SWRPA Congestion Mitigation Study (CMS)
Task 4A Technical Memorandum

1. INTRODUCTION

1.1 Study Background

The SWRPA Congestion Mitigation Study (CMS) covers a 55-mile east-west corridor along I-95 and the Merritt Parkway in southwestern Connecticut, extending between the New York State Line on the west and the Town of Branford on the east. In a north-south direction, the primary study area reaches Danbury along Route 7, Shelton along Route 8, and Hamden along I-91. This area incorporates a range of land uses, including urban centers, such as Stamford, Norwalk, Bridgeport, Danbury, and New Haven; suburban towns such as Greenwich, Westport, Fairfield and Stratford; and semi-rural areas in the towns of Wilton, Weston, Monroe, and Easton.

In his 1999 report for the Connecticut Regional Institute for the 21st Century, *Connecticut Strategic Economic Framework*, Dr. Michael Gallis observed, "Coastal Connecticut has one of the strongest concentrations of economic, institutional, cultural and research resources of any corridor in the New York metro region. Stamford has a large concentration of financial and high tech companies and corporate headquarters. New Haven has the institutional resources… Bridgeport… has large new investments in commercial and residential developments and a significant specialty port." [1]

However, the report also notes, "Severe congestion problems in the lower section of this corridor effectively block access for the upper portions to fully compete for economic activity in the New York metro market."

Without improvements to the study area transportation system, including enhancement of alternatives to the private car, this growth will create massive traffic congestion and delay along the limited number of access routes through Southern Fairfield and New Haven Counties. Congestion continues to increase not only for passenger transportation, but also for freight transportation. Due to the absence of alternative truck routes or an efficient rail freight distribution system, much of the through truck traffic moving between New York and Boston is funneled into the I-95 corridor, further adding to the congestion and safety problems these regions face.

Two solutions for congestion are possible – increase total transportation capacity or decrease demand for services during periods of peak demand. The reduction of vehicular travel demand and automobile dependency in this transportation and land use context is a daunting task. Numerous studies and improvement initiatives over the last twenty years have attempted to address this issue at the regional level with varying degrees of success.

[1] Michael Gallis and Associates, Connecticut Regional Institute for the 21st Century, *Connecticut Strategic Economic Framework*, 1999 edition, page 8

This effort, however, takes a broader approach to identifying solutions to traffic congestion by focusing on the collective needs of five planning regions: The South Western Regional Planning Agency (SWRPA), Housatonic Valley Council of Elected Officials (HVCEO), Greater Bridgeport Regional Planning Agency (GBRPA), Valley Regional Planning Agency (VRPA), and South Central Regional Council of Governments (SCROG).

1.2 Division of Strategies by Mode

For the purposes of this study, both traditional and non-traditional strategies to alleviate roadway congestion have been identified. These strategies include both transportation and land use alternatives that influence the demand for transportation service and/or transportation capacity. The strategies presented in this technical memorandum offer both immediate measures for implementation by Connecticut Department of Transportation (ConnDOT) and local communities, as well as longer-term, comprehensive transportation and land use policy changes that will address regional congestion.

For discussion purposes, this document has been divided into three basic sections, each focused on a "package" of alternative investment strategies:

- Low Capital, including Transportation Demand Management (TDM) and Transportation Systems Management (TSM);
- Highway/Roadway; and
- Non-Highway (Rail, Bus and Other).

These different packages are not rigidly defined, since many of the strategies incorporate supporting elements from multiple categories or require coordination among two or more categories. For example, a rail capital strategy may include the addition of rail park-and-ride spaces which in turn may require improvements to surrounding roadways or even to a highway exit to improve access and make the parking improvement more effective.

2. LOW CAPITAL STRATEGIES

Since the completion of the Connecticut Turnpike over 40 years ago and the construction of the Super 7 expressway segment through the City of Norwalk in the early 1970's and late 1980's, no significant length of general purpose limited access highway lanes has been constructed within the South Western Region. In the study area outside of the South Western Region, the Route 8 freeway, planned since the 1940's and completed in 1982, was the last significant segment of limited access highway to be completed in the study area. Instead, most of the transportation improvements within the study area have been in the form of low capital improvements: additional auxiliary lanes to accommodate weaving on I-95, the construction of turning lanes on State and local routes, signal system coordination and automation projects, and construction of sidewalks, bicycle paths, and other amenities within downtown business districts.

Another avenue that has been evaluated to address congestion is the application of Transportation Demand Management (TDM) strategies. TDM is a generic term encompassing a wide range of strategies that have been employed by jurisdictions across the United States to reduce peak hour vehicular travel and increase overall mobility. These measures include the collection of parking fees at work sites; the payment of a flexible transportation allowance in place of employer-paid parking; parking priority or parking fee reductions for High Occupancy Vehicles (HOVs) such as carpools and vanpools; increased or redesigned transit service; revised development standards for parking, building density, and on-site commercial development to foster greater utilization of transit, bicycles and walking; and the encouragement of flexible work hours and telecommuting.

Transportation Demand Management (TDM) has seen many incarnations. At one time the strategies we now identify as TDM were used to address a fuel shortage. As the geography of economic growth moved from urban areas and highway systems into suburban areas, TDM strategies became popular as a tool for managing roadway congestion. With the introduction of the Clean Air Act Amendments of 1990 and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), emphasis was on applying TDM strategies, also referred to as Transportation Control Measures (TCM) to air quality as well as congestion management. The Transportation Efficiency Act for the 21st Century (TEA 21) continues to acknowledge TDM as an integral part of a comprehensive transportation program.

2.1 Rideshare Programs

Across the nation, transportation management organizations, such as Rideworks, the Rideshare Company, and MetroPool, were formed to work together with local municipalities and employers to identify and implement travel demand management programs. One key reason for the emergence of these organizations was the recognition of the link between transportation and economic growth. If goods and people cannot move around a region, it becomes difficult to attract personnel to jobs, have access to resources, and ship goods.

Metropool is the primary transportation management organization within the study area. Headquartered in Stamford, it serves the South Western, Housatonic Valley, and Bridgeport regions, as well as Westchester, Rockland, Putnam and Dutchess counties in New York. Satellite offices have been opened in Danbury, Bridgeport and White Plains. Metropool offers a wide range of services including workshops, transportation and commuter support services, information-sharing services, ridematching, and a web site. Metropool also conducts periodic surveys and focus groups.

MetroPool was formed in the early 1980's as an outgrowth of the Southwest Area Commerce and Industry Association (SACIA), and was intended initially to be employer-funded. However, over the years most of the funding has come from federal and state government sources. Today, Metropool pursues a broad market-oriented approach to

outreach to commuters, residents, the business community, and goods movement managers. Over the years, it has found that its most effective campaigns have been directed to reach people through their employers.

Recent surveys sponsored by Metropool have identified a number of issues that affect the utilization of alternative modes of travel. In particular, the agency has found that carpools and vanpools experience significant turnover as individual employees experience shift changes, job changes, and other variations in the commuting pattern. The availability of transportation information through web sites and e-mail updates is helpful to recruit new participants for these services, as well as to solicit corporate participation in tax incentive programs such as Deduct-a-Ride and Guaranteed Ride Home programs.

Rideworks is the transportation management agency serving the Greater New Haven area, including Milford to the west and the Shoreline area to the east of New Haven. In addition to administering the Telecommute CT program, Rideworks also serves a critical role in the development and implementation of a marketing program for the Shore Line East commuter rail service under contract with ConnDOT.

Like Metropool, its day-to-day outreach activities include working with employers through focus groups, surveys and videos, as well as identifying a customer- oriented approach to building ridership for alternative travel modes. To accomplish these objectives, Rideworks has found that it is helpful to identify opportunities for recognition for its corporate participants and to provide peer recognition of companies that have successfully implemented travel demand management programs. Often corporate participants will approach Rideworks when they face specific transportation issues related to parking capacity and location, corporate relocation, and employee retention. Rideworks has also sponsored or facilitated regional TDM initiatives, such as the Guaranteed Ride Home program for Shore Line East rail commuters and the Coastal Link bus service.

2.2 Parking Management & Reduction Strategies

There is a well-documented correlation between parking availability and cost and the percentage of work trips made by transit.[2] This relationship is not surprising, since in downtown areas parking can be a significant component of auto travel costs, if this cost is not subsidized or assumed by the employer. Parking incentives offer developers the option of providing fewer parking spaces in conjunction with the implementation of a Transportation Demand Management program.

Employers often subsidize employee parking in one of two ways – in many cases without even setting a consistent policy to do so. They may own surface or garage parking which employees use at no charge, or they may lease parking on or off-site and provide the space to employees for free or at a discount relative to the lease rate or market value.

[2] For just one example, refer to Pushkarev and Zupan, *Public Transportation and Land Use*, 1977.

The four major cities located within the study area – Stamford, Norwalk, Bridgeport and New Haven – have significant differences in their policies regarding parking management. In both downtown Stamford and downtown Norwalk, most on-site parking is provided without charge to employees of businesses located in these areas. In downtown Bridgeport and downtown New Haven, the existing inventory is a mix of paid parking facilities owned by both private operators and by municipal parking authorities, as well as numerous “free” parking facilities associated with individual buildings or employers.

Employers can alter this policy in one of two ways. One is a "cold turkey" approach where employers simply stop subsidizing parking or reduce the subsidy substantially. The other approach is to provide an option to the subsidy in the form of cash. Under the "cash out," employers offer employees a choice of continuing to accept subsidized parking or taking the cash equivalent of the subsidy. The rationale for the cash out is some employees receiving free or subsidized parking may prefer to "pocket" the cash and take transit or carpools to work.

Other variables favoring application of the measure are:

- Competing parking facilities (e.g., other private, public, commercial) are well utilized and competitively priced, thereby limiting opportunities for solo drivers to simply shift parking locations.

- Transit offers a good alternative.

- Uncontrolled parking supplies (streets, vacant land, neighborhoods) are minimal.

The effectiveness of employer parking pricing and subsidy reduction in reducing solo driving depends on:

- Proportion of employees receiving subsidized parking;
- Current pricing levels and changes in the price level; and
- The attractiveness of travel and parking alternatives.

Employee parking demand management strategies have not been utilized by any major employers in Connecticut, although there are several instances in the state where corporations have faced a similar condition of *de facto* parking shortage due to site constraints or growth in employment.

2.3 Flexible Transportation Allowance

A transportation allowance known as "TransitCheck" or other financial instrument can be utilized to level the playing field between employees who receive employer-subsidized or free parking and those who choose to use carpools, vanpools or transit. By offering this option, employers demonstrate their commitment to alternative transportation and reduction of vehicular congestion.

During the 1980's, several major Hartford employers took the lead in implementation of these programs. The Travelers Insurance Company and Hartford Steam Boiler (HSB) both included a charge for parking for drive-alone employees as part of their effort to reduce employee parking. Reduction of employee vehicle trips ranged from 25 percent at Travelers to 14 percent at HSB. Parking charges associated with these voluntary initiatives were $25 per month at Travelers and up to $110 per month at HSB.

Recent changes in the tax code permit all employers to offer a tax-free benefit to employees who commute to work by methods other than driving alone. Prior to 2002, the Deduct-A-Ride or Commuter Choice benefit was limited to $65 per month, and the parking benefit to $175 per month. On January 1, 2002, the transit benefit was raised to $100 per month.

2.4 Employer Trip Reduction Ordinance

Trip reduction ordinances (TROs) are regulations passed by local governments and air quality districts requiring employers and/or developers to implement trip reduction or transportation systems management (TSM) programs. A TRO specifies a goal the trip reduction program must strive to reach, usually a reduction in the proportion or percentage of solo drivers or peak period auto trips among employees. For example, the goal may be no more than 60 percent of commuters driving alone to work, or no more than 55 percent of all workers commuting during the peak period, or a five percent reduction annually in the proportion of workers driving alone to work over the next X number of years. The ordinances may apply to virtually all employers in a jurisdiction, or may be targeted to employers by type of business, number of employees) or location.

Across the United States, Employee Commute Options (ECO) and Employee Trip Reduction (ETR) programs were an outgrowth of more localized efforts to mandate the level of traffic growth permitted at new real estate developments. During the 1980's, some 30 communities nationwide implemented ordinances aimed at reducing or mitigating growth and its effects on traffic.

Building on these local and State-level efforts, the federal Clean Air Act Amendments of 1990 (CAAA) required employers with 100 or more employees located in "severe" air quality non-attainment areas, such as Fairfield County, to meet targeted levels of Average Passenger Occupancy (APO) set at 25 percent above the current average. Each employer was required to formulate an Employee Commute Options (ECO) plan that "convincingly demonstrate[d]" achievement of the target within two years after plan approval.

However, in early 1996, the requirements of this Act were downgraded from mandatory to voluntary, and all states with severe air quality non-attainment areas were given the opportunity to develop their own regulatory framework.

The State of Connecticut's continuing ECO program has focused on voluntary participation and the provision of incentives to employers and vanpool participants. Under the terms of the 1992 National Energy Policy Act, employers may offer a transportation allowance benefit of up to $65 per employee per month, on a pre-tax basis. The expense is fully tax deductible for the employer. Through administration of the TransitCheck program in the Stamford area, the State has provided a $1 match for every $2 provided by employers to support employees' use of transit and vanpools. In other parts of the country, similar regional voucher programs have been implemented.

2.5 Flexible Work Hours

Flexible work hours strategies are employer-sponsored programs in which employees are permitted to choose from various work schedules, so that the number of peak hour trips is reduced as work starting and ending times are spread throughout a greater portion of the day. These initiatives offer additional benefits to employers, such as reduced absenteeism and lateness; increased employee job satisfaction; and extended coverage of office functions. In a flex-time work program, there is a "core period" during which all employees are present and flex-time bands at the beginning and end of the day where only a portion of the work force is present. While this strategy is extremely popular with employees, it can be problematic for some businesses due to the need for appropriate supervision, support personnel and, in some cases security, over a longer interval during the day.

Staggered work hours are similar to flex-time in the use of a longer period of work arrival and departure, however, a greater degree of employer direction may be used in this program. For example, a series of work shifts may be organized in a manufacturing sector firm with the same start times for each person within a given production team or area. In a compressed work week program, employees work more hours each day, and then receive extra time off to compensate.

Common arrangements include scheduling three twelve-hour shifts per week (especially for hospital and public safety workers), four ten-hour days per week, or a nine-hour workday for nine days over a two-week period with an extra weekend day on one of the two weekends. These programs are also generally popular with employee participants, but like flex-time they may not be suitable for every type of business. A growing number of Connecticut and study area employers have implemented flex-time programs like these over the last 10-15 years.

2.6 Telecommuting

Telecommuting is the practice of permitting employees to work from their home for all or a portion of their work days. More and more job tasks are likely to be candidates for

telecommuting in the future as advances in technology continue. The type of work performed by an employee is the most important determinant in the decision as to whether to telecommute. As both employers and employees become more accustomed to the practice of telecommuting, and as commute times lengthen as a result of congestion, the frequency of telecommuting is likely to increase. Likewise, as the number of telecommuters increase, more employers will evaluate and consider the benefits of telecommuting. As a result of telecommuting, travel demand, and therefore congestion, can be reduced.

Telecommuting alternatives to working out of the home are satellite offices and executive office suites. Satellite offices are established by a single organization that provides the technology and support for a group of telecommuters within that organization. Telecommuters still have to travel to get to these locations, but the commute is generally shorter than to the central office.

The continuation of technological advances and on-line resources has led to an increase in the number of worker categories for whom telecommuting is considered an option. The U.S. workforce has been shifting from jobs in manufacturing and other heavy industries to jobs in the information technology and management sectors. Studies identify the percentage of the overall workforce from which telecommuters will be drawn at between 50 and 70 percent. Factors influencing both immediate and future institution of telecommuting options for these employees include supervisor/employee acceptance of telecommuting and type of work.

At the local level, Telecommute Connecticut! is a program sponsored by the Connecticut Department of Transportation and administered by Rideworks that promotes telecommuting as a viable and flexible work option that reduces the number of work trips and therefore traffic congestion. Telecommute Connecticut! is a free resource for Connecticut's employers with a goal of assisting in design and implementation of telecommuting programs.

Telecommute Connecticut! commissioned a statewide survey of employers and employees to estimate how many workers in Connecticut telecommute.[3] An estimated 117,000, or 7 percent, of the 1,668,000 workers in Connecticut telecommute at least one day per month. Since 1997, the number of work sites with telecommuters has remained the same, but the number of telecommuters at these work sites has increased. Of those employees who do not currently telecommute, 27 percent indicated that their work lends itself to telecommuting and 33 percent would like to work from home at least some of the time. Only about 14 percent of non-telecommuting employees have employers who currently permit telecommuting.

The survey results also showed that the average Connecticut telecommuter reports to a worksite that is over 25 miles away from his/her home. Every day spent working at home saves a 51 mile round trip by car per telecommuter. With an estimated 117,000

[3] Telecommute Connecticut! Website news article, *Survey Measures Telecommuting in Connecticut For the First Time*, 2001

telecommuters in Connecticut, telecommuting provides a reduction of 37.2 million vehicle miles traveled every month.[4]

Employers completing the survey indicated that the biggest drawbacks of telecommuting are the inability to hold spur-of-the-moment meetings and the notion that employees must be in the office to serve customers and perform other important tasks. These results show that there is plenty of demand for telecommuting in Connecticut and that employers still need to be convinced of the benefits of telecommuting.[5]

Individual employers develop telecommuting policies for their workplaces. Employers need to address legal issues and employee performance issues before instituting a program. Legal issues which may need to be addressed prior to establishing a regular home-based telecommuting program include zoning, home-office business licensing, home insurance, taxation, and employee protection issues such as worker compensation.

Office managers are often reluctant to allow employees to work at home because of concerns that employees will be distracted and employee performance on a day-to-day basis cannot be as easily evaluated. Clear communication between employer and employee about the employee's performance is important for successful home-based telecommuting.

The General Services Administration (GSA) estimated that it costs about $10,200 per year to provide the office space and equipment for a non-telecommuting employee and $9,500 per year for an employee who telecommutes.[6] Other cost reductions include those associated with decreases in employee turnover, decreases in absenteeism, and increased productivity. Various sources have estimated that cost reductions may average $10,500 per year for each telecommuter.[7]

Development costs required to start telecommuting programs include computer hardware, software, phone lines, other office equipment, and marketing and training materials. The operating costs of a telecommuting program include administrative costs, marketing and advertising costs, employee and manager training costs, and equipment upgrades and maintenance.

Total development costs have been estimated at $6,000 for a home-based telecommuter and $9,500 for a telecenter-based telecommuter. The annual recurring costs range from $2,500 to $3,500 for home-based and telecenter-based telecommuters.[8] Equipment costs vary depending on the extent to which the employer is willing to provide telecommuters with equipment. According to a recent survey, the majority of telecommuting employees are required to provide some or all of their equipment.[9]

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[4] ibid.
[5] ibid.
[6] General Services Administration, *Workplace Evaluation Study*, 1999
[7] Virginia Department of Transportation, *VDOT/DRPT Telework Study*, 2001
[8] ibid.
[9] Niles, J.M. JALA International, Inc. *Telework in the U.S.-Telework America Survey*, 2000

The principal benefit identified in most studies is the reduced cost of real estate, but this reduction is only possible if less overall work space is required at the central work location and telecommuters share space when they do come to the central office to work.

Other general benefits an employer can expect include increased productivity, decreased absenteeism, increased employee retention and attraction, decreased long-term disability costs, reduced overhead and office space costs, reduced parking space needs, and improved morale. Increasing availability of information and communication technologies has expanded telecommuting capabilities to many difference professions and positions. Trends over the last decade show that telecommuting has become a desirable way to work. High-speed internet access is advancing the ability to share, review, manipulate, and discuss information between individuals and in teams from remote locations. Further advances in telecommunications technology, such as video conferencing, could accelerate this trend.

The general benefits of telecommuting for the employee include reduced commuting time and commuting stress; decreased costs for transportation, parking, clothing, and food; increased job satisfaction and enhanced quality of life; and increased work efficiency due to the telecommuter's ability to work away from normal office distractions.

2.7 Value Pricing

Value pricing is a strategy utilized on toll roadway facilities where higher tolls or fares are charged during the peak period in order to encourage peak period travelers to shift their travel to off-peak times or, in the case of roadways, to utilize less congested facilities or alternative modes. Value pricing may also be applied to transit.

Value pricing strategies are generally considered in locations and corridors where tolled facilities already exist. While the Merritt Parkway and the Connecticut Turnpike (I-95) were originally built as toll facilities, tolls were removed from these facilities by state legislation in 1985. At the present time, there are no tolled roads or bridges in the state. Many institutional and equity issues will need to be addressed before value pricing would be adopted within the study area.

A desirable effect of value pricing is to encourage ridesharing, shifts in travel to off-peak times, use of other modes (rail or bus), or use of other roadways. Value pricing could encourage some long distance travelers and trucks to divert travel from I-95 to the Route I-84 corridor, but many trips are constrained by locations of residences and locations and hours of employment.

Previous studies and discussions have failed to produce a consensus on the benefits of additional road capacity to the motorist regardless of pricing structure.. The issues of rights of way, environmental effects, noise, traffic on the approaches to expressways, and aesthetics would have to be resolved for a value-priced facility just as for a conventional highway. Since the State of Connecticut does not have any explicit policy about when, where and how value pricing strategies could be applied within the state, these policies would have to be developed through a consultative transportation planning process.

2.8 Truck Management Trends

Many TDM programs focus on modifying or reducing passenger travel demand, but applications also exist for managing truck traffic. Encouraging shippers to explore other modes of transport such as rail and water can help manage truck traffic. Truck traffic can also be reduced if "dead-head loads" (e.g., movement of empty trucks caused when deliveries or pickups do not have a matching load nearby for the opposite trip) were minimized. Dead-head loads may be avoided through the use of consolidated loads with regional distributions. Freight delivery times can be altered to avoid deliveries during peak congestion periods. The benefits of reducing truck traffic include congestion reduction, savings in road maintenance costs, energy conservation and reduced crash risk.

A separate issue of truck management is provision of adequate highway truck rest areas. A 2001 report by ConnDOT, the *Truck Stop and Rest Area Parking Study*, identified a serious deficiency in the number of rest area parking spaces available for truckers in both the study area and throughout the remainder of the state.[10] Each of the eight I-95 rest areas in the CMS study area – two each in Darien, Fairfield, Milford, and Branford – is operating at or over capacity for overnight truck parking during peak shipping periods (i.e. the pre-Christmas season). During peak overnight hours, trucks can be observed parking in unauthorized spaces within the rest area facilities, as well as on adjacent areas of highway shoulder.

The *Truck Stop and Rest Area Parking Study* concluded that over 1,000 additional parking slots would need to be constructed to fully meet projected needs.[11] ConnDOT has evaluated each of the state's public and private truck rest areas to determine where additional spaces can be constructed most quickly and cost effectively. Due to right-of-way constraints, rest areas within the CMS study area can provide relatively few additional spaces, while other locations in the state are more likely to receive additional capacity. For through truck movements, the location of truck rest areas within the state is probably not as significant an issue as their identification by signage and their availability at times of peak demand.

3. HIGHWAY/ROADWAY STRATEGIES

Highway and roadway strategies apply to both the study area's limited access facilities, such as I-95, I-84, I-91, Route 15 and Route 8 as well as to non-limited access arterial roadways, such as Route 1, Route 7, Route 25 and Route 34. These facilities serve a wide range of functions within the study area, ranging from long distance travel between metropolitan areas to local trips to businesses schools and shopping. The range of strategies within this category is equally varied, including:

- Intelligent Transportation Systems;

[10] Connecticut Department of Transportation, Goods Movement Planning, Office of Intermodal Policy Planning, *Truck Stop and Rest Area Parking Study*, April 2001, page 8
[11] ibid., page 5

- Traffic Operational Strategies;
- High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Strategies; and
- Additional General Purpose Highway Lanes.

3.1 Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) involve application of management strategies and technologies to increase efficiency and safety of the national, regional and local surface transportation systems. Rather than solving transportation challenges solely by building additional infrastructure capacity, ITS strategies strive to use existing facilities more efficiently by applying technology and management strategies to collect, transfer, process and share historical and real-time transportation information.

The information is valuable to transportation agencies responsible for operating and managing the systems, and also to the traveling public who must make decisions about which mode to use, which route to take, or what time of day to travel. These systems can help reduce congestion, improve safety, and improve mobility.

A major thrust of the Federal ITS Program is to encourage integration of ITS strategies to capitalize on synergies between ITS functions. Federal regulations require development of a regional ITS architecture to identify system integration opportunities and interfaces between systems where standards should be used. The regional architecture must be in place by 2005. ITS projects identified for implementation must conform to the regional ITS architecture. Until the regional ITS architecture is in place, all major ITS projects must have a project-level architecture to ensure proper consideration of regional integration. ConnDOT has prepared an Intelligent Transportation Systems Implementation Plan to serve as the Regional ITS Architecture for the State of Connecticut. The key ITS program areas are:

- Incident Management;
- Motorist Patrol;
- Route Diversion Planning;
- Traveler Information Systems; and
- Computerized Traffic Signal Systems.

3.1.1 Incident Management

Incident management is defined as the systematic, planned, and coordinated use of human, institutional, mechanical, and technical resources to reduce the duration and impact of incidents, and improve the safety of motorists, crash victims, and emergency responders. These resources are also used to increase the operating efficiency, safety, and mobility of the highway by systematically reducing the time to detect and verify incidents; implement appropriate responses; and safely clear the incident while managing the affected flow until full capacity is restored.

Incident management focuses on unexpected or "non-typical" events and thus reduces unpredictability in transportation system performance. In addition to improving reliability, the reduction of secondary accidents is also a benefit. Incident management programs have been found to reduce delay associated with congestion caused by incidents by 10 to 45 percent.

Accident detection, traffic monitoring and surveillance in Southwestern Connecticut occur at ConnDOT's Bridgeport Operations Center (BOC). This facility is responsible for traffic surveillance along 56 miles of I-95 from the New York State Line to Interchange 56 in Branford, along Route 7 from I-95 to Interchange 2, along Route 8 from I-95 to Interchange 2, and along I-91 from I-95 to Interchange 4. In addition to these limits for the highway surveillance system, the area encompassed by the BOC includes sections of other limited access highways including Route 15, Route 7, Routes 8 and 25, and Interstate 91.

Over 90 video cameras provide coverage of highway and interchange locations within the study area. These cameras are spaced approximately every half-mile along I-95 within the limits of the surveillance system. The locations of the cameras have been designed to correspond to the specific detector stations. This allows the different field elements -- cameras and detectors-- to be served by a single field cabinet. The video cameras make use of pan, tilt and zoom capabilities.

3.1.2 Motorist Patrol

A motorist patrol strategy consists of the advanced deployment of incident response vehicles along a corridor where high levels of traffic congestion and accident experience indicate a need for the fastest possible response by State Police and other public safety agencies. Connecticut Highway Assistance Motorist Patrol (CHAMP) operates along the I-95 Corridor from the New York State Line in Greenwich through Branford. These patrols are each assigned to a specific coverage area and are on duty from 5:30 A.M. to 7:00 P.M. Service patrol vehicles are expanded pick-up type trucks with compartments for necessary tools and equipment to assist motorists in need. They are responsible for clearing traveling lanes of debris and vehicles when necessary. Service patrol personnel provide free assistance to motorists involved in minor accidents and help those with disabled vehicles with such services as changing tires, providing "jump starts" and refueling.

Regional Incident Management Teams, comprised of fire chiefs, police chiefs, State Police, DEP, towing and recovery services personnel EMS and ConnDOT personnel, are located within all portions of the study area and have been charged with developing coordinated policies and procedures for managing incidents and highway closures.

ConnDOT is also a member of both TRANSCOM and the I-95 Corridor Coalition. TRANSCOM is comprised of various transportation operating agencies in New York, New Jersey and Connecticut. The I-95 Corridor Coalition includes public/private transportation agencies from Virginia to Maine. As a member of these groups,

ConnDOT shares traffic information with other member agencies. The I-95 Corridor Coalition has developed an Incident Exchange Network (IEN) for sharing traffic information among agencies. The IEN is a network of computers located at different operations centers throughout the I-95 corridor. The I-95 Corridor Coalition has developed guidelines for managing corridor, regional and local incidents at different levels of severity and potential impact.

3.1.3 Route Diversion Planning

An important aspect of incident management is development of traffic diversion plans that allow motorists to bypass sections of roadways when incidents occur. Traffic diversion plans have been developed for the Route I-95 Corridor and plans for other corridors are in preparation. Diversion routes have been formulated with the assistance and cooperation of regional planning agencies, local traffic engineering and public works departments and police. Procedures have been established for consultation and cooperation when incidents occur.

3.1.4 Traveler Information Systems

There are two general types of traveler information ITS applications. Pre-trip traveler information systems enable travelers to change plans prior to their departure, while en-route traveler information systems provide travelers already on the transportation network with information on unexpected incidents or congestion. The information can range from a simple alert to route diversion information. Dissemination of this information results in lower levels of congestion and faster clearance times for incidents. It also reduces the levels of "unpredictability" regarding traffic operations and contributes to a reduction in secondary accidents. Traveler information systems can include multimodal information as well as information on traveler services.

Variable message signs are generally deployed on highways and are typically located prior to an important motorist decision point. The information displayed on the signs reports specific conditions or situations on the surrounding network, and is used as part of an overall approach to congestion and incident management. Highway Advisory Radio (HAR) stations are used to provide specific information at key locations on a more immediate basis than is possible using VMS. Ten-watt transmitters are used with an anticipated broadcast radius of five miles. Four HAR stations are installed along I-95 with a fifth transmitter deployed at the Route 8 and 15 interchange.

ConnDOT has added real-time information capabilities to its website including a scrolling list of active traffic incidents, video camera images from the Newington Operations Center and BOC, and average travel speed information for the Hartford area freeways. Newly deployed systems will provide even more extensive pre-trip and en-route information to Connecticut travelers. Video images are made available to any local media outlet that requests them. In addition to these video images, a fax broadcast service has been developed to share traffic condition reports with various agencies and

media outlets. Currently, information is faxed from the BOC to Metro Networks, Shadow Traffic, STAR 99.9, WEBE, Channels 8 and 12, Metropool and Rideworks.

3.1.5 Computerized Signal Systems

There are 43 signal systems in South Western Connecticut, covering approximately 375 intersections. Both closed-loop and time-based signals have been deployed. In-pavement roadway loop detectors are used throughout Connecticut as part of the computerized signal systems. These detectors, referred to as system detectors, are installed on various approaches to intersections and are used to collect traffic flow data. This data is used by system operations personnel to evaluate traffic conditions and determine if changes are required to system timing plans. These detectors can also be used to support traffic responsive operation, whereby timing plans are automatically changed to suit the current traffic conditions. ConnDOT uses traffic responsive operation on a limited basis, having found this type of operation to not be consistently reliable. Along the I-95, I-91, and I-84 corridors, special timing plans have been developed for signal systems along roadways that act as diversion routes for Interstate traffic.

3.2 Traffic Operational Strategies

For the purposes of this report, the following engineering strategies are listed under this category:

- Access Management;
- Intersection and Roadway Widening;
- Modern Roundabouts;
- Ramp Metering; and
- Traffic Calming.

3.2.1 Access Management

Existing development patterns in many urban and suburban portions of the study area reflect the desire for easy auto access, separation of different land uses and low initial infrastructure cost, rather than effective traffic management. These factors often result in the development of commercial strips on arterial roadways that contain an excessive number of driveways, few secondary street connections, and a poor relationship between the commercial area and surrounding residences and community facilities.

Existing development limits the ability of many study area municipalities to strategically widen roads, modify circulation patterns or provide turn lanes at intersections. Over time, the proliferation of individual driveways along an arterial, such as U.S. Routes 1 and 7, Black Rock Turnpike (Route 59), Long Ridge Road, and High Ridge Road can cause conflict between through traffic movement and site access. These conflicts result in added travel delay as the time required to safely maneuver to and from the roadway can be frustratingly long. Such delays potentially cause drivers to make unsafe entrances

and exits. The result is increased accidents, as motorists attempt to improperly cross opposing traffic or pass vehicles on the right side.

Access management strategies seek to eliminate, reduce, space or regulate the number of curb cuts and driveways that occur along a roadway. Managing the number of driveways in areas with conflicting vehicle turning movements provides safer and more efficient traffic operation. In many cases, only minor modification to existing parking or internal circulation patterns may be needed to allow closure of unnecessary curb cuts. At the same time, these strategies assure adequate access to adjoining properties for vehicles and pedestrians. In this context, access management balances the transportation and land use needs of the community.

Access improvements, either as dedicated transportation projects, or in conjunction with development and re-development of frontage properties, are intended to better coordinate or reduce the number of driveway curb cuts to the roadway mainline, while maintaining or enhancing the level of accessibility to these properties.

Curb cuts can be controlled by:

- Elimination of unnecessary curb cuts with the goal of a single access point per property;
- Providing shared driveways and curb cuts between adjacent properties and providing for cross property easement to facilitate circulation;
- Replacing access from arterial roadways with access from side streets, frontage roads or service roads;
- Better definition of driveway openings, and, where appropriate, reducing the driveway width, especially where the entire frontage is open to traffic;
- Channelization of existing driveways to properly define and identify locations for entrance and exit, and for one-way movement within the site.

As documented in National Cooperative Highway Research Project Report #348, *Access Management Guidelines for Activity Centers*, during the last two decades, a number of states including Colorado, Florida, Maryland, Michigan, New Jersey and Wyoming, have developed statewide access management policies or guidelines to direct and control access permitting on state routes.[12] Typically these guidelines provide statewide standards for driveway spacing, intersection spacing, signal spacing, number of driveways per site, and driveway offset distances. Connecticut exercises some degree of control over access both through municipal site development standards and through the State Traffic Commission (STC) application process.

Over the years, the growth of traffic on major travel routes and commercial corridors has caused ConnDOT to evaluate and implement numerous improvements to increase the efficiency of traffic operations on many of the study area's arterials. Some of these past improvements can be characterized as access management, such as improvements to

[12] Transportation Research Board, National Cooperative Highway Research Project Report #348, *Access Management Guidelines for Activity Centers*, 1992

King's Highway in Fairfield and to Boston Road in Bridgeport. A number of access management-type projects have recently been designed or undertaken within the project study area, including a driveway re-alignment in the City of Bridgeport at the intersection of U.S. Route 1 and the Bayview and Shoppers' Fair shopping centers.

All major commercial arterials within the study area are potential candidates for application of access management strategies. Typically, the process for developing an access management strategy for a particular corridor or corridor segment would begin with a planning study at the local or regional level to establish appropriate access management standards. These standards can then be incorporated as an Access Management Plan within the municipal Plan of Conservation and Development and also can be the basis for access management regulations adopted either as an amendment to the municipal zoning regulation or as a stand-alone local regulation.

As noted above, access management policies in Connecticut are implemented at the local level in coordination with existing STC guidelines and requirements. Past experience with the development of access management plans has shown that considerable amounts of public information and outreach are the key elements to building support and understanding for an access management approach. Individual property owners often have significant concerns regarding maintenance of access to their property. However, town- or citywide access management policies can provide support for the implementation of a corridor-specific access management improvement program. Access management strategies are typically less costly than road widening, lane addition or other capacity enhancement strategies.

3.2.2 Intersection and Roadway Widening

Intersection and roadway widening involves adding lanes along one or more approaches to an existing intersection to accommodate higher levels of congestion and delay through the intersection. This strategy may adversely impact adjacent properties and the environment in the vicinity of the intersection.

3.2.3 Modern Roundabouts

A modern roundabout is a circular intersection with specific design and traffic control features that include yield control of all entering traffic, channelized approaches and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 30 miles per hour. The roundabout concept initially became popular in the United States in the early 1990s and the first two roundabouts were built in Summerlin, Nevada in March 1990. As of October 1997, there were 38 roundabouts in operation in the United States.

Roundabouts have been proposed for community enhancement at a number of locations as they provide a gateway treatment to a community and force the traffic to slow down. They can bridge and buffer the transition between commercial corridors and residential areas. Roundabouts provide benefits to pedestrians and motorists at locations where

heavy pedestrian volumes conflict with high traffic volumes. Pedestrians are provided a large refuge area within the roundabout, and they also benefit from traffic being "calmed." Motorists benefit because the roundabout typically has a higher traffic throughput and lower levels of delay than a conventional intersection.

Roundabouts cannot work at every intersection. Roundabouts typically require a large amount of space for construction and opportunities to build them may be limited by physical or geometric constraints. Grades or unfavorable topography could limit visibility or complicate construction of a roundabout. Furthermore, because of potential conflicts from queuing traffic, the design of a roundabout close to major traffic generators or traffic control devices warrants detailed investigation.

Roundabouts need local and regional acceptance. If the community is supportive of the concept, a feasibility study should be performed for every location a roundabout is proposed to ensure that the site and design are appropriate.

3.2.4 Ramp Metering

Ramp metering is a traffic control technique that regulates vehicle entry onto the freeway to improve stability of freeway flow and throughput during peak traffic hours. Traffic flow is regulated through the coordinated use of traffic signals and sensors. Sensors control the sequencing of traffic signals to ration the rate of vehicle access onto the highway according to available capacity. Ramp metering has been used since the late 1960's in a number of locations around the United States such as the Eisenhower Expressway in Chicago, the Gulf Freeway in Houston, the Van Wyck Expressway in New York, and a number of locations in the Los Angeles area. The evolution of ramp metering is a result of observing peak-hour congestion along the freeway and unsafe merge operations at the freeway-ramp junction. As traffic volumes increase in any given corridor, this strategy may have significant benefits in freeway operation.

Ramp metering applications may be limited by the available storage area for queued vehicles on metered ramps. In some locations, new or redesigned ramps have been constructed to support ramp metering applications. In other locations, HOV bypass ramps have been used on metered ramps to provide an incentive for HOV use. While bypass ramps offer an effective enhancement of both HOV and ramp metering concepts, additional rights of way are required to build such improvements. Another issue to be considered is the length of the acceleration lanes provided downstream of the ramp meter, as vehicles (particularly trucks) would have a shorter distance to accelerate than if the ramp was not metered.

3.2.5 Traffic Calming

Traffic calming is the use of physical design techniques to reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users. Traffic calming strategy may include a variety of physical measures, including:

- Vertical changes in the street, such as speed humps, speed tables;
- Lateral changes in the street, such as chicanes, offset intersections, lane shifts;
- Reduction of pavement widths through medians, edge treatments, entrance features, roundabouts; and
- Streetscape modifications, such as the installation of textured and colored pavements, landscaping, street trees.

The first full-scale traffic calming program was established in Berkeley, California, in 1975 through a citywide traffic management plan. Seattle, Washington, conducted neighborhood-wide demonstrations of traffic calming in the early 1970's. Municipalities and regions following the lead of Seattle and Berkeley included Eugene, Oregon; Montgomery County, Maryland; San Jose, California; Charlotte, North Carolina; and Austin, Texas. Currently, traffic calming is used at the neighborhood level to calm traffic on high volume streets and increase the quality of life.

3.3 High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Strategies

The term High Occupancy Vehicles (HOV) includes carpools, vanpools and buses. These vehicles can be given preferential treatment over Single Occupancy Vehicles (SOV) to encourage ridesharing and increase the effective roadway capacity.

3.3.1 HOV Priority Lanes

HOV priority lanes were first implemented in the 1960's in San Francisco on the Oakland Bay Bridge and in Washington D.C. on the Shirley Highway. In the early 1970's, facilities were added in New York, Seattle, and Los Angeles. HOV use increased significantly in the 1980's and 1990's. By 1997, in the United States alone, HOV facilities existed in 18 states with additional facilities planned in many more. HOV lanes can be separated from traffic using buffers or physical barriers or they can be directly adjacent to normal travel lanes and designated with signs and markings only.

The most successful HOV projects in the United States have been in Houston, Southern California, Seattle and Washington D.C. The HOV system in Houston currently consists of 90 miles of HOV lanes, ramps, park and ride lots and transit centers. The lanes exist on six freeways in Houston and are barrier-separated and reversible. In contrast, some communities have constructed HOV lanes to find them unsuccessful in encouraging carpooling. In New Jersey, the HOV lanes on I-287 and I-80 were eliminated after a public outcry that they were underutilized.

Within Connecticut, HOV Lanes currently exist on I-91 north of Hartford and on I-84 and I-384 east of Hartford. These facilities feature buffer-separated lanes and separate ramps for the HOV vehicles entering the interstate. The buffer separating the HOV lanes from general traffic is a 17-foot wide recessed swale. The I-84 and I-384 HOV lanes were officially opened in September 1989 and the I-91 lanes opened in December 1992. As of November 2000, 21 miles of HOV lanes existed in the Hartford area. In early

2001, the I-84 lanes were extended 1.25 miles into downtown Hartford. This extension allows commuters into Hartford direct access without merging into general traffic.

According to ConnDOT's *High Occupancy Vehicle Lane Report* from November 2001, during the morning peak period, the I-84 and I-384 westbound HOV lane carried 1,178 total vehicles with 3,519 people. During the AM peak period, The I-91 southbound HOV lane carried 1,296 total vehicles with 3,779 people. For I-84, the average vehicle occupancy is 2.16 persons per automobile and 32% of the HOV users commute in vans and buses. For I-91 the occupancy is 2.20 persons per automobile and the number of commuters in vans and buses is 28%.[13]

The Victoria Transport Policy Institute lists guidelines for development of effective HOV facilities.[14] These guidelines recommend development of HOV lanes when the following factors are present:

- More than one million people in the metropolitan region;
- High levels of traffic congestion in the corridor;
- Access to an employment center with 100,000 or more workers;
- Well-designed highway facilities;
- 25 or more scheduled buses during peak periods;
- Supportive TDM programs and policies with ongoing marketing;.
- Visible enforcement; and
- Cooperation among responsible transportation agencies.

The first challenge in implementation of HOV facilities is the necessity to convince drivers to carpool. Although HOV treatments encourage carpools and transit use, it is still up to the driver to make the decision. In order to truly encourage HOV facility use, the improvements must be paired with other rideshare programs.

Another inherent problem with HOV facilities is often referred to as the "empty lane syndrome". Drivers stopped on the roadway look over at the HOV lane and think that it is underutilized in comparison to the lane that they are in, even though many more people are in fact traveling in the HOV lane. One of the keys to a successful HOV program is enforcement of the restrictions. An HOV lane in which so many violators are present that the number of vehicles approaches that of an adjacent lane does nothing to encourage carpooling. Enforcement costs money and time and must be considered early in the design phase of an HOV facility.

The primary obstruction to implementation of HOV lanes in the study area is the availability of right-of-way in the corridor. Due to the built-up nature of the communities along the coast, a separate facility would be nearly impossible without significant environmental impacts and costs. Available right-of-way along I-95 and the Merritt

[13] Connecticut Department of Transportation, *High Occupancy Vehicle Lane Report*, November 2001, page 4

[14] Victoria Transport Policy Institute, *HOV Priority*, accessed at www.vtpi.org/tdm/tdm19.htm in May 2002

Parkway is severely limited, as identified in the following section, *Additional General Purpose Highway Lanes*.

3.3.2 Express Toll Lanes/HOT Lanes/Managed Lanes

One subset of facility pricing currently being explored throughout the country is known as Express Toll Lanes. Variations on this theme include High-Occupancy/Toll (HOT) Lanes and Managed Lanes. Express toll facilities typically have been constructed as express lanes alongside freeway lanes. Access is provided at a limited number of locations to reduce entering and exiting maneuvers that could adversely affect throughput in the travel lanes. Travel speeds and demand on the facility is managed through pricing. Pricing is based on the travel demand and the cost of travel in the peak direction is set at a level higher than in the non-peak direction. Prices may also be adjusted throughout the day.

HOT Lanes are a variation on toll lanes that allow certain classes of vehicles, such as HOV, vanpools, transit buses, discounted or free access to the tolled lanes. In some current applications, HOT lane projects are implemented on facilities originally constructed as HOV lanes. For reasons that vary by locale and facility, some HOV lanes tend to be underutilized. Conversion of HOV to HOT lanes is a way to make better use of the available capacity of the lanes by allowing lower-occupancy traffic to "buy-in" to the lanes.

The 91 Express Lanes project in Orange County, California, which opened in late 1996, was the first express toll lane facility in the United States. During the first two years of operation, vehicles with three or more occupants were allowed toll-free access to the express lanes. The operators were allowed to charge tolls to HOV-3+ traffic at a 50 percent discount after the second year subject to financial considerations spelled out in the franchise agreement with California Department of Transportation (Caltrans),

The Houston QuickRide value pricing demonstration project, in place since 1998, is an example of an HOV-HOT conversion. The 13-mile HOV lane on the Katy Freeway was originally constructed as a single-lane express bus lane. Over time, HOV-2+ traffic was allowed access to the lane. Demand on this lane grew to the point that during peak hours of the day, access was restricted to HOV-3+ in order to maintain free flow speeds. However, this strategy left the lane underutilized during these hours. The QuickRide program allows HOV-2 traffic to buy-in to the HOV lane when it is operating under an HOV-3+ definition as a way to utilize the excess capacity of the lane during the peak hours without degrading the quality of service provided by the lane.

Another example of HOV lane conversion is the I-15 Managed Lanes in San Diego, California. In that case, two-lane reversible HOV lanes were set up with dynamic pricing (e.g. prices change with demand as frequently as every 5 minutes) to ensure that a free flow of traffic is maintained. In that case, SOV traffic was allowed to buy-in to the lanes. The San Diego Association of Governments (SANDAG) is currently planning to upgrade the facility to a four-lane bi-directional facility and to extend it by 12 miles in length.

3.4 Addition of General Purpose Lanes

Over the years, several proposals have been made to increase the number of lanes available for general traffic on I-95. In the mid-1980's, ConnDOT developed a Southwest Corridor Transportation Study. The technical analysis component of this study found that 2010 travel needs in the I-95 and Merritt Parkway corridors would require the addition of three travel lanes on I-95 in each direction and the addition of two travel lanes in each direction on the Merritt Parkway.[15] However, as noted in ConnDOT's 1998 *Southwest Corridor Study Update*, "During the analysis phase of the data that had been collected and generated it became apparent that major expansion of the Merritt Parkway was not feasible… Analysis work [for I-95 improvements only] continued until 1992 when Draft EIS preparation was halted pending the Department's Strategic Financial Plan."[16]

Roadway design plans to enhance through traffic operations and interchange/ramp traffic movements have also been developed for the other limited access routes in the study area. However, with the exception of the extension plans for Route 25 and Route 34, none of these plans involves the construction of additional travel lanes or the addition of through travel capacity.

For interstate highways, such as I-95, improvements involving the addition of highway lanes must meet national engineering guidelines to obtain federal funding. These guidelines are based on national standards and incorporate features such as a minimum lane width of 14 feet, shoulder and median widths of 12 feet, and minimum interchange spacing one-mile intervals. While the existing configuration of I-95 within the study area does not consistently meet these criteria, it is likely that any new construction within the I-95 right-of-way or adjacent land would require extensive review to determine whether these criteria would apply or where exemptions could be granted. In addition, the region's current designation as a non-attainment area for ozone under the Clean Air Act, would require an extensive review of environmental impacts associated with construction. The current designations are "severe non-attainment" for all of Fairfield County (with the exception of the City of Shelton) and "serious non-attainment" for New Haven County and the City of Shelton.[17]

According to the *Southwest Corridor Study Update*, ConnDOT completed highway projects valued at $695 million between 1985 and 1998. Nearly all of these funds were devoted to continuing maintenance and rehabilitation of the region's nearly 50-year-old highway infrastructure. Of this amount, more than half consisted of bridge improvements to address urgent maintenance and operation deficiencies on facilities such as the Mianus River Bridge in Greenwich and the Bridgeport Harbor crossing structures. In addition, $93 million has been expended on safety improvements, such as intersection

[15] Connecticut Department of Transportation, *Southwest Corridor Transportation Study Update,* 1998, page 3
[16] ibid, page 4
[17] United States Environmental Protection Agency, *Nonattainment Areas for Criteria Pollutants* ("Green Book"), accessed at http://www.epa.gov/oar/oaqps/greenbk/oncs.html#CONNECTICUT on 9/4/02.

improvements, signing, illumination, guide rail, median barrier, and operational lane improvements. Just over $100 million has been spent on roadway and interchange reconstruction.[18]

Since the Update Report was issued, work has been completed on the addition of a southbound operational lane on I-95 between exit 8 and exit 10 in Stamford and Darien at a cost of approximately $39 million. In addition, on U.S. Route 1 from Greenwich to Branford, ConnDOT has prepared design plans for operational improvements at more than 400 intersections, including plans for left turn lanes and traffic signal enhancement. A significant number of these improvements are proceeding to construction. Most recently, a suggestion was made that the I-95 highway shoulder could be utilized as a travel lane during the peak period. To date, this proposal has not moved forward due to substantial safety and traffic operations concerns relating to the physical configuration, width and non-continuous nature of the shoulder area.

Planned improvements to other study area roadways during the 2002-2020 study time horizon are detailed in the *Existing Conditions Report* for the SWRPA's 2020 Congestion Mitigation Systems Plan.[19] With the exception of the reconstruction of the Quinnipiac River Bridge and the connecting segments of I-95 at the I-91 interchange and Exit 54, the eastern boundary of the study area, none of the planned improvements will add through travel capacity for general highway traffic.

The *Southwest Corridor Study Update* provides an estimate of the cost for converting I-95 shoulders to a travel lane. The addition of one lane in each direction was estimated to cost $825 million excluding right-of-way costs due to structural and operational changes. Further evaluation indicated that these right-of-way costs would be substantial. The report notes:

> *With over 125 structures on this portion of I-95* [Greenwich to Branford], *excluding Bridgeport, the major cost will be the widening of the bridges. Of the 37 bridges over I-95, 15 bridges have abutments too close to the existing shoulder and will have to be completely replaced. In addition, 5 long bridges only have 3' shoulders and would have to be widened by 9' and the remaining bridges would have to be widened 4'. Extensive work will also be required on all ramps in order to facilitate the shoulder lane.*[20]

[18] Connecticut Department of Transportation, *Southwest Corridor Transportation Study Update*, 1998, page 26

[19] Wilbur Smith Associates, *SWRPA 2020 Congestion Mitigation Systems Plan, Existing Conditions Report*, 2002, page 4-14

[20] Connecticut Department of Transportation, *Southwest Corridor Transportation Study Update*, 1998, page 59

4. NON-HIGHWAY STRATEGIES

The major non-highway capital facility in the study area is the extensive rail system operated by Metro North on the New Haven Main Line and New Canaan, Danbury and Waterbury branch lines. Over the next twenty years, the role of passenger rail services on each of these lines can be substantially increased to meet the travel demands of intra-state intermediate and reverse-peak travelers. A variety of adjustments and investments in infrastructure and service design would facilitate this new focus for rail services. Some of these rail-oriented strategies to induce travelers to travel by train rather than by car can be implemented incrementally and in the short term. Other strategies, such as Light Rail Transit (LRT) or a combination of LRT and commuter rail modes, are bolder and will require greater time, planning and investment.

In addition, the study area has several existing bus operators, each serving a distinct urbanized area. Many of the bus routes currently connecting residential areas to town centers and the commuter rail stations have available capacity to serve additional riders. However, in many northern, non-coastal areas, transit service to commuter rail stations is non-existent. By implementing bus capital improvements such as Bus Rapid Transit (BRT), or operational improvements such as new express or shuttle bus routes leading from residential areas to commuter rail stations and city centers, more trips can be made without the use of private automobiles.

4.1 Commuter Rail Capital & Service

Currently, 90 percent of Metro-North's approximately 70,000 peak passenger trips on the New Haven Line start or end at Grand Central Terminal (GCT),[21] while only 10 percent of peak travelers make "intermediate" trips between stations along the line. Existing rail services on the New Haven Main Line and its branch lines are not designed to serve these travel markets. The design of the services may tend to discourage "intermediate trips" between non-terminal stations on the line. Nonetheless, intermediate travel, intrastate travel and reverse commute (e.g., morning eastbound, evening westbound) travel are the fastest growing segments of ridership on the New Haven Main Line, as noted in ConnDOT's 2002 *Southwest Corridor Report, Year Four Update*.[22]

According to the *Year Four Update*, "morning peak ridership on the New Haven Line in Connecticut has increased by 368 riders in the past year and 2,581 riders since the base year of 1997. This number represents a 12 percent growth in morning peak ridership between 1997 and 2000. During the same period, there has been an even more significant increase in intrastate and reverse commute trips, including an increase of over 400 peak 'offs' at Stamford from reverse commute trains, and almost another 280 at Greenwich, South Norwalk and Bridgeport."[23]

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[21] Connecticut Department of Transportation, Bureau of Public Transportation, *Fleet Management Plan Connecticut Commuter Rail*, July 2001, Page 28.
[22] Connecticut Department of Transportation, *2002 Southwest Corridor Report, Year Four Update*, 2002
[23] ibid., page 13-14

Table 4-1, drawn from data presented in the *Year Four Update Report*, summarizes ridership at five sample stations in Spring 2001:

Table 4-1
Morning Deboardings (Offs) at Selected Metro North New Haven Line Stations

AM Peak Offs Inbound (westbound)	**1997 Counts**	**Spring 2001**	**Total Change 1997-2001**	**Percent Change 1997-2001**
Bridgeport	191	233	42	22%
South Norwalk	334	516	182	54%
Stamford	1316	2373	1057	80%
Greenwich	250	334	84	34%
AM Peak Ons				
Bridgeport	526	1712	1186	225%
AM Reverse Peak Offs				
Greenwich	407	575	168	41%
Stamford	911	1328	417	46%
South Norwalk	110	206	96	87%
Bridgeport	81	98	17	21%
New Haven	128	123	-5	-4%

Source: Connecticut Department of Transportation, *2002 Southwest Corridor Report, Year Four Update*, 2002, page 14

The *Year Four Update* notes, "Ridership estimates provided by Metro-North show a continuing annual growth in Connecticut intrastate ridership. Reports indicate that between 1995 and 2001 intrastate ridership has grown by more than 50 percent and between 1997 and 2000 there has been a 30 percent growth." [24]

The report highlights several initiatives taken by ConnDOT and Metro North to encourage use of the rail line by intrastate commuters, such as direct branch services; expanded parking in Bridgeport; shuttle bus connections to additional parking at the New Haven Coliseum; and new Commuter Connections services in Stamford. An additional rail station also was constructed in downtown New Haven to better connect New Haven Line and Shore Line East customers to employment, retail and entertainment sites within the city.

Also, recent schedule changes have increased the number of trains stopping at stations such as Greenwich which serve a significant number of intrastate and reverse commuters. Shore Line East service has also increased service by adding two trains during the morning and evening peak periods. This new service provides single-seat service for shoreline commuters to New Haven, Bridgeport and Stamford.

During peak periods, the majority of riders on the New Haven Main Line board at stations west of New Haven and commute to New York City. For New York City

[24] ibid., page 14

commuters, the train is arguably the most time-efficient and cost-competitive travel option. The train is also a cost-competitive travel option for intrastate commuters: on a per-mile basis, intrastate fares are substantially lower than fares to New York City and are competitive with vehicle operating costs.

Factors that tend to discourage intrastate travel include:

- ***Lack of direct service*** - Metro-North's current zone schedule often requires persons traveling between station pairs along the Main Line to transfer at New Haven, Bridgeport, South Norwalk or Stamford. Thus, a single-seat ride may be unavailable for many intrastate commuters, particularly for those persons using service to or from Greenwich.

- ***Branch Service Structure*** – Travel on the Danbury, New Canaan and Waterbury branch lines is not always fast, reliable and convenient. Schedules oriented to serving the GCT-bound commuter, track geometry, outdated infrastructure and speed restrictions are some of the constraints limiting the success of branch line service.

- ***Station Location and Spacing*** – The design of New Haven Line service focuses on park-and-ride access for GCT-bound commuters. As a result, stations do not provide adequate access to major destinations in each of the towns served by rail.

Over the next decade, ConnDOT expects GCT-bound ridership to grow annually by 1.9 percent and 5.1 percent during peak and off-peak periods, respectively.[25] By contrast, travel between intermediate stations is projected to increase annually by 7.6 percent and 3.3 percent during peak and off-peak periods. Substantial growth is also projected for Shore Line East service. As a result of planned improvements to Shore Line East stations and major construction projects on parallel highway facilities, ConnDOT expects Shore Line East ridership to grow 8 to10 percent annually over the next five years.

4.1.1 Rail Capital Strategies

New Stations at Regional Destinations **-** Over the next twenty years, localities in the I-95 corridor, in cooperation with ConnDOT, should be encouraged to target development of major destinations such as office complexes and retail developments at existing rail stations and at other locations along existing rail lines where a new stations or platforms could be developed. Such development should be paired with fare policies and service improvements that would encourage future travelers to substitute rail travel for highway travel to these new or expanded destinations.

[25] Connecticut Department of Transportation, Bureau of Public Transportation, *Fleet Management Plan Connecticut Commuter Rail,* July 2001, Page 28.

4.1.2 Rail Service Strategies

Continue marginal adjustments to existing services – Metro North and ConnDOT should continue to plan and implement adjustments and improvements to existing services. Such changes in service should be responsive to both complaints and requests of riders and consistent with identified growth opportunities. More frequent weekend service has already been identified as a necessary improvement. Metro North plans to meet this need by adding 38 new train trips to weekend schedules by 2010.

Lower off-peak fares for short-distance trips – Metro North and ConnDOT should consider implementing price incentives to encourage use of commuter rail for local trips along the New Haven Main Line and branch line services. Lower fares for short trips contributing to congestion on I-95 may help relieve highway congestion. Such service must be planned carefully, however, to ensure that attracting more short distance riders does not detract from the railroad's principal mission.

More direct service between intermediate stations – Market research should be conducted to quantify person and vehicle trips areas served by stations within the study area. Station pairs with the potential for significant travel volume should be targeted for service and station improvements as a means of encouraging commuters to shift from the roads to the rails. Improvements may include additional or new direct services between identified stations, additional stops during off-peak periods and new overlay services connecting branch line stations with Main Line stations.

Feeder/Distributor services – Rail service on the New Haven line already functions with a web of publicly and privately provided feeder and distributor bus services at major stations, including New Haven, Bridgeport, Norwalk and Stamford. At the origin end of the passenger trip, the productivity of bus shuttles serving rail passenger stations is often low due to a preference for direct park-and-ride connections at the origin rail station. However, at the destination end of the rail-bus trip, shuttles tend to be more attractive to customers and more economic to operate. In devising bus feeder/distribution strategies to encourage rail as an alternative to highway travel it is most fruitful in the immediate term to focus on the use of buses to extend the service area of downtown stations. Planners should identify locations where congestion and unavailability of parking discourage automobile travel, but walk distances greater than ten minutes from the rail station discourage pedestrian movement between the rail station and the passenger's non-home destination.

Improved branch line service frequency and orientation – In contrast to main line services, branch line services in Connecticut tend to be relatively sparse and lightly patronized. Looking ahead 20 years, Connecticut could feature these currently underutilized transportation corridors in plans for growth that are less automobile oriented by providing options that can reduce future highway congestion. To influence growth and development in these corridors, Connecticut should invest now in services using the Danbury, Waterbury and even the Hartford-Springfield branches with a higher frequency of service and a greater density of stations. Service improvements should be

generally oriented toward intrastate travel to major destinations in the state such as Stamford, Norwalk, Bridgeport, and New Haven as well as toward shorter intermediate trips.

Overlay services to penetrate new travel markets – With greater investment in service, infrastructure and investment, Connecticut could target new sub corridors in the I-95 corridor with attractive dedicated services that complement existing GCT-oriented services. These overlay services could be independent of the schedule of services to and from New York City but would use conventional railroad equipment federally approved for use in traffic with other elements of the nation's "general railroad system". Development of such overlay services would need to be guided by a combination of market research and land use/transportation coordination. In most cases, the new services could link residential areas with commercial and retail destinations that are difficult to access due to highway congestion. In other cases, the new services could be one element in the design of a transit oriented development corridor where higher densities of development are encouraged at key transit nodes to facilitate the economic use of rail transport as an alternative to highway travel.

4.1.3 Rail Parking Facilities

With regard to park and ride lots, the Metro North Commuter Rail line has been a victim of its own success. Many lots fill up early in the morning every day and require potential riders to drive in to work or to other stations to find parking. New parking capacity in garages and surface lots in South Norwalk and downtown Bridgeport filled quickly after opening, while the New Haven rail station has reached the limit of its current parking capacity as well.

Additional parking expansion is anticipated at Stamford, Stratford, Milford and New Haven stations. Negotiations are underway between ConnDOT, the Town of Fairfield and a private developer for a joint development project for a new rail station and 1,200 car parking facility in the Black Rock section of Fairfield. A study of the parking situation at the each of the Darien and Norwalk stations is currently underway.

The *Southwest Corridor Transportation Study, Year Four Update* notes, "One of the major inhibitors to increasing rail ridership is the lack of adequate parking at rail stations along the New Haven Line and at Shore Line East rail stations." The issue of rail station parking is so critical that the Update and the Plan proposed three actions related to increasing rail station parking:

- Evaluate and implement, where feasible, rail parking management strategies;
- Conduct a major study of rail station parking as a prelude to the development of commuter parking strategies; and
- Continue the Department's program of rail station parking expansion."[26]

[26] Connecticut Department of Transportation, *2002 Southwest Corridor Report, Year Four Update*, 2002, page 15

ConnDOT continues its evaluation of the feasibility of constructing a new station and 1,000 car parking facility in West Haven. ConnDOT is also reviewing plans to develop a new parking structure at Union Station in New Haven.

4.2 Light Rail Transit

Light rail transit (LRT) originated in the late 1800's with the invention of the streetcar or trolley. Modern LRT, which was reinvigorated in the 1970's, is an electric railway system designed to transport a lower volume of passengers at lower costs than typical heavy rail or subway costs. It may use shared right-of-way or be on an exclusive facility and may operate at ground level, aerially or underground. LRT intersections can be at-grade or grade separated. Pull-offs and stations are features typically associated with an exclusive LRT line.

According to the American Public Transit Association, there were 24 LRT systems operating in the United States in 1999 serving almost one million trips daily. Portland, Oregon, is famous for the success of its light rail transit system and the associated improvements in air quality and livability. In Dallas, DART reported that LRT and bus ridership have increased each month since the opening of their LRT lines in June 1996. Recognizing the success of LRT, many new projects have been implemented in recent years. In the New York Metropolitan Area, the Hudson-Bergen Light Rail Service was launched in April 2000. The first segment of this line spans 7.5 miles and includes 12 stations. Elsewhere in New Jersey, a 1.2 mile extension of Newark's subway is underway. Sacramento, which has operated successful light rail service for 16 years, is also building two extensions to its system. Phoenix, Arizona, and Minneapolis, Minnesota both have received funding for the development of new LRT lines. .

One of the major benefits of LRT is its flexibility. LRT may operate as an exclusive facility in its own right-of-way or on city streets where it shares rights-of-way with other vehicles. Developing LRT as an exclusive facility provides the greatest travel time benefits as well as opportunities for the construction of stations and supporting development.

The major hurdle to LRT implementation is finding available right-of-way to construct dedicated LRT lines. In addition, although construction costs are less than many subway systems, LRT lines have major infrastructure improvements associated with their construction. Tracks must be constructed wherever LRT is to operate and maintenance facilities are needed along the line.

The most ambitious rail-oriented passenger transportation program that could be considered to relieve highway congestion in southwestern Connecticut's I-95 corridor would employ elements of the innovative rail transit programs pioneered in Karlsruhe, Germany. With dynamic and persistent leadership over the last 25 years, the small German city of Karlsruhe developed an extensive light rail transit network that featured

track sharing by high speed conventional railway trains and lower speed, light-weight transit cars.

The Karlsruhe light rail cars operate like streetcars in downtown areas picking up and dropping off passengers in city streets by offices, apartment blocks and retail districts. In this setting, the trolleys share the city streets with cars and trucks while receiving priority at all traffic lights and intersections.

The light rail vehicles also share track on regional rail corridors with heavy freight, regional commuter and intercity high speed trains. This innovative joint use of rail infrastructure by heavy and light rail applications has been the topic of considerable study in Europe and North America. Systems modeled after the Karlsruhe design which employ similar track sharing principles are in operation or development elsewhere in Western Europe. However, the differences in weight and speed between the conventional railway and light rail equipment may raise issues of safety that need to be addressed prior to implementation of such a system in the United States. A waiver of certain national standards may also be needed to move forward with design and implementation of such a system.

In the context of the New Haven line and its branches, implementation of a successful system would require technological investments and institutional cooperation in order to receive a waiver of national standards. Technological requirements would likely include installation of a positive train control (PTC) system to bring trains to a full stop and avert any potential collision in the event of operator error in responding to directions from the signal system and train controllers. Recommendations for institutional cooperation would likely include a shared staff to operate the conventional and light rail equipment, a common book of operating procedures and rules for all operators on the line, a common radio system for light and conventional rail operations, a shared dispatch center for all operations on the line, and an effective personnel fatigue management program.

In the I-95 corridor, implementation of Karlsruhe-type local transit services would serve passenger trips oriented toward Greenwich, Stamford, Norwalk, Bridgeport, New Haven, Danbury, Waterbury, and their suburbs to operate on segments of track shared with Metro-North, Amtrak and freight equipment while also operating in “street car” mode to collect and distribute trips in downtowns and neighborhoods. Additional study is necessary to determine which system configuration best meets the needs of travelers in the study area and to determine what infrastructure, technology and institutional arrangements would be necessary to create such a bold new transit system in Southwestern Connecticut.

4.3 Bus Rapid Transit

With congestion on the rise, buses using city streets and even expressways often have trouble maintaining schedules and the resultant bus travel times are usually higher than those of automobiles. Bus Rapid Transit (BRT), or “busways,” offers ways to counteract travel time and convenience disadvantages of bus relative to automobile travel. BRT

aims to make transportation via bus quicker and easier in order to more effectively compete with the automobile. There are a range of BRT techniques.

An example of a simple BRT application is a special bypass lane and signal priority for buses on existing roads, triggered by a device in the bus, which allows buses to bypass queues of stopped automobiles at traffic signals. A more elaborate BRT application is a full-blown multi-million dollar transitway dedicated exclusively for buses, much like LRT service, but using buses and asphalt instead of trains and tracks. Other BRT improvements include bus lanes on expressways and arterial roads and bus-only ramps.

BRT can use exclusive right-of-way or share right-of-way with rail or highway facilities. It typically has a design speed similar to that of a major arterial or an expressway. Station pull-outs are provided at bus stops. Busways can intersect with surface streets or be grade separated.

Busways have recently been implemented in several major cities in the United States and numerous foreign locations. In the Americas, BRT success stories in Pittsburgh and Miami are often used to promote BRT as the up-and-coming transit alternative for medium-sized cities. With 10,000 passengers per hour per direction, the successful busway in Ottawa, Canada, has been the subject of much research on BRT systems. The BRT system in Curitiba, Brazil, averaged 350 unlinked transit trips per capita in 1996.

The strength of BRT is its flexibility. Buses are able to switch from exclusive busways to dedicated lanes to mixed traffic as necessary, allowing for feeder services to circulate on surface streets and then enter an exclusive facility. Pull-offs can be easily constructed along a BRT line to allow express buses to bypass stations along the route. BRT can be relatively inexpensive to construct, although operating costs are generally higher than Commuter Rail or Light Rail.

The weaknesses of BRT are the similar to those of LRT. For the most effective operation, exclusive right-of-way is needed in areas where roadway congestion is the worst. These are often the same areas where right-of-way is at a premium. Other BRT alternatives could involve signal priority or bus lanes. Signal priority can increase delays at signals, which could be negatively received by the driving public. Bus lanes often require the taking of a general-purpose lane on an already congested arterial, which could decrease levels of service for non-transit users.

Another major challenge posed by BRT is the perception that commuter rail is for many classes of rider, but buses are designed to serve those who cannot afford a car. Additional bus service would require additional operating funds as well as capital funds; however with improved travel times on routes, the same number of buses can often be used with improved headways.

ConnDOT and Capital Region Council of Governments (CRCOG) have recently made a commitment to BRT in the greater Hartford area. Hartford was selected as one of ten Federal Transit Agency (FTA) BRT Demonstration cities in the United States. The first

BRT project, the New Britain to Hartford Busway, is a 10-mile 12-station exclusive busway. The project is currently in the design phase with completion estimated at late 2004 or 2005.

Two additional BRT studies are currently underway in the Hartford region. The Griffin Line, an active rail line between Hartford and East Granby, is currently being considered for its potential development of BRT to serve corridor communities and Bradley Airport. This line was previously considered for light rail as well. Additionally, the Manchester Busway feasibility study is currently considering the potential of BRT in a corridor consisting of a rail line and a highway HOV lane between Hartford and Vernon.

4.4 Bus Operations & Service

There are numerous strategies and associated services and policies that may be applicable to address current bus operations in southwestern Connecticut. These strategies will need to be reviewed and considered in light of empirical data and public input to determine which strategies will best accomplish the goals set forth in this study. This section presents an overview of both traditional and non-traditional strategies that may be part of an overall congestion mitigation strategy in southwestern Connecticut.

4.4.1 Express Bus Service

Express bus service is limited-stop service that is generally geared towards transporting persons from outlying suburban areas into a central business district (CBD). The service is typically focused around peak travel times. Express services generally use coaches or full size buses and pick up passengers at major locations and suburban park and ride lots. In rare cases, express buses also provide off-peak CBD-based service

In the South Western and Grater Bridgeport planning regions, the Coastal Link has proven to be an effective and very successful program. There have been instances where buses have operated at capacity and drivers have had to turn away riders during peak periods. This service offers potential for expansion in this region along other corridors and roadways that connect towns between transit jurisdictions. Existing service in the Route 1 corridor should be considered for expanded service.

Express bus service is most appropriate in areas that fit the above criteria. It enables motorists to avoid congestion, a lack of parking, and the high cost of parking. It provides an alternative for people that do not wish to drive. Although there are many strengths of this service, it is not widely used as there are some drawbacks. One major drawback is that many services only operate in the peak hour, limiting passenger flexibility. In addition, suburbanization has dispersed passengers, limiting the number of convenient collection points and placing some routes too far away from potential passengers.

4.4.2 Shuttle Service

Shuttle services provide transit connections between workplaces and other major destinations and key locations such as train stations and fringe park-and-ride lots.

"Circulator" shuttles also provide mobility in a CBD area. Shuttle service can utilize small buses or vans. In the case of shuttles at train stations, their operations are based around schedules of the train system and are utilized by employees to get to and from the workplace. Shuttles are operated both by public and private transportation providers.

Shuttle service is used in urban areas and their suburbs throughout the country. It is utilized at rail stations throughout the country to offer needed connections to all types of workplaces located further away than walking distance of a rail station. Shuttle service is practical wherever there are rail stations or other major collection points for persons to utilize this service. It also lessens the need for and reduces the number of vehicles in a CBD area.

Circulator service is utilized in many downtown areas, sometimes in classic "trolley style" vehicles, to provide connections inside a CBD or downtown area. Circulators improve accessibility to downtown destinations that are neither well-served by bus nor within walking distance. Circulator services may also be used to link "fringe" park and ride lots with major employment and other destinations. Such services may reduce the total number of vehicles in a downtown area while offering reliable and convenient connections for commuters and other travelers.

The majority of shuttles currently operating in the study area connect rail riders to employment sites in the region. The expansion of shuttle service to include fringe park-and-ride and other key locations can reduce the number of vehicles in a CBD, as well as offer an attractive alternative to the single occupant vehicle. This can also have a positive impact on downtown parking in areas where this is an issue.

4.4.3 Fare Policy

Fare policies are a major factor influencing transit usage and also a major component of non-service strategies. Fare policies need to be reviewed on all modes, as well as between modes, to encourage transit usage to the greatest extent feasible. Fare pricing should be set at such a rate as to make service attractive to the potential user and simple to understand. Policies to be considered include free or reduced-price transfer between modes, such as rail to bus, express bus to local bus, between local bus systems, and on circulator services. In areas where parking supply and pricing are concerns, transit fare pricing and transit availability are key opportunities for making transit a desirable option.

Transit fare media alternatives should also be considered. Currently, transit fares, fare media and policies vary by transit system and by operator. Consideration should be given to implementation of a universal fare media for use among all transit providers within the study area. Additional non-transit applications for such a universal transit card should also be explored. While this will raise many administrative challenges, the transit user will benefit by traveling between service areas with greater ease.

One example of a successful program is the Metrocard utilized throughout the New York City MTA area. This single card allows riders to ride, transfer, and access all services through a single fare medium.

A regional fare card accepted on all of the region's services will simplify the use of public transportation and improve mobility throughout the region, thus making transit a more attractive alternative to driving. The use of a common fare card will also provide better data on how riders use the various services, thereby helping the individual agencies plan improvements to their services. Thus, implementation of a regional fare card program would provide significant benefits to the region and its residents.

4.4.4 Guaranteed Ride Home

A program of this type minimizes employee concerns about carpools or transit use in the case of a personal emergency or if overtime work is required. The most common form of this policy is an employer voucher for taxi use or use of an employer-owned vehicle in case of emergency. This policy forms an inexpensive and well-received adjunct to an overall TDM program. According to the available literature, most companies that have implemented this policy have found abuse of the program to be non-existent. As noted in section 2.1.1, regional Guaranteed Ride Home programs are operated in Fairfield County by Metropool and Rideworks in the Greater New Haven area.

4.4.5 Bus Priority Traffic Signal Preemption

Priority treatments at traffic signals are often used on arterials to decrease bus travel times. Many priority applications are used to allow a bus to bypass a signal only if that bus is behind schedule. Others simply minimize the travel time on a bus route. Signal priority treatments can be "active," in which a detector is on the bus, or "passive," in which a detector is placed in the ground. Signal priority can force a signal to stay green for an approaching bus when the signal is about to turn yellow. It also can turn a signal from red to green for a waiting bus. Signal priority systems have been proven to reduce travel times by up to 10 percent in a Central Business District.

4.5 Bicycle & Pedestrian Strategies

Some of the potential benefits from bicycle and pedestrian strategies are enhanced mobility options and the reduction of short distance (less than five miles) trips on a region's roadways.

A key feature in implementing bicycle and pedestrian improvements is to identify where pedestrian and bicycle facilities exist, where the facilities should be improved, and where there is a need for further development. This identification may cover a single corridor or a network of facilities throughout a municipality or region. Furthermore, this identification process must address congestion that may exist in the bicycle/pedestrian system and maximize the network's ability to help reduce it.

Examples of bicycle and pedestrian facilities include sidewalks, multi-use paths, shared lanes and bike lanes as part of an existing roadway. They may be shared or exclusive to one mode. For example, pedestrians or bicyclists may share a sidewalk or multi-use path, or bicycles may be prohibited. Conversely, a bike lane or shared motor vehicle/bike lane may or may not be suitable for pedestrians.

Bicycle and pedestrian facilities must be designed in a matter sensitive to their users, well maintained, and promoted to maximize their usage. Furthermore, the facility design must address hazards such as roadway conflicts and security issues. Education, encouragement and enforcement are three keys to successfully increasing walking and biking. "Education" not only refers to the perspective of users of a bicycle/pedestrian system, but also to planners, designers, and local agencies who will have jurisdiction over such a network.

Education and awareness lead to "encouragement." Local businesses, employers, and agencies should consider promotional and incentive programs to encourage people to walk or bike instead of using their automobiles. These may include walking and biking events and campaigns; employee reimbursement for non-motorized transportation; and opportunities for commuters to rent or borrow bicycles from employers or community organizations.

One of the most important ways to improve pedestrian and bike transportation is consider land use issues. Land use and design features must become more tailored toward pedestrians if automobile use is to be discouraged in urban areas. Central Business Districts, existing neighborhoods, and new developments may be created or modified to be more pedestrian- and bicycle-oriented. Street furniture and pedestrian accommodations will also help to encourage people to get out of their cars.

Increased pedestrian and bicycle usage also impacts public transportation usage. The best way to maximize the usage of bicycle and pedestrian facilities is to make them as convenient as possible. Therefore, it is important to ensure that the pedestrian and bicycle paths go where people want to go and integrate easily with other modes of transportation. Thoughtful design of intermodal facilities is one of the keys to this integration. There is a strong likelihood that public transportation may be partially required for a non-motorist's journey.

From a commuting standpoint, an individual may require a bus or train to get to work. However, it is advantageous to have adequate facilities to walk or bike to and from the transit stop. Furthermore, the transition from one mode of transportation to another should be smooth. . For example, a bicycle path that serves a train station will not be successful if there is not adequate bicycle parking at the station or storage on the train. Other examples include providing bike racks on buses so that an intermediate journey may be made by public transit, but the beginning and end are made by bicycle.

The unique commuting needs of walkers and cyclists should be accommodated. For example, a bicyclist may require changing facilities when he or she arrives at work, and before returning home.

Enhancing pedestrian and bicycle facilities is particularly advantageous in an urban and suburban region such as southwestern Connecticut. These facilities will improve access and reduce the need for vehicular travel, therefore reducing congestion on roadways. Bicycle and pedestrian trips may substitute for a longer automobile trip. For example, if there was a small local store that was accessible to pedestrians and bicyclists, it may be a more desirable trip destination than a more distant supermarket.

Overall, bicycle routes throughout the five planning regions that make up the study corridor are typically oriented in a north-south direction. This has much to do with the series of ridges that mark the topography of this portion of the state. In order for bicycle and pedestrian travel to have any impact on congestion, a continuous east-west route must exist that is relatively flat and convenient to employment and activity centers. While the state bicycle map illustrates Route 1 as a viable cross state route, it contains high-volume and high-speed traffic that is likely to deter all but the most advanced cyclists.

Improving highways in the corridor to accommodate bicycle and pedestrian travel offers the greatest potential for mitigating vehicular congestion. State owned rights-of-way in the Merritt Parkway and Interstate 95 corridors could include separate facilities for bicycles and pedestrians. These corridors can provide interregional connectivity that can have an impact on the number of short distance trips. While it is unlikely that such facilities will be the ultimate solution in reducing congestion, they can be developed as part of a broader strategy to offer more modes of transportation and discourage the existing trend of automobile reliance.

Non-motorized transportation also provides many benefits, including internal benefits and external benefits, as indicated in the Table 4-2.

Table 4-2
Internal/User and External Benefits of Non-Motorized Transportation

Benefits to User	External Benefits
Financial savings	Reduced congestion
Health benefits	Reduced road and parking facility expenses
Increased mobility for non-drivers	Reduced accidents
Enjoyment	Reduced pollution
	Resource conservation
	Increased travel choices (reduced automobile dependency)

Source: Victoria Transport Policy Institute, www.vtpi.org/tdm/tdm25.htm

4.6 Ferry Transportation

At the turn of the 20th century, luxury steamboats of the Fall River Line plied the waters of Long Island Sound offering passenger service between New York and Boston, with stops at many of the port cities in between. The only current commercial passenger ferry operation in the study area is located in Bridgeport and provides service to Port Jefferson, Long Island. From time to time, proposals have been put forward for ferry operation

between various cities and towns within the study area and to other destinations on Long Island and New York City. However, with the exception of brief experimental runs, none of these proposals has resulted in implementation of continuing service

ConnDOT's March 2001 *Intrastate Passenger Commuter Ferry Study* identifies proposed ferry services between the Admiral's Wharf project area in Stamford harbor and LaGuardia Airport, with subsequent stops at Pier 34 and Pier 11 in Manhattan.[27] Sample schedules developed by one potential provider show an intention to provide three morning peak period trips and three evening peak period trips. This service is designed to serve the daily commuter and the cost of a monthly commuter pass is estimated at $400 to $450. The developers of Admiral's Wharf expect to launch these commuter services in 2003.

4.7 Non-Highway Goods Movement

The *Connecticut Strategic Economic Framework* report (Gallis Report) issued in 1999 by the Connecticut Regional Institute for the 21st Century notes the "massive concentrations of economic, institutional and cultural resources [within a "New Atlantic Triangle" that] extends from New York, through Stamford and Hartford to Boston."[28] Implicit within this characterization is the almost complete transformation of the study area's economy over the last three decades from a manufacturing base to an office-based service sector economy. In spite of this trend, the flow of goods within the CMS study area is a critical piece of the transportation puzzle. The movement of freight (both to corridor businesses and through the study area) has dramatic implications for the health of the regional economy and its role in a broader Northeast economic network. Existing and projected future traffic congestion will impede economic growth if alternatives are not identified for the movement of goods.

According to the 1997 National Commodity Flow Survey conducted by the U.S. Census Bureau, on a national basis, truck shipment accounts for 72 percent of goods movement by value and 69 percent by tonnage, while shipment by rail accounts for four percent of shipments by value and 14 percent by tonnage. Air shipment accounts for three percent of movement by value, but a much smaller percentage of tonnage. Domestic waterborne movement, primarily in the Great Lakes and Mississippi River systems, represents approximately one percent of shipments by value and five percent of shipments by tonnage. Intermodal shipments including postal service, package delivery services and truck/rail intermodal account for the remaining volume and value of goods movement.[29]

Within Connecticut, over 74 percent of the volumes of commodities that travel into, out of or through Connecticut travel by truck. Of the remaining commodities, 19 percent (primarily petroleum products and stone) travel by water, six percent by rail and one

[27] Connecticut Department of Transportation, *Intrastate Passenger Commuter Ferry Study*, March 2001
[28] Gallis, Connecticut Regional Institute for the 21st Century, *Connecticut Strategic Economic Framework*, 1999 Edition, Page 5
[29] US Census Bureau, National Commodity Flow Survey, 1997

percent by air.[30] ConnDOT's 2001 *Statewide Transportation Improvement Plan* further emphasizes the importance of goods movement:

> *To be competitive in the global economy, U.S. producers must maximize the efficiency of production and distribution. For example, just-in-time delivery systems have greatly reduced overhead costs and "hub and spoke" distribution systems have increased efficiency. As manufacturers rely more extensively on improved logistics to increase economic efficiency, demand on highway capacity and reliability increase.*[31]

To assist Connecticut companies in competing effectively in global, national and regional markets, the State of Connecticut must maintain and improve access to both in-state and out-of-state ports, airports and rail freight intermodal facilities to enable companies to ship and receive goods as quickly and efficiently as possible. ConnDOT must also continue to coordinate with commercial vehicle operators and state regulatory agencies to identify and implement ways to facilitate the movement of goods by minimizing truckers' travel delays on existing highways.

The 2000 *Cross Harbor Freight Movement Study Final Report* prepared for New York City Economic Development Corporation notes a similar set of major trends in goods movement in the both the Greater New York region and the U.S.:[32]

- ***Increasing Reliance on Just-in-Time Delivery*** – Just-in-time delivery has increased the emphasis on the predictability and timing of deliveries of raw materials, components, and semi-finished products. Reliance on a "just-in-time" strategy also results in the movement of more shipments, each of which tends to be smaller in size.

- ***Greater Use of Outsourcing*** – Increased use of outsourcing means that more components must be transported between companies, rather than simply being moved within a factory or plant.

- ***Market Expansion –*** To meet just-in-time production requirements, components must be transported from other continents instead of being brought in from suppliers located across town or moved across the production floor.

According to this report, the implications of these logistics changes include:

- Greater number of freight movements;
- Increased reliance on trucking;
- Increasing emphasis on intermodal transfers; and

[30] Connecticut Department of Transportation, Southwest Corridor Commodity Flow Study, Interim Report No 1, January 1999, page 12
[31] Connecticut Department of Transportation, Statewide Transportation Improvement Plan, 2001
[32] New York City Economic Development Corporation, *Cross Harbor Freight Movement Study*, 2000

- Development of large-scale distribution centers at the periphery of the metropolitan region.

Connecticut's ports have a maritime heritage dating back to colonial times. Two of the state's three commercial deepwater ports – Bridgeport and New Haven – are located within the CMS study area. In addition, more limited commercial marine facilities, such as marinas, transfer stations, and barge docks are located in the harbors of Stamford, Norwalk and Branford. Although none of the state's ports currently receive service from scheduled ocean-going container ships, port operators in both Bridgeport and New Haven have carved out market niches that they can productively and economically serve, specifically petroleum, lumber, metal, and for Bridgeport, tropical fruit. Previous studies indicate that these commodities are principally oriented to consumers or shippers within the state, with a more limited market in central Massachusetts.

The New Haven Main Line rail route is one of the oldest and most historic in the country. During the first 120 years of its existence (1849-1969), the rail mode played a critical role in the economic development of the study area by serving not only passenger traffic, but also providing access to the many factories of Stamford, Norwalk, Bridgeport and New Haven, as well as providing incoming shipments of coal and raw materials from all over the United States. During this period, rail access was considered one of the primary factors in the location of any business and the volume of rail freight shipments, measured in carloads, was viewed as an important indicator of overall economic activity.

The study area's economy has shifted dramatically away from this pattern. With the completion of the Connecticut Turnpike (I-95) in 1959 and the decline of railroad service throughout the Northeast, truck movement became a more cost-effective alternative for the shipment of most types of goods within the study area. The current pattern of office-based services, as noted in the *Existing Conditions Report*, has caused much of the study area's remaining rail freight service to be associated with the shipment of construction stone and a few other bulky, low-value commodities. Few of the industrial sidings and spurs along the New Haven Mainline remain in active use.

The high volume of truck traffic on I-95 has been identified as significant concern through the four public listening sessions. Other goods movement-related issues identified at the listening sessions include:

- Traffic congestion in the I-95 corridor makes delivery schedules hard to maintain for manufacturing and distribution firms located in the study area and may also add to the cost of incoming shipments.
- Rail can be a better choice for large volume shipments of lower value items, however, so few large shippers are still located in southwestern Connecticut that rail is not a viable option for most businesses within the study area.
- There is a perception of increased potential for damage to higher value goods with rail shipment.

- Rail movement requires a spur onto the property of the receiving business and few of the businesses within the study area have active spurs or are even located adjacent to a rail freight line.
- Trucks cannot run at night because of complaints from neighboring home-owners.

A recent ConnDOT report, *Container Barge Feeder Service Study*, based on earlier regional studies conducted in Bridgeport, New Haven and New London, documents the opportunities for a container barge service to be operated in conjunction with the Port Authority of New York and New Jersey between the major container shipping terminals in northern New Jersey (Port Elizabeth and Port Newark) and the Connecticut ports.[33]

> To compete effectively, rail freight must respond to customer service requirements. Most rail shipments entering Connecticut fall within a limited range of bulk commodities… The manufacturing and distribution companies who currently receive goods by rail accept significantly longer shipment times than would be required by truck shipment for their low-value, non-time-sensitive raw materials and products… Connecticut's small market size and relatively low volume of freight output make it difficult to justify additional private-sector investment in serving the state's rail customers or potential rail intermodal customers.[34]

A major constraint on increased rail service in the study area is the poor connection for freight rail between the New Haven mainline and the U.S. rail network to the west of the Hudson River. The 2000 *Cross Harbor Freight Movement Study Final Report* prepared for New York City Economic Development Corporation notes:

> There are only two points where rail freight can directly cross the Hudson River: a railcar float across New York harbor, and a rail bridge at Selkirk, New York near Albany. Railcar floats provide limited capacity for cross harbor movements… The Selkirk crossing require New York-bound [and Connecticut-bound] freight from the south to travel 140 miles north up the west side of the Hudson River, only to return on the opposite side to reach the city… Currently, over 83 percent of goods bound for destinations east of the Hudson River are carried by truck, while only 2.8 percent travels by rail… Trucking dependence threatens the economic growth of the New York City area… Traffic congestion raises the cost of goods in the city, increases wear and tear on transportation infrastructure, deteriorates air quality, and increases accident rates.[35]

Container Barge - While the market opportunities appear to be positive for a container barge service, as of February 2002, no operator has been contracted for this service. The

[33] Connecticut Department of Transportation, Office of Intermodal Planning, *Container Barge Feeder Service Study*, March 2001.
[34] Connecticut Department of Transportation**,** *Connecticut Intermodal Management System, Final Report*, 1996
[35] New York City Economic Development Corporation, *Cross Harbor Freight Movement Study Final Report*, 2000

capital cost of initiating this type of service has been identified at between $4.5 million and $18 million. Operating costs of $800 to $1,300 per container have been estimated. This cost level places the service at a competitive disadvantage with truck movement.

New York Cross Harbor Rail Tunnel **-** The New York City Economic Development Commission report identified significant regional economic benefits that would result from the construction of a rail freight tunnel across New York Harbor. New York City and state agencies are currently evaluating this project for further study, environmental impacts and potential long-term funding capability. Capital costs involved in harbor tunnel construction have been projected in the range of $1.5 to $2.5 billion. An Environmental Impact Statement is currently underway.

5. LAND USE STRATEGIES

Local zoning and other land use regulations, such as site development standards, roadway standards, and environmental regulations, can support a wide range of transportation strategies identified in the preceding sections. As noted in the *Existing Conditions Report* for the Vision 2020 Study, Connecticut's State Plan of Conservation and Development identifies a statewide goal of focusing economic development within areas that already have urban development, such as regional centers, neighborhood conservation areas and growth areas. The state planning principle that guides development can be summarized as "centers and corridors." New housing and commercial growth is to be concentrated where public water and sewer infrastructure in place or planned as part of a local capital program.

In the State Plan, municipalities are encouraged to identify areas within their borders that are or could responsibly become medium to high-density centers and those outlying areas that should remain at low density. Major roadways that connect centers should be considered for appropriate levels and densities of growth.

As part of the Federal Highway Act of 1962 Congress included language that required urban areas with a population of 50,000 or greater to implement a transportation planning process in order to remain eligible for federal transportation funds. This planning process was to be comprehensive, continuous, and cooperative in nature. Congress was prompted to take this action by the serious congestion on the nation's transportation system in and around our major urban areas. The formation of Metropolitan Planning Organizations (MPOs) in each urban area was prescribed by this act. Noting that the nation's urbanized areas were often comprised of more than one local government body, these MPOs were to contain representatives of most local governments in the urban area. MPOs are required to update their Master Plans every three years. The regional plans are generally consistent with the fundamental strategies of the State Plan. The regional plans identify established primary and secondary centers, major areas of concentrated growth, and major water, sewer, and road infrastructure.

The *Connecticut Strategic Economic Framework* report supports the centers and corridors framework.[36] The report defines centers as "dense clusters of urban and economic activities" and recognizes traditional urban centers and emerging centers composed of mixed office and retail land use concentrations. The regions' centers and corridors are experiencing substantial new construction and traffic. The question is how growth within the new and established centers and along the corridors can be shaped so that the regional land use patterns support congestion mitigation.

The strategies being explored for addressing congestion issues in the study area include a variety of land use management techniques. Necessarily, the location and concentration of development determines trip patterns, and has a direct impact on traffic volumes and locations of congestion. The general aim of the land use management strategies explored is to influence the patterns of residential, commercial and industrial development over time. This, strategy in turn, can diminish auto dependency, reduce vehicle miles traveled (VMT), encourage transit ridership, and promote the use of, alternative modes of travel.

5.1 Local Land Use Regulation

In general, Connecticut state statutes grant authority to regulate land use to its 169 municipalities. Municipalities may enact zoning and building regulations, develop master plans or plans of conservation and development governing use of land within their boundaries, designate special development districts and engage in other land use planning and decision-making functions.

State regulation of land use planning is minimal. The state requires that local land use plans are consistent with the State Plan of Conservation and Development and mandates that municipalities develop zoning codes and building regulations that are consistent with state laws protecting natural resources such as watersheds, wetlands and coastal resources, but municipalities may comply with these requirements in any manner they choose.

Regional regulation of land use planning is virtually nonexistent. Under state law, regional planning agencies have only an advisory role in land use planning. Regional planning agencies develop regional plans of conservation and development to guide local land use policies for growth and development, but these plans are not binding on the municipalities within the region. Municipalities are required to consult with regional planning agencies prior to rezoning land or approving zoning applications affecting properties that cross or are adjacent to municipalities, but the opinions offered by the regional planning are advisory in nature.

Municipalities may choose to coordinate land use policies through regional planning agencies or with adjacent municipalities. However, municipalities may not formalize their cooperation in the form of an inter-municipal compact without violating state law.

[36] Michael Gallis & Associates, Connecticut Regional Institute for the 21st Century *Connecticut Strategic Economic Framework,* 1999

As a result of Connecticut's structural framework for land use planning, municipalities are encouraged to concentrate planning efforts within their borders, a situation which limits opportunities for enforcing regional land use goals.

5.2 Innovative Land Use Policies and Regulations

"Smart growth" is a policy framework that promotes land use choices that encourage development of compact, mixed-use communities reminiscent of the communities that existed prior to widespread dependence on the automobile and the advent of sprawl. The coexistence of "town center" commercial and housing uses, varied housing styles, walkable neighborhoods and development densities capable of supporting efficient transit operations are among the desired results of smart growth-type developments.

Three land use strategies are commonly used to accomplish "smart growth": Traditional Neighborhood Development, Transit Oriented Development and Transfer of Development Rights. Each of these strategies may be implemented in a variety of development contexts including urban infill and adaptive reuse projects, suburban redevelopment and small-town and rural revitalization. Through the use of zoning overlays, these strategies can help shape not only land use patterns, but community character.

5.2.1 Smart Growth

Smart growth is a land use planning tool that has the potential to ameliorate congestion while creating better communities. As a term, it has come into prominence within the planning profession over the last few years. It is a further evolution of the earlier growth management movement, which emerged in response to increasing land consumption, or sprawl, and increasing traffic congestion. Smart Growth America, a coalition of the American Planning Association (APA) and 60 other public interest groups, has defined smart growth as a land development ethic that balances conservation, economic viability, community livability and environmental protection.

Smart Growth America has identified ten guiding principles of smart growth:

- Strengthen and direct development toward existing communities.
- Provide a variety of transportation choices.
- Create walkable neighborhoods.
- Mix land uses.
- Create a range of housing opportunities and choices.
- Take advantage of compact building design.
- Encourage community and stakeholder collaboration.
- Foster distinctive, attractive places with a strong sense of place.
- Make development decisions predictable, fair, and cost-effective.
- Preserve open space, farmland, natural beauty and critical environmental areas.

These principles and Smart Growth America's general approach are similar to the approaches adopted by the U.S. Environmental Protection Agency's Development, Community, and Environment Division, the Urban Land Institute, and the National Governors Association for Best Practices.

The Connecticut Chapter of the American Planning Association (CCAPA) has circulated a position paper on smart growth, entitled "Can Connecticut Grow Smarter?" In this paper, CCAPA recommends a smart growth strategy similar to that proposed by Smart Growth America. The paper also recognizes additional smart growth concepts that are critical to Connecticut's long-term economic and environmental health such reinvestment in and revitalization of central cities and inner suburbs; new investment in transportation systems to alleviate congestion and improve connections between developed and developing places; and the use of the natural environment as an organizing feature of development.

Long-term economic growth, the development of efficient transportation systems, optimization of infrastructure investment, preservation of open space, conservation of natural resources, and the promotion of established urban centers are the primary benefits Connecticut is likely to reap from smart growth.

Smart growth techniques that encourage compact development patterns and reduced land consumption have the greatest potential to support development of transit services and decrease auto dependency. Such techniques will, therefore, be the focus of this study.

5.2.2 Traditional Neighborhood Development

Traditional neighborhood design (TND) is a concept developed as part of the neo-traditional planning movement of the late 1980's. That movement evolved into "New Urbanism", a school of planning practice that emphasizes use of neighborhood design to contain sprawl, encourage community cohesiveness and reduce auto dependency.

Like New Urbanism, TND seeks to use neighborhood design to achieve certain social and environmental goals. TND is often characterized by integration of residential, retail and small office uses; the placement of sheltered and unsheltered parking behind residential and commercial buildings; construction of buildings close to the street with minimal front yard or setback requirements; location of alleys and other vehicle access points behind buildings; and placement of sidewalks, benches, shade trees and other pedestrian amenities throughout the development.

Like other smart growth techniques, TND may be applied to the development of new neighborhoods or the revitalization of older neighborhoods. Municipalities seeking to achieve TND-style developments have several tools available to them. First, municipalities may use their zoning powers to designate land uses, establish the minimum size of development parcels, and to prescribe lot coverage, set-back and density requirements. State statutes granting municipalities the authority to establish mixed-use zones are particularly helpful to achievement of TND objectives. Connecticut zoning

district designations such as 'Planned Unit Developments' are applied to undeveloped areas where a community would like to see either a self-sustaining development or a new community nucleus. Zone designations such as a 'Neighborhood Business Zone' are applied to an area where a mixture of uses already occurs and activities such as residences over a store are allowed by special exception.

The mixing of uses common in Planned Unit Development and Neighborhood Business zones helps promote the creation of pedestrian friendly communities. For example, the clustering of housing, office and retail uses in a single neighborhood may encourage persons to live and work in the same community and to travel by bicycle of on foot, rather than by car. Planned Unit Development and Neighborhood Business zones cannot guarantee that TND objectives will be achieved, or even pursued. First, although such zoning classifications encourage the mixing of uses, they do not mandate a certain balance of uses. Also, while a mixed-use zone can include height and bulk standards, the zoning regulations cannot be used to prescribe architectural or other design standards. In a Planned Unit Development, however, the developer may choose to use restrictive covenants or create a homeowners association to privately regulate certain elements of design or uses within the development.

Under certain circumstances, municipalities may also create zoning overlay districts, urban renewal areas and design districts to achieve planning goals at the neighborhood level. An example of overlay zoning is the Essex Heritage Gateway Zoning regulation. This regulation allows the applicant to petition to replace existing regulations with a specific concept plan for a defined geographic area. The concept plan includes limitations on allowable uses, bulk, placement and coverage, as well as design standards applicable to any proposed development within the area covered by the plan. The goal of such zoning amendments is to accommodate the desire for development while protecting properties with unique historic, aesthetic or environmental characteristics. The City of Norwalk has also used design district overlays as an element of urban renewal projects to encourage rehabilitation and adaptive reuse of historic structures and to ensure that new development is architecturally consistent with existing design elements.

Connecticut state statutes provide two additional tools for maintaining elements of traditional neighborhoods: historic districts and village districts. As noted earlier in this section, the design elements of TND are similar to the neighborhood design elements that dominated our nation's cities and towns prior to our widespread reliance on the automobile. Protecting our past is therefore a way to chart a course for the future.

In neighborhoods where a significant number of structures within a specified geographic area meet state or federal requirements for historic structures, it is possible to seek designation of that neighborhood as an historic district. In Connecticut, state statutes[37] allow municipalities to create historic districts after study and with the approval of two-thirds of all property owners within the district. Once an historic district is in place, a governing commission may review delay demolition of historic structures or prominent architectural elements for up to ninety days, and review and comment on requests for the

[37] Connecticut General Statutes, §7-147a-§7-147m (2002).

alteration of existing and construction of new buildings, structures and parking facilities within the district.

The village district legislation recently adopted by Connecticut allows municipalities to actually regulate character and architectural style to protect areas with distinctive character, landscape and historic structures.[38] Specifically, municipalities may regulate alterations and improvements, new construction, substantial reconstruction and rehabilitation of properties within the district. Municipalities may also regulate the design and placement of buildings, the maintenance of public views, the design and placement of public roadways, and other elements that affect community character.

Municipalities choosing to create a village district must follow strict guidelines established by both the legislation and the Connecticut Historical Commission. For example, municipalities must establish clear criteria and procedures for the designation of districts and for the review of proposals for development within the district. To prevent abuse of power over design, the statute also requires that a planning or architectural consultant selected by the planning and zoning commission review all applications for new construction and/or substantial reconstruction that are within the district and visible from the road.

The first Connecticut municipality to designate a village district was the Town of Brooklyn. This village district encompasses the historic center of the town along Route 6 in rural northeastern Connecticut. Since then, several municipalities have explored this option and adopted some form of village district zoning.

Despite the apparent benefits of TND, there are also obstacles -- namely cost, limited government support and lack of unity between development goals and lifestyle choices. In general, the costs of developing a TND are higher than traditional single use developments for several reasons. First, large tracts of land are often necessary to construct communities large enough to achieve an appropriate balance between residential and non-residential uses, accommodate all elements of the development scheme and achieve economies of scale. The complexity of site design, the length of the land use approval process and the provision of extensive public amenities within the development also drive up development costs. In some areas of the country, cost barriers have been exacerbated by lukewarm government support for TND projects. Numerous reasons exist for the lack of strong government support. Fear of the potential impacts of large-scale development, the need for zoning changes, lack of appropriate infrastructure, fear of reduced property values, resistance to change and perceived loss of control over land use decisions within the development are some of the frequently cited reasons.

Although the barriers of cost and limited government support are real, lack of unity between development goals and lifestyle choices is arguably the most significant barrier to creating successful TNDs. Recent evaluation of TND communities indicates that despite the presence of site design elements that encourage diversity, development of a strong sense of community and reduced dependence on the automobile, the lifestyle

[38] Connecticut Public Act 00-145 (2000).

choices made by TND residents are no different than those of persons living in traditional suburban neighborhoods. One recent study reported that households residing in TND communities neither owned fewer automobiles nor used transit more frequently than persons living in traditional suburban neighborhoods. The location of parking behind structures often created a perception of reduced automobile usage, but that driveways, garages and alleys behind structures were crowded with cars. [39] Further research was recommended to determine if and how TND and similar development patterns could serve as an effective congestion mitigation tool. Development of quantitative performance measures has also been recommended. To date, no comprehensive study has been completed, but EPA research indicates that TND projects that integrate transit, bicycle and pedestrian elements into site design can potentially cut the number of vehicle miles traveled by residents in half and significantly reduce auto emissions.[40]

Studies have also reported that the high cost of entry-level housing and the proliferation of "special purpose" TNDs such as mature living communities have limited the ability of many TNDs to attract a diverse pool of residents.

Opportunities for the creation of TND communities exist in both the urban and suburban portions of the study area. The cities of Bridgeport, New Haven, Norwalk and Stamford have active community development and urban renewal programs designed to encourage mixed use development and revitalize urban centers. TND strategies could complement and support those revitalization efforts. Similarly, many of the regional sub-centers such as Stratford and Milford have several large former industrial sites or vacated mall sites that could be effectively redeveloped with TND.

In rural portions of the study area, TND strategies could be used to encourage further development of town centers. Such strategies could be particularly useful to meet a smaller community's need to diversify its housing stock to better meet the housing needs of populations with limited mobility such as the elderly. The challenge for these communities is to simultaneously retain the character and the economic viability of these traditional villages.

5.2.3 Purchase of Development Rights/Transfer of Development Rights

With both the purchase and transfer of development rights, the development potential of a parcel is removed or reduced and relocated to another "receiving" parcel. This technique is often used to preserve open space or environmentally sensitive land, to protect active farmland from development pressure, to protect community character, the preserve the historic significance of a structure or view, or to target development density in city or town center, growth corridors or other appropriate locations.

A purchase of development rights (PDR) occurs when a governmental entity or other party purchases the rights to future development from a property owner and then retires

[39] Brown & Cropper, *New Urban and Standard Suburban Subdivisions*, Journal of the American Planning Association, Autumn, 2001, Page 402 to 419

[40] *Greening the American Dream*, New Urban News, Volume 6, Number 7, October/November 2001

those development rights. The purchasing entity typically pays the fair market value of possible future development to the property owner. The property owner, in turn, retains ownership of the property and existing improvements but forfeits his right to additional development of the property in the future. In some cases, the assessed value of the property may also be reduced to reflect the restrictions against future development which conveys a second financial benefit on the owner – reduced property taxes.

In the past, governmental entities were most often the purchasers of development rights. This technique for controlling growth, however, is expensive for both governmental entities and taxpayers. First, pressure to acquire development rights as a means of limiting growth often occurs in areas with climbing property values and a scarcity of available for development. These conditions drive up the cost of development rights. Second, many government entities do not budget for such costs thus special revenue streams must be created or funds set aside for other capital improvements must be reallocated in order to complete the purchase. This scenario creates competition between a community's interest in controlling growth and a community's need to maintain a certain level of services and improvements. Finally, although many persons may favor using PDR to control growth, they may favor maintenance of funds for other publicly funded services and improvements over the purchase of private development rights that may not appear to have the same public benefit. Fear of property tax increases to support PDR programs may also result in limited public support for such a strategy.

In recent years, not-for-profit organizations have started to create PDR programs as a strategy for preserving farmland and protecting historic structures and neighborhoods. Such organizations have combined their ability to unite persons with similar interests around a common cause and to raise public and private funds to effectuate the purchase of development rights outside the public domain.

The transfer of development rights (TDR), in contrast, involves the purchase of development rights and the relocation – rather than retirement – of those rights to a different parcel of land. Unlike PDR, a supporting program is needed in order for TDR to operate efficiently. Typically, a TDR program is created by a municipality, county or other government entity having jurisdiction over land use planning. Elements of such a program may include the designation of a "receiving area" for transferred rights; the creation of a "bank" for transferred rights that are sold, but not paired with a receiving parcel at the time of sale; a fair process for valuing transferred rights; limits on how much "transferred" density a may parcel may receive; and administering transfers across jurisdictional lines.

The most well-known and successful TDR program has operated for over twenty years in Montgomery County, Maryland. The TDR program has protected a 90,000-acre agriculture reserve in the county's upper portion by allowing development rights to be transferred to down-county receiving areas where residential densities were increased. In addition to its TDR program, Montgomery County has sought to manage overall growth. In the last 20 years, Montgomery County has created a master plan for every one of its

communities, acquired parkland along hundreds of miles of streams, channeled development near Metro stations, revived older commercial centers, and created more affordable housing than any other suburban county in America.

Although successful, Montgomery County's TDR program has not been without criticism. Owners of farmland contend that their development rights have lost market value as a result of down-county resistance to further increases in development densities. In order to maintain the support and participation of farmers, Montgomery County has added farm supports, direct purchase of open space, and conservation easements to its program.

The State of New York has also taken steps to support TDR by passing legislation enabling municipal TDR programs. The legislative purpose is to: (1) protect the natural, scenic or agricultural qualities of open lands, (2) enhance sites and areas of special character or special historical, cultural, aesthetic or economic interest or value and (3) enable and encourage flexibility of design and careful management of land in recognition of land as basic and valuable natural resource. The legislation also provides guidance with respect to the designation and mapping of districts, the issuance of certificates of development rights, tax assessments, development rights banks, and the impact of TDRs on low and moderate income housing.

5.2.4 Transit Oriented Development

Transit-oriented development is a land use technique that combines two land development strategies: (1) concentrate development in areas near or adjacent to rail stations and other transit hubs; and (2) develop with densities sufficient to support low cost, time-efficient and frequent transit service to minimize dependence on automobiles. This development concept is not new, but mirrors the patterns of traditional downtown development found in many of the study area's towns and cities.

Transit-oriented development techniques may be applied to new developments, as well as to the redevelopment of existing city or town centers. The redevelopment of downtown neighborhoods in Stamford and Norwalk in the 1980's and 1990's, for example, resulted in the construction or substantial renovation of housing, office and retail space within walking distance to rail stations. Upgrades to rail facilities and service complemented these development activities. In both Stamford and Norwalk, use of rail for intra-state travel increased dramatically within a short time after completion of the downtown and transit improvements. Transit-oriented development has also been successful near other commuter rail stations. The Merritt 7 office complex in Norwalk is one example of a new development project incorporating both rail station improvements and design elements that promote station access for project tenants. Approximately 500 luxury rental apartments were constructed at the Merritt 7 complex in 2001 and 2002, making the site both a point of departure and a destination in each of the peak commuting periods. Development of a new commuter rail station in the Black Rock section of Fairfield in conjunction with a park-and-ride facility and a major commercial development has also

been proposed. Plans for this project anticipate construction of 1.3 million square feet of office space, and a railroad station, and a 1,200car parking facility for commuters.

On a much smaller scale, the Cannondale Crossing station in Wilton illustrates how the principle of transit-oriented development can also be applied in a rural retail “village” setting to create an attractive destination for regional visitors while revitalizing an historic rail station.