TECHNICAL REPORT NO. 1
BACKGROUND STUDIES

Downtown High Street Corridor Action Plan

Columbus, Ohio

Prepared for the
City of Columbus
and the
Mid-Ohio Regional Planning Commission

by
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CHAPTER 1

INTRODUCTION

It can truly be said that downtown Columbus is today being reborn. Over the past decade, more than $600 million has been invested in this area in the form of public improvements, joint development projects, and privately financed new developments and renovations. Similar activities are expected to continue through the remainder of the 1980's. Nowhere have these changes been more dramatic than along the High Street corridor. Anchored on the north end by the completed Ohio Center and Nationwide developments and on the south end by the planned Capitol South multi-use complex and the Franklin County complex, with major new state and private office buildings presently under construction in the central area surrounding the State Capitol, a new downtown is being created to serve the needs of the Columbus metropolitan area and the State of Ohio to the Year 2000 and beyond.

PURPOSE OF THIS STUDY

A critical element necessary to ensure the continuation of this ongoing central area growth and development is enhanced accesibility via both the private automobile and public transportation. Planned roadway system improvements such as the Spring/Sandusky Interchange Project and the I-670 Extension Project will help to address the need for improved connections between the regional freeway/expressway system and central area traffic circulation routes. However, in order to provide proper transit service, both today and in the future, a plan must be developed which improves and accomodated required transit operations.

The timing is thus especially propitious to determine what the appropriate role and function should be for <u>all</u> of the major streets in the downtown area, not only with respect to general traffic circulation, but particularly in regard to public transportation system operations. The purpose of this study was, therefore, to develop and analyze a range of feasible transportation alternatives (including transit, pedestrian, and highway systems) which might be applied to the key High Street corridor.

In considering alternatives for the High Street corridor, it is clear that concepts must be connected to reality and practicality. The transit facility needs to fit into the downtown street and circulation system; it should not cause disruptions and conflicts such that net benefits are minimal; the type of facility must be of such scale and character to be buildable in the reasonably near future; and, cost-effective and feasible solutions must be the aim of the design effort.

REPORT CONTENTS

On the basis of this brief review of the context for a new transit facility, the following specific objectives are being addressed in the conduct of the High Street Corridor Action Plan project:

1. Identify the most workable, acceptable, and affordable alternative for the accomodation of transit patrons and vehicles in the downtown and one that would be an asset to the downtown.

2. Develop a cost-effective design for the selected alternative (recognizing the current pressure for transportation facility capital funds in Columbus).

3. Produce an Action Plan for the transit facilities that presents strong support for an UMTA capital grant.

4. Present any other support and documentation needed for the City's successful application for UMTA assistance -- including an environmental assessment report documenting the alternatives analyses.

5. Develop functional plans for the downtown street system, given the selected transit facilities, and for specific identified problem areas.

The contents of this technical report present the results of more than nine months of analysis which has: (1) explicitly defined the current problems and issues which inhibit the efficient operation of the existing street, transit and pedestrian movement systems in downtown Columbus, (2) developed forecasts of Year 2000 traffic and transit vehicle and patron demands which will have to be accommodated in the central area, and (3) developed and evaluated an interrelated group of street system and transit operational improvement alternatives designed to ensure efficient utilization of the transportation system in the Year 2000 and beyond.

The project has now reached the stage where the members of the Project Advisory Committee are being presented with the Consultant's recommended package of street system, transit operations, and pedestrian system changes which appear both necessary and sufficient to satisfy the objectives of this assignment. Following this anticipated concurrence, the "preferred" alternative will be detailed and the project Environmental Assessment Report will be prepared. These documents will then be circulated for Federal, State, and local agency review and approval. The actual implementation of the High Street Corridor Action Plan will then begin.

INFORMATION RESOURCES

In the performance of the work conducted to-date, the project team has placed a heavy reliance upon data and information generated by a multitude of participating agencies. Some of the more important of these information resources, although by no means all of those utilized, are listed as follows:

1. Current traffic volumes provided by the Mid-Ohio Regional Planning Commission (MORPC), the Ohio Department of Transportation (ODOT), and the City of Columbus Department of Traffic and Parking;

2. Current and short-range future transit operational data provided by the Central Ohio Transit Authority (COTA);

3. Current and future land use and development plans provided by MORPC and the City of Columbus Department of Development;

4. Existing and future parking system characteristics provided by MORPC and the City Department of Traffic and Parking; and,

5. Year 2000 person-trip and vehicle-trip projections provided by MORPC and the Ohio Department of Transportation.

Supplemented by original field data collection by the consultant team, this extensive data base has provided a more than adequate background against which to plan the future transportation system of the Columbus Central Area.

CHAPTER 2

INVENTORIES AND SURVEYS

The first major effort of the High Street Corridor study was to obtain relevant data and information as background for the project. This included the acquisition of all data and information presently available from various departments of the City as well as from other agencies. After reviewing this information, supplemental surveys and inventories were undertaken to create a complete data base. The results of these efforts are described in the following sections.

TRANSIT SYSTEM

The purpose of this section is to briefly describe current central area transit operations in Columbus and to identify and quantify significant problems, issues, and constraints associated with transit operations in the downtown. In addition, a brief description is provided of the future framework for transit operations in Columbus within which any central area transit operational improvements would have to be accommodated.

Characteristics of the Existing Transit System

Current transit services in the Columbus region are operated by the Central Ohio Transit Authority (COTA). COTA currently operates both radial and crosstown bus routes and in total provides service on 17 local radial routes, 18 express radial routes, and 12 local crosstown bus routes on a typical weekday. Figure 2-1 illustrates the current COTA route structure for the entire metropolitan area.

The current COTA bus fleet consists of 322 vehicles. Except for fifty-two 35-foot vehicles, the COTA fleet consists of standard 40-foot transit buses. As described in the COTA "Transit Development Program" [1/], COTA anticipates the acquisition of 30 articulated transit buses and 50 standard size, advance design buses over the next five years. Since these vehicles are to be used both to replace existing obsolete equipment as well as for moderate service expansion, the estimated fleet size in 1985 will be approximately 355 vehicles. Initial estimates prepared by COTA indicate that the 1990 fleet size will be approximately 375 vehicles, consisting of 320 standard transit buses and approximately 55 articulated coaches.

1/ "Transit Development Program - Central Ohio Transit Authority", Columbus, Ohio, May 1983.

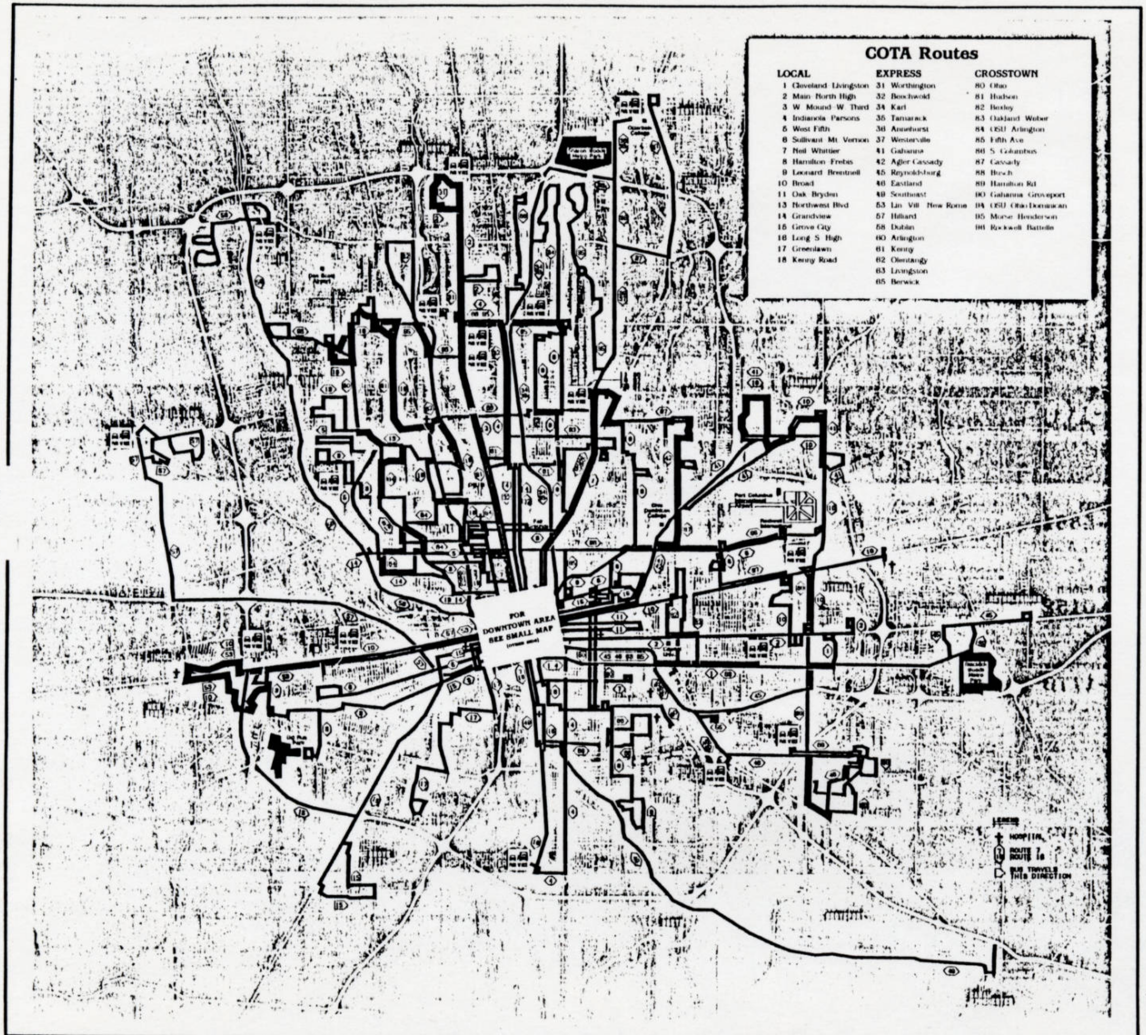

Figure 2-1
EXISTING COTA OPERATIONS

SOURCE: CENTRAL OHIO TRANSIT AUTHORITY

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Beyond the five year planning horizon of the transit development program, COTA anticipates continual vehicle replacement and moderate service expansion. Initial estimates prepared by the Mid-Ohio Regional Planning Commission (MORPC), as part of their Year 2000 Transportation Plan Development, project an estimated COTA fleet size of approximately 590 vehicles. Including replacement vehicles, MORPC has estimated that approximately 530 new transit vehicles would have to be purchased by COTA over the time period of 1987-2000. Conversely, preliminary estimates by COTA staff envision a Year 2000 fleet size of about 450 vehicles. Table 2-1 summarizes the existing and proposed future COTA transit fleet size under these varying assumptions.

A variable which may significantly influence these current projections of future fleet size is the ongoing North Corridor Alternatives Analysis Study being undertaken by MORPC. The range of transit alternatives being considered for implementation in the North Corridor area by the Year 2000 include, but are not limited to: some form of fixed guideway transit facility (mode unspecified but likely busway), reserved high occupancy vehicle (HOV) freeway lanes, and TSM improvements (i.e., ramp metering, bus bypass lanes, etc.). Dependent upon the final alternative selected for implementation in the North Corridor, a future year vehicle fleet somewhat smaller in size than that currently anticipated may be required by the Year 2000.

For the year 1990, it is currently projected that approximately 55 of COTA's vehicles will be articulated, with these vehicles likely to be assigned to the heavier volume local routes. Current plans call for the initial group of 30 articulated buses to be available by 1985 and to be assigned to Routes 1-Cleveland/Livingston, 2-Main/North High, and 10-Broad Street. It is also anticipated that an additional local route (most likely Route 4-Indianola/Parsons) may have some articulated vehicles assigned to it during the peak periods.

Figures 2-2 and 2-3, respectively, illustrate the local and express routes operating within the Columbus central area as of Fall 1983. As illustrated on these figures, the major orientation of both local and express service in the region is High Street. Figure 2-4 summarizes existing local bus operations on High Street with an emphasis upon defining the directional volumes of local buses along this facility during both the AM and PM peak hours. As illustrated on Figure 2-4, morning peak hour transit operations are relatively balanced in both the northbound and southbound directions. Southbound volumes reach a maximum of 66 vehicles in the segment between Broad Street and Town Street, with northbound volumes peaking between Broad Street and Long Street at a volume of 72 vehicles.

Since January of 1983, the majority of COTA's express bus operations have been oriented to express terminals located on the north and south sides of the central business district at, respectively, Town Street/Pearl Street and at Spring Street/Long Street. Thus, all express buses volumes along High Street operate as through vehicle movements without stopping to pick-up or discharge passengers at local bus stops along the facility. As illustrated on Figure 2-5, northbound and southbound express bus volumes are relatively balanced during the morning and afternoon peak periods.

Table 2-1

EXISTING AND PROPOSED TRANSIT SYSTEM

Transit Service Characteristics	Analysis Year				
	1982	1985	1990	2000	
				COTA	MORPC
Total Fleet Size (including spare vehicles)	322 1/	355 2/	375 2/	450 3/	590 4/
Standard Transit Buses (40-foot, 48 passenger)	322	325	320	360	500
Articulated Transit Buses (60-foot, 70 passenger)	0	30	55	90	90
Transit Operations on High Street (PM Peak Hour, 2 directions - Broad to State) 5/ 6/					
- Local Bus	135	150	155	190	245
- Express Bus	49	55	55	70	90
- Totals	184	205	210	260	335

Notes:

1/ Source: Central Ohio Transit Authority (COTA)

2/ Source: COTA Transit Development Program May 1983, and MORPC Transportation Improvement Program, June 1983

3/ Source: Discussions with COTA Staff

4/ Source: MORPC, Year 2000 Regional Transportation Plan (Technical Documentation Report), May 1983

5/ Preliminary estimates for 1985, 1990 and 2000 assume continuation of current COTA central area service philosophy (i.e., percentage of total 1990 and 2000 local and express operations on High Street would remain basically the same as 1983 observed levels)

6/ Estimates for 1985, 1990, and 2000 rounded to the nearest 5 vehicles

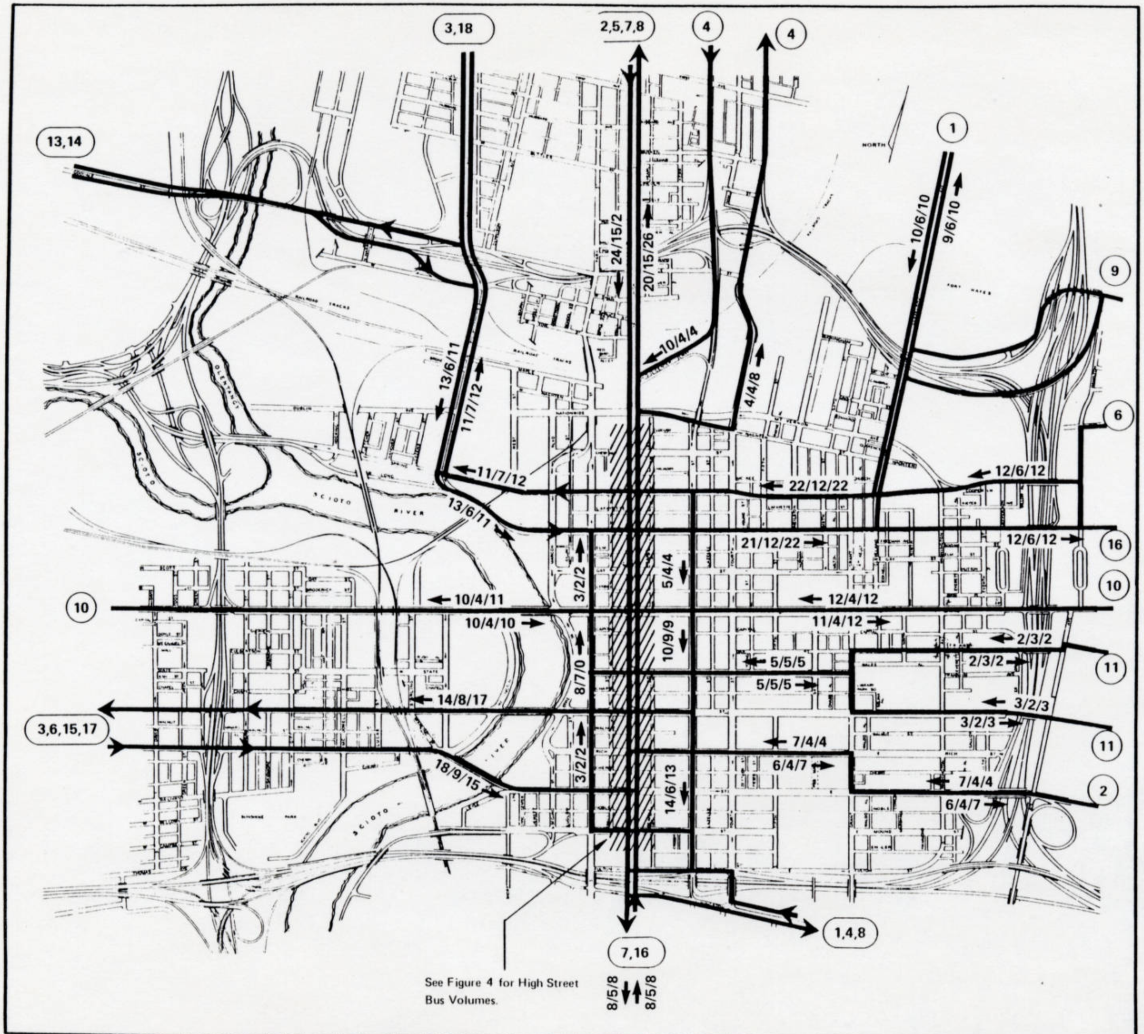

Figure 2-2
EXISTING ROUTINGS AND VOLUMES–
Local Bus Routes

LEGEND:

LOCAL BUS ROUTING PATTERN

(10) ROUTE NUMBER

DIRECTION OF BUS MOVEMENT

00/00/00 HOURLY BUS VOLUME
(A.M. Peak/Midday/ P.M. Peak)
[7-8 A.M./11:30-12:30/4:30-5:30 P.M.]

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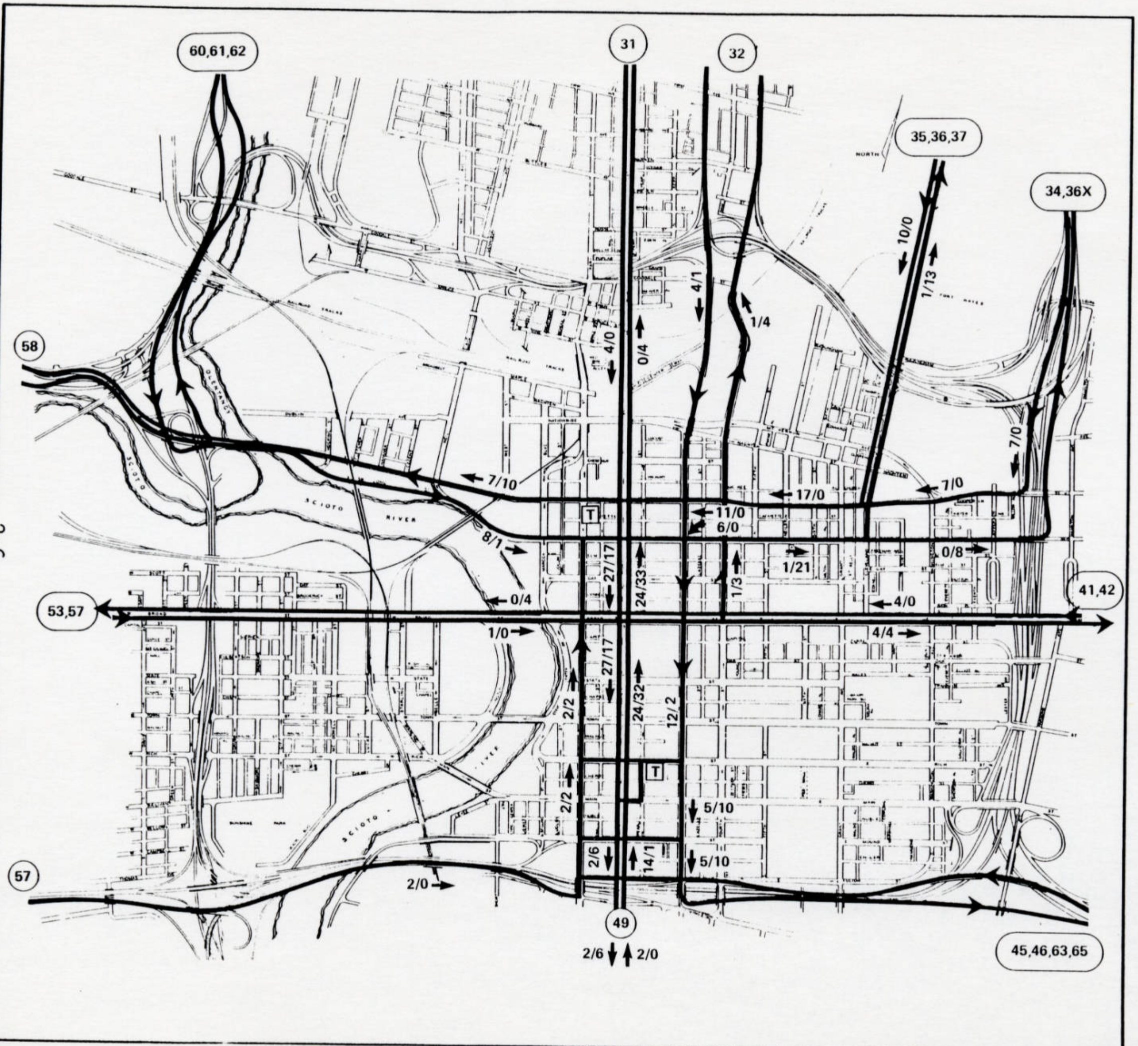

Figure 2-3
EXISTING ROUTINGS AND VOLUMES–
Express Bus Routes

LEGEND:

EXPRESS BUS ROUTING PATTERN

(10) ROUTE NUMBER

DIRECTION OF BUS MOVEMENT

00/00 HOURLY BUS VOLUME
(A.M. Peak/ P.M. Peak)
[7:00-8:00 A.M./ 4:30-5:30 P.M.]

[T] EXPRESS TERMINALS

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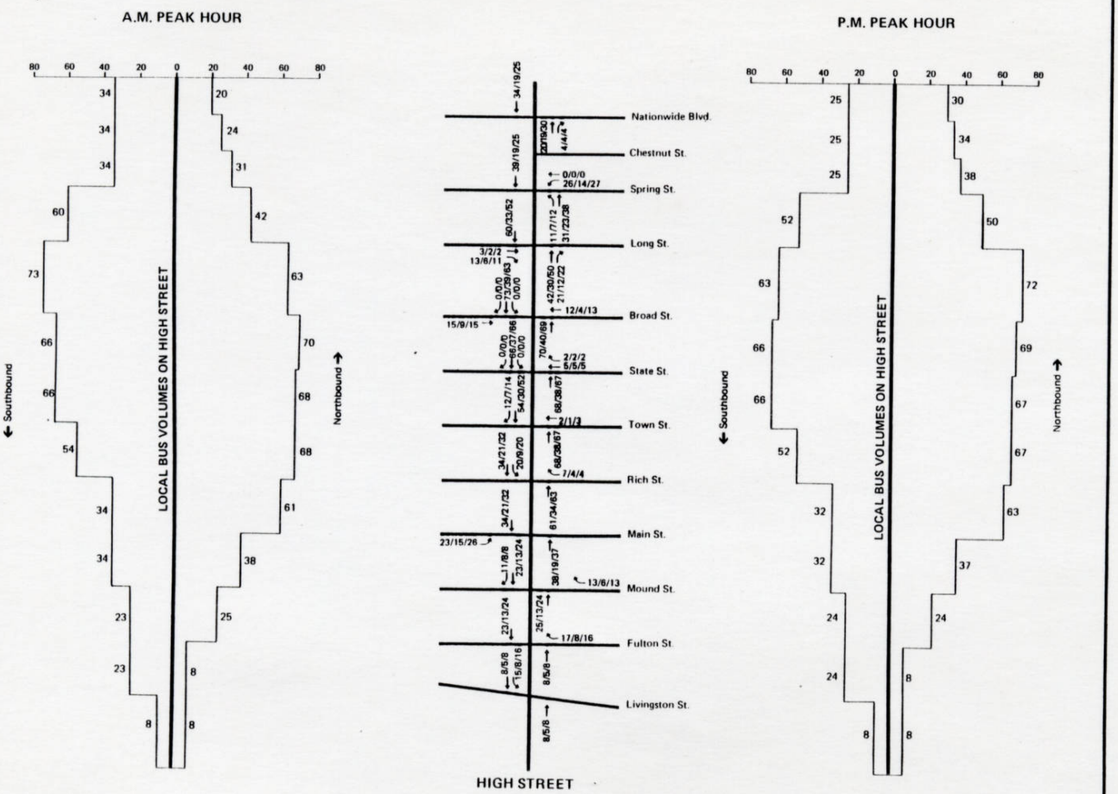

Figure 2-4
EXISTING LOCAL BUS VOLUMES ON HIGH STREET

A.M. PEAK HOUR (7:00-8:00)
MIDDAY (11:30-12:30)
P.M. PEAK HOUR (4:30-5:30)

00/00/00

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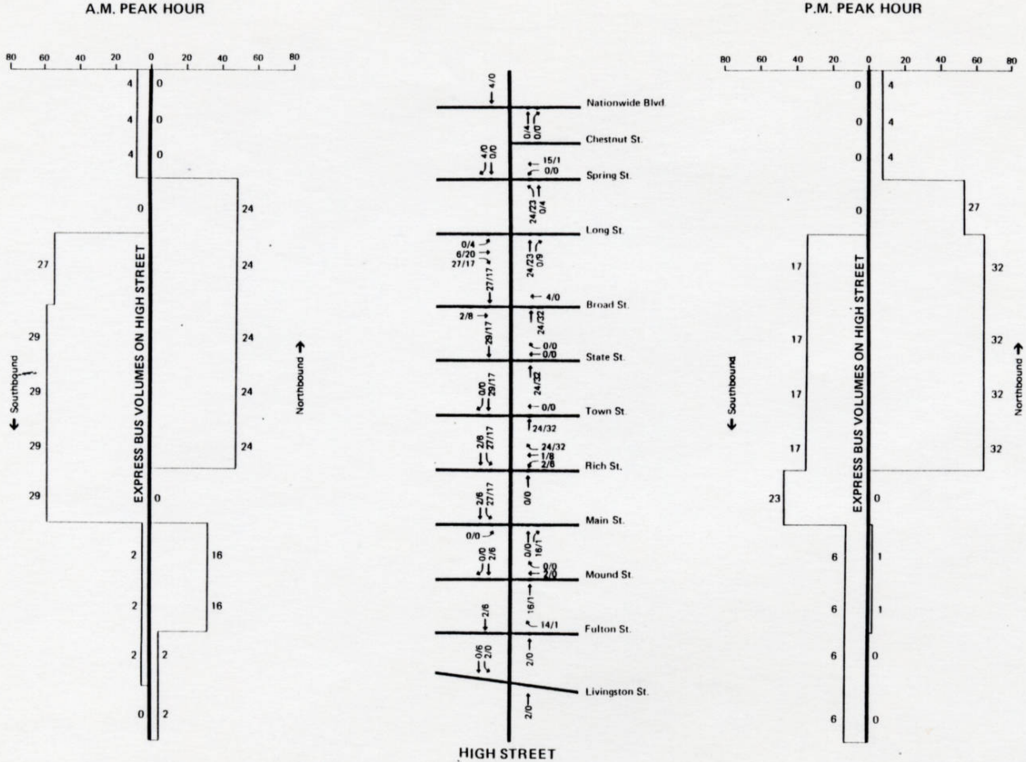

A.M. PEAK HOUR
P.M. PEAK HOUR
00/00

Figure 2-5
EXISTING EXPRESS BUS VOLUMES ON HIGH STREET

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During the morning peak hour, southbound express bus volumes maintain a level of 27 to 29 vehicles between Long Street and Main Street, with a volume of 24 vehicles maintained northbound between Rich Street and Spring Street. In the afternoon peak hour, southbound volumes range between 17 at Long Street and 23 at Rich/Main Street. In the northbound direction, peak hour express bus volumes hold constant at a level of 32 vehicles between Rich Street and Long Street, dropping to 27 vehicles between Long Street and Spring Street. Even though the express buses moving along High Street no longer interfere directly with local buses operating in the northbound and southbound curb lanes by stopping to pick-up or discharge passengers, the express buses do have a major impact upon traffic circulation along High Street due to the operating characteristics of the vehicles and their movements to and from the express bus terminals located one block east and west of High Street proper.

Figure 2-6 presents a summary of the total peak hour bus volumes along High Street for both the morning and afternoon peak periods, in both the northbound and southbound directions. The total of local and express buses during the morning period in the southbound direction peaks at a value of 100 vehicles between Long Street and Broad Street, while the northbound direction vehicle peak of 94 vehicles occurs between State Street and Broad Street. During the PM peak hour, the southbound combined volumes peak at a value of 83 buses on the segment from Broad Street to Town Street with the northbound peak of 105 vehicles occurs in the segment between Broad Street and Long Street.

Existing Central Area Transit Usage

At the current time, the COTA system transports approximately 84,000 passengers on a typical weekday. Of this total, approximately 5,700 are express bus users, with the remaining 78,000 being passengers on local radial and crosstown operations. All of the express passengers and approximately 51,000 of the total local passengers either begin or end their transit trip within the Columbus Innerbelt. As a supplement to COTA data on total transit usage into and out of the Innerbelt, a total of 1170 interview surveys were taken of persons waiting to board buses at 22 locations in the downtown area. These locations included all bus stops along High Street itself as well as the north and south express bus terminals and the more important boarding locations along Broad Street east and west of High Street. These interviews were undertaken between 12:00 Noon and 6:00 PM.

In addition to these interviews, field observations were made of the total number of boarding and alighting passengers at the designated stop locations during the morning peak (7:00 -9:00 AM), mid-day (11:00 AM - 1:00 PM), and PM peak (4:00 - 6:00 PM) travel periods. Table 2-2 summarizes this latter information. As illustrated on Table 2-2, a total of 18,509 boarding and alighting passenger movements were observed during these three time periods. This represents approximately 33 percent of the 57,000 total COTA boardings and alightings estimated to take place within the central area on an average weekday.

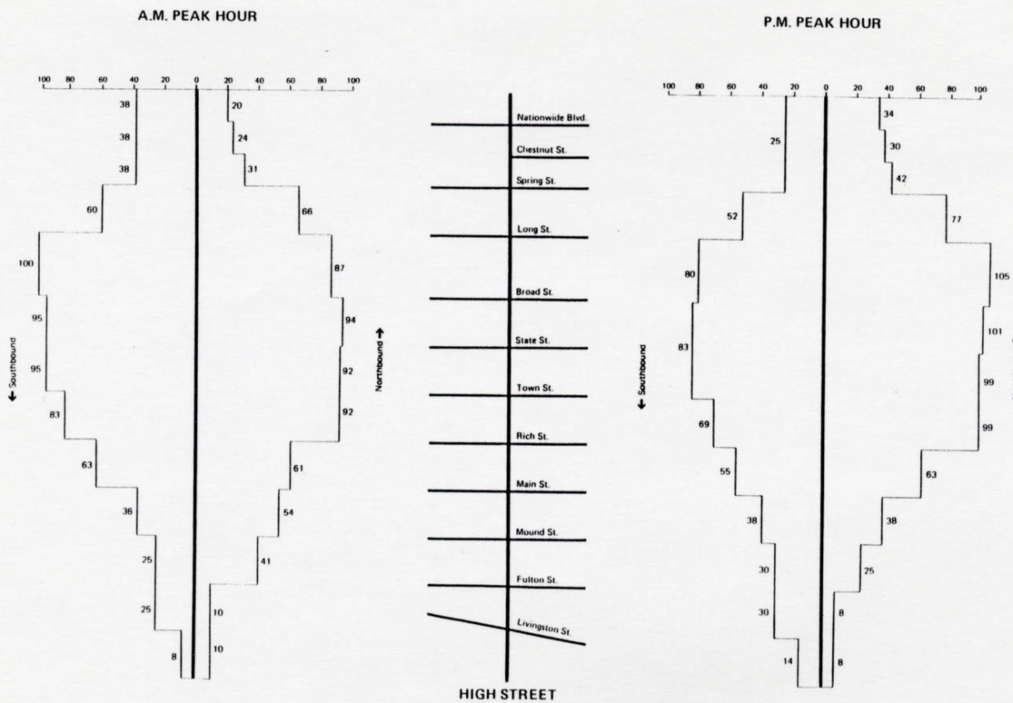

Figure 2-6

TOTAL PEAK HOUR BUS VOLUMES ON HIGH STREET

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Table 2-2
SUMMARY OF OBSERVED PASSENGER MOVEMENTS[1/]

Time Period	Passenger Movements Number Alighting	 Number Boarding	 Total
A.M. Peak (7:00 - 9:00 AM)	4,102	1,339	5,441
Midday (11:00 AM - 1:00 PM)	2,719	2,589	5,308
P.M. Peak (4:00 - 6:00 PM)	1,414	6,346	7,760
Totals	8,235	10,274	18,509

1/ Source: Consultant field observations, July 1983.

An important element in planning future transit improvements in downtown Columbus is knowledge of the peak waiting passenger accumulations at major boarding locations. Table 2-3 summarizes the observed peak waiting passenger accumulations at 25 locations in the downtown, including both the north and south express bus terminals. Figure 2-7 graphically illustrates the magnitude of observed waiting passenger accumulations at the ten most heavily utilized stop locations. At these ten locations, observed maximum passenger accumulation ranged from a high of 180 persons at the south express terminal to a low of 29 persons at the stop along the west side of High Street between State Street and Chapel Street. As expected, the heaviest peak concentrations of waiting passengers at any given moment were observed at the north and south express bus terminals (109 and 180 passengers, respectively) and at the bus stops around the High Street/Broad Street intersection.

A general "rule of thumb" employed by several transit operations in the United States is that the maximum passenger accumulation at any specific stop should not exceed 100 persons at any given time. Excluding the north and south express terminals from consideration by this criteria, the existing bus stop in the northwest quadrant of the High and Broad Street intersection along the west side of High Street and the stop on the northeast quadrant of the same intersection along the east side of High Street both exceed this desired maximum accumulation value with observed peaks of 152 and 103 persons, respectively.

As a supplement to the bus stop usage data collection, interviews were conducted with approximately 1200 passengers waiting to board COTA buses in the downtown. Analysis of this detailed information allowed for a rather precise determination to be made of the major transit trip origins and destinations in the central area and the characteristics of COTA transit users. While the data was collected and tabulated on a bus stop and transit route specific basis, only summaries of this information will be presented here for the sake of brevity. The detailed data tabulations are contained in the Appendix to this report.

As illustrated on Table 2-4, the predominant transit trip purpose of the persons interviewed was "work", accounting for 60.1 percent of the total responses. "School" and "shopping" trips accounted for 5.8 and 6.7 percent, respectively, of the respondents. The combination of "personal business", "recreation/entertainment", and "other" trip purposes accounted for the remaining 27.4 percent of the total interview responses received.

An important evaluation criteria in the examination of alternative transit operational improvements in downtown Columbus will be the affect of any proposed routing modifications upon the average walking distance of existing transit riders. Table 2-5 presents a summary of the average walking distance of the persons responding to this interview question. As illustrated on this table, the average walking distance of all transit riders who responded to this question was slightly less than two city blocks. Approximately 27 percent of the respondents indicated they walked less than one block, an additional 27 percent walked only one block, a total of 32 percent walked three or four blocks, and slightly less than 15 percent walked more than four blocks.

Table 2-3
OBSERVED PEAK WAITING PASSENGER ACCUMULATIONS[1/]

Central Area Bus Stop Location	Type of Stop	No. Waiting Passengers	Time
1. Rich & Pearl	South Express Terminal	180	5:00 PM
2. High & Broad NW	Transfer	152	5:15 PM
3. Spring between Front & Wall St.	North Express Terminal	109	4:45 PM
4. High & Broad NE	Transfer	103	5:15 PM
5. Broad & High SE	Transfer	74	5:15 PM
6. Broad & Third NE	Reg.	50	5:00 PM
7. Broad & Front SW	Reg.	46	5:15 PM
8. Broad & Third SE	Reg.	38	5:00 PM
9. Broad between High & Pearl N	Transfer	30	7:30 AM
10. High between State & Chapel W	Transfer	29	5:00 PM
11. High & Rich NE	Transfer	17	5:00 PM
12. Broad & Fourth SE	Reg.	16	5:15 PM
13A High & Long NE	Transfer	13	5:15 PM
14B High & Nationwide	Reg.	13	4:00 PM
15. High & Nationwide SW	Reg.	12	4:30 PM
16. High & Mound SW	Transfer	11	12:00 Noon
17. Mound & High NE	Transfer	10	5:00 PM
18. Broad & Front NW	Transfer	9	5:15 PM
19. Rich & High SE	Transfer	7	4:00 PM
20A High between Town & Walnut	Transfer	5	5:00 PM
21B Front & Broad NE	Transfer	5	4:45 PM
22C High & Rich SW	Transfer	5	4:15 PM
23. High & Long NW	Reg.	4	4:45 PM
24. Third between Sprint & Lafayette W	Reg.	3	4:45 PM
25. Third & Town SW	Reg.	1	5:00 PM
26. Third & Main SW	Reg.	0	0

[1/] Source: Consultant field observations, July 1983

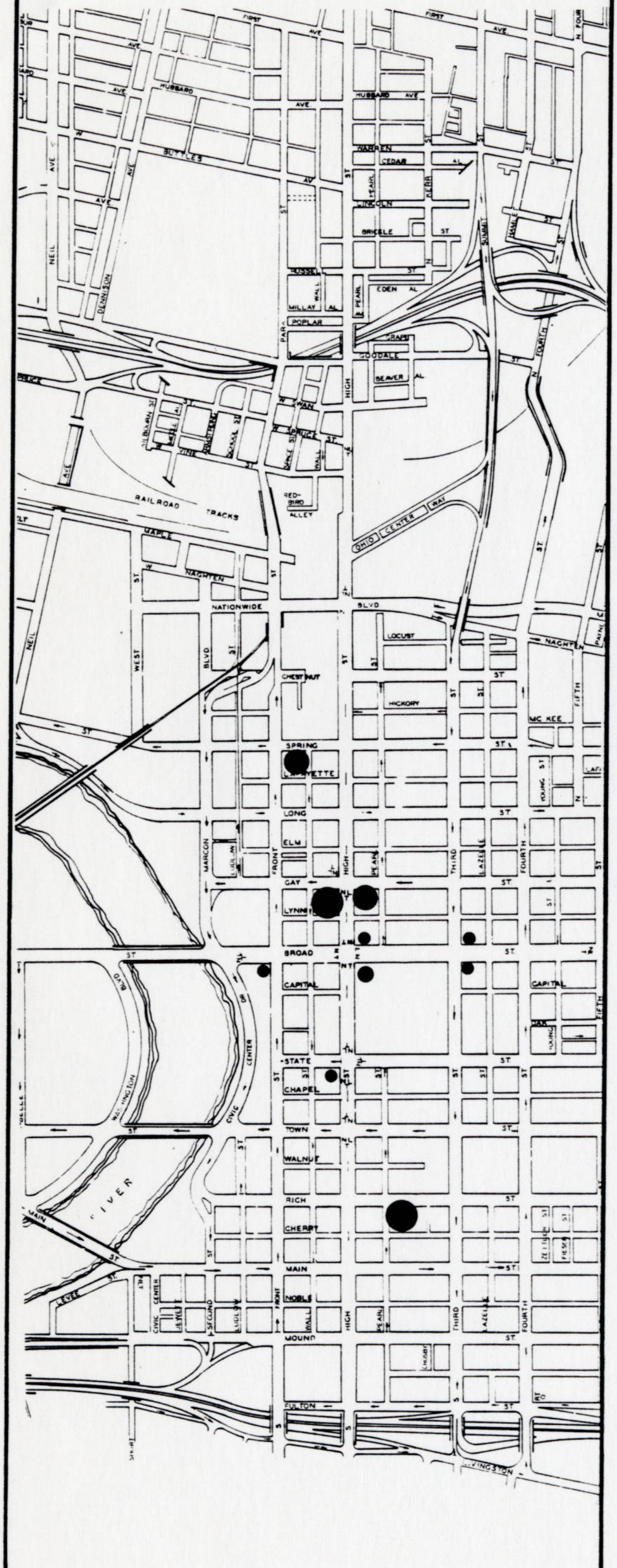

Figure 2-7

MAXIMUM OBSERVED WAITING PASSENGER ACCUMULATION

LEGEND:

- 25-50 PERSONS
- 51-100 PERSONS
- 101-150 PERSONS
- 150-200 PERSONS

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Table 2-4

SUMMARY OF TRANSIT TRIP PURPOSE[1/]

Trip Purpose	No. of Responses	Percent of Total Responses
Work	663	60.1%
School	64	5.8
Shopping	74	6.7
Personal Business, Recreational Entertainment, Other	307	27.4
TOTALS	1,103	100.0%

1/ Source: Tabulation of consultant field surveys, July 1983.

Table 2-5

AVERAGE WALKING DISTANCE - TRANSIT RIDERS[1/]

Distance Walked (blocks)	No. of Responses	Percent of Total
Less than 1	211	27.2%
1	209	26.9
2	152	19.6
3	96	12.4
4	52	6.7
5	20	2.6
More than 5	37	4.8
TOTALS	777	100.0%

Average walk distance = 1.9 blocks

1/ Source: Tabulation of consultant field surveys, July 1983.

Table 2-6 presents a combination of the "trip purpose" and "number of blocks walked" responses, which allowed a determination to be made of the average walking distance to the bus stop of boarding by trip purpose. As illustrated on this table, the average walking distance of "work" trips is 2.1 blocks, for "school" trips 3.7--blocks, for "shopping" trips--2.1 blocks, for "personal business and recreation/entertainment" trips 2.5 blocks, and for "other" trips--2.2 blocks. Based upon this cross tabulation, the average distance walked for all trip purposes is 2.2 blocks, slightly more than the average walking distance measured on the basis of total persons responding to this question alone.

The final element of transit operational data is illustrated on Table 2-7. This table presents the summary of PM transfers (from 3:30 PM to 12:00 Midnight) between all local COTA routes operating in the central area. In total, some 3,827 passengers were observed as transferring between local bus routes in the downtown area. The largest number of transfers observed were from Route 1-Cleveland/Livingston (17.0 percent), Route 2-Main/North High (15.0 percent), and Route 10-Broad Street (10.6 percent).

The routes to which passengers transferred to showed similar characteristics to the routes transferred from information. Route 1-Cleveland/Livingston received the highest number of transfers (20.9 percent) followed by Route 10-Broad Street (12.4 percent), Route 6-Sullivant/Mt. Vernon (12.2 percent) and Route 16-Long/South High (10.9 percent). This information, supplemented by the bus stop specific transfer data obtained from the passenger interviews, was subsequently employed in examining the implications of future route structure modifications in the central area.

PEDESTRIAN SYSTEM

In general, the width of sidewalks in the High Street corridor ranges between 12 and 20 feet. Sidewalks along High Stret itself vary between 16 and 20 feet with most of the widths less than 20 feet occurring on the west side of the street. Along Front Street, sidewalk widths are consistently in the range of 14 to 16 feet. Sidewalk widths along Third Street vary in width from 7 to 20 feet -- with 12 to 15 feet being the most typical width. Sidewalk widths on cross-streets, such as Gay, Broad, and State Street, are typically 16 to 20 feet except in some sections where the width reduces to around 10 feet.

In order to determine the volume of pedestrians on the sidewalk system, counts were conducted at several locations within the core area. These counts were conducted on Tuesdays, Wednesdays, and Thursdays during the last week of June and the first week of July in 1983. The results of these surveys are summarized in Figures 2-8, 2-9, and 2-10. The highest observed pedestrian volume occurred on the east side of High Street, between Gay and Lynn Streets, where the two-way volume reached 3,800 persons per hour during the 12:00 noon to 1:00 P.M. time period. In this same section, 1,500 persons were observed walking in both directions on the sidewalk during a single 15-minute period.

Another element of the pedestrian system is the grade-separated walkways which began with the City Council Ordinance of 1968 which established a requirement for all

Table 2-6

DISTANCE WALKED TO BUS STOP BY TRIP PURPOSE

	Number of Blocks Walked												
	1 or Less		2		3		4 or 5		6 or More		Avg. Walking Distance (blocks)	Total Observed	
Trip Purpose	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%
Work	181	34.0%	97	18.2%	49	9.2%	47	8.8%	13	2.4%	2.1	387	72.6%
School	3	0.6	4	0.8	0	0.0	2	0.4	4	0.8	3.7	13	2.4
Shopping	11	2.1	7	1.3	7	1.3	1	0.2	1	0.2	2.1	27	5.1
Personal Business	30	5.6	25	4.7	10	1.9	11.	21	6	1.1	2.5	82	15.4
Recreation/ Entertainment	4	0.8	3	0.6	1	0.2	1	0.2	1	0.2	2.5	10	1.9
Other	6	1.1	5	0.9	1	0.2	1	0.2	1	0.2	2.2	14	2.6
TOTALS	235	44.1%	141	26.5%	68	12.8%	63	11.8%	26	4.9%	2.2	533	100.0%

Table 2-7

PM TRANSFERS – LOCAL ROUTE TO LOCAL ROUTE

Route Transferred From:	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	Route Transferred From Total	Percent of Total Transfers
	Route Transferred To:																		
1 – Cleveland/Livingston	--	76	87	41	87	101	27	40	19	90	22	1	2	10	46	0	0	649	17.0%
2 – Main/North High	77	--	24	49	19	80	14	25	16	129	32	1	2	10	96	0	0	574	15.0
3 – W. Mound/W. Third	122	33	--	25	27	44	17	10	4	29	10	1	0	6	45	0	0	373	9.7
4 – Indianola/Parsons	39	29	9	--	4	38	6	10	0	23	10	4	0	0	15	0	0	187	4.9
5 – West Fifth Street	23	4	9	10	--	23	1	6	7	18	4	0	0	4	24	0	0	133	3.5
6 – Sullivant/Mt. Vernon	53	21	12	16	12	--	24	18	9	34	32	0	2	8	6	0	0	247	6.5
7 – Neil/Whittier	38	12	16	8	2	19	--	25	10	53	16	1	2	2	18	0	0	222	5.8
8 – Hamilton/Frebis	72	39	12	5	13	38	15	--	7	46	10	0	0	4	54	0	0	315	8.2
9 – Leonard/Brentnell	10	4	7	0	13	7	2	5	--	4	10	1	4	0	36	0	0	103	2.7
10 – Broad Street	83	87	12	0	6	61	38	58	7	--	16	1	2	10	24	0	0	405	10.6
11 – Oak/Bryden	37	13	12	0	0	22	0	6	4	14	--	0	4	2	24	0	0	138	3.6
13 – Northwest Blvd.	47	6	11	0	1	1	0	5	1	5	0	--	0	2	12	0	0	91	2.4
14 – Grandview	70	4	11	0	4	8	3	1	3	5	2	0	--	2	6	0	0	119	3.1
15 – Grove City	35	0	1	0	0	3	0	2	0	1	0	0	0	--	6	0	0	48	1.3
16 – Long/S. High	94	12	27	0	0	15	5	9	6	18	2	0	0	4	--	0	0	192	5.0
17 – Greenlawn	0	0	2	0	0	1	0	4	0	1	0	0	0	0	6	--	0	14	0.4
18 – Kenny Road	0	6	2	0	0	5	0	0	1	3	0	0	0	0	0	0	--	17	0.4
TOTALS	800	346	254	154	188	466	152	224	94	473	166	10	18	64	418	0	0	3,827	100.0%
Percent of Total Transfers	20.9	9.0	6.6	4.0	4.9	12.2	4.0	5.9	2.5	12.4	4.3	0.3	0.5	1.7	10.9	0.0	0.0		

Source: Central Ohio Transit Authority transfer survey, July 1983.

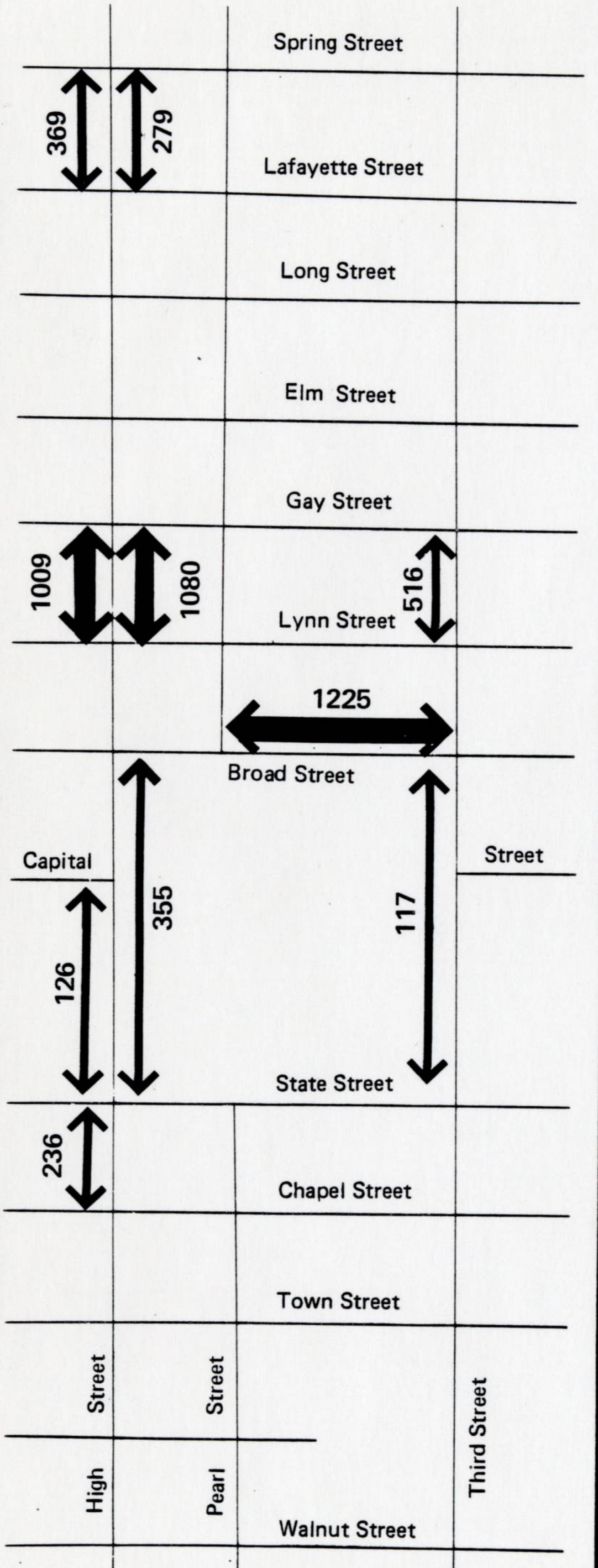

Figure 2-8
OBSERVED PEDESTRIAN FLOW VOLUMES

AM PEAK HOUR
(7:30 – 8:30 AM)

LEGEND:

- 0-500 PEDS./HR.
- 500-1000 PEDS./HR.
- 1000-2000 PEDS./HR.
- 2000-4000 PEDS./HR.

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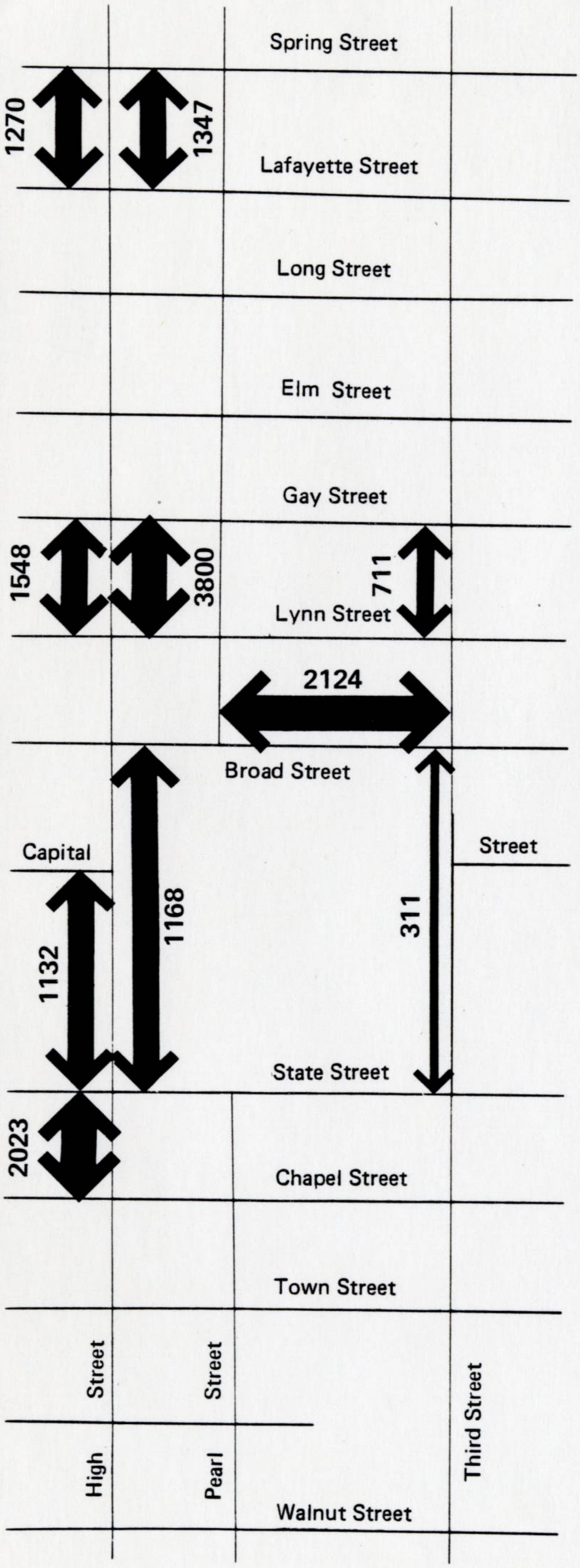

Figure 2-9
OBSERVED PEDESTRIAN
FLOW VOLUMES

MIDDAY PEAK HOUR
(12:00 Noon – 1:00 PM)

LEGEND:

- 0-500 PEDS./HR.
- 500-1000 PEDS./HR.
- 1000-2000 PEDS./HR.
- 2000-4000 PEDS./HR.

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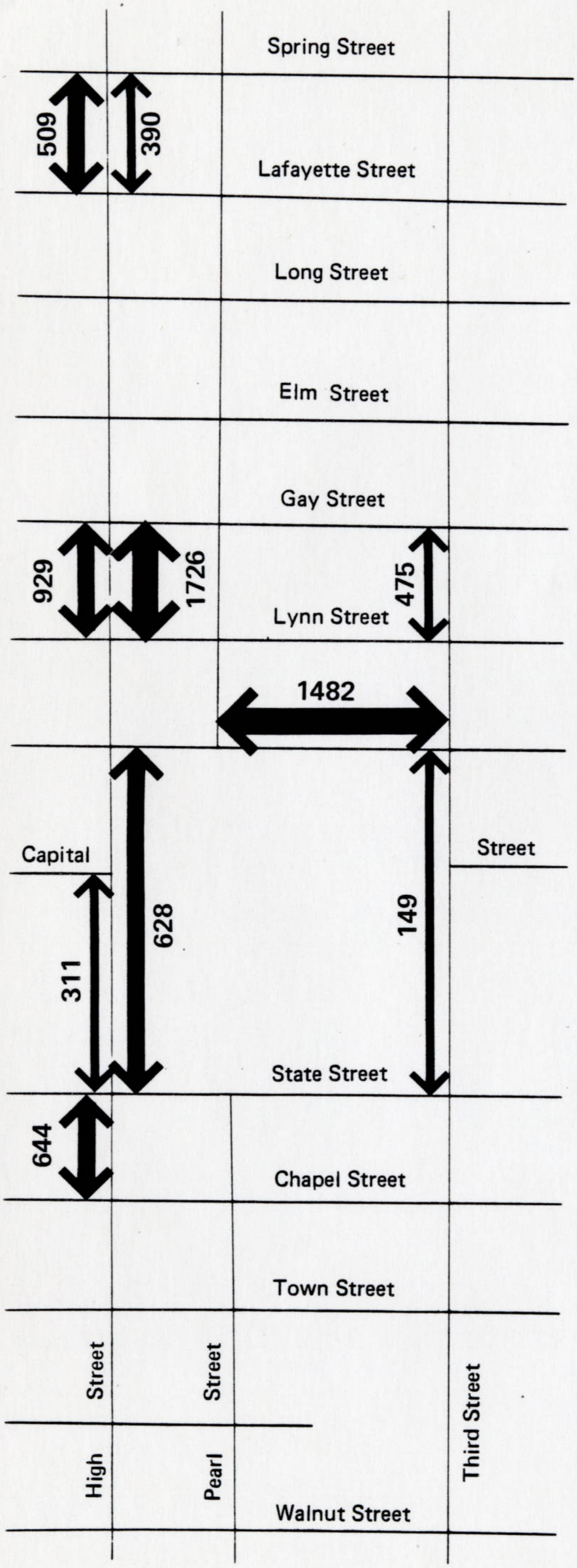

Figure 2-10
OBSERVED PEDESTRIAN
FLOW VOLUMES

PM PEAK HOUR
(4:15 – 5:15 PM)

LEGEND:

- 0-500 PEDS./HR.
- 500-1000 PEDS./HR.
- 1000-2000 PEDS./HR.
- 2000-4000 PEDS./HR.

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new buildings in the downtown area to build second floors at an elevation of 18'-7" above street level for possible future connectors to a second-level walkway system.

The first pedestrian access sstem was a below-grade tunnel connecting the Statehouse parking garage to the old Neil House in 1962. This was extended to the State Office Tower in 1975. The City's first overhead walkway system was erected in 1978 connecting the BancOhio Headquarters building with the Capitol Garage on Fifth Street which was shortly followed by the Franklin County Justice Administration bridge connecting their annex and parking facilities in 1979.

As new developments occurs, the grade-separated walkway system is planned to be expanded to create a system of walkways along the High Street corridor. The key elements of this walkway system plan are illustrated in Figure 2-11.

The central element of the new development is Capitol South, a multi-use facility with major retailing functions. Present plans include a second-level pedestrian walkway system throughout the three-block area with over-head connectors at High Street to Lazarus and at Rich Street to a parking facility. These connections are illustrated in the master plan for Capitol South as shown in Figure 2-12.

It is understood that the Lazarus Company is in full agreement with the benefits of the walkway system and that they are prepared to proceed with renovations and new construction to make the walkway system a reality. They plan to receive the second-level walkway system from Capitol South directly into their second floor retail level on High Street, and plan to modify the second floor to continue the pedestrian movement through their store, north to the Huntington/State Office Building complex and south to a possible new Lazarus parking structure on Town Street. This parking structure includes plans to extend bridges south and west to connect overhead to their existing parking garages. The new Columbia Gas Company has provided planning concepts to receive an overhead pedestrian bridge from the Lazarus parking garage.

Additional projects include Huntington Center, which is under construction, and the planned the new State Office Building, both located on High Street fronting Capitol Square. These buildings are planned to connect with the below-grade pedestrian walkway system under High Street to the Statehouse parking garage and to interconnect with the existing State Office Tower under Broad Street.

HIGHWAY SYSTEM

Physical Characteristics

The basic pattern of existing one-way traffic movements within the High Street corridor are illustrated in Figure 2-13. As can be seen, Third and Fourth, as well as Front and Marconi Streets, operate as one-way pairs in the north-south direction. The primary east-west pair is Spring and Long Streets. Town and Main Streets operate as a one-way pair west of High Street. Main Street in the study area originally operated one-way eastbound, however, it was changed to two-way east of High Street when the southbound I-71 movements were not permitted to enter the downtown via the Fourth Street ramp on the south side of the City. The existing lane usages at intersections within the study area are illustrated in Figure 2-14.

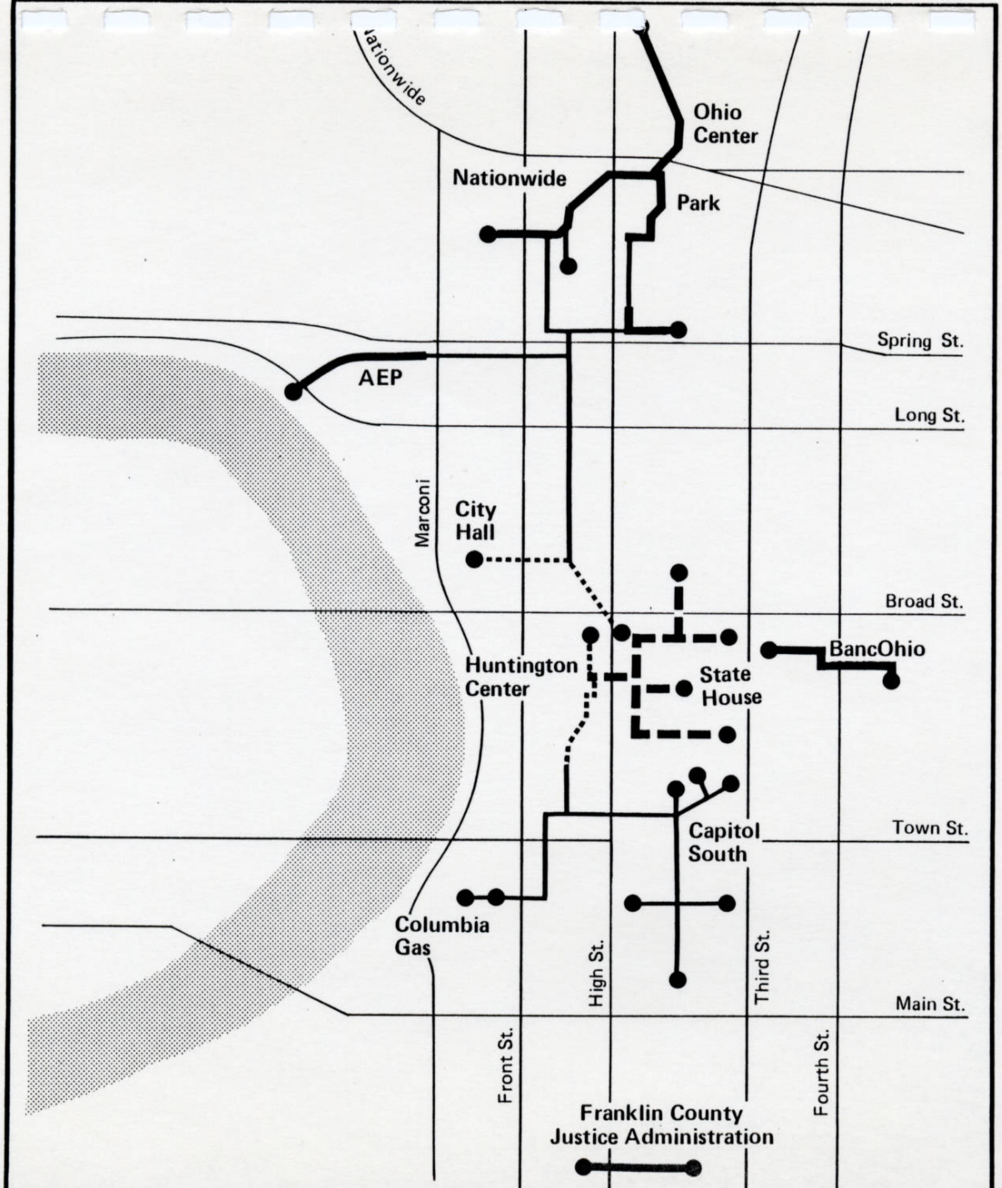

Figure 2-11
EXISTING AND PROPOSED GRADE-SEPARATED WALKWAY SYSTEM

- Existing Overhead
- Proposed Overhead
- Existing Below Grade
- Proposed Below Grade

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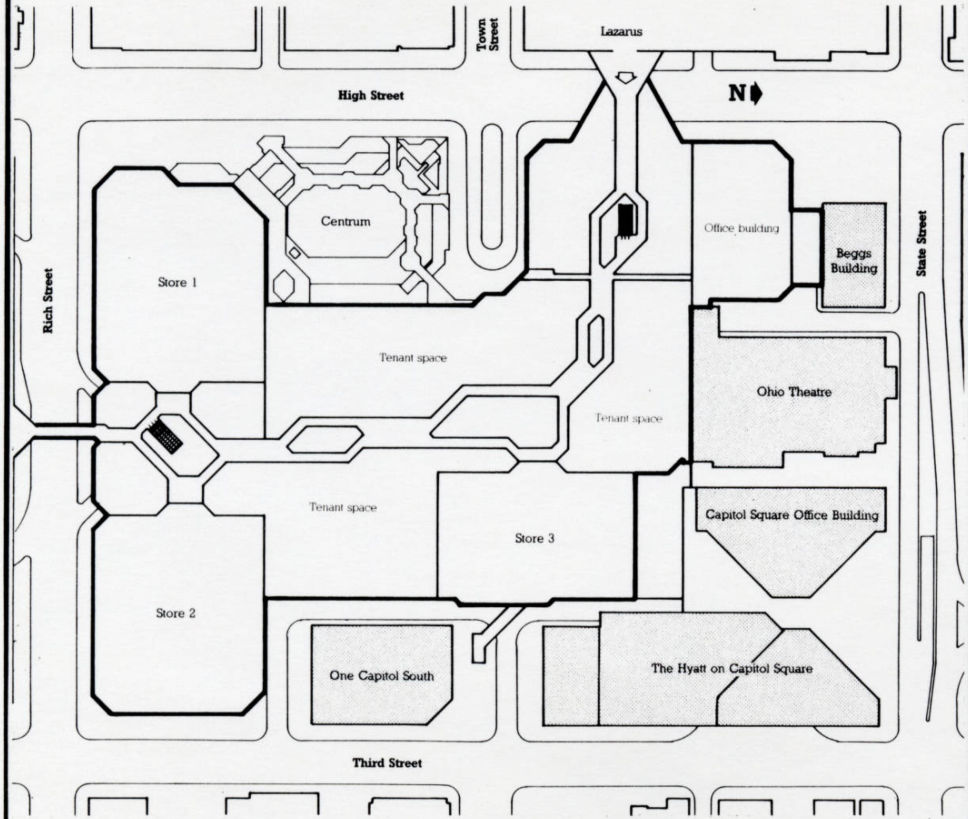

Figure 2-12
CAPITOL SOUTH
MASTER PLAN

Source: Columbus Monthly,
November, 1983

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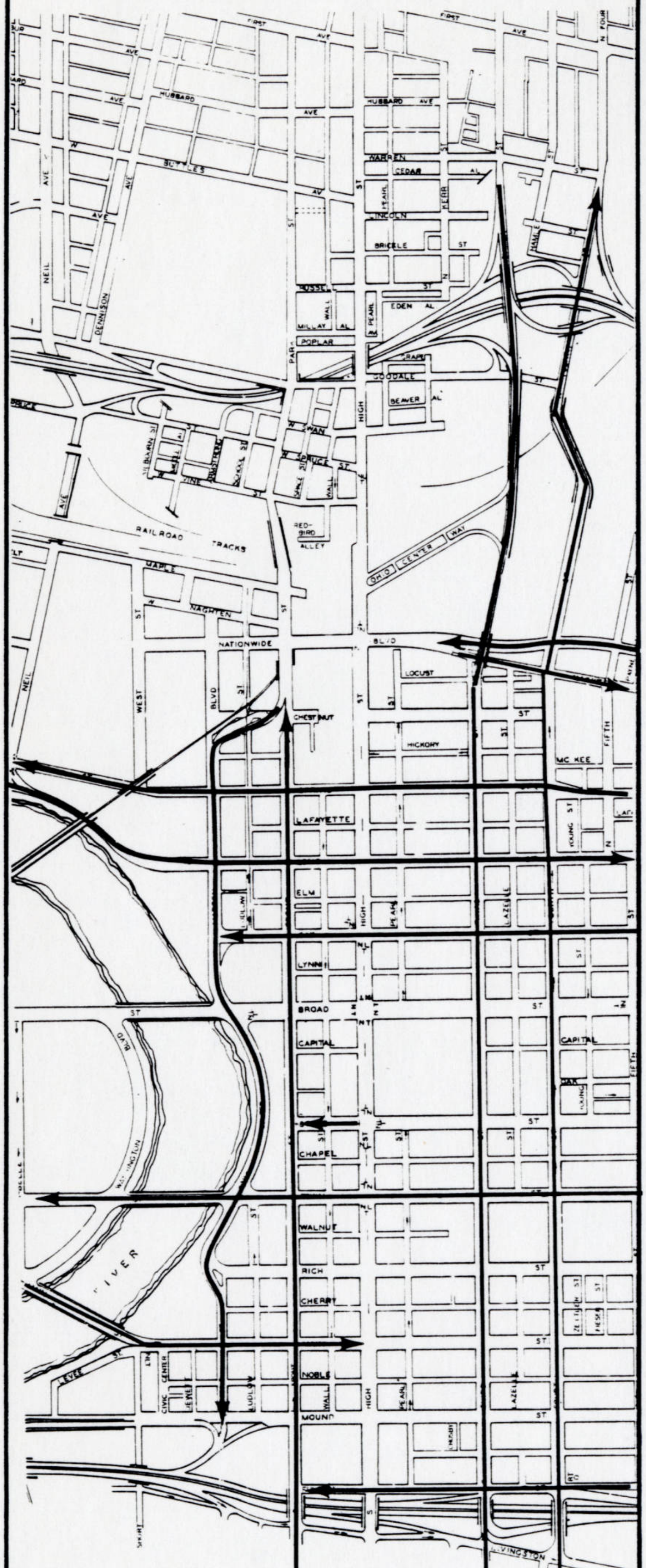

Figure 2-13
EXISTING PATTERN OF
ONE WAY STREETS

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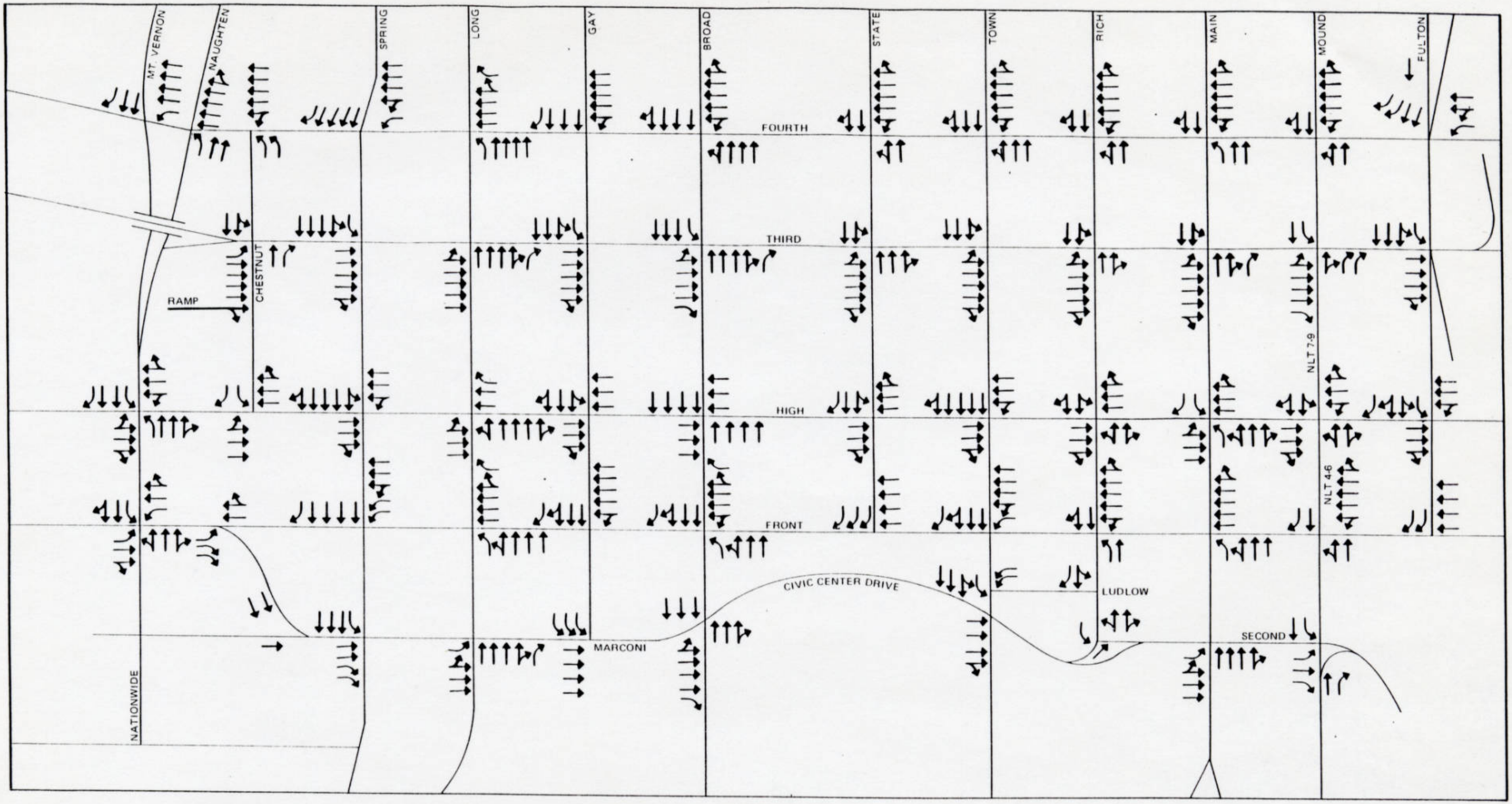

Figure 2-14
EXISTING (1983) LANE USAGE AT INTERSECTIONS

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In the future, Main and Rich Streets are proposed to become a one-way pair through the study area due to the potential closure of Town Street between High and Third Streets to permit the development of Capitol South. Rich Street traffic (i.e., westbound traffic) would turn either at Front or Ludlow Streets to access the Town Street bridge over the river.

The only other major change in the regional and arterial street system which would affect the downtown area is the planned reconstruction of the Innerbelt on the north side of the City. This includes the total reconstruction of the freeway, ramp modifications, and the construction of the airport connector to the northeast. The major changes include the extension of Nationwide Boulevard connecting to Route 315 north of the Innerbelt (and replacing the present direct connections with Spring and Long Streets) and the direct linkages of Third and Fourth Streets with the airport connector.

Traffic Volume Surveys

Two types of traffic volume surveys were conducted as part of this study. The first was a cordon count conducted on all roadways entering and exiting the City (i.e., crossing the Innerbelt). The second was intersection turning movement counts at 39 intersections within the downtown area.

The cordon counts were taken at 26 locations from May 25 to July 12, 1983 on Tuesdays, Wednesdays, and Thursdays. At four of the count locations, two-week directional counts were conducted to assess the variations in daily traffic flows. The raw data from the machine counts was reviewed for accuracy and displayed on City of Columbus coding forms. The forms were delivered to the City of Columbus, Division of Traffic, for processing on their computer and returned to the consultant. All directional counts were then analyzed multiplying the raw average daily traffic by standard ODOT annual expansion factors. In order to ascertain the validity of the counts, all counts were added together by directionality (inbound versus outbound) and compared. The difference between the inbound and outbound counts was approximately three percent. The inbound counts were then adjusted to equal the outbound counts and average weekday daily traffic volume levels were determined for the internal cordon stations. The results of this exercise are illustrated in Figure 2-15.

From this cordon count data, the distribution of vehicle-trips to and from the downtown area by day of week and hour of the day were determined. The results of these analyses are shown in Figures 2-16 and 2-17, respectively. Supporting data for Figure 2-17 is listed in Table 2-8. In addition, the accumulation of vehicles within the downtown by hour of the day was determined as illustrated in Figure 2-18.

Intersection turning movement counts were taken at 36 locations on Tuesdays, Wednesdays, and Thursdays from June 28 to July 13, 1983 during the hours of 7:00 to 9:00 A.M., 11:00 A.M. to 1:00 P.M., and 4:00 to 6:00 P.M. Supplemental counts were taken at three locations on August 10, 1983. Intersection counts conducted by ODOT in 1981 and 1982 were added to this data base to provide turning movement volumes at 48 intersections within the study area.

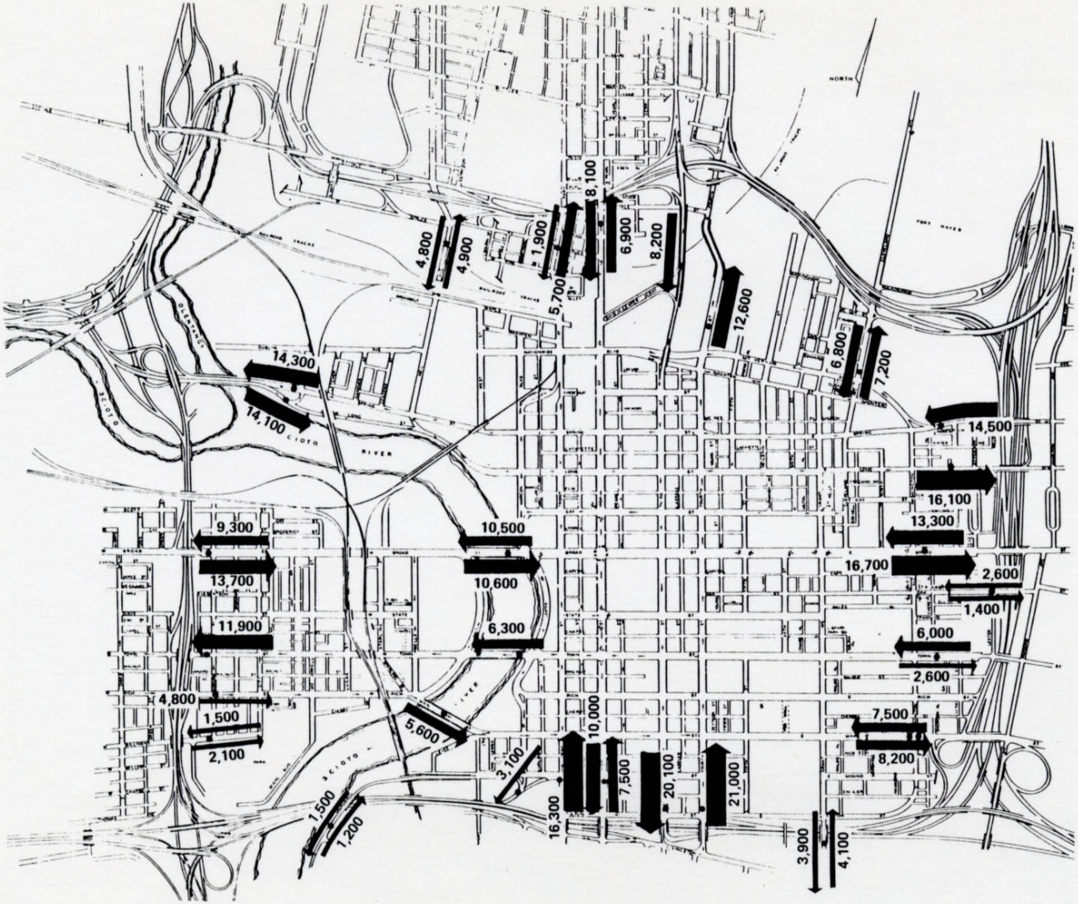
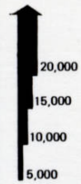


Figure 2-15
AVERAGE WEEKDAY 24-HOUR
TRAFFIC VOLUME LEVELS (1983)
AT INNERBELT CORDON

LEGEND:

• COUNT LOCATION



NUMBER OF VEHICLES

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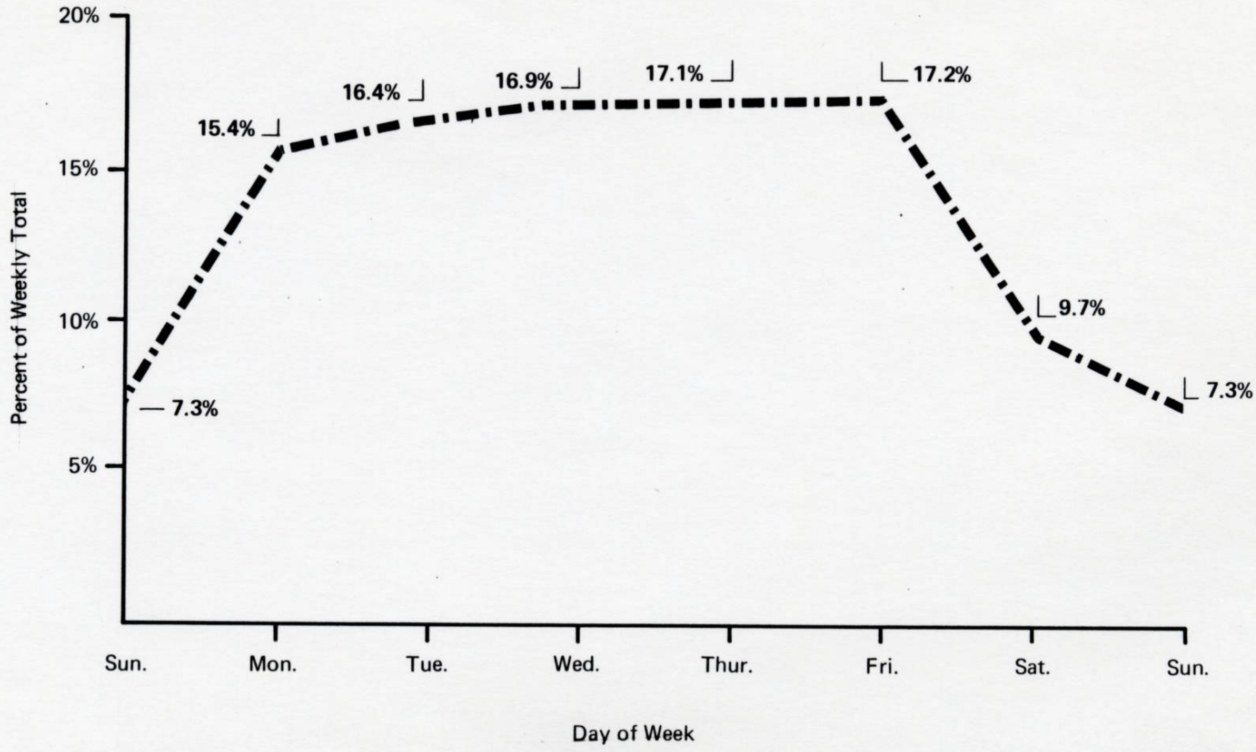

Figure 2-16
DISTRIBUTION OF VEHICLE-TRIPS TO THE DOWNTOWN (WITHIN INNERBELT) BY DAY OF THE WEEK

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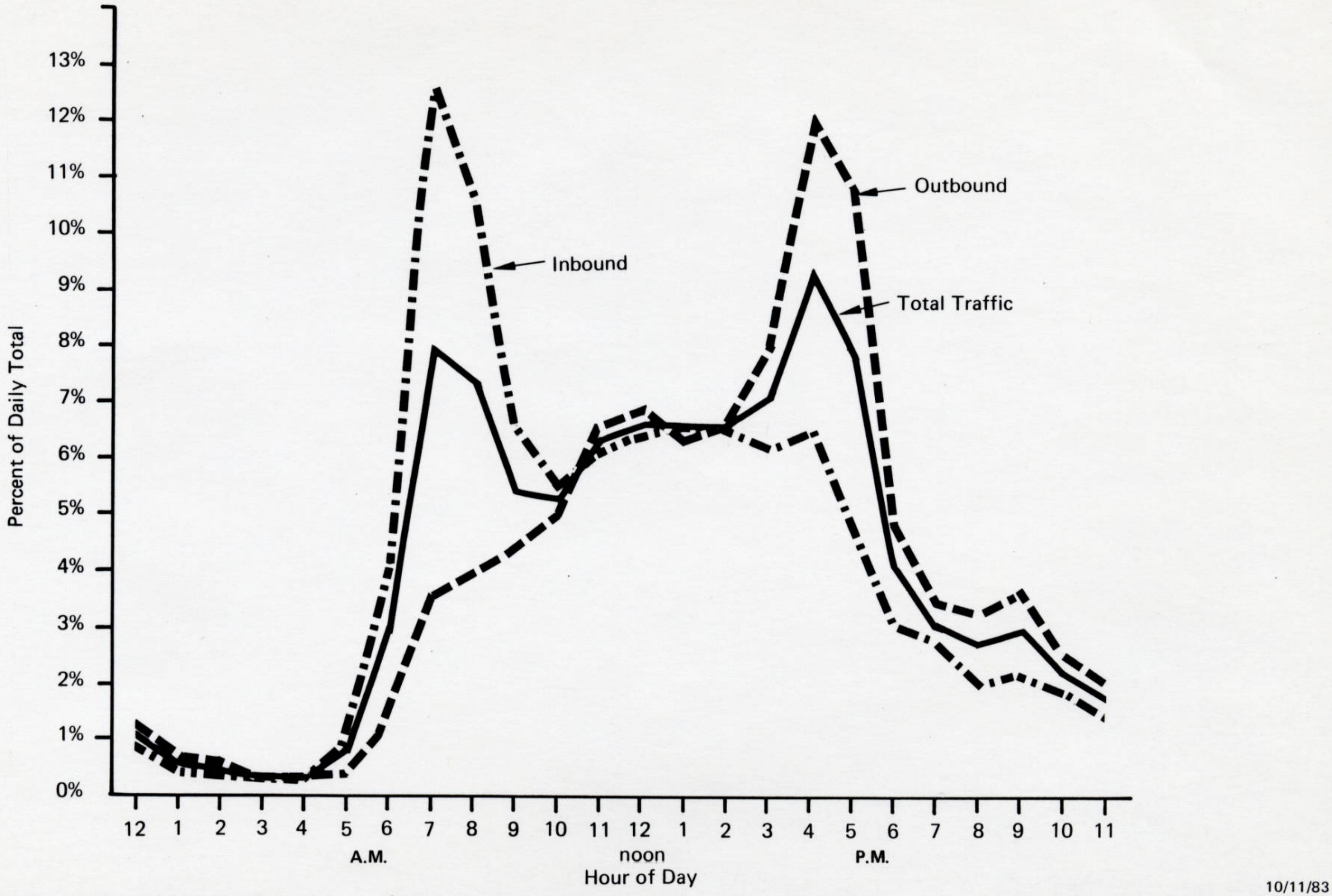

Figure 2-17

DISTRIBUTION OF VEHICLE-TRIPS TO AND FROM THE DOWNTOWN AREA (WITHIN INNERBELT) BY HOUR OF THE DAY

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COLUMBUS, OHIO

Table 2-8

DISTRIBUTION OF VEHICLE-TRIPS TO AND FROM THE DOWNTOWN AREA (WITHIN INNERBELT) BY HOUR OF THE DAY[1/]

Hour	Percent of Inbound Traffic	Percent of Outbound Traffic	Percent of Total Traffic
12 - 1 AM	0.87	1.29	1.06
1 - 2 AM	0.45	0.72	0.59
2 - 3 AM	0.38	0.67	0.53
3 - 4 AM	0.30	0.32	0.31
4 - 5 AM	0.33	0.29	0.31
5 - 6 AM	1.07	0.47	0.76
6 - 7 AM	4.39	1.56	2.92
7 - 8 AM	12.64	3.59	7.97
8 - 9 AM	10.72	4.04	7.27
9 - 10 AM	6.54	4.46	5.46
10 - 11 AM	5.55	5.05	5.29
11 - 12 Noon	6.07	6.68	6.39
12 - 1 PM	6.41	6.91	6.67
1 - 2 PM	6.66	6.36	6.49
2 - 3 PM	6.58	6.69	6.64
3 - 4 PM	6.22	8.00	7.14
4 - 5 PM	6.57	12.02	9.39
5 - 6 PM	4.69	10.82	7.86
6 - 7 PM	3.16	4.92	4.07
7 - 8 PM	2.74	3.47	3.12
8 - 9 PM	2.10	3.30	2.72
9 - 10 PM	2.22	3.65	2.98
10 - 11 PM	1.91	2.59	2.26
11 - 12 PM	1.43	2.13	1.80
TOTAL	100.00	100.00	100.00

1/ Based upon 1983 cordon count data.

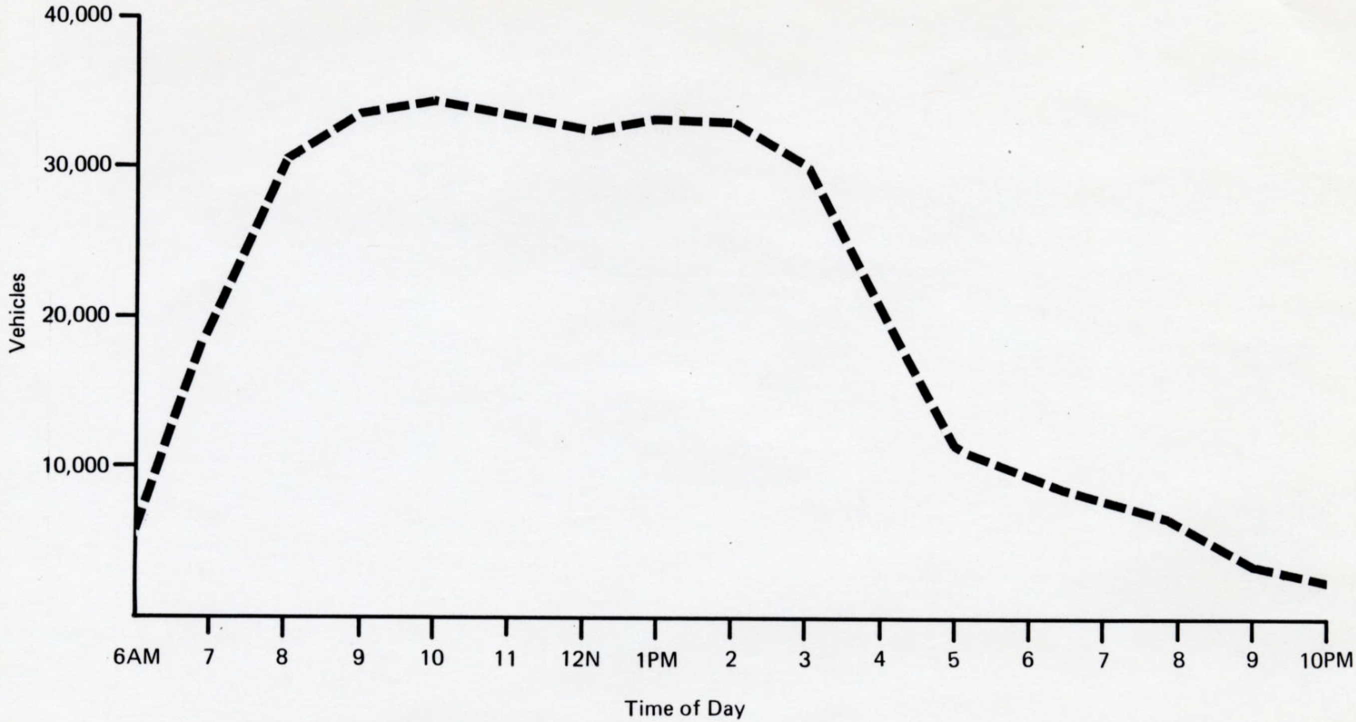


Figure 2-18

ACCUMULATION OF VEHICLES WITHIN THE DOWNTOWN (WITHIN INNERBELT) BY HOUR OF DAY

* AVERAGE WEEKDAY
* BASED ON 1983 CORDON COUNT

Based on the above information, peak A.M., mid-day, and P.M. hours were selected and the counts were adjusted for average weekday conditions using standard ODOT factors. The adjusted volumes were plotted on an aerial map and the total inbound and outbound traffic volume of a specific approach of an intersection was calculated. These volumes were compared to the volumes at adjacent intersections and adjustments were made where necessary to "balance" the system. The results of this work is summarized in the maps enclosed in the back pocket of the Appendix to this report.

In addition to the 24-hour volume counts conducted by the study team, the City conducted many counts within the downtown prior to the initiation of this project. Machine counts were taken mid-block on many key arterials including a comprehensive count of traffic along High Street itself. The results of these surveys are illustrated in Figure 2-19.

Vehicle Occupancy Survey

Vehicle occupancy surveys were conducted on June 20 and 21, 1983 for thirteen traffic movements at eight intersections throughout the City. These surveys were conducted by observing traffic from 8:30 to 11:30 A.M. Each vehicle, excluding commercial vehicles, was counted and the number of occupants of each vehicle was recorded. The field data was then summarized by number of vehicles and number of occupants to arrive at an average vehicle occupancy figure. The results of this work is summarized in Table 2-9.

Vehicle Classification Survey

Data for the vehicle classification survey was collected in conjunction with the vehicle occupancy data on June 20 and 21, 1983. All vehicles passing each location were classified into four categories: (1) passenger vehicles, (2) small commercial vehicles (single unit trucks and vans), (3) large commercial vehicles, and (4) buses. The field data was then summarized to obtain the percentages of each type of vehicle observed by location. The results of this survey are summarized in Table 2-10.

Supplemental Information

In addition to the above, information was collected to determine the relevance of such items as accident statistics, emergency vehicle routings, and service vehicle movements. Accident statistics for 1980, 1981, and 1982 were reviewed and plotted, however, there were no unusual findings since the greatest number of accidents occur at the intersections with greatest volumes. With respect to emergency access routings, it was determined that the City does not have an official emergency access plan. The two nearby fire stations located at Fourth street and Nationwide Boulevard and at Fulton and Third Streets generally use the routes of least resistance depending upon the time of day and day of week. Finally, with respect to truck service activities, the majority of goods movement takes place on the secondary streets and most establishments can be served via these secondary streets. This condition significantly reduced the need to conduct detailed field study of on-street goods movements. While not studied in detail as part of this project, these three elements must be and have been considered in the determination of feasibile traffic and transit alternatives within the High Street corridor.

Figure 2-19
24-HOUR TRAFFIC VOLUMES ON ROADWAYS WITHIN THE DOWNTOWN AREA

*Counts Conducted By the City Division of Traffic Engineering and Parking in 1983.

*Actual Counts (not adjusted by season or day of week).

← Volume for direction shown.
↔ Two-Way Volume

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services

Table 2-9

SUMMARY OF VEHICLE-OCCUPANCY SURVEY[1/]

Location	Persons per Vehicle
Southbound on High Street @ Nationwide Boulevard	1.44
Westbound on Nationwide Boulevard @ High Street	1.60
Southbound on Third Street @ Chestnut Street	1.26
Eastbound on Long Street @ Marconi Boulevard	1.25
Eastbound on Broad Street @ Marconi Boulevard	1.57
Southbound on Marconi Boulevard @ Broad Street	1.33
Northbound on High Street @ Main Street	1.56
Eastbound on Main Street @ High Street	1.55
Northbound on Grant Avenue @ Main Street	1.22
Westbound on Main Street @ Grant Avenue	1.31
Westbound on Broad Street @ Washington Avenue	1.40
Southbound on Cleveland Avenue @ Spring Street	1.73
Westbound on Spring Street @ Cleveland Avenue	1.47
Overall	1.41[2/]

1/ Passenger vehicles only; does not include commercial vehicles or buses.

2/ Peak hour: 1.50 persons per vehicle; non-peak condition: 1.39 persons per vehicle.

Table 2-10

SUMMARY OF VEHICLE-CLASSIFICATION SURVEY

Location	Percentage Distribution			
	Passenger Vehicles	Small Commercial Vehicles	Large Commercial Vehicles	Buses
Southbound on High Street @ Nationwide Boulevard	83.1	8.8	0.0	8.1
Southbound on Third Street @ Chestnut Street	88.6	10.7	0.7	0.0
Eastbound on Long Street @ Marconi Boulevard	82.2	16.3	0.4	1.1
Eastbound on Broad Street @ Marconi Boulevard	85.1	13.5	0.5	0.9
Southbound on Marconi Boulevard @ Broad Street	85.1	14.9	0.0	0.0
Northbound on High Street @ Main Street	79.6	11.6	1.0	7.8
Northbound on Grant Avenue @ Main Street	83.3	14.8	1.9	0.0
Westbound on Main Street @ Grant Avenue	93.8	5.2	1.0	0.0
Westbound on Broad Street @ Washington Avenue	90.6	8.0	0.6	0.8
Southbound on Cleveland Avenue @ Spring Street	87.4	12.6	0.0	0.0
Westbound on Spring Street @ Cleveland Avenue	88.3	10.6	0.0	1.1
Overall	85.9	11.4	0.5	2.2

TRANSPORTATION PLANNING DATA

While the transportation planning (modeling) process is described in detail in Chapter 4, the "inventories" part of the project did supply data and information for the planning and modeling processes. The results of these inventories and surveys are briefly summarized in the following sections.

Traffic Analysis Zones

In analyzing and forecasting travel demands, it is usually impossible to work with an individual unit of land use, such an employee or a househould, simply because of the large numbers involved. Transportation planning data, therefore, is normally grouped or aggregated into small spatial units called zones or traffic analysis zones. This convention allows transportation planners to develop and apply computer techniques to estimate and forecast traffic volumes on the transportation facilities in the study area. The zonal system used for this study, which is very similar to that used by ODOT and MORPC in their studies, is shown in Figure 2-20.

Land Use and Employment Data

Data and information associated with land use and employment levels were obtained from the City and MORPC. Existing and projected employment values were not readily available, therefore, many meetings and worksessions with all responsible agencies were required to obtain "final" estimated employment levels, by zone, for use in the transportation modeling process. The results of study team adjustments, together with the recommendations by the relevant public agencies, are illustrated in Tables 2-11, 2-12, and 2-13. The values shown in these tables were determined by representatives of the appropriate public agencies as "final" values to be used in this study.

Parking Data

Most transportation demand modeling techniques estimate travel to the final destination (i.e., assignment of work trips to a person's place of employment). While this is probably satisfactorily accurate for regional studies, it was judged not to be accurate enough for this study. Therefore, it was necessary to assign trips to the place where the vehicle was parked. In order to implement this estimation technique, it was necessary to ascertain the number of parking spaces, together with the cost of these spaces, by traffic analysis zone. Existing and projected parking data was obtained from the City and MORPC. Summaries of this information are shown in Tables 2-14 and 2-15 (for 1983 and Year 2000, respectively).

Trip Tables

In order to estimate travel on the transportation facilities, it is first necessary to estimate the number of trips which occur between traffic analysis zones (i.e., zonal interchanges). A listing of these trip interchanges in an orderly format, is called a trip table and this listing may be printed or stored on a media which can be read by a computer. This study obtained the basic trip tables from ODOT and MORPC as background data for this project.

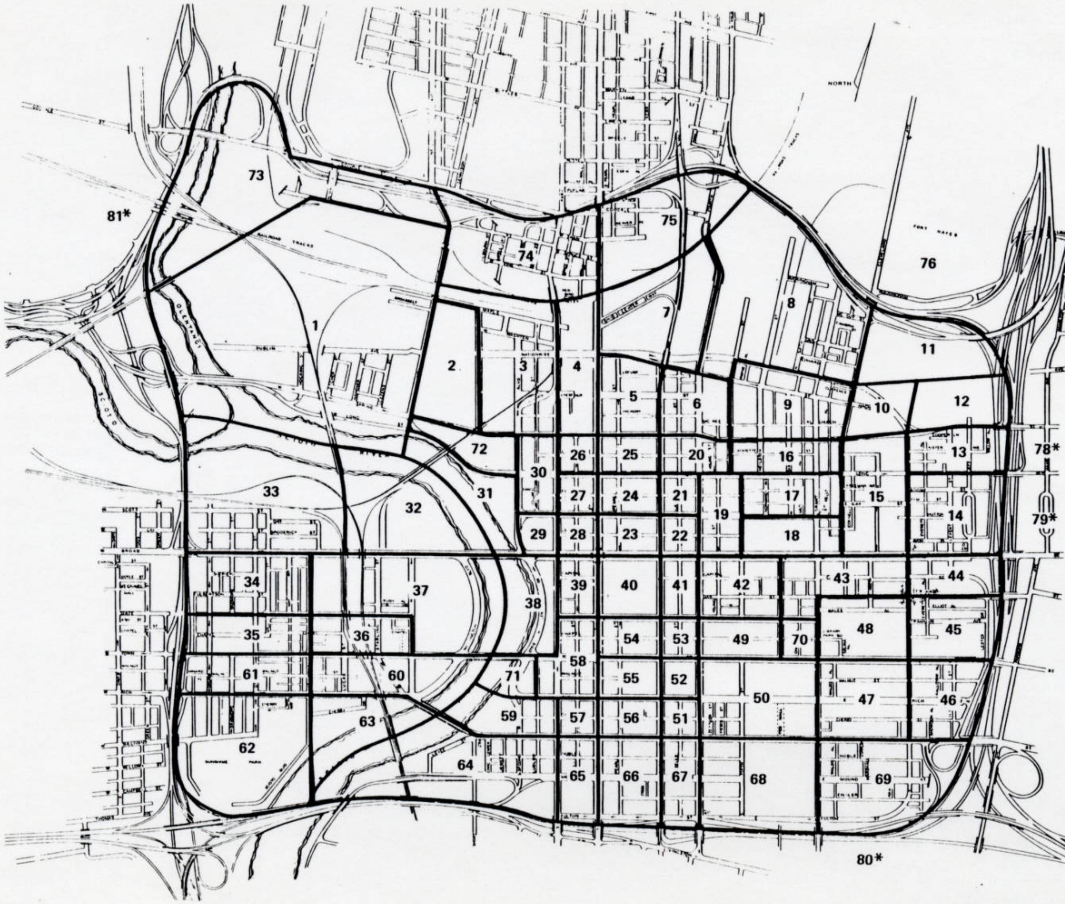


Figure 2-20
CBD TRANSPORTATION PLANNING ZONES

*Year 2000 Zones Only

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services

Table 2-11

1980 EMPLOYMENT BY ZONE

Centroid	Employment	Centroid	Employment	Centroid	Employment
1	2,049	31	553	61	96
2	269	32	46	62	139
3	1,000	33	598	63	33
4	5,007	34	401	64	579
5	4,726	35	69	65	947
6	638	36	427	66	1,821
7	955	37	306	67	544
8	731	38	3,150	68	1,020
9	571	39	2,138	69	265
10	45	40	707	70	1,946
11	103	41	2,865	73	477
12	278	42	1,100	74	929
13	151	43	2,462	75	404
14	628	44	215	Total	77,424
15	304	45	109		
16	225	46	171		
17	107	47	425		
18	1,581	48	360		
19	2,643	49	814		
20	346	50	1,028		
21	4,042	51	91		
22	2,316	52	234		
23	6,749	53	1,280		
24	1,401	54	537		
25	872	55	66		
26	438	56	434		
27	1,337	57	124		
28	1,873	58	2,666		
29	441	59	31		
30	2,357	60	634		

Table 2-12

1983 EMPLOYMENT ESTIMATES BY ZONE

Centroid	Employment	Centroid	Employment	Centroid	Employment
1	2,055	31	553	61	96
2	269	32	46	62	139
3	1,000	33	598	63	33
4	5,007	34	401	64	579
5	5,726	35	69	65	947
6	638	36	427	66	1,821
7	1,025	37	306	67	544
8	744	38	3,150	68	1,108
9	571	39	2,138	69	265
10	45	40	707	70	2,527
11	103	41	3,145	71	499
12	278	42	1,100	72	929
13	151	43	2,462	73	404
14	732	44	215	74	1,120
15	304	45	109	75	2,200
16	225	46	183	Total	83,197
17	107	47	425		
18	1,581	48	376		
19	2,643	49	814		
20	346	50	1,176		
21	4,042	51	91		
22	2,316	52	234		
23	6,837	53	1,280		
24	1,401	54	537		
25	872	55	66		
26	438	56	434		
27	1,337	57	149		
28	1,873	58	2,666		
29	441	59	31		
30	2,357	60	634		

(a) Zone 71 is a new zone created by splitting Zone 58 at Ludlow Street (Zone 71 is to the west of Ludlow). Zone 72 is a new zone created by splitting Zone 31 at W. Long Street (Zone 72 is to the north of W. Long).

Table 2-13

YEAR 2000 EMPLOYMENT ESTIMATES BY ZONE

Centroid	Employment	Centroid	Employment	Centroid	Employment
1	2,055	31	553	61	96
2	1,532	32	246	62	139
3	1,000	33	598	63	33
4	5,439	34	401	64	579
5	5,726	35	69	65	947
6	638	36	427	66	2,100
7	1,025	37	1,386	67	544
8	1,318	38	3,150	68	1,108
9	750	39	8,000	69	265
10	275	40	707	70	2,300
11	153	41	3,254	71	1,120
12	278	42	1,100	72	2,200
13	151	43	2,462	73	500
14	732	44	215	74	1,100
15	600	45	109	75	431
16	421	46	183	Total	102,901
17	107	47	425		
18	1,681	48	600		
19	2,643	49	814		
20	346	50	1,176		
21	4,042	51	91		
22	2,316	52	234		
23	7,117	53	1,448		
24	1,401	54	4,000		
25	872	55	1,500		
26	1,000	56	434		
27	2,725	57	655		
28	2,700	58	2,666		
29	441	59	61		
30	2,357	60	634		

Table 2-14

DATA FOR 1983 PARKING ALLOCATION MODEL

Zone Number	Number of Parking Squares	Parking Cost [1/]
3	3037	$1.04
4	1013	2.63
5	1220	1.83
6	467	.71
7	512	3.91
19	576	2.20
20	366	1.22
21	76	0
22	576	4.56
23	160	4.06
24	1082	3.22
25	1139	1.85
26	64	2.36
27	502	3.00
28	224	2.39
29	88	0
30	1167	2.22
31	134	1.69
38	127	0
39	338	3.56
40	1322	2.72
41	372	1.51
42	2032	2.62
49	904	1.02
50	1200	1.65
51	328	1.44
52	123	.61
53	428	2.74
54	330	0
55	535	2.75
56	500	1.92
57	514	1.75
58	1240	1.72
59	565	1.41
64	742	.56
65	420	1.83
66	1459	1.36
67	464	.30
68	1400	.49
71	200	0
72	1074	0
74	508	.34
75	1873	1.13

1/ Weighted average of cost per space in 1983 dollars.

Table 2-15

ATA FOR YEAR 2000 PARKING ALLOCATION MODEL

Zone Number	Number of Parking Spaces	Parking Cost 1/
3	3037	$1.04
4	1185	2.63
5	1220	1.83
6	467	.71
7	1262	3.91
19	576	2.20
20	366	1.22
21	76	0
22	576	4.56
23	160	4.06
24	1082	3.22
25	1139	1.85
26	290	2.36
27	1060	3.00
28	555	2.39
29	88	0
30	1167	2.22
31	134	1.69
38	127	0
39	200	3.56
40	1322	2.72
41	415	1.51
42	2032	2.62
49	904	1.02
50	1200	1.65
51	328	1.44
52	123	.61
53	495	2.74
54	330	0
55	0	2.75
56	4000	1.92
57	716	1.75
58	1640	1.72
59	565	1.41
64	742	.56
65	420	1.83
66	1570	1.36
67	464	.30
68	1400	.49
71	200	0
72	1074	0
74	508	34
75	1873	1.13

1/ Weighted average of cost per space in 1983 dollars.

Highway Network

In order to estimate travel on the transportation facilities, it is necessary to ascertain the characteristics of the highway system. The characteristics required are as follows:

1. Physical location

2. Distance

3. Number of lanes

4. Type of facility (i.e., one-way, two-way, arterial, freeway, etc.)

5. Turning restrictions

6. Parking lot entrances and exits

7. Average speeds

This data was obtained from the City of Columbus, MORPC, ODOT, field surveys, and from aerial photographs.

Employee and Shopper Surveys

Surveys were conducted of employees and shoppers within the High Street corridor. The purpose of these surveys was to obtain general information concerning mode of travel, live zone distributions, portal of entry/exit to the downtown, time of arrival/departure, vehicle occupancy levels, transit boarding and alighting locations, and other general transportation planning data.

These surveys were conducted in July and August of 1983. Through contacts made by the Chamber of Commerce, 12,300 employee questionnaires were distributed to ten major employers. A total of 5,418 responses were received. Shoppers at Lazarus, Madison's and The Limited were also interviewed. A total of 269 interview forms were completed.

The following is a summary of some of the key points derived from the analysis of these surveys:

- Bus captures a greater share of trips in the area between Gay Street and Town Street than in either of the areas north or south of there.

- Downtown shoppers are more likely to use bus than employees in the same stores.

- Long Street at S.R. 315 is the primary access or egress point to downtown. Third and Fourth Streets at I-70, I-71 are the next most significant.

Cleveland Avenue and the Long Street/Spring Street pair at I-71 also carry a large share of in and out traffic.

- o The employee survey revealed an auto occupancy slightly lower than that observed on downtown streets because park-and-ride commuters were included in the survey.

- o Over 20 percent of High Street bus boardings and alightings by corrridor employees occur at Nationwide Boulevard. This is second only to High and Broad Streets where over 21 percent of the access occurs.

- o Routes 2 and 10 each carry approximately 11 percent of downtown work trip bus passengers. Other routes carrying over 5 percent of downtown work trip bus passengers are 1, 4, and 8.

- o Almost 88 percent of corridor employees park within the corridor. Two percent park west of the corridor; 10 percent park immediately east of the corridor.

- o Approximately 90 percent of downtown shoppers and retail employees are able to park within three blocks of their destination. Eighty-one percent utilize off-street parking.

- o Nearly 76 percent of work trips are made by auto (see Table 2-16).

- o Fifty-five percent of shoppers and 61 percent of retail employees use auto as mode of travel (see Table 2-17).

The distribution of peak period arrival and departure times for work trips is shown in Figure 2-21. The distribution of work trips crossing the Innerbelt is shown in Figure 2-22. Figure 2-23 shows the distribution of vehicle occupancy rates for downtown work trips. A more complete summary of the surveys and survey results are contained in the Appendix to this report.

ENGINEERING SURVEYS

Aerial Photography and Base Mapping

On flights that occurred on June 7, and July 22, 1983, Clyde E. Williams & Associates (CEWA) photographed a total of about eleven (11) square miles of the downtown Columbus, Ohio area at photo scales of 1"=2000', 1"=1000', 1"=400' and 1"=200'. Over 270 photographs were taken with a Wild RC-8 precision mapping camera. Photographic enlargements printed on reproducible mylar were prepared of selected areas at various scales.

Using the 1"=200' aerial photography, CEWA prepared 1"-50' planimetric maps of an area extending from just north of Nationwide Boulevard on the north to I-70 on the south. The corridor was centered on High Street with Third Street and Front Street

Table 2-16

MODE SPLIT OF DOWNTOWN WORK TRIPS [1/]

District	Auto	Bus	Park-and-Ride	Walk	Other
North of Gay Street	81.8	12.5	5.3	0.2	0.2
South of Gay Street, North of Town street	59.6	24.9	14.3	0.6	0.6
South of Town Street	76.1	16.1	7.1	0.4	0.3
Total	75.6	16.0	7.7	0.4	0.3

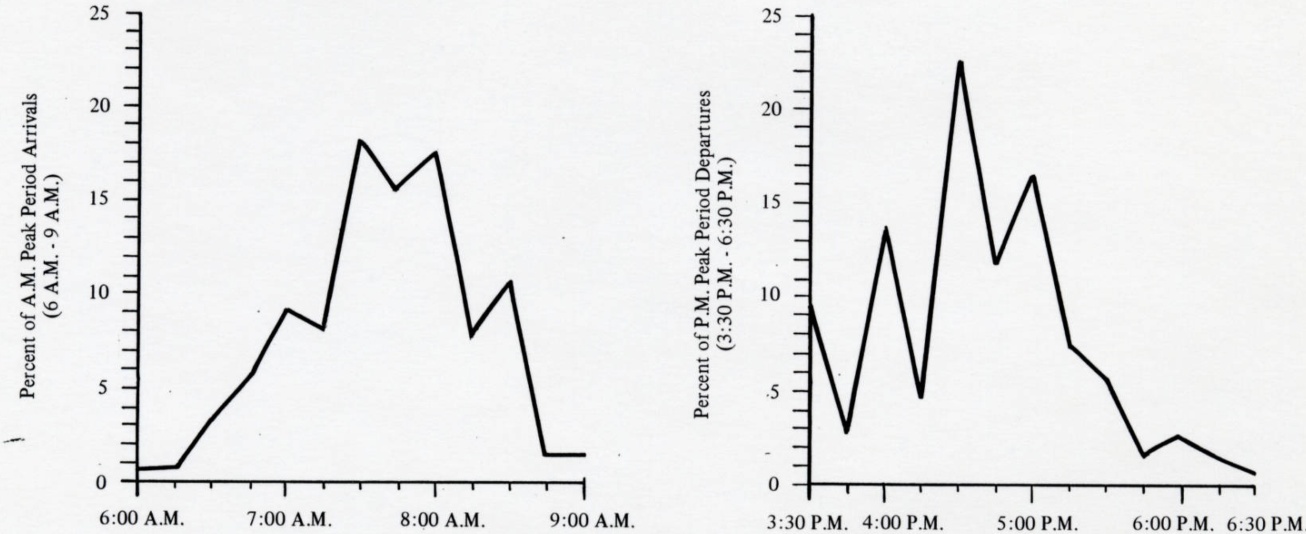
[1/] Source: Downtown Employee Interview Survey.

Table 2-17

SURVEY OF DOWNTOWN SHOPPERS AND RETAIL EMPLOYEES:
MODE OF TRANSPORTATION TO DOWNTOWN 1/

Mode	Shoppers Percent	Employees Percent
Auto	55	61
Bus	43	35
Taxi	1	1
Walk	1	3
Other	0	0

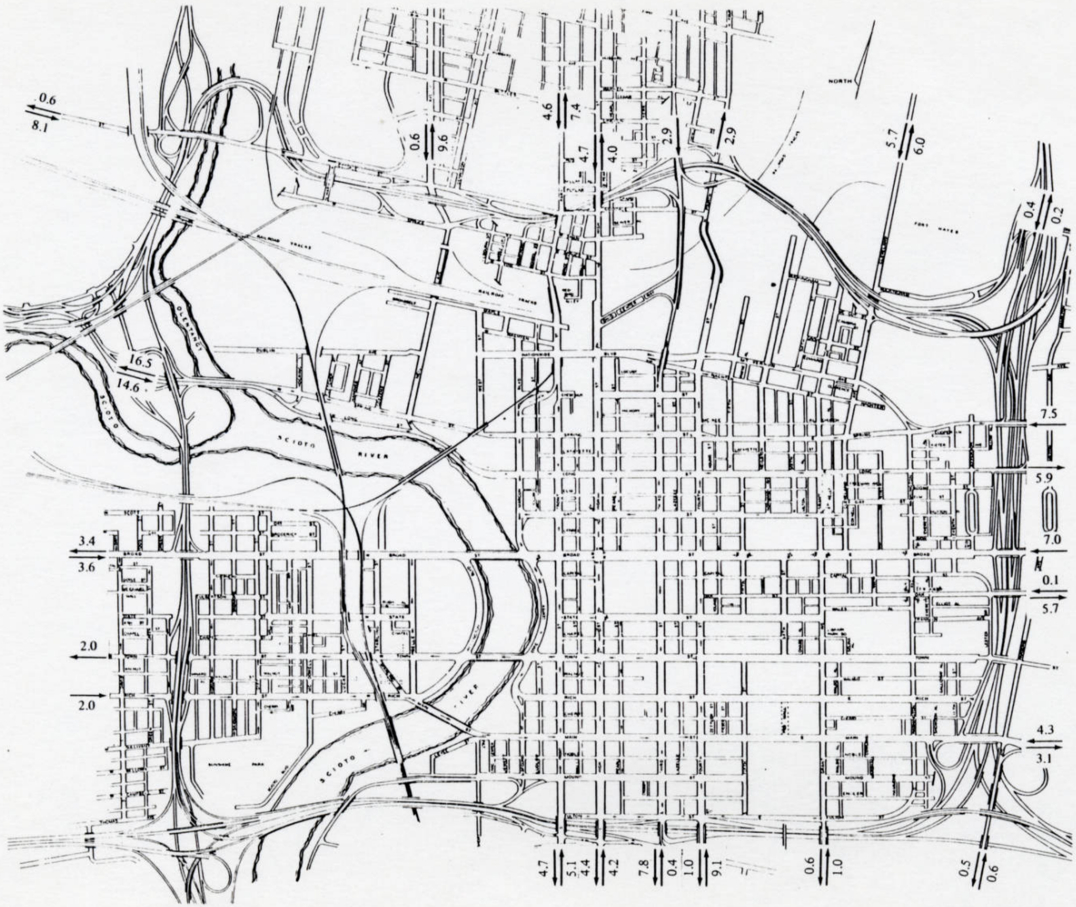
1/ Source: Downtown Shoppers' Interview.



Source: Downtown Employee Interview Survey

Figure 2-21
DISTRIBUTION OF DOWNTOWN WORK PEAK PERIOD ARRIVAL AND DEPARTURE TIMES

High Street Corridor Action Plan
COLUMBUS, OHIO



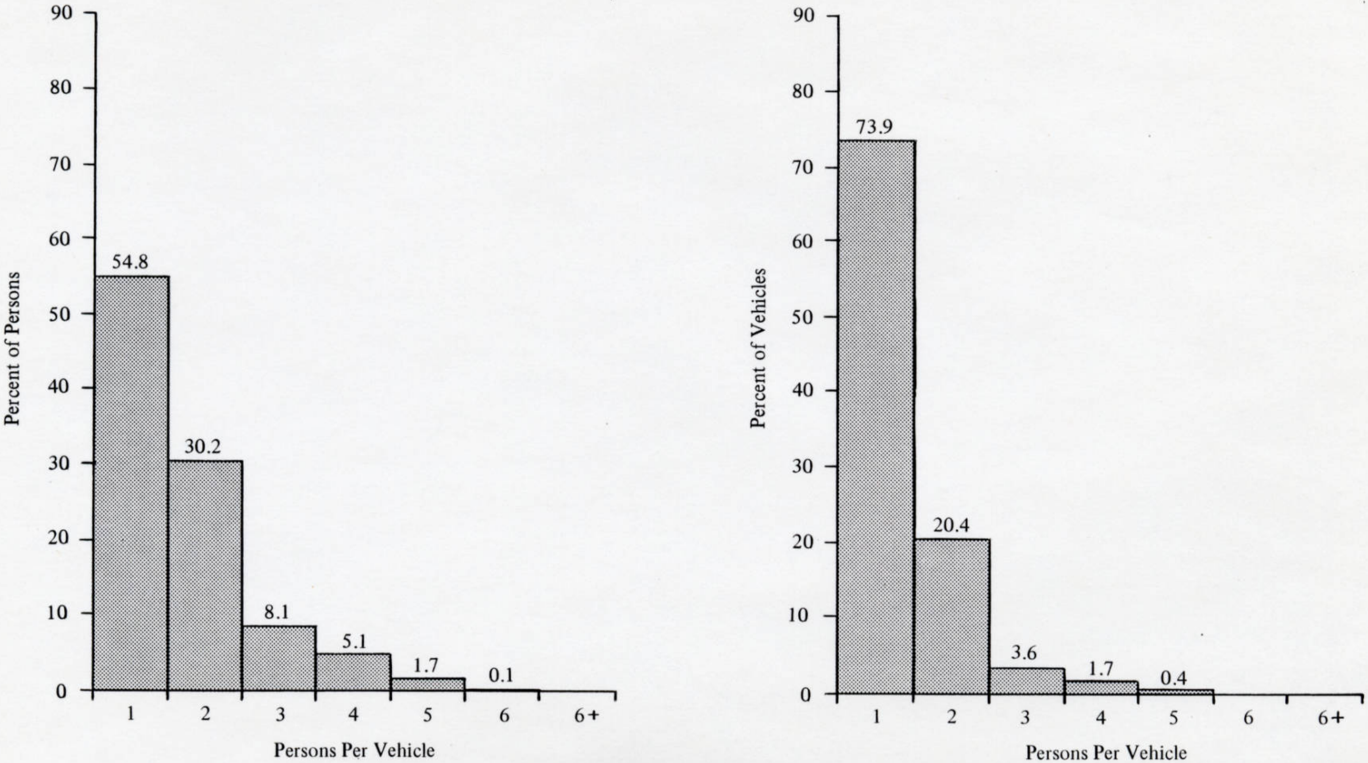
Source: Downtown Employee Interview Survey

Figure 2-22
DISTRIBUTION OF WORK TRIPS CROSSING THE INNERBELT

High Street Corridor Action Plan
COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services

Source: Downtown Employee Interview Survey



Average Auto Ocupancy = 1.35

Figure 2-23
VEHICLE OCCUPANCY FOR DOWNTOWN COLUMBUS WORK TRIPS

High Street Corridor Action Plan
COLUMBUS, OHIO

being the east and west limits respectively. The detail shown along these streets included building faces, sidewalks, manholes, vault covers, poles, traffic lights, hydrants, catch basins, fences, and trees, i.e., essentially all detail that could be identified and plotted from the aerial photographs.

This work was accomplished through a Santoni Stereo Plotter using stereo models scaled to horizontal measurements taken in the field. The input scale was 1"=50' and went directly from the plotter to an Auto-Trol interactive graphic computer. This allowed the graphic detail to be stored on disc or magnetic tape to be plotted back at a later date or to be easily reformated in sheets or scales different from those originally input. In all, twenty-two (22) stereo models from three flight lines were required to map the corridor.

<u>Utilities</u>

The firm of John E. Foster & Associates identified the utility types within the High Street corridor. This information was obtained from:

Ohio Bell Telephone Company
Columbia Gas Company
Columbus & Southern Electric Company
Warner Amex Qube
City of Columbus Division of Water
City of Columbus Division of Electric
City of Columbus Division of Traffic
City of Columbus Division of Sewers

Through this investigation, the approximate location and sizes of utilities within the major streets in the High Street corridor were determined. Unfortunately, the information cannot be detailed since the locations and depths are not accurate. Identification of exacate locations will have to be field located at a later time. At this time, the City of Columbus water main has the only immediate concern to any reconstruction within the High Street corridor; specifically along High Street. The water main is of considerable age and is believed to be at a shallow depth. If any major reconstruction occurred on High Street, the main would have to be rebuilt.

CHAPTER 3

ASSESSMENT OF EXISTING CENTRAL AREA TRANSPORTATION SYSTEM

The purpose of this chapter is to provide an assessment of the present transit, pedestrian, and highway systems. Each system was reviewed in order to highlight any deficiencies or problems which must be addressed in the development of an action plan for the High Street corridor.

TRANSIT OPERATIONS

There does not exist at this time any generally accepted criteria by which to measure the "level of service" under which a street operates when it is used as a major transit facility. While it is possible through traditional traffic engineering analysis techniques to define the level of service provided at a specific urban arterial intersection and to modify this value based upon the volume of observed bus operations and the presence or absence of bus stops near the intersection, similar criteria do not exist by which to determine at what point a specific volume of buses requires that some type of significant physical or operational improvement be made to a street in order to allow those buses to operate in an efficient manner. However, a number of general "planning guidelines" have been defined in recent years which, coupled with actual observed transit operational experience, can allow for a reasonably precise quantification to be made of the level of service at which a surface transit facility operates.

Research by Barton-Aschman and others indicates that the maximum volume of buses which can efficiently operate in a mixed traffic curb lane situation in one direction is approximately 60 vehicles per hour. For buses operating in an exclusive (transit only) curb lane 10-12 foot in width, the maximum operational value is approximately 100 vehicles. Operational experience in Seattle, Portland (Oregon), and Minneapolis has determined that 180 vehicles is the desirable maximum number of one directional bus operations which can be accommodated on a transit facility of sufficient width (18-22 feet) to allow passing of stopped buses and "skip-stop" operations to take place.

From a transit operational standpoint, these values for the maximum number of vehicles which can be accomodated for conditions of buses: in mixed traffic in a curb lane, in an exclusive curb transit lane, and in an exclusive transit facility wide enough to allow for passing of stopped buses, represent the "service volume" equivalent to that which would be found for a comparable highway operation at Level of Service C/D operating conditions. The range in the number of vehicles shown on Table 3-1 is that which is felt to reasonably represent the range in service volume associated with each of the various levels of service from "A" (uncongested, free-flow conditions) to "F" (total breakdown with stop and go operation).

Table 3-1

TRANSIT FACILITY LEVEL OF SERVICE DEFINITIONS

Level of Service	Interpretation[1/]	Volume/Capacity[2/] Ratio	TRANSIT FACILITY TYPE AND SERVICE VOLUMES[3/] Bus in Mixed Traffic-Curb Lane	Bus in Exclusive 10-12 Foot Lane	Bus in Exclusive 18-20 Foot Lane	Bus on Exclusive Transit Street
A,B	Uncongested operations; all vehicles clear in a single signal cycles.	0.00 - 0.70	0 - 52	0 - 88	0 - 158	0 - 158
C	Light congestion; occasional backups on critical approaches.	0.71 - 0.80	53 - 60	89 - 100	159 - 180	159 - 180
D	Congestion on critical approaches, but intersection functional. Vehicles required to wait through more than one cycle during short peaks. No long standing lines formed.	0.81 - 0.90	61 - 68	101 - 112	181 - 202	181 - 202
E	Severe congestion with some long standing lines on critical approaches. Blockage of intersection may occur if traffic signal does not provide for protected turning movements.	0.91 - 1.00	69 - 75	113 - 125	203 - 225	203 - 225
F	Total breakdown with stop-and-go operation.	1.01 +	76 +	126 +	226 +	226 +

NOTES:

1/ Source: Highway Capacity Manual, 1965

2/ Volume/Level of Service "E" Capacity

3/ Source: "Bus Use of Highways: Planning and Design Guidelines" and Barton-Aschman Associates, Inc.

Using these generalized level of service criteria, an assessment was made of both the current transit facility level of service along High Street as well as what the change in level of service would be were the existing mixed traffic curb lane operation to be superceded by either an exclusive, bus only curb lane or the provision of a two-lane, one-way transitway type facility. Tables 3-2 through 3-5 illustrate the results of this analysis for the following four conditions:

Table 3-2 - Existing level of service, PM peak hour local buses only, southbound direction

Table 3-3 - Existing level of service, PM peak hour, local buses only, northbound direction

Table 3-4 - Existing level of service, PM peak hour, local plus express buses, southbound direction

Table 3-5 - Existing level of service, PM peak hour, local plus express buses, northbound direction

Tables 3-2 and 3-3 summarize the existing traffic level of service on High Street during the PM peak hour considering only the presence of local buses. For this situation, the same as currently found along High Street, severe congestion levels were identified in both the northbound and southbound directions, predominantly between Long Street on the north and Main Street on the south. Were the existing mixed traffic curb lane to be dedicated solely to bus movement, the associated levels of service would improve substantially with no depreciable congestion being projected to occur given existing local bus volumes. However, this analysis does not consider what the implications would be upon vehicle conflicts and additional personal vehicle congestion resulting from the removal of right turning vehicles from the existing High Street curb lanes. Finally, were a two-lane transitway to be provided for both the northbound and southbound directions along High Street, the resulting level of service associated with the current levels of local buses would result in virtually free-flow conditions.

Tables 3-4 and 3-5 take this analysis one step further and examine the implications of mixing both local and express buses into a single transit facility (i.e., a single curb lane or a two-lane transitway). As might be expected, extremely severe levels of congestion (LOS "F") could be expected to occur under the curb lane/mixed traffic operating scenario due to the large volume of buses in both the northbound and southbound directions. Indeed, the magnitude of bus volumes in the northbound direction during the PM peak hour are such that even were the curb lane to be dedicated totally to transit usage, level of service C/D conditions would still be found in the segment of High Street from Rich Street on the south through Long Street on the north. Only through the implementation of a two-lane, one-directional transitway in both the northbound and southbound directions could the existing volumes of local plus express bus movement along High Street be accommodated without any noticeable congestion levels.

Table 3- 2

EXISTING TRANSIT LEVEL OF SERVICE ON HIGH STREET -- PM Peak Hour
Bus Operations — Local Buses Only
Direction — Southbound

FROM	TO	Bus Volume	Transit Facility Options: Curb Lane - Mixed Traffic V/C[1/]	LOS[2/]	Exclusive Curb Bus Lane V/C[3/]	LOS	Two-lane, One-way Transitway V/C[4/]	LOS
Ohio Center Way	Nationwide Blvd.	25	0.33	A	0.20	A	0.11	A
Nationwide Blvd.	Chestnut Street	25	0.33	A	0.20	A	0.11	A
Chestnut Street	Spring St.	25	0.33	A	0.20	A	0.11	A
Spring St.	Long St.	52	0.69	B	0.42	B	0.23	A
Long St.	Broad St.	63	0.84	D	0.50	B	0.28	A
Broad St.	State St.	66	0.88	D	0.53	B	0.29	A
State St.	Town St.	66	0.88	D	0.53	B	0.29	A
Town St.	Rich St.	52	0.69	B	0.42	B	0.23	A
Rich St.	Main St.	32	0.43	B	0.26	A	0.14	A
Main St.	Mound St.	32	0.43	B	0.26	A	0.14	A
Mound St.	Fulton St.	24	0.32	A	0.19	A	0.11	A
Fulton St.	Livingston St.	24	0.32	A	0.19	A	0.11	A
Livingston St.	Beck St.	8	0.11	A	0.06	A	0.04	A

Notes:

1/ Assumes capacity (LOS "E") of 75 buses per hour

2/ Level of Service (LOS) definitions as per Table 3-_.

3/ Assumes capacity (LOS "E") of 125 buses per hour

4/ Assumes capacity (LOS "E") of 225 buses per hour

Table 3- 3

EXISTING TRANSIT LEVEL OF SERVICE ON HIGH STREET -- PM Peak Hour
Bus Operations — Local Buses Only
Direction — Northbound

			Transit Facility Options					
			Curb Lane - Mixed Traffic		Exclusive Curb Bus Lane		Two-lane, One-way Transitway	
FROM	TO	Bus Volume	V/C[1/]	LOS[2/]	V/C[3/]	LOS	V/C[4/]	LOS
Ohio Center Way	Nationwide Blvd.	30	0.40	B	0.24	A	0.13	A
Nationwide Blvd.	Chestnut Street	34	0.45	B	0.27	A	0.15	A
Chestnut Street	Spring St.	38	0.51	B	0.30	A	0.17	A
Spring St.	Long St.	50	0.67	B	0.40	B	0.22	A
Long St.	Broad St.	72	0.96	E	0.58	B	0.32	A
Broad St.	State St.	69	0.92	E	0.55	B	0.31	A
State St.	Town St.	67	0.89	D	0.54	B	0.30	A
Town St.	Rich St.	67	0.89	D	0.54	B	0.30	A
Rich St.	Main St.	63	0.84	D	0.50	B	0.28	A
Main St.	Mound St.	37	0.49	B	0.30	A	0.16	A
Mound St.	Fulton St.	24	0.32	A	0.19	A	0.11	A
Fulton St.	Livingston St.	8	0.11	A	0.06	A	0.04	A
Livingston St.	Beck St.	8	0.11	A	0.06	A	0.04	A

Notes:

1/ Assumes capacity (LOS "E") of 75 buses per hour

2/ Level of Service (LOS) definitions as per Table 3-_.

3/ Assumes capacity (LOS "E") of 125 buses per hour

4/ Assumes capacity (LOS "E") of 225 buses per hour

Table 3- 4

EXISTING TRANSIT LEVEL OF SERVICE ON HIGH STREET -- PM Peak Hour
Bus Operations — Local plus Express Buses
Direction — Southbound

			Transit Facility Options					
			Curb Lane - Mixed Traffic		Exclusive Curb Bus Lane		Two-lane, One-way Transitway	
FROM	TO	Bus Volume	V/C 1/	LOS 2/	V/C 3/	LOS	V/C 4/	LOS
Ohio Center Way	Nationwide Blvd.	25	0.33	A	0.20	A	0.11	A
Nationwide Blvd.	Chestnut Street	25	0.33	A	0.20	A	0.11	A
Chestnut Street	Spring St.	25	0.33	A	0.20	A	0.11	A
Spring St.	Long St.	52	0.69	B	0.42	B	0.23	A
Long St.	Broad St.	80	1.07	F	0.64	B	0.36	A
Broad St.	State St.	83	1.11	F	0.66	B	0.37	A
State St.	Town St.	83	1.11	F	0.66	B	0.37	A
Town St.	Rich St.	69	0.92	E	0.55	B	0.31	A
Rich St.	Main St.	55	0.73	C	0.44	B	0.24	A
Main St.	Mound St.	38	0.51	B	0.30	A	0.17	A
Mound St.	Fulton St.	30	0.40	B	0.24	A	0.13	A
Fulton St.	Livingston St.	30	0.40	B	0.24	A	0.13	A
Livingston St.	Beck St.	14	0.19	A	0.11	A	0.06	A

Notes:

1/ Assumes capacity (LOS "E") of 75 buses per hour

2/ Level of Service (LOS) definitions as per Table 3-_.

3/ Assumes capacity (LOS "E") of 125 buses per hour

4/ Assumes capacity (LOS "E") of 225 buses per hour

Table 3- 5

EXISTING TRANSIT LEVEL OF SERVICE ON HIGH STREET -- PM Peak Hour
Bus Operations – Local plus Express Buses
Direction – Northbound

			Transit Facility Options					
			Curb Lane - Mixed Traffic		Exclusive Curb Bus Lane		Two-lane, One-way Transitway	
FROM	TO	Bus Volume	V/C 1/	LOS 2/	V/C 3/	LOS	V/C 4/	LOS
Ohio Center Way	Nationwide Blvd.	34	0.45	B	0.27	A	0.15	A
Nationwide Blvd.	Chestnut Street	38	0.51	B	0.30	A	0.17	A
Chestnut Street	Spring St.	42	0.56	B	0.34	A	0.19	A
Spring St.	Long St.	77	1.03	F	0.62	B	0.34	A
Long St.	Broad St.	105	1.40	F	0.84	D	0.47	B
Broad St.	State St.	101	1.35	F	0.81	D	0.45	B
State St.	Town St.	99	1.32	F	0.79	C	0.44	B
Town St.	Rich St.	99	1.32	F	0.79	C	0.44	B
Rich St.	Main St.	63	0.84	D	0.50	B	0.28	A
Main St.	Mound St.	38	0.51	B	0.30	A	0.17	A
Mound St.	Fulton St.	25	0.33	A	0.20	A	0.11	A
Fulton St.	Livingston St.	8	0.11	A	0.06	A	0.04	A
Livingston St.	Beck St.	8	0.11	A	0.06	A	0.04	A

Notes:

1/ Assumes capacity (LOS "E") of 75 buses per hour

2/ Level of Service (LOS) definitions as per Table 3-_.

3/ Assumes capacity (LOS "E") of 125 buses per hour

4/ Assumes capacity (LOS "E") of 225 buses per hour

One major implication of this transit level of service analysis was that consideration had to be given to the potential use of more than just High Street in the Year 2000 in order to adequately accommodate increased levels of transit usage at acceptable levels of service.

PEDESTRIAN MOVEMENTS

High Street is a heavily traveled pedestrian area interconnecting major retail, governmental, and office facilities. At the present time, vehicular traffic dominates the public right-of-way, and pedestrian amenities are either non-existent or in poor condition. Further private development along High Street will depend, in part, upon the public's perception that it is a convenient and safe place for people to walk.

Pedestrian volumes on the sidewalks as high as 3,800 persons per hour were observed with 1,150 persons observed walking in both directions on the sidewalk in a single fifteen-minute period. For a good level of service ("B"), design criteria specify 7 to 10 persons per foot width per minute. In addition, two feet should be added to the width to account for window shopping and to reflect the fact that people avoid walking close to walls. Therefore, as an example, a sidewalk width of 10 to 13 feet is needed to properly accomodate a pedestrian volume of 1,150 persons in 15 minutes. This is a clear width exclusive of obstacles such as parking meters, poles, fire hydrants, trash cans, bus shelters, queued bus patrons, etc.

One of the major problems is that pedestrian movements on the sidewalks are complicated by large queues of persons waiting at bus stops along High Street. At several bus stop locations, waiting passengers interfere with or totally block sidewalk movements. Given the lack of formal bus waiting areas or shelters, bus passengers disperse from the curb area to the fronts of buildings which provide informal seating and waiting areas and provide protection from inclement weather. This dispersal of waiting bus passengers across the entire sidewalk width interferes with convenient movement of pedestrians along the sidewalks.

HIGHWAY SYSTEM

Approximately 158,200 vehicles enter and leave downtown Columbus (316,400 vehicles total two-way) on a typical weekday. The distribution of vehicles entering and leaving the downtown, by Innerbelt portal, was shown in Chapter 2.

With respect to High Street itself, there is an observed directionality of vehicle-trips with approximately 44 percent of the vehicles traveling northbound and 56 percent traveling southbound. The reason for this appears to be the greater use of Front Street (northbound) than the use of Marconi/Civic Center Drive (southbound). The variation in 24-hour volumes on High Street is illustrated in Figure 3-1.

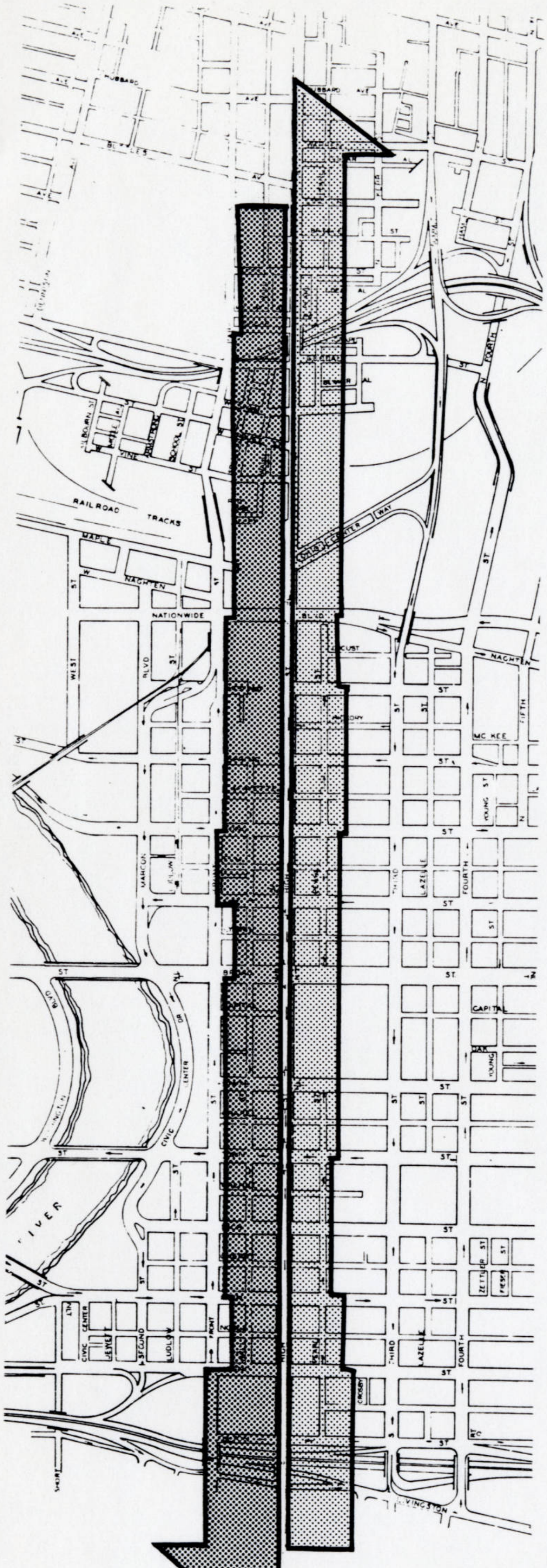
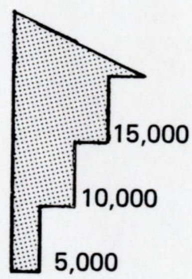


Figure 3-1
VARIATION OF 24-HOUR TRAFFIC VOLUMES ALONG HIGH STREET



SCALE: VEHICLES PER DAY

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In general, the existing traffic demands on corridor streets can be accomodated at good levels of service. However, there are several intersections scattered throughout the corridor which experience low and undesirable levels of service. The results of intersection capacity analyses for the AM and PM peak hours are illustrated in Figures 3-2 and 3-3. The intersections with "E" levels of service are as follows:

AM Peak Hour	Approach with Lowest Level of Service
Front @ Broad	: eastbound left turn
High @ Spring	: northbound left turn
High @ Long	: northbound right turn

PM Peak Hour	Approach with Lowest Level of Service Or Observed Problem
Front @ Nationwide	: southbound left turn
Front @ Broad	: eastbound left turn
High @ Spring	: northbound left turn
High @ Long	: northbound right turn
Third @ Town	: east approach and westbound left turn
Third @ Main	: eastbound right turn
Third @ Fulton	: timing

In most cases, it appears that the low level of service calculated for the above intersections could be improved with signal timing and/or phasing modifications. In the next stage of the project, possibilities for improving traffic flow and operations were investigated as part of the traffic/transit circulation alternatives.

However, it should be noted that the most difficult intersections to "solve" are the intersections along Third Street on the south side of the downtown. This is due to the high volume of vehicles desiring to enter the eastbound on-ramp to I-70/71. The ramp at this location simply cannot accomodate the demand and alternatives to this movement are not realistic nor practical. This deficiency in the Innerbelt ramping system to serve travel to and from the east via I-70 is, and will be, a serious problem in providing proper access to the downtown.

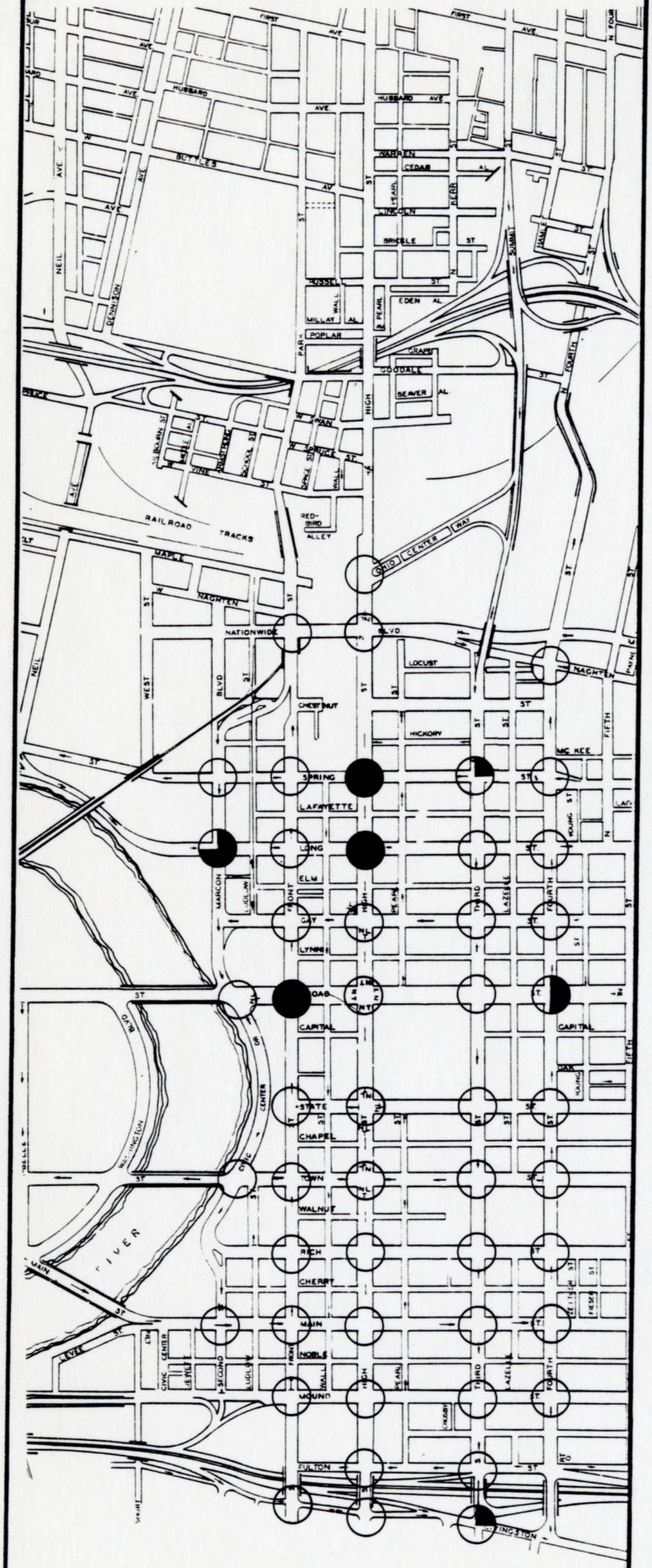
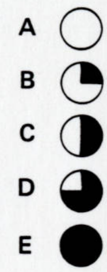


Figure 3-2
AM PEAK HOUR:
INTERSECTION LEVEL OF SERVICE (1983)

* Isolated intersection analysis.
* Intersection level of service reflects level of service on worst approach leg or movement.
* Based upon existing signal timings and 1965 HCM analysis procedures.

LEVEL OF SERVICE



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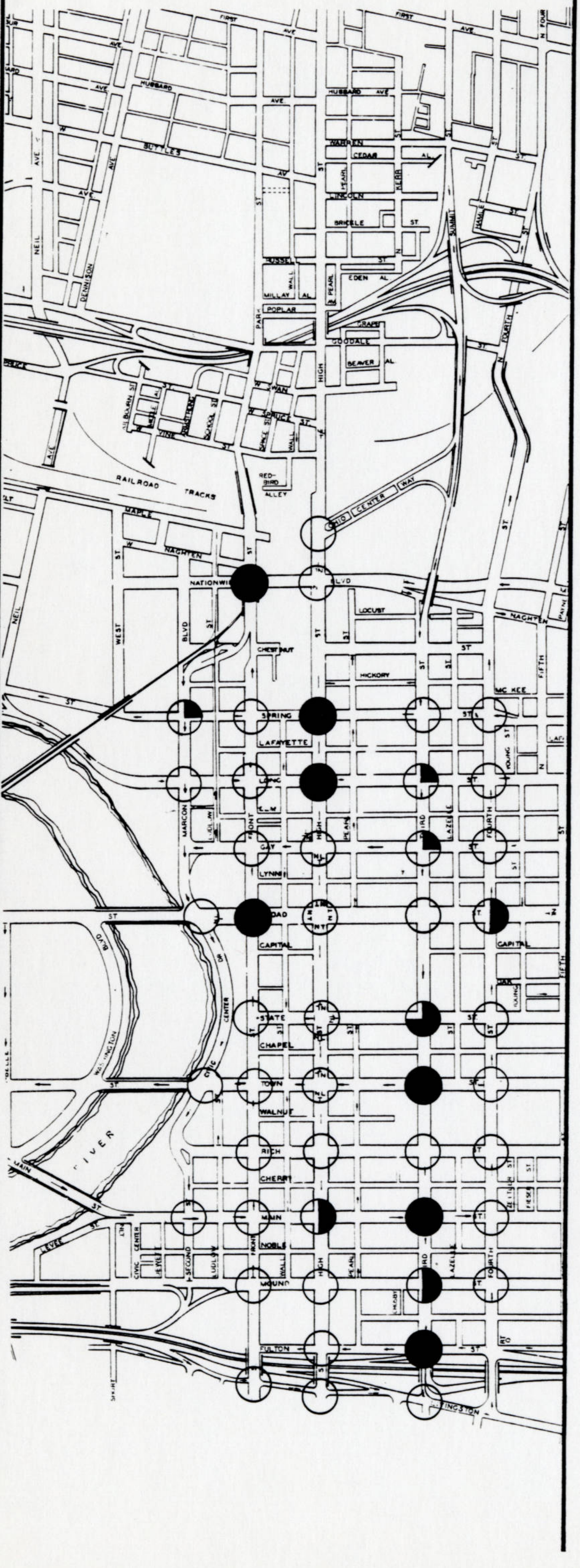

Figure 3-3
PM PEAK HOUR:
INTERSECTION LEVEL OF SERVICE (1983)

* Isolated intersection analysis.
* Intersection level of service reflects level of service on worst approach leg or movement.
* Based upon existing signal timings and 1965 HCM analysis procedures.

LEVEL OF SERVICE

A
B
C
D
E

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CHAPTER 4

TRAVEL DEMAND MODELING PROCEDURES

INTRODUCTION

Transportation planners have in the last thirty years developed a series of mathematical techniques, normally implemented on a high speed computer, to estimate and forecast traffic. These techniques are primarily oriented toward regional analysis and are used by the planning groups in the Columbus region, such as the Ohio Department of Transportation (ODOT) and the Mid-Ohio Regional Planning Council (MORPC). As regional analysis tools, these techniques normally concentrate on major transportation facilities, such as freeways and major arterials, and on daily traffic volumes. The information required in the High Street Corridor Action Plan study, though, was more detailed than just daily traffic on major transportation facilities. In order to develop and evaluate alternative plans for the High Street corridor, it was necessary to estimate traffic on all streets in the downtown area and to ascertain this traffic flow during the peak hours. To produce this type of traffic information, the study team developed a set of travel demand modeling procedures which enhanced the regional forecasts through the use of standard travel demand computer programs.

The study's travel demand procedures consisted of a series of applications of UTPS [1/] computer programs and three specially written computer programs, which are compatible with UTPS programs. In general, these procedures and programs accept the regional forecasts and revise these forecasts to produce more detailed traffic volume estimates for the central business district (CBD). The basic acceptance of the regional forecasts is performed in a manner which 'isolates' the travel to and from the CBD and,therefore, reduces the computer data and information required in the rest of the process. In general, the forecasting procedures used in the study are as follows:

(1) From the regional process obtain travel to, from, and through the CBD, using a standard UTPS computer program called NAG.

(2) Adjust the daily travel, from Step 1, if employment in the CBD is different from the employment used in the regional forecasts and/or to correct for traffic volumes at the CBD corridor. This adjustment is performed using a specially written program called FACTOR 1.

(3) Use the daily travel and peak hour peaking characteristics to develop a peak hour travel estimate to, from, and through the CBD. This step is performed using a specially written computer program called FACTOR 2.

1/ The Urban Transportation Planning System computer programs developed by the U.S. Department of Transportation.

(4) Adjust the peak hour travel to take into consideration the location and capacity of parking in the CBD.

(5) Allocate the peak hour travel to the highway system using a UTPS computer program called UROAD.

This chapter describes these forecasting procedures in detail and reviews the results of applying the procedures to the present (1983) and to a future year (2000). The first subsection of this chapter reviews the need for spatial analysis areas and will describe the areas used in this study. The second subsection discusses the method of describing the highway system in the study area. The third and fourth subsections describe the computer procedures used. The third subsection discusses the methodologies for adjusting the travel patterns and the fourth subsection describes the traffic allocation (i.e. assignment) procedures. The final two subsections discuss the results of applying the procedures to 1983 conditions and to a year 2000 forecast.

In general, the High Street Corridor Action Plan study used a series of computerized techniques to modify and enhance the travel estimates produced by the regional travel demand modeling system. These techniques reduced the data information by over 90 percent, allowed changes to be made in the land use forecasts, produced peak hour travel estimates, and allocated vehicle trips to parking facilities. The techniques were developed to be compatible with the standard transportation planning computer programs used by the Ohio Department of Transportation and the Mid-Ohio Regional Planning Council. The key steps of the procedure and technique used in this study are shown in Table 4-1.

ANALYSIS AREAS

In the analysis and forecasting of travel, it is usually impossible to work with an individual unit of activity or land use, such as an employee or a household, simply because of the large numbers involved. Transportation planning data, therefore, is normally grouped or aggregated into small spatial units called zones or traffic analysis zones. This convention allows transportation planners to develop and apply computer techniques to estimate and forecast traffic volumes on the transportation facilities in the study area. The use of traffic analysis zones is also an excellent method of storing and reporting land use data such as employment and parking spaces. This study used the traffic analysis zones, from those used in the regional study, with some minor additions. The use of the regional study zones allowed this study to make full use of the land use data and forecasts available from MORPC. For a few areas, the regional zones were 'split' into two zones in order to make a more accurate traffic assignment. For the 1983 analysis, there were 77 traffic zones in the study area. Figure 2-20, in Chapter 2, shows these traffic analysis zones. For the Year 2000 forecast, there were 81 traffic analysis zones in the study area, with the additional zones being added in the eastern portion of the study area. The Year 2000 traffic analysis zones are also shown in Figure 2-20.

TABLE 4-1
GENERAL PROCEDURE TO ESTIMATE PEAK HOUR CBD VEHICLE TRIPS

PROGRAMS AND DATA	COMMENTS
Regional Networks and Trip Tables | | V	From regional process, i.e from ODOT and MORPC
"NAG" | | V	Program used to isolate the CBD trips
CBD Trip Table | | V	Daily CBD Vehicle Trip Table
"FACTOR1" | | V	Program to correct daily volumes due to changes in employment and/or corrdon line volumes
CBD Trip Table | | V	Final daily CBD vehicle trip table
"FACTOR2" | | V	Program to estimate peak hour trip tables
CBD Peak Hour Trip Tables | | V	Peak hour CBD vehicle trip table
"PARK ALLOCATION" | | V	Program to assign trips to parking lot zones
CBD Peak Hour Trip Tables	Final peak hour CBD vehicle trip tables

In addition to traffic analysis zones within the study area, it was necessary to have traffic analysis zones at each highway location at the boundary of the study area. These traffic analysis zones are required in order to account for and to analyze traffic going to, from, and through the study area. In the computer procedures, these traffic analysis zones are 'handled' in the same manner as the study area traffic analysis zones, although, of course, there is no land use associated with these zones. In many cases, the traffic analysis zones representing highways are referred to as external stations or external cordons. For the 1983 analysis there were 41 external stations, as shown in Figure 4-1. For the Year 2000 forecast, there were 44 external stations, as shown in Figure 4-2.

NETWORKS

In order to allocate travel to individual highway segments, it is first necessary to describe the highway system in a manner which is acceptable to the computer programs which will perform the travel allocation. This description is, typically, a summary of the characteristics of a highway segment between two other highway segments, e.g. a highway block. The record containing this description is usually called a highway link and the data contained on this record consists of the following:

(1) An "A" node number: a number representing one end of the highway segment. This number must be higher than the highest analysis zone number and must be unique within the network.

(2) A "B" node number: The number representing the other end of the highway segment. The same rules apply to this variable as the "A" node number.

(3) The length of the highway segment: For this analysis the distance was specified in hundredths of a mile.

(4) The facility type: A numerical code ranging from 1 to 6. This code is used in the procedures to establish the speed of the highway segment and will be described in greater detail in the following paragraph.

(5) The area type: Another code ranging from 1 to 4. This code is also used to establish the speed of the highway segment.

(6) The number of lanes for moving traffic: This data item is coded as the number of lanes which can be used for traffic and excludes parking lanes and reserved lanes, such as for buses.

(7) One-or/Two-way movement: The highway link record can be coded in a manner that the computer can easily recognize if the highway segment is a one-way or two-way highway.

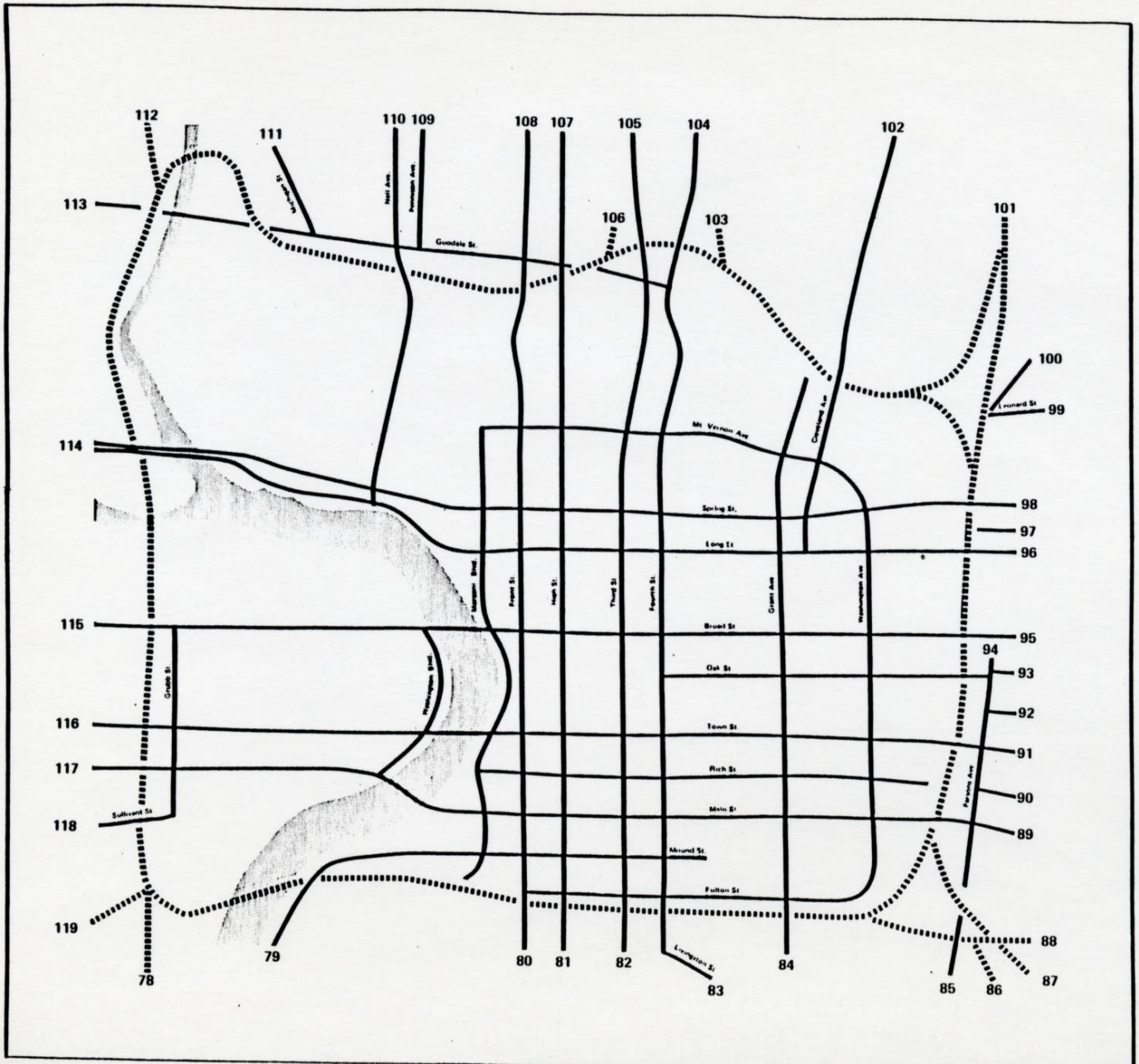

Figure 4-1
1983 EXTERNAL CORDON STATIONS

External Cordon

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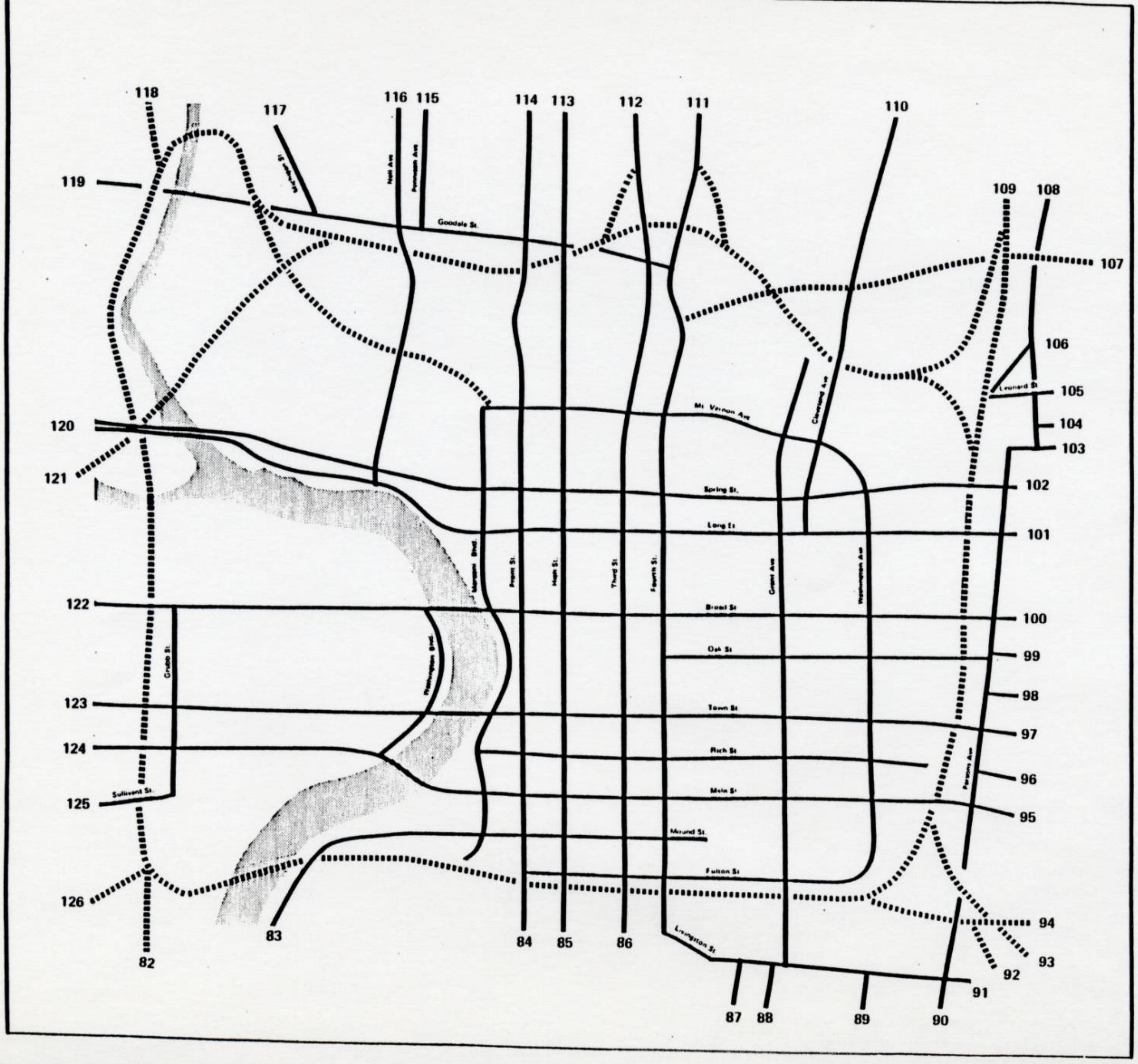

Figure 4-2

2000 EXTERNAL CORDON STATIONS

External Cordon

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These link records are used in a UTPS program, called HNET, to build a description of the highway system in a format which can be used by other UTPS programs. This description is normally called a network since the "A" and "B" node numbers allow the computer to match individual highway segments into a complete highway system. In order to estimate how a driver might use this highway system, the computer must be able to estimate the travel time on each highway segment. This estimation is performed by assigning average highway speeds to each highway segment based upon the facility and area code. For this study, the highway segments were stratified into nineteen definitions. These definitions included: the type of highway, such as one-way, two-way, or freeway; the location of the highway; the type of land uses near the highway; and the pedestrian traffic. Given these definitions, the study team used travel time surveys to estimate the average speed for each definition. A complete description of the highway definitions and average speeds, used for 1983, is shown in Table 4-2. In addition to the highway speeds, these denfinitions were also used to specify the capacity of the highway segments. These capacities are also shown in Table 4-2. The 1983 and Year 2000 highway networks used in this study are shown in Figures 4-3 and 4-4, respectively.

DEVELOPMENT OF TRIP TABLES

The High Street Corridor Action Plan study used a series of computerized techniques to enhance the estimate of regional travel. The normal regional transportation study allocates traffic to each highway segment based upon an estimate of regional travel. This regional travel is usually specified, for computer analysis, by estimating the number of trips between each possible pair of traffic analysis zones. Since the regional model for the Columbus area has approximately 1,200 traffic analysis zones, this means that the regional model must investigate over 1,400,000 pairs of traffic analysis zones (interchanges) in order to assign traffic to a highway system. The resources required to perform this analysis may be within reason when major regional issues are to be explored, but are excessive for subarea analysis.

The first step in this analysis was, therefore, to reduce the requirements of investigating the entire regional trip movements, i.e. trip tables. This step used standard UTPS programs to isolate the trips to, from, and through the study area and to assign these trips to the study area's traffic analysis zones. Since the maximum number of traffic analysis zones in this study was 126, this step reduced the number of possible interchanges from 1,400,000 to approximately 16,000. The methodology used to isolate the study area trips is not exactly precise, for various reasons, and, therefore, the next step in the process was to adjust the new trip table to match the regional volumes or, in the case of the 1983 analysis, to match ground counts at the cordon line. It was ascertained, early in the project, that the traffic analysis required for this study could not be predicated upon daily volumes and that the major traffic issues would require capacity analysis and traffic engineering solutions based upon peak hour traffic. Therefore, the next step in developing the trip tables was to adjust the regional isolated daily trips to peak hour trips. This step was performed using a specially written computer program. It was also recognized that regional trip tables were specific to the traffic analysis zone of the trip maker's destination and not to the zone of the vehicle's destination, i.e. the parking space. Therefore, the final step of the analysis was to modify the trip tables so that the destination was a reasonable parking lot, or garage destination rather than an employment destination.

Table 4-2

DESCRIPTION OF HIGHWAY STRATIFICATIONS
TO ESTIMATE SPEEDS AND CAPACITIES

Facility Type	Area Type	Description	Speed: Miles per hour	Capacity: Vehicles per lane per hour
1	1	Two way street in CBD core area. Pedestrian traffic, driveways, double parking, bus volumes, and opposing left turns at intersections.	15	680
1	2	Two way street in outer CBD. Pedestrian traffic, driveways, double parking, bus volumes, and opposing left turns.	15	680
1	3	Two way street in outer edge of study area. Minimal pedestrian traffic, bus stops, driveways, and opposing traffic and turns. Improved signal progression. Area west of Marconi, east of Grant, north of Nationwide, south of Fulton.	23	680
1	4	Two way street with moderate bus volumes (20-50 buses/hours) in outer CBD. Primarily High Street north of Spring and south of Main.	18	580
2	1	One way street in CBD core area. Same conditions as area type 1 above minus opposing traffic and left turns at intersections.	20	680
2	2	One way street in outer CBD. Same conditions as area type 1 above minus opposing traffic and left turns at intersections.	23	680
2	3	One way street in outer edge of study area. Same conditions as for area type 3 above minus opposing traffic and left turns at intersections.	28	680
2	4	Not used		
3	1-3	Right turns	20	680
3	4	Right turns with moderate bus volumes. Primarily High Street.	18	580
4	1-3	Left turns	20	680

Table 4-2 (continued)

4	4	Secondary surface streets. Secondary consideration in progression, narrow lane-width, opposing traffic, and left turns. Examples are Washington Avenue and 5th Street.	15	580
4	5	Marconi - Civic Center and High Street between Main and Spring.	18	580
5	1	Centroid Connector	15	10,000
5	2	External Station Connector	15	10,000
5	3	Not used		
5	4	Broad Street West of Marconi	25	680
5	5	Broad Street East of Marconi	18	580
6	1	Freeway Ramp. Low speed ramp facility with traffic control at intersection with surface street or high speed facility connector with substantial weaving movements.	20	700
6	2	High speed connector. Connects two high speed freeway facilities at major interchange.	35	1,500
6	3	Freeway link.	50	1,800

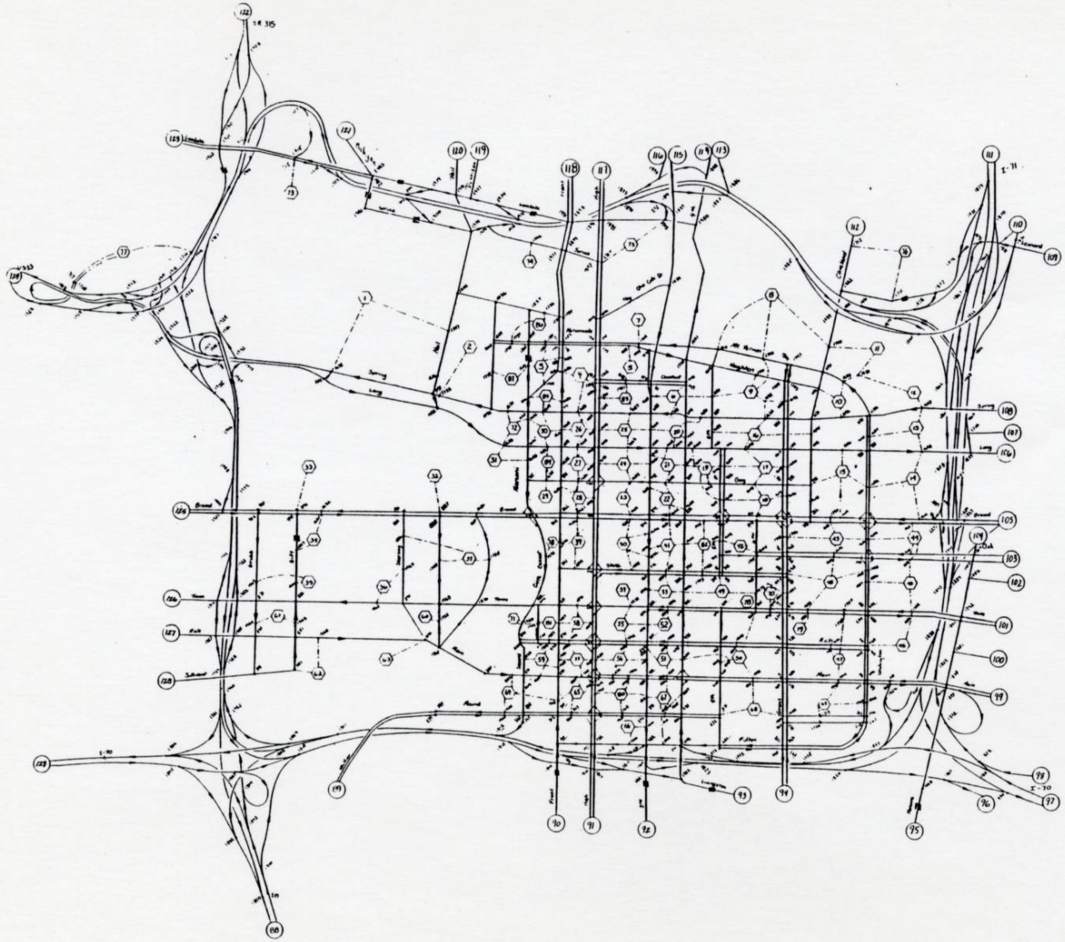

Figure 4-3
1983 HIGHWAY NETWORK

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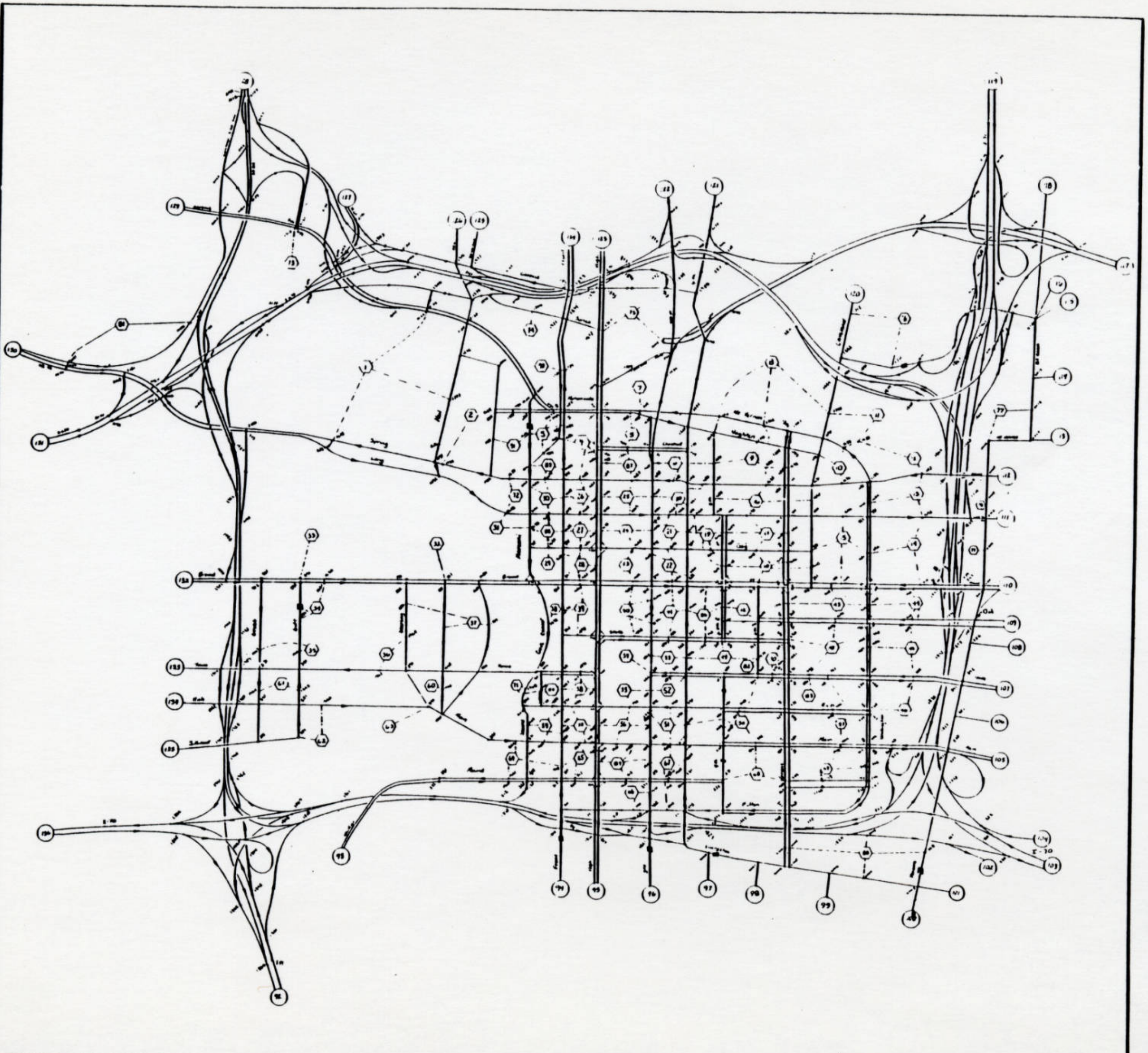

Figure 4-4

2000 HIGHWAY NETWORK

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Subarea Isolation

The first step in developing a trip table for the study area was to obtain the regional trip tables and isolate all trips going to, from, and through the study area. The regional trip tables are provided by the Ohio Department of Transportation (ODOT) which had been developed using land use estimates and forecasts provided by the Mid-Ohio Regional Planning Council (MORPC). The trip estimate from ODOT, which came the closest to approximating a 1983 trip pattern, was developed using 1976 land use estimates and 1980 transportation facilities. The year 2000 forecast of trips, provided by ODOT, was an estimate using the latest land use forecasts, provided to ODOT by the MORPC, and the transportation plan for the region.

The method of isolating the trip patterns was to use the UTPS program NAG. This program allows the analyst to describe a cordon around the study area by specifying the highway segments on the cordon by their "A" and "B" nodes. The analyst also specifies a traffic analysis zone number (or centroid number) which should be assigned to each highway segment on the cordon -- for the 1983 analysis there were 41 of these cordon stations and for the Year 2000 analysis there were 44 of these stations. The program then interrogates each zone to zone movement to ascertain if the movement will cross one or more of these cordon stations or if the movement is totally within the cordon. Whenever a movement crosses the cordon, the program writes a record showing the number of trips and the cordon station crossed and the study area zone or other cordon station crossed. After interrogating all regional trip movements, the program writes a new trip table containing all trips, assigned to the study area traffic analysis zones, which cross the cordon or take place totally within the study area. This process is a fairly standard procedure and is normally called subarea isolation or "windowing."

Daily Trip Movement Adjustment

The subarea isolation procedure produces a trip table of daily vehicles to, from and through the study area. This trip table may not, though, be completely accurate or acceptable. There are several reasons for this. First, the regional model may not have used the same land use estimates as the subarea study is using and therefore the trips may be slightly incorrect. For example, the 1983 subarea isolation step used a trip table developed from a 1976 land use estimate. A second reason is a more technical reason.

The program NAG uses a single method of determining which highway segments will be used. This method is called the all-or-nothing path selection method and consists of allocating travel to a single unique set of highway segments, a path, for any given zone to zone movement. The selection of this single path is based upon a criteria, usually time, and the computer attempts to minimize this criteria (i.e., the path selected is the minimum time path). There are other more sophisticated methods of allocating travel to highway segments, such as, methods which consider the capacity of the highway segments and methods which allocate travel to all "reasonable" paths. Most regional models use one or more of these more sophisticated methods; the ODOT uses the method which considers the capacity of the highway sement. Obviously, an all-or-nothing method will provide a different estimate of traffic on a highway segment than will one of the more sophisticated methods and the results from a NAG isolation application will not fully agree with an estimate of highway volumes prepared from a regional analysis.

A third reason to adjust the trip table is that, even with the sophisticated methods of assigning traffic, most analysts will adjust the computer estimated volumes in order to take into affect non-quantifiable aspects of the highway system. Thus, adjustments are required if the subarea cordon volumes are to agree with the "final" regional traffic estimates.

The method of adjusting the subarea daily trip tables was to apply a specially written computer program which corrected the trips to and from the study area's traffic analysis zones while maintaining the topology of the trip table produced by the NAG program. That is, the program attempted to produce a trip table as similar as possible to the NAG trip table while still meeting the total volumes specified by the analyst. In order to implement the program, the analyst must determine the traffic volume with the results from the NAG program. Using this information, a ratio of required volume to NAG volume must be computed, for each zone, and be provided to the program. The program, which is called FACTOR1, will then produce a subarea trip table which agrees with the analyst's specification. A more detailed and technical description of program FACTOR1 is included in a separate document transmitted to the client.

For the 1983 analysis the daily trip table adjustment program was used to modify both the cordon station volumes (traffic analysis zones 78 to 119) and the study area zones (traffic analysis zones 1 to 77). As the base (i.e., required) condition for 1983 cordon station volumes, the study team used a series of daily traffic counts at the cordon stations. These counts were provided by the city traffic engineering department and ODOT. Daily travel to and from the study area zones was adjusted using estimates of employment. The ratio input to the program was the ratio of estimated 1983 employent to the 1976 employment used in the regional forecast. The daily adjustment program was also used for the Year 2000 forecast. The required traffic volumes at the cordon stations were volumes provided by ODOT and MORPC and represented the volumes produced by the regional model and modified by the professional analysts of ODOT and MORPC.

Peak Hour Trip Tables

The next step in the process was to convert the adjusted daily trip tables into peak hour trip tables. This step was implemented by writing a computer program which accepted the daily trip table and peak hour factors for each cordon station and produced a set of peak hour trip tables. The peak hour factors required were the percent of trips occurring in the peak hour by direction. This peak hour program, called FACTOR2, operates in a manner similar to the daily adjustment program in that it attempts to maintain the topology of the daily trip table while meeting the constraints of the required volumes at the cordon station. A detailed description of this program is contained in the separate document, transmitted to the client, that contains a more technical description of the programs and procedures used in the modeling process.

The peak hour factors for the 1983 analysis were obtained from traffic counts performed by the study team and provided by ODOT and the city traffic engineering office. A complete list of external station locations and the peak hour factors for 1983 is shown in Table 4-3. For the morning peak hour, the peak hour factors are much higher inbound (i.e., to the study area) than they are outbound while in the afternoon the directional peaking characteristics are reversed. The total cordon factor is approximately 16 percent for the morning, with 10.2 percent inbound and 5.8 percent outbound. In the afternoon the

TABLE 4-3
PEAKING FACTORS AT EXTERNAL STATION LOCATIONS FOR 1983

STATION	PEAKING FACTORS			
	A.M.		P.M.	
	INBOUND	OUTBOUND	INBOUND	OUTBOUND
78: I-71; south of I-70	10.6	5.6	6.6	10.5
79: Whittier	3.5	12.9	13.1	7.9
80: South Front; south of CBD	6.3	9.9	9.7	7.7
81: South High; south of CBD	9.1	3.4	7.5	8.3
82: South Third; south of CBD	7.4	4.8	7.6	9.3
83: Livingston	7.2	5.8	7.9	8.3
84: Grant	10.6	2.6	5.4	10.5
85: Parsons; South of Main	8.8	7.9	9.3	9.1
86: I-70 exit 102B	NA	7.3	NA	12.0
87: I-70; southeast of CBD	12.5	4.6	6.5	11.0
88: I-70 exit 108A	3.7	NA	4.2	NA
89: East Main; east of CBD	13.3	4.0	5.4	10.7
90: Connection of regional zone 302 to Parsons	10.2	5.1	7.3	10.3
91: East Town; east of CBD	13.5	3.0	7.7	15.8
92: Connection of regional zone 301 to Parsons	10.2	2.4	7.3	4.0
93: Oak	8.8	2.1	7.3	13.7
94: Parsons; North of Oak	7.3	6.2	6.9	9.0
95: East Broad; east of CBD	10.3	6.2	8.9	13.3
96: East Long; east of CBD	NA	2.0	NA	13.7
97: Dummy connection	NA	NA	NA	NA
98: East Spring; east of CBD	15.9	NA	5.7	NA
99: Old Leonard	4.9	4.5	9.3	10.5
100: Leonard	8.7	5.6	8.6	10.0
101: I-71; north of Leonard	10.3	4.1	6.4	8.7
102: Cleveland	10.5	4.5	6.5	9.0
103: I-670 exit 4A	NA	10.4	NA	6.0
104: North Fourth; north of CBD	NA	5.2	NA	11.6
105: North Third; north of CBD	8.3	NA	7.5	NA
106: Westbound I-670 ramp; west of N.Third	4.9	NA	11.6	NA
107: North High; north of CBD	6.5	3.4	6.6	8.1
108: Park Street	6.9	6.5	14.1	10.1
109: Dennison	2.7	0.0	8.2	6.5
110: Neil	7.5	10.8	10.1	7.8
111: Michigan	2.0	14.5	7.0	6.1
112: SR 315	12.1	7.4	8.3	9.5
113: Goodale	8.3	11.9	9.7	8.9
114: US 33	11.7	6.5	6.9	9.7
115: West Broad; west of CBD	9.9	6.5	7.9	9.7
116: West Town; west of CBD	NA	8.7	NA	8.7
117: West Rich; west of CBD	9.1	NA	7.3	NA
118: Sullivant	12.7	2.2	5.7	13.4
119: I-70; west of I-71	9.9	5.6	7.1	9.3
Cordon total factors	10.2	5.8	7.3	10.0

total cordon factor is approximately 17.3 percent, with 7.3 percent inbound and 10.0 percent outbound. The peaking factors can vary significantly by highway segment. In 1983, the highest morning peak hour factor was at East Spring Street, which had 15.9 percent of its daily volume occurring in the morning peak hour. In the evening, the highest peak hour facator was at East Town, which had 15.8 percent of its outbound traffic occurring in the evening peak hour.

For the Year 2000 analysis, the peak hour factors, developed from the 1983 ground counts, were also used. For highway segments which were present in the Year 2000 highway system, but not in the 1983 system, the peak hour factors used were the 1983 factors on highway segments which were similar to the Year 2000 highway segment. For example, the Airport Connector (I-670) highway segment was given a peak factor which corresponded to the peaking factor for I-71, just north of Leonard. A complete list of Year 2000 external stations and their associated peak hour factors is shown in Table 4-4. Although the Year 2000 peak hour factors were the same as the 1983 peak hour factors, by external station, the total cordon peak hour factors need not be the same. As shown in Tables 4-3 and 4-4, there is a slight difference between 1983 and Year 2000 total cordon peak hour factors, while the morning inbound percent increasing by 0.7 of a percent and the afternoon outbound percent decreasing by 0.2 percent.

Although the peak hour factors remained fairly constant, this does not mean that the peak hour trips, for the two analysis years, were similar. Indeed the external stations overall had a substantial increase in travel. The estimated evening peak hour volumes at the external stations, for both 1983 and 2000 is shown in Table 4-5. Overall, there was approximately a 45 percent increase in traffic volume between 1983 and 2000, with the outbound volume having a slightly greater increase (50 percent) than the inbound volume (42 percent). Much of this increase in travel occurred in the "new" highway segments, such as the airport (I-670) connector, and the freeway segments, such as I-70 and I-71. Many of the arterial highways showed minor growth and, in some cases (such as East Town Street), had a small decrease. This fairly substantial growth in traffic volume at the external stations does not mean that the traffic within the CBD increased in the same proportion. The growth in the CBD employment was approximately twenty percent and traffic within the CBD grew at approximately the same rate. It is estimated that evening peak hour traffic in the CBD area will grow by approximately 32 percent, in the outbound direction, and actually decrease slightly in the inbound direction. This change in traffic is, of course, uneven with some areas having a substantial growth while other areas had minor or no growth in traffic. The estimated evening peak hour vehicle trips generated and attracted to the internal study area zones are shown in Table 4-6.

The slight decrease in evening peak hour inbound trips to the CBD is fairly interesting. Even though total trips to and from the CBD increased, the model estimated that evening inbound trips would decrease. The reason for this is that the peak hour model, implemented in the program FACTOR2, reduced the percent of evening inbound trips, over the 1983 estimate. A summary of the peaking characteristics produced by the model is shown in Table 4-7. It was estimated that in 1983 the evening peak hour trips inbound to the CBD would be approximately 6.4 percent of all inbound trips, while the estimate for the Year 2000 was 4.9 percent. The model also estimated a similar movement for the morning peak hour where an estimated 2.9 percent of all outbound trips occur in 1983 and only 2.1 percent occur in the Year 2000. The opposing movements, therefore, have a reverse trend, with the percent inbound morning trips and the percent outbound evening trips being higher in the Year 2000 than in the 1983 estimates. This shift in CBD peaking characteristics is logical, as the CBD gains office employment at a faster rate than retail and other non-employment growth.

TABLE 4-4
PEAKING FACTORS AT EXTERNAL STATION LOCATIONS FOR 2000

STATION	PEAKING FACTORS A.M. INBOUND	A.M. OUTBOUND	P.M. INBOUND	P.M. OUTBOUND
82: I-71; south of I-70	10.6	5.6	6.6	10.5
83: Whittier	3.5	12.9	13.1	7.9
84: South Front; south of CBD	6.3	9.9	9.7	7.7
85: South High; south of CBD	9.1	3.4	7.5	8.3
86: South Third; south of CBD	7.4	4.8	7.6	9.3
87: Livingston	7.2	5.8	7.9	8.3
88: Connection with regional zones from Livingston	10.6	2.6	5.4	10.5
89: Connection with regional zones from Livingston	10.6	2.6	5.4	10.5
90: Parsons; south of Livingston	8.8	7.9	9.3	9.1
91: Livingston; east of Parsons	8.8	7.9	9.3	9.1
92: I-70 exit 102B	NA	7.3	NA	12.0
93: I-70; southeast of CBD	12.5	4.6	6.5	11.0
94: I-70 exit 108A	3.7	NA	4.2	NA
95: East Main; east of CBD	13.3	4.0	5.4	10.7
96: Connection of regional zone 302 to Parsons	10.2	5.1	7.3	10.3
97: East Town; east of CBD	13.5	3.0	7.7	15.8
98: Connection of regional zone 301 to Parsons	10.2	2.4	7.3	4.0
99: Oak	8.8	2.1	7.3	13.7
100: East Broad; east of CBD	10.3	6.2	8.9	13.3
101: East Long: east of CBD	NA	2.0	NA	13.7
102: East Spring; east of CBD	15.9	NA	5.7	NA
103: Mt. Vernon	15.9	NA	5.7	NA
104: Connections to regional zones from St.Clair	15.9	NA	5.7	NA
105: Old Leonard	4.9	4.5	9.3	10.5
106: Leonard	8.7	5.6	8.6	10.0
107: Airport Connector	10.3	4.1	6.4	8.7
108: St. Clair	15.9	NA	5.7	NA
109: I-71; north of Leonard	10.3	4.1	6.4	8.7
110: Cleveland	10.5	4.5	6.5	9.0
111: North Fourth; north of CBD	NA	5.2	NA	11.6
112: North Third; north of CBD	8.3	NA	7.5	NA
113: North High; north of CBD	6.5	3.4	6.6	8.1
114: Park Street	6.9	6.5	14.1	10.1
115: Dennison	2.7	0.0	8.2	6.5
116: Neil	7.5	10.8	10.1	7.8
117: Michigan	2.0	14.5	7.0	6.1
118: SR 315	12.1	7.4	8.3	9.5
119: Goodale	8.3	11.9	9.7	8.9
120: US 33	11.7	6.5	6.9	9.7
121: I-670	15.9	NA	5.7	NA
122: West Broad; west of CBD	9.9	6.5	7.9	9.7
123: West Town; west of CBD	NA	8.7	NA	8.7
124: West Rich; west of CBD	9.1	NA	7.3	NA
125: Sullivant	12.7	2.2	5.7	13.4
126: I-70; west of I-71	9.9	5.6	7.1	9.3
Cordon total factors	10.9	6.0	7.0	9.8

TABLE 4-5
COMPARISON OF 1983 AND 2000 P.M. PEAK HOUR VOLUMES AT EXTERNAL STATIONS

STATION DESCRIPTION	STATION NUMBER		P.M. PEAK HOUR VOLUMES INBOUND			OUTBOUND		
	1983	2000	1983	2000	PCT. CHANGE	1983	2000	PCT. CHANGE
I-71; South of I-70	78	82	2165	4472	106.6	3568	6288	76.2
Whittier	79	83	164	311	89.6	106	179	68.9
South Front	80	84	558	621	11.3	88	174	97.7
South High	81	85	543	600	10.5	818	849	3.8
South Third	82	86	171	190	11.1	509	563	10.6
Livingston	83	87	392	218	-44.4	673	115	-82.9
Grant	84	NA	224	NA	NA	390	NA	NA
Regional zones to Livingston	NA	88	NA	103	NA	NA	207	NA
Regional zones to Livingston	NA	89	NA	116	NA	NA	195	NA
Parsons	NA	90	NA	601	NA	NA	469	NA
Livingston	NA	91	NA	900	NA	NA	656	NA
Parsons	85	NA	722	NA	NA	726	NA	NA
I-70 exit 102B	86	92	NA	NA	NA	334	330	-1.2
I-70, South of CBD	87	93	3600	5278	46.6	5712	8601	50.6
I-70 exit 108A	88	94	316	213	-32.6	NA	NA	NA
East Main	89	95	329	259	-21.3	863	849	-1.6
Regional zones to Parsons	90	96	6	6	0.0	4	12	200.0
East Town	91	97	265	250	-5.7	429	356	-17.0
Regional zones to Parsons	92	98	8	6	-25.0	70	29	-58.6
Oak	93	99	249	141	-43.4	186	92	-50.5
Parsons	94	NA	273	NA	NA	474	NA	NA
East Broad	95	100	1364	1350	-1.0	1808	2534	40.2
East Long	96	101	NA	135	NA	1163	543	-53.3
East Spring	98	102	397	43	-89.2	NA	82	NA
Old Leonard	99	105	97	62	-36.1	112	194	73.2
Leonard, North of Leonard	100	106	714	92	-87.1	587	114	-80.6
Mt. Vernon	NA	103	NA	158	NA	NA	199	NA
Regional zones to St.Clair	NA	104	NA	81	NA	NA	53	NA
Airport Connector	NA	107	NA	2570	NA	NA	3603	NA
St. Clair	NA	108	NA	262	NA	NA	597	NA
I-71, North of Leonard	101	109	3883	4818	24.1	5050	6168	22.1
Cleveland	102	110	397	285	-28.2	453	747	64.9
I-670 exit 4A	103	NA	NA	NA	NA	317	NA	NA
North Fourth	104	111	NA	NA	NA	1151	2223	93.1
North Third	105	112	1111	1452	30.7	NA	NA	NA
Westbound I-670 ramp	106	NA	247	NA	NA	NA	NA	NA

TABLE 4-5 (CONTINUED)
COMPARISON OF 1983 AND 2000 P.M. PEAK HOUR VOLUMES AT EXTERNAL STATIONS

STATION DESCRIPTION	STATION NUMBER		P.M. PEAK HOUR VOLUMES INBOUND			OUTBOUND		
	1983	2000	1983	2000	PCT. CHANGE	1983	2000	PCT. CHANGE
North High	107	113	559	581	3.9	688	661	-3.9
Park Street	108	114	118	227	92.4	170	239	40.6
Dennison	109	115	18	136	655.6	24	71	195.8
Neil	110	116	799	1097	37.3	546	790	44.7
Michigan	111	117	140	212	51.4	NA	NA	NA
SR 315	112	118	3353	4688	39.8	3873	5346	38.0
Goodale	113	119	785	877	11.7	726	1057	45.6
US 33	114	120	1182	188	-84.1	1503	14	-99.1
I-670	NA	121	NA	2738	NA	NA	5210	NA
West Broad	115	122	944	1339	41.8	1286	1469	14.2
West Town	116	123	NA	NA	NA	614	1215	97.9
West Rich	117	124	398	496	24.6	NA	NA	NA
Sullivant	118	125	142	78	-45.1	237	50	-78.9
I-70, west of I-71	119	126	2827	3398	20.2	3524	4709	33.6
Cordon Total			29322	41648	42.0	38781	58129	49.9

Table 4-6

EVENING PEAK HOUR VEHICLE TRIPS
TO INTERNAL STUDY AREA ZONES

	P.M. PEAK HOUR VOLUMES					
	Inbound			Outbound		
Zone Number	1983	2000	Pct. Change	1983	2000	Pct. Change
33	96	97	1.0	176	249	41.5
34	120	75	-37.5	192	168	-12.8
35	33	15	-54.5	62	51	-17.7
36	42	37	-11.9	78	81	3.8
37	41	135	2293	74	316	327.0
38	254	188	-26.0	473	502	6.1
39	264	681	158.0	468	1646	251.7
40	69	61	-11.6	135	141	4.4
41	182	170	-6.6	355	454	27.9
42	103	90	-12.6	204	231	13.2
43	202	161	-20.3	410	419	2.2
44	28	15	-46.4	52	51	-1.9
45	98	92	-6.1	185	217	17.3
46	87	113	29.9	193	270	39.9
47	253	270	6.7	504	688	36.5
48	42	51	21.4	84	136	61.9
49	92	92	0.0	178	218	22.5
50	231	192	-16.9	430	429	-0.2
51	18	12	-33.3	36	39	8.3
52	43	32	-25.6	74	79	6.8
53	278	160	-42.4	489	383	-21.7
54	91	545	498.9	191	1316	589.0
55	22	235	968.2	40	591	1377.5
56	113	69	-38.9	214	160	-25.2
57	16	62	287.5	34	163	379.4
58	504	505	0.2	955	1303	36.4
59	29	50	72.4	43	106	146.5
60	86	70	-18.6	157	158	0.6
61	26	10	-61.5	40	32	-20.0
62	64	36	-43.8	87	81	-6.9
63	51	38	-25.5	93	91	-2.2
64	92	122	32.6	154	254	64.9

Table 4-6 (continued)

Zone Number	P.M. PEAK HOUR VOLUMES Inbound 1983	2000	Pct. Change	Outbound 1983	2000	Pct. Change
1	173	54	-68.8	266	297	11.7
2	78	149	91.0	112	648	478.6
3	83	66	-20.5	138	181	31.2
4	644	280	-56.5	1106	790	-28.6
5	441	339	-23.1	803	870	8.3
6	68	59	-13.2	137	141	2.9
7	247	191	-22.7	422	520	23.2
8	57	125	119.3	123	293	138.2
9	50	46	-8.0	90	121	34.4
10	13	47	261.5	35	103	194.3
11	78	12	-84.6	152	42	-72.4
12	83	153	84.3	181	473	161.3
13	27	46	70.4	66	98	48.5
14	86	51	-40.7	167	143	-14.4
15	28	35	25.0	56	101	80.4
16	25	46	84.0	51	103	102.0
17	18	12	-33.3	27	25	-7.4
18	116	118	1.7	242	281	16.1
19	331	261	-21.1	609	620	1.8
20	49	37	-24.5	100	105	5.0
21	506	404	-20.2	915	959	4.8
22	300	219	-27.0	551	573	4.0
23	688	565	-17.9	1236	1375	11.2
24	143	112	-21.7	292	289	-1.0
25	124	84	-32.3	235	240	2.1
26	81	135	66.7	137	330	140.9
27	168	278	65.5	309	676	118.8
28	227	185	-18.5	404	479	18.6
29	58	45	-22.4	102	107	4.9
30	365	144	-60.5	657	366	-44.3
31	69	15	-78.3	113	39	-65.5
32	10	72	620.0	15	150	900.0

Table 4-6 (continued)

Zone Number	P.M. PEAK HOUR VOLUMES Inbound 1983	2000	Pct. Change	Outbound 1983	2000	Pct. Change
65	159	67	-57.9	291	203	-30.2
66	142	112	-21.1	288	319	10.8
67	73	56	-23.3	141	147	4.3
68	126	150	19.0	241	337	39.8
69	54	83	53.7	112	196	75.0
70	340	2137	-30.3	690	642	-7.0
71	212	208	-1.9	401	548	36.7
72	255	77	-69.8	449	155	-65.5
73	66	47	-28.8	129	146	13.2
74	108	125	15.7	191	298	56.0
75	47	84	78.7	97	242	149.5
76	245	199	-18.8	513	592	15.4
77	152	23	-84.9	293	59	-79.9
78	NA	13	NA	NA	40	NA
79	NA	38	NA	NA	100	NA
80	NA	40	NA	NA	94	NA
81	NA	113	NA	NA	340	NA
TOTAL	11083	10538	-4.9	20545	27019	31.5

Table 4-7

SUMMARY OF STUDY AREA PEAK FACTORS

	1983		2000	
	Inbound	Outbound	Inbound	Outbound
PEAKING AT EXTERNAL CORDON STATIONS:				
o Percent of morning (A.M.) Trips to daily trips	10.2	5.8	10.9	6.0
o Percent of evening (P.M.) trips to daily trips	7.3	10.0	7.0	9.8
PEAKING AT INTERNAL STUDY AREA ZONES:				
o Percent of morning (A.M.) trips to daily trips	14.2	2.9	15.6	2.1
o Percent of evening (P.M.) trips to daily trips	6.4	11.3	4.9	12.8

The difference between the external station peaking characateristics and the CBD zone peaking characteristics and the CBD zone peaking characteristics, see Table 4-7, is also reasonable. The external stations exhibit peaking characteristics which are similar to most major highway segments, with the predominant flow being higher than the minor flow, but only to a limited extent; a 60/40 split of traffic volume is the classical peak hour split for major thoroughfares. This type of split is primarily caused by the mix of residential and employment land uses. The heavy directional split in the CBD is primarily caused by the predominance of employment land use and the lack of residential land use.

Parking Allocation Procedure

Although the regional trip tables were isolated and adjusted to peak hour trip tables, they were typical regional trip tables in that the trips ended at the final location of the traveler. That is, if a person worked in a specific traffic analysis zone, the trip representing that person's work trip also ended in the specific traffic analysis zone. This of course is only relatively true -- in many cases the vehicle used by the traveler is parked at some other location and the person completes his trip by walking to the final destination. For regional analysis, this difference between the person's destination and the vehicle's destination is fairly irrelevant, since the traffic analysis zones are large enough that most of the time both destinations are in the same zone. For this study, though, traffic analysis zones were only one or two city blocks and, therefore, the two destinations could easily be in two different zones. The final step in the preparation of the trip tables was to adjust the peak hour trip tables to reflect the parking location of the traveler's vehicle. This step was called the parking allocation procedure.

The technique used to adjust the trip table in the parking allocation procedure is a modification of a CBD travel demand modeling effort developed for the Los Angeles region.[2/] The technique has been used in the modeling of CBD travel in St. Paul, Minnesota and in Houston, Texas. In essence the technique is a logit model which assigns a "disbenefit" to a zone based upon the number of parking spaces in the zone, the cost of parking, and the time required to walk from the zone to the final destination zone. Each zone in the study area is considered as a candidate parking zone for a given destination zone and the technique calculates the disbenefit for each zone. This disbenefit is then used to allocate the trips to the parking zones. The mathematical formulation of the model is as follows:

2/ "Task Termination Report, Internal CBD Travel Demand Modeling," by Barton Aschman Associates, Inc., August, 1976.

PROB(i,k,j) = EXP(UT(k,j))/SUM OF ALL EXP(UT(k,j))

Where:

PROB(i,k,j) is the probability of a trip going from zone i to zone j will park in zone k

EXP is the exponential function

UT(k,j) is a linear function describing the disbenefits of parking in zone k if the final destination is zone j.

The formulation of the linear function for this study is as follows:

UT(k,j) = Log(Parking Capacity)-0.01613*Cost-1.06537*Time

Where:

Log is the natural logarithm

Parking Capacity is the number of long term parking spaces in zone k

Cost is the cost of driving to zone k and parking in zone k, an operating cost of 10.5 cents per mile was used in this study

Time is the time, in minutes, to walk from zone k to zone j

The parking allocation procedure (i.e., the computer program) applied this mathematical formulation to each external station to internal zone and internal zone to external station movement. Thus it was possible that trips to and from an internal zone could be "parked" in any or all zones of the study area. The model though (as can be seen from the formulation) attempts to park the vehicle as near as possible to the final destination zone. A major independent variable, affecting the selection of the parking location, is the number of parking spaces (or capacity) in the traffic analysis zone. Although the model cannot constrain the number of vehicles parked to the number of spaces, the capacity variable in the model is significant enough to insure a substantial compliance of this constraint. The parking allocation procedure was implemented by developing a computer program called PARK ALLOCATION. This program is described in the technical document mentioned previously in this report section.

The parking allocation procedure was applied to the 1983 and Year 2000 trip tables. The results of this application, for the P.M. peak hour, is shown in Table 4-8. Not all zones in the study area were subjected to the parking allocation procedure. During the study it was found that areas in the western and eastern portion of the study area were not included in the parking inventory conducted by the City nor were there forecasts of parking spaces in these zones. The parking allocation procedure was, therefore, only applied to the "core" area of the study area, as shown in Figure 4-5. The information shown in Table 4-8 is only for the traffic analysis zones in the core area.

TABLE 4-8
SUMMARY RESULTS OF APPLYING THE PARKING ALLOCATION PROCEDURE

ZONE	1983				2000			
	PARKING SPACES	P.M. PEAK HOUR OUTBOUND TRIPS			PARKING SPACES	P.M.PEAK HOUR OUTBOUND TRIPS		
		BEFORE PARKING ALLOC.	AFTER PARKING ALLOC.	PERCENT CHANGE		BEFORE PARKING ALLOCA.	AFTER PARKING ALLOC.	PERCENT CHANGE
3	3037	138	750	433.5	3037	181	596	229.3
4	1013	1106	629	-43.1	1185	790	498	-37.0
5	1220	803	799	-0.5	1220	870	715	-17.8
6	467	137	150	9.5	467	141	148	5.0
7	512	422	297	-29.6	1262	520	541	4.0
19	576	609	587*	-4.4	576	620	592*	-4.5
20	366	100	232	132.0	366	105	244	132.4
21	76	915	280*	-69.4	76	959	261*	-72.8
22	576	551	698*	26.7	576	573	726*	26.7
23	160	1236	386*	-68.8	160	1375	326*	-72.7
24	1082	292	1018*	248.6	1082	289	1089*	276.8
25	1139	235	489	108.1	1139	240	500	108.3
26	64	137	67	-51.1	290	330	219	-33.6
27	502	309	357	15.5	1060	676	790	16.9
28	224	404	297*	-26.5	555	479	756*	57.8
29	88	102	73	-28.4	88	107	69	-35.5
30	1167	657	632	-3.8	1167	366	386	5.5
31	134	113	55	-51.3	134	39	19	-51.3
38	127	473	196*	-58.6	127	502	345*	-31.3
39	338	468	490*	4.7	200	1646	663*	-59.7
40	1322	135	774	473.3	1322	141	1519*	977.3
41	372	355	271	-23.7	415	454	328	-27.8
42	2032	204	333	63.2	2032	231	386	67.1
49	904	178	215	20.8	904	218	236	8.3
50	1200	430	396	-7.9	1200	429	396	-7.7
51	328	36	92	155.6	328	39	78	100.0
52	123	74	67	-9.5	123	79	67	-15.2
53	428	489	312	-36.2	495	383	437*	14.1
54	330	191	154	-19.4	330	1316	492*	-62.6
55	535	40	238	495.0	0	591	100	-83.1
56	500	214	146	-31.8	4000	160	1172	632.5
57	514	34	314	823.5	716	163	451	176.7
58	1240	955	783	-18.0	1640	1303	1282	-1.6

TABLE 4-8 (CONTINUED)
SUMMARY RESULTS OF APPLYING THE PARKING ALLOCATION PROCEDURE

ZONE	1983				2000			
	PARKING SPACES	P.M. PEAK HOUR OUTBOUND TRIPS			PARKING SPACES	P.M.PEAK HOUR OUTBOUND TRIPS		
		BEFORE PARKING ALLOC.	AFTER PARKING ALLOC.	PERCENT CHANGE		BEFORE PARKING ALLOCA.	AFTER PARKING ALLOC.	PERCENT CHANGE
59	565	43	127	195.0	565	106	183	72.6
64	742	154	197	27.9	742	254	287	13.0
65	420	291	167	-42.6	420	203	126	-37.9
66	1459	288	315	9.4	1570	319	297	-6.9
67	464	141	104	-26.2	464	147	90	-38.8
68	1400	241	262	8.7	1400	337	350	3.9
71	200	401	202	-49.6	200	548	240*	-56.2
72	1074	449	506	12.7	1074	155	224	44.5
74	508	191	180	-5.8	508	298	281	-5.7
75	1873	97	127	30.9	1873	242	267	10.3

NOTES:

Zones with an * are zones where the outbound trips exceed the capacity of the lot as defined in this study. This capacity is defined as 70 percent of the spaces being used by trips leaving the CBD. Trips made completely withing the CBD are anticipated to use short term spaces or on street informal spaces, i.e. drop-off and pick up.

Total parking spaces in 1983 in 31,401 and total spaces in 2000 is 37,008. The percent change is the change between outbound trips before the parking allocation and outbound trips after the parking allocation.

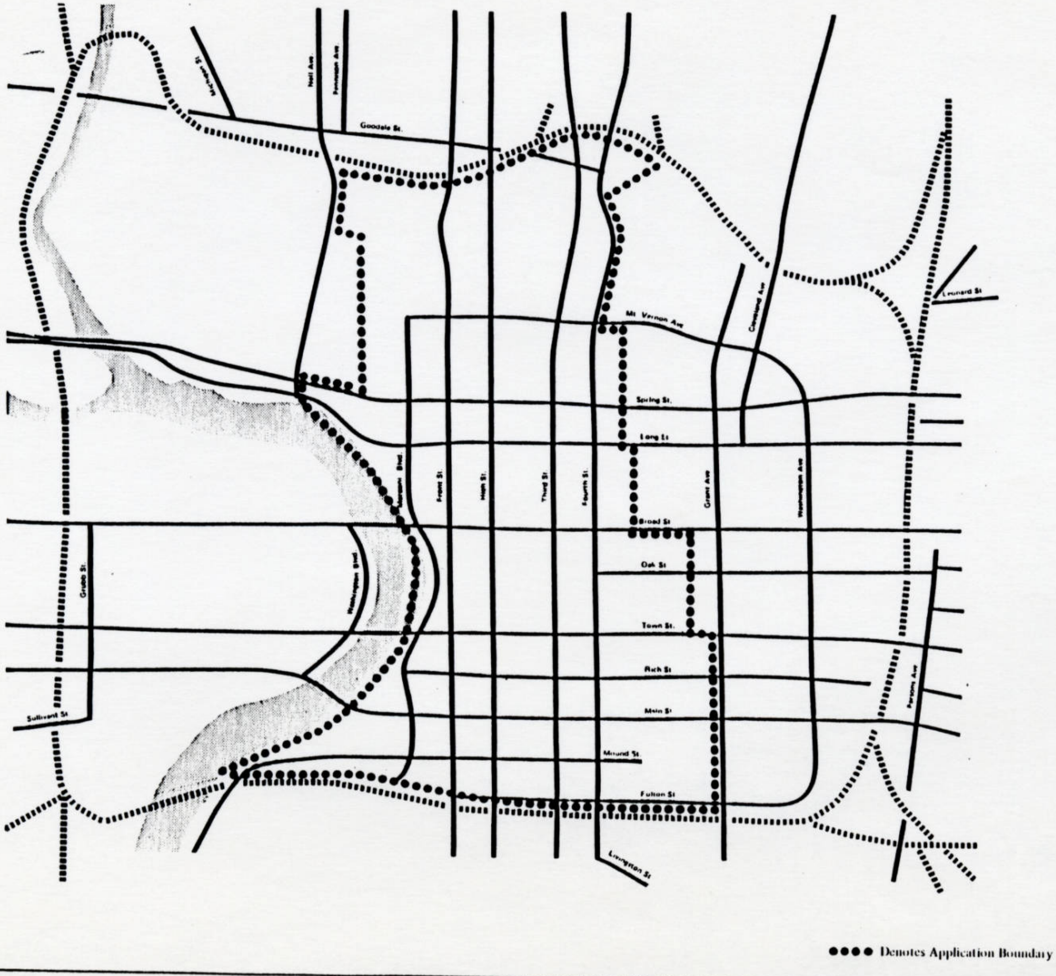

Figure 4-5

PARKING ALLOCATION MODEL
AREA OF APPLICATION

Parking Allocation

High Street Corridor Action Plan
COLUMBUS, OHIO

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The parking allocation procedure did, indeed, modify the number of trips leaving and arriving at the individual traffic analysis zone level. In the 1983 analysis, the number of outbound P.M. peak hour trips increased by as much as 800 percent in some zones and decreased by as much as 68 percent in other zones, as shown in Table 4-8. Of the 43 zones in the core, the parking allocation procedure only allowed seven zones, in 1983, to have vehicles in excess of the parking capacity and most of these "busts" were of a fairly minor nature. The primary "over-loaded" zones occurred in the area bounded by Broad Street, High Street, Long and Fourth Street (Zones 21, 22, 23, and 24) -- indicating a substantial demand for parking with a sparsity of parking spaces in this vicinity. In the Year 2000 forecast, the number of over-loaded zones increased slightly since the forecasted parking spaces did not increase as fast as the parking demand; the spaces increased, between 1983 and 2000, by 18 percent (31,400 to 37,100) while the demand increased by 28 percent (14,800 to 18,900).

Exogenous Adjustments

The Columbus traffic engineering department identified seven traffic analysis zones which had multiple parking facilities with different street exits and entrances. It was felt that to combine these facilities in the given larger zone might produce illogical traffic volume assignments. The problem, though, was that the employment data and forecasts was not sufficiently detailed enough to "split" these zones using the procedures described previously. In addition, one of the zones was not in the "core" area and, therefore, was not subject to the parking allocation procedure. Given this, it was decided to implement this "split" after the other procedures had been applied. The zones were divided using a standard UTPS computer program called USZEQ.

The basic methodology to split the zones was to ascertain the number of parking spaces in each section and to allocate the trips, from the parking allocation procedure, in proportion to the parking spaces. Of the seven zones which were "split," six were divided using this basic procedure. These zones were: (1) Zone 3 was split into 4 zones; (2) Zones 5, 30, 42, 58 and 66 were split into 2 zones each.

The other zone which required adjustment was Zone 70, which contains the Grant Hospital. There are two large garages which serve the Grant Hospital but are not in Zone 70. These garages are in Zones 47 and 49. Since Zone 70 was not in the core area, all travel to the Grant Hospital was allocated to Zone 70 and the required revision was to "move" these hospital trips to the major parking garages. The procedure to implement this move was to allocate 10 percent of the hospital trips to Zone 70 and to allocate the other 90 percent of the hospital trips to the parking garages based on the size of the parking garages thereby making each garage a special traffic analysis zone. This entire procedure added ten traffic analysis zones to the process. Since little was known about the employment in these "split" zones and since the basic reporting procedures were already implemented, this report shows data for the original zones rather than the split zones.

ASSIGNMENT METHODOLOGY FOR THE 1983 HIGHWAY NETWORK

Introduction

In order to ascertain the traffic volumes on individual highway segments, it is necessary to allocate the zone to zone trips to the highway segments. This procedure is normally called the traffic assignment technique and there are standard computer programs in the UTPS system to implement this technique.

This study produced 1983 "assignments" for several reasons. The first reason was to test the trip table modification techniques under controlled conditions, i.e., where the external station volumes were known and where there were observed traffic volumes (ground counts). The second reason was to ascertain the best traffic assignment technique. There are several methods by which trip tables can be allocated to a highway network and this study explored these methods to determine the most appropriate technique for a small and detailed area. Once the assignment methodology was selected, it was still necessary to ascertain calibration parameters for this assignment technique. The third reason was to identify any major differences between the calibrated assignment and the actual ground counts. Even with a calibrated assignment technique, there will be highways or corridors which tend to be over- or under-assigned, due to non-quantifiable reasons. By determining these areas for the base year, the analysts can make manual adjustments for the future year assignments.

Assignment Procedures

All traffic assignment procedures are based upon the ability of the computer program to identify the "best" paths through a highway network. This identification is performed by interrogating the network description, described previously, and to ascertain the minimum "cost" between each pair of traffic analysis zones -- where "cost" is normally the travel time but can be a linear function of travel time and distance. The technique to identify these minimum costs is called "tree building." Once the computer has identified each possible path in the network, the trips are assigned to these paths, for each zone pair, and summed for each highway segment (or highway line). There are basically three types of highway assignments: an all-or-nothing assignment technique, a probabilistic multipath technique, and a capacity restraint technique.

The all-or-nothing assignment technique allocates all the trips, for a given zone to zone pair, to the "best" path. This is the basic assignment technique and tends to over assign the "good" highway segments and under assign the "poor" highway segments. The study team dismissed this assignment technique from the candidate technqiues. The probabilistic multipath technique, sometimes called the stochasic assignment technique, selects a series of feasible paths for each zone to zone pair and assigns trips to these feasible paths based upon their travel times and distances. The technique uses a fairly sophisticated mathematical algorithm to ascertain feasible paths and to allocate travel between these feasible paths. Past experience has shown that this technique can produce adequate assignments, given proper calibration of the network speeds and the dispersal parameter (a user-provided parameter to the program called the THETA value). Capacity restraint techniques attempt to "merge" the traffic volumes assigned to the highway segments with the capacity of the highway segment and to adjust the speed on the highway segment to produce a balanced "loading" of all highway segments.

Most regional highway assignments use capacity restraint techniques, since this is the only assignment methodology wich can consider both highway volumes and capacities. The only problem with capacity restraint techniques is that they only consider the volume and capacity for each individual highway segment -- thus a short "bottle-neck" only has the time reduced on the bottle-neck link and not "up-stream" of the bottle-neck. Normally, for regional assignments, this difficulty is not significant, especially when freeways are designed with proper lane balance.

The initial intent of the study team was to use capacity restraint techniques to perform the assignments for the study area. It was unfortunately determined, however, that there were bottle-necks in the downtown area, primarily at the freeway ramps on the south side of the area, and these bottle-necks prohibited the program from producing reasonable assignments -- the primary problem being a large over-assignment to the southern ramps and an under-assignment to the Spring and Long ramps. The study team, therefore, attempted to calibrate a stochastic assignment. This technique proved to be superior to the capacity restraint assignment given the highway speeds shown in Table 4-2 and a THETA parameter of 0.08.

<u>1983 Assignment Results</u>

The modified tables and the stochastic assignment procedure produced a simulated assignment of traffic in the study area which was very similar to the ground counts taken during the study. The trip table methodology insured that the traffic volumes at the external stations were very close to the actual ground counts. A comparison of these assigned volumes and ground counts is shown in Table 4-9 and Figure 4-6.

Ground counts and the computer assignment volumes were also compared at a cordon just inside the freeway loop in order to determine whether the techniques were allocating travel to the freeways in a reasonable manner. Figure 4-7 shows the location of these inner-loop cordon stations, while Table 4-10 shows the results of comparing the ground counts with the assigned volumes. For the total cordon, the computer assigned volumes were within the range of the ground counts. (It should be noted that ground counts were taken at certain stations on different dates and these counts differed considerably.)

When the internal cordon volumes are summarized by the cardinal directions, the assignment is not quite as good as when the comparison is made for the entire cordon, but is very adequate for a computerized assignment. The north side of the cordon tends to be under-assigned in the northbound direction and the south side of the cordon tends to be over-assigned in the southbound direction. The ground counts and computer assignment, for the internal cordon, are summarized by direction in Figure 4-8.

Screen line checks were also made of the traffic volumes within the study area. Figure 4-9 shows a summary of the assigned and counted vehicles on three north-south screen lines. For east-west travel across Marconi/Civic Center, the traffic assignment is very close to the actual ground counts. For travel across High Street, the assignment is slightly high in the eastbound direciton mainly because of an over-estimation of traffic on Long Street. The screen line across 4th Street also shows this over-assignment in the eastbound direction and again the problem is primarily an over-estimation of traffic on Long Street -- in the westbound direction the assignment is slightly low.

Table 4-9

PM PEAK HOUR EXTERNAL CORDON
ASSIGNED VOLUME AND GROUND COUNT COMPARISON

External Station Number	1983 PM Peak Hour Counts		1983 PM Peak Hour Assigned Volumes	
	Inbound	Outbound	Inbound	Outbound
78	2,165	3,568	2,165	3,523
79	164	106	164	109
80	558	88	558	81
81	543	818	542	798
82	171	509	171	513
83	392	673	392	657
84	224	390	224	444
85	722	726	721	722
86	0	334	0	319
87	3,600	5,712	3,594	5,613
88	316	0	315	0
89	329	863	328	859
90	6	4	6	4
91	265	429	264	431
92	8	70	8	147
93	249	186	248	186
94	273	474	272	471
95	1,364	1,808	1,360	1,782
96	0	1,163	0	1,162
97	0	0	0	0
98	259	0	259	0
99	97	112	97	111
100	714	587	712	579
101	3,883	5,050	3,868	4,994
102	397	453	395	514
103	0	317	0	308
104	0	1,151	0	1,203
105	1,111	0	1,106	0
106	247	0	244	0
107	559	688	556	619
108	118	170	117	175
109	18	24	18	27
110	799	546	793	555
111	140	0	139	0
112	3,353	3,873	3,322	3,829
113	785	726	773	720
114	1,182	1,503	1,158	1,498
115	944	1,286	928	1,267
116	0	614	0	617
117	398	0	388	0
118	142	237	139	230
119	2,827	3,524	2,741	3,480
Total	29,322	38,781	29,085	38,547

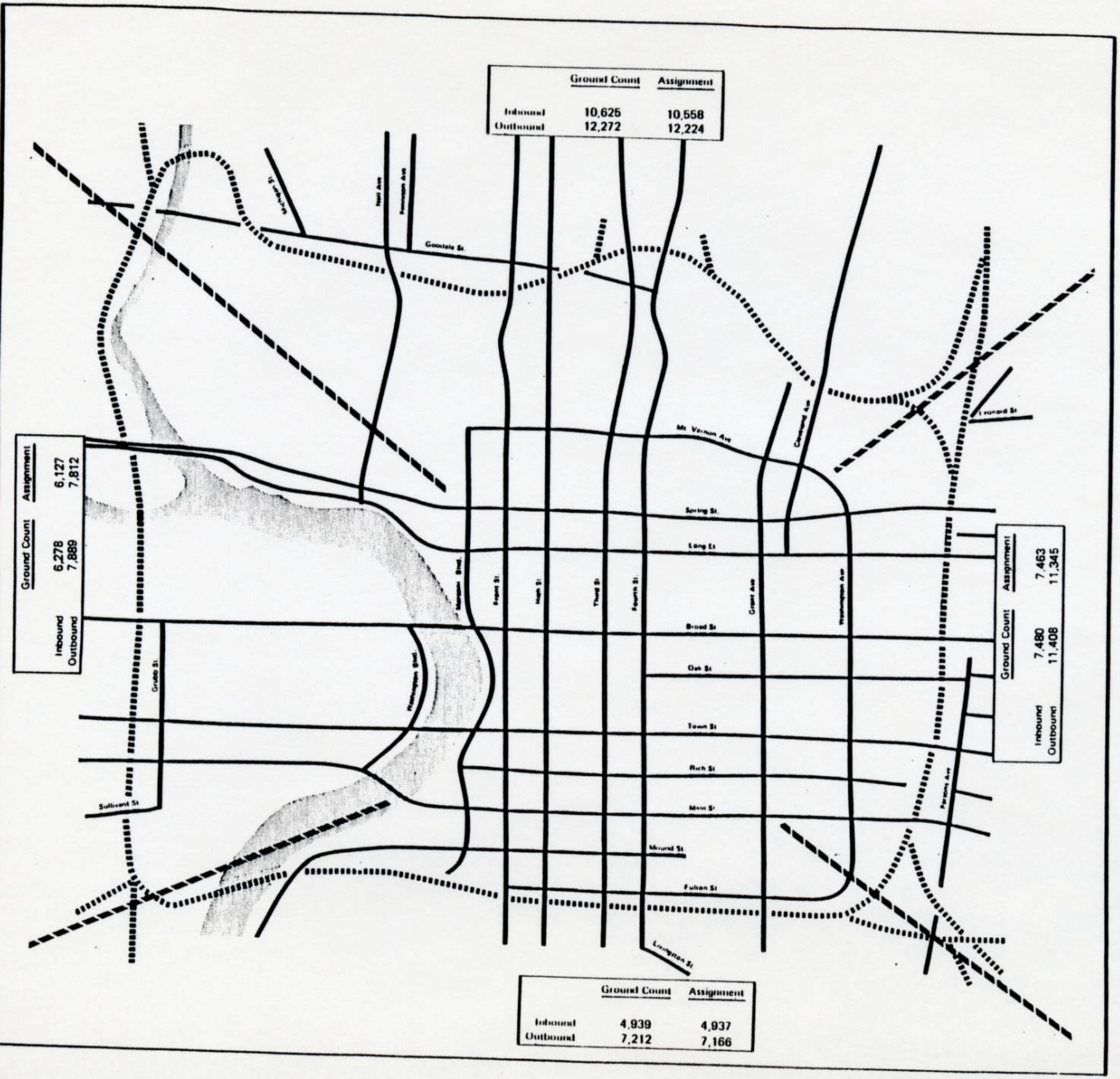

Figure 4-6

1983 PM PEAK HOUR ASSIGNED VOLUME AND GROUND COUNT COMPARISONS AT EXTERNAL CORDON

External Cordon

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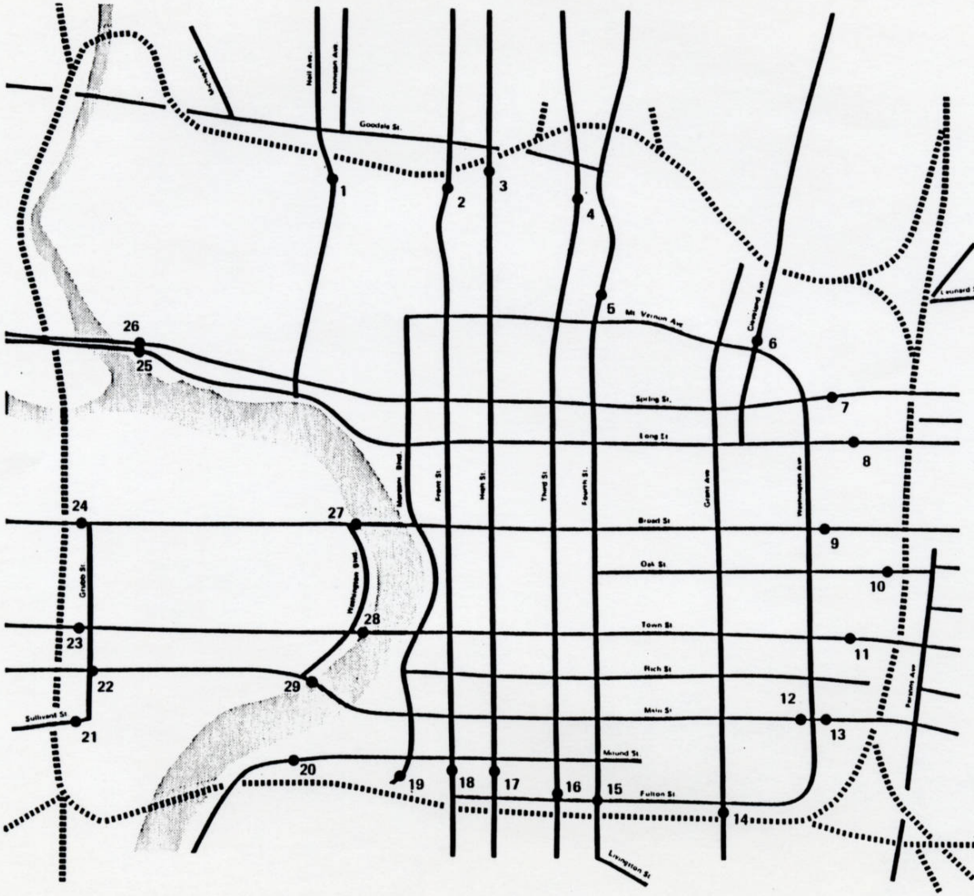

Figure 4-7

INTERNAL CORDON STATION NUMBERS

Internal Cordon

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Table 4-10

1983 PM PEAK HOUR INTERNAL CORDON ASSIGNED VOLUME AND GROUND COUNT COMPARISON

North Cordon

Location Number	Northbound Count Low	Northbound Count High	Northbound Assignment	Southbound Count Low	Southbound Count High	Southbound Assignment
1	822	-	321	286	-	218
2	877	-	730	123	-	171
3	477	-	159	527	-	212
4	-	-	-	531	-	742
5	1,560	-	1,170	-	-	-
6	911	-	619	392	-	608
Subtotal	4,647	-	2,999	1,859	-	1,951

East Cordon

Location Number	Eastbound Count Low	Eastbound Count High	Eastbound Assignment	Westbound Count Low	Westbound Count High	Westbound Assignment
7	-	-	-	645	827	669
8	1,574	2,858	2,625	-	-	-
9	1,632	2,458	1,451	777	1,291	1,166
10	269	-	673	140	-	171
11	319	-	125	446	-	121
12	-	-	-	400	-	613
13	1,078	-	1,090	-	-	-
Subtotal	4,872	6,982	5,965	2,408	3,104	2,740

Table 4-10 continued

South Cordon

Location Number	Southbound Count Low	Southbound Count High	Southbound Assignment	Northbound Count Low	Northbound Count High	Northbound Assignment
14	442	-	434	229	-	221
15	-	-	-	1,457	1,607	1,717
16	2,372	2,820	3,766	-	-	-
17	895	904	541	424	483	209
18	-	-	-	943	1,328	1,383
19	648	904	946	-	-	-
20	116	-	101	157	164	160
Subtotal	4,473	5,186	5,788	3,210	3,811	3,690

West Cordon

Location Number	Westbound Count Low	Westbound Count High	Westbound Assignment	Eastbound Count Low	Eastbound Count High	Eastbound Assignment
21	206	-	234	146	-	136
22	-	-	-	289	-	407
23	1,391	-	1,046	-	-	-
24	952	-	1,005	1,011	-	971
25	-	-	-	832	-	801
26	1,839	-	1,777	-	-	-
Subtotal	4,388	-	4,062	2,278	-	2,315
(27)	994	-	1,079	873	-	912
(28)	753	-	682	-	-	-
(29)	-	-	-	555	-	461

Total Internal Cordon

	Outbound Count Low	Outbound Count High	Outbound Assignment	Inbound Count Low	Inbound Count High	Inbound Assignment
Total	18,380	21,203	18,814	9,755	11,052	10,696

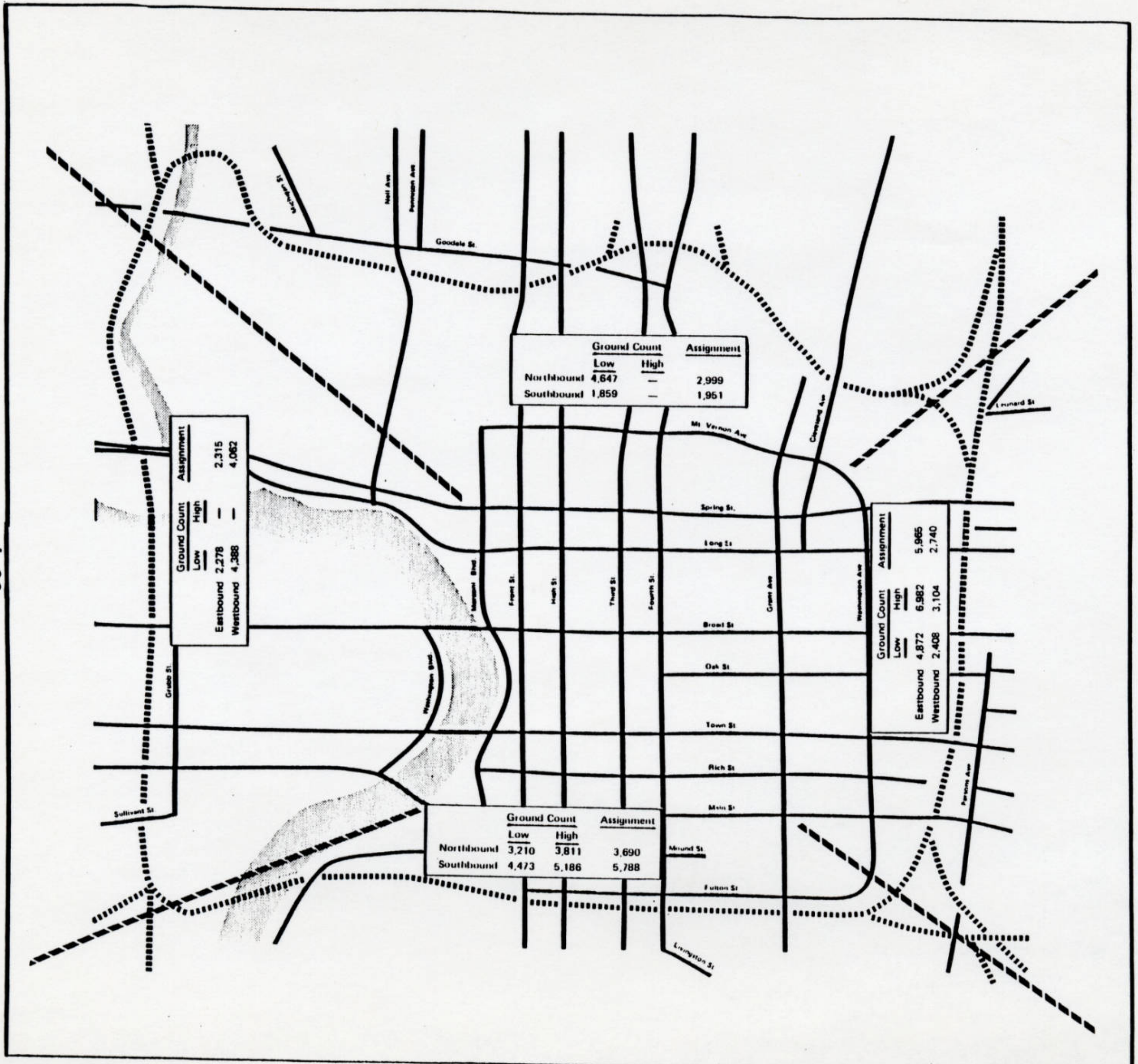

Figure 4-8

1983 PM PEAK HOUR
ASSIGNED VOLUME AND
GROUND COUNT COMPARISON
AT INTERNAL CORDON

Internal Cordon

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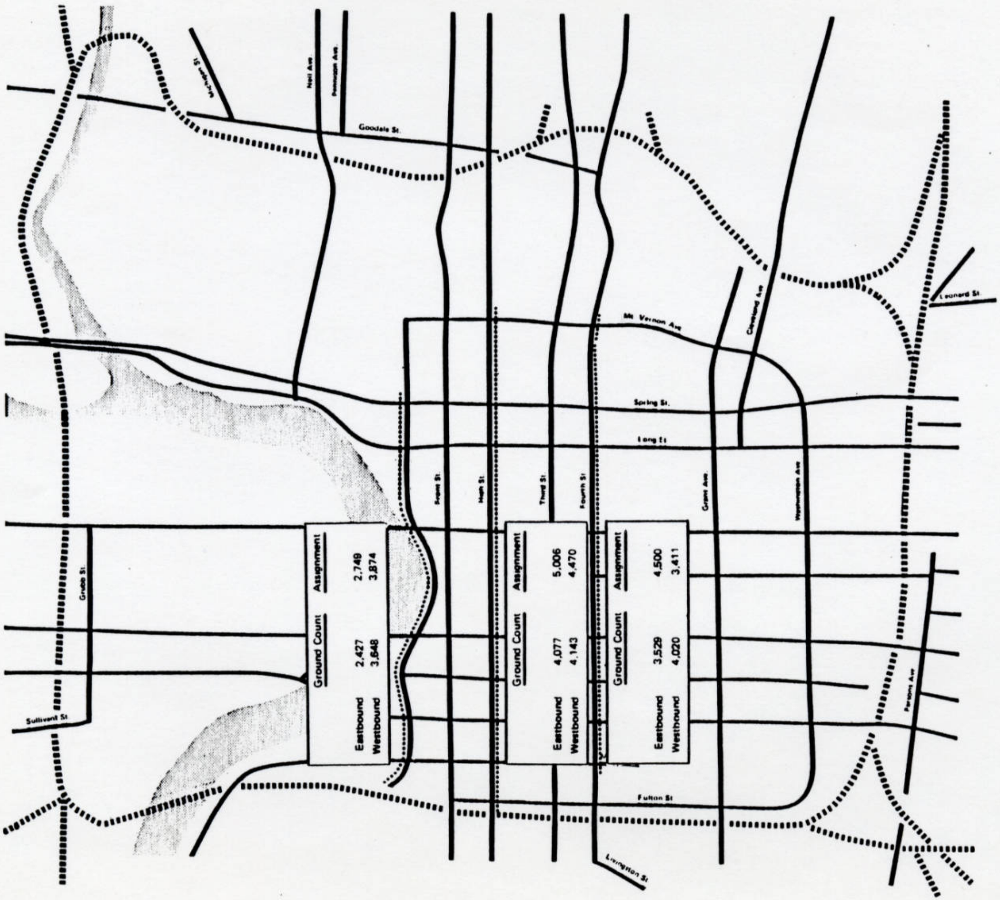

Figure 4-9

1983 PM PEAK HOUR
ASSIGNED VOLUME AND
GROUND COUNT COMPARISON
AT CBD SCREENLINES

Marconi Boulevard / Civic Center Drive
High Street
Fourth Street

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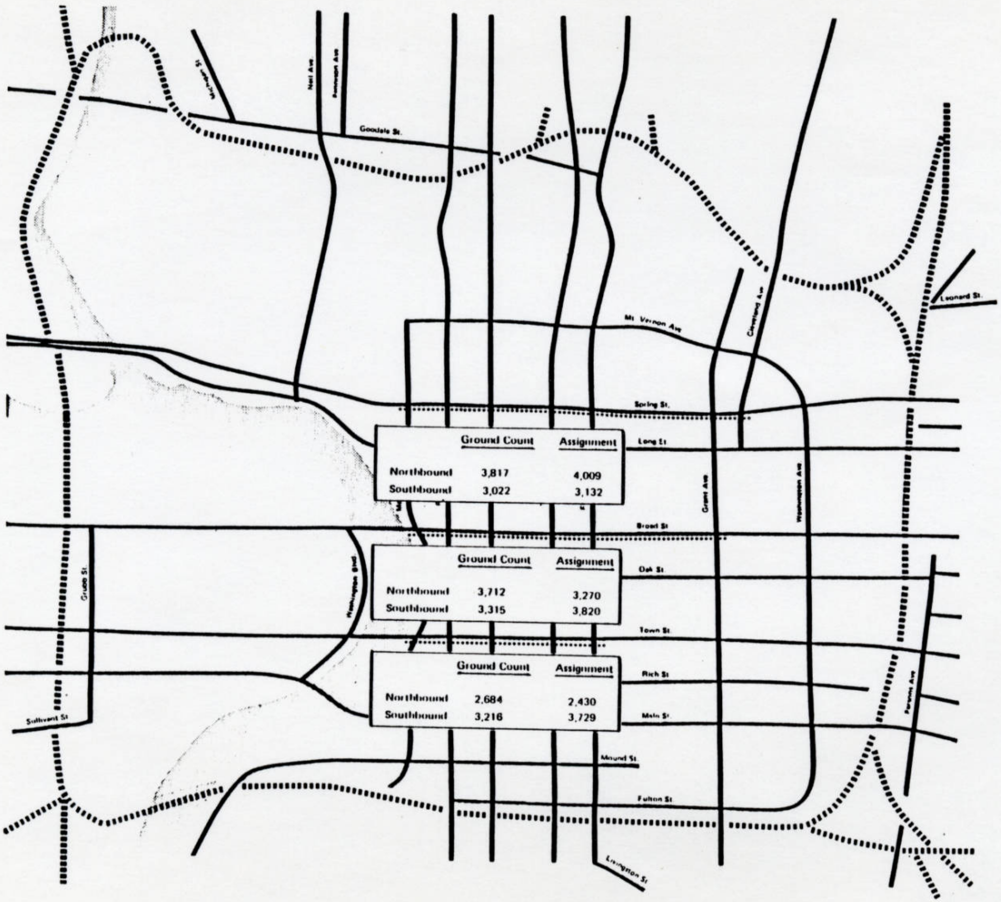

Figure 4-10

1983 PM PEAK HOUR ASSIGNED VOLUME AND GROUND COUNT COMPARISON AT CBD SCREENLINES

Spring Street
Broad Street
Town Street

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Three east-west screen lines were also reviewed. These screen lines are shown on Figure 4-10 and consist of screenlines at Spring Street, Broad Street, and Town Street. At every screen line, the assigned volume was within 16 percent of the ground count, which is an excellent comparison for computer assigned traffic to actual ground counts.

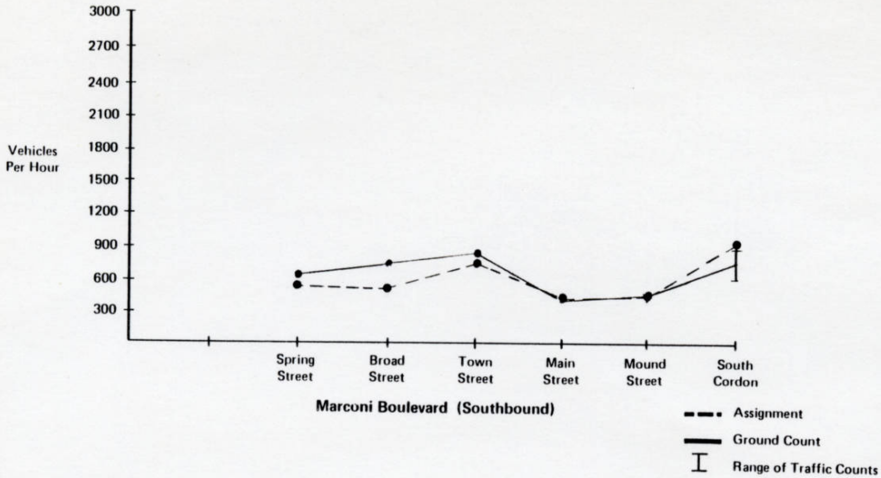
In addition to the cordon and screenline checks, the traffic along the main roads in the study area was compared with the assignment. This comparison is shown on Figures 4-11 through 4-16. For most of the highways, the computer assignment is very close to the actual ground counts, although there are some segments of highway where the assignment and the ground counts do differ considerably. The northbound traffic on High Street tends to be under-assigned and this under-estimation was considered in the estimation of Year 2000 traffic. The assignment tended to over-estimate traffic on Third Street near the south freeway ramp. This ramp is considerably congested in the evening and people are obviously attempting to avoid the ramp by using the Main Street and the Broad Street ramps. It appears that close to 800 vehicles, which could have used this freeway ramp in the evening peak hour, are diverting to Broad and Main Street. This diverison was taken into consideration in estimating the Year 20000 traffic volumes. The assigned traffic volumes on Long Street, between Marconi and Cleveland, appeared to be too high, but a review by the Columbus traffic engineering department suggested that the ground counts on this highway were probably too low and that the assignment was closer to the actual volumes than was the ground count. Overall the computer assignment match the ground counts with a degree of accuracy well within the limits normally placed upon computer generated assignments.

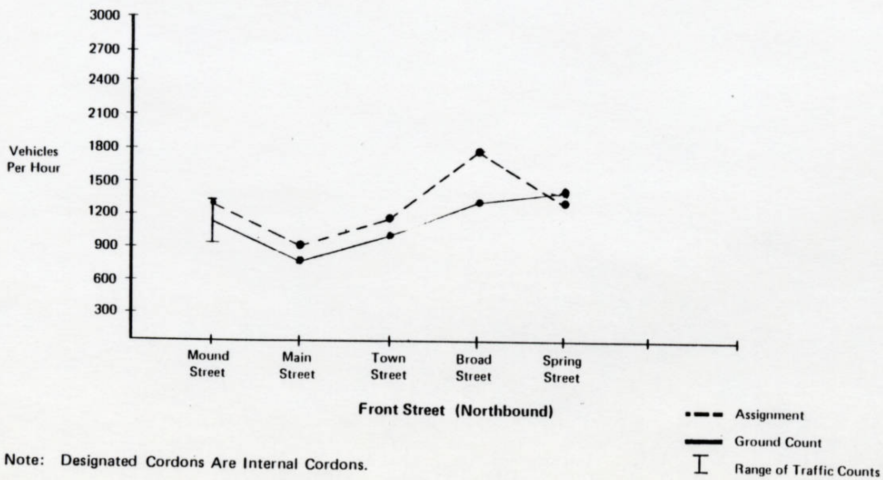
As another check on the assignment process, the input speeds were compared to the speeds estimated by the assignment process after assigning the traffic volumes. These speeds are estimated taking into consideration the capacity and the volume of each highway segment, in a manner similar to the capacity restraint technique. Figures 4-17 through 4-22 show the speeds used in the assignment and the resulting speeds after assignment. In almost all cases, the two speeds agree quite closely, with the exceptions being the speeds on Marconi and Third Street near the freeway ramps.

In summary, the application of the assignment methodology for the base year achieved the objectives of the study team. The trip table enhancement programs proved to be effective and the assignment technique produced a good match with the 1983 ground counts. The few areas of differences between assignment and ground counts, were noted and adjustments were made to the Year 2000 assignment results.

ASSIGNMENT METHODOLOGY FOR THE YEAR 2000 HIGHWAY NETWORK

The procedures developed, using the 1983 data, were applied to the Year 2000 trip tables and highway network. The basic trip volumes developed, for the Year 2000, have been summarized previously in this chapter and will not be repeated in this section. The Year 2000 base case highway network, used in this study was shown in Figure 4-4. The major highway additions in the Year 2000 network are the I-670 connector to the downtown, feeding Third and Fourth Streets, and the Nationwide connector on the west side of the study area feeding I-670 and Route 315. It was found that the assignment procedure used for the 1983 base case (i.e., the THETA value and the speeds shown in Table 4-2) were adequate for the Year 2000 assignments.





Note: Designated Cordons Are Internal Cordons.

Figure 4-11

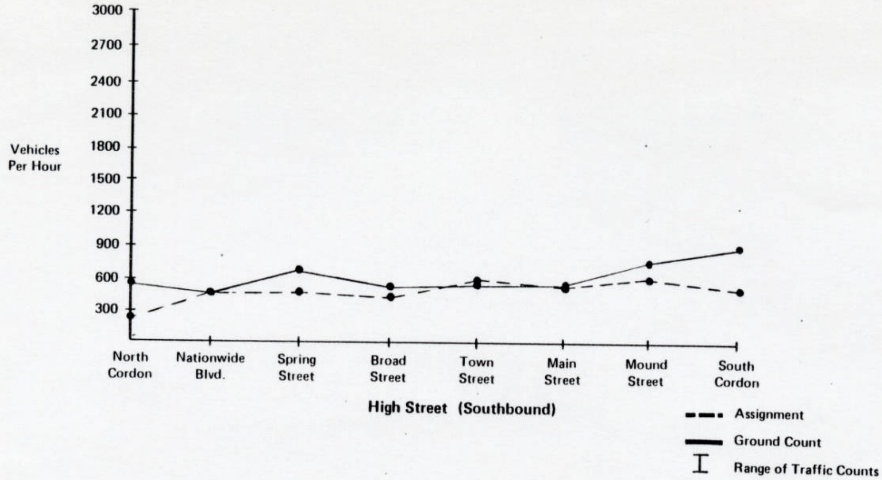
1983 PM PEAK HOUR
ASSIGNED VOLUME
TO COUNT COMPARISON

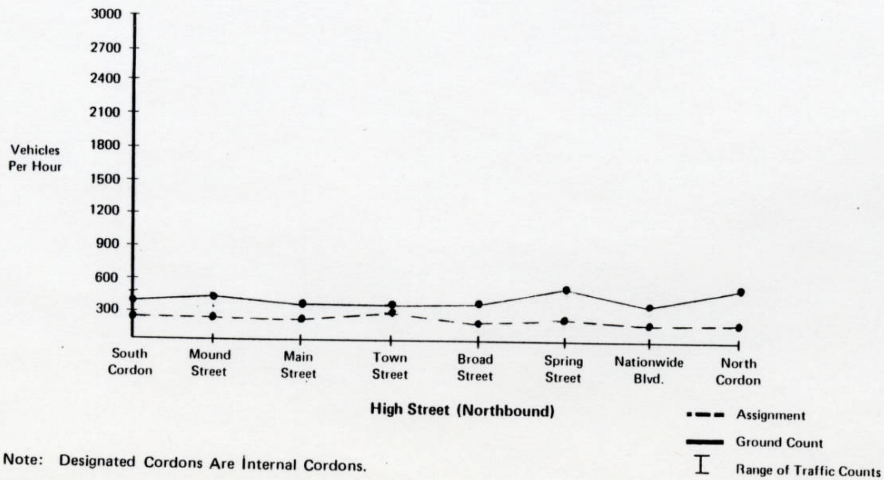
Marconi Boulevard/ Front Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

Figure 4-12

1983 PM PEAK HOUR
ASSIGNED VOLUME
TO COUNT COMPARISON

High Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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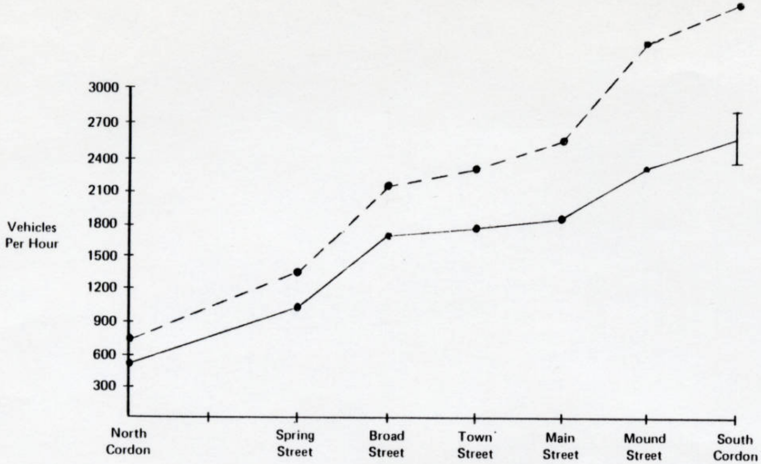
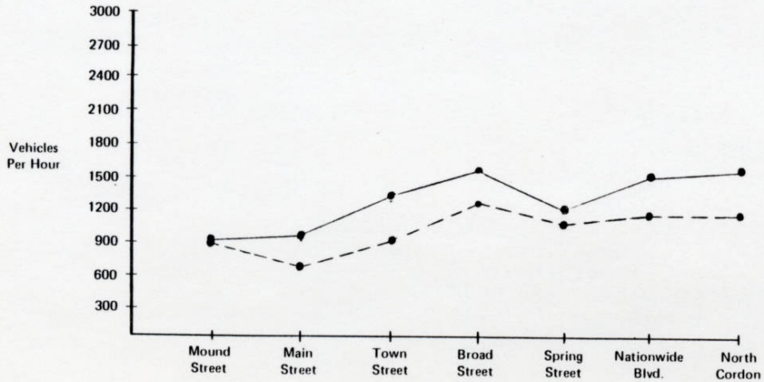
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services



Third Street (Southbound)

- - - Assignment
— Ground Count
I Range of Traffic Counts



Fourth Street (Northbound)

- - - Assignment
— Ground Count
I Range of Traffic Counts

Note: Designated Cordons Are Internal Cordons.

Figure 4-13

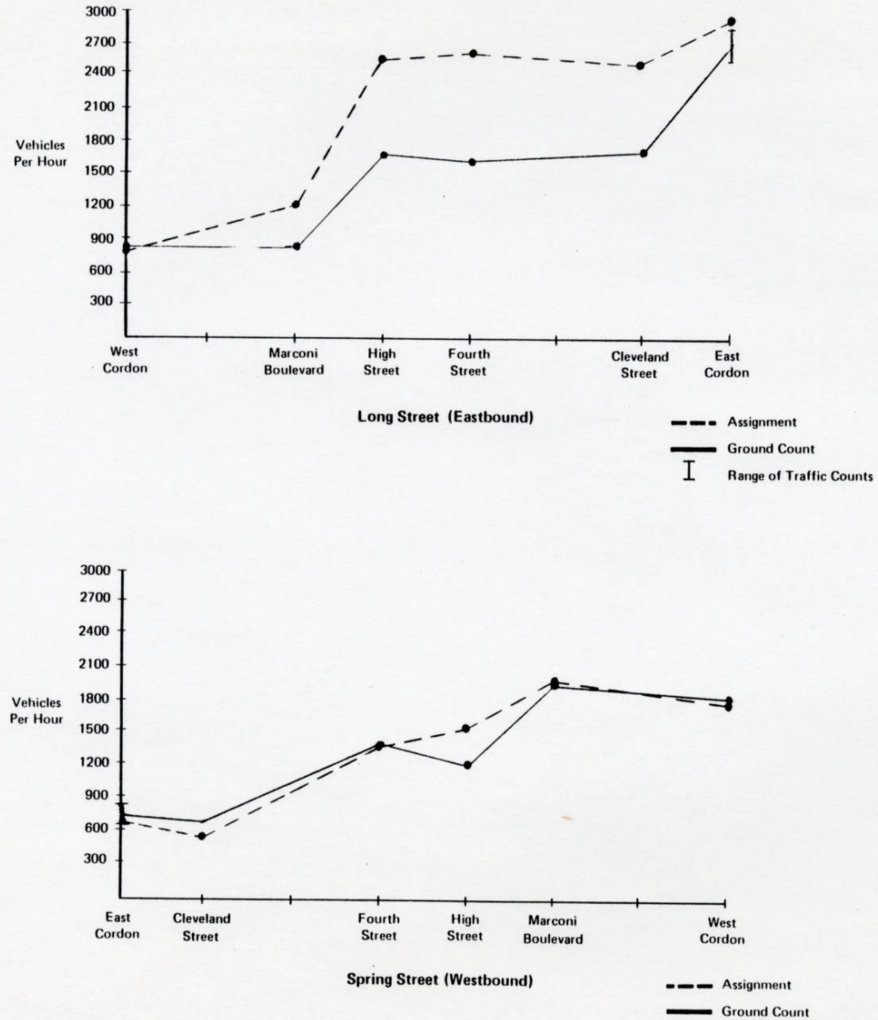
1983 PM PEAK HOUR
ASSIGNED VOLUME
TO COUNT COMPARISON

Third Street / Fourth Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services



Note: Designated Cordons Are Internal Cordons.

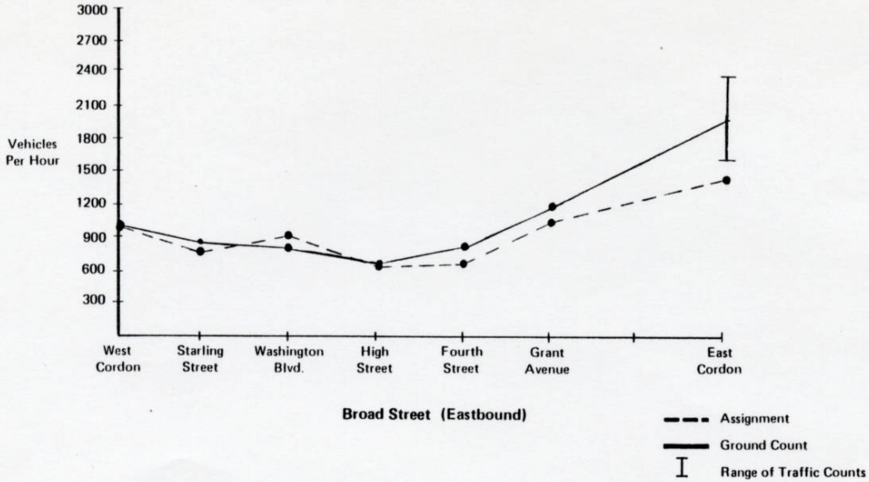
Figure 4-14

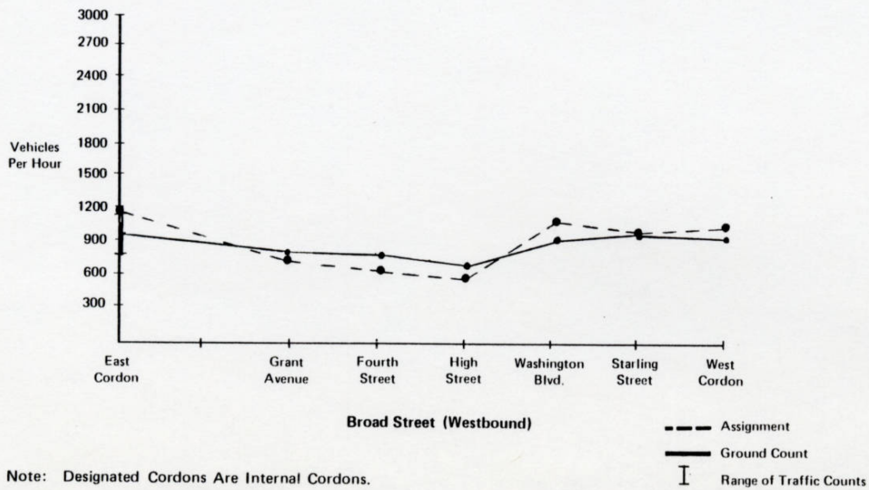
1983 PM PEAK HOUR
ASSIGNED VOLUME
TO COUNT COMPARISON

Long Street/ Spring Street

High Street Corridor Action Plan
COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

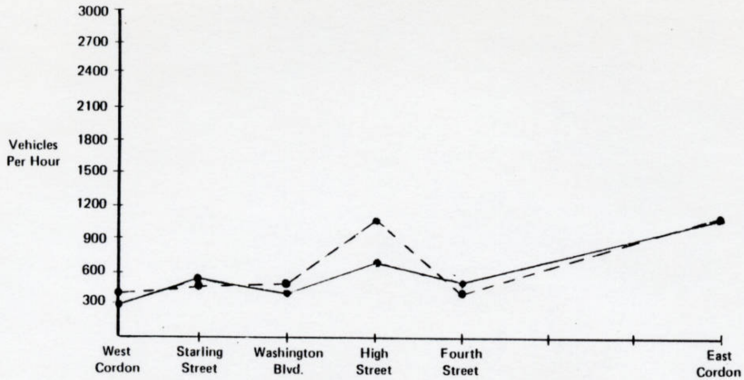
Figure 4-15

1983 PM PEAK HOUR
ASSIGNED VOLUME
TO COUNT COMPARISON

Broad Street

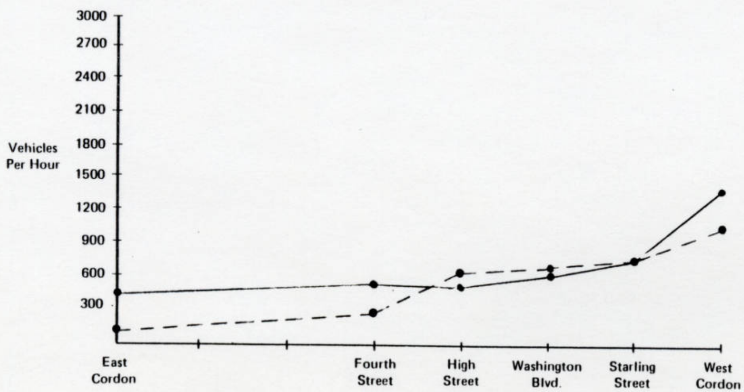
High Street Corridor Action Plan
COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services



Main Street (Eastbound)

- - - Assignment
—— Ground Count
I Range of Traffic Counts



Town Street (Westbound)

- - - Assignment
—— Ground Count
I Range of Traffic Counts

Note: Designated Cordons Are Internal Cordons.

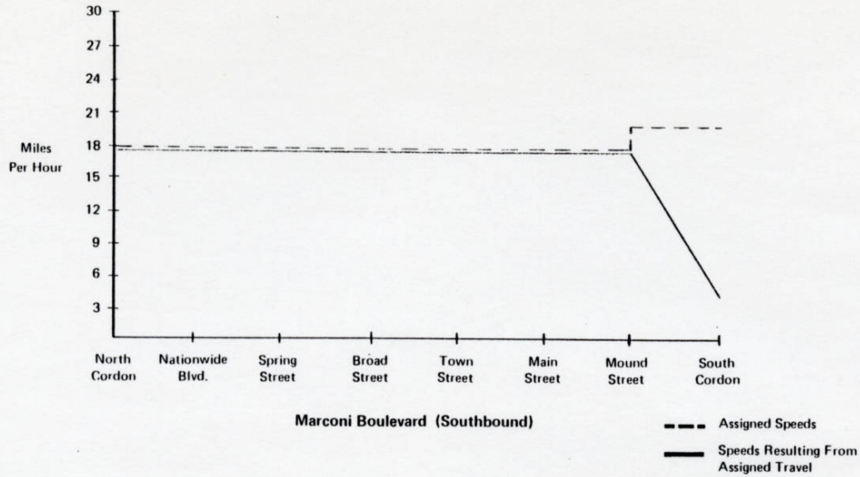
Figure 4-16

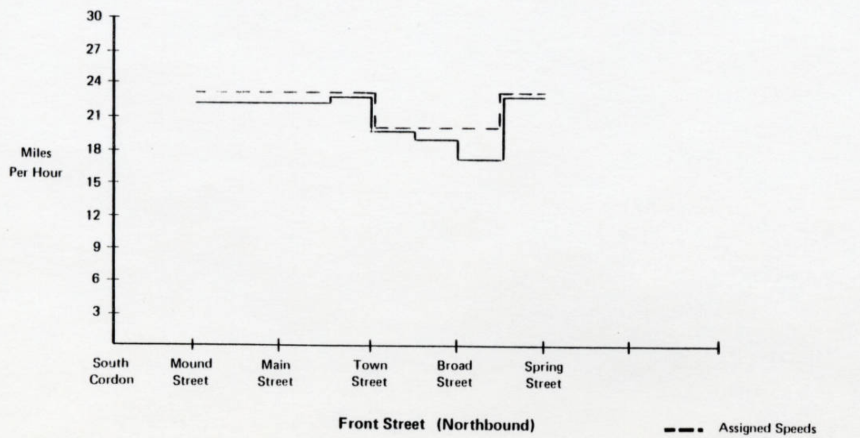
1983 PM PEAK HOUR ASSIGNED VOLUME TO COUNT COMPARISON

Main Street/ Town Street

High Street Corridor Action Plan
COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

Figure 4-17

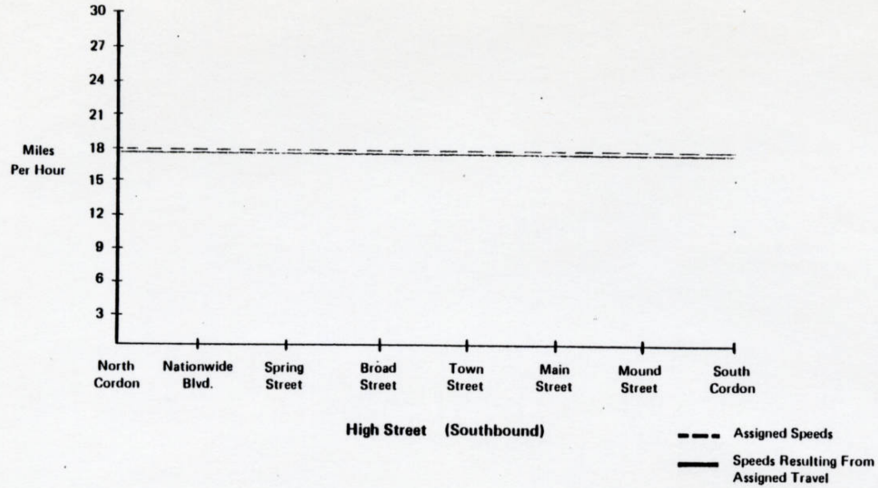
1983 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED COMPARISON

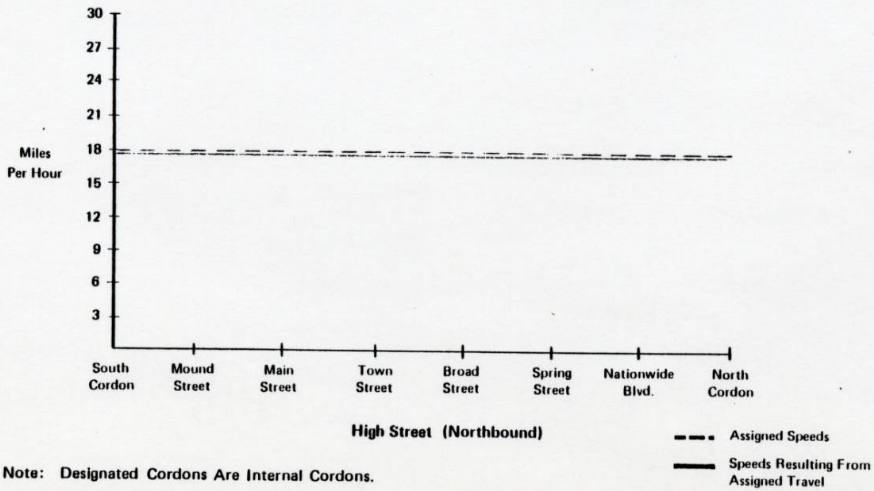
Marconi Boulevard / Front Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

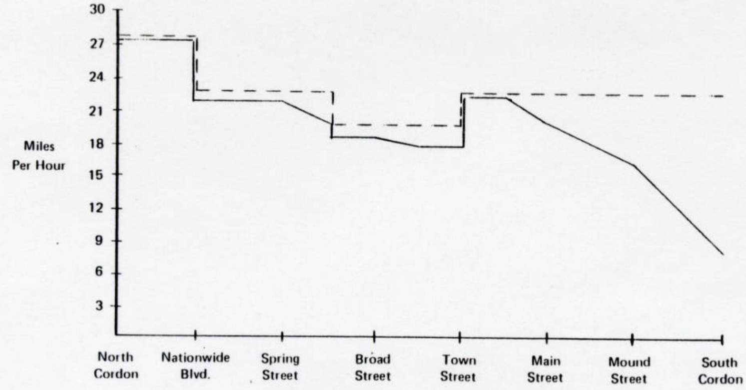
Figure 4-18

1983 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

High Street

High Street Corridor Action Plan
COLUMBUS, OHIO

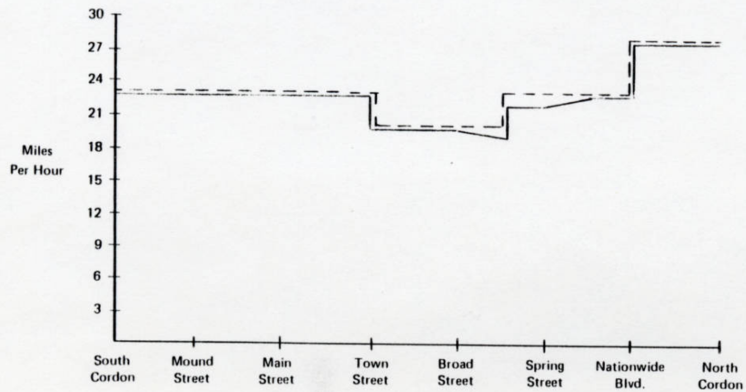
Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services



Third Street (Southbound)

Assigned Speeds

Speeds Resulting From Assigned Travel



Fourth Street (Northbound)

Assigned Speeds

Speeds Resulting From Assigned Travel

Note: Designated Cordons Are Internal Cordons.

Figure 4-19

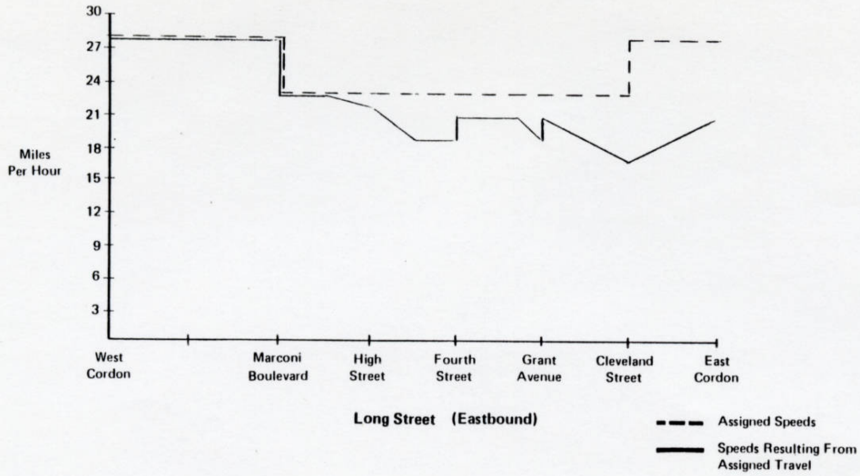
1983 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED COMPARISON

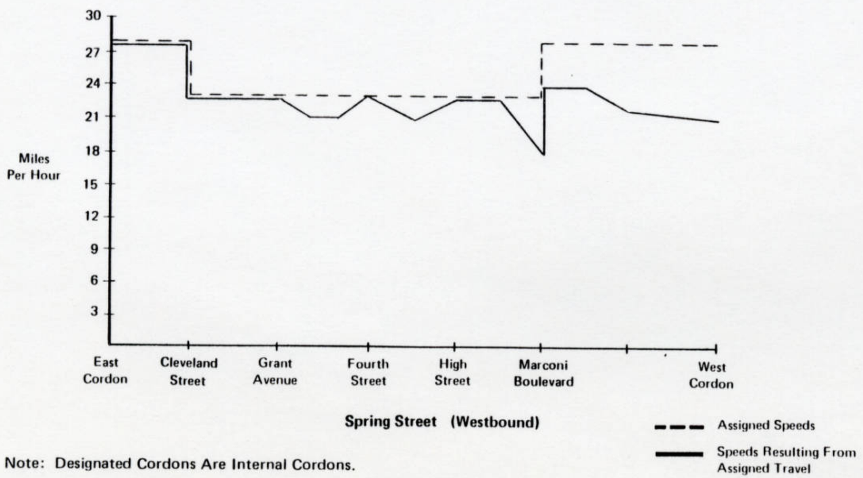
Third Street / Fourth Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

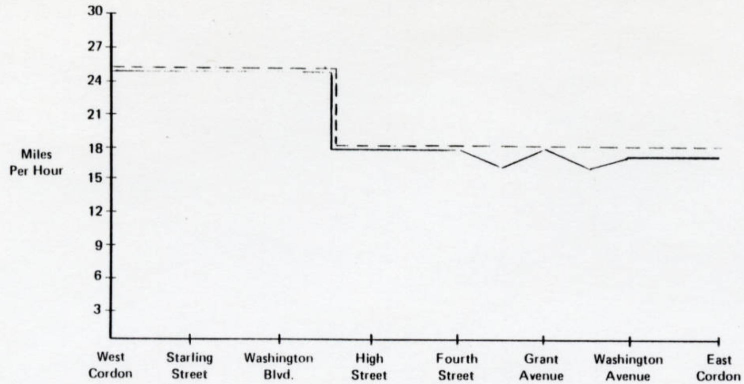
Figure 4-20

1983 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED COMPARISON

Long Street/
Spring Street

High Street Corridor
Action Plan
COLUMBUS, OHIO

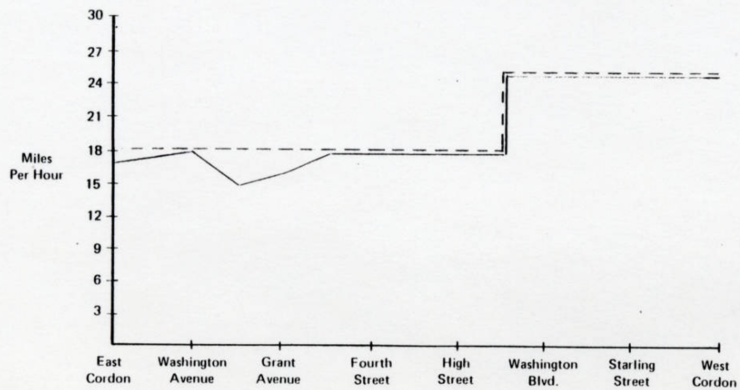
Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services



Broad Street (Eastbound)

- - - Assigned Speeds

——— Speeds Resulting From Assigned Travel



Broad Street (Westbound)

- - - Assigned Speeds

——— Speeds Resulting From Assigned Travel

Note: Designated Cordons Are Internal Cordons.

Figure 4-21

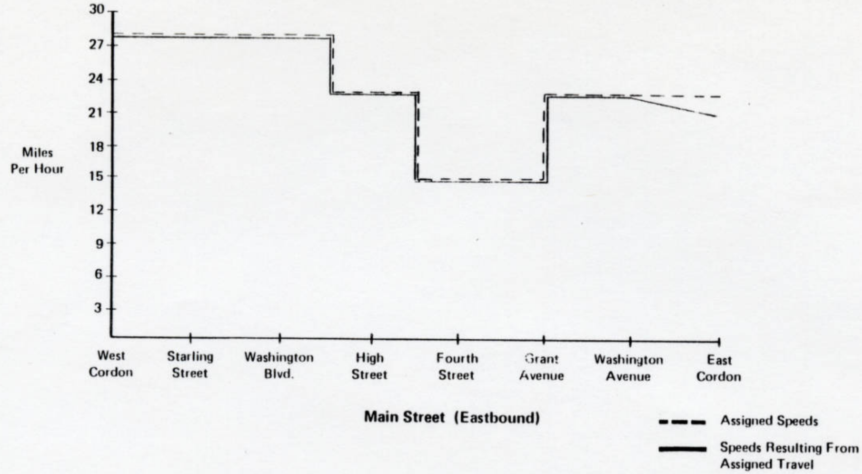
1983 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED COMPARISON

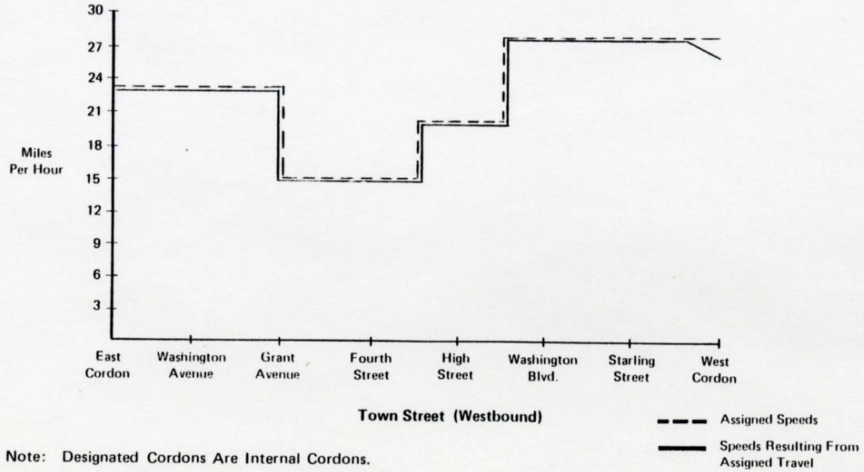
Broad Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

Figure 4-22

1983 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED COMPARISON

Main Street / Town Street

High Street Corridor Action Plan
COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services

The daily traffic volumes for the Year 2000 assignment were obtained from the Ohio Department of Transportation and were isolated using the program NAG. The city traffic engineering department and MORPC reviewed the ODOT capacity restraint regional traffic assignment and made manual adjustments to the daily volume at the external cordon line. These manually adjusted volumes were the base volumes used to modify the output of the NAG process using the program FACTOR1, as previously described.

Year 2000 Assignment Results

This section presents the general results of the Year 2000 traffic assignment and compares it with the 1983 assignment results. A more detailed assessment of the impacts of the highway volumes, especially on the arterial streets within the study area, can be found in Chapter 5. The traffic comparisons presented in this section deal only with the Year 2000 base case volumes since the volumes, at this scale, are similar for both the base case and the preferred High Street alternative.

The total number of vehicle trips taking place to, from, and through the study area increased by approximately 39 percent between 1983 and 2000 -- from 49,400 trips to 68,400 trips in the P.M. peak hour. For vehicle trips either begining or ending in the study area, the increase was only about 21 percent (from 27,200 P.M. peak hour trips to 33,000 P.M. peak hour trips); while the through trips showed a considerable increase of approximately 60 percent (from 22,100 to 35,400 P.M. peak hour vehicle trips).

When the traffic at the external cordon is compared, there is a substantial difference between the cardinal directions. Traffic from the west increases by approximately 64 percent and from the east by approximately 53 percent, while the south cordon increases by 50 percent and the north cordon by only 31 percent (see Table 4-11 and Figure 4-23). These directional differences are caused by shifts in population, employment, and the freeway system. Even more significant is the shift from local arterials to freeways, at the external cordon. The number of vehicle trips on freeways, at the external cordon, is 66 percent higher than in 1983, while the increase in traffic for the arterials is only 30 percent (see Table 4-12). This increase in freeway travel, at the external cordon, would indicate that the freeway ramps in the study area would have a significant increase in traffic. This is indeed the case, with the traffic on the freeway ramps within the study area increasing by 43 percent. This increase is quite substantial considering that traffic to and from the study area only increased by approximately 20 percent (over 45 percent of all traffic on the freeway ramps is not generated nor attracted to the study area; see Table 4-13).

This use of the freeway ramps by non-study area traffic is surprising; however, the percent between 1983 and 2000 is essentially consistent. When the freeway ramp volumes are stratified by the cardinal directions, there is a substantial difference in the percent change between 1983 and 2000 as shown in Table 4-14. The ramps on the east side of the study area actually decrease by approximately 14 percent, while the north side ramps increase by 127 percent. This difference is obviously caused, to a great extent, by the addition of the I-670 connector and the Nationwide connector. The ramps on the west side have a minor increase, of 28 percent, while the south side ramps increase at approximately the average study area rate of approximately 50 percent. The additional freeways in the north appear to be relieving the west side ramps to some extent, while the south ramps appear to be little affected by the additional freeways. The increase in the freeway ramp volumes in the north have a significant effect on the arterials in the study area, especially the north-south arterials feeding the freeway ramps.

TABLE 4-11
COMPARISON OF EXTERNAL STATION P.M. PEAK HOUR TRAFFIC VOLUMES BY DIRECTION

DIRECTION	1983 COUNT	1983 ASSIGNMENT	2000 ASSIGNMENT	PERCENT CHANGE
SOUTH CORDON				
INBOUND	4939	4937	8132	64.7
OUTBOUND	7212	7166	10025	39.9
TOTAL	12151	12103	18157	50.0
EAST CORDON				
INBOUND	7480	7463	10906	45.8
OUTBOUND	11408	11345	17858	57.4
TOTAL	18888	18808	28764	52.9
NORTH CORDON				
INBOUND	10625	10558	13496	27.0
OUTBOUND	12272	12224	16245	32.4
TOTAL	22897	22782	29741	30.5
WEST CORDON				
INBOUND	6278	6127	9114	48.8
OUTBOUND	7889	7812	13724	74.0
TOTAL	14167	13939	22838	63.8

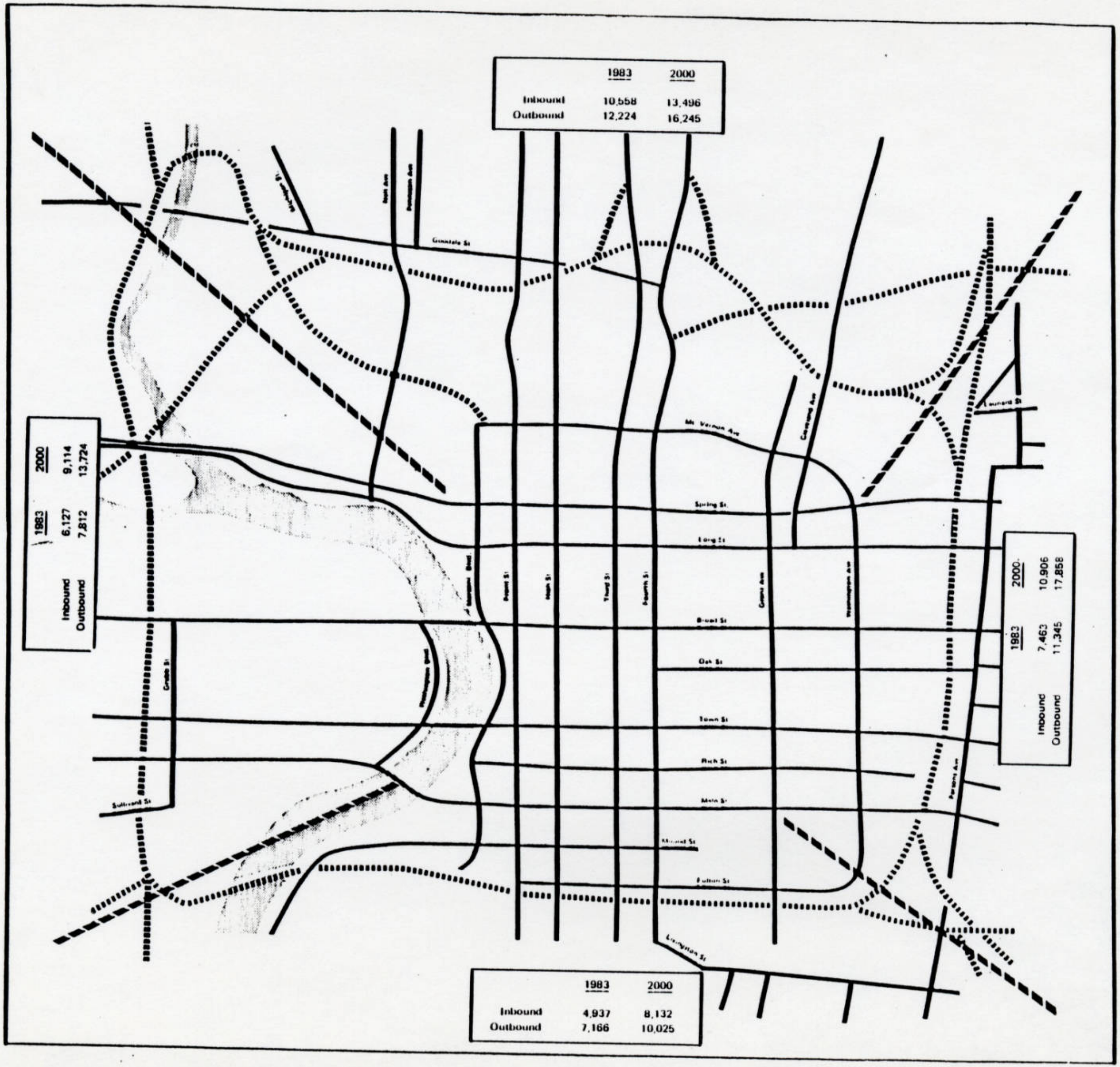


Figure 4-23

2000 and 1983 PM PEAK HOUR ASSIGNED VOLUME AT EXTERNAL CORDON

External Cordon

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
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TABLE 4-12
SUMMARY OF P.M. PEAK HOUR TRAFFIC AT EXTERNAL STATIONS STRATIFIED BY TYPE OF HIGHWAY

	INBOUND TRIPS			OUTBOUND TRIPS			ALL TRIPS		
	1983	2000	PERCENT CHANGE	1983	2000	PERCENT CHANGE	1983	2000	PERCENT CHANGE
FREEWAYS	13038	20917	60.4	18505	31306	69.2	31543	52223	65.6
NON-FREEWAYS	16284	20731	27.3	20276	26823	32.3	36560	47554	30.1
ALL STATIONS	29322	41648	42.0	38781	58129	49.9	68103	99777	46.5

TABLE 4-13
COMPARISON OF 1983 AND 2000 TRAFFIC ON FREEWAY RAMPS

	OFF-RAMP MOVEMENTS	ON-RAMP MOVEMENTS	ALL RAMP MOVEMENTS
TRAVEL THROUGH STUDY AREA			
1983 P.M. TRIPS	4364	5992	10356
2000 P.M. TRIPS	7271	7355	14626
PERCENT CHANGE	66.6	22.7	41.2
TRAVEL TO AND FROM STUDY AREA			
1983 P.M. TRIPS	3701	8179	11880
2000 P.M. TRIPS	4091	13021	17112
PERCENT CHANGE	10.5	59.2	44.0
ALL TRAVEL			
1983 P.M. TRIPS	8065	14171	22236
2000 P.M. TRIPS	11362	20376	31738
PERCENT CHANGE	40.9	43.8	42.7
PERCENT OF THROUGH TRIPS			
1983 P.M. TRIPS	54.1	42.3	46.6
2000 P.M. TRIPS	64.0	36.1	46.1
PERCENT CHANGE	18.3	-14.7	-1.1

TABLE 4-14
SUMMARY OF FREEWAY RAMP VOLUMES

	OFF-RAMP MOVEMENTS	ON-RAMP MOVEMENTS	ALL RAMP MOVEMENTS	DIRECTIONAL SPLIT (ON/ALL)
FOR ALL TRIPS USING RAMPS				
EAST SIDE RAMPS				
1983 P.M. TRIPS	2802	4067	6869	59.2
2000 P.M. TRIPS	2325	3596	5921	60.7
PERCENT CHANGE	-17.0	-11.6	-13.8	2.5
NORTH SIDE RAMPS				
1983 P.M. TRIPS	1886	3043	4929	61.7
2000 P.M. TRIPS	4535	6629	11164	59.4
PERCENT CHANGE	140.0	117.8	126.5	-3.4
WEST SIDE RAMPS				
1983 P.M. TRIPS	1670	2893	4563	63.4
2000 P.M. TRIPS	2729	3118	5847	53.3
PERCENT CHANGE	63.4	7.8	28.1	-15.9
SOUTH SIDE RAMPS				
1983 P.M. TRIPS	1707	4168	5875	70.9
2000 P.M. TRIPS	1773	7033	8806	79.9
PERCENT CHANGE	3.9	68.7	49.9	12.7
ALL RAMPS				
1983 P.M. TRIPS	8065	14171	22236	63.7
2000 P.M. TRIPS	11362	20376	31738	64.2
PERCENT CHANGE	40.9	43.8	42.7	0.8

TABLE 4-14 (CONTINUED)

	OFF-RAMP MOVEMENTS	ON-RAMP MOVEMENTS	ALL RAMP MOVEMENTS	DIRECTIONAL SPLIT (ON/ALL)
FOR TRIPS WHICH TRAVEL THROUGH THE STUDY AREA				
EAST SIDE RAMPS				
1983 P.M. TRIPS	1767	1915	3682	52.0
2000 P.M. TRIPS	1735	1573	3308	47.6
PERCENT CHANGE	-1.8	-17.9	-10.2	-8.6
NORTH SIDE RAMPS				
1983 P.M. TRIPS	1269	1908	3177	60.1
2000 P.M. TRIPS	2998	2430	5428	44.8
PERCENT CHANGE	136.1	27.4	70.9	-25.5
WEST SIDE RAMPS				
1983 P.M. TRIPS	747	1037	1784	58.1
2000 P.M. TRIPS	1968	1644	3612	45.5
PERCENT CHANGE	163.5	58.5	102.5	-21.7
SOUTH SIDE RAMPS				
1983 P.M. TRIPS	581	1132	1713	66.1
2000 P.M. TRIPS	570	1708	2278	75.0
PERCENT CHANGE	-1.9	50.9	33.0	13.5
ALL RAMPS				
1983 P.M. TRIPS	4364	5992	10356	57.9
2000 P.M. TRIPS	7271	7355	14626	50.3
PERCENT CHANGE	66.6	22.7	41.2	-13.1

TABLE 4-14 (CONTINUED)

	OFF-RAMP MOVEMENTS	ON-RAMP MOVEMENTS	ALL RAMP MOVEMENTS	DIRECTIONAL SPLIT (ON/ALL)
FOR TRIPS TO AND FROM STUDY AREA				
EAST SIDE RAMPS				
1983 P.M. TRIPS	1035	2152	3187	67.5
2000 P.M. TRIPS	590	2023	2613	77.4
PERCENT CHANGE	-43.0	-6.0	-18.0	14.7
NORTH SIDE RAMPS				
1983 P.M. TRIPS	617	1135	1752	64.8
2000 P.M. TRIPS	1537	4199	5736	73.2
PERCENT CHANGE	149.1	270.0	227.4	13.0
WEST SIDE RAMPS				
1983 P.M. TRIPS	923	1856	2779	66.8
2000 P.M. TRIPS	761	1474	2235	66.0
PERCENT CHANGE	-17.6	-20.6	-19.6	-1.2
SOUTH SIDE RAMPS				
1983 P.M. TRIPS	1126	3036	4162	72.9
2000 P.M. TRIPS	1203	5325	6528	81.6
PERCENT CHANGE	6.8	75.4	56.4	11.9
ALL RAMPS				
1983 P.M. TRIPS	3701	8179	11880	68.8
2000 P.M. TRIPS	4091	13021	17112	76.1
PERCENT CHANGE	10.5	59.2	44.0	10.6

The Year 2000 assignment was subjected to the same review as the 1983 assignment, i.e., cordon, screenline, and highway volume summaries. The traffic volumes at the external stations, for 1983 and Year 2000, are shown in Tables 4-5 and Figure 4-23. The internal cordon data, for both years, is shown on Table 4-15 and Figure 4-24. The internal cordon data agrees closely with the freeway ramp volumes, with the exception that the east cordon has even a greater decrease in traffic volume than does the east freeway ramps.

The screenline summaries are shown on Figures 4-25 and 4-26. The Marconi/Civic Center screenline shows essentially no increase in traffic between 1983 and Year 2000, while the High Street screenline shows only a minor increase. The screenline on Fourth Street, i.e., vehicle trips crossing 4th Street, shows a substantial decrease. The east-west screenline, showing traffic flow north and south, though, have substantial traffic volume increases. The Spring Street screenline has a fifty percent increase in traffic, while the Broad Street screenline has an increase of approximately 30 percent. The Town Street screenline has a 50 percent increase in traffic, southbound, and a 30 percent increase in traffic northbound. These screenlines indicate that the I-670 connector and the Nationwide connector will modify the general flow of traffic in the study area to a substantial degree.

When the individual highways are summarized, see Figures 4-27 through 4-32, there are some highways which have minor traffic inceases and some which have major increases. Marconi/Civic Center does not have a great increase in traffic except from Main Street south (feeding athe freeway ramp at Second Street). Front Street has a general increase in traffic with the greatest increase being in the area north of Broad Street (feeding the Nationwide connector). Traffic volumes on High Street are less than the 1983 estimates, except for the southbound trips between Town and Main Streets. There is a substantial increase of traffic on Third and Fourth Streets since both streets serve the I-670 connector and the freeway ramps to the south. Long and Spring Streets have generally less traffic in Year 2000 than in 1983, due to the reduction of their use as freeway "feeders" -- while Broad Street has little change in traffic volumes in the eastbound direction and a slight decrease in traffic volumes in the westbound direction. Main and Town Streets tend to have more traffic where they feed the freeway system (the east side for Main and the west side for Tonwn) and less traffic where they function as local access arterials.

The assignment speed and resultant speeds were also compared as shown in Figures 4-33 through 4-38. As with the 1983 checks, the assigned speed was similar to the resultant speed with the exception of the speeds on Third and Fourth as they approach the freeway ramps. In both cases, the arterials are heavily congested and the resultant speed decreases significantly.

This general review of the Year 2000 highway assignment indicates that the techniques developed produced a reasonable forecast. The travel on the freeways increased considerably over the general increase in traffic. The reasons for this increase appear to be: (1) the addition of freeway lane miles in the study area (e.g., I-670 connector), (2) the change in population and employment distribution (which inceases the travel through the study area), and (3) the increase in suburban population which increases the use of the freeway for study area bound trips. This increase in freeway traffic has reduced the traffic impacts for several of the study area arterials, especially the east-west street's but at the same time significantly increase the traffic impacts on the arterial streets feeding the freeways.

Table 4-15

2000 VS 1983 PM PEAK HOUR
ASSIGNED VOLUME AT INTERNAL CORDON

North Cordon

Location Number	Northbound 1983 Assigned Volume	Northbound 2000 Assigned Volume	Southbound 1983 Assigned Volume	Southbound 2000 Assigned Volume
1	321	724	218	106
2	730	790	171	152
3	159	140	212	212
4	-	-	742	492
5	1,170	4,205	-	-
6	619	608	608	530
Subtotal	2,999	6,467	1,951	1,492

East Cordon

Location Number	Eastbound 1983 Assigned Volume	Eastbound 2000 Assigned Volume	Westbound 1983 Assigned Volume	Westbound 2000 Assigned Volume
7	-	-	669	728
8	2,625	1,588	-	-
9	1,451	1,323	1,166	360
10	674	651	171	128
11	125	169	121	138
12	-	-	613	179
13	1,090	981	-	-
Subtotal	5,965	4,712	2,740	1,533

Table 4-15 (continued)

South Cordon

Location Number	Southbound 1983 Assigned Volume	Southbound 2000 Assigned Volume	Northbound 1983 Assigned Volume	Northbound 2000 Assigned Volume
14	434	240	221	64
15	-	-	1,717	2,128
16	3,766	5,431	-	-
17	541	658	209	253
18	-	-	1,383	1,632
19	946	1,718	-	-
20	101	180	160	360
Subtotal	5,788	8,227	3,690	4,437

West Cordon

Location Number	Westbound 1983 Assigned Volume	Westbound 2000 Assigned Volume	Eastbound 1983 Assigned Volume	Eastbound 2000 Assigned Volume
21	234	46	136	77
22	-	-	407	351
23	1,046	2,305	-	-
24	1,005	1,400	971	691
25	-	-	801	423
26	1,777	1,819	-	-
Subtotal	4,062	5,570	2,315	1,542

Total Internal Cordon

	Outbound 1983 Assigned Volume	Outbound 2000 Assigned Volume	Inbound 1983 Assigned Volume	Inbound 2000 Assigned Volume
Total	18,814	24,976	10,696	9,004

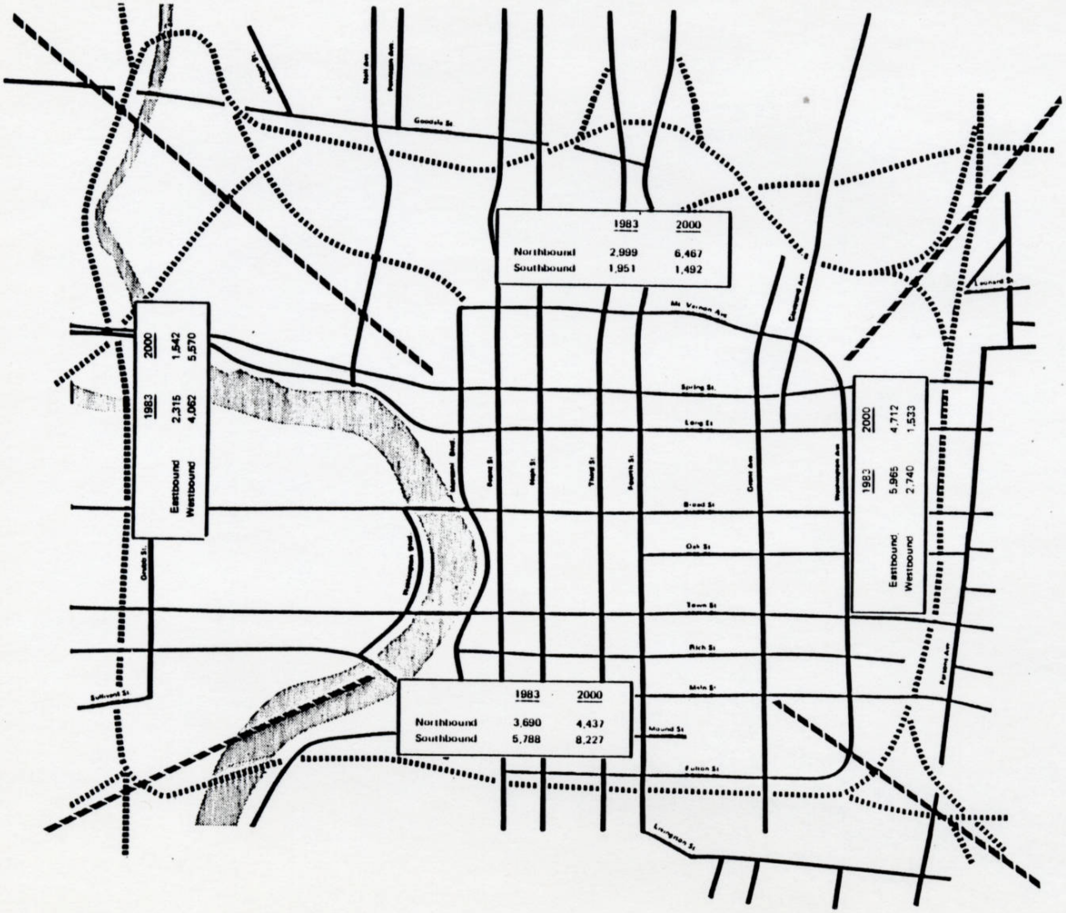

Figure 4-24

2000 and 1983 PM PEAK HOUR ASSIGNED VOLUMES COMPARISON AT INTERNAL CORDON

Internal Cordon

High Street Corridor Action Plan

COLUMBUS, OHIO

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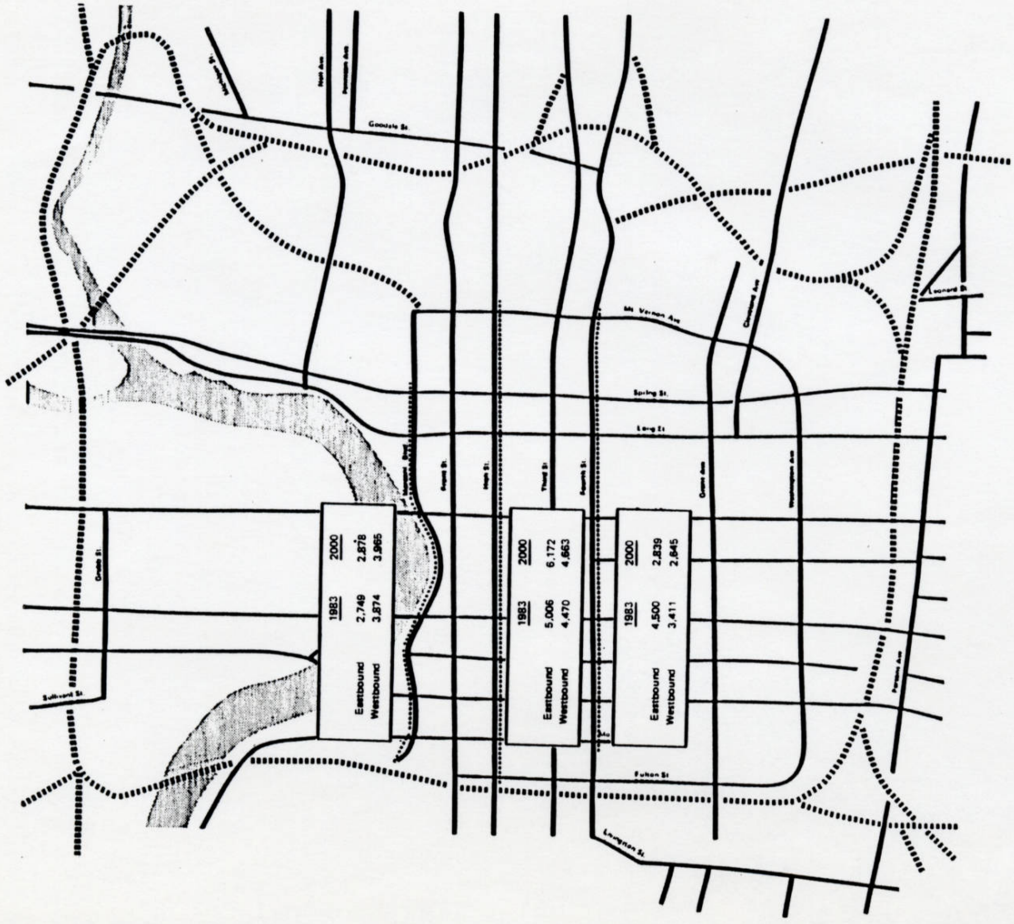

Figure 4-25

2000 and 1983 PM PEAK HOUR ASSIGNED VOLUMES COMPARISON AT CBD SCREENLINES

Marconi Boulevard/
Civic Center Drive
High Street
Fourth Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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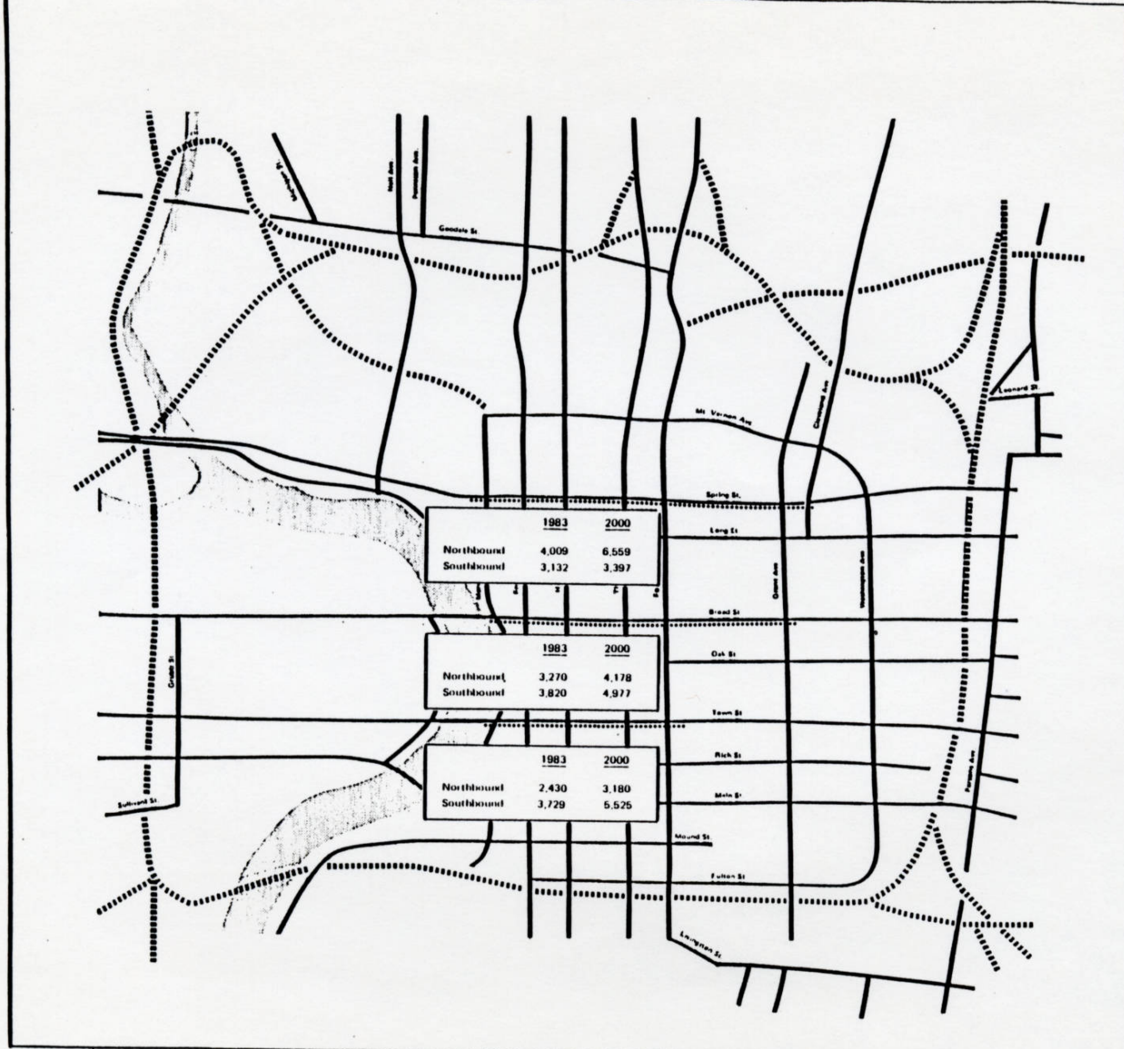

Figure 4-26

2000 and 1983 PM PEAK HOUR ASSIGNED VOLUMES COMPARISON AT CBD SCREENLINES

Spring Street
Broad Street
Town Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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John E. Foster and Associates, Inc.
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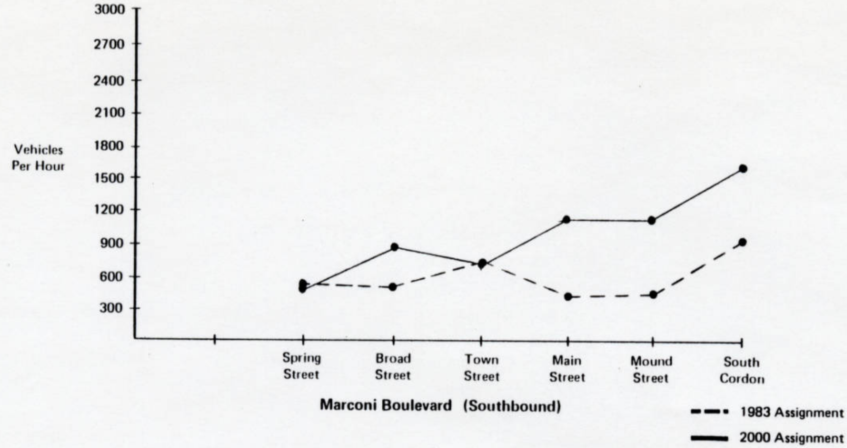

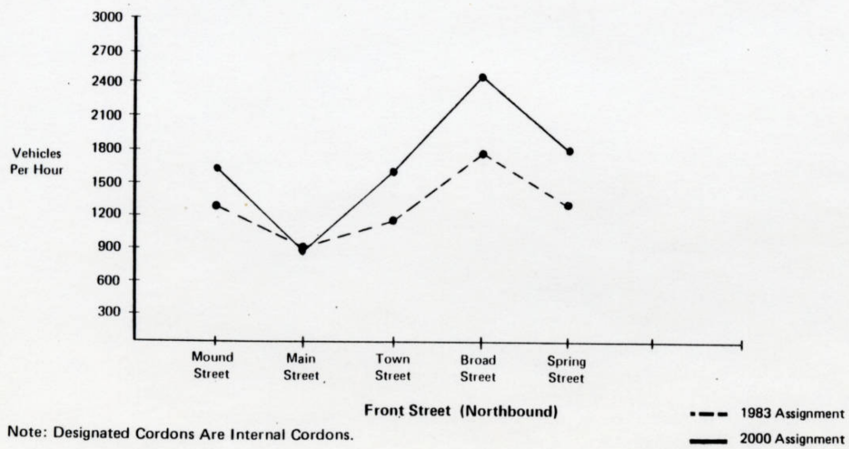

Note: Designated Cordons Are Internal Cordons.

Figure 4-27

1983 and 2000 PM PEAK HOUR ASSIGNED VOLUME COMPARISON

Marconi Boulevard / Front Street

High Street Corridor Action Plan

COLUMBUS, OHIO

Barton-Aschman Associates, Inc.
Clyde E. Williams & Associates, Ltd.
John E. Foster and Associates, Inc.
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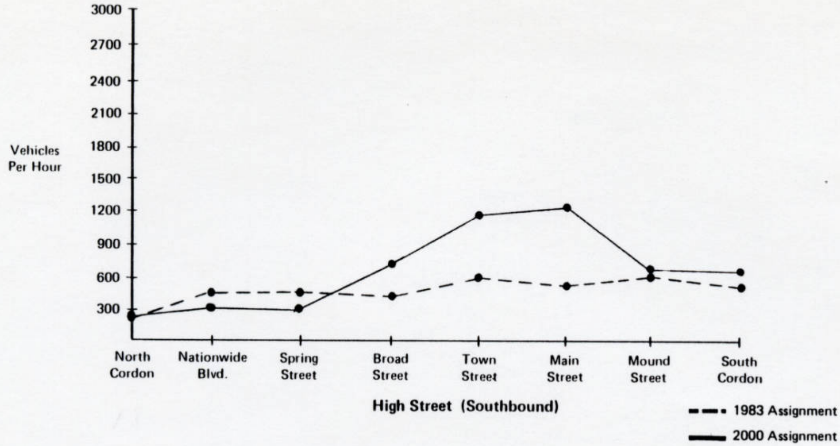

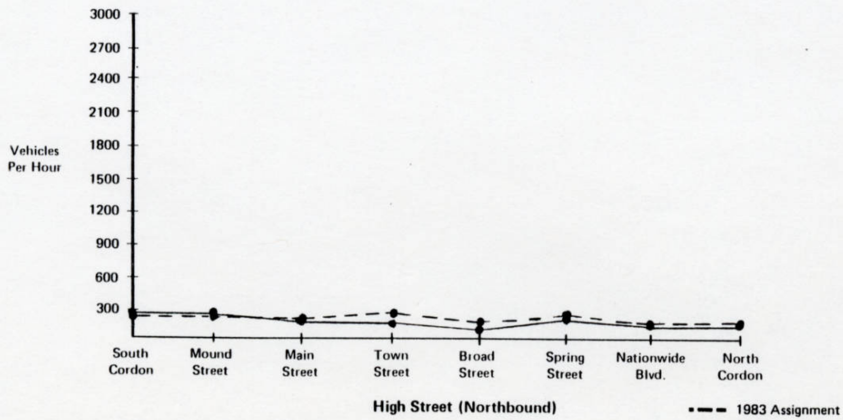

Note: Designated Cordons Are Internal Cordons.

Figure 4-28

1983 and 2000 PM PEAK HOUR ASSIGNED VOLUME COMPARISON

High Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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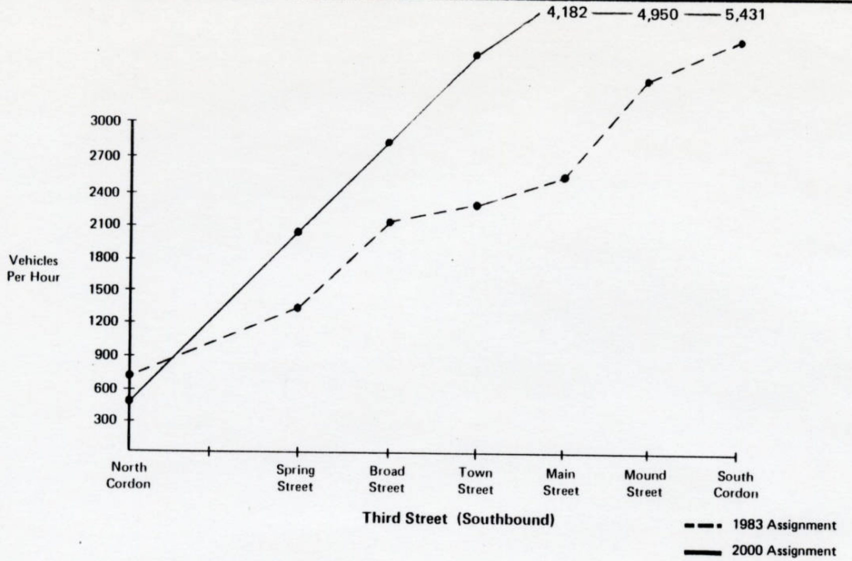
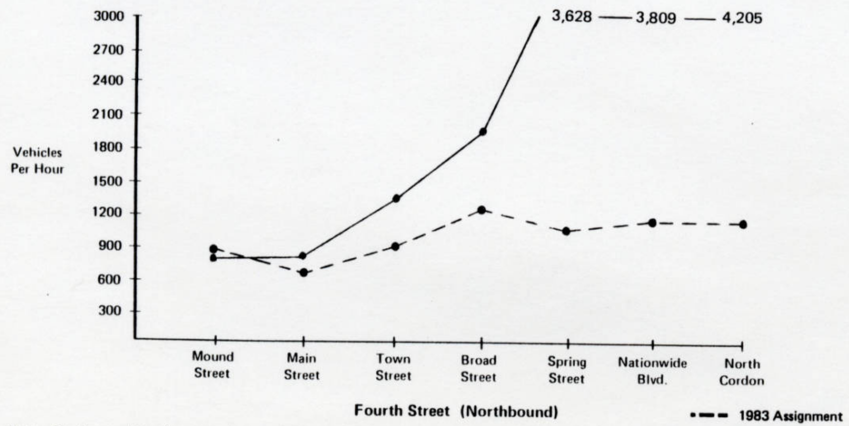
John E. Foster and Associates, Inc.
James T. Robinson Marketing Services





Note: Designated Cordons Are Internal Cordons.

Figure 4-29

1983 and 2000 PM PEAK HOUR ASSIGNED VOLUME COMPARISON

Third Street / Fourth Street

High Street Corridor Action Plan
COLUMBUS, OHIO

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John E. Foster and Associates, Inc.
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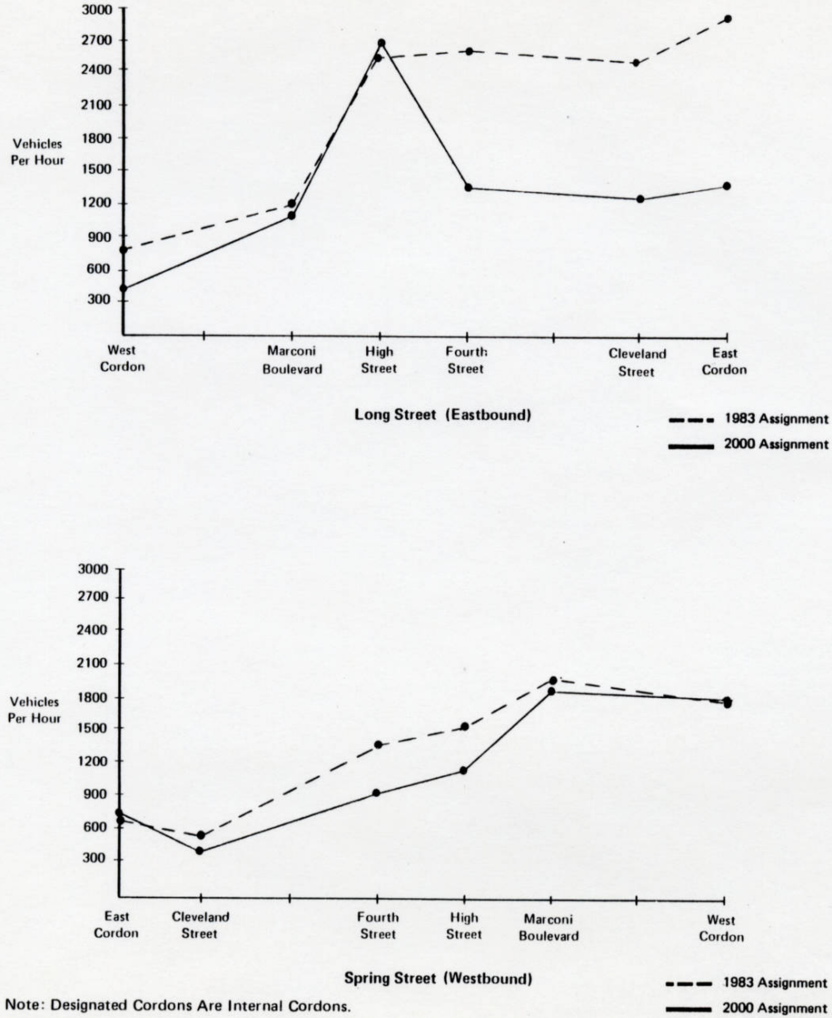

Note: Designated Cordons Are Internal Cordons.

Figure 4-30

1983 and 2000 PM PEAK HOUR
ASSIGNED VOLUME COMPARISON

Long Street / Spring Street

High Street Corridor Action Plan
COLUMBUS, OHIO

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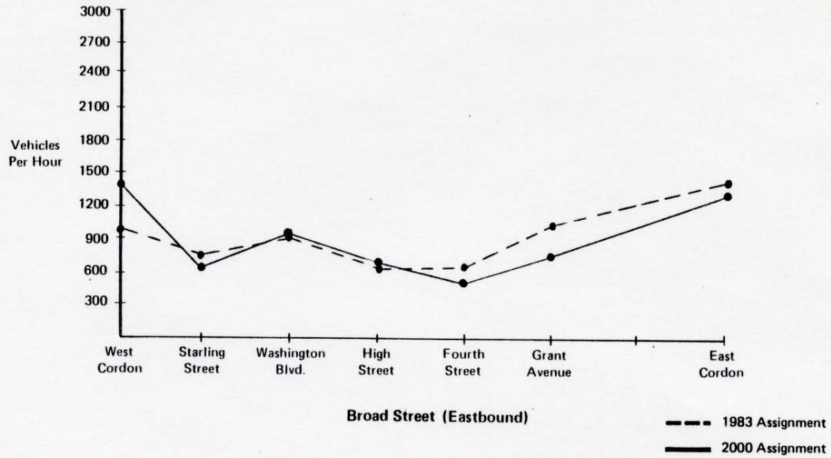

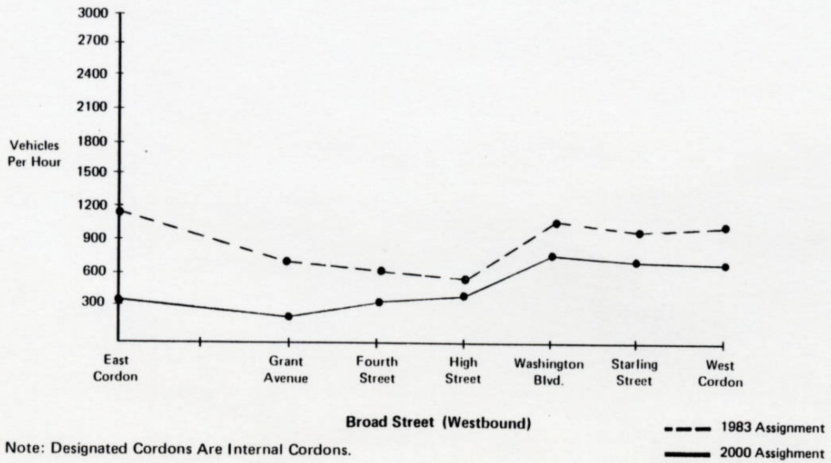

Note: Designated Cordons Are Internal Cordons.

Figure 4-31

1983 and 2000 PM PEAK HOUR ASSIGNED VOLUME COMPARISON

Broad Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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John E. Foster and Associates, Inc.
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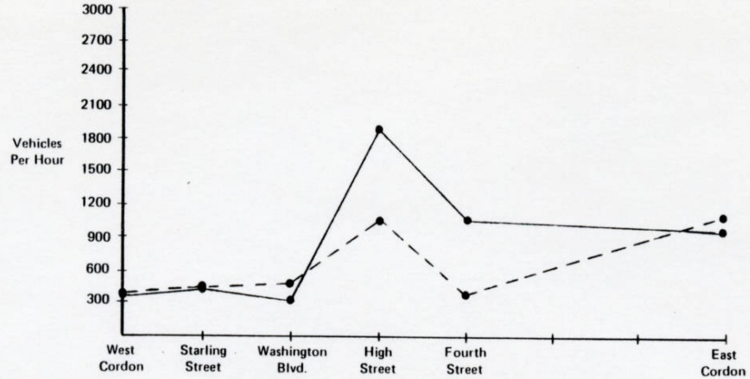
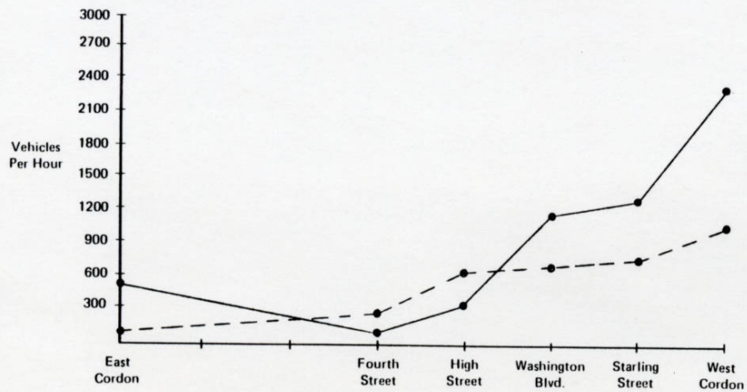


Main Street (Eastbound)

- - - 1983 Assignment
—— 2000 Assignment



Town Street (Westbound)

- - - 1983 Assignment
—— 2000 Assignment

Note: Designated Cordons Are Internal Cordons.

Figure 4-32

1983 and 2000 PM PEAK HOUR ASSIGNED VOLUME COMPARISON

Main Street / Town Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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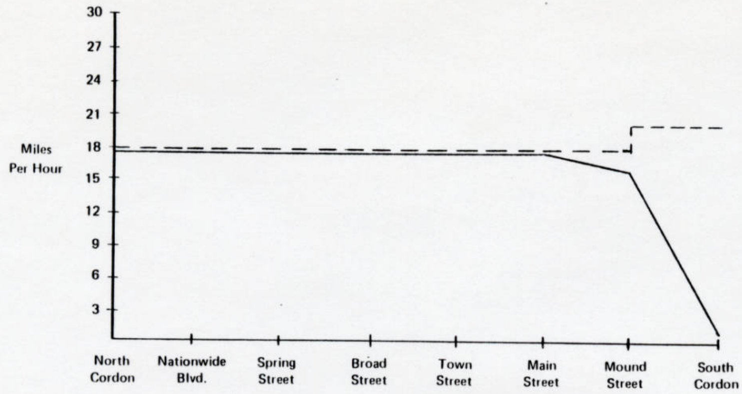
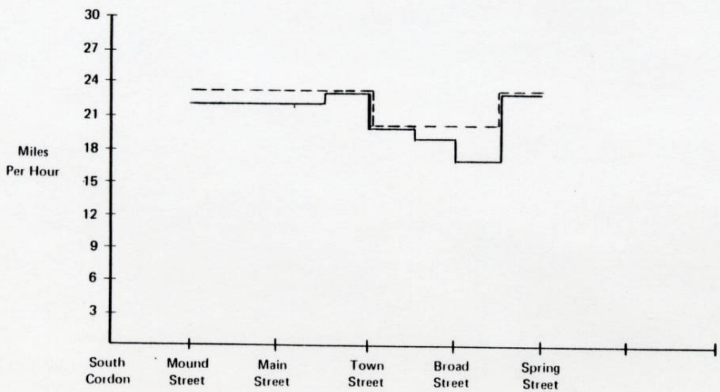


Marconi Boulevard (Southbound)

- - - Assigned Speeds

——— Speeds Resulting From Assigned Travel



Front Street (Northbound)

- - - Assigned Speeds

——— Speeds Resulting From Assigned Travel

Note: Designated Cordons Are Internal Cordons.

Figure 4-33

2000 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

Marconi Boulevard / Front Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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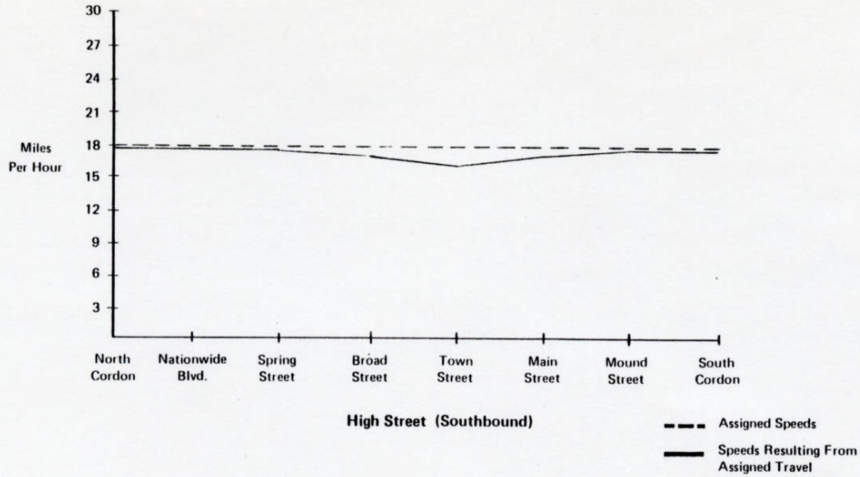

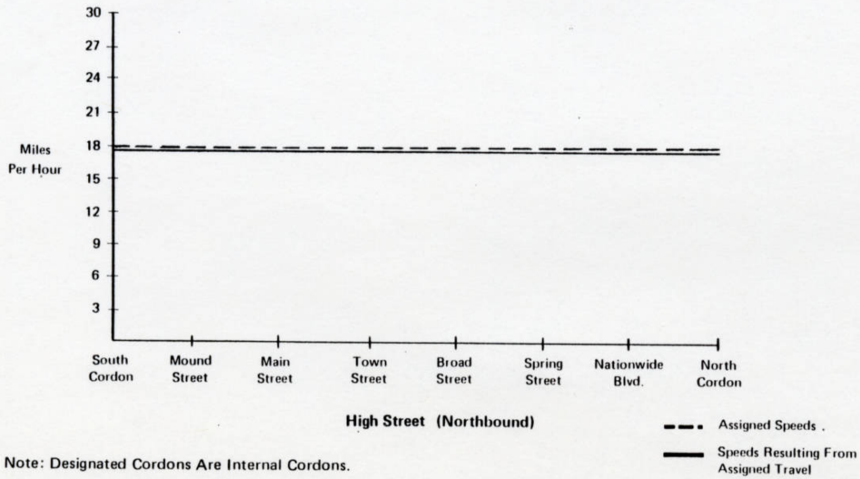

Note: Designated Cordons Are Internal Cordons.

Figure 4-34

2000 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

High Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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John E. Foster and Associates, Inc.
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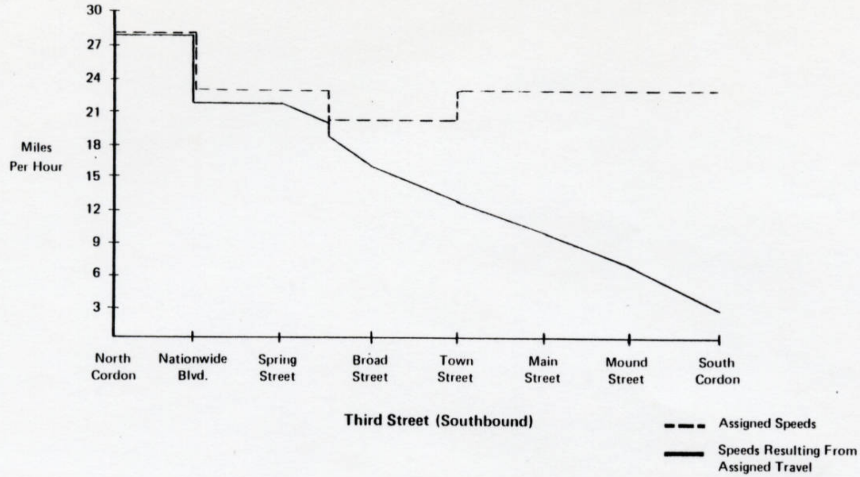

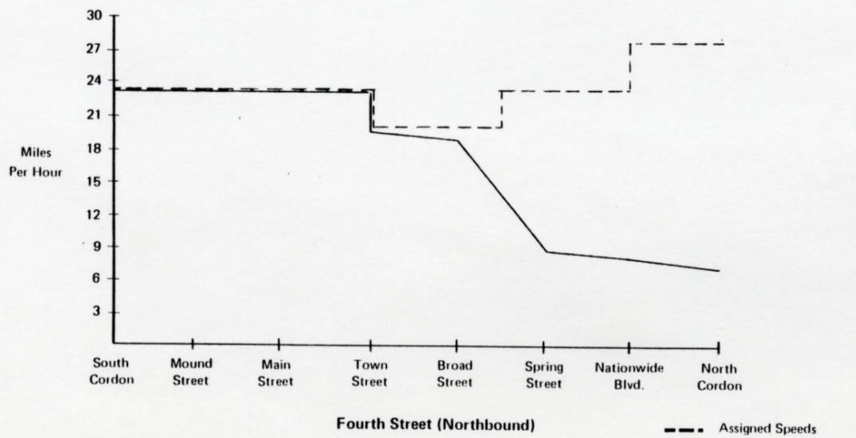

Note: Designated Cordons Are Internal Cordons.

Figure 4-35

2000 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

Third Street / Fourth Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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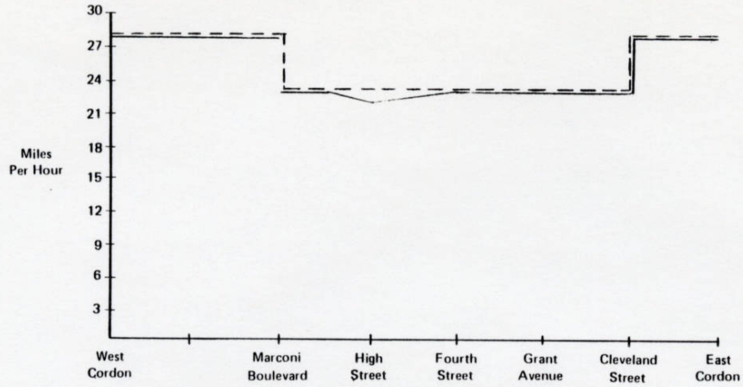
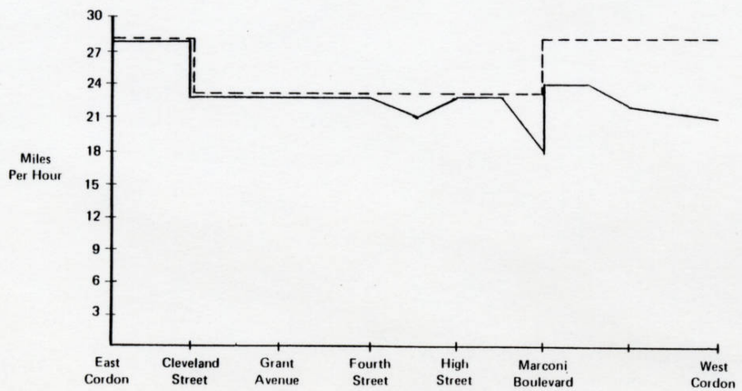


Long Street (Eastbound)

- - - - Assigned Speeds

—— Speeds Resulting From Assigned Travel



Spring Street (Westbound)

- - - - Assigned Speeds

—— Speeds Resulting From Assigned Travel

Note: Designated Cordons Are Internal Cordons.

Figure 4-36

2000 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

Long Street / Spring Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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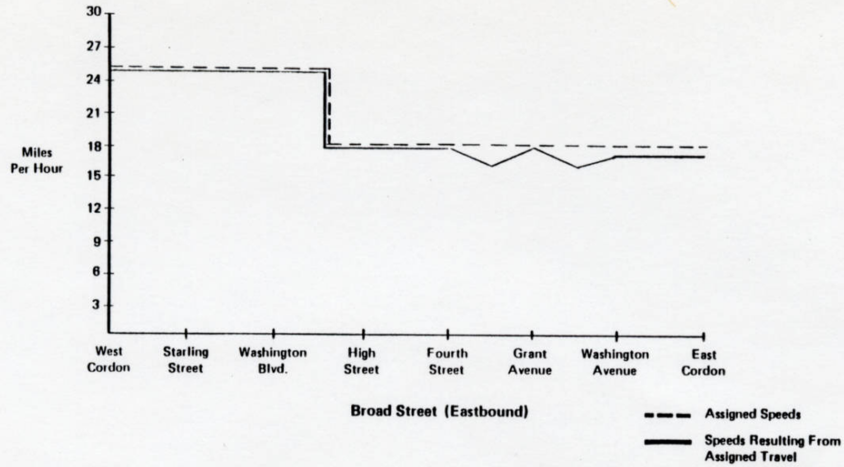

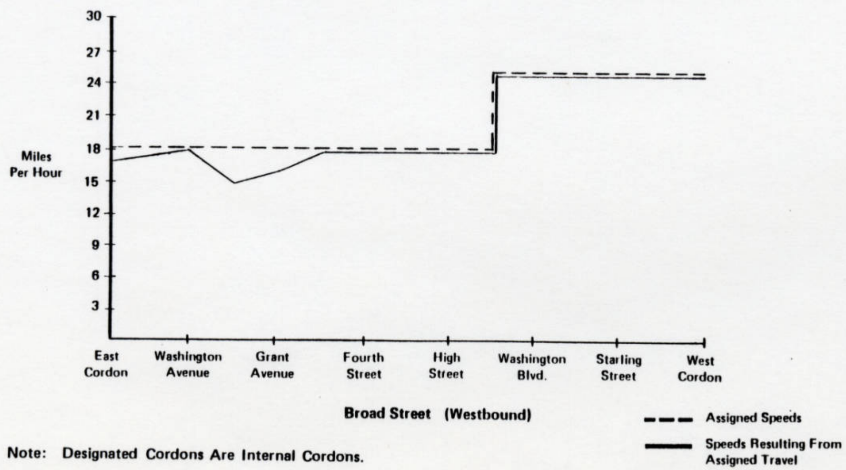

Note: Designated Cordons Are Internal Cordons.

Figure 4-37

2000 PM PEAK HOUR
ASSIGNED SPEED AND
RESULTANT SPEED
COMPARISON

Broad Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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John E. Foster and Associates, Inc.
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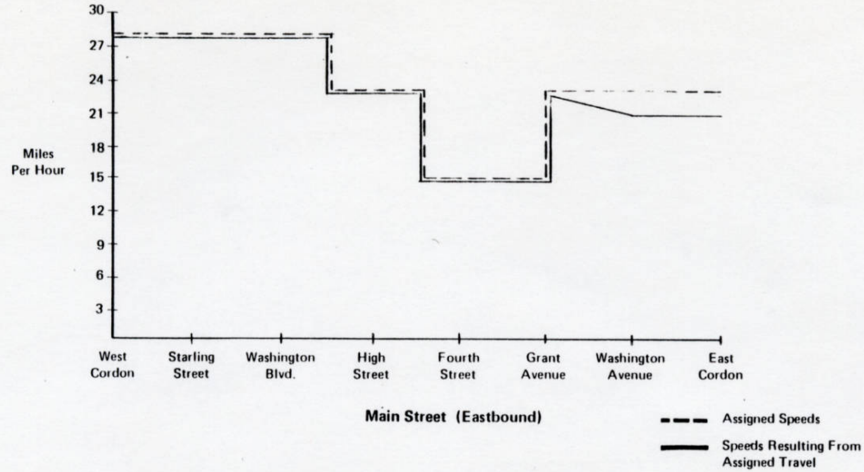

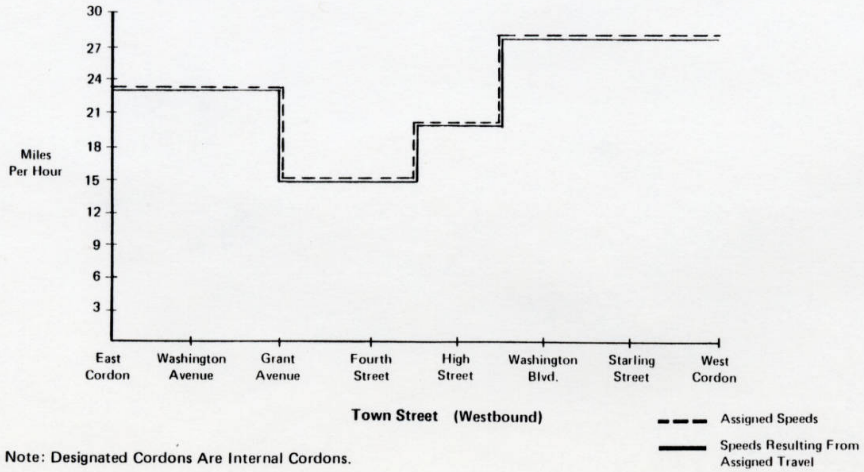

Note: Designated Cordons Are Internal Cordons.

Figure 4-38

2000 PM PEAK HOUR ASSIGNED SPEED AND RESULTANT SPEED COMPARISON

Main Street / Town Street

High Street Corridor Action Plan

COLUMBUS, OHIO

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CHAPTER 5

ESTIMATES OF FUTURE TRAVEL DEMANDS

This chapter focuses on the estimates of travel demands for the Year 2000 design condition. The projected transit travel demands were used both in the "sizing" of the basic transit alternatives considered, in terms of such factors as number of transit movement lanes required, and in the initial evaluation of alternatives relative to their capability to provide a proper level of transit service both in the near- and longer-term future. Local and express bus volumes were estimated separately to allow for the effect of necessary route revisions and associated operational modification to the present central area transit system operations. Projected highway traffic volumes were also assessed in terms of the ability of the future highway system to accommodate projected demands. The derivation of future base case Year 2000 traffic volumes was described in Chapter 4.

TRANSIT SYSTEM DEMANDS

In developing the Year 2000 estimates of transit vehicle and patron waiting area requirements in the study area, the results of the most recent MORPC transit network assignments were employed. The basic Year 2000 transit network, upon which this assignment is based, assumes some form of fixed guideway transit facility in the North Corridor. The exact form of this fixed guideway facility is the subject of the ongoing North Corridor Alternatives Analysis Study.

The latest MORPC Year 2000 transit assignment projects a total of 116,500 linked, revenue person trips per day, as compared to the current COTA patronage of 58,800 daily linked, revenue trips. This represents an increase of approximately 98 percent from the present level of COTA system usage in the region. On a regional basis, it is estimated that the transit modal share will increase from 2.1 percent today to approximately 3.2 percent in the Year 2000.

Relative to the Columbus Central Area, it is estimated that the Year 2000 transit system would generate approximately 20,600 transit person-trips on a daily basis. Of this total, approximately 14,000 would be home-based work trips with the remaining 6,600 trips being home-based non-work and non-home based trips. By comparison, the 1980 Census identified approximately 11,600 Central Area work trips being made by transit on a typical day. Thus, there is forecast of an increase in Central Area work trips made by transit between today and the Year 2000 of approximately 2,400 person trips or, about a 21 percent increase.

Although the total volume of Central Area transit trips is projected to increase, the percentage of total regional transit person-trips destined for the central business district is estimated to decrease slightly between today and the Year 2000. It is estimated that today approximately 20 percent of COTA's total transit trips have either origins or destinations within the central business district. The MORPC Year 2000 transit plan forecast shows this figure to decrease slightly to approximately 18 percent of total regional transit person-trips. This finding is not totally unexpected given the substantial increases in non-CBD employment which are projected to occur in the region, and the fact that much of the projected increase in COTA local, cross-town, and express service over the next ten to fifteen years is projected to occur in areas other than within the Columbus Innerbelt. For the purposes of this analysis then, it was assumed that the Year 2000 regional transit patronage will be approximately 116,500 persons, with Central Area transit usage equal to approximately 20,600 person-trips per day.

Estimate of Year 2000 Bus Volumes from the MORPC Network

The MORPC adopted Year 2000 transit network consists of three basic transit modes: local bus, fixed guideway (assumed to be light rail transit), and express bus. Given the assumed operating headways for each of the various lines (transit routes) assumed to be operating in the Year 2000 for each of these three transit modes, the UTPS program UNET calculates the number of vehicles required on each line and the resulting total number of transit lines and vehicles operating during the peak hours on each link of the transit system. From an examination of this information, it was possible to define the directional volume of local and express bus and fixed guideway transit vehicles operating on each link of the street system in downtown Columbus under the proposed MORPC Year 2000 network.

To determine Year 2000 bus volumes for the MORPC network, it was necessary to estimate "bus equivalents" for the fixed guideway/LRT line which the network assumed to be operational in the North Corridor and in downtown Columbus by the Year 2000. In the calculation of these "bus equivalents", it was assumed that the same equivalent number of seats would be provided in the Year 2000 were this fixed guideline transit line to be replaced with sufficient numbers of local and express buses to provide an equivalent level of service. Thus, an equivalency factor equal to the assumed vehicle capacity of the fixed guideway vehicles (160 persons) divided by the assumed vehicular capacity of all other bus operations (50 passengers) was employed.

Using this assumption, an estimate of the total number of Year 2000 transit vehicles in the Columbus Central Area, as related to the MORPC adopted Year 2000 Transit Plan, was developed. Figure 5-1 summarizes the results of this analysis. As illustrated in this figure, the total two-directional volume of peak hour transit vehicles along High Street proper is estimated to range from approximatley 130 vehicles at Mound Street on the south to approximately 165 vehicles just south of Nationwide Boulevard on the north. In the central portion of High Street (i.e., the area south of Long Street and north of State Street), the total two-way volumes range from 280 to 300 vehicles during the PM peak-hour.

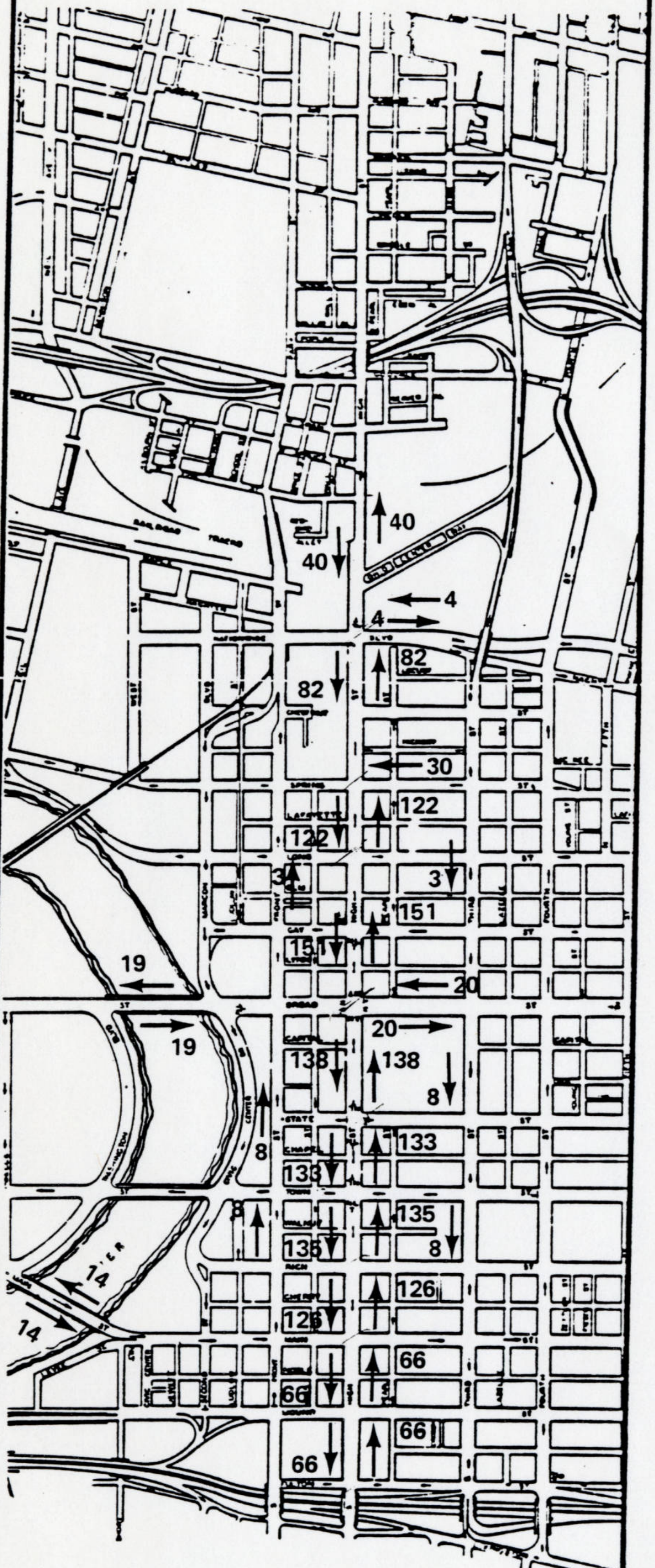

Figure 5-1
ESTIMATED YEAR 2000
TRANSIT VEHICLES
(As Per MORPC Adopted
Year 2000 Plan)

← Direction of Vehicle Movement

151 Number of Transit Vehicles (Total of Local, Express, and LRT Equivalents)

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COLUMBUS, OHIO

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By comparison, the PM peak-hour, two-directional volume on High Street today in the area between Broad Street and Long Street is approximately 185 vehicles. Thus, using the outputs of the Year 2000 adopted transit network, there is predicted to be an increase of between 115 and 120 vehicles in the central portion of the High Street corridor relative to currently observed volumes. This represents a percentage increase of approximately 63 percent relative to the existing two-directional, total, peak hour bus volumes.

Estimated Peak Hour Transit Patronage

As a companion to the estimation of Year 2000 transit vehicle volumes, an examination was made of the forecast transit patronage associated with the MORPC adopted Year 2000 Transit Network. As was the case with the transit vehicles, estimates of total daily transit patronage on the adopted Year 2000 transit system were available in terms of local bus, express bus, and fixed guideway (assumed to be light rail transit) modes. These daily transit patronage volumes were converted first to PM peak, two-hour volumes and then adjusted to represent peak, one-hour patronage within that peak period. The factors utilized in this calculation were those currently being observed today for COTA's existing Central Area transit operations. The resulting estimated PM peak hour volumes, by mode and direction, on the segments of the downtown street system included in the Year 2000 transit network are illustrated in Figure 5-2. The peak hour volumes shown in Figure 5-2 represent the total number of transit passengers by mode who are aboard the transit vehicles on a particular segment of street during the PM peak hour. Thus, these volumes represent both persons boarding in the downtown area (revenue passengers and transfer passengers) as well as persons passing through the central business district on local buses.

To relate the estimated Year 2000 peak hour transit vehicles to forecasted patronage, a calculation was made of the average vehicle occupancy and load factor on downtown transit links. The results of this calculation are illustrated in Figure 5-3. In general, this average vehicle occupancy and load factor analysis concluded that there is an overall balance between forecast transit usage and transit vehicle supply.

Overall, load factors ranging from approximately 0.65 through 0.85 predominated along High Street from Mound Street on the south to Spring Street on the north. From Spring Street north to Ohio Center Way, load factors were somewhat higher, in the range of 0.80 to 0.96. It should be noted that this load factor analysis employed an average vehicle capacity of 50 seats and did not consider the effect of allowing standees on any of the vehicles. Two significant overload areas were observed on the Broad Street and Main Street river crossings of the Scioto River, where load factors of 1.15 and 1.38, respectively, were calculated. Thus, it appears that the initial MORPC assumptions on the level of east/west transit usage into downtown Columbus were somewhat underestimated in terms of vehicle supply in the development of the Year 2000 transit network. Appropriate modifications in terms of reduced headways to provide increased numbers of vehicles, and hence adequate passenger capacity, should be examined in future refinements of this adopted long-range transit plan.

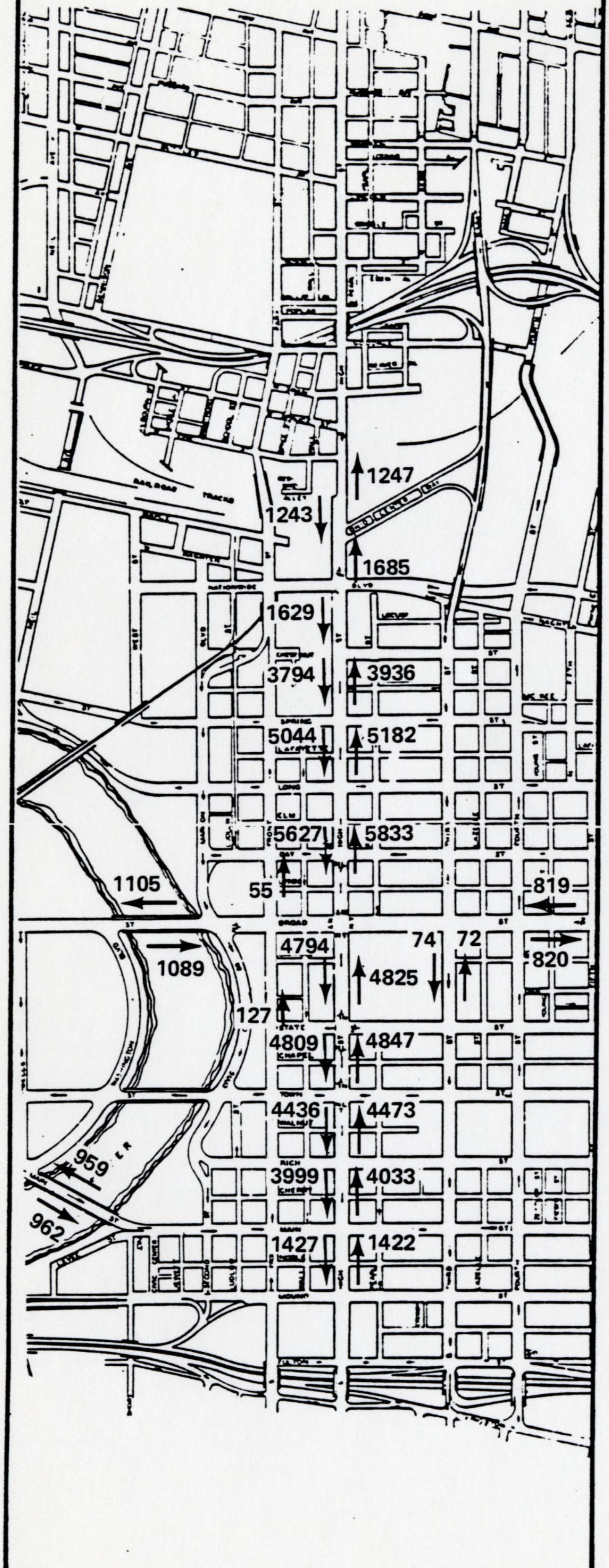

Figure 5-2
FORECAST YEAR 2000
PM PEAK HOUR TRANSIT VOLUME

Source: MORPC Year 2000 Transit Assignment, Network NAAP

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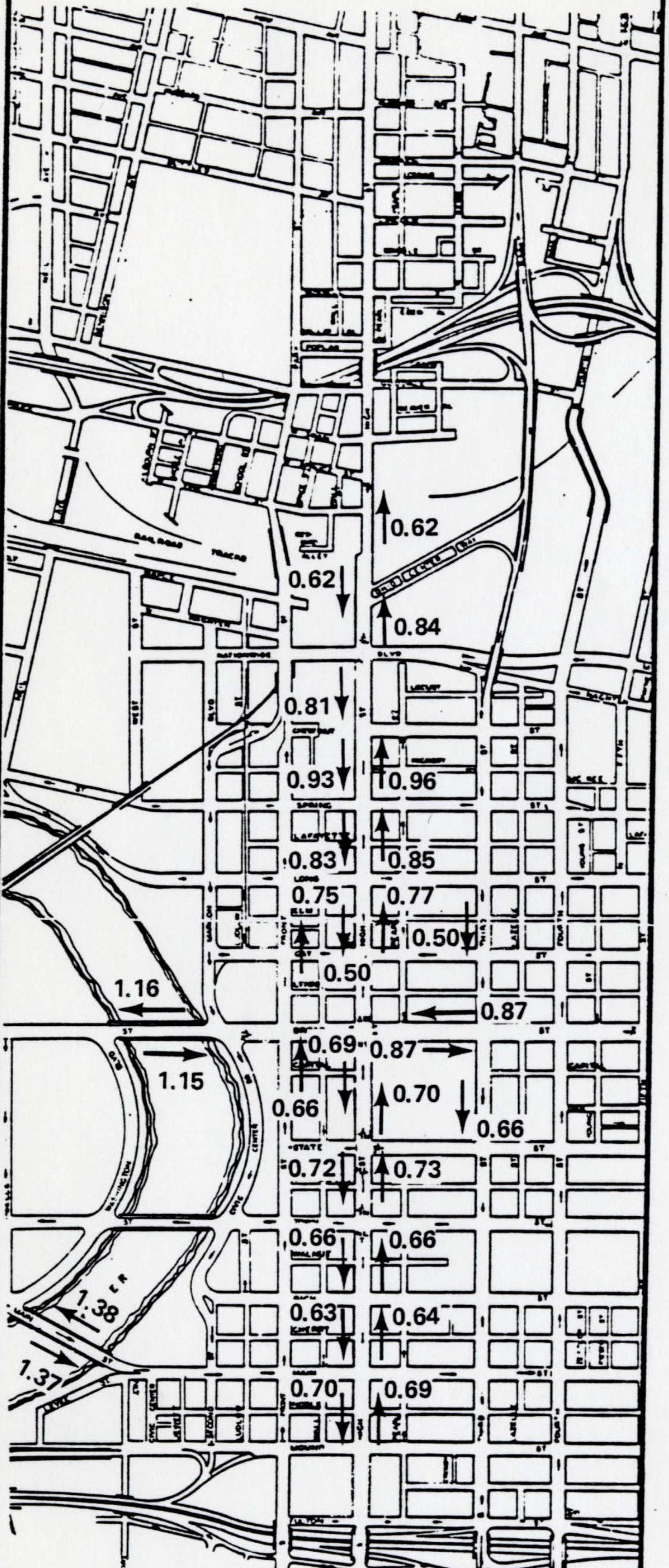

Figure 5-3
FORECAST YEAR 2000
PM PEAK TRANSIT LOAD FACTORS

$$0.00 = \text{Load Factor} = \frac{\text{Average Vehicle Occupancy}}{\text{50.0 Seats per Vehicle}}$$

High Street Corridor Action Plan

COLUMBUS, OHIO

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In examining each of the various components (i.e., local, fixed guideway (LRT), and express bus) of the transit supply/demand relationships, it was determined that, in general, the local buses had a good load factor balance of approximately 0.65 - 0.70, that the typical LRT load factor was substantially lower (in the 0.40 - 0.50 range), and that the express bus load factors were generally 1.0 or higher. Thus, while the overall load factor in the downtown area appears to be reasonable (hence indicating that the total number of vehicles proposed to operate in the Year 2000 is appropriate to the estimated demand for transit usage), there appears to be a need for a reassessment of the mix of the services between local, LRT or equivalent bus, and express bus in order to ensure that the load factors on each of these service components are more reasonable.

By comparison, the COTA system today experiences a 53 percent load factor for the total system over the entire 3:30 P.M. - 6:00 P.M. peak period in terms of unlinked passengers per bus trip. Relative to this system-wide available capacity utilization of 53 percent, local buses are loaded to approximately 59 percent of capacity, expresses to 68 percent and cross-town routes to approximately 12 percent. Since these observed load factors are over a 2 1/2 hour period, it would not be unrealistic to expect capacities about 50 percent greater than this average value during the peak one hour of the total 2 1/2 hour period. Thus, an average system-wide capacity utilization of 53 percent over a 2 1/2 hour period would probably be equivalent to approximately a 80 percent system-wide utilization factor during the peak one hour of the 2 1/2 hour period. Overall, this latter value is generally equivalent to that forecast to occur on the Central Area transit services during the PM peak hour in the Year 2000.

Conclusions

Year 2000 PM peak hour bus volumes in the High Street corridor, based on the latest MORPC transit assignment, are estimated at 300 to 310 vehicles (including the North Corridor LRT vehicles expressed as bus equivalents). By coincidence, this is approximately the same bus volume estimated earlier by Barton-Aschman for 1990, based on a continuation of COTA service expansion policies from the current Transit Development Program. However, it is significantly less than the earlier estimates prepared of Year 2000 bus volumes (i.e., about 400 vehicles), based on a further extension of current COTA service expansion policies. Thus, it would appear that High Street corridor peak hour, two-directional, total bus volumes will be somewhere in the range between 300 and 400 vehicles by Year 2000.

The physical requirements in terms of traffic movement lanes for accommodating Year 2000 bus volumes are effectively the same for either end of this range --two dedicated transit lanes in each direction. Subsequent analyses use the MORPC estimate of 310 peak hour buses in the High Street corridor as a "design value" for Year 2000 conditions.

HIGHWAY SYSTEM DEMANDS

Projected Year 2000 traffic demands were derived from the modeling process described in Chapter 4. Through this modeling process, AM and PM peak hour traffic volumes on the case area street system were derived. The projected peak hour volumes, for traffic entering and exiting the High Street corridor during the AM and PM peak hours, are showin in Figures 5-4 and 5-5, respectively.

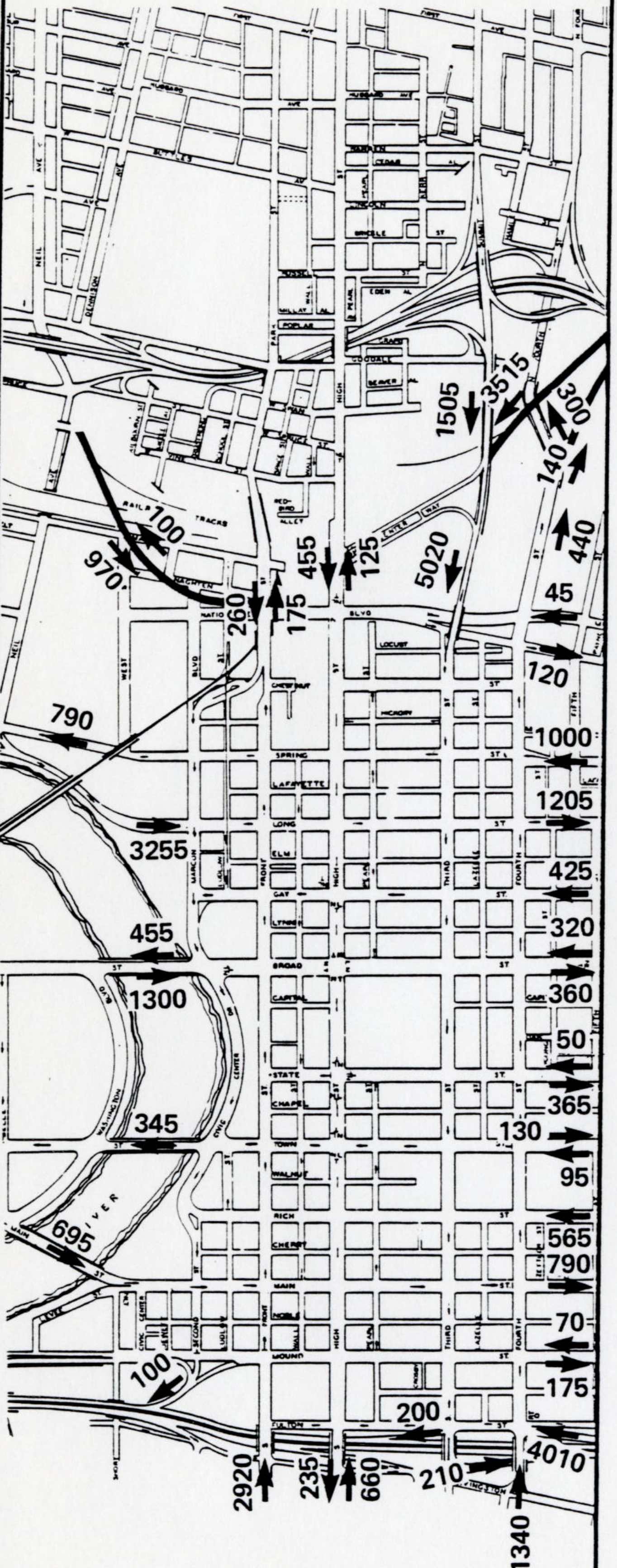

Figure 5-4
YEAR 2000 AM PEAK HOUR
TRAFFIC DEMAND
(BASE CASE)

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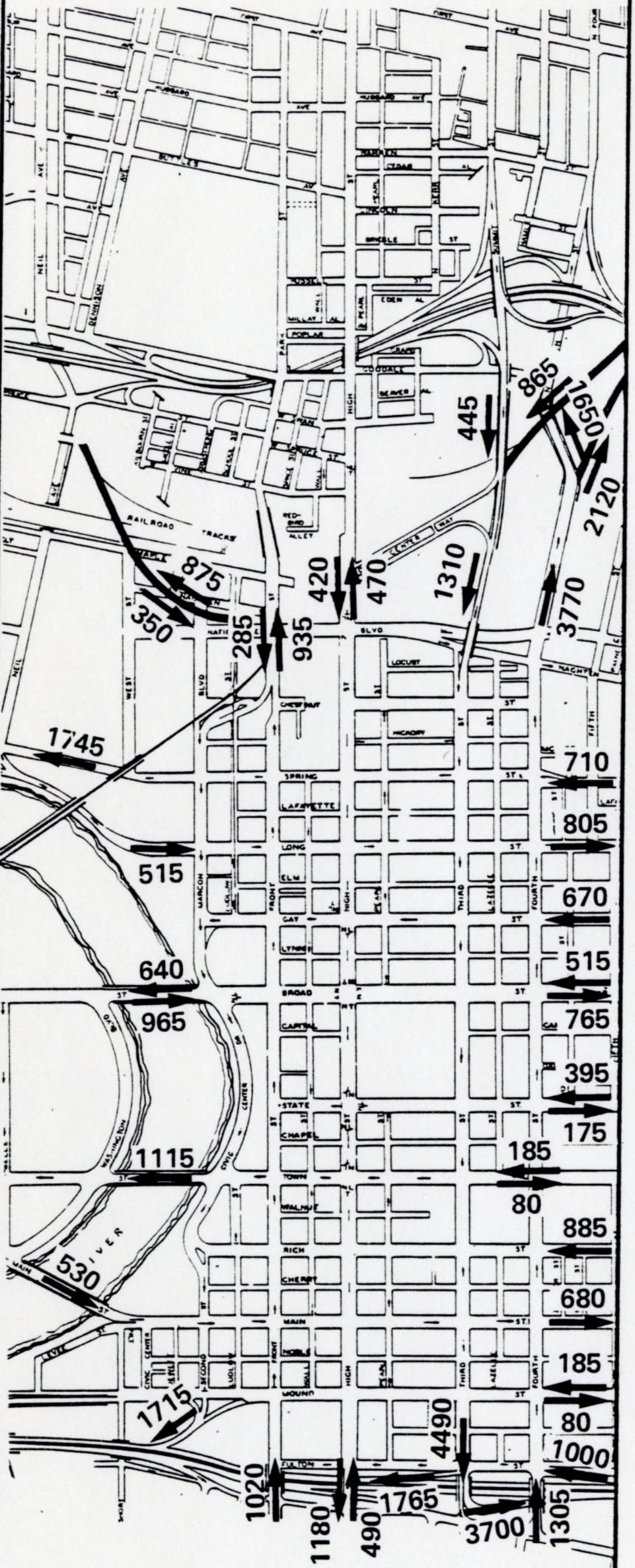

Figure 5-5
YEAR 2000 PM PEAK HOUR
TRAFFIC DEMAND
(BASE CASE)

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With respect to High Street itself, the highest Year 2000 traffic volumes occuring during the AM peak hour would be in the range of 400 to 600 vehicles per hour in each direction. However, during the PM peak hour, traffic volumes would be in the order of 1000 vehicles southbound and 500 to 600 vehicles northbound. Under the assigned base case highway system, over 1,500 vehicles could desire to travel southbound on High Street between Rich and Main Streets. This high volume of traffic is due primarily to the large parking garage assumed for the Capitol South project.

Traffic volume increases are also projected for other arterial and arterial corridors within the downtown area. Most of the projected traffic demands can be accommodated by the existing highway system. However, demand estimates for the Third and Fourth Street corridor far exceeds the capacity levels which can be provided.

The projected demands at the Third and Fourth Streets ramps serving I-70/71 on the south and I-670 on the north create significant traffic problems. As can be seen in Figures 5-4 and 5-5, over 4,000 vehicles desire to exit I-70 at the Fourth Street ramp during the AM peak hour and 3,700 PM peak hour vehicles desire to enter eastbound I-70/71 at Third Street (at the southern Innerbelt). On the north side, over 3,500 vehicles desire to exit the planned Airport Connector at Third Street during the AM peak hour and over 2,100 vehicles desire to access the Airport Connector during the PM peak hour from Fourth Street. It should be noted that Third and Fourth Streets also handle relatively high volumes of "through" traffic, i.e., traffic that does not have an origin or destination within the downtown. On some segments of Third and Fourth Streets, between 20 and 30 percent of the projected traffic volumes is "through" traffic. This traffic should theoretically stay on the external street system and not pass through the downtown.

Third and Fourth Streets also carry a large portion of traffic expected to enter and exit the downtown area. By design of the highway system, there are very few alternatives for the efficient movement of traffic to and from the major traffic corridors. Travel to and from the Airport Connector is focused on Third and Fourth Streets. In like manner, travel to and from I-70 is focused on the Third and Fourth Street ramps on the south side of the City. The programmed I-670 projected does not in any way provide a relief to present or potential traffic problems on the southside of the City. Even with the construction of I-670, it will be necessary to construct a new ramping system serving I-70 since projected traffic volumes cannot be handled by a single ramp system on the south Innerbelt. Modifications are necessary to alleviate problems and to accommodate future travel demands. Since it is beyond the scope of this project to define possible new ramping systems, the derived Year 2000 travel demands were used in all subsequent analyses.

Projected PM peak hour traffic volumes at corridor intersections are shown in Figure 5-6. Each of the intersections was assessed in terms its ability to accommodate the projected traffic volumes. The proposed lane usage at each intersection are illustrated in Figure 5-7. Existing signal timings were used in the capacity analyses where the directionality of the streets remains the same as exists today, however, at a few intersections, signal timings were optimized if the change seemed reasonable within the signal system.

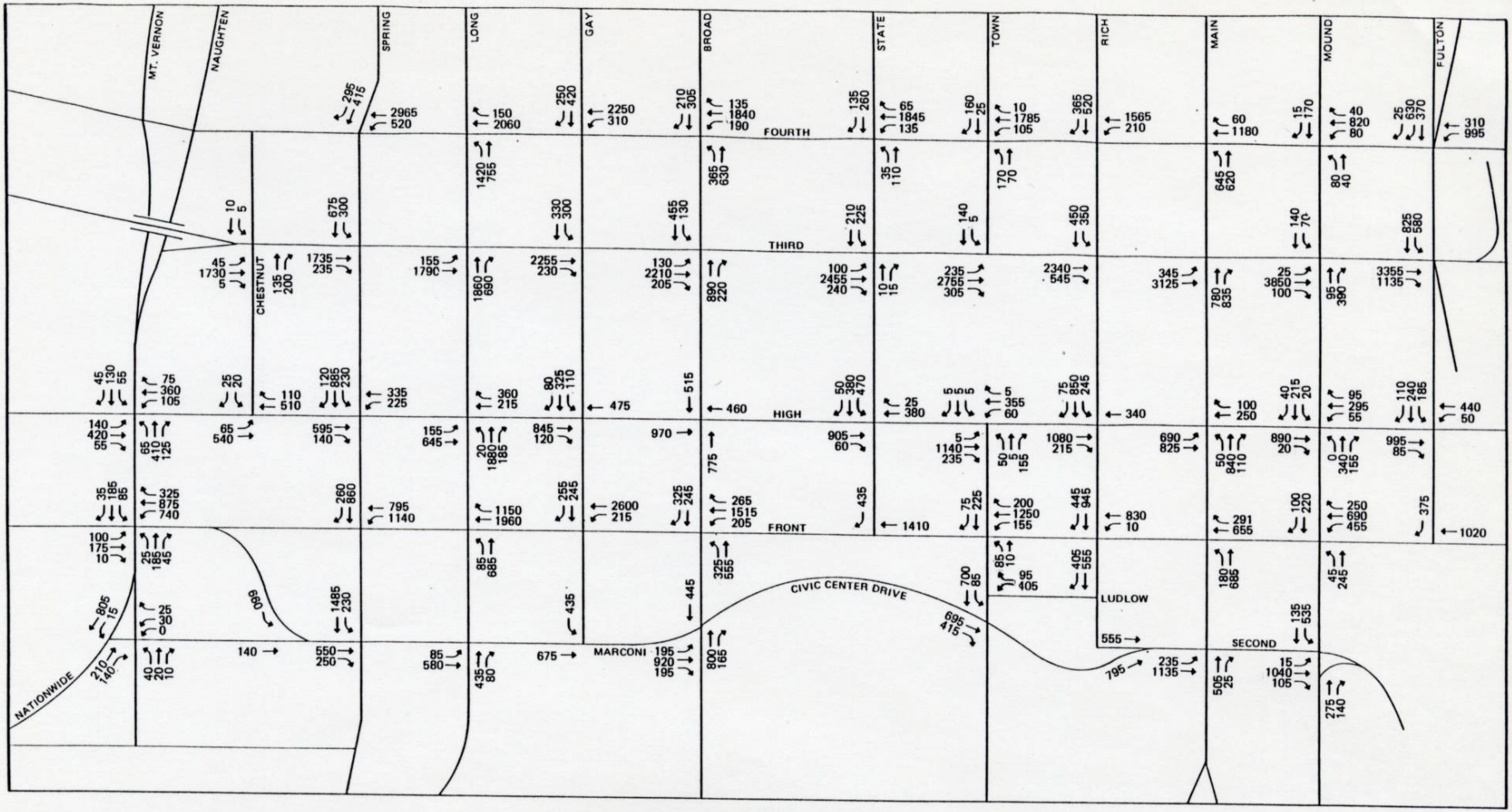

Figure 5-6

PM PEAK HOUR TRAFFIC VOLUMES AT INTERSECTIONS
YEAR 2000, BASE CASE

←N

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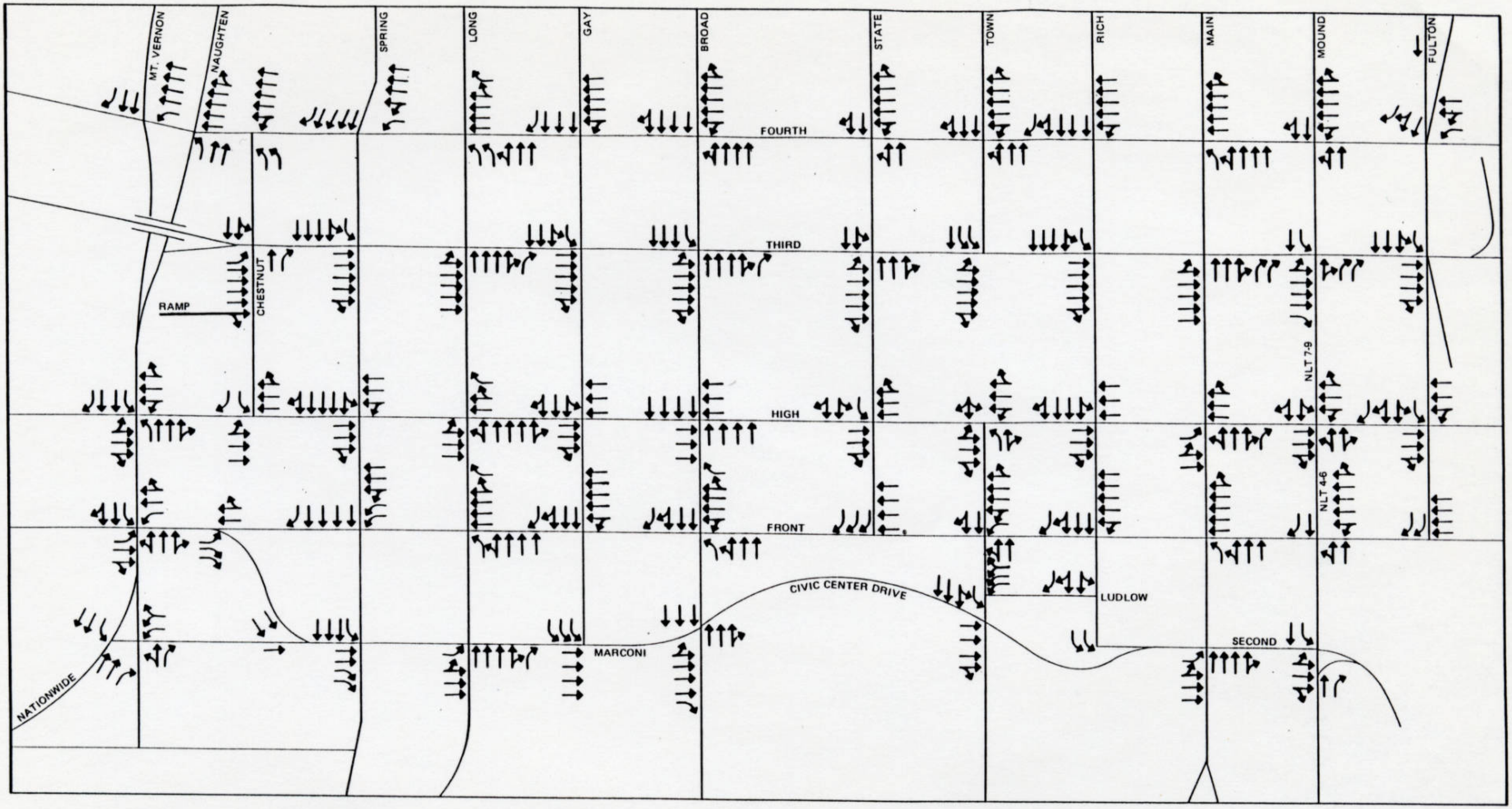

Figure 5-7
ASSUMED LANE USAGE AT INTERSECTIONS
FOR THE BASE CASE YEAR 2000 CONDITION

←N

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The results of the capacity analysis are shown in Table 5-1 and Figure 5-8. As can be seen, the majority of the intersections operate at acceptable levels of service. Only four intersections would have unacceptable levels of service. The problem at Second and Mound Streets is simply the high volumes of traffic desiring to enter the Innerbelt westbound. The low level of services on Third at Fulton and Mound is also due to the high volume of traffic desiring to access the Innerbelt. At the intersection of Broad and Front, an "E" level of service results from the high volume of traffic desiring to turn left from Broad Street to Front Street. This traffic uses an exclusive left turn lane and a through-left optional lane. The problem exists today and there does not appear to be any reasonable solution to the problem. Except for these four locations, the downtown street system can accommodate the projected Year 2000 traffic volumes during the critical PM peak hour.

Table 5-1

INTERSECTION LEVELS OF SERVICE
PM PEAK HOUR, YEAR 2000 BASE CASE

Intersection	Level of Service	Intersection	Level of Service
Second @ Mound	F	Third @ Fulton	F
Second @ Main	A	Third @ Mound	E 1/
Civic Center @ Town	A	Third @ Main	D 1/
Marconi @ Broad	A	Third @ Rich	A
Marconi @ Long	A	Third @ Town	D
Marconi @ Spring	B+	Third @ State	B+
Front @ Mound	A	Third @ Broad	D
Front @ Main	A	Third @ Gay	A
Front @ Rich	A	Third @ Long	C
Front @ Town	A	Third @ Spring	D+
Front @ State	A	Fourth @ Mound	A
Front @ Broad	E	Fourth @ Main	A
Front @ Gay	A	Fourth @ Rich	A
Front @ Long	D	Fourth @ Town	A
Front @ Spring	C	Fourth @ State	A
Front @ Nationwide	D+ 2/	Fourth @ Broad	D+ 1/
High @ Fulton	A	Fourth @ Gay	A
High @ Mound	A	Fourth @ Long	D 1/
High @ Main	D+ 1/	Fourth @ Spring	D
High @ Rich	C+		
High @ Town	B		
High @ State	C 1/		
High @ Broad	D+		
High @ Gay	A		
High @ Long	B 1/		
High @ Spring	C 1/		
High @ Nationwide	A 3/		

1/ Timing plan optmized

2/ "F" level of service for left turns of north, east, and south approaches.

3/ "D" level of service for east approach left turn (55 vehicles)

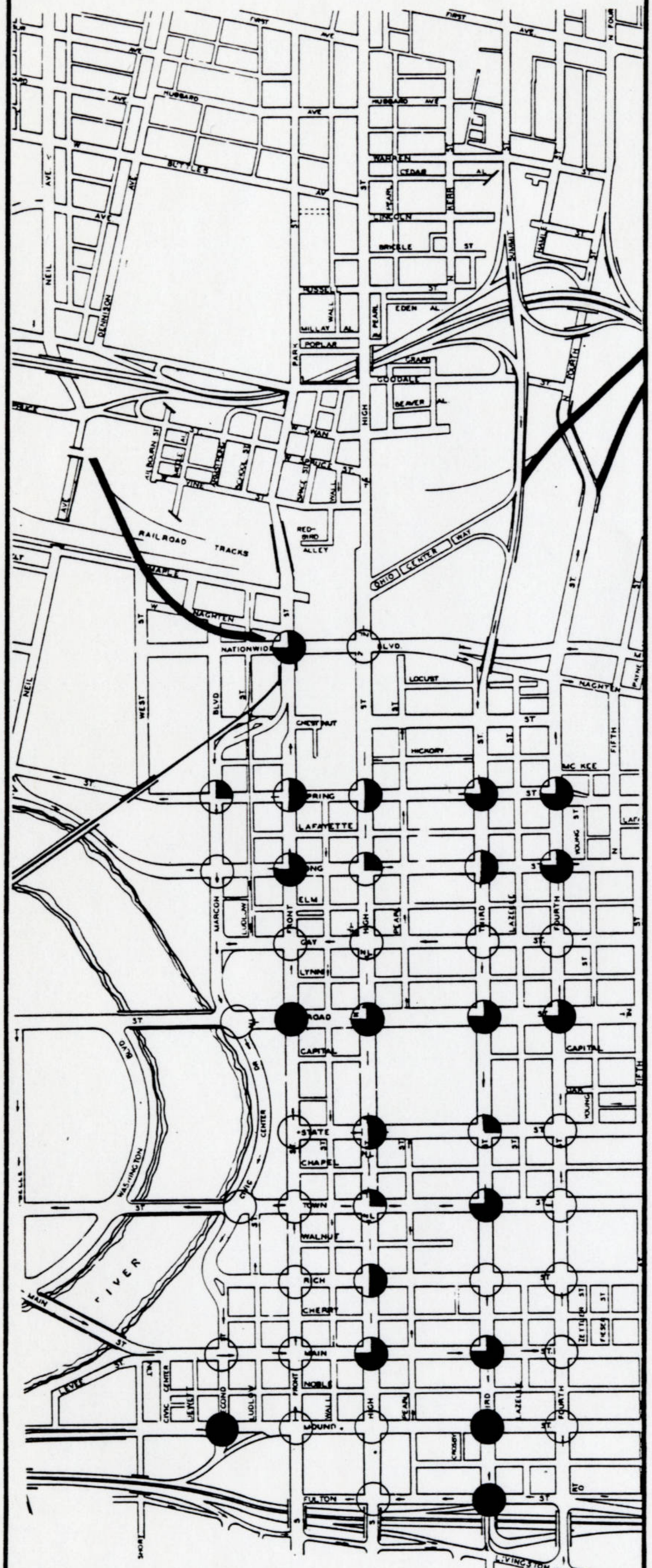

Figure 5-8

INTERSECTION LEVEL OF SERVICE
PM PEAK HOUR
YEAR 2000 BASE CASE

LEVEL OF SERVICE

A
B
C
D
E

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CHAPTER 6

CENTRAL AREA TRANSPORTATION SYSTEM ALTERNATIVES

The previous chapters summarized the study findings regarding the highway, transit, and pedestrian systems with respect to present conditions as well as conditions which are likely to take place in the Year 2000. As noted previously, proper plans must be developed in order to accomodate the projected growth in the transit system. The transit system itself must be properly integrated into the downtown highway system which will experience significant changes due to street closures, the planned reconstruction of the northern Innerbelt, and the projected growth in traffic volumes. At the same time, the transit system plan must interface with an improved pedestrian system and provide proper pedestrian and transit patron amenities. The overall plan must be workable, acceptable, affordable, and an asset to the downtown. The purpose of this chapter is to describe the physical and developmental framework, urban design objectives, and an assessment of possible transportation system alternatives.

PHYSICAL AND DEVELOPMENTAL FRAMEWORK

The core area of downtown Columbus is a vital, vibrant and active place. Major investments in office towers, hotels, theaters, a convention center, governmental offices, including the State Capitol complex, and utility headquarters collectively create the sense of a dynamic regional center. Absent in this mix, however, is a strong cohesive component of retail development. The Lazarus Department Store is the only major shopping facility attraction in the downtown area, although some ancillary retail occurs intermittently in the base of many office buildings, and there exist a few single-purpose retail buildings.

This development has largely focused itself along two principal axes, Broad Street and High Street, with sub-axes along Gay and State Streets, and Marconi Boulevard. The architectural expressions created by these investments is indeed varied and results in a rather delightful, electric impression.

Examples of the more traditional are the staid historic setting of the State Capitol, the historic building grouping to the south and east, the Ohio Theater immediately to the south, the Great Southern complex and its neighbors, a building grouping along Gay Street between High and Third, the LeVeque Tower, City Hall, the Atlas Building, Huntington Plaza, and several bank buildings. Examples of more contemporary expressions are the Franklin County Complex, the Nationwide Insurance Complex, the State Office Tower, Huntington Trust and Huntington Center, the Borden Building, and the Ohio Power and Electric Company headquarters on Marconi Boulevard. The recently opened Hyatt Hotel and office complex, the Hyatt Hotel - Ohio Center complex, the Columbia Gas Company and the Ohio Power and Electric Company headquarters are angular, trendy additions to the overall central area image.

Three candidate streets in the High Street corridor each have their own relationship to this development character and pattern. These streets, Third, High, and Front all have rather distinct CBD limits by virtue of development gaps caused by I-70/71 on the south, and Nationwide Boulevard and the I-670/railroad corridor on the north, but that is where the similarities end.

Third Street, as it enters the central area from the north, can best be characterized by intermittent, low-scale buildings containing secondary service uses, with large gaps created by fronting parking lots. The edges tighten up for a moment between Gay and Broad Streets, and then give way to the State Capitol on the west. They tighten again from State Street to south of Town Street with the new Hyatt complex on the west and the church building group on the east. From south of Town, the image of the street is entirely influenced by the vast acreage of surface parking lots that occupy at least half of the frontage. As a candidate for use as a transportation corridor, it is at it's best between Gay and Town, because of the nature of development that transportation might serve, but the remaining eight blocks have an uninspiring image and little development for transportation to serve. Further, the only known development that might change this is the Capitol South complex, and current plans would indicate little importance being placed on the development value of Third Street except for parking and parking access.

High Street, as it enters the core area from the south, is celebrated by the Franklin County offices, courts and administration building. Franklin Commons makes a contribution to the street image, and then gives way to a group of renovated historic buildings including the Great Southern project. On the west side of the street, from Mound to Rich and on the east side from Main to Town, development has faltered and given way to low-rise buildings containing marginal uses and parking lots. Near Town Street, the Centrum attempts to improve the street image; while between Town and State Streets, development tightly embraces High Street and then gives way to the very positive image of the State Capitol and grounds. Across the street, the new Huntington Center and Plaza are infilling the frontage, leaving only a few hundred feet of open land, which is thought to be a prime site for new state offices. Between Broad and Spring Streets, development is less dynamic with lower-rise buildings and ground floor retail frontages intermittently interrupted by surface parking lots. At Spring Street, on the east side, the frontage is defined by substantial office development including the Federal Building and Two Nationwide Plaza giving way to the Sensenbrenner Park environment and the Hyatt Hotel - Ohio Center Plaza and edifice across Nationwide Boulevard. On the west side, surface parking takes command of the frontage before giving way to the playful grace of the Nationwide complex's cascading gardens and strong building edifice. As it did on the south, the High Street experience ends abruptly with the strong development statement by the Nationwide office tower and Hyatt Hotel - Ohio Center complex in contrast to the openness created by the I-670 corrdior, the rail lines and surface parking lots.

Several ancilliary perceptions merit mention:

1. There is a high degree of pedestrian activity along the street, particularly in the zone between State Street and Gay Street, and particularly during the mid-day.

2. There is a high bus presence, particularly during the peak hours, with large attendant accumulations of waiting passengers on the sidewalks during the evening peak period.

3. The overall physical condition and appearance of the street space is uninspiring at best. This situation is compounded by the presence of private and public amenity improvements that are immediately adjacent and because of the overall quality of the edging development.

As a candidate for a transportation corridor, the densities of development would certainly point to trip origins and destinations in the immediate vicinity. The largest development gap is between Main and Town Streets, the site for the Capitol South development, which will hopefully have active frontage on the east side of the street.

Front Street, as it enters the core area from the south, has a negative beginning. Crossing the I-70/71 corridor and from Fulton to Town, parking lots and structures dominate, interrupted only by the back of the County Jail and a storage building. At Town Street, development embraces the street, and intermittent gaps are infilled with small parks and the yard/lawn of City Hall until Gay Street, where parking lots again begin to invade the frontage. From Gay to Spring, moderate-rise but ancilliary-use buildings create a relatively continuous easterly edge with parking lots on almost the entire westerly edge. From this point north, with the exception of the new Electric Company building, parking lots and structures consume the frontage until the grade-separated I-670 and rail corridor preclude development.

Because of the nature and orientation of development, coupled with the fact that Front Street is markedly lower in elevation than High or Third Street, one gets an overall "back door" impression. Front Street is at its best between Town and Broad Streets where Lazarus, State offices, Huntington Trust, LeVeque Tower and the City Hall make positive contributions. As a candidate for a transportation corridor, Front Street feels far removed from the north-south axis of downtown development.

Although there is no formally adopted overall, physical plan for downtown Columbus, there are several important projects under consideration. These include:

- The Capitol Square Plan that involves renovation of the State Capitol grounds and the adjacent street segments, including both Broad and High Streets.

- The Capitol South development includes a major multi-level retail component and would occupy the now-vacant site between High, Third, Main and State Streets and connect, at an upper level across High Street, into the existing Lazarus Department Store.

- With the Capitol South development comes another opportunity -- a grade-separated walkway system. A second-level walkway system already exists at several locations:

  - The Ohio Center/Hyatt complex is linked through Sensenbrenner Park to the Nationwide complex.

  - The Franklin County Complex is interlinked.

- The BancOhio complex between Third and Fourth Street is linked overhead to the parking garage to the east.

- The State Capitol has several below-grade linkages under Broad, High and State Streets.

The Capitol South project offers the opportunity to add a key link to these pre-existing facilities. Although the link between the State Capitol and the Nationwide complex will probably develop over time with redevelopment activities, the potential does exist to create additional north/south and east/west linkages to offer a climate-controlled or moderated, grade-separated pedestrian circulation system. If properly designed, this system could make a transportation corridor more accessible.

Efforts to capitalize on the Scioto Riverfront have already been made; the Battelle Park between Broad and Gay Streets, the street tree and flag pole treatment along Marconi Boulevard, and Centennial Park between Rich and Main Streets are improvements already in place. To the extent possible, a transportation corridor improvement should reinforce and link these efforts.

URBAN DESIGN OBJECTIVES

As a way of guiding both the evaluation of alternatives and the subsequent refinement of a selected alternative, the following urban design objectives were developed:

Transit-related

- o Develop adequate, discrete areas to accomodate the projected accumulations of transit passengers.

- o Manage transit vehicle operations (routing, scheduling, and berth assignments) to more-evenly distribute waiting passenger accumulations and reduce the wall-effect and spatial compression that occurs when large numbers of buses are present at stop locations at the same time.

- o Provide land-side passenger amenities (shelter, seating, system information, etc.) to improve the quality of system-image and the transit experience.

- o Consider the opportunity to allow for the functional and physical inclusion of Light Rail Transit (LRT) as part of the ultimate central area transit system.

- o Provide facilities and enforcement measures to assure efficient operation of both transit vehicles and general traffic.

- o Locate the facility with sensitivity to trip origins and destinations.

Pedestrian-related

- o Provide adequate sidewalk dimensions (exclusive of transit passenger waiting areas) to assure passage of the projected volumes of pedestrians, including considerations of window shopping and street-element "shy" factors.

- o Locate the facility with respect to the pedestrian circulation linkage needs and demands, both in the short-term and long-term.

- o Provide interface opportunities with other existing and potential pedestrian circulation systems at (above- and below-grade) in order to facilitate both general pedestrian movement and transit passenger distribution and transit facility accessibility.

- o Provide facilities and amenities that serve and enhance the pedestrian travel mode experience.

General vehicular circulation-related

- o Provide for logical and efficient flow of general traffic in order to minimize traffic congestion (actual or perceived) and to avoid air and noise quality problems.

- o Provide for the off-peak period (weekend and evening) use of the selected facility(s) in order to maximize it's/their usefulness to the general public, and to avoid a dis-used/abandoned visual perception.

City image and development-related

- o Encourage rehabilitation and redevelopment by providing a more attractive setting and environment for investment.

- o Match the integrity and quality of adjacent public improvements (such as Franklin Commons, the Centrum, State Capitol grounds, Nationwide plaza/gardens, Sensenbrenner Park, etc.) in order to contribute toward the unity of the downtown environment and generate a positive public perception.

- o Place the facility(s) in such a position so as to maximize thier economic development potential with regard to both existing and new potential investments.

TRANPORTATION SYSTEM ALTERNATIVES

With respect to the transit system, it was necessary to identify reasonable alternatives to the present "curb-lane, transit in mixed traffic, and fringe express bus terminal" operational concept now being employed in downtown Columbus. Two basic types of transit operational alternatives were considered -- "generic" and "locational". Generic alternatives describe the basic system categories that have been used to provide transit service in downtown areas, such as bus lanes, bus streets, and bus terminals. These alternative solutions could potentially be appropriate anywhere. The other basic type of alternative can be classified as locational, or related to specific streets or locations in a downtown area, such as High, Front, Third, or other streets in downtown Columbus.

Generic Alternatives

Generically, there are two types of downtown transit systems: (a) systems which allow line-haul, regional transit vehicles to self-distribute passengers; and, (b) systems which provide a terminal(s) from which passengers are distributed on a secondary system such as skyways, shuttle buses, or automated people-movers. All downtown transit operational alternatives can be assigned to one of these two basic categories, as shown in Figure 6-1.

Within the self-distribution group of alternatives, there are three basic subcategories: (a) systems which disperse distribution on many streets, (b) systems which combine distribution linearly on just a few streets or facilities, and (c) systems which combine dispersed and linear distribution. The latter two categories are basically variations on the basic theme of transit service concentration. Within the terminal group of alternatives, there are two basic subcategories: (a) central terminal and (b) fringe terminal. These five subcategories encompass all of the downtown transit operational alternatives considered for possible application in the High Street Corridor. For simplicity, this discussion is limited to the major categories of dispersed, concentrated linear, and terminal service concepts. The following paragraphs describe some of the variations of these three generic categories.

Most major American cities of the size of Columbus or larger typically operate transit systems that incorporate characteristics of at least two, and sometimes all three, of the generic categories described above. Thus, for example, while the Washington Metropolitan Area Transit Authority (WMATA) operates basically a "dispersed" bus system in the central core of Washington, D.C., it also has several substantial bus terminal complexes located immediately adjacent to major downtown activity centers (i.e., Federal Triangle and the Southwest Employment Center). Similarly, the Denver Regional Transit District's downtown operations plan includes a major transit/pedestrian mall on which electrically-powered vehicles are operated, exclusive bus lanes on two parallel streets, and regional express bus terminals at each end of the transit mall. Indeed, COTA itself operates a "hybrid" system in that most local, north-south oriented bus operations are concentrated on High Street, but fringe area, off-street terminals are provided to accommodate most express bus boardings and alightings.

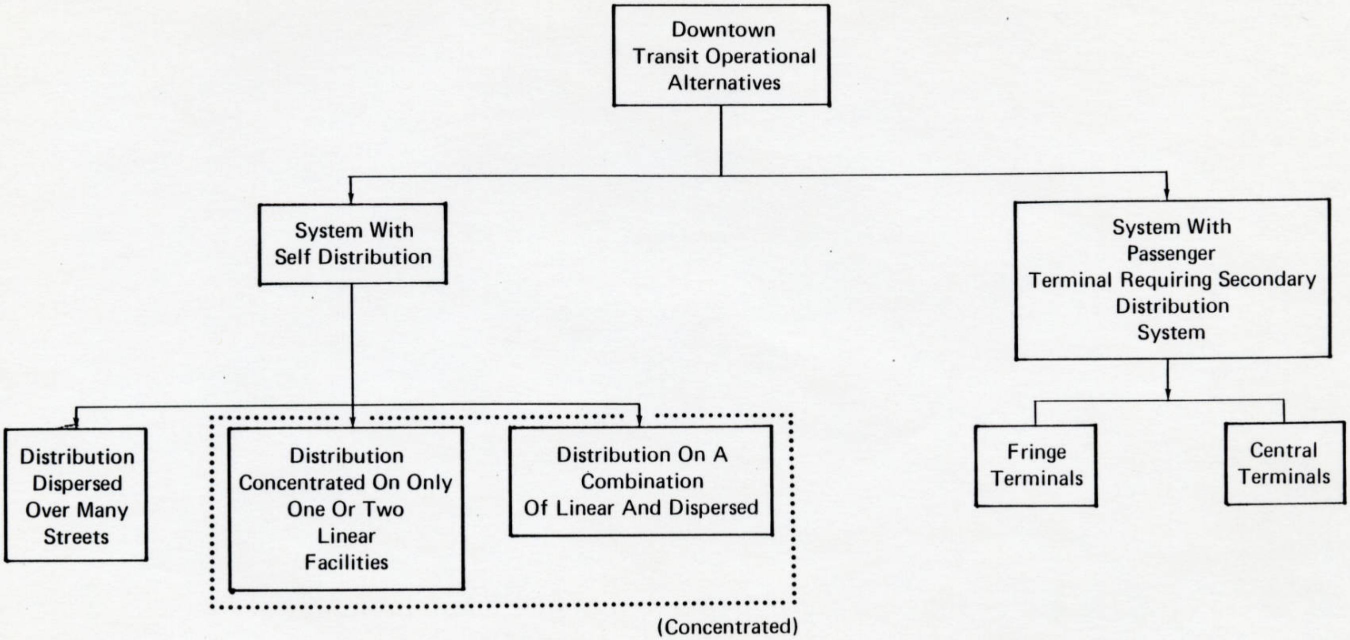

Figure 6-1
DOWNTOWN TRANSIT OPERATIONAL ALTERNATIVES

Dispersed System Alternative

A "dispersed" transit distribution system is one in which bus service is spread fairly uniformly across several streets in a central area and operated in mixed traffic. This alternative is conceptually illustrated in Figure 6-2.

Vehicular travel time in the downtown area may be longer by bus than in an auto, because bus passengers cannot direct the path or bus route, and depending on the route, may have to ride longer in traffic than an auto driver who can drive closer to his destination. Dispersed distribution systems are flexible and routes can readily be shifted to serve changes in downtown land use patterns. They do not displace normal downtown street operations except, perhaps, on-street parking during certain times of the day. However, mixed traffic curb lanes can create congestion and capacity problems for both buses and autos during peak periods, particularly where substantial turning movements occur.

Under the dispersed concept, the potential for increasing bus movement capacity along a particular street may be extremely limited because of the heavy competing demands of general vehicular traffic. In addition, the conflicts of buses loading/unloading at the curb and merging with auto traffic reduce overall street capacity. There is generally poor inter-route transfer capability, since the routes are not concentrated at any one point. The dispersed system generally contributes to, or is supportive of, a sprawling of downtown development, rather than a concentration of core area development.

Concentrated/Linear System Alternative

The concept of linear distribution provides a continuous, concentrated strip of high transit accessibility by having all routes distribute passengers along a limited number of street facilities (see Figure 6-3). Good examples of this concept are transit malls or exclusive bus streets by which many, if not all, routes enter the downtown and distribute through the core area. It is most applicable where development is already concentrated, or is planned to be concentrated, in one or more corridors, and where auto access can be provided adjacent to the linear strip or corridor (e.g., at the fringe of the downtown core). This service concept may take a cruciform pattern with service concentrated on one north-south and one east-west street (or streets). Essentially, this alternative represents the situation in Columbus prior to the initiation of the express bus terminals in early 1983. Before that time, the vast majority of COTA operations were concentrated upon High and Broad Streets.

Obviously, this concept best serves a linear development pattern where the majority of all transit destinations are within walking distance of the transit street(s). Except for where it may intersect another transit street in another cardinal direction, this concept does not create a point service concentration, since service and major destinations are spread along the corridor or street. The overall downtown bus travel time is improved and transfers to other routes are facilitated. The linear street(s) has (have) increased capability for handling high bus volumes. The number of potential auto/bus conflicts is reduced. The potential dislocation of autos and auto access to adjacent street(s) can create auto movement problems, including limitations on the

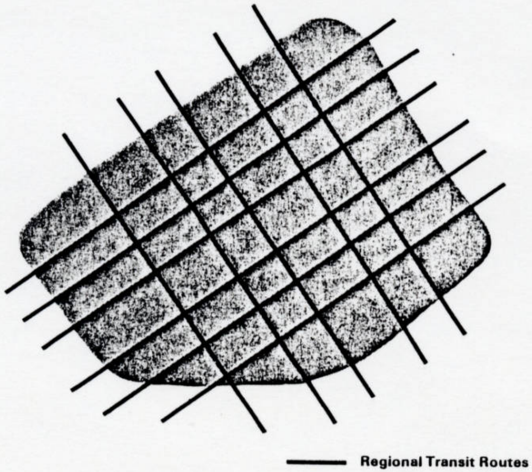

Figure 6-2
EXAMPLE OF DISPERSED DISTRIBUTION CONCEPT

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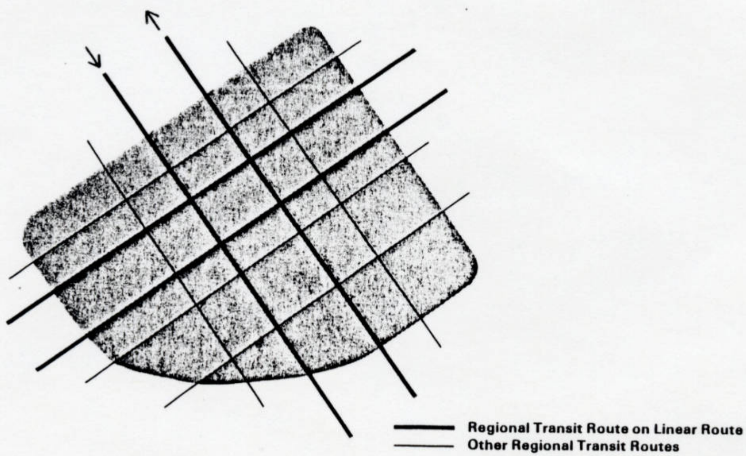

Figure 6-3
EXAMPLE OF LINEAR/ CONCENTRATED DISTRIBUTION CONCEPT

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capacity of those streets to accommodate the increased auto volumes. If land uses along the proposed transit emphasis street(s) do not require auto access, experience in other cities indicates that the system can work quite well from a traffic circulation perspective.

A linear system attempts to minimize overall walking distance by locating as many routes as possible through the center of downtown transit passenger destinations. The aggregation of a number of routes into a few pathways generally requires some kind of preferential bus treatment to provide adequate transit capacity. These treatments can include at-grade alternatives, grade separated alternatives, and tunnels. Within the subcategory of at-grade alternatives are systems which provide for movement in mixed traffic, in exclusive lanes (reverse or normal flow), or exclusive streets. Each of these alternatives can be further defined in terms of factors which affect all alternatives such as:

- one-way or two-way auto traffic
- median or curb bus passenger loading
- bypass lane or single file in bus lane
- on-street parking permitted
- preferential traffic signal treatment
- type of bus stop operation (skip stop, one stop, etc.)
- time period of operation (peak hours, mid-day, 24 hours)
- provision for auto turns, taxi and service vehicle access and circulation
- bus fare collection (pay to board, pay to leave)
- traffic control devices (signs, pavement markings, signals)
- information systems
- land access treatment

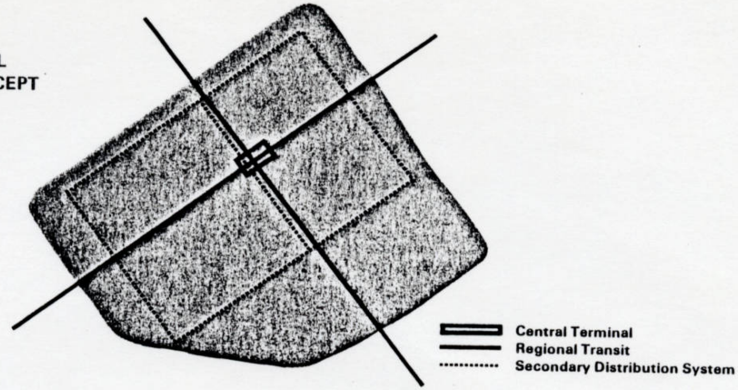
Terminal Alternatives

Two cases have been chosen to illustrate the generic terminal concept (see Figure 6-4). Both are quite similar. In each case, one or more sites are chosen at which the regional transit system loads and unloads all downtown and transferring passengers. A secondary distribution system is established to move passengers to and from ultimate downtown destinations and also serves other intra-downtown trips. Obviously, if a terminal is located within walking distance of a final trip destination, transfer to another vehicle is not required.

The key concern of the terminal system is the transfer. Because terminals are expensive and difficult to locate, only a few terminals can usually be constructed. Thus, if all trips are not within walking distance of the terminal, a transfer to a secondary distribution system is required. The advantage of terminal systems is that they essentially move much of the bus loading and unloading functions off congested central area streets. The principal disadvantage is the extra time required for passengers to transfer and wait for another vehicle. This additional transfer has been identified as a significant reason for the limited success of these systems.

Since early 1983, virtually all of COTA's express bus operations have been functioning under a variation of the "fringe distribution" terminal concept. Except for the east-west express routes still located on Broad Street, COTA's express operations enter either the north or south express terminal, discharge or board passengers (dependent upon time of day), traverse High Street in "closed-door" operation in a middle traffic

EXAMPLE OF CENTRAL TERMINAL DISTRIBUTION CONCEPT



EXAMPLE OF FRINGE DISTRIBUTION CONCEPT

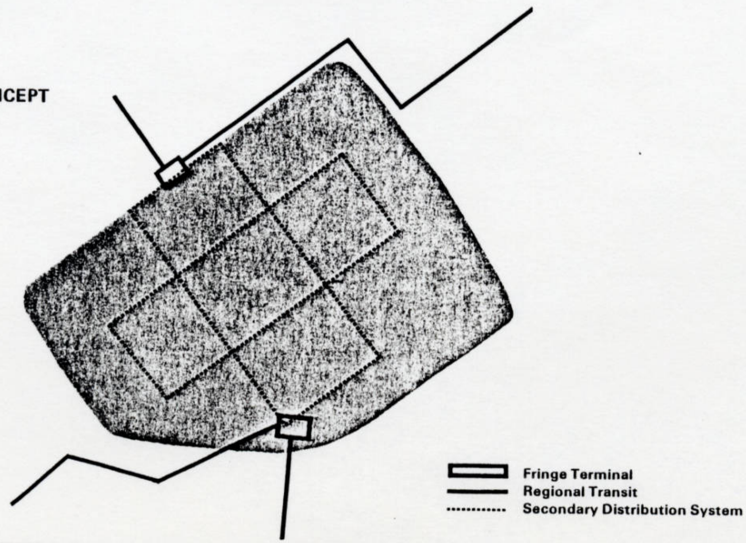


Figure 6-4
EXAMPLES OF CENTRAL TERMINAL DISTRIBUTION CONCEPTS

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lane, and enter the other terminal prior to completing their route. At the present time, no specialized, secondary distribution system exists to serve the COTA express bus terminals. Thus, express bus riders with origins or destinations in the central portion of downtown must walk between the terminals and their ultimate destinations or transfer to a COTA local bus operating on High Street in order to complete their trip.

Evaluation of Generic Alternatives

Each of the generic transit service alternatives as applied to downtown Columbus has basic strengths and weaknesses. Table 6-1 provides a comparision of the alternatives, while Table 6-2 lists the basic strengths and weaknesses of each generic concept.

Based upon an analysis of the material in Tables 6-1 and 6-2, there are good reasons for eliminating both the "dispersed" and "terminal" concepts from further consideration. Elimination of the "dispersed" alternative is warranted because of its inherent structural deficiencies. Dispersion of north-south transit operations across several streets in downtown Columbus is inconsistent with present and projected land use patterns that concentrate most office and retail development within 1-1½ blocks on each side of High Street. In 1983, 42 percent of the total employment inside the downtown freeway loop or over 35,000 employees were located within one block of High Street (ie. the north-south corridor bounded by Front and Third Streets). By the Year 2000, employment in this narrow High Street corridor is expected to increase to over 50,000 or about 50 percent of all Central Area employees.

Walking distances under a dispersed service concept would be greater for most transit riders than under other concepts that tend to put most service near the center of trip destinations. A service pattern that sought to avoid the need for exclusive or preferential transit lanes through dispersion would require spreading service over at least four north-south streets.

Serious disadvantages of the terminal concepts include high capital cost, increased trip time due to transfers and/or increased walking distances, major downtown land commitment, extensive time to implement, and inflexibility of the concepts to changes in downtown land use.

Locational Alternatives

Having pared the generic list of central area transit operational concepts to a preferred basic system concept of "concentrated/linear" service, the potential locational alternatives can now be considered. Obviously, this basic service concept could take any of several specific forms in downtown Columbus. Considering the number and location of north-south streets in the downtown High Street Corridor and the

Table 6-1
COMPARISION OF GENERIC TRANSIT SERVICE ALTERNATIVES

Considerations	Downtown Transit Alternatives		
	Dispersed	Concentrated/Linear	Terminal
Description	Bus operation dispersed over many streets with little or no preferential treatment for buses	Majority of bus operations concentrated on one or two linear, exclusive bus streets or facilities	Bus passenger distribution performed from either multiple fringe or a single central bus terminal(s).
Example	Downtown Washington, D.C.	Portland, Oregon 10th/11th Street Transit Malls	COTA express bus terminals, Port Authority Bus Terminal, New York City
Bus Operation Characteristics	Buses operate on several streets in mixed traffic with little or no preferential treatment	Buses operate on some exclusive or preferential bus facilities plus other streets as necessary	Bus travels to fringe or central terminal and unloads passengers. Bus then proceeds back to end of line
Bus Passenger Distribution Characteristics	Passengers walk from bus stop to destination, or transfer to another bus to get closer to destination	Passengers walk to destination or transfer to another bus to get closer to destination	Some passengers walk to destination. Most have to transfer to a secondary distribution system such as a downtown shuttle bus.
Typical Bus Facilities Required	Bus stops/shelters	Expanded bus loading/unloading facilities; several exclusive bus lanes plus bus stops /shelters on other streets	Several major fringe bus terminals (or a single central terminal) plus a secondary distribution system
Impact on Overall Trip Time for Downtown Destination	Negative - Buses must move with automobile traffic; sometimes requiring long walk trips	Some positive impact- Improves bus travel times for some routes and probably shortens most walk distances	Negative impact - transfer and wait for secondary distribution vehicle is required which increases overall transit trip time.

Table 6-1 (Continued)
COMPARISION OF GENERIC TRANSIT SERVICE ALTERNATIVES

Considerations	Downtown Transit Alternatives: Dispersed	Concentrated/Linear	Terminal
Impact on Other Downtown Street Operations and Activities	Many bus/auto conflicts; contributes to general street and intersection congestion but doesn't prohibit any activities except on-street parking	Moderate relocation of auto traffic required for exclusive facilities. Some access problems for auto related land uses adjacent to facilities. Generally reduces auto/bus conflicts	May remove regional buses from CBD but may increase total number of buses in core depending on nature of secondary distribution vehicle.
Costs	Low to moderate capital cost required for shelters	Moderate to high capital costs, especially for passenger loading/unloading facilities, transitways	Significant capital costs to build terminals and secondary distribution system
Flexibility to Change in Downtown Land Use, Regional Transit	Flexible - Buses can be moved quite easily	Moderate Flexibility - could be problem with major land use shifts away from a linear development pattern.	Not Flexible - Requires major, long term commitment to fixed facilities
Impact on Non-CBD Destined Trips	Requires some inconvenient transfers and walks between transfers	Requires some transfers and walks between transfers	Detrimental to non-CBD travellers; that is, through passengers (i.e., German Village to Ohio State University)
Implementation Requirements	Minor (related to shelter and stop improvements)	Major planning, construction, and, possibly, business access relocation required	Major planning, construction, and, possibly, business and access relocation required
Capability to Handle Increased Bus Volumes	Moderate, subject to impacts upon traffic capacity	Capability depends on number of exclusive lanes and loading space available	Fixed capacity determined by site size

Table 6-2
STRENGTHS AND WEAKNESSES OF THE GENERIC DOWNTOWN BUS OPERATIONAL CONCEPTS

	Dispersed	Concentrated/Linear	Terminal
Description	-- Buses operate on many streets in mixed traffic with little or no preferential treatment	-- Bus operations performed on a combination of: (1) streets with exclusive or preferential treatment and (2) other downtown streets as necessary	-- Bus travels to fringe or central terminal and unloads passengers. Bus then proceeds back to origin of route for another trip.
Strengths	-- Flexible with respect to changes in downtown land use and regional transit plans	-- Improved bus travel times for some routes	-- Fringe terminal operation takes buses out of downtown to reduce auto/bus conflicts in the core
	-- Does not prohibit any downtown street operation or activities except possibly on-street parking	-- Probably shortens most walk distances	-- Provides direct access to destination for passengers within easy walking distance of terminal (2-3 blocks maximum)
	-- Low capital investment required	-- Has good capability to handle increased bus volumes, assuming a number of exclusive lanes and loading spaces are available	
		-- Generally reduces auto/bus conflicts	
		-- Transfers to other routes are facilitated by the aggregation of bus routes at several common locations	

Table 6-2 (Continued)
STRENGTHS AND WEAKNESSES OF THE GENERIC DOWNTOWN BUS OPERATIONAL CONCEPTS

	Dispersed	Concentrated/Linear	Terminal
Weaknesses	-- Buses operate in mixed traffic thereby contributing to general street and intersection congestion	-- Requires relocation of auto traffic from streets for exclusive transit facilities	-- Transfer to secondary distribution system required for most trips
	-- Because buses operate in mixed traffic, overall bus trip time usually longer than comparable auto trip	-- Access problems for auto related land use adjacent to transit only streets.	-- The transfer and wait for distribution vehicle increases overall transit trip time; travel time not competitive with auto
	-- As volume of buses increases, more buses must be dispersed to the fringe of the downtown to obtain the necessary bus capacity	-- May result in pooer levels of transit service to areas at fringes of central area	-- If secondary distribution vehicle is a bus, the total number of buses required in the core area may increase.
	-- Longer walk trips and the need for additional transfers for bus passengers within downtown	-- Reduces flexibility to respond to major land use/transit system changes	-- Significant capital cost involved in building terminals and secondary distribution system
	-- Runs counter to adopted Columbus central area development plans and policies	-- Requires major capital expenditures for exclusive/perferential transit facilities	-- Limited flexibility to changes in land use, transportation system
	-- Encourages non-concentrated, dispersed land use patterns		-- Detrimental to non-CBD oriented transit passengers, especially those destined for locations immediately beyond the CBD
			-- Lengthy implementation time required due to need to locate and design terminal(s), acquire property and construct facilities

location of principal transit trip generators (see the discussion of present and future employment adjacent to High Street in the preceding section), five (5) "families" of concentrated/linear transit service concepts have been defined, reflecting alternative service levels on one or more corridor streets. Within each of these generalized "families", there are several variations reflecting different emphases in transit preferential treatment and local traffic circulation capacity on individual streets. Each of the five "families" of transit operational alternatives are briefly described below:

1. High Street Only. This group of service alternatives basically continues the COTA transit service philosophy now being employed in downtown Columbus (i.e., the majority of local and express bus operations on north/south downtown streets will continue to be concentrated on High Street). The four variations considered within this group include (1) mixed use of High Street by transit and general traffic, (2) exclusive dedication of the High Street right-of-way for transit and pedestrian operations, and (3) and (4) variations of these two options associated with alternative levels of accommodation of local traffic circulation needs.

2. High Street/Third Street Pair. The six alternatives in this group feature the physical separation of northbound and southbound transit operations (now concentrated on High Street) into relatively equal components on High and Third Streets. Conceptually, this is analogous to the situation in Portland, Oregon, where a two-street transitway is now in operation. Among the six alternatives in this family, there are variations in regard to the directionality of transit operations on High and Third Streets relative to that of general traffic (i.e., with-flow, contra-flow) and variations associated with the degree to which general traffic circulation will be maintained on High Street (ie. number of lanes retained for general traffic).

3. High Street/Front Street Pair. This group of six service alternatives is similar to that described above for the High Street/Third Street pair. The High Street/Front Street family reflect alternative directionality of transit operations (with-flow or contra-flow) and variable combinations of general traffic capacity on High and Front Streets.

4. Front Street/Third Street Pair. The two alternatives examined for this family continue the philosophy of concentrating transit operations on no more than two streets, but remove the majority of service from High Street by reallocating northbound and southbound operations somewhat equally to Front and Third Streets. The variations considered were those which would have contra-flow or with-flow transit operations along Front and Third.

5. Front Street/High Street/Third Street. The two operational alternatives considered within this family examine the possibilities of a more uniform distribution of transit service among the three principal development streets in the corridor, rather than on one or two streets. As such, it approaches (at least for north-south bus service) the generic "dispersed" service alternative that was assessed and discarded in the preceding evaluation stage. Variations considered here examine the implications of with-flow or contra-flow transit operations along Front and Third Streets with transit operations along High Street essentially unchanged from today except for a lower volume of buses.

Evaluation of Alternatives

In total, twenty different locational/operational alternatives are associated with the five groups described aboved. To narrow the range of alternatives to a more manageable group, these twenty alternatives were subjected to a first-cut or "fatal flaw" evaluation. A summary of this evaluation is illustrated in Figure 6-5 on the following page. The operational concept associated with each of the twenty alternatives is defined in simple diagrammatic form and the results of the "fatal flaw" evaluation are indicated for each concept. Six (6) evaluation factors or criteria were drawn from the total list of impact considerations that would be involved with a complete alternatives analysis or EIS assessment. These six criteria were selected because of their major impact upon the basic planning and operational feasibility of any alternative. In effect, if an alternative were judged to be seriously deficient in any one of these criteria, that could represent a "fatal flaw" in that alternative.

The performance of each alternative in terms of each of the six criteria, was judged on either a qualitative or quantitative scale of 1-5, with 1 being the "best" and 5 being the "worst" ranking. The total "score" for each alternative was then determined through addition of the individual factor performance scores. These totals are shown in the far right hand column of the matrix in Figure 6-5. Under this assessment procedure, a low score is best. Equal weighting was given to all criteria.

The criteria used in this initial assessment are described below:

A. Provide transit operational capacity to accommodate Year 2000 demands. This criterion uses the 2000 estimates of peak hour, peak directional bus volumes to determine whether the transit operational concept being considered can, in fact, accomodate the projected level of bus operations. An alternative would best meet this criterion when it provides capacity for at least 160 buses in each direction during peak periods (i.e., basically, the Year 2000 demand level). If a total of two exclusive transit lanes in each direction were provided by an alternative, the best or lowest score of "one" was given; the use of mixed traffic/transit lanes to achieve adequate transit capacity was given a some what higher or worse score.

B. Minimize right turn conflicts with transit lanes. This criterion highlights those alternatives in which significant interference of right turning general traffic would result from a particular transit operational scenario. Thus, an alternative would best meet this criterion when it has no conflicts between right turning general traffic and transit service in a preferential/exclusive lane. Conversely, the "worst" score would occur when there were four or more conflicts between right turning traffic and transit lanes as measured along a single cross street. Obviously, such right-turn conflicts increase with the number of corridor streets having exclusive transit lanes.

C. Miminize bus passenger walking distance. This reflects a qualitative assessment of the degree to which the transit operational alternatives relate to employment and major activity centers (i.e., potential transit trip generators) in downtown Columbus. Alternatives that push major transit service away from the primary employment and development spine along High Street were judged to be worse than those which tended to concentrate service along High Street.

	FRONT	HIGH	THIRD	A	B	C	D	E	F	Summary Score
HIGH ONLY										
1	▲ 4½	▽ 1½ ▼ 1½ ▲ 1½ △ 1½	▼ 4½	3	4	2	5	2	1	17
2	▲ 5	▽ 2 △ 2	▼ 5	1	1	1	1	3	3	10
3	▲ 5	▽ 1½ ▼ 1½ △ 2	▼ 4½	2	2	2	3	3	2	14
4	▲ 4½	▽ 2 ▲ 1½ △ 1½	▼ 5	2	2	2	3	3	3	15
HIGH/ THIRD										
5	▲ 5	▼ 3 △ 2	▽ 2 ▼ 2	1	2	3	2	3	2	13
6	▲ 5	▽ 2 ▼ 3	▼ 2 △ 2	1	2	4	3	3	2	15
7	▲ 5	▲ 2 △ 2	▽ 2 ▼ 2	1	3	3	2	5	2	16
8	▲ 5	▽ 2 ▲ 2	▼ 2 △ 2	1	1	3	2	5	2	14
9	▲ 4½	▼ 2 ▲ 1½ △ 1½	▽ 2 ▼ 2	2	3	4	4	5	2	20
10	▲ 5	▽ 2 ▼ 2 ▲ 2	▼ 2 △ 2	1	2	3	5	5	2	18
HIGH/ FRONT										
11	▽ 2 ▲ 2	▼ 2 △ 2	▼ 5	1	1	4	2	5	4	17
12	▲ 2 △ 2	▽ 2 ▼ 2	▼ 5	1	3	4	2	5	4	19
13	▽ 2 ▲ 2	▲ 3 △ 2	▼ 5	1	2	4	3	3	4	17
14	▲ 2 △ 2	▽ 2 ▲ 3	▼ 5	1	2	4	2	3	4	16
15	▽ 2 ▲ 2	▼ 2 ▲ 2 △ 2	▼ 5	1	2	4	5	5	4	21
16	▲ 2 △ 2	▽ 1½ ▼ 1½ ▲ 2	▼ 4½	2	3	3	4	5	4	21
FRONT/ THIRD										
17	▲ 2½ △ 1½	▼ 2½ ▲ 2½	▽ 1½ ▼ 2½	3	4	3	3	3	3	19
18	▽ 2 ▲ 2	▼ 3 ▲ 3	▼ 2 △ 2	1	1	4	4	3	3	16
FRONT/ HIGH/ THIRD										
19	▽ 1 ▲ 3	▽ 1 ▼ 2 ▲ 2 △ 1	▼ 3 △ 1	2	3	3	5	3	1	17
20	▲ 3 △ 1	▽ 1 ▼ 2 ▲ 2 △ 1	▽ 1 ▼ 3	2	5	3	5	3	1	19

2 Number of lanes for transit or general traffic movement

½ Indicates substantial mixed transit and general traffic movement in a single lane.

△ Transit Lane(s)
▲ General Traffic Lane(s)

RELATIVE IMPACT SCALE

● 5 Does Not Meet Criterion
◒ 3 Somewhat-Meets Criterion
○ 1 Best Meets Criterion

CRITERIA KEY

A-Provide Transit Operational Capacity To Accommodate Year 2000 Demands.

B-Minimize Right Turn Conflicts With Transit Lanes.

C-Minimize Bus Passenger Walking Distances.

D-Provide Adequate Bus Passenger Waiting Areas and Amenities Together With Adequate Sidewalk Capacities.

E- Provide Adequate Traffic Capacity.

F- Provide Flexibility to Accomodate Possible Land Use Changes.

Figure 6-5
HIGH STREET CORRIDOR ALTERNATIVES AND PRELIMINARY EVALUATION

D. Provide adequate bus passenger waiting areas and amenities together with adequate sidewalk capacities. This qualitative factor assesses the degree to which the alternatives do or do not provide an opportunity for enhancement of pedestrian movement and bus waiting areas in the corridor. Thus, where a combination of transit and general traffic movement on a particular street required a pavement width such that minimal, if any, expansion of the existing sidewalk width could be provided, the alternative(s) would score poorly in terms of meeting this criterion. For example, any alternative that retained the present six lanes on High Street for auto and transit use with no opportunity for expanded pedestrian circulation/passenger waiting space received the poorest score (ie. a "five").

E. Provide adequate traffic capacity. This criterion assesses the reduction in traffic flow capacity along Front, High, and Third Streets that will result from the implementation of the various alternatives. At present there are effectively seven general traffic lanes in each direction for the three streets combined (assuming one lane in each direction on High Street is already lost to general traffic use because of bus activity). If three or more general traffic lanes in one direction were lost under an alternative, the poorest score (a "five") was given. If two lanes were lost in one or both directions, a score of "three" was given. Loss of only one lane in one or both directions produced a "two" rating. No best scores or "ones" were given because all of the alternatives resulted in some loss of general traffic capacity.

F. Provide flexibility to accomodate possible land use changes. This qualitative factor assesses the capability of an alternative to react to changes in the structure of development in downtown Columbus over the next 10-15 years. Thus, locational alternatives which emphasize operational rather than physical modifications to existing transit service would score better than alternatives requiring major capital investments that could reduce flexibility for subsequent service adjustments.

A brief discussion of the evaluation process and results for each "family" of locational alternatives is given below:

"High Only" Alternatives

Alternatives 1 through 4 in Figure 6-5 comprise the "High Only" family of alternatives, and reflect the concentration of transit service on High Street with only minor bus service on Front and Third.

Alternative 1 equates roughly to existing conditions on High Street in that transit volumes now occupy the curb lane in each direction, plus perhaps one-half the capacity of an adjacent lane in each direction as a result of bus maneuvering. This leaves an effective 1½ lanes in each direction for general traffic on High Street during peak periods. On Front and Third Streets, present transit operations are assumed to consume roughly a ½ lane in each direction, leaving an effective 4½ lanes for general traffic movement on each street. This alternative scored poorly in Criterion D in that it provides little in the way of bus passenger waiting areas, sidewalk capacity, and pedestrian amenities.

Alternative 2 received the lowest or best scoring in this family. That alternative calls for converting High Street into a transit-only facility, providing two lanes for buses in each direction with the remainder of the present street witdh being devoted to expanded sidewalk, pedestrian, and bus passenger waiting area. This alternative scored very well in four key criteria: provision of adequate transit capacity to accommodate Year 2000 demands, minimization of right turn conflicts with transit lanes, minimization of bus passenger walking distances by placing transit service in a convenient relationship to major employment concentrations, and provision of adequate sidewalk capacity, bus passenger waiting area, and pedestrian amenities.

Alternatives 3 and 4 eliminate one direction of general traffic on High Street. However, maintaining general traffic in one direction reduces the amount of street width that can be converted to bus passenger waiting areas and pedestrian amenities and causes a worse score for those alternatives in this critical criterion.

"High/Third" Alternatives

This group includes Alternatives 5 through 10 whose common characteristic is a split of transit service between High and Third Streets with little or no service on Front Street. As a family, they scored better than the High/Front Alternatives in terms of flexibility to accommedate possible land use change. This is because the "center of gravity" of transit service in the High/Third alternatives is to the east side of the High Street corridor, where there is physically more space for future growth.

Alternatives 5 and 6 provide three lanes of general traffic on High Street and two lanes of general traffic on Third Street with two exclusive transit lanes on each street. In Alternative 5, the transit lanes on High Street run contra-flow to the southbound general traffic lanes, and the transit lanes on Third Street run in the same direction as the general traffic lanes. In Alternative 6 these conditions are reversed with the Third Street transit lanes running contra-flow and the High Street transit lanes running with general traffic flow. Both alternatives received moderate scores for most of the criteria to total a reasonably low score of 13 for Alternative 5 and 15 for Alternative 6. The latter alternative received a worse score in minimizing bus passenger walking distance because all northbound bus service must board and alight passengers on the east side of Third Street, which produces longer walking distances to destinations, within the High Street Corridor.

Alternatives 7 and 8 also reflect contra-flow and with-flow bus lanes on High and Third Streets, but are different from Alternatives 5 and 6 in two respects: general traffic would operate northbound on High Street and only two lanes of general traffic would be provided on High Street instead of the three lanes in the preceding two alternatives. Both 7 and 8 scored poorly in providing adequate general traffic capacity in that only two southbound general traffic lanes would be available in the entire three-street Front/High/Third Corridor (i.e., the two southbound lanes on Third Street).

Alternatives 9 and 10 retain two-way, general traffic on High Street. Requirements for transit capacity result in a loss of three southbound lanes. They also scored poorly in providing expanded bus passenger waiting areas and pedestrian amenities since

Alternative 10 requires the retention of all six lanes on High Street, and Alternative 9 requires five High Street lanes.

"High/Front" Alternatives

Alternatives 11 through 16 concentrate transit service on High and Front Streets with little or no service provided on Third Street. The alternatives are structured very similarly to those in the High/Third Street family, essentially reflecting various combinations of contra-flow and with-flow transit lanes on High and Front Streets.

Alternatives 11 and 12 have serious flaws in that they provide only two lanes of general traffic capacity for northbound traffic for the entire, three street corridor. Alternatives 15 and 16 which retain two-way general traffic on High Street have a significant imbalance in general traffic capacity with four northbound and seven southbound lanes. They also scored poorly in terms of providing adequate bus passenger waiting area and pedestrian amenities by offering little or no additional sidewalk width on High Street.

All of these alternatives scored poorly in minimizing bus passenger walking distances and in providing flexibility to accomodate future land use changes by providing a somewhat off-center location for transit service. With approximately half of the transit service operating on Front Street (at least in one direction), walking distances are increased for employment on the eastern side of the High Street Corridor, particularly considering that the block between High and Third Street is a long block roughly twice the width of the normal blocks in the Corridor. Flexibility to accommodate land use change is constrained by the weighting of transit service toward the river or "short" side of the High Street Corridor, which has less area for possible growth.

"Front/Third" Alternatives

Alternatives 17 and 18 split public transit service between Front and Third Streets with little or no transit on High Street. Alternative 17 would retain some transit on High Street with an effective 2½ lanes in each direction for general traffic, while Alternative 18 would have no transit on High Street and would provide three lanes in each direction for general traffic. By orienting the transit lanes on Front and Third Streets in a contra-flow direction, Alternative 18 scored very well in minimizing right turn conflicts between general traffic and the exclusive transit lanes. On all other criteria, the alternatives received moderate to poor ratings.

"Front/High/Third" Alternatives

Alternatives 19 and 20 provide both general traffic and exclusive transit lanes on all three streets. The High Street design for both alternatives is the same -- two general traffic lanes in each direction and one exclusive bus lane in each direction. The difference between the alternatives is in the direction of bus lane operations on Front and Third Streets, -- contra-flow in Alternative 19 and with-flow in Alternative 20.

Each alternative has at least one serious flaw. Both retain six lanes of traffic on High Street, and thus, provide no additional area for improved bus passenger waiting and pedestrian amenities. Alternative 20 scored poorly in terms of minimizing right turn conflicts with transit lanes. That alternative has the greatest number of right turn conflicts (four) of any of the twenty alternatives evaluated. By spreading transit service across the entire, three-street corridor, both alternatives retain reasonable flexibility to shift service emphasis to respond to possible changes in land use.

Summary of Fatal Flaw Evaluation

As illustrated in the matrix, the "scores" range from a low of 10 for Alternative 2 to a high of 21 for Alternatives 15 and 16. In examining the results of the assessment, there are clearly a number of alternatives with "fatal flaws" that can probably be eliminated from further serious consideration.

Any alternative scoring "five" (i.e., a solid black circle in the Figure 6-5 matrix) for one or more of the six key criteria should be considered as having a "fatal flow". Eleven of the 20 alternatives have such flaws. Of the remaining nine, four alternatives (i.e., numbers 13, 14, 17 and 18) scored a "four" on at least two criteria or had no scores better than a "three". This suggests they either had no particular strong points or were significantly deficient in one or more areas. This left five alternatives with low or good overall scores and no critical deficiency in any one criterion:

- Alternative 2 - Four (4) lane exclusive transitway on High Street (score of 10).
- Alternative 3 - High Street transitway with two dedicated transit lanes northbound, one transit-only lane southbound and two general traffic lanes southbound, one of which would be utilized for transit operations as well, thus reflecting 1½ southbound transit lanes and 1½ southbound general traffic lanes (score of 14).
- Alternative 4 - High Street transitway with two dedicated transit lanes southbound, one transit-only lane northbound, and two general traffic lanes northbound, one of which would be utilized for transit operations as well, thus reflecting 1½ northbound transit lanes and 1½ northbound general traffic lanes (score of 15).
- Alternative 5 - High Street/Third Street paired transitways with contra-flow transit operations on High Street and with-flow operations on Third Street (score of 13).
- Alternative 6 - High Street/Third Street paired transitways with two dedicated transit lanes southbound on High Street and two contra-flow dedicated transit lanes northbound on Third Street (score of 15).

Final Evaluation

In examining the five "finalists" in more detail, further strengths and weaknesses associated with them were identified. A secondary assessment or "second cut" of these final locational alternatives was conducted in order to better differentiate between their strengths and weaknesses. In this secondary assessment, several additional criteria were considered in an attempt to include to the degree possible all of the major evaluation criteria defined by the Project Advisory Committee. The additional criteria considered were:

- -- Funding potential
- -- Enhancement of High Street image
- -- Impact upon bus operating costs
- -- Impact upon safe and efficient traffic management
- -- Impact upon bus passenger transfer walking distances
- -- Potential pedestrian/vehicular conflicts
- -- Study area frontage with enhanced visual setting
- -- Ease of general traffic circulation
- -- Impact upon access to off-street parking areas
- -- Impact upon air and noise quality

As was the case with the initial assessment of the twenty locational alternatives, the secondary assessment of the five "final" locational alternatives was conducted in a qualitative/quantitative manner using a scale of 1-5 with 1 indicating the "best" possible performance of an alternative relative to each secondary assessment criterion and 5 indicating the "worst" possible performance. Table 6-3 summarizes the results of this secondary assessment of the "final locational alternatives."

The principal conclusion to be drawn from the secondary assessment is that Alternative 2 -- "Four Lane Transitway on High Street" -- emerges as an even stronger alternative relative to the other three "finalists". In this second round evaluation it scored better than any of its competitors on seven of the ten criteria and, in fact, recorded the best possible score on those seven criteria. Its final combined score from the two-stage evaluation process of 25 points versus that of its nearest competitor at 38 points is a significant and clear margin of superiority. The results of this evaluation indicate that the preferred transit service concept for the High Street Corridor is Alternative 2: a four-lane transitway on High Street.

Table 6-3
SECOND-STAGE ASSESSMENT OF "FINAL" LOCATIONAL ALTERNATIVES

	Locational Alternatives				
	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
INITIAL ASSESSMENT SCORES	10	14	15	13	15
SECOND-STAGE IMPACT ASSESSMENT FACTORS:					
--Funding potential	1	2	2	3	3
--Enhancement of High Street image	1	2	2	3	3
--Impact on transit operating costs	1	2	2	2	2
--Traffic management implications	1	3	3	2	3
--Impact on transferring passenger walking distance	1	3	3	4	5
--Effect on pedestrian/vehicular conflicts	1	2	2	3	4
--Amount of street frontage with enhanced setting	2	2	2	1	1
--Ease of general vehicular circulation	4	3	3	3	3
--Impact upon access to off-street parking facilities	1	2	2	4	4
--Impact on air/noise quality	2	3	3	1	1
SECOND-STAGE ASSESSMENT SCORES:	15	24	24	26	29
TOTAL SCORES	25	38	39	39	44

CHAPTER 7

DESCRIPTION OF THE PREFERRED PLAN

The previous chapter described the development and evaluation of twenty possible transportation alternatives for the High Street corridor. The evaluation of these twenty alternatives led to the definition of a recommended or "preferred" plan which entails the development of a four-lane transitmall along High Street. The purpose of this chapter is to describe the recommended design considerations of the preferred plan, to explain the proposed transit operations, and to define the impact of the proposed transitmall on the highway system.

DESIGN CONSIDERATIONS

The preferred plan proposes the adaptive re-use of the 100-foot right-of-way on High Street as a transit-priority facility with the following characteristics:

Zone 1:

From Long Street to Main Street, a four-lane (46-foot curb-to-curb pavement width) travelway would be provided for exclusive weekday (7 AM to 6:30 PM) transit use. This action, in concert with the resultant average 27-foot sidewalk widths, would be adequate to satisfy the urban design objectives described in Chapter 6.

Zones 2 and 3:

From Long Street north to Chestnut Street and from Main Street south to Fulton Street, a five lane (56-foot pavement width) transitional travelway would be provided. This basic facility cross-section would accomodate general traffic flow including transit vehicles, and include 22-foot sidewalks. These dimensions also would be adequate to satisfy the design objectives described in Chapter 6.

Zone 4:

From Chestnut Street north to Nationwide Boulevard (a distance of only one block), a six-lane roadway cross-section is necessary in order to adequately accomodate both general vehicular traffic demands in this area and bus movements. The design of this zone was driven primarily by the design objective to provide adequate traffic movement capacity. Despite being able to provide only a marginally adequate sidewalk dimension of 17 feet, virtually all of the urban design objectives can be met.

The following more-detailed description of design considerations applies to each zone:

Zone 1:

Generally, it is within this zone where three highly-interrelated phenomena will be at work:

- o A high degree of general pedestrian activity,
- o Large accumulations of transit passengers, particularly in the peak periods, and
- o High volumes of bus vehicles due to the fact that almost all routes will be operated along these blocks.

A key consideration in the design of this zone was developing a "split-stop" transit operational scenario in which two sets of bus berths are located on each block-face, with each berthing area planned to operate somewhat independently of the other. This action will tend to spread out the peak transit passenger accumulation demands. At the same time, by breaking up the berthing positions into two segments on each block face, there will be a reduction in the "wall of metal" effect caused by the presence of large numbers of buses during a short period of time.

The typical block plan and it's attendant cross-section (Figures 7-1 and 7-2, respectively), illustrate the placement of the 46-foot, four-lane transit travelway, and the 27-foot sidewalk zones that would be created. Although only schematic, these illustrations demonstrate the principal bus movements taking place in the center zone (two lanes) of the street, bus berthing in the outer two lanes at the edge of the sidewalk zones, transit passenger waiting and amenity uses immediately adjacent to the berthing positions, and the maintenance of general pedestrian flow along the building frontage. Design testing indicates a high potential for the development of major improvements to specially serve both the transit patron and general pedestrian needs, including street trees, pedestrian-scale lighting, and passenger waiting shelters.

Zones 2 and 3:

Within these areas, largely because of the fewer number of bus routes anticipated to be present, less pressure will exist for transit demands. Thus, the stops are configured in a more conventional one-stop-per-block fashion. In these zones, the vehicular travelway is expanded to a 56-foot (five-lane) facility to accommodate the needs of both transit vehicles and general traffic. These zones still achieve a 22-foot overall sidewalk width in which adequate space for waiting passengers, pedestrian flow, and street amenities can co-exist. This zone configuration is illustrated in Figures 7-3 and 7-4.

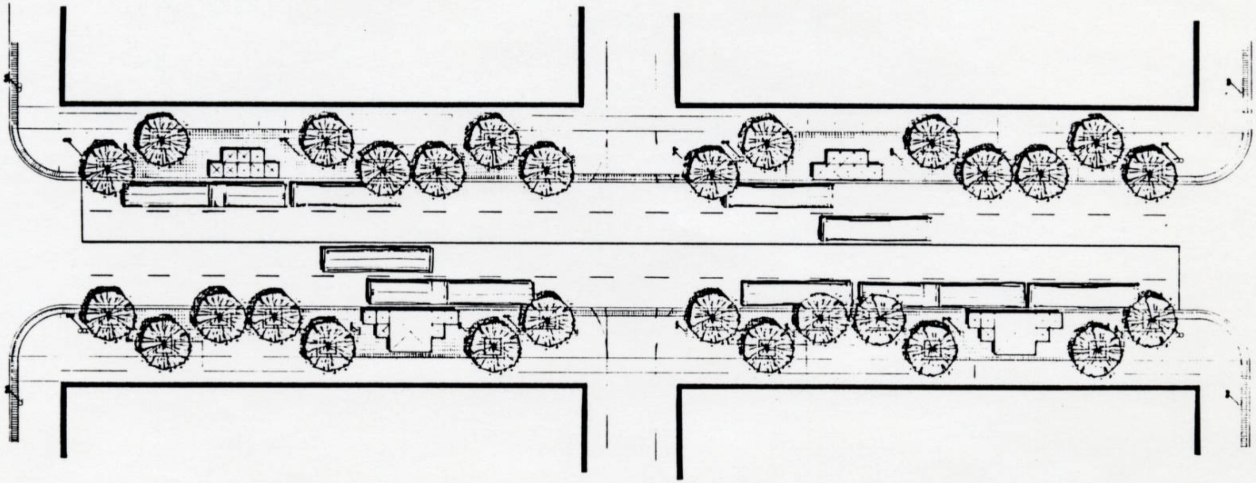

Figure 7-1
PLAN VIEW OF PROPOSED FOUR-LANE TRANSITMALL

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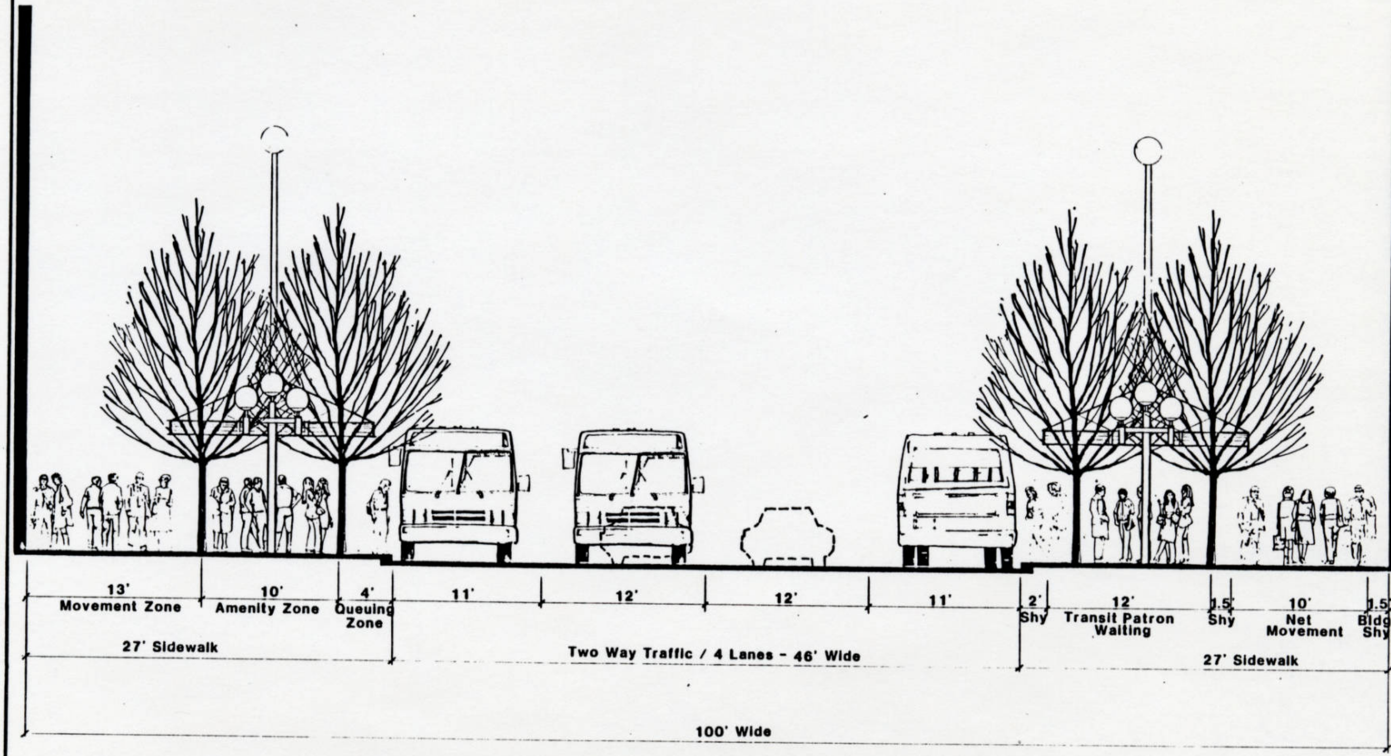

Figure 7-2
CROSS-SECTION OF PROPOSED FOUR-LANE TRANSITMALL

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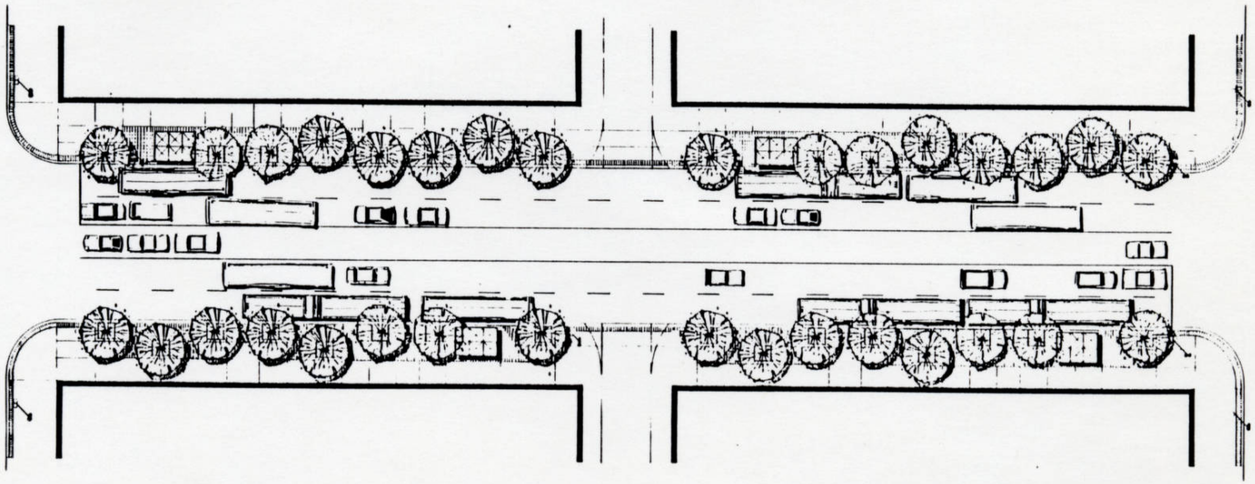

Figure 7-3
PLAN VIEW OF FIVE-LANE
TRANSITIONAL SECTION FOR TRANSITMALL

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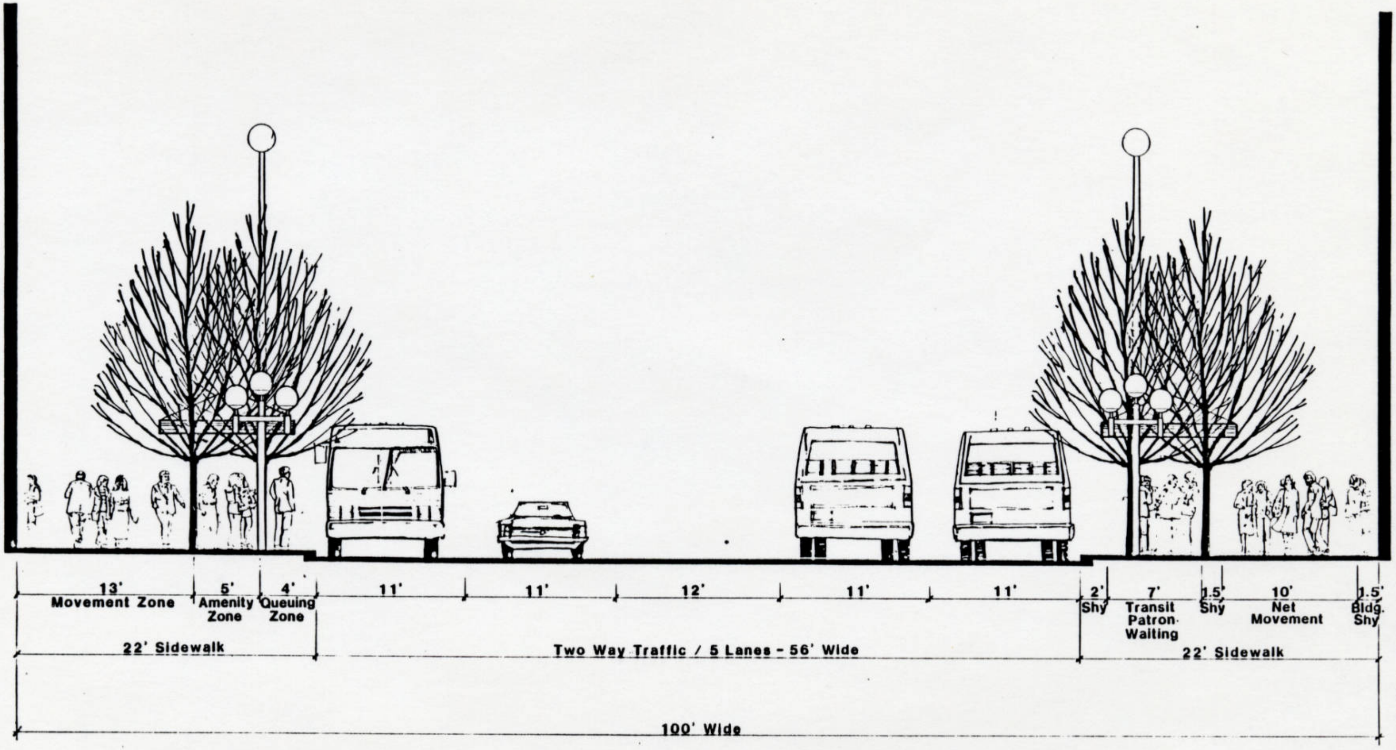

Figure 7-4
CROSS-SECTION OF PROPOSED FIVE-LANE TRANSITIONAL SECTION FOR TRANSITMALL

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Zone 4:

As previously noted, this one-block area responds principally to heavy general-traffic turn demands at both Nationwide Boulevard and Chestnut Street. The resultant six-lane, 66-foot roadway configuration would provide 17-foot sidewalks capable of handling general pedestrian flow, but with little potential for the provision of substantial transit passenger waiting areas and related amenities. Although less gracious and dynamic, amenities such as street trees and lighting would still be present in this one-block section to maintain the basic design character and visual image of the more substantial streetscape improvements which would be provided in the blocks to the south.

CENTRAL AREA TRANSIT OPERATIONS

In general terms, the recommended future year transit operations in downtown Columbus will be basically the same as those observed today although made somewhat simplier in form and more efficient in operation. As a continuation of the current COTA operational philosophy, all local and express buses entering the Downtown from the north and south would be concentrated along High Street, with no north-south operations other than non-passenger carrying vehicle turnbacks at the end of local or express routes operating on Third or Front Streets.

One significant question regarding the general form of future central area transit operations not finally resolved is that of the ultimate future location of the north and south express bus terminals. When these two facilities were originally constructed, it was the intention of COTA that they would remain only on an interim basis until the development of the final future year transit plan for Downtown Columbus. In particular, the existing north terminal just west of High Street between Spring and Long Streets is severely constrained with respect to expansion possibilities. Initial investigations by the COTA staff have identified the potential for relocation of the north terminal to a site on the north side of Spring Street just west of High Street or still further north in the parking area for the Ohio Center Complex north of Ohio Center Way and east of High Street. The latter location could conceivably be integrated into the design of the terminal point of the high occupancy vehicle ramp connections to I-670 which are planned to be constructed at this location. As will be described in the following paragraphs, the ultimate location of this proposed new north terminal facility has the potential for substantial modification to the local and express bus operational pattern presented here.

The situation with respect to the south express bus terminal is perhaps more certain at this time than is that for the north. Plans for the Capital South development have included a proposed bus terminal integrated into the parking garage for the development for a number of years. This appears to be the most logical location for such a express bus terminal and local bus off-street layover point to be constructed in the southern half of the downtown area. It is recommended that COTA and the City of Columbus continue to work with the developers of the Capital South project to ensure that adequate terminal facilities for COTA bus operations are provided for as part of the total development package.

Proposed Local Bus Operations

The implementation of the proposed four-lane transitmall along the central portion of the High Street corridor will necessitate some minor modifications and revisions to existing downtown routings of COTA local bus operations. In large measure, these route modifications will affect only the downtown terminus and layover points now utilized by COTA local bus routes. The proposed Year 2000 local transit operations scheme for Downtown Columbus is illustrated in Figure 7-5.

At the central area entry points, the future year local bus routing plan is identical to that observed today, with but one exception. This exception represents the modification of Route 2 - Main Street, which currently operates in both directions along East Rich Street from High Street east to South Grant Avenue. With the proposed modification of the traffic circulation pattern in downtown such that Rich Street and Main Street will become a one-way couple, it will be necessary for eastbound Route 2 vehicles to utilize Main Street while the westbound vehicles remain on Rich Street as is the situation today.

In general, all of the required local bus routing modifications will take place within the rather confined area bounded by Long Street on the north, Mound Street on the south, Third Street on the east, and Front Street on the west. The general revisions to the current local bus circulation plan in the downtown area is described below in terms of general groups of buses rather than repeating the same information for each individual local route.

Local bus operations approaching downtown from the northwest (Routes 3, 13, 14, and 18, will exhibit little change in their downtown routings. These routes would all enter from the north and west along Long Street, turn south onto High Street and traverse the downtown on this facility, with Route 3 (West Mound) leaving to the west on Town Street and returning on Rich, and Routes 13, 14, and 18, (which all presently terminate in the downtown and utilize Rich/Third/Mound/Long Streets for their turnaround point) representing prime candidates for use of the South Express Bus Terminal facility as a terminus/route layover point.

Similarly, Routes 2, 4, 5, 7, and 8 approaching the downtown from the north along High and Third Streets would see very little change in their current operational pattern. All of these routes traverse the downtown area via High Street with Route 2 leaving to the east along Rich/Main Street, Route 4 exiting the High Street corridor to Livingston Avenue, as does Route 8, and Route 7 continuing south on High Street into the German Village area. Route 5, a downtown terminus route which presently utilizes Rich/Third/Mound/High as its reversal loop, would be diverted into the South Express Bus Terminal complex.

Routes 1, 6, 9, and 16 which approach the downtown from the northeast quadrant of the region would continue to utilize Spring and Long Streets to enter the central area. Routes 1, 6, and 16 would continue as through routes, while the current Route 9 terminal loop around the State Capitol would be shifted south to the South Express Bus Terminal facility.

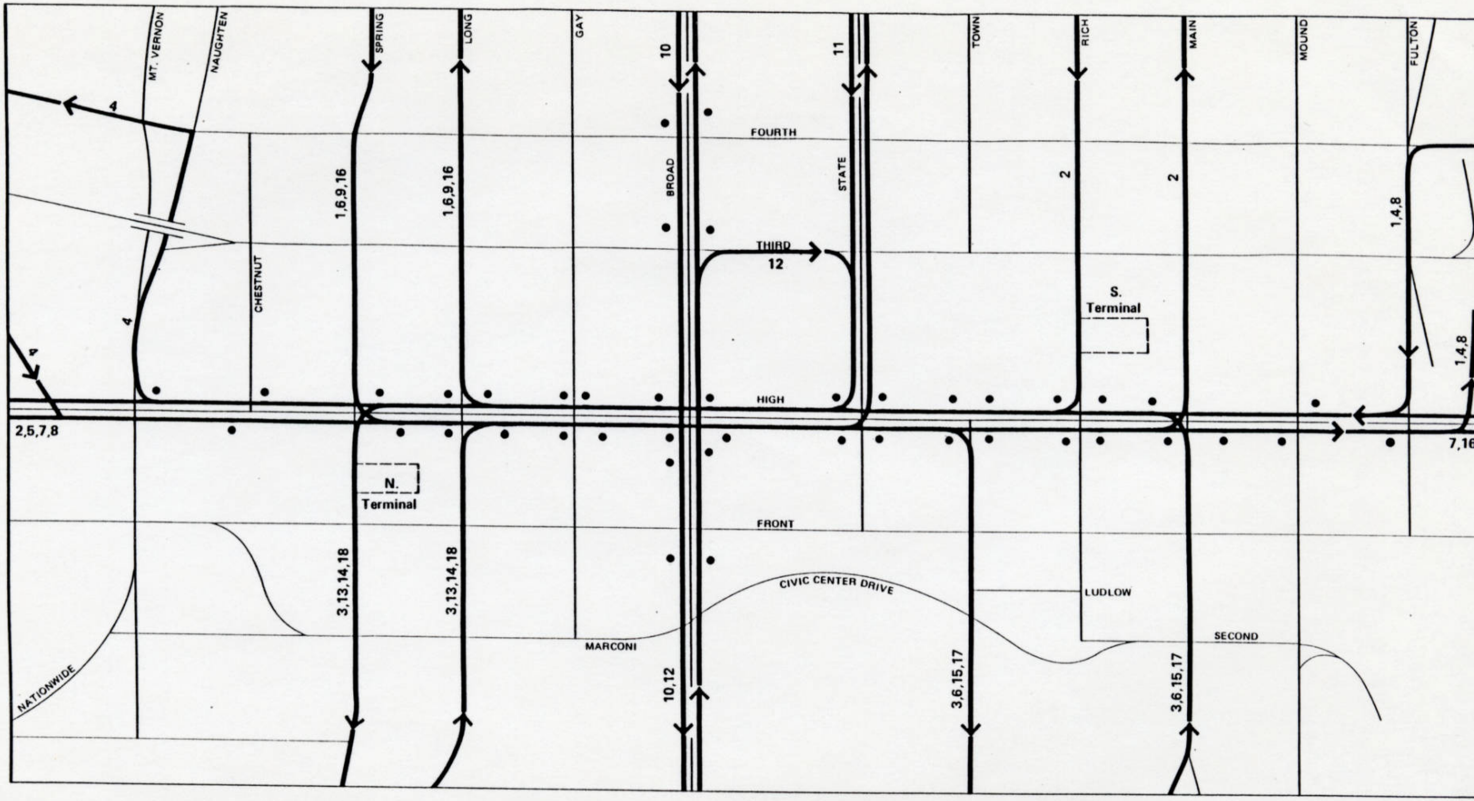

Figure 7-5

PROPOSED YEAR 2000 LOCAL TRANSIT OPERATIONS

Legend:
- Local Bus Routings
- 3 COTA Route Number
- ● Major Bus Stop/Shelter Location

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Route 10 - East Broad/West Broad, would continue to operate as a through route along Broad Street in the downtown area. Similarly, Route 11 - Oak/Bryden would continue to enter the downtown area along East State Street but rather than its current terminus loop routing of State/Front/Broad/Third, it is suggested that this local route's downtown terminal point be shifted to the ultimately determined North Express Bus Terminal location.

Local routes approaching from the south (Routes 1, 4, 7, 8, and 16) have already been discussed in the course of the other half of these through route operations. In the same manner, local service from the southwest on Rich and Town Streets (Routes 3, 6, 15, and 17) have been previously discussed. It is suggested, however, that Routes 15 - Grove City and 17 - Greenlawn, which both currently utilize a Front/Long/Third/Town loop to terminate their downtown operations, be considered for termination at the North Express Bus Terminal.

In consolidating all of these local routes onto the proposed High Street transitmall, it will be necessary to identify appropriate stop locations under a "skip stop" or "A bus/B bus" operational scenario. Each block of the transitmall will, in general, accommodate two berthing areas of sufficient size to handle three or four buses at each location at any one time (the number varying on the mix of articulated versus standard size transit coaches anticipated to use each stop). It is felt most appropriate at this time not to explicitly identify which local buses become "A-group" buses and which become "B-group" buses since it is felt that this detailed operational decision is best left to the COTA staff to be made in the course of other service modifications and adjustments over the next three to five years. In particular, the decision on which individual routes to designate as "A" buses and which as "B" buses will be dependent upon the manner in which the route to route transfer patterns change once the route restructurings actually begin to take place. In general terms, major route to route transfer patterns should attempt to be accommodated within either the same berthing area or at a minimum in two immediately adjacent berthing areas along the same block face. This will help to minimize potential transferring passenger/vehicular traffic conflicts at the intersections where cross streets intersect the transitmall.

It would also probably be a generally beneficial policy to designate about one-half of the through routes as "A" buses and the remainder as "B" buses, so as not to load any stop locations with all through routes and the other stop location on the same block face being served by only CBD terminal routes. The number of berthing areas proposed for implementation as part of the preferred transitmall alternative should allow for maximum flexibility in developing local bus operational patterns at each stop. Indeed, it might even be advantageous for COTA to "field test" some of the suggested modifications for route terminal points in the downtown during the final planning and design stages of the transitmall. This will allow for the identification of any specific operational problems and the development of policies and procedures to alleviate any such constraints before the ultimate future downtown routing pattern is finalized.

Recommended Express Bus Routing Pattern

As illustrated on Figure 7-6, the proposed Year 2000 express bus routing plan in the downtown area is quite similar to that which exists today. Basically, the future express routing scheme continues to utilize the presence of two express bus terminals,

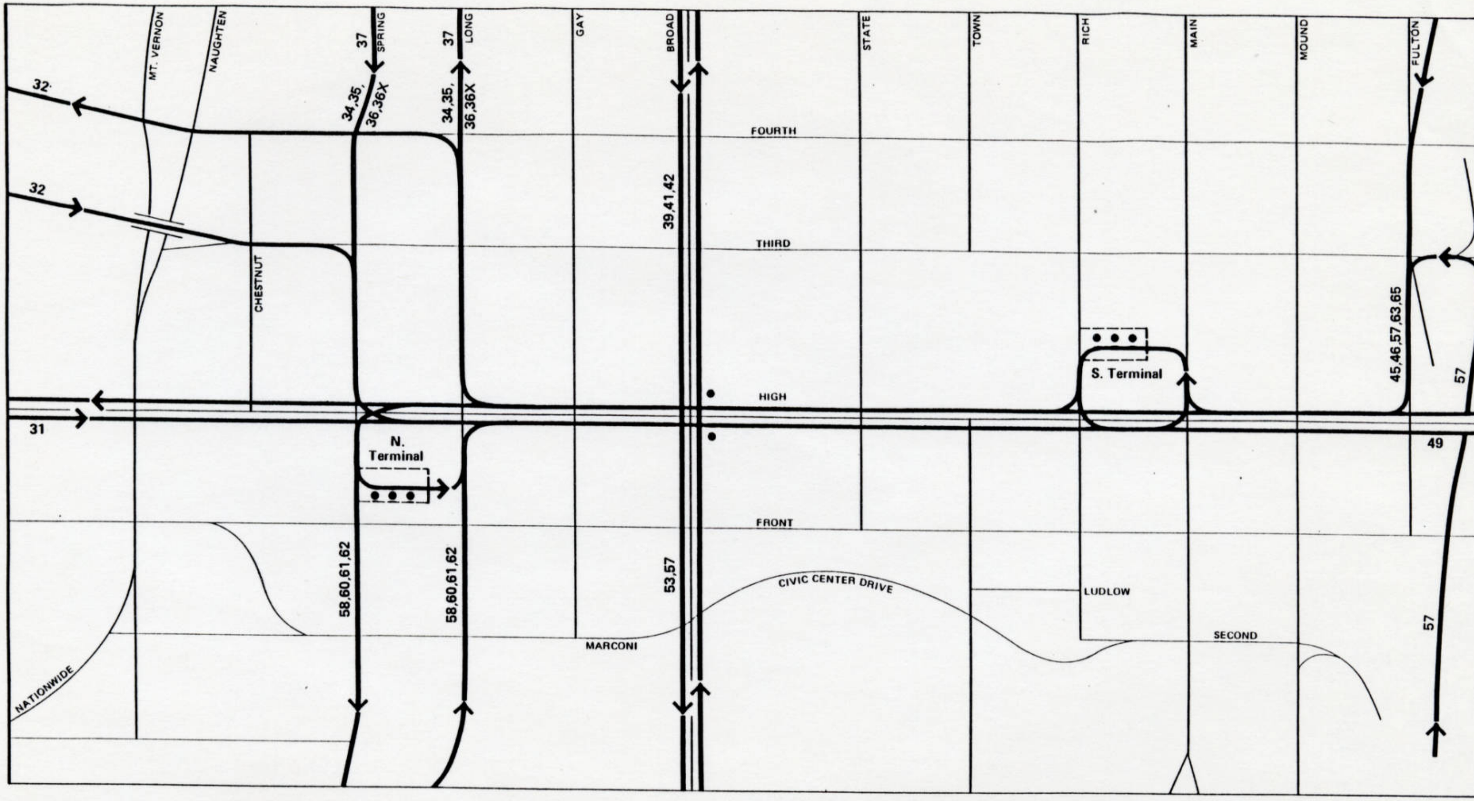

Figure 7-6
PROPOSED YEAR 2000 EXPRESS TRANSIT OPERATIONS

Legend: ▬ Express Bus Routings
33 COTA Route Number
● Major Bus Stop/Shelter Location

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one located to the north and one located to the south of the core of the central business district. As noted previously, it is likely that the existing north express bus terminal will be relocated in the next three to five years to a location north of Spring Street. Potential north terminal relocation sites which have been identified to date by COTA staff include the block bounded by Spring, Front, Chestnut, and High Streets and the Ohio Center parking area. Relocation of the north terminal to the block immediately north of the existing terminal location would likely have a minimal impact upon express bus routings into downtown. Conversely, should the new north terminal be implemented in the Ohio Center area in conjunction with the high occupancy vehicle ramp connections to I-670, it would be relatively difficult to re-route some of the express buses now using the existing north terminal to a terminal located at Ohio Center. Should the Ohio Center location be ultimately selected for the new terminal site, it is likely that many of those express routes now using the north terminal would have to utilize on-street loading locations in conjunction with other COTA local buses in order to minimize extremely circuitous routings.

In general, the proposed express bus routings would be as described below. Express routes approaching the Downtown area from the northwest (Routes 58, 60, 61, and 62) would continue to operate along their current routing, entering and leaving the downtown via Spring and Long Streets, utilizing High Street between this one-way street pair and endind at the South Express Bus Terminal point terminous of these routes. Express routes from the north (31 and 32) would similarly continue to utilize High Street and the Third Street/Fourth Street couple to enter the Columbus central area and then travel via High Street to the south terminal.

Express Routes 34, 35, 36, 36X, and 37 from the northeastern portion of the metropolitan region would continue to enter the central area via Cleveland Avenue and the I-71/Spring Street/Long Street interchange complex, then traverse the Downtown on High Street (as opposed to use of Third and Front) to the south terminal.

Express operations along East Broad Street (Routes 39, 41, and 42) and West Broad Street (Routes 53 and 57) would show little change from current routings. The only contemplated significant change to these routes would that of shifting the northbound Route 57 operations from Front Street over to northbound High Street.

Express routes from the southeastern quadrant of the region (Routes 45, 46, 63, and 65) would see their southbound operation shifted from Third Street to High Street but otherwise show no appreciable routing changes. Finally, Route 49 would continue to operate from areas south of the Downtown via High Street through the north and south express bus terminals.

Based upon the results of discussions with COTA staff, it appears possible to provide a limited number of additional express bus stops along High Street between the north and south express bus terminals which are presently at the edges of the downtown development core. In particular, it appears that an express bus boarding and alighting location can be defined along both the east and west sides of High Street just south of Broad Street. In the southbound direction, the express bus stop would be located as a farside stop in front of the new Huntington Bank building. The northbound express stop would be a nearside intersection stop at the Ohio State Capitol. With the addition of this major stop point at the "transit centroid" of the region, no current express bus riders would have greater than a two-block walk to their ultimate destination, a significant improvement over the situation which currently exists with the majority of express riders being able to board only at either the north or south express bus terminals.

Should the decision be made to relocate the North Express Terminal to the Ohio Center Complex, it would be necessary to designate one of the local stops in the area between Spring Street and Nationwide Boulevard as an additional express bus stop (similar to that which would be done at the Broad/High intersection). This would ensure that walking distances for current north express terminal users is held to the current distance. It may also be necessary to designate one of the berthing areas on High Street just north of, or just south of, Long Street as an express bus stop as well should the current north terminal be relocated to Ohio Center.

An important consideration in designating joint local and express bus berthing areas will be an analysis to determine that the number of express and local buses anticipated to use a particular berthing area during the peak period can be adequately accommodated at these locations. It may be necessary to adjust the express bus schedules slightly to reduce the probability of two or three express buses arriving at a High Street berthing area at the same time that two or three local buses are boarding passengers at the same location. Given the time savings associated with express bus service once the routes have crossed the Innerbelt, it would not be unrealistic to schedule express buses five to ten minutes after the peak group of local buses in order to reduce the probability of such berthing area overload conditions.

ASSESSMENT OF RESULTANT HIGHWAY SYSTEM

As stated previously, the recommended transitmall would formally operate between Main and Long Streets. However, in the transition zone north of Long Street, only buses and taxis would operate northbound between Long and Spring Streets. All traffic other than buses and taxis would be restricted from using the "mall" during the hours of 7:00 AM to 6:30 PM on normal weekdays. All traffic would be permitted to use the "mall" during other hours of the day and on weekends and holidays. This time management of the transitmall will provide 24-hour activity on High Street thereby enhancing the life and character of the street and its environs.

With the closure of High Street to general traffic during the defined hours, southbound traffic could exit High Street at Nationwide Boulevard, Chestnut Street, Spring Street, or Long Street. Traffic desiring to enter High Street in this section could do so at Spring Street, Chestnut Street, or Nationwide Boulevard. Traffic would be denied access to High Street from Long Street due to the high volume of buses turning left at Spring Street to access the northern express bus terminal (if it stays in this location).

Northbound traffic could exit High Street at Fulton, Mound, or Main Streets. Traffic desiring to enter High Street in this section could do so at these same three streets.

In order to determine the feasibility of closing High Street to general traffic during the day, Year 2000 traffic volumes were assigned to the resultant downtown street system. The projected AM and PM peak hour volumes, as they enter and exit the corridor, are illustrated in Figures 7-7 and 7-8, respectively. Figures 7-9 and 7-10 show the increases in AM and PM peak hour volumes on parallel streets in the corridor due to the proposed transitmall. As can be seen, the volume increases on Marconi/Civic Center, Front, Third, and Fourth during the AM peak hour are relatively minor. During the PM peak hour, traffic volume increases on the parallel streets is much greater. The most significant impact occurs on Third and Fourth Streets where over 500 vehicles are added to both streets near Spring and Long. Near Main Street, approximately 860 vehicles would be added to Third Street.

While the traffic impact of the proposed transitmall appears to be ominous, the alternatives must be carefully considered. If the objective is to provide adequate transit service in the downtown in the future, then two north-south exclusive transit lanes are required in each direction. If exclusive transit lanes are not provided, then there would be a requirement for three or four bus lanes in each direction. By not providing the exclusive transit lanes on High Street, as defined in the preferred plan, then bus movements would have to be shifted to parallel streets. This would have a greater detrimental impact on traffic flow than the proposed transitmall.

Also, capacity analyses of the intersections within the corridor indicate that the intersection levels of service will not significantly deteriorate beyond those determined for the Year 2000 base case condition. The projected PM peak hour traffic volumes at the corridor intersections are shown in Figure 7-11. The recommended lane usage at the intersections, assuming the proposed transitmall, are shown in Figure 7-12. The results of the intersection capacity analyses are shown in Table 7-1 and Figure 7-13.

All intersections will (or can be made to) operate at acceptable levels of service with the exception of five intersections. Four of these five intersections were shown to operate at unacceptable levels of service in the assessment of the Year 2000 base case conditions (Chapter 5).

The additional intersection which will experience a low level of service is the intersection of Third and Broad Streets. When the urban design plan was prepared, the separate right turn lane from Broad Street to Third Street was eliminated in conformance with the Capitol Square plan. Given the projected low level of service, it will probably be necessary to provide an exclusive right turn lane (lengthened from its present dimension) on eastbound Broad Street. With this right turn lane and a through-right optional lane, the intersection level of service can be raised to "D".

Based upon the results of this study, the preferred transportation alternative is functional. It has the least impact on the highway system and it meets the criteria for providing future transit requirements. Therefore, it is recommended that the proposed four-lane transitmall on High Street, as described previously, be adopted as the most reasonable transportation alternative for the High Street corridor. Assuming the adoption of this alternative by the Project Advisory Committee, a subsequent report will document the detailed aspects of the plan -- including cost implications and funding requirements. In addition, a separate Environmental Impact Assessment report will be prepared as required by UMTA as part of the grant application.

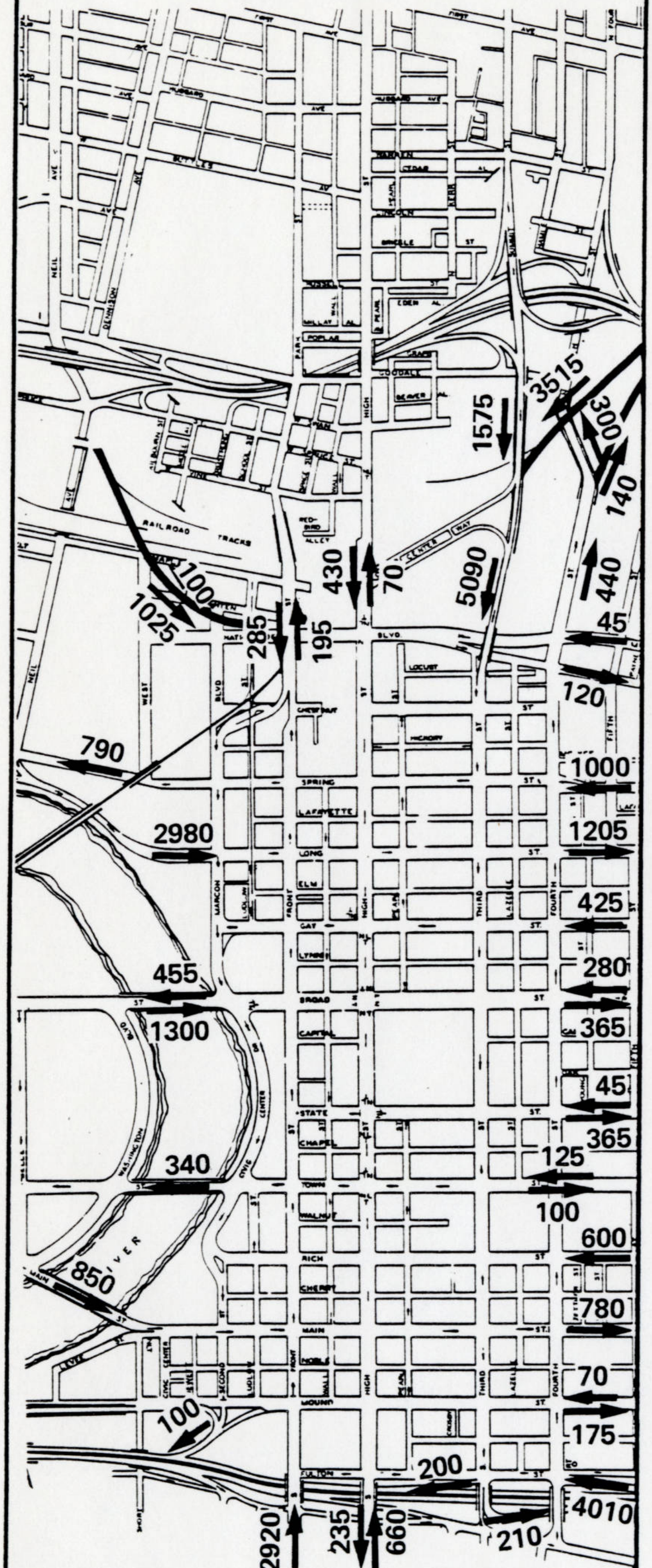

Figure 7-7
YEAR 2000 AM PEAK HOUR TRAFFIC DEMAND
(WITH TRANSITMALL)

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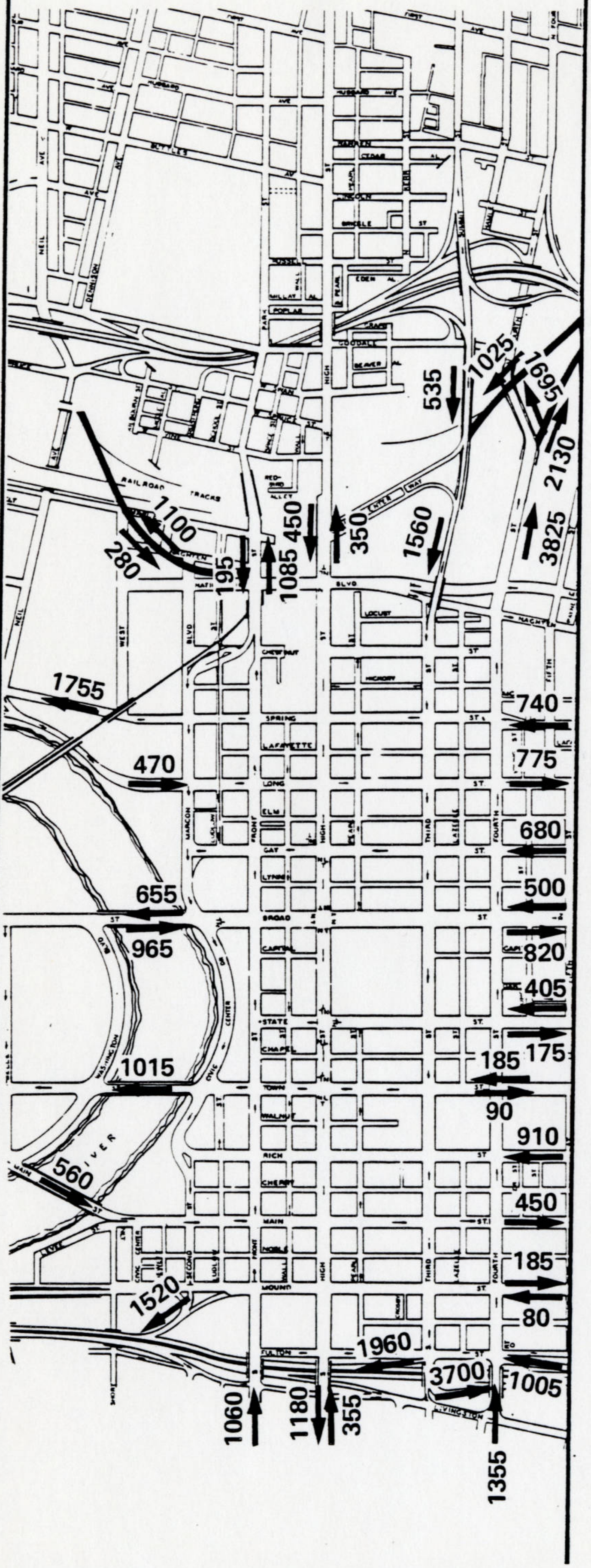

Figure 7-8
YEAR 2000 PM PEAK HOUR TRAFFIC DEMAND
(WITH TRANSITMALL)

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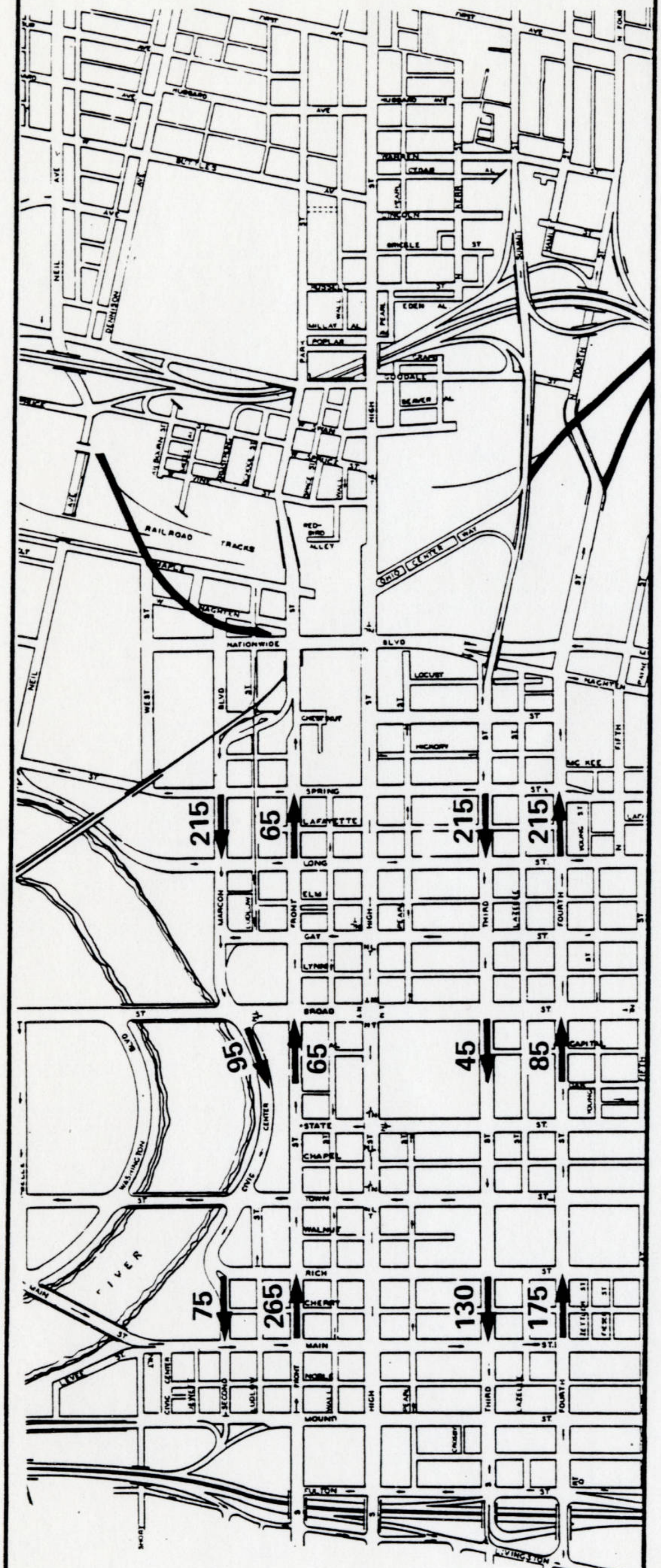

Figure 7-9

INCREASES IN YEAR 2000 TRAFFIC VOLUMES ON PARALLEL STREETS DUE TO THE PROPOSED TRANSITMALL

AM PEAK HOUR

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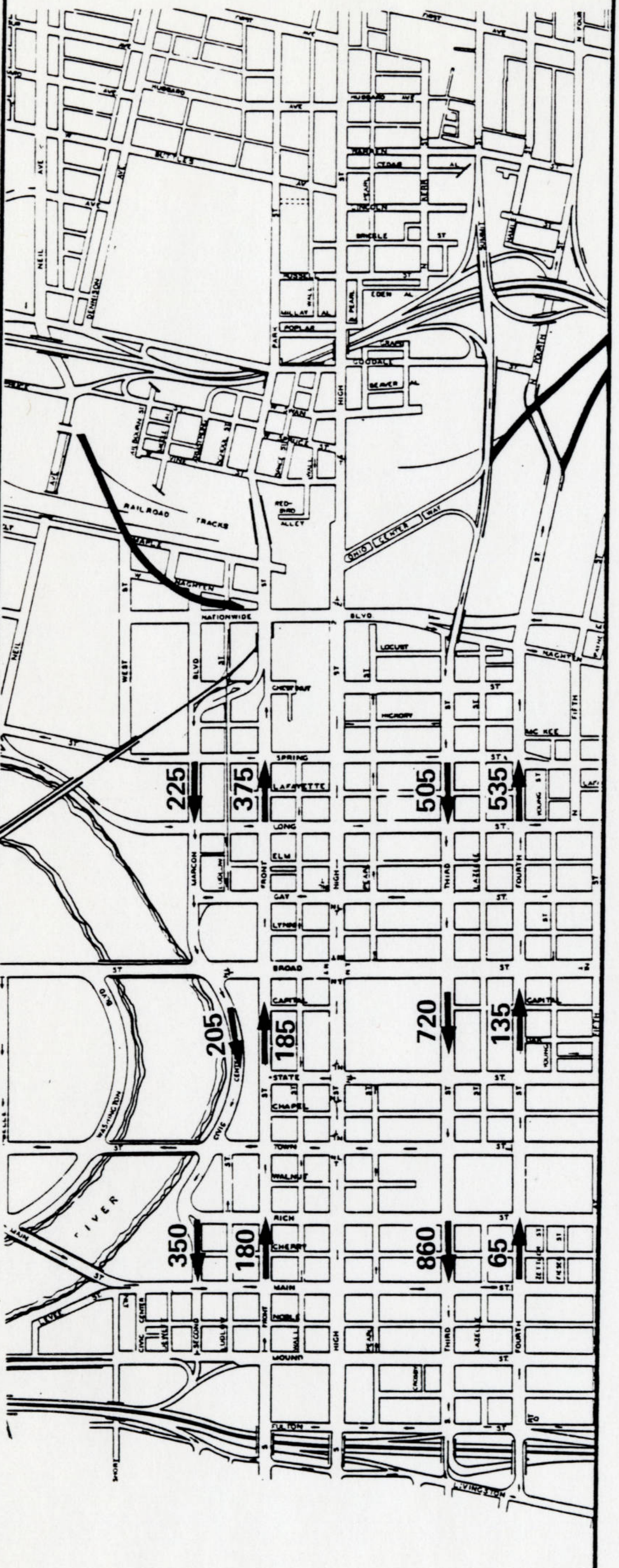

Figure 7-10
INCREASES IN YEAR 2000 TRAFFIC VOLUMES
ON PARALLEL STREETS DUE TO
THE PROPOSED TRANSITMALL

PM PEAK HOUR

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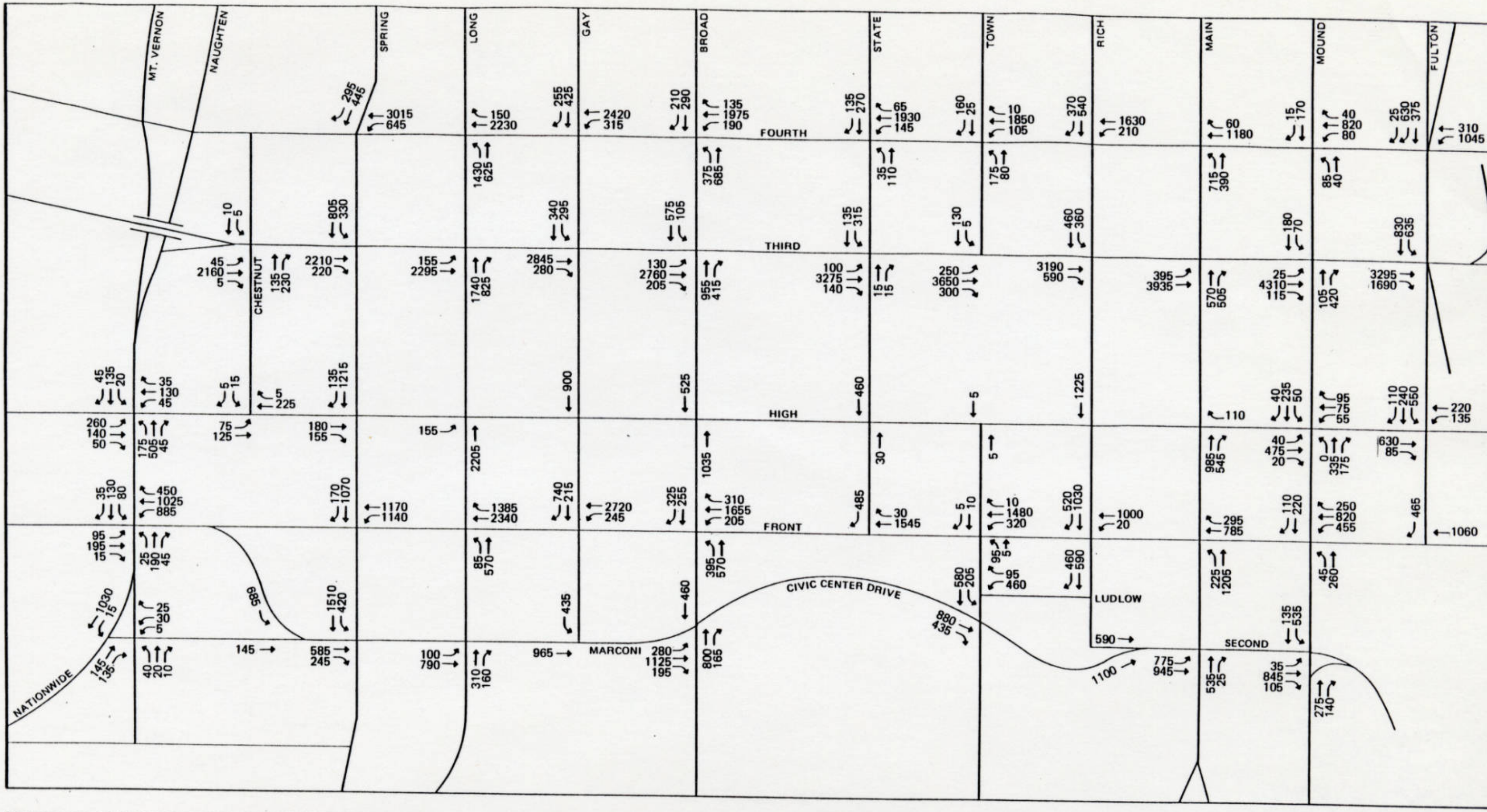

Figure 7-11

PM PEAK HOUR TRAFFIC VOLUMES AT INTERSECTIONS
YEAR 2000, WITH TRANSITMALL

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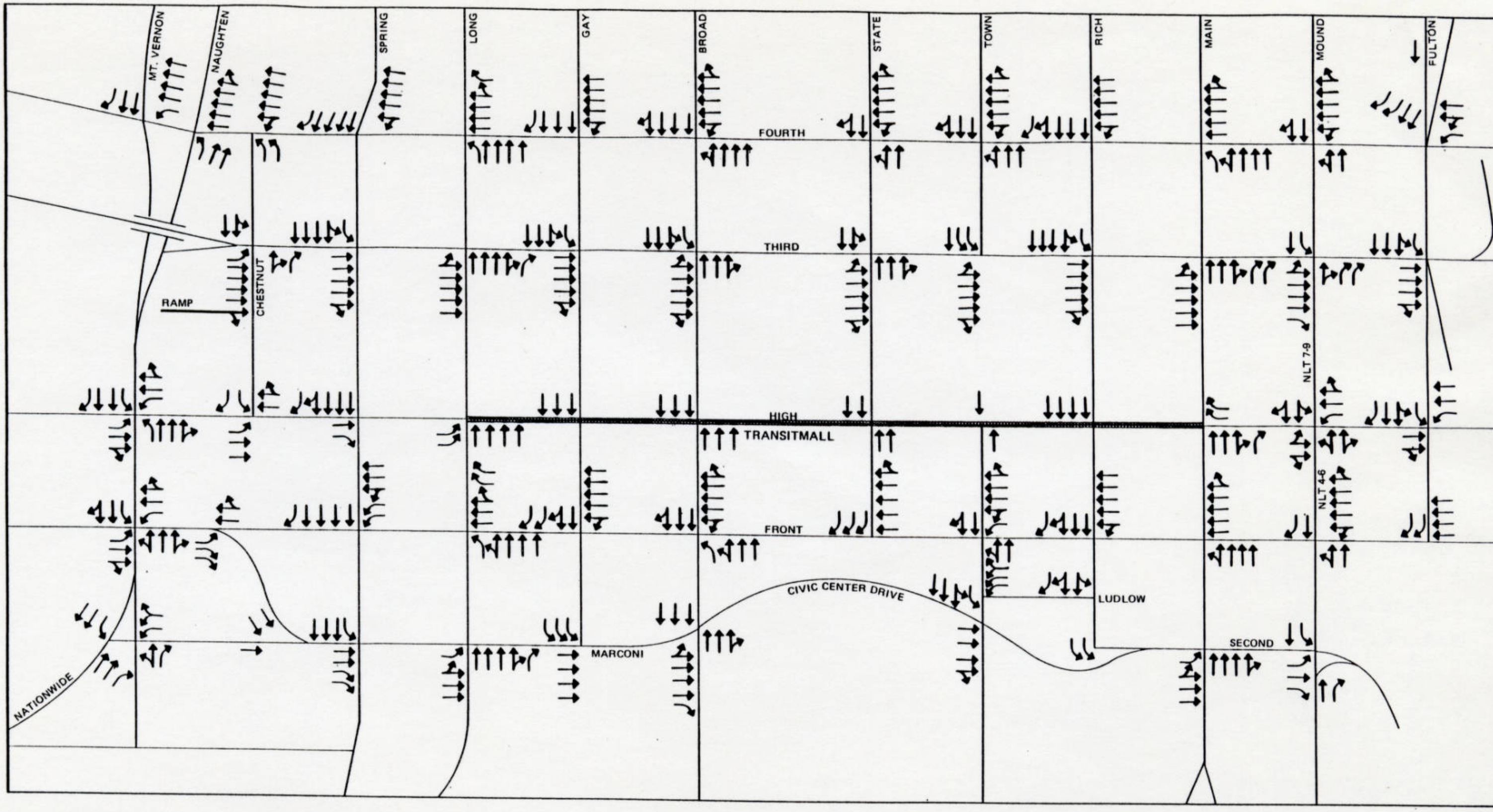

Figure 7-12
RECOMMENDED LANE USAGE AT INTERSECTIONS FOR YEAR 2000 WITH TRANSITMALL

(General Traffic; Bus and Taxi Movements to and from the Transitmall Are Not Shown)

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Table 7-1

INTERSECTION LEVELS OF SERVICE
PM PEAK HOUR, YEAR 2000 WITH TRANSITMALL

Intersection	Level of Service	Intersection	Level of Service
Second @ Mound	F	Third @ Fulton	F
Second @ Main	C+	Third @ Mound	F 1/
Civic Center @ Town	A	Third @ Main	D 1/
Marconi @ Broad	A	Third @ Rich	D
Marconi @ Long	A	Third @ Town	D+ 1/
Marconi @ Spring	D+	Third @ State	D+ 1/
Front @ Mound	A	Third @ Broad	F 1/
Front @ Main	A	Third @ Gay	A
Front @ Rich	A	Third @ Long	D 1/
Front @ Town	A	Third @ Spring	A 1/
Front @ State	A	Fourth @ Mound	A
Front @ Broad	C 1/	Fourth @ Main	D
Front @ Gay	D+	Fourth @ Rich	A
Front @ Long	D+ 1/	Fourth @ Town	A
Front @ Spring	D+	Fourth @ State	A
Front @ Nationwide	D 2/	Fourth @ Broad	D 1/
High @ Fulton	B 3/	Fourth @ Gay	A
High @ Mound	A	Fourth @ Long	D 1/
High @ Main	C	Fourth @ Spring	D
High @ Rich	A		
High @ Town	A		
High @ State	A		
High @ Broad	A		
High @ Gay	A		
High @ Long	C 1/		
High @ Spring	A		
High @ Nationwide	A		

1/ Timing plan optimized.

2/ "F" level of service for left turns on the north, east, and south approaches.

3/ "F" level of service for the northbound left turn of 135 vehicles.

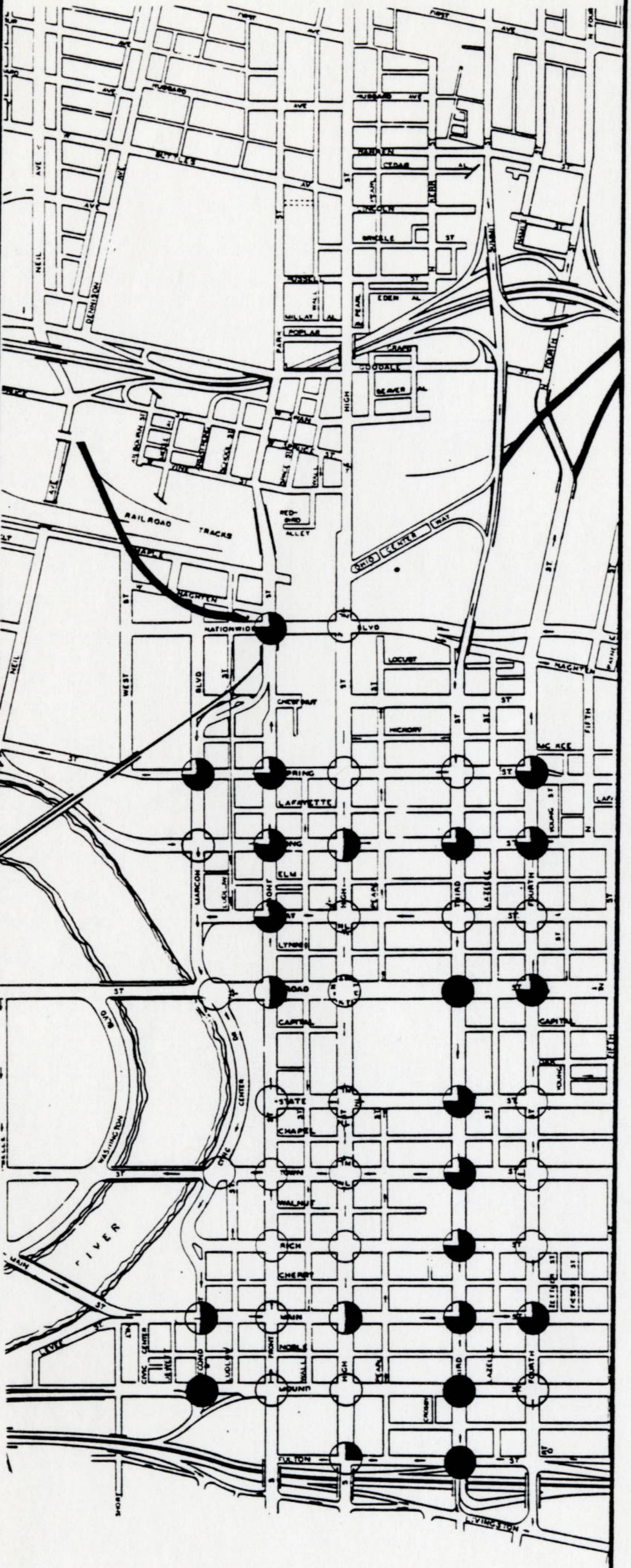

Figure 7-13

INTERSECTION LEVEL OF SERVICE,
PM PEAK HOUR,
YEAR 2000 WITH TRANSITMALL

LEVEL OF SERVICE

A ○
B ◔
C ◑
D ◕
E ●

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