DOWNTOWN TRAFFIC STUDY
Middletown, Connecticut

Prepared For

PLANNING AND ZONING DEPARTMENT
MIDDLETOWN, CONNECTICUT

By

WILBUR SMITH ASSOCIATES

August, 1989

WILBUR
SMITH
ASSOCIATES

ENGINEERS • ECONOMISTS • PLANNERS

135 COLLEGE STREET • P.O. BOX 9412 • NEW HAVEN, CT 06534 • (203) 865-2191 • FAX 203-624-0484 • TELEX 650-269-1754

August 2, 1989

Mr. George Reif
Planning Director
City of Middletown
202 Municipal Building
Middletown, Connecticut 06457

RE: Downtown Traffic Study, Middletown, Connecticut

Dear Mr. Reif:

In accordance with our March 8, 1989, agreement and on-going discussions with you and other key municipal officials, we are pleased to submit this comprehensive traffic assessment and needs study for downtown Middletown. This report evaluates existing problem areas and recommends near term improvements as well as long range transportation strategies.

We trust that this report will provide you with the necessary technical information and data to allow for a comprehensive review and a determination as to how the City would like to proceed with their Master Plan.

If during your review of the transmitted materials you have any questions or if it would be appropriate to get together to discuss these in greater detail, please feel free to contact us at anytime.

Respectfully submitted,

Robert P. Jurasin

Robert P. Jurasin, P.E.
Regional Vice President

RPJ:las
Registered Professional Engineer
Connecticut Number 09626

CONTENTS

ILLUSTRATIONS

TABULATIONS

Chapter 1
INTRODUCTION

Located along the banks of the scenic Connecticut River, Middletown, Connecticut was named for its geographic location within the State. Middletown is located approximately 15 miles due south of Hartford, and approximately 9 miles east of Meriden, placing it near the actual center of the State.

Recent development trends, both within Middletown and in the immediate neighboring communities, have raised concern that existing roadway infrastructure in the central business district (CBD) of Middletown may be incapable of supporting acceptable traffic operations. In recent years, the Middletown area has experienced significant growth, both within the CBD itself, as well as adjacent portions of the City. These development trends are expected to continue and will surely impact traffic operations within the CBD.

The focus of concern is the CBD, as illustrated in Figure 1, and consists primarily of two travel corridors: Main Street from Rapallo Avenue to Union Street/Pleasant Street; and Washington Street (Connecticut Route 66/S.R. 545) from High Street to DeKoven Drive. The intersections considered in the study are specified in Figure 1.

It is generally recognized that the ability to develop properties in this area, and adjacent portions of the City, may be constrained by traffic congestion if no improvements are made. Traffic congestion already occurs in parts of the study area and, although some roadway improvements are planned as

part of individual (private) land development projects and State projects, there currently exists no comprehensive traffic management plan for the City of Middletown.

The need for such a program was recognized by the City of Middletown in response to current traffic problems within the identified study area, in order to provide for all anticipated land development projects. In addition, it was felt that such a study should also coordinate implementation of improvement projects.

The initial sections of this report identify existing traffic patterns, turning movements, accident patterns, pedestrian operations, and points of congestion or substandard operations. The latter sections address anticipated 1994 traffic conditions and present roadway improvement programs for existing problem areas as well as projected near term and long range future operational deficiencies.

Chapter 2
EXISTING INFRASTRUCTURE

This portion of the report describes the roads, traffic controls, and land uses within the study area as they exist and operate today, and summarizes the data collection efforts. These data will form the basis for subsequent analysis of future conditions, and the development of possible future roadway improvement strategies.

Description of Roads

The primary means of entering and exiting Middletown is via Connecticut Route 66, which consists of Washington Street (west of Main Street) and Main Street (north of Washington Street via the Arrigoni Bridge).

Washington Street is a two to five-lane major urban arterial which operates with a posted speed limit of 30 miles per hour (mph) in the study area. This relatively straight thoroughfare provides two travel lanes in both the eastbound and westbound directions, with exclusive turn lanes at Main Street only. Parking turnouts are located along the eastbound curbline of Washington Street at several locations. East of Main Street, Washington Street narrows, providing only one travel lane in either direction.

Main Street is the primary north/south arterial in the CBD. The most notable characteristic of Main Street is its width, measuring nearly 90 feet from curb to curb at several locations, which in part serves to accommodate angled,

on-street, metered parking along most of its length. Main Street provides two travel lanes in either direction, with exclusive turn lanes only at the Union Street/Pleasant Street intersection. At several locations, at-grade mid-block pedestrian crosswalks are provided. This road operates with no posted speed limit.

High Street, located west of and parallel to Main Street, operates with a posted speed limit of 25 mph. On-street parallel parking is permitted in several mid-block locations along its generally straight, level course. One travel lane is provided in either direction, with exclusive turn lanes at the Washington Street and Church Street intersections.

Broad Street, located west of and parallel to Main Street, operates as a secondary collector road, which connects Church Street on the south and Washington Street on the north. Broad Street operates with a posted speed limit of 25 mph, and provides on-street parallel parking at several mid-block locations. Single lanes measuring approximately 15 feet wide provide two-directional flow.

Court Street is located south of and parallel to Washington Street, connecting DeKoven Drive to the east and High Street to the west. West of Main Street, Court Street provides one-way westbound movement, whereas to the east of Main Street, two-way directional movement is provided. Court Street measures approximately 25 to 30 feet wide, and several locations along Court Street afford on-street parallel parking.

College Street, located south of and parallel to Court Street, provides two-lane, two-directional (east/west) movement from DeKoven Drive to Broad Street. From Broad Street to High

Street, one-way eastbound travel is permitted. On-street parallel parking is permitted at several mid-block locations.

Church Street is an east/west directional road located south of College Street. Two directional movement is provided by single travel lanes in either direction, with exclusive turn lanes provided at the Broad Street and Pleasant Street/South Main Street intersections only. Church Street operates with a posted speed limit of 25 mph, and on-street parallel parking permitted along most of its straight hilly course.

South Main Street is a major urban arterial which operates with a posted speed limit of 30 mph and provides on-street, parallel, metered parking along most of its length. At the southern portion of the study area, primary movement into and out of the CBD is accomplished by use of South Main Street. At the Connecticut Route 17 rotary, South Main Street provides two travel lanes in each direction, and widens to provide a five-lane roadway section measuring approximately 60 feet wide immediately south of Church Street.

Pleasant Street, immediately east of this location, is a continuation of the five-lane (South Main Street) roadway section, which also operates with a posted speed limit of 30 mph. Parking turnouts provide metered parallel parking along Pleasant Street.

Union Street is aligned opposite Pleasant Street, and provides a two-lane approach to Main Street. Two-directional travel is provided by Union Street, which also accommodates on-street parallel parking operations, and measures approximately 60 feet wide at Main Street.

DeKoven Drive is a two-lane road which operates with a posted speed limit of 30 mph. This is an alternate north/south travel route through the CBD, located between Main Street to the west and Connecticut Route 9 to the east. Direct access to/from Connecticut Route 9 is provided along DeKoven Drive at Washington Street; south of College Street (at Metro Lane); and, Union Street. On-street parking is prohibited on DeKoven Drive. Rapallo Avenue also provides an alternate north/south travel route through the CBD, and is essentially an extension of DeKoven Drive north of Washington Street.

Grand Street is offset with Rapallo Avenue at Main Street, forming a four-leg intersection measuring approximately 30 feet wide. Grand Street provides two-lane, two-directional movement, and accommodates on-street parallel parking.

North of Washington Street, Liberty Street, Ferry Street, and Green Street provide one-directional movement away from Main Street. These three streets all measure approximately 20 feet wide and accommodate on-street parallel parking operations.

Existing Traffic Control Devices

Nearly all of the intersections under consideration in this study operate under traffic signal control. Along Washington Street, the signalized intersections at High Street and Broad Street operate as part of a larger interconnected signal system. Both of these intersections operate as semi-actuated signals, featuring vehicle loop detectors embedded in the pavement on the minor street approaches.

A second interconnected traffic signal system operates along Main Street, and includes existing signals at Grand Street/

Rapallo Avenue, Liberty Street, Washington Street, Court Street, College Street, Church Street, and Union Street/Pleasant Street/Crescent Street. All of the signals in this system are of the fixed-time type, which operate without the benefit of vehicle loop detection and rely on preset timing patterns.

In both signal systems, a fire pre-emption phase is provided which, when activated, initiates a series of signal timing changes along the subject arterial to provide more favorable traffic flow for emergency vehicles. At the Washington Street/DeKoven Drive intersection, a railroad pre-emption feature is provided. This is activated with the approach of a train on the rail line located immediately east of and adjacent to DeKoven Drive.

Pedestrian push buttons and crosswalks are standard features of all signalized intersections studied. As mentioned earlier, several mid-block pedestrian crosswalks are provided, such that vehicles are required to stop once a pedestrian has initiated a crossing maneuver. At the Main Street/Liberty Street intersection, mainline traffic on Main Street is stopped only with the use of the pedestrian push button. It was observed that a uniformed crossing guard has been deployed to supplement the pedestrian push button provided.

Several intersections within the study area currently operate under other types of traffic control. These locations are as follows:

- Court Street at Broad Street--Three-way STOP-sign control;

- Union Street at River Road and Harbor Drive--Yield control on the River Road approach; and,

- The Connecticut Route 17/South Main Street/Loveland Street rotary--Loveland Street, southbound South Main Street and Mill Street approaches under STOP-sign control.

Land-Use Description

A diverse mix of land uses are found within the Middletown CBD. Wesleyan University occupies a large tract of land to the west of High Street and south of Washington Street, with the standard compliment of college-use buildings. On the east side of High Street, opposite the University, residential land use prevails, with many of the existing buildings named as designated historical structures.

Moving eastward through the CBD, the areas to the west of Broad Street are primarily residential, while the tract of land located between Broad Street and Main Street supports a mix of residential and commercial land use. Main Street frontage accommodates dense commercial land use with a mix of retail, public service, restaurant, and office uses.

South of Court Street and east of Main Street, predominant land use is large-scale retail (Sears, Waldbaums, Goodyear Service). Further south and east, smaller-scale retail and industrial land uses exist (Water Pollution Abatement plant, Peterson Oil Co., State Armory, Pelton's Drugs, etc.).

Southernmost in the study area, Middlesex Memorial Hospital is located on Crescent Street, near the South Congregational Church, Zion Baptist Church, St. Mary's Church, and the First Methodist Church within the immediately adjacent blocks. Also

located in this sector are several professional and medical office buildings in support of the nearby Hospital.

Traffic Volumes

An extensive data collection program was undertaken in an effort to establish current traffic volumes within the Middletown CBD. These traffic volumes will serve as a basis for projections of future traffic volumes, and the assessment of appropriate traffic engineering improvement strategies.

Manual turning movement counts were conducted during the week of April 10-14, 1989, during the periods of peak commuter activity. Typically, these periods fall between the hours of 7:00 to 9:00 A.M., and from 4:00 to 6:00 P.M. Concurrent with these volume counts, vehicle classification (passenger cars versus trucks/busses) were recorded in order to establish the composition of existing traffic. Along with these and other technical data collected relating to traffic flow, observations of queuing and delay were made, as well as notation of other existing operational deficiencies.

The aforementioned manual turning movement counts were conducted at the following intersections, which are located on Figure 1:

- Connecticut Route 66 (Washington Street) at High Street;
- Connecticut Route 66 (Washington Street) at Broad Street;
- Connecticut Route 66 (Washington Street) at Main Street;
- Washington Street at DeKoven Drive;

- Connecticut Route 66 (Main Street) at Rapallo Avenue;
- Connecticut Route 66 (Main Street) at Grand Street;
- Connecticut Route 66 (Main Street) at Green Street;
- Connecticut Route 66 (Main Street) at Liberty Street;
- Connecticut Route 66 (Main Street) at Ferry Street;
- Main Street at Court Street;
- Main Street at College Street;
- Main Street at Pleasant Street, Union Street, and Crescent Street;
- Union Street at DeKoven Drive;
- Union Street at River Road and Harbor Drive;
- Broad Street at Court Street;
- Broad Street at Church Street;
- Church Street at High Street;
- Church Street at Pleasant Street and South Main Street; and,
- The Connecticut Route 17/Loveland Street/South Main Street/Mill Street rotary.

Although some of the intersections exhibited slightly different peak-hour periods, a single common peak hour for each of the morning and evening commuter peaks was determined. These time periods reflect the greatest overall downtown traffic demand. The traffic volumes for existing 1989 A.M. peak hour (7:45 - 8:45 A.M.) and P.M. peak hour (4:15 - 5:15 P.M.) are graphically illustrated in Figures 2 and 3.

Accident Experience

An analysis of accident occurrence and contributory causes was undertaken to identify high accident locations within the study area, determine what types of accidents are most prevalent, and formulate corrective strategies to mitigate the future potential of incidents. Accident data was provided by the Connecticut Department of Transportation (ConnDOT), Bureau of Planning, for the most recent three year period from October 1, 1985 to September 30, 1988.

ConnDOT accident reports include only those accidents which involve personal injury or $1,000 in property damage. Table 1 summarizes ConnDOT accident experience at intersections and along roadway segments within the study area. These data indicate that the segment of Washington Street from High Street to Main Street, accounts for more than half of all reported accidents.

A relatively stable trend of occurrence frequency has been experienced throughout the study area, with yearly accident totals ranging from 57 to 71 incidents. Also provided in Table 1 is the number of reported injuries for each location studied. These data indicate that, for the study area as a whole, a downward trend in the number of injuries per year is occurring.

Table 1
ACCIDENT ANALYSIS
Downtown Traffic Study
Middletown, Connecticut

ROADWAY SEGMENTS	NUMBER OF REPORTED ACCIDENTS AND (INJURIES) PER YEAR (1) 1985-1986	1986-1987	1987-1988	1985-1988 TOTAL	CONTRIBUTORY CAUSES AS PERCENTS OF REPORTED TOTALS Follow Too Close	Failure to Grant ROW	Traffic Control Violation	Driver or Pedestrian Inattentive	Other (2)
Along Washington Street									
High Street to Broad Street	9 (4)	2 (0)	6 (1)	17 (5)	11.8	47.0	29.4	5.9	5.9
Broad Street to Main Street	3 (0)	2 (1)	4 (1)	9 (2)	0.0	55.6	0.0	11.1	33.3
Main Street to Rapallo Avenue/ DeKoven Drive	3 (2)	0 (0)	2 (1)	5 (3)	0.0	0.0	0.0	40.0	60.0
Along Main Street									
Washington to Grand Street	3 (1)	3 (0)	3 (1)	9 (2)	0.0	75.0	0.0	12.5	12.5
INTERSECTIONS									
Washington Street at:									
High Street	15 (12)	18 (21)	21 (14)	54 (47)	20.4	44.4	14.8	14.8	5.6
Broad Street	4 (1)	1 (0)	4 (0)	9 (1)	22.2	11.1	11.1	11.1	44.5
Main Street	6 (6)	9 (4)	9 (7)	24 (17)	37.5	33.3	8.3	12.5	8.3
Rapallo Avenue/ DeKoven Drive	3 (3)	4 (0)	7 (6)	14 (9)	35.7	21.4	28.6	14.3	0.0

(Continued)

Table 1 (Continued)
ACCIDENT ANALYSIS
Downtown Traffic Study
Middletown, Connecticut

ROADWAY SEGMENTS	NUMBER OF REPORTED ACCIDENTS AND (INJURIES) PER YEAR (1) 1985-1986	1986-1987	1987-1988	1985-1988 TOTAL	CONTRIBUTORY CAUSES AS PERCENTS OF REPORTED TOTALS Follow Too Close	Failure to Grant ROW	Traffic Control Violation	Driver or Pedestrian Inattentive	Other (2)
Main Street at:									
Rapallo Avenue/ Grand Street	11 (6)	4 (2)	5 (4)	20 (12)	30.0	50.0	5.0	10.0	5.0
Court Street	3 (1)	8 (7)	3 (2)	14 (10)	21.4	64.3	14.3	0.0	0.0
Pleasant Street/ Crescent Street	5 (4)	5 (5)	3 (2)	13 (11)	0.0	46.2	38.4	7.7	7.7
Broad Street at Court Street	2 (6)	1 (1)	4 (0)	7 (7)	0.0	57.1	28.6	14.3	0.0
TOTAL	67 (46)	57 (41)	71 (39)	195 (126)					

(1) Data provided by ConnDOT Bureau of Planning Research and Data; one year periods from October 1 to September 30 of each year.

(2) Includes mechanical failure, driver on wrong side of road, improper lane change, drivers view obstructed, and unknown or conflicting stories.

SOURCE: Wilbur Smith Associates.

The location with the highest three-year total number of reported accidents is the Washington Street/High Street intersection, at which 54 accidents involving 47 injuries were recorded. The data indicates that the number of incidents at this location is increasing steadily, with nearly half (44.4 percent) of all accidents due to a motorist's failure to grant opposing traffic the right-of-way.

A second accident-prone location is the Main Street/ Washington Street intersection, which has experienced a three-year total of 24 accidents involving 17 injuries. Approximately 37 percent of all accidents at this location were caused due to a motorist following the preceding vehicle too closely, 33 percent attributable to a failure to grant right-of-way, and nearly 13 percent due to pedestrian or motorist inattentiveness. These statistics are highly indicative of congested peak-hour conditions, as are normally experienced in the CBD environment.

ConnDOT also provides statewide rankings of high accident locations at intersections and roadway segments located on State highways. For all locations, the Suggested List of Surveillance Study Sites (SLOSSS) report compares actual observed accident rates for each two-year period with a mathematically-derived statistical rate which could be expected for any particular roadway or intersection type. If the actual observed rate is determined to be greater than that which could be expected normally, then the subject location is included in the SLOSSS report.

Several locations within the study area are cited in the most recent SLOSSS report, which is based on 1985-1987 accident data. These locations are listed below, along with their statewide ranking. The Connecticut Route 17 Rotary, for example, is the "36th worst" location in the State, relative to accident occurrence.

LOCATION	RANKING
• Connecticut Route 17 rotary intersection	36
• Connecticut Route 9 at DeKoven Drive	456
• Connecticut Route 66 at Broad Street	1,200
• Connecticut Route 66 at High Street	1,317

Chapter 3
EVALUATION METHODOLOGY

The adequacy of the roadway system was evaluated to determine the need for improvements. Volume/capacity relationships of the roadway network in the site environs were tested using the analysis techniques described in the 1985 Highway Capacity Manual, "Special Report 209," issued by the Transportation Research Board, National Research Council, Washington, D.C.

The capacity of a roadway or intersection is defined as "the maximum rate of vehicles which have a reasonable expectation of passing a given section of a lane or roadway during a given time period under prevailing conditions." Prevailing conditions refer to physical operating conditions and traffic characteristics. Specific variables which affect capacity include roadway alignment, number and width of lanes, one-way or two-way operations, type of traffic control measures, turning movements, percentages of truck and bus traffic, metropolitan area size, traffic peaking characteristics, and parking regulations.

Level of Service Definitions - A study of capacity is important in determining the ability of a specific roadway or intersection to accommodate traffic under various levels of service. Level of service is a qualitative measure describing driver satisfaction with a number of factors that influence the degree of traffic congestion. These factors include speed and travel time, traffic interruption, freedom of maneuverability, safety, driving comfort and convenience, and delay.

There are six levels of service describing flow conditions. The highest, Level of Service A, describes a condition of free flow, with low volumes and high speeds. There is little or no restriction in maneuverability due to the presence of other vehicles, and drivers can maintain speeds with little or no delay. This occurs when vehicle progression is extremely favorable, and most vehicles arrive during the green phase of a traffic signal.

Level of Service B represents a stable traffic flow with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane operations.

Level of Service C, which is normally utilized for design purposes, describes a stable condition of traffic operation. It entails moderately restricted movements due to higher traffic volumes, but traffic conditions are not objectionable to motorists.

Level of Service D, acceptable for traffic operation in urban environments and during peak hours of traffic flow, reflects a condition of more restrictive movement for motorists. Queues and delays may occur during short peaks, but lower demands occur often enough to permit clearance of developing queues, thus preventing excessive backup. At Level of Service D, the influence of congestion becomes more noticeable and longer delays may result from unfavorable vehicle progression.

Level of Service E is defined as the actual capacity of the roadway or intersection, and involves delay to all motorists due to congestion. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor vehicle progression.

The lowest, Level of Service F, is described as forced flow and is characterized by volumes greater than the theoretical roadway capacity. Complete congestion occurs and, in extreme cases, the volume passing a given point drops to zero. This is generally considered unacceptable traffic operations.

Levels of service criteria for signalized intersections is quantified in terms of delay, which may be used as a measure of driver discomfort, excess fuel consumption, and lost travel time. Specifically, level of service criteria, stated in terms of the average "stopped" delay per vehicle, are as follows:

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (seconds)
A	5.0 or less
B	5.1 - 15.0
C	15.1 - 25.0
D	25.1 - 40.0
E	40.1 - 60.0
F	Greater than 60.0

Level of Service criteria for unsignalized intersections, however, is given in terms of reserve or unused capacity of the approach lane in question under STOP control.

LEVEL OF SERVICE	RESERVE CAPACITY (vehicles per hour)
A	400 or more
B	300 - 399
C	200 - 299
D	100 - 199
E	0 - 99
F	Demand exceeds capacity of lane

These levels of service are defined by the 1985 Highway Capacity Manual, "Special Report 209," published by the Transportation Research Board, National Academy of Sciences.

Chapter 4
EXISTING TRAFFIC AND PEDESTRIAN OPERATIONS

Included herein is a summary of the results of analyses relative to existing traffic operations within the study area. It is intended to provide an understanding of the degree of adequacy of the existing roads and traffic controls in the Middletown CBD, and to identify those locations which currently experience congestion due to infrastructural deficiencies.

Current Level of Service (LOS)

Table 2 details the levels of service (LOS) at study area intersections for the weekday A.M. and P.M. peak-hour periods of commuter activity. Computer-generated intersection capacity analyses indicate that two locations currently experience an unacceptable LOS E during the A.M. peak hour, while five intersections exhibit unacceptable Level of Service F operations during the P.M. peak hour.

The Washington Street/Main Street intersection currently operates at LOS E during the morning peak hour, with an approximate average stopped delay of 42.7 seconds per vehicle. Also operating at LOS E during the A.M. peak hour, the Main Street/Grand Street/Rapallo Avenue intersection experiences an average stopped delay of 46.6 seconds per vehicle.

Table 2

EXISTING 1989 PEAK-HOUR TRAFFIC OPERATIONS

Downtown Traffic Study

Middletown, Connecticut

INTERSECTION	EXISTING 1989 LEVELS OF SERVICE	
	A.M. Peak Hour (7:45-8:45 A.M.)	P.M. Peak Hour (4:15-5:15 P.M.)
Washington/High	C	F
Washington/Broad	B	B
Washington/Main	E	D
Washington/DeKoven	C	F
Main/Ferry	A	B
Main/Liberty	A	A
Main/Green	A	B
Main/Grand/Rapallo	E	F
Court/Broad	A	B
Main/Court	B	B
Church/High	B	F
Church/Broad	B	B
Church/Pleasant/South Main	B	B
Pleasant/Main/Union	C	C
Union/DeKoven	C	F
Union/River/Harbor	A	A
Main/College	B	B

SOURCE: Wilbur Smith Associates.

During the P.M. peak hour, the following intersections currently experience vehicular demand well over capacity and operate at failing levels:

- Washington Street at High Street;
- Washington Street at DeKoven Drive;
- Main Street at Grand Street and Rapallo Avenue;
- Church Street at High Street; and,
- Union Street at DeKoven Drive.

Additional analyses indicate that all other locations within the study area currently experience favorable traffic operations during the A.M. and P.M. peak-hour period.

Field Observations of Problem Areas

Concurrent with our traffic counting program, detailed field observations were made regarding traffic operations, and areas of deficiencies. The results of our analyses generally concur with the observed traffic conditions.

Excessive queues, indicative of high average delay, were observed at the following intersections:

- Main Street at Washington Street;
- Washington Street at High Street; and,
- Main Street at Grand Street and Rapallo Avenue.

Although significant queues were also observed at the Main Street/Pleasant Street/Union Street/Crescent Street intersection, such queues were generally cleared with each cycle of traffic signal operation, thus preventing excessive delay.

Traffic signal timing and phasing at most intersections are such that only permitted (as opposed to "protected") left-turn movements are allowed from shared left-turn/through lanes. These conditions result in left-turning vehicles stopped in a shared left-turn/through lane, waiting for gaps in the opposing through flow. This effectively blocks an entire through lane, and severely diminishes intersection capacity.

Many intersections operate with single lane approaches where heavy vehicular demand requires exclusive turn lanes. Examples of such a condition are the intersections of Church Street/High Street and Washington Street/DeKoven Drive and Washington Street/Main Street during the P.M. peak hour. At these locations, the existing available pavement width on one or several approaches is not sufficient to allow a through vehicle to bypass a vehicle waiting to complete a turning movement.

Figure 4 depicts the study area and identifies the location of several problem areas. Throughout the study area, specific deficiencies induced by high traffic volumes, high accident experience, unusual roadway geometry and narrow lanes, were noted at various locations.

As illustrated in Figure 4, major east/west movement is evidenced along the Connecticut Route 66 corridor through the CBD, namely along Washington Street west of Main Street, oriented to/from the Arrigoni Bridge. Heavy east/west movement is also experienced along Connecticut Route 17 and Main Street south of Washington Street, at the rotary intersection in the southern portion of the CBD. North/south movement on DeKoven Drive is identified as a third primary corridor of vehicular flow.

Another source of delay and congestion is on-street parking. As mentioned earlier, several locations throughout the CBD provide angled or parallel on-street parking which interrupts traffic volumes when parking maneuvers are executed. Parking or exiting vehicles which are backing or executing sharp low-speed turns often cause movement of through traffic to stop abruptly. The intrusion of vehicles engaged in parking maneuvers frequently causes moving through traffic to swerve into adjacent travel lanes as a means of avoiding collision.

As with most rotary intersections, the Connecticut Route 17/Loveland Street/South Main Street rotary involves several unusual movements. The combination of STOP-sign controlled approaches, short storage bays, high speeds, unusual geometry, and high traffic volumes often make for severe congestion. Additionally, these conditions at this location result in the high accident rate experienced in recent years.

Pedestrian Activity

Despite the emphasis on pedestrians in the CBD, there appeared to be no consistently recurring problems with vehicle/pedestrian activity. For example, while there is a significant amount of traffic at the Main Street/Washington Street intersection (approximately 2,250 vehicles per hour), pedestrians are generally able to cross with little delay, either by waiting for a naturally-occurring gap in traffic or by using the pedestrian push buttons.

On Main Street, predominant movement of pedestrians is across the side streets, and not across Main Street itself. This is presumably due to the location of parking spaces along

both sides of the entire length of Main Street, and that patrons of retail establishments generally are able to park on the same side of Main Street as their desired destination. The convenience of providing parking along both the east and west sides of Main Street does encourage illegal mid-block U-turns, observed to be executed by vehicles searching for parking spaces.

As mentioned earlier, there are three mid-block pedestrian crossings across Main Street, located north of Court Street, north of Washington Street, and north of Union Street. Based on the observed pedestrian activity during peak hours, these mid-block crossings appear to operate efficiently. Although vehicular traffic is required to stop for pedestrians in the crosswalk, such crossing maneuvers do not occur with such a frequency that progression of through traffic on Main Street is significantly delayed.

Pedestrian movement was also observed along High Street during peak hours. As suspected, the primary component of the pedestrian activity appeared to be students walking to and from the Wesleyan University campus. As also suspected, the students appeared generally younger than those observed elsewhere in the study area, and were consequently able to take advantage of shorter gaps in vehicular traffic on High Street.

Chapter 5
FUTURE TRAFFIC PROJECTIONS

Traffic volumes on the downtown roadway network were forecast to the year 1994. Future projections were based on a downtown land development program as well as a forecast of growth outside the Central Business District. An analysis of future conditions was undertaken to determine the ability of the existing downtown roadway network to accommodate traffic under projected 1994 conditions.

To project 1994 base traffic volumes, existing morning and evening peak-hour traffic volumes were increased by 3 percent per year, consistent with regional growth and development trends. In addition, traffic associated with future development was added directly to 1994 background traffic volumes. The following future development plan was provided by the City Planning Department:

- Middlesex Mutual - 212,000 square feet of office space and 700 parking spaces to be located southeast of the intersection of Broad Street and Court Street;

- The Municipal Building - 48,000 square feet of office space and 200 parking spaces to be located adjacent to Columbus Plaza;

- The Court Building - 60,000 square feet of office space and 200 parking space to be located adjacent to Columbus Plaza; and,

- The Sears Auto Building - 192,000 square feet of office space and 640 parking spaces to be located southwest of the intersection of DeKoven Drive and Court Street.

Also considered in this effort, were possible locations for additional downtown parking. The following are all in addition to those associated with the proposed office developments listed above:

- Located adjacent to Columbus Plaza, an additional 360 parking spaces;

- Located southwest of the intersection of DeKoven Drive and Court Street, an additional 555 parking spaces; and,

- Located southeast of the intersection of Washington Street and Broad Street, an addition 120 parking spaces.

For purposes of network analysis, it was assumed that the above would be constructed and fully operational by the year 1994.

Future trip generation for Middlesex Mutual and assignment of that traffic to the CBD network was based on the traffic study, "Traffic Analyses, Middlesex Mutual Assurance Company, Home Office, Middletown, Connecticut," dated May, 1987, by the Maguire Group. Estimates of trip generation for the remainder of the future development plan were based on the Institute of Transportation Engineers, Trip Generation Manual, 4th Edition, dated 1987.

Table 3 summarizes future trips associated with the 1994 development plan. This plan will add approximately 775 trips to the CBD network during the 1994 morning peak-hour and 745 during the evening peak-hour.

These trips were assigned to the CBD network based on the locations and accessibility of the major commuter arterials. Estimated approach/departure routing distributions are as follows (also, see Figure 5):

Orientation	Percent
Connecticut Route 66 - to/from East	25
Connecticut Route 66 - to/from West	20
Connecticut Route 9 - to/from North	15
Connecticut Route 9 - to/from South	15
Connecticut Route 17 - to/from South	15
Main Street - to/from South	5
Church Street Local Streets - to/from West	5
TOTAL	100

Combined 1994 A.M. and P.M. peak-hour traffic volumes for the CBD are shown on Figures 6 and 7. Anticipated 1994 peak-hour volumes include growth of base traffic plus traffic associated with the 1994 City plan of development.

Table 3

ESTIMATED TRAFFIC GENERATION

DOWNTOWN PLAN OF DEVELOPMENT

Downtown Traffic Study

Middletown, Connecticut

PROJECT (1)	ESTIMATED TRIPS A.M. Peak Hour Enter	Exit	Total	P.M. Peak Hour Enter	Exit	Total
Municipal Building -Court/DeKoven (2) 48,000	72	11	83	13	66	78
Court Building -DeKoven (2) 60,000	90	13	103	16	82	98
Sear Auto -DeKoven (2) 192,000	287	43	330	50	263	313
Middlesex Mutual (3) 212,000	217	41	258	50	204	254
TOTAL (4)	665	110	775	130	615	745

(1) Future plan of development provided by Planning Department, City of Middletown.
(2) Trip generation based on Institute of Transportation Engineers Trip Generation Manual, 4th Edition, 1987; ITE Code 710.
(3) Trip generation based on "Traffic Analysis, Middlesex Mutual Assurance Company, Home Office, Middletown, Connecticut," dated May, 1987, by the Maguire Group.
(4) Total volumes rounded to nearest five vehicles per hour.

SOURCE: Wilbur Smith Associates.

Chapter 6
RECOMMENDED ROADWAY IMPROVEMENT PROGRAM

This Chapter presents roadway and intersection improvements necessary to achieve safe and efficient traffic operations throughout the downtown study area. Near term mitigation measures as depicted in Figure 8, are based on an assessment of existing problem areas as well as anticipated 1994 needs.

As discussed earlier, heavy left-turn movements often are the primary contributing factor to failing operations at intersections. Left-turn movements require gaps or stoppage in the oncoming flow of traffic in order to safely complete the maneuver. This significantly reduces vehicular capacity in an intersection. Exclusive turn lanes and/or exclusive traffic signal phasing are often required to allow left turns to flow freely and uninterrupted.

On Main Street, for example, exclusive turn lanes are not provided. Left turns are executed from shared left-turn/ through lanes and must stop and await gaps in the opposing traffic flow effectively blocking through traffic which retards vehicular flow.

On Washington Street at Main Street, exclusive turn lanes and phasing is provided. An advanced green phase allows eastbound left turns to flow protected and unopposed for about three seconds. This exclusive green time allotment is insufficient, however, to clear the left-turn demand.

Solutions to the above described problems include, but are not limited to the following:

- Provide Exclusive Left-Turn Lanes - This effectively removes left-turn traffic from the mainstream flow, thus providing through traffic to progress freely;

- Upgrade Traffic Signal to Provide Exclusive Left-Turn Phases - This will provide gaps/stoppage in oncoming traffic and allow left turns to flow freely;

- Coordinate Traffic Signals; and,

- Left-Turn Prohibition - This will convert potential left-turn movements into through movements, thus eliminating conflicting flow patterns.

Connecticut Route 66 (Washington Street) Operations - The Washington Street corridor currently carries approximately 20,000 vehicles per day. Severe congestion and delays occur in both directions for several hours each day. At times congestion extends from the Arrigoni Bridge into the Town of Middlefield making travel sluggish and frustrating.

Several segments of the Route 66 corridor from Portland to Meriden are currently under study and/or design by the Connecticut Department of Transportation (also refer to Chapter 7). In conjunction with this State work, it is recommended that a comprehensive traffic management plan be undertaken from the Coginchaug River to the Arrigoni Bridge, as this area will play a critical role in Middletown's future. Specific to the

study area, under anticipated 1994 conditions, Washington Street should be widened to provide a fifth lane. This fifth lane should provide storage at intersections for left-turn vehicles in both directions.

Intersection of Washington Street/Main Street - The major east/west flow on Route 66 contributes to failing peak-hour operations at this location. Left-turn volumes from the eastbound Washington Street approach to Main Street are well over 300 vehicles per hour during peak periods. In order to increase vehicular capacity and improve operations, the following is suggested:

- Widen Washington Street and Main Street to provide 3-lane intersection approaches in all directions. Removal of approximately eight on-street parking spaces may be required:

  - Washington Street Eastbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One exclusive right-turn lane.

  - Washington Street Westbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One combination right-turn/through lane.

  - Main Street Northbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One combination right-turn/through lane.

- Main Street Southbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One combination right-turn/through lane.

- Upgrade traffic signal to provide optimal timing/ phasing in accordance with the revised geometry.

It is recognized that improvements to the westbound approach on Washington Street have physical limitations. The curb-to-curb travel width of Washington Street, east of Main Street is 38 feet. Sidewalks to the north and south are 12 feet wide and 7 feet wide, respectively. It may be possible to widen the vehicular travelway by reducing the northerly sidewalk from 12 feet to 6 feet. The new 44-foot width would provide four, 11-foot lanes (three lanes westbound and one lane eastbound).

It should be further noted that Washington Street is currently offset at Main Street which forces westbound through traffic to negotiate a lane shift of approximately 10 feet across Main Street. The above roadway widenings will improve intersection alignment as well as increase vehicular capacity.

Removal of about eight parking spaces on Main Street will be required to provide additional travel width for exclusive turn lanes.

Intersection of Washington Street/High Street - This area is also experiencing the impact of the major Route 66 east/west vehicular demand. Approximately 1,500 feet west of High Street, Connecticut Route 72 feeds Washington Street resulting in congestion and delays due to the added vehicular demand. Vehicular capacity must be increased in order to accommodate existing demand. The following engineering improvements are suggested:

- Widen intersection approach legs as follows:

  - Washington Street Eastbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One combination through right-turn lane.

  - Washington Street Westbound:

    - One exclusive left-turn lane;
    - One exclusive through lane; and,
    - One combination through right-turn lane.

  - High Street Northbound:

    - One exclusive left-turn lane; and,
    - One combination right-turn through lane.

  - High Street Southbound:

    - One exclusive left-turn lane; and,
    - One combination through right-turn lane.

- Modify traffic signal timing/phasing in accordance with the revised geometry.

Washington Street will require 12 feet of widening on both approach legs. High Street will require 9 feet of widening on the southbound approach.

Intersection of Washington Street/DeKoven Drive - This location is critical as it provides a primary access point to the CBD from Connecticut Route 9. Access to Connecticut Route 9 from the CBD is permitted for southbound movements only. Intersection approach widening, lane striping and operations needs are as follows:

- Washington Street Eastbound:

  - One combination left-turn/through lane; and,
  - One exclusive right-turn lane.

- Washington Street Westbound:

  - One combination left-turn/through/right-turn lane.

- DeKoven Drive Northbound:

  - One exclusive left-turn lane; and,
  - One exclusive through lane.

- Rapallo Avenue Southbound:

  - One combination right-turn through lane.

Washington Street need only be restriped to provide two lanes eastbound/one lane westbound. The west (southbound) side of DeKoven Drive will require about 6 feet of widening to accommodate the suggested two-lane northbound approach.

The traffic signal control should be upgraded and optimized in accordance with the revised geometry.

Intersection of Union Street/DeKoven Drive - A concentration of peak-hour volume at this location is the result of the River Road access to Connecticut Route 9 northbound located 350 feet east of DeKoven Drive. In order to alleviate existing congestion and accommodate vehicular demand, intersection widening is needed to provide two lane approaches--one combination left-turn through lane and one combination right-turn through lane, in all directions. Traffic signal timing and phasing should be modified in accordance with geometric improvements.

The existing 36-foot width of DeKoven Drive should be widened by 12 feet to provide 48 feet. Union Street east of DeKoven Drive should be widened on the north (westbound) side by 12-14 feet.

Intersection of Church Street/High Street - Severe congestion and delays are caused by high peak period volumes and substandard roadway conditions. Vehicular capacity is restricted by narrow pavement widths and the inability of through traffic to bypass left-turn vehicles stopped in the intersection. Pavement widenings are required to provide two lanes on three intersection approaches and three lanes on the forth:

- Church Street Eastbound:

  - One combination left-turn/through lane; and,
  - One combination right-turn/through lane.

- Church Street Westbound:

  - One combination left-turn/through lane; and,
  - One combination right-turn/through lane.

- High Street Northbound:

  - One exclusive left-turn lane; and,
  - One combination right-turn/through lane.

- High Street Southbound:

  - One exclusive left-turn lane;
  - One exclusive through lane; and,
  - One combination right-turn/through lane.

The existing 32-foot High Street should be widened by 16 feet to provide a curb-to-curb width of 48 feet. Church Street, currently 90 feet wide, should be widened by 8 feet. On-street parking located on Church Street east of High Street should be removed on both sides within 250 feet of High Street.

Optimization of traffic signal timing/phasing is required in conformance with the revised geometry.

Intersection of Main Street/Grand Street/Rapallo Avenue - One of the critical areas within the CBD, this intersection with the adjacent St. John's Square/Hartford Avenue Rotary

provides vehicular access to Connecticut Route 66 east and west, Connecticut Route 9 north and south and the Central Business District. The following roadway modifications, lane restriping and operations improvements are needed to accommodate this existing high demand area:

- Grand Street Eastbound:

  - One combination left-turn/through/right-turn lane.

- Rapallo Avenue Westbound:

  - One exclusive left-turn lane; and,
  - One exclusive right-turn lane.

- Main Street Northbound:

  - One combination left-turn/through lane; and,
  - One combination right-turn through lane.

- Main Street Southbound:

  - One exclusive left-turn lane;
  - One exclusive through lane; and,
  - One combination through right-turn lane.

Removal of approximately six on-street parking spaces will be required on the north (westbound) side of Rapallo Avenue. Upgrade and optimize traffic signal timing and phasing per above.

Court Street/Broad Street Operations - While Court Street was not recommended for roadway improvements in planning for the Middlesex Mutual development, it is felt that the opening of this facility will result in a concentration of traffic in this area of a magnitude to warrant improvements. Consideration should be given to installing a traffic signal at the intersection of Court Street/Broad Street. In addition, removal of on-street parking may be required for the entire length of Broad Street and Court Street in order to increase vehicular capacity.

Traffic Signal Control System

In conjunction with the development of enhanced roadway geometrics, development of a recommended traffic signalization control system was also evaluated. Based on a thorough review of existing and anticipated future traffic volumes traveling in the Main Street/Washington Street corridors, a proposed, new traffic control system was developed.

A review of existing traffic control systems on the market and their applicability to operations in the Main Street/ Washington Street corridors led to the recommendation for installation of a "closed loop" traffic control system. This state-of-the-art system is a micro-processor based, local signal system that provides for both pre-programed and traffic responsive operations. The system is monitored by a microprocessor located in a central location (the City Engineer's Office), to monitor operations of the on-street traffic signals. The proposed "closed loop" system, in addition to providing capabilities to establish timing plans for both the local intersections and the entire system, provides an up to the minute system status report on traffic

flows, speeds, occupancy, and controller operations. This system reports back to the central office by means of leased telephone lines thus providing the system operator with information regarding on-street conditions and controller operations.

The proposed "closed loop" system provides for several operating modes, including; fully traffic responsive, time of day timing plans, manual pattern selection programs, fully coordinated back-up system operations, and local or system flash operation.

The "closed loop" system is comprised of local traffic controllers at each intersection, a single on-street master micro-computer, auto-dial communication modules which provide for communications between the local intersections and the central office, and a central office micro-computer and printer which permits system monitoring capabilities, production of condition reports, and direct up-loading and down-loading of data between the central office and the local intersections. The "closed loop" system is designed as a "user friendly" operation and does not require a computer expert to operate the system.

The recommended "closed loop" system provides the City of Middletown not only flexibility to control operations along the Main Street and Washington Street corridors, but also provides flexibility and expansion capabilities so that additional signalized intersections, beyond the initial closed loop system can be added to the system.

Costs associated with installation of a "closed loop" system is compatible with other types of traffic control systems, plus minimal additional costs associated with the

leasing of telephone lines and the installation of the central office micro-computer system.

Opticom Priority Control System is a feature proven successful which facilitates speed access for emergency vehicles. Optical detection devices located at traffic signal controllers at each intersection sense high speed flashing signals from oncoming emergency vehicles and synchronize the signal system. Opticom is compatible with all traffic signal equipment.

Intersection of Main Street/Ferry Street - In conjunction with any new signal system, installation of a traffic signal is recommended at the intersection of Main Street/Ferry Street in order to facilitate emergency egress for the Central Fire Station. Phasing should exhibit a flashing yellow indication at all times for Main Street operations except in the event of an emergency. Emergency pre-emption, actuated by the Fire Department will stop traffic on Main Street in favor of emergency vehicles.

The recommended improvement plan included herein, specifically addresses the needs associated with the described Central Business District Development Program provided by the City Planning Department. While this is indeed a highly realistic future plan, actual land development is dynamic and will vary depending on market demands at a given point in time.

Chapter 7
LONG-RANGE FUTURE STRATEGIES

The recommended transportation improvement plan described in the previous chapter is based on mitigation of existing problem areas as well as a future needs assessment under the 1994 plan of development. Long-range growth beyond 1994 may necessitate major traffic mitigation projects. The Connecticut Routes 9/17/66 interchange projects under study by the State Department of Transportation, may be prerequisites to continued growth of commercial development. This chapter presents information on these State projects as well as recommendations for administrative and transportation systems management strategies that the City of Middletown could pursue in addressing long-range traffic impacts within the downtown study area. Figure 9 illustrates long-range coordination for downtown improvements.

Connecticut Route 9 State Projects

The State of Connecticut Department of Transportation is currently undertaking preliminary planning and feasibility studies for improvement projects along the Connecticut Route 9/Connecticut Route 17 corridor in Middletown. This section will provide general background information concerning potential recommendations and their possible impacts on the study area. These studies are scheduled for completion in the summer of 1990. Implementation of any recommended improvement plan will require several years, depending on the complexity of the project and available funding. At this time, without specific recommendations and approved scheduling, these

projects should not be considered in the conclusions and recommendations of this study.

The State is investigating several improvement projects along the Connecticut Routes 9 and 17 corridors, including the following:

- Construction of an interchange with Connecticut Route 66 and Connecticut Route 9 to be located immediately north of the Arrigoni Bridge;

- Construction of an interchange with Connecticut Routes 9/17 to be located just south of the CBD in the vicinity of Silver Street;

- Reconstructing the rotary at Connecticut Route 17/South Main Street/Loveland Street into a more conventional 4-leg configuration under traffic signal control;

- An overlay to widen Connecticut Route 17 from the rotary into the Town of Durham; and,

- Removal of the two existing traffic signals on Connecticut Route 9 at Hartford Avenue and Washington Street, and widening to provide an additional through lane.

The interchange concept, to be located north of the Arrigoni Bridge, is to provide direct and easy access for the major movements to and from Connecticut Routes 66 and 9. Under the present configuration, one must travel through the St. John's Square/Hartford Avenue street system, creating severe

congestion and delays. There is clearly a need to alleviate congestion in this area. Residual congestion from this area effects Connecticut Route 9 from Miller Street to Washington Street; and Rapallo Avenue from Main Street to Green Street in the CBD.

The interchange concept at Connecticut Routes 17/9 south of the CBD will be designed to facilitate vehicular access to the southerly portion of the CBD. One major benefit will be to improve emergency access for Middlesex Memorial Hospital. Under its present configuration for example, access to Connecticut Route 9 southbound from the Hospital vicinity involves travel through the local street system resulting in delayed response time. An interchange in the Silver Street area will significantly reduce local street traffic and improve operations in the southerly CBD.

Connecticut Route 9 is a major corridor from central Connecticut to the coastline. During the peak summer season, Connecticut Route 9 carries major volumes of beach and recreational traffic. The Central Connecticut Expressway, presently under construction will add more volume to Connecticut Route 9 by improving access from Interstate Route 84, Waterbury, New Britain, and Farmington areas. Vehicular capacity on Connecticut Route 9 in Middletown must be increased to accommodate the anticipated growth in traffic. The State is analyzing the effects of removing the two traffic signals on Connecticut Route 9 at Hartford Avenue and Washington Street; and, adding another through lane to Connecticut Route 9 adjacent to the CBD. In conjunction with the above, access to the CBD will be prohibited with raised median barriers through these intersections.

In addition, operational improvements are anticipated for Connecticut Route 17 in Middletown from the South Main Street/Loveland Street rotary into the Town of Durham. As recommended by the State, the rotary will be converted to a 4-leg, conventional, intersection configuration under traffic signal control. An overlay of Connecticut Route 17 will upgrade geometrics and increase vehicular capacity from South Main Street/Loveland Street into the Town of Durham.

It should be noted that the above descriptions of corridor improvement projects are in a preliminary study phase. Final recommendations, design layouts, scheduling and funding for the above are highly speculative at this time. Based on the urgency of needs and ease of implementation, however, it is expected that construction of the Connecticut Route 9/17 interchange in conjunction with removal of the traffic signal at Washington Street will be completed within two years. A Connecticut Route 9/66 interchange concept north of the Arrigoni Bridge will be more difficult due to anticipated high construction costs, right-of-way acquisition requirements, and physically difficult engineering in association with wetlands and grade separated geometrics.

Connecticut Route 66 State Projects

Connecticut Route 66 will be widened to four lanes in Middletown from the Coginchaug River to Camp Street. Additional widening will occur at intersections to provide exclusive turn lanes. The project will be advertized in September, 1989, to begin construction in April, 1990.

In Middlefield, Connecticut Route 66 is being considered for widening to four lanes from Jackson Hill Road to the Meriden/Middlefield Town Line. Additional widening at major intersections will accommodate exclusive turn lanes. This project is just under study with no schedule for completion.

In conjunction with the above Connecticut Route 66 work being undertaken by the State of Connecticut, it is strongly recommended that a comprehensive vehicular needs assessment be undertaken from the Coginchaug River to the Arrigoni Bridge. This corridor is certain to be a critical factor in determining Middletown's ability to grow and prosper.

Long-Range Considerations for the CBD

The following recommendations are based on the data and analyses contained in the previous chapters of this report, as well as programs/strategies that have proven workable and implemented in other municipalities that have been faced with similar problems.

Main Street Operations - Not unlike downtown areas of similar size, movement of traffic along Main Street is inhibited by several factors such as dense retail and commercial activity, on-street parking turnover, heavy pedestrian volumes, etc. While Main Street provides four travel lanes, often times it is effectively reduced to two lanes because of constant turnover of on-street parking spaces. One travel lane is blocked during the turnover of on-street parking spaces as parked vehicles back up into the travelway, and motorists seeking to park anticipate the vacancy.

High on-street parking turnover and the associated congestion and delays are common to downtown areas of high density commercial development and as such, it is not recommended that on-street parking be removed. The objective in attempting to achieve the highest level of operations is to limit Main Street access to Main Street business and divert non-local traffic away from Main Street.

This objective is accomplished by making the parallel roadways (DeKoven Drive, Broad Street, High Street) more attractive to non-local traffic. These parallel arterials can best be utilized as bypass routes to Main Street activity. Treatment of bypass arterials will be discussed in a later section in this report.

As discussed earlier, continuous turnover of on-street parking spaces effectively cuts Main Street vehicular capacity in half. Similarly, when left-turn vehicles await gaps in opposing traffic flow they consequently block the traffic flow of the innermost travel lane. When left-turn stoppage of traffic occurs simultaneous to on-street parking turnover, it is conceivable that Main Street can be blocked off entirely from the movement of through traffic. In order to assure that at least one travel lane on Main Street will experience continuous movement of through traffic in at least one lane, left-turn prohibition should be implemented on Main Street with three exceptions: the intersections of Grand Street/Rapallo Avenue; Washington Street; and, Union Street/Pleasant Street. At these intersections, exclusive left-turn bays should be implemented to allow progressive movement of through traffic.

Left-turn prohibition will make access to Middlesex Mutual and the adjacent parking garage more difficult, particularly from the south. The garage is designed to allow Middlesex Mutual traffic (726 spaces) to enter and exit via Court Street, with public access (347 spaces) at College Street. Middlesex Mutual traffic approaching from the southernmost areas of the CBD (South Main Street/Main Street Extension vicinity), must either use DeKoven Drive to Court Street; or, find their way up to Washington Street and enter via Main Street.

To facilitate access from all directions, Court Street should be converted to carry two-directional flow for its entire length.

The width of Main Street, measuring nearly 90 feet curb-to-curb, also contributes to vehicular delay. Pedestrian phases take up a significant portion of the traffic signal cycle due to the length of time necessary to cross Main Street on foot. During this time, vehicles are stopped on all intersection approaches. It is suggested that traffic signals be upgraded to actuate phasing which will allow concurrent movement of pedestrians and vehicular traffic. Concurrent phasing would allow northbound/southbound Main Street traffic to flow simultaneously with adjacent minor street pedestrian crossing. Similarly, when minor street vehicular traffic flows, pedestrians will be crossing Main Street.

In the event of any pedestrian/vehicle conflict, the vehicle should yield right-of-way to the pedestrian at all times. It is imperative that this policy be strictly enforced for the safety of all.

DeKoven Drive/High Street Operations - This series of north/south directional arterials run parallel to Main Street and should be used as a means of diverting traffic away from Main Street. It is suggested, therefore, that these roadways be modified to facilitate north/south travel for non-local traffic. Maximizing the capacity and progressive movement of these arterial routes will allow non-local traffic to bypass Main Street activity. Removal of on-street parking on Broad Street and High Street will increase vehicular capacity. Sequencing of traffic signals based on time coordination will enhance progressive movement of through traffic.

Transportation Systems Management

Transportation Systems Management (TSM) encompasses a wide variety of possible actions to improve the efficiency and capacity of existing facilities. In an urban community such as Middletown, TSM projects that should be considered to alleviate traffic congestion included:

- A coordinated effort by the City with existing employers and future developers to implement a systematic program for staggered work hours, thus reducing the concentration of vehicular traffic volumes during the historic A.M. and P.M. peak traffic hours;

- A concentrated effort to establish employee subsidized and supported car/van pool programs, that would achieve a higher passenger occupancy rate per vehicle, thereby effectively reducing the number of vehicles on the roadway network;

- Establishment and/or enhancement of public transit programs to encourage a mode shift from the single occupancy vehicle to public transit;

- Review of on-street parking regulations to eliminate/prohibit on-street parking in order to provide additional capacity along segments of the roadway network and at critical intersections; and,

- A comprehensive, systematic review of existing traffic control devices (traffic signals/signs and pavement markings) to ensure that these devices are installed and operating in accordance with all Federal, State and local regulations to provide the safest and most efficient use of the existing roadway network.

Administrative Strategies

Some of the most effective measures that the City of Middletown can consider to more effectively and efficiently manage their growing traffic problems fall into this category. An integral element of this "management" is the establishment of clear, concise and implementing programs for controlling future growth. These strategies fall into the following general categories:

- Establishment of a program that would require developers to prepare and submit a comprehensive "Traffic Impact Studies" for any new "major" development. The definition of a "major" development could be based on a development exceeding "X" number of square feet of Gross Floor Area (GFA), "Y" number

of on-site parking spaces, total volume of site generated traffic or some combination of variables. The required Traffic Impact Studies should, at a minimum, be required to address the following: description of site, description of serving roadways, existing traffic volumes, existing levels of service on serving roadways and key intersections, proposed development, future traffic volume generation and directional distribution, growth rates for non-site traffic, other approved developments which will add traffic to the system, future capacity analysis of serving roadways and key intersections, along with recommendations to ensure that the roadway system will continue to operate in a safe and efficient manner;

- Establishment of a program to reduce the number of on-site parking spaces required by zoning ordinance to effectively reduce the number of potential sight generated trips;

- Rezoning of existing and undeveloped land to effectively limit the type and size development that could take place in the future;

- Moratoria or defined scheduling of development within the impacted area of the downtown study, thereby allowing development to take place at such time as there are adequate public facilities available to provide the required services; and,

- Development of a "User Fee/Impact Fee." Critical to the success of the City's ability to provide the required public services is the adoption of a technically sound municipal ordinance for assessing developers for their share of the costs for specific identified improvements within the CBD, based on a "fair and equitable" cost-sharing formula.

Specific criteria for the development of this formula may include the following variables, either separately or in an agreed upon combination:

- New site generated traffic volumes assigned to the roadway within the corridor study area;
- Site acreage available for development that will impact those sections of the corridor roadways;
- The number of on-site parking spaces for the proposed development;
- Gross floor area (square footage) of the proposed development;
- Type of development; and/or,
- Other identifiable and quantifiable elements which can be rationally and equitably assigned to a specific development or developer, to determine their fair contribution for identified improvements; and,

- Establishment of a curb-cut control plan to regulate the number of drives (access roads) onto the corridor roadways, to serve as a guide for future development along with a stricter interpretation of traffic impact to promote combined access to abutting adjacent properties.

Clearly, the City of Middletown can with the adoption of these administrative strategies take the necessary steps to address and plan for the long-term traffic impacts associated with the continued development. Advanced planning for these corridors is something that must be pursued, if the City is to continue to grow and at the same time provide for the most efficient and safe use of its street system by the general public. Recognizing that traffic impact, as a product of development, is a dynamic and constantly changing condition, the City must retain the flexibility to review each development, on a case-by-case basis, then weigh the economic benefits that would be recognized, by allowing the development to take place against the possible impacts on its public facilities.

Recognizing that the recommendations contained in this report are based on a series of assumptions concerning various general development scenarios, it is important that the City of Middletown be cognizant of changing development trends and then be willing to adapt their policies, programs and procedures to reflect these constantly changing demands for adequate roadway facilities.

Wilbur Smith Associates has over the past several years been in the forefront of assisting municipalities throughout the Northeast in developing and implementing these strategies

and can in conjunction with the City of Middletown prepare the necessary legislative guidelines for establishment of these programs. These programs can be implemented by Middletown often times at little or no cost, with funding for these programs, provided by these developer impact assessment fees.

Consideration must also be given to converting the east/west directional roadways in the CBD to one-way operations for the most efficient movement of traffic. Depending on the location and magnitude of future development, for example, Court Street and Williams Street may best be utilized as one-way westbound arterials, while College Street and possibly Church Street may carry traffic eastbound only. Long-term growth will require diversion of non-local traffic to the major highway system.

Chapter 8
SUMMARY AND CONCLUSION

A comprehensive traffic study was undertaken for the Central Business District in Middletown, Connecticut. The study area consisted primarily of the Main Street and Washington Street travel corridors. Several downtown intersections were analyzed in an area east of High Street, west of DeKoven, north of South Main Street/Connecticut Route 17 rotary and south of St. John's Square.

Data collection and field reconnaissance programs provided peak period turning movement traffic volumes, traffic flow patterns, physical roadway conditions, traffic control measures, pedestrian activity and problem areas.

Future conditions were considered based on a 1994 Central Business District plan of development and growth trends in the region.

Roadway improvement plans included existing 1989 needs; projected 1994 needs; and, long-range transportation strategies.

Transportation systems analysis for downtown Middletown has determined that near-term growth in the downtown area can be accommodated by upgrading Washington Street to service through (non-local) traffic. Washington Street should provide exclusive left-turn lanes for heavy left-turn volumes and an upgraded coordinated traffic signal system. Several other downtown intersections will also require minor pavement

widening for exclusive turn lanes with improved traffic signal timing/phasing. These intersections include DeKoven Drive/Union Street; Church Street/High Street; and, Main Street/Grand Street/Rapallo Avenue.

Land development in the CBD beyond 1994 projections will require roadway improvements on a much larger scale. Transportation improvement strategies may require the following:

- More restricted use of Main Street (left-turn prohibition, for example) and upgrading the traffic signal system;

- Upgrade arterials parallel to Main Street (DeKoven Drive and High Street) to allow north/south directional traffic to bypass Main Street and encourage the use of these arterials with enhanced access;

- Convert east/west directional roadways (Court Street, College Street, Williams Street, and Church Street) into one-way arterials to increase vehicular capacity; and,

- Invest into enhanced access to Connecticut Route 9. Possible interchanges, Connecticut Route 9/Connecticut Route 66 to the north and Connecticut Route 9/Connecticut Route 17 to the south will divert traffic away from Main Street and Washington Street resulting in increased vehicular capacity on the downtown street system.