AN ANALYSIS OF THE DETERMINANTS OF THE COMMUTING AND RESIDENCE PATTERNS OF THE OKLAHOMA CITY AIR MATERIEL AREA LABOR FORCE

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Submitted to the Faculty of the Graduate College
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in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
May, 1970

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PREFACE

The purpose of this dissertation is to analyze the various determinants of the commuting and residence patterns of the Oklahoma City Air Materiel Area labor force. The study attempts to determine those economic, social, geographical, and worker characteristics that were most significantly related to these patterns as they existed in 1967 and those factors which were most important in restructuring these patterns between 1960 and 1967.

The objective of the analysis is to provide a better knowledge of the factors which influence the drawing power of a large employer from its labor market area. The Oklahoma City Air Materiel Area offered a unique opportunity for a study of this nature. The OCAMA was the largest single employer in Oklahoma when the study was performed in 1967. In addition, the management of OCAMA was very interested in measuring the impact of OCAMA on the Oklahoma economy and were very helpful in providing assistance and support in the surveying of the OCAMA workers and in the gathering of data from their personnel records. Also, detailed information on the commuting behavior and residential distribution of the OCAMA work force existed for 1960. This enabled the analysis of commuting and residence patterns over time. Studies of this type are virtually nonexistent in the literature.

I would like to express my gratitude for the complete cooperation extended by the Oklahoma City Air Materiel Area in making this project

possible. A very special expression of thanks must go to Mr. Kenneth E. Lowe, Chief, Personnel Management Branch, the OCAMA coordinator for the project, and Mr. John Parish who directed the computer programming to compile the data used in the analyses.

I would like to take this opportunity to express my appreciation for guidance given by the following members of my committee: Dr. Larkin B. Warner and Dr. Joseph J. Klos, who encouraged me to undertake the study and who made many suggestions and contributions during the course of writing the dissertation; Dr. Richard W. Poole, who gave invaluable advice based on his experiences in performing a study of the OCAMA work force in 1960; Dr. Robert Morrison, for his interest and assistance.

Finally, I would like to express appreciation to my wife, Sandra, who provided the encouragement and made the necessary sacrifices to make the degree possible.

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CHAPTER I

INTRODUCTION

The objective of this study is to analyze as thoroughly as possible the various economic, social, and geographical factors and worker attributes that determine the commuting and residence patterns of the work force of a large employer. The study will attempt to determine those factors that are most significant in shaping the structure of these patterns as they exist at some given time and those which are most important in restructuring these patterns over time. This analysis, hopefully, will lead to a better knowledge of the forces that determine the drawing power of an employer from its geographical labor market area.

The problem of the daily journey-to-work has been the subject for study by many researchers and for numerous purposes during the past three or four decades. This diverse interest in commuting and sources of labor is noted by James H. Thompson:

> Among those who have conducted investigations in this field have been labor economists studying the broader problem of labor mobility, sociologists and city planners investigating population, housing, or transportation problems, government officials and others interested in the economic development of particular areas.[1]

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[1]James H. Thompson, Labor Market Areas for Manufacturing Plants in West Virginia (Morgantown: Bureau of Business Research, West Virginia University, December, 1955), p. 1.

The value of a knowledge of commuting patterns and the determinants of these patterns is evident from the uses that have been made of commuting data. According to one geographer, commuting distance "...can be used as a basis for delimiting labor market areas or 'laborsheds'."[2] Related to its function in delineating the spatial extent of a labor market area, Lonsdale points out the role of journey-to-work patterns as providing "...the basis for delimiting networks of overlapping regions across the whole expanse of a territory."[3] Further, one author has asserted that the boundaries of economic regions should no longer be aligned with inappropriate political areas; for example, the county.[4] Rather, Fox has proposed that these regional boundaries be redefined on the basis of the labor market of the area. The labor market area utilized by Fox would be the geographical region encompassed by a one-hour travel time "radii" from center to periphery.[5] "Almost all the labor resident in the area /the labor market/ is sold within it, and almost all the goods consumed in the area are bought within it."[6] This geographical unit, designated by Fox as a "Functional Economic Area," would replace the current Standard Metropolitan Statistical Area and the State Economic Area as the basic units for

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[2]Richard E. Lonsdale, "Two North Carolina Commuting Patterns," Economic Geography, Vol. 42, 1966, p. 114.

[3]Ibid., p. 115.

[4]Karl A. Fox and T. Krishna Kumar, "The Functional Economic Area: Delineation and Implications for Economic Analysis and Policy," Papers and Proceedings of the Regional Science Association, Vol. 15, 1965, pp. 57-85.

[5]Ibid., pp. 58-59.

[6]Ibid.

statistical data collection and regional analysis. Quite obviously, then, an examination of data on commuting, especially travel time, would be essential to this schema in delimiting the labor market area and the consequent geographical-economic unit.[7]

An understanding of the relationship between commuting and local labor supply is essential to any attempt to measure the actual and potential labor supply of an area or region. Knowledge of this relationship is especially important in decisions concerning the expansion of the level of operation of existing firms and the location of new industries. Leonard P. Adams and Thomas W. Mackesey conclude that

> there is so much variation in distances workers will travel and in the numbers who can be recruited from outlying areas that current spot-checks are needed to determine the outer limits of a local labor market.[8]

For example, the adequacy of the local labor supply for required expansion in operation is of strategic importance in locating defense installations such as the Oklahoma City Air Materiel Area (OCAMA), whose labor force is the subject of this study, and in allocating and adjusting the prime responsibilities of these installations. The concern for an adequate labor supply was the determining factor in the selection of the location of OCAMA over alternative locations in

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[7]For a discussion of the Standard Metropolitan Statistical Area and proposed alternative area classification schemes see: Brian J. L. Berry, Peter G. Goheen and Harold Goldstein, Metropolitan Area Definition: A Re-Evaluation of Concept and Statistical Practice (Revised). United States Bureau of the Census Working Paper No. 28 (Washington: United States Government Printing Office, 1969).

[8]Leonard P. Adams and Thomas W. Mackesey, Commuting Patterns of Industrial Workers (Ithaca: Cornell University Housing Research Center, 1955), p. 85.

the Midwest.[9] The existence and extent of a "laborshed" was the concern of the numerous housing and transportation studies undertaken during World War II.

Other authors have expressed the importance of the examination of commuting patterns to regional analysis. Richard W. Poole has stressed the study of labor characteristics and commuting as a data item necessary to the generation of information on income, population, and employment needed to facilitate regional studies.[10] Poole acknowledges the importance of commuting patterns for regional personal income accounts and the implications of commuting for urban economic base studies.[11] The presence of intercounty commuting necessitates the distinction in personal income estimates between the place of wage and salary disbursement and the place of residence of the recipient. The importance of this distinction is made clear in a study by the Bureau of Business Research at the University of Kentucky on intercounty commuting in Kentucky.[12] The report states

> Available sources of data on personal income from wages and salaries, to a large extent, credit the income to the county in which it is earned. Since many workers reside in a county other than the county in which they work, commuting estimates make possible the allocation of income to the county of residence of the worker.[13]

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[9] Twenty-Five Years at Tinker Air Force Base (Oklahoma City: U.S. Air Force, 27 February 1967), p. 1.

[10] Richard W. Poole, "Implications of Labor Characteristics and Commuting Patterns for Regional Analysis: A Case Study," Land Economics, Vol. XL, No. 1, February, 1964, p. 111.

[11] Ibid.

[12] Charles B. Garrison, Intercounty Commuting in Kentucky (Lexington: Bureau of Business Research, University of Kentucky, May, 1961).

Similarly, in urban base analysis, failure to account for the magnitude and direction of commuting would lead to an inaccurate base employment figure.[14]

Further, commuting is a subject worthy of analysis because of its role as a determinant of labor mobility. As one pair of researchers note, the changes that have occurred in worker commuting patterns mean that "there is a new type of labor mobility. The employer now has access to laborers in distant areas through the medium of commuting--a kind of mobility that formerly was relatively unknown."[15] Similarly, Adams and Mackesey indicate the significance of commuting for labor mobility. They state that "the journey to work, like migration, is a type of labor mobility."[16] In fact, since commuting increases the number of job opportunities available to an individual, given his place of residence, it has become a partial substitute for migration.[17]

Analysts have given other reasons than those mentioned above for the importance of the study of commuting patterns. One group of researchers at the Transportation Center at Northwestern University who studied the journey-to-work to employment centers at the periphery of the city, noted that "the nature of the peripheral journey-to-work has

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[14]Poole, p. 115. For a methodological discussion of the situs problem in estimating county income payments see: Lewis C. Copeland, Methods for Estimating Income Payments in Counties (Charlottesville, Virginia: Bureau of Population and Economic Research, University of Virginia, 1952), pp. 14-16.

[15]James W. Martin and John L. Johnson, "Labor Market Boundaries--Intercounty Commuting to Employment," Current Economic Comment, Vol. XVII, No. 2, May, 1955, p. 31.

[16]Adams and Mackesey, p. 83.

[17]Ibid.

significant implications for the extent of future metropolitan transportation problems."[18] The study of the peripheral journey-to-work and the concomitant emerging character of peripheral laborsheds they conclude, "should, therefore, give some insight into the process now changing the spatial organizational structure of American cities."[19] Likewise, Carrison points out that

> Commuting data may also be useful to municipalities and state authorities in planning new public facilities and improving existing facilities; ...In addition, information concerning the distribution of users of public facilities may be helpful to local governmental units in designing revenue programs.[20]

The importance of an analysis of labor force commuting characteristics is apparent from the significance given to an understanding of commuting patterns and the uses made of travel-to-work data referred to above. While all of these are important reasons for studying commuting behavior they are cited not as the objectives of this study but rather as the justification for a thorough investigation of the determinants of commuting behavior.

Purpose of the Study

The purpose of this study is to relate through a system of hypotheses information on characteristics of the Oklahoma City Air Materiel Area labor force, OCAMA, and the central Oklahoma area to the commuting patterns of the OCAMA work force. The objective of the

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[18]Edward J. Taaffe, Barry J. Garner, and Maurice H. Yeates, The Peripheral Journey to Work (Chicago: Northwestern University Press, 1963), p. 3.

[19]Ibid.

[20]Carrison, p. 1.

analysis is to discover the factors which are most important in determining the present OCAMA commuting patterns and those factors which have been significant in changing these patterns over time.

Choice of OCAMA for Study

In July, 1967 when the study was performed, Tinker Air Force Base, headquarters of OCAMA, had just completed its twenty-fifth year of operation. The present location of Tinker, southeast of Oklahoma City, was selected by the War Department in 1941 to provide a centrally located maintenance and supply depot. From this beginning, OCAMA has become the largest and most important facility in the logistical operation of the Air Force. The OCAMA employs more than 20,000 civilians in performing its basic mission of supply, maintenance, and modification of aircraft, engines and accessories.

The choice of OCAMA as the subject for an analysis of commuting and its causal factors stems primarily from four considerations: 1) the opportunity to conduct a detailed study of the largest single employer in Oklahoma, 2) the willingness of OCAMA personnel to assist in the study and to provide information from their personnel records, 3) the possibility of a high level of response on the part of the employees to a questionnaire, and 4) the existence of very detailed data on characteristics and commuting patterns of the OCAMA labor force for an earlier date which could serve as bench mark data for an analysis of commuting patterns over time.

The total civilian employment of OCAMA was 23,885 at the time this study was initiated. This work force was the largest for any single employer in the state of Oklahoma. It was found from the study that in

1967 OCAMA drew its employees from 29 of Oklahoma's 77 counties and from more than 160 cities in Oklahoma. Thus, OCAMA has a very widespread economic impact on Oklahoma. A knowledge of the size and geographical extent of this impact was an important by-product of this study. The absolute size of OCAMA and its size relative to the employment in surrounding areas and the state made OCAMA a uniquely interesting subject for this type of study.

Another important consideration in selecting OCAMA's work force for an analysis of commuting was the availability of highly reliable data maintained by OCAMA on each civilian employee. These records provided information on education, wages and salary, and other personal characteristics which are important to a detailed analysis of commuting.

In addition, the complete cooperation on the part of the OCAMA administrative personnel made it possible to distribute a detailed questionnaire to the employees and secure a very high rate of reliable response. Of the total work force of 23,885, 2,000 employees were not included in the survey for various reasons which will be explained in a later chapter. Of the 21,885 employees surveyed, 21,436 returned questionnaires. Thus, the rate of response to the questionnaire was 97.95 per cent. After the questionnaires were checked it was found that 20,786 of these 21,436 questionnaires were reliable and complete enough to be included in the analysis. Therefore, the effective rate of return (useable questionnaires as a per cent of total surveyed) was 94.98 per cent. This rate of response to a questionnaire, given the large number surveyed, is very unusual and makes this study rather unique when compared to the level of coverage of a single firm labor

force in other commuting studies.[21]

A very significant factor which influenced the selection of OCAMA for a commuting study was the availability of bench mark data on characteristics and commuting of its employees for an earlier year. The source of this data was a descriptive report based on a survey of the OCAMA work force performed by Richard W. Poole in 1960.[22] The methodology and findings of this study will be summarized in subsequent chapters.

Plan of Presentation

The study consists of six chapters. Chapter II provides a review of the literature on journey-to-work commuting and outlines some of the hypotheses suggested by the literature. This will place the empirical study of the commuting patterns of OCAMA's labor force in proper perspective to previous commuting studies. Chapter III discusses the sources of data and outlines the methodology used in analyzing the data.

In Chapter IV the residence and commuting patterns of the OCAMA work force in 1967 are presented. A major portion of this chapter is devoted to analyzing factors affecting the commuting patterns. These

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[21]In a similar survey performed at OCAMA in 1960, Richard W. Poole also received a high rate of response. Poole does not report the rate of response to his questionnaire; however, he reports that 18,529 questionnaires were completed. OCAMA personnel records show that in January of 1960, OCAMA's total labor force was 19,420. Thus, Poole's rate of response would have been approximately ninety-five per cent.

[22]Richard W. Poole, Characteristics and Commuting Patterns of the Oklahoma City Air Materiel Area Labor Force (Oklahoma City: U.S. Air Force, 8 October 1962).

factors are analyzed in three categories--characteristics of the central Oklahoma area, characteristics of OCAMA, and personal attributes of the OCAMA employees.

The purpose of Chapter V is to present the changes that have occurred in OCAMA's labor force commuting behavior since 1960 and to investigate factors responsible for these changes. The method of analysis is similar to that followed in Chapter IV. First, there is a comparison of the two commuting patterns, and second an analysis is made of selected factors associated with the geographical area around OCAMA, OCAMA characteristics, and personal characteristics of the employees. The factors analyzed in Chapter V for their possible role in changing commuting patterns were selected on the basis of the analysis in Chapter IV which reveals those factors most significantly related to the home-to-work commuting patterns of OCAMA workers.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review a portion of the body of literature on commuting to work. In addition, the last section of the chapter will set forth hypotheses which have been suggested by the literature and which will be tested in this study.

One would be embarking on an extremely arduous and seemingly endless endeavor in any attempt to review the innumerable studies which have dealt with some facet of the journey-to-work. Not only would such an undertaking be oppressive it would be of little benefit since the branches of this vast body of literature are only related as are the extremes of a continuum. The review that follows is rather modest in its coverage. Only a few of the more important studies which have been concerned with analyzing factors which are associated with journey-to-work behavior will be discussed.

A review of the numerous empirical studies of commuting reveals a large number of differing approaches and conclusions. This diversity results from, among other things, the different objectives underlying the studies, the differences in emphasis of the researchers on the various factors that influence commuting patterns, and the availability and quality of data as well as the methods used to generate additional data for analysis. The review of the literature presented here will deal with the findings of these studies and the various

objectives and methodologies of the researchers.

World War II Commuting Studies

The advent of the Second World War created much interest in the problems of the daily journey-to-work. As James Thompson notes in his survey of previous commuting studies,

> A number of extensive surveys of commuting patterns were made during the early part of World War II. The best known of these surveys was conducted by the Institute of Traffic Engineers and covered 48 war plants. Theodore M. Matson, former Director of the Yale University Bureau for Street Traffic Research, analyzed the results in a publication entitled War Worker Transportation. Other commuting-distance surveys were conducted during the war period in Indiana, Massachusetts, Michigan, New Jersey, New York, and Ohio. In almost all cases, the purpose of these wartime surveys was to obtain information on transportation and housing needs. Most of the surveys covered large numbers of workers, but the information obtained from each respondent was usually limited to place of residence and method of commuting.[1]

One of the earliest and most comprehensive (in terms of the number of workers surveyed) of these wartime studies was the state-wide survey of 233 manufacturing establishments by the Massachusetts State Planning Board. This study was performed in 1942 and its results, with respect to information on commuting, were reported in an article by J. Douglas Carroll, Jr.[2] This study utilized a questionnaire which was completed by more than 160,000 factory workers. The following data items were utilized in the analysis: (1) nature of product, (2) location of plant, (3) total number of employees, (4) place of residence of each employee responding, (5) distance to work one-way, (6) method of

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[1]Thompson, pp. 1-2.

[2]J. Douglas Carroll, Jr., "Some Aspects of Home-Work Relationships of Industrial Workers," Land Economics, Vol. XXIV, 1949, pp. 414-422.

transportation, and (7) would the respondent move closer to work?[3] Carroll's main concern was the effect of plant differences and community differences on employee residence and travel patterns.[4]

Of course, the wartime need for immediate information on housing and transportation facilities was the overriding purpose of these studies. There was little interest in the dynamics of commuting patterns or in analyzing many of the factors which influence commuting behavior.

Studies of Determinants of Commuting Behavior

A number of studies have dealt with the relationship of various factors to commuting behavior. However, not all of these analyses have been concerned just with journey-to-work commuting. Each of the studies discussed below has dealt specifically with determining the influence of selected factors on home-work separation.

Few studies of the factors influencing commuting have investigated only a single or small number of variables, most have analyzed a set of variables. Those factors studied can be rather broadly grouped into three classes: 1) characteristics of the geographical labor area, for example, the size and distribution of population, transportation and housing supply, income or wage differentials, and the number and distribution of employment opportunities; 2) employer characteristics, such as hiring policies, growth rate or size, wage levels, seniority system, stability of employment, and location; and 3) attributes of the

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[3]Ibid., p. 414.

[4]Ibid.

workers, for example, age, sex, skill, income, educational attainment, and many others.

In a study by James W. Martin and John L. Johnson the effect of a number of such factors on the extent of intercounty commuting in Kentucky was investigated.[5] The study was based on a sample of nearly 100,000 industrial employees with the information being compiled from employer payroll records. The data were generated from a series of studies by the University of Kentucky dealing with the distribution of income payments by county. Martin and Johnson found that the volume of intercounty commuting was greater in areas with rapid, large-scale growth in employment opportunities and better road facilities. Also, the proportion of workers who commuted between counties was greater for heavy construction and manufacturing, in seasonal employment, and the larger the work force. The skill and sex of the worker were the only labor characteristics studied, and only skill of worker was found to be related to the volume of intercounty commuting. Martin and Johnson observed that intercounty commuting was more prevalent among unskilled workers than among those with higher skill levels.[6] Because the study excluded consideration of commuting to employment other than that which was intercounty, any conclusions about the determinants of commuting behavior are very limited in nature.

The methodological approach employed by James H. Thompson in his study of labor market areas for manufacturing in West Virginia was much

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[5]Martin and Johnson, pp. 29-37.

[6]Ibid.

the same as many of the earlier empirical studies.[7] His questionnaire survey of 23 manufacturing establishments included "high-wage and low-wage industries; large and small establishments; old and new plants; some firms with predominately male employees and others hiring chiefly female labor."[8] The study included 4,253 workers, or about 41 per cent of the total employment of the 23 firms.[9] The chief objective of Thompson's study was "to determine the geographical extent of the labor market areas and the nature and extent of commuting in several representative West Virginia communities."[10] His study is unique in that in determining the sources of labor supply he uses two measures of the labor market area. These are "the original sources of labor supply (based upon the residential locations of workers when hired) and the present commuting area (based on their places of residence at the time of the study)."[11] By this method, changes in residences are reflected in the resulting commuting patterns. Thus, while his study does not reveal the dynamic nature of commuting patterns, information on residence when hired does provide an indication of the attitude of workers toward seeking employment at other locations than their place of residence and their propensity to gravitate residentially toward their place of employment.

Thompson's study included an analysis of probably the greatest

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[7]Thompson

[8]Ibid., p. 2.

[9]Ibid.

[10]Ibid., p. 1.

[11]Ibid., p. 4.

number of factors which affect commuting patterns of the early commuting studies. He investigated more than twenty area, plant or industry, and personal factors. Thompson found that wider commuting patterns resulted from a lack of alternate employment opportunities and from low population density.[12] He concluded that higher wage, more rapidly expanding plants or industries had a greater proportion of long-distance commuters.[13] In addition, he found that a great number of the firms studied had hiring policies that resulted in more constricted commuting patterns than for firms which had no policies.[14] Thompson found that a number of worker attributes affect commuting patterns. The median commuting distance and the proportion of long-distance commuters were greater for males, married workers, hourly or factory workers, employees with fewer years of employment, workers engaged in part-time farming, and for those who lived long distances from their present employment when they were hired.[15]

In contrast to the methodological approach utilized in the studies mentioned above, is that employed by Herbert Parnes in his study of the local labor market of manufacturing establishments in Columbus, Ohio.[16] The Parnes study was one of a series of studies in methods of estimating local area manpower resources and requirements. With this objective,

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[12]Ibid., pp. 19-20.

[13]Ibid., pp. 22-23.

[14]Ibid.

[15]Ibid., pp. 24-27.

[16]Herbert S. Parnes, A Study in the Dynamics of Local Labor Force Expansion (Columbus: Research Foundation, Ohio State University, 1951).

he investigated the nature and sources of the World War II expansion in manufacturing labor supply in the Columbus, Ohio Industrial Area and compared that expansion with pre- and postwar years of rising employment.

Parnes notes that " 'expansion' may result from more intensive utilization of the manpower resources of a surrounding territory, or from an extension of the territory from which individuals are drawn."[17] A study of labor force participation rates, migration, and changes in labor market area can explain how the change has occurred in the quantity of manpower available to an area. This explains why he studied "new hires." His study was based on approximately a 20 per cent sample of the personnel records of newly hired persons at twenty-two large manufacturing firms in Franklin County, Ohio during the period 1940-1950.[18] However, as noted by Adams and Mackesey, the restriction of Parnes' study to only recently hired workers limits the conclusions that can be made from the analysis about employee commuting patterns.[19]

Parnes found that the following factors were associated with the commuting distances of the newly hired employees: the wage rate--the higher the wage received, generally, the greater the distance commuted; the skill level--the more skilled workers drove farther (as would be expected from the above finding on wage rate); length of service--the new hires generally lived closer to their place of employment; and age--commuting distance increased as age increased up to thirty to thirty-

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[17]Ibid., p. 3.

[18]Ibid., p. 7.

[19]Adams and Mackesey, p. 13.

four years and then declined.[20]

The Leonard Adams and Thomas Mackesey study of commuting patterns in several upstate New York industrial areas performed in 1951 is one of the most comprehensive studies to date of the journey-to-work problem. The primary objective of this study, as stated by the authors, was "to examine commuting patterns of industrial production workers from the standpoint of the significance of these patterns in determining labor supply, especially labor for defense plants..."[21] To this end, the authors provide a thorough summary of World War II and early postwar studies of commuting. Their method of study involved integrating data from previous studies, employer personnel records, and a questionnaire survey of long-distance commuters, to analyze the commuting patterns of industrial workers in three contrasting New York areas. The availability of data from studies performed in these communities during World War II allowed a comparison of commuting patterns over time. However, the conclusions possible from this analysis were limited mainly to distance traveled and mode of transportation.

The findings of Adams and Mackesey, in general, support those of the studies noted above. With respect to characteristics of the industrial workers which are associated with commuting distance Adams and Mackesey found that long-distance commuters, those traveling twenty miles or farther one-way, differed from the labor force as a whole in that most were married, home owners, and had fewer years of employment.[22]

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[20]Parnes, pp. 161-177.

[21]Adams and Mackesey, p. 5.

[22]Ibid., pp. 59-61.

In addition, on the average, they had lived in their place of residence longer than they had been employed and a large percentage indicated that they were unwilling to change residence to shorten their home-work trip.[23]

Richard E. Lonsdale has stressed the importance of two geographic variables--population and distance--in determining the commuting patterns of a firm's work force. Lonsdale studied the labor force commuting patterns of two relatively small employers in North Carolina.[24] To determine the degree of influence of population and distance on the firms' commuting patterns Lonsdale utilized probability models based on gravity or interaction concepts. Lonsdale formulated a series of models, each with different assumptions about the effect of distance and population on the number of workers who commute from a particular area to the plants studied. Each model was then used to simulate the geographical distribution of workers by distance and time zones. He concludes that the geographical distribution of workers can be approximated by gravity models which express the number of commuters as varying directly with population size and inversely with distance.[25]

To explain the treatment of distance and population in the simulation models, i.e., the coefficients on population and distance, Lonsdale relates the geographical distribution of the workers to other variables. He concludes that the number of commuters from an area will exceed the number predicted by the geographic simulation models if the area is

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[23]Ibid., pp. 61-64.

[24]Lonsdale —

[25]Ibid., pp. 130-136.

characterized by low per capita income, a stagnant or declining population, and a high percentage of the labor force in agriculture.[26]

Urban Travel Studies

More recent theoretical and empirical studies of the journey-to-work and residential location have been in the context of the broader problem of urban travel. In a recent article, John F. Kain provides an excellent review of the findings of the more significant of these studies since World War II.[27] Kain notes that there have been more than two-hundred large-scale postwar home-interview origin and destination studies performed under the auspices of the Bureau of Public Roads. In addition, there have been a great number of rapid transit feasibility studies, state sponsored motor vehicle use studies, city traffic counts, and the extremely important 1960 Census of Population which provided data on mode of travel to work and residents' places of work.[28]

In his review, Kain groups these studies and analyses into two classes: (1) aggregative and descriptive, and (2) micro or behavioral analyses. He classifies as descriptive or aggregative those studies which are concerned with the volume, spatial origin and destination, purpose, and mode of urban travel. Notable examples of this general type of urban travel study are the Chicago Area Transportation Study,[29]

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[26]Ibid., pp. 136-138.

[27]John F. Kain, "Urban Travel Behavior," in Leo F. Schnore and Henry Fagin, Urban Research and Policy Planning (Beverly Hills: Sage Publications, Inc., 1967), pp. 161-192.

[28]Ibid., pp. 161-163.

[29]Chicago Area Transportation Study, Final Report, Vol. 1 (Chicago: Western Engraving and Embossing Co., December, 1959).

David A. Gorman and Stedman Hitchcock's analysis of Central Business District traffic in ninety-one cities,[30] and mode of travel studies by Wilbur Smith and Associates,[31] Frank B. Curran and Joseph T. Stegmaier,[32] and Russel G. Berryman.[33]

Those urban travel analyses concerned with the determinants of the volume and length of journey-to-work trips Kain classifies as micro or behavioral in nature. These trip generation and residential location models incorporate such urban social and economic factors as automobile ownership, population density and racial composition, income, cost of residential space, and valuations of commuting time in an attempt to simulate or predict the pattern of urban travel. This general class of urban travel studies is characterized by a number of theoretical and methodological analyses. The Detroit Area Transportation Study[34] and Robert B. Mitchell and Chester Rapkin[35] developed the basic methodology utilized in most recent urban transportation studies. William Alonso,

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[30]David A. Gorman and Stedman Hitchcock, "Characteristics of Traffic Entering and Leaving the Central Business District," Public Roads, 30 (August, 1959), pp. 213-220.

[31]Wilbur Smith and Associates, Future Highways and Urban Growth (New Haven: Wilbur Smith and Associates, 1961).

[32]Frank B. Curran and Joseph T. Stegmaier, "Travel Patterns in 50 Cities," Public Roads, 30 (December, 1958), pp. 105-123.

[33]Russel G. Berryman, "Mass Transportation Post Card Survey" Penn-Jersey Transportation Study, Paper No. 16 (Philadelphia: Penn-Jersey Transportation Study, May, 1962). (mimeographed.)

[34]Detroit Metropolitan Area Traffic Study, Report on the Detroit Metropolitan Area Traffic Study, Part I: Data Summary and Interpretation (Lansing, Michigan: Speaker-Hines and Thomas, Inc., 1955).

[35]Robert B. Mitchell and Chester Rapkin, Urban Traffic: A Function of Land Use (New York: Columbia University Press, 1954).

John F. Kain, Herbert Mohring, Richard Muth, and Lowdon Wingo have developed the basic theoretical models of residential location.[36] Many researchers have performed empirical investigations of these relationships.

Numerous other studies have investigated the various determinants of commuting behavior, both from the standpoint of analyzing individual worker behavior and with the objective of explaining the geographical distribution of employees of a plant or group of plants.[37] The review presented here was intended to provide background for this study. Thus, the attempt was to review only a few studies which are representative of the many studies of this general type.

Suggested Hypotheses

A review of studies which have dealt with home-work commuting patterns suggests that a number of variables are related to journey-to-work travel behavior. Chapter I set forth the purpose of this study which is to relate through a system of hypotheses a set of character-

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[36]William Alonso, "A Theory of the Urban Land Market," Papers and Proceedings of the Regional Science Association, 6 (1960), pp. 149-157; John F. Kain, "The Journey-to-Work as a Determinant of Residential Location," Papers and Proceedings of the Regional Science Association, 9 (1962), pp. 137-160; Herbert Mohring, "Land Values and the Measurement of Highway Benefits," Journal of Political Economy, 69 (June, 1961), pp. 236-249; Richard F. Muth, "The Spatial Structure of the Housing Market," Papers and Proceedings of the Regional Science Association, 7 (1961), pp. 207-220; Lowdon Wingo, Jr., Transportation and Urban Land (Washington, D.C.: Resources for the Future, Inc., 1961).

[37]For additional references on commuting studies see the author's Selected Bibliography. Also, very comprehensive surveys of the literature on commuting patterns are provided by Adams and Mackesey, and Louis K. Loewenstein, The Location of Residences and Work Places in Urban Areas (New York: The Scarecrow Press, Inc., 1965).

istics of the OCAMA laborshed area, OCAMA, and the OCAMA labor force to the commuting behavior of the OCAMA employees. The factors which will be analyzed have been suggested, for the most part, by previous studies.

The variables which have been found to most significantly affect journey-to-work behavior and which, therefore, will be analyzed in this study are the following: 1) laborshed characteristics--distribution of population, employment opportunities, and transportation facilities; 2) employer characteristics--hiring policies, rate of growth, and wage rates; and 3) employee attributes--age, sex, skill, educational attainment, income, home ownership and type of residence, length of employment, shift, and marital status.

It is the objective of this study to determine the importance of these factors in shaping the laborshed area of the Oklahoma City Air Materiel Area. The data and methodology used in the analyses will be discussed in Chapter III.

CHAPTER III

SOURCES OF DATA AND METHOD OF ANALYSIS

The purpose of this chapter is to provide a discussion of the various sources and types of data and to set forth the methodology used in analyzing the OCAMA labor force commuting patterns. The first major section of the chapter will discuss the primary data sources, the data items received from each, and the procedure used in integrating information from these sources. The second portion of the chapter will describe the methodology to be used in Chapters IV and V for analyzing the commuting patterns to identify the most significant factors influencing commuting behavior of the OCAMA work force.

Sources of Data

There were three primary sources of data which provided detailed information on OCAMA's employees. These were (1) existing OCAMA records maintained by the personnel division, (2) a questionnaire survey of OCAMA civilian employees, and (3) Richard W. Poole's 1960 study of characteristics and commuting patterns of the OCAMA labor force. A secondary source of information was interviewing. Personal interviews were utilized in the pre-testing of the questionnaire and in gathering information on the hiring policies of OCAMA. Also, many informal discussions were held with several of the employees of the OCAMA personnel and information offices to acquaint the author with the

history and operation of OCAMA.

In addition to the data on OCAMA and its work force, data on selected characteristics of the counties in the OCAMA laborshed area will be used in analyzing the OCAMA labor force commuting patterns. These data items will be discussed below.

OCAMA Personnel Records

The OCAMA Division of Personnel maintains records on each of its employees. These records are stored on electronic computer tapes and, therefore, can be updated periodically. The record on each employee contains numerous items necessary to the personnel division for payroll, promotion and layoff, and for assessing personnel needs. Only a portion of these data items was of concern to this study. These items were extracted from the master records and integrated with information obtained by a questionnaire survey.

The items which were felt to be important to an analysis of commuting behavior and were taken from the master file for each worker were the following: (1) employee's time clock number (This number was used as the basis for matching the employee's master record information with his questionnaire.), (2) sex, (3) absenteeism (days of sick leave), (4) personnel classification--salaried (Graded) or hourly (Wageboard, Foreman, or Laborer), (5) educational attainment, (6) type of physical impairment, and (7) annual income, excluding overtime.

Questionnaire

In addition to the above information, data on other personal characteristics of the workers was desired but not available in existing

OCAMA personnel records. In order to get this information, as well as data on the commuting behavior and geographical distribution of OCAMA employees by residence, it was necessary to develop a questionnaire to be completed by each employee.

As noted earlier, one purpose of the study of OCAMA's work force was to update the study made by Poole in 1960. The OCAMA personnel and information offices, as well as many persons and agencies outside of OCAMA, had found Poole's study to provide very useful information on the OCAMA labor force. Thus, the updating of Poole's study dictated that certain questions be included in the questionnaire in order to generate comparable data. In addition to these few questions, additional data items which were not collected in the 1960 study were desired by OCAMA and by others seeking information on the OCAMA work force. For example, the Oklahoma Employment Security Commission desired data on the extent of agricultural background of OCAMA employees. However, these constraints were not great given the type of questionnaire that was developed. A description of the development of the questionnaire, a copy of the pre-test and final questionnaires, and the dissemination and collection procedure employed are outlined in Appendix A.

Poole's Study

The third major source of data on OCAMA workers was Richard W. Poole's study of the OCAMA work force in 1960. The product of Poole's study was essentially descriptive and interpretive in nature as opposed to analytical. This was the result of the purpose of the study which was to provide OCAMA's personnel and information officials with

detailed social and economic data on OCAMA's work force. Other groups such as private state-local civic, planning and development groups, local business firms, and various state-local government agencies also desired information on Oklahoma's largest single employer, OCAMA.

The data for Poole's study were obtained from two sources: (1) existing OCAMA records, and (2) a questionnaire survey of all OCAMA employees.[1] Appendix B provides a copy of Poole's questionnaire.

His report presented data on selected characteristics of the labor force. These items included, in addition to certain personal characteristics, data on place of residence, home ownership, type of residence (farm, non-farm), travel distance and time, and mode of transportation.[2]

Economic and Social Characteristics of the OCAMA Labor shed

In 1967, OCAMA drew its civilian employees from twenty-nine counties in central Oklahoma. However, only ten counties accounted individually for seventy-five or more OCAMA workers (see Figure 1).[3] The purpose of this section is to provide a description of these ten

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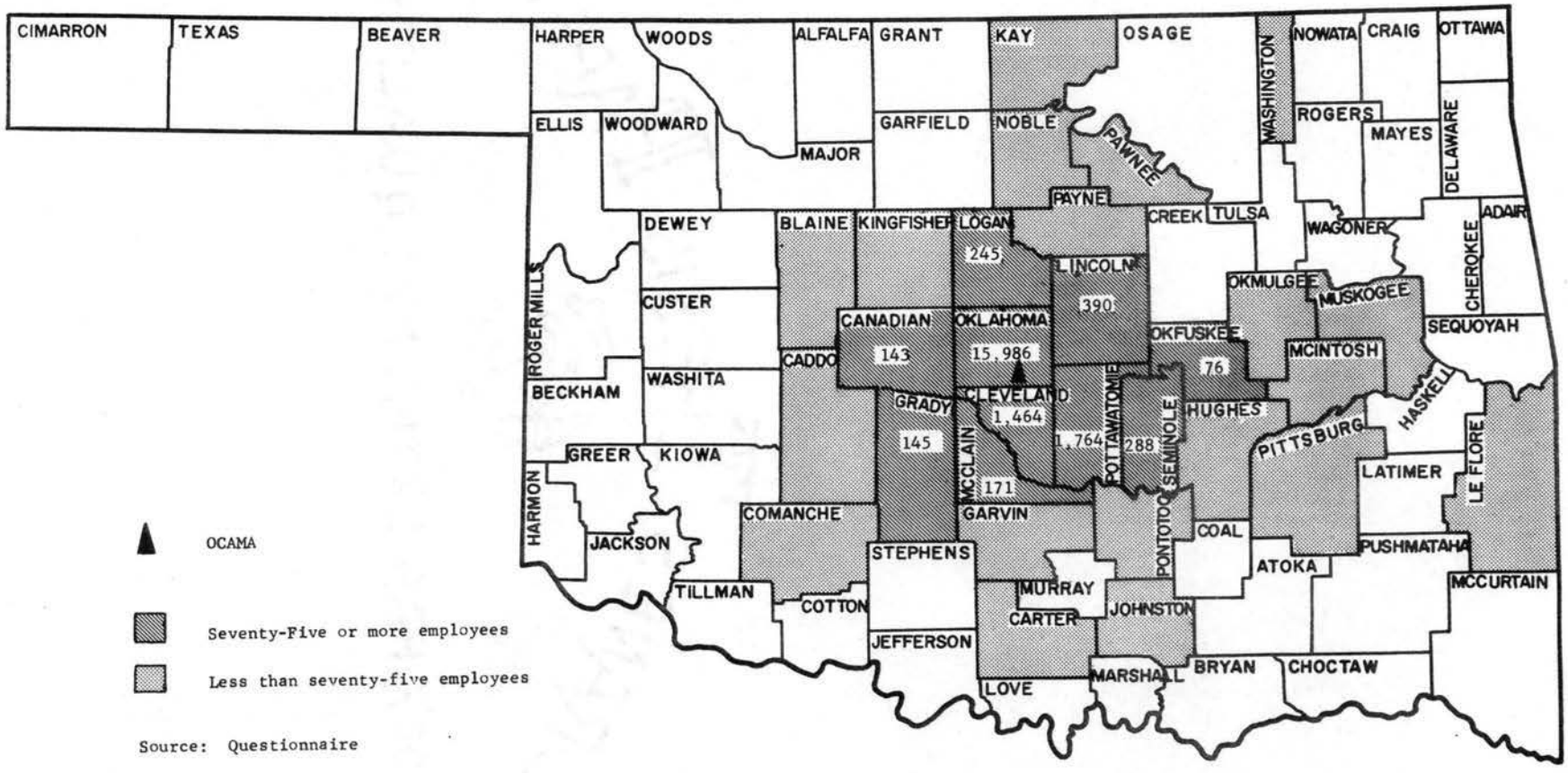
[1]A description of the procedure used in developing the questionnaire and in integrating the data from it with existing data, as well as the manner of reporting the data is provided in Richard W. Poole, "Implications of Labor Characteristics and Commuting: A Case Study," pp. 111-112.

[2]Other strategic data items were obtained, for example, place of residence when hired, length of time in current residence, and type of residence when hired, which were not reported. Regrettably, this data is not available for analysis.

[3]These ten counties supplied approximately 99.4 per cent of OCAMA's labor force in 1967. See Chapter IV for a discussion of the distribution of all civilian employees by city and county of residence.



Source: Questionnaire

Figure 1. Distribution of OCAMA Employees by County of Residence, 1967 (Number Given for Counties with Seventy-Five or More Employees)

counties on the basis of selected economic and social characteristics. These characteristics will be of importance in the analysis of OCAMA labor force commuting patterns which will be presented in Chapters IV and V. Table I provides a summary of these characteristics and will be the basis for the discussion that follows.

Population. The population of the ten-county area was approximately three-quarters of a million in 1966. This represents an increase of 11 per cent from 1960 (compared with a State gain of 6.4 per cent in the same period). While this increase would characterize the ten-county area as a population growth area, this clearly is not the case for each of the ten counties. Three counties, Oklahoma, Cleveland, and Canadian (the three counties in the Oklahoma City SMSA), accounted for over ninety-seven per cent of the population increase. In addition to these three counties, only Lincoln County had a percentage increase in population that exceeded the percentage increase for the State as a whole. Logan and Seminole counties experienced sharp declines in their populations and the population in the remaining four counties remained relatively stable during this period.

Of the ten counties only Oklahoma County and three counties to the south and southeast of OCAMA (Cleveland, Pottawatomie, and Seminole) are characterized by population densities greater than for the state as a whole. The other six counties, in general, are sparsely populated. These county population densities are related, as would be expected, to the residence patterns of OCAMA employees which will be discussed in Chapter IV.

Per Capita Income. For the study area as a whole, per capita personal income in 1967 was above per capita personal income for the

TABLE I

CHARACTERISTICS OF OCAMA LABORSHED COUNTIES
(Counties with Seventy-five or More
OCAMA Employees as Residents)

County	POPULATION			INCOME				EMPLOYMENT					
					Farm Earnings[c] as a Per Cent of Total Personal Income				Agricultural[e]				
	Total[a] (000) 1966	Per Cent[a] Change 1960-1966	Density[b] Per Square Mile 1966	Per Capita[c] Personal 1967	1959	1967	Average[d] Weekly Manufacturing Wages 1967	Manufacturing[d] 1967	Total 1967	Per Cent of Total Employment	Per Cent[e] of Labor Force Unemployed 1967	Density[f] of Paved Roads Miles per Square Mile 1959	1967
Canadian	31.0	25.5	35.0	g	g	g	$102.32	g	g	g	g	.30	.41
Cleveland	72.6	52.5	132.7	g	g	g	103.61	g	g	g	g	.48	.71
Grady	29.4	-0.6	26.9	$2,204	14.68	11.27	93.49	1,130	2,240	25.2	5.4	.20	.27
Lincoln	20.0	6.7	20.6	1,753	5.96	5.09	91.05	360	1,430	30.1	4.0	.18	.27
Logan	17.5	-6.5	23.4	2,127	11.62	10.83	73.31	NA	1,580	29.0	3.2	.24	.30
McClain	12.8	0.8	22.9	1,800	17.22	16.00	NA	100	1,080	33.8	9.1	.39	.49
Okfuskee	11.8	0.6	18.5	1,395	10.63	13.01	59.88	NA	990	34.9	6.9	.17	.24
Oklahoma	483.3	10.0	681.7	3,028[h]	.82	.85	121.66	30,700[h]	5,500[h]	2.1[h]	4.3[h]	1.03	1.31
Pottawatomie	42.0	1.2	52.7	2,246	2.39	2.63	102.41	850	1,875	17.2	6.0	.28	.44
Seminole	26.3	-6.2	41.8	1,974	2.80	1.09	72.57	1,100	1,250	15.1	6.7	.34	.45
State	2,478.0	6.4	35.9	2,623	6.57	4.84	120.33	116,200	139,000	14.3	4.3	.23	.30

[a]U.S. Department of Commerce, Bureau of the Census, Current Population Reports; Population Estimates and Projections, Series P-25, No. 427, July 31, 1969.

[b]Derived from: Current Population Reports, Series P-25, No. 427, and Statistical Abstract of the United States, U.S. Department of Commerce, Bureau of the Census.

[c]U.S. Department of Commerce, Office of Business Economics, unpublished estimates, April 17, 1969.

[d]Oklahoma Employment Security Commission, County Employment and Wage Data: Oklahoma 1967, August, 1968. Manufacturing employment and wage data are based on information reported by employers covered by the Oklahoma Employment Security Act.

[e]Oklahoma Employment Security Commission, Oklahoma Labor Force Estimates, March, 1968.

[f]Derived from: Oklahoma State Highway Department, Total Road Mileage 1960 and Total Road Mileage 1968, and U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States. Figures exclude local city streets which are not an extension of the State highway system.

[g]See Oklahoma County. Data given only for the Oklahoma City SMSA which includes Canadian, Cleveland, and Oklahoma Counties.

[h]Figure is for Oklahoma City SMSA which includes Canadian, Cleveland, and Oklahoma Counties.

NA - Not Available

State. Per capita personal income for the ten-county area was approximately $2,825.[4] For the State the figure was $2,623 (Table I). However, the per capita income for the ten-county area is influenced greatly by the Oklahoma City SMSA whose per capita income was $3,028 in 1967. Only three of the remaining seven counties, Grady, Logan, and Pottawatomie, had per capita incomes above $2,000, and none exceeded the State figure. In the other four counties, Lincoln, McClain, Okfuskee, and Seminole, per capita personal income was more than $375 below the State average.

Agricultural and Manufacturing Income and Employment. During the period 1960 to 1967 agriculture declined in relative importance in the Oklahoma economy while the manufacturing sector grew rapidly. For the ten-county study area much the same trend can be discerned; although, once again, the data for the ten-county area are dominated by Oklahoma County and the Oklahoma City SMSA. For example, in 1967 the Oklahoma City SMSA accounted for 85.6 per cent of total personal income and 91.6 per cent of manufacturing earnings in the ten counties.[5]

While total farm earnings for the ten counties rose during the period 1959 to 1967, farm earnings declined as a percentage of total personal income for the ten counties. In 1959, farm earnings were 1.9 per cent of total personal income in the ten counties; in 1967, they

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[4]Derived from: U.S. Department of Commerce, Office of Business Economics, unpublished county income estimates, April 17, 1969.

[5]Ibid. Manufacturing earnings for Okfuskee County are not given in order to avoid disclosure. The 91.6 per cent figure applies to the remaining nine counties.

were 1.7 per cent.[6] On the contrary, manufacturing earnings increased relative to total personal income for the ten-county area. Manufacturing earnings more than doubled from 1959 to 1967 and increased as a percentage of total personal income for the ten counties from 8.6 per cent in 1959 to 11.1 per cent in 1967.[7]

Highways. There are no natural physical characteristics such as large bodies of water or mountains which would greatly influence the general geographic pattern of OCAMA employee residence and commuting patterns. However, significant differences in the densities of paved roads do exist between the counties (Table I).[8] Six of the ten counties in the study area have paved road densities at least twenty-five per cent greater than for the State as a whole. More significant, in terms of the effect of highway facilities on commuting patterns, is the fact that with the exception of Canadian County to the west and Oklahoma County, in which OCAMA is located, the four remaining counties with paved road densities above the State figure are to the south and southeast of OCAMA. The effect of highway facilities on commuting patterns will be investigated in Chapters IV and V.

Figure 2 shows the major State and federal traffic arteries connecting OCAMA with various areas of the State. As the figure reveals,

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[6]Ibid. Estimates of income are not available by county for 1960; therefore, 1959 was used.

[7]Ibid.

[8]In 1967, the density of paved roads in Oklahoma was .30 miles per square mile (See Table I). The corresponding figure for the U.S. was .22 (Derived from: U.S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, Annual Report, Highway Statistics, September, 1968, Table M-2, p. 166).

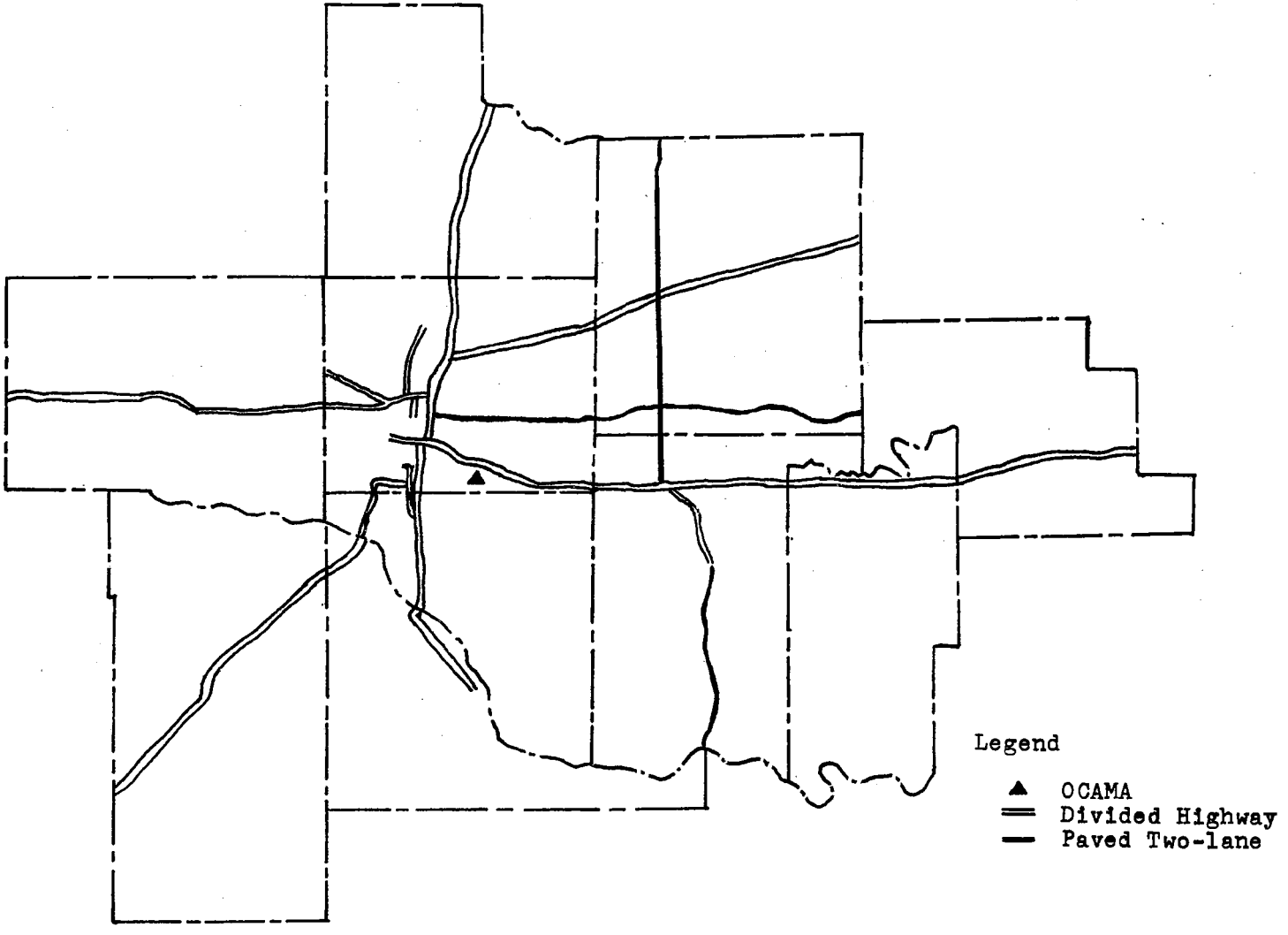

Figure 2. Major Highways in the Oklahoma City Air Materiel Area Labor Market, 1967

OCAMA is well situated with respect to the State's interstate highways and Oklahoma City's by-pass system. As might be expected, the density of paved highways appears to have some positive relationship to the density of population. As Table I reveals, those counties with the greater population densities tend also to have the higher paved road densities. The importance of this relationship in explaining the OCAMA labor force commuting patterns will be analyzed in Chapter IV. The road densities for the ten counties for 1960 and 1967 are listed in Table I. As noted earlier, these changes in highway facilities in the OCAMA labor market area will be related to commuting patterns later in the study. However, it may be noted in describing the area that all of the counties have experienced rather significant increases in paved roads during this period.

Summary. This section has revealed that the central Oklahoma area from which OCAMA draws its labor force is a very heterogeneous group of counties. Six of the ten counties had declining or rather stable populations during the period 1960 to 1966, two counties experienced substantial population growth, and two others paralleled the State in its rate of population growth.

The counties are diverse in other respects also. Per capita income ranged from a low of $1,395 in Okfuskee County to a high of $3,028 in the Oklahoma City SMSA. Okfuskee and Oklahoma Counties and the Oklahoma City SMSA provided the extremes for the ten counties for other characteristics also. For example, Okfuskee County had the lowest average weekly manufacturing wage, $59.88, while the average weekly manufacturing wage was $121.66 in Oklahoma County. Okfuskee County was the most sparsely populated of the ten counties with 18.5

persons per square mile and Oklahoma County the most densely populated with 682 persons per square mile. In addition, Okfuskee County and the Oklahoma City SMSA provided the extremes in agricultural employment. Nearly 35 per cent of Okfuskee County employed residents were engaged in agriculture in 1967, while the corresponding figure for the Oklahoma City SMSA was 2.1 per cent.

Methodology

The methodology that will be used to analyze the commuting behavior of the OCAMA work force is the following. First, the spatial distribution of OCAMA workers, based on place of residence, and their journey-to-work patterns will be described. Then, selected areal, employment, and worker characteristics will be investigated for their role as factors affecting commuting behavior.

To analyze the relationship between characteristics of the central Oklahoma area--spatial distribution of population, commuting distance to OCAMA, and intervening employment opportunities--and the geographical distribution of OCAMA workers' residences, gravity or interaction relationships will be hypothesized. These relationships will be estimated by the use of least squares regression techniques. The gravity model formulations and the regression estimating equations will be described in Chapter IV.

The second part of the analysis will attempt to explain the variation in the origin of OCAMA workers not accounted for in the interaction models by investigating the relationship between selected characteristics of OCAMA and the residential distribution and commuting patterns of the OCAMA work force. The final phase of the analysis will relate

certain attributes of OCAMA workers to their commuting behavior. These relationships will be investigated by use of least squares multiple regression analysis. This model will be set forth in Chapter IV.

Following the above analysis, the 1960 and 1967 OCAMA labor force residence and commuting patterns will be compared. This comparison will be made on the basis of data from the two studies on commuting distance and time, and place of residence. Alterations in the commuting and residence patterns which occurred between 1960 and 1967 will be related to changes that have occurred in selected personal, employment, and areal factors in an attempt to discover any cause-and-effect relationships that may exist.

CHAPTER IV

DESCRIPTION OF THE OCAMA LABOR FORCE RESIDENCE AND COMMUTING PATTERNS AND ANALYSIS OF FACTORS AFFECTING THESE PATTERNS

The purpose of this chapter is to describe the geographical distribution of OCAMA's work force in 1967 by place of residence, to characterize the commuting behavior of these workers, and to investigate selected personal, OCAMA, and areal characteristics which may influence the OCAMA work force residence and commuting patterns. The first portion of the chapter will describe the geographical distribution of OCAMA workers by city and county of residence. Next the journey-to-work patterns of these workers will be described from the standpoint of driving distance and driving time. The last section of the chapter will use the methodology set forth in Chapter III to analyze various factors which affect the commuting behavior of OCAMA workers.

Residence Patterns

County of Residence

In 1967, OCAMA drew its employees from twenty-nine of Oklahoma's seventy-seven counties (See Figure 1). Following is an alphabetical list of the twenty-nine counties and the number of employees living in each:

Blaine	2	McClain	171
Caddo	9	McIntosh	1
Canadian	143	Muskogee	1
Carter	2	Noble	1
Cleveland	1,464	Okfuskee	76
Comanche	1	Oklahoma	15,986
Garvin	28	Okmulgee	5
Grady	145	Pawnee	2
Hughes	28	Payne	6
Johnston	1	Pittsburg	1
Kay	3	Pontotoc	7
Kingfisher	14	Pottawatomie	1,764
LeFlore	1	Seminole	288
Lincoln	390	Washington	1
Logan	245	Total	20,786

As the foregoing data indicate, sixteen of these counties accounted for fewer than ten employees each.[1] However, 23.09 per cent, or 4,800, of the OCAMA workers lived outside of Oklahoma County where OCAMA is located.[2]

Table I in Appendix C presents the county of residence of OCAMA workers classified by sex for all employees, salaried employees, and hourly employees.

City of Residence

In reporting their place of residence, OCAMA employees were asked to indicate their city of residence, or if rural, the city nearest

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[1]Twenty-nine Oklahoma counties were reported as the county of residence by the OCAMA employees in 1967. However, two of these counties, Washington and LeFlore, represent unusual circumstances. These two counties are considerable distances from OCAMA which would preclude daily commuting from them. In fact, one of the two employees involved indicated that while his home was in the county reported as his place of residence that he lived in Oklahoma City during the week and returned home only on weekends.

[2]It was noted in Chapter III that 10 counties supplied 99.4 per cent of the OCAMA labor force in 1967.

their place of residence. The number of cities reported totaled 168. Of the entire labor force, 91.5 per cent (19,019) reported that they lived inside a city. The remaining 8.5 per cent indicated that their place of residence was a farm or was located in a rural nonfarm area.

Following is a list of those cities which were the place of residence of two-hundred or more employees (one per cent or more of the OCAMA work force). The percentages these employees represent of the total OCAMA labor force are indicated in parentheses after the number of employees.

Oklahoma City	7,579	(36.46)
Midwest City	4,749	(22.84)
Del City	2,126	(10.22)
Shawnee	1,183	(5.69)
Norman	680	(3.27)
Moore	585	(2.81)
Choctaw	309	(1.48)
Tecumseh	243	(1.16)
Edmond	217	(1.04)
Guthrie	208	(1.00)
Total	17,879	(86.01)*

*Because of rounding, detail does not add to total.

As indicated above, these ten cities accounted for eighty-six per cent of the total OCAMA labor force in 1967.

Table II in Appendix C provides detailed statistics on city of residence or city nearest residence of employees classified by sex. The total figures for each city include (1) individuals within the corporate limits, and (2) individuals outside of the corporate limits who reported the city as nearest their place of residence. Some of the latter individuals lived in a different county. Thus, a summation of the figures for cities in a given county will not yield the county total.

Commuting Patterns

In any attempt to describe commuting patterns there arises the question of the most satisfactory measure of commuting. The majority of studies have employed distance traveled. A few analysts have preferred to measure commuting in time and some have incorporated both distance and time by using miles per hour as a measure of commuting. The argument for using travel time or miles per hour is that a worker's willingness to commute depends in part on the "effort" involved and that this consideration on the part of the worker is more accurately reflected by a measure based on time. For example, distance traveled does not reflect congestion or quality of highway facilities; these factors, obviously important to a commuter, are inherent in travel time or miles per hour.

An additional measure which has been suggested is travel cost. The assumption is that as travel costs increase with increased distance traveled they act to discourage commuting. However, data collected in this and other studies show that a great number of OCAMA employees have reduced travel costs by forming car pools. In addition, most employees who travel great distances alone have no realistic idea of the total costs of commuting.[3]

As noted above, distance has been the measure of commuting employed in most studies. Distance can be approximated without interviewing or surveying the workers as would be necessary with time

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[3]Employees were asked to report their travel costs per week. The cost estimates of a great number of long-distance commuters indicated that they considered only their expenses for fuel.

or cost measures. In this study data were collected on commuting distance, time, and costs. The OCAMA labor force commuting patterns will be expressed in terms of both distance and time. However, most of the analysis of commuting which will follow will relate only to commuting distance in order to facilitate comparisons with other studies.

Commuting Distance

The mean driving distance, one-way, for all OCAMA employees was 14.4 miles in 1967. The median distance was ten miles. This divergence between the median and mean driving distance is due to the fact that many workers traveled considerable distances. Table II shows the distribution of OCAMA workers by miles driven one-way to work.

Figure 3 depicts the percentage distribution of OCAMA employees by driving distance. The various peaks in the distribution are associated with the geographical location of many towns and cities in which OCAMA employees lived. For example, the peaking of the distribution at three and five miles represents the driving distances for employees living primarily in Midwest City and Del City. The next three peaks (at ten, twelve, and fifteen miles) are attributable to employees living in Oklahoma City, Moore, and adjacent communities. The twenty-mile peak represents primarily Norman residents while the thirty-five-mile and forty-mile peaks are those associated essentially with Shawnee and Tecumseh employees respectively.

A cumulative percentage distribution of OCAMA employees by driving distance is given in Table II. This distribution and Figure 3 provide an approximation of the spatial extent of OCAMA's local labor market or laborshed. In terms of cumulative percentages, 50 per cent of the

employees lived within ten miles of CCAMA, 69 per cent within fifteen miles, 80 per cent within twenty miles, 88 per cent within thirty miles, and nearly one-hundred per cent within seventy miles. The greatest one-way driving distance reported was 130 miles.

TABLE II

DISTRIBUTION OF EMPLOYEES BY DRIVING DISTANCE
(ONE-WAY)

Distance, One-Way (in miles)	Number	Per Cent of Total	Cumulative Per Cent
0-5	6,410	30.83	30.83
6-10	4,029	19.38	50.21
11-15	3,990	19.20	69.41
16-20	2,147	10.32	79.73
21-25	1,011	4.86	84.59
26-30	681	3.26	87.85
31-35	802	3.86	91.71
36-40	645	3.10	94.81
41-50	527	2.53	97.34
51-60	326	1.58	98.92
61-70	157	.77	99.69
71-85	42	.20	99.89
86 and over	19	.11	100.00

Mean: 14.4 miles

Median: 10 miles

Source: Questionnaire

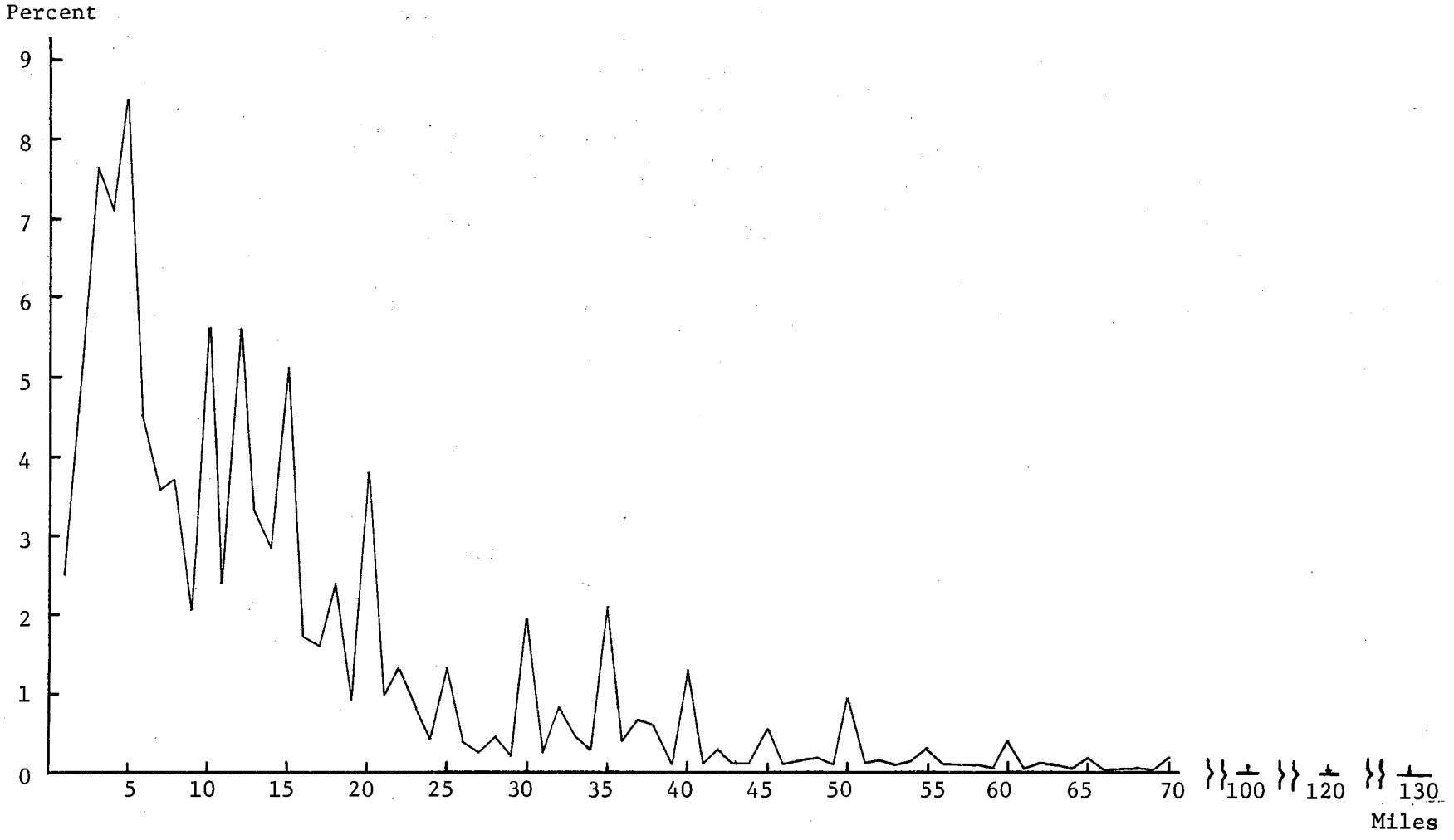

Figure 3. Percentage Distribution of OCAMA Employees by One-Way Driving Distance, 1967

While there is no "average" commuting distance found among the many journey-to-work studies, OCAMA workers, in general, drive distances considerably above the national average. A federal government survey conducted in October, 1963, found that 55 per cent of American workers commute farther than four miles (78 per cent for OCAMA workers) and 24 per cent commute ten miles or farther (compared to 50 per cent for OCAMA workers.)[4] Thus, the geographical extent of OCAMA's labor market, if measured by commuting distance of its employees, is indeed large.

Commuting Time

Time spent traveling to and from work is a very important item in analyzing commuting patterns. Unlike driving distance, travel time takes into consideration the quality of highway facilities, traffic congestion, population density, and various driver characteristics.

The average travel time to work, one-way, for OCAMA employees was twenty-five minutes in 1967. The median time was twenty minutes. Again, this divergence between the mean and median was caused by extreme values influencing the former. For example, over four-hundred OCAMA employees spent more than one hour in traveling one-way to work.

Table III shows the absolute, percentage, and cumulative percentage distributions of OCAMA employees according to their reported travel time by various time intervals. It is evident that the majority of the long-distance commuters are able to travel at relatively high

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[4]U.S. Department of Commerce, Bureau of Census, "Home-to-Work Travel," advance report, 1963 Census of Transportation (Washington: Government Printing Office, 1965), p. 6.

TABLE III

DISTRIBUTION OF EMPLOYEES BY TRAVEL TIME
(ONE-WAY)

Travel time, One-Way (in minutes)	Number	Per Cent[a] of Total	Cumulative[b] Per Cent
1-5	461	2.22	2.22
6-10	2,752	13.24	15.46
11-15	4,115	19.80	35.26
16-20	3,647	17.55	52.81
21-25	2,352	11.32	64.13
26-30	3,024	14.55	78.68
31-35	919	4.42	83.10
36-40	814	3.92	87.02
41-45	1,388	6.68	93.70
46-50	295	1.42	95.12
51-60	608	2.93	98.05
61-70	108	.52	98.57
71-80	174	.84	99.41
81-90	88	.42	99.83
91-100	5	.02	99.85
101-110	17	.08	99.93
111-120	12	.06	99.98
120 and over	7	.03	100.00

Mean: 25.1 minutes

Median: 20 minutes

Source: Questionnaire

[a]Because of rounding, detail does not add to total.

[b]Percentages have been adjusted so that detail will add to 100.

speeds.[5] This relationship between travel distance and travel time (i.e., increased miles per hour with increased distance) results, as expected, from the proximity of OCAMA to major highway arteries (Interstate Highways 35, 40, and 44) and the congestion which results from the population density in the immediate OCAMA area. Thus, workers residing in areas considerable distances from OCAMA (especially to the east and southeast) may enjoy high average driving speeds.

Analysis of Factors Associated with OCAMA Employee Commuting Patterns

This portion of the chapter will analyze various factors which affect the commuting patterns of the OCAMA work force. The factors studied will be selected characteristics of the central Oklahoma area, of OCAMA, and of the OCAMA labor force. These characteristics will be related through a system of hypotheses to the commuting patterns of the OCAMA work force which were described in the first section of this chapter.

Commuting Patterns and Areal Characteristics

This section will investigate selected characteristics of the central Oklahoma area, the area from which OCAMA draws its labor supply, for their possible effect on the drawing power of OCAMA (as measured by

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[5]The mean driving distance for all employees was 14.4 miles and the mean driving time was 25.1 minutes. Thus, the "average" speed would be approximately 34.4 miles per hour. The data show that those employees living within 3 miles of OCAMA drove at an average speed of approximately 15.5 miles per hour, while those employees living 88 miles or farther averaged approximately 47.6 miles per hour.

the commuting pattern of its employees). Those factors which will be analyzed are commuting distance and the distribution of population, the alternative employment opportunities, and the central Oklahoma highway system.

Distribution of Population. To test the importance of the distribution of population in the central Oklahoma area in explaining the residence and commuting patterns of OCAMA workers a simple interaction model or gravity probability model was used. The use of gravity models to investigate the importance of population and distance in predicting the number of potential commuters from one area into another is concisely stated by Robert Lonsdale. He writes,

> The gravity concept holds that the potential interaction between two points or areas is directly proportional to their populations and inversely proportional to the distance between them. In the case of commuting, the gravity idea can be conceived as suggesting that an individual plant (or group of plants) attracts commuters from surrounding areas in direct proportion to the population of the area and in inverse proportion to the distance between the area and the plant.[6]

As Figure 4 indicates, the density of OCAMA commuter origins is not uniform nor does it diminish at a constant rate with increased distance. The purpose of utilizing a gravity model is to determine to what degree this uneveness in the origin of OCAMA commuters is attributable to differences in distance and the spatial arrangement of population.

With respect to the geographical distribution of OCAMA employee residences, it is hypothesized that the "drawing power" of OCAMA, i.e., the number of workers per capita drawn by OCAMA from the surrounding counties, is a function of commuting distance between the county and

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[6]Lonsdale, p. 124.

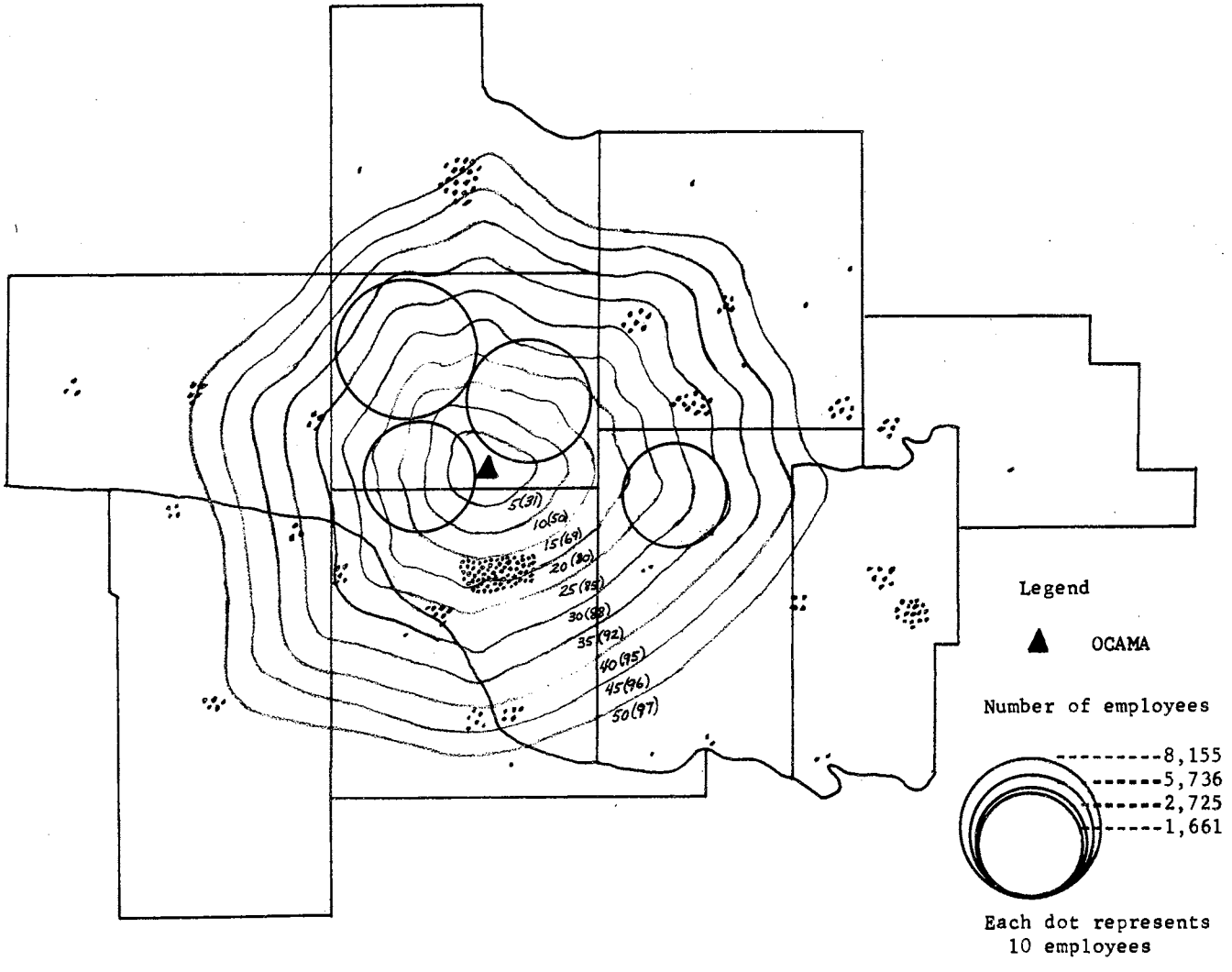

Figure 4. The OCAMA Laborshed and Commuting Mileage Isolines (Five-mile intervals; Figures in Parentheses Indicate Per Cent of Commuters Enclosed by that Line)

OCAMA and the population of the county. The interaction model employed to test this hypothesis was the following:

$$C_i = \frac{k\ P_i}{D_i^{\ b}}$$

Where C_i is the number of OCAMA employees from county i, P_i is the population of county i, D_i is the commuting distance between the center of county i and OCAMA, k is a constant, and b is the exponent on D.[7]

The number of workers per county is based on the residential distribution of OCAMA workers as of July, 1967 which was presented earlier.[8] County population figures were obtained from the Bureau of the Census population estimates for 1966.[9] Commuting distances used in the model were obtained for the counties by construction of a commuting distance isoline. (See Figure 4.)

In order to estimate this gravity relationship regression analysis was employed with the number of commuters per ten thousand population from a county treated as an exponential function of the commuting distance from the center of the county to OCAMA.[10] The regression

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[7]For a comprehensive treatment of gravity and spatial interaction models see Walter Isard, Methods of Regional Analysis: An Introduction to Regional Science (New York: John Wiley and Sons, Inc., 1960).

[8]Only counties whose geographical centers were within the eighty mile isoline were included in the analysis. The eighty mile isoline included 99.88 per cent of OCAMA's labor force. In addition to the ten counties characterized in Chapter II, the following countieswere included in the analysis: Caddo, Garvin, Hughes, Kingfisher, Payne, and Pontotoc.

[9]U.S. Department of Commerce, Bureau of the Census, Current Population Reports; Population Estimates, Series P-25, No. 401, August 28, 1968.

[10]Isard., pp. 508-510.

equation is:

$$\log N_i = \log k - b \log D_i,$$

where N_i is the number of OCAMA commuters per ten thousand population from county i, and the other terms are defined as above. The estimating equation derived is:

$$\log N_i = 5.4637 - 2.3447 (\log D_i).$$

When both variables, N_i and D_i, are transformed to logarithms, approximately 51 per cent of the variation in logarithms of commuter totals is statistically explained. This equation can be expressed in the following gravity model form:

$$C_i = \frac{5.46\ P_i}{D_i^{2.34}}$$

The scatter diagram and regression line are presented in Figure 5. The regression line is fitted to the actual values. The "Y" intercept (k) of the regression line is 5.4637, and the slope of the line (b) is -2.3447. This negative value indicates that the number of workers drawn per capita decreases with increasing commuting distance from OCAMA at an exponential rate exceeding the square of the distance. The coefficient of correlation (r) between the logarithms of the two variables (N_i and D_i) is a strong negative value of -.712. The coefficient of determination (r^2) of .512 indicates, as noted above, that commuting distance and population distribution explain approximately 51 per cent of the total variation in the logarithm of the dependent variable--workers per 10,000 population.

One can see from Figure 5 the deviations of the actual values from the regression line which provides the expected values. The deviations of the residuals from regression (expected log of N_i - actual log of N_i)

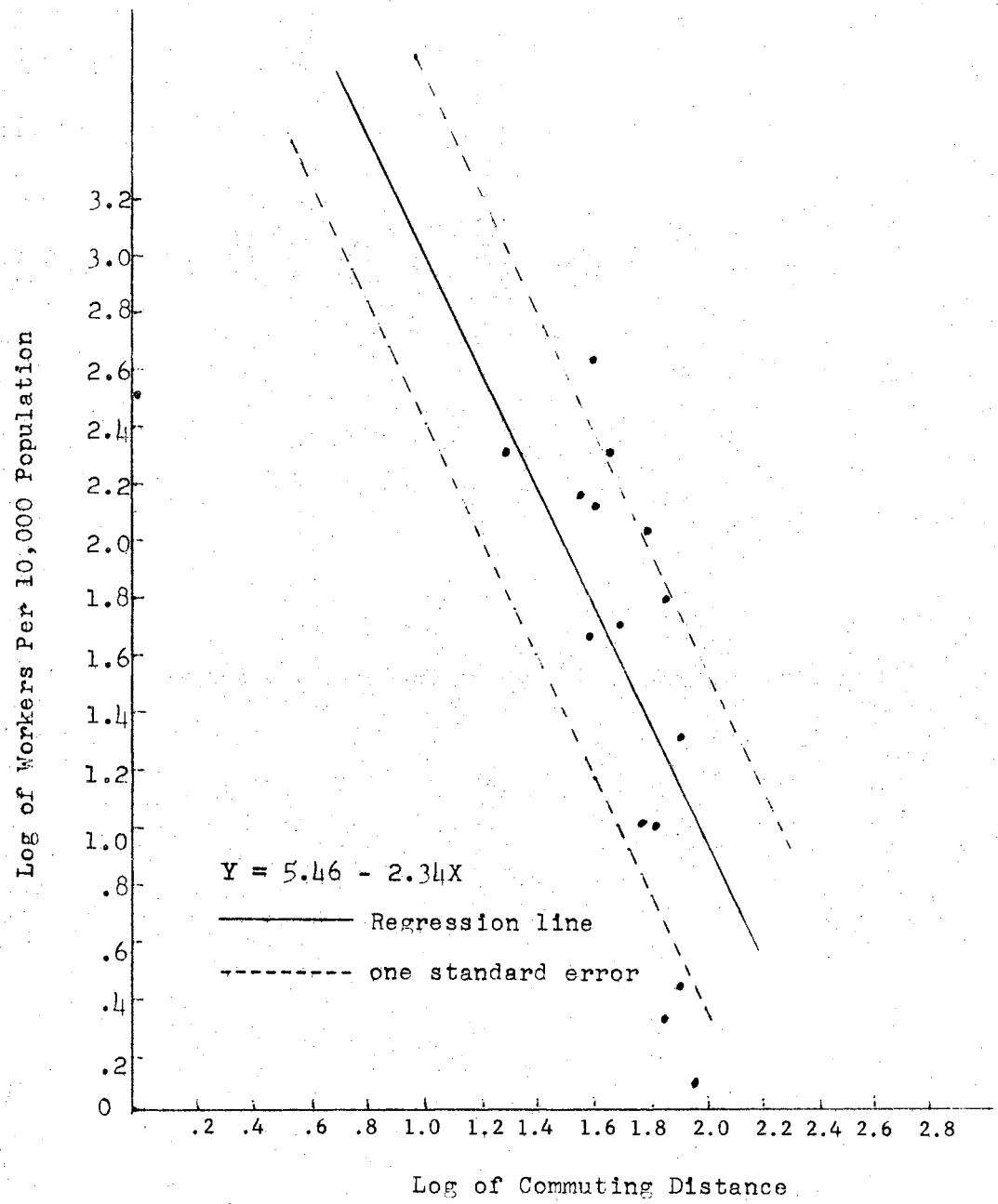

Figure 5. Regression of OCAMA Workers Per Ten Thousand Population on Commuting Distance

are measured in terms of the standard error of estimation.[11] The standard error of estimation indicates how well the regression line fits the distribution. The standard error of the commuting distance model is .58147. The calculation of the residuals from regression makes it possible to map the laborshed counties on the basis of the magnitude of the difference between the estimated and observed values in terms of the standard error of estimate. The spatial pattern of the residuals is represented in Figure 6.

A clear pattern of overestimation and underestimation of OCAMA's drawing power by the model is revealed by Figure 6. The drawing power of OCAMA from the counties east of Oklahoma County is vastly underestimated. Also, there is slight underestimation of two counties to the southwest of OCAMA and Logan County to the north.

The pattern of underestimation to the east of OCAMA may be due in part to the lack of any major urban centers. Thus, few intervening opportunities exist between OCAMA and the residents of these counties. The underestimation by the model of these counties and the two to the southwest and one to the north of OCAMA may also be attributable to the highway system in the OCAMA area. This relationship will be discussed later in this chapter.

The overestimation by the model of counties to the west of OCAMA and a few counties to the extreme south and north of OCAMA may be accounted for, in some cases less conclusively than in others, by the same factors causing underestimation in the case of some counties--

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[11]For a thorough treatment of residuals see Edwin N. Thomas, Maps of Residuals from Regression: Their Characteristics and Uses in Geographic Research (Iowa City: Department of Geography, State University of Iowa, No. 2, 1960).

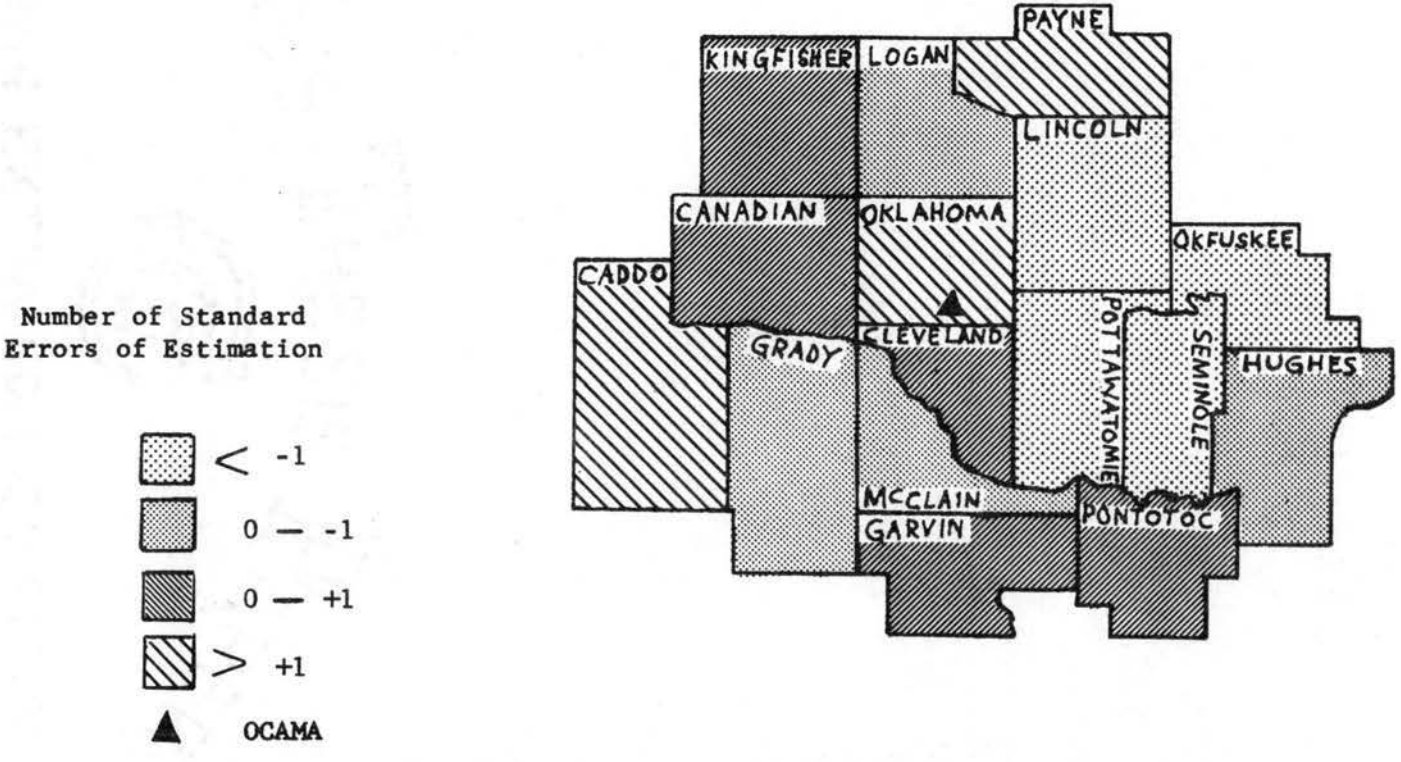

Figure 6. Residuals From the Regression of OCAMA Workers Per Ten Thousand Population on Commuting Distance

urban centers and highways. Oklahoma City clearly provides a great number of alternative employment opportunities for residents of Oklahoma County and counties to the west of Oklahoma County. The same is true for Cleveland County to the south of OCAMA. The presence of Oklahoma University in Norman, and the rapidly growing city of Moore provide many employment opportunities for residents of Cleveland County and counties to the south.

In addition to the above factors, urban centers and highways, the nature of the gravity model may affect the predicted relationship between two geographical areas. The model does not, for instance, incorporate the interaction between sub-areas nor does it take into consideration the influence of population centers outside of the area on the peripheral counties of the area being considered. For example, the presence of Enid to the north of Kingfisher County, Ardmore to the south of Garvin County, and Lawton to the southwest of Grady County attribute to the overestimation of OCAMA's drawing power in these three counties. However, the drawing power model and the spatial pattern of the residuals are very useful tools with which to roughly measure the degree of significance of the relationship between commuting distance and population distribution and OCAMA's drawing power. In addition, they indicate that there may be a significant relationship between OCAMA's drawing power and intervening employment opportunities.

Intervening Opportunity Model. On the basis of the spatial pattern of the residuals in the commuting distance model it is hypothesized that variation in the dependent variable also is a function of intervening employment opportunities. This relationship was first hypothesized by Samuel A. Stouffer. Stouffer stated this hypothesis, in

reference to migration, in the following way:

> ...there is no necessary relationship between mobility and distance...the number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities....The relation between mobility and distance may be said to depend on an auxiliary relationship, which expresses the cumulated (intervening) opportunities as a function of distance.[12]

More recent researchers have hypothesized a similar relationship to that of Stouffer and have treated intervening opportunities as a measure of "social distance" between two masses as opposed to using physical distance.[13]

To investigate this relationship in the case of OCAMA's drawing power on the surrounding area an interaction model of the form

$$C_i = \frac{k\ P_i}{(O_i...)^b}$$

was employed where $O_i...$ equals the summation of manufacturing employment in all counties between county i and OCAMA. Data on intervening manufacturing employment were calculated from Table I in Chapter II.[14]

To estimate the interaction model a regression model of the form

$$\log N_i = \log k - b \log O_i...$$

was used where N_i again is commuters per 10,000 population in county i.

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[12]Samuel A. Stouffer, "Intervening Opportunities: A Theory Relating Mobility and Distance," American Sociological Review, Vol. 5 (December, 1940), pp. 845-867.

[13]See Isard, pp. 542-544, for a discussion of intervening opportunities as a measure of social distance.

[14]Intervening manufacturing employment has customarily been used as a measure of intervening employment opportunity in gravity models. Given the nature of the bulk of OCAMA's activities this seems to be the appropriate measure in this analysis.

The scatter diagram and regression line of the intervening opportunity model are presented in Figure 7.

The relationship between OCAMA's drawing power and intervening opportunity is expressed by a correlation coefficient of -.49, lower than the correlation coefficient in the commuting distance model. The resulting coefficient of determination, .24, is also lower. This value indicates that approximately 24 per cent of the variation in the log of OCAMA's drawing power is explained by the log of intervening opportunities. The corresponding figure for the commuting distance model was 51 per cent. Thus, intervening opportunity, as a measure of "social distance," is not as satisfactory as physical commuting distance in explaining the variation in OCAMA's drawing power.

The estimating equation derived from the intervening opportunities model was

$$\log M_i = 2.673 - .352 \log O_{i...}$$

with a standard error of estimation equal to .7201. Figure 8 presents the residuals of regression of OCAMA drawing power on intervening opportunity. With the exception of Oklahoma County only peripheral counties are overestimated by the intervening opportunity model. Oklahoma County is encircled by counties which were underestimated. This would indicate that the employment opportunities in Oklahoma City are not as strong in their affect on the number of prospective commuters from counties to the north, southwest, and west (counties where commuters to OCAMA must pass through or by-pass Oklahoma City) as the intervening opportunity model would indicate. This result, no doubt, is due in part to certain characteristics of OCAMA and to the highway system which allows easy and fast travel through or around Oklahoma City from

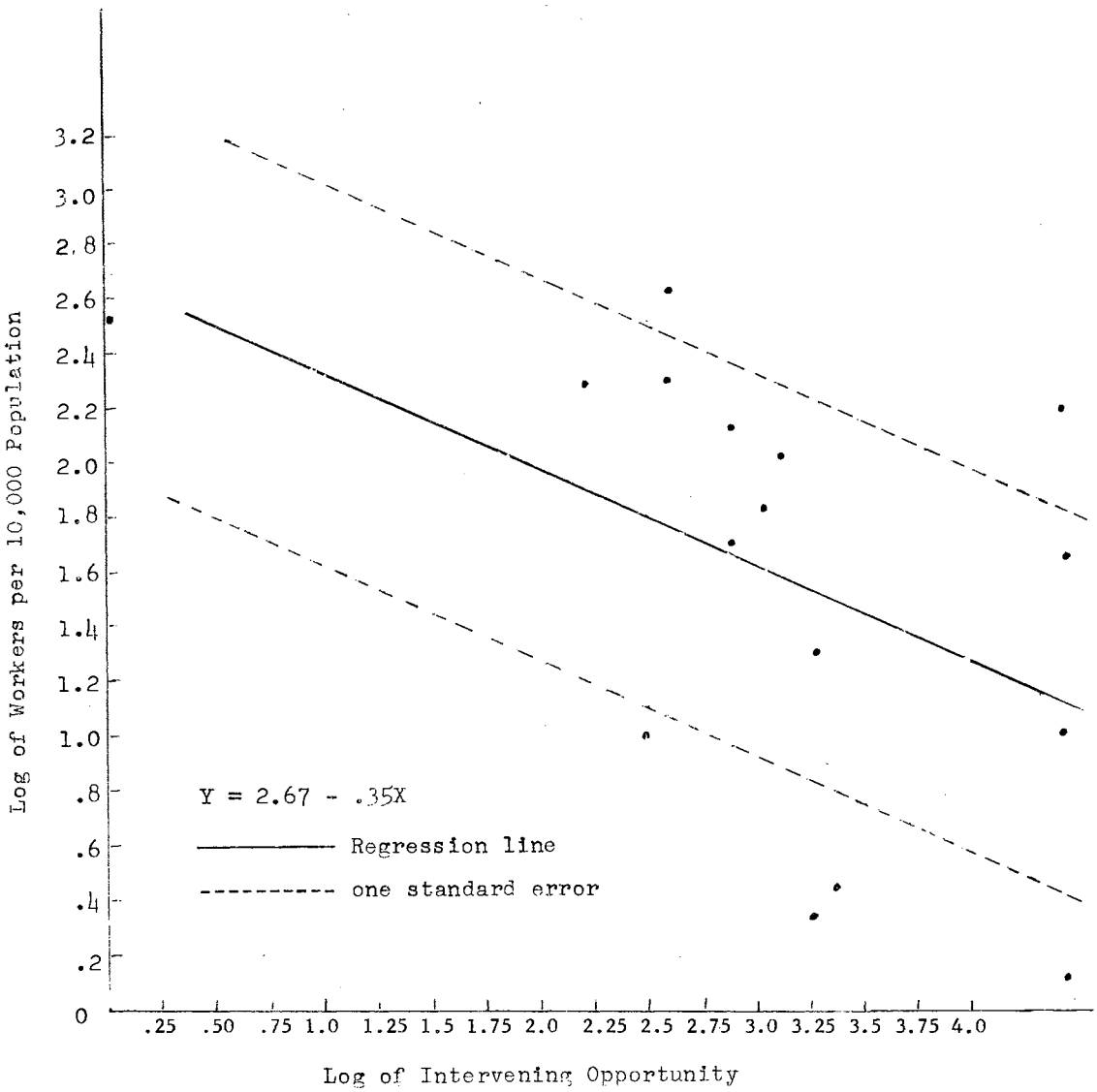

Figure 7. Regression of OCAMA Workers Per Ten Thousand Population on Intervening Opportunity

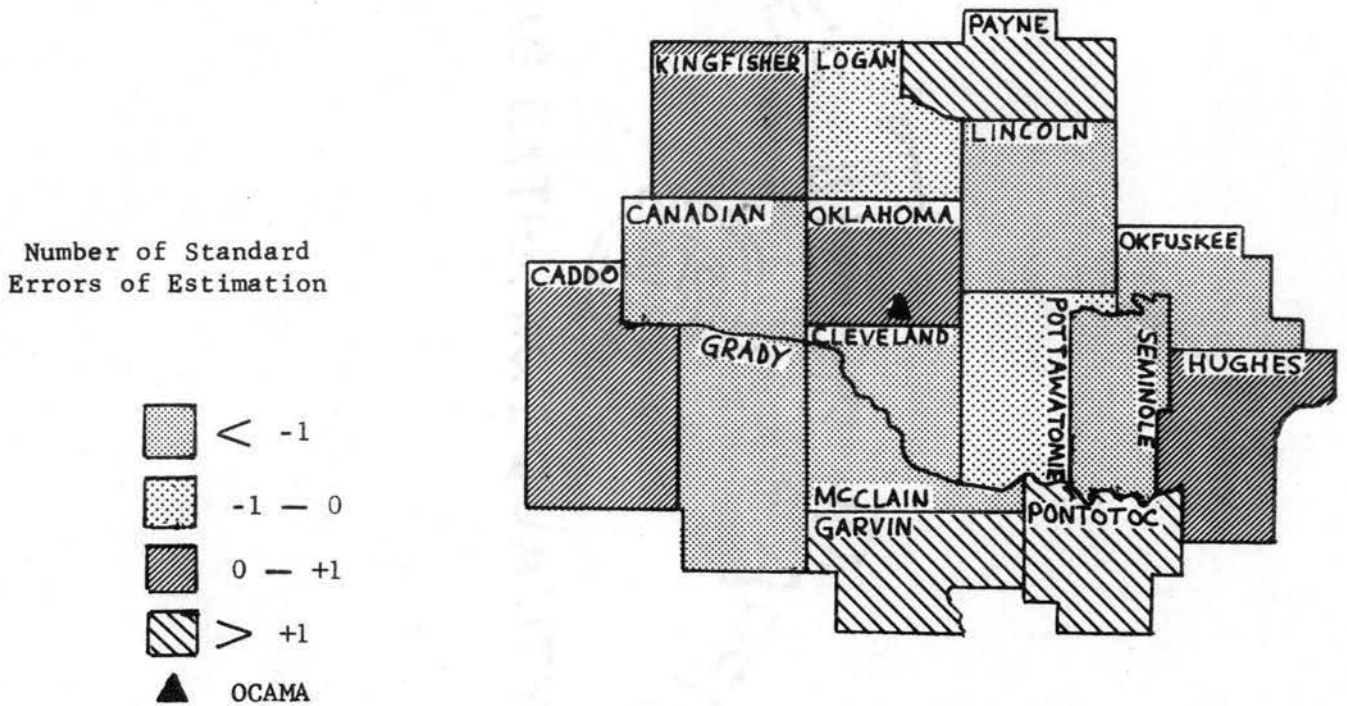

Figure 8. Residuals From the Regression of OCAMA Workers Per Ten Thousand Population on Intervening Opportunity

most of these counties.

The location of positive residuals (overestimation of OCAMA's drawing power) at the periphery of the group of counties suggests that OCAMA's drawing power from these counties is very likely affected by factors not accounted for in this analysis. For example, job opportunities very near to these counties (relative to the distance of these counties to OCAMA) but not intervening between the county and OCAMA may be an important variable in explaining the variation of the dependent variable. As noted earlier, gravity models are most useful when the area of application is isolated and is not influenced by phenomena not located within the study area. However, as noted above, the use of an interaction model does provide useful knowledge about the nature of OCAMA's drawing power.

A number of important facts are revealed by a comparison of Figures 6 and 8. The most important of these relates to the seven counties which are underestimated in both the commuting distance and intervening opportunity models. Each of these counties, Grady, Lincoln, Logan, McClain, Okfuskee, Pottawatomie, and Seminole has good accessibility to OCAMA as revealed by Figure 2 in Chapter III and, in general, there are no large intervening urban areas. In addition, Table I in Chapter III presents interesting facts about each of these counties. With few exceptions, these counties are homogeneous with respect to income, population, and intensity of agricultural employment. In general, these counties have relatively low per capita incomes (all with a per capita income at least $375 below the State figure in 1967), low manufacturing wage rates, declining or stagnant populations, and more than one-fourth of all employment engaged in agriculture.

This homogeneity would suggest that these variables may also have a significant affect on the commuting pattern of OCAMA workers. One relationship that will be discussed in detail later is that between the wages of OCAMA and those prevailing in a region. If OCAMA's wages are appreciably above those prevailing in a region, one can expect the workers from this region to show a greater willingness to commute longer distances. Thus, relative wages may affect OCAMA's drawing power from these counties.

A contrast can be made between the above seven counties and Cleveland and Canadian Counties. In the case of the latter two counties OCAMA's drawing power was slightly overestimated in the commuting distance model and slightly underestimated in the intervening opportunity model. These two counties could more appropriately be characterized as growth counties. Both experienced significant population increases from 1960 to 1966. Also, manufacturing wages, although lower than for the state as a whole, were higher than the above seven counties. In addition to these factors, commuters from Canadian County must pass through Oklahoma City or circumvent it on highways inferior (during the period studied) to those connecting the seven counties to OCAMA. For most residents of Cleveland County (Moore and Norman) the divided highways leading to OCAMA are not direct but rather lead north toward Oklahoma City and then east to OCAMA. These factors seem to indicate that in the case of these two counties the highway connection with OCAMA and the employment opportunities within the two counties act to dampen OCAMA's drawing power from them.

The two models have illustrated that commuting distance, intervening employment opportunities and the distribution of population are

important factors affecting the drawing power of OCAMA, commuting distance more so than intervening opportunities. Obviously, OCAMA's actual drawing power is the result of not only these factors but others not accounted for in this analysis. The purpose of the remainder of this chapter will be to analyze additional factors which affect OCAMA's drawing power from the central Oklahoma area.

Transportation Facilities. The previous section revealed that commuting distance, intervening opportunities, and population distribution are important factors in explaining the drawing power of OCAMA from the central Oklahoma area, the model based on commuting distance explaining approximately 51 per cent of the variation in OCAMA's drawing power. Obviously other factors significantly affect the drawing power of OCAMA. One of the most important factors explaining the commuting pattern of OCAMA workers is the system of highways in the area surrounding OCAMA.

As noted above, in the case of seven of the counties included in the commuting distance and intervening opportunity models the drawing power of OCAMA was underestimated in both models. Due to the highway facilities in the central Oklahoma area, OCAMA is readily accessible from each of these counties.[15] Divided, limited access highways connect the population centers of each of these counties to OCAMA. Also, the commuting distance model overestimated two of the counties, Canadian and Cleveland, very near OCAMA. These two counties, as noted, have less desirable highway connections with OCAMA. Figure 2 in Chapter II

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[15] In 1967, 99.1 per cent of OCAMA workers drove automobiles or belonged to car pools. Therefore, the highway system is particularly important in determining the willingness of workers to commute long distances to OCAMA.

depicts the system of divided highways in the OCAMA area in 1967. A comparison of this figure with Figure 9 showing the population centers in the central Oklahoma area reveals the relationship of the highway system to OCAMA and the urban areas. The ability of OCAMA workers living in the outlying areas to commute to OCAMA quickly and easily with little congestion was noted in the discussion of commuting distance and commuting time at the beginning of this chapter.

The significance of highway facilities on OCAMA's drawing power and labor force commuting patterns will be more thoroughly analyzed in Chapter V. The approach in Chapter V will be to present changes in the commuting patterns of OCAMA workers between 1960 and 1967 and relate these to changes that have occurred in the highway system in the OCAMA area. This analysis will enable a better understanding of the effect of transportation facilities on commuting.

Commuting Patterns and OCAMA Characteristics

This section will analyze selected characteristics of OCAMA itself for any relationship that might exist between them and the commuting patterns of the OCAMA labor force. Unfortunately, this analysis cannot provide a measurement of the degree of relationship between commuting and these OCAMA characteristics as was possible in the investigation of population, distance and intervening opportunities. The data can be analyzed for suggested relationships; the degree of relationship cannot be precisely measured. The OCAMA characteristics to be analyzed are its hiring policies, growth, and wage rates.

OCAMA Hiring Policies. Some researchers have found that the hiring policies of a firm may influence the commuting patterns of the firm's

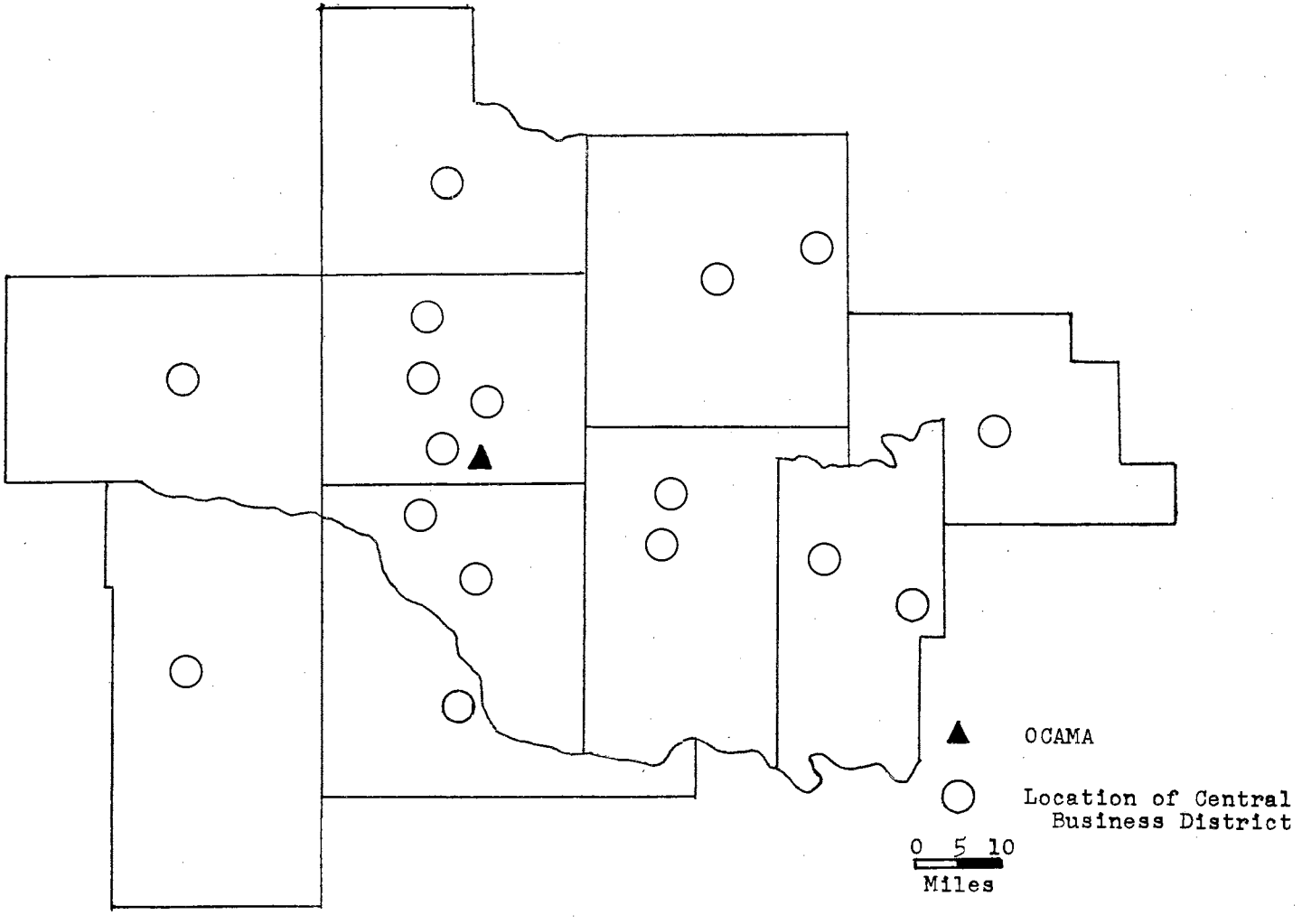

Figure 9. Location of Selected Cities in the Ten County OCAMA Laborshed (Primary City(ies) in Each County)

work force. In particular, James Thompson found in his study of commuting patterns of manufacturing employees in West Virginia that a definite relationship exists between employment policies of a firm and the commuting patterns of its labor force. In one local labor market where the labor market area was found to be comparatively small, two of the four firms studied by Thompson had hiring policies which discouraged long-distance commuting.[16] In another case, seven of fourteen chemical firms surveyed by Thompson had definite hiring policies concerning the place of residence of workers. These firms all had policies setting geographical limits on the distance a worker could live from his place of employment. Their policies ranged from an established distance limit of fifteen to twenty-five miles to that of requiring that workers reside in the county in which the firm was located.[17]

Similarly, Martin and Johnson discovered hiring policies among a few firms which restricted their labor market area to that of the county's boundaries.[18] They observed that the preference for county residents was usually "based on a fear that an increased number of commuters would enlarge the degree of labor turnover, absenteeism, tardiness, or all three."[19]

In their study of commuting patterns of industrial workers in upstate New York, Adams and Mackesey observed no personnel policies which prevented the hiring of long-distance commuters. However, they

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[16]Thompson, p. 76.

[17]Ibid.

[18]Martin and Johnson, p. 35.

[19]Ibid.

found instances of policies which encouraged workers to travel short distances. An example of this was the sponsoring by management of new housing for workers near the plant.[20]

Dwight D. Kelley in a summary of findings of a study of commuting by the Indiana State Employment Service also noted a tendency on the part of employers to restrict the commuting distance of their employees. The Indiana study concluded that most employers found that absenteeism and turnover were higher among workers commuting more than a few miles. Thus, some employers restricted hiring to their home county.[21]

The OCAMA personnel office in charge of hiring has no policy placing a geographical limit on the distance an employee may live from OCAMA.[22] Nor does OCAMA exercise any preference for workers living in areas adjacent to OCAMA or within Oklahoma County. The absence of any policy or preference with regard to place of residence of workers is evident in the extensive geographical area from which OCAMA draws its employees. As noted earlier, OCAMA drew its labor force from twenty-nine of Oklahoma's seventy-seven counties in 1967. Also, twenty-three

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[20]Adams and Mackesey, p. 56.

[21]Dwight D. Kelley, "Indiana Survey Studies Commuting Patterns," Labor Market, U.S. Department of Labor, Employment Service Division, (Washington: 1947), p. 11.

[22]Interview with Mr. Arthur T. Sikes, Chief, Placement Section 2, Personnel Division, OCAMA, July, 1968. Though no study of the effects of long-distance commuting on worker efficiency had been made at OCAMA the personnel officials generally felt that considerable commuting by employees had no significant effect on their efficiency. It was found from an investigation of sick leave records for the year ending July, 1967 that the employees who drove 20 miles or farther had averaged 6.6 days sick leave while the average for all employees was 7.0 days. Also, employee separation records for the same period revealed that very few employees indicated that commuting distance was the primary reason for leaving employment at OCAMA.

per cent of its work force resided outside of Oklahoma County in which OCAMA is located.

Contrary to geographical limits on home-work separation, OCAMA relies heavily on outlying areas for its growing labor demands and, therefore, actively solicits residents of distant areas for employees. Announcements of OCAMA employment vacancies are distributed by the local civil service commission to state and federal employment offices in cities in a wide area of Oklahoma. The effect of these practices is the extensive labor shed area as noted above.

OCAMA Expansion. Among students of commuting there has been disagreement as to the significance of size of establishment in its relation to worker commuting patterns. The Carroll, and the Adams and Mackesey studies found size of establishment to be of little or no significance in its effect on commuting patterns.[23] On the other hand, Thompson in his study of commuting patterns of manufacturing employees in West Virginia found evidence of a slight direct relationship between size of establishment and length of commuting pattern.[24] Martin and Johnson in their analysis of intercounty commuting in Kentucky discovered a very strong direct relationship between commuting distance and size of firm. They note that "The most clear-cut showing of all, if the Kentucky data are typical, is the variation in commuting with the size of the employer...larger plants, measured by the number of employees, have more commuting on the whole than do smaller plants."[25]

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[23]Carroll, pp. 418-419; Adams and Mackesey, p. 54.

[24]Thompson, p. 22.

[25]Martin and Johnson, p. 33.

Since the present study did not include establishments other than OCAMA, there can be no analysis of the comparative absolute size of establishment and its relation to commuting patterns. However, the effect of the expansion of OCAMA, measured by the change in the number of employees, on the commuting patterns of its work force can be gauged.

In 1967, at the time of the study, OCAMA's labor force numbered 23,885, 20,786 of whom completed and returned a questionnaire providing information on their journey-to-work behavior. Of these 20,786 employees, 4,553, or 22 per cent, had been employed by OCAMA one year or less. These figures represent a rapid growth in the number of OCAMA employees. (See Table III in Appendix C for the distribution of OCAMA employees by length of service.) The average driving distance for all OCAMA employees was 14.4 miles in 1967. An indication of the effect of OCAMA employment expansion on its laborshed area is given by the commuting behavior of the relatively new employees (those with one year or less employment at OCAMA). For these employees the average commuting distance was 18.6 miles. Thus, new employees drove on the average approximately four miles farther than the OCAMA labor force as a whole.

The fact that new employees drove farther than the labor force as a whole may be due in part to the lack of sufficient time to adjust their place of residence such that it is closer to OCAMA. Also, it may result from the belief on the part of these employees that with little tenure they are most vulnerable to layoff as the result of a military cutback and thus are reluctant to alter their place of residence. In addition to these factors, the tendency of newer employees to travel longer distances on the average may be due to the composition of these

new employees. Table III in Appendix C reveals that 1,798, or approximately 40 per cent, of the 4,553 employees with one year or less of employment were females. Females comprised about 25 per cent of the total OCAMA labor force. Most commuting studies have found that men commute farther to work on the average than do women. This was found to be the case in the OCAMA study, with men driving only slightly farther than women. However, in the case of the new employees, the presence of a disproportionately large number of women who commute considerable distances may offset the tendency over time for these employees to shorten their home-work separation. Since 85 per cent of all OCAMA female employees are married, many of the new female employees are secondary job holders in their families and thus very likely will not move their place of residence closer to OCAMA over time. This latter effect may mean that OCAMA's recent expansion in employment has increased the amount of long-distance commuting and that these employees may not alter their place of residence and commuting patterns appreciably in the future.

An alternative method of gaining some idea of the effect of OCAMA labor force expansion on commuting behavior is to look at length of service of long-distance commuters (those driving twenty miles or farther one-way).[26] The median length of service of those who traveled twenty miles or farther, one-way, to work was seven years. The median

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[26]The twenty-mile figure was used to define a long-distance commuter because (1) eighty per cent of all OCAMA workers commuted less than twenty miles, (2) only seven per cent of those employees who drove less than twenty miles lived in counties other than Oklahoma County, and (3) this definition is comparable to that employed in other commuting studies. See, for example, Adams and Mackesey, and Thompson.

years of service for all OCAMA employees was higher at 9 years. Also, employees with one year or less employment comprised 26.4 per cent of all employees who traveled twenty miles or farther to work. On the other hand, as noted above, employees with one year or less employment at OCAMA, irrespective of driving distance, represented 22.0 per cent of all OCAMA employees. Thus, employees with one year or less employment were more prevalent among long-distance commuters than they were among the labor force as a whole. Either method shows that the expansion of OCAMA employment has resulted in a somewhat larger laborshed area, since new employees commute slightly greater distances than employees with greater years of employment at OCAMA.[27] The relationship of length of service and commuting distance will be investigated further in the section dealing with personal characteristics of OCAMA employees.

OCAMA Wage Rates. The greater willingness of workers to commute long distances from areas with relatively low wage rates to employment in areas with higher wage rates has been observed by a number of researchers.[28] In fact, higher paying alternative employment would be, a priori, the justification for long-distance commuting.

Many benefits are afforded the employee of OCAMA which are not

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[27]An inverse relationship between years of employment and commuting distance was also noted by Lonsdale, p. 128; Parnes, p. 170; Thompson, pp. 25-26; Roy Gerard, "Commuting and the Labor Market Area," Journal of Regional Science, Vol. 1, 1958, p. 128; Helen M. Conant, "The Locational Influence of Place of Work on Place of Residence," (unpublished Master's Thesis, Department of Sociology, University of Chicago, 1952), pp. 132-133, cited in Loewenstein, p. 131.

[28]See, for example, Lonsdale, pp. 126-130; Martin and Johnson, p. 34; Kelley, p. 11.

measured by the wage paid by OCAMA, for example, paid vacation, sick leave, a seniority system, job security, and retirement benefits. Still one would expect the OCAMA's drawing power would be strong from those areas (counties) in which wages and employment opportunities are relatively low. Employment opportunities and their effect on OCAMA drawing power were analyzed earlier.

Table I in Chapter III presented both per capita personal income and average weekly manufacturing wages for the ten counties from which OCAMA drew 99.4 per cent of its work force in 1967. Table IV provides a comparison of the average weekly wage paid by OCAMA to workers in the ten laborshed counties with the average weekly manufacturing wage in each of these counties. In each case the average weekly wage of OCAMA employees is higher than the average weekly manufacturing wage. For the counties in which OCAMA's drawing power was underestimated in both the commuting distance and intervening opportunity models, the difference between the average OCAMA weekly wage and the average weekly wage in manufacturing ranges from twelve dollars in Pottawatomie County to fifty dollars in Okfuskee County. Thus, OCAMA's drawing power, at least from this set of counties, is strengthened by its high wages relative to those existing for manufacturing employment in these counties.[29] These wage differentials and their effect on OCAMA's

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[29]The wage rates for each county are those reported by the Oklahoma Employment Security Commission for all covered manufacturing establishments. Thus, the quality of labor is not held constant in this comparison of wage levels. The lower wage levels in these counties may simply reflect that there are a number of low-wage manufacturing industries which employ many unskilled or semi-skilled workers. Therefore, the lack of employment opportunities at a given skill level may be the impetus to commuting to OCAMA rather than a lower wage level for that skill level.

TABLE IV

AVERAGE WEEKLY WAGE RATES FOR OCAMA AND MANUFACTURING EMPLOYMENT, 1967
(For Counties With Seventy-Five or More OCAMA Employees)

County	Average Weekly OCAMA Wage 1967 (1)	Average Weekly Manufacturing Wage 1967 (2)	Difference Between OCAMA Wage and Manufacturing Wage (1) - (2)
Canadian	$118.57	$102.32	$16.25
Cleveland	131.70	103.61	28.09
Grady	113.63	93.49	20.14
Lincoln	116.76	91.05	25.71
Logan	113.78	73.31	40.47
McClain	115.84	NA	---
Okfuskee	109.88	59.88	50.00
Oklahoma	130.52	121.66	8.86
Pottawatomie	114.77	102.41	12.36
Seminole	107.71	72.57	35.14

Source: Column (1) OCAMA Personnel Records.
Column (2) Oklahoma Employment Security Commission, County Employment and Wage Data: Oklahoma 1967, August, 1968.

drawing power are, of course, accentuated by the general lack of alternative employment opportunities in these counties. These two factors, comparative wage rates and availability of jobs in the home county, as well as job security through tenure, play an important role in setting and maintaining a pattern of commuting by OCAMA workers.

The Relationship of Employee Attributes to Commuting Behavior

A great number of journey-to-work studies have dealt with the relationship of employee attributes to their commuting behavior. In general, most studies have revealed that men travel farther than women,[30] higher income workers farther than middle or lower income workers,[31] younger workers farther than older workers,[32] that recently hired workers journey greater distances than those with more tenure,[33] and that renters travel farther than home owners.[34]

The purpose of this section is to analyze the relationship between personal characteristics of the OCAMA labor force and their commuting patterns. The analysis will be performed by using a least squares

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[30]Adams and Mackesey, p. 13; Thompson, p. 24; Poole, "Characteristics and Commuting Patterns...," p. 28.

[31]Carroll, p. 421; Beverly Duncan, "Factors in Work-Residence Separation: Wage and Salary Workers, Chicago, 1951," The American Sociological Review, XXI (February, 1956), pp. 49-50; Parnes, p. 174; Thompson, p. 23.

[32]Parnes, p. 171; Thompson, p. 24.

[33]See footnote 27 this chapter.

[34]Adams and Mackesey, p. 60; Thompson, p. 26; Westchester County Department of Planning, Employee Travel Patterns in Westchester County (White Plains: Westchester County Department of Planning, 1957), p. 25, cited in Loewenstein, p. 131.

multiple regression model which incorporates as independent variables a set of selected employee characteristics. The use of multiple regression techniques provides a measure of the significance of the set of employee attributes in explaining the variation in employee commuting behavior and indicates the nature of the relationship between any one characteristic and commuting.

Model. The regression model used was of the form

$$Y = B_0 + B_1X_1 + B_2X_2 \cdots + B_pX_p + e.$$

Dependent variables. The analysis was performed first using driving distance as the dependent variable and then driving time. Data on both of these measures of commuting behavior were obtained from responses to the questionnaire. The results of the two analyses (the amount of variation in the dependent variable explained by the set of independent variables) were essentially the same. Therefore, the results of the model which treated commuting distance as the dependent variable will be emphasized in the discussion which follows.

Independent variables. Following is a list of the employee characteristics used as the independent variables in the regression analysis:

Home Ownership (rent, own, live with relative)
Type of residence (farm, nonfarm)
Length of service
Shift
Marital status
Age
Sex
Skill level (unskilled, semi-skilled, skilled)
Salary
Educational attainment

Data on sex, skill level, salary, and educational attainment were from the employee's personnel records. Data on the other variables were obtained by the questionnaire. Only individuals whose records were

complete (whose questionnaire and personnel record were complete with respect to all of the variables) were included in the analysis. The deletion of incomplete records from the analysis provides a higher level of reliability in the results.[35]

Table V provides the results of the analysis of variance. As the table indicates the sum of squares explained by the model is significant at the one per cent level of significance. In addition, the table indicates that all of the independent variables except age are significant at least at the five per cent level of significance. However, the coefficient of determination associated with the model indicates that the set of employee characteristics used in the analysis accounts for or explains only 12 per cent of the variation in driving distance. When driving time was treated as the dependent variable the variation explained by the set of independent variables was approximately 10 per cent. Thus, nearly 90 per cent of the variation in driving distance and driving time is due to factors other than those included in the model. This analysis indicates that this set of employee attributes would be inadequate to explain or predict the commuting behavior of the OCAMA work force. The above analysis omits very important factors which are not characteristics of the employee himself, for example, alternative employment opportunities, as well as subjective preferences of the worker, e.g., preference for residential space, schools, and other considerations.

Though the set of employee characteristics does not explain a very

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[35]The number of employees included in the analysis as a result of the deletion of incomplete records was 16,606.

TABLE V

ANAYLSIS OF VARIANCE OF OCAMA EMPLOYEE DRIVING DISTANCE, 1967

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F Ratio
Total (corrected)	16,605	2,795,274.1		
R (due to model/mean)	34	332,277.5	9,772.87	65.752**
Home ownership	2	11,195.6	5,597.80	37.662**
Type of residence (farm, nonfarm)	1	228,667.8	228,667.80	1,538.473**
Length of service	1	610.8	610.80	4.110*
Shift	2	3,039.7	1,519.84	10.225**
Marital status	3	1,514.2	504.73	3.396*
Age	1	256.4	256.40	1.725
Sex	1	15,745.3	15,745.30	105.934**
Skill level	2	1,657.6	828.79	5.576**
Wage	1	16,422.2	16,422.20	110.489**
Educational attainment	20	4,933.0	246.65	1.659*
Error		2,462,996.6	148.63	

*Significant at .05
**Significant at .01

large portion of the variation in commuting behavior (as measured by driving distance or time), it is desirable to investigate the manner in which each characteristic is related to commuting behavior. First, an explanation of the treatment of the discrete or qualitative variables in the regression analysis and the interpretation of their regression coefficients is necessary. The use and interpretation of quantitative variables in regression analysis is straightforward. However, when a variable such as home ownership is included in regression analysis a somewhat different approach to the interpretation of the results pertaining to this variable is necessary. Seven qualitative variables were included in the set of ten independent variables. These were home ownership, type of residence, shift, marital status, sex, skill level, and educational attainment. Educational attainment was a discrete variable since the alternative levels included some which were not quantificable on a nominal scale of measurement, e.g., doctoral degree.

For each of these seven variables "dummy" variables were created such that the coding of the qualitative variables would not influence their relationship with the dependent variable. As a result of this method a regression coefficient is obtained for each level of the variable rather than a single coefficient as is obtained for a quantitative variable. For example, a regression coefficient is derived for each classification of skill level (See Appendix D).

Table VI lists each of the ten independent variables giving for the quantitative variables the regression coefficient and for each of the seven discrete variables the mean driving distance of the employees in each level or category of the variable. The latter is given in place of the regression coefficient because of the ease of interpretation.

The coefficient on age as mentioned above is not significantly different from zero at the .05 level of significance. The regression coefficient on length of service indicates that the relationship between tenure and commuting distance is not a particularly strong one, however,

TABLE VI

REGRESSION COEFFICIENTS FOR QUANTITATIVE VARIABLES AND MEAN DRIVING DISTANCE FOR EACH CLASSIFICATION OF THE QUALITATIVE VARIABLES
(Dependent Variable: Driving Distance)

Independent Variable	Regression Coefficient	Mean Driving Distance (one-way, in miles)
Home Ownership		
Own	---	13.84
Rent	---	14.25
Live with relative	---	17.06
Type of Residence		
Farm	---	22.89
Nonfarm	---	13.35
Shift		
Day	---	14.10
Swing	---	14.21
Graveyard	---	12.87
Marital Status		
Married	---	14.16
Single	---	13.62
Widowed	---	13.94
Divorced	---	13.51
Sex		
Male	---	14.87
Female	---	12.99
Skill Level		
Unskilled	---	13.79
Semi-skilled	---	19.94
Skilled	---	13.31

TABLE VI (Continued)

Independent Variable	Regression Coefficient	Mean Driving Distance (one-way in miles)
Educational Attainment		
None or 1st grade	---	20.10
2nd grade	---	17.95
3rd grade	---	14.01
4th grade	---	15.68
5th grade	---	15.46
6th grade	---	14.11
7th grade	---	14.69
8th grade	---	14.47
9th grade	---	14.57
10th grade	---	14.17
11th grade	---	14.05
12th grade	---	13.95
1 year of college	---	13.59
2 years of college	---	13.77
3 years of college	---	14.11
4 years of college, no degree	---	14.11
Bachelor's degree	---	13.89
Bachelor's plus graduate study	---	15.10
Master's degree	---	14.57
Master's degree and additional graduate study	---	17.15
Doctor's degree	---	13.71
Length of Service	-0.034	---
Age	-0.015	---
Salary	-0.032	---

it is an inverse relationship. The length of service coefficient shows that as employment increases by one year commuting distance declines by .034 miles, which indeed is slight. Any difference at all appears to be due to the presence of a great number of relatively new employees who commute on the average considerably farther than the OCAMA work force as a whole (see the analysis in this chapter dealing with OCAMA expansion). The regression coefficient on salary, which was measured

as weekly income excluding overtime pay, indicates a slight inverse relationship with commuting distance. The coefficient of -0.032 implies that as weekly income increased by ten dollars driving distance would decrease by approximately one-third mile. This latter finding is in disagreement with the findings of other studies as noted earlier.

A clearer indication of the relationship of each of the qualitative variables to employee commuting patterns is given by a comparison of the mean driving distance for each variable category than by a comparison of regression coefficients. A comparison of mean driving distances indicates that: employees who rented their homes drove slightly farther on the average than home owners, and employees who lived with a relative, in most cases young, new employees, drove considerably farther than home owners or renters; as expected, since OCAMA is located adjacent to an urban center, those residing on a farm traveled much greater distances than nonfarm residents, 22.9 miles for the former and 13.4 miles for the latter; male employees commuted 14.9 miles on the average while female employees commuted an average of 13 miles; and married workers traveled slightly farther than single or widowed employees.

Differences in average driving distance existed for other variables but were less significant or were less clear in their meaning. For example, employees working the graveyard shift (11:00 p.m. to 7:00 a.m.) drove 12.9 miles on the average as compared to the day and night shifts which averaged 14.1 and 14.2 miles respectively. Average driving distances for various levels of educational attainment are difficult to interpret. The average driving distance declines rather consistently from the first level through the level of one year of

college, declining from 20.1 miles to 13.6 miles. However, above one year of college there is no consistent pattern. The most noticeable difference for this group is the average driving distance of 17.2 miles for those employees with a master's degree and additional graduate work. Overall, it would appear that at least through the level of one or two years of college, the average commuting distance decreases as educational level increases. One problem that must be noted in comparisons of this type is that some of the educational attainment categories contain relatively small numbers (See Appendix D). This may weaken somewhat any statements about relative driving distances. This problem applies to a less degree to the other variables discussed above.[36]

Summary

This chapter has attempted to relate various factors (areal, OCAMA, and employee characteristics) to the drawing power of OCAMA from its laborshed counties. The analysis has shown that the distribution of population and the commuting distance between OCAMA and the laborshed counties explains a significant portion of OCAMA's drawing power from the central Oklahoma area. Other important factors explaining OCAMA's drawing power are OCAMA's wage rates relative to wage rates in the surrounding area and OCAMA's expansion in employment. Also important to

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[36]So few workers were classified, according to the scheme used, as semi-skilled that little can be concluded with any reliability about the relationship between skill level and commuting behavior. However, as Table V in Appendix C indicates, if employees are classified as salaried (professional and clerical) and hourly (production), it is found that hourly workers travel considerably farther than salaried employees, 16.4 miles for hourly employees and 11.9 miles for salaried employees.

OCAMA's drawing power are the alternative employment opportunities in the OCAMA labor market area. The analysis has shown that a set of selected OCAMA employee attributes accounted for a very small proportion of the variation in worker commuting behavior. The purpose of Chapter V is to contrast the OCAMA labor force commuting patterns in 1967 with the commuting patterns in 1960 and to investigate selected factors which may have been responsible for the observed changes.

CHAPTER V

CHANGES IN OCAMA LABOR FORCE RESIDENCE AND COMMUTING PATTERNS: 1960 TO 1967

Most noticeably missing from the literature on commuting are studies of changes in commuting patterns over time. Because of differences in the area, the plant, the economic conditions (e.g., wartime or peacetime, recession or expansion), or in the characteristics of the local work force under study, it is often difficult or inappropriate to make conclusions about commuting which are universally applicable on the basis of one-time studies. This idea is probably best expressed by Leonard Adams and Thomas Mackesey who state that

> Studies of changes in worker commuting patterns over periods of time are almost nonexistent. Only a few managements are conscious of potential problems connected with the journey to work and most of the reports prepared have covered situations at a specific time only. When an attempt is made to explain long-term variations in patterns, additional variables such as worker housing and community preferences, location of new plants, and new road construction must be considered. With the cooperation of management such studies might be made from personnel records, supplemented by information from workers on their work histories and a general knowledge of population, employment, unemployment, housing construction, and other trends in the area where the plant(s) are located. This type of analysis might well produce conclusions sufficiently accurate to predict future patterns for the plants and areas studied.[1]

Commuting patterns may change as a result of alterations in economic conditions in the region, changes in a plant's manpower

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[1]Adams and Mackesey, p. 85.

requirements, or as a result of changes in physical characteristics of the area--population shifts or highway improvements. The purpose of this chapter is to analyze the changes that occurred in the residence and commuting patterns of the OCAMA work force between 1960 and 1967.[2] These changes will be measured in terms of county and city of residence, and commuting distance and time. In addition, selected factors which appeared in Chapter IV to be significant in their relation to the 1967 commuting patterns will be analyzed for their role in altering the commuting patterns between 1960 and 1967.

Residence and Commuting Patterns

County and City of Residence

In Chapter IV, the geographical distribution of OCAMA employees by place of residence in 1967 was presented. The OCAMA employees resided in twenty-nine of Oklahoma's seventy-seven counties. In 1960, OCAMA drew its employees from twenty-four counties. Figures 2 and 10 give the distribution of OCAMA employees by county of residence for 1967 and 1960 respectively. From 1960 to 1967 eleven counties were added to the list of counties of residence while six counties that were reported in 1960 were not reported as the place of residence of OCAMA employees in 1967.

During the 1960 and 1967 period there was a substantial increase in the number of OCAMA employees who commuted to OCAMA from residences outside Oklahoma County. In 1960, 17.3 per cent of all OCAMA employees lived in counties other than Oklahoma County. By 1967, this percentage

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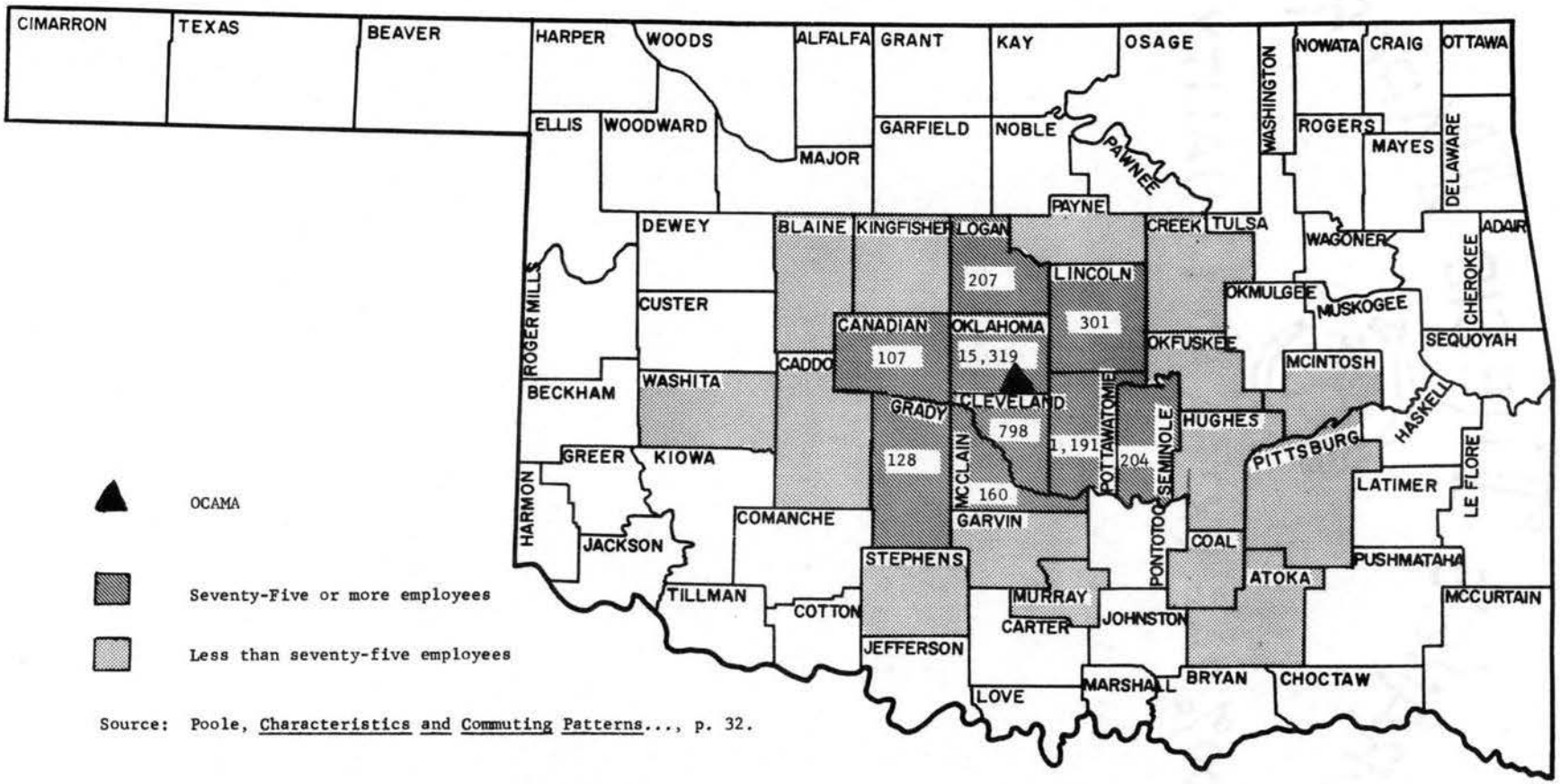
[2]All references to the 1960 OCAMA labor force residence and commuting patterns are from R. W. Poole, Characteristics and Commuting Patterns.



Source: Poole, Characteristics and Commuting Patterns..., p. 32.

Figure 10. Distribution of OCAMA Employees by County of Residence, 1960 (Number Given for Counties with Seventy-Five or More Employees)

had increased to 23.1 per cent. In 1960, 3,210 OCAMA workers lived in counties other than Oklahoma County. This number increased to 4,800 in 1967, an increase of 49.5 per cent. A comparison of Figures 2 and 10 reveals the spreading that occurred in the OCAMA laborshed area from 1960 to 1967.

The wider distribution of OCAMA employees by county of residence is also reflected in the distribution of OCAMA workers by city of residence. Table II in Appendix C gives the distribution of employees by city in 1967. In reporting their place of residence by city, or if rural, the city nearest their residence, the OCAMA employees reported 120 cities in 1960 and 168 in 1967.

During the period 1960 to 1967 there were significant shifts in the spatial distribution of employees by city of residence. Table VII gives the number of employees in 1960 and 1967 for those cities which supplied two-hundred or more employees in 1967. As the table reveals, the number of OCAMA employees living in each city changed considerably from 1960 to 1967.

The most significant change in the distribution of OCAMA workers by city of residence was the decline in the number of Oklahoma City residents. In 1960, Oklahoma City was the place of residence of 9,445 employees which represented 51 per cent of the total OCAMA labor force. The number of OCAMA employees living in Oklahoma City had declined to 7,579 in 1967, and were 36.5 per cent of the OCAMA work force. This change represents an 11.3 per cent decrease in the number of employees residing in Oklahoma City.

On the other hand, noticeable gains were made by Moore, Del City, Shawnee, and Midwest City. Moore and Shawnee are in Cleveland and

TABLE VII

DISTRIBUTION OF OCAMA EMPLOYEES BY CITY OF RESIDENCE, 1960 AND 1967
(For Those Cities Reported as Place of Residence by 200 or More OCAMA Employees in 1967)

	1967		1960	
City	Total	Percentage of All Employees	Total	Percentage of All Employees
Oklahoma City	7,579	36.5	9,445	51.0
Midwest City	4,749	22.8	3,754	20.3
Del City	2,126	10.2	666	3.6
Shawnee	1,183	5.7	846	4.6
Norman	680	3.3	561	3.0
Moore	585	2.8	145	.8
Choctaw	309	1.5	422	2.3
Tecumseh	243	1.2	130	.7
Edmond	217	1.0	165	.9
Guthrie	208	1.0	180	1.0
Total	17,879	86.0*	16,314	88.1*

*Because of rounding, detail may not add to total.

Source: Data for 1960 are from Poole, Characteristics and Commuting Patterns..., Table 44, pp. 75-76. Data for 1967 are from the questionnaire.

Pottawatomie counties respectively; Del City and Midwest City are in Oklahoma County. The number of OCAMA employees living in Moore increased by 303.5 per cent from 1960 to 1967 and in 1967 accounted for 2.8 per cent of all OCAMA workers. The number residing in Del City increased by 219.2 per cent and represented 10.2 per cent of the OCAMA employees in 1967. The percentage increases for Shawnee and Midwest City were 39.8 and 26.5 per cent respectively.

Cities and counties which were not the place of residence of OCAMA employees in 1960 but were reported in 1967 as their place of residence by OCAMA workers reflect the changing economic conditions in the central

Oklahoma area and changes in OCAMA labor requirements. Those factors associated with alterations in the OCAMA labor force residence pattern will be discussed later in this chapter.

Commuting Patterns

The median driving distance for OCAMA employees in 1967 was 10 miles and the mean driving distance was 14.4 miles. In 1960, the corresponding figures were 11 miles and 13.9 miles respectively. If the employees are classified as salaried (professional and clerical) and hourly (production) it is found that the median driving distance for salaried workers in 1967 was 12 miles while for hourly employees the median was 16 miles.[3] In 1960, the median driving distance for salaried employees was 11 miles, and for hourly employees it was 15 miles. A comparison of these figures on average driving distance for the two years would seem to indicate that no significant changes occurred in the OCAMA labor force commuting patterns during the seven-year period.

However, when the data are further classified by sex it is found that a very significant change occurred in the commuting behavior of female employees, especially in the hourly female category. In 1960, the median driving distance for hourly female employees was 13 miles; in 1967, it had increased to 17 miles. The greatest one-way driving distance reported by a female employee in 1960 was 62 miles. However, in 1967 there were 20 female employees who reported that they drove

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[3]This fact was revealed by the analysis in Chapter IV. For the distribution by driving distance of OCAMA employees classified by sex and job category (salaried or hourly) see Table V in Appendix C.

more than 62 miles one-way to work and the greatest driving distance reported by a female was 120 miles. Whereas in 1960, 9.91 per cent of all female employees reported a driving distance of 20 miles or farther, in 1967 the percentage of all female employees driving 20 miles or farther was 16.59.

Table VIII and Figure 11 also reveal changes that occurred in OCAMA's labor force commuting patterns between 1960 and 1967. These data reflect the shifts that occurred in the residential distribution of the OCAMA labor force during this period. The greater percentage of employees commuting one to five miles in 1967 reflects the increase in the number of employees who lived in Del City and Midwest City which border OCAMA to the west and north respectively. On the other hand, the decreased percentage of workers commuting six to twenty miles in 1967 corresponds to the decline in the number who resided in Oklahoma City and the remainder of Oklahoma County. The increase in the percentage of workers commuting distances greater than twenty miles, 20.27 per cent in 1967 and 17.73 per cent in 1960, is due to the enlarged geographical area from which OCAMA drew its labor force.

Chapter IV presented the 1967 OCAMA labor force commuting patterns in terms of driving time as well as distance. A comparison of data on commuting time for 1960 and 1967 reveals that even though the mean and median driving distance had not changed appreciably the average time spent in the journey-to-work had declined significantly. In 1960, the median travel time was thirty minutes for all employees, twenty-five minutes for salaried employees, and thirty minutes for hourly employees. In 1967, the median driving times were: all employees, twenty minutes; salaried employees, twenty minutes; and hourly employees,

TABLE VIII

DISTRIBUTION OF OCAMA EMPLOYEES BY COMMUTING DISTANCE ZONES, 1960 AND 1967

Commuting Distance (Miles)	1960			1967		
	Number of Employees	Per Cent of Total	Cumulative Per Cent	Number of Employees	Per Cent of Total	Cumulative Per Cent
1-5	5,270	28.44	28.44	6,410	30.83	30.83
6-10	3,779	20.40	48.84	4,029	19.38	50.21
11-15	4,213	22.74	71.58	3,990	19.20	69.41
16-20	1,982	10.69	82.27	2,147	10.32	79.73
21-30	1,196	6.45	88.72	1,692	8.12	87.85
31-40	1,241	6.70	95.42	1,447	6.96	94.81
41-50	422	2.28	97.70	527	2.53	97.34
51-60	245	1.32	99.02	326	1.58	98.92
Over 60	181	.98	100.00	218	1.08	100.00
Total	18,529	100.00	100.00	20,786	100.00	100.00

Source: Data for 1960 are from R. W. Poole, Characteristics and Commuting Patterns..., Table 30, pp. 62-63. Data for 1967 are from the questionnaire.

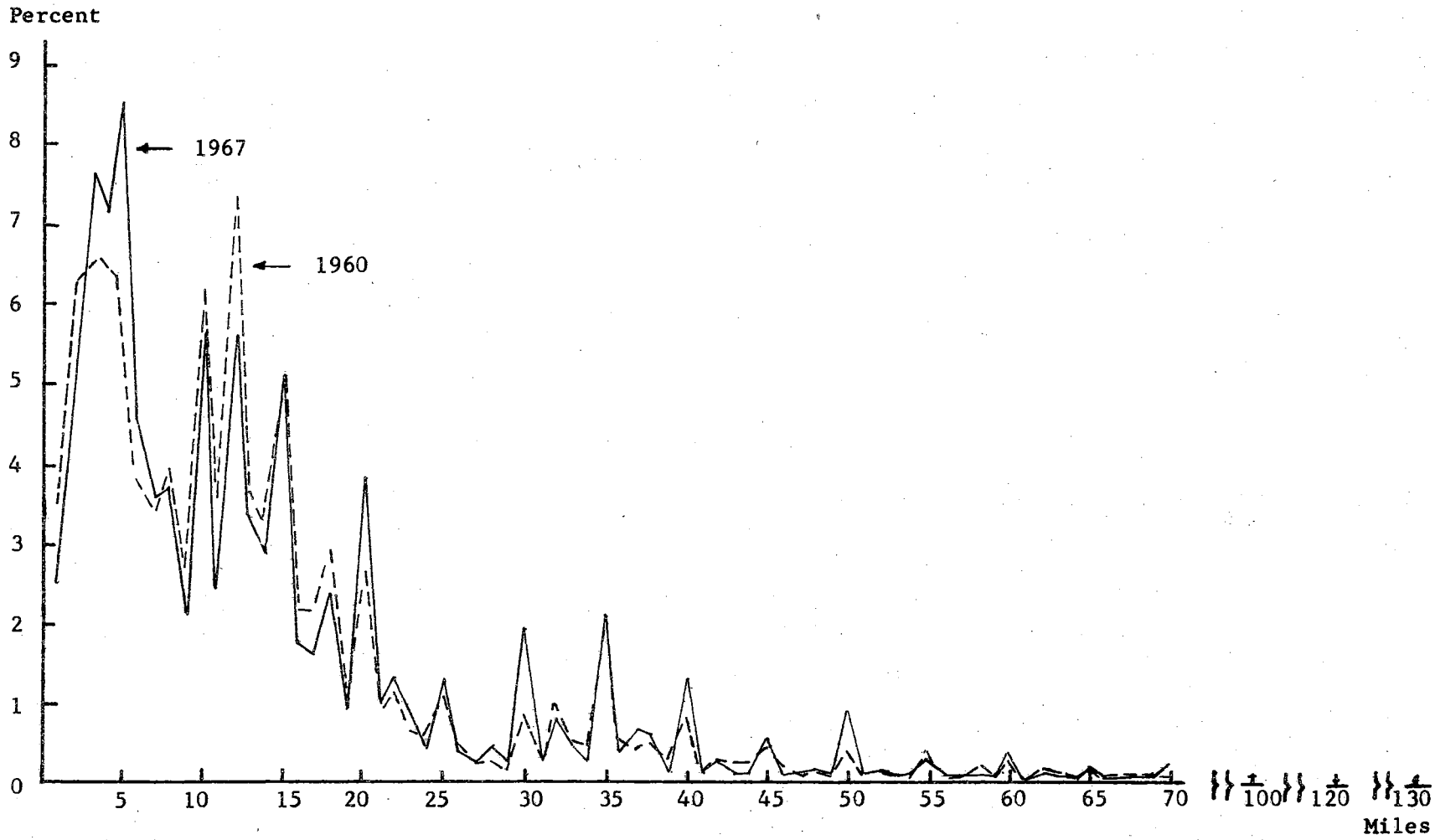

Figure 11. Percentage Distribution of OCAMA Employees by One-Way Driving Distance, 1960 and 1967

twenty-five minutes. This sizable decrease in driving time, quite clearly, is the result of great improvements and expansions in highway facilities in the OCAMA vicinity and in the central Oklahoma area. These highway changes will be outlined and related to the changes in the OCAMA labor force commuting patterns in the next section.

Factors Associated With the Changes in the Commuting Patterns

In Chapter IV selected factors were related to the 1967 OCAMA labor force commuting patterns. Those factors which were investigated as possible determinants of the 1967 patterns were: population distribution, commuting distance, and intervening employment opportunities, OCAMA hiring policies, expansion, and wage rates, and selected personal characteristics of the OCAMA labor force. The purpose of the following analysis is to discuss factors which may have accounted for the changes that occurred in the residence and commuting patterns of the OCAMA labor force between 1960 and 1967. The factors to be analyzed are 1) shifts in the distribution of population, 2) expansion in the highway system, and 3) changes in the composition of the OCAMA labor force.

Population Distribution

In Chapter IV a significant relationship was found between the number of OCAMA commuters originating from a county and the population of the county and commuting distance separating it from OCAMA. The purpose here is to determine to what extent changes in the distribution of population in the central Oklahoma area altered the structure of the

OCAMA laborshed area.

Table I in Chapter III presented the 1966 distribution of population by county in the central Oklahoma area and the percentage change in each county's population between 1960 and 1966. Table IX presents for each of the ten counties the percentage increase between 1960 and 1967 in the number of OCAMA employees residing in each county. As the table shows, for five of the ten counties the number of OCAMA employees increased by more than a third. When the change in the number of OCAMA employees living in each county was correlated with the change in the population for the county a simple correlation coefficient of 0.82 resulted. This coefficient is significant at the 1 per cent level of significance. When the population changes were adjusted for commuting distance between the county centers and OCAMA the correlation coefficient was lower rather than higher as might be expected.[4] Thus, the increase in the number of OCAMA workers was rather closely associated with the population change that occurred in each county. This finding, of course, is not surprising since the analysis in Chapter IV revealed that the drawing power of OCAMA was closely related to the distribution of population in the central Oklahoma area.

Highway System

Figure 2 in Chapter III depicts the highway system, especially the

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[4]When the change in the population of each county was divided by the commuting distance separating the county from OCAMA and then correlated with the change in the number of commuters the resulting correlation coefficient was 0.64. When the change in population was divided by the square of the commuting distance the resulting coefficient was 0.57. Similar coefficients were derived when the percentages in population and numbers of commuters were used.

TABLE IX

NUMBER AND PER CENT OF OCAMA EMPLOYEES RESIDING IN TEN CENTRAL OKLAHOMA COUNTIES, 1960 AND 1967

County	1967 (1)		1960 (2)		Percentage Increase in OCAMA Employees 1960-1967 (3)
	Number	Per Cent of Total Employment	Number	Per Cent of Total Employment	
Canadian	144	0.7	107	0.6	34.6
Cleveland	1,483	7.2	798	4.3	85.8
Grady	145	0.7	128	0.7	13.3
Lincoln	378	1.8	301	1.6	25.6
Logan	243	1.2	207	1.1	17.4
McClain	169	0.8	160	0.9	5.6
Okfuskee	79	0.4	48	0.3	64.6
Oklahoma	15,917	77.2	15,319	83.0	3.9
Pottawatomie	1,768	8.6	1,191	6.5	48.4
Seminole	290	1.4	204	1.1	42.2

Source: Column (1) Questionnaire
Column (2) Poole, Characteristics and Commuting Patterns..., Table 40, p. 72.

system of divided, limited access highways, as it existed in 1967 in the ten county area surrounding OCAMA. Very significant changes occurred in the transportation facilities during the period 1960 to 1967. Figure 12 presents the additions that were made to the highway system that existed in 1960. The changes that occurred in the central Oklahoma area highway system appear to account to a large extent for the alterations that occurred in the OCAMA labor force commuting

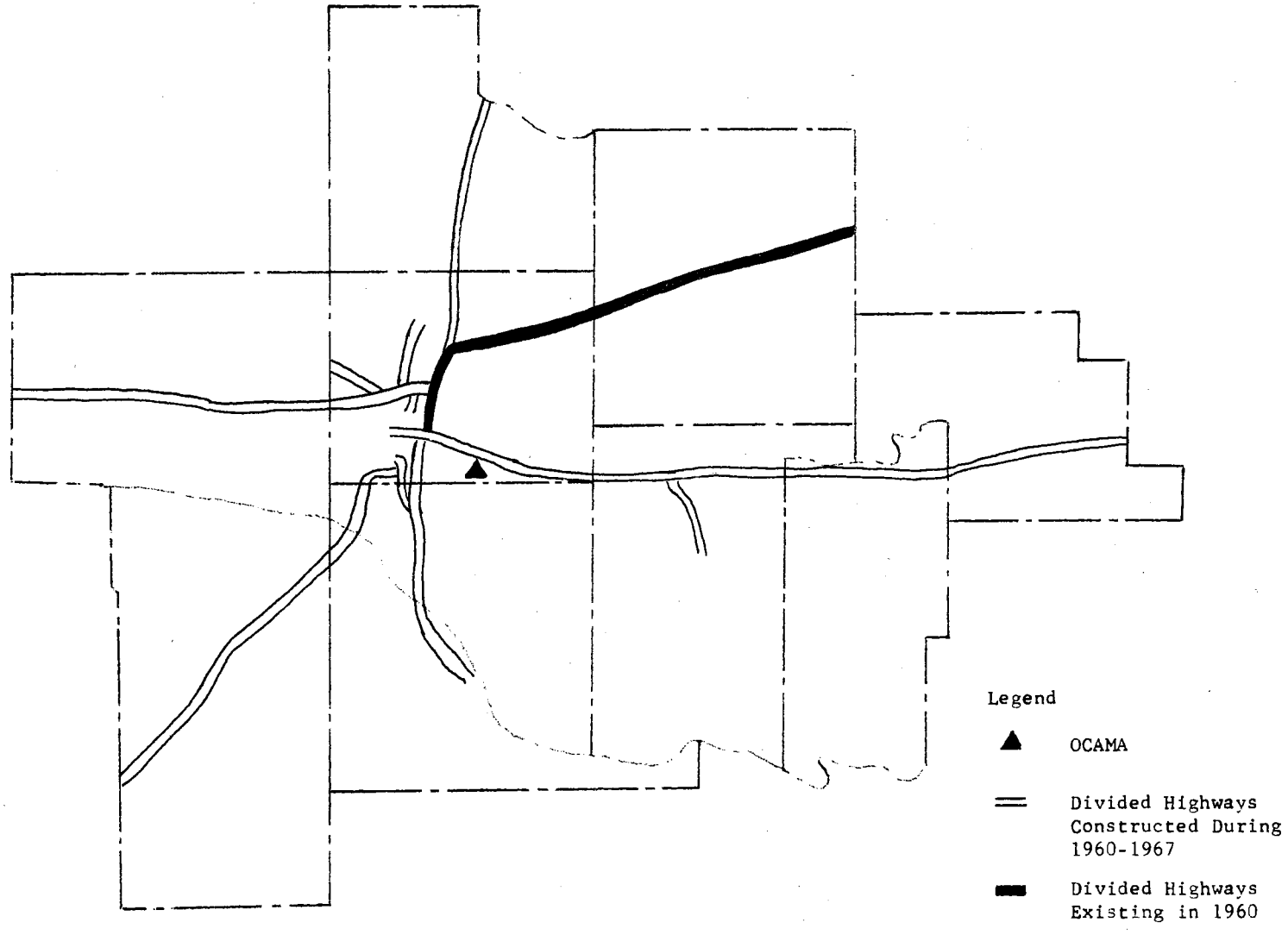

Figure 12. Additions to the System of Four-Lane, Divided Highways in the Central Oklahoma Area, 1960-1967

patterns. During the period 1960 to 1967 four-lane, limited access highways were constructed which radiated to the north, east, south, southwest, and west of OCAMA. These areas were brought closer to OCAMA in terms of both distance and time. As Chapter IV noted, the median distance traveled by the OCAMA labor force in 1967 was essentially equal to the median driving distance in 1960. However, the median time spent in commuting to work declined from thirty minutes in 1960 to twenty minutes in 1967. Thus, commuters from outlying areas were able in 1967 to travel these high-speed roads directly to OCAMA.

The most significant changes that occurred in the highway system in the OCAMA laborshed were (1) the construction of portions of Interstate 40 which extended west from OCAMA to downtown Oklahoma City, and west from El Reno in Canadian County to Clinton in Custer County, and east from OCAMA more than one-hundred miles to Checotah in McIntosh County, (2) an extension of Interstate 35 north from Oklahoma City into the state of Kansas and south to Purcell in McClain County, (3) construction of U.S. 62 connector and the H. E. Bailey Turnpike extending ninety-two miles southwest of OCAMA into the state of Texas, and (4) U.S. 177 connecting the Tecumseh urban area in Pottawatomie County to I-40 at Shawnee. In addition to these highway expansions, improvements were made in the street and expressway system in the Oklahoma City vicinity. Most notable were the Southwest Expressway (I-40 and U.S. 62) making OCAMA more easily accessible from southwest and west Oklahoma City, and the South Central and Broadway Expressways in south and north Oklahoma City respectively.

These highway changes were significant in geographically reshaping and expanding OCAMA's labor market area. The analysis in Chapter IV

found seven counties in which OCAMA's drawing power was underestimated in both the commuting distance and intervening opportunity interaction models. As a result of the highway changes, the population centers of six of these seven counties, Grady, Logan, McClain, Okfuskee, Pottawatomie, and Seminole, were linked directly to OCAMA, thus making OCAMA more readily accessible for residents of these counties and enlarging OCAMA's drawing power from them. The most significant changes in the number of commuters occurred in counties to the east and southeast of OCAMA. Three counties, Okfuskee, Pottawatomie, and Seminole, experienced increases in their number of OCAMA commuters during the period 1960 to 1967 of 64.6 per cent, 48.4 per cent, and 42.2 per cent respectively. These are considerably greater than the 12.2 per cent increase in the OCAMA labor force as a whole. These three counties during the six-year period 1960 to 1966 had population changes of 0.6 per cent, 1.2 per cent, and -6.2 per cent respectively. Thus, the construction of Interstate Highway 40 would seem to account for the sharp increase in OCAMA's drawing power from these counties.

Labor Force Composition

A comparison of personal characteristics of the OCAMA labor force in 1960 and 1967 reveals that the most significant change occurred in the hourly female category. In 1960, the median age and length of service of this group of workers were 50 years and 11 years respectively. In 1967, the median age of hourly female employees was 41 years and the median years of employment was 1 year. The number of hourly female employees increased by 65.7 per cent, from 757 in 1960 to 1,254 in 1967. The percentage increase in the OCAMA work force as a

whole was only 12.2 per cent. This rapid expansion in the employment of females in production coupled with a high rate of retirement of older females who had been employed in hourly positions in 1960 resulted in a much younger group of employees in this category with a greatly shortened length of service.[5] More than forty-six per cent of the hourly female employees had less than one year of employment. In addition to the above changes in the hourly female category, in 1967, 84.9 per cent of the hourly female employees were married and only 3.2 per cent were widowed, whereas in 1960 only 56.7 per cent were married and 29.1 per cent were widowed.

This change in the composition of OCAMA's labor force was noted in Chapter IV in the analysis dealing with personal characteristics and commuting behavior of the OCAMA work force. The short-run effect of the increase in the number of female employees and the change in the characteristics of these new workers--younger and a greater percentage married--on the commuting patterns of OCAMA's labor force has been to increase only slightly the average commuting distance. Whether the longer-run effects will be different from the short-run influence depends on the willingness of these new female employees to continue to commute considerable distances. To the extent that they are secondary income earners, and possibly travel to work with their husbands, there may be no residence adjustment which would decrease their home-work separation.

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[5]In 1967, 63.4 per cent of the hourly female employees had 1 year or less employment. In 1960, 31.7 per cent of the female hourly employees were 55 years of age or older, thus a great number would have retired by the time the study was performed in 1967.

This chapter has related three factors to the changes that occurred in the OCAMA labor force residential and commuting patterns from 1960 to 1967. These factors were county population changes, improvement and expansion of the central Oklahoma highway system, and the changing composition of the OCAMA labor force. The most important factor altering the residence and commuting patterns during this period seems clearly to be the growing highway facilities which made OCAMA more accessible to residents of the population centers of the counties in the central Oklahoma area.

CHAPTER VI

SUMMARY AND CONCLUSIONS

This study has attempted to accomplish two primary objectives: 1) to describe and explain the commuting behavior and residence patterns of the Oklahoma City Air Materiel Area labor force as they existed in 1967; and 2) to determine those factors which were most significant in explaining the alterations that occurred in the OCAMA work force commuting and residence patterns between 1960 and 1967. The study of the residence and commuting patterns of the labor force of OCAMA revealed that the OCAMA laborshed area is a large geographical portion of Oklahoma. In 1967, OCAMA drew its work force from 29 Oklahoma counties and from 166 different cities. Twenty-three per cent of OCAMA's workers lived in counties other than Oklahoma County where OCAMA is located, and over 15 per cent lived outside the Oklahoma City SMSA (Oklahoma, Cleveland, and Canadian Counties). The purpose of this chapter is to summarize the findings of this study. First, the findings of the analysis of factors associated with the 1967 OCAMA labor force commuting patterns will be presented, and then the results from the analysis of factors associated with the changes that occurred in the commuting and residence patterns of OCAMA employees between 1960 and 1967 will be given.

Factors Associated With the 1967 OCAMA Commuting Patterns

Possible factors explaining the 1967 residence and commuting patterns of the OCAMA work force were analyzed in three categories: 1) geographic and economic characteristics of the OCAMA laborshed area, 2) characteristics of OCAMA, and 3) personal characteristics of the OCAMA labor force. Gravity potential or interaction models were utilized to measure the degree of relationship between OCAMA's drawing power from its laborshed and the distribution of population, commuting distance, and intervening employment opportunities. It was found that when distance (commuting distance between OCAMA and the county center) was related statistically to the drawing power of OCAMA (OCAMA workers per 10,000 population in the county) approximately 51 per cent of the variation in county commuter totals was explained. When intervening employment opportunities were substituted for commuting distance in the model, only 24 per cent of the variation in OCAMA's drawing power from its laborshed counties was statistically accounted for.

This analysis suggests that while distance, population distribution, and intervening opportunities are important in structuring the OCAMA laborshed area, other factors are important in explaining the residential patterns and commuting behavior of OCAMA workers. Some of these possible factors were suggested by the regression techniques used to estimate the interaction models. A comparison of the residuals from regression for the two models revealed that OCAMA's drawing power from one group of seven counties was underestimated by both models. These counties were generally characterized by the following factors: direct

accessibility to OCAMA via limited access, divided highways; relatively low per capita incomes (all with a per capita income at least $375 below the State figure in 1967); low manufacturing wage rates; declining or stagnant populations (except Lincoln County); and high relative importance of agriculture in most of the counties.

The pattern of highways seems to be one of the most important factors in explaining OCAMA labor force commuting patterns. As noted above, the population centers of those counties where OCAMA's drawing power was underestimated in both the commuting distance and intervening opportunity models have direct accessibility to OCAMA by the highway system in the OCAMA laborshed area. Residents of these counties are able to travel at high average speeds directly to OCAMA. Thus, OCAMA is closer in time to many long-distance commuters, especially those living to the southeast of OCAMA, than it is to many residents of Oklahoma City and other parts of Oklahoma County and counties to the north and northwest which are geographically closer. The effect of the transportation supply on the OCAMA labor force commuting patterns will be discussed further as a factor explaining changes in the commuting behavior of OCAMA employees between 1960 and 1967.

Three characteristics of OCAMA were analyzed for their possible effect on the commuting patterns of the OCAMA labor force. These factors were the hiring policies of OCAMA, OCAMA's expansion, and OCAMA wage rates. All three of these factors appear to have an expanding effect on OCAMA's drawing power.

The OCAMA personnel office has no policy with respect to the residential location of its employees. Nor does OCAMA attempt to encourage new employees recruited from distant areas to relocate their residences

to shorten their journey-to-work trip. In order to expand its work force to meet newly assigned responsibility, OCAMA has found it necessary to recruit heavily from the surplus labor areas in the central Oklahoma area. This is reflected in the wide geographical distribution of worker residences.

The effect of the expansion in the size of OCAMA's labor force on the geographical area of OCAMA's labor market area was revealed by the greater commuting distances of the newer employees. Employees with one year or less employment traveled an average distance of 18.6 miles one-way while the average for the labor force as a whole was 14.4 miles. Or, stated in terms of long-distance commuting, employees with one year or less employment were 26.4 per cent of those employees who traveled twenty miles or farther one-way to work but were only 21.9 per cent of all OCAMA employees. The OCAMA had expanded its employment by 2,774 in the year preceding the time the study was performed. This labor force expansion had the effect of expanding the OCAMA laborshed area.

The OCAMA average weekly wage rate was higher than the average weekly manufacturing wage rate in nine of the ten OCAMA laborshed counties in 1967.[1] The difference in these wage rates varied from $8.86 in Oklahoma County to $50.00 in Okfuskee County. These differentials were especially high for those counties which were underestimated in both the commuting distance and intervening opportunities models. For example, the wage differentials for the four counties most underestimated by the commuting distance model were: Pottawatomie,

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[1]The average weekly manufacturing wage rate was not available for McClain County (See Table I).

$12.36; Lincoln, $25.71; Seminole, $35.14; and Okfuskee, $50.00. High average wage rates and expanding employment opportunities at OCAMA coupled with low numbers of manufacturing employment opportunities and low average manufacturing wage rates in most of these counties have resulted in a strong OCAMA drawing power from the central Oklahoma area.

Many studies have stressed the importance of attributes of workers in influencing their commuting behavior. To test the degree of association between selected OCAMA labor force personal characteristics and the commuting behavior of the OCAMA work force least squares multiple regression techniques were employed. The finding of the analysis was that the set of selected characteristics--home ownership, type of residence, length of service, shift, marital status, sex, age, skill level, salary, and educational attainment--did not account, statistically, for an appreciable portion of the total variation in employee commuting distances and times. The percentage of the total variation in employee commuting distance and commuting time explained by this set of characteristics was 11.39 per cent and 10.31 per cent respectively.

The analysis indicated that driving distance and age are not statistically related and that driving distance is only slightly inversely related to length of service and income. This latter finding, that income and commuting distance are inversely related, is in disagreement with most commuting studies that have dealt with this relationship. Also, it was found that home owners drove on the average less than renters and those residing with a relative; farm dwellers commuted much farther than urban dwellers; male employees journeyed farther than female workers; and married workers traveled only slightly farther than single workers. Differences in commuting behavior when

employees were classified by shift and skill level were unclear. When employees were classified by educational attainment it was observed that commuting distance declined rather steadily through one year of college, but showed no clear trend for higher educational levels.

Determinants of Changes in the OCAMA Commuting Patterns

When the residence patterns of the OCAMA labor force were compared for the two years 1960 and 1967 some rather significant changes were noted. In 1960, OCAMA drew its labor force from twenty-four counties; in 1967, OCAMA employees lived in twenty-nine counties. Eleven counties were added to the list in 1967 while six counties that were reported in 1960 were not reported in 1967. The number of cities reported as the place of residence of OCAMA employees increased greatly between 1960 and 1967. In 1960, the OCAMA labor force lived in 120 Oklahoma cities; in 1967, this number had increased to 168. However, ten cities alone accounted for 86 per cent of all OCAMA employees in 1967 and 88 per cent in 1960.

The most significant changes with respect to the distribution of OCAMA employees by city of residence occurred in the immediate OCAMA area. The number of OCAMA employees living in Oklahoma City declined by 11.3 per cent, from 9,445 in 1960 to 7,579 in 1967. On the other hand, the number of employees residing in Midwest City and Del City, cities contiguous to OCAMA, increased by 55.5 per cent in total, from 3,754 to 4,749 in Midwest City and from 666 to 2,126 in Del City.

When the commuting patterns for the two years were compared no appreciable change was shown in the average driving distance, however,

the average driving time declined significantly. The average driving distance in 1960 was 13.9 miles; in 1967, it was 14.4 miles. The increase in the average driving distance was due primarily to the increase in the number of OCAMA employees who drove considerable distances. For example, the number of employees who commuted 50 miles or farther one-way increased by 27.7 per cent during the seven-year period, from 426 in 1960 to 544 in 1967.

The median commuting time declined from 30 minutes in 1960 to 20 minutes in 1967 and the mean driving time declined from 30.9 minutes in 1960 to 25.1 minutes in 1967. The fact that there was a significant decrease in the average commuting time despite the expanded geographical distribution of OCAMA employees' residences can be attributed largely to the changes that occurred in the highway system in the OCAMA laborshed. These changes in the transportation system were noted above. During the period 1960 to 1967 a divided highway was extended or newly constructed which connected OCAMA with most population centers in the central Oklahoma area. The degree of expansion of the highway system in the ten county OCAMA laborshed, the area from which OCAMA drew 99.4 per cent of its labor force in 1967, is shown by the fact that each of these ten counties experienced at least a 25 per cent increase in its density of paved roads (See Table I). These highway changes, of course, allowed high speed travel from all areas of the OCAMA laborshed to OCAMA. These expansions in the highway system in the central Oklahoma area seem to be one of the most important factors reshaping OCAMA's laborshed area.

Chapter III presented the changes that occurred in the distribution of population in the OCAMA laborshed area during the period 1960 to

1966. In Chapter V, those county population changes were related to the changes from 1960 to 1967 in the number of OCAMA employees residing in each of the laborshed counties. It was found that a very high association existed between the absolute change in the population of each county and the change that occurred in the county's number of OCAMA commuters. The correlation coefficient for this relationship was 0.82. Thus, it could be concluded that the changes in the distribution of population significantly altered the geographical distribution of commuter origins.

In addition to the changes in the population distribution in the OCAMA laborshed area there were considerable alterations in the highway system. The construction of a four-lane, divided highway connecting OCAMA with the population centers in most of the counties in the central Oklahoma area also accounted for a large part of the change that occurred in the geographical distribution of OCAMA workers. This impact of new road construction was most significant in increasing OCAMA's drawing power from the counties to the east and southeast. These counties experienced slow or declining population growth during the period 1960 to 1966. However, three of these counties had increases in their number of OCAMA workers of more than 40 per cent.

The third factor analyzed for its influence in changing the commuting and residence patterns during the seven-year period was the composition of the OCAMA labor force. The only significant change noted in the labor force was in the composition of female employees, especially in the hourly female category. The number of hourly female employees increased by 65.7 per cent in the seven-year period compared to an increase of 12.2 per cent in the labor force as a whole. This

rapid expansion in the employment of females in production coupled with a high rate of retirement of older females resulted in a much younger group of female workers with a greatly reduced length of service. In 1960, the median age for hourly female employees was 50 years; in 1967, the median age had declined to 41 years. The median years of employment also declined greatly, from 11 years in 1960 to 1 year in 1967.

The commuting behavior of this group also changed dramatically during this period. In 1960, hourly female employees drove on the average 13.2 miles one-way. The average driving distance of this group increased to 16.9 miles in 1967. In 1960, the greatest one-way driving distance reported by an hourly female worker was 55 miles; in 1967, there were 23 hourly female employees who reported that they drove more than 55 miles and the greatest one-way driving distance reported by an hourly female employee was 85 miles.

It was observed in Chapter V that while the short-run effects of this change in the OCAMA work force composition, as well as the expansion in OCAMA employment, had resulted in an increase in the amount of commuting, the long-run effects are uncertain. It is possible that the new employees who were long-distance commuters had not accumulated sufficient seniority to feel secure in their positions and were not willing to move closer. To the extent this is true, then over time these workers may gravitate closer. However, as noted above, 85 per cent of the hourly female workers were married and were, therefore, secondary income earners. Thus, they may not be willing to relocate their place of residence in order to shorten their work trip and the effect of the change in labor force composition may result in a rather permanent expansion in the OCAMA labor market area.

This study has found that two characteristics of the central Oklahoma area--population distribution and transportation facilities--seem to influence greatly the geographical configuration of the OCAMA laborshed. Other factors were also found to be important. For example, those counties which supplied a greater number of OCAMA employees than the gravity potential models would predict were characterized as lower wage and income counties with a high proportion of their employed residents engaged in agriculture.

These findings provide insight into the strategic variables in predicting future interaction between employment centers and the peripheral areas. A knowledge of the interaction between employment growth centers and the outlying areas, especially when these areas are economically stagnant or declining, is vitally important to planning--planning for urban growth and change, planning an area transportation system, and in planning for economic development of backward areas. Commuting may be a vehicle for stimulating the economic growth of depressed areas. With adequate transportation facilities commuting to employment in the urban center may provide a source of income to residents of depressed areas. Commuting may serve as an intermediate step in an urbanization process that culminates in migration or it may serve as a substitute for migration, thereby, more permanently injecting income into these areas. Future study of journey-to-work behavior, especially of long-distance commuters, would provide valuable information for developmental decision making.

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APPENDIX A

PROCEDURE FOR PRE-TESTING, DISSEMINATION, AND COLLECTION OF QUESTIONNAIRE

This appendix outlines the procedure used in developing the questionnaire which was distributed to the OCAMA employees. In addition, it describes the method of distributing and collecting the questionnaires, the coverage of the survey, and the process of integrating the data from the questionnaire with the information from the employee's personnel record.

Pre-testing

In order to allow a great number of questions to be asked of the employees, and for the reviewing and data transfer to computer data cards to be simple, rapid, and accurate, it was decided early in the development of the questionnaire to use a method of pre-coding the answers where practicable. To test the feasibility of this method and to check the ability of employees to understand and correctly respond to the questions, a pre-test questionnaire was administered to a sample group of employees. A copy of this questionnaire is included in this appendix.

In order to test for possible weaknesses in the questionnaire a sample of thirty employees was selected by the OCAMA Personnel Management Branch. This branch services the personnel problems of the

four OCAMA directorates and in this function works in close contact with the supervisors in the various directorates. The Branch is functionally divided into two sections each servicing two of the directorates. A simple random sampling procedure was not used in selecting the thirty employees for the test group because of the difficulty that would be encountered in selecting employees completely at random, and because the number of strata that would have been necessary in order to meet the objectives of pre-testing the questionnaire would have been quite large. It was felt that a much simpler alternative procedure could be used which would select a group highly desirable as a test group in this situation. The procedure used was for the personnel director of each of the two sections to select a group of fifteen employees which would provide the following characteristics: a cross-section of employees from each of the major subdivisions (organizations) of the directorates, a cross-section of the workers according to type of job (janitor, apprentice, secretary, engineer, etc.), and a cross-section of the pay levels.

The pre-test questionnaire was then forwarded to each of the employees in the sample group with instructions to complete the questionnaire and return it to the personnel office for their directorate. The completed questionnaires were checked for possible errors that could be detected, for incompleteness, and for inconsistencies. Each of the thirty respondents was then asked a series of questions by the author in a personal interview. A copy of the questions asked is included at the end of this appendix. The purpose of the brief interview was to get impressions about the structure of the questionnaire, to check for questions whose meanings were unclear or were

thought to be too personal, and to discover the reasons for any errors or omissions. This step was helpful in designing the final questionnaire. It was found that the pre-coding of answers and the statement of most of the questions on the pre-test questionnaire were easily understood. However, as a result of information gained from the pre-testing some of the questions were deleted or reworded on the final questionnaire.

Final Questionnaire

Structure

A copy of the final questionnaire is at the end of this appendix. The questionnaire was designed to speed the data collection process and to enable computer tabulating without further coding. This was accomplished as noted above by pre-coding the answers and having respondents circle code numbers or letters opposite appropriate responses to the questions. Those questions whose answers were numbers (e.g., travel distance or time) needed no coding. This eased the procedure of editing the 20,000 plus questionnaires that were returned and made possible the transfer of the data to data processing cards without first transferring the information to data sheets.

For those questions where all alternative answers could not be listed, a category "other, please specify" was listed, allowing the respondent the opportunity to give an additional alternative. The numbers corresponding to the alternative answers were placed to the right side of the questionnaire to enable a keypunch operator to quickly and accurately make the data transfer.

One constraint placed on the questionnaire related to the number of possible questions that could be asked. It was felt that the key-

punching and verifying procedure would be simplified and the cost of the data transfer process lessened considerably if the maximum number of digits that could result from a completed questionnaire was limited to eighty. The eighty-digit constraint was a result of the number of columns on a data processing card. However, this constraint was of no major consequence due to the method of pre-coding the alternative responses which allowed a great number of questions to be asked.

Appended to the questionnaire were lists of states and Oklahoma counties and cities, each with a corresponding number, and a map of Oklahoma County and the Oklahoma City city limits from which a respondent living in this area could locate his place of residence. The use of these items on the questionnaire was debated since they could lead to confusion on the part of the respondent. However, they were employed quite satisfactorily in the pre-test questionnaire and were found to present few problems in the answering of the final questionnaire.

Coverage

The questionnaire survey was not designed to be a sample survey but rather attempted to include all civilian employees. At the time the survey was performed, June, 1967, the total OCAMA civilian work force numbered 23,885. Of this total, 3,099 did not participate in the survey for various reasons.

One reason for non-participation was the decision to eliminate from the survey those employees with less than thirty days of employment at OCAMA. The exclusion of these employees from the survey was undesirable, but was felt necessary for two related reasons. First,

a listing of these employees by organization was not available. A statistical listing of employees by organization was prepared from the Personnel Management and Civilian Skills Locator System--the master file maintained on each employee. (See the dissemination process described below.) However, the standard time lapse between the employee's date of starting to work and the incorporation of his records into the skill locator system was approximately thirty days. This meant that the name and organization of any employee hired during the thirty-day period prior to the distribution of the questionnaire would not be included on the statistical listing utilized for control in the dissemination and collection of the questionnaires.

The absence of information on the location of these new employees was a factor in the decision to omit them from the survey. In addition, a major factor contributing to this decision was the fact that information on these employees from the master personnel record would not be readily available. A copy of the computer tape containing the master records was reserved for the nearest date to that on which the questionnaire was distributed. If a tape compiled at a later date had been reserved, it would have included many of the employees who were new at the time the questionnaire was disseminated but it would not have included records for many of the employees who would have left employment with OCAMA during the lapsed time.

In addition to the exclusion of new employees, a great number of employees, 1,584, could not be included in the survey because they were unavailable for one of the following reasons: annual leave, sick leave, or temporary assignment at another installation (TDY).

As a result of the above factors, 21,874 employees received a

questionnaire. Of this number 21,436, or 97.95 per cent of the workers, returned a questionnaire. Thus, only 438 employees or 2.05 per cent of the employees chose not to participate. After the completed questionnaires were edited, 20,786 were found to be reliable and complete enough to be used. This number, as noted earlier, represents an "effective" rate of response of 94.98 per cent (useable questionnaires as a per cent of total number surveyed).

Dissemination and Collection Procedure

In order to get a maximum number of questionnaires completed and returned a procedure was established to ensure maximum control over the dissemination and collection of the questionnaires. The following procedure was used to provide the necessary control. An alphabetical listing of employees by organization was generated from the personnel master records. These lists and an appropriate number of questionnaires were distributed to all OCAMA organizations with a letter of instruction signed by the personnel director (a copy of the letter is included at the end of this appendix). The letter directed that a questionnaire be completed by each employee on the organization's statistical listing presently on duty and returned within fourteen days. As the questionnaires were returned to the supervisors and forwarded to the personnel director's office a check mark was to be placed by each respondent's name on the statistical listing. Questionnaires for employees on annual leave or sick leave were allowed to be held for an additional twenty-seven days and were to be completed as the employee became available.

In the event an employee had been transferred to another organiza-

tion, the questionnaire was to be forwarded to him at his new organization and this was to be indicated on the statistical listing. If the employee's new organization was not known to the supervisor, he was instructed to send the employee's name to the personnel office. In turn, employees recently transferred into an organization were added to the statistical listing and their questionnaires completed and returned upon receipt from their previous assignment. The instructions called for drawing a line through the names of employees who had been separated. At the end of the forty-one day period the statistical listing together with remaining questionnaires was to be returned to the personnel office. This procedure was used by Poole in his study and in both surveys proved effective in control and provided a very high level of response.

Questionnaire Review

To ensure that data used in the analysis were reliable, each questionnaire was reviewed upon its return. The purpose of the review was to eliminate from the survey those questionnaires that were too incomplete to provide adequate data, questionnaires that contained errors that could be detected by cross-checking against other answers, and those questionnaires that contained obviously erroneous answers. The careful examination of each questionnaire and the elimination of some for the above reasons ensured that the data were highly reliable.

Keypunching and Integration of the Data

When the questionnaires had been reviewed, those found to be acceptable (20,786) were forwarded to the data processing division for

transfer to computer cards. The transfer of data to data processing cards was done directly from the questionnaires. The operation was made simple by the arrangement of the questionnaire such that each answer appeared in columns on the right side of the questionnaire. To ensure correct data transfer the keypunching operation was verified by repeating the process.

Once the transfer to computer cards had been completed the data were transferred to a computer tape. Computer programs were then written to extract data from the master tape and integrate it with the data from the questionnaires. The integration of the data for each employee from the two sources was achieved by using the employee's time clock number which appeared in both records.

PRE-TEST QUESTIONNAIRE

OCAMA Labor Study Questionnaire

Note: All answers should be placed in the space provided at the right of the question. With few exceptions, your answer should consist of a number or a circle placed around a number next to the appropriate response. In some cases the question may clearly not apply to you and should be left blank. Please make all answers (numbers, words, or circles) so that they can be read accurately.

1. CLOCK NUMBER: Place your clock number in the space to the right. _____

2. CURRENT ADDRESS:

   (a) County. Place in the blank the number appearing next to the name of the county in which you live. (A listing of counties and their numbers is on Page 6 of this questionnaire.) _____

   (b) Is your residence inside a city limits? (Circle the appropriate number.)
   Yes--1
   No--2

   (c) City. Place in the blank the number appearing next to the name of the city in which you live, or if your residence is outside the city limits then the closest city. (A listing of Oklahoma cities is on Page 7 of this questionnaire. If the city in which you live does not appear in the list then print the name of the city in the blank to the right.) _____

   (d) If this is an Oklahoma City, Midwest City, The Village, Nichols Hills, Bethany, or Warr Acres address, then locate your residence on the map on Page 8 of this questionnaire and place the number of that area in the blank to the right. _____

   (e) How long have you lived at this address? Years_____

   (f) At this address do you (Circle the appropriate number.)
   Rent--1
   Own--2
   Live with parents or relatives--3

   (g) If this residence is a farm, give its size in acres. _____

3. ADDRESS WHEN HIRED BY OCAMA FOR THE FIRST TIME

If the address where you lived when you were hired by OCAMA for the first time is the same as your present address, then skip question 3 and go on to question 4. If the address is not the same, then complete question 3.

(a) If the address was in Oklahoma, then place in the blank the number of the county and city where you lived when first hired. (The same listing of counties and cities used in question 2 should be used. If the city is not listed then print the name of the city in the blank next to the word "city.")

County_____

City_____

(b) If the address was not in Oklahoma, then place in the blank the number appearing next to the name of the state (in the list of states and foreign countries on Page 6 of this questionnaire.)

_____

(c) If the address was an Oklahoma City, Midwest City, The Village, Nichols Hills, Bethany, or Warr Acres address, then locate that address on the map on Page 8 of this questionnaire and place the number of that area in the blank to the right.

_____

(d) At this address did you (Circle the appropriate number.)

Rent--1

Own--2

Live with parents or relatives--3

(e) Was this residence a farm? (Circle the appropriate number.)

Yes--1

No--2

(f) Is your present residence closer to OCAMA than your last previous residence? (Circle the appropriate number.)

Yes--1

No--2

(g) If your answer to question 3f was yes, was the main reason for moving to your present residence to get closer to your work? (Circle the appropriate number.)

Yes--1

No--2

(h) Would you move closer to OCAMA if housing like you now have were available at an equal price? (Circle the appropriate number.)

Yes--1

No--2

4. TRAVEL TO WORK DATA

(a) What is the driving distance from your home to the OCAMA parking lot (one-way based on the route normally taken to work)? _____

(b) How long does it normally take to make this trip? (in minutes)_____

(c) How do you normally get to work? (Circle the appropriate number.)

Auto--1

Bus--2

Bicycle--3

Motorbike or Motorcycle--4

Walk--5

(Please specify) _____ Other--6

(d) Do you belong to a car pool? (Circle the appropriate number.)

Yes--1

No--2

(e) What is the approximate amount of money you spend each week for transportation to and from work? (Round off your answer to the nearest dollar.) $ _____

(f) What is your next best alternative means of transportation to get to work? (Circle the appropriate number.)

Auto--1

Bus--2

Bicycle--3

Motorbike or Motorcycle--4

Walk--5

Other--6

(g) Is bus service available from your present residence to OCAMA? (Circle the appropriate number.)

Yes--1

No--2

(h) If bus service is available from your residence to OCAMA but you do not use it which one of the following best describes your reason for not riding a bus? (Circle the appropriate number.)

Costs more than my present means of transportation--1

Takes longer to get to work by bus--2

Do not like to ride a bus--3

Other, please specify_____--4

(i) If bus service is not now available but were made available in the future, would you use it rather than your present means of travel to work? (Circle the appropriate number.) Yes--1

No--2

(j) How much farther would you be willing to travel to work (not necessarily to OCAMA) than you now do? (in miles) _____

(k) How much additional time would you be willing to spend in traveling one-way to work (not necessarily to OCAMA)?

(in minutes) _____

(l) If you live 20 miles or farther from OCAMA why have you not moved closer? (Circle the one most appropriate number.)

Inadequate housing available closer to OCAMA --1

Own home where now live --2

Prefer smaller city --3

Present residence allows part-time farming --4

Job is temporary --5

Plan to move in the near future --6

Community ties --7

Family obligations --8

Other, please specify _____ --9

5. WORK EXPERIENCE

(a) How long have you worked at OCAMA? Years _____

Months _____

(b) What shift are you now working? (Circle the appropriate number.)

Day--1

Swing--2

Graveyard--3

(c) Which one of the following best describes what you were doing just before you were hired by OCAMA?

Employed elsewhere--1

In school--2

Housewife--3

Disabled--4

In the Armed Forces--5

Unemployed, but seeking employment--6

Other, please specify _____--7

(d) Was your last previous job in Oklahoma? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes--1

No--2

(e) Was your last previous job in Oklahoma City? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes--1

No--2

(f) Was your work full-time farming when hired by OCAMA? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes--1

No--2

(g) If you live 20 miles or farther from OCAMA, would you seek employment nearer your place of residence if it were available? (Circle the appropriate number.)

Yes--1

No--2

(h) If you have service at another AFLC installation, did you come to OCAMA because of DOD phase-out? (Circle the appropriate number.)

Yes--1

No--2

(i) If your answer to 5h is yes, then indicate from which AFLC installation you transferred. (Circle the appropriate number.)

Middletown--1

Mobile--2

Rome--3

6. PERSONAL DATA

(a) Are you (Circle the appropriate number.)

Married--1

Single--2

Widowed--3

Divorced--4

(b) What is the size of your family (including yourself) living at your place of residence? _____

(c) How many other members of your family living with you work (excluding yourself)? _____

(d) What is the approximate total monthly income of all members of your family living with you (including yourself)? (Circle the number next to the interval which includes your monthly family income.)

Less than $199--1

$200 to $399--2

$400 to $599--3

$600 to $799--4

$800 to $999--5

$1,000 to $1,199--6

$1,200 to $1,399--7

Over $1,400--8

(e) How many people living with you who are not now working would take full-time jobs if they were offered to them (not necessarily at OCAMA)? _____

(f) What is your age? _____

(g) Place of birth: Place in the blank the number of the state or foreign country where you were born in the list on Page 6 of this questionnaire. If place of birth was in Oklahoma, then also indicate the county. (If the name of the foreign country in which you were born is not listed, then print the name of that country in the blank.)

State _____

Foreign Country _____

County (if in Oklahoma) _____

(h) Was your place of birth a farm? (Circle the appropriate number.)

Yes--1

No--2

(i) What was the single most important reason for your accepting employment at OCAMA? (Read all choices and then circle the number next to the one most important.)

Higher pay--1

Disliked previous employment--2

Disliked previous place of residence--3

Desired to return to Oklahoma--4

Desired to live in Oklahoma--5

I was offered a transfer and had little choice--6

Opportunities for job advancement--7

Fringe Benefits (Paid vacation, retirement plan, etc.)--8

Other, please specify _____ --9

(j) What was your last completed level of education? (Read all choices and then circle the one appropriate letter.)

Did not graduate from high school --A

High school vocational program graduate --B

High school general or college preparatory program graduate --C

Two-year post-high school technical Institute graduate other than Okmulgee Tech --D

Graduate of post-high school trade program other than Okmulgee Tech --E

Graduate of two-year program at Okmulgee Tech --F

Completed an apprenticeship program in trade --G

Graduate of a technical program at a two-year junior college --H

Graduate of a two-year junior college in other than a technical program --I

Bachelor's degree or higher --J

Business, commercial, or secretarial school --K

Other (Please specify) _____ --L

OKLAHOMA COUNTIES

COUNTY	CODE
Adair	01
Alfalfa	02
Atoka	03
Beaver	04
Beckham	05
Blaine	06
Bryan	07
Caddo	08
Canadian	09
Carter	10
Cherokee	11
Choctaw	12
Cimarron	13
Cleveland (County)	14
Coal	15
Comanche (County)	16
Cotton	17
Craig	18
Creek	19
Custer	20
Delaware (County)	21
Dewey (County)	22
Ellis	23
Garfield	24
Garvin	25
Grady	26
Grant	27
Greer	28
Harmon	29
Harper	30
Haskell (County)	31
Hughes	32
Jackson	33
Jefferson	34
Johnston	35
Kay	36
Kingfisher (County)	37
Kiowa	38
Latimer	39
Leflore	40
Lincoln	41
Logan	42
Love	43
McClain	44
McCurtain	45
McIntosh	46
Major	47
Marshall	48
Mayes	49
Murray	50
Muskogee (County)	51
Noble (County)	52
Nowata (County)	53
Okfuskee (County)	54
Oklahoma (County)	55
Okmulgee (County)	56
Osage	57
Ottawa	58
Pawnee (County)	59
Payne	60
Pittsburgh	61
Pontotoc	62
Pottawatomie	63
Pushmataha	64
Roger Mills	65
Rogers	66
Seminole (County)	67
Sequoyah	68
Stephens	69
Texas (County)	70
Tillman	71
Tulsa (County)	72
Wagoner (County)	73
Washington (County)	74
Washita	75
Woods (County)	76
Woodward (County)	77

STATES

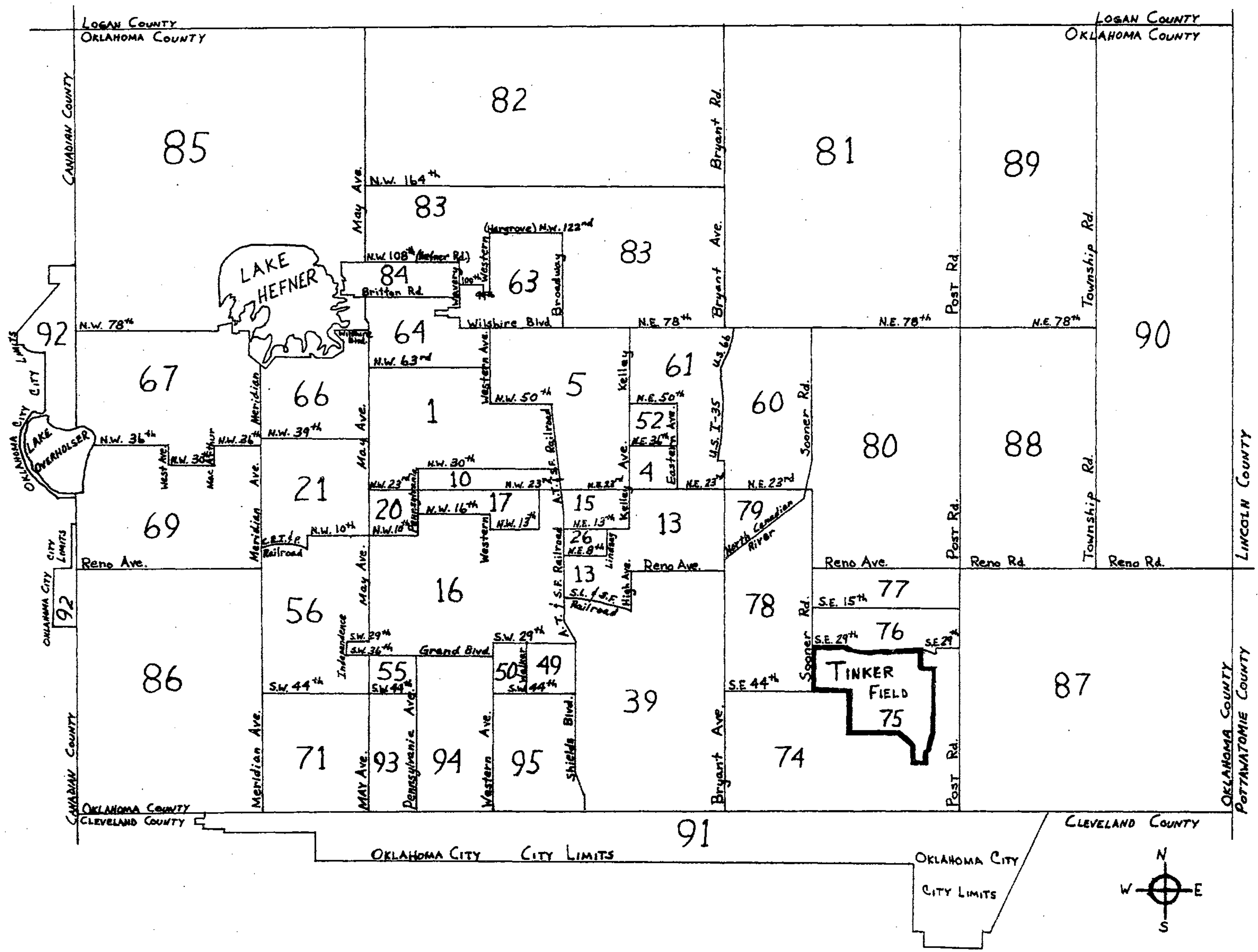
STATE	CODE
Alabama	01
Alaska	02
Arizona	03
Arkansas	04
California	05
Colorado	06
Connecticut	07
Delaware (State)	08
Florida	09
Georgia	10
Hawaii	11
Idaho	12
Illinois	13
Indiana	14
Iowa	15
Kansas	16
Kentucky	17
Louisiana	18
Maine	19
Maryland	20
Massachusetts	21
Michigan	22
Minnesota	23
Mississippi	24
Missouri	25
Montana	26
Nebraska	27
Nevada	28
New Hampshire	29
New Jersey	30
New Mexico	31
New York	32
North Carolina	33
North Dakota	34
Ohio	35
Oklahoma (State)	36
Oregon	37
Pennsylvania	38
Rhode Island	39
South Carolina	40
South Dakota	41
Tennessee	42
Texas (State)	43
Utah	44
Vermont	45
Virginia	46
Washington (State)	47
West Virginia	48
Wisconsin	49
Wyoming	50
District of Columbia	51
Puerto Rico	52

CONTINENTS

CONTINENTS	CODE
Africa	53
Asia	54
Australia	55
Canada	56
Cuba	57
Europe	58
Mexico	59
South America	60

OKLAHOMA CITIES

CITY	CODE	CITY	CODE	CITY	CODE	CITY	CODE
Ada	001	Cushing	065	Luther	129	Sand Springs	193
Afton	002	Cyril	066	Macomb	130	Sapulpa	194
Agawam	003	Dale	067	Madill	131	Sasakwa	195
Agra	004	Davenport	068	Mangum	132	Sayre	196
Alex	005	Davis	069	Marietta	133	Seminole	197
Allen	006	Del City	070	Marlow	134	Sentinel	198
Altus	007	Dewey	071	Maud	135	Seward	199
Alva	008	Dibble	072	Maysville	136	Shattuck	200
Amber	009	Dover	073	McAlester	137	Shawnee	201
Anadarko	010	Drumright	074	McLoud	138	Skiatook	202
Antlers	011	Duncan	075	Medford	139	Snyder	203
Apache	012	Durant	076	Meeker	140	Sparks	204
Arcadia	013	Dustin	077	Meridian	141	Spencer	205
Ardmore	014	Earlsboro	078	Miami	142	Spiro	206
Arkoma	015	Eason	079	Midway	143	Stigler	207
Asher	016	Edmond	080	Midwest City	144	Stillwater	208
Atoka	017	Elk City	081	Minco	145	Stilwell	209
Aydelotte	018	Elmore City	082	Moore	146	St. Louis	210
Barnsdall	019	El Reno	083	Morris	147	Stratford	211
Bartlesville	020	Enid	084	Mounds	148	Stroud	212
Beaver	021	Erick	085	Muldrow	149	Sulphur	213
Beggs	022	Eufaula	086	Mulhall	150	Tahlequah	214
Bethany	023	Fallis	087	Muskogee	151	Talihina	215
Bethel Acres	024	Fairfax	088	Mustang	152	Tecumseh	216
Binger	025	Fairview	089	Newalla	153	Temple	217
Blanchard	026	Fowler	090	New Castle	154	The Village	218
Boise City	027	Frederick	091	Newkirk	155	Thomas	219
Boley	028	Fort Gibson	092	Nichols Hills	156	Tipton	220
Bowlegs	029	Geary	093	Nicoma Park	157	Tishomingo	221
Bradley	030	Glencoe	094	Ninnekah	158	Tonkawa	222
Bristow	031	Grandfield	095	Noble	159	Tribbey	223
Brooksville	032	Guthrie	096	Norman	160	Trousdale	224
Buffalo	033	Guymon	097	Nowata	161	Tryon	225
Burns Flat	034	Harjo	098	Oilton	162	Tulsa	226
Byars	035	Harrah	099	Okarche	163	Tuttle	227
Cache	036	Hartshorne	100	Okeene	164	Union City	228
Calumet	037	Haskell	101	Okemah	165	Valley Brook	229
Calvin	038	Healdton	102	Okfuskee	166	Verden	230
Caney	039	Heavener	103	Oklahoma City	167	Vinita	231
Carnegie	040	Hennessey	104	Okmulgee	168	Wagoner	232
Carney	041	Henryetta	105	Owasso	169	Walters	233
Cashion	042	Hobart	106	Paden	170	Wanetta	234
Castle	043	Holdenville	107	Pauls Valley	171	Warr Acres	235
Cement	044	Hollis	108	Pawhuska	172	Warwick	236
Chandler	045	Hollywood	109	Pawnee	173	Washington	237
Checotah	046	Hominy	110	Pearson	174	Watonga	238
Chelsea	047	Hooker	111	Perkins	175	Waurika	239
Cherokee	048	Hugo	112	Perry	176	Wayne	240
Cheyenne	049	Jacktown	113	Picher	177	Waynoka	241
Chickasha	050	Jay	114	Piedmont	178	Weatherford	242
Choctaw	051	Jenks	115	Pink	179	Weleetka	243
Chrisney	052	Jones	116	Pocasset	180	Wellston	244
Claremore	053	Karns	117	Pocola	181	Wetumka	245
Cleveland	054	Kendrick	118	Ponca City	182	Wewoka	246
Clinton	055	Kingfisher	119	Poteau	183	Wheatland	247
Coalgate	056	Konawa	120	Prague	184	Wilburton	248
Collinsville	057	Krebs	121	Pryor	185	Wilson	249
Comanche	058	Langston	122	Purcell	186	Woodman	250
Commerce	059	Laverne	123	Richland	187	Woods	251
Cordell	060	Lawton	124	Ringling	188	Wynnewood	252
Coweta	061	Lehigh	125	Ripley	189	Yale	253
Coyle	062	Lexington	126	Rosedale	190	Yukon	254
Crescent	063	Lima	127	Rush Springs	191		
Cromwell	064	Lindsay	128	Sallisaw	192		



Logan County
Oklahoma County
Canadian County
Lincoln County
Oklahoma County
Pottawatomie County
Cleveland County
Oklahoma City City Limits
Lake Hefner
Lake Overholser
Tinker Field
N.W. 164th
N.W. 108th (Hefner Rd)
(Hargrove) N.W. 122nd
Britton Rd.
Wilshire Blvd
N.W. 78th
N.E. 78th
N.W. 63rd
N.W. 50th
N.E. 50th
N.W. 39th
N.W. 36th
N.E. 36th
N.W. 30th
N.W. 23rd
N.E. 23rd
N.W. 16th
N.W. 13th
N.E. 13th
N.W. 10th
N.E. 8th
Reno Ave.
Reno Rd.
S.E. 15th
S.W. 29th
S.E. 29th
S.W. 36th
Grand Blvd.
S.W. 44th
S.E. 44th
May Ave.
Meridian Ave.
Western Ave.
Bryant Ave.
Bryant Rd.
Kelley Ave.
Eastern
Lindsay
High Ave.
Shields Blvd.
Pennsylvania Ave.
Independence
Walker
Waverly
Broadway
Sooner Rd.
Post Rd.
Township Rd.
U.S. 66
U.S. I-35
A.T. & S.F. Railroad
C.R.I. & P. Railroad
S.L. & S.F. Railroad
North Canadian River
West Ave.
Mac Arthur
85
82
81
89
83
84
63
92
64
67
66
61
5
1
60
52
80
88
90
21
10
4
17
15
20
79
69
26
13
16
56
77
78
76
55
50
49
86
39
87
75
71
93
94
95
74
91
N
S
E
W

Information on Pre-testing of Questionnaire

1. Name _____

2. How long did it take you to complete the questionnaire? _____

3. Were there any questions which applied to you which you did not answer?

   Yes _____

   No _____

   If so, which ones? _____

   Why?

4. Were there any questions where you found it hard to understand what information was wanted?

   Yes _____

   No _____

   Which ones? _____

5. Were you able to locate your residence on the map (if applicable)?

   Yes _____

   No _____

6. Did you find the questionnaire too long? Yes _____

   No _____

7. Where did you answer the questionnaire? At home _____

   At work _____

8. Any additional comments?

9. Education level _____

OCAMA Labor Study Questionnaire

Note: All answers should be placed in the space provided at the right of the question. With few exceptions, your answer should consist of a number or a circle placed around a number next to the appropriate response. In some cases the question may clearly not apply to you and should be left blank. Please make all answers (numbers, words, or circles) so that they can be read accurately. When using the lists at the end of the questionnaire care should be taken that the proper list is being used.

1. CLOCK NUMBER: Place your clock number in the space to the right. [ ][ ][ ][ ][ ][ ] (1-6)

2. CURRENT ADDRESS:

(a) County. Place in the blank the number appearing next to the name of the county in which you live. (A listing of counties and their numbers is on page 6 of this questionnaire.) _____ (7-8)

(b) Is your residence inside a city limits? (Circle the appropriate number.) (9)

Yes----- 1

No------ 2

(c) City. Place in the blank the number appearing next to the name of the city in which you live, or if your residence is outside the city limits then the closest city. (A listing of Oklahoma cities is on page 7 of this questionnaire. If the city in which you live does not appear in the list then print the name of the city in the blank to the right.) _____ (10-12)

(d) If this is an Oklahoma City, Midwest City, The Village, Nichols Hills, Bethany, Del City, or Warr Acres address, then locate your residence on the map on page 8 of this questionnaire and place the number of that area in the blank to the right. _____ (13-14)

(e) How long have you lived at this address? Years _____ (15-16)

Months _____ (17)

(f) At this address do you (Circle the appropriate number.) (18)

Rent---- 1

Own----- 2

Live with parents or relatives---- 3

(g) If this residence is a farm, give its size in acres. _____ (19-21)

3. ADDRESS WHEN HIRED BY OCAMA FOR THE FIRST TIME

Skip this question and go on to question 4 if your present address is the same as your address when you were hired by OCAMA for the first time. If your present address is not the same as your address when hired by OCAMA for the first time, then complete question 3.

(a) If the address where you lived when first hired by OCAMA was in Oklahoma, then place in the blank the number of the county and city. (The same listing of counties and cities used in question 2 should be used. If the city is not listed then print the name of the city in the blank next to the word "city.")

County _____ (22-23)

City _____ (24-26)

(b) If the address was not in Oklahoma, then place in the blank the number appearing next to the name of the state (in the list of states and foreign countries on page 6 of this questionnaire). _____ (27-28)

(c) If the address was an Oklahoma City, Midwest City, The Village, Nichols Hills, Bethany, Del City, or Warr Acres address, then locate that address on the map on page 8 of this questionnaire and place the number of that area in the blank to the right. _____ (29-30)

(d) At this address did you (Circle the appropriate number.)

Rent-----	1	(31)
Own-----	2	
Live with parents or relatives----	3	

(e) Was this residence a farm? (Circle the appropriate number.)

Yes-----	1	(32)
No------	2	

(f) Is your present residence closer to OCAMA than your last previous residence? (Circle the appropriate number.)

Yes-----	1	(33)
No------	2	

(g) If your answer to question 3f was yes, was the main reason for moving to your present residence to get closer to your work? (Circle the appropriate number.)

Yes-----	1	(34)
No------	2	

4. TRAVEL TO WORK DATA

(a) What is the driving distance from your home to the OCAMA parking lot (one way based on the route normally taken to work)?
(in miles)_____ (35-37)

(b) How long does it normally take to make this trip? (in minutes)_____ (38-40)

(c) How do you normally get to work? (Circle the appropriate number.)

Auto----------	1	(41)
Bus----------	2	
Bicycle----------	3	
Motorbike or Motorcycle----------	4	
Walk----------	5	
Other (Please specify)_____	6	

(d) Do you belong to a car pool or ride club? (Circle the appropriate number.)

Yes-----	1	(42)
No------	2	

(e) What is the approximate amount of money you spend each week for transportation to and from work? If you drive an auto, calculate the cost at 8¢ per mile for each mile driven in one week. (Round off your answer to the nearest dollar.) $_____ (43-44)

(f) What is your next best alternative means of transportation to get to work? (Circle the appropriate number.)

No other means of transportation available-	1	(45)
Auto----------	2	
Bus----------	3	
Bicycle----------	4	
Motorbike or Motorcycle----------	5	
Walk----------	6	
Other (Please specify)_____	7	

(g) If you live in Oklahoma City, Midwest City, Del City, The Village, Nichols Hills, Bethany, or Warr Acres, is bus service available from your present residence to OCAMA? (Circle the appropriate number.)

Yes----- 1 (46)

No------ 2

(h) If your answer to 4g was YES, but you do not use the bus service, which one of the following best describes your reason for not riding a bus? (Circle the one most appropriate number.)

Costs more than my present means of transportation---------- 1 (47)

Takes longer to get to work by bus---------- 2

Do not like to ride a bus---------- 3

Other (Please specify) _____ 4

(i) If your answer to 4g was NO, would you use bus service if it were made available in the future, rather than your present means of travel to work? (Circle the appropriate number.)

Yes----- 1 (48)

No------ 2

(j) How much farther would you be willing to travel one-way to work (not necessarily to OCAMA) than you now do? (in miles) _____ (49-50)

(k) How much additional time would you be willing to spend in traveling one-way to work (not necessarily to OCAMA)? (in minutes) _____ (51-52)

(l) Would you move closer to OCAMA if housing like you now have were available at an equal price? (Circle the appropriate number.)

Yes----- 1 (53)

No------ 2

(m) If you live 20 miles or farther from OCAMA why have you not moved closer? (Circle the one most appropriate number.)

Inadequate housing available closer to OCAMA---------- 1 (54)

Prefer area where now live to that surrounding OCAMA---------- 2

Own home where now live---------- 3

Prefer smaller city---------- 4

Present residence allows part-time farming---------- 5

Job is temporary---------- 6

Plan to move in the near future---------- 7

Community ties---------- 8

Family obligations---------- 9

Other (Please specify) _____ 0

5. WORK EXPERIENCE

(a) How long have you worked at OCAMA?

Years_____ (55-56)

Months_____ (57-58)

(b) What shift are you now working? (Circle the appropriate number.)

Day---------- 1 (59)

Swing-------- 2

Graveyard---- 3

(c) Which one of the following best describes what you were doing just before you were hired by OCAMA? (Circle the appropriate number.)

Employed at another AFLC	1	(60)
Employed elsewhere	2	
In school	3	
Housewife	4	
Disabled	5	
In the Armed Forces	6	
Unemployed, but seeking employment	7	
Other (Please specify)_____	8	

(d) Was your last previous job in Oklahoma? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes	1	(61)
No	2	

(e) Was your last previous job in Oklahoma City? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes	1	(62)
No	2	

(f) Was your work full-time farming when hired by OCAMA? (Leave blank if you have held no other job.) (Circle the appropriate number.)

Yes	1	(63)
No	2	

(g) If you live 20 miles or farther from OCAMA, would you seek employment nearer your place of residence if it were available? (Circle the appropriate number.)

Yes	1	(64)
No	2	

(h) If you have service at another AFLC installation, did you come to OCAMA because of DOD phase-out? (Leave blank if you have never worked at another AFLC installation) (Circle the appropriate number.)

Yes	1	(65)
No	2	

(i) If your answer to 5h was YES, then indicate from which AFLC installation you transferred. (Circle the appropriate number.)

Middletown	1	(66)
Mobile	2	
Rome	3	

6. PERSONAL DATA

(a) Are you (Circle the appropriate number.)

Married	1	(67)
Single	2	
Widowed	3	
Divorced	4	

(b) What is the size of your family (including yourself) living at your place of residence? _____ (68-69)

(c) How many other members of your family living with you work (excluding yourself)? _____ (70)

(d) How many people living with you who are not now working would take full-time jobs if they were offered to them (not necessarily at OCAMA)? _____ (71)

(e) What is your age? _____ (72-73)

(f) Place of birth: Place in the blank the number (in the list on page 6 of this questionnaire) of the state or foreign country where you were born. If place of birth was in Oklahoma, then also indicate the county. (If the name of the foreign country in which you were born is not listed, then print the name of that country in the blank.)

State---------- _____ (74-75)

Foreign Country-------- _____ (74-75)

County (if in Oklahoma) _____ (76-77)

(g) Was your place of birth a farm? (Circle the appropriate number.) Yes----- 1 (78)

No----- 2

(h) What was the single most important reason for your accepting employment at OCAMA? (Read all choices and then circle the number next to the one most important.)

Higher pay---------- 1 (79)

Disliked previous employment---------- 2

Desired to return to Oklahoma---------- 3

Disliked previous place of residence---------- 4

Desired to live in Oklahoma---------- 5

I was offered a transfer and had little choice---------- 6

Opportunities for job advancement---------- 7

Fringe Benefits (Paid Vacation, retirement plan, etc.)--------- 8

Other (Please specify) _____ 9

(i) What was your last completed level of education? (Read all choices and then circle the one appropriate letter.)

Did not graduate from high school---------- A (80)

High school vocational program graduate---------- B

High school general or college preparatory program graduate---------- C

Two-year post-high school technical institute graduate other than Okmulgee Tech---------- D

Graduate of post-high school trade program other than Okmulgee Tech---------- E

Graduate of two-year program at Okmulgee Tech---------- F

Completed an apprenticeship program in trade---------- G

Graduate of a technical program at a two-year junior college---------- H

Graduate of a two-year junior college in other than a technical program------ I

Bachelor's degree or higher---------- J

Business, commercial, or secretarial school---------- K

Other (Please specify)_____ L

OKLAHOMA COUNTIES

COUNTY	CODE
Adair	01
Alfalfa	02
Atoka	03
Beaver	04
Beckham	05
Blaine	06
Bryan	07
Caddo	08
Canadian	09
Carter	10
Cherokee	11
Choctaw	12
Cimarron	13
Cleveland (County)	14
Coal	15
Comanche (County)	16
Cotton	17
Craig	18
Creek	19
Custer	20
Delaware (County)	21
Dewey (County)	22
Ellis	23
Garfield	24
Garvin	25
Grady	26
Grant	27
Greer	28
Harmon	29
Harper	30
Haskell (County)	31
Hughes	32
Jackson	33
Jefferson	34
Johnston	35
Kay	36
Kingfisher (County)	37
Kiowa	38
Latimer	39
Leflore	40
Lincoln	41
Logan	42
Love	43
McClain	44
McCurtain	45
McIntosh	46
Major	47
Marshall	48
Mayes	49
Murray	50
Muskogee (County)	51
Noble (County)	52
Nowata (County)	53
Okfuskee (County)	54
Oklahoma (County)	55
Okmulgee (County)	56
Osage	57
Ottawa	58
Pawnee (County)	59
Payne	60
Pittsburgh	61
Pontotoc	62
Pottawatomie	63
Pushmataha	64
Roger Mills	65
Rogers	66
Seminole (County)	67
Sequoyah	68
Stephens	69
Texas (County)	70
Tillman	71
Tulsa (County)	72
Wagoner (County)	73
Washington (County)	74
Washita	75
Woods (County)	76
Woodward (County)	77

STATES

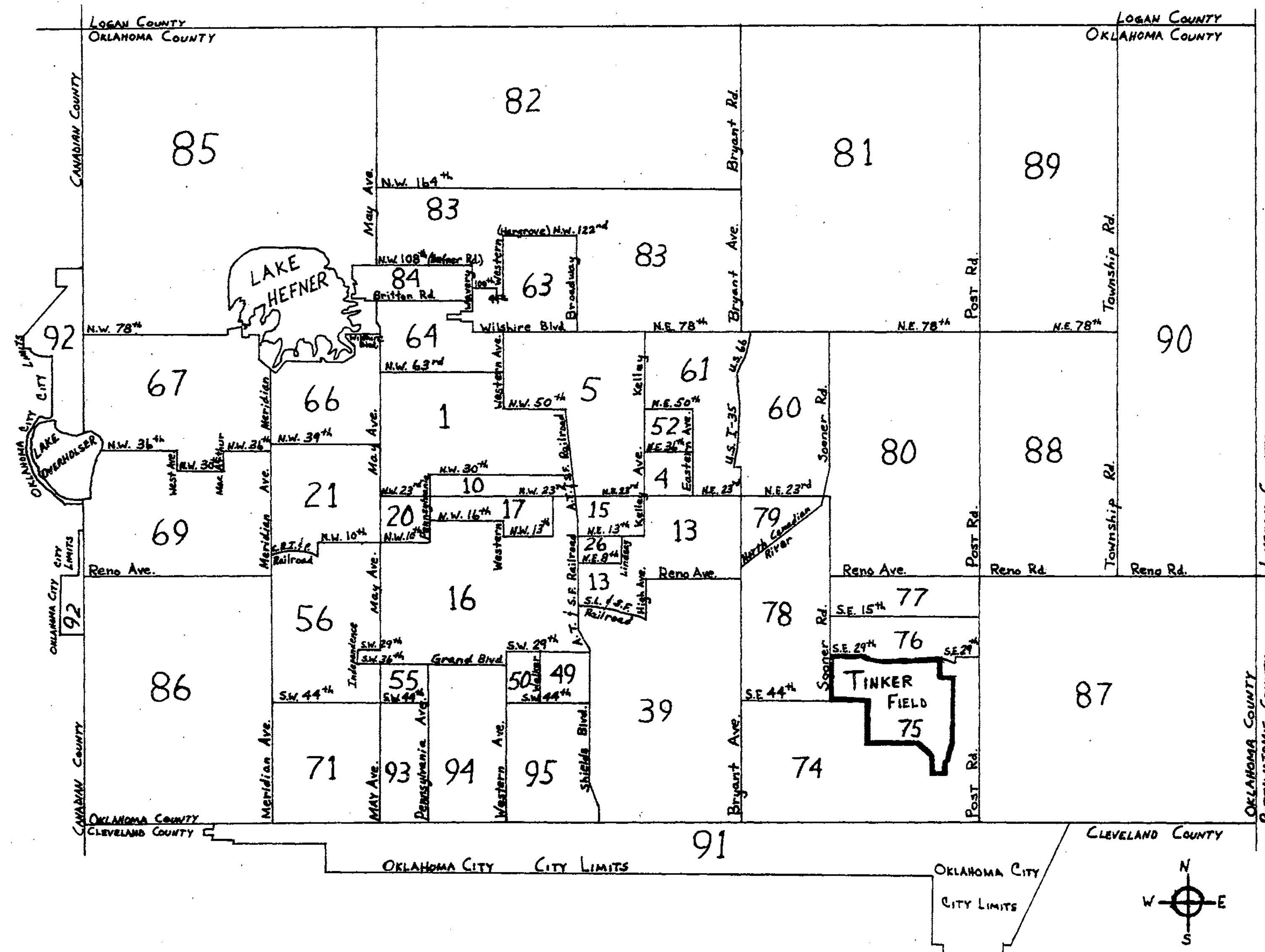
STATE	CODE
Alabama	01
Alaska	02
Arizona	03
Arkansas	04
California	05
Colorado	06
Connecticut	07
Delaware (State)	08
Florida	09
Georgia	10
Hawaii	11
Idaho	12
Illinois	13
Indiana	14
Iowa	15
Kansas	16
Kentucky	17
Louisiana	18
Maine	19
Maryland	20
Massachusetts	21
Michigan	22
Minnesota	23
Mississippi	24
Missouri	25
Montana	26
Nebraska	27
Nevada	28
New Hampshire	29
New Jersey	30
New Mexico	31
New York	32
North Carolina	33
North Dakota	34
Ohio	35
Oklahoma (State)	36
Oregon	37
Pennsylvania	38
Rhode Island	39
South Carolina	40
South Dakota	41
Tennessee	42
Texas (State)	43
Utah	44
Vermont	45
Virginia	46
Washington (State)	47
West Virginia	48
Wisconsin	49
Wyoming	50
District of Columbia	51
Puerto Rico	52

CONTINENTS

CONTINENTS	CODE
Africa	53
Asia	54
Australia	55
Canada	56
Cuba	57
Europe	58
Mexico	59
South America	60

OKLAHOMA CITIES

CITY	CODE	CITY	CODE	CITY	CODE	CITY	CODE
Ada	001	Cushing	065	Luther	129	Sand Springs	193
Afton	002	Cyril	066	Macomb	130	Sapulpa	194
Agawam	003	Dale	067	Madill	131	Sasakwa	195
Agra	004	Davenport	068	Mangum	132	Sayre	196
Alex	005	Davis	069	Marietta	133	Seminole	197
Allen	006	Del City	070	Marlow	134	Sentinel	198
Altus	007	Dewey	071	Maud	135	Seward	199
Alva	008	Dibble	072	Maysville	136	Shattuck	200
Amber	009	Dover	073	McAlester	137	Shawnee	201
Anadarko	010	Drumright	074	McLoud	138	Skiatook	202
Antlers	011	Duncan	075	Medford	139	Snyder	203
Apache	012	Durant	076	Meeker	140	Sparks	204
Arcadia	013	Dustin	077	Meridian	141	Spencer	205
Ardmore	014	Earlsboro	078	Miami	142	Spiro	206
Arkoma	015	Eason	079	Midway	143	Stigler	207
Asher	016	Edmond	080	Midwest City	144	Stillwater	208
Atoka	017	Elk City	081	Minco	145	Stilwell	209
Aydelotte	018	Elmore City	082	Moore	146	St. Louis	210
Barnsdall	019	El Reno	083	Morris	147	Stratford	211
Bartlesville	020	Enid	084	Mounds	148	Stroud	212
Beaver	021	Erick	085	Muldrow	149	Sulphur	213
Beggs	022	Eufaula	086	Mulhall	150	Tahlequah	214
Bethany	023	Fallis	087	Muskogee	151	Talihina	215
Bethel Acres	024	Fairfax	088	Mustang	152	Tecumseh	216
Binger	025	Fairview	089	Newalla	153	Temple	217
Blanchard	026	Fowler	090	New Castle	154	The Village	218
Boise City	027	Frederick	091	Newkirk	155	Thomas	219
Boley	028	Fort Gibson	092	Nichols Hills	156	Tipton	220
Bowlegs	029	Geary	093	Nicoma Park	157	Tishomingo	221
Bradley	030	Glencoe	094	Ninnekah	158	Tonkawa	222
Bristow	031	Grandfield	095	Noble	159	Tribbey	223
Brooksville	032	Guthrie	096	Norman	160	Trousdale	224
Buffalo	033	Guymon	097	Nowata	161	Tryon	225
Burns Flat	034	Harjo	098	Oilton	162	Tulsa	226
Byars	035	Harrah	099	Okarche	163	Tuttle	227
Cache	036	Hartshorne	100	Okeene	164	Union City	228
Calumet	037	Haskell	101	Okemah	165	Valley Brook	229
Calvin	038	Healdton	102	Okfuskee	166	Verden	230
Caney	039	Heavener	103	Oklahoma City	167	Vinita	231
Carnegie	040	Hennessey	104	Okmulgee	168	Wagoner	232
Carney	041	Henryetta	105	Owasso	169	Walters	233
Cashion	042	Hobart	106	Paden	170	Wanetta	234
Castle	043	Holdenville	107	Pauls Valley	171	Warr Acres	235
Cement	044	Hollis	108	Pawhuska	172	Warwick	236
Chandler	045	Hollywood	109	Pawnee	173	Washington	237
Checotah	046	Hominy	110	Pearson	174	Watonga	238
Chelsea	047	Hooker	111	Perkins	175	Waurika	239
Cherokee	048	Hugo	112	Perry	176	Wayne	240
Cheyenne	049	Jacktown	113	Picher	177	Waynoka	241
Chickasha	050	Jay	114	Piedmont	178	Weatherford	242
Choctaw	051	Jenks	115	Pink	179	Weleetka	243
Chrisney	052	Jones	116	Pocasset	180	Wellston	244
Claremore	053	Karns	117	Pocola	181	Wetumka	245
Cleveland	054	Kendrick	118	Ponca City	182	Wewoka	246
Clinton	055	Kingfisher	119	Poteau	183	Wheatland	247
Coalgate	056	Konawa	120	Prague	184	Wilburton	248
Collinsville	057	Krebs	121	Pryor	185	Wilson	249
Comanche	058	Langston	122	Purcell	186	Woodman	250
Commerce	059	Laverne	123	Richland	187	Woods	251
Cordell	060	Lawton	124	Ringling	188	Wynnewood	252
Coweta	061	Lehigh	125	Ripley	189	Yale	253
Coyle	062	Lexington	126	Rosedale	190	Yukon	254
Crescent	063	Lima	127	Rush Springs	191		
Cromwell	064	Lindsay	128	Sallisaw	192		


Logan County
Oklahoma County
Canadian County
Lincoln County
Oklahoma County
Pottawatomie County
Cleveland County
Oklahoma City City Limits
Lake Hefner
Lake Overholser
Tinker Field
85
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87
71
93
94
95
74
91
N.W. 164th
N.W. 122nd
N.W. 108th (Hefner Rd.)
Britton Rd.
Wilshire Blvd.
N.W. 78th
N.E. 78th
N.W. 63rd
N.W. 50th
N.E. 50th
N.W. 39th
N.W. 36th
N.W. 30th
N.W. 23rd
N.E. 23rd
N.W. 16th
N.W. 13th
N.E. 13th
N.W. 10th
N.E. 8th
Reno Ave.
Reno Rd.
S.E. 15th
S.W. 29th
S.E. 29th
S.W. 36th
Grand Blvd.
S.W. 44th
S.E. 44th
May Ave.
Meridian Ave.
Western Ave.
Broadway
Bryant Ave.
Bryant Rd.
Post Rd.
Township Rd.
Kelley Ave.
Eastern Ave.
Lindsay
High Ave.
Sooner Rd.
U.S. I-35
U.S. 66
North Canadian River
A.T. & S.F. Railroad
S.L. & S.F. Railroad
C.R.I. & P. Railroad
Independence
Pennsylvania Ave.
Shields Blvd.
West Ave.
MacArthur
Oklahoma City City Limits
N
S
E
W

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS OKLAHOMA CITY AIR MATERIEL AREA (AFLC)
TINKER AIR FORCE BASE, OKLAHOMA 73145

REPLY TO ATTN OF: OCACU (Ray Grimes/2666)

30 JUN 1967

SUBJECT: Request for personnel Data (OCAMA Labor Study Survey)

TO: All Directorates and Staff Offices

1. An OCAMA Labor Study has been approved by the Commander. The purpose of the study is to obtain statistical data on employee commuting patterns and other vital statistics which are not available from the personnel records. This information will be used by OCAMA and local civic and state organizations to improve community services.

2. A supply of questionnaires is furnished your organization for each employee as indicated on the attached stat listing. Request survey forms be completed in the following manner:

a. Forms should be completed by all employees presently on duty and forwarded to OCACU no later than 14 July 1967. Employees should be encouraged to complete the questionnaires as soon as possible, and these should be sent to OCACU as they are turned in. A check mark should be placed by the name of each employee on the stat listing when he returns his completed questionnaire.

b. Questionnaires for employees who are on annual or sick leave may be held until 10 Aug 1967. During this time, questionnaires should be completed and forwarded as employees become available. On 10 August, the stat listing, together with remaining questionnaires, will be forwarded to OCACU.

c. In the event an employee on your listing has been transferred to another organization, the questionnaire should be forwarded to him at his new organization. If the employee's new organization is not known, then his name and questionnaire should be sent to OCACU.

d. The name of an employee who has been transferred into your organization should be added to the stat listing and, upon receipt from his previous assignment, his questionnaire completed and forwarded to OCACU.

e. A line should be drawn through the name of all employees who have been separated.

3. It is requested that your support and prompt attention be given to completing the survey as expeditiously as possible.

B. E. FORREST, Colonel, USAF
Chief of Personnel

2 Atch
1. Stat Listing
2. Questionnaires

APPENDIX B

QUESTIONNAIRE USED BY RICHARD W. POOLE TO SURVEY OCAMA EMPLOYEES IN 1960

OCAMA LABOR STUDY

CLOCK NUMBER: _____

FULL NAME: _____
(Last) (First) (Middle)

(Read questions carefully before answering)

1. CURRENT ADDRESS: _____
(Number & Street or Rural Rt) (City) (County)

(a) Is your residence inside a city limits?
(Circle one): YES NO

(1) If NO, then give distance and direction from nearest town (For example: 2 miles S.E. of Shawnee):

_____
(Miles) (Direction) (Town)

(b) If this is an Oklahoma City address, give the area in which located.
(Circle one): SE SW NW NE

(c) How long have you lived at this address?

_____years, _____months.

(d) Do you (Check one): _____rent, _____own, _____live with parents or relatives.

(e) If this residence is a farm, give its size. _____acres.

2. ADDRESS WHEN HIRED BY OCAMA for the First Time. (NOTE: If same as above, write in "SAME" and skip Questions 2a, 2b, 2c, & 2d.) Give ONLY City, County, and State:

_____
City -- If rural, list direction and distance from nearest town

_____ _____
County State

(a) If this was an Oklahoma City address, give the area in which located
(Circle one): SE SW NW NE

(b) At this address did you (Check one): _____rent, _____own,

_____live with parents or relatives.

(c) If this residence was a farm, give its size: _____acres.

(d) Was the main reason for moving from this address to get you closer to work?

(Circle one): YES NO

3. TRAVEL TO WORK DATA:

(a) What is the driving distance from your home to the OCAMA parking lot (One-way based on route normally taken to work)?

_____ miles

(b) How long does it normally take? _____ minutes

(c) How do you normally get to work? (Circle one):

BUS AUTO BICYCLE WALK If Other, specify

_____

(d) Do you belong to a car pool? (Circle one): YES NO

4. EMPLOYMENT AND PERSONAL DATA:

(a) How long have you worked for OCAMA? _____years & _____months.

(b) Place of Birth: _____ (County) & _____ (State), or _____ (Foreign Country)

(c) Was your place of birth a farm? (Circle one): YES NO

(d) Are you (Circle one): SINGLE MARRIED WIDOWED

(e) If MARRIED, does your spouse work? (Circle one): YES NO

(f) Your age _____.

APPENDIX C

DETAILED CHARACTERISTICS OF THE OCAMA EMPLOYEES

The data presented in the following tables were organized in the following manner. Each employee was initially classified into a graded, wageborad, foreman, or laborer personnel classification. These categories were then combined and an employee classified as salaried (graded) or hourly (wageboard, foreman, or laborer) on the basis of the manner in which their remuneration was stated and similarites in the type of position held. The graded personnel classification is composed of clerical and administrative employees who are usually referred to as "white collar" workers. The hourly classification contains employees who are usually involved in physical labor. They are commonly referred to as "blue collar" or production workers. This division into salaried and hourly personnel is logical since the nature of work is considerably different in each classification. In addition to the above dichotomy, the employees in each of the two personnel classifications were further classified by sex, where applicable. This manner of data organization was utilized by Poole in his study of the OCAMA work force. Thus, comparable data on selected general characteristics of the OCAMA labor force is available for the two years.

TABLE I

DISTRIBUTION OF EMPLOYEES BY COUNTY OF RESIDENCE BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

County	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Blaine	2	2	---	2	2	---	---	---	---
Caddo	9	8	1	1	1	---	8	7	1
Canadian	143	113	30	47	22	25	96	91	5
Carter	2	2	---	---	---	---	2	2	---
Cleveland	1,464	1,200	264	679	474	205	785	726	59
Comanche	1	---	1	1	---	1	---	---	---
Garvin	28	27	1	4	3	1	24	24	---
Grady	145	120	25	36	23	13	109	97	12
Hughes	28	26	2	1	1	---	27	25	2
Johnston	1	1	---	1	1	---	---	---	---
Kay	3	3	---	1	1	---	2	2	---
Kingfisher	14	11	3	3	2	1	11	9	2
LeFlore	1	1	---	---	---	---	1	1	---
Lincoln	390	317	73	107	57	50	283	260	23
Logan	245	196	49	66	36	30	179	160	19
McClain	171	145	26	41	27	14	130	118	12
McIntosh	1	1	---	1	1	---	---	---	---
Muskogee	1	1	---	---	---	---	1	1	---
Noble	1	1	---	---	---	---	1	1	---
Okfuskee	76	62	14	16	8	8	60	54	6
Oklahoma	15,986	11,784	4,202	7,802	4,476	3,326	8,184	7,308	876
Okmulgee	5	5	---	1	1	---	4	4	---
Pawnee	2	2	---	---	---	---	2	2	---
Payne	6	6	---	1	1	---	5	5	---
Pittsburg	1	1	---	---	---	---	1	1	---
Pontotoc	7	6	1	2	1	1	5	5	---
Pottawatomie	1,764	1,339	425	515	286	229	1,249	1,053	196
Seminole	288	235	53	38	26	12	250	209	41
Washington	1	1	---	---	---	---	1	1	---
29 COUNTY TOTAL	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254

TABLE II

DISTRIBUTION OF EMPLOYEES BY CITY OF RESIDENCE OR NEAREST RESIDENCE BY SEX AND BY JOB CATEGORY
(Cities Listed Alphabetically)

City and County[a]	All Employees[b]			Job Category		Number of Employees Reporting As	
	Total	Male	Female	Salaried	Hourly	City of Residence	City Nearest Residence
Ada, Pontotoc	7	6	1	2	5	3	4
Agra, Lincoln	3	2	1	1	2	1	2
Alex, Grady	5	4	1	2	3	1	4
Amber, Grady	3	3	---	1	2	2	1
Anadarko, Caddo	2	1	1	1	1	2	---
Apache, Caddo	2	2	---	---	2	1	1
Arcadia, Oklahoma	27	22	5	6	21	11	16
Ardmore, Carter	1	1	---	---	1	1	---
Asher, Pottawatomie	12	10	2	2	10	3	9
Aydelotte, Pottawatomie	1	---	1	---	1	1	---
Bethany, Oklahoma	158	129	29	90	68	151	7
Bethel Acres, Pottawatomie	26	23	3	15	11	12	14
Binger, Caddo	3	3	---	1	2	---	3
Blanchard, McClain	57	44	13	15	42	37	20
Boley, Okfuskee	5	5	---	---	5	3	2
Bowlegs, Seminole	5	4	1	---	5	1	4
Bradley, Grady	1	1	---	---	1	1	---
Byars, McClain	2	2	---	1	1	1	1
Calvin, Hughes	1	1	---	---	1	---	1
Carney, Lincoln	6	6	---	---	6	2	4
Cashion, Kingfisher	8	6	2	---	8	2	6
Castle, Okfuskee	4	4	---	---	4	3	1
Chandler, Lincoln	51	40	11	16	35	33	18
Checotah, McIntosh	1	1	---	1	---	---	1
Chickasha, Grady	48	43	5	12	36	45	3
Choctaw, Oklahoma	309	229	80	114	195	207	102
Cleveland, Pawnee	2	2	---	---	2	2	---
Coyle, Logan	2	1	1	1	1	---	2
Crescent, Logan	12	10	2	1	11	7	5
Cromwell, Seminole	5	5	---	1	4	---	5
Cushing, Payne	3	3	---	---	3	1	2
Dale, Pottawatomie	34	27	7	9	25	8	26
Davenport, Lincoln	10	10	---	---	10	7	3
Del City, Oklahoma	2,126	1,570	556	1,172	954	2,096	30
Dewey, Washington	1	1	---	---	1	1	---
Dibble, McClain	8	8	---	---	8	1	7
Dover, Kingfisher	2	1	1	1	1	1	1
Drumright, Creek	1	1	---	---	1	---	1
Dustin, Hughes	1	1	---	---	1	---	1
Earlsboro, Pottawatomie	35	30	5	5	30	12	23
Edmond, Oklahoma	217	186	31	96	121	198	19
Elmore City, Garvin	1	---	1	---	1	1	---
El Reno, Canadian	57	48	9	15	42	54	3
Fallis, Lincoln	2	1	1	2	---	2	---
Fowler, Lincoln	3	2	1	---	3	---	3
Guthrie, Logan	208	164	44	57	151	155	53
Harjo, Pottawatomie	1	1	---	---	1	---	1
Harrah, Oklahoma	172	130	42	54	118	83	89
Heavener, LeFlore	1	1	---	---	1	1	---
Henryetta, Okmulgee	3	3	---	1	2	1	2
Holdenville, Hughes	24	22	2	2	22	15	9
Jacktown, Lincoln	1	1	---	---	1	---	1
Jones, Oklahoma	76	59	17	21	55	53	23
Kingfisher, Kingfisher	6	6	---	2	4	4	2
Konawa, Seminole	23	22	1	3	20	5	18
Langston, Logan	5	5	---	1	4	4	1
Lawton, Comanche	1	---	1	1	---	1	---
Lexington, Cleveland	45	42	3	4	41	21	24
Lima, Seminole	6	5	1	---	6	4	2
Lindsay, Garvin	10	9	1	2	8	3	7
Luther, Oklahoma	23	20	3	7	16	14	9
Macomb, Pottawatomie	18	12	6	2	16	1	17
Maud, Pottawatomie & Seminole	40	31	9	6	34	26	14
Maysville, Garvin	8	8	---	1	7	4	4
McAlester, Pittsburg	1	1	---	---	1	1	---
McLoud, Pottawatomie	157	113	44	48	109	96	61
Meeker, Lincoln	118	89	29	38	80	41	77
Meridian, Logan	4	4	---	1	3	---	4
Midwest City, Oklahoma	4,749	3,367	1,382	2,798	1,951	4,678	71
Minco, Grady	41	28	13	10	31	27	14

TABLE II (Continued)

City and County[a]	All Employees[b]			Job Category		Number of Employees Reporting As	
	Total	Male	Female	Salaried	Hourly	City of Residence	City Nearest Residence
Moore, Cleveland	585	464	121	250	335	562	23
Morris, Okmulgee	1	1	---	---	1	---	1
Mulhall, Logan	3	3	---	---	3	3	---
Muskogee, Muskogee	1	1	---	---	1	---	1
Mustang, Canadian	34	23	11	14	20	25	9
Newalla, Oklahoma	58	40	18	19	39	25	33
New Castle, McClain	14	10	4	5	9	8	6
Nichols Hills, Oklahoma	19	13	6	11	8	18	1
Nicoma Park, Oklahoma	172	139	33	63	109	142	30
Ninnekah, Grady	1	---	1	---	1	---	1
Noble, Cleveland	64	59	5	13	51	41	23
Norman, Cleveland	680	555	125	390	290	644	36
Okarche, Canadian & Kingfisher	2	1	1	1	1	1	1
Okemah, Okfuskee	10	9	1	1	9	5	5
Okfuskee, Okfuskee	2	2	---	---	2	2	---
Oklahoma City, Oklahoma, Canadian, & Cleveland	7,579	5,654	1,925	3,204	4,375	7,489	90
Okmulgee, Okmulgee	2	2	---	---	2	2	---
Paden, Okfuskee	50	40	10	9	41	23	27
Pauls Valley, Garvin	4	4	---	1	3	3	1
Pearson, Pottawatomie	4	3	1	2	2	1	3
Perry, Noble	1	1	---	---	1	1	---
Piedmont, Canadian	5	5	---	2	3	5	---
Pink, Pottawatomie	7	6	1	---	7	---	7
Pocasset, Grady	4	3	1	1	3	---	4
Ponca City, Kay	3	3	---	1	2	3	---
Prague, Lincoln	71	61	10	12	59	31	40
Purcell, McClain	64	57	7	12	52	44	20
Sasakwa, Seminole	5	5	---	---	5	3	2
Seminole, Seminole	168	123	45	21	147	104	64
Seward, Logan	1	1	---	1	---	1	---
Shawnee, Pottawatomie	1,183	906	277	359	824	945	238
Sparks, Lincoln	13	10	3	2	11	2	11
Spencer, Oklahoma	198	148	50	72	126	171	27
Stillwater, Payne	3	3	---	1	2	3	---
St. Louis, Pottawatomie	8	8	---	---	8	1	7
Stratford, Garvin	5	5	---	1	4	---	5
Stroud, Lincoln	9	8	1	1	8	2	7
Tecumseh, Pottawatomie	243	176	67	70	173	184	59
The Village, Oklahoma	78	64	14	54	24	76	2
Tishomingo, Johnston	1	1	---	1	---	---	1
Tribbey, Pottawatomie	1	1	---	---	1	---	1
Trousdale, Pottawatomie	3	3	---	1	2	---	3
Tryon, Lincoln	12	11	1	2	10	5	7
Tuttle, Grady	34	31	3	8	26	23	11
Union City, Canadian	3	2	1	1	2	3	---
Valley Brook, Oklahoma	30	28	2	7	23	26	4
Verden, Grady	1	1	---	---	1	1	---
Wanette, Pottawatomie	8	7	1	1	7	---	8
Warr Acres, Oklahoma	77	55	22	44	33	72	5
Warwick, Lincoln	10	10	---	2	8	3	7
Washington, McClain	13	13	---	5	8	8	5
Watonga, Blaine	2	2	---	2	---	2	---
Wayne, McClain	15	12	3	2	13	7	8
Weleetka, Okfuskee	2	2	---	---	2	1	1
Wellston, Lincoln	50	42	8	18	32	30	20
Wetumka, Hughes	2	1	1	---	2	1	1
Wewoka, Seminole	67	64	3	5	62	40	27
Wheatland, Oklahoma	4	4	---	1	3	4	---
Woods, Oklahoma	2	1	1	1	1	2	---
Yukon, Canadian	36	30	6	13	23	34	2
All Other	48	37	11	17	31	34	14
TOTAL	20,786	15,616	5,170	9,366	11,420	19,019	1,767

[a] Some cities are in more than one county. For these cities, more than one county is listed.

[b] Some individuals reporting a city as nearest their place of residence may live in a county other than the one in which the city is located. Thus, a summation of the foregoing figures for cities in a given county may not yield the county total. The extent to which this occurs can be determined by comparing this table against Table 46.

TABLE III

DISTRIBUTION OF EMPLOYEES BY YEARS OF SERVICE BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Years of Service	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Under 1 year	2,774	1,547	1,227	1,081	436	645	1,693	1,111	582
1	1,779	1,208	571	617	259	358	1,162	949	213
2	1,967	1,528	439	695	346	349	1,272	1,182	90
3	710	489	221	472	262	210	238	227	11
4	397	261	136	201	72	129	196	189	7
5	732	586	146	365	223	142	367	363	4
6	725	561	164	377	220	157	348	341	7
7	481	361	120	300	181	119	181	180	1
8	500	377	123	309	188	121	191	189	2
9	490	353	137	327	197	130	163	156	7
10	348	238	110	212	108	104	136	130	6
11	438	322	116	272	159	113	166	163	3
12	486	396	90	261	175	86	225	221	4
13	348	251	97	197	102	95	151	149	2
14	292	201	91	167	77	90	125	124	1
15	840	685	155	364	232	132	476	453	23
16	1,391	1,042	349	578	310	268	813	732	81
17	1,233	1,047	186	443	282	161	790	765	25
18	532	436	96	217	141	76	315	295	20
19	798	697	101	305	238	67	493	459	34
20	1,014	944	70	379	332	47	635	612	23
21	493	461	32	217	195	22	276	266	10
22	428	364	64	190	143	47	238	221	17
23	293	224	69	144	86	58	149	138	11
24	428	303	125	203	122	81	225	181	44
25	817	685	132	449	342	107	368	343	25
26	52	49	3	24	22	2	28	27	1
TOTAL	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
MEDIAN YEARS	9	11	4	9	12	6	9	11	1

NOTE: Data do not include employees reporting less than one month of service.

TABLE IV

DISTRIBUTION OF EMPLOYEES BY LEVEL OF EDUCATION, BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Level of Education Completed	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
None	18	15	3	7	5	2	11	10	1
1st Grade	3	3	---	---	---	---	3	3	---
2nd Grade	9	9	---	---	---	---	9	9	---
3rd Grade	27	27	---	---	---	---	27	27	---
4th Grade	58	57	1	1	1	---	57	56	1
5th Grade	111	109	2	2	2	---	109	107	2
6th Grade	180	176	4	6	5	1	174	171	3
7th Grade	422	401	21	21	15	6	401	386	15
8th Grade	1,637	1,492	145	166	124	42	1,471	1,368	103
9th Grade	837	728	109	135	97	38	702	631	71
10th Grade	1,240	996	244	262	161	101	978	835	143
11th Grade	1,081	798	283	310	165	145	771	633	138
12th Grade	10,779	7,372	3,407	5,274	2,548	2,726	5,505	4,824	681
1 Year College	991	727	264	652	409	243	339	318	21
2 Years College	684	527	157	470	323	147	214	204	10
3 Years College	315	254	61	225	171	54	90	83	7
4 Years College - No Degree	99	78	21	73	54	19	26	24	2
Bachelors Degree	1,176	973	203	1,106	906	200	70	67	3
Graduate Work	281	248	33	272	240	32	9	8	1
TOTAL	19,948	14,990	4,958	8,982	5,226	3,756	10,966	9,764	1,202
MEDIAN YEARS	12	12	12	12	12	12	12	12	12

TABLE V

DISTRIBUTION OF EMPLOYEES BY DRIVING DISTANCE (ONE-WAY), BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Distance, One-Way (in miles)	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1	531	337	194	255	100	155	276	237	39
2	1,054	715	339	556	275	281	498	440	58
3	1,580	1,121	459	915	543	372	665	578	87
4	1,485	1,111	374	847	540	307	638	571	67
5	1,760	1,282	478	1,059	646	413	701	636	65
6	936	712	224	420	242	178	516	470	46
7	743	590	153	290	182	108	453	408	45
8	765	613	152	248	142	106	517	471	46
9	417	329	88	141	78	63	276	251	25
10	1,168	865	303	430	208	222	738	657	81
11	500	393	107	190	114	76	310	279	31
12	1,162	880	282	449	250	199	713	630	83
13	684	524	160	309	184	125	375	340	35
14	581	455	126	279	184	95	302	271	31
15	1,063	728	335	488	244	244	575	484	91
16	352	271	81	179	115	64	173	156	17
17	333	256	77	170	108	62	163	148	15
18	487	369	118	238	138	100	249	231	18
19	185	146	39	87	58	29	98	88	10
20	790	566	224	436	254	182	354	312	42
21	200	164	36	111	79	32	89	85	4
22	278	210	68	176	115	61	102	95	7
23	168	144	24	91	70	21	77	74	3
24	90	75	15	43	30	13	47	45	2
25	275	212	63	138	85	53	137	127	10

TABLE V (Continued)

Distance, One-Way (in miles)	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
26	86	70	16	36	25	11	50	45	5
27	55	48	7	25	19	6	30	29	1
28	96	82	14	25	15	10	71	67	4
29	44	39	5	16	13	3	28	26	2
30	400	307	93	131	67	64	269	240	29
31	55	48	7	11	8	3	44	40	4
32	172	140	32	42	25	17	130	115	15
33	91	74	17	30	21	9	61	53	8
34	54	45	9	19	12	7	35	33	2
35	430	320	110	120	62	58	310	258	52
36	82	71	11	24	17	7	58	54	4
37	136	112	24	42	28	14	94	84	10
38	124	93	31	40	18	22	84	75	9
39	26	24	2	7	7	0	19	17	2
40	277	190	87	80	31	49	197	159	38
41	17	12	5	6	5	1	11	7	4
42	54	45	9	10	5	5	44	40	4
43	21	16	5	5	2	3	16	14	2
44	24	20	4	6	5	1	18	15	3
45	117	88	29	20	7	13	97	81	16
46	21	15	6	2	1	1	19	14	5
47	28	24	4	5	5	0	23	19	4
48	38	32	6	5	5	0	33	27	6
49	16	12	4	3	2	1	13	10	3
50	191	147	44	34	15	19	157	132	25
51	26	21	5	2	0	2	24	21	3
52	33	28	5	3	2	1	30	26	4
53	19	18	1	2	1	1	17	17	0
54	31	23	8	6	2	4	25	21	4
55	66	53	13	15	7	8	51	46	5
56	25	24	1	0	0	0	25	24	1
57	17	14	3	4	2	2	13	12	1
58	18	17	1	0	0	0	18	17	1
59	10	9	1	2	2	0	8	7	1
60	81	71	10	12	8	4	69	63	6
61	8	6	2	6	4	2	2	2	0
62	24	24	0	3	3	0	21	21	0
63	18	18	0	1	1	0	17	17	0
64	12	10	2	0	0	0	12	10	2
65	32	26	6	2	1	1	30	25	5
66	4	2	2	0	0	0	4	2	2
67	10	9	1	1	1	0	9	8	1
68	10	9	1	2	1	1	8	8	0
69	2	1	1	1	0	1	1	1	0
70	37	35	2	0	0	0	37	35	2
71	4	4	0	0	0	0	4	4	0
72	6	6	0	1	1	0	5	5	0
74	2	2	0	0	0	0	2	2	0
75	17	16	1	3	2	1	14	14	0
76	3	3	0	2	2	0	1	1	0
77	1	1	0	0	0	0	1	1	0
78	1	0	1	1	0	1	0	0	0
80	5	5	0	1	1	0	4	4	0
85	3	2	1	1	1	0	2	1	1
86	3	3	0	0	0	0	3	3	0
88	2	2	0	0	0	0	2	2	0
90	2	2	0	0	0	0	2	2	0
92	1	0	1	1	0	1	0	0	0
95	1	1	0	0	0	0	1	1	0
100	6	6	0	3	3	0	3	3	0
104	1	1	0	1	1	0	0	0	0
120	2	1	1	1	0	1	1	1	0
130	1	1	0	0	0	0	1	1	0
TOTAL	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
MEAN DISTANCE	14.40	14.86	13.01	11.94	12.06	11.26	16.41	16.36	16.89
MEDIAN DISTANCE	10	11	10	9	9	9	12	12	12

TABLE VI

DISTRIBUTION OF EMPLOYEES BY TRAVEL TIME (ONE-WAY) BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Travel Time, One-Way (in minutes)	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
1-5	461	309	152	250	130	120	211	179	32
6-10	2,752	1,918	834	1,595	918	677	1,157	1,000	157
11-15	4,115	3,098	1,017	2,097	1,264	833	2,018	1,834	184
16-20	3,647	2,691	956	1,627	874	753	2,020	1,817	203
21-25	2,352	1,794	558	1,116	689	427	1,236	1,105	131
26-30	3,024	2,266	758	1,275	718	557	1,749	1,548	201
31-35	919	727	192	412	266	146	507	461	46
36-40	814	627	187	335	204	131	479	423	56
41-45	1,388	1,076	312	411	235	176	977	841	136
46-50	295	240	55	76	46	30	219	194	25
51-55	103	86	17	26	20	6	77	66	11
56-60	505	418	87	93	54	39	412	364	48
61-70	108	95	13	14	8	6	94	87	7
71-80	174	151	23	18	10	8	156	141	15
81-90	88	85	3	8	6	2	80	79	1
91-100	5	5	---	---	---	---	5	5	---
101-110	17	14	3	10	7	3	7	7	---
111-120	12	10	2	1	---	1	11	10	1
121 & Over	7	6	1	2	1	1	5	5	---
TOTAL	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
MEAN TIME	25.09	25.70	23.23	22.09	22.21	21.92	27.55	27.58	27.31
MEDIAN TIME	20	20	20	20	20	20	25	25	25

TABLE VII

TRANSPORTATION MEDIA USED IN TRAVELING TO WORK BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Type of Transportation	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Numerical Distribution									
Total	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
Automobile	20,607	15,465	5,142	9,310	5,414	3,896	11,297	10,051	1,246
Walk	78	67	11	21	13	8	57	54	3
Bus	52	42	10	21	13	8	31	29	2
Motorcycle	33	32	1	9	9	---	24	23	1
Bicycle	3	3	---	---	---	---	3	3	---
Other	13	7	6	5	1	4	8	6	2
Percentage Distributions									
Total Employment	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Automobile	99.14	99.03	99.46	99.40	99.34	99.50	98.92	98.87	99.36
Walk	.38	.43	.21	.22	.24	.20	.50	.53	.24
Bus	.25	.27	.19	.22	.24	.20	.27	.28	.16
Motorcycle	.16	.21	.02	.10	.16	---	.21	.23	.08
Bicycle	.01	.02	---	---	---	---	.03	.03	---
Other	.06	.04	.12	.06	.02	.10	.07	.06	.16
Total Employment	100.00	75.13	24.87	100.00	58.19	41.81	100.00	89.02	10.98
Automobile	100.00	75.05	24.95	100.00	58.15	41.85	100.00	88.97	11.03
Walk	100.00	85.90	14.10	100.00	61.90	38.10	100.00	94.74	5.26
Bus	100.00	80.77	19.23	100.00	61.90	38.10	100.00	93.55	6.45
Motorcycle	100.00	96.97	3.03	100.00	100.00	---	100.00	95.83	4.17
Bicycle	100.00	100.00	---	---	---	---	100.00	100.00	---
Other	100.00	53.85	46.15	100.00	20.00	80.00	100.00	75.00	25.00
Total Employment	100.00	NA	NA	45.06	NA	NA	54.94	NA	NA
Automobile	100.00	NA	NA	45.18	NA	NA	54.82	NA	NA
Walk	100.00	NA	NA	26.92	NA	NA	73.08	NA	NA
Bus	100.00	NA	NA	40.38	NA	NA	59.62	NA	NA
Motorcycle	100.00	NA	NA	27.27	NA	NA	72.73	NA	NA
Bicycle	100.00	NA	NA	---	NA	NA	100.00	NA	NA
Other	100.00	NA	NA	38.46	NA	NA	61.54	NA	NA

NA: Not Applicable. NOTE: Percentages have been adjusted so that detail will add to 100.

TABLE VIII

DISTRIBUTION OF EMPLOYEES BY AGE AND SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Age	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
17	11	8	3	3	---	3	8	8	---
18	94	38	56	42	2	40	52	36	16
19	288	118	170	141	1	140	147	117	30
20	406	192	214	180	7	173	226	185	41
21	310	192	118	122	24	98	188	168	20
22	377	260	117	139	44	95	238	216	22
23	421	291	130	164	58	106	257	233	24
24	423	323	100	150	67	83	273	256	17
25	390	286	104	147	67	80	243	219	24
26	366	281	85	153	85	68	213	196	17
27	357	250	107	170	84	86	187	166	21
28	337	238	99	170	97	73	167	141	26
29	354	269	85	178	118	60	176	151	25
30	351	279	72	160	106	54	191	173	18
31	343	262	81	185	120	65	158	142	16
32	355	267	88	196	133	63	159	134	25
33	388	292	96	194	127	67	194	165	29
34	439	345	94	209	141	68	230	204	26
35	441	348	93	226	159	67	215	189	26
36	455	342	113	236	160	76	219	182	37
37	447	334	113	217	141	76	230	193	37
38	476	352	124	223	135	88	253	217	36
39	522	395	127	240	156	84	282	239	43
40	641	498	143	326	216	110	315	282	33
41	704	533	171	344	212	132	360	321	39
42	743	578	165	343	215	128	400	363	37
43	734	573	161	341	214	127	393	359	34
44	755	608	147	349	238	111	406	370	36
45	763	605	158	383	254	129	380	351	29
46	818	642	176	358	237	121	460	405	55
47	753	612	141	338	232	106	415	380	35
48	621	504	117	287	206	81	334	298	36
49	649	533	116	275	189	86	374	344	30
50	532	416	116	251	155	96	281	261	20
51	500	410	90	202	139	63	298	271	27
52	478	348	130	225	124	101	253	224	29
53	467	365	102	200	121	79	267	244	23
54	392	309	83	153	89	64	239	220	19
55	389	281	108	156	77	79	233	204	29
56	327	247	80	131	78	53	196	169	27
57	329	241	88	147	79	68	182	162	20
58	308	222	86	130	64	66	178	158	20
59	279	213	66	100	56	44	179	157	22
60	274	209	65	106	56	50	168	153	15
61	212	153	59	87	38	49	125	115	10
62	178	134	44	67	33	34	111	101	10
63	150	110	40	50	22	28	100	88	12
64	99	71	28	35	18	17	64	53	11
65	108	72	36	44	16	28	64	56	8
66	86	65	21	34	19	15	52	46	6
67	55	38	17	19	5	14	36	33	3
68	45	33	12	18	6	12	27	27	---
69	29	17	12	16	7	9	13	10	3
70	5	5	---	1	1	---	4	4	---
71	6	3	3	3	---	3	3	3	---
72	1	1	---	---	---	---	1	1	---
73	2	2	---	2	2	---	---	---	---
74 and over	3	3	---	---	---	---	3	3	---
TOTAL	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
MEAN AGE	41.36	41.88	39.80	41.08	42.17	39.55	41.60	41.72	40.58
MEDIAN AGE	42	43	41	42	43	41	43	43	41

TABLE IX

MARITAL STATUS BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Marital Status	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Numerical Distribution									
Total Employment	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
Married	17,213	13,686	3,527	7,474	5,011	2,463	9,739	8,675	1,064
Single	3,074	1,840	1,234	1,497	413	1,084	1,577	1,427	150
Widowed	499	90	409	395	26	369	104	64	40
Percentage Distributions									
Total Employment	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Married	82.81	87.64	68.22	79.80	91.94	62.90	85.28	85.33	84.85
Single	14.79	11.78	23.87	15.98	7.58	27.68	13.81	14.04	11.96
Widowed	2.40	.58	7.91	4.22	.48	9.42	.91	.63	3.19
Total Employment	100.00	75.13	24.87	100.00	58.19	41.81	100.00	89.02	10.98
Married	100.00	79.51	20.49	100.00	67.05	32.95	100.00	89.07	10.93
Single	100.00	59.86	40.14	100.00	27.59	72.41	100.00	90.49	9.51
Widowed	100.00	18.04	81.96	100.00	6.58	93.42	100.00	61.54	38.46
Total Employment	100.00	NA	NA	45.06	NA	NA	54.94	NA	NA
Married	100.00	NA	NA	43.42	NA	NA	56.58	NA	NA
Single	100.00	NA	NA	48.70	NA	NA	51.30	NA	NA
Widowed	100.00	NA	NA	79.16	NA	NA	20.84	NA	NA

NA: Not Applicable.
NOTE: Percentages have been adjusted so that detail will add to 100.

TABLE X

HOME OWNERSHIP BY SEX
(For All Employees, Salaried Employees, and Hourly Employees)

Item	All Employees			Salaried Employees			Hourly Employees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Numerical Distribution									
Total Employment	20,786	15,616	5,170	9,366	5,450	3,916	11,420	10,166	1,254
Own	16,217	12,536	3,681	7,392	4,665	2,727	8,825	7,871	954
Rent	3,522	2,415	1,107	1,534	676	858	1,988	1,739	249
Live with relatives	1,047	665	382	440	109	331	607	556	51
Percentage Distributions									
Total Employment	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Own	78.02	80.28	71.20	78.92	85.60	69.64	77.28	77.42	76.08
Rent	16.94	15.46	21.41	16.38	12.40	21.91	17.41	17.11	19.85
Live with relatives	5.04	4.26	7.39	4.70	2.00	8.45	5.31	5.47	4.07
Total Employment	100.00	75.13	24.87	100.00	58.19	41.81	100.00	89.02	10.98
Own	100.00	77.30	22.70	100.00	63.11	36.89	100.00	89.19	10.81
Rent	100.00	68.57	31.43	100.00	44.07	55.93	100.00	87.47	12.53
Live with relatives	100.00	63.51	36.49	100.00	24.77	75.23	100.00	91.60	8.40
Total Employment	100.00	NA	NA	45.06	NA	NA	54.94	NA	NA
Own	100.00	NA	NA	45.58	NA	NA	54.42	NA	NA
Rent	100.00	NA	NA	43.55	NA	NA	56.45	NA	NA
Live with relatives	100.00	NA	NA	42.02	NA	NA	57.98	NA	NA

NA: Not Applicable. NOTE: Percentages have been adjusted so that detail will add to 100.

APPENDIX D

RESULTS OF THE MULTIPLE REGRESSION ANALYSIS OF OCAMA EMPLOYEE CHARACTERISTICS AND COMMUTING PATTERNS

RESULTS OF THE MULTIPLE REGRESSION ANALYSIS OF OCAMA EMPLOYEE CHARACTERISTICS AND COMMUTING PATTERNS

INDEPENDENT VARIABLE	DEPENDENT VARIABLE					
	Model I: Distance			Model II: Time		
	F - Ratio[a] from AOV	Regression Coefficient	Standard Error of Regression Coefficient[b]	F - Ratio[a] from AOV	Regression Coefficient	Standard Error of Regression Coefficient[b]
Home Ownership	37.7**			26.7**		
Rent		-1.34**	0.253		-1.60**	0.287
Own		-2.10**	0.256		-1.81**	0.290
Live with relatives		3.44			3.41	
Type of Residence	1,538.5**			1,064.3**		
Non-farm		-6.78**	0.173		-6.40**	0.196
Farm		6.78			6.40	
Shift	10.2**			21.4**		
Day		0.69**	0.209		1.18**	0.238
Swing		0.90**	0.250		1.43**	0.284
Graveyard		-1.59			-2.61	
Marital Status	3.4*			2.7*		
Married		0.65**	0.250		0.70*	0.283
Single		-0.36	0.366		-0.27	0.415
Widowed		0.24	0.486		0.07	0.551
Divorced		-0.53			-0.50	
Sex	105.9**			116.0**		
Male		1.36**	0.133		1.62**	0.151
Female		-1.36			-1.62	
Skill Level	5.6**			3.1*		
Unskilled		-3.53	2.884		-2.36	3.274
Semi-skilled		8.20	5.751		5.71	6.529
Skilled		-4.67			-3.35	
Education	1.7*			3.3**		
None or 1st grade		8.92	8.226		15.85	9.337
2nd grade		5.21	3.912		3.02	4.440
3rd grade		-1.52	2.351		0.08	2.669
4th grade		1.37	1.698		3.63	1.927
5th grade		0.95	1.321		1.39	1.500
6th grade		-1.34	1.079		-1.87	1.224
7th grade		-0.37	0.838		0.25	0.952
8th grade		-0.81	0.651		-0.64	0.739
9th grade		-0.60	0.718		-0.36	0.816
10th grade		-1.24	0.670		-1.47	0.766
11th grade		-1.50*	0.695		-2.01*	0.789
12th grade		-1.66**	0.585		-2.45**	0.664
1 year of college		-2.30**	0.700		-3.49**	0.794
2 years of college		-2.01**	0.739		-2.33**	0.839
3 years of college		-1.37	0.891		-2.25*	1.012
4 years of college, no degree		-1.37	1.416		-2.67	1.608
Bachelor's degree		-1.79**	0.695		-2.43**	0.799
Bachelor's degree plus graduate study		0.30	1.123		-1.30	1.275
Master's degree		-0.61	1.468		-0.30	1.667
Master's degree and additional graduate study		3.85	2.673		2.57	3.034
Doctor's degree		2.11			3.22	
Length of Service	4.1*	-0.034*	0.016		0.03	0.02
Age	1.7	-0.015	0.011	39.3**	0.08**	0.01
Salary	110.5**	-0.032**	0.003	173.9**	-0.05**	0.003

*Significant at 0.01.
**Significant at 0.05.

Model I--Coefficient of Determination (r^2) = 0.1189
Model II--Coefficient of Determination (r^2) = 0.1031

[a]For the analysis of variation for Model I, see Table V, p. 75.

[b]Standard errors are not given for the last level of each independent variable.

VITA

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