housing to Planning District 1.[5]

Step VIII — Total growth between 1977 and 1985 was calculated at the planning district level. Based on this growth, quartiles were established and each planning district was placed into the appropriate quartile: I 0-25%; II 25-50%; III 50-75%; IV over 75%.

Step IX — Analysis of building trends, total growth found in Step VIII, and available residential acreage was performed at the O. D. zone level. This resulted in a reallocation of the base figures found in Step VI.

Note: It is of utmost importance to project dwelling units and population in conjunction with one another due to the fact that manipulation of one category has a direct effect on the other.

Step X — 2005 dwelling unit totals were established for each O. D. zone as discussed earlier.

Step XI — 2005 county-wide population was projected based on the Cumberland County Joint Planning Board Standard Projections. Fort Bragg population was factored out and held constant. This yielded a county-wide 2005 population of 366,919.

Because the population of Fort Bragg was used in the base year of the Joint Planning Board Standard Projections, it was deemed necessary to calculate the growth rate used in the Standard Projections between 1985-2005 and determine, from 1985 base data, the amount Fort Bragg grew and subtract that total from the 2005 projections.

Step XII — By regressing the ratio between county-wide population and urban area population for the years 1980 through 2000, it was found that 85.5 percent of the 2005 county-wide population would be accounted for by the urban area, hence the 2005 urban area population was found by multiplying the new 2005 county-wide population projection by .855.

Step XIII — It was found that persons per household should approximately equal 2.4. By dividing projected 2005 population by 2005 dwelling units, derived in Step III above, a person per household figure of 2.44 was obtained, thus verifying the figure found by linear regression.

Step XIV — Through use of the compound interest model, a growth rate/year was calculated based on the urban area population in 1985 and 2005. This rate was then used to compute planning district and O. D. zone population base figures for 2005. Only those O. D. zones which increased in dwelling units were shown to increase in population.

Step XV — During the preceeding steps, group quarters population was held constant.

Step XVI — Due to the fact that in several planning districts the housing growth far exceeded population growth, and in many districts, projected population far exceeded available acreage for housing, adjustments were made based on analysis of building and relocation trends.

Mean Family Income Projections for 2005

Projections for mean family income were performed in the same fashion as the 1985 projections for this category. The main variation in procedure was the ranking of all planning districts by quartiles,

based on relative wealth in relation to all other planning districts in the study area. These quartiles were used as a basis to rank added dwelling units between 1985 and 2005 according to income. This procedure would then take the additional dwelling unit income into consideration when computing the overall planning district mean. Planning districts were again analyzed to determine if the added dwelling units affected the planning district overall mean.

A detailed description of the methodology for 2005 mean family income follows:

Step I — The Cumberland County Joint Planning Board Standard Projections were converted from 1976 to 1977 dollars to be consistent with the 1985 projections. This was accomplished by multiplying the Standard Projections for per capita income by 1.06.

Step II — Because the Standard Projections give per capita income by city and county, one total figure for the urban area must be determined. Because the 2005 urban area was considered 85.5 percent city and 14.5 percent county, the following procedure was performed to obtain the urban area per capita income:

(.145 x 2005 county per capita income)

+

(.855 x 2005 city per capita income)

This procedure was performed for all the years given in the Standard Projections. Linear regression was then performed to yield the 2005 per capita income figure for the urban area in 1977 dollars.

Step III — The Standard Projections, given in the form of per capita income, were converted to mean family income by multiplying them by a factor of 2.44 persons per household.

Step IV — A growth rate between 1985 and 2005 was calculated at the urban area level.

Step V — This growth rate was applied on the 1985 planning district and O. D. zone level to achieve the 2005 planning district and zonal mean family income.

Step VI — Quartiles of 2005 urban area mean family income were then computed and each O. D. zone and planning district ranked according to relative wealth of each zone and district to the others. These quartiles were then used to rank added dwelling units between 1985 and 2005. In many instances, the new housing was assumed to rank in a higher quartile than the existing dwelling units. New housing was then classified as a higher rank on the quartile scale.

Step VII — Planning districts were once again analyzed to determine if the added households affected the district mean family income total; this was then recorded.

Employment Projections for 2005

Employment projections for the 2005 transportation study area were based on a combination of past employment trends, projected labor force growth, available commercial and industrial land, and the Land Use Policies Plan. Employment was divided into six categories, as determined by the North Carolina State Department of Transportation Planning and Research Branch, and are listed in Chapter I.

The following is projection and allocation processes for 2005 employment.

Step I — Employment was regressed against time using the Cumberland County Joint Planning Board Standard Projections for 1980, 1990, 2000, and the 1985 projections included in this report. Fort Bragg was factored out of these Standard Projections and held constant at the 1985 estimate. This yielded a 2005 county employment total.

Step II — It was assumed that 85 percent of the county population would be accounted for by the urban area. Thus, the projected county employment, obtained in Step I, was multiplied by 85 percent.

Step III — Total employment increase between 1985 and 2005 was computed.

Step IV — The amount of the total employment increase between 1985 and 2005 in each particular group, I, II, III, IV, V, or school, was computed. This was calculated by finding the percentage of total employment each group accounted for in 1985 and applying this same percentage for 2005. In effect, the ratio of group employment to total employment was held constant from 1985 to 2005.

Note: Procedure for Allocating 1/2 Employment Growth.

Step V — One-half of total group increase was allocated to planning districts. The percentage each planning district represented of total urban area group employment in 1985 was determined. This percentage was used to obtain group employment at the planning district level, i.e., Planning District 1 accounted for 28 percent of Group I employment in 1985. Multiply the total 2005 Group I urban area employment by 28 percent to obtain 2005 Group I employment for Planning District 1.

Step VI — The percent each O. D. zone comprised of total planning district employment by group for 1985 was derived. This same percentage was used to allocate 2005 O. D. zone group employment from planning district total, i.e., O. D. Zone 1 accounted for two percent of the Group I employment for Planning District 1 in 1985, thus multiplying the 2005 Group I employment for Planning District 1 by two percent.

The following steps outline the procedure used for allocating the remaining 1/2 of employment by group.

Step VII — To allocate remaining Group I employment, the Cumberland County Joint Planning Board Industrial Areas Plan was utilized to obtain future industrial locations.[6] The ratio of seven employees/acre was used when allocating number of employees to each O. D. zone. Also, the vacant land tabulation was utilized in deciding where the most available appropriately zoned acreage was located.

Step VIII — The Cumberland County Joint Planning Board Commercial Areas Plan was utilized in pinpointing future Group II and Group III employment. This Plan specified minimum site acreage for specific types of commercial development, as well as defineable locations for future commercial establishments. Also, a study by the consulting firm of Hammer, Siler, George Associates was utilized in obtaining an employee/acre ratio used in the allocation process.[7]

Step IX — Several sources were used in the Group IV and Group V allocation process. Fifty percent of the remaining Group IV and Group V employees were distributed in Planning District 1 as recommended by the Downtown Fayetteville 1975/2000 Plan.[8] Through detailed analysis of this Plan, it was found that 131 employees/acre should be used in allocating office employment to O. D. zones.

Step X — The 50 percent remaining Group IV and Group V employees were allocated to Planning Districts 2 through 10 by means of a ratio method. The percentage of total population growth between 1985 and 2005 that each planning district accounted for was computed. This percentage was then used to allocate remaining employees. Hence, the remaining employment was allocated according to each planning district's relative population increase as shown in Table 10. A ratio of 112 employees/acre was used in the allocation process. This was determined through analysis of the Downtown Fayetteville Plan and the Land Use Policies Plan.

Step XI — The final steps for employment projections dealt with allocating school employment. The Fayetteville Downtown Plan called for a Meeting and Education Center to be located in Planning District 1. This accounted for 80 employees of a total of 1,285 to be allocated throughout the study area.

Step XII — The Land Use Policies Plan specifies criteria for public and private school location.

Step XIII — Each planning district was ranked according to relative population increase with respect to all other planning districts. The three most burgeoning Planning Districts, 3, 4, and 9, which together account for 63 percent of the total population increase, received one elementary school, one junior high school, and one high school. One elementary school was added to the remaining six planning districts with the exception of Planning District 6, which received one junior high school and one elementary school. Analysis of current employees/school throughout the urban area yielded the following:

50 employees per elementary school
75 employees per junior high school
100 employees per high school

Lastly, analysis of future transportation construction, i.e., Interstate 95 and corresponding interchanges, was used in the employment allocation process.

TABLE 10

2005
Employment Allocation
by Planning District

Planning District	% Population Increase	Group IV Employees	Total Allo-cation	% Population Increase	Group V Employees	Total Allo-cation
2	7.8	652	51	7.8	1878	147
3	21	652	135	21	1878	394
4	26	652	170	26	1878	488
5	6.7	652	44	6.7	1878	126
6	10.5	652	68	10.5	1878	197
7	3.0	652	21	3.0	1878	56
8	1.5	652	10	1.5	1878	28
9	15.7	652	102	15.7	1878	295
10a	7.8	652	51	7.8	1878	147

FOOTNOTES

[1] Cumberland County Joint Planning Board, Land Use Policies Plan, 1978, pp. 6-2 to 6-5.

[2] Cumberland County Joint Planning Board, Commercial Areas Plan, 1974, pp. 26 - 32.

[3] Hammer, Siler, George Associates, Adjustment Factors for Converting Current Dollars to Constant Dollar Values Based on Consumer Price Index, 1978.

[4] Employment Security Commission of North Carolina, North Carolina Labor Force Estimates, 1978, pp. 66 - 67.

[5] C.H.N.M.B., Fayetteville Conceptual Plan, 1978, pp. 1 - 26.

[6] Cumberland County Joint Planning Board, Industrial Areas Plan, 1978, pp. 15 - 23.

[7] Hammer, Siler, George Associates, Downtown Fayetteville 1975/2000, 1975, pp. 56 - 77.

[8] Ibid.

CHAPTER III

FINDINGS AND CONCLUSION

A final projection for 1985 population, dwelling unit, income and employment by planning district and O. D. zone is shown in Appendix A. The last line in this table gives a total urban area composite sum for each category. The 2005 projections for each category by planning district and O. D. zone are found in Appendix B. Also found in this table is a summary for the Urban Area in each of the four categories.

The foregoing hypothesis (page 15) was verified in two of the four categories. A correlation coefficient (r), the measure of strength of direct relationship between two variables, and a coefficient of determination (R^2), the variance explained by the regression line, was found for eight comparisons.

To verify the reliability of the regression equation used to project 1985 and 2005 population, a comparision was made between the actual population for 1977, 1978, and 1979, and the projected 1985 and 2005 population. Table 11 reveals the r and R^2 value of each relationship when the actual urban area population of a particular year (or combination of years) is used in the regression equation. For example, the 1977 actual Urban Area population of 208,906 when used in the regression equation yields the projected urban area population of 246,246 for 1985, and 312,385 for 2005, with r of .9965 and an R^2 of .9930. Observation of this table quickly reveals the extraordinary amount of variance explained by the regression equation in all the comparisons made.

TABLE 11

Results of Regression Analysis

Population	r	R^2
1977 Actual (208,906) 1985 Projected (246,246) 2005 Projected (312,385)	.9965	.9930
1978 Actual (226,213) 1985 Projected (246,246) 2005 Projected (312,385)	.9996	.9991
1979 Actual (228,318) 1985 Projected (246,246) 2005 Projected (312,385)	.9998	.9997
1977 Actual (208,906) 1978 Actual (226,213) 1979 Actual (228,318) 1985 Projected (246,246) 2005 Projected (312,385)	.9906	.9814
Dwelling Units	**r**	**R^2**
1977 Actual (66,598) 1985 Projected (79,364) 2005 Projected (128,217)	.9965	.9930
1978 Actual (67,951) 1985 Projected (79,364) 2005 Projected (128,217)	.9979	.9946
1979 Actual (69,491) 1985 Projected (79,364) 2005 Projected (128,217)	.9979	.9958
1977 Actual (66,598) 1978 Actual (67,951) 1979 Actual (69,491) 1985 Projected (79,364) 2005 Projected (128,217)	.9946	.9892

The same comparisons were also made using total yearly urban area dwelling unit totals. After numerous steps and adjustments to the original base data by means of ratio allocation methods, vacant land availability, and compound interest techniques, Table 11 reveals the strong R^2 values in each of the regression equations, the lowest R^2 value being .9892.

Due to the fact that income and employment data are not computed for the Urban Area except during the censal year, verification of validity for these two categories cannot be performed at this time. However, the foregoing hypothesis has been substantiated through the use of various elementary statistical techniques which compare projected and estimated data with actual data.

The purpose of this thesis was to devise a methodology which could be used to project population and economic variables on a small scale using limited historic data given on a larger scale. This was shown to be possible as well as reliable. Due to the nature of projection into the future, only time can validate the results of this study. It is expected that this methodology can be adapted to other regions with little difficulty, and that the thoroughfare planning process can be expedited through the use of these methods of population and economic projection techniques.

APPENDIX A

1985 PROJECTIONS

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1	32,350	11,073	25,626	8404	5178	3845	4342	2946	977
1	13	0	0	21	359	92	671	187	0
2	143	6	15,847	81	168	17	400	75	0
3	46	16	15,657	40	28	4	0	5	0
4	72	25	15,715	101	166	0	0	5	0
5	3	1	15,008	29	448	112	3	128	0
6	147	51	15,624	947	31	0	0	4	0
7	84	29	28,194	259	59	11	153	4	0
8	3	1	15,008	20	43	84	187	89	0
9	232	75	16,812	161	422	0	224	130	0
10	40	14	13,719	85	8	11	0	0	0
11	222	77	15,419	221	121	28	262	202	0
12	60	21	16,770	394	45	95	488	125	0
13	267	86	16,754	0	0	0	0	0	0
14	825	277	10,485	34	0	202	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
23	130	45	13,446	114	32	11	0	16	56
24	316	108	13,548	519	67	0	0	5	0
25	360	125	10,588	230	0	61	0	36	0
26	144	50	10,504	362	56	140	3	12	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	189	0	0
30	539	187	12,805	711	236	49	7	358	128
31	832	249	15,138	33	109	0	12	125	0
32	564	196	12,749	34	31	0	0	5	78
40	507	176	12,674	538	0	32	0	4	0
88	325	113	13,437	37	0	27	0	4	0
89	187	65	13,456	37	8	14	0	10	0
90	1252	429	25,025	682	27	31	0	19	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
91	583	201	25,019	37	24	0	11	14	121
92	1169	402	24,788	210	17	89	11	19	82
93	985	339	25,026	30	262	110	0	69	0
131	1907	662	43,388	12	22	0	97	59	51
132	2238	777	43,174	384	31	318	173	124	0
133	1570	545	43,308	17	28	0	0	38	60
134	144	50	13,951	101	42	10	10	0	0
135	1240	429	13,930	17	0	0	0	69	0
136	1109	385	27,504	61	24	0	0	154	0
137	662	230	26,111	17	27	202	62	81	34
138	112	39	27,527	5	147	56	172	166	0
139	2393	831	27,504	14	131	375	92	85	43
142	890	309	61,090	0	0	0	0	8	0
143	32	11	61,052	253	35	15	18	73	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
144	881	306	60,780	47	131	397	156	62	130
145	619	215	61,301	2	50	0	20	8	0
146	1860	646	61,092	12	14	0	0	15	0
155	1385	481	61,294	0	0	0	25	8	56
156	683	237	56,033	131	236	497	169	34	0
158	936	325	61,295	56	9	54	10	8	30
159	323	112	61,280	21	13	0	0	0	59

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
2	27,534	8958	31,783	1159	1987	1911	628	1745	2490
33	1122	0	0	0	0	0	0	0	485
34	1267	440	27,856	428	17	0	12	4	30
35	325	99	17,903	0	10	10	21	4	0
36	1956	679	17,901	8	35	11	5	10	0
37	1613	560	19,625	0	0	0	0	0	177
39	1460	507	27,854	15	10	10	3	50	50
41	668	232	27,168	15	0	0	0	4	0
42	306	2	25,484	0	0	0	3	700	0
43	1480	514	27,171	34	265	76	3	11	108
44	1663	567	27,853	34	31	4	22	80	148
45	2454	852	19,622	15	31	11	0	0	123
46	1950	677	18,266	26	75	297	4	92	0
140	328	114	39,749	0	0	337	4	5	49
141	1492	518	39,963	17	0	0	0	39	49

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
2 cont.									
147	328	114	39,958	17	3	0	0	0	161
148	636	221	39,965	21	28	0	10	64	0
149	1270	441	39,963	0	6	0	11	8	0
150	1783	619	39,724	24	0	0	0	0	0
151	0	0	0	90	337	15	76	78	0
152	221	47	39,972	82	314	525	138	282	0
153	314	109	39,959	0	0	0	0	0	0
154	614	211	39,968	0	64	15	12	54	1052
160	662	230	36,741	0	0	0	0	0	0
161	1388	482	37,155	111	391	190	118	154	0
166	276	43	35,934	85	215	218	25	62	61
198	1958	680	37,047	137	155	192	161	44	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
3	43,525	15,111	31,149	936	2847	1166	387	736	940
167	0	0	0	0	86	151	25	0	0
168	351	122	35,500	20	405	63	60	14	0
169	6823	2369	34,677	79	100	70	26	70	130
172	2791	969	26,713	9	14	43	5	5	75
173	1630	566	35,508	591	35	30	0	57	0
174	426	148	35,505	0	10	20	14	8	0
175	2033	704	20,026	64	130	75	34	268	0
176	1990	691	21,701	10	30	22	5	5	0
177	2105	731	33,105	21	101	10	25	38	0
178	1809	628	32,567	0	363	57	19	25	0
179	2773	963	32,940	0	75	357	4	45	60
180	1921	667	32,084	5	7	7	5	0	82
181	2030	705	28,611	21	27	10	25	0	180
186	2215	769	32,792	17	10	10	10	0	67

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
3 cont.									
187	804	279	31,929	29	5	0	0	16	0
189	4982	1730	32,485	26	21	24	23	16	0
190	1737	603	29,015	0	43	39	0	11	269
191	2506	870	32,694	14	77	24	39	16	77
192	4599	1597	32,826	30	24	43	7	16	0
197	0	0	0	0	1284	111	66	126	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
4	12,708	4412	31,870	108	53	33	10	44	56
121	1112	386	32,274	0	0	0	0	8	0
122	314	109	32,136	0	0	5	0	0	0
123	562	195	31,800	0	0	0	0	0	0
171	3427	1190	32,720	82	12	13	5	11	56
182	2028	704	32,176	21	26	5	0	8	0
183	1204	418	30,334	0	0	0	0	0	0
184	187	65	30,814	0	15	0	0	12	0
185	432	150	32,209	0	0	0	5	0	0
194	3442	1195	32,363	5	0	10	0	5	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
5	20,787	7199	32,200	780	1723	587	250	2094	505
116	1483	515	31,329	30	22	14	0	4	52
118	783	272	30,972	2	0	0	0	0	0
119	1351	469	30,976	27	18	14	2	5	0
120	590	205	31,300	18	19	0	0	0	0
124	412	143	30,906	221	10	14	0	0	0
125	2207	765	31,390	26	0	0	3	4	0
126	1765	613	31,359	18	206	156	10	41	0
127	2773	963	31,003	67	110	0	0	8	51
128	1388	482	36,312	17	449	70	100	33	0
129	75	8	36,204	0	6	50	10	1872	0
130	1339	465	30,949	61	22	14	0	8	0
157	1253	435	36,097	227	500	126	43	55	250
170	2333	810	31,455	30	126	72	5	17	0
188	1794	623	31,357	15	60	24	14	8	55

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
5 cont.									
195	1241	431	31,399	21	175	33	63	39	97

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6	18,507	6386	30,023	6381	576	321	279	275	734
38	720	250	29,662	24	172	122	92	41	0
85	225	78	33,612	111	10	0	0	21	0
86	213	74	33,921	44	8	0	15	15	0
87	294	102	30,881	20	29	0	0	0	0
94	965	335	29,395	1090	140	0	0	30	60
95	643	215	29,566	326	2	15	0	32	0
96	818	268	32,961	18	33	60	66	18	180
97	372	129	34,770	559	0	11	11	0	0
98	6	2	34,933	282	0	46	14	14	0
99	824	286	34,578	18	4	5	11	4	0
100	210	73	33,065	0	5	10	0	0	0
101	144	50	31,448	0	27	0	0	4	0
102	202	70	32,000	2	0	0	0	0	0
103	562	195	19,871	360	0	0	10	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6 cont.									
104	236	82	19,876	0	10	10	0	19	0
105	1264	439	28,835	18	0	0	0	15	0
106	1132	393	29,614	0	27	5	0	0	300
107	657	228	26,948	5	0	0	0	0	0
108	1872	650	29,834	0	5	0	5	3	70
109	947	314	29,804	100	49	19	20	18	75
110	1313	456	29,154	12	0	0	0	6	0
111	121	42	29,463	0	5	5	0	0	0
112	645	224	29,712	613	25	0	10	5	0
113	804	279	29,594	2727	0	0	0	4	0
114	1371	476	29,724	40	25	5	8	26	0
115	469	163	29,763	12	0	8	0	0	0
117	170	59	29,669	0	0	0	0	0	0
193	588	204	29,665	0	0	0	17	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6 cont.									
199	720	250	28,342	0	0	0	0	0	49

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
7	6615	2274	23,181	248	202	106	58	184	128
70	683	237	23,944	44	58	46	0	17	0
71	233	58	23,309	28	0	0	0	82	0
72	213	74	23,128	0	20	0	0	0	0
73	573	199	23,288	0	0	8	0	15	0
74	225	78	23,107	10	0	5	38	0	0
75	219	76	23,283	0	6	0	0	0	0
76	824	286	23,224	0	20	13	0	0	47
77	429	149	23,030	14	19	0	0	0	0
78	792	275	21,195	58	38	30	0	41	0
79	363	126	21,727	24	29	4	20	15	0
80	458	159	21,985	24	6	0	0	0	0
81	432	150	21,201	14	6	0	0	13	0
82	95	33	23,843	24	0	0	0	0	0
83	144	50	23,267	0	0	0	0	1	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
7 cont.									
84	60	21	23,253	2	0	0	0	0	0
237	236	82	26,000	3	0	0	0	0	36
238	636	221	25,292	3	0	0	0	0	45

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
8	2958	1027	23,505	116	46	12	17	21	73
64	92	32	23,747	2	0	0	0	0	0
65	63	22	23,764	68	0	0	0	0	0
66	455	158	22,947	8	0	2	0	0	0
67	1524	529	23,703	4	20	10	17	0	73
68	308	107	22,931	7	0	0	0	15	0
69	317	110	23,722	27	25	0	0	6	0
236	199	69	23,722	0	1	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
9	31,981	10,954	29,089	3627	1635	743	211	326	488
47	1598	555	23,166	81	161	56	66	152	0
48	2635	915	23,536	108	104	3	3	12	0
49	1089	378	32,657	53	0	11	0	5	0
50	153	53	32,514	37	578	35	4	0	0
51	1567	544	32,389	95	31	374	55	5	0
52	601	87	32,628	0	0	0	38	0	150
53	1155	401	31,854	14	0	0	4	14	0
54	927	322	32,103	11	0	0	0	5	0
56	556	193	20,859	151	7	80	0	5	0
57	3456	1200	23,508	11	147	42	0	8	0
58	4012	1393	32,642	15	0	0	0	5	0
59	1745	606	32,176	20	146	0	5	38	0
60	737	256	32,624	0	0	0	0	0	0
61	239	83	29,895	11	5	0	10	0	77

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
9 cont.									
62	328	114	31,667	23	0	0	0	0	105
63	1976	686	32,466	11	120	11	1	0	0
162	1910	634	27,257	21	0	0	0	8	0
163	1140	396	26,781	0	0	0	0	0	0
164	1112	386	25,726	0	8	20	0	0	0
165	2111	733	26,692	148	300	111	25	64	0
234	112	39	21,187	2800	0	0	0	0	0
235	662	230	32,480	6	0	0	0	0	75

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10a	15,330	5,321	22,844	162	323	503	229	3353	215
196	0	0	0	0	0	0	0	2685	NA
200	2316	804	18,606	68	159	220	189	193	60
201	1324	458	18,611	18	21	0	0	0	123
202	1382	480	24,239	18	21	0	0	0	0
203	392	136	16,229	0	0	0	0	0	32
204	1547	537	19,044	18	31	229	23	5	0
205	2068	718	18,665	18	25	15	0	0	0
206	985	342	24,002	0	5	24	5	5	0
207	755	262	24,525	0	21	0	0	5	0
208	196	68	24,224	0	21	0	0	0	0
209	52	18	25,556	0	0	0	0	0	0
210	478	166	25,537	0	1	0	0	17	0
211	1650	573	25,533	0	3	0	0	0	0
212	757	263	25,409	4	0	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10a cont.									
213	671	233	25,544	18	15	0	0	4	0
214	521	181	24,234	0	0	15	12	0	0
215	236	82	25,540	0	0	0	0	439	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10b	33,961	6649	18,617	0	0	0	0	43,143	0
216	3069	576	22,283	0	0	0	0	250	NA
217	960	0	0	0	0	0	0	1,284	NA
218	1044	188	13,456	0	0	0	0	2,411	NA
219	1106	384	15,455	0	0	0	0	1,236	NA
220	3344	1161	15,455	0	0	0	0	0	NA
221	510	177	15,455	0	0	0	0	4,459	NA
222	101	0	0	0	0	0	0	1,716	NA
223	671	0	0	0	0	0	0	118	NA
224	4694	1630	15,455	0	0	0	0	14	NA
225	1322	459	29,700	0	0	0	0	755	NA
226	1483	515	15,455	0	0	0	0	0	NA
227	6787	0	0	0	0	0	0	14,256	NA
228	1704	0	0	0	0	0	0	8,564	NA
229	2205	402	27,999	0	0	0	0	1,857	NA

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10b cont.									
230	0	0	0	0	0	0	0	331	NA
231	0	0	0	0	0	0	0	69	NA
232	1629	0	0	0	0	0	0	4,990	NA
233	3332	1157	15,455	0	0	0	0	833	NA
TOTAL	246,246	79,364	27,143	21,921	14,570	9227	6411	54,867	6609

APPENDIX B

2005 PROJECTIONS

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1	34,733	11,638	39,700	10,304	6728	4916	5877	5434	1352
1	13	0	0	25	440	121	938	296	0
2	143	6	24,400	97	210	36	612	222	0
3	46	16	24,000	48	50	4	131	39	0
4	72	25	24,000	125	240	0	0	66	0
5	3	1	23,300	33	563	133	3	286	135
6	147	51	24,000	945	37	0	0	69	0
7	84	29	43,400	312	71	11	312	135	0
8	3	1	21,800	24	131	87	225	369	0
9	232	75	23,100	194	516	0	401	419	0
10	40	14	21,000	101	10	14	0	0	0
11	897	427	23,700	266	210	28	315	244	0
12	273	130	46,600	474	129	116	587	151	0
13	267	86	46,600	0	0	0	0	0	0
14	825	277	36,000	40	0	255	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
15	475	165	16,000	35	216	651	4	206	0
16	265	92	23,700	164	704	86	277	75	0
17	334	116	24,200	63	0	14	0	119	0
18	1160	390	33,300	117	69	81	0	170	63
19	629	199	33,800	40	85	45	0	49	0
20	153	53	33,000	158	522	17	3	131	0
21	29	10	21,200	191	22	0	581	137	0
22	271	94	21,400	793	246	16	0	6	0
23	130	45	20,700	437	75	13	0	19	0
24	316	108	20,700	624	91	0	0	6	0
25	360	125	16,300	277	6	75	0	43	0
26	144	50	16,100	436	90	169	3	14	0
27	0	0	0	0	31	0	0	0	0
28	0	0	0	0	166	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
29	0	0	0	0	25	0	227	0	0
30	539	187	19,700	861	245	71	7	432	158
31	832	249	23,300	39	125	8	14	151	0
32	564	196	19,600	40	33	22	0	6	78
40	507	176	19,500	652	15	46	0	4	0
88	325	113	20,700	74	9	40	0	4	0
89	187	65	20,700	74	8	20	0	12	0
90	1252	429	38,500	796	27	53	0	21	0
91	583	201	38,500	43	34	16	13	16	145
92	1169	402	38,100	285	27	115	13	22	98
93	985	339	38,500	36	262	150	0	83	0
131	1907	662	66.700	14	32	8	117	87	61
132	2943	847	66,400	465	57	399	208	150	0
133	2065	595	66,600	20	31	8	0	176	121

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
134	144	50	21,400	124	45	20	12	0	0
135	1240	429	21,400	20	3	0	0	83	0
136	1109	385	42,300	73	24	0	0	192	0
137	662	230	40,100	20	27	253	75	98	41
138	112	39	42,300	5	147	67	209	206	0
139	2393	831	42,300	17	131	451	111	102	51
142	890	309	93,900	0	0	0	0	9	0
143	32	11	93,300	304	38	34	22	103	0
144	881	306	93,300	57	131	484	190	75	160
145	619	215	94,200	2	50	0	24	9	0
146	1860	646	93,300	15	14	0	0	18	0
155	1385	481	94,100	0	0	0	30	9	67
156	683	237	86,100	158	236	598	201	41	0
158	1231	350	94,100	66	9	81	12	54	37

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
1 cont.									
159	323	112	94,100	25	13	0	0	0	70

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
2	32,348	11,211	46,100	1291	2391	2436	807	2253	3027
33	1122	0	0	0	0	0	0	0	579
34	1267	440	40,400	465	20	0	14	17	36
35	325	99	26,000	0	12	12	25	5	0
36	1956	679	26,000	10	42	13	6	12	0
37	2122	613	28,500	0	0	0	0	0	211
39	1460	507	40,400	19	12	12	4	60	60
41	668	232	39,400	19	0	8	0	20	0
42	306	2	37,000	0	0	0	4	845	0
43	1947	1014	39,400	41	319	107	4	2	129
44	2187	867	40,400	41	37	4	26	97	177
45	3228	1152	28,400	19	37	13	0	0	147
46	2565	1177	26,500	27	90	381	21	123	50
140	328	114	57,600	0	0	406	5	6	59
141	1492	518	58,000	20	0	0	0	47	59

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
2 cont.									
147	328	114	58,000	20	3	0	0	0	192
148	636	221	58,000	25	34	0	12	77	0
149	1270	441	58,000	0	7	0	13	10	0
150	2345	669	57,600	29	0	0	0	0	0
151	0	0	0	108	406	18	91	94	0
152	221	47	58,000	99	378	632	167	340	0
153	413	159	58,000	0	0	0	0	0	0
154	614	211	58,000	0	77	18	14	65	1256
160	871	530	53,300	0	0	16	15	0	0
161	1826	632	53,900	112	470	239	147	186	0
166	276	43	52,100	92	259	294	45	108	72
198	2575	730	53,700	145	188	263	194	119	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
3	56,562	25,611	48,800	1126	4027	1651	601	1282	1348
167	480	200	45,000	0	224	214	87	112	0
168	533	222	51,500	24	529	100	112	67	0
169	8974	2869	50,300	95	120	116	41	196	155
172	3671	1569	38,700	11	137	75	27	72	90
173	1630	566	51,500	711	42	60	0	69	0
174	426	148	51,500	0	12	32	17	23	0
175	2674	1704	29,000	77	156	114	41	346	0
176	2618	1691	31,500	12	196	50	6	26	0
177	2105	731	48,000	25	121	12	30	46	0
178	1809	628	47,200	0	437	69	23	30	0
179	2773	963	47,800	0	90	430	5	54	72
180	2527	1667	46,500	6	9	8	6	0	98
181	2670	1205	41,500	25	32	12	38	0	215
186	2914	1769	47,600	20	12	12	12	0	80

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
3 cont.									
187	1058	1279	46,300	35	6	0	0	19	0
189	6553	3730	47,100	32	25	53	28	19	225
190	3687	1603	42,100	0	52	79	0	13	321
191	3296	920	47,400	17	253	29	47	19	92
192	6049	2097	47,600	36	28	51	8	19	0
197	115	50	39,000	0	1546	135	79	152	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
4	29,419	11,797	46,200	130	544	145	182	541	292
121	3326	1386	46,800	0	0	0	12	55	0
122	2025	844	46,600	0	0	6	0	7	0
123	4788	1995	46,100	0	0	0	23	15	0
171	4776	1990	47,500	99	14	56	56	163	67
182	2667	804	46,700	25	32	16	40	122	0
183	3163	1318	44,000	0	0	4	12	21	175
184	187	65	44,700	0	18	18	0	20	50
185	3960	1650	46,700	0	480	15	27	20	0
194	4527	1745	46,900	6	0	30	12	118	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
5	25,027	10,149	46,600	839	2106	835	345	2654	653
116	1951	715	45,400	36	26	17	0	5	62
118	1030	772	44,900	2	0	0	0	0	0
119	1777	969	44,900	33	54	17	2	16	0
120	776	305	43,900	22	23	0	0	0	0
124	542	243	44,800	222	12	17	0	0	0
125	2903	865	45,500	32	0	0	4	5	0
126	1765	613	45,500	22	248	188	12	49	0
127	2772	1013	45,000	71	132	8	0	10	61
128	1388	482	52,700	21	540	84	120	40	0
129	75	8	52,500	0	7	100	25	2300	50
130	1339	765	44,900	63	26	17	0	10	0
157	1648	485	52,400	233	603	192	73	132	299
170	3069	1310	45,600	37	152	86	6	21	0
188	2360	1123	45,500	19	72	29	17	10	65

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
5 cont.									
195	1632	481	45,500	26	211	80	86	56	116

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6	25,476	16,236	43,500	8880	1173	539	404	529	1002
38	1347	850	43,000	29	207	163	110	49	0
85	225	78	48,700	134	12	0	0	25	0
86	680	324	49,200	653	10	8	18	18	0
87	886	352	44,800	24	35	0	0	0	0
94	1269	835	42,600	1312	168	8	6	64	72
95	1045	1015	42,900	392	122	26	15	66	0
96	818	268	47,800	22	40	80	94	50	215
97	490	329	50,400	973	0	29	23	28	0
98	5	2	50,700	339	0	55	17	17	0
99	1084	786	50,100	22	5	30	13	5	0
100	776	573	48,000	0	6	12	0	0	0
101	144	50	45,600	0	32	0	0	5	0
102	570	570	46,400	302	0	0	0	0	0
103	1040	945	28,800	433	0	0	12	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6 cont.									
104	236	82	28,800	0	12	12	0	23	0
105	1363	689	41,800	22	0	0	0	18	0
106	1489	1393	42,900	0	72	6	0	0	358
107	657	228	39,100	6	0	0	0	0	0
108	1572	650	43,300	0	5	8	23	19	84
109	1246	814	43,200	120	139	47	24	35	90
110	1727	956	42,300	14	0	0	0	6	50
111	760	542	42,700	0	86	14	7	4	0
112	849	724	43,100	738	110	8	12	13	75
113	1058	529	43,000	3283	0	8	0	5	0
114	1803	1376	43,100	48	111	14	10	79	0
115	397	163	43,200	14	0	11	0	0	0
117	170	59	43,000	0	0	0	0	0	0
193	773	304	43,000	0	0	0	20	0	9

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
6 cont.									
199	947	750	41,100	0	0	0	0	0	49

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
7	8701	4774	33,600	1978	779	388	91	278	203
70	698	437	34,700	53	70	56	0	21	0
71	206	108	33,800	34	0	0	0	99	0
72	280	124	33,500	0	24	0	0	0	0
73	1330	899	33,800	0	0	10	0	18	0
74	196	78	33,500	12	0	6	55	10	0
75	188	76	33,800	0	7	0	0	0	0
76	893	386	33,700	1180	424	98	0	6	56
77	429	149	33,400	17	39	24	0	0	0
78	1041	575	30,700	70	46	44	0	59	0
79	377	126	31,500	29	35	4	25	18	0
80	702	459	31,900	29	47	24	5	15	50
81	868	650	30,700	17	87	32	6	31	0
82	325	233	34,600	29	0	0	0	0	0
83	189	103	33,700	500	0	58	0	1	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
7 cont.									
84	42	21	33,700	2	0	32	0	0	0
237	310	132	37,700	3	0	0	0	0	43
238	537	221	36,700	3	0	0	0	0	54

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
8	3891	2127	34,100	1640	215	190	30	103	137
64	78	32	34,400	2	0	16	0	0	0
65	54	22	34,500	582	0	0	0	50	0
66	386	158	33,300	510	0	2	0	0	0
67	2005	829	34,400	4	104	52	25	14	87
68	405	307	33,300	9	0	0	0	18	0
69	701	610	34,400	533	110	120	5	21	50
236	262	169	34,400	0	1	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
9	41,955	17,704	42,200	4560	2088	1098	356	639	808
47	2101	955	33,600	97	194	67	101	200	0
48	3466	1415	34,100	130	125	83	3	14	0
49	1932	1378	47,400	64	0	13	0	6	0
50	801	353	47,200	45	696	42	5	0	0
51	2061	794	47,000	114	37	382	86	21	50
52	791	387	47,300	0	80	40	61	15	179
53	1519	501	46,200	17	0	16	15	45	0
54	1219	622	46,600	13	0	40	0	6	0
55	2841	1580	46,800	13	33	0	0	6	97
56	731	193	30,300	183	9	96	0	16	0
57	4546	1400	34,100	13	177	50	0	10	0
58	4077	1493	47,300	18	0	0	0	6	0
59	2295	1106	46,700	24	176	40	6	46	175
60	970	506	47,300	0	0	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
9 cont.									
61	314	183	43,400	13	46	0	23	28	92
62	1431	914	46,000	27	0	8	0	46	125
63	2593	1186	47,100	13	144	13	1	0	0
162	2012	734	39,500	25	0	16	10	38	0
163	1499	396	38,900	0	0	0	0	0	0
164	1463	386	37,300	0	9	25	0	33	0
165	2276	933	38,700	178	362	167	45	103	0
234	147	39	30,700	3566	0	0	0	0	0
235	870	330	47,100	7	0	0	0	0	90

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10a	20,312	10,321	33,100	195	451	788	327	4194	357
196	0	0	0	0	0	0	0	3240	0
200	1646	804	27,000	80	193	289	236	261	72
201	2742	1258	27,000	22	25	32	8	25	147
202	1818	680	35,200	22	25	0	10	25	0
203	392	136	23,500	0	0	32	10	26	38
204	1809	737	27,600	22	37	283	28	34	0
205	2220	918	27,100	22	30	42	0	0	50
206	985	342	34,800	0	6	37	6	6	0
207	766	262	35,600	0	25	0	0	6	0
208	357	168	35,100	0	25	0	0	0	0
209	552	268	37,000	0	0	0	0	0	0
210	1267	966	37,000	0	1	0	0	21	0
211	2170	1373	37,000	0	66	32	10	15	50
212	1495	763	36,800	5	0	0	0	0	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10a cont.									
213	1183	1133	37,000	22	18	23	5	5	0
214	685	431	35,000	0	0	18	14	0	0
215	236	82	37,000	0	0	0	0	530	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10b	33,961	6649	27,600	0	0	0	0	44,474	0
216	3069	576	38,300	0	0	0	0	258	0
217	960	0	0	0	0	0	0	1324	0
218	1044	188	19,500	0	0	0	0	2485	0
219	1106	384	22,400	0	0	0	0	1274	0
220	3344	1161	22,400	0	0	0	0	0	0
221	510	177	22,400	0	0	0	0	4597	0
222	101	0	0	0	0	0	0	1769	0
223	671	0	0	0	0	0	0	122	0
224	4694	1630	22,400	0	0	0	0	14	0
225	1322	459	43,000	0	0	0	0	778	0
226	1483	515	22,400	0	0	0	0	0	0
227	6787	0	0	0	0	0	0	14,696	0
228	1704	0	0	0	0	0	0	8828	0
229	2204	402	40,400	0	0	0	0	1914	0

DISTRICT AND O. D. ZONE	POPULATION BY PLANNING DISTRICT AND O. D. ZONE	DWELLING UNITS BY PLANNING DISTRICT AND O. D. ZONE	INCOME BY HOUSEHOLD	EMPLOYMENT BY GROUPS BY ZONE					
				1	2	3	4	5	School
10b cont.									
230	0	0	0	0	0	0	0	341	0
231	0	0	0	0	0	0	0	71	0
232	1629	0	0	0	0	0	0	5144	0
233	3332	1157	22,400	0	0	0	0	859	0
TOTAL	312,385	128,217	39,800	30,843	20,502	12,986	9020	62,381	9179

LIST OF REFERENCES

C.H.N.M.B. Fayetteville Conceptual Plan. San Francisco, 1978.

Cumberland County Joint Planning Board. Land Use Policies Plan. Fayetteville, North Carolina, 1978.

Cumberland County Joint Planning Board. Commercial Areas Plan. Fayetteville, North Carolina, 1974.

Cumberland County Joint Planning Board. Industrial Areas Plan. Fayetteville, North Carolina, 1978.

Cumberland County Joint Planning Board. Report on the Economy, Environment, and Government of Cumberland County, North Carolina. Fayetteville, North Carolina, 1975.

Cumberland County Joint Planning Board. Fayetteville Urban Area Annual Report. Fayetteville, North Carolina, 1977.

Division of Highways of the North Carolina Department of Transportation. Report on the Capacity-Deficiency Analysis and Development and Analysis of Alternatives. Fayetteville Urban Area Transportation Study, Technical Report No. 4, 1977.

Division of Highways of the North Carolina Department of Transportation. Report on the Origin-Destination Study and Development of Travel Forecast Models. Fayetteville Urban Area Transportation Study, Technical Report No. 2, 1975.

Employment Security Commission of North Carolina. North Carolina Labor Force Estimates. September, 1978.

Hammer, Siler, George Associates. Adjustment Factors for Converting Current Dollar to Constant Dollar Values Based on Consumer Price Index. Washington, DC, 1978.

Hammer, Siler, George Associates. Downtown Fayetteville 1975/2000. Washington, DC, 1975.

Isserman, Andrew M., "The Accuracy of Population Projections for Subcounty Areas," Journal of the American Institute of Planners, Vol. 43, No. 3 (July, 1977), 247-259.

North Carolina Department of Transportation, Thoroughfare Planning and Research Branch. "Thoroughfare Planning Principles," Raleigh, 1980. (mimeographed)

Pegram, J., "Origin-Destination Surveys." Seminar given at Transportation Planning and Plan Reevaluation, Raleigh, North Carolina, January 22, 1980.

United States Department of Commerce, Bureau of the Census. Guide for Local Area Population Projections. Technical Paper 39 (July, 1977).

United States Department of Transportation, Federal Highway Administration. A Report on Forecasting and Estimating Methods (June, 1964).