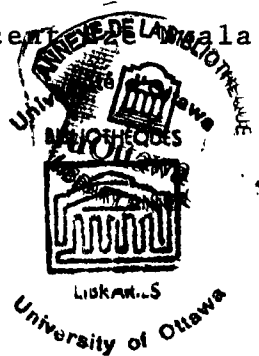


THE SPATIAL DYNAMICS OF THE JOURNEY TO WORK FROM A  
 LOW AND A HIGH INCOME RESIDENTIAL NEIGHBOURHOOD -  
 A CASE STUDY OF LOWER TOWN EAST AND ROCKCLIFFE PARK  
 VILLAGE, OTTAWA, ONTARIO, 1963.

by

Vincent ANNE DE LA ROSA



Thesis submitted to the Faculty of Arts  
 of the University of Ottawa in partial  
 fulfillment of the requirements for the  
 degree of Master of Arts in Geography.

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## INTRODUCTION

The purpose of this thesis is to analyse the pattern of the daily journey to work from Lower Town East, a low income neighbourhood and Rockcliffe Park Village, a high income suburban district. In other words the investigation intends to view the daily journey to work as a dispersion from the place of residence to the place of work. It is also the intention of this study to apply the gravity model to explain the ultimate daily travel to work patterns from these two residential neighbourhoods.

The neighbourhoods differ greatly from each other as will be demonstrated in chapter one. Suffice to say that both areas are inhabited by two classes of people, the low income employees on the one hand and the high income earners on the other hand. These districts were selected in order to determine whether or not distance, a factor of prime concern to the working population of most urban centres, plays the same role in the travel to work patterns of these two neighbourhoods.

As Schnore indicates, "the ability to minimize effort varies among the population: it has been suggested earlier that the ability to meet diseconomies transferred from the plant to the worker by the necessity of a journey to work are borne with varying ease by different sectors of the labour force. While the low income manual worker might

find it necessary to minimize the journey to work, the higher income white collar worker has presumably greater ability to meet the costs of commuting from further afield".<sup>1</sup> It is therefore implied that distance affects the pattern of movement to work of the working population. On the one hand, the low income worker, concerned with the transport costs of commuting, tends to seek employment as near as possible to his home as an economic measure of reducing the amount of money spent on transportation. On the other hand, the high income earner, preoccupied with better housing conditions not found around major employment centres, pays little regard to the transportation costs of the journey to work. In view of these differences between both classes of people, their patterns of work travel would, all things being equal, be different from each other. As a consequence, the low income workers would normally cluster around the employment nodes nearest their homes, whereas the high income earners may have a more dispersed journey to work pattern.

Interest in the commuting patterns of these two neighbourhoods was stimulated by the fact of their adjacent locations (Fig. 1) as well as the disparity in their income

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<sup>1</sup> Schnore, L. "The Separation of Home from Work: A Problem for Human Ecology", Social Forces (May 1954) pp. 336-343.

levels. The study is an attempt to find whether the distance to work for both neighbourhoods would appreciably differ in view of their proximity and their contrasting dwelling area ratings. The working hypothesis of this study may be put in the following way, "The distribution pattern to work for the low income worker as opposed to the high income employee is determined by the distance to work and the spatial occurrence of jobs in the metropolitan area".

The study has a geographical basis because it deals with space-relations. It attempts to analyse the spatial linkage between residence and workplace, in other words, it is concerned with patterns in space. "Broadly, the geographer is looking for spatial form and spatial relations or, in other words, for patterns of distributions and interactions, something with which other disciplines are less concerned and which they are therefore less likely to discover".<sup>2</sup> The thesis is also dynamic in nature because it involves movement of people from one locality to another. In effect it regards human populations as "complex oscillating particles, with short loops connecting places of sleep, work and recreation and longer loops connecting old hearths and new areas of migration".<sup>3</sup> A dominant element of the analysis

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2 Murphy, R. An Introduction to Geography, Chicago Rand McNally & Company, 1960, p. 5.

3 Haggett, P. Locational Analysis in Human Geography, London: Edward Arnold, 1965, p. 32.

is distance which has been identified by Nystuen<sup>4</sup> as a fundamental concept of geographical studies.

Having presented the thesis problem, the study may therefore proceed to define the elements of the hypothesis operationally. The journey to work is a characteristic feature of the present-day urban life. Every day a constant stream of people leave their homes and travel to employment centres and back again. This daily migration of people has been described by Liepmann as "tide of daily ebb and flow". The picture presented is of 'conflux' at the work-place and 'dispersion' from residence. The latter is the focus of this paper. The question then is, what steps should be taken to measure the phenomenon. Owing to the failure of Canadian Censuses to include information on usual work-place, the following sources of data are used. The major data source for the paper is the Statistical Review, National Capital Region, published in 1964 by the National Capital Commission, Ottawa. It contains a mine of information pertinent to the study. There is some record about the daily movement of people for 1963 in the national capital. This information is aggregated for each traffic zone whose daytime and night populations are given. The daytime population is recorded according to five occupational categories

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4 Nystuen, J.D. "Identification of Some Fundamental Spatial Concepts", in Spatial Analysis, A Reader in Statistical Geography, ed. by B.J.L. Berry & D.F. Marble, New Jersey: Prentice-Hall, 1968, pp. 35-36.

composed of 1) Professional, business and Clerical; 2) Retail; 3) Manufacturing and Industry; 4) others and 5) Federal Government. For this study four of these employments were chosen while the fourth item in the list was dropped as a result of its heterogeneous character. In addition there is information on the average family income for each traffic zone.

The Greater Ottawa City Directory forms the next major source of data. By this means it was possible to find out the residential and occupational addresses of persons living in any locality of the Ottawa-Hull metropolitan area. The City Directory has merit because it gives a finer breakdown of place of work information than will be contained in a census report whose data is indicated in an aggregate form even if it were available. The Greater Ottawa City Directory for 1963 was chosen in conformity with the Statistical Review for comparative reasons. Other relevant documents consulted in this investigation include the Lower Town Social Survey published by the City of Ottawa and the Ottawa-Hull Transportation Study published by DeLeuw, Cather and Associates in 1965.

In the first chapter, the study areas were placed in their geographic setting. There was an attempt to define the characteristics of both neighbourhoods which mark them out as separate urban entities. Apart from the fact that

both areas have different locations, (Fig. 1) they are moreover ethnically and demographically different. In terms of city structure, Lower Town East belongs to Burgess's "transition zone surrounding the central business district with residential areas being 'invaded' by business and industry from the inner core." Whereas Rockcliffe Park Village falls in 'the zone of better residences with single family dwellings'. The establishment of the differences between the two areas is brought out by the choropleth map of the average family income for Ottawa-Hull in 1963. The second chapter is a review of the literature pertinent to the topic. The last section of this chapter contains the working hypothesis of this thesis.

The third chapter examines the distribution of employment in Ottawa and Hull. Using the information on employment per traffic zone as contained in the Statistical Review it was possible to illustrate the spatial occurrence of jobs in the metropolitan region. Above all the main employment concentrations in the Ottawa-Hull conurbation were identified. Here the Location Quotient was used to identify the major work concentrations according to their spatial variability in relation to four major employments found in the region.

The fourth chapter focusses on the actual distribution of workers from Lower Town East and Rockcliffe Park

Village. The City Directory provided the source of data. Firstly, all the persons who lived in this neighbourhood in 1963 and indicated their places of employment were recorded. Their distribution proved difficult to map. However certain work-place locations such as the Ottawa General Hospital, the University of Ottawa, the Civic Hospital, the Dominion Bureau of Statistics or other government institutions were relatively easy to locate. On the other hand, some work-places were more difficult to pin down to a definite area in the metro-area. These include the various branches of the Bank of Nova Scotia, the Royal Bank of Canada, the Canadian Imperial Bank of Commerce together with IGA and Loblaws food stores which are highly dispersed throughout the city. Labourers and certain construction workers, who did not specify their employment addresses, could not also be located. By this process it was possible to identify the work-places of nine hundred and eleven of the one thousand, two hundred employees who gave their work locations from Lower Town East. For Rockcliffe Park Village, one hundred and forty-one persons out of one hundred and seventy-five persons were eventually located.

Next, the one thousand and fifty-two workers from these districts were reclassified according to the four employment categories listed earlier as 1) Professional, Business and Clerical; 2) Retail; 3) Manufacturing and Industry; and 4) Federal Government. The procedure of reclassi-

fication is as follows. If a worker indicated that he was employed, for instance, either in the Department of Labour, the Department of National Defence or any of the Crown Corporations such as the Central Mortgage and Housing Corporation, he was consequently grouped under Federal Employment. On the contrary, a person may be employed in Manufacturing and Industry but in addition to his/her work address states his/her function, for example, administrative assistant or clerk, he or she was then classified under clerical. Persons like company presidents, university professors, dentists, surgeons and embassy officials were grouped as professional, business and clerical workers. Those who gave their industry and manufacturing addresses without specifying their particular functions whether administrative or engaged in the actual processes of production were classified under Manufacturing and Industry. Persons stating their work locations as Henry Macks, Joe Feller, Woolworth Ltd., or Freimans Ltd., automatically belonged to Retail Employment.

The testing of the hypothesis forms the fifth chapter. Here the gravity model is applied to the distribution pattern in order to predict whether or not there is any correlation between distance and mass. For this reason the product moment correlation coefficient was calculated.

Distance was measured in the conventional way by drawing

~~straight lines between the employment centres and the cen-~~

tres of the neighbourhoods. With the determination of the mile-distances to work, the data was plotted on scatter-diagrams. Furthermore the analysis was subjected to more vigorous testing by the use of interactance hypothesis. Detailed disucssion of this method will be found in this chapter. The final chapter deals with the conclusion and evaluation of the study. Following the final chapter are three appendices containing the tables used in the text and a selected bibliography of the works consulted while writing the thesis.

## CHAPTER I

THE LOCATION AND CHARACTERISTICS OF LOWER TOWN EAST  
AND ROCKCLIFFE PARK VILLAGE-OTTAWA

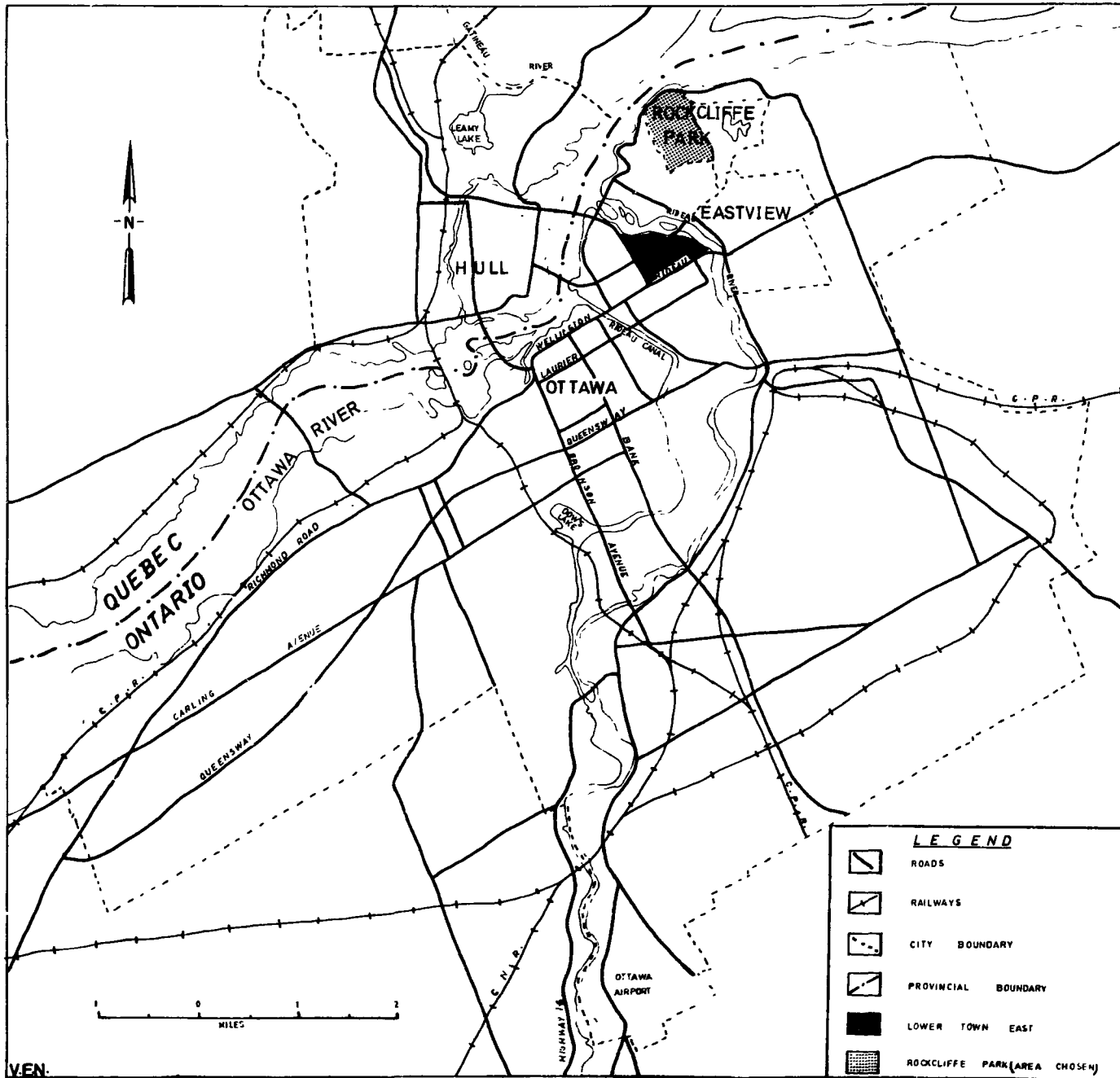
This chapter attempts to place the study areas within a geographical setting and secondly to justify their selections for the present analysis.

Lower Town East Neighbourhood and Rockcliffe Park Village form distinct urban residential entities within the Ottawa-Hull Metropolitan complex. This area is one of the fastest growing conurbations of Canada with a total population of 494,535 persons.<sup>1</sup> The Ottawa-Hull metropolis is exceeded population-wise only by the millionaire cities of Montreal and Toronto and the metropolitan centres of Vancouver and Winnipeg, thus ranking fifth among Canadian Cities.

In terms of location Lower East and Rockcliffe Park Village are situated within easy access of each other on the southern bank of the Ottawa River (fig. I). Both neighbourhoods are separated physically from each other by the slow-flowing Rideau River which tumbles over the Rideau Falls into the Ottawa River, a few hundred yards below the confluence of the Ottawa and Gatineau Rivers.

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<sup>1</sup> Census of Canada, 1966, No. 92-615, Vol. I, Population, Dominion Bureau of Statistics, November, 1967, p. 9.



THE LOCATION OF THE STUDY AREA IN OTTAWA-HULL REGION.  
 Fig. 1

Lower Town East skirts the eastern section of the Central Business District of Ottawa, at a distance of one-half mile from Confederation Square. It is separated from the City of Eastview on the east by the Rideau River, bounded by Rideau Street on the south and demarcated westwards by the four lane King Edward Avenue. By and large it is a triangular-shaped neighbourhood.

Rockcliffe Park Village lies north-east of Lower Town across the Rideau River, overlooking the Ottawa and Gatineau rivers. It is a high-class residential suburb enjoying some special privileges not found elsewhere in the metropolitan area. Commercial and industrial establishments are forbidden in order to preserve the special village characteristics of this area. The study does not include the entire area of Rockcliffe Park Village. The part involved in this analysis is defined by Maple Lane, Lisgar Road and Acacia Avenue.

Both neighbourhoods are well served by roads and are accessible to all points in Ottawa-Hull.

#### Internal Characteristics.

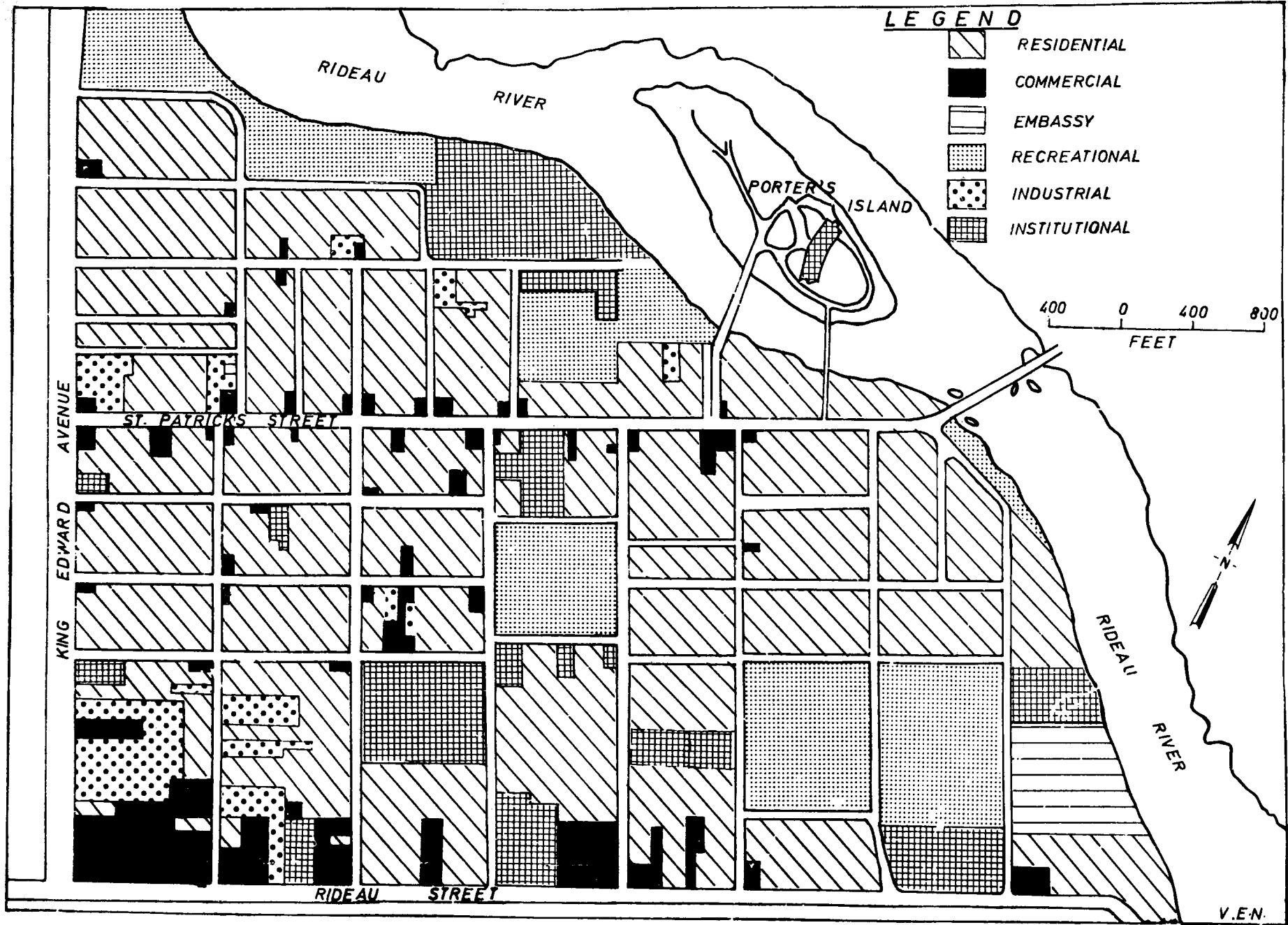
Apart from different geographic locations, the two areas are quite distinct from each other. Historically Lower Town East is one of the earliest urban quarters of Ottawa and Hull, being the direct outcome of the construc-

tion of the Rideau Canal. By 1865<sup>2</sup> most of the area had been built up. Although originally established for residential uses it has since undergone many changes. Rockcliffe Park Village was a later development.

In terms of city structure, Lower Town East belongs to the transition zone immediately located outside the Central Business District. Perhaps it is its transitional character which distinguishes it clearly from Rockcliffe Park Village. Although Lower Town East has a residential function, it has been invaded by business and industrial activities spilling over from the city core (Fig. II). As can be observed in figure 2, a greater proportion of the neighbourhood is occupied by residences, some of institutional character like the Convent of the Good Shepherd and some senior citizens' residence such as McDonald Manor, Porters Island Lodge and the Jewish Home for the Aged. Other institutional uses include several Roman Catholic

---

2 Actually the first lots were rented on Rideau Street by Colonel By in 1827 and in 1829 there had risen 126 civilian houses. Lower Town was later incorporated as Bytown in 1847 and further in 1855 as the City of Ottawa. See City of Ottawa, Lower Town East Neighbourhood Study, 1966, Planning Branch, p. 5 for a summary history of the area.



LOWER TOWN EAST - OTTAWA LAND USE  
 Fig. 2

Churches, Separate Schools, and the Jewish Community Centre and Synagogue. In addition, this neighbourhood is characterised by neatly kept parks and open spaces administered by Federal and City Governments. The existence of such large parks close to the heart of the downtown district is what this area shares in common with the City of Montreal where large parks are located adjacent to the city core.

Besides the distinguishing mixture of residential, business and industrial uses in this neighbourhood another feature which gives it a different outlook is the presence of a wide gamut of dwelling structures. In essence the multiple family building predominates but there occur some single-detached houses, apartment buildings and rooming houses. This is quite alien to Rockcliffe Park Village.

As Norman Shulman observed in his article, Lower East Town " 'is primarily a French-speaking, Roman Catholic working-class area, with almost 80% of its population belonging to this category' "<sup>3</sup>. This fact is better illustrated in Table I following:

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<sup>3</sup> Shulman, N. "Mutual Aid and Neighbouring Patterns: The Lower Town Study", Anthropologica, N.S. Vol. IX, No. 2, 1967, pp. 51-60

TABLE I  
 Lower Town Neighbourhood, Ethnic Composition, 1961.  
 (Percent of Population)

	British	French	Italian	German
Neighbourhood	17	73	2	1
Northern Part	13	79	2	1
Southern Part	24	60	2	2
Eastern Part	39	35	1	4
Adjacent Areas				
Northwest	14	80	1	1
West	16	76	1	1
South	39	41	2	4
Ottawa City	55	26	3.1	

Source: City of Ottawa, Lower Town East Neighbourhood Study, 1966. For the neighbourhood as a whole, the French constitute the largest single ethnic group accounting for 73% of the total population of the entire neighbourhood. The next recognizable group is of British origin which forms only 17% of the resident population. The above table indicates the predominance of the French population; but it is perhaps its religious character which distinguishes Lower Town East from other neighbourhoods in Ottawa. Its French occupants chose to call it by the Roman Catholic parish name, Saint Anne, a point which Tracy Morey, the Ottawa Citizen staff reporter mentioned in his article as follows, "The majority of the

adult population is Roman Catholic-French Canadian and they refer to the area according to parishes, East Lower Town, for instance, is known as Ste. Anne's.<sup>4</sup> Apart from its Roman Catholic French population, it is also one of the densely-populated parts of Ottawa as is shown in Table II below:

TABLE II  
Population Growth, 1958-65

		<u>Lower Town East Neighbourhood</u>			
		<u>North</u>	<u>South</u>	<u>East</u>	<u>Total</u>
Population	1958	2,820	4,820	1,435	8,614
	1965	2,697	4,716	1,980	9,393
Percent Change		-4	+8	+38	+9
Distribution (%)	1958	33	51	16	100
	1965	29	50	21	100

Source: City of Ottawa, Assessment Records.

Nearly 10,000 persons live in a residential space of 81 acres.<sup>5</sup> By the City of Ottawa standards this is a high population density.

<sup>4</sup> Morey, T. "Lower Town-reguvenating the total community", The Ottawa Citizen, Ottawa, Citizen Press, August 17, 1968, p. 29.

<sup>5</sup> Lower Town East Neighbourhood Study, City of Ottawa, 1965, p. 7.

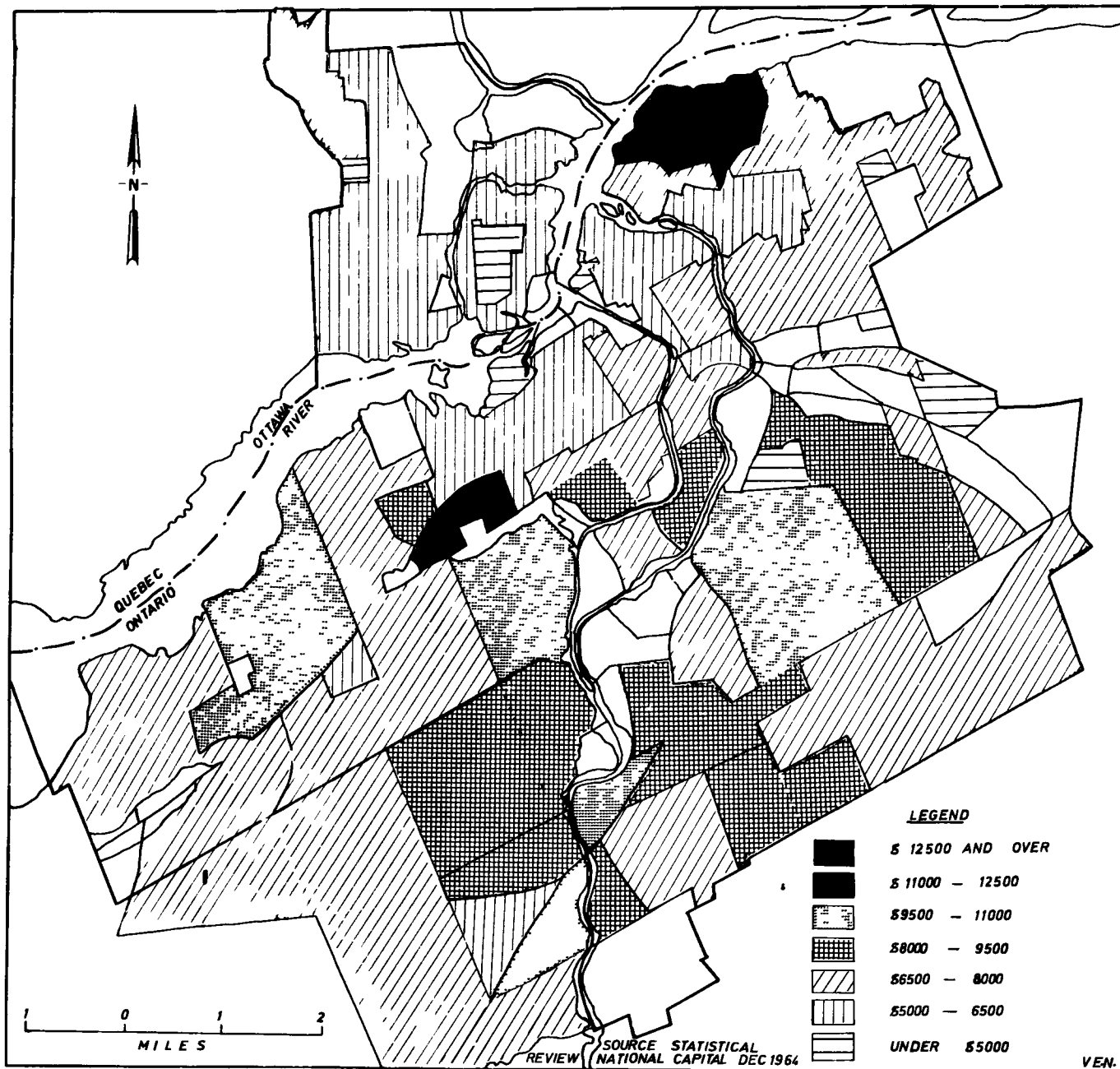
The most significant characteristic, however, from the point of view of this study, is that this area is a low income district. In his article Shulman comments on its low income population. The area has remained for many years inhabited by low income workers and this state of affairs has not changed in recent years. The average family income for Lower Town East in 1961 was \$4,650 or 25% below the city average and 10% below the average for all Centre Town.<sup>6</sup> The magnitude of this picture may be better grasped by reference to Figure 3 which shows the distribution of the average family income for Ottawa-Hull in 1963. Although the area falls in the \$5,000-\$6,500 income bracket, the actual average family income for the district was \$5,750. Thus from nearly every point of view Lower Town may be considered a low income neighbourhood.

Rockcliffe Park Village differs greatly from Lower Town East. Morphologically the area belongs to the high class residential zone. It is a low-density suburban district with only 0.5 persons per room.<sup>7</sup> Housing in Rockcliffe Park Village comprises single detached dwellings, mainly two

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6 Lower Town East Neighbourhood Study, loc. cit., City of Ottawa, 1965.

7 Census of Canada, 1961, Population and housing characteristics by census tracts, Catalogue: 95-528 Dominion Bureau of Statistics, April, 1963, p. 13.



THE DISTRIBUTION PATTERN OF AVERAGE FAMILY INCOME IN THE OTTAWA-HULL METROPOLITAN REGION, 1963.  
 Fig. 3

or three storeys, with extensive, fashionable gardens and well-trimmed lawns. The buildings here differ considerably in age and there is a mixture of old and new dwellings found in this affluent neighbourhood. The high status of this area is further marked by the occurrence of private swimming pools, lawn tennis grounds and even in some cases vegetable gardens.

The inhabitants of Rockcliffe Park Village are composed of company presidents and vice-presidents, high government civil servants, parliamentarians, university professors and embassy officials. Most of the occupants are of the high income group as Figure 3 illustrates. Indeed it is the only portion of Ottawa-Hull in 1963 with an average family income above \$12,500 per annum. By virtue of its population and other obvious reasons, Rockcliffe Park Village can be described as "the stock-broker belt".<sup>8</sup> To all intents and purposes it is a homogeneous high class neighbourhood. The above are the characteristics of the neighbourhoods, whose population travel to work patterns, form the focus of the present study.

---

<sup>8</sup> Beaujeu-Garnier, J., Geography of Population, London: Longmans, Green & Co. Ltd., (1966), p. 266.

## CHAPTER II

## THE JOURNEY TO WORK - A REVIEW OF THE LITERATURE

Among the group of researchers who have probed the matter of the journey to work are sociologists, economists, engineers, town planners and geographers. The initial interest shown in the mobility pattern of the worker manifested itself first in Europe and later in the United States of America. Today there exists a wide gamut of publications on the journey to work and allied studies on transportation. The latter is mainly the result of the work of engineers and town planners and is particularly prominent in U.S. where many transportation studies of metropolitan centres have been conducted.

It is proposed here to review the literature pertinent to the journey to work and subsequently enunciate a hypothesis for the present study. Before starting a review of the relevant texts on the topic, the writer wishes to express the immense difficulty and sometimes actual impossibility experienced in his attempt to acquire all the works from their widely scattered locations. Despite this difficulty, the major texts were available and are therefore going to receive attention here.

Apart from the two major works, a number of articles and texts on the journey to work have failed to include a

summary of the studies so far published on the subject. The two exceptions are John Wolforth's book, "Residential Location and the Place of Work" and Howard Lapin's "Structuring the Journey to Work". Of these two, the most exhaustive review of the literature of travel to work is Wolforth's. The other scholarly publications on journey to work are Liepmann's<sup>1</sup> and Taaffe's,<sup>2</sup> but apart from these, there are many other published articles in a number of journals and periodicals, particularly those in the fields of sociology, engineering, town planning and geography.

#### The Journey to Work As A Part of the Urban Process

Most writers on the journey to work recognise the contribution of work-travel to urbanization. But the role of journey to work in urbanism did not assume significant proportions until the era of the industrial revolution. Indeed, prior to the age of industrialism, the home served the dual purpose of residence and workshop. As Lewis Mumford observed:

---

1 Liepmann, K.K. The Journey to Work, Its Significance for Industrial and Community Life, (London: Kegan Paul Ltd., 1944).

2 Taaffe, E.J. et al; The Periphel Journey to Work-A Geographic Consideration, (Chicago: Northwestern University Press, 1963).

The workshop was a family, likewise the merchant's country house, The members ate together at the same table, worked in the same rooms, slept in the same or common hall, converted at night into dormitories, joined in the family prayers, participated in the common amusements.<sup>3</sup>

The early cities were thus characterised by the association of work and residence under one roof. Other writers who have drawn attention to this peculiar feature of pre-industrial society include James Vance.<sup>4</sup>

However the industrial revolution broke this symbiotic relationship between the home and the workshop. As a consequence industries began to function separately from living quarters and towns began to acquire definite distinguishable land use patterns. The emergence of specific functional urban morphologies in effect increased tremendously the distance between residence and workplace. As Mumford pointed out, the industries of the early phases of industrialism brought a "break between domestic life and work, both in space and in function".<sup>5</sup> At the turn of the 18th century, the journey to work became increasingly long, especially with technological changes which not only revo-

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3 Mumford, L. The City in History, Its Origins, Its Transformation and Its Prospects, (New York: Harcourt, Brace and World, 1961) p. 281.

4 Vance, J.E. "Labor-Shed, Employment Field and Dynamic Analysis in Urban Geography", Economic Geography, vol. 36 (1960) pp. 189-220.

5 Mumford, L. Op. Cit., p. 284.

lutionised industrial techniques but also affected industrial locations. As towns began to be planned, zoning laws were introduced to check haphazard development of urban growth and the distance between home and the employment centre expanded extensively.

The conscious effort in city planning brought about the establishment of residential neighbourhoods as opposed to commercial districts, industrial nodes vis-à-vis office blocks. The direct outcome of this seeming spatial segregation of urban zones is the great distance between home and workplace. Besides, the commuting distance also plays an important role in the ecological structuring of the city and it is not surprising that Gist noted, "the separation of workplace from home is a significant aspect of urbanization and is especially important from the stand-point of the ecological patterning of the city".<sup>6</sup>

Not only does the journey to work promote the spatial concentration of urban functions in distinct zones, it also contributes to the outward migration of old industries in need of expansion from the city core to the suburban fringe. Furthermore new industries have become footloose as a consequence of the journey to work possibility. The

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<sup>6</sup> Gist, A.P. and L.A. Halbert, Urban Society, New York: Thomas Crowell, 1956) p. 78.

culminative effect of these factors of urbanised life is the existence of intricate intra-city movements which have many facets. The main waves of this urban mobility are described by Liepmann as 'conflux' and 'dispersion' waves which become complicated by 'cross-currents' and 'counter-currents'.<sup>7</sup> City movements today consist of travel from the core to the fringe, movement from the periphery to downtown and movement from one end of the city to the other. The growing importance of peripheral commuting in cities has assumed such great proportions that Taaffe and his colleagues believed that peripheral labor-sheds throw some light on "the processes changing the spatial organizational structure of American cities".<sup>8</sup> Recently Richard S. Thoman and M.H. Yeates, while investigating the functional structure of the Georgian Bay<sup>9</sup> vicinity drew attention to the use of journey to work as a measure for the delimitation of region. From all considerations the journey to work is a part of the

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7 Liepmann, K.K. Ibid. p. 3

8 Taaffe, E.J. et al. Ibid. p. 3

9 Thoman, R.S. & M.H. Yeates, Delimitation of Development Regions in Canada (With special attention to the Georgian Bay Vicinity) Kingston: Dept. of Geography, Queen's University, 1966) pp. 104-6.

urban process. The increased density of private cars on city streets and the presence of over-head bridges in present-day large urban agglomerations are a recognition of the work-travel which poses other economic and social problems to the urban environment.

#### The Economic Aspects of the Journey to Work

One of the features of the journey to work which has been considered by writers in this field of study is its economic implications for society. Although many authors seem to incorporate this aspect of the journey to work as a social problem, there are three who regard it as a separate factor. Liepmann devoted two of her chapters to the economic implications of travel to work, pointing out its advantages to the entrepreneur and the employee. One of the advantages derived by the employer from the journey is mobility of labour regarded as "the very breath of life to modern industry".<sup>10</sup> Journey to work increases the 'labor-shed' of industries.

The economic effects of work-travel on the employee are assessed from the daily cost to the worker. These effects are weighed in terms of money spent on the daily journey which Liepmann summarised in the following words:

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1 Liepmann, K.K. op. cit. p. 10.

"Neither are the travelling expenses of individual workers taken into account in the determination of wages, nor are the costs of travelling in any way assessable as a fixed percentage of the respective individual earnings or of the pooled incomes of the families".<sup>11</sup>

As she later on remarked the amount spent in travel to work can only be conveniently accounted for by high income groups of the "zone of better residences".

John Kain is another author who has investigated at length the problem of urban travel behaviour. Kain treats residential location and the journey to work as one indivisible whole and regards the costs of commuting as an important variable explaining the theoretical models of most residential locations. An explanation for residential location is intricately interwoven with the journey to work which compels the low income employee to examine his income and residential preferences. Most origin and destination studies have failed to consider the family income of the worker which, among other things, has been identified as an important explanatory factor. As Kain noted, the consumption of residential space has been stressed as a superior good in all theoretical models of residential locations but he thought that consumption rose with income, for as he put it:

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11 Liepmann, K.K. Op. Cit., p. 10

"Thus, higher income, ceteribus paribus, should cause workers to reside farther from their workplaces at least in those situations where the cost of residential space per unit decrease from the workplace. On this basis high income workers would be expected to live farther away from the workplaces and to make longer work-trips than low income workers".<sup>12</sup>

In another article Kain identified the amount of money spent on transportation as responsible for the variations in the patterns of trips to work amongst low and high income employees.

Writing also on the economics of the journey to work, Lowdon Wingo is of the opinion that the complex transportation patterns may be the result of forces such as time and money whose constraints vary among the population in accordance with their income levels. Money is a greater restraint on distance to work for low income employees than for high income earners who place priority on time. By and large, both groups have different commuting patterns. It has also been noted that the costs of the journey to work enter into the production costs of local firms. For example, when such a firm moves to a new location, it is compelled to offer premium wages, especially to female labour, in order to compensate for the extended trip. Without any doubt the journey to work presents obvious economic problems both to the

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<sup>12</sup> Kain, J.F. Urban Travel Behaviour, in Urban Research Policy Planning, p. 185.

employer and the employee and to society in general.

The social problems of the journey to work

The social problems of the journey to work have received far greater attention from sociologists than from any other group of workers. Of the writers who have taken up the issue Liepmann, Carrol, Westergard and Thompson are outstanding. A recurrent problem in the works of these authors is the time spent en route to the workplace. Indeed attempts have been made to determine the time spent between the home and the workplace but no universal agreement has been reached as to the limit involved. Liepmann<sup>13</sup> affirms and observes that some writers have stipulated a period of 30 minutes; however, in many cases this figure has proved impracticable. Time spent between the home and the employment centre throughout the cities of the world varies greatly and constitutes a great concern to urban society. Time lost in the journey to work has often formed the topic for consideration for most Transportation Commissions and indeed this very problem echoed at the signing of the United States Urban Transportation Act by President Johnson who remarked

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13 Liepmann, K.K. op. cit. p. 52.

"When I consider the problems this bill is trying to cope with, I am thankful that I work at home except on Saturdays".<sup>14</sup> The means to reduce the time spent on the journey to work has constantly been a goal of city planners.

Apart from the loss of time incurred in work travel, an associated problem is the strain accompanying it. As the Barlow Report maintained, the fatigue and loss of energy suffered by the worker not only affects his degree of efficiency at work but also is detrimental to the employer's cost of production. Dealing with the social implications of this topic, Jean Thompson<sup>15</sup> enumerated the social problems as comprising excessive discomfort experienced during commuting, the creation of divided loyalty in the individual as well as in the home and finally, the effect the journey to work has on local governments which have become the monopoly of local businessmen and manual workers to the exclusion of professional and administrative personnel.

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14 U.S. Department of Housing and Urban Development, Cities on the Move, (Washington D.C. 1967)

15 Thompson, J. "The Journey to Work-Some Social Implications", Town and Country Planning, (November, 1950) pp. 441-446.

There are other social problems connected with the daily travel to work. The divorce between home and work stimulates the growth of specialised services but it will suffice to mention the social implications which accompany the establishment of such services. The growth of the catering industry, restaurants and snack bars is a sociological alteration in the habits of the working population which Liepmann regarded as a revolutionary innovation for women. Indeed the prime objective of the establishment of such services was to help provide light meals during work break periods. This function, as we know, has been changed today and thus in many large urban centres we find these establishments operating far into the night, well beyond the stipulated journey to work periods. The social problems arising from the journey to work cannot be fully assessed as Westergaard <sup>16</sup> pointed out when he was writing on the commuting pattern in the London region. Generally, it may be impossible to assess completely the degree of waste in resources and energy caused by the daily migration between homes and jobs.

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<sup>16</sup> Westergaard, J. "Journey to work in the London Region", Town Planning Review, 28 (1957) pp. 37-62.

Towards The Development Of A Working Hypothesis

From a review of the various works on this topic and the consideration of the main aspects of the journey to work, certain factors seem to be dominant in formulating theories to predict the travel to work patterns of workers. These forces are income and distance though there are other factors. Liepmann, the first to write a major text on the journey to work, was not concerned with the formulation of a journey to work theory but with pointing out its social and economic consequences for society. The first to advance a theory of work-travel is Douglas J. Carrol who hypothesized that:

Forces are in operation tending to minimize distances between home and place of work and the concentrative effect of these forces is an important factor conditioning total residential arrangement of urban populations. 17

Among the forces contributing towards the reduction of distance between home and the employment centre is income. Taaffe and his associates also agree that income, occupational structure and the presence of employment opportunities affect the distribution of workers. In view of these factors the hypothesis of the current study is: (1) that the distribution pattern to work for the low income employee

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17 Carrol, J.D. "The Relationship of Home to Workplaces and the spatial Pattern of Cities", Social Forces 30 (March, 1952) pp. 271-282

as compared with that of the high income earner is governed by distance. (ii) that the journey to work pattern may be explained by the spatial occurrence of jobs in the city.

## CHAPTER III

THE EXAMINATION OF THE DAYTIME POPULATION DISTRIBUTION  
IN THE OTTAWA-HULL METROPOLITAN REGION: 1963

There have been various attempts to estimate the daytime population patterns of the cities among demographers and urban geographers. Research in this direction has encountered a great deal of difficulty because of the limited nature of existing data; moreover, where data is available, it is usually unsuitable, as the population is recorded at the place of residence rather than at the place of work. There is therefore a serious need for recording the population of cities during working hours. Such a need was recognised long ago by Mark Jefferson<sup>1</sup> and since that period the problem has received attention by such scholars as Breese, Chapin, Foley and Weir<sup>2</sup>, as well as some planning agencies.

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1 Jefferson, M. "The World's City Folks," Geographical Review, Vol. 21, pp. 446-465, 1931.

2 Breese, G.W. The Daytime Population of the Central Business District of Chicago, (Chicago:University of Chicago Press) 1949; see also Chapin, F.S. Jr., Urban Land Use Planning, 2d ed., (Urbana: University of Illinois Press) 1965 especially chap. 5; Foley, D.L. "Urban Daytime Population: A Field for Demographic-Ecological Analysis," Social Forces, Vol. 32, pp. 323-330, 1954, and finally see Weir, T.R. "Land Use and Population Characteristics of Central Winnipeg", Geographical Bulletin No. 9, Ottawa, pp. 5-21, 1956.

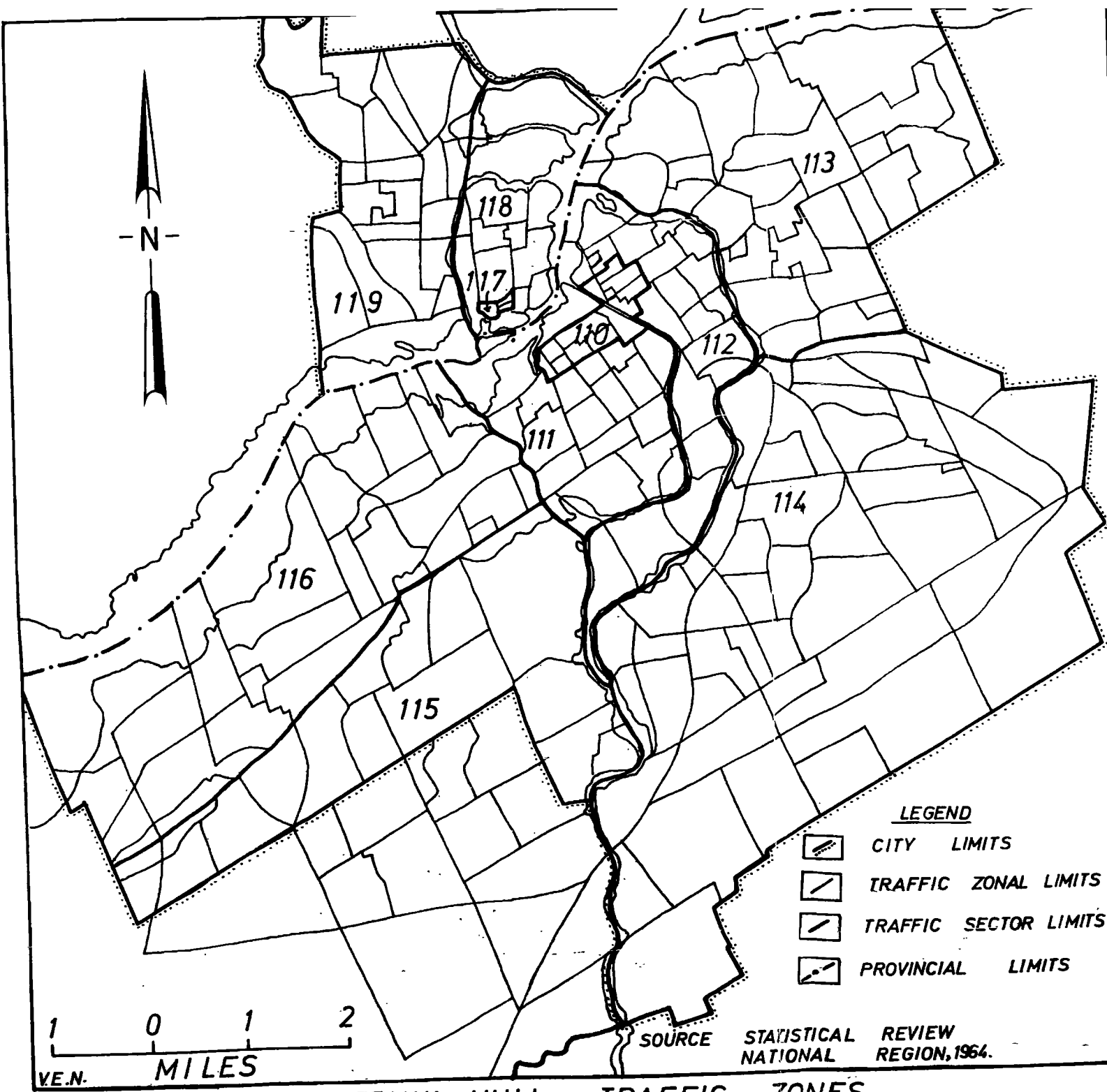
Daytime population has been defined in a variety of ways but the following definition seems to be the most appropriate.

For any given standard location the daytime population at the selected hour represents the sum of the number of persons physically present in the area working, attending school, shopping, conducting personal business, enroute from one place to another, or engaging in other activities away from their homes, and a number of residents remaining at the location.<sup>3</sup>

From the point of view of this study, interest is focussed on the distribution of the working population and so does not incorporate all classes of people identified by the U.S. Bureau of Census definition. It has already been pointed out that information on the distribution of population during working hours is lacking for most Canadian cities though a few isolated origin and destination studies have been carried out. However, the spatial spread of the employed population of the Ottawa-Hull metropolitan district can be investigated through the Statistical Review of the National Capital Region. This data source records its information according to the traffic zones of the cities concerned. For each traffic zone the total resident population and the total employed population during the day are given. Furthermore the total working population is broken down into five

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<sup>3</sup> This is U.S. Bureau of the Census definition of daytime population.

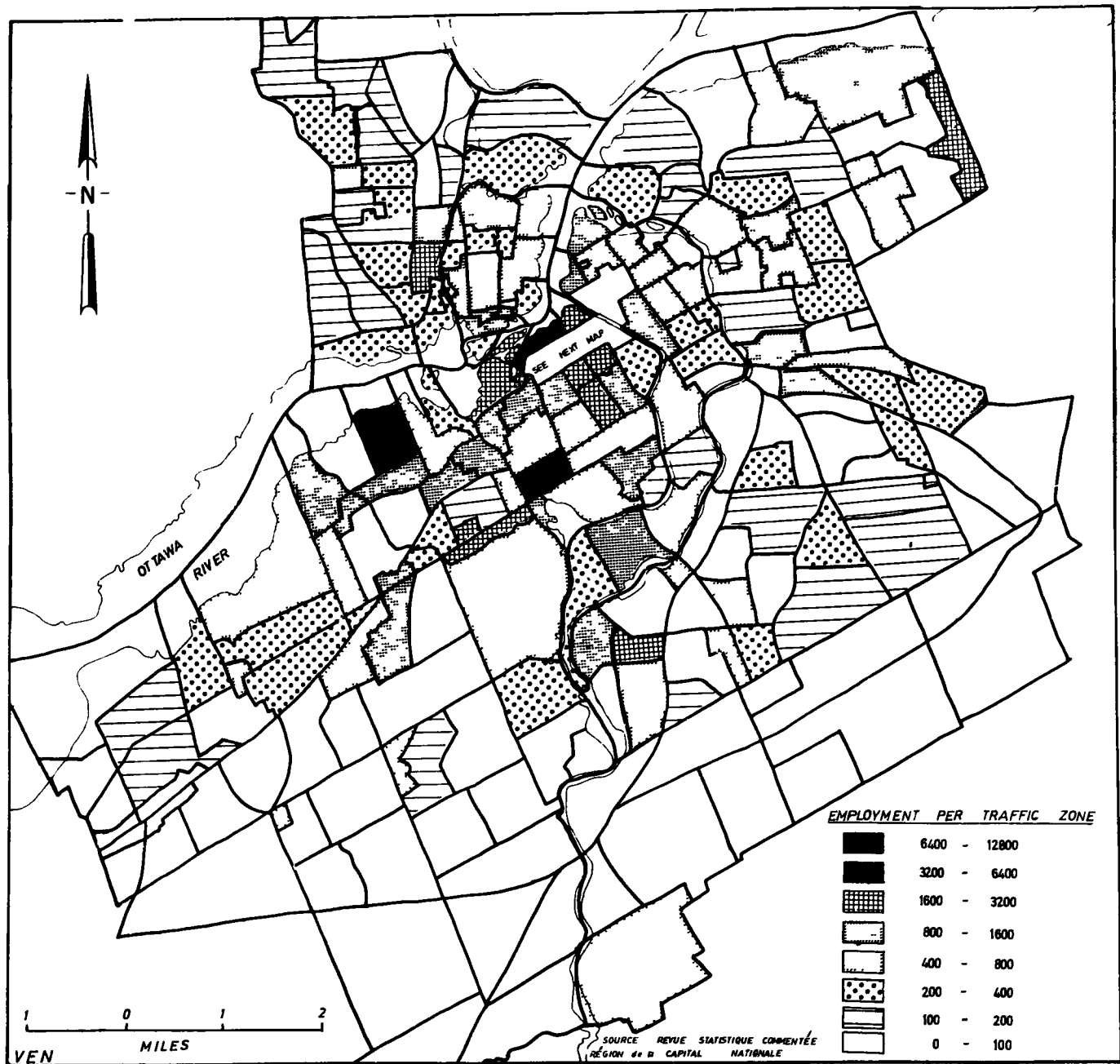


OTTAWA-HULL TRAFFIC ZONES  
1963.

occupational groups, namely: professional, office and clerical; retail trade; manufacturing and industry; other categories and federal government. Using this data as a base, the study proceeds to look at the spatial variability of the gainfully occupied population of the Ottawa-Hull conurbation, an area comprising 235 traffic zones (Fig. 4) aggregated into ten traffic sectors.

#### General Distribution of Employment in Ottawa and Hull

An adequate way to look at the population of any urban agglomeration during the business hours is to examine the spatial variation of employment. As Weir notes in his paper, there are four principal methods by which the daytime population can be measured; however, only one of these measures will be examined in detail in this study. The parameter concerned is the proportion of the gainfully employed. As has been pointed out earlier, information is supplied on the number of employed population and exists for each of the traffic zones used in the present analysis. Employment includes all gainfully occupied persons from the age of five and over throughout the area under investigation. With the availability of such data, a map (Fig. 5) showing the spatial distribution of employment in Ottawa and Hull was compiled. The diagram exposes the uneven distribution of the gainfully employed population in the district: peak areas



THE SPATIAL DISTRIBUTION OF EMPLOYMENT IN THE OTTAWA - HULL REGION, 1963.

Fig. 5

of employment concentration stand out against places with a low density of employed people. One result, or rather one striking revelation presented by the map, is that the presence of high and low areas of employment means that there is a considerable population movement between traffic zones daily. Perhaps the magnitude of this population movement from one zone to another can be better illustrated by calculating the daily migration of workers and the percentage change per traffic zone. (See Table 3).

In the table mentioned above some traffic zones of four traffic sectors were selected to illustrate the daily variation of population mobility amongst the different sectors of Ottawa. Column 5 indicates the number of employed persons entering each of the traffic zones in 1963 and column 6 shows the percentage change in population. As can be observed, some traffic zones are without any resident population at night but by day, swollen with people. For example, traffic zone (01) in traffic sector 111, which corresponds to Parliament Hill or to the region of the Mall on Sparks Street, at night has a population of 98 persons but during the day has a teeming working population of 12,523 persons. Column 6 demonstrates the degree of population flow in percentage rates. In some traffic zones the daily percentage change is as high as 100% indicating the intensity of the daily journey to work.

The areas with a daily percentage change of 100% and over indicate the zones of greatest employment concentrations which, on the map, are depicted as having from 6,400 to 12,800 workers. Of these employment nodes, the Central Business District of Ottawa ranks highest with a total working population of 43,374 as against a resident population of 6,331. Even in this zone of maximum employment opportunities there are internal contrasts. Figure 6 is a good illustration of this situation. But one can even better appreciate the regional difference in employment pattern by glancing at Table 5 which portrays the functional concentration of work. There are 12,523 workers in traffic zone (01) corresponding to the area enclosed by Elgin, Wellington, Kent and Albert Streets. The class of workers found in this node are mainly those engaged in the professional, office and clerical fields, and in the employment of the federal government. Zone 07, enclosed by Laurier, Elgin and Lisgar streets, and by the Rideau Canal on the east, is dominated by Federal Government Employment. Of significance throughout the CBD is the low incidence of manufacturing and industrial workers.

Beyond the Central Business District the intensity of employment concentration decreases gradually towards the urban fringes but the picture is by no means uniform as there exist other zones of conflux. These pockets of em-

TABLE 3

Differentials Between Resident and Daytime Population for Some Employment Districts of the Ottawa-Hull Metropolitan Area By Traffic Zones, 1963.

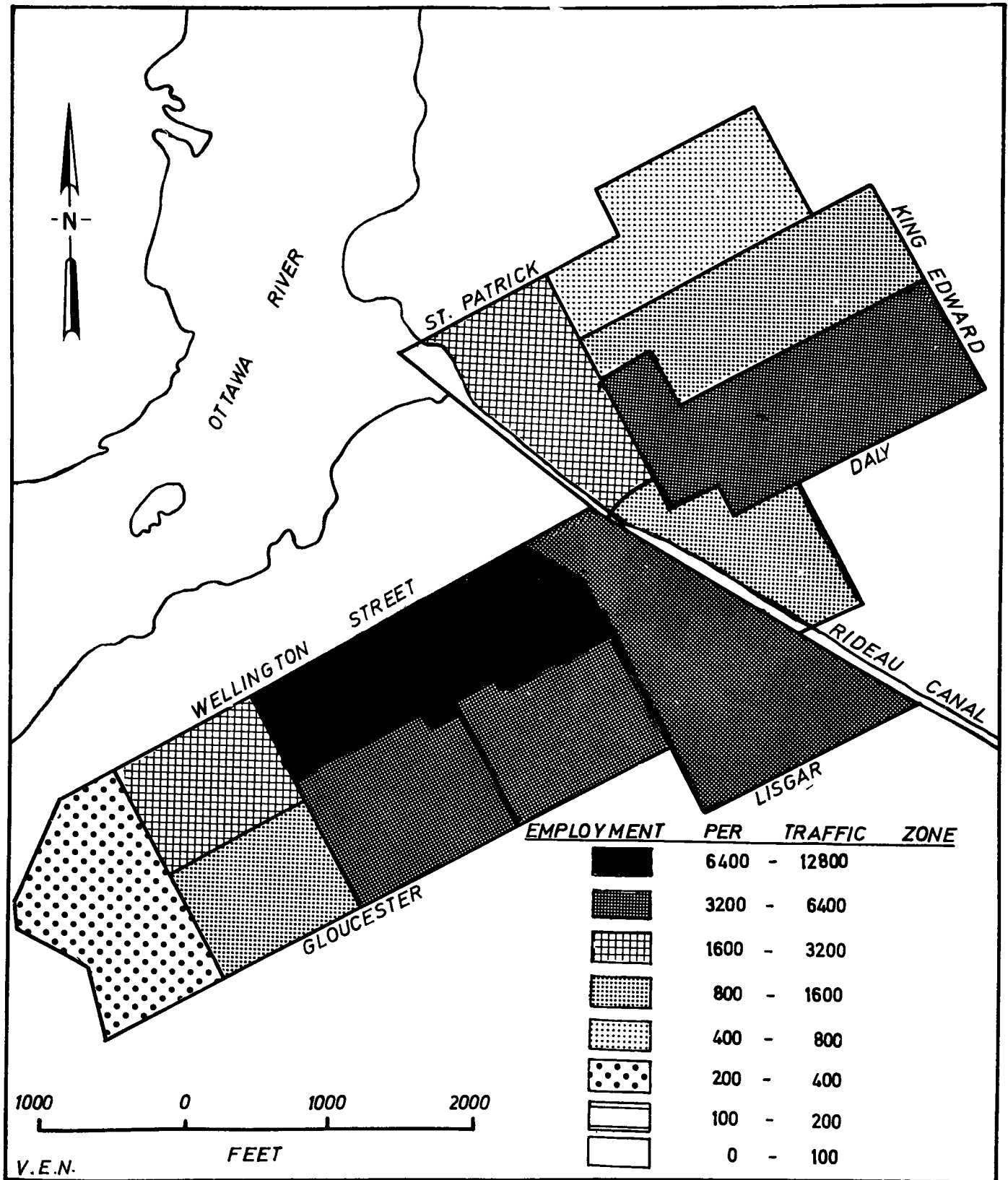
Traffic Sector	Traffic Zone	Resident Population	Daytime Population	Net Daily Migration	Percent Change
110	01	98	12253	14425	126.7
	02	131	2778	2647	20.2
	03	650	271	379	-5.8
	04	665	1323	658	-9.8
	05	371	4399	4028	10.8
	06	136	4516	4380	32.2
	07	60	6030	5970	99.5
	08	156	1566	1410	90.3
	09	952	5226	4274	4.48
	10	1119	1478	359	-0.30
	11	1960	592	1368	-0.6
	12	33	2672	2639	79.9
111	01	0	1476	1476	100.0
	02	0	3774	3774	100.0
	03	0	300	300	100.0
	04	1588	2008	420	-0.2
	05	1608	1480	128	-0.0
	08	1870	2178	308	0.1
	12	2660	2507	153	-0.0
	15	3234	3558	324	0.1
	16	0	801	801	100.0

TABLE 3 CONTINUED

	01	450	1305	855	1.9
112	02	0	890	890	100.0
	04	574	753	179	0.3
	10	140	379	257	1.8
	16	0	141	141	100.0
	18	0	1119	1119	100.0
	20	0	185	185	100.0
113	22	0	1225	1225	100.0
	24	0	494	494	100.0
	25	0	1641	1641	100.0
	26	0	715	715	100.0
	01	0	27	27	100.0
	03	0	42	42	100.0
	05	0	75	75	100.0
	07	0	1403	1403	100.0
	08	160	213	53	-0.3
	11	447	398	49	-0.1
	14	0	72	72	100.0
	18	0	138	138	100.0
114	20	287	270	17	-0.0
	23	0	527	527	100.0
	24	0	40	40	100.0
	28	53	163	110	2.0
	29	0	947	947	100.0
	30	0	1792	1792	100.0
	32	512	622	110	0.2
	35	74	402	328	4.4

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Source: Statistique Revue Commentee, Region de la Capitale Nationale, Decembre 1964.



THE VARIATION OF EMPLOYMENT IN DOWNTOWN OTTAWA

Fig. 6

ployment concentrations are located in Tunney's Pasture, Lebreton Flats, Confederation Heights, the region of Booth street and Carling Avenue, the commercial ribbon development between Bank and Lyon streets and the National Research Council offices in the northeast of Ottawa. Other islands of high employment density are found in the outlying shopping centres, including the area occupied by E.B. Eddy Paper Mill immediately beyond the Chaudière Bridge linking Ottawa and Hull. The areas of low employment occurrence shown in figure 5 correspond to residential quarters. Apart from these quarters, the pattern presented is a generalised one and an effort will therefore be made to show the functional concentration of the daytime population of the Ottawa-Hull agglomeration.

The Functional Classification of the Ottawa and  
Hull Employment Centres

Figures 5 and 6 are generalised illustrations of the employment situation in Ottawa and Hull and do not give any indication of the functional specialization of the major employment centres. Data employed in the preparation of diagram 5 permits a differentiation of the principal workplaces by functions. The purpose is to show the local specialization of each employment node. To arrive at any meaningful picture of local specialization of job concentration in the Ottawa-Hull area, all traffic zones where

the daytime population exceeded the resident population were chosen. Having chosen the chief employment districts, it became essential to arrive at an index which can express local specialization and make comparisons possible. As a result of the nature of the data utilised in the study, the Unadjusted Index of Local Specialization or, what is popularly termed the Location Quotient, was selected.

The Location Quotient has a number of merits and is particularly favourable to calculations such as the current study intends to investigate. One of its major assets is that the index is expressed in relative terms and therefore makes comparisons feasible. Furthermore it has the added advantage of easy applicability to intra-city study, a characteristic which is confirmed by John M. Mattila and Wilbur Thompson<sup>4</sup> who have used this particular index. The index of local specialization is expressed by the formula:

$$\frac{e_i}{e_t} \quad \text{or} \quad \frac{E_i}{E_t} \quad \text{where } e_i \text{ local industry employment}$$

$$\frac{E_i}{E_t} \quad \text{or} \quad \frac{e_t}{E_t} \quad \text{et local total employment}$$

$$\frac{E_i}{E_t} \quad \text{or} \quad \frac{e_t}{E_t} \quad \text{Ei national industry employment}$$

$$\frac{E_i}{E_t} \quad \text{or} \quad \frac{e_t}{E_t} \quad \text{Et national total employment}$$

The index is essentially useful in relating the significance of an industry to a locality in comparison to the importance of the industry to the nation.

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<sup>4</sup> These co-authors used this particular index in chapter 10 of J.P. Gibbs book, Urban Research Methods, Princeton: D. Van Nostrand, Inc., 1961) pp. 329-348.

TABLE 4

Employment Total of Four Major Employment Groups in the  
Principal Employment nodes of the Ottawa-Hull Metropolitan  
District, 1963

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Occupational Class	Total Occupational Employment	Location Quotient
Professional Office and Clerical	30,334	2.54
Retail Trade	20,885	1.74
Manufacturing and Industry	15,004	1.25
Federal Government	53,120	4.45
Total Employment	119,343	9.98

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Source: Compiled from the Statistical Review, National Capital  
Region, December, 1964.

One anomaly in the location quotient index is the incorporation of national figures which may render it of limited application to local studies such as the present one. In order to make it applicable, some necessary adjustments have to be made to fit the data available. Where national figures were brought in, these were replaced by metropolitan figures. Thus the formula reads as follows:

$$\frac{e_i}{e_t} \quad \text{or} \quad \frac{E_i}{E_t} \quad \text{where}$$

$e_i$	local occupational employment per traffic zone.
$e_t$	local total employment per traffic sector.
$E_i$	metropolitan occupation employment.
$E_t$	total metropolitan employment.

Prior to the application of the index, the sum of the occupational class for each of the major employment zones was determined. Table 4 gives the totals for each of the occupational categories used. As is evident in Tables 5 to 13 and as Appendix A indicates, the number of persons employed in each occupational group is given. These figures were then applied to the formula above to arrive at the location quotients represented in decimal figures. Taking the figures of professional, office and clerical employment in traffic zone (01) of Sector 110, Table 5, and applying it to figures in Table 4, an index of 1.6 was obtained. The operation was performed in the following way:

<u>5,309</u>		where	5,309	local professional, office and clerical employment
<u>12,523</u>	1.66		12,523	total local employment per traffic sector
<u>30,334</u>			30,334	Total professional, office and clerical for all the traffic sectors
119,343			119,343	total employment for four classes of occupation used.

By this procedure the location index for all the traffic zones, identified was calculated. Tables 5-13 in Appendix A give the location indices of the major employment traffic zones of each of the 10 traffic sectors covering the metropolitan area of Ottawa and Hull. Furthermore the statistics of employment for each of the four occupation groups concerned are also included in the appendix.

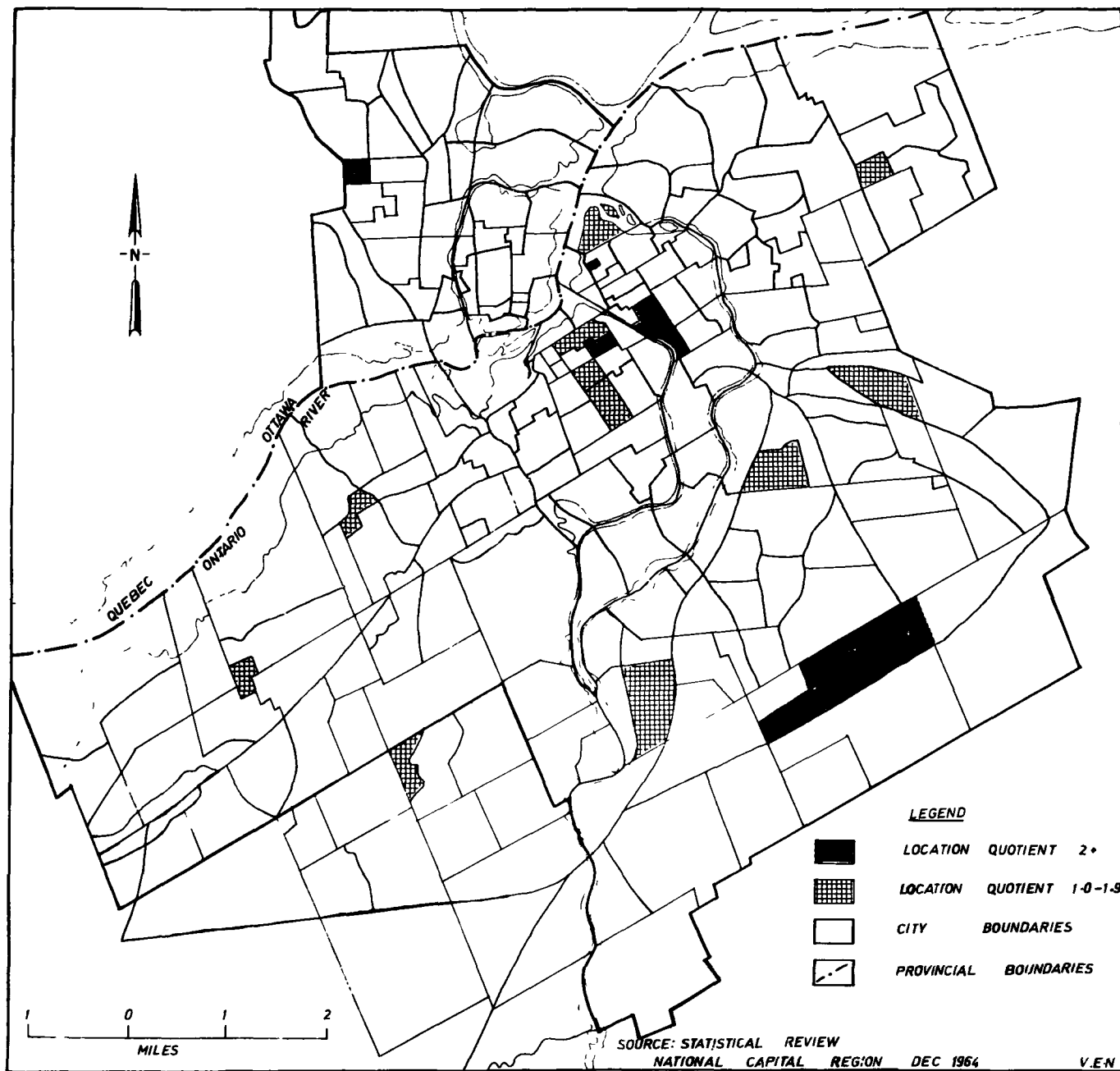
The next problem was to map the indices in such a way as to show the spatial specialization of each of the main employment nodes. Index values ranged from 0.1 to 8.3. Functional specialization of the work-places was to be indicated by mapping only values greater than one, since Mattila and Thompson contend "an index value greater than one presumably indicates that the locality has "extra" workers, produces a "surplus" of the good or service and "exports" this surplus",<sup>5</sup> In other words an index above

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<sup>5</sup> Mattila, J.M. and W.R. Thompson, "The Measurement of the Economic Base of the Metropolitan Area", in Urban Research Methods, by J.P. Gibbs, (Princeton: D. Van Nostrand Company, Inc., 1961) pp. 333-334.

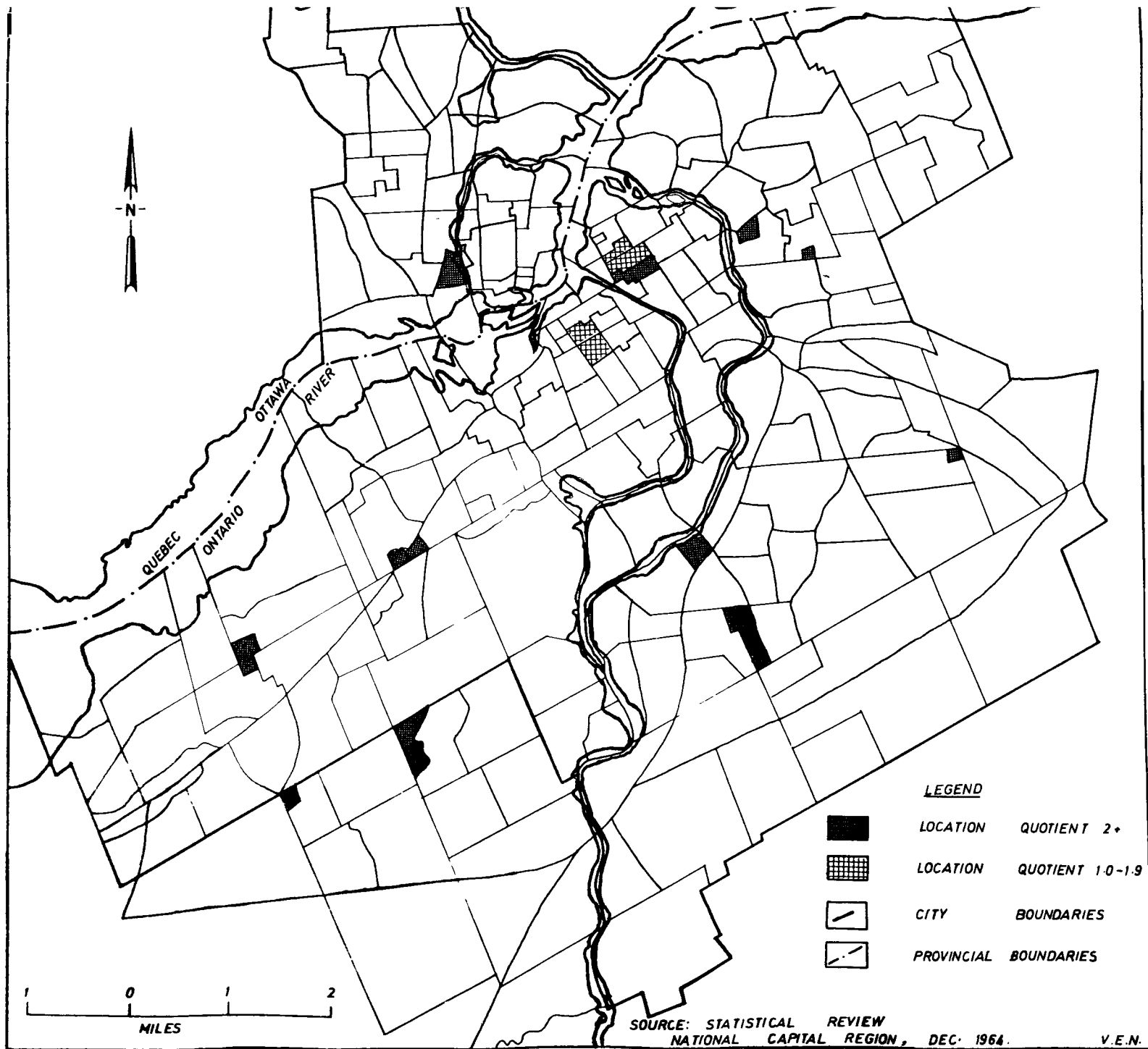
one expresses the degree of specialization of that locality. Taking cognizance of values exceeding one unit, four maps were therefore drawn to illustrate the spatial specialization and concentration of four occupational groups in Ottawa and Hull. (See figures 7, 8, 9, 10)

As the diagrams reveal, each of the four major occupations employing the majority of the workers in Ottawa and Hull is concentrated at definite locations of the city. Figure 7 shows the spatial concentration of federal government employment in Ottawa and Hull. Most of the federal government employment is located south of the Ottawa River, mainly on Parliament Hill and adjoining areas on both sides of the mouth of the Rideau Canal. The other locations include Tunney's Pasture, Confederation Heights, the strip of land just west of Dow's Lake extending unto Preston street and enclosed by the Central Experimental Farm Station in the South, the Central Mortgage and Housing Corporation Offices and the National Research Council Offices along Montreal Road which run northwards into the Royal Canadian Air Force base east of Manor Park. Across the Ottawa River in Hull is the lone Federal Department of Printing Bureau which is located at the north of the island of Hull. Generally speaking, the Federal Government Employment is fairly dispersed throughout the city, but more or less within a four to five mile limit from Confederation Square.

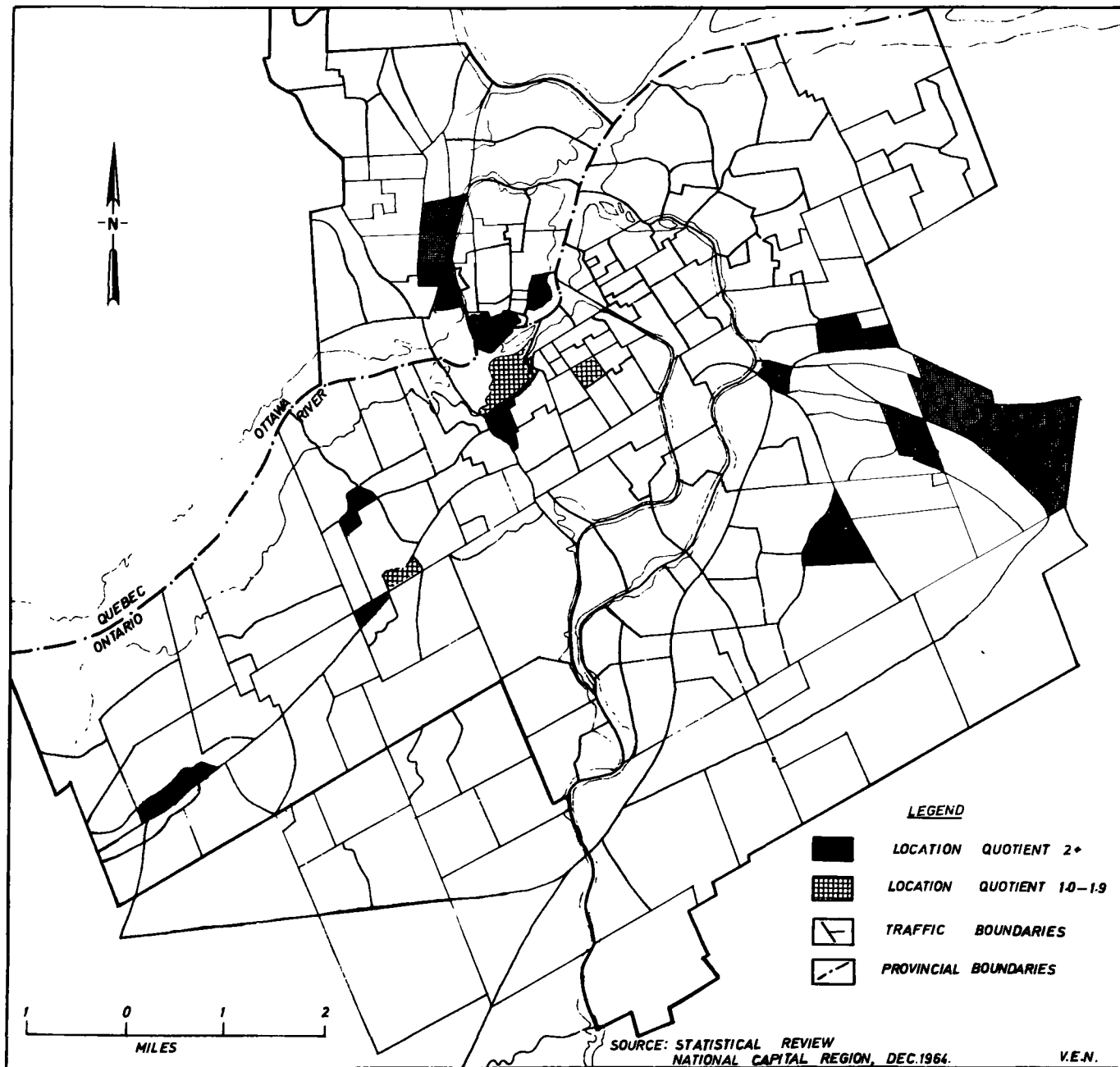


THE SPATIAL CONCENTRATION OF PROFESSIONAL MANAGERIAL AND CLERICAL EMPLOYMENT IN THE OTTAWA-HULL URBAN AREA

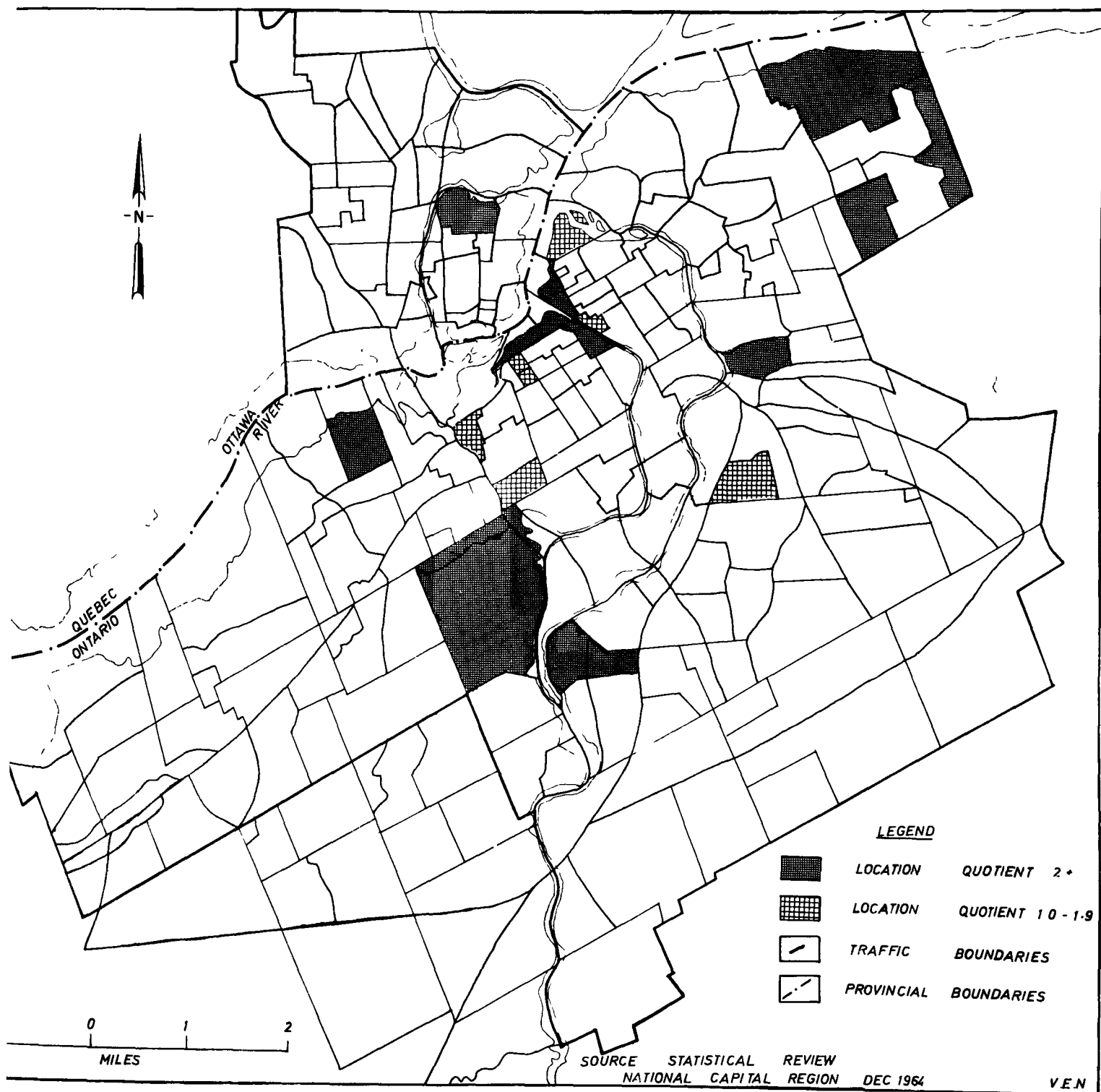
Fig. 7



THE SPATIAL CONCENTRATION OF COMMERCIAL EMPLOYMENT IN THE OTTAWA-HULL URBAN AREA. Fig. 8



THE SPATIAL CONCENTRATION OF MANUFACTURING AND INDUSTRIAL EMPLOYMENT IN THE OTTAWA-HULL URBAN AREA.



THE SPATIAL CONCENTRATION OF FEDERAL GOVERNMENT EMPLOYMENT IN THE OTTAWA-HULL URBAN AREA.

Fig. 10

Commercial employment, in contrast to federal government employment, is more widely dispersed throughout the city. (Fig. 8) Retail trade employment is chiefly concentrated in the downtown district of Ottawa but, as the diagram reveals, the outlying shopping centres also have location quotients of 2 and more. The locations with an index of concentration of less than two are extensions of retail trade activity or, more precisely, commercial ribbon developments of the Central Business District. A striking fact about the location of retail trade is its occurrence along the chief traffic routes of the city. Each retail trade location is so situated as to serve the commercial needs of each urban quarter. Professional, office and clerical employment (Fig. 9) displays great spatial concentration but does not show so great a specialization as federal government or retail trade employment. Of these three categories, it is the federal government employment which displays the greatest specialization. This is understandable since the dominant employment activity in the Ottawa-Hull metropolitan area is the federal government. Few manufacturing and industrial businesses are located in the Ottawa-Hull conurbation and therefore it is not unexpected that this particular occupational activity should display high location quotient index values. In general, manufacturing and industrial employment is concentrated along the rail routes or along

the main arteries of Ottawa and Hull, Figures 7, 8, 9, and 10, illustrate the concentration of the large majority of the daytime population of Ottawa and Hull as well as the spatial distribution of these four different functional groups in the Ottawa-Hull urban region. Furthermore, a study of the daytime population pattern of the city reveals the internal structure of the city. All the areas with low location indices not shown in the location concentration maps of the four industrial classes are mainly residential in function.

In the next chapter the analysis of the movement to work of two residential districts in Ottawa and Hull will be made. But more importantly, the distribution of the workers from Lower Town East and Rockcliffe Park Village will be analysed in relation to the major functional employment zones established here.

## CHAPTER IV

THE JOURNEY TO WORK FOR WORKERS OF LOWER TOWN EAST AND  
ROCKCLIFFE PARK VILLAGE

The study of the spatial organization of cities has assumed a prominent place in urban geography in recent years. Cities are looked upon as spatial organisms capable of interactions and, as has been observed by Taaffe and his associates, cities are viewed "not only as static mosaics of different land uses but as dynamic interdependent complexes of movements, orientations and traffic flow".<sup>1</sup> The location of the various parts of the mosaic with respect to one another becomes meaningful in terms of linkages and reciprocal relationships. The central theme of this thesis is the examination of journey to work linkage of workers from Lower Town East and Rockcliffe Park Village to other parts of the Ottawa-Hull agglomeration.

Before the distribution patterns to work for the workers of both neighbourhoods are determined, there are certain aspects of the data which demand some clarification.

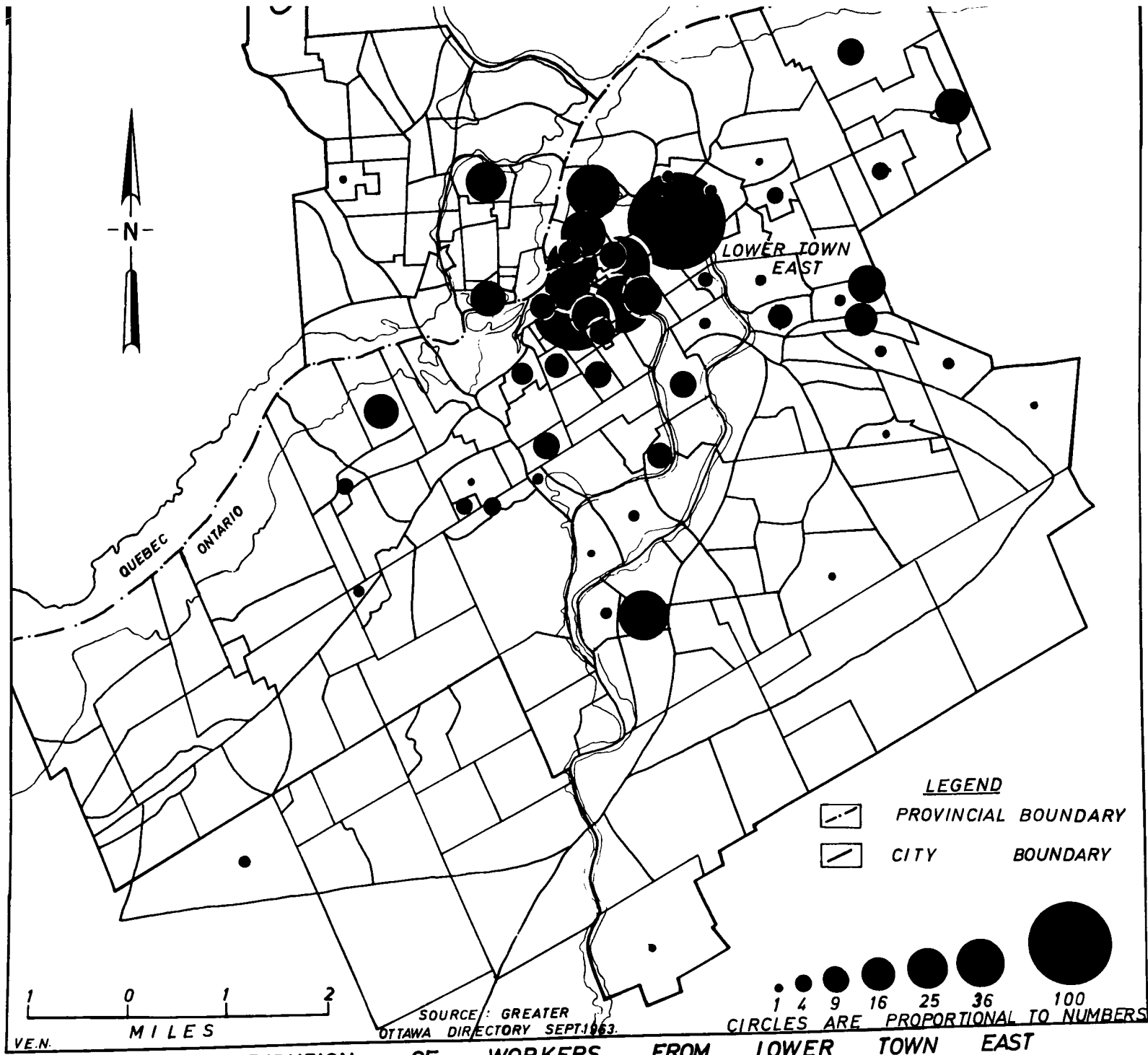
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<sup>1</sup> Taaffe, E.J., Garner, B.J., & Yeates, M.Y., op. cit. p. 3.

Only movement crossing traffic zones are analysed. However, there are persons living in these neighbourhoods who also work there. They do not cross traffic boundaries but do undertake some form of journey to work, no matter how small the distance from home. They are consequently brought into our analysis. No account is taken of the movement of employees working in these districts from other neighbourhoods since they do not reside in them. They therefore fall outside the scope of this study.

The methodology of the determination of place of work needs some explanation. Since data on the usual workplace is non-existent, an analysis of the place of work was made by reference to the *Might City Directory for Greater Ottawa (1963)*. The Directory is especially suited to this type of analysis because of the availability of the work addresses of individuals. There are five sections of the directory, each with some items of journey to work information; but the particular aspects of interest to the present investigation include the individual's name, place of residence, type of occupation, place of work, the orientation of streets in Ottawa and Hull, the occupants of a given home and the location of a business enterprise.

With the aid of these aspects of the directory, the writer began to locate the inhabitants of these neighbourhoods and their places of work and to determine their



THE DISTRIBUTION OF WORKERS FROM LOWER TOWN EAST IN OTTAWA - HULL AREA 1963.

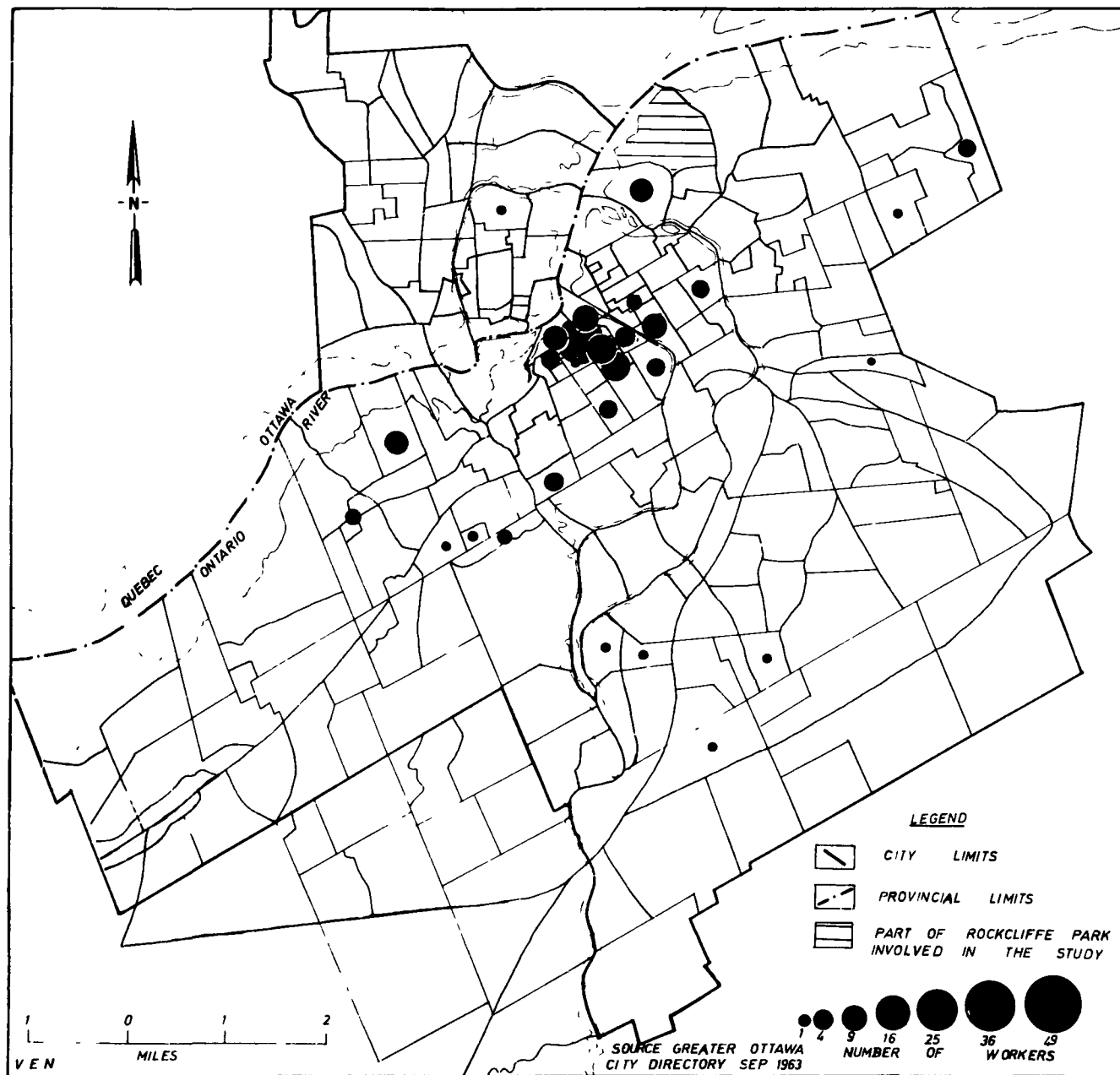
Fig. 11

occupational classes. Having done this, the work addresses were then transferred onto the map using the traffic zones in figure 4 as the base. The City Directory was particularly helpful in this respect since not only were the names of the business enterprises given but also the side of the street on which the business concern was situated was indicated. By this process, of the one thousand two hundred persons living in Lower Town whose work addresses were known, nine hundred and eleven persons were accurately placed on the map (see figure 11). This number represents nearly 80% of our sample and therefore is considered representative of the population. The remaining one third of our sample proved difficult to place on the map either because they are labourers with no definite employment location or work in banks, grocery stores which have dispersed locations throughout the city and consequently cannot be pinned down to a definite site. Thus our sample may be said to give a true picture of the actual journey to work situation.

The nine hundred and eleven employees living in Lower Town East were reclassified according to the four occupational categories of data as given below:

LOWER TOWN EAST

Professional, Business and Clerical	260
Retail	229
Manufacturing and Industry	86
Federal Government	<u>336</u>
Total	911



THE DISTRIBUTION OF WORKERS FROM ROCKCLIFFE PARK VILLAGE WITHIN THE OTTAWA-HULL REGION, 1963.

Fig. 12

For Rockcliffe Park Village of the one hundred and seventy-five workers in the sample, one hundred and forty-one were accurately located on the map. (Fig. 12) They are regrouped in the following fashion:

ROCKCLIFFE PARK VILLAGE

Professional, Business and Clerical	58
Retail	9
Manufacturing and Industry	6
Federal Government	68
Total	141

Glancing at figure 11 which gives the spatial spread of workers from Lower Town East Neighbourhood in the Ottawa-Hull Metropolitan area, one can identify distinct patterns which more or less approximate the major functional employment zones illustrated in figures 7-10 in the last chapter. First of all, there is a massive clustering of workers near their homes. The largest proportional circle indicates the number of people living in the neighbourhood and working there. This group most probably walks to work. A second concentration of workers is found around the Central Business District of Ottawa which coincides with employment specialised regions defined by figures 7 and 8. The CBD, as we know, has the largest concentration of jobs in the Capital Region.

Beyond this major employment district, there is a gradual reduction in the number of workers which may be

caused either by an increase in distance or a decrease in the number of employment availability; a zone employment deficit, as it may seem. Leaving this area of low employment occurrence, there exist significant isolated clusters of workers which are more or less coterminous with the chief Federal Government Employment Nodes and a few manufacturing and industry identified in figures 9 and 10 in the last chapter. One can easily name these areas which comprise the Department of Public Printing Bureau and the E.B. Eddy pulp and paper mill in Hull. Westwards, near the southern bank of the Ottawa River is the single concentrated employment district in which occur two important Federal departments; the Department of National Health and Welfare and the Dominion Bureau of Statistics. Southwards there is the large employment node near the bifurcation of the Rideau Canal and the Rideau River. This centre houses a number of important Federal Government ministries such as the Post Office, the Fisheries Department, the Canadian Broadcasting Corporation Offices, and the Department of Public Works. These areas correspond to the employment zone running west of Rideau river in the south of figure 10, with a location quotient of two and more. In the east there is another cluster of workers which is indicative of the pull of industries located on the periphery of the city on workers from Lower Town (fig. 9).

Northeastwards, there are two significant work concentrations. The larger one, of these two, is the National Research Council, while the smaller one represents the Royal Canadian Air Force Base. In general, one may conclude that the low income workers from Lower Town East have a tendency to seek employment near their homes which may probably be attributed to the effect of distance on the workers. But one may also conclude that this may be the result of the existence of large job opportunities near their homes. On the contrary, the isolated single large work concentrations are mainly a function of the spatial occurrence of jobs in the metropolis.

The Journey to Work for Workers from Rockcliffe Park Village

The journey to work pattern for Rockcliffe Park Village differs significantly from that of the Lower Town East Neighbourhood. Figure 12 illustrates this point. Here, in contrast to the clustering of workers near their homes observed for Lower Town East, there is movement away from place of residence. Rockcliffe Park Village high-income workers seem to congregate in the city-core, otherwise called the Central Area of Ottawa. This group of workers represents particularly people employed in the professional, business and clerical occupations and persons employed in Federal Government as well as a small proportion of people engaged in Retail Activity. Outside this zone of employment concentration, there occur scattered isolated workers in the conurbation. As may be noticed, these approximate, by and large, the Federal Government employment centres already mentioned. Around Carling Avenue and Booth there are clusters of workers who are engaged in the Department of Energy, Mines and Technical Surveys. (Fig. 10). Near Rockcliffe Park Village there is a lone group of workers who represent those working in Government House, either as Secretaries or as Domestic Servants. Comparing figures 11 and 12, one notes that, for both neighbourhoods, there is an association of low and high income workers about the Central Business District of Ottawa.

In general the high income earners tend to travel longer distances to work than do low income workers. This fact notwithstanding, the illustrations seem to indicate that the high and low income employees work wherever there are employment opportunities, irrespective of the length of work travel. The diagrams (figures 11 and 12) demonstrate that, in spite of the conscious effort made in recent years to disperse centrally located employment centres from the city-core, the Central Business District of Ottawa is still the dominant employment node of Ottawa and Hull. Moreover the patterns to work illustrated in figures 11 and 12 do seem to be closely governed by the presence of the main specialised functional zones represented in figures 7-10. However this fact will be analysed in more detail in the following chapter.

## CHAPTER V

## THE TESTING OF THE HYPOTHESIS

The use of statistical formulae, deterministic and probabilistic models to test geographic distributions over space is very common in recent geographic investigations. This trend seems to have been very strongly entrenched in the fields of urban geography or central place studies, geomorphology and regional science. Adopting this practice, it is intended here to use the gravity model, derived from physics and Newton's law of gravitation,<sup>1</sup> to analyse the journey to work distributions established in the current study.

The application of the gravity-model to geographic phenomenon especially those relating to one or another forms of human interaction abounds in many empirical works. Among the scholars who have utilised the model are Reilly and Converse who investigated retail areas,<sup>2</sup> Mackay, inter-actance among Canadian cities with reference to telephone

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1 Carrothers, G.A.P., "The Gravity and Potential Concepts of Human Interaction", Journal of the American Institute of Planners, 22 (1956), pp. 94-102.

2 Reilly, W.J. The Law of Retail Gravitation, (New York: Ronald Press, 1931). Converse, P.D. "Retail Trade Areas in Illinois," Univ. of Illinois Bull. (Business Studies No. 4), XLII (1946), p. 68.

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messages and marriages,<sup>3</sup> and more recently Kariel, the spatial diffusion of the Alaskan Camper in Washington State.<sup>4</sup>

Each of these authorities, while employing the gravity-potential model, has modified the original equation. None the less each version of the equation whether in the original or the simplified form is used to express the interaction taking place between two centres and this interaction will be inversely proportional to the distance separating them. In the simplified form it is expressed as:

$$I_{ij} = P_i P_j / D_{ij}$$

- where  $I_{ij}$  = interaction between centres i and j
- $P_i$  = population of centre i
- $P_j$  = population of centre j
- $D_{ij}$  = distance between centres i and j

Another form of the gravity-potential model also employed in the present analysis is the interactance hypothesis which "predicts the number of interactions of any one specific kind among people, when observed in groups, from their basic dimensions of time, space, population and per capita

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3 Mackay, J.R., "The Interactance Hypothesis and Boundaries in Canada," Canadian Geographer, XI (1958), pp. 1-8.

4 Kariel, H. G., "Spatial Diffusion: The Alaskan Camper Unit in Washington State", Canadian Geographer, XII (1968) pp. 63-72.

activity.<sup>5</sup> The hypothesis in basic form is formulated as:

$$\frac{P_A P_B}{D}$$

where  $P_A$  = the population of one centre

$P_B$  = the population of another centre

$D$  = distance separating both centres

Population in both equations is used in the conventional sense where it refers to an aggregation of elementary units and  $D$  is a space dimension which expresses distance or nearness which may be measured in miles or other units. The gravity-potential model is geographical in nature and incorporates the concept of distribution.

#### Application of the Gravity-Potential Model

The application of the gravity-potential model in the present analysis required some reorganisation of the data as illustrated in Tables 14 and 15. In both tables column one represents distance expressed in miles derived by connecting the centres of the neighbourhoods and the centres of the traffic zones where workers from both districts worked in 1963. Figures 13 and 14 illustrate the

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<sup>5</sup> For the initial use of the hypothesis see S.C. Dodd, "The Interactance Hypothesis, A Gravity Model Fitting Physical Masses and Human Groups", American Sociological Review, 15 (1959), pp. 245-256. It is further used by J.R. Mackay, Op. Cit. pp. 1-8.

TABLE 14

Correlation coefficient of Distance to Work and the Distribution of Workers from Lower Town East-Ottawa By Product Moment Correlation

X	Y	XY	X <sup>2</sup>	Y <sup>2</sup>
Distance in Miles	Distribution of Workers			
0.45	153	68.85	0.2025	23409
0.45	11	4.95	0.2025	121
0.50	61	30.50	0.2500	3721
0.55	2	1.10	0.3025	4
0.55	2	1.10	0.3025	4
0.55	3	1.65	0.3025	9
0.58	2	1.16	0.3364	4
0.70	23	16.10	0.4900	529
0.75	47	35.35	0.5625	2209
0.75	34	25.50	0.5625	1156
0.87	42	36.54	0.7569	1764
0.87	8	6.96	0.7569	64
0.90	53	47.70	0.8100	2809
0.95	3	2.85	0.9025	9
1.00	23	23.00	1.0000	529
1.05	30	31.50	1.1025	900
1.05	1	1.05	1.1025	1
1.10	103	113.30	1.2100	10609
1.25	4	5.00	1.5625	16
1.45	2	2.90	2.1025	4
1.55	12	18.60	2.4025	144
1.60	13	20.80	2.5600	169
1.60	8	12.80	2.5600	64
1.75	20	35.00	3.0625	400
1.90	27	51.30	3.6100	729
1.95	9	17.55	3.8025	81
2.00	2	4.00	4.0000	4
2.05	13	26.65	4.2025	169
2.25	24	54.00	5.0625	576

TABLE 14 -- Continued

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2.40	9	21.60	5.7600	81
2.40	1	2.40	5.7600	1
2.45	10	24.50	6.0025	100
2.50	4	10.00	6.2500	16
2.50	3	7.50	6.2500	9
2.50	17	42.50	6.2500	289
2.95	2	5.90	8.7025	4
3.00	11	33.00	9.0000	121
3.00	2	6.00	9.0000	4
3.10	2	6.20	9.6100	4
3.15	1	3.15	9.9225	1
3.15	1	3.15	9.9225	1
3.20	1	3.20	10.2400	1
3.20	24	76.80	10.2400	576
3.50	19	66.50	12.2500	361
3.50	2	7.00	12.2500	4
3.50	4	14.00	12.2500	16
3.75	2	7.50	14.0625	4
4.00	1	4.00	16.0000	1
4.00	4	16.00	16.0000	16
4.05	5	20.25	16.4025	25
4.25	4	17.00	18.0625	16
4.75	2	9.50	22.5625	4
5.00	1	5.00	25.0000	1
5.00	2	10.00	25.0000	4
5.00	42	210.00	25.0000	1764
9.00	1	9.00	81.0000	1
9.05	2	18.10	81.9025	4

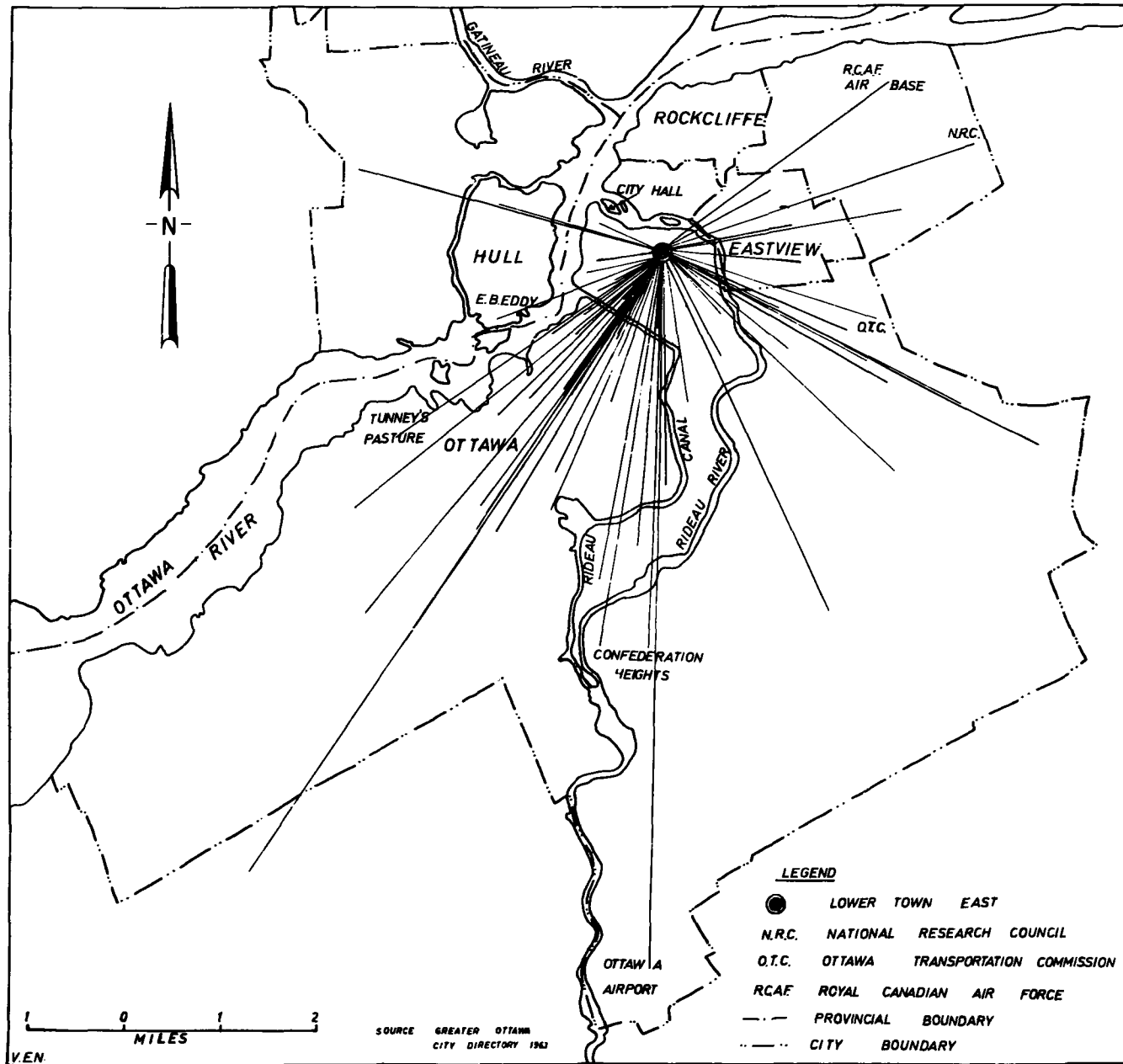
Correlation Coefficient -0.33

TABLE 15

Correlation Coefficient of Distance to Work and the Distribution of Workers from Rockcliffe Park Village-Ottawa by Product Moment Correlation Coefficient.

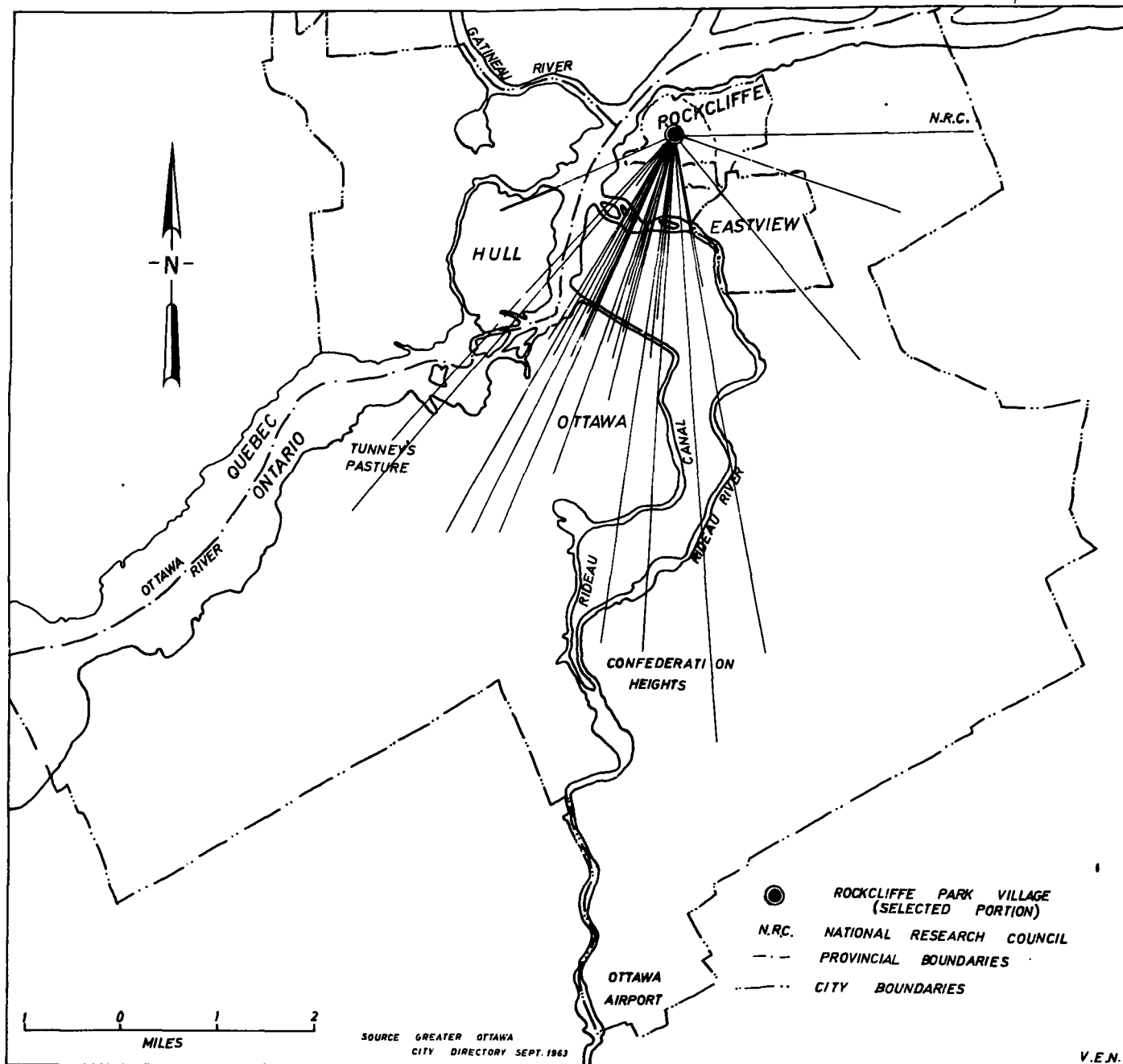
X Distance in Miles	Y Distribution of Workers	XY	$X^2_m$	$Y^2$
0.75	5	3.75	0.5625	25
1.60	4	6.40	2.5600	16
1.80	2	3.60	3.2400	4
1.95	7	13.65	3.8025	49
2.00	1	2.00	4.0000	1
2.05	10	20.50	4.2025	100
2.05	6	12.30	4.2025	36
2.40	4	9.60	5.7600	16
2.40	30	72.00	5.7600	900
2.40	10	24.00	5.7600	100
2.45	4	9.80	6.0025	16
2.50	11	27.50	6.2500	121
2.50	1	2.50	6.2500	1
2.50	7	17.50	6.2500	49
2.50	6	15.00	6.2500	36
2.60	4	10.40	6.7600	16
2.60	1	2.60	6.7600	1
3.05	1	3.05	9.3025	1
3.10	4	12.40	9.6100	16
3.80	4	15.20	14.4400	16
4.25	6	25.50	18.0625	36
4.60	5	23.00	21.1600	25
4.65	2	9.30	21.6225	4
4.70	1	4.70	22.0900	1
5.15	2	10.30	26.5225	4
5.45	1	5.45	29.7025	1
5.45	1	5.45	29.7025	1
6.45	1	6.45	41.6025	1

Correlation Coefficient -0.31



LINEAR DISTANCES TO WORK FROM LOWER TOWN EAST NEIGHBOURHOOD - OTTAWA 1963.

Fig. 13



LINEAR DISTANCES TO WORK FROM ROCKCLIFFE PARK VILLAGE - OTTAWA, 1963. FIG. 14

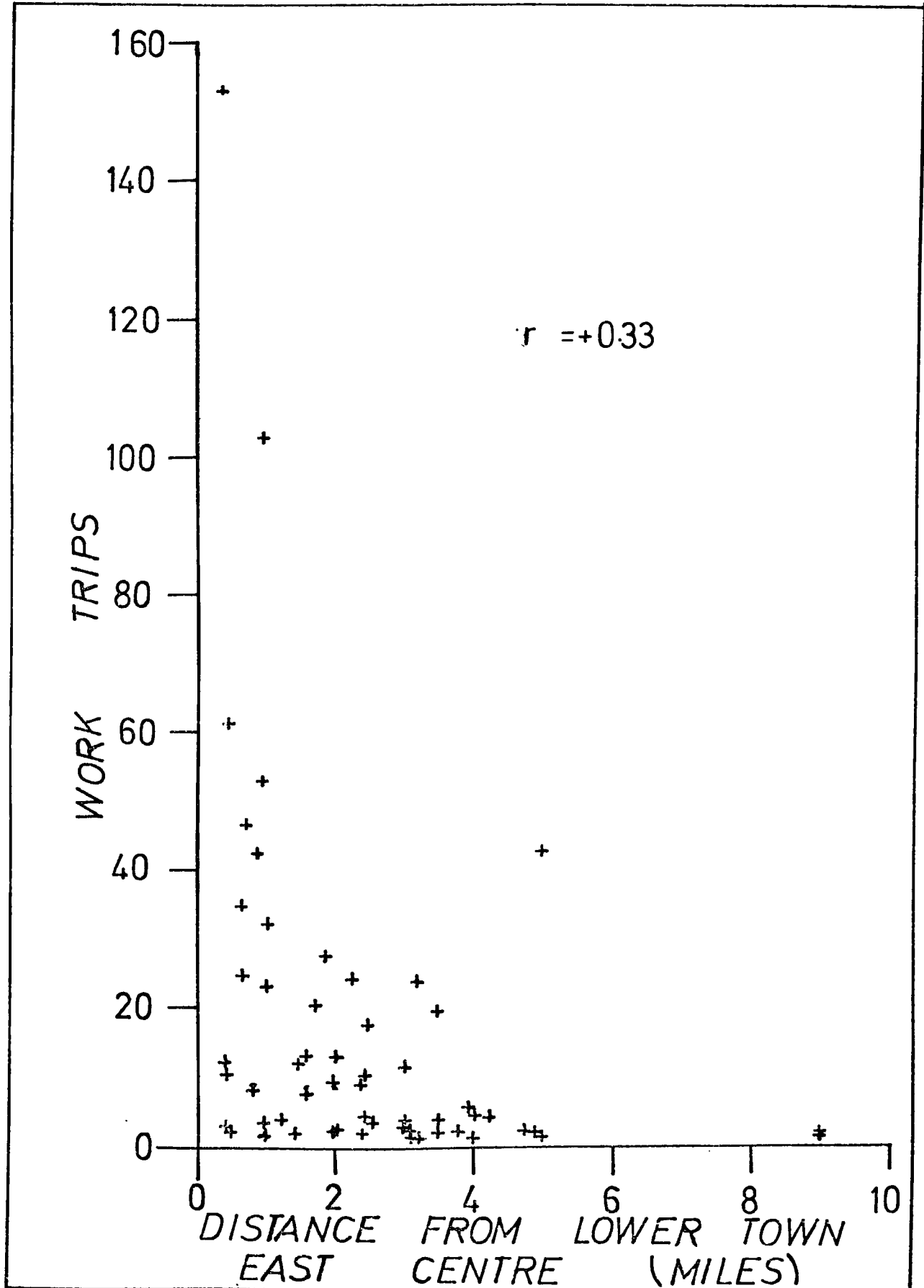
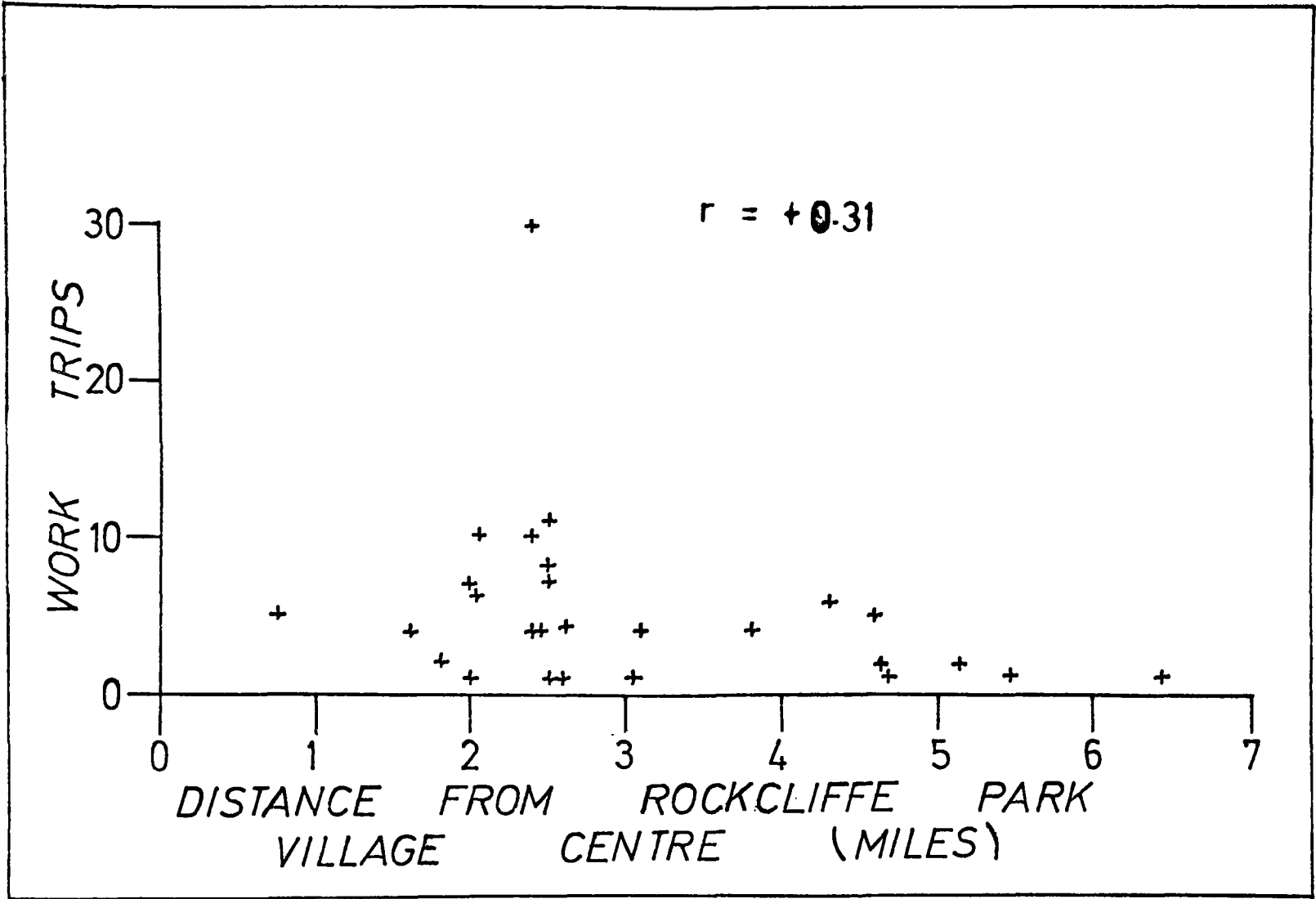


Fig. 15

Fig. 16



linking of the neighbourhoods to the traffic zones concerned by means of star-diagrams. Column two shows the number of workers found in each traffic zone for the period while column three is the product of columns one and two; column four represents the squares of column one and column five, the squares of column two.

Next the data in the above tables were plotted graphically as shown in Figures 15 and 16 for Lower Town East and Rockcliffe Park Village respectively. The number of workers found in a traffic zone is represented by work trips in both illustrations. Reference to figure 15 reveals the large concentration of workers from Lower Town East within the zero to two mile limit. Beyond this zone, there is a gradual decline in the number of workers (work trips) travelling certain given distances. Thus, with an increase in distance, there is a corresponding decrease in the number of workers working at that distance away from home.

On the average, workers from Lower Town East have a journey to work length of two miles. This linear distance

seems to conform with the City of Ottawa Survey finding for the same region in 1965 as shown in the table below.

TABLE 16

Distance to Work By Income Group - Lower Town East (per cent of families)

<u>Income</u>	<u>Miles</u>		
	0-1	1-2	2
Under \$3,000	81	11	8
\$3,000-\$4,999	34	26	40
\$5,000 +	37	21	42

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Source: City of Ottawa, Planning Branch, Social Survey, 1951.

As the above table indicates, the low income workers prefer to work not far from home. Only 8% of the working families under \$3,000 make a journey beyond the two-mile ring, while 81% of the families work between the zero to one mile limit. It is interesting to note that with an increase in income there is a corresponding rise in the number of families working beyond the two-mile zone (42%). Thus for low income inhabitants of Lower Town East there is an apparent preference for short journey to work patterns.

In contrast Figure 16 differs from Figure 15. Here a substantial number of workers (work trips) does not appear until the two-mile ring. The illustration moreover reveals the greater spread of workers than is the case in the preceding diagram. Here beyond the three mile zone one observes a definite break in the pattern and clustering of workers does not occur until about the five-mile limit. A comparison of the two illustrations reveals a greater preference for workers from Rockcliffe Park Village to commute longer distances to work than for Lower Town East workers. The graphical illustrations indicate that our results seem to agree with the gravity model though it cannot be said categorically that the trend is true.

In order to ascertain whether or not the model offers any cogent explanation to our hypothesis, it was necessary to correlate distance and the number of workers working at given traffic zones. For this calculation of linear relationship, the product moment correlation was chosen using the standard equation for this particular correlation. Referring to Table 14, the following figures were substituted in the correlation coefficient for Lower Town East:

Sum of X = 140.82

Sum of Y = 911

Sum of  $X^2$  = 536.7352

Sum of  $Y^2$  = 536628

Number of items = 57.

Solving the product moment equation with the above figures, a negative correlation coefficient of -0.33 for Lower Town East. The same process was repeated for our data for Rockcliffe Park Village to derive a negative correlation coefficient of -0.31. The results of our calculations confirm the earlier observation that the hypothesis of this study is true. In other words with an increase in distance from residence there is an accompanying decrease in the number of persons found working farther from home. However the coefficients may have occurred by 'chance', that is to say, that their significance is suspect as it may have happened by chance. Therefore the correlation coefficients were tested. The r-values were statistically significant at the .05 level of confidence. These values are however low and thus were not considered completely satisfactory and a more stringent approach of testing the data was therefore needed. The more rigorous interactance model was adopted. The interactance model is another form of the gravity model. Here the idea is to test the pull of employment opportunities on the workers from Lower Town East and

Rockcliffe Park Village. Put in another way to measure the volume of interactions between two populations.

In order to carry out the test, the data was again rearranged as shown in Tables 17-24 contained in Appendix B. The nine hundred and eleven employees from Lower Town as well as the one hundred and forty-one workers from Rockcliffe Park Village were redistributed among the four employment classes involved in this analysis and the total number of employees in each of the traffic zones in a particular employment were noted. In the tables contained in Appendix B, there are altogether eight columns prepared for the correlation of employment opportunities and the number of workers attracted by each employment group. The columns are shown as follows:

#### Columns

- 1 represents the Traffic Sector
- 2 represents the traffic zones in a traffic sector
- 3  $P_A$  represents the total no. of employment opportunities in a traffic zone for a particular employment activity
- 4  $P_B$  represents the aggregation of the no. of workers from a neighborhood engaged in a particular employment group
- 5 D represents distance between the traffic zones and the centres of the neighborhoods
- 6  $P_A P_B$  represents the products of  $P_A$  and  $P_B$

DISTRIBUTION OF LOWER TOWN EAST  
WORKERS TO PROFESSIONAL, BUSINESS  
AND CLERICAL EMPLOYMENT.

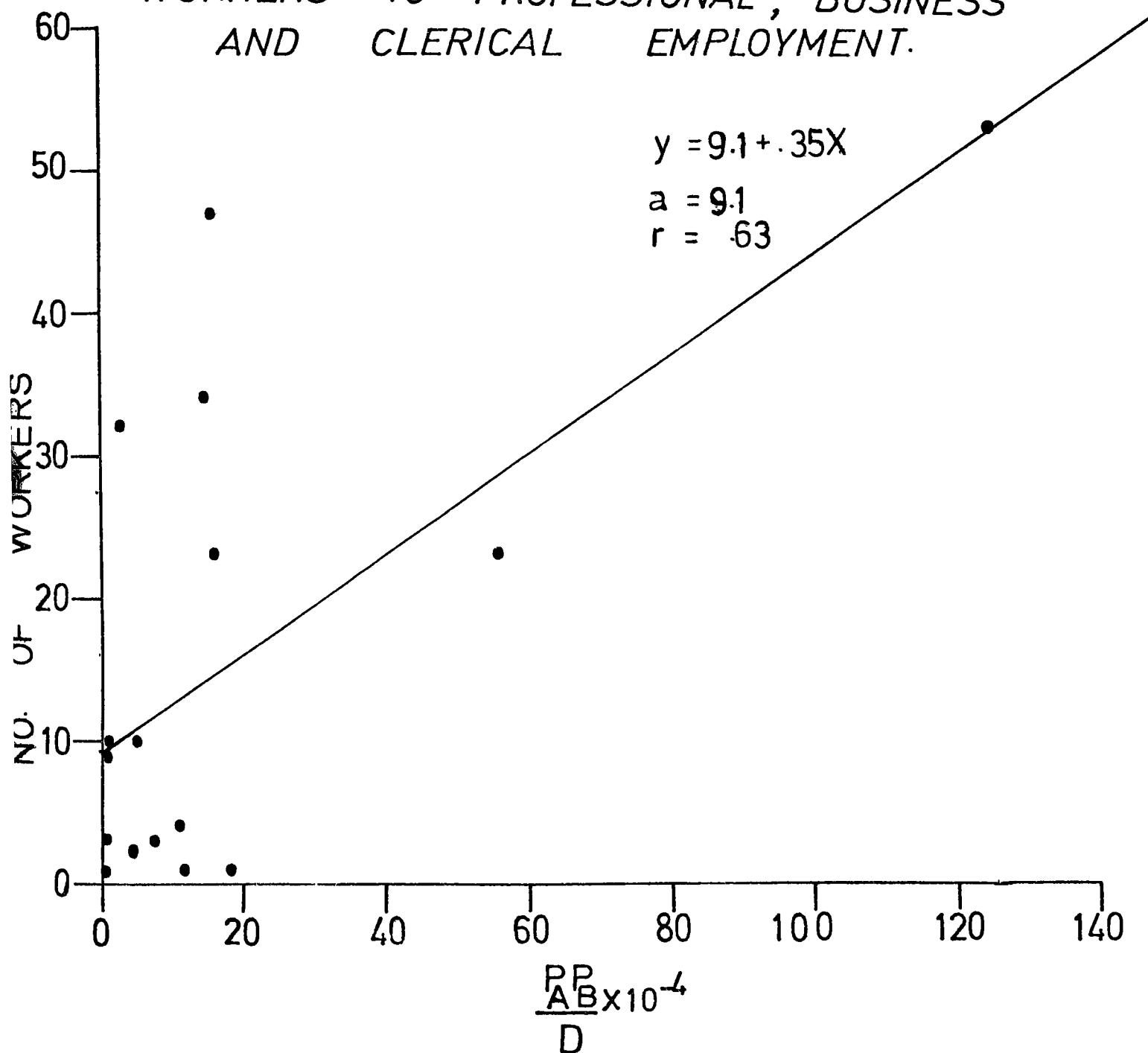


Fig. 17

DISTRIBUTION OF LOWER TOWN  
EAST WORKERS TO RETAIL  
EMPLOYMENT.

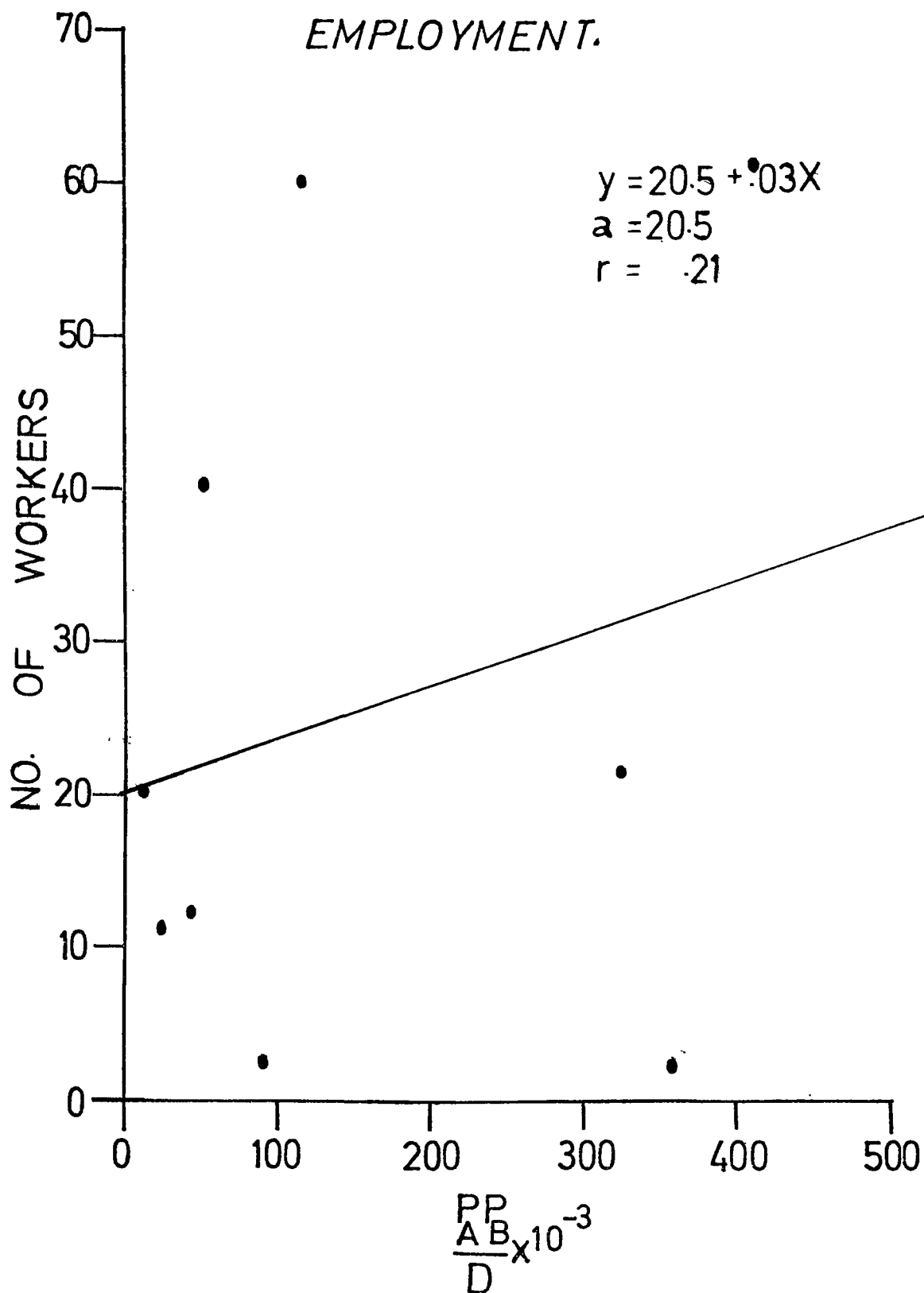


Fig. 18

DISTRIBUTION OF LOWER TOWN EAST WORKERS  
TO MANUFACTURING AND INDUSTRY  
EMPLOYMENT

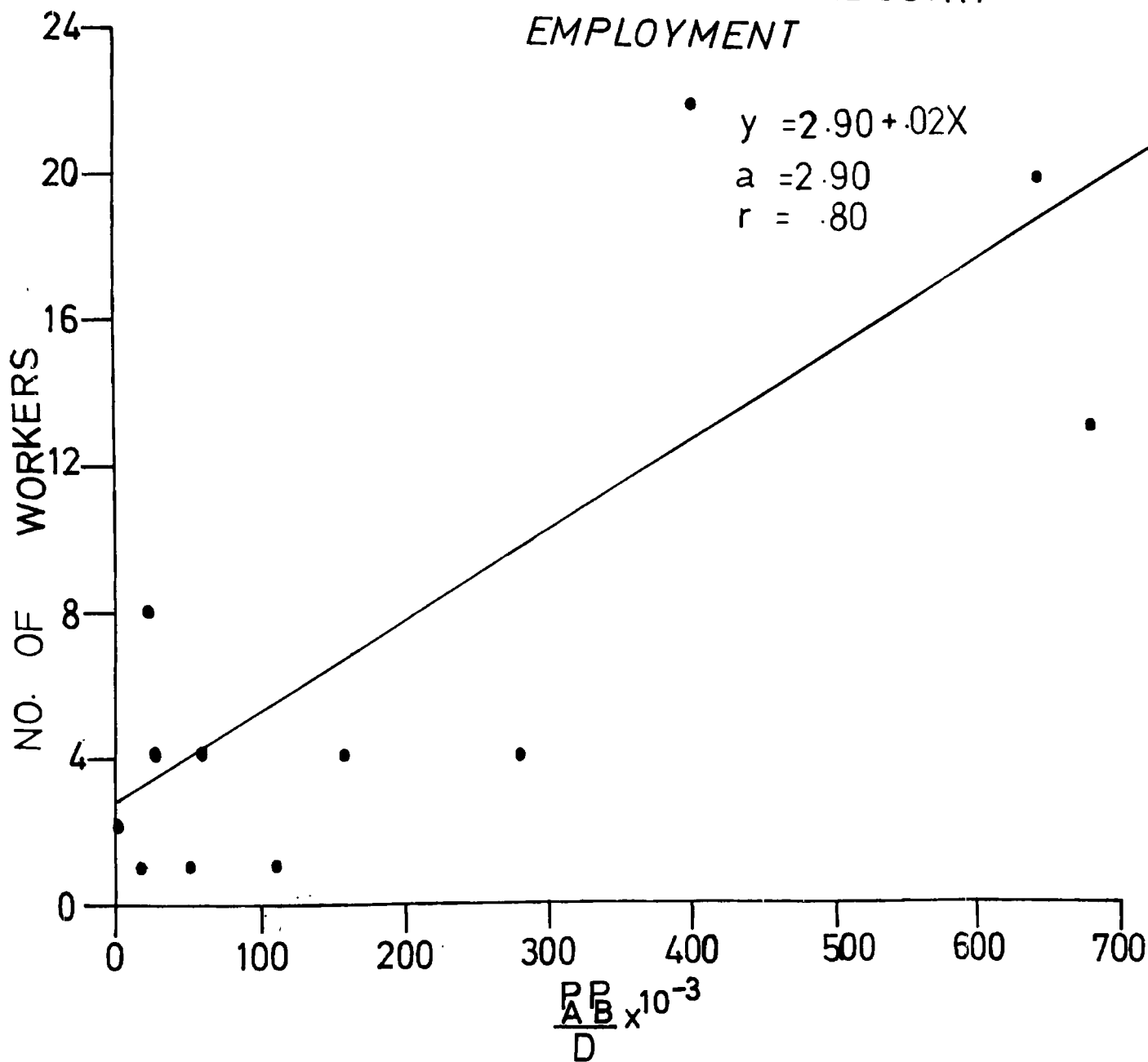


Fig. 19

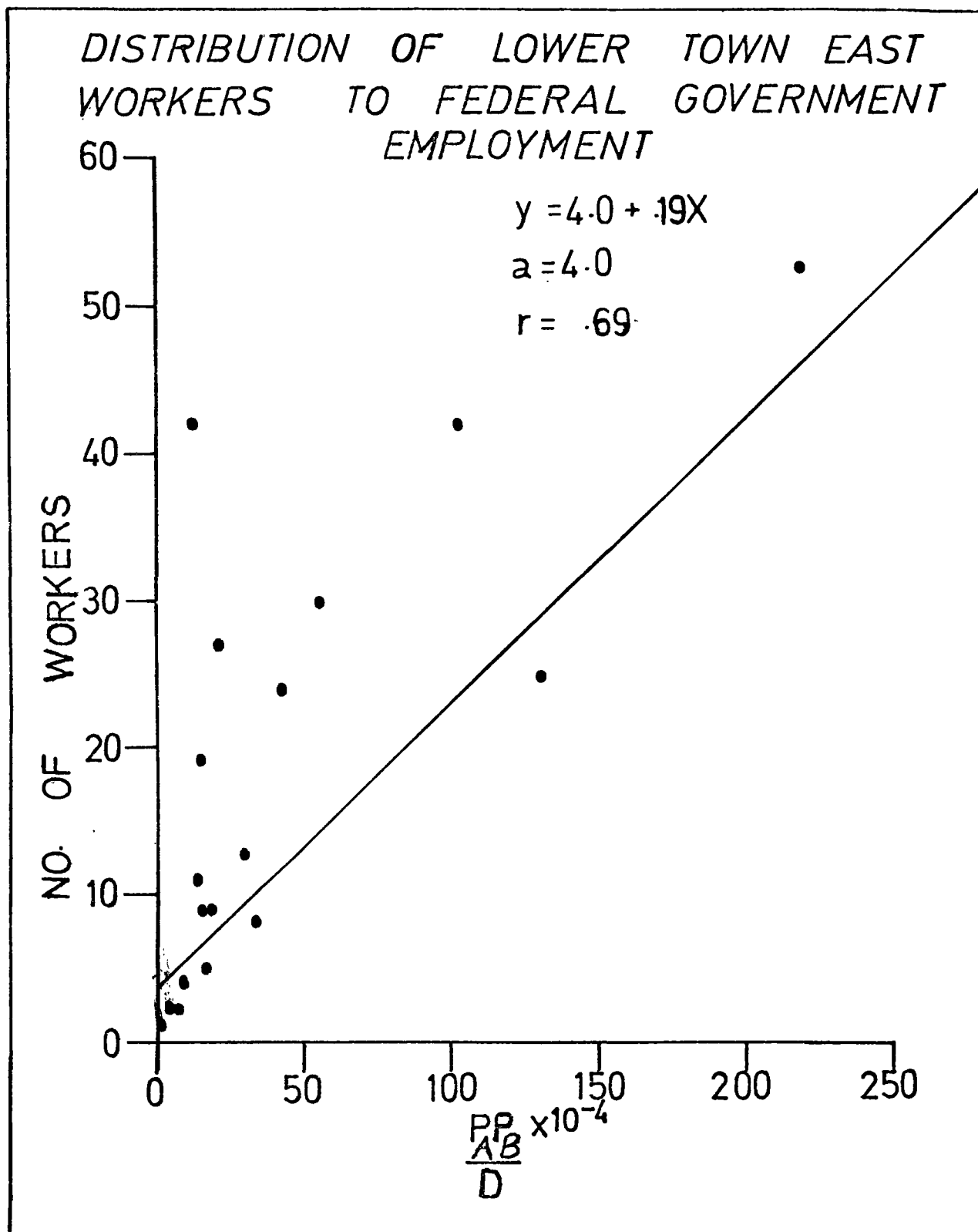


Fig. 20

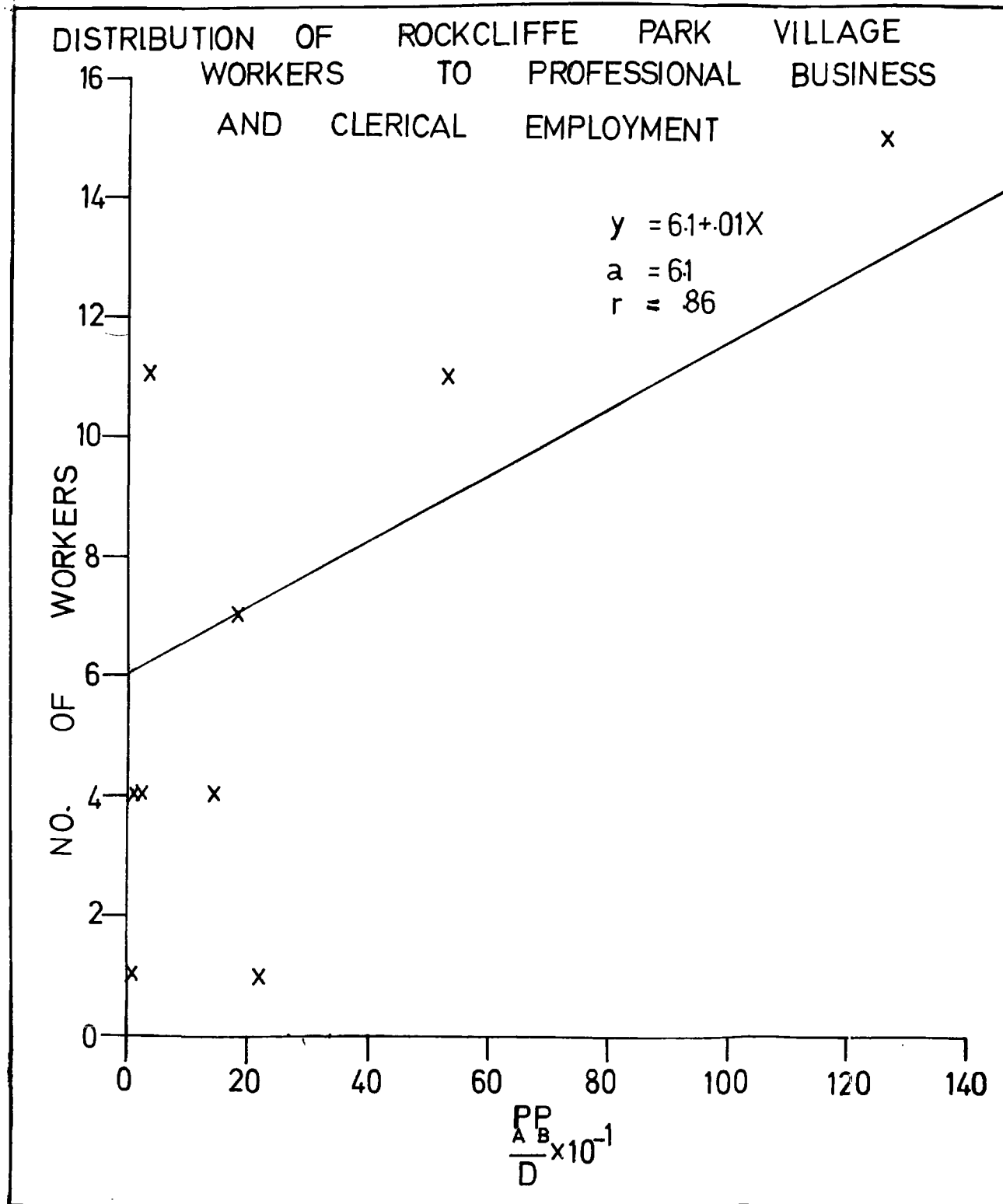


Fig. 21

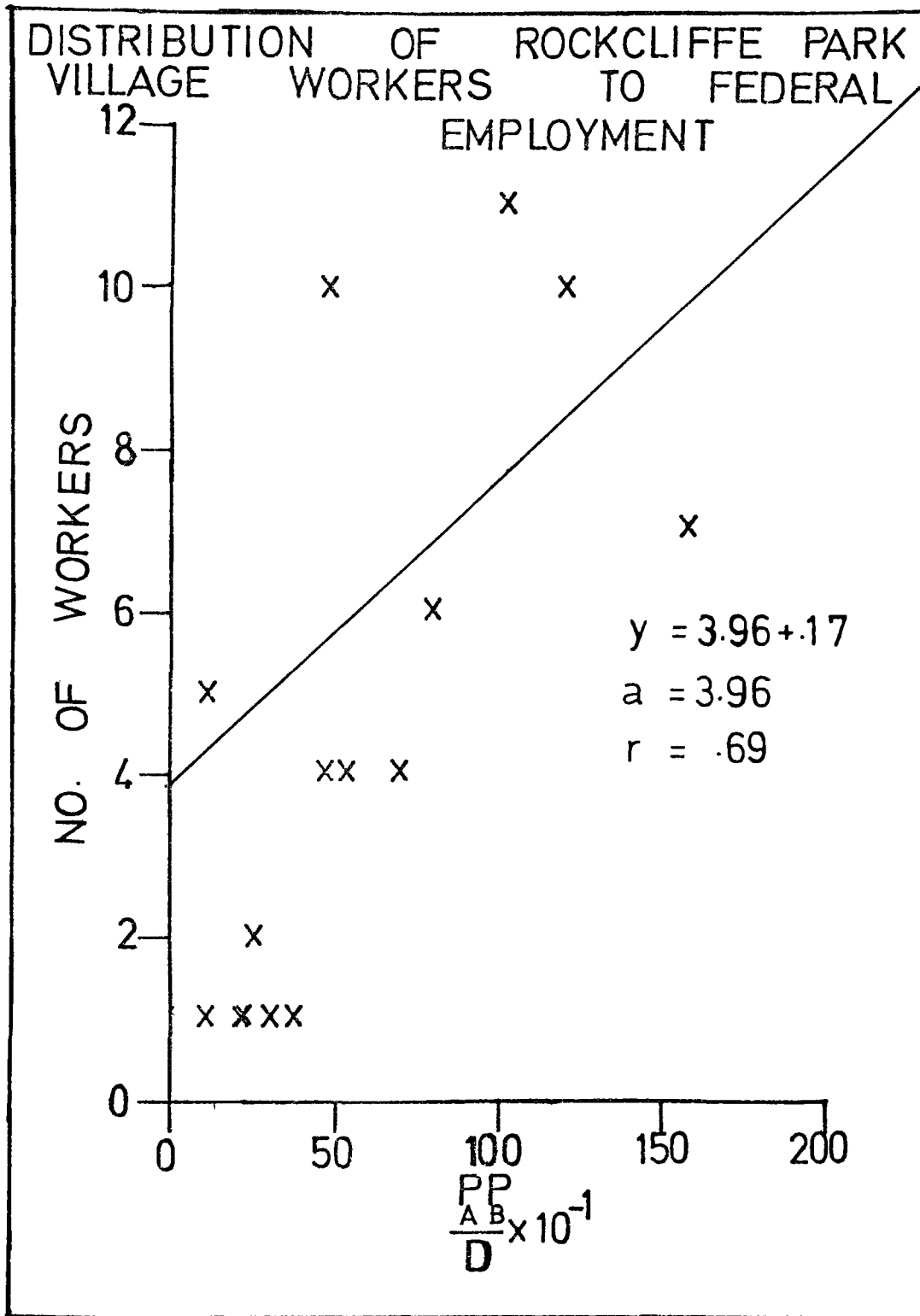


Fig. 22

7  $P_{A B} / D$  represents the product of  $P_A$  and  $P_B$  divided by distance thus giving us the index of interaction

8 represents the reduction of index of interaction by multiplying it by ten raised by bar one, two, three and four.

With the derivation of the indices of interactions, scatter-diagrams of the pull of specific employment nodes on the workers from both neighbourhoods were drawn. (Figures 17-22) The reduced values of indices of interaction were plotted along the abscissa and the actual distribution of workers per traffic zone along the ordinate on the other hand.

A comparison of the dispersion graphs reveal certain trends existing between the availability of jobs in each particular occupational class and the number of persons working in such employment groups. Federal Government Employment has the greatest pull on the workers from both areas, as the trend of the dots indicates, followed by Professional, Business and Clerical Occupation. This, of course, is not surprising as these two categories are the largest employers in Ottawa and Hull, consequently would attract or absorb more workers than all the other occupation groups. Manufacturing and Industry does not seem to exert a strong pull on the workers of Rockcliffe Park Village but certainly does on Lower Town East working population. Retail occupation exerted the weakest influence on the working classes of both neighbourhoods. These observations

are merely rough estimates of the exact situations and as a consequence the data was subjected to correlation analysis.

In the first instance, the total number of jobs and the spatial distribution of the workers for the fifty-seven zones for Lower Town East and for one hundred and forty-one workers from Rockcliffe Park Village were correlated.

Tables 25 and 30 show how these numbers were arranged for the determination of the correlation coefficients. The  $r$  values for correlating availability of employment opportunities and the number of workers drawn to such jobs were for Lower Town East (+0.60) and for Rockcliffe Park Village (+0.77). These values were far higher than those obtained by correlating distance and mass. Furthermore each of the four occupations was correlated similarly for both neighbourhoods. Professional, Business and Clerical Occupation for Lower Town East and Rockcliffe Park Village yielded  $r$  values of +0.63 and +0.86 respectively (Tables 26 and 31); Retail Occupation, +0.21 and -1.00 (Tables 27 and 32); Manufacturing and Industry, +0.80 and +0.93 (Tables 28 and 33); and Federal Government, +0.69 and +0.69 (Tables 29 and 34). These correlation coefficients were then tested for significance. The significance values were observed to be statistically high at the .01 level of confidence. Only Retail Occupation was not statistically significant at the .01 level of confidence.

Although the correlation coefficients were significant, the analysis was carried a stage further by fitting regression lines to our graphs. These lines indicate the line of best fit that represents the relationship between employment opportunities and the number of persons engaged in such opportunities. The simple regression for calculating the linear relationship between two variables was chosen. It is expressed by the formula:

$$Y = a + bX$$

where  $a$  = the Y intercept, or the constant

$b$  = the slope (or regression coefficient)  
of "Y on X".

By computing the values of  $a$  and  $b$  using the normal equation for deriving these values, it was possible to fit regression lines to our data. (Figs. 17-22) The lines indicates the actual relationship that any change in the X-axis produces a similar change in the Y-axis.

Having ascertained the correlation coefficients and the regression lines for each of the dispersion graphs, it may therefore be possible to state more positively, whether or not, the spatial spread of jobs in Ottawa and Hull is a better indicator of the journey to work patterns for workers from Lower Town East and Rockcliffe Park Village. A comparison of the coefficients obtained for both urban quarters by correlating distance and mass (+0.33 and +0.31)

and those derived by correlating spatial occurrence of jobs and the number of workers attracted by such jobs (+0.60 and +0.77) reveals that the latter offers a better explanation of the journey to work patterns of Lower Town East and Rockcliffe. The latter variables correlated give higher coefficients and consequently may be affirmed as a better measure of the real journey to work situation.

Comparing the individual employment groups, it can be noted that the Federal Government Employment generated more interactions than other employment categories. The regression lines for this employment activity for both districts are steepest of the four employment divisions and confirmed by the trend of the dots. Professional, Business and Clerical also displayed high coefficients demonstrative of the great interaction between it and the working population of these two neighbourhoods. The results are not surprising since these two employment activities engage by far the greatest number of the working population of the Ottawa metropolitan area. Manufacturing and industry shows a great interaction with workers from Lower Town East as the correlation coefficient (+0.80) indicates. This is not unexpected because of the preponderance of cheap labour in this employment activity for which Lower Town East forms a source of supply. Furthermore the high coefficient for this particular employment activity for Lower Town East may be

explained by the presence of such large employers as E.B. Eddy and Company Limited located so close to it. One would therefore, other things being equal, expect a high degree of movement of workers between it and Lower Town East.

Retail employment emerges with the lowest correlation coefficients for both districts. The reason for this special situation may be sought in the location of this employment activity in definite sites of the metropolitan region. Apart from the Central Business District of Ottawa and two workers commuting to Carlingwood shopping centre in 1963, rarely did workers find jobs in other outlying planned neighbourhood stores. Each of these outliers was developed to serve its locality and therefore their working populations may not live far away from them. Secondly the low correlation coefficients for retail employment may be due to the way the workers from both areas were reclassified but more important is the fact that a lot of people, who worked in food stores such as the IGA or Loblaws whose dispersed locations did not permit locating them at any one location, were excluded from the analysis. The exclusion from our data of these group of workers may have been largely responsible for the low r-values for retail activity. Moreover the low correlation value for Rockcliffe Park Village workers in retail activity is not hard to explain since there are few inhabitants of this neighbourhood

engaged in retail activity.

Generally, the interactions between the number of jobs in each of the four employment classes and the distribution of workers from Lower Town East and Rockcliffe Park Village seem to be a better indicator of the journey to work patterns of the working population of the Metropolitan area. The high and low income workers may find employment anywhere in the Capital Region so long as the job exists in spite of the distance from home. One may therefore conclude that the work-travel patterns of workers may be explained more fully by the availability of jobs in the metropolitan region.

## CHAPTER VI

## CONCLUSION

The last chapter, in effect, demonstrated that the main elements of the present study have been investigated. It may therefore be appropriate, at this stage to state our conclusions.

The study may be regarded as offering a new way of looking at the journey to work. Earlier investigations have concentrated on the employment centres and then attempted to find where the employees of the workplaces lived. In other words they concentrated on establishing 'the spheres of influence' or 'the laborsheds' of employment areas. Rather than follow this established tradition, the present analysis departs from it and examines what may be termed the journey to work region of a neighbourhood. The analysis thus began from the residential quarter and terminated at the place of work. The study may also be regarded as demonstrating the value of such publications as the Statistical Review<sup>1</sup> and the Might City Directory. These were important sources of data, as the Canadian Census does not include

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<sup>1</sup>This is a report published by the National Capital Commission, covering the whole area of the Ottawa-Hull Metropolitan Region and contains demographic and statistical information for every traffic district in the Capital Region in 1963.

workplace data normally found in Censuses.

By and large, the patterns of journey to work for Lower Town East and Rockcliffe Park Village residents differ but, comparatively speaking, their patterns approximate the entire area of Ottawa and Hull. The low income working population of Lower Town East prefers, on the whole to commute shorter distances from their residences while the high income earners of Rockcliffe Park Village travel farther away from home. The study also reveals the spatial linkages of workers to other parts of Ottawa and Hull. Furthermore, the analysis demonstrates that, although distance may affect the intra-urban travel of low income workers, it is by no means the only determinant factor. The spatial distribution of workers may be explained in stronger terms by using the occurrence of jobs as an index.

Finally the findings of this study may be summarised point by point as follows:

(i) The examination of the intra-city movement of workers from Lower Town East and Rockcliffe Park Village gives some insight into the spatial and functional organization of Ottawa and Hull.

(ii) The study provides evidence on the divorce between residence and workplace which may be useful to planning. For instance, the analysis may prove useful to the authorities of the Lower Town East Urban Renewal Project

in the relocation of workers to be displaced from their homes. With the knowledge of the average travel distance of the inhabitants of the area demonstrated by this analysis, they can proceed to determine at what distance to relocate the displaced persons without meeting with much dissent.

(iii) The investigation demonstrates the applicability of probability models such as the gravity and inter-actance models and statistical formula to geographic data.

In conclusion and in spite of the handicap of data limitations for such small units of the city as are the neighbourhoods used in the analysis, the study may be said to have achieved its goal in establishing the spatial patterns of journey to work from Lower Town East and Rockcliffe Park Village.

APPENDIX A

TABLE 5

Location Quotient of the Main Employment Zones in the Traffic  
Sector 110 of the National Capital Region, 1963.

Occupational Class.	Traffic Sector 110											
	Traffic Zones											
	01	02	03	04	05	06	07	08	09	10	11	12
Professional Office and Clerical	5309	249	38	207	914	2345	137	178	988	294	120	8
	1.6	0.3	0.05	0.6	0.8	2.0	0.08	0.4	0.7	0.7	0.8	0.00
Retail Trade	1588	165	5	147	809	315	43	97	2722	430	237	11
	0.7	0.2	0.0	0.5	1.0	0.3	0.0	0.0	3.0	1.5	1.7	0.0
Manufacturing and Industry	361	73	22	50	41	312	0	31	121	58	5	51
	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal Government	4240	1890	0	755	1395	1105	5825	1025	755	460	0	2645
	0.7	1.4	0.0	1.2	0.6	0.5	2.0	1.4	0.3	0.6	0.0	2.1
Total Employment	12523	2778	271	1323	4399	4516	6030	1566	5226	1478	592	2672

Source: Statistical Review, National Capital Region, December 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 6

Location Quotient of the Main Employment Zones in the Traffic Sector 111 of the National Capital Region, 1963.

Occupational Class	Traffic Zones									
	01	02	03	04	05	08	12	15	18	
Professional Office and Clerical	0	0	0	226	153	641	750	233	0	
	0.0	0.0	0.0	0.4	0.4	1.1	1.1	0.6	0.0	
Retail Trade	0	0	0	294	58	646	331	291	0	
	0.0	0.0	0.0	1.0	0.0	1.7	0.7	0.4	0.0	
Manufacturing and Industry	0	0	300	356	510	328	232	388	0	
	0.0	0.0	8.3	1.4	2.8	1.5	0.9		0.0	
Federal Government	1746	3774	0	916	687	128	693	2517	800	
	2.1	2.1	0.0	0.9	1.0	0.0	0.5	1.5	2.2	
Total Employment	1746	3774	300	2008	1480	2178	2507	3558	801	

Source: Statistical Review, National Capital Region, December 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 7

Location Quotient of the Main Employment Zones in the Traffic  
Sector 112 of the National Capital Region, 1963.

Occupational Class	Traffic Zones			
	01	02	04	09
Professional	461	0	429	633
Office and Clerical	1.4	0.0	2.2	2.2
Retail Trade	28	0	0	119
	0.0	0.0	0.0	0.0
Manufacturing and Industry	0	0	0	14
	0.0	0.0	0.0	0.0
Federal Government	691	890	0	0
	1.1	2.2	0.0	0.0
Total Employment	1305	890	753	1112

Source: Statistical Review, National Capital Region, December, 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 8

Location Quotient of the Main Employment Zones in the Traffic  
Sector 113 of the National Capital Region, 1963.

Occupational Class	Traffic Zones							
	10	16	19	26	22	24	25	26
Professional Office and Clerical	31 0.0	0 0.0	0 0.0	0 0.0	0 0.0	224 1.8	0 0.0	0 0.0
Retail Trade	339 5.0	110 4.5	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Manufacturing and Industry	0 0.0	0 0.0	0 0.0	158 7.5	0 0.0	0 0.0	0 0.0	0 0.0
Federal Government	0 0.0	0 0.0	1119 2.2	0 0.0	1225 2.2	0 0.0	1641 2.2	715 2.2
Total employment	397	141	1119	185	1225	494	1641	715

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

**TABLE 9**  
**TABLE 9**

**Location Quotient of the Main Employment Zones in the Traffic  
Sector 114 of the National Capital Region, 1963.**

Occupational Class	Traffic Zones																	
	01	03	04	05	07	08	10	11	14	18	20	23	29	30	32	35	36	40
Professional Office and clerical	6	0	106	0	242	85	32	71	0	0	44	88	0	0	20	105	0	336
	0.8	0.0	1.1	0.0	0.6	1.4	0.6	0.7	0.0	0.0	0.6	0.6	0.0	0.0	0.0	1.0	0.0	3.0
Retail Trade	0	0	20	0	218	0	31	19	0	121	21	399	0	0	270	55	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	5.1	0.0	4.4	0.0	0.0	2.5	0.1	0.0	0.0
Manufacturing and Industry	9	0	182	0	0	0	87	198	66	66	70	2	0	0	0	0	0	0
	2.2	0.0	4.1	0.0	0.0	0.0	3.4	4.0	7.5	7.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal Government	0	42	0	0	0	302	0	0	0	0	0	0	947	1792	159	0	0	0
	0.0	2.1	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2	0.5	0.0	0.0	0.0
Total Employment	27	42	364	70	1403	213	208	398	72	138	270	527	947	1792	622		152	431

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 10

Location Quotient of the Main Employment Zones in the Traffic  
Sector 115 of the National Capital Region, 1963.

Occupational Class	Traffic Zones				
	01	02	20	25	26
Professional Office and Clerical	0 0.0	0 0.0	210 1.2	0 0.0	5 0.0
Retail Trade	10 0.0	6 0.0	295 2.5	513 5.7	0 0.0
Manufacturing and Industry	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Federal Government	1868 2.2	511 2.2	0 0.0	0 0.0	0 0.0
Total Employment	1878	517	640	528	36

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 11

Location Quotient of the Main Employment Zones in the Traffic  
Sector 116 of the National Capital Region, 1963.

Occupational Class	Traffic Zones					
	05	14	16	18	22	28
Professional Office and Clerical	2 0.0	333 1.2	62 0.2	35 0.0	337 1.1	2 0.0
Retail Trade	57 0.0	103 0.0	221 1.4	41 0.9	589 2.8	0 0.0
Manufacturing and Industry	0 0.0	646 4.8	159 1.3	68 2.1	130 0.0	16 4.1
Federal Government	5083 2.2	8 0.0	7 0.0	37 0.3	0 0.0	0 0.0
Total Employment	5142	1098	960	255	1179	32

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

TABLE 12

Location Quotient of the Main Employment Zones in the Traffic  
Sector 118 of the National Capital Region, 1963.

Occupational Class	Traffic Zones			
	01	09	10	14
Professional Offices and Clerical	0	0	32	0
Retail Trade	0 0.0	87 0.8	0. 0.0	0 0.0
Manufacturing and Industry	1308 8.3	0 0.0	0 0.0	472 8.3
Federal Government	0 0.0	0 0.0	1206 2.1	0 0.0
Total Employment	1308	594	1246	472

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

Location Quotient of the Main Employment Zones in the Traffic Sector 119 of the National Capital Region, 1963.

Occupational Class	Traffic Zones						
	02	08	10	13	14	15	20
Professional Office and Clerical	0	26	14	9	0	870	0
	0.0	0.0	0.0	2.4	0.0	3.9	0.0
Retail Trade	63	244	136	0	0	0	0
	1.1	0.7	0.6	0.0	0.0	0.0	0.0
Manufacturing and Industry	183	773	485	0	187	0	0
	4.6	3.5	3.5	0.0	8.3	0.0	0.0
Federal Government	0	34	0	0	0	0	0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Employment	324	1775	1135	14	187	870	20

Source: Statistical Review, National Capital Region, 1964.

\*\* The figures given in decimal numbers are location quotients.

APPENDIX B

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 110

Traffic Zones	Professional Business and Clerical	Retail	Manufacturing and Industry	Federal Government	Total *
01	5309	1588	361	4240	12523
02	249	165	73	1890	2778
03	38	5	22	-	271
04	207	147	50	755	1323
05	914	809	41	1395	4399
06	2345	315	312	1105	4516
07	137	43	-	5825	6030
08	178	97	31	1025	1566
09	988	2722	121	755	5226
10	294	430	58	460	1478
11	120	237	5	-	592
12	8	11	51	2645	2672

\* NOTE: Total Employment is for five Occupational Categories Contained in the Statistical Review, National Capital Region - 1963.

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 111

99

Traffic Zones	Professional Business and Clerical	Retail	Manufacturing and Industry	Federal Government	Total Employment *
01	-	-	-	1746	1746
02	-	-	-	3774	3774
03	-	-	300	-	300
04	226	294	356	916	2008
05	153	58	528	687	1408
07	62	106	33	-	622
08	641	646	328	128	2178
09	544	111	73	66	1896
12	750	331	232	693	2507
15	233	291	388	2517	3588
18	-	-	-	800	801
21	-	-	-	-	110

\* See Footnote in Traffic Sector 110

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 112

100

Traffic Zones	Professional, Business and Clerical	Retail	Manufacturing and Industry	Federal Government	Total Employment *
01	461	28	-	691	1305
02	-	-	-	890	890
04	429	-	-	-	753
09	633	119	14.	-	1112

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 113

Traffic Zones	Professional, Business and Clerical	Retail	Manufacturing and Industry	Federal Employment	Total Employment *
10	31	339	-	-	397
16	-	110	-	-	111
19	-	-	-	1119	1119
20	-	-	158	-	185
22	-	-	-	1225	1225
24	224	-	-	-	494
25	-	-	-	1641	1641
26	-	-	-	715	715

\* Same as in Traffic Sector 110

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 114

101

Traffic Zones	Professional, Business and Clerical	Retail	Manufacturing and Industry	Federal Employment	Total Employment *
01	6	-	9	-	27
03	-	-	-	42	42
04	106	20	182	-	364
05	-	-	-	-	70
07	242	218	39	-	1403
08	85	-	-	102	213
10	32	31	87	-	208
11	71	19	198	-	398
14	-	-	66	-	72
18	-	121	-	-	138
20	44	21	70	-	270
23	88	399	2	-	527
24	-	-	-	-	40
28	-	3	-	-	163
29	-	-	-	947	947
30	-	-	-	1792	1792
32	20	270	26	159	622
35	105	55	-	-	402
36	-	-	-	-	152
40	336	-	-	-	431

\* Same as in Traffic Sector 110

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 115

102

Traffic Zones	Professional, Business and Clerical	Retail	Manufacturing and Industry	Federal Government	Total Employment *
01	-	10	-	1868	1878
02	-	6	-	511	517
20	210	295	-	-	640
25	-	513	-	-	528
26	5	-	-	-	36

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 116

05	2	57	-	5083	5142
14	333	103	646	8	1098
16	62	221	159	7	960
18	35	41	68	37	225
22	337	589	130	-	1179
28	2	-	16	-	32

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 118

01	-	-	1308	-	1308
09	-	87	-	22	594
10	32	-	-	1206	1246
14	-	-	472	-	472

THE MAIN EMPLOYMENT TRAFFIC ZONES IN TRAFFIC SECTOR 119

02	-	63	183	-	324
08	26	244	773	34	1775
10	14	136	485	-	1135
13	9	-	-	-	14
14	-	-	187	-	187
15	853	-	-	-	870
20	-	-	16	-	20

\* Same as for Traffic Sector 110

APPENDIX C

TABLE 17

PROFESSIONAL, BUSINESS AND CLERICAL EMPLOYMENT

Traffic Sector	Traffic Zones	P	P	D	P P	P P	P P X10-4
		A	B		A B	A B	A B
		Total No. of PBC Employees per Traffic Zones	No. of workers from Lower Town East	Distance in miles		D	D
						Index	
110	01	5309	53	1.10	1380340	12548545.4	125.0
	06	2345	23	.95	531700	559684.2	56.0
111	07	62	9	1.95	16120	8266.6	0.8
	09	544	10	2.34	141440	57730.6	5.7
	21	110	10	2.45	28600	11673.4	1.1
112	01	461	47	.75	119860	159813.3	16.0
	04	429	34	.75	111540	148720.0	14.9
	09	633	23	1.00	164580	164580.0	16.5
	11	162	3	.55	42120	76581.8	7.6
	13	20	3	.58	5200	8965.5	0.8
	19	1119	2	1.55	68900	47517.2	4.7
	20	265	1	1.45	290940	200648.2	20.0
113	17	5	2	1.55	1300	838.7	0.1
	20	158	32	1.95	41080	21066.6	2.1
119	09	29	1	4.00	7540	1855.0	0.2
	10	1711	4	4.05	444860	109841.9	11.0
119	15	870	1	1.90	226200	119052.6	11.9
			P Total				
			B				
			260				
							104

TABLE 18

RETAIL EMPLOYMENT

Traffic Sector	Traffic Zones	$P_A$ Total No. of Retail employees per Traffic Zone	$P_B$ No. of Retail Workers from Lower Town East	Distance in miles	$P_A P_B$	$\frac{P_A P_B}{D}$ index	$\frac{P_A P_B}{D} \times 10^{-3}$
110	01	1588	21	1.10	363652	330592.0	331.0
	09	2722	61	.50	623338	415558.6	416.0
	10	430	11	.45	111800	24844.4	24.8
111	12	331	12	1.55	75799	48902.5	48.9
112	06	34	20	.45	7786	173202.2	17.3
	07	231	60	.45	52899	117553.0	118.0
	08	104	40	.45	23816	52924.0	52.9
113	05	87	2	.55	19923	362226.0	362.0
	07	233	2	.55	53357	97012.7	97.0

 $P_B$  Total

229

TABLE 19

MANUFACTURING AND INDUSTRY EMPLOYMENT

Traffic Sector	Traffic Zones	P A Total No. of Manu- facturing and Industry employees per Traffic Zone	P B No. of Manu- facturing and Industry Workers from Lower Town East	D Distance in Miles	P P A B	P P A B D Index	P P A B D $\times 10^{-3}$
110	01	361	4	1.10	31046	28223.6	282.0
111	06	35	8	2.05	3010	1468.2	14.7
112	06	16	4	.45	1376	3057.7	30.5
	07	211	22	.45	18146	40324.4	403.
	15	115	13	1.60	10890	68062.5	680.
113	12	59	2	1.25	9890	6181.2	61.8
114	04	182	2	2.95	15652	5305.7	53.1
	11	398	2	3.10	34228	11065.4	111.0
	14	66	1	3.15	5676	1830.9	18.3
115	28	4	2	9.05	344	38.01	0.3
116	14	646	4	3.05	55556	15873.1	159.0
118	01	1308	20	1.75	112488	64278.8	643.0

P  
B Total

86

TABLE 20

FEDERAL EMPLOYMENT

Traffic Sector	Traffic Zones	P A		P B		Distance in miles	P P A B	P P A B / D Index	P P A B / D X 10 <sup>-4</sup>
		Total No. of Federal Employees per Traffic Zone	No. of workers from Lower Town East						
110	01	4210	25	1.10	1424640	1295127.2	130.0		
	07	5825	53	.90	1957200	2174666.6	217.0		
	12	2645	42	.87	888720	1021517.2	102.0		
111	01	1746	30	1.05	586656	558720.0	55.9		
	02	3774	10	1.50	1268064	845376.0	84.5		
	15	2517	13	2.75	845712	307531.6	30.7		
	18	800	2	3.50	268800	7680.0	7.6		
112	02	890	8	.87	299040	343724.1	34.4		
	07	227	9	.45	76272	1694.9	17.0		
113	19	1119	9	1.95	375984	192812.3	19.2		
	22	1225	11	3.00	411600	137200.0	13.7		
	25	1641	19	3.50	551376	157536.0	15.8		
	26	715	4	2.50	240240	96096.0	9.6		
	29	947	2	5.00	318192	63638.4	6.3		
114	30	1792	42	5.00	606112	120422.4	12.0		
	48	347	1	9.00	116592	12954.6	1.3		
115	01	1868	5	3.75	661248	176332.8	17.6		
	05	5083	24	3.95	1707888	432376.7	43.2		
118	10	1206	27	1.90	405216	213271.5	21.3		

P B total  
336

TABLE 21

PROFESSIONAL, BUSINESS AND CLERICAL EMPLOYMENT

Traffic Sectors	Traffic Zones	<sup>P</sup> <sub>A</sub> Total No. of P, B, & C Employees per Traffic Zone	<sup>P</sup> <sub>B</sub> No. of P.B. & C. Workers from Rockliffe Park Village	D Distance in miles	<sup>P P</sup> A B	<sup>P P</sup> $\frac{A B}{D}$ index	<sup>P P</sup> $\frac{A B}{D} \times 10^{-1}$
110	01	5309	15	2.40	307922	1283.0	128.0
	05	914	1	2.45	53012	216.3	22.0
	06	2345	11	2.50	136010	544.0	54.0
	08	641	4	2.40	37178	154.9	15.0
111	09	144	11	2.05	8352	40.7	40.0
	12	750	4	2.60	3000	11.5	1.1
112	09	633	7	1.95	36714	188.2	19.0
	11	88	4	3.10	5104	16.4	1.6
114	35	105	1	6.45	6090	9.4	1.0

<sup>P</sup><sub>B</sub> Total

58

TABLE 22

RETAIL EMPLOYMENT

Traffic Sectors	Traffic Zones	P A Total No. of Retail employees per traffic zone	P B No. of Retail workers from Rockcliffe Park Village	D Distance in miles	P P A B	P P <u>A B</u> D index
110	01	1588	7	2.40	14292	59.5
	09	2722	2	1.80	24498	136.1
			————— P B Total 9			

TABLE 23

MANUFACTURING AND INDUSTRY EMPLOYMENT

Traffic Sectors	Traffic Zones	P <sub>A</sub> Total No. of Manufacturing and Industry employees per traffic zone	P <sub>B</sub> No. of M X 1 workers from Rockliffe Park Village	D Distance in miles	P P A B	P P <u>A B</u> D Index
110	01	361	3	2.40	2166	9.0
114	01	9	1	3.50	54	0.1
116	14	646	2	5.15	3876	7.5

---

P<sub>B</sub> Total 6

TABLE 24

FEDERAL GOVERNMENT EMPLOYMENT

Traffic Sectors	Traffic Zones	P A Total No. of Federal Govt. Employees per traffic zone	P B No. of Federal workers from Rockliffe Park Village	Distance in miles	P P A B	P P $\frac{A \cdot B}{D}$ index	P P $\frac{A B X 10^{-1}}{D}$
110	01	4240	10	2.40	288320	1201.3	120.0
	02	1890	4	2.40	128520	535.5	54.0
	05	1395	1	2.45	94860	387.1	39.0
	07	5825	7	2.50	396100	1584.4	158.0
111	01	1746	10	2.40	118728	494.7	49.0
	02	3774	11	2.50	256632	1026.5	103.0
	15	2517	4	3.60	171156	475.4	48.0
113	05	128	5	0.75	8704	116.0	12.0
	25	1641	4	1.60	111588	697.4	70.0
	26	715	1	2.00	48620	243.1	24.0
114	29	947	1	5.45	64396	118.1	12.0
	30	1792	1	5.45	121856	223.5	22.0
115	01	1868	2	4.65	127024	273.1	27.0
116	05	5083	6	4.25	345644	813.2	81.0
118	10	1206	1	2.60	82008	315.4	32.0

P  
B Total

68

THE CORRELATION COEFFICIENT OF THE TOTAL NUMBER OF JOBS AND THE SPATIAL DISTRIBUTION OF WORKERS FROM LOWER TOWN EAST FOR THE 57 TRAFFIC ZONES INVOLVED IN THE ANALYSIS.

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X	Y
Number of Jobs	Distribution of Workers from Lower Town East.
1098	14
2443	133
2672	42
2070	11
5226	61
188	2
710	2
2507	12
12523	103
6030	53
4516	12
870	1
1746	30
3774	10
32	2
255	2
1896	10
622	9
1480	2
3558	13
801	27
1246	10
110	20
1308	1
72	2
549	2
947	42
1792	2
4	5
1878	24
5142	47
1305	8
890	33

X	Y
615	3
753	34
744	13
862	2
604	13
265	1
960	2
188	2
892	3
710	8
1112	13
880	4
2871	4
1225	11
1641	19
209	4
146	1
185	1
27	17
72	1
364	2
163	1
398	2
753	3

Correlation Coefficient      0.60

THE CORRELATION COEFFICIENT OF THE TOTAL NUMBER OF PROFESSIONAL, BUSINESS AND CLERICAL JOBS AND THE SPATIAL DISTRIBUTION OF WORKERS FROM LOWER TOWN EAST.

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X	Y
$\frac{P_A P_B}{D} \times 10^{-4}$	Number of Workers from Lower Town East
Index	
125.0	53
56.0	23
0.8	9
5.7	10
1.1	10
16.0	47
14.9	34
16.5	23
7.6	3
0.8	3
4.7	2
20.0	1
0.1	2
2.1	32
0.2	1
11.0	4
11.9	1

Correlation Coefficient = + 0.63

Correlation Coefficient of Total Number of Retail Jobs and  
the Spatial Distribution of Workers from Lower Town East.

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X	Y
$\frac{P_A P_B}{D} \times 10^{-3}$	Number of Workers from Lower Town East
331.0	21
416.0	61
24.8	11
48.9	12
17.3	20
118.0	60
52.9	40
362.0	2
97.0	2

Correlation Coefficient + 0.21

Correlation Coefficient of Total Number of Manufacturing and Industry Jobs and the Spatial Distribution of Workers from Lower Town East.

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X	Y
$\frac{P_A P_B}{D}$	Number of Workers from Lower Town East
282.0	4
14.7	8
30.5	4
403.0	22
680.0	13
61.8	2
53.1	2
111.0	2
18.3	1
0.3	2
159.0	4
643.0	20

Correlation Coefficient + 0.80

Correlation Coefficient of Total Number of Federal Government Jobs and the Spatial Distribution of Workers from Lower Town East.

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X	Y
$\frac{P_A P_B}{D} \times 10^{-4}$	Number of Workers from Lower Town East
130.0	25
217.0	53
102.0	42
55.9	30
84.5	10
30.7	13
7.6	2
34.4	8
17.0	9
19.2	9
13.7	11
15.8	19
9.6	4
6.3	2
12.0	42
1.3	1
17.6	5
43.2	24
21.3	27

Correlation Coefficient + 0.69

Correlation Coefficient of the Total Number of Jobs and the Spatial Distribution of Workers from Rockcliffe Park Village for 28 Traffic Zones involved in the Analysis.

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X Number of Jobs	Y Distribution of Workers from Rockcliffe Park Village
12523	30
271	4
2507	4
3558	4
209	4
1641	4
1890	4
188	5
1746	9
1112	7
3774	10
4516	10
1896	11
2178	4
6142	6
6030	6
3558	5
1098	2
398	2
1246	2
715	1
42	1
622	1
947	1
1792	1
4399	1
2871	1
416	1

Correlation Coefficient + 0.77

Correlation Coefficient of Total Number of Professional,  
Business and Clerical Jobs and the Spatial Distribution of  
Workers from Rockcliffe Park Village.

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X	Y
$\frac{P_A P_B}{D} \times 10^{-1}$	Number of Workers from Rockcliffe Park Village
128.0	15
22.0	1
54.0	11
15.0	4
40.0	11
1.1	4
19.0	7
1.6	4
1.0	1

Correlation Coefficient = + 0.86

Correlation Coefficient of Total Number of Retail Jobs and the Spatial Distribution of Workers from Rockcliffe Park Village.

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X	Y
$\frac{P_A P_B}{D}$	Number of Workers from Rockcliffe Park Village
59.5	7
136.1	2

Correlation Coefficient = - 1.00

TABLE 33

Correlation Coefficient of Total Number of Manufacturing and Industry Jobs and the Spatial Distribution of Workers from Rockcliffe Park Village.

X	Y
$\frac{P_A P_B}{D}$	Number of Workers from Rockcliffe Park Village
9.0	3
0.1	1
7.5	2

Correlation Coefficient = + 0.93

TABLE 34

Correlation Coefficient of Total Number of Federal Government Jobs and the Spatial Distribution of Workers from Rockcliffe Park Village.

$\frac{P_A P_B}{D} \times 10^{-1}$	Y Number of Workers from Rockcliffe Park Village
120.0	10
54.0	4
39.0	1
158.0	7
49.0	10
103.0	11
48.0	4
12.0	5
70.0	4
24.0	1
12.0	1
22.0	1
27.0	2
81.0	6
32.0	1

Correlation Coefficient = + 0.69

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