

INDUSTRIAL LOCATION IN THE BOSTON SMSA

by

Paula Jean Waters

Submitted in Partial Fulfillment  
of the Requirements for the  
Degree of Bachelor of Science  
at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June, 1973

Signature of Author.....  
Department of Urban Studies, May 15, 1973

Certified by.....  
Thesis Supervisor

Accepted by.....  
Chairman, Departmental Committee on Theses



## ABSTRACT

### Industrial Location in the Boston SMSA

by

Paula Jean Waters

Submitted to the Department of Urban Studies and Planning on May 15, 1973 in partial fulfillment of the requirements for the degree of Bachelor of Science.

In the past twenty years, the trend of industrial location has changed in urban areas. Such is the case of the Boston SMSA. This thesis will analyse the location decision of firms in the Boston SMSA in light of their labor needs, land needs, and service needs, focusing on the decline of certain industries in the core cities and the rapid growth of industries along Route 128.

Census data shows that in many cases, industry has followed its labor supply. In cases where this did not occur, firms relocated or adjusted to the new labor supply. The tightness in the labor supply of some skill groups suggests that industry and local governments should seek some means of extending the labor market to include a wider area.

Thesis Supervisor: Arthur Solomon

Title: Associate Professor of Urban Studies and Planning

## TABLE OF CONTENTS

	Page
CHAPTER 1      The Location of Households and Firms	1
CHAPTER 2      Physical Locational Features of the Boston SMSA	7
Land, Transportation and Services in the Boston SMSA	
Land, Transportation and Services in Suburban Boston	10
CHAPTER 3      Land Supply Characteristics of Boston and the Route 128 Area	16
CHAPTER 4      The Location Decision of Firms in the Boston SMSA	21
The Location of Retail and Service Firms	23
The Location of Wholesaling and Distributing Firms	24
The Location of Manufacturing Firms	25
The Location of Research and Development Firms	30
CHAPTER 5      The Effects of Industrial Location on the Central City and the Suburbs	33

## LIST OF CHARTS AND TABLES

Industrial Parks in Greater Boston	11
Sites Available for Industrial Development In the Boston Central City	12
Areas Zoned for Industry In the Boston Central City	13
Public Transportation in Greater Boston	14
Skill Group Concentration in Suburban Boston, Route 128 Cities and Towns	18
Commuting in the Boston SMSA	19
Population Distribution in the Boston SMSA	21

List of Charts and Tables Cont'd

Page

Number of Retail and Service Firms	23
Number of Wholesaling Firms	24
Manpower Needs of Manufacturers	25
Number of Manufacturing Firms	29
Labor Distribution for Research and Development	31
Number of Route 128 Firms	31
Breakdown of Route 128 Firms	31

## CHAPTER 1

### THE LOCATION OF HOUSEHOLDS AND FIRMS

Cities are composed of two major entities - households and firms. It is the location decisions of these two interlocking groups which determine the shape, size and atmosphere of the urban scene. The location of both firms and households are based on technological advancement and transportation systems. Technological advancement determines the means of producing goods, while the means of producing transportation available at a given time determines how people and products shall be moved.

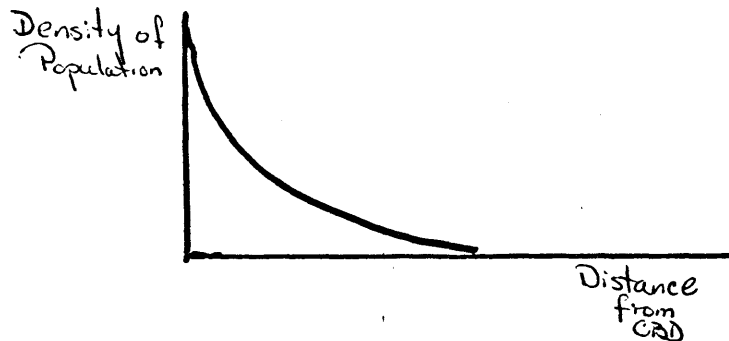
During the early part of American history, the best means of transportation was by water. Therefore households and firms or "cities" located near the ocean or upon navigable waterways flourished. To many early industries, transportation and its costs were the most important locational features. Production was done by the hands of skilled craftsmen. This methodology was feasible in those days because the population was small enough for the suppliers to meet the demand. Transportation of labor was no problem in that towns were small, and people kept close together for protection against attack. Thus, as a result, jobs for the most part were within walking distance from the home.

Since the Industrial Revolution began in American life has become more complex. The Revolution began in New England where there was an abundance of low-cost energy - swiftly moving water. Thus the textile industry was born. The turn of the century brought about larger plants with increased production.

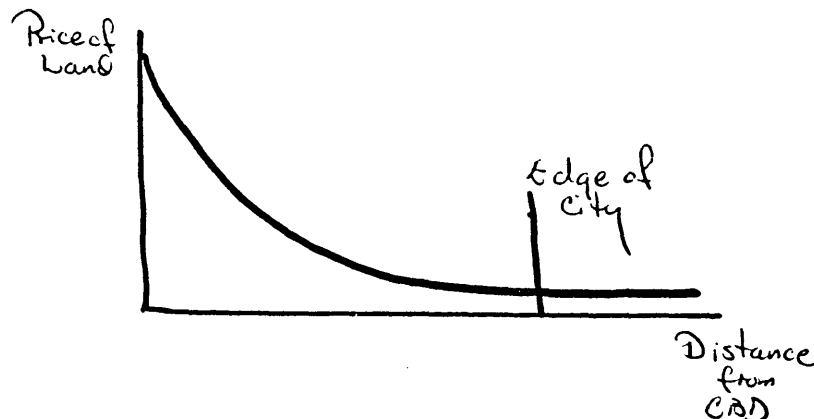
Subsequently, industry sought to locate in large cities, with large populations, which were also located near trans-shipment points. Trans-shipment points were areas where two or more forms of transportation intersected. Businesses located here to minimize the transit costs of shipping raw materials and/or products. For instance, Chicago became the meat packing capital because the meeting of the many rail lines and the availability of a port allowed meat to be shipped in and sent out to all parts of the country without having to change from one form of transportation to another. Dealers in imported jewels located on the seacoast at that time, because raw materials could be shipped in by boat and picked up directly.

The advent of industry to these areas encouraged a great flow of population from rural areas and other countries into what was the city, expanding it to even greater bounds than before. The increase in population induced more industry to locate in the urban areas, creating that cycle as described by Jay Forrester.<sup>1</sup>

Besides seeking the best location nationally, industry and households locate in particular patterns within urban areas, in arrangements which will maximize their satisfaction. For example, those areas closest to the labor supplies, and transportation systems will be more highly valued by firms than those areas farther away. Likewise, households seek to locate close to jobs and commercial concerns. The area in most demand by industry and households we will call the Central Business District.



The high density of population in the Central Business District (CBD) implies a high demand for land. As distance increases from the CBD prices fall off until they reach the price of farmland. It is at this point that urban areas cease and rural areas begin.



According to modern theorists, households and firms bid for prime locations within urban areas. The bids of these two entities reflect the desire to maximize profits on the part of the firm and to maximize utility on the part of the household. One of the most avid proponents of the theory of bid rents is William Alonso. In his book, Location and Land Use, he shows how land and wages are related to the distance of location away from the central city.

Theoretically, land rents are based on the price of farm land summed with the cost of transportation to the CBD. Transportation costs consist of the out-of-pocket costs, such as the cost of operating an automobile or taking public transportation, and hidden costs such as the cost of the time spent in commuting. The household must take these costs into consideration when deciding on a location. Industry must consider the location of households - meaning the labor supply - as well as the amount of wages which will be offered to labor in order to induce them to travel to work.<sup>2</sup>

There are several factors which influence industrial location. There are factors which make firms choose one city over others. There are factors which influence the firm's decision to locate in a particular part of an



urban area. This paper will discuss the location decisions of different types of firms within the metropolitan area of Boston, focusing especially on the central cities and the cities and towns surrounding Route 128. Although the decision to locate in a given area is based on many factors, this paper will concern itself specifically with transportation, labor supplies, land supplies, and the availability of sewage and water systems within urban and suburban communities.

## FOOTNOTES - CHAPTER 1

1. Forrester, Jay, Urban Dynamics, 1969
2. In offering wages, industry should add the cost of travel to the basic rate, thereby giving differential rates to its workers according to how far away they live from the place of work.

## CHAPTER 2

### PHYSICAL LOCATIONAL FEATURES OF THE BOSTON SMSA

In the Boston area, many new industries, as well as many old central city businesses are locating in suburban communities. One of the factors contributing to decisions to decentralize is that suburban industrial sites contain land in abundance. Land is important to industry in that it allows for modernization of production techniques and facilities and provides essentially space for accommodating future expansion and growth. In addition, the land must be serviced by water and sewage and other things necessary for production.

Another constraint upon industrial site selection is that of transportation. Transportation is important to the firm in that it is the means by which raw materials and labor are imported and by which products are transferred to markets. The transportation system is necessary to all phases of industry, especially distributors, wholesalers and retailers which either depend on shipping products to market or receive buyers. These factors are all important in determining the location of the firm.

#### Land, Transportation and Services in the Boston Central City

Since Colonial days, Boston has continued to be a growing area of population and industrial and commercial concentration. As this growth continued, water and sewage systems were developed to service the needs of the city's citizens. As a result, Boston is able to service industry adequately for its needs.

However, land and usable industrial space for modern industry are scarce commodities, and at this time, very few new industries make their home in Boston. Even if land were available in large amounts, it would be very expensive, compared to other areas of the SMSA, and of the vacant lots which do exist, only two are large enough to interest modern industry in the least.<sup>1</sup> Also, most of the manufacturing space in the city is what was left from the textile industry. It is multi-storied, and unattractive to modern firms which make use of the one-story plant.

The city of Boston was once a very important location of industry because it was a trans-shipment point for transportation. At that point in history, rail was used for continental travel and water transport was used for international transportation. Access to these modes of transportation made Boston the great center of economic activity that it is. However, in recent times, the port of Boston has lost some of its importance to the Port of New York, and rail travel has given way to the truck. International shipping is done by air.

Although Boston has an international airport which would sustain foreign trade, it does not have the necessary highway facilities to make industrial location in the city practical. Only two major multi-laned, limited-access highways enter the central business district - the Southeast Expressway, and the Massachusetts Turnpike.<sup>2</sup> The Expressway heads southeast to the south shore of Boston, while the Turnpike leads westward, away from Boston. Traffic on these arteries is very heavy and much too congested for industrial use. Even so, most of the industrial land does not border on the highways: most industrial space is serviced by rail, no longer the major mode of transport.

Public transportation is handled by the Massachusetts Bay Transportation Authority (MBTA). The system consists of bus lines which service many of the nearby suburbs in addition to the central city, and of subway lines which run through Boston and other neighboring towns and cities. This transportation system allows for quick mobility of central city resident and their near neighbors within the Boston core at a rather inexpensive cost. This feature of the MBTA has made the working population of Boston essentially a unified market of diversified skills.

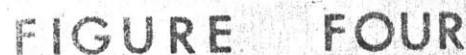
### Land, Transportation and Services in Suburban Boston

Although population has been increasing in the suburbs, it is much more dispersed than in the core city of Boston in that the total population has larger land area to occupy outside the central city. Because the population density of suburban areas is smaller than that of the city of Boston, there is much available vacant land and at much lower costs per square foot. There is little ready-built industrial space except for the old textile mills of the Lawrence area.

Suburban communities, for the most part, do not have extensive water and sewage systems. The systems in existence were built for residential communities, not for heavy-duty industry. Developers and industry must pay for installation of adequate services on industrial sites.

Suburban Boston has been made famous because of the "miracle highway", Route 128. Route 128 is a circumferential highway which rings Boston at a distance of from nine to ten miles out from the city. Its eighty-mile length passes through over twenty cities and towns of suburban Boston from Gloucester on the northeast to Hull on the southeast. Intersecting with this highway are several radial arteries which connect the suburbs with the rest of the state. Among them are Interstate 95, the Southeast Expressway, Interstate 90 (the Massachusetts Turnpike), Route 2, Route 3, and Interstate 93. The arterial system encourages industrial growth by making interstate and inter-regional transportation faster. It is a necessity for suburban life in that public transportation is scarce, and most travel is done by automobile.

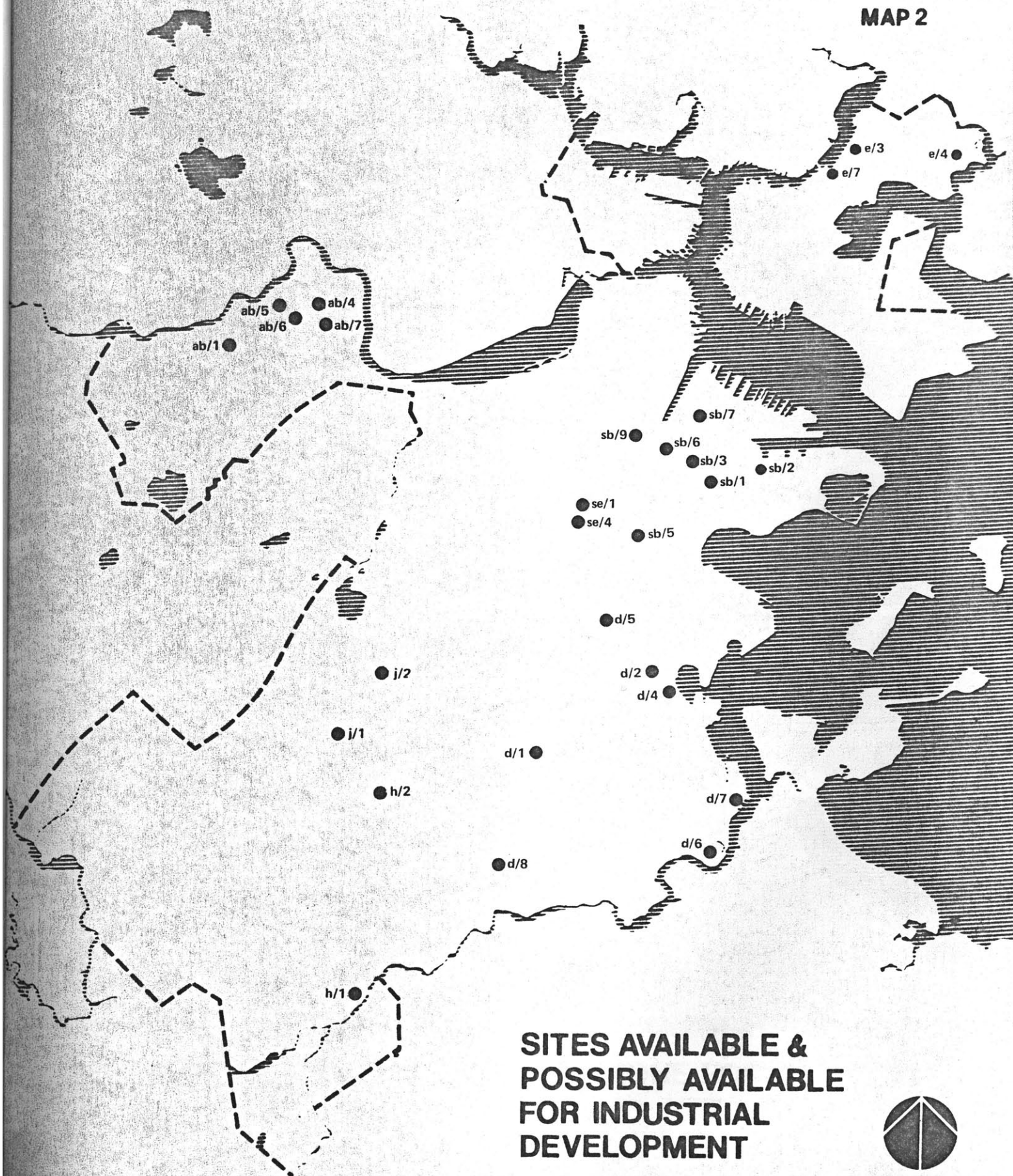
1961



From: Industrial Land Needs through  
1980, Greater Boston Economic  
Study Committee, 1962

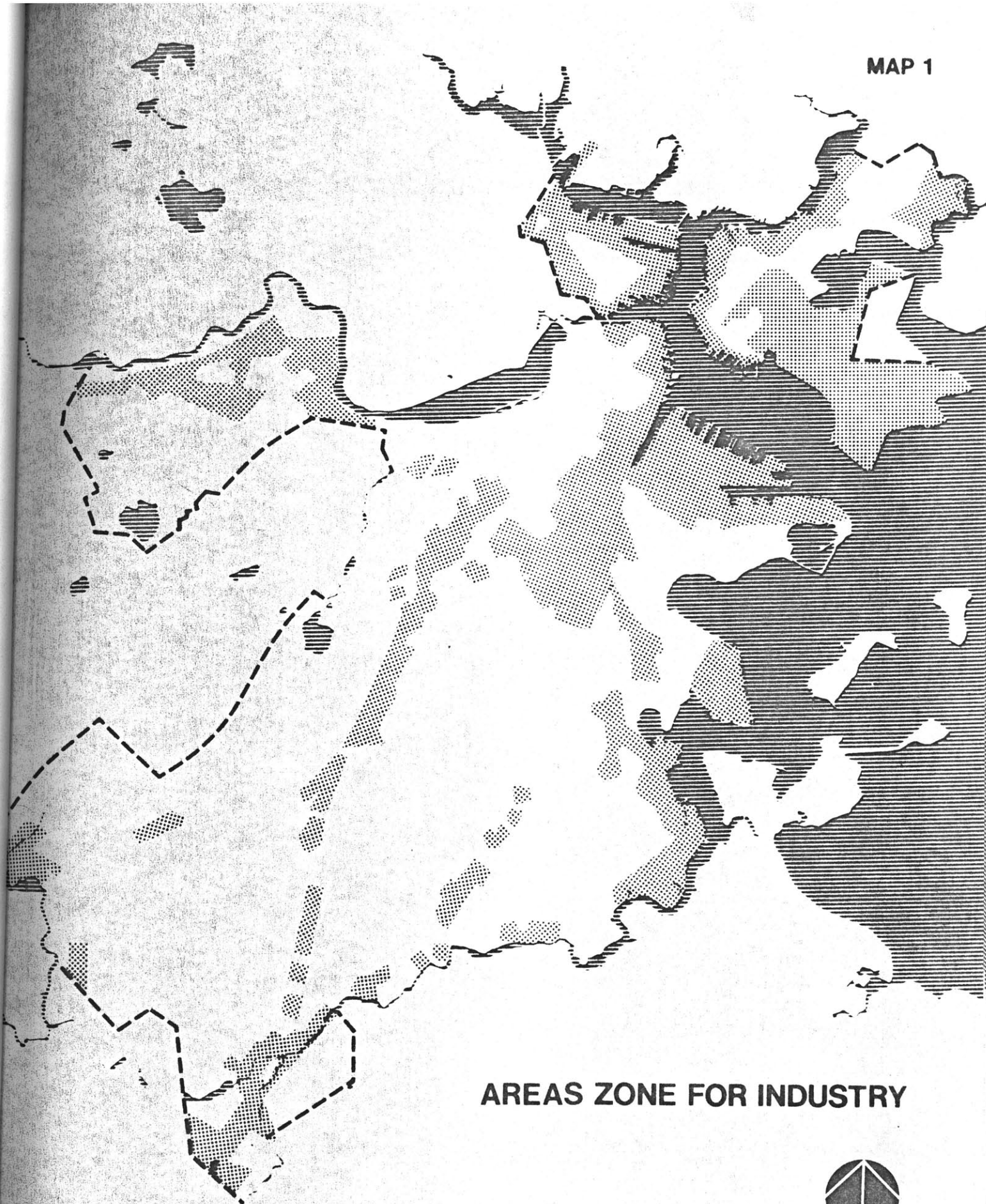


MAP 2





MAP 1



AREAS ZONE FOR INDUSTRY





## FOOTNOTES - CHAPTER 2

1. See Massachusetts Department of Commerce and Development, Massachusetts Space Listings, 1970
2. Route 9 is a parallel artery to the Massachusetts Turnpike, and it runs between the outskirts of Boston to the city of Worcester. It is said that because of the two parallel routes, traffic congestion is less and for this reason, the Western suburbs have developed more so than the other sectors of the SMSA outside the central city.

### CHAPTER 3

## LAND SUPPLY CHARACTERISTICS OF BOSTON AND THE ROUTE 128 AREA

The Boston SMSA is composed of several labor markets, not just one unified one. What are the characteristics of this market (or markets) and what is the spatial distribution of the labor supplies of industry? This chapter will focus on the labor supply of Boston and other nearby central cities as opposed to the suburban Route 128 areas in which much industrial growth is occurring.

Since the end of the Second World War , middle income population has been moving out of the central city to the suburbs. This exodus has changed the distribution of skills within the Boston area. Many areas now contain a predominance of one skill group as opposed to others. The spatial setting of labor skills has affected industry by changing the locational patterns and by making some recruitment of labor difficult.

Burt illustrates this fact in his study of the labor supply characteristics along Route 128,

"...The most frequently reported recruitment problem was for female clerical help, especially experienced secretaries. It was pointed out that Route 128 locations, generally distant from public transportation, imposed a commuting problem on women without automobiles.<sup>1</sup>

"...With regard to male labor, the situation is substantially different. For recruitment of professional, scientific and engineering personnel the Route 128 area is considered ideal. In fact, the selection of sites along Route 128, especially in the western sub area and in the Wedge<sup>2</sup>, seems dominated by the desire to be close to the supply of this type of labor.<sup>3</sup>

This feature of the labor supply could be eliminated

if the market were unified by more mobility and ease of transportation within the SMSA, but statistics collected from surveys of industry <sup>4</sup> and those compiled in the Massachusetts Commuters Survey point to the conclusion that most workers are not willing to travel long distances to work.<sup>5</sup> Consequently, the Boston Metropolitan area can be described as an aggregate of nearly independent labor markets.

In areas where the supply of a particular labor group is scarce, industry has tried several means of attracting workers. The methods have included offering new employees fringe benefits, higher wages than competing firms, and pleasant atmospheres in which to work. Another method used was giving incentives to present employees to find new employees. For example, one firm gave old employees who recruited someone who became a permanent worker, a bonus. The amount of the bonus depended on the skill of the new employee.

The offering of higher wages of some firms in the suburbs has put other firms in a position of non-competitiveness in that those firms who could not afford to increase wages lost the labor in the tight labor market.

When the skill levels necessary to industry were non-existent, firms adapted to the situation by turning those jobs over to machines.

Comparing the central cities of Boston, Cambridge, and Somerville with twenty-two of the towns which border Route 128, one can notice differentiations between median educational levels and labor supplies of the different areas.

In the central cities the labor market is more concentrated, but at the same time it is differentiated in terms of the numbers of persons working at each skill level. So even though Boston is only about twenty-five percent management and professional labor, it has ten times as many in that skill category as Lexington whose population is sixty-one percent professional and management. Be that as it may, the central city of Boston contains only twenty-five percent of the total population of the SMSA, and that percentage is dwindling as time passes. Looking only at those cities which border Route 128, one can readily see the potential of the labor market. For example, the number of professional and management labor along the western segment of Route 128 rivals the Boston market.

LOCATION	MANAGEMENT <sup>+</sup>	CLERICAL	CRAFTSMAN	OPERATIVE
South of Boston	13,669	11,021	7,086	4,228
West of Boston	60,748	29,268	23,296	9,100
North of Boston	27,140	18,060	13,973	13,344

+ also includes professional labor.

(Source: 1970 Census of Population, Boston SMSA)

APPENDIX

CHAPTER 3

<u>City or Town</u>	<u>Work Force in Survey</u>	<u>% Work in County of Residence</u>	<u>% work Outside County</u>	<u>Not Report.</u>
Boston	259,781	183,140 (70.5)	50,559	26,082
Cambridge	46,090	28,382 (61.6)	13,274	4,434
Sommerville	36,660	20,192 (55.1)	13,251	3,217
Bedford	4,888	1,592 (32.1)	3,107	260
Beverly	15,537	12,083 (77.8)	2,518	936
Braintree	14,183	8,266 (58.0)	5,313	644
Burlington	8,205	6,205 (75.6)	1,698	302
Canton	6,538	3,582 (54.8)	2,664	292
Danvers	10,422	7,612 (73.0)	2,024	786
Dedham	10,459	4,285 (41.0)	5,463	711
Gloucester	10,671	8,652 (81.1)	1,105	914
Lexington	12,504	9,287 (74.3)	2,673	544
Needham	11,650	5,004 (43.0)	5,935	711
Newton	38,429	19,877 (51.7)	15,430	3,122
Norwood	13,213	8,130 (61.5)	4,438	645
Peabody	19,634	12,707 (64.7)	5,523	1,404
Randolph	10,730	4,463 (41.6)	5,554	713
Reading	9,029	5,997 (66.4)	2,684	348
Wakefield	10,734	6,850 (63.8)	3,239	188
Waltham	26,216	20,179 (77.0)	4,393	1,644
Wayland	5,092	3,473 (68.2)	1,378	241
Wellesley	10,739	4,573 (42.6)	5,713	453
Weston	4,033	2,516 (62.4)	1,329	188
Westwood	5,014	2,168 (43.3)	2,545	291
Woburn	15,379	11,259 (73.2)	3,291	829

(Source: Census of Population, Boston SMSA)



## FOOTNOTES - CHAPTER 3

1. Burt, Everett J., Changing Labor Supply Characteristics Along Route 128, 1961, p. 11.
2. The wedge is defined as that area lying to the west of Boston between Routes 2 and 9 and Route 128 and Interstate 495.
3. Burt, Op. Cit., pp. 15-16.
4. Burt, Plant Relocation and the Core City Worker, 1967.
5. See Appendix.

## CHAPTER 4

## THE LOCATION DECISION OF FIRMS IN THE BOSTON SMSA

How well do industries and firms in the Boston region choose location so as to maximize profits, given the location of land, services, transportation and labor supplies? How has the development of Route 128 affected industrial location and growth? The purpose of this chapter is to compare the answers to the following questions in response to the above.

1. Where does economic theory say that industry should locate in the Boston region?
2. Where, in actuality, have firms located within the SMSA?

With the trends in population growth since the turn of the century, it seems that industry would someday move away from the central city. In the Boston area, the population of the suburbs has been increasing each year in absolute numbers and as a total percentage of the population of the SMSA.<sup>+</sup>

Year	SMSA Population	Boston Population	Outside Boston
1900	1,321,000	561,000 (42.5%)	760,000 (57.5%)
1910	1,602,000	671,000 (41.9%)	931,000 (58.1%)
1920	1,869,000	748,000 (40%)	1,121,000 (60%)
1930	2,169,000	781,000 (36%)	1,387,000 (64%)
1940	2,210,000	771,000 (34.9%)	1,439,000 (65.1%)
1950	2,411,000	801,000 (33.2%)	1,609,000 (66.8%)
1960	2,413,236	697,197 (28.9%)	1,716,039 (71.1%)
1970	2,652,575	641,071 (24.2%)	2,011,504 (75.8%)

Most of the people who were moving into suburbia were of the middle class, who commuted to the city for jobs. After World War II, many of the middle class who had been city dwellers began leaving the central city for suburbia, also, being helped along by the Federal Housing Administration which gave low-interest loans for home-building. This segment of the population sought land, good schools, and cleanliness which the city could not offer.

As a result of growing suburbs, retail and service stores moved outward to tap the new market and to recover the old. Manufacturing firms, wishing to expand their assembly line processes, also began moving out of the central city. Because of the rise in trucking as opposed to sea and transportation by rail and the lack of available land for expansion, warehousing and distributing also left the core city of Boston. With the '50's came the boom in research and development firms and the electronics industry, and these also located in suburban areas. As a consequence of the shifting of residential and industrial location, the central city lost jobs and population. However, Boston has regained many of the jobs lost by the growth of the service sector of the economy.

### The Location of Retail and Service Firms

Economic theory would state that within an SMSA retail establishments should locate wherever there is a market. Transportation costs of goods in retail trade are usually borne by the producer. The most successful retailers are those who locate close to their market, thereby maximizing part of the utility function of the buyer. Therefore, retail firms should follow population.

Services include hotels, motels, auto repair shops, movies, amusements, business offices, camps and personal services. These firms also tend to follow population or to locate in places attractive enough for visitors

City or town	Population		# of Retail Firms		No. of Service Firms	
	1970	1960	1967	1963	1967	1963
Boston	641,071/	697,197	6230	6940	5034	4987
Cambridge	100,361/	107,716	909	1041	715	627
Somerville	88,799/	94,627	565	653	353	396
Bedford	13,967/	6,774	63	66	70	46
Peveryly	38,348/	36,108	294	293	190	164
Braintree	35,050/	31,069	47	30	158	138
Burlington	21,980/	12,852	89	63	88	59
Canton	17,100/	12,771	103	103	114	81
Danvers	26,151/	21,926	194	165	119	98
Dedham	26,938/	23,869	223	177	149	138
Gloucester	27,941/	25,789	284	291	175	145
Lexington	31,886/	27,929	151	132	225	139
Needham	29,748/	25,793	190	147	194	105
Newton	91,066/	92,384	760	535	699	482
Norwood	30,815/	24,898	243	206	159	143
Peabody	48,080/	32,202	365	315	221	158
Randolph			153	109	108	91
Reading			113	96	114	88
Wakefield	25,402/	24,295	196	177	149	109
Waltham	61,582/	55,413	472	447	410	319
Wayland	13,461/	10,444	41	42	56	32
Wellesley	28,051/	26,071	208	182	200	135
Westwood	12,750/	10,354	60	56	65	46
Woburn	37,406/	31,214	225	203	161	134

(Source: Census of Business, Census of Manufacturing, Census of Population, 1963, 1967, 1970)

In most cases, retail and service enterprises have located where economic theory has conceptually dictated. Where the central cities of Boston and Cambridge have lost population, they have not lost their importance as attractions for tourists. Subsequently, the drop in retail firms was accompanied by a rise in services, which are not very land-intensive because they can build upward.

In the suburbs, Route 128 and other highways locations for these firms in that they attract travelers as well as person from other suburban areas.

#### The Location of Wholesaling and Distributing Firms

Wholesalers and distributors are land-intensive firms with a large emphasis on transportation. According to economic theory, these firms should seek to maximize profits by minimizing land costs and transportation costs. Locationally speaking, land in the suburbs is less expensive and more plentiful than land in the central city. Also, for local and regional areas, trucking is one of the cheapest means of transferring goods. Therefore, the majority of distributors should locate in suburban areas, near limited-access highways.

City	1967	1963	City	1967	1963
Boston	2536	2970	Lexington	31	33
Cambridge	323	340	Needham	136	123
Somerville	137	141	Newton	245	232
Total	2996	3451	Peabody	69	63
Bedford	13	8	Randolph	23	19
Beverly	22	25	Reading	15	12
Braintree	47	30	Wakefield	61	44
Burlington	40	27	Waltham	187	133
Canton	43	28	Wayland	9	7
Danvers	21	25	Wellesley	87	68
Dedham	53	30	Westwood	20	18
Gloucester	35	38	Woburn	54	39

Grand  
Total

1480 1102

(Census of Business, 1963, 1937)

Many of the wholesaling firms have not, however, decentralized from the central city. Some have nearby markets within Boston and would increase transportation<sup>1</sup> costs by moving away.

### The Location of Manufacturing Firms

The factors which influence the location of manufacturing firms are almost varied as the different types of industry. Land needs, labor needs, and transportation needs vary from firm to firm. Let us analyse some of the needs of the following firms, holding others constant.<sup>2</sup>

1. Footwear
2. Office and Computing Machines
3. Communication Equipment
4. Ship and Boat Building
5. Optical Instruments

<u>Manpower Needs</u>	<u>Opt. Instr.</u>	<u>Footwear</u>	<u>Office &amp; Computing Machines</u>	<u>Communica. Equipment</u>	<u>Ship &amp; Boat Building</u>
Management	13.5%	4.3%	7.5%	9.5%	7.0%
Scientists	21.0%	.5%	12.0%	13.0%	7.0%
Computer Analysts	15.0%	.5%	2.5%	14.9%	---
Sales Professionals	2.5%	2.2%	7.0%	2.1%	.5%
Clerical	12.5%	9.2%	12.5%	15.7%	2.0%
Technicians	11.0%	---	8.5%	7.8%	---
Skilled Craftsmans	19.5%	22.7%	8.5%	4.7%	26.5%
Semi-skilled Production	6.5%	41.7%	27.5%	34.7%	48.0%
Unskilled & Factory	3.0%	20.0%	2.0%	1.7%	3.0%
Total	101.1%	88.0%	104.0%	94.0%	89.5%

### Management

On the average, management comprises less than ten percent of manufacturing firms' employment. The availability of abundant management manpower is not essential enough to influence the firm's location decision.

### Scientists

The necessity of scientists in the manufacturing industries ranges from non-existent to significant. Firms such as footwear, clothing, and other apparel need few, if any scientists, unlike concerns which create advanced technological equipment.

### Computer Analysts

Computer analysts are necessary in those industries which use automatic computation as a means of producing precision parts. However, abundant supplies of this skill group are not necessary.

### Sales professionals

In those manufacturing concerns where new products are continually being created, sales professionals are needed. In many firms, sales employees are needed where new products and old products need pushing. They should not, however, be a factor in industrial location.

### Clerical assistance

The need for clerical workers also varies from firm to firm. The major jobs of this skill group are to keep records and to take care of correspondence. Their employment averages at about ten percent of the totals.

### Technicians

Manufacturing industries which incorporate the use of highly-specialized equipment need technicians. The use of this skill group varies from industry to industry.

### Skilled Craftsmen

This skill group is used when artistic or man-made operations are in order. In such firms, their use is very important.

### Semi-skilled Production Employees

Skilled production workers account for a large block of industry's labor force. It is this labor group which works the assembly line and its processes. The availability of this labor group should affect industrial location.

### Unskilled production and factory labor

This labor group is not widely used by manufacturing and of the five types of industry listed above, only the footwear industry uses them to any significant degree.

Industrial labor needs cannot be generalized in that requirements vary from industry to industry and firm to firm. Each industry and firm must be evaluated individually to recognize their labor needs.

### Land Requirements

The land requirements of manufactures are as varied in some cases as the labor requirements. Some firms, such as those involved in ship-building would need the waterfront land of the CBD. Other firms have less specific needs as far as land goes. Some



are more land intensive than others. Land intensity and special spatial needs should have an effect on manufacturers.

#### Transportation Needs

Highway, rail and air are the three major means by which manufactures transfer goods. Firms which use trucks as a means of transportation (which is the majority of manufacturing firms)<sup>3</sup> would tend to locate in the suburbs. Those firms who do most of their shipping by rail have a more varied selection of location in that most industrial sites in the central city, as well as some suburban sites, are serviced by speed tracks. Firms which use air as their means of transportation could locate in the central city for convenience or in suburban areas to avoid congestion.

#### Where Manufacturers Should Locate

Since many manufacturing firms use semi-skilled labor, it would seem that they should locate either in the central city or in the northern suburbs, in order that they might tap the labor supply. The firms which use highly-skilled labor should locate in the western suburbs. Land-intensive firms should locate in the suburbs to minimize land costs, while industries such as boat-building, must locate in special areas.

## NUMBER OF MANUFACTURING FIRMS

	1967	1963
Boston	1,774	2,086
Cambridge	311	368
Somerville	150	155
Bedford	25	NA
Beverly	55	57
Braintree	57	37
Burlington	49	NA
Canton	46	48
Danvers	54	46
Dedham	36	24
Gloucester	61	67
Lexington	26	18
Needham	61	53
Newton	112	102
Norwood	67	63
Peabody	131	122
Randolph	27	18
Reading	14	22
Wakefield	62	67
Waltham	220	226
Wayland	4	NA
Wellesley	NA	20
Westwood	7	NA
Woburn	92	84
(Source: Census of Manufacturing, 1963, 1967)		

Many manufacturing firms have located based on the residential location of its management. As a results, they have run into tight labor supplies in the suburbs.

#### Location of Research and Development Firms

Research and development firms, in many cases, use the following priotities for formulating location decisions:<sup>4</sup>

1. Requirements concerning size of the site in acres.
2. Proximity to an educational and cultural center which would be an attraction for professional personnel.
3. Nearby attractive residential areas.
4. Opportunity for expansion.
5. Ready access to transportation.
6. Adequate services available.
7. Adequate supplies of semi-skilled and skilled labor.

Three of the first four priorities imply a location in suburban Boston. The central city cannot offer the large amounts of land for building and eventual expansion, and the residential areas which are populated most heavily with professionals are those located outside the city. However in the core city are many colleges and universities and Boston has a reputation as a cultural center. The central city also contains adequate labor supplies, available services, and transportation systems. However, according to its priorities, the major location of research and development firms is in the suburbs.

5

---

Labor Distribution for Research and Development

---

Management - 13.5%  
 Scientists - 21.0%  
 Computer Analysts - .5%  
 Sales Professionals - 2.5%  
 Clerical - 12.0%  
 Technicians - 11.0%  
 Skilled craftsmen - 19.5%  
 Semi-skilled production - 6.5%  
 Unskilled & factory - 3.0%

6

---

Route 128 Firms

---

<u>Date</u>	<u># of Companies</u>	<u># Change</u>	<u>% Change</u>
June, 1955	53	--	--
July, 1957	158	105	98.1
Sept, 1958	226	68	43.1
Jan., 1960	277	51	22.2
May, 1961	334	57	20.6
Nov., 1962	596	62	18.6
Dec., 1965	574	178	44.9

---

Breakdown of  
Route 128 Firms

---

<u>Type of Firm</u>	<u># of Firms</u>
Manufacturing	94
Research & Development	66
Manufacturing, Research & Development	56
Warehousing	51
Distributing	114
Services	193
<hr/> Total	<hr/> 574

## FOOTNOTES - CHAPTER 4

1. Note: Transportation costs are a function of time as well as distance. Therefore, if the time that it takes for a firm to ship goods from suburbia to some point in the inner city equals the time for a delivery between two points in the CBD, the suburban delivery is more expensive because of the higher cost of operating a vehicle over a greater distance.
2. Taken from Manpower Skill Study for Massachusetts, Massachusetts Department of Commerce and Development, June 1970. Percentages do not equal 100.0% due to incomplete data.
3. See U. S. Department of Commerce, Characteristics of 63 Modern Industrial Plants, 1967
4. Burt, Everett J. Changing Labor Supply Characteristics Along Route 128, 1961 Appendix
5. Massachusetts Department of Commerce and Development, Op. Cit. Appendix
6. Massachusetts Dept. of Commerce and Development, Listing of Firms Along Route 128, 1965
- + Source: Census of Population 1960, 1970

## CHAPTER 5

### The Effects of Industrial Location on the Central City and Suburbs

Industrial location is of utmost importance to cities and towns. In fact, many planners and administrators advocate as a common solution to the problems of unemployment and weak tax base, the encouragement of industry's entrance into an area. This policy in the long run, may cause further unemployment and higher taxes. Such is the case in the Boston area.

The suburbs, in order to finance their school systems, have invited industry to locate there. In order to provide services for new firms, sometimes a community's tax was increased. At the same time, industries which hired semi-skilled and unskilled factory labor adapted themselves to new suburban environments where this type of labor is scarce. So rather than pay higher wages to induce and make able the commuting of the skill groups from the central city out to the suburbs, firms changed their processes to do without this type of labor. Consequently, a stagnant sector of the labor force is trapped within the inner city without jobs.

Therefore, the continual growth of industry in the suburbs and the corresponding growth of population will eventually cause a rise in the taxes in order that people may receive adequate basic services. Simultaneously, the slower growth of industry within the central city, especially manufacturers, leaves a large sector of less-skilled labor with few jobs within reach by public transportation.

In addition, the growth of service jobs within the central city are attracting middle-class professionals to work, and the private market is presently building middle-income apartments to house them. Therefore, more taxpayers are being brought back into the city because of industrial location.

Given present trends, it may be beneficial to both the central city and the suburbs to extend labor markets by providing more public transportation. More transportation would allow the central city resident to obtain some jobs in suburban firms, thereby making the recruitment job of industry a bit easier. This could be done by extending bus lines into the western and northern suburbs. The extension of this service will also allow further mobility of the suburban labor market, thus making it more unified, again easing the recruitment of employers.

However, planners should analyze the long-range effects of extended public transportation on population and industry, because the fate of these determine the fate of the city as we know it today.

## BIBLIOGRAPHY

Alonso, William, Location and Land Use, Harvard University Press, Cambridge, Massachusetts, 1964

Bone, A. J., Route 128 Study, Survey of Industrial Development, M.I.T. Press, 1958

Boston Redevelopment Authority, Enterprises to be Relocated In the Central Business District, Boston, 1968

\_\_\_\_\_, Planning Department, Industrial Land Use, Boston, 1972

\_\_\_\_\_, Industrial Redevelopment and Relocation Opportunities in the City of Boston, Boston 1966

Burt, Everett J., Changing Labor Supply Characteristics Along Route 128, Federal Reserve Bank of Boston, Boston 1961

\_\_\_\_\_, Plant Relocation and the Core City Worker, Department of Housing and Urban Development, Washington, 1967

Forrester, Jay W., Urban Dynamics, M.I.T. Press, Cambridge, Massachusetts 1969

Greater Boston Economic Study Committee, Industrial Land Needs Through 1980, Associated Center of the Committee for Economic Development, Boston 1962

\_\_\_\_\_, Land Use in Greater Boston in 1960, Associated Center of the Committee for Economic Development, 1962

Grodzins, Morton, Metropolitan Area as a Racial Problem, University of Pittsburgh Press, Pittsburgh, 1959

Lansing, John, and Eva Mueller, The Geographic Mobility of Labor, Institute for Social Research, Ann Arbor, Michigan, 1967

Levy, Michael, Federal Revenue Sharing with the States, National Industrial Conference Board, New York, 1970

Massachusetts Department of Commerce and Development, Manufacturing Commuting Survey, Massachusetts Bay Central

\_\_\_\_\_, Listing of Firms Along Route 128, 1965  
(Mimeo)



\_\_\_\_\_, Manpower Skills Survey, Boston, 1970

Mills, Edwin, Urban Economics, Scott Foresman and Company, Glenview, Illinois, 1972

U. S. Bureau of Labor and Statistics, Area Wage Survey, The Boston Metropolitan Area, U. S. Government Printing Office, Washington, 1971

Massachusetts Executive Department, The Latest Listing of Manufacturing Space in Massachusetts, Boston, 1970 (?)

\_\_\_\_\_, Massachusetts Land Sites, Boston 1970 (?)

U. S. Department of Commerce, Economic Development Administration, Characteristics of 63 Modern Industrial Plants, 1969