THE DISAPPEARANCE OF RAILROAD COMMUTATION IN BOSTON, MASSACHUSETTS

by

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ABSTRACT

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Boston is beset by transportation difficulties similar to those faced by most large cities in the United States. Since the end of World War II, daily commuters as well as short term shoppers have been abandoning all forms of mass transit in favor of the less efficient, in terms of total travel cost and the amount of downtown land area devoted to transportation facilities, but more flexible private automobile.

The trend away from railroad useage by passengers has been so great and losses so heavy that there is question whether the railroads can continue to transport short distance passengers without government assistance. The general intent of this thesis is to determine the implication on downtown Boston of the cessation of railroad commuter service in terms of additional street and parking facilities. It was assumed that those passengers that came downtown now would continue to come downtown.

The capabilities of both streets and parking facilities to handle present and the anticipated new Government and Prudential Centers were investigated. It was concluded on the basis of the traffic estimates derived in Parts IV and VI that the present roadway system with suggested improvements to two present rotaries and making the Charlestown Bridge one way could accommodate the anticipated traffic to and from present facilities in the downtown area. However, these streets would be utilized to about 90% of their capacity. Since this would be very near or at the practical capacity of the entire street system, it is doubtful that any new traffic either through or destination could be accommodated.

Parts V and VI concluded that there would be a total shortage of almost 20,000 parking spaces in the downtown area if the present railroad commuters journeyed to the downtown area by automobile. This shortage would be increased to at least 22,000 upon completion of the Prudential Center. The Government Center would cause additional shortages in its immediate area, but not in the total downtown parking requirements.

Part VII concluded that the provision of sufficient parking facilities to accommodate the anticipated increased requirements would be a powerful inducement to present M. T. A. patrons to use their own automobiles to come downtown. This increased traffic desire would be

partially offset by former railroad patrons who could not afford, or would not desire, to drive downtown. Past experience indicates that the net effect of street or parking facilities on the M. T. A. has been a substantial decrease in patronage. Such a decrease, if it occurred during the peak hours would increase total traffic beyond the capacity of the street system.

Thesis Supervisor: John T. Howard, Professor of City Planning, in charge of the Department

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INTRODUCTION

The railroads serving Boston have been experiencing financial problems for many years. Passenger service has been provided for reasons that did not always have profit making as their roots. In the pre-World War I era when passenger cars were made of wood, steam locomotives could be bought for about $30,000. and trainmen received wages only for the hours they actually worked, often but four hours a day; deficits, if any, were easily absorbed by profits made in the handling of freight.

The termination of World War I signaled the beginning of a long decline in passenger train useage. War inventions can sometimes be applied to peace time use. The gasoline engine, little more than a laboratory curiosity when the United States entered the war, emerged a relatively reliable means of transportation. In the space of a few years the automobile, previously a rich man's toy, became the poor man's "necessity". Trucks which hauled fighting men in war time hauled freight in peace time. Shoppers began to drive to the downtown area and shunned using the mid-morning and mid-afternoon trains which railroads had provided to help utilize more fully their equipment.

The railroad unions became increasingly more powerful and succeeded in forcing the payment of a full day's wages to train crews for whatever work was available.

The process of gradual decline in railroad useage by passengers continued through the great depression, although automobile registrations showed no appreciable decline during the same period. World War II saw the rebirth of commuter train useage. The military machine mobilized for the

conflict demanded unprecedented quantities of steel, petroleum and rubber which drastically curtailed their use by the civilian economy. Annual production of automobiles was reduced from millions to a few thousand. Gasoline and tires were severely rationed. Passenger revenues increased and freight profits rose to permit the payment of wages demanded by the unions and the meeting of passenger train and terminal charges without difficulty if a profit from passenger operations was not realized.

The termination of World War II signaled another decline in railroad passenger useage. Now not only the shopper but also the commuter abandoned all types of mass transit in favor of the automobile. The trucking industry equipped itself with fleets of efficient trailer trucks and began to effectively challenge the railroads for much of the short to medium distance freight previously carried exclusively by the railroads. Wage rates and equipment costs began to rise. A full day's wages must still be paid to the trainmen, but at a rate that is three times the pre-World War I rate. Steam locomotives that cost $30,000. in 1916 have been replaced by diesel locomotives costing more $200,000.each.

Freight profits diminished and could no longer absorb passenger operation losses. As a result, passenger service has been repeatedly reduced. Fare increases have been sought and granted on several occasions amid loud outcries by the users that they are exorbitant and by the railroads that they are insufficient.

Still the financial difficulties continue unabated. The New York, New Haven & Hartford Railroad has filed bankruptcy proceedings three times in the last twenty-four years, resulting in substantial reduction down of its indebtedness. The Boston & Albany Railroad has

completely abandoned service on its Highlands Branch between suburban Newton and Boston. The New Haven Railroad received Federal Court permission to abandon all passenger service on the Old Colony Division, serving the communities south of Boston. Service has been continued during the past year only through payment of a $900,000. subsidy by the cities and towns served. Other abandonments are being forecast or considered. Passenger line abandonment may become more widespread with the passage of the Transportation Act of 1958. Under certain circumstances a railroad may petition to the I.C.C. for the right to abandon lines engaged in intra-state as well as interstate operations.

The increasing shift from travel to downtown Boston by commuter railroads to private automobiles has caused not only solvency problems for public transportation, but has also created an ever increasing demand for parking facilities and roadways. Many studies have been made to determine what must be done to reverse this tendency. I propose to study the implications of substituting the private automobile for the commuter railroad on the amount of additional land that must be used to provide highways and parking in downtown Boston.

It is my thesis that it would be possible for the private automobile to succeed the railroad passenger car yet allow the central city to exist as we know it. Inherent in this thesis is the assumption that there would be no further increase in the number of automobiles, exclusive of those substituted for the railroad trains, coming downtown.

The replacing of railroads by automobiles directly affects both roadway useage and parking requirements. Both of these factors will be considered and proposals made to meet the additional demand created on an average weekday in 1957 adjusted to present estimated levels. The

year 1957 was chosen because it is the latest year for which complete data is available. An employment study was done by the Greater Boston Economic Study Committee during the same year providing employment data need for this thesis.

The required roadways must be found for both the A.M. and P.M. peaks. Part II examines the roadway useage by all vehicles during the peak hours. To this traffic volume an automobile equivalent for the peak hour railroad commuters must be added. Part III discerns the magnitude of this volume. The total volume of traffic for the peak hours, its flow over the various downtown streets and proposals to meet the resulting traffic movements are covered in Part IV.

Parking requirements and proposals to meet the peak parking demand, which occurs during the mid-afternoon, are found in Part V.

The implications of the proposed Prudential Center and Government Center upon roadway use and parking demands are examined in Part VI.

The M.T.A. was assumed to remain stable in spite of the past trend away from use of mass transit described previously. Part VII discusses the probable impact of increased roadway and parking capacity on M.T.A. patronage.

Some of the data, based on assumptions, was necessarily inexact. Wherever possible exact figures were used and computations made as precisely as permitted.

ASSUMPTIONS

In order to set limits on what has been termed by many to be a limitless problem, certain assumptions were made. These assumptions, summarized below and accompanied by brief comments set the limits of consideration.

(1) That any land used eliminated for needed roads or parking was to be relocated within the downtown area.

(2) That the M.T.A. patronage will stabilize at present levels. This matter is more fully covered in Part VII.

(3) That the data presented in the Maguire[1], Coverdale and Colpitts[2] and the 1954 Cordon Count[3] reports are accurate. Minor modifications to these data are made in the assignment of traffic to the enumerated zones and determination of commuter parking requirements.

(4) That only projects in execution at the writing of this thesis shall be considered to affect the present road and parking needs of the downtown area. These projects are: the Central Artery, Southeast Expressway, a second two lane tunnel, The Bedford Street and Central-Kilby Street Garages, New York Streets redevelopment and the West End redevelopment.

1. The Joint Board for the Metropolitan Master Highway Plan (Charles A. Maguire and Associates, Consulting Engineers), The Master Highway Plan for the Boston Metropolitan Area, Boston, Mass., February 1, 1948

2. Coverdale and Colpitts, Report on Traffic Studies For the Boston Metropolitan Area, New York, July 22, 1957

3. Boston Traffic Commission, Comparative Studies of Cordon Counts, Years 1927, 1932, 1938, 1950, 1954, Boston, Mass., 1954

(5) That the Prudential Center and the Government Center will be built according to the current plans as cited in Part VI of the text.

(6) That statistics compiled by the Greater Boston Economic Study Committee[4] and the Boston City Planning Board[5] staff reflect true employment in the Central Business District as defined by the Planning Board. See Appendix 1.

(7) That weather conditions do not interfere and reduce traffic speeds or the number of available roads.

(8) That all roads will be in use during peak hours and when otherwise needed.

(9) That the percentage of through traffic and traffic destined for each downtown zone is uniform over the entire year.

(10) That automobiles destined for each zone will be willing to park anywhere within that zone.

4. Greater Boston Economic Study Committee, Research Staff Report to the Downtown Subcommittee, Boston, 15 September, 1948

5. Boston City Planning Board, Research Division, Floor Space Requirements 1975 (Unpublished), 1959

CONCLUSIONS

On the basis of the analysis and assumptions in this thesis I conclude:

1. That the estimated peak hour traffic that would result from a transfer to private automobiles by present railroad commuters can be accommodated in the downtown area in addition to the present peak hour traffic with improvements to existing streets. The total estimated inbound destination and through traffic during the A.M. peak hour is 28,873 vehicles, which is 89.4% of the maximum possible entering traffic that could be handled. The rotaries at Haymarket Square and the Longfellow Bridge would have to be improved by installation of traffic signals and improvement to the existing grade separation facilities. The Charlestown Bridge would have to be made one way inbound in the A.M. peak hour and one way outbound in the P.M. peak to accommodate five lanes of traffic or both sides of the Central Artery widened by one lane from Charlestown to new exit ramps between Fort Hill Square and the South Station access ramps.

2. That the existing parking supply falls far short of the anticipated needs. There are not even enough spaces in the entire downtown area, exclusive of the South End, to accommodate the total commuter demands. A total of 19,890 spaces would have to be provided to accommodate the peak parking demand.

3. That although curb parking restrictions indicated on Map I must be rigidly enforced during the peak hours to facilitate the near capacity traffic volumes, some of the restricted areas should be legalized for parking during the off peak hours. Some one way streets in the downtown area are three lanes wide with parking prohibitions on both sides. In many cases the street system is such that intersections cannot handle this volume of traffic. Off peak parking on one side

would not affect traffic flow adversely if sufficient loading zones were provided for trucks to eliminate double parking.

4. That the construction of the Government and Prudential Centers will increase the parking deficit and may over tax the road system during the peak hours. If these two centers are built as planned, additional parking facilities will be needed to satisfy the additional requirements. Some new parking facilities are anticipated for each center, but indications are that the new facilities will not meet the anticipated demand. If an increased work force in the downtown area results from construction of these two centers, the road system may not be able to accommodate the additional automobiles that these workers may desire to drive.

5. That the MTA will experience a further loss in patronage as a result of the provision of additional parking and traffic improvements.

6. That the inability of the street system to accommodate additional through traffic makes it undesirable to provide sufficient parking facilities and formulate necessary curb restrictions to allow all current railroad users to travel to downtown Boston by automobile. If railroad service is not to be continued, rail-borne rapid transit facilities should be provided to at least such a point that the required parking facilities will not pose a threat to the surrounding road system or land use.

7. That the method used is essentially valid for peak hour calculations, but more accurate data is needed for daytime volumes, automobiles garaged in the downtown area and destinations by type of trip.

I

DESCRIPTION of DOWNTOWN BOSTON

Boston, Massachusetts, is one of the oldest settlements in the United States. At one time it was the principal seaport along the Atlantic coast. Although it has fallen from its pre-eminent position as a maritime city, it still ranks among the leading commercial cities of the United States. In addition to being the capital city of Massachusetts and the largest city in New England, Boston is an insurance, medical and cultural center of world importance. Additional thousands are attracted to the city by its number, size and variety of shopping facilities and the presence of many federal government agency offices that serve the entire region.

Downtown Boston has been defined as that section of the city lying east of Massachusetts Avenue and bounded by the Charles River, Boston Harbor and South Bay-Fort Point Channel on the north, east and south respectively in the various traffic studies and daily traffic counts made since 1927. This downtown area has been subdivided into 17 zones for purposes of origin and destination surveys made as part of the 1945 Maguire study and the 1955 Coverdale and Colpitts study. Appendix 31 indicates the boundaries of each zone. These boundaries have been adhered to in this thesis for both traffic and parking determinations with minor variations. The downtown area as defined in the traffic surveys includes more land than the areas defined as the Central Business District (C.B.D.) by the Boston City Planning Board

and the G.B.E.S.C. in their studies. A comparison of these latter two areas will be found in Appendix 1. The Planning Board's definition of the C.B.D. has been superimposed upon a generalized land use map of the area defined as Downtown Boston for comparison in Appendix 2. Table 1 describes each zone, its area and principle land uses.

Table 1

O&D Zone	Size Acres	Principle Land Uses	Most Widely Known As
0301	58	Manufacturing R.R. Terminal	North Station Area
0302	98	Residential	North End
0303	62	Wholesale, Warehousing	Faneuil Hall Market
0304	125	Office, Retail	Financial District
0305	68	Office, Retail	Shopping District
0306	228	Office, Retail, R.R. Terminal	South Station; Park Square
0307	142	Manufacturing, Residential	South End; N. Y. Streets
0308	152	Residential	South End
0309	104	Residential, Hospital	South End; City Hospital
0310	160	Residential, R.R. Yard	South End; Prudential Center
0311	160	Residential	Back Bay
0312	106	Office, Retail	Copley Square; Back Bay
0313	64	Park	Boston Common; Public Garden
0314	73	Residential	Beacon Hill
0315	136	Residential	Beacon Hill; West End
0316	26	Offices, Entertainment	Scollay Square
0317	86	Retail, Wholesale	Haymarket Square

The maps of the downtown area indicate the multiplicity of narrow streets that give Boston both its charm and traffic headaches. This situation is not unique to Boston as many visitors would have the local citizenry believe. All of the older eastern cities, both large and small, suffer from constriction of their traffic arteries. The Central Artery through the heart of the downtown was constructed in a bold attempt to act as a distributor for destination traffic and to by-pass through traffic around the downtown land uses. Part of this highway has been depressed under Dewey Square, near the South Station, to form the longest six lane vehicular tunnel in the world.

II

PEAK HOUR ROADWAY USEAGE

Many vehicles enter Downtown Boston and continue through without stopping in addition to those vehicles that had origins and destinations (O&D) within the Downtown area. Sufficient highways are being constructed to route this through traffic around the periphery of the Downtown area. Of paramount importance then is the traffic with an A.M. destination or a P.M. origin in the Downtown area. Traffic estimated to have a peak hour O. or D. was computed in this section and found to be 15,953 in the A.M. peak and 17,048 in the P.M. peak. This traffic volume will be added to the automobiles required to transport the present railroad commuters and the needed capacities of the various Downtown streets determined.

Both the Maguire and Coverdale & Colpitts traffic surveys gave all O&D information in terms of an "Average Annual Daily Traffic" total from each of seven sectors to each of the seventeen downtown zones. While this information serves as an indicator of the relative attractiveness of one zone over another, the critical volume for traffic design is the one or two hours of heavy useage that usually coincide with mass transit commuter peaks.

The traffic counts taken for the Coverdale & Colpitts study indicate that the total daily O&D traffic is 296,790 vehicles, an increase to 201% of the 1945 total of 148,030. This number was broken down for traffic between each sector and each of the 17 zones and presented in graphical form in the report. Since the original data was unavailable, it was necessary to scale the width of each band to

ascertain the number of vehicles that originated or had destinations in each zone. A proportion was formulated between the scaled width of each zone, the scaled width of all traffic orignating from or destined for downtown from each particular sector, the known number of vehicles destined for downtown from that particular sector and the number of vehicles destined for the zone in question to determine the approximate number of vehicles destined for each zone. The process was repeated for each of the seven sectors of travel. The system held the overall error to a minimum. Errors for individual zones, especially zones having relatively little O&D traffic, may have been as high as 10% due to inability to achieve greater measuring accuracy. Appendix 3 indicates the number of O&D vehicles for each zone from each direction and the total trips to and from each zone.

The 1955 study also indicated that 68,758 vehicles passed through the downtown area without stopping. Of this volume, it is estimated that 21,810 will use the Central Artery when it is finished, 3,695 will use Storrow Drive and 43,253 will use Massachusetts Avenue. Appendix 4 breaks these totals down by direction of travel and probable highway used.

No hourly breakdown of through traffic as a percentage of total traffic entering the Downtown Area was given in either the 1954 or 1955 studies. It is therefore assumed that the percentage of through traffic during the peak hours is identical to the percentage of through traffic for the entire day[1].

1. This assumption may be incorrect, but there are no grounds for assuming a different proportion.

No mention was made in the 1955 report of traffic having both its origins and its destinations within the downtown area. The Maguire report indicated that the volume of downtown interzonal traffic was about 20% of the total O&D traffic. It is assumed that the interzonal traffic is a constant percentage of the O&D traffic from hour to hour; and further, is the same percentage now as it was in 1945[2].

The traffic assignments in the 1955 study were compared with the count taken by the Boston Traffic Commission of all vehicles and persons entering the Outer Cordon, which corresponds to the downtown area defined in the traffic studies, but also includes some traffic on the westerly side of Massachusetts Avenue[3].

Although the Coverdale & Colpitts' study was made one year later than the Traffic Commission's cordon count, the Coverdale & Colpitts' study indicates a drop of 13.2% in total traffic. All traffic studies have indicated an increasing volume of traffic during each successive year. These studies seem to indicate a substantial decrease. The M.T.A. one way station counts showed a decrease in actual patronage in the

2. This assumption may be high since the peak hour traffic is assumed to consist of commuters. Most interzonal trips were by taxi and there probably is a peak during the midday, but there is no hourly breakdown of interzonal trips to support this contention.

3. Estimates were made for the amount of O&D traffic using Massachusetts Avenue in Robert G. Davidson's Thesis, Travel of Persons to Downtown Boston, M.I.T., 1954, P.23. Since no accurate estimate is available, an estimate of the through traffic potential to Massachusetts Avenue was made from the 1955 study data in Appendix 4 to make the overall volumes of both studies comparable.

downtown area from 1954 to 1955. This would tend to suggest an actual vehicle increase in 1955, or a very high loss in total trips to and from the downtown area. See Appendix 31 for M.T.A. patronage. A more probable explanation is the fluctuation of volumes from day to day and the methods of adjusting for the average day[4].

For computations in this thesis the 1955 counts are assumed to be correct.

The seven sectors used to define the direction from which the downtown O&D traffic traveled included the same communities in both the 1945 and 1955 surveys with one exception. In the 1945 survey Roxbury was included in the traffic from the southeast; in 1955 Roxbury was included in the traffic from the southwest. Adjustment for this difference will be made as necessary in later sections of this study. In all other respects, the two surveys can be compared directly. The 1945 study

4. The Cordon Count was taken from 7:00 A.M. to 12:00 noon on Monday, June 7, from 12:00 noon to 6:00 P.M. on Tuesday, June 8, and from 6:00 P.M. to 12:00 midnight on Wednesday, June 9, 1954. The counts recorded on each of these three days were added to find the 17 hour totals. The weather conditions on those days is not known. Traffic has been known to fluctuate from day to day and as much as 20% from the preceding week, a difference which would permit as much as a 7% increase in 1955 traffic over 1954 if the conditions were as described. The 1955 survey traffic counts were made from October 15, 1955 to January 5, 1956 on all seven days of the week and the results adjusted for an average day.

   An examination of the 1955 data indicates an average daily O&D for Zone 0313 (The Boston Common and Public Garden) of 7,430, which was over nine times the 1945 average daily O&D for that zone, a figure which is very questionable as an annual average daily figure. This may mean that other totals are in error. The winter months experience a lower average daily count than the annual average daily count. This might explain part of the difference. The method used to find the 1955 average daily traffic is not known, nor in any way indicated in this report.

described the sectors as Area 1 through Area 7. During the design phase of the 1945 report each area, except Area 7 (South Boston), was to be served by a new expressway. These expressways received their names from their compass direction with respect to downtown Boston. The Southeast, Southwest, Western, Northwest, Northern and Northeast Expressways would serve Areas 1, 2, 3, 4, 5 and 6 respectively. Area 6 was also to be served by the East Boston Expressway. These directional descriptions were used in the 1955 study in lieu of the area designations and will also be used in this study.

The Southeast sector includes all traffic between downtown Boston and Weymouth, Braintree, Quincy, Milton, Dorchester and communities beyond, using streets between Route 138 and Route 3A.

The Southwest sector includes all traffic between downtown Boston and Dedham, Jamaica Plain, West Roxbury, Roxbury, Hyde Park and all communities beyond, using streets between Great Plain Road, Needham and East Street, Dedham.

The Western sector includes all traffic between downtown Boston and Allston, Brighton, Brookline, Newton, Waltham, Watertown and all communities beyond, using streets between Trapelo Road, Lincoln and Cedar Street, Wellesley.

The Northwest sector includes all traffic between downtown Boston and Arlington, Belmont, Cambridge, Medford, Somerville, Winchester and all communities beyond, using streets between Woodland Road, Medford and Route 2.

The Northern sector includes all traffic between downtown Boston and Charlestown, Everett, Malden, Melrose and all communities beyond, using streets between Main Street, Melrose and the Lynn Fells Parkway, Melrose.

The Northeast sector includes all traffic between downtown Boston and Chelsea, Lynn, Revere, Saugus, East Boston, Winthrop and all communities using streets between Route 129, Lynn and Nahant Road, Nahant.

The seventh sector has no directional name comparable to the other six. Only traffic movements between downtown Boston and South Boston are included.

Appendix 6 shows the approximate area covered by each sector.

A map of the downtown area was examined and traffic to and from each direction was assigned to the entering and exiting streets that it probably uses. No data is available to indicate which streets traffic from any direction was actually using, so it was necessary to assume the streets of use for each sector. In all cases the assignment of streets for use by each successive sector overlap the street assignment for the previous sector with the exception of certain streets to the east. All entering streets except Norway and St. Botolph Streets, which are not through streets, and carry relatively little traffic, and the Warren Avenue Bridge, which is now closed, were included in the inbound traffic assignments. All exiting streets except St. Botolph, St. Stephen, Haviland and Burbank Streets, which also are not through streets and carry relatively little traffic, were included in the outbound traffic assignments. The presently completed section of the Central Artery was added to both inbound and outbound traffic facilities. Since no traffic counts are available for the Central Artery, percentages were assumed to be the sector average. For purposes of these computations only roadways now in use were considered. The capacity of the Central Artery section now under construction from Kneeland Street to Massachusetts Avenue and the Southeast Expressway will be considered in a later section.

Dorchester Avenue, Broadway, Dover Street, Massachusetts Avenue, Albany Street and Harrison Avenue were assigned to entering and exiting traffic from the Southeast.

Albany Street, Harrison Avenue, Washington Street, Tremont Street, Columbus Avenue, Huntington Avenue, Westland Avenue and Boylston Street were assigned to entering and exiting traffic from the Southwest. Shawmut Avenue was also assigned to exiting traffic.

Huntington Avenue, Westland Avenue, Boylston Street, Newbury Street, Commonwealth Avenue, Storrow Drive, The Harvard Bridge and The Longfellow Bridge were assigned to entering and exiting traffic from the west. Marlborough Street was also assigned to entering traffic and Beacon Street was assigned to exiting traffic.

Storrow Drive, The Harvard Bridge, The Longfellow Bridge, The Craigie Bridge and the Central Artery were assigned to entering and exiting traffic from the Northwest.

The Craigie Bridge, Central Artery and the Charlestown Bridge were assigned to entering and exiting traffic from the north.

The Central Artery, Charlestown Bridge and Sumner Tunnel were assigned to entering and exiting traffic from the Northeast.

Northern Avenue, Congress Street, Summer Street, Broadway and Dover Street were assigned to entering and exiting traffic from South Boston.

An examination of the 1954 Cordon Count confirms the belief that the inbound peak hour was 8:00 to 9:00 A.M. and the peak outbound hour was 5:00 to 6:00 P.M.[5] The percentage of the 7:00 A.M. to 12:00

5. Boston Traffic Commission, Comparative Studies of Cordon Counts, Years 1927, 1932, 1938, 1950, 1954, Boston, Mass., 1954, P. 20 and 21.

midnight total traffic that was carried by each road during the morning and evening peak hours was computed. An average percentage for each direction of travel was then computed using the peak hour percentages of the individual roads assigned to carry traffic to and from the respective direction. See Table 7-1 of Appendix 7-1 for data. This average percentage was corrected for a 24 hour day. See Table 7-2 in Appendix 7-2 for the adjusted percentages and resulting volumes for 1955 traffic for the A.M. and P.M. peak hours.

To raise the number of peak hour vehicles from 1955 to 1957 it was assumed that the increase was proportional to the increase of vehicle ownership in the Boston Metropolitan area. The excise tax payments directly reflect private vehicle ownership. The number of excise taxes paid increased from 871,000 in 1955 to 948,000 in 1957, or 8.81%. This factor was applied to both the A.M. and P.M. peak hours in Table 7-3 of Appendix 7-2.

No excise tax data is available to indicate the vehicle change from 1957 to the present time. The number of vehicle excise taxes increased from 720,000 in 1950 to 948,000 in 1957, or 31.7%, an average of 4% per year. From 1955 to 1957 the increase averaged almost 4$\frac{1}{2}$%. At these rates the vehicle increase from 1957 to May 1959 would be between 6% and 7%. The higher figure will be used in these calculations. See Table 7-3 in Appendix 7-3 for data.

Both trucks and automobiles are included in the calculations for Tables 7-1, 7-2, 7-3 and 7-4. Since automobile equivalents will be added for present railroad commuters in subsequent computations, it is necessary to distinguish between the number of total vehicles and the number of automobiles. The 1954 Cordon Count lists both the number of

trucks and the number of automobiles by half hour totals. See Table 8-1 of Appendix 8-1 for peak hour data. No breakdown was made by street by half hour. However, a breakdown was made by street for daily totals. See Table 8-2 of Appendix 8-2 for data. An average percentage of the total daily automobile traffic was computed for each direction of travel, using the daily percentage of individual roads in the same manner used to derive composite peak hour percentages on Pg. 12. Percentages, not absolute numbers, are used so no correction was made to expand the base counts from 17 to 24 hours. Since there is no peak hour percentage breakdown by roads, a proportion was set up between the daily percentage of automobile traffic by direction, the average percentage of total automobile traffic, the percentage of automobile traffic during the peak hours by direction and the average percentage of total automobile traffic during the peak hours to find the percentage of automobile traffic by direction during the peak hours. It was assumed that the latter percentage is proportional to the daily automobile percentage. See Tables 9-1 and 9-2 in Appendix 9 for the number of automobiles during the 1957 A.M. and P.M. peaks by directions.

The peak hour traffic from the west was further adjusted to include new drivers who used their automobiles for the first time when the Highlands Branch of the Boston & Albany Railroad abandoned service. About 1,600 persons daily used the railroad. Practically all were peak period passengers. The results of a brief survey made by Mr. Arthur Stratton were published in the Boston Herald on June 22, 1958. It was found that of the 1,600 people, 600 switched to the main line of the Boston & Albany R.R. A "substantial percentage" of the remainder use the M.T.A. now. If the "substantial percentage" is assumed to be 1/2 of the remainder, or 500 persons, then 500 person-trips are now made by automobile during each peak period.

In Part III it will be shown that the A.M. and P.M. railroad peak periods were each about 1½ hours long. The average peak hour was about 79% of the peak total, or 395 people formerly using the Highlands Branch. If there are 1.5 persons per automobile, estimated by the Boston College Research Bureau,[6] 263 new automobiles must be added to each peak for traffic from the west.

Table 2 is a compilation of highway useage by automobiles and trucks in May 1959 for both peak hours by direction of travel. To these totals will be added the new automobiles for the peak hour railroad commuters to find the total peak hour demand on the road system if railroad commutation ceased.

Table 2

Automobiles and Trucks During A.M. and P.M. Peak Hours in May 1959

Direction	A.M. Peak Autos	A.M. Peak Trucks	P.M. Peak Autos	P.M. Peak Trucks
SE	2,320	460	2,730	270
SW	2,145	345	2,845	175
W	4,123*	450	4,738*	235
NW	2,770	370	2,875	55
N	710	205	855	75
NE	1,140	305	1,550	100
SB	450	160	430	115
	13,658	2,295	16,023	1,025

* Includes 263 automobiles due to elimination of Boston and Albany Highland Branch

6. Interview with Robert G. Davidson on January 13, 1959.

III

PEAK HOUR RAILROAD USEAGE

Not all railroad commuters entering the downtown area are destined for one of the 17 zones enumerated in the previous sections. This section investigated the number of passengers coming to destinations in the downtown area during the A.M. peak hour and leaving during the P.M. peak hour. A factor of persons per automobile was used to convert these person totals to estimated additional automobiles in the peak hours. This data will be used to determine the ability of the downtown streets to carry the anticipated traffic.

No railroad commuting information was given in the Coverdale and Colpitts Study, but some data is available as a result of two recent studies[1,2].

The American Municipal Association survey listed peak period and total daily passengers by railroad line. The peak time period was also indicated in addition to peak passengers but no hourly breakdown was given. At the time of writing this thesis only information for the New York, New Haven and Hartford Railroad and the Boston and Maine Railroad is available. The Boston and Albany Railroad data has not yet been released by the railroad. Twelve thousand four hundred and ninety-four commuters were carried between 7:00 and 9:30 A.M. by the New Haven Railroad in March 1958 and 7,036 were carried on the Boston and Maine Railroad between 4:30 and 6:00 P.M. in March 1959 according to survey data. The Boston and Maine counts are outbound totals only. The New

1. The American Municipal Association, AMA-Railroad Survey (Spring 1959), Washington, D.C.

2. DeLeuw, Cather & Company, Report To The Old Colony Area Transportation Commission On Plans For Improved Suburban Transit, Brookline, Mass., April, 1959.

Haven peak data may include both inbound and outbound passengers. It is assumed that the peak counts are for inbound only.

The DeLeuw, Cather and Company report studied various alternate mass transit possibilities if the Old Colony railroad service was discontinued. Various data on present Old Colony passenger volumes, half hourly arrivals and departures of passengers and downtown destination information was included. An average weekday total of 7,809 inbound passengers were carried by the Old Colony in October 1958 according to their report.

The two surveys were compared for Old Colony data. Both reports listed data for March 1958. Both used New Haven Railroad records as their source. DeLeuw, Cather and Company compiled totals for arriving and departing passengers on Tuesday, March 11, 1958. Eight thousand one hundred eleven passengers arrived between 7:30 and 9:30 A.M. on that day, which was 4% more than the A.M.A. survey indicated for the daily average inbound peak.

According to the A.M.A. survey 8,927 passengers entered Boston during the entire day in that same month, or 8,670 when adjusted[3] for an annual average day. DeLeuw, Cather and Company made a survey during October 1958 and found that an average of 7,809 passengers arrived during an entire weekday, or 7,660 when adjusted[3] for an annual average weekday. This would indicate an average loss of 11.3% between March and October 1958. The Boston and Maine Railroad Statistical Department estimates a

3. Thesis By Robert G. Davidson, Pg. 29, Table VIII.

total loss of about 33% from March 1958 to March 1959 due in part to a reduction in service. The estimated Old Colony loss between March and October 1958 seems correct. Additional loss may have been suffered by the Old Colony between October 1958 and May 1959, but the amount is not available and is assumed to be negligible. It is assumed that the other two New Haven R.R. lines also lost passengers and that the loss between March 1958 and the present for all New Haven lines is 12%. This estimate may be incorrect but no data exists to adjust this figure.

The Boston and Maine data was compiled from actual ticket collection report for March 1959. No change below these levels is assumed.

Kitchel[4] estimates that about 5,000 commuters were carried by the Boston and Albany Railroad during each peak in 1956. The loss of daily commuter patronage on the individual railroads between 1956 and 1957 was estimated by this author to be in proportion to the annual revenue passengers carried to determine if there was any correlation between the Boston and Albany and either of the other railroads. See Table 10-1, 10-2 and 10-3 of Appendix 10 for data. The B. and A. R.R. percentage loss was almost identical to the percentage loss of the New Haven Railroad. The Boston and Maine loss was significantly higher than the other two. It was also noted that the Boston and Maine loss from March 1958 to the present is much higher than the estimated loss for the New Haven Railroad. Therefore, it is assumed that the loss of patronage

4. Robert S. Kitchel, Jr., Capacity And Use of Commuter Railroads In Boston, Harvard Graduate School of Design, January 25, 1959 (unpublished)

from March 1958 to March 1959 on the Boston and Albany is about the same as the New Haven Railroad, 12%.

The Maguire Report indicated six main directions of railroad commuter travel. These fell within the Southeast, Southwest, Western, Northwest, Northern and Northeast sectors. The Old Colony corresponds to the Southeast vehicle desire line. Both the New Haven Main Line and Branch Lines through Back Bay correspond to the Southwest vehicle desire line. The Western vehicle desire line includes both the entire Boston and Albany Railroad and the Fitchburg Division of the Boston and Maine Railroad. The Northwest, Northern and Northeast vehicle desire lines correspond to the New Hampshire District, West Route and East Route respectively of the Boston and Maine. See Table 11-3 of Appendix 11 for the adjusted peak railroad commuters by direction.

The DeLeuw, Cather and Company report indicated that only 91.46%[5] of the daily passengers on the Old Colony actually had destinations within the downtown area. In 1945 92.7% of all commuters had downtown destinations. This would seem to indicate that the proportion of downtown destinations has remained constant since 1945. The peak counts for each direction have therefore been adjusted by applying a 91% factor. DeLeuw, Cather and Company also found that the peak inbound hour, 8:00 to 9:00 A.M. was 75% of the 7:30 to 9:30 A.M. peak and 77.8% of the 7:30 to 9:00 A.M. peak; and that the peak outbound hour, 5:00 to 6:00 P.M. was 79.7% of the 4:30 to 6:00 P.M. peak[6]. See Table 11-1 of Appendix 11 for data. The 75% factor was applied to the New Haven

5. DeLeuw, Cather and Company Report, Appendix A-Table 13
6. DeLeuw, Cather and Company Report, Appendix A-Table 10

Railroad peak data. The Boston and Albany Railroad estimates were adjusted by a 78% factor for the peak hour and the Boston and Maine data was reduced to 80% for the peak hour. The A.M. peak hour percentage was higher than the P.M. peak hour percentages as found by DeLeuw, Cather and Company, but due to patronage differences, the number of persons carried was almost identical[6]. This relationship is assumed to be true for all commuter lines at present as Kitchel found it was in 1958. See Table 11-2 of Appendix 11 for computations.

To find the equivalent number of automobiles for the present railroad passengers, a factor of 1.5[7] persons per automobile was used.

The number of new automobiles during each peak hour from each direction is summarized in Table 3. This number will be added to the volumes in Table 2 to find the total expected peak demand.

Table 3

Estimated New Peak Hour Automobiles With Downtown Destinations by Highway O and D Direction

Direction	A.M. Peak Hour	P.M. Peak Hour
SE	2,865	2,865
SW	2,080	2,080
W	2,420	2,420
NW	760	760
N	1,190	1,190
NE	1,040	1,040
SB	0	0
	10,355	10,355

6. DeLeuw, Cather and Company Report, Appendix A-Table 10

7. A study of persons per automobile was referred to on Page 27 of Robert G. Davidson's thesis. Mr. Davidson was contacted by this author concerning the persons per automobile ratio at various hours of the day. Mr. Davidson recalled that the ratio fluctuated from a low of 1.3 in the early morning to a high of 1.9, or 2.0 in the evening, and averaged 1.57. The ratio was about 1.60 during the A.M. and P.M. peak hours. Some variation was observed between 9:00 A.M. and 5:00 P.M. with an average ratio of 1.65. Mr. Davidson estimated that the present peak hour ratio was about 1.5. This figure is also used in the American Municipal Association Survey. 1.5 persons per automobile will be used for peak hour traffic and 1.65 persons per automobile during the mid-day in this thesis.

IV

PEAK HOUR TRAFFIC WITHOUT RAILROAD COMMUTING

In the previous two sections the amount of traffic during May 1959 peak hours under present conditions and the additional traffic that would be expected if the commuter trains ceased operating was estimated. All traffic was broken down by the seven directions of travel to and from the downtown area.

No estimate was made of the eventual destination by zone in the downtown area. Neither was any estimate made of the zone origin of the P.M. peak traffic leaving the downtown area. Such estimates were made in this section together with the probable roads that this traffic will use in the downtown area and the ability of these roads to carry the traffic. An amount of traffic equal to 31% of the present traffic was added for interzonal traffic not covered by the 1955 study.

Table 2 estimated that the A.M. peak traffic under existing conditions in May 1959 was 15,953. It is assumed that all peak hour automobile traffic is commuter traffic and therefore that its distribution within the downtown area is proportional to the daytime employment in each zone. The peak hour truck traffic is assumed to be proportional to the total truck O and D in each zone.

In 1957 G.B.E.S.C. made a complete survey of employment in the C.B.D. as they defined it (see Appendix 2) for all workers covered by unemployment compensation. This survey compared 1947 employment data against the results of their 1957 survey by block. U. S. census data indicates that about 20.6% of the total labor force in the B.M.A. was not covered by unemployment compensation. The Research Division

of the Boston City Planning Board believes that about the same percentage of downtown employment is not covered by unemployment compensation. One hundred eighty-five thousand one hundred eighty-eight employees in the G.B.E.S.C. study area are so covered. This is 79.4% of the 223,337 estimated total employment. Of the 38,149 not covered, 20,770 people were employed by all levels of government. The G.B.E.S.C. data was corrected by this author to include the uncovered employment. Other minor modifications were made for errors discovered by G.B.E.S.C. in their data. Although the adjusted G.B.E.S.C. study includes the vast majority of the downtown employment, significant parts of the downtown area were omitted. No employment is recorded in the G.B.E.S.C. report for zones 0307, 0308 and 0309, and the hospital areas are not included in zones 0306 and 0315. Lesser employment is also excluded.

The data was then reassembled by this author in O and D zones. See Appendix 12-1 through 12-17 for breakdown by O and D. zone. Since commuting traffic assignments are assumed to be a function of total employment, the uncovered areas within the downtown zones were surveyed to make employment estimates. Employment was divided into eight categories: Manufacturing, Wholesale, Warehousing, Office, Garages (commercial), Retail, Professional and Institutional. Estimates of floor space devoted to each of the first five categories were made from information given in the Sanborn Atlas[1] for that section of the city. The floor areas were then divided by a square foot per employee factor representing the average area per employee for the downtown area. Factors for Warehousing and Garages were arrived at by observation

1. The Sanborn Map Co., Insurance Maps of Boston, Massachusetts, New York, 1938 (Revised), Volumes One North, Two North and Two South.

of various warehouse and garage operations by the author. The other three square foot factors were developed by the Research Division of the Boston City Planning Board. A factor of square feet per employee did not seem applicable for the latter three categories. Most of the retail space in question consists of small stores owned by their occupants and the square foot per employee ratios vary greatly. It was decided to estimate employment by counting the number of stores in the zone and applying a factor of employees per store derived from census data of a city with comparable stores. Such data for Boston is heavily weighed by the presence of a few large department stores in the C.B.D. which accounts for over 50% of the retail store employment in the entire city[2]. Chelsea, Massachusetts, was selected as a city with no regional shopping center and in general containing the same type of stores as those in question. A Census of Business for Massachusetts[3] was made by the U. S. Census Bureau in 1954. The total employment and number of stores for both Retail Trade (food stores, general merchandise, etc.) and Selected Services (personal services, repair services, etc.) were included. The type of stores listed in these two categories correspond to the type of stores found in the Boston area under study. A factor of three employees per store was used. See Table 13-1 of Appendix 13 for data.

Professional employment was gathered from telephone book listings of telephone members with the notation of "Phys., Surg., Atty., Lwr." and others. See Table 13-2 of Appendix 13 for complete list.

2. The U. S. Census Bureau reported 110,430 people in Retail Trade and Selected Services in 1954. The Planning Board Research Division estimates 55,740 of these people were employed within the C.B.D. in 1957.

3. U. S. Department of Commerce, Bureau of The Census, 1954 Census Of Business, Washington, D.C., 1956, Bulletin R-1-21, Retail Trade Massachusetts, and Bulletin S-1-21, Selected Services, Massachusetts.

Each professional was assumed to have one assistant. Institutions were contacted by the author and asked their daytime work force. Schools and colleges with an adult student body were also asked their enrollments. For purposes of this survey students are considered to be part of the commuting work force. Appendix 12-1 through 12-17 summarizes the data by O and D zone. Additional data on police and fire stations are listed in Tables 14-1 and 14-2 respectively of Appendix 14. Boston public school data are listed in Appendix 15.

No breakdown by zone in O and D information between automobiles and trucks was made in the Coverdale and Colpitts Study. The Maguire Report did, however, make such a breakdown. The data for each zone was presented in graphical form. The total O and D for each zone was scaled and the results totaled. See Appendix 16-1 to 16-7 for data. The peak hour truck traffic for each zone was assumed to be proportional to the daily total 1945 truck traffic. This assumption may be in error due in part to the removal of much of the market district from Zones 0302 and 0303 and construction of the Central Artery in these and other zones of the downtown area.

No O and D breakdown has been made to indicate what the downtown distribution is from the various directions of travel. It has been previously assumed that the total distribution during the peak hours is proportional to employment. It is further assumed that the distribution of peak hour automobiles from each direction is proportional to employment. See Appendix 16-1 through 16-7 for data. Appendix 16-8 summarizes the A.M. peak destinations and the P.M. peak origins by zones for travel from all directions under existing conditions in May 1959.

DeLeuw, Cather and Company made O and D surveys by zone .

within the downtown area of railroad passengers using the Old Colony. No downtown distribution surveys from the other directions of travel were made in this study. It was therefore assumed that the zone distribution to and from each direction is proportional to the Old Colony zone distribution. Not all zones in the downtown area were destinations or origins of peak hour railroad commuters. All zones with less than one percent of the daily total Old Colony commuters were not considered to have any peak hour O or D. The other zones, representing 94.7% of the daily downtown destinations by Old Colony users, were proportionately increased to equal 100% of the new automobiles during the A.M. and P.M. peak hours. See Appendix 17-1 through 17-7 for data. Appendix 17-8 summarizes by zone the additional automobiles in the A.M. and P.M. peak hours due to discontinuance of railroad commuting.

The total A.M. peak hour destination traffic is 26,308 vehicles. Twenty seven thousand four hundred three vehicles constitute the total P.M. peak hour outbound traffic. All through traffic is assumed to be routed around the downtown area. This was checked against the Cordon Count to determine the ability of the road network to carry this traffic. All roads at the Outer Cordon except Massachusetts Avenue and the Harvard Bridge, which carry mostly through traffic, and those lightly traveled non-through streets previously excluded on page 17 were included.

No Central Artery data was included, however. Since through traffic will be carried on both the Central Artery and Storrow Drive, only part of the additional capacity of the Central Artery will be realized for O and D traffic. With the aforementioned streets excluded,

20,196 vehicles entered the Outer Cordon during the A.M. peak hour in 1954. This is 6,112 fewer than the new requirement. However, not all roads reached their individual peak hour counts during the peak hour. A separate calculation was made taking the highest hour for each road, and adding these totals to the estimated net capacity of the Central Artery, Massachusetts Avenue and the Harvard Bridge to find the present possible capacity. Appendix 4 indicates that 2,565 vehicles constituted through traffic entering the downtown area during the peak hour. On this basis it was found that the sum of the highest hour entering traffic on the various roads was 30,104 or 3,796 more than the new requirement. The P.M. peak hour was investigated in like manner. Twenty-three thousand sixty-six vehicles exited the Outer Cordon between 5:00 and 6:00 P.M. in 1954, or 4,337 fewer than the calculated requirement. The sum of the highest hour exiting traffic was 33,898 vehicles, or 6,495 more than the calculated requirement. See Appendix 18 for data.

By combining Appendix 14 and Appendix 16 the total traffic from each direction to each zone that is anticipated if the railroads stop operating commuter service can be obtained. If the estimated peak hour through traffic found in Appendix 4 is added, the peak hour traffic flow on the various streets within the downtown area as well as at the cordon line can be compared with the ability of the streets to handle this traffic. Traffic from one of the seven directions destined to each of the downtown zones was assigned to various roads in accordance with the assignments made on page 17 and a 1938 map of traffic flow in the downtown area. The 1938 study was used only to indicate the relative importance of various downtown streets. The actual traffic volumes

were disregarded, having changed considerably in 19 years. It is not known exactly which roads a person actually uses to get from a particular direction to a specific zone. Probably not all persons destined for a particular zone from the same direction use the same roads to reach their destinations, so the assignment of roads of travel is in the judgment of the author one way that vehicles from a particular direction to a zone might travel to that zone. Assignments had to be made to investigate the ability of the entire system to carry the anticipated traffic. This process was repeated for each of the seven directions for the A.M. peak. See Appendices 19-1 through 19-7 for data. The traffic on each street from all directions was totaled and adjusted for the capacity of the road.[4] The estimated volumes of destination traffic on each downtown street derived from Appendix 4 and Appendix 19 are indicated on Map I. While the estimated capacity was lower, this investigation verified the contention that the road system with enforced curb parking restrictions could carry the anticipated traffic. One-half of the through traffic is assumed to be using each side of the road to which it was assigned.

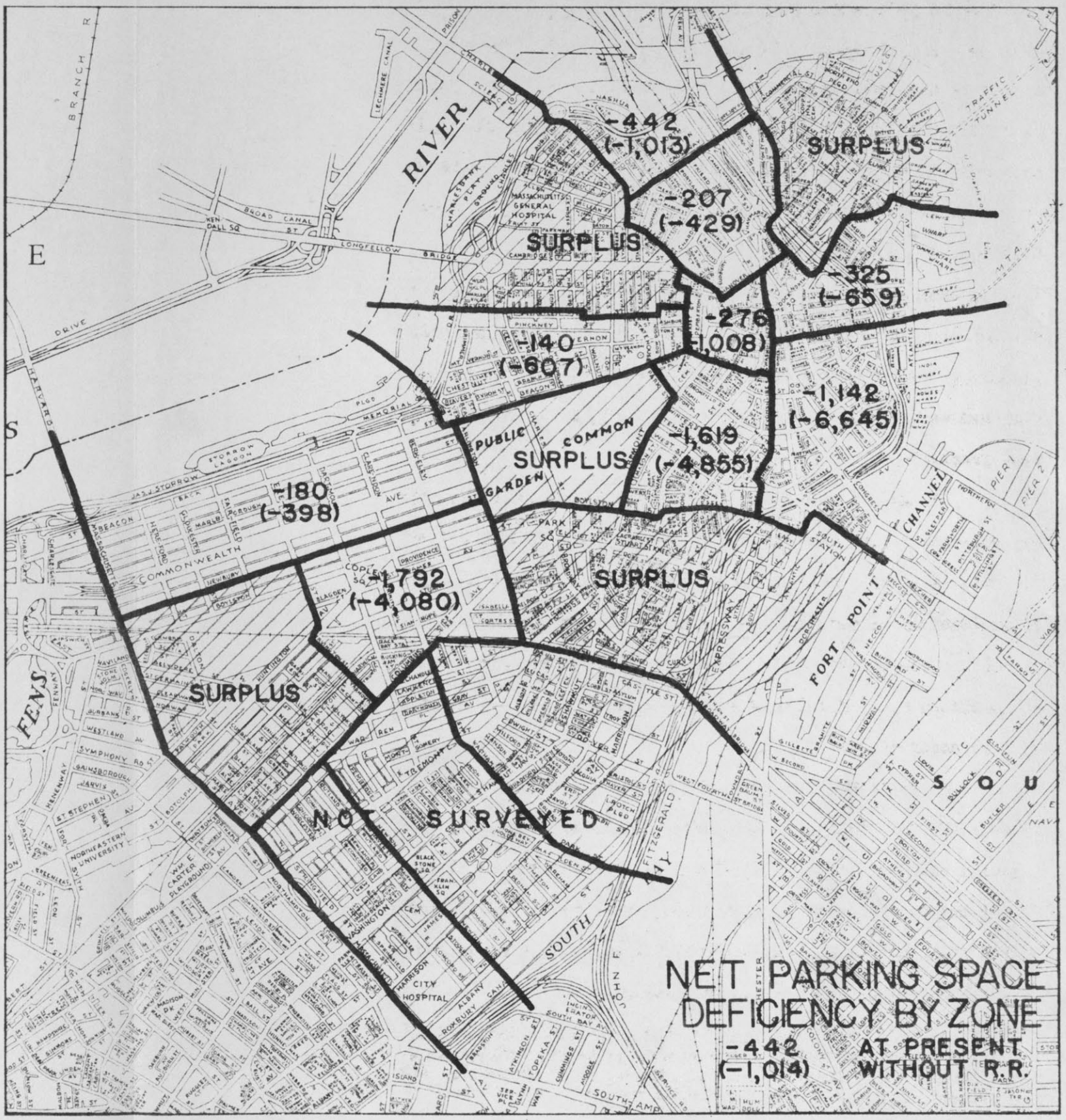
4. The Central Artery and Storrow Drive are estimated to carry about 1,500 vehicles per lane, the estimated capacity of "Expressways" in the Report On The Detroit Metropolitan Area Traffic Study By The Michigan State Highway Department and others, Part 1, pg. 108 and a figure used by many highway authorities. The Detroit Study also listed an estimated capacity of 840 vehicles per lane per hour of green time for each direction, or about 400 vehicles per lane per direction during the peak hours. This total was checked against computations derived using a method developed by Dr. Bruce D. Greenshields, Director of Traffic Division, University of Michigan and Professor of Transportation at University of Michigan. It was found that under the same traffic conditions indicated in the Detroit Study 660 vehicles per lane in the peak hour could be accommodated. This total was used for computations in this thesis. See Appendix 20 for calculations.

Earlier in this section an estimate was made of possible peak traffic that could be carried on the road network during the peak hours. This estimate was re-investigated on the basis of assigned traffic flows on Map I. It was found that certain streets in the downtown area and not entering roadways limited capacity in five instances. In nine other instances the entering streets limited the possible capacity. All other entering roads are being used to capacity. The A.M. peak hour traffic was estimated to be 26,308 vehicles. Map I indicates that 26,721 destination vehicles entered, or 1.57% more than estimated. Two thousand five hundred sixty-five additional through traffic vehicles also used the road system, or a total of 29, 286 vehicles during the peak hour. Map I indicated that a total of 3,045 additional vehicles could have entered the downtown area during the peak A.M. hour using the same distribution system. This is the total possible volume under present conditions. No more additional destination or through traffic can be accommodated.

A distribution pattern investigation of the P.M. peak hour was not undertaken. One more exiting street[5] exists than entering, adding about 1,320 vehicles to the P.M. peak hour total, raising it to 33,651. The estimated P.M. peak hour demand is 27,308, or substantially less than the demand.

Several changes must be made to the road system if this volume of traffic is to use the system. The rotaries at Haymarket Square

5. Both Shawmut Avenue and Beacon Street are one way outbound; Marlborough Street is one way inbound; all other streets are two way.


-442
(-1,013)
SURPLUS
-207
(-429)
SURPLUS
-325
(-659)
-276
(-1,008)
-140
(-607)
-1,142
(-6,645)
-1,619
(-4,855)
SURPLUS
-180
(-398)
-1,792
(-4,080)
SURPLUS
SURPLUS
NOT SURVEYED
NET PARKING SPACE
DEFICIENCY BY ZONE
-442 AT PRESENT
(-1,014) WITHOUT R.R.

and the Longfellow Bridge must be eliminated and replaced by signalized intersections and partial grade separation[6]. The Charlestown Bridge should be made one way inbound during the A.M. peak to allow five lanes of inbound traffic. If this is found to be undesirable, three inbound lanes should be permitted and the Central Artery widened by one lane on the southbound side from Charlestown to a new exit ramp south of Fort Hill Square joining Purchase Street. Parking, stopping, taxi stand and loading zone prohibition indicated on Map I must be rigidly enforced if the anticipated traffic is to be accommodated. Not more than 26,700 vehicles, or 2,581 less than the estimated destination and through traffic, can be accommodated under present traffic and curb restriction enforcement practices.

No mention was made of interzonal traffic in the distribution calculations. The Maguire report found it amounted to 31% of the daily traffic. The peak hour interzonal traffic would be about 4,940 vehicles. An additional 8 lanes would be needed to accommodate this traffic. Since no information exists on its distribution and many more lanes exist in the downtown area than are required, it is assumed that interzonal traffic will be accommodated.

In addition to the parking prohibition indicated on Map I, it would be very desirable to provide other curb spaces to be used for disabled vehicles. The proposed volumes are so near absolute capacity on all but two roads that an accident, flat tire or other such driver foible will cause the system to fail unless trouble spaces are provided to which disabled vehicles may be removed.

6. The preliminary street plan for the Government Center indicates that new ramps to the Central Artery and some grade separation is proposed which should ease this problem. The M. D. C. is presently designing improvements for the Longfellow Bridge rotary.

Table 4 summarizes the estimated peak hour traffic by zone if railroad commuting ceases.

Table 4

Estimated Peak Hour Traffic By Zone From All Directions Without Commuter Railroads in May 1959

Zone	A.M. Peak Hour*	P.M. Peak Hour*
0301	808	876
0302	285	261
0303	906	829
0304	8,678	9,061
0305	4,529	4,809
0306	3,709	3,859
0307	402	355
0308	155	124
0309	246	230
0310	445	463
0311	653	677
0312	2,189	2,409
0313	0	0
0314	673	698
0315	1,055	1,158
0316	965	964
0317	606	632
	26,304**	27,396 **

*Data from Tables 16-8 and 17-8

**Computations on page 33 indicate a road system capacity of 32,331 during the A.M. peak hour and 33,651 during the P.M. peak hour

Table 4A

Estimated Peak Hour Traffic By Direction From All Zones Without Commuter Railroads In May 1959

Direction	A.M. Peak Hour*	P.M. Peak Hour*
SE	5,645	5,865
SW	4,569	5,100
W	6,990	7,389
NW	3,900	3,692
N	2,107	2,121
NE	2,483	2,685
SB	610	544
	26,304	27,396

* Data from Appendices 16-1 through 16-7 and Appendices 17-1 through 17-7

V

PARKING REQUIREMENTS

The previous sections have shown how much traffic on the streets of Downtown Boston will increase if the commuter railroads cease functioning. Once these automobiles reach their destinations some place to store them must be provided. The total parking demands, present facilities and propcsals to assuage the calculated deficit were investigated in this section.

All of the C.B.D. and most of the additional land, except the South End, was subjected to a complete parking survey in the fall of 1958 by the Boston City Planning Board. Legal and habitually used illegal street spaces were inventoried by block. Off street spaces were plotted on maps, parking garages distinguished from lots. Areas where unmetered parking was permitted were not recorded except on streets within the C.B.D.

The author personally surveyed other unmetered areas within Downtown Boston for which data was incomplete except zones 0307, 0308 and 0309 in order to adapt this survey to the needs of individual zones. The author has observed many empty spaces in these three zones during the peak parking demand and Appendix 17-8 indicates that these zones are unaffected by railroad commuting. The data was then compiled by traffic O and D zone and is presented in Appendix 21. The parking zones deviated slightly from the O and D zone map in Appendix 31. A total of 43 illegal and 338 legal spaces found between West Canton Street, Columbus Avenue, Wellington Street and the New Haven Railroad tracks were not included. These spaces were considered too remote

from any employment or shopping area in Zone 0310 or 0312. Seven hundred garage and 143 street spaces in the Bowdoin Square section of Zone 0315 were transferred to Zone 0316.

The total number of commuter automobiles for the peak entering hour was calculated in the previous section. Not all commuters enter the city between 8:00 and 9:00. Cordon counts do not exist for the period 12:00 midnight to 7:00 A.M. However, this traffic is very small, only 10% of the daily total. The 7:00 to 8:00 A.M. vehicle traffic is quite substantial. The estimated present destination automobiles for that hour was computed using the method outlined in Part III for peak hour destination traffic. See Tables 22-1 and 22-2 of Appendix 22-1 for data. The downtown distribution of this traffic is assumed to be proportional to employment, as was the A.M. peak hour distribution pattern. See Table 22-4 of Appendix 22-2 for data. Additional commuters use the railroads between 7:30 and 8:00 A.M. at present. DeLeuw, Cather and Company[1] data indicates that 28.2% of the peak hour entering passengers entered between 7:30 and 8:00 A.M. This quantity was converted to new entering automobiles by the same method outlined for the peak hour railroad commuters. See Table 22-3 of Appendix 22-1 for data. The distribution pattern for the 7:30-8:00 A.M. present railroad users is assumed to be the identical to the present 8:00 to 9:00 A.M. railroad distribution pattern. See Table 22-4 of Appendix 22-2 for data. Table 22-4 also summarizes the total estimated pre 8:00 A.M. commuters by zone.

The assumption that all present 7:00 to 9:00 traffic is commuter traffic was compared with the existing parking situation for

1 DeLeuw, Cather and Company Report, Appendix A-Table 10. See also Table 11-1 of Appendix 11 of this thesis.

verification. Table 2 and Table 22-2 indicate an estimated 7:00 to 9:00 A.M. present commuter volume of 23,316 exclusive of the South End. Appendix 21 indicates about 35,695 spaces, exclusive of the South End, exist within the downtown area, or 13,379 more than needed for commuters. The 1954 Cordon Count indicates a peak accumulation between 9:00 A.M. and 4:00 P.M. of 12,686 vehicles, or about 11,000 automobiles. Most of the downtown spaces are used during the peak accumulation period. This indicates that the assumption that the 7:00 to 9:00 traffic is commuter traffic is correct.

The total commuter parking needs by zone if the railroads cease carrying passengers are compared with the available parking spaces by zone in Appendix 23. In Part IV it was found that the traffic volumes will be so heavy that existing parking regulations and some present legal spaces will have to be restricted during the peak hours. Therefore, only off street and the remaining legal on street spaces are considered to be available for commuter parking. In six zones there are not enough existing spaces to accommodate the estimated commuter traffic. Zones 0304 and 0305 have large deficits that cannot be offset by Surpluses in adjacent zones. See Appendix 23 for data.

Additional space must be provided to handle the demands of shoppers. There is a widespread feeling among planners and merchants that the number of shoppers coming to the downtown area is continually declining, but at an unknown and non-linear rate. Others are changing from mass transit to automobiles. For this study it is assumed that the number of shoppers coming downtown in May 1959 is equal to the 1955 levels. The word "shopper" as used herein includes all people coming downtown between 9:00 A.M. and 5:00 P.M. for a short time, i.e. non-

commuters. See Appendix 24 for data. The number of shoppers does not equal the non-commuter automobiles destined for a particular zone. Since there are large residential areas within the downtown area, automobiles that are owned by residents must be separated out[1].

It was assumed that the number of owner automobiles garaged in any zone is proportional to the number of dwelling units in that zone. See Appendix 25 for data. This assumption is not completely accurate. In Zone 0302 there is a higher number of estimated owner automobiles than total non-commuter automobiles with origins or destinations in the zone. Only 150 non-commuter automobiles are estimated for Zone 0315. Since this zone contains the Massachusetts General Hospital, this estimate seems unrealistically low. It was arbitrarily assumed that 500 shopper automobiles would have destinations in Zone 0302 and 1,150 such automobiles would have destinations in Zone 0315. No changes in the other zone totals were made to accommodate these assumed increases in Zones 0302 and 0315.

The increase of traffic volumes between 1945 and 1955 was compared by zone to and from all directions in Table 26-1 of Appendix 26-1. A comparison between the traffic increases for each direction to and from all zones was made in Table 26-2 of Appendix 26-2. The average increase was 2.01 times the 1945 estimates. All zones seemed

1 About 114,000 persons of Boston's 740,000 residents live in the downtown area. About 160,000 automobiles were garaged within the city limits according to Excise Tax Records for 1957, or one automobile for every 4.62 persons. Assuming that ratio of persons per automobile garaged in the downtown area is the same as the ratio as for the entire city, about 24,700 automobiles would be garaged in the downtown area. As there is no breakdown of automobile registrations by any of the City's subdivisions, no accurate correction for the actual downtown area persons per automobile can be made.

to show a reasonable increase except Zone 0313, containing the Boston Common and Public Garden, which experienced an increase to 9.07 times the 1945 O and D. This seems very high for an annual increase[2]. The 1955 traffic for this zone was reduced to 2.01 times the 1945 level and the balance was assigned to the adjacent zones in proportion to their estimated shopper traffic. See Table 26-3 of Appendix 26-2 for data. Substantial growth was experienced in the Southeast and Northeast directions. This growth is to a large extent due to the provision for new or improved highways.

The estimated shopper traffic for some of the downtown zones is probably higher than the actual volumes, since traffic destined for the downtown area between 5:00 P.M. and 12:00 midnight is included in estimated shopping traffic totals. This is particularly true in Zones 0306 and 0307 which contain entertainment facilities. Zone 0315 would experience evening visitor traffic destined for the Massachusetts General Hospital. No adjustment has been made in the data to account for this situation because no information on non-peak hour distribution is available or could be assumed with accuracy.

DeLeuw, Cather and Company found that the 9:00 A.M. to 5:00 P.M. passenger total was equal to about 16.8%[3] of the peak hour entering passengers on the Old Colony. This percentage is assumed to be applicable to all railroads. The resulting totals, found in Table 27-1 of Appendix 27, were divided by a factor of 1.65[4] persons per automobile. Assignment to zones was made in proportion to the peak hour percentage used in Appendix 17. See Table 27-2 of Appendix 27 for data.

2 The 1955 traffic counts were taken between October 1955 and January 1956. A special Christmas display was maintained on the Boston Common during part of this traffic survey period. The method of computing the average daily traffic is not known.

3 DeLeuw, Cather and Company Report, Appendix A-Table 10. See also Table 11-1 of Appendix 11.

4 See footnote on Page 25.

The accumulation charts of the 1954 Cordon Count were investigated to determine a turnover rate for shopper traffic. Since the accumulation charts only reflect the cumulative difference between the inbound and outbound traffic, no comparisons were made for commuter traffic. The counts did not compile data before 7:00 A.M. and no counts were made of automobiles exiting from the cordon that had their origins within. It was felt that accumulation counts from 9:00 A.M. to 5:00 P.M. are valid, however. Since these automobiles are entering for shopping and it was previously assumed that all 7:00-9:00 A.M. traffic was commuter traffic, there are no shoppers in the area prior to 9:00 A.M. Both cordons were examined for data. See Table 28-1 of Appendix 28.

The high turnover rate in the Outer Cordon reflects the relatively higher proportion of curb spaces in the non-C.B.D. areas. These gross turnover rates are similar to rates found in other cities[5]. The Syracuse study found that the average turnover rate between 8:00 A.M. and 6:00 P.M. was 3.62. The Eno Foundation[6] data indicates that the turnover rate for General Merchandise, Apparel and Furniture (G.A.F.) sales range from 3.5 to 4.0 for an 8 hour day. This rate is believed to be comparable to the turnover experienced in downtown Boston since the Eno Foundation also found that the gross turnover ratio[7] for cities with populations between 500,000 and 1,000,000 was about 5, which corresponds to the Inner Cordon turnover rate. A turnover rate of 3.75 cars per space will be used. See Table 28-2 of Appendix 28 for data.

5 See: Traffic and Parking Survey Commission, Traffic and Parking in the Central District, Syracuse, N. Y., Dec. 15, 1951, part 2, Pg. 1 and Eno Foundation for Traffic Control, Parking, Saugatuck, Conn., 1957, Pg. 54, Table II-27.

6 Eno Foundation, Highway Traffic Estimation, 1956, Pg. 113.

7 Eno Foundation, Parking, Pg. 56, Table II-29.

The required shopper parking spaces were added to the total estimated commuter traffic to find the gross parking requirements. The Eno Foundation study on parking found that the practical capacity[8] of the total parking facilities was about 90% of the total number of spaces. An amount to provide 10% vacant spaces in each zone was added to the estimated parking requirements. These parking requirements were then compared with the existing parking facilities. See Appendix 29 for data.

On the basis of the data presented in Appendix 29 there is a calculated net deficit of 19,890 parking spaces. Surplus spaces in a zone are assumed to be utilized by a zone having a deficit in parking facilities. This assumption seems reasonable since each zone with surplus spaces is adjacent to at least two zones with parking space deficits. Map II indicates existing parking garages and lots. See Zone Map opposite for estimated present surpluses or deficits and calculated surpluses or deficits without commuter railroads. It is considered to be beyond the scope of this thesis to make detailed site recommendations for new parking facilities. The proposed facilities should have one two-lane exit for each 500 cars stored[9], and no more than 1,000 cars capacity unless exits are at least 250 feet apart with no more than two exits leading to the same street.

8. Eno Foundation, Parking, Pg. 41
9. Results of a peak hour discharge rate survey by the Transportation Section of the Boston City Planning Board in August, 1958 (unpublished)

Table 5 summarizes the surplus and deficit of parking spaces by zone.

Table 5

Surplus and Deficit of Parking Spaces by Zone for Estimated Total Automobile Traffic in May 1959 Without Railroads

Zone	Surplus	Deficit
0301	-	1,530
0302	2,050	-
0303	-	996
0304	-	10,348
0305	-	7,341
0306	5,872	-
0307	*	-
0308	*	-
0309	*	-
0310	806	-
0311	-	903
0312	-	6,167
0313	110	-
0314	-	916
0315	1.628	-
0316	-	1,521
0317	-	634
	10,466	30,356
	Net Deficit	19,890

* Not surveyed

The calculated net deficit is higher than that required to provide facilities for former railroad commuters (13,707)spaces. This is due to the lower turnover rate (3.75 vs. 7.12), the error in assuming that all non-commuter daily traffic entered the downtown area between 9:00 A.M. and 5:00 P.M., and the application of a 90% use factor. The current facilities are used at a rate of 92.8% of absolute capacity, which is above the estimated practical capacity.

Tables 5A, 5B and 5C summarize the parking needs for the estimated present traffic and the calculated total traffic if the commuter railroads cease operating for commuter automobiles, shopper automobiles and automobiles garaged in the downtown area, respectively by zone. Tables 5D and 5E indicate the net parking deficit and the land area required to meet the deficit, if 4 story or 8 story garages are erected, for present traffic and the calculated total traffic if the commuter railroads cease operating.

Table 5A

Parking Spaces Required For Commuting Traffic in May 1959

Zone	Existing Spaces*	Required Spaces** At Present	Required Spaces** Without Railroads
0301	950	1,039	1,207
0302	2,560	325	325
0303	1,154	1,015	1,015
0304	5,052	5,567	12,195
0305	2,589	4,305	6,607
0306	6,962	3,310	5,250
0307	***	421	421
0308	***	129	129
0309	***	287	286
0310	2,586	632	623
0311	2,047	596	910
0312	2,183	2,754	3,403
0313	335	0	0
0314	1,244	487	930
0315	3,798	1,401	1,637
0316	1,739	622	1,255
0317	2,496	857	857
	35,695	23,474	37,015

* Data from Appendix 21
** Data from Table 22-4
*** Not surveyed

Table 5B

Parking Spaces Required For Shopper Traffic in May 1959

Zone	Existing Spaces*	Required Spaces** At Present	Required Spaces** Without Railroads
0301	950	1,019	1,025
0302	2,560	133	133
0303	1,154	968	968
0304	5,052	1,470	1,685
0305	2,589	2,255	2,330
0306	6,962	4,513	4,575
0307	***	824	824
0308	***	423	423
0309	***	729	729
0310	2,586	968	968
0311	2,047	1,735	1,745
0312	2,183	2,094	2,115
0313	335	220	220
0314	1,244	993	1,010
0315	3,798	307	314
0316	1,739	1,654	1,675
0317	2,496	1,965	1,965
	35,695	22,270	22,704

* Data from Appendix 21
** Data from Table 27-2
*** Not surveyed

Table 5C

Parking Spaces Required For Automobiles Garaged in Downtown Boston in May 1959

Zone	Existing Spaces*	Required Spaces** At Present	Required Spaces** Without Railroads
0301	950	117	117
0302	2,560	3,480	3,480
0303	1,154	153	153
0304	5,052	12	12
0305	2,589	13	13
0306	6,962	1,138	1,138
0307	***	2,275	2,275
0308	***	2,565	2,565
0309	***	2,915	2,915
0310	2,586	2,075	2,075
0311	2,523#	3,100	3,100
0312	2,183	750	750
0313	335	0	0
0314	1,779@	1,618	1,618
0315	3,867&	3,880	3,880
0316	1,739	57	57
0317	2,496	562	562
	36,775	24,710	24,710

* Data from Appendix 21
** Data from Appendix 25
*** Not surveyed
\# 476 spaces in private garages included
@ 535 spaces in private garages included
& 69 spaces in private garages included

Table 5D

Net Parking Deficit and Land Area Required to Meet Deficit for Present Parking Needs in May 1959

Zone	Area (acres)	Parking Space Net Deficit*	4 Story Garages Land Area (acres)	4 Story Garages % of Zone Area	8 Story Garages Land Area (acres)	8 Story Garages % of Zone Area
0301	58	442	0.76	1.31	0.38	0.66
0302	98	-	-	-	-	-
0303	62	325	0.56	0.90	0.28	0.45
0304	125	1,142	1.96	1.57	0.98	0.98
0305	68	1,619	2.78	4.09	1.39	2.05
0306	228	-	-	-	-	-
0307	142	**	-	-	-	-
0308	152	**	-	-	-	-
0309	104	**	-	-	-	-
0310	160	-	-	-	-	-
0311	160	189	0.33	0.21	0.17	0.11
0312	106	1,792	3.08	2.90	1.54	1.45
0313	64	-	-	-	-	-
0314	73	149	0.26	0.36	0.13	0.18
0315	136	-	-	-	-	-
0316	26	276	0.47	1.81	0.24	0.91
0317	82	207	0.36	0.44	0.18	0.22
		6,141	10.56		5.29	

* Total deficit has been offset by surpluses in 5 downtown zones and net deficit (32.6% of total deficit) has been applied proportionately to 9 zones with deficits.

** Not surveyed

Table 5E

Net Parking Deficit and Land Area Required to Meet Deficit for Parking Needs if Railroads Cease Operating in May 1959

Zone	Area (acres)	Parking Space Net Deficit*	4 Story Garages Land Area (acres)	4 Story Garages % of Zone Area	8 Story Garages Land Area (acres)	8 Story Garages % of Zone Area
0301	58	1,013	1.74	3.0	0.87	1.5
0302	98	-	-	-	-	-
0303	62	659	1.13	1.82	0.57	0.91
0304	125	6,645	11.42	9.14	5.71	4.57
0305	68	4,855	8.36	12.3	4.18	6.15
0306	228	-	-	-	-	-
0307	142	**	-	-	-	-
0308	152	**	-	-	-	-
0309	104	**	-	-	-	-
0310	160	-	-	-	-	-
0311	160	598	1.03	0.64	0.52	0.32
0312	106	4,080	7.04	6.64	3.52	3.32
0313	64	-	-	-	-	-
0314	73	607	1.03	1.41	0.52	0.71
0315	136	-	-	-	-	-
0316	26	1,008	1.73	6.8	0.86	3.4
0317	86	429	0.74	0.86	0.37	0.43
		19,894	34.22		17.12	

* Total deficit has been offset by surpluses in 5 downtown zones and net deficit (62.5% of total deficit) has been applied proportionally to 9 zones with deficits.

** Not surveyed

The previous six tables contrast the parking needs if the commuter railroads cease operating with the needs under present conditions. While the disappearance of railroad commuting would require a substantial increase in parking spaces, in no instance does a surplus zone become a deficient zone. All zones that have surplus spaces have more than enough extra spaces to meet the additional needs imposed by a transfer from railroad usage to automobiles. In those areas with a current calculated shortage, the disappearance of railroad commutation would greatly in-

crease the parking deficit in all of the nine zones.

At the present time sufficient parking facilities exist to accommodate the actual demand. Additional facilities would reduce over-use and permit drivers to find parking spaces more easily and reduce the need of going from one garage to another to find available spaces. If only four story garages were erected to meet the parking needs if railroad users switched to automobiles, some zones probably would not be able to provide the necessary land area. Zone 0305 would have to release 12.3% and Zone 0304, 9.14% of the land area to provide parking. All other zones would be required to dedicate less than 7% of their total land area.

If eight story garages were constructed in zones with large deficits, no zone would have to dedicate more than 6% of its total area for new parking. Since elevator-type garages are proving not to be able to handle peak hour traffic, it is recommended that new facilities required to meet the deficit found in the preceding tables be ramp-type garages. An eight-level garage is usually considered to be unadaptable to ramp operations because of the number of turns a driver would have to make to use an upper level. If at least two parking floors were below street level and the above- ground ramps had fewer turns, such as the Dusseldorf, Germany, garage10, these objections would be eliminated.

It has been assumed that automobiles destined for any zone would be willing to park anywhere within that zone. Much of the property along the waterfront is little used and could be converted to parking. The water-front area is included in the total area for several zones. The inclusion of this area substantially reduces the calculated percentage of land to be dedicated to parking for Zones 0303 and 0304. Waterfront parking could

10 "Glass Garage Hangs Its Ramps From Roof", Architectural Forum, January, 1954, Pg. 157

be used to meet commuter parking needs but is too far from the ultimate destinations of shoppers. Unless nearby garages (within 600 to 800 feet of the nearest store that the shopper is destined) are reserved in some way for shoppers, a deficit for shopper parking will continue to exist. The rate structure is the best known way, except leaving the garages closed until after 9:00 A.M., to control the type of parker using the facility. It would be desirable to have a progressive rate structure for garages to be used by shoppers and thus encourage a higher turnover rate and a lower or flat daily rate for commuter parking.

If the proper rate structures were instituted, waterfront land used for parking and eight or more storied garages were erected, the downtown area could continue to exist as we know it.

VI

THE GOVERNMENT AND PRUDENTIAL CENTERS

In the previous sections the effect of a cessation of railroad commuting on existing land use has been explored. Two substantial land use changes are proposed for the downtown area. The effect of elimination of railroad commuting on the proposed Government and Prudential Centers was explored in this section.

The Government Center, located in Zones 0316 and 0317, as proposed contains new buildings for all levels of government to house agencies located in private office buildings in the downtown area. A total of approximately 2,500,000 square feet of office buildings space would be provided employing about 11,000 people[1]. This proposed center would occupy almost all of Zone 0316. Since most employees of this proposed center now work in the downtown area, the center's effect upon traffic and entering street requirements would be small. The proposed street pattern would actually relieve the anticipated congestion in Haymarket Square Area. The effect upon the parking requirements for the zone would be substantial. If the same proportion of automobile commuters is assumed for the Government Center as for the entire downtown area, about 1,700 new spaces for employees would be needed. Additional spaces would be needed for short term parking. Some of the employees who now work in the Government Center area would be forced to move, but this number is small compared to the new labor force. A parking space defiency

1 Based on Boston City Planning Board Research Division Estimates of 230 S.F. of Office Floor space per employee.

already exists in the area as indicated in Appendix 29.

The Prudential Center will contain shopping facilities, a hotel, apartment houses and a convention hall in addition to the proposed office buildings. The estimated employment is about 10,000 people by the Boston College Seminar Research Bureau[2]. If this labor force is now located in the downtown area, the effect on peak hour roadway capacity should also be small. It might actually be beneficial to the traffic situation in Zone 0304, where most office buildings are now located. If, however, this labor force is in addition to the existing work force and the same percentage use automobiles as do for the entire downtown area, then about 1,700 additional automobiles, or one-half of the remaining possible capacity of the roads, would be used by these people. This assumes that the vehicles could adjust to the streets with surplus capacity. It was found that the practical parking capacity was actually 10% less than the number of spaces. The estimated total peak hour highway traffic is also about 10% less than the number of vehicles that the system can carry so in actuality the system is probably at its true capacity and it could not carry the extra traffic generated by the Prudential Center.

Total commuter parking is about equal to total shopping parking requirements in the entire downtown area. A total of 3,780 spaces, which allows for 10% vacancies, would have to be provided if this ratio was true in the Prudential Center. An additional 1,400 spaces must be provided for the 1,750 apartments if the dwelling unit per automobile ratio assumed in Part V is true. A total of 5,180 spaces would thus be required. Current plans for the center indicate that a 4,000 car garage

2 Interview with Robert G. Davidson on January 13, 1959

will be built, leaving a deficit of 1,180 spaces. No allowance has been made for automobile parking required for the convention hall. This space would be in addition to the estimated 1,180 space deficit.

While the effect on the entering traffic may or may not be critical, the erection of the Government Center and Prudential Center according to the present plans will increase the parking deficit by at least 3,000 spaces.

The addition of 1,700 spaces in Zone 0316 due to the Government Center would raise the land allocation for new parking from 3.4% to 7.3% if eight story garages are constructed. This can probably be accommodated without great difficulty. The 1,180 space shortage in the Prudential Center would require an allocation of only 0.91% of the total land area in Zone 0310.

VII

STABILIZATION OF THE MTA

One of the assumptions made in this thesis was that the MTA patronage would remain stable at present levels and that only railroad commuters would change to private automobiles.

This assumption was investigated to determine its accuracy. Various counts are taken at MTA stations each year indicating how many patrons paid fares at that station. It is generally assumed that this constitutes one-half of the total daily patrons using the facility. The data derived from these counts is presented in Appendix 31-1. The change in annual patronage was plotted for both the Inner Cordon and the Back Bay-South End against the change in the total revenue passengers carried by the entire system superimposed. While all three showed a general decline, both the Inner Cordon and the Back Bay-South End patronage declined at a slower rate than the total revenue passenger rate. See Appendix 31-2 for data.

The Back Bay-South End area where little traffic and parking improvement has been undertaken has declined surprisingly little except between 1952 and 1953 which may or may not have been due to some special cause, since most of the loss was regained during the succeeding year.

The Inner Cordon showed substantial decline between 1950 and 1951, 1954 and 1955, and 1957 and 1958, which coincides with the opening of the Storrow Drive, the first part of the Central Artery and an additional section of the Central Artery respectively.

On the basis of these observations, I conclude that the provision of the proposed additional parking and enforcement of curb

parking regulations will prove to be a powerful inducement to present MTA riders to abandon the transit system in favor of their own automobiles. In the previous section it was concluded that the road system would reach its practical capacity if the present railroad commuters used their own automobiles. Not all commuters would desire to use automobiles, nor could some of the present railroad commuters afford to own automobiles for commuting. Some of the present railroad commuters would use the MTA, allowing some present MTA users in turn to use their automobiles. However, the net result would be a worsening of the traffic situation and a decline in MTA patronage.

Since the road system is calculated to reach its practical capacity if the present railroad commuters use their own automobiles, it would not be possible for any present MTA users to use their own automobiles if the result were a net increase in roadway use during the peak hour. This indicates that while it is possible to accommodate the theoretical increased traffic, it would not be possible to accommodate the probable increased traffic.

CONCLUSION

The previous sections conclude that it would be possible to accommodate the theoretical increase of traffic if the present railroad users traveled to the downtown area by private automobile. The theoretical total volume, including present through traffic, was estimated to reach the practical capacity of the road system. This means that no additional traffic, either destination or through, could be accommodated without the construction of additional roads. An additional road in the planning stage, the Inner Belt, could accommodate through traffic now using the Storrow Drive and Massachusetts Avenue. Additional through traffic now using the Central Artery could not be accommodated on any highway now existing or planned. A new highway to accommodate this traffic would have to be located in the downtown area of highest intensity and most expensive land use.

The dedication of so much high value land to a new highway through the downtown area would be undesirable. If sufficient highway capacity is to be reserved for future through traffic, not all of the calculated parking deficit should be eliminated. It would be equally undesirable to adopt new curb parking restrictions and may be desirable to rescind some of the existing curb restrictions, thus reducing the number of destination vehicles that could be carried on the street system to about the present levels. If the present traffic level is maintained, additional parking should be provided for shoppers and undesirable remaining illegal curb parking. This would mean that railroad operations should be continued or be replaced by rail-borne rapid transit service over some of the existing railroad roadbeds to terminals located where the use of automobiles in place of railroad commutation does not pose a threat to the surrounding road system or land use.

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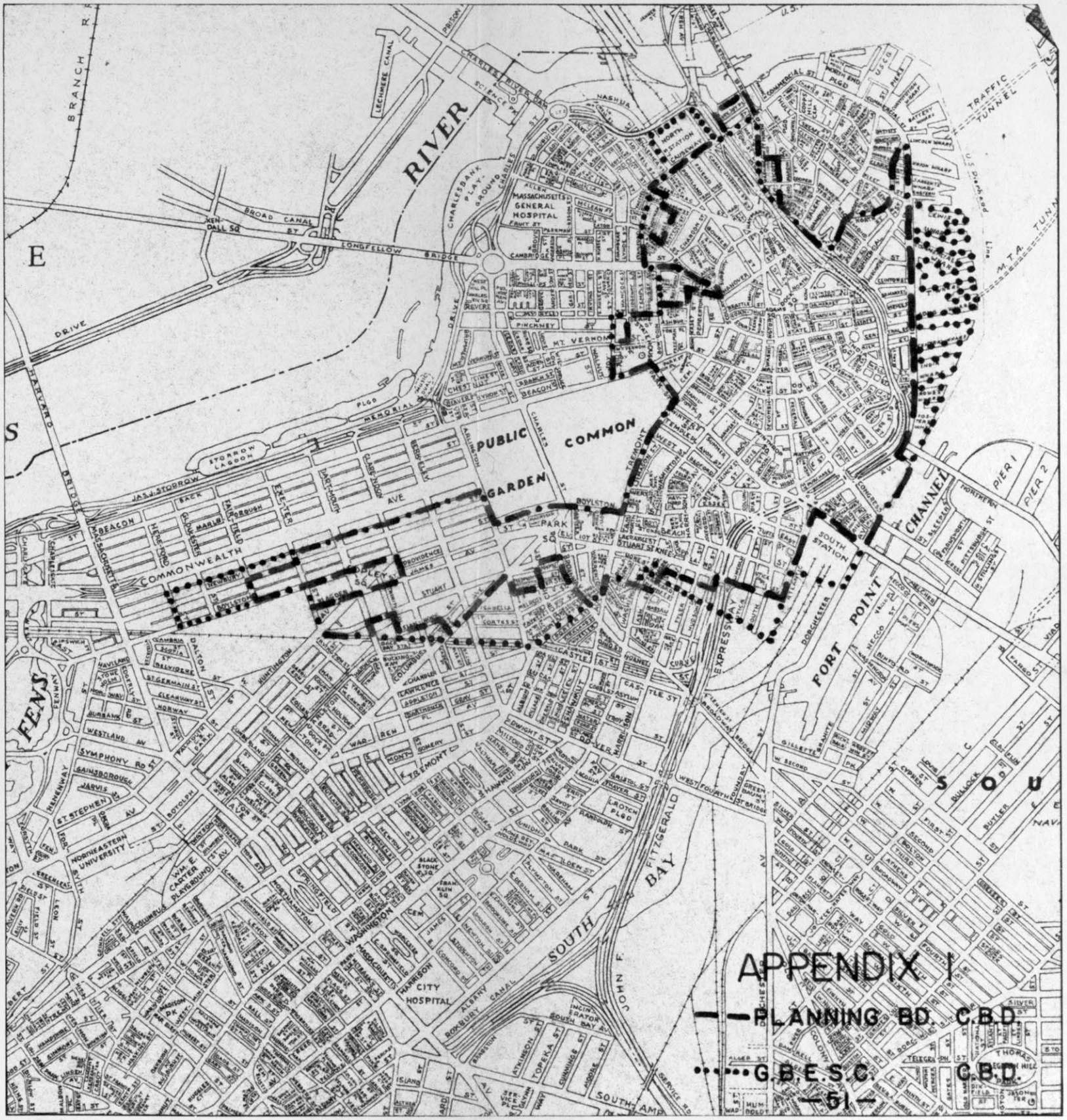
APPENDIX I
PLANNING BD. C.B.D.
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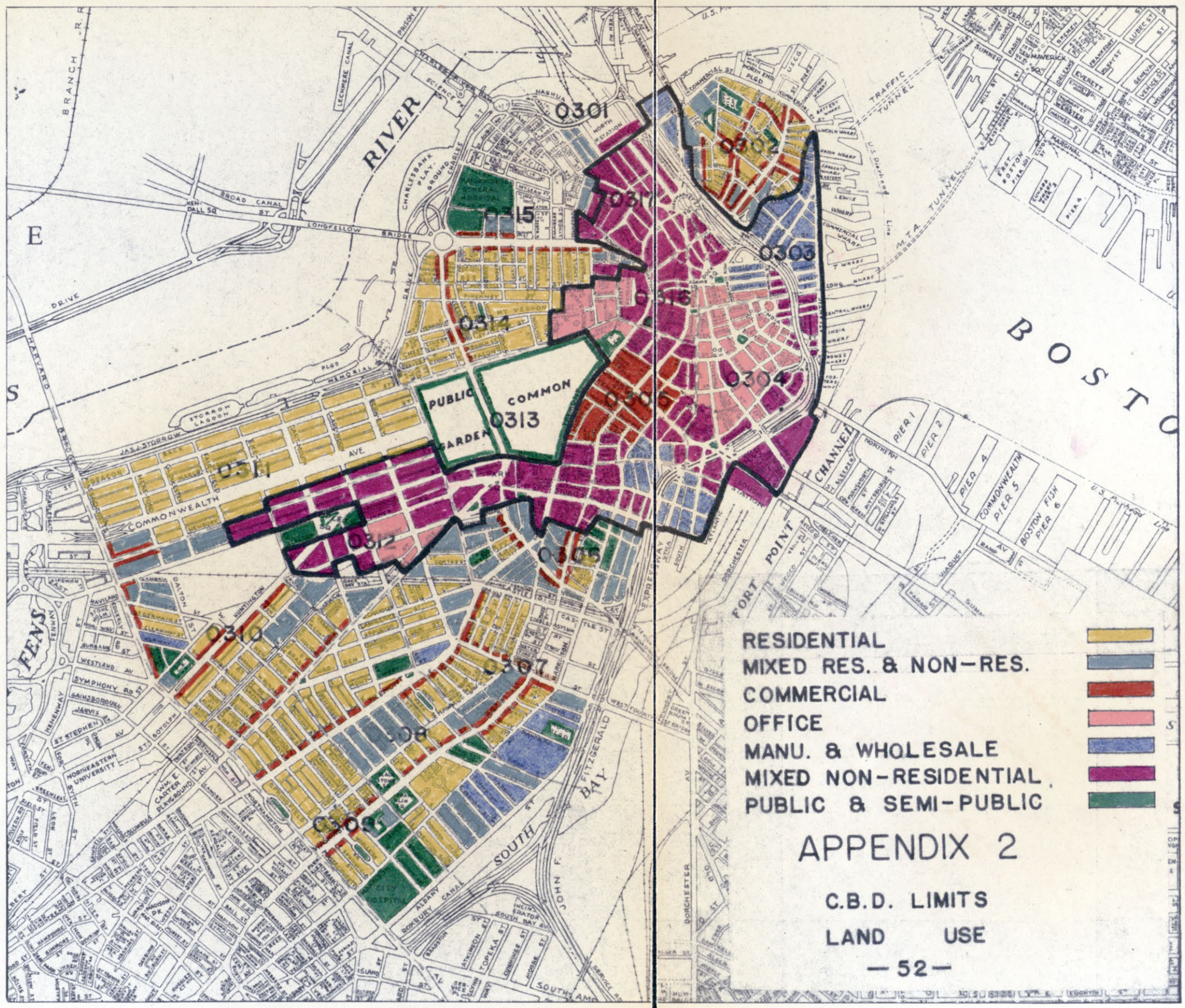


APPENDIX 2

C.B.D. LIMITS

LAND USE

Appendix 3

Number of Average Daily O And D Vehicles To And From Each Direction By Zone In 1955

Zone	S.E.	S.W.	W.	N.W.	N.	N.E.	S.B.
	49,424*	48,045*	83,187*	55,060*	17,798*	31,093*	12,060*
0301	1,570	1,950	2,100	1,020	2,160	1,900	580
0302	1,180	780	1,290	1,270	800	1,370	370
0303	1,970	2,740	2,910	3,580	1,160	2,290	850
0304	5,900	2,930	6,470	5,760	1,990	2,290	900
0305	6,300	2,540	6,800	5,370	1,830	3,280	850
0306	8,200	8,800	10,200	7,040	1,960	6,220	3,450
0307	2,700	4,300	3,240	1,660	860	980	800
0308	2,600	2,150	2,750	895	560	980	320
0309	2,600	3,320	2,910	2,820	430	460	800
0310	1,380	2,930	6,470	895	530	1,440	420
0311	2,600	2,150	10,000	3,580	760	1,240	320
0312	3,100	3,900	11,000	3,840	760	1,830	530
0313	790	780	2,100	2,940	300	520	0
0314	2,200	1,170	3,070	3,460	270	920	530
0315	1,570	1,760	1,940	3,460	1,330	1,310	320
0316	1,570	3,900	3,720	2,300	1,260	2,490	530
0317	3,100	1,950	6,300	5,120	1,030	1,570	480
	49,330	48,050	83,270	55,010	17,990	31,090	12,050

*Data from Pgs. 34 through 40

Source: Coverdale and Colpitts Study, 1955

Appendix 4

The Coverdale and Colpitts' report summarizes the traffic passing through the downtown area without stopping as well as the traffic with downtown origins and destinations. The data was presented as a series of maps showing daily travel between two or more of the seven directions defined for O and D traffic. Traffic assignments were made by this author as a "best guess" of the roads that would actually be used. No such assignments were made in the Coverdale and Colpitts' report for the present road network. It was assumed that no through traffic would use any other downtown street.

Table 4-1

Through Traffic Trips Potential To Central Artery, Storrow Drive and Massachusetts Avenue In May 1959

							1955 Peak Hrs.		1959 Peak Hrs***	
Directions	N & SE	N & SW	NW & SE	W & SE	NE & SE SW, W, SB	All Directions	A.M.**	P.M.**	A.M.	P.M.
Total	6,296	5,717	13,017	31,112	24,557*		½ of 8.9%	½ of 9.7%		
Central Artery	6,296	5,717	0	0	12,731	24,744	1,100	1,200	1,280	1,400
Storrow Drive	0	0	0	0	11,826	11,826	525	575	610	670
Mass. Ave	0	0	13,017	0	0	13,017	580	630	675	735

*83,064 of which 31,093 O and D and 27,396 other vehicles are not potential to downtown Boston streets.

**Average of adjusted percentages from Table 7-2

***Increased by 8.81% from 1955 to 1957 and 7% from 1957 to May 1959

Source: Coverdale and Colpitts Report, Pgs. 41 through 45

Appendix 5

Comparison of 1955 Coverdale and Colpitts Report
With 1954 Boston Traffic Commission Cordon Counts

Coverdale and Colpitts Report (Annual Average Day)

O and D :	296,667
Through (In) :	68,758
Through (Out) :	68,758
	434,183

B.T.C. Cordon Counts (7:00 A.M. to 12:00 Midnight)

Inbound:	260,329
Outbound:	258,192
	518,521

Expanded To 24 Hours
518,521 X 1.10* = 570,373

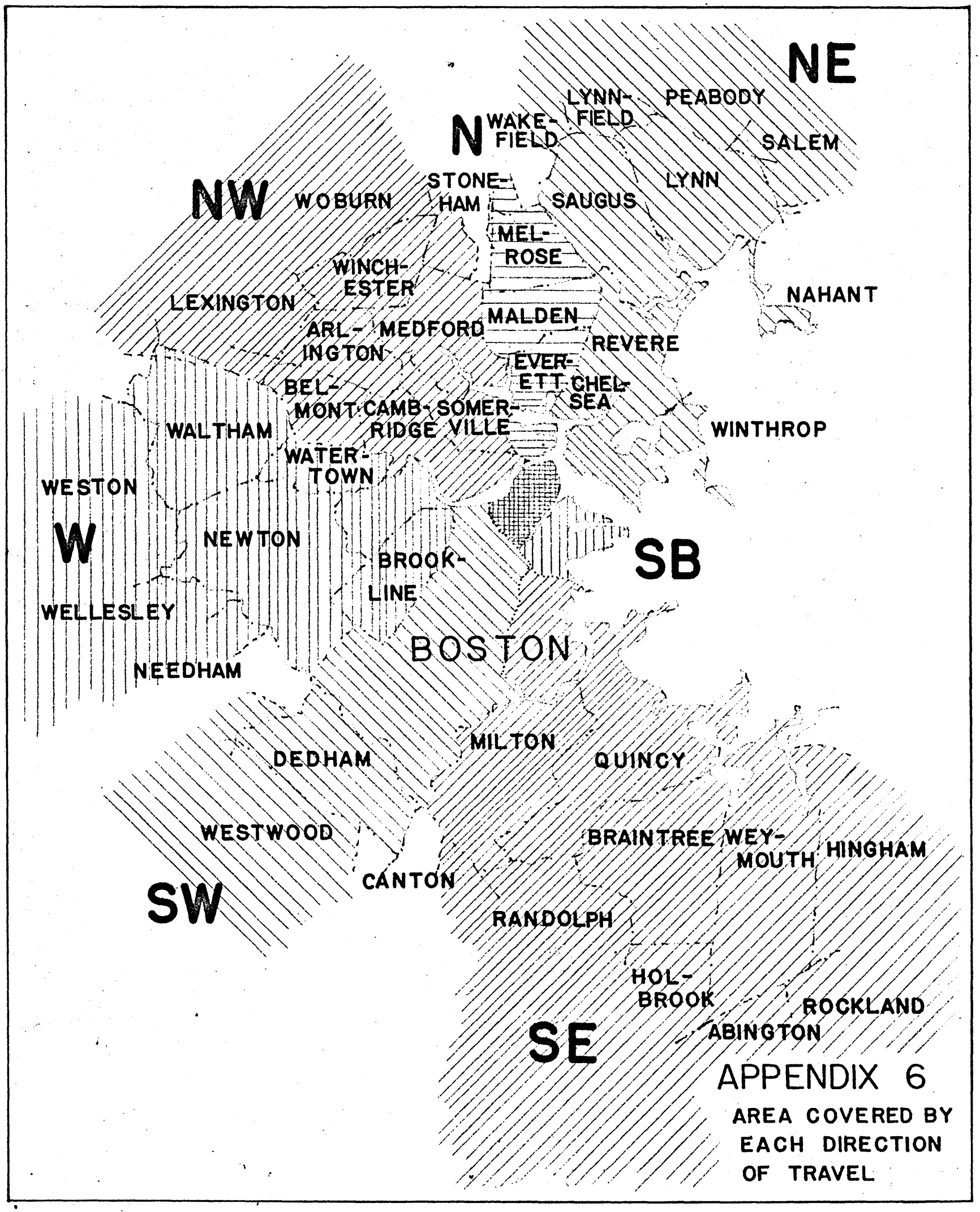
Adjusted For Annual Average Day
570,373 ÷ 1.14* = 500,328

Difference Between Two Totals

1955 Report:	434,183
1954 Counts:	500,328
	- 66,145

or 13.2% loss from B.T.C. Cordon Counts

*Thesis by Robert G. Davidson, Pg. 24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NW
W
SB
BOSTON
SW
SE
LYNN-FIELD
PEABODY
WAKE-FIELD
SALEM
LYNN
STONE-HAM
WOBURN
SAUGUS
MEL-ROSE
WINCH-ESTER
LEXINGTON
NAHANT
MALDEN
ARL-INGTON
MEDFORD
REVERE
EVER-ETT
CHEL-SEA
BEL-MONT
CAMB-RIDGE
SOMER-VILLE
WINTHROP
WALTHAM
WATER-TOWN
WESTON
NEWTON
BROOK-LINE
WELLESLEY
NEEDHAM
MILTON
DEDHAM
QUINCY
WESTWOOD
BRAINTREE
WEY-MOUTH
HINGHAM
CANTON
RANDOLPH
HOL-BROOK
ROCKLAND
ABINGTON
APPENDIX 6
AREA COVERED BY EACH DIRECTION OF TRAVEL

Appendix 7-1

7:00 to 8:00 A.M. and 8:00--9:00 A.M. Inbound Traffic As a Percent Of Total Inbound Traffic; And 5:00 to 6:00 P.M. Outbound Traffic As A Percent Of Total Outbound Traffic From 7:00 A.M. To 12:00 Midnight

Street	7:00 to 8:00 A.M.	8:00 to 9:00 A.M.	5:00 to 6:00 P.M.
Dorchester Avenue	8.23	7.7	9.7
Broadway	8.24	10.1	10.2
Dover Street	8.86	11.3	10.8
Massachusetts Ave.	8.64	10.6	10.6
Albany Street	7.91	13.2	11.8
Harrison Avenue	9.1	10.9	16.5
Washington Street	7.84	7.7	11.4
Shawmut Avenue	0 *	0 *	14.5
Tremont Street	6.84	9.2	9.0
Columbus Avenue	8.57	9.3	10.2
St. Botolph Street	5.27**	6.6**	7.2**
Huntington Avenue	4.45	9.8	11.5
St. Stephen Street	0 **	0 **	5.0**
Westland Avenue	7.23	8.1	9.0
Burbank Street	0 **	0 **	4.0**
Norway Street	6.92**	8.3**	0 *
Haviland Street	0 **	0 **	6.7**
Boylston Street	4.28	9.2	14.5
Newbury Street	3.0	3.7	9.0
Commonwealth Avenue	5.13	6.6	8.7
Marlborough Street	7.76	9.4	0 *
Beacon Street	0 *	0 *	8.9
Storrow Drive	7.7	12.6	10.6
Harvard Bridge	6.89	6.2	9.0
Longfellow Bridge	7.73	9.3	11.8
Craigie Bridge	7.72	10.3	9.8
Central Artery	NO COUNTS AVAILABLE		
Warren Ave. Bridge	CLOSED TO TRAFFIC		
Charlestown Bridge	10.52	9.5	9.9
Sumner Tunnel	8.22	7.9	10.3
Northern Avenue	8.4	9.1	8.5
Congress Street	6.12	7.7	3.1
Summer Street	6.06	7.2	6.7

*One Way Street
**Street Not Included in Traffic Assignments

Source: Boston Traffic Commission, Cordon Counts, 1954, Pgs. 20 and 21

Appendix 7-2

The 1954 Cordon Count recorded 260,329 vehicles inbound and 258,192 vehicles outbound from 7:00 A.M. to 12:00 midnight, or a total of 518,521 vehicles. Traffic engineers use a factor of 1.10 to expand these counts to a 24 hour total[1]. Upon application of this factor to the vehicle total and dividing the result by two, it was found that the average daily inbound (destination) traffic was 285,187. The average daily outbound (origin) traffic was the same. The 17 hour inbound and outbound totals were divided into this total to find the inbound (1.09) and the outbound (1.11) expansion factors. These factors are used in Table 7-1 to adjust the A.M. and P.M. peak percentages found in the Cordon Count for a 24 hour day.

Table 7-2

Number of Vehicles by Direction for 1955 A.M. and P.M. Peak Hours

Direction	1955* O or D	A.M. Peak %	÷1.09	A.M. Peak Veh.	P.M. Peak %	÷1.11	P.M. Peak Veh.
SE	24,665	10.6	9.7	2,390	11.6	10.5	2,585
SW	24,025	9.7	8.9	2,140	12.0	10.8	2,595
W	41,635	9.7	8.9	3,705	10.5	9.5	3,955
NW	27,505	10.7	9.8	2,695	10.0	9.0	2,475
N	8,995	9.5	8.7	785	9.9	8.9	800
NE	15,545	8.7	8.0	1,240	10.1	9.1	1,415
SB	6,025	9.2	8.4	525	8.3	7.5	470
				13,480			14,295

*Source: Coverdale and Colpitts, Pg. 34-40. Totals were divided by two to find number of vehicles

1 Thesis By Robert G. Davidson, Pg. 24

Appendix 7-3

Table 7-3

Number of Vehicles by Direction for 1957 A.M. and P.M. Peak Hours

Direction	1955 A.M. Peak	% Incr.	1957 A.M. Peak	1955 P.M. Peak	% Incr.	1957 P.M. Peak
SE	2,390	8.81	2,600	2,585	8.81	2,805
SW	2,140	8.81	2,330	2,595	8.81	2,825
W	3,705	8.81	4,030	3,955	8.81	4,300
NW	2,695	8.81	2,935	2,475	8.81	2,740
N	785	8.81	855	800	8.81	870
NE	1,240	8.81	1,350	1,415	8.81	1,540
SB	525	8.81	570	470	8.81	510
			14,670			15,590

Table 7-4

Estimated Number of Vehicles by Direction for May 1959 A.M. and P.M. Peak Hours

Direction	1957 A.M. Peak	% Incr.	May 1959 A.M. Peak	1957 P.M. Peak	% Incr.	May 1959 P.M. Peak
SE	2,600	7.	2,780	2,805	7.	3,000
SW	2,330	7.	2,490	2,825	7.	3,020
W	4,030	7.	4,310	4,300	7.	4,710
NW	2,935	7.	3,140	2,740	7.	2,930
N	855	7.	915	870	7.	930
NE	1,350	7.	1,445	1,540	7.	1,650
SB	570	7.	610	510	7.	545
			15,690			16,785

Appendix 8-1

Automobile Traffic As A Percent Of Total Traffic During Peak Hours

A.M. Peak Hour (8:00 to 9:00)

Automobiles:	20,683
Trucks :	3,146
Total	23,829

20,683 ÷ 23,829 = 86.2% Automobiles

P.M. Peak Hour (5:00 to 6:00)

Automobiles:	23,560
Trucks :	2,337
	25,897

23,560 ÷ 25,897 = 91% Automobiles

Source: Boston Traffic Commission, Cordon Count, 1954, Pgs. 28 and 30

Appendix 8-2

Automobile Traffic As A Percent Of Total Traffic Between 7:00 A.M. and 12:00 Midnight By Street

Street	Inbound	Outbound
Dorchester Avenue	82.6	79.2
Broadway	84.0	82.9
Dover Street	82.0	80.0
Massachusetts Avenue	83.0	84.6
Albany Street	83.6	85.4
Harrison Avenue	83.8	80.5
Washington Street	81.3	78.4
Shawmut Avenue	0 *	84.8
Tremont Street	85.0	85.0
Columbus Avenue	82.3	84.1
St. Botolph Street	93.5**	88.0**
Huntington Avenue	90.6	91.0
St. Stephen Street	0 **	88.0**
Westland Avenue	93.9	93.6
Burbank Street	0 **	88.0**
Norway Street	85.4**	0 **
Haviland Street	0 **	83.8**
Boylston Street	85.2	83.7
Newbury Street	82.2	83.3
Commonwealth Avenue	92.4	85.5
Marlborough Street	92.7	0 *
Beacon Street	0 *	88.8
Storrow Drive	99.9	99.7
Harvard Bridge	80.0	85.8
Longfellow Bridge	83.6	82.8
Craigie Bridge	87.3	87.0
Central Artery	NO COUNTS AVAILABLE	
Warren Ave. Bridge	CLOSED TO TRAFFIC	
Charlestown Bridge	67.3	80.7
Sumner Tunnel	89.7	89.4
Northern Avenue	62.7	62.6
Congress Street	67.5	52.4
Summer Street	72.6	79.5
Average	85.6	82.3

*One Way Street
**Streets Not Included in Traffic Assignments

Source: Boston Traffic Commission, Cordon Count, 1954, Pg. 19

Appendix 9

Table 9-1

Number of Autos by Direction for May 1959 A.M. Peak Hours

Direction	Ave. % By 17 Hrs.	% By Direction	Deviation (1.00=0%)	% During Peak Hr.	Peak Hr. x Dev.	Veh. in A.M. Peak	Autos in A.M. Peak
SE	85.6	83.2	0.97	86.2	83.7	2,780	2,320
SW	85.6	85.9	1.00	86.2	86.2	2,490	2,145
W	85.6	88.9	1.04	86.2	89.5	4,310	3,860
NW	85.6	87.7	1.02	86.2	88.2	3,140	2,770
N	85.6	77.3	0.90	86.2	77.5	915	710
NE	85.6	78.5	0.92	86.2	79.0	1,445	1,140
SB	85.6	73.8	0.86	86.2	74.3	610	450
							13,395

Table 9-2

Number of Autos by Direction for May 1959 P.M. Peak Hours

Direction	Ave. % By 17 Hrs.	% By Direction	Deviation (1.00=0%)	% During Peak Hr.	Peak Hr. x Dev.	Veh. in P.M. Peak	Autos in P.M. Peak
SE	82.3	82.1	1.00	91.	91.	3,000	2,730
SW	82.3	85.2	1.03	91.	94.2	3,020	2,845
W	82.3	86.0	1.04	91.	95.1	4,710	4,475
NW	82.3	88.8	1.08	91.	98.2	2,930	2,875
N	82.3	83.9	1.02	91.	91.8	930	855
NE	82.3	85.1	1.03	91.	94.1	1,650	1,550
SB	82.3	71.6	0.87	91.	79.2	545	430
							15,760

Appendix 10

Comparisons of 1956 and 1957 Peak Period Passengers Carried By Railroads

Table 10-1

Boston and Albany R.R.

Year	Annual Revenue Pass.	Peak Pass.	% Loss Over 1956
1956	2,929,784	5,000*	--
1957	2,891,500	4,900**	2%

Table 10-2

New York, New Haven and Hartford R.R.

Year	Annual Revenue Pass.	Peak Pass.	% Loss Over 1956
1956	14,443,652	13,000*	--
1957	14,101,911	12,700**	2.3%

Table 10-3

Boston and Maine R.R.

Year	Annual Revenue Pass.	Peak Pass.	% Loss Over 1956
1956	14,420,860	14,000*	--
1957	12,375,863	12,000**	14.2%

*Estimates made by Robert S. Kitchel, Jr. and supported by the Boston College Research Seminar Bureau
**Computed values

Appendix 11

Table 11-1

Percentage Distribution of Inbound and Outbound Old Colony Passengers on March 11, 1958*

Inbound Time	% Of Daily Total	Outbound Time	% Of Daily Total
12:00 M.- 7:30 A.M.	7.9	12:00 M.- 9:00 A.M.	2.8
7:30 - 8:00	18.6	9:00A.M.- 4:30 P.M.	11.4
8:00 - 9:00	61.3	4:30 - 5:00	15.3
9:00 - 9:30	1.8	5:00 - 6:00	60.0
9:30AM.- 5:00 P.M.	8.5	6:00 - 6:30	4.0
5:00PM.-12:00 M.	1.9	6:30 -12:00 M.	6.5
	100.0		100.0

Table 11-2

Comparison Of A.M. Peak Hour and P.M. Peak Hour Passengers Carried on March 11, 1958*

Peak Hour	Daily Total For Direction	% Of Daily Total	Peak Hour Pass.
8:00-9:00 A.M.	9,934	61.3	6,090
5:00-6:00 P.M.	10,192	60.0	6,120

Table 11-3

Number of New Automobiles by Direction for Peak Hour Railroad Commuters in May 1959

Direction	Peak Period Volume	Loss to May 1959	Downtown Destination	% in Peak Hour	Persons Per Auto	New Autos in Peak Hour
SE	7,227**	12%	91%	75%	1.5	2,865
SW	5,267**	12%	91%	75%	1.5	2,080
W	4,900***	12%	91%	78%	1.5	1,995
W	873****	0	91%	80%	1.5	425
NW	1,570****	0	91%	80%	1.5	760
N	2,456****	0	91%	80%	1.5	1,190
NE	2,137****	0	91%	80%	1.5	1,040
SB	0	-	-	-	0	0
						10,355

Source:

*DeLeuw, Cather and Company Report, Appendix A-Table 10

**New Haven Railroad Data for A.M.A. Survey

***Estimate for Boston and Albany Railroad

****Boston and Maine Railroad Data for A.M.A. Survey

Appendix 12-1

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 01

GBESC STUDY (ADJUSTED) = 6008

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	54	Stores X 3 Empl./Store =	162
Manufacturing	215,000	SF ÷ 225 SF/Empl. =	955
Wholesale	50,000	SF ÷ 540 SF/Empl. =	93
Warehousing	406,000	SF ÷ 5000 SF/Empl. =	81
Office		SF ÷ 203 SF/Empl. =	0
Garages (Commercial)		SF ÷ 10,000 SF/Empl. =	0
Professional		Offices X 2 Empl. Ea. =	0
Institutional			
	Massachusetts D.P.W.		2800

TOTAL EMPLOYMENT NOT COVERED BY GBESC 4091

TOTAL EMPLOYMENT FOR ZONE 10,099

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 02

GBESC STUDY (ADJUSTED) = 607

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	518	Stores X 3 Empl./Store =	1554
Manufacturing	22400	SF ÷ 225 SF/Empl. =	100
Wholesale	0	SF ÷ 540 SF/Empl. =	0
Warehousing	1,027,400	SF ÷ 5000 SF/Empl. =	206
Office	6,700	SF ÷ 203 SF/Empl. =	33
Garages (Commercial)	228,500	SF ÷ 10,000 SF/Empl. =	23
Professional	29	Offices X 2 Empl. Ea. =	58
Institutional			
Police Sta 8 (44 X $\frac{1}{2}$)			22
Hanover Fire Station			12
Boston Public Schools			45
N. Bennett St. Industrial School (Nights Only)			0
Coast Guard Station			499

TOTAL EMPLOYMENT NOT COVERED BY GBESC 2552

TOTAL EMPLOYMENT FOR ZONE 3159

Appendix 12-3

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 03

GBESC STUDY (ADJUSTED) = 9856

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail		Stores X 3 Empl./Store =	0
Manufacturing		SF ÷ 225 SF/Empl. =	0
Wholesale		SF ÷ 540 SF/Empl. =	0
Warehousing		SF ÷ 5000 SF/Empl. =	0
Office		SF ÷ 203 SF/Empl. =	0
Garages (Commercial)		SF ÷ 10,000 SF/Empl. =	0
Professional		Offices X 2 Empl. Ea. =	0
Institutional			

TOTAL EMPLOYMENT NOT COVERED BY GBESC 0

TOTAL EMPLOYMENT FOR ZONE 9856

APPENDIX 12-4

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 04

GBESC STUDY (ADJUSTED) = 54,143

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail		Stores X 3 Empl./Store	= 0
Manufacturing		SF ÷ 225 SF/Empl.	= 0
Wholesale		SF ÷ 540 SF/Empl.	= 0
Warehousing		SF ÷ 5000 SF/Empl.	= 0
Office		SF ÷ 203 SF/Empl.	= 0
Garages (Commercial)		SF ÷ 10,000 SF/Empl.	= 0
Professional		Offices X 2 Empl. Ea.	= 0
Institutional			

TOTAL EMPLOYMENT NOT COVERED BY GBESC 0

TOTAL EMPLOYMENT FOR ZONE 54,143

APPENDIX 12-5

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 05

GBESC STUDY (ADJUSTED) = 41,784

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail		Stores X 3 Empl./Store	= 0
Manufacturing		SF ÷ 225 SF/Empl.	= 0
Wholesale		SF ÷ 540 SF/Empl.	= 0
Warehousing		SF ÷ 5000 SF/Empl.	= 0
Office		SF ÷ 203 SF/Empl.	= 0
Garages (Commercial)		SF ÷ 10,000 SF/Empl.	= 0
Professional		Offices X 2 Empl. Ea.	= 0
Institutional			

TOTAL EMPLOYMENT NOT COVERED BY GBESC 0

TOTAL EMPLOYMENT FOR ZONE 41,784

Appendix 12-6

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 06

GBESC STUDY (ADJUSTED) = 30,340

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	219	Stores X 3 Empl./Store	=	657
Manufacturing	40,000	SF ÷ 225 SF/Empl.	=	178
Wholesale	0	SF ÷ 540 SF/Empl.	=	0
Warehousing	25,700	SF ÷ 5000 SF/Empl.	=	5
Office	5,000	SF ÷ 203 SF/Empl.	=	25
Garages (Commercial)	13,000	SF ÷ 10,000 SF/Empl.	=	2
Professional	19	Offices X 2 Empl. Ea.	=	38
Institutional				
Broadway Fire Sta.				19
Boston Public Schools				57
Tufts Medical and Dental Schools*				814

TOTAL EMPLOYMENT NOT COVERED BY GBESC 1795

TOTAL EMPLOYMENT FOR ZONE 32,135

*Students Only - Others Included in GBESC Study

Appendix 12-7

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 07

GBESC STUDY (ADJUSTED) = 0

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	406	Stores X 3 Empl./Store =	1218
Manufacturing	115,600	SF ÷ 225 SF/Empl. =	51
Wholesale	0	SF ÷ 540 SF/Empl. =	0
Warehousing	248,200	SF ÷ 5000 SF/Empl. =	50
Office	167,000	SF ÷ 203 SF/Empl. =	82
Garages (Commercial)	134,000	SF ÷ 10,000 SF/Empl. =	13
Professional	10	Offices X 2 Empl. Ea. =	20
Institutional			
Police Station 4 (274 X $\frac{1}{2}$)			82
Warren - Clarendon Fire Station			12
Boston Public Schools			15
Franklin Technical Inst.			353
French Shriner Shoe Co.			1500
Hub Mail Bldg.			634

TOTAL EMPLOYMENT NOT COVERED BY GBESC 4085

TOTAL EMPLOYMENT FOR ZONE 4085

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 08

GBESC STUDY (ADJUSTED) = 50

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	306	Stores X 3 Empl./Store	=	918
Manufacturing	298,800	SF ÷ 225 SF/Empl.	=	133
Wholesale	0	SF ÷ 540 SF/Empl.	=	0
Warehousing	106,400	SF ÷ 5000 SF/Empl.	=	21
Office	5,000	SF ÷ 203 SF/Empl.	=	25
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	=	0
Professional	12	Offices X 2 Empl. Ea.	=	24
Institutional				
Harrison Ave. Fire Sta.				12
Boston Public Schools				66

TOTAL EMPLOYMENT NOT COVERED BY GBESC 1199

TOTAL EMPLOYMENT FOR ZONE 1249

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 09

GBESC STUDY (ADJUSTED) = 0

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	200	Stores X 3 Empl./Store =	600
Manufacturing	0	SF ÷ 225 SF/Empl. =	0
Wholesale	0	SF ÷ 540 SF/Empl. =	0
Warehousing	35,700	SF ÷ 5000 SF/Empl. =	7
Office	3,200	SF ÷ 203 SF/Empl. =	16
Garages (Commercial)	22,000	SF ÷ 10,000 SF/Empl. =	2
Professional	41	Offices X 2 Empl. Ea. =	82
Institutional			
Boston Public Schools			27
Boston City Hospital 3,400 X $\frac{1}{2}$			1700
Mass. Memorial Hospital 700 X $\frac{1}{2}$			350

TOTAL EMPLOYMENT NOT COVERED BY GBESC 2784

TOTAL EMPLOYMENT FOR ZONE 2784

APPENDIX 12-10

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 10

GBESC STUDY (ADJUSTED) = 1342

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	257	Stores X 3 Empl./Store	= 771
Manufacturing	0	SF ÷ 225 SF/Empl.	= 0
Wholesale	22,000	SF ÷ 540 SF/Empl.	= 41
Warehousing	28,500	SF ÷ 5000 SF/Empl.	= 6
Office	17,000	SF ÷ 203 SF/Empl.	= 84
Garages (Commercial)	48,000	SF ÷ 10,000 SF/Empl.	= 5
Professional	39	Offices X 2 Empl. Ea.	= 78

Institutional

Police Sta. #16 (194 X ½)	97
Boylston Fire Station	12
Boston Public Schools	92
Bently School of Accounting	936
Boston Col. of Occ. Therapy	80
Christian Science Church Headquarters and Pub. House	2500
Sherry Biltmore Hotel*	95

*Exact Figure Not Disclosed. Hotel Vendome Has 219 Rooms With A Daytime Work Force of 100. The Sherry Biltmore Has 207 Rooms. A Proportional Work Force Was Assumed.

TOTAL EMPLOYMENT NOT COVERED BY GBESC 4797

TOTAL EMPLOYMENT FOR ZONE 6139

Appendix 12-1.1

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 11

GBESC STUDY (ADJUSTED)			= 1652
AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)			
Retail	33	Stores X 3 Empl./Store	= 99
Manufacturing	25,000	SF ÷ 225 SF/Empl.	= 111
Wholesale	0	SF ÷ 540 SF/Empl.	= 0
Warehousing	0	SF ÷ 5000 SF/Empl.	= 0
Office	86,500	SF ÷ 203 SF/Empl.	= 426
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	= 0
Professional	540	Offices X 2 Empl. Ea.	= 1080
Institutional			
Boston Public Schools			20
Private Schools* 23 X 40 Each			720
Burdett College			500
Emerson College			510
Fisher Jr. College			285
Garland School			189
Mass. Coll. of Optometry			115
Hotel Vendome			100
TOTAL EMPLOYMENT NOT COVERED BY GBESC			4155
TOTAL EMPLOYMENT FOR ZONE			5807

*5 Schools Were Telephoned. Total Varied From 35 to 50

Appendix 12-12

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 12

GBESC STUDY (ADJUSTED) = 25,833

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	60	Stores X 3 Empl./Store	=	180
Manufacturing	0	SF ÷ 225 SF/Empl.	=	0
Wholesale	23,000	SF ÷ 540 SF/Empl.	=	426
Warehousing	87,500	SF ÷ 5000 SF/Empl.	=	18
Office	0	SF ÷ 203 SF/Empl.	=	0
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	=	0
Professional	0	Offices X 2 Empl. Ea.	=	0
Institutional				
Police Dep't Hq. (424 X 3/4)				318
Hoover Motors				40

TOTAL EMPLOYMENT NOT COVERED BY GBESC 982

TOTAL EMPLOYMENT FOR ZONE 26,815

APPENDIX 12-13

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 13

GBESC STUDY (ADJUSTED) = 0

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	0	Stores X 3 Empl./Store	=	0
Manufacturing	0	SF ÷ 225 SF/Empl.	=	0
Wholesale	0	SF ÷ 540 SF/Empl.	=	0
Warehousing	0	SF ÷ 5000 SF/Empl.	=	0
Office	0	SF ÷ 203 SF/Empl.	=	0
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	=	0
Professional	0	Offices X 2 Empl. Ea.	=	0
Institutional				

TOTAL EMPLOYMENT NOT COVERED BY GBESC 0

TOTAL EMPLOYMENT FOR ZONE 0

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 14

GBESC STUDY (ADJUSTED) = 3234

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	115	Stores X 3 Empl./Store	=	345
Manufacturing	4500	SF ÷ 225 SF/Empl.	=	20
Wholesale	0	SF ÷ 540 SF/Empl.	=	0
Warehousing	0	SF ÷ 5000 SF/Empl.	=	0
Office	55000	SF ÷ 203 SF/Empl.	=	271
Garages (Commercial)	40,000	SF ÷ 10,000 SF/Empl.	=	4
Professional	41	Offices X 2 Empl. Ea.	=	82

Institutional

Mt. Vernon Fire Sta.	6
Boston Public Schools	16
Private Schools* 2 X 40	80
Carnegie Institute	190
New England College of Pharmacy	230
Portia Law School	250

TOTAL EMPLOYMENT NOT COVERED BY GBESC 1494

TOTAL EMPLOYMENT FOR ZONE 4728

*See note for Zone 0311

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 15

GBESC STUDY (ADJUSTED) = 13,719

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	114	Stores X 3 Empl./Store =	342
Manufacturing	49,000	SF ÷ 225 SF/Empl. =	218
Wholesale	0	SF ÷ 540 SF/Empl. =	0
Warehousing	16,000	SF ÷ 5000 SF/Empl. =	5
Office	4,600	SF ÷ 203 SF/Empl. =	23
Garages (Commercial)	55,000	SF ÷ 10,000 SF/Empl. =	6
Professional	12	Offices X 2 Empl. Ea. =	24
Institutional			
Police Sta. 3(129 X $\frac{1}{2}$)			65
Bowdoin Fire Station			17
Boston Public Schools			36
Industrial Technical School			370
Suffolk Univ.			1084
Boston School Committee Annex			60
TOTAL EMPLOYMENT NOT COVERED BY GBESC			2250
TOTAL EMPLOYMENT FOR ZONE			15,969

APPENDIX 12-16

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 16

GBESC STUDY (ADJUSTED) = 6027

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	0	Stores X 3 Empl./Store	= 0
Manufacturing	0	SF ÷ 225 SF/Empl.	= 0
Wholesale	0	SF ÷ 540 SF/Empl.	= 0
Warehousing	0	SF ÷ 5000 SF/Empl.	= 0
Office	0	SF ÷ 203 SF/Empl.	= 0
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	= 0
Professional	0	Offices X 2 Empl. Ea.	= 0
Institutional			

TOTAL EMPLOYMENT NOT COVERED BY GBESC 0

TOTAL EMPLOYMENT FOR ZONE 6027

APPENDIX 12-17

TOTAL EMPLOYMENT IN DOWNTOWN BOSTON BY TRAFFIC O. D. ZONES

ZONE 03 17

GBESC STUDY (ADJUSTED) = 8170

AREA OF ZONE NOT COVERED BY GBESC STUDY (ADJUSTED)

Retail	32	Stores X 3 Empl./Store	=	96
Manufacturing	0	SF ÷ 225 SF/Empl.	=	0
Wholesale	37,000	SF ÷ 540 SF/Empl.	=	68
Warehousing	10,500	SF ÷ 5000 SF/Empl.	=	2
Office	0	SF ÷ 203 SF/Empl.	=	0
Garages (Commercial)	0	SF ÷ 10,000 SF/Empl.	=	0
Professional	0	Offices X 2 Empl. Ea.	=	0
Institutional				

TOTAL EMPLOYMENT NOT COVERED BY GBESC 166

TOTAL EMPLOYMENT FOR ZONE 8336

Appendix 13

Table 13-1

Chelsea, Mass. Store Employment

Type	Number of Stores	Work Force Full & Part Time	Work Force Full Time	Workers Per Store Full & Part Time	Workers Per Store Full Time
Selected Services	208	546	489	2.62	2.35
Retail Trade	518	1,894	1,479	3.65	2.87
	726	2,440	1,968	3.36	2.71

Table 13-2

Telephone Book Listings of Professional Offices

Artist
Attorney
Bean Sprouts
Counselor
Dentist
Doctor
Dramatic Teacher
Lawyer
Obstetrician
Orthodontist
Osteopath
Piano Tuner
Physician
Psychologist
Surgeon
Tutor

Appendix 14

Table 14-1

Police Department Employment*

Station No.	O and D Zone	Total Employment
Sta. 8	0302	44
Sta. 2	0304	141
Traffic Div.	0304	168
Sta. 4	0307	204
Sta. 16	0310	194
Headquarters	0312	424
Sta. 3	0315	129
		1,304

Table 14-2

Fire Department Employment, Day Shift 8:00 A.M.-6:00 P.M.**

Station Name	O & D Zone	Engine Company No.	Men on Duty	Ladder Company No.	Men on Duty	Squad or Rescue Companies	Total Men in Station
Hanover	0302	8	1 officer 5 men	1	1 officer 5 men		12
Fort Hill	0304	25	1 officer 5 men	8	1 officer 5 men	Deputy Chief Sq. Dep.Ch.& Driver	14
Broadway	0306	26	1 officer 5 men	17	1 officer 5 men	Squad 7 1 off. & 6 men	19
Warren-Clarendon	0307	22	1 officer 5 men	13	1 officer 5 men		12
Harrison	0308	3	1 officer 5 men	3	1 officer 5 men		12
Boylston	0310	33	1 officer 5 men	15	1 officer 5 men		12
Mt. Vernon	0314	10	1 officer 5 men				6
Bowdoin	1315	4	1 officer 5 men	24	1 officer 5 men	Rescue Co. 1 off. & 4 men	17
							104

*Includes only Police Stations not in G.B.E.S.C. Study Area,
Source: Boston Police Department, Annual Report, Boston, Mass., 1956
**Source: Interview with Deputy Chief Patrick E. Collins
Boston Fire Department by Miss Helen C. Maher

Appendix 15

Boston Public School Employment

Name	O&D Zone	Teachers	Custodians	Clerical	Administrative	Total
Eliot	0302	15	2	1	0	18
Michelangelo J.H.S.	0302	19	3	2	3**	27
Lincoln	0306	35	6	1	0	42
Quincy	0306	10	1	1	3*	15
Williams	0307	9	1	1	3*	14
Franklin	0307	0	1	0	0	1
Rice	0308	40	2	1	3*	46
Bancroft	0308	8	1	1	0	10
Bates	0308	8	1	1	0	10
Dwight	0309	11	1	1	3*	13
Alcott	0309	9	1	1	3*	14
Technical H.S.	0310	65	8	2	3**	78
Perkins	0310	11	2	1	0	14
Prince	0311	14	2	1	3*	20
Faneuil	0314	10	2	1	3*	16
Blackstone J.H.S.	0315	9	3	2	1***	15
Mayhew	0315	3	1	1	0	5
Winchell	0315	10	2	1	3*	16
						374

*District Supervisor, Doctor and Nurse
**Headmaster, School Doctor and Nurse
***Headmaster

Source: Interview by the author with Assistant Superintendent Philip J. Bond, Boston School Department on March 10, 1959. Data as of March 6, 1959.

Appendix 16-1

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK) FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

SE Direction

	AUTOMOBILES			TRUCKS		
Zone	Employment	A.M. Peak	P.M. Peak	145 Truck O and D	A.M. Peak	P.M. Peak
	230,765*	2320 **	2730 **	40,030***	460 **	270 **
0301	10,099	101	119	1,410	16	10
0302	3,159	32	37	1,690	19	11
0303	9,856	99	117	5,640	65	38
0304	54,143	544	640	5,350	62	36
0305	41,784	421	494	4,510	52	30
0306	32,135	323	380	5,640	65	38
0307	4,085	41	48	2,820	32	19
0308	1,249	13	15	1,410	16	10
0309	2,784	28	33	1,410	16	10
0310	6,139	62	73	1,410	16	10
0311	5,807	58	69	1,130	13	8
0312	26,815	269	317	1,690	19	11
0313	0	0	0	0	0	0
0314	4,728	48	56	850	10	6
0315	13,619	137	162	1,130	13	8
0316	6,027	61	71	1,970	23	13
0317	8,336	84	99	1,970	23	13
		2321	2730		460	271

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

Appendix 16-2

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK)

FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

SW Direction

	AUTOMOBILES			TRUCKS		
Zone	Employment	A.M. Peak	P.M. Peak	†45 Truck O and D	A.M. Peak	P.M. Peak
	230,765*	2145 **	2845 **	40,030***	345 **	175 **
0301	10,099	94	124	1,410	12	6
0302	3,159	29	39	1,690	15	7
0303	9,856	92	122	5,640	49	25
0304	54,143	503	667	5,350	46	23
0305	41,784	388	516	4,510	39	20
0306	32,135	298	396	5,640	49	25
0307	4,085	38	50	2,820	24	12
0308	1,249	12	15	1,410	12	6
0309	2,784	26	34	1,410	12	6
0310	6,139	57	76	1,410	12	6
0311	5,807	54	72	1,130	10	5
0312	26,815	249	330	1,690	15	7
0313	0	0	0	0	0	0
0314	4,728	44	58	850	7	4
0315	13,619	126	168	1,130	10	5
0316	6,027	56	75	1,970	17	9
0317	8,336	77	103	1,970	17	9
		2143	2845		346	175

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

Appendix 16-3

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK) FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

W Direction

	AUTOMOBILES			TRUCKS		
Zone	Employment	A.M. Peak	P.M. Peak	145 Truck O and D	A.M. Peak	P.M. Peak
	230,765*	4123 **	4738 **	40,030***	450 **	235 **
0301	10,099	180	207	1,410	16	8
0302	3,159	56	65	1,690	19	10
0303	9,856	176	202	5,640	63	33
0304	54,143	967	1111	5,350	60	31
0305	41,784	747	855	4,510	51	26
0306	32,135	574	659	5,640	63	33
0307	4,085	73	84	2,820	32	17
0308	1,249	22	26	1,410	16	8
0309	2,784	50	57	1,410	16	8
0310	6,139	110	126	1,410	16	8
0311	5,807	102	119	1,130	13	7
0312	26,815	478	551	1,690	19	10
0313	0	0	0	0	0	0
0314	4,728	85	98	850	10	5
0315	13,619	243	280	1,130	13	7
0316	6,027	108	124	1,970	22	12
0317	8,336	149	171	1,970	22	12
		4120	4735		451	235

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

Appendix 16-4

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK)

FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

NW Direction

	AUTOMOBILES			TRUCKS		
Zone	Employment	A.M. Peak	P.M. Peak	145 Truck O and D	A.M. Peak	P.M. Peak
	230,765*	2770 **	2875 **	40,030***	370 **	55 **
0301	10,099	121	126	1,410	13	2
0302	3,159	38	39	1,690	16	2
0303	9,856	118	123	5,640	52	8
0304	54,143	649	675	5,350	50	7
0305	41,784	503	521	4,510	42	6
0306	32,135	386	401	5,640	52	8
0307	4,085	49	51	2,820	26	4
0308	1,249	15	16	1,410	13	2
0309	2,784	33	35	1,410	13	2
0310	6,139	74	76	1,410	13	2
0311	5,807	70	72	1,130	10	1
0312	26,815	322	334	1,690	16	2
0313	0	0	0	0	0	0
0314	4,728	57	59	850	7	1
0315	13,619	163	170	1,130	10	1
0316	6,027	72	75	1,970	18	3
0317	8,336	100	104	1,970	18	3
		2770	2877		369	54

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

Appendix 16-5

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK)

FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

N Direction

	AUTOMOBILES					TRUCKS				
Zone	Employment	A.M. Peak		P.M. Peak		†45 Truck O and D	A.M. Peak		P.M. Peak	
	230,765*	710	**	855	**	40,030***	205	**	75	**
0301	10,099	31		37		1,410	7		3	
0302	3,159	10		12		1,690	9		3	
0303	9,856	30		37		5,640	29		10	
0304	54,143	167		200		5,350	28		10	
0305	41,784	128		155		4,510	23		8	
0306	32,135	99		119		5,640	29		10	
0307	4,085	13		15		2,820	14		5	
0308	1,249	4		5		1,410	7		3	
0309	2,784	9		10		1,410	7		3	
0310	6,139	19		23		1,410	7		3	
0311	5,807	18		22		1,130	6		2	
0312	26,815	82		99		1,690	9		3	
0313	0	0		0		0	0		0	
0314	4,728	14		18		850	4		2	
0315	13,619	42		50		1,130	6		2	
0316	6,027	19		22		1,970	10		4	
0317	8,336	26		31		1,970	10		4	
		711		855			205		75	

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK) FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

NE Direction

	AUTOMOBILES			TRUCKS		
Zone	Employment	A.M. Peak	P.M. Peak	145 Truck O and D	A.M. Peak	P.M. Peak
	230,765*	1140 **	1550 **	40,030***	305 **	100 **
0301	10,099	50	68	1,410	11	4
0302	3,159	16	21	1,690	13	4
0303	9,856	49	66	5,640	43	14
0304	54,143	267	364	5,350	41	13
0305	41,784	206	281	4,510	34	11
0306	32,135	159	216	5,640	43	14
0307	4,085	20	27	2,820	21	7
0308	1,249	6	8	1,410	11	4
0309	2,784	14	19	1,410	11	4
0310	6,139	30	41	1,410	11	4
0311	5,807	29	39	1,130	9	2
0312	26,815	132	180	1,690	13	3
0313	0	0	0	0	0	0
0314	4,728	23	32	850	6	2
0315	13,619	67	91	1,130	9	2
0316	6,027	30	40	1,970	15	5
0317	8,336	41	56	1,970	15	5
		1139	1549		306	98

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

TRAVEL TO EACH ZONE (A.M. PEAK) AND FROM EACH ZONE (P.M. PEAK) FOR BOTH AUTOMOBILES AND TRUCKS IN 1959

SB Direction

	AUTOMOBILES					TRUCKS				
Zone	Employment	A.M. Peak		P.M. Peak		145 Truck O and D	A.M. Peak		P.M. Peak	
	230,765*	450	**	430	**	40,030***	160	**	115	**
0301	10,099	20		19		1,410	6		4	
0302	3,159	6		6		1,690	7		5	
0303	9,856	19		18		5,640	22		16	
0304	54,143	105		101		5,350	21		15	
0305	41,784	82		78		4,510	18		13	
0306	32,135	63		60		5,640	22		16	
0307	4,085	8		8		2,820	11		8	
0308	1,249	2		2		1,410	6		4	
0309	2,784	5		5		1,410	6		4	
0310	6,139	12		11		1,410	6		4	
0311	5,807	11		11		1,130	5		3	
0312	26,815	52		50		1,690	7		5	
0313	0	0		0		0	0		0	
0314	4,728	9		9		850	3		2	
0315	13,619	27		25		1,130	5		3	
0316	6,027	12		11		1,970	8		6	
0317	8,336	16		16		1,970	8		6	
		449		430			161		114	

*Data from Appendicies 12-1 through 12-17
**Data from Table 2
***Data from Maguire Report, Pgs. 33 and 115

Appendix 16-8

Number of Automobiles in Present May 1959 A.M. and P.M. Peak Hours by Zones from all Directions

Zone	A.M. Peak		P.M. Peak	
	Autos	Trucks	Autos	Trucks
	13,658*	2,295*	16,023*	1,025*
0301	597	81	700	37.
0302	187	98	219	42
0303	583	323	685	144
0304	3,202	308	3,758	135
0305	2,475	259	2,900	114
0306	1,902	323	2,231	144
0307	242	160	283	72
0308	74	81	87	37
0309	165	81	193	37
0310	364	81	426	37
0311	342	66	404	28
0312	1,584	98	1,861	41
0313	0	0	0	0
0314	280	47	330	22
0315	805	66	946	28
0316	358	113	418	52
0317	493	113	580	52
	13,653	2,298	16,021	1,022

*Data from Table 2

Appendix 17-1

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

SE Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 2865 **	P.M. Peak Hour 2865 **
0301	1.29	34	34
0302	0	0	0
0303	0	0	0
0304	49.9	1430	1430
0305	17.35	497	497
0306	14.35	411	411
0307	0	0	0
0308	0	0	0
0309	0	0	0
0310	0	0	0
0311	2.36	68	68
0312	4.87	141	141
0313	0	0	0
0314	3.33	95	95
0315	1.78	51	51
0316	4.77	137	137
0317	0	0	0
	100.00	2,864	2,864

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

SW Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 2080	**	P.M. Peak Hour 2080	**
0301	1.29	27		27	
0302	0	0		0	
0303	0	0		0	
0304	49.9	1038		1038	
0305	17.35	361		361	
0306	14.35	298		298	
0307	0	0		0	
0308	0	0		0	
0309	0	0		0	
0310	0	0		0	
0311	2.36	49		49	
0312	4.87	102		102	
0313	0	0		0	
0314	3.33	69		69	
0315	1.78	37		37	
0316	4.77	99		99	
0317	0	0		0	
	100.00	2080		2080	

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

W Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 2420 **	P.M. Peak Hour 2420 **
0301	1.29	31	31
0302	0	0	0
0303	0	0	0
0304	49.9	1208	1208
0305	17.35	419	419
0306	14.35	347	347
0307	0	0	0
0308	0	0	0
0309	0	0	0
0310	0	0	0
0311	2.36	57	57
0312	4.87	118	118
0313	0	0	0
0314	3.33	81	81
0315	1.78	43	43
0316	4.77	115	115
0317	0	0	0
	100.00	2,419	2,419

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

NW Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 760 **	P.M. Peak Hour 760 **
0301	1.29	10	10
0302	0	0	0
0303	0	0	0
0304	49.9	379	379
0305	17.35	132	132
0306	14.35	109	109
0307	0	0	0
0308	0	0	0
0309	0	0	0
0310	0	0	0
0311	2.36	18	18
0312	4.87	37	37
0313	0	0	0
0314	3.33	26	26
0315	1.78	14	14
0316	4.77	36	36
0317	0	0	0
	100.00	761	761

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

Appendix 17-5

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

N Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 1190 **	P.M. Peak Hour 1190 **
0301	1.29	15	15
0302	0	0	0
0303	0	0	0
0304	49.9	595	595
0305	17.35	206	206
0306	14.35	171	171
0307	0	0	0
0308	0	0	0
0309	0	0	0
0310	0	0	0
0311	2.36	28	28
0312	4.87	58	58
0313	0	0	0
0314	3.33	40	40
0315	1.78	21	21
0316	4.77	57	57
0317	0	0	0
	100.00	1,191	1,191

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

NE Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 1040 **	P.M. Peak Hour 1040 **
0301	1.29	13	13
0302	0	0	0
0303	0	0	0
0304	49.9	518	518
0305	17.35	180	180
0306	14.35	148	148
0307	0	0	0
0308	0	0	0
0309	0	0	0
0310	0	0	0
0311	2.36	25	25
0312	4.87	51	51
0313	0	0	0
0314	3.33	35	35
0315	1.78	18	18
0316	4.77	50	50
0317	0	0	0
	100.00	1,038	1,038

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

Appendix 17-7

TRAVEL TO EACH ZONE (A.M. PEAK HOUR) AND FROM EACH ZONE (P.M. PEAK HOUR)

FOR NEW AUTOMOBILES IN 1959

SB Direction

Zone	Peak Hour Percentage 100%*	A.M. Peak Hour 0	**	P.M. Peak Hour 0	**
0301	1.29	0		0	
0302	0	0		0	
0303	0	0		0	
0304	49.9	0		0	
0305	17.35	0		0	
0306	14.35	0		0	
0307	0	0		0	
0308	0	0		0	
0309	0	0		0	
0310	0	0		0	
0311	2.36	0		0	
0312	4.87	0		0	
0313	0	0		0	
0314	3.33	0		0	
0315	1.78	0		0	
0316	4.77	0		0	
0317	0	0		0	
	100.00	0		0	

*Zones with less than 1% of daily Old Colony destinations neglected and remainder proportionately increased to total 100%

**Data from Table 3

Appendix 17-8

Travel To Each Zone (A.M. Peak Hour) and From Each Zone (P.M. Peak Hour) For New Automobiles in 1959 For All Directions

Zone	A.M. Peak Hour		P.M. Peak Hour	
	10,355	**	10,355	**
0301	130		130	
0302	0		0	
0303	0		0	
0304	5,168		5,168	
0305	1,795		1,795	
0306	1,484		1,484	
0307	0		0	
0308	0		0	
0309	0		0	
0310	0		0	
0311	245		245	
0312	507		507	
0313	0		0	
0314	346		346	
0315	184		184	
0316	494		494	
0317	0		0	
	10,353		10,353	

**Data from Table 3

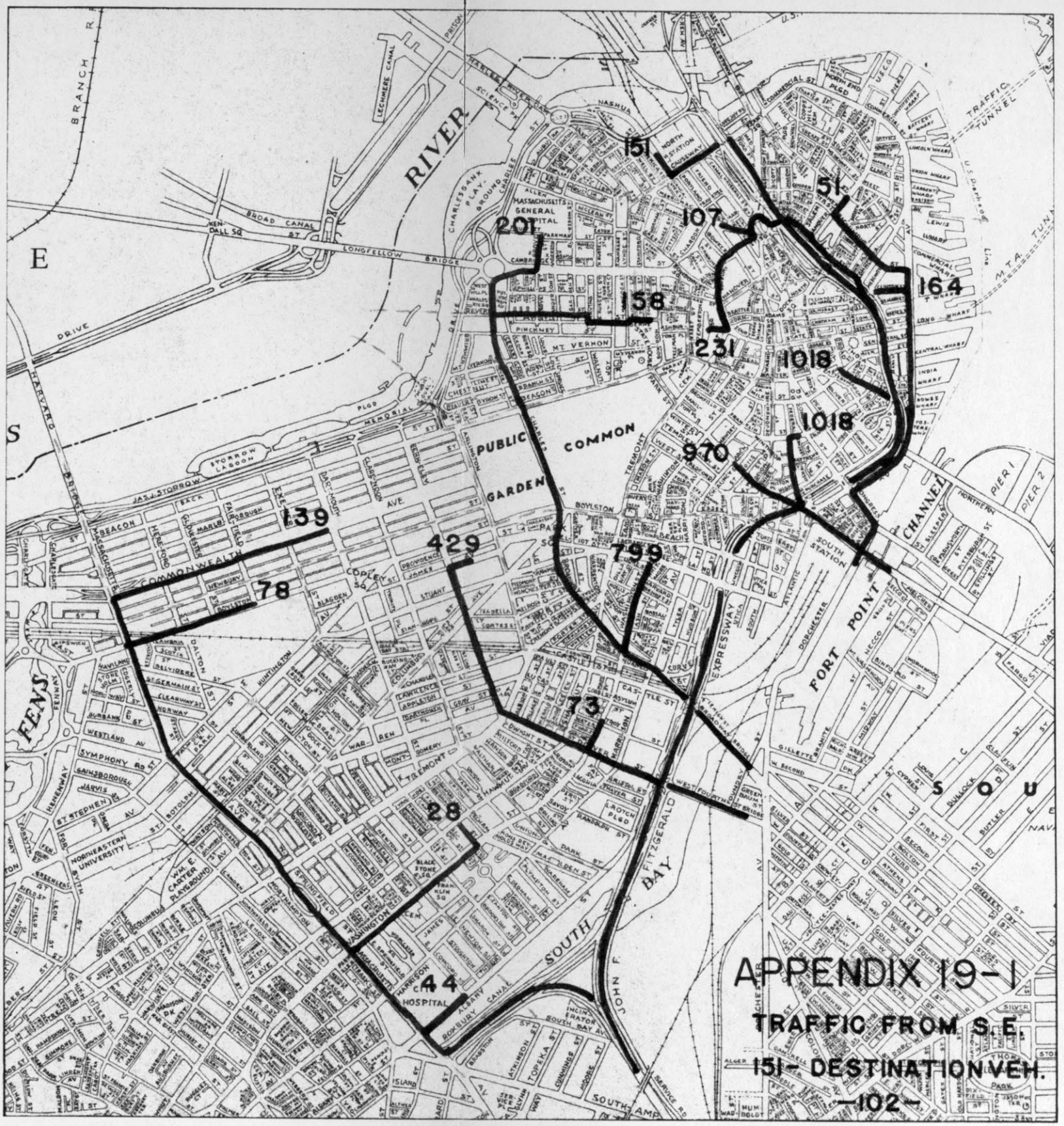
Appendix 18

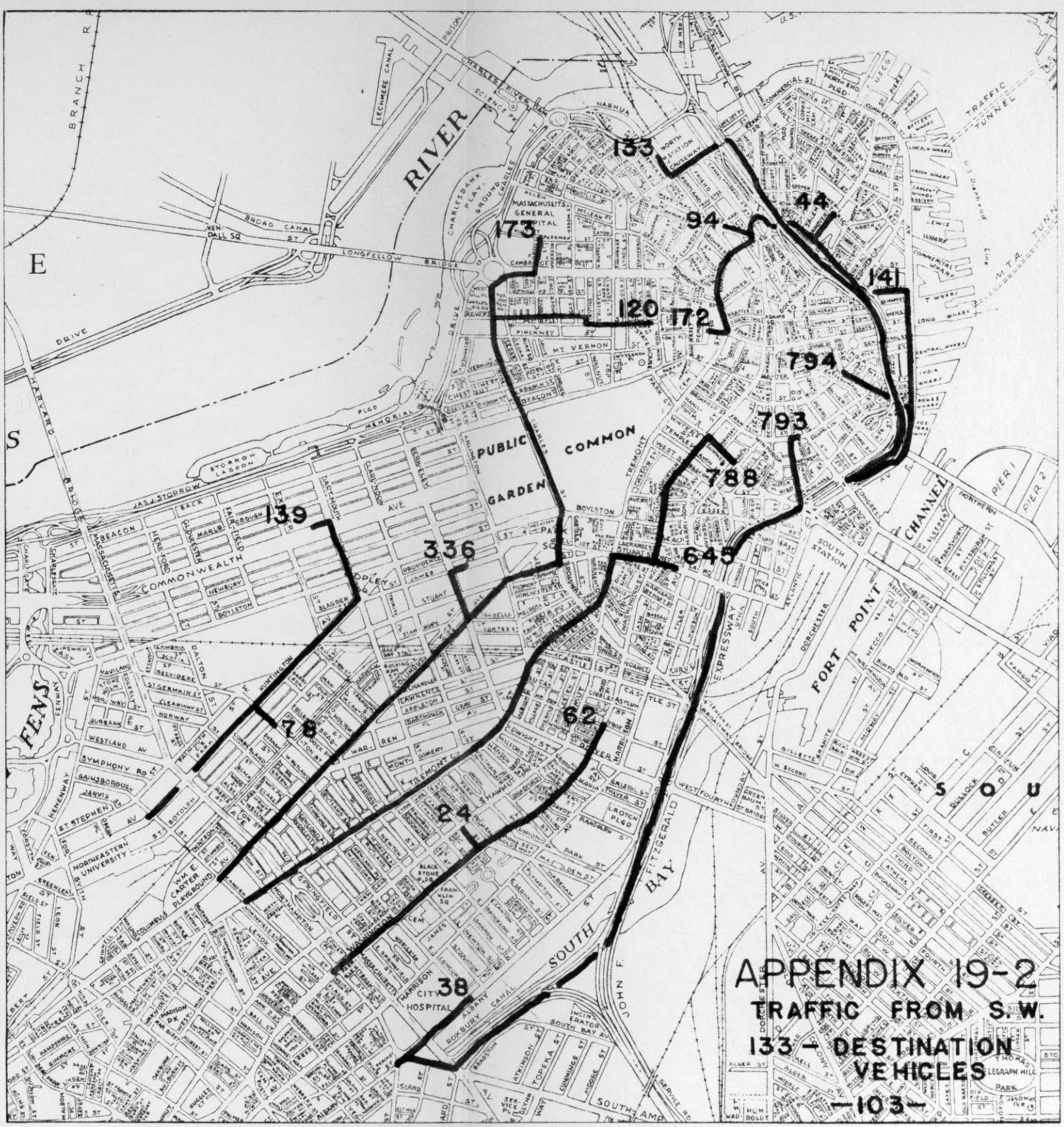
A.M. Peak Hour Entering And P.M. Peak Exiting Traffic Volumes By Streets In 1954

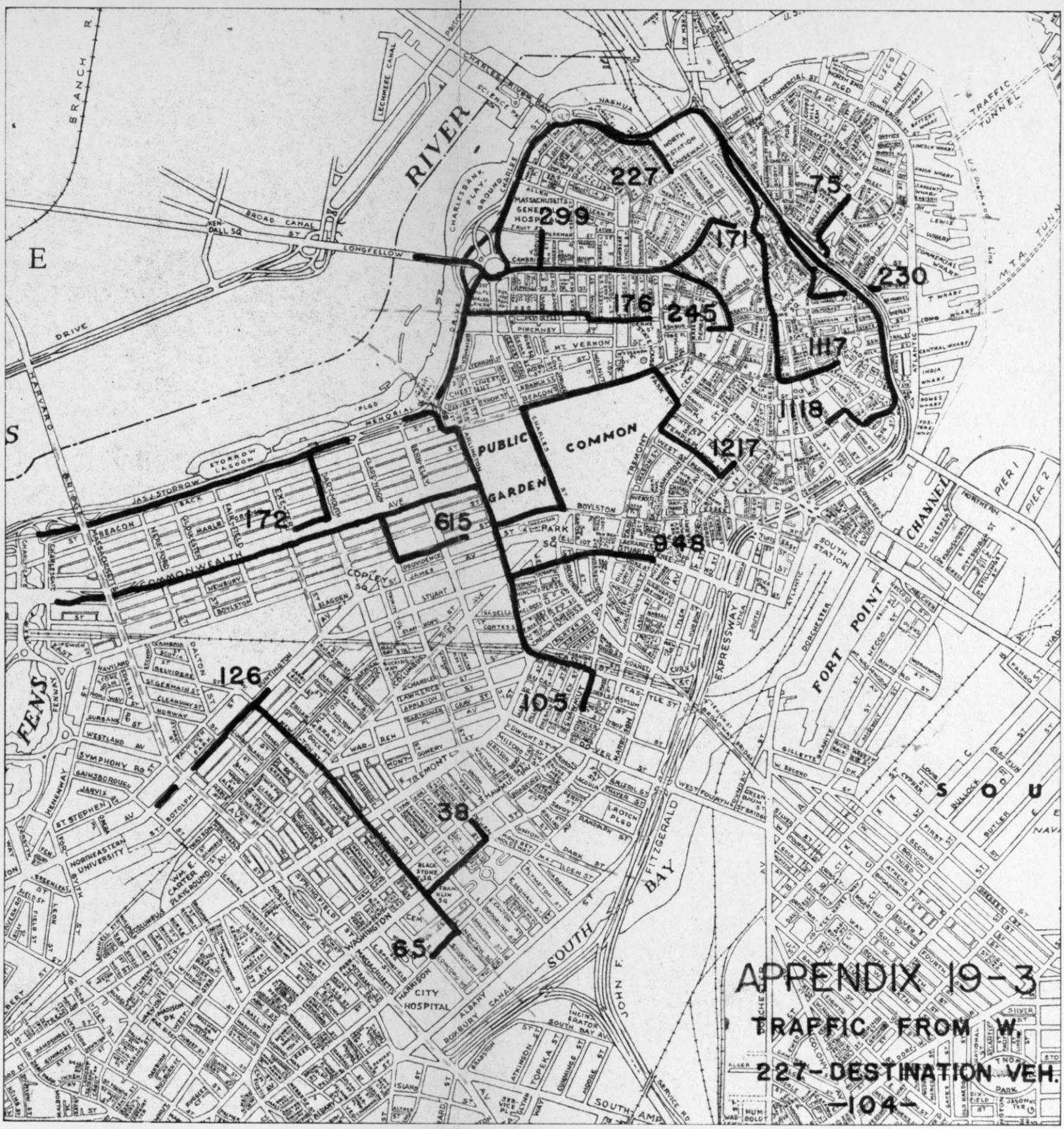
Street	ENTERING A.M. Peak Hour	Highest Hour	EXITING P.M. Peak Hour	Highest Hour
Dorchester Avenue	881	912	1,319	1,474
Broadway	865	865	785	812
Dover Street	718	718	503	540
Massachusetts Ave.	1,487**	1,488**	1,472**	1,472**
Albany Street	1,006	1,006	843	843
Harrison Avenue	394	394	1,117	1,117
Washington Street	751	619	386	386
Shawmut Avenue	0*	0*	787	787
Tremont Street	636	636	515	571
Columbus Avenue	1,046	1,165	912	912
St. Botolph Street	82**	103**	100**	131**
Huntington Avenue	1,229	1,275	1,369	1,369
St. Stephen Street	0*	0*	73**	175**
Westland Avenue	572	572	429	448
Burbank Street	0*	0*	27**	119**
Norway Street	200**	236**	0*	0*
Haviland Street	0*	0*	119**	160**
Boylston Street	551	577	672	672
Newbury Street	64	184	99	132
Commonwealth Avenue	1,264	1,556	1,020	1,540
Marlborough Street	256	265	0*	0*
Beacon Street	0*	0*	1,528	1,528
Storrow Drive	3,142	3,142	2,744	2,744
Harvard Bridge	1,165	1,474	1,703	1,703
Longfellow Bridge	986	1,027	1,494	1,494
Craigie Bridge	2,164	2,164	1,947	1,948
Central Artery	NO COUNTS AVAILABLE			
Warren Ave. Bridge	CLOSED TO TRAFFIC			
Charlestown Bridge	986	1,100	1,867	1,947
Sumner Tunnel	1,136	1,260	1,596	1,596
Northern Avenue	635	1,030	541	1,144
Congress Street	381	820	60	247
Summer Street	740	1,062	571	1,082
	20,196	30,104	23,066	33,898

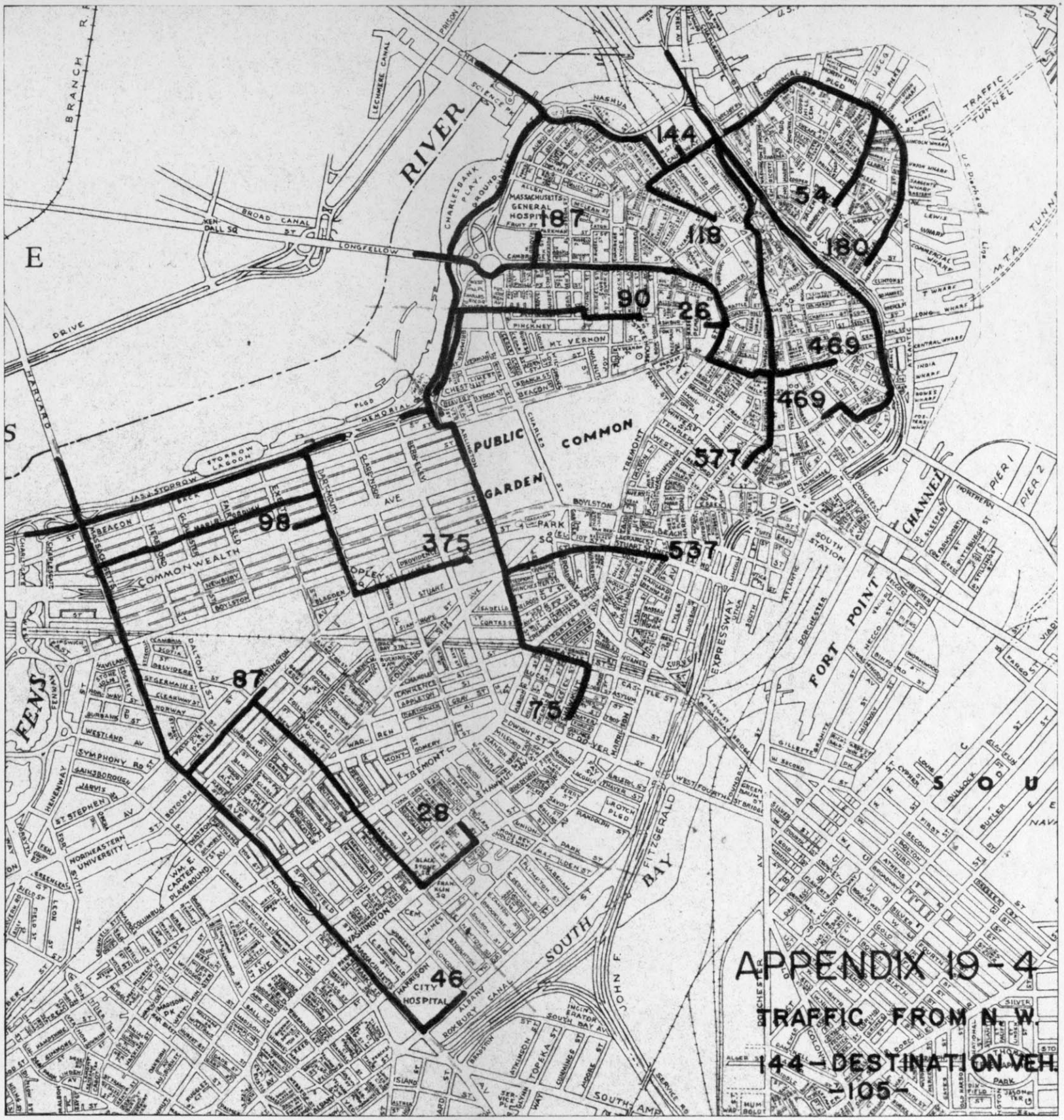
*One way street
**Street not included in totals

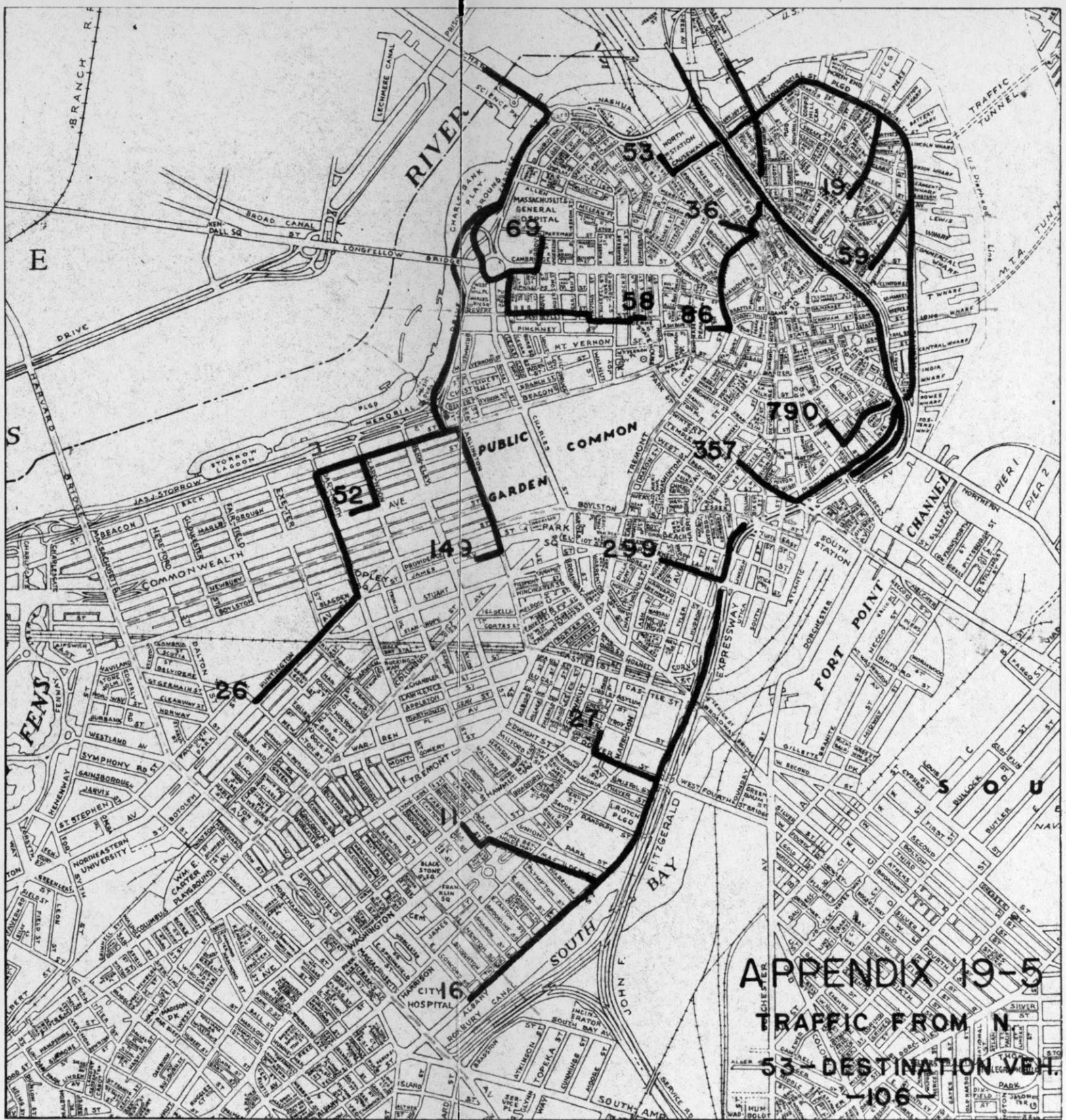
Source: Boston Traffic Commission, Cordon Counts, 1954, Pgs. 20 and 21

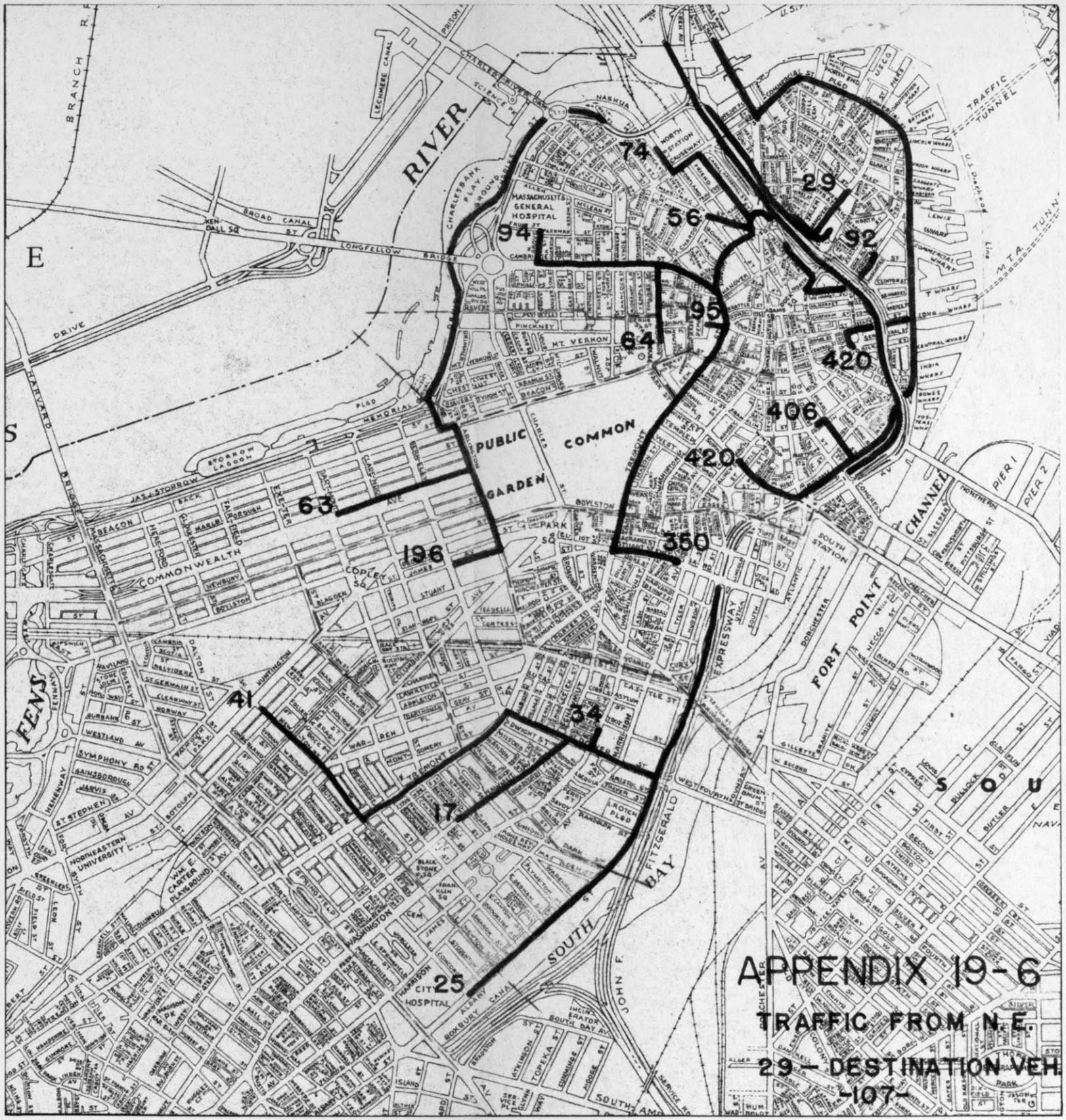

151
51
107
201
164
158
231
1018
1018
970
139
429
799
78
73
28
44
APPENDIX 19-1
TRAFFIC FROM S.E.
151- DESTINATION VEH.
-102-

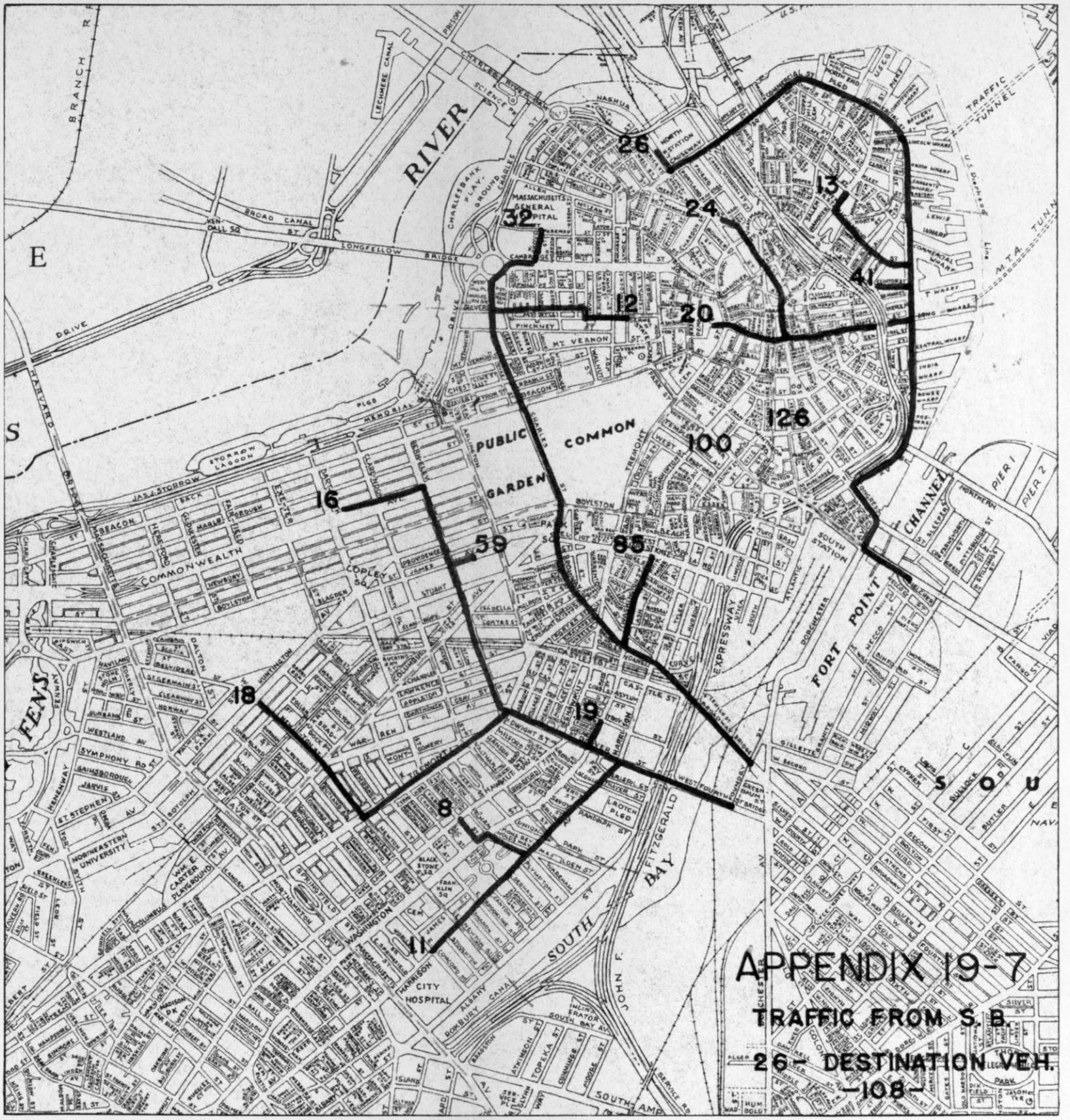

133
44
94
173
141
120
172
794
793
788
645
139
336
78
62
24
38
APPENDIX 19-2
TRAFFIC FROM S.W.
133 - DESTINATION
VEHICLES
-103-


227
75
299
171
230
76
245
1117
1118
1217
615
948
172
126
105
38
65
PUBLIC GARDEN
COMMON
FORT POINT CHANNEL
SOUTH BAY
FITZGERALD EXPRESSWAY
CITY HOSPITAL
FENS
RIVER
APPENDIX 19-3
TRAFFIC FROM W.
227-DESTINATION VEH.
-104-


144
54
187
119
180
90
26
469
469
577
537
98
375
87
75
28
46
APPENDIX 19-4
TRAFFIC FROM N.W.
144-DESTINATION VEH.


APPENDIX 19-5
TRAFFIC FROM N.
53-DESTINATION VEH.
53
36
19
69
59
58
86
790
357
52
149
299
26
27
11
16
RIVER
PUBLIC GARDEN
COMMON
COMMONWEALTH
FORT POINT
CHANNEL
SOUTH BAY
FITZGERALD
EXPRESSWAY
TRAFFIC TUNNEL
MASSACHUSETTS GENERAL HOSPITAL
HARRISON CITY HOSPITAL
NORTHEASTERN UNIVERSITY
WM. E. CARTER PLAYGROUND
CHARLES BANK PLAY-GROUND
LONGFELLOW BRIDGE
HARVARD BRIDGE
BROAD CANAL
DRIVE
MEMORIAL
PARK
BOYLSTON
BEACON
TREMONT
SOUTH STATION
NORTH STATION
MT VERNON
PINCKNEY
NASHUA
DALTON
HUNTINGTON
FENWAY
SYMPHONY RD
GAINSBOROUGH
ST STEPHEN
WESTLAND AV
MASSACHUSETTS
ARLINGTON
BERKELEY
CLARENDON
DARTMOUTH
EXETER
FAIRFIELD
HEREFORD
GLOUCESTER
HEMENWAY
NEWBURY
STUART
PROVIDENCE
JAMES
BLADEN
OPLEY
PIER 1
PIER 2
NORTHERN
SOUTH
ALBANY
ATKINSON
TOPEKA
SOUTH AMP


74
29
56
92
94
95
64
420
406
420
63
196
350
41
34
17
25
PUBLIC GARDEN
COMMON
RIVER
CHARLES
BOSTON
COMMONWEALTH
FENS
FORT POINT
CHANNEL
SOUTH BAY
MASSACHUSETTS GENERAL HOSPITAL
CITY HOSPITAL
NORTHEASTERN UNIVERSITY
SOUTH STATION
TRAFFIC TUNNEL
M.T.A.
BROAD CANAL
LONGFELLOW BRIDGE
HARVARD BRIDGE
JAS. J. STORROW LAGOON
CHARLESBANK PLAY-GROUND
WM. E. CARTER PLAYGROUND
BOSTON COMMON
PARK SQ.
COPLEY SQ.
BEACON
BOYLSTON
PINCKNEY
MT. VERNON
NASHUA
NORTH STATION CAUSEWAY
MEMORIAL DRIVE
SOUTH
FITZGERALD
JOHN F.
PIER 1
PIER 2
APPENDIX 19-6
TRAFFIC FROM N.E.
29 – DESTINATION VEH.


26
13
24
32
41
12
20
126
100
16
59
85
18
19
8
11
APPENDIX 19-7
TRAFFIC FROM S. B.
26 - DESTINATION VEH.
-108-

Appendix 20

Calculation Of Maximum Traffic Volume Per Street Lane During A.M. Peak Hour By Greenshields Method

Assumptions:
Fixed Time Signal (60 Seconds)
Equal Division Of Green Time Between Each Direction (27 Seconds)

Dr. Greenshields found that the time interval between vehicles crossing an intersection which had been stopped at the intersection varied from 3.8 seconds for the first vehicle to cross the intersection to 2.1 seconds between the fifth and sixth vehicles. The interval was:

First vehicle,	3.8 seconds
Second "	3.1 "
Third "	2.7 "
Fourth "	2.4 "
Fifth "	2.2 "
Sixth and later	2.1 "

In the 27 seconds allotted 11 vehicles can pass through the intersection. As there are 60 cycles per hour, a total of 660 vehicles can pass thru the intersection per lane of travel.

Appendix 21

Present Parking Facilities by O and D Zone

Zone	On Street		Off Street			Total	Total
	Illegal	Legal	Garage	Lot	Total	Legal	Spaces
0301	132	43	0	775	775	818	950
0302	195	87	1,560	718	2,278	2,365	2,560
0303	273	123	0	758	758	981	1,154
0304	378	438	3,335	901	4,236	4,674	5,052
0305	178	211	2,146	844	2,200	2,411	2,589
0306	280	434	3,281	2,967	6,248	6,482	6,962
0307	*	*	*	*	*	*	*
0308	*	*	*	*	*	*	*
0309	*	*	*	*	*	*	*
0310	400**	952**	815	819	1,634	2,186	2,586
0311	179	1,468	400***	0	400	1,868	2,047
0312	368	529	700	568	1,268	1,815	2,183
0313	59	276	0	0	0	276	335
0314	477	503	100****	164	264	767	1,244
0315	384	252	400#	2,772@	3,172	3,414	3,798&
0316	140	264	800	535	1,335	1,599	1,739&
0317	214	384	706	1,192	1,898	2,282	2,496
					26,466	31,938	35,695

*Not surveyed (about 3000 total spaces)
**431 illegal and 338 legal street spaces not included
***476 in private garages not included
****535 in private garages not included
#69 in private garages not included
@2,010 in redeveloped West End included
&700 garage and 143 street spaces in Bowdoin Square included in Zone 16

Appendix 22-1
Table 22-1
Number of Vehicles by Direction for May 1959, 7:00-8:00 A.M.

Direction	1955* Vehicles	7:00-8:00 A.M. %	÷ 1.09*	1955 7-8 A.M. Vehicles	% Incr.* 1955-59	1959 7-8 A.M. Vehicles
SE	24,665	8.50	7.8	1,925	16.3	2,240
SW	24,025	7.03	6.45	1,550	16.3	1,805
W	41,635	6.02	5.52	2,340	16.3	2,725
NW	27,505	7.51	6.89	1,920	16.3	2,230
N	8,995	9.12	8.36	585	16.3	680
NE	15,545	9.37	7.59	1,180	16.3	1,370
SB	6,025	7.54	6.92	415	16.3	485
						11,535

*Data from Tables 7-2, 7-3 and 7-4

Table 22-2

Number of Automobiles by Direction for May 1959, 7:00 to 8:00 A.M.

Direction	Ave. % by 17 Hrs.	% by Direction	Deviation (1.00=0%)	% During 7-8 A.M.	7-8 A.M. x deviation	7-8 A.M. Vehicles	Autos in 7-8 A.M.
SE	85.6	83.2	0.97	88.7	86.0	2,240	1,930
SW	85.6	85.9	1.00	88.7	88.7	1,805	1,600
W	85.6	88.9	1.04	88.7	92.3	2,725	2,515
NW	85.6	87.7	1.02	88.7	90.5	2,230	2,020
N	85.6	77.3	0.90	88.7	79.8	680	545
NE	85.6	78.5	0.92	88.7	81.6	1,370	1,120
SB	85.6	73.8	0.86	88.7	76.2	485	370
							10,100

Table 22-3

Number of New Automobiles by Direction for 7:30 to 8:00 A.M. Railroad Commuters in May 1959

Direction	Peak Hour Autos	% of Peak Hour Autos	New Autos in Peak Hour
SE	2,865	28.2	807
SW	2,080	28.2	587
W	1,995	28.2	563
W	425	28.2	120
NW	760	28.2	214
N	1,190	28.2	336
NE	1,040	28.2	294
SB	0	-	0
			2,921

Appendix 22-2

Table 22-4

Present And New Commuter Automobiles To Each Zone From All Directions

Zone	Present Automobiles 7:30 to 8:00 A.M.	Present Automobiles Total Present Autos	New Automobiles 7:30 to 8:00 A.M.	New Automobiles Total New Autos	Total Autos
	10,100*		2,921**	13,276	
0301	442	1,039	38	168	1,207
0302	138	325	0	0	325
0303	432	1,015	0	0	1,015
0304	2,365	5,567	1,460	6,628	12,195
0305	1,830	4,305	507	2,302	6,607
0306	1,408	3,310	411	1,895	5,250
0307	179	421	0	0	421
0308	55	129	0	0	129
0309	122	287	0	0	286
0310	268	632	0	0	623
0311	254	596	69	314	910
0312	1,170	2,754	142	649	3,403
0313	0	0	0	0	0
0314	207	487	97	443	930
0315	596	1,401	52	236	1,637
0316	264	622	139	633	1,255
0317	364	857	0	0	857
	10,094	23,747	2,915	13,268	37,015

*Data from Table 22-2
**Data From Table 22-3

Appendix 23

Comparison Of The Total Number of Commuter Automobiles And Available Parking Spaces

Zone	Commuter Automobiles	Available Parking Spaces	Deficit
0301	1,207	808	399
0302	325	2,294	
0303	1,015	966	49
0304	12,194	4,660	7,534
0305	6,607	2,411	4,196
0306	5,205	6,456	
0307	421	*	
0308	129	*	
0309	287	*	
0310	632	2,186	
0311	910	1,679	
0312	3,403	1,770	1,633
0313	0	260	
0314	930	767	163
0315	1,637	3,363	
0316	1,255	1,580	
0317	857	2,263	

*Not surveyed

Appendix 24

Non - Commuter Automobiles In 1955 By Zone

Zone	Total Vehicles	Trucks*	1955 Commuter Autos**	Other Autos
0301	5,640	765	930	3,945
0302	3,520	920	290	2,310
0303	7,750	3,060	908	3,782
0304	13,120	2,900	4,989	5,531
0305	13,485	2,445	3,845	7,190
0306	22,935	3,060	2,956	16,919
0307	7,270	1,530	376	5,364
0308	5,128	765	115	4,148
0309	6,670	765	256	5,649
0310	7,032	765	565	5,702
0311	10,325	615	534	9,176
0312	12,480	920	2,467	8,093
0313	3,715	0	0	3,715
0314	5,810	460	435	4,915
0315	5,845	615	1,200	4,030
0316	7,885	1,070	555	6,260
0317	9,775	1,070	767	7,935

*14.4% of total vehicles distributed as in Appendix 16
**85.6% of vehicle totals in 1955 from Tables 7-2 and 22-1 distributed proportionatly by zone employment totals

Appendix 25

Shopper Automobiles By Zone in 1955

Zone	Dwelling Units	Owner Autos	Non-Commuter Autos**	Shopper Autos
	30,552*	24,700		
0301	145	117	3,945	3,828
0302	4,300	3,480	2,320	***
0303	189	153	3,782	3,629
0304	15	12	5,531	5,519
0305	16	13	7,910	7,897
0306	1,407	1,138	16,919	15,781
0307	2,819	2,275	5,364	3,089
0308	3,175	2,565	4,148	1,583
0309	3,602	2,915	5,649	2,734
0310	2,564	2,075	5,702	3,627
0311	3,828	3,100	9,176	6,076
0312	927	750	8,093	7,343
0313	0	0	3,715	3,715
0314	1,997	1,618	4,915	3,297
0315	4,804	3,880	4,030	150
0316	70	57	6,260	6,203
0317	694	562	7,935	7,373
		24,710	105,394	81,844

*Data from U. S. Census, 1950
**Data from Appendix 24
***This assumption of persons per auto does not apply in this zone but no known correction can be applied

Appendix 26-1

Comparison of Maguire and Coverdale and Colpitts
Studies of Average Daily O and D Traffic From All Directions By Zone

Zone	Maguire	Coverdale & Colpitts	Growth Factor
	147,925*	296,667**	
0301	6,720	11,280	1.68
0302	4,130	7,060	1.71
0303	11,060	15,500	1.40
0304	19,930	26,240	1.32
0305	16,950	26,970	1.55
0306	26,860	45,870	1.71
0307	5,320	14,540	2.74
0308	4,060	10,255	2.53
0309	4,260	13,340	3.13
0310	4,000	14,065	3.52
0311	8,940	20,650	2.31
0312	11,980	24,960	2.08
0313	820	7,430	9.07
0314	5,060	11,620	2.30
0315	6,320	11,690	1.85
0316	6,610	15,770	2.39
0317	5,010	19,550	3.91
	148,030	296,790	2.01

*Data From Maguire Report, Pgs. 35 through 41.
**Data From Coverdale and Colpitts Report, Pgs. 34 through 40.

Appendix 26-2

Table 26-2

Comparison Of Maguire and Coverdale and Colpitts Estimated Traffic Volumes By Directions To and From All Downtown Boston Zones

Direction	Maguire	Coverdale & Colpitts	Growth Factor
SE	25,002	59,714*	2.39
SW	19,433	37,955*	1.95
W	42,127	83,187	1.97
NW	29,688	55,060	1.86
N	9,999	17,798	1.78
NE	13,581	31,093	2.29
SB	8,095	12,060	1.49
	147,925	296,667	2.01

*Roxbury totals deleted from SW totals and added to SE totals for comparison

Table 26-3

Estimated Adjusted Shopper Traffic For 1955 By Zone

Zone	Shopper Autos*	Adjustment	Adjusted Shopper Autos
0301	3,828		3,828
0302	500**		500
0303	3,629		3,629
0304	5,519		5,519
0305	7,897	+565	8,462
0306	15,781	+1125	16,906
0307	3,089		3,089
0308	1,583		1,583
0309	2,734		2,734
0310	3,627		3,627
0311	6,076	+435	6,511
0312	7,343	+525	7,868
0313	3,715	-2,891	824
0314	3,297	+436	3,733
0315	1,150**		1,150
0316	6,203		6,203
0317	7,373		7,373

*Data from Appendix 25
**Adjustment made for error in assumptions

Appendix 27

Table 27-1

Number of New Automobiles By Direction For Shoppers Using Railroads in May 1959

Direction	Peak Hour Passengers*	%Shoppers	Persons Per Auto	New Shopper Autos
SE	4,597	16.8%	1.65	467
SW	3,120	16.8%	1.65	318
W	2,993	16.8%	1.65	305
W	637	16.8%	1.65	65
NW	1,140	16.8%	1.65	116
N	1,785	16.8%	1.65	182
NE	1,560	16.8%	1.65	159
SB	0	-		
				1,612

*New peak hour autos from Table 11-3, Appendix 11 Multiplied by 1.5

Table 27-2

Number of Total Shopper Autos By Zone In May 1959

Zone	% Distribution	New Autos	Present Autos	Total Shopper Autos
		1,612		
0301	1.29	21	3,828	3,849
0302	0	0	500	500
0303	0	0	3,629	3,629
0304	49.9	805	5,519	6,324
0305	17.35	280	8,462	8,742
0306	14.35	232	16,906	17,138
0307	0	0	3,089	3,089
0308	0	0	1,583	1,583
0309	0	0	2,734	2,734
0310	0	0	3,627	3,627
0311	2.36	38	6,511	6,549
0312	4.87	78	7,868	7,946
0313	0	0	824	824
0314	3.33	54	3,733	3,787
0315	1.78	29	1,150	1,179
0316	4.77	77	6,203	6,280
0317	0	0	7,373	7,373
		1,614		

Appendix 28

Table 28-1

Turnover Rates in 1954 Inner and Outer Cordons, 9:00 A.M. to 5:00 P.M.

Cordon	Inbound with Destination	Net Accumulation	Turnover Rate
Inner	48,505	9,100	5.33
Outer	90,300	12,686	7.12

Table 28-2

Total Parking Spaces Required for Shopper Automobiles in May 1959

Zone	Total Shopper Autos*	Turnover Rate	Required Spaces
0301	3,849	3.75	1,025
0302	500	3.75	133
0303	3,629	3.75	968
0304	6,324	3.75	1,685
0305	8,742	3.75	2,330
0306	17,138	3.75	4,575
0307	3,089	3.75	824
0308	1,583	3.75	423
0309	2,734	3.75	729
0310	3,627	3.75	968
0311	6,549	3.75	1,745
0312	7,946	3.75	2,115
0313	824	3.75	220
0314	3,787	3.75	1,010
0315	1,179	3.75	314
0316	6,280	3.75	1,675
0317	7,373	3.75	1,965

*Data from Table 27-2 of Appendix 27

Appendix 29

Estimated Parking Requirements Compared With Existing facilities By Zone in May 1959

Zone	Commuter Parking*	Shopper Parking**	Total With 10% Vacancy	Existing**** Facilities	Surplus	Deficit
0301	1,209	1,025	2,480	950		1,530
0302	325	133	510	2,560	2,050	
0303	1,015	968	2,150	1,154		996
0304	12,194	1,685	15,400	5,052		10,348
0305	6,607	2,330	9,930	2,589		7,341
0306	5,205	4,575	1,090	6,962	5,872	
0307	421	824	1,380	***		
0308	129	423	610	***		
0309	287	729	1,130	***		
0310	632	968	1,780	2,586	806	
0311	910	1,745	2,950	2,047		903
0312	3,403	2,115	8,350	2,183		6,167
0313	0	220	245	355	110	
0314	930	1,010	2,160	1,244		916
0315	1,637	314	2,170	3,798	1,628	
0316	1,255	1,675	3,260	1,739		1,521
0317	857	1,965	3,130	2,496		634
					10,466	30,356

*Data from Appendix 23
**Data from Table 28-2 of Appendix 28
***Not surveyed
****Data from Appendix 21

Appendix 30-1

M.T.A. Counts-One Way Traffic Admitted At Rapid Transit Stations and Subway Entrances On Dates Indicated Within Outer Cordon

		Jan. 6 1947 Mon.	Dec. 8 1948 Wed.	1949	Dec. 6 1950 Wed.	Dec. 5 1951 Wed.	Dec. 2 1952 Tues.	Dec. 3 1953 Thurs.	Dec. 8 1954 Thurs.	Dec. 14 1955 Thurs.	Dec. 5 1956 Wed.	Dec. 11 1957 Wed.	Dec. 10 1958 Wed.
North Station	I	39200	29400		26500	2300	24500	20100	21500	17600	17100	15200	15200
Union-Friend	I	9100	8900		7000	6600	5800	5200	4600	3900	4200	3800	3600
Haymarket	I	13900	11000		7100	6300	5500	7000	6300	5500	5700	5500	4400
Bowdoin	I	3100	2900		2300	2200	2000	2000	1900	1700	1700	1800	1800
Adams	I	900	700		500	600	500	200	300	200	200	200	100
Scollay	I	17000	11400		10600	10000	10000	9300	8800	7800	7800	7900	7600
Charles	I	6900	6800		5300	5100	5000	4900	4500	4300	4100	4000	4100
Park	I	50600	58805		52800	46200	45800	45400	43900	38400	35100	40000	35200
Winter-Summer	I	74800	78800		72200	72600	68900	66000	74700	67700	66000	69700	57600
Washington Boyl.	I	17300	16600		12800	11440	10400	10200	9200	10100	8600	7000	7500
So. Sta. Under	I	39400	30300		25200	22800	20200	20700	20000	18500	16100	16000	16000
Atlantic	I	6000	5100		3400	4200	3800	4000	3200	3200	3100	2800	2800
Milk-State-Dev.	I	26000	25500		22400	20200	21900	19600	20900	18300	19100	21000	19000
Boylston-Essex	I	29200	27400		25300	22500	20400	18300	18400	14800	15400	14200	11700
Dover		10700	9900		7600	7200	7100	7000	5600	5200	5000	4800	4600
Northampton		(12900)	(10900)		(9200)	(9800)	(8700)	(8600)	(7700)	(6100)	(6000)	(6200)	(5800)
2/3 of Total*		8600	7300		6100	6500	5800	5700	5200	4000	4000	4100	3900
Arlington		21800	20100		16700	16300	16400	16900	16200	14300	14500	14500	15200
Copley		20000	13300		14000	12800	13200	15300	11800	11600	11500	11600	11600
Massachusetts		(32900)	(34400)		(23700)	(22800)	(22600)	(21200)	(21100)	(19400)	(17600)	(17100)	(16600)
3/4 of Total*		24600	25800		17800	17100	17000	15900	15800	14600	13200	12800	12500
Mechanics		4200	3400		2900	2600	2500	2500	2400	1900	1700	1600	1500
Symphony		(11100)	(8200)		(6300)	(4800)	(4900)	(5200)	(4200)	(3300)	(3200)	(3500)	(3600)
1/2 of Total*		5600	4100		3200	2400	2500	2600	2100	1700	1600	1800	1800
Tremont		12000	13500		9300	9900	9900	9400	8500	7600	7300	6700	5900
Total Outer Cordon		440800	415005		346800	328540	318900	306200	305500	272900	263800	266800	243600
Total Inner Cordon		333300	312605		269200	253740	244500	253900	256100	212000	204000	209100	186600
Difference		107500	102400		77600	74800	74400	52300	67400	60900	59800	57700	57000
Total M.T.A.		1069800	1015680		830707	763640	769500	746700	729200	661100	640500	645800	600900

I Inner Cordon Stations

*Adjustment For Stations With Service Areas Extending West of Massachusetts Avenue

Source: Metropolitan Transit Authority Records

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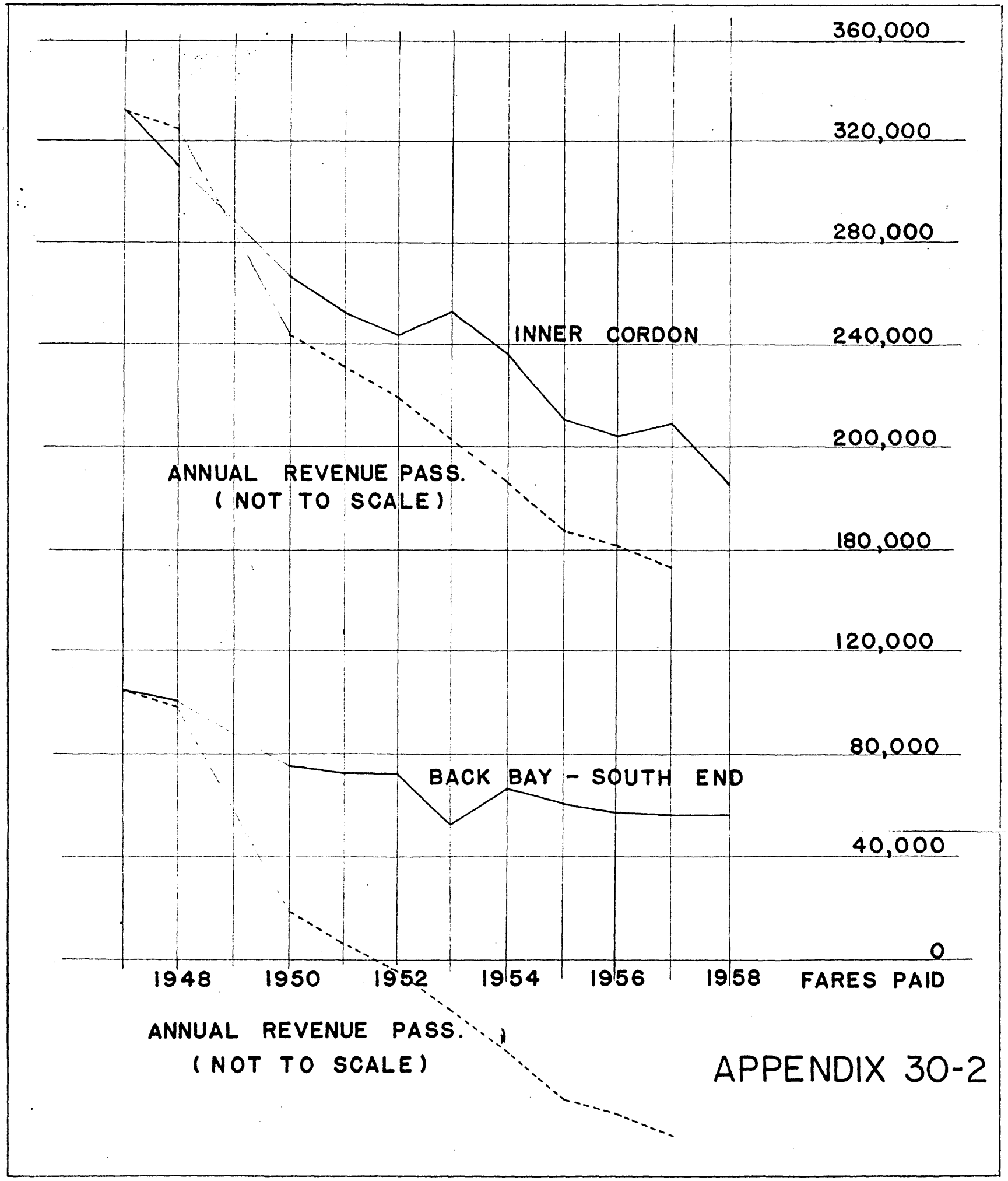
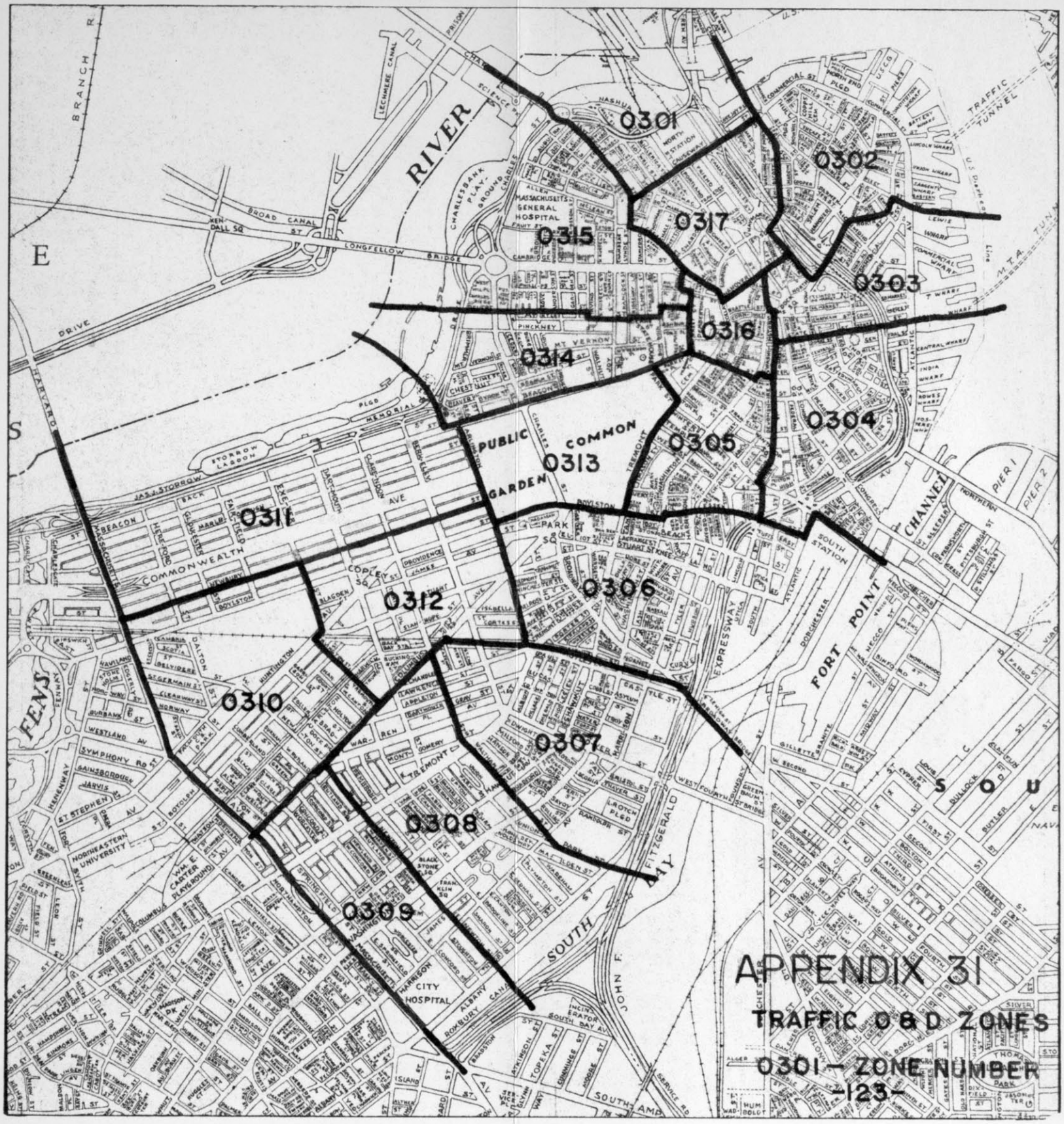

360,000
320,000
280,000
INNER CORDON
240,000
200,000
ANNUAL REVENUE PASS.
(NOT TO SCALE)
180,000
120,000
80,000
BACK BAY - SOUTH END
40,000
0
1948
1950
1952
1954
1956
1958
FARES PAID
ANNUAL REVENUE PASS.
(NOT TO SCALE)
APPENDIX 30-2


0301
0302
0303
0304
0305
0306
0307
0308
0309
0310
0311
0312
0313
0314
0315
0316
0317
APPENDIX 31
TRAFFIC O & D ZONES
0301 – ZONE NUMBER

MAP 1 - TRAFFIC

AM PEAK HOUR TRAFFIC WITHOUT RAILROADS

122 — DIRECTION OF TRAVEL

660 — ESTIMATED TRAFFIC / CAPACITY OF STREET

SCALE: 1"=400'-0"

NOTE - THE FITZGERALD EXPRESSWAY UNDER CONSTRUCTION FROM FORT HILL SQ. (ROXBURY CANAL NOT SHOWN)

CHARLES RIVER

CHARLESTOWN

BOSTON COMMON

PUBLIC GARDEN

COPLEY SQ

BACK BAY

SOUTH END

BLACKSTONE SQ

FRANKLIN SQ

BOSTON CITY HOSPITAL

MASSACHUSETTS GENERAL HOSPITAL

NORTH STATION

HAYMARKET SQ

SOUTH STATION

FORT POINT CHANNEL

SOUTH BOSTON

EAST BOSTON

UNITED STATES NAVY YARD

HOOSAC PIER No 1

CONSTITUTION WHF

BATTERY WHF

COMMONWEALTH PIER

JOHN F. FITZGERALD EXPRESSWAY

SUMNER TUNNEL

MASSACHUSETTS AVE BRIDGE

LONGFELLOW BRIDGE

CHARLESTOWN BRIDGE

BOSTON HARBOR

MAP 2 - PARKING

EXISTING FACILITIES:

GARAGE

OPEN LOT

1500 RATED CAPACITY

CURB RESTRICTIONS:

NO PARKING ANY TIME

NO PARKING 7AM-6 PM

NO PARKING 8AM-10AM

NEW NO PARKING 8AM-10AM

SCALE: 1" = 400'-0"

NOTE - THE FITZGERALD EXPRESSWAY UNDER CONSTRUCTION FROM FORT HILL SQ. (ROXBURY CANAL NOT SHOWN)