MOBILITY
A Transportation Plan: 2004-2028

South Central Regional Council of Governments
127 Washington Avenue
North Haven, Connecticut

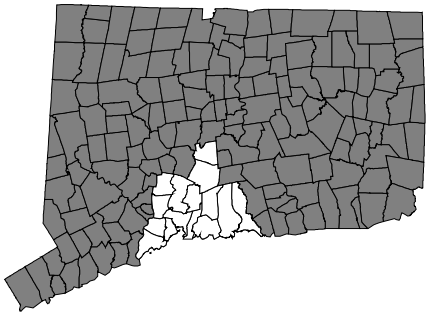
February, 2004

The fifteen-town South Central Connecticut region is composed of Bethany, Branford, East Haven, Guilford, Hamden, Madison, Meriden, Milford, New Haven, North Branford, North Haven, Orange, Wallingford, West Haven and Woodbridge. Mayors and first selectmen guide areawide planning and programming through the South Central Regional Council of Governments, 127 Washington Avenue, 4th Floor-West, North Haven, Connecticut, 06473-1715, (203) 234-7555, /www.scrcog.org/. The Regional Planning Commission, representatives of municipal planning and zoning commissions, addresses land-use planning on behalf of the Council.

This report was prepared in cooperation with the U.S. Federal Highway Administration, the U.S. Federal Transit Administration, the Connecticut Department of Transportation and the Connecticut Office of Policy and Management. The opinions, findings and conclusions expressed in this report are those of the South Central Regional Council of Governments and do not necessarily reflect the official views of other government organizations.

Plan Adoption

Mayors and first selectmen adopted the *Plan* on February 25, 2004 after a January-February, 2004 review that included a January 5 Council-hosted public meeting, January 14 review by the Council's Transportation Committee and January 28 Council adoption of a "Draft Plan" identical to the final document.



Contents

Figures

Contents

A Plan Perspective

Mobility extends and adjusts the region's transportation plan.[1] Goals and direction reflect basic transportation needs, traditional traveler responses and public sector cost constraints. New initiatives that improve key highway links, enhance the region's public transportation system and tie transportation investment to development opportunities are basic.

Proposals focus on the I-91 and I-95 corridors where most people live and work— they support a corridor-oriented *Regional Plan of Development* that recognizes South Central Connecticut's key northeast corridor location.[2] *Transportation Plan* elements built on new central I-95 commitments address well-established freeway choke points, seek to furnish a far more attractive core-oriented transit product and try to make a now well-defined regional trail system a reality. Major new transit proposals await results of a SCRCOG-sponsored *Transit Initiatives Study* in early 2005—suggesting whether, how and where the region can provide a significantly more attractive product.[3]

Moving Beyond Current Experience

Plan proposals draw traditional responses and new initiatives into a common framework. Traditional responses including better highway management, selected capacity increases and incremental new transit services remain basic in the low-to-moderate density region. Companion programs promote carpoolng, attempt to limit trip-making and advance "intelligent transportation systems" applications—seeking to make efficient use of existing infrastructure and limit long-term investment.

The *Plan* blends transit and highway spending consistent with *financial constraints* (Tables 1 and 2).[4] Proposals that move beyond financial constraints focus on emerging freeway bottlenecks and seek to lay the foundation for a more useful 21st century transit system.

A financially constrained *Plan* will not "get the job done". Only well-defined concepts, public support and new state spending can move the region beyond current financial constraints and build a good balanced long-term transportation framework.

Continuing Review and Outreach

New ideas, new state-federal-regional emphases and basic federal law require *Plan* review at three year intervals. Review ties a planning-programming process together—one based on a cooperative Council of Governments-ConnDOT relationship and continuing *Transportation Improvement Program* adjustment.[5]

Joint SCRCOG, ConnDOT, transit operator and municipal efforts through the next three years will enhance an already strong public-private sector planning relationship, emphasize transportation system management per a national "Intelligent Transportation Systems" thrust and seek an increasingly meaningful dialogue with the minority community consistent with national environmental justice goals (Figure 1 and Table 3).[6]

Central I-95 construction will dominate the region's transportation agenda through the next eight to 10 years.

Key Needs

Freeways	
I-95 West	selectively widen from six to eight lanes west of Kimberly Avenue. (beyond Plan resources, begin with Study)
Arterials	
including US1 US5, Rt 10, Rt 17, Rt 63, Rt 69 and Rt 80	consistent three- or five-lane sections to facilitate turning movements and limit traveler delay. Beyond current programming. (not in Plan, study per SCRCOG work program).
Transit System	
I-91 North Commuter Rail Service	an attractive New Haven-Meriden-Hartford-Springfield commuter service that limits peak hour I-91 highway demand. (awaits "Study" completion; limited support available per Plan)
Bus System	sufficient operating funds to support new service initiatives, expand current services and/or reconfigure current service. (beyond Plan resources)
Rail/Bus	new capital/operating initiatives expected from SCRCOG's "Transit Initiatives Study" (Wilbur Smith Associates) early in 2005 (beyond Plan resources)
Regional Door-to-Door Service	enhance Greater New Haven Transit District's capacity to serve as a regional provider. (beyond Plan resources)
Trail System	
East Shore	develop East Haven-to-Madison Shoreline Greenway Trail. (beyond Plan resources)
New Haven	extend Canal Line south from Orange Street to harbor (Per Plan, after 2016)
Meriden-Wallingford	complete Quinnipiac River Linear Trail. (largely beyond Plan resources)
New Haven-West Haven	upgrade/extend Savin Rock Trail east "around" New Haven Harbor to Lighthouse Point (Per Plan, after 2016)

Table 1: New Resources. Important near-term needs are either unaffordable in the short-run (next 12 to 13 years) or lie beyond a "financially constrained" 25 year *Plan* . (Note: subject to revision per January, 2004 *Plan* review process.*)*

Twenty Five Year Capital Pogram
2004-2028
Year 2004 Dollars (000s)

	Available	*In 25 Year Plan*
Early in the 25 Year Period		
Bus and Paratransit [(a)]	98,571	100,071
Rail [(a)]	352,796	397,796
Highways (New Capacity)	1,276,700	1,229,304
Later in the 25 Year Period		
Bus and Paratransit	40,690	42,190
Rail	164,000	164,000
Highways (New Capacity)	562,700	200,540
Twenty Five Years		
Bus and Paratransit [(a)]	139,261	142,261
Rail [(a)]	516,796	561,796
Highways (New Capacity)	1,839,400	1,429,844

Table 2: South Central Connecticut Financial Constraints. Per federal law, 25 year ConnDOT-defined financial guidelines provide a basic planning constraint—they suggest how much expected U.S. Federal Highway Administration, U.S. Federal Transit Administration and state support might be used in each of the state's 15 planning regions. Constraints make clear priorities important. [(a)] overage with highway funds. (Source: Chapter 3.)

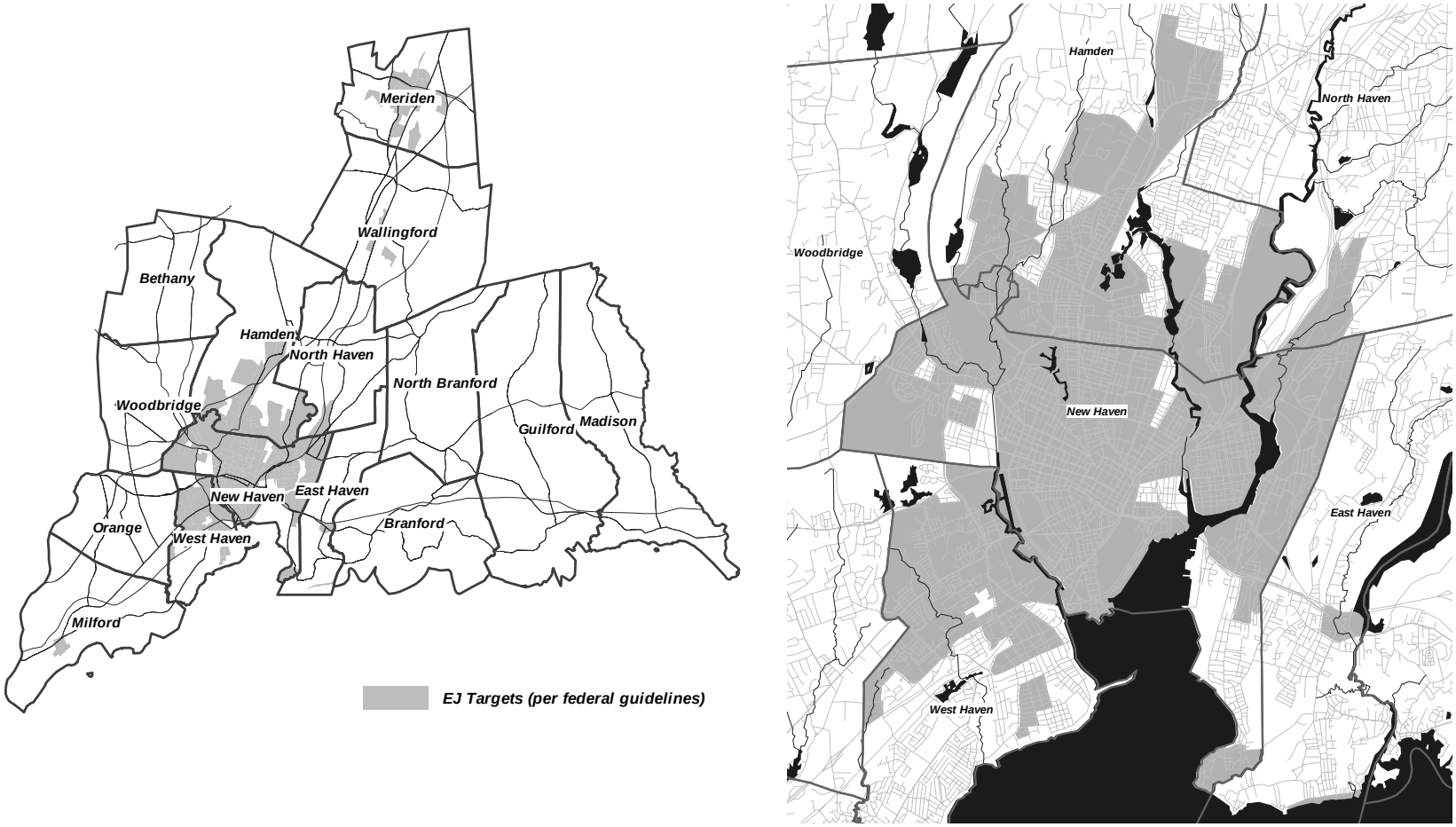


Figure 1: Environmental Justice. Outreach ensures that residents of low-income and minority-oriented areas have an opportunity to participate in the planning-programming process and that projects impacting "environmental justice target" areas in which they live are carefully assessed per a national EJ thrust. See U.S. Department of Transportation, Federal Highway Administration, *FHWA Actions to Address Environmental Justice in Minority Populations and Low-income Populations, 6640.23,* December 2, 1998 and SCRCOG's *Environmental Justice Briefing Package, Transportation Planning: 2003-2004 Goals and Outreach* (North Haven: SCRCOG, 2003). Data per U. S. Bureau of the Census, *2000 Census of Populatuion and Housing, SF3, CD* (Washington: BOC, 2001) illustrating block groups with more than 10.75% of residents living below the federally-defined poverty level (the regional average) and/or with a minority population of more than 25.04 percent (the regional average). Federal guidance defines poverty and minorities.

Selected Intelligent Transportation System Applications
South Central Connecticut ITS Early Deployment Plan

Element	*Purpose*	*Element*	*Purpose*
Monitoring			
Freeway Surveillance	Fiberoptiics communications, microwave or image detection.	Automatic Vehicle Location	Connecticut Transit and Greater New Haven Transit District vehicles tracked continuously. Improve schedule adherence.
Arterial Surveillance	Volume data with traffic management, video image at high-density locations.		
Information Sharing			
Pre-Trip Information	Internet with statewide ConnDOT home page.	En Route Information	Traveler advisory radio. Highway advisory radio.
Dynamic Ridesharing	Real time rideshare formation. (form carpool "on line")		Variable message signs.
Management			
Incident Management	Limit freeway/arterial closure due to accidents, keep public aware. Pre-planning; known response to given circumstance. Alert emergency services. Clear freeway incidents fast.	Ramp Metering	Optimize freeway performance.
		Traffic Management	Best arterial operations with given geometry and hardware.
		Connecticut Transit Transit Security	Improve on-board security.

Table 3: An ITS Early Deployment Plan. The region's *ITS Plan* adapts technology to help meet travel needs. Readily available technology, emerging capabilities and a national ITS commitment can make local highway and transit systems more useful and effective. Intelligent Transportation System applications recognize new possibilities inherent in new technology. System-oriented elements address transit, highway and pedestrian needs as a whole—recognizing statewide initiatives and Northeast Corridor ITS partnerships. See TransCore, *Intelligent Transportation System Strategic Deployment Plan*, prepared for the Connecticut Department of Transportation and the South Central Regional Council of Governments (Newington: TransCore, 1999).

1. The Twenty Five Year Plan in Brief

An Overdue Response

Basic I-95 capacity is about 50 years old—current central I-95 initiatives are overdue. Historic travel corridors that link towns within the region and tie the region to adjacent areas have not been improved since the completion of I-91 and I-691 25-to-30 years ago. Population gains, employment shifts, longer-commuting distances and more through traffic now strain an aging highway system. Projects intended to relieve congestion including the Route 34 Freeway extension and the East Rock Connector (New Haven) were never pursued. Transportation problems that emerged in the 1970's matured by the 1980's and became intolerable in the 1990's. Even slow local growth expected through the next 25 years will lock up more key freeway sections and arterial links without major new investment (Figure 2).

Now Opportunity

The *Plan* focuses on new highway and transit capacity after an extended period of infrastructure renewal (Table 4).[7] Substantial capacity-oriented investment along the freeway system and at key arterial choke points can help maintain mobility in the moderate density environment.

Objectives

Major improvements and operating change can complement one another within a framework that:

- *reinforces the region's central urban spine and supports vigorous central commercial growth*. Most new highway and transit investment must be channeled into urban corridors where 70 percent of the region's year 2025 population will live (Figure 3).

- *offers a selective new transit agenda*. New resources can gradually move the transit system beyond a financially constrained horizon. The *Plan* suggests how stronger core-bound transit in major corridors can complement highway investment. Faster, more frequent service and a wider range of schedules can capture about 20 percent of the core-bound peak hour travel market—moving well beyond a current seven-to-ten percent level that brings only 2,000 people to downtown New Haven in the morning peak hour.

- *keeps the freeway system moving*. Neither new transit commitments nor enhanced ridesharing/demand management programs that limit trip-making can substitute for new highway capacity. A mix of investment and management can keep freeway performance in bounds while modest growth continues.

- *protects new arterial investment*. Important suburban facilities deserve good access control—limiting the number and location of curb cuts on important facilities. Basic design decisions and access management policies built into land use controls can protect new highway investment.

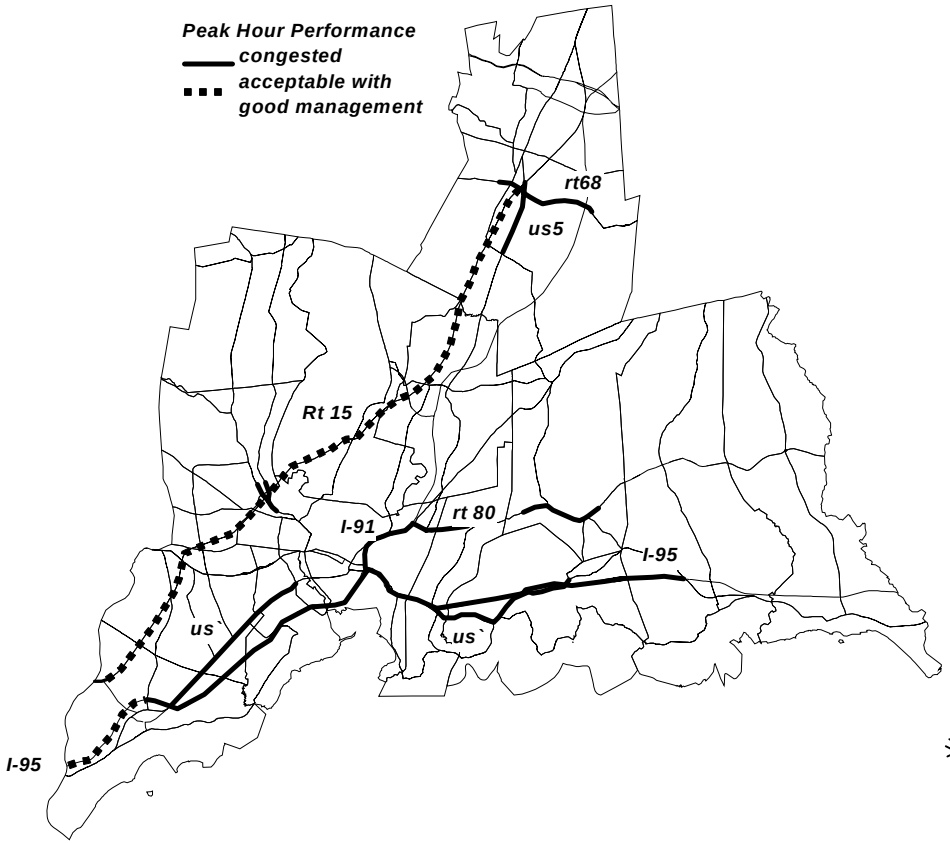


Figure 2: Peak Period Highway Performance—The Year 2025 Without New Capacity. Even slow growth through the next 25 years will lock up key freeway sections and important arterial links unless current programs are pursued and major new commitments emerge—commitments beyond those in the region's *Transportation Improvement Program.* Freeway management can help smooth flow, selected new transit responses can reduce highway demand and demand management can help dampen peak hour travel—none can substitute for basic new highway capacity.

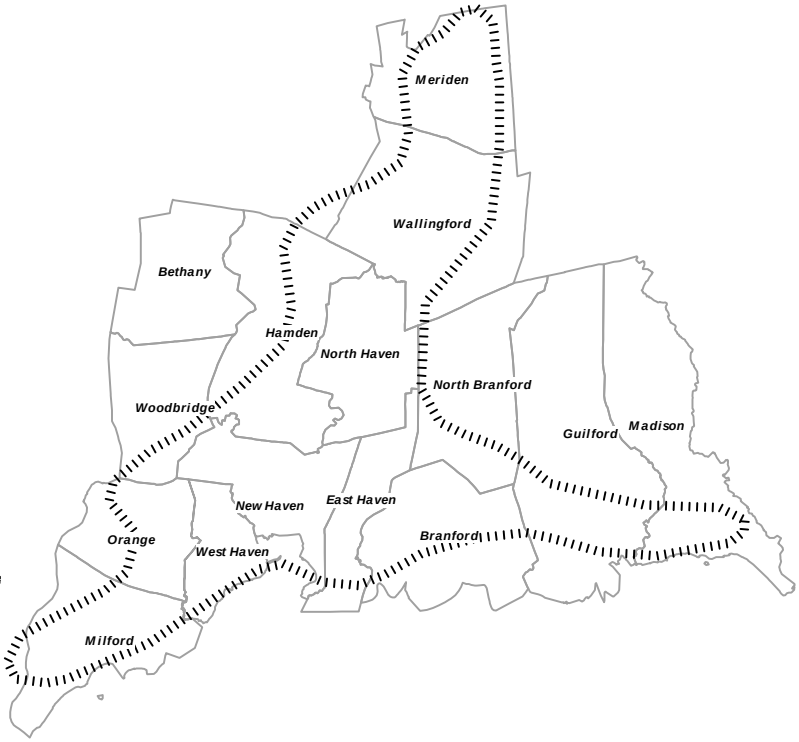


Figure 3: The Urban Spine. SCRCOG's *Vision for the Future*, the region's plan of development, suggests why most new highway and transit investment must be channeled into urban corridors that will contain 70 percent of the region's year 2025 population and 90 percent of its jobs. See South Central Regional Council of Governments, *Vision for the Future* (North Haven: SCRCOG, 2000).

Key Plan Goals

Complete central I-95 improvements.
resolve the I-95 Long Wharf capacity/environment/cost issue.
Look beyond central I-95 needs.
begin to respond to I-95 east and I-95 west needs.
Good traffic/transit/information management during the 2004-2012 central I-95 construction program.
Build a more attractive transit system for the 21st century.
reinforce ridesharing/demand management commitments.
reinforce Greater New Haven Transit District as *Americans with Disabilities Act* and regional scale special purpose door-to-door (paratransit) provider.
assess opportunities identified in conndot's "New Haven – Hartford – Springfield Commuter Rail Implementation Plan" in 2004.
build a second Union Station (New Haven) garage.
build a new Metro North West Haven station (preferred), Orange alternate.
expand Shore Line East parking (beyond current programming).
Begin to seriously think about more I-95 capacity.
identify I-95 west management opportunities, widening costs, issues and alternatives.
assess options, costs and benefits due from conndot's "I-95: Branford-to-Rhode Island Feasibility Study" in June, 2004.
Financially Balance the 25-Year Program
observe state programming guidelines for the region as review of the region's plan continues at three-year intervals.
maintain clear priorities; implement programmed projects.
plan and program in close association with conndot.

Table 4: Plan Goals. The *Plan* focuses on new highway and transit capacity after an extended period of infrastructure renewal.

Build a more attractive fixed route transit system.

More I-95 west capacity between West Haven and Milford (here in West Haven).

Reinforce the Greater New Haven Transit District as a regional scale special purpose door-to-door provider—building on its *Americans with Disabilities Act* service delivery capabilities.

Guidelines

Clear guidelines and consistent application can maximize return on investment.

Highway Design. Design responses that respect the environment are basic. Contemporary highway investment from Seattle, Washington to Washington, D.C. offers too many examples of sensitive design to settle for less here. Urban geometry and urban amenities that enhance the environment are basic.

Arterials. Major regional arterials including portions of US 1, US 5 and Route 80 continue to need consistent well-designed three, four and five lane sections to meet near-term traffic burdens. New commitments that reflect high design standards and better access control should be defined.

Cost Effective Rail Transit Investment. New investment can make Metro North, Shore Line East and inland (New Haven-Hartford-Springfield) service more attractive commuting options—establishing key elements of a useful year 2028 transit system. Attractiveness hinges on a quality product, a seamless intermodal interface, competitive point-to-point travel times and expanded parking.

Key Rail and Bus Stops. Transit friendly environments at important stops are more than amenities. Comprehensive design commitments that meet riders' needs, encourage relatively dense adjacent development and limit auto-transit friction can make the region's long-term transit commitment clear. Key elements involve shelter, system information, real time transit information and high design standards.

Commitments

Multi-year commitments built into the region's *Transportation Improvement Program* will begin to make a difference through the next few years (Figures 4 and 5).

Transit

Connecticut Transit New Haven Garage. Replace the 55-year-old James Street facility with a new $64 million garage on State Street (Hamden) by the year 2008.

Shore Line East Commuter Package. A $22 million station improvement package that upgrades Madison and Guilford stops, relocates the Branford stop and expands suburban parking complements investment that brought a new downtown New Haven State Street-Chapel Street station "on line" in late-2001.[8] Capital improvements and new service provide a meaningful east shore transit alternative while I-95 construction proceeds.

Downtown New Haven Bus Stop Improvement Program. A $1.5 million commitment that improves eight high volume stops in 2004-2005—offering riders larger shelters, better lighting and radiant heating.

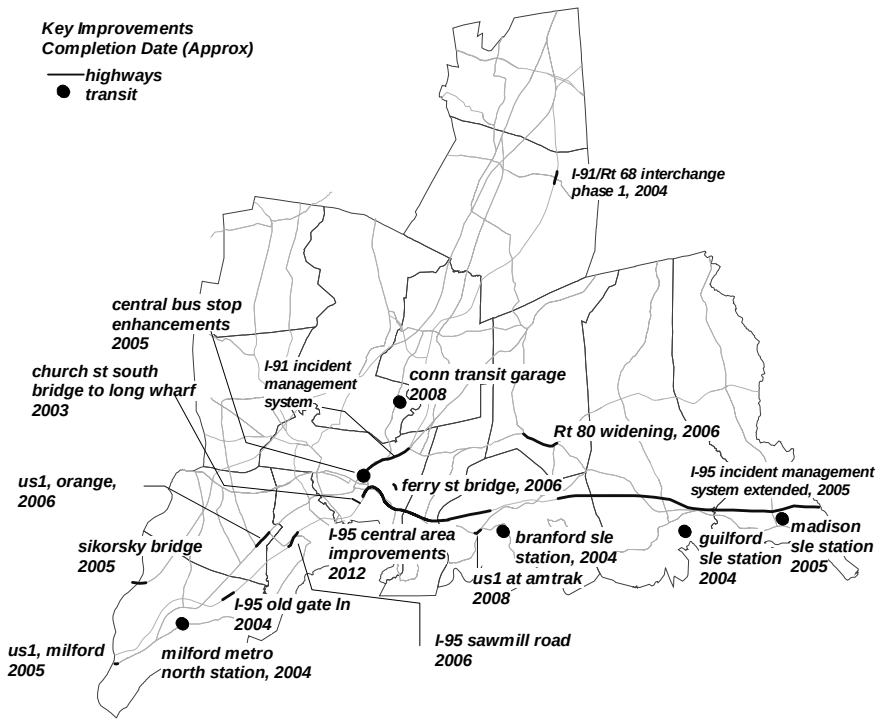


Figure 4: Capital Commitments. The region's *Transportation Improvement Program* makes a $1.8 billion commitment to improve the system through the next 10 years. (Source: Table 35 including commitments to interrgional and statewide projects.)

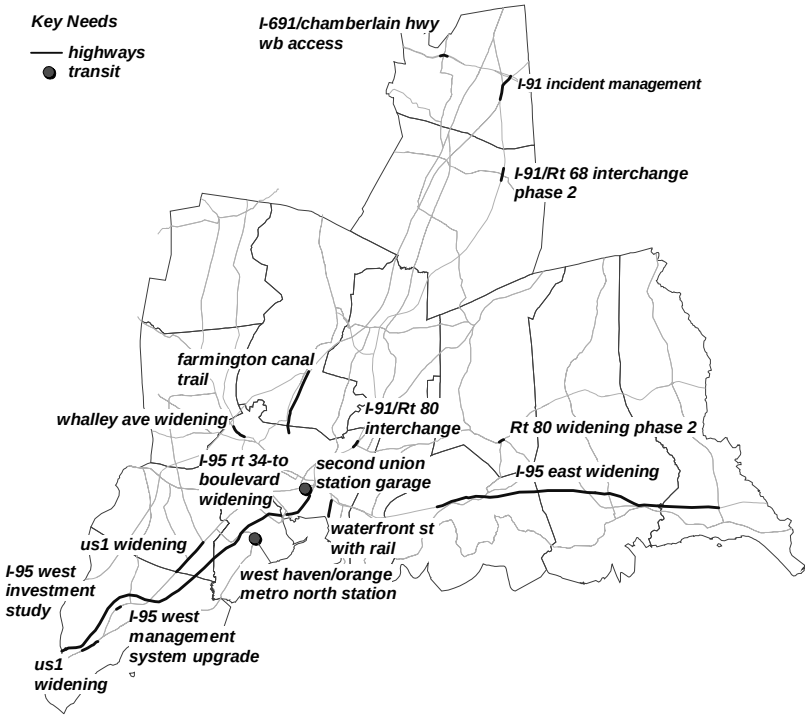


Figure 5: Major Capital Needs. The *Plan* proposes spending $1.5 billion through the 2004-2028 period to begin to provide the kind of mobility that the region expects. (Source: Table 36.)

Highways

Incident Management. Extend the current I-95 detection/video cam system east beyond Branford through Madison to Westbrook and north along I-91 to Route 80 (New Haven) (Figure 6). Install a new I-91 subsystem between East Main and I-691 (Meriden).

I-91. Improve the Route 68 (Wallingford) interchange—reducing peak hour delay and providing mid-range development flexibility.

I-95. Reconfigure Old Gate Lane (Milford) and Sawmill Road (West Haven) and interchanges to add capacity—complementing Marsh Hill Road (Orange) work completed in 2001 and Leetes Island Road (Branford) completed in 2002.

I-91—I-95. A one billion, 12-year central freeway package that begins the process of unsnarling the outmoded central interchange and providing necessary new I-95 capacity between Branford (Cedar Street) and Route 34 (Figure 7). Roadside improvements, including a new $30 million "Yale Boathouse" near Canal Dock Road (New Haven), complement the main line freeway program.

Route 80. Widen Route 80 between Twin Lakes Road and North Branford Center (Route 22) to complement recent work immediately to the west.

US 1 West. Begin to provide a continuous five-lane section through much of Milford and Orange after an extended planning/design period.

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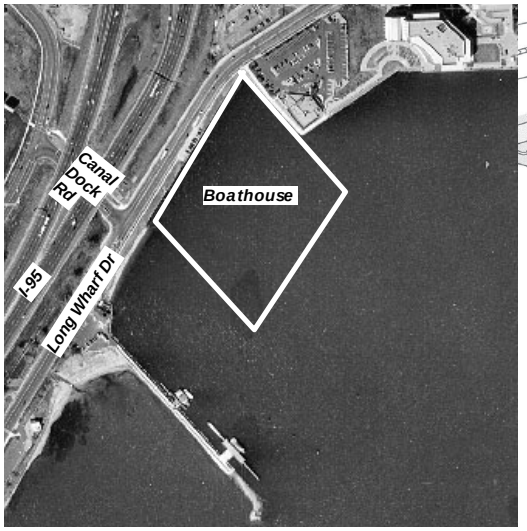
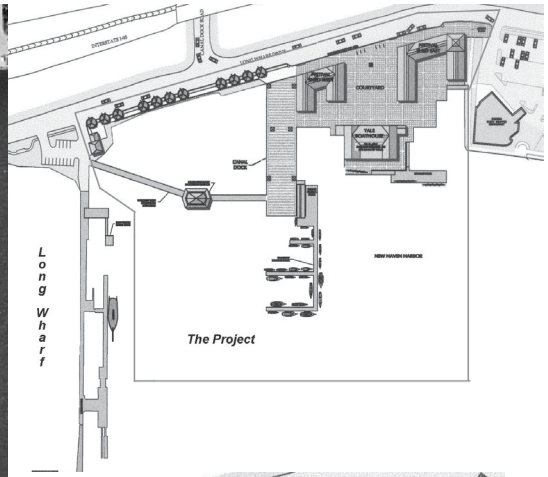
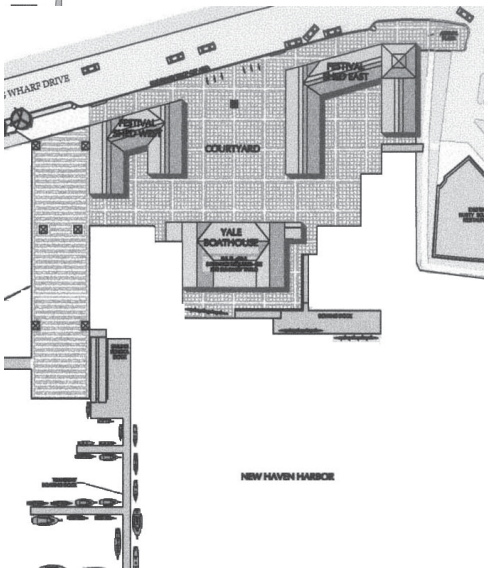
Figure 6: ConnDOT Traffic Control Centers. Bridgeport (I-95, upper left) and Newington (I-91 and I-84) control centers are the foundation of an expanding statewide incident management/traffic control system. Photos courtesy of the Connecticut Department of Transportation.

A $30 million I-95 commitment will build a new public multipurpose “Boathouse” at Long Wharf Drive and Canal Dock Road (Parcel H) through the next few years (right)—incorporating remnants of the east shore Yale Boathouse to be demolished for the new Quinnipiac River Bridge (left).





New Boathouse site plan courtesy of the City of New Haven and Lanagan Engineering and Environmental Services. Rendering of the existing Yale Boathouse courtesy of Parsons Brinckerhoff Quade & Douglas in *I-95 New Haven Harbor Crossing Corridor Improvement Program: Yale Boathouse and Fitch Foundry Relocation Study, Final Report, Phase 2*, prepared for ConnDOT (Glastonbury, Ct: Parsons, 2002).



I-95 at the New Haven-East Haven line, looking east. Now at left and after relocating the Woodward Avenue ramps at right. Courtesy of the Connecticut Department of Transportation and Parsons Brinckerhoff.

Figure 7: The I-95 Program. A $1 billion, 12-year central freeway package begins the process of unsnarling the outmoded central interchange; providing necessary new I-95 capacity between Branford (Cedar Street) and Route 34; and improving the highway environment.

The 25-Year Financially-Constrained Plan

A $1.4 billion 25-year spending program can begin to put important new facilities and services in place—leaving $400 million for new initiatives through the 2017-2028 period.

Transit

Milford Railroad Station. Expand parking by about 250 spaces with structured parking to meet existing needs and support a continuing downtown enhancement program.

Union Station Parking Garage (New Haven). Build a second Union Station garage with New Haven Parking Authority revenue bonds or via the private sector—advancing work originally programmed in the early 1990's.

West Shore Commuter Rail Station. Build a new $36 million, 1,000 space station at in West Haven or Orange to complement state I-95 west New Haven-to-Greenwich five percent peak period single occupancy vehicle travel reduction goals.[9]

Highways

Arterial Signal Control. Make continuing traffic control attention a regular part of the region's "Congestion Management System" program.[10]

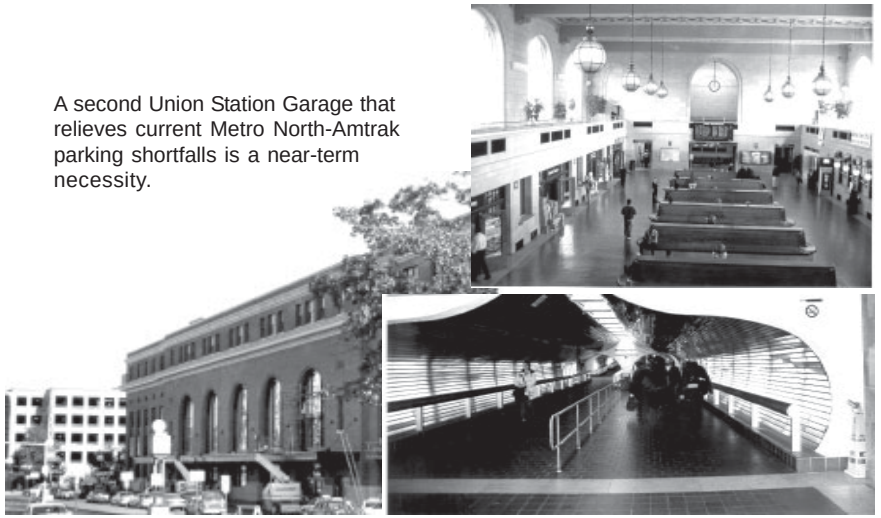
I-95 at Long Wharf. Add new capacity at Long Wharf—opening the I-91 southbound choke point and complementing I-95 investment to the east. ConnDOT's *New Haven Harbor Access Preliminary Engineering Study* (2002) offers basic options for the 1.5 mile Route 34-to-Boulevard freeway link (Figure 8).[11] New Haven's *New Haven Harbor Access* (2002) guides local access needs.

I-91 North. Improve the I-91/Route 80 interchange (New Haven) to eliminate an extended northbound late-afternoon main line backup and complete improvements at Route 68 (Wallingford).

Intelligent Transportation Systems. Revamp now outmoded I-95 west monitoring hardware, introduce a real time freeway speed information capability and accelerate installation of a bus automatic vehicle location/real time on-street information system.

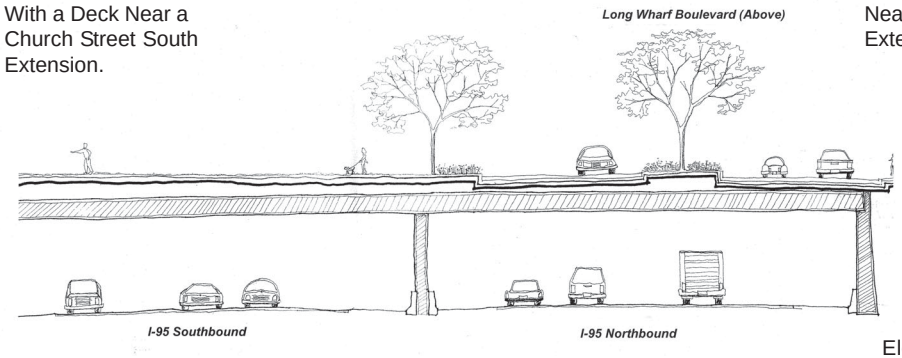
I-691 (Meriden). Revise westbound access to the Interstate at Route 71 (Chamberlain Highway) to encourage relatively dense development at an important central corridor node.

US 1 West. Complete major elements of the widening package between Route 114 (Oange) and Roses Mill Road (Milford) and near Silver Sands Parkway (Milford).

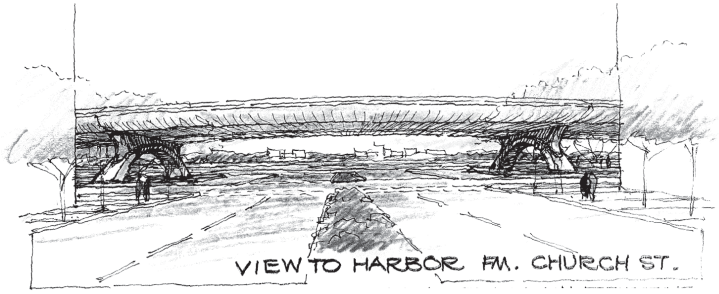


A second Union Station Garage that relieves current Metro North-Amtrak parking shortfalls is a near-term necessity.

Depressed Section With a Deck Near a Church Street South Extension.



Depressed Section Deck Near a Church Street South Extension.



Elevated Freeway Shown Over a Church Street South Extension.

Figure 8: I-95 Options at Long Wharf. Early design suggests that an at-grade facility is likely to prove necessary given high costs associated with a depressed section and poor experience with elevated facilities. Illustrations and freeway cost courtesy of the Connecticut Department of Transportation and Parsons Brinckerhoff appearing in Parsons Brinckerhoff Quade & Douglas, *Preliminary Engineering Study, New Haven Harbor Access*, prepared for ConnDOT (Glastonbury: Parsons, 2002). *Plan* proposals target another $86 million for local roadway and harborside access improvements.

I-95 Main Line Freeway Cost
Long Wharf
Year 2010 Cost Estimates
Canal Dock Road-to-Boulevard

At-Grade	110,000,000
Elevated	225,000,000
Depressed	675,000,000

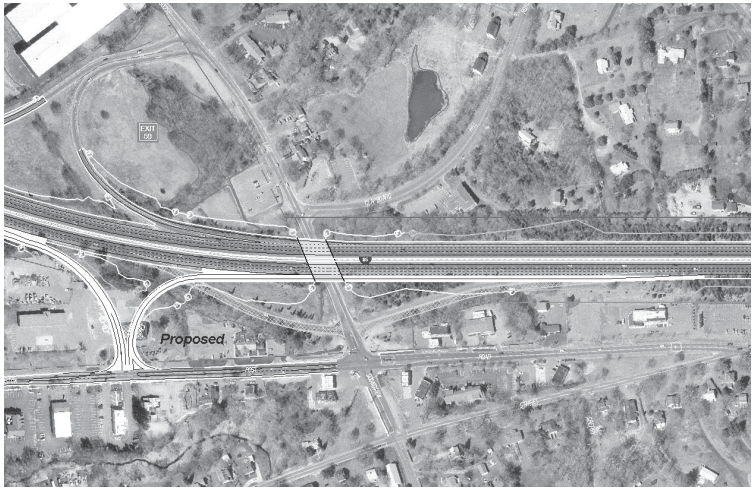
At-Grade Freeway Shown with a Signature Pedestrian Bridge Crossing I-95 (looking northbound) at an extended Church Street Street South—tying Church South to Veterans Memorial Park and the waterfront.

I-95 West. An advanced planning/environmental impact assessment that suggests, with some precision, whether, where, how and at what cost the Interstate can be widened from from six-to-eight lanes between the Boulevard and the new Moses Wheeler (Housatonic River) Bridge scheduled to replace its 50-year-old predecessor by 2010.

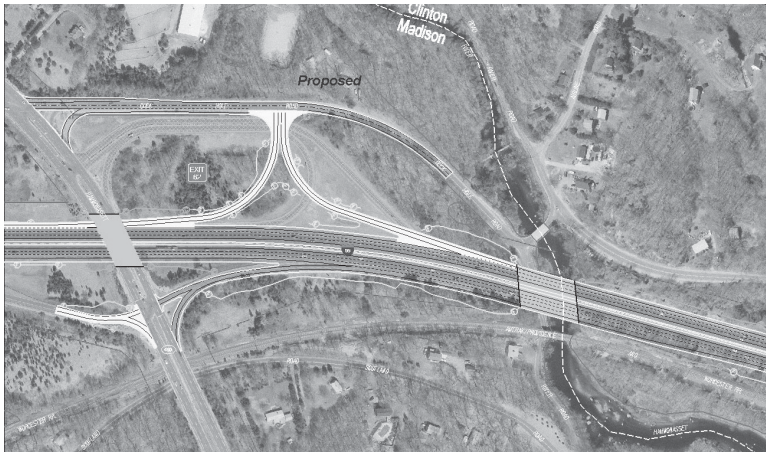
I-95 East. Widen the freeway east from Branford through Madison as an element of ConnDOT's proposed 54-mile-long improvement. Draw on the Department's *I-95 Corridor Branford to Rhode Island Feasibility Study* now considering how to widen the freeway from four-to-six lanes between Cedar Street (Branford) and the Rhode Island state line.[12] Effect long-needed interchange improvements including those at exit 59 in Guilford (Goose Lane) and exit 62 in Madison (the Hammonassett Connector) (Figure 9).

Whalley Avenue. Widen upper Whalley Avenue east of the Wilbur Cross Parkway—working east along Whalley Avenue from Amity Road to Emerson Street (about 0.75 miles).

Build Key Elements of the Regional Trail System. Bring well-defined sections of the Farmington Canal Trail south from Connolly Parkway through Downtown New Haven—including the Connolly Parkway-to-New Haven City Line section now under design. Complement Wallingford's Quinnpiac River Linear Trail with a Senior Citizen Connector.[13]



I-95 at Goose Lane (Guilford, Exit 59)



I-95 at the Hammonsassett Connector (Madison, Exit 62)

Figure 9: I-95 East. ConnDOT's *I-95 Corridor Feasibility Study* addresses longstanding interchange issues along with a basic widening proposal—moving from four the six lanes. Early proposals are reflected in Clough Harbor and Associates, *I-95 Corridor, Branford to Rhode Island Feasibility Study, Prelimiinary Improvement Concepts*, prepared for ConnDOT (Rocky Hill, Ct: Clough, October, 2003). The 18-month-long *Study* will be completed in June, 2004.

Needs: Beyond Financial Constraints

Major new initiatives with clear cut benefits warrant attention now.

Transit

Connecticut Transit Bus Service. Increase system commitments to reinforce service on key arterial routes, expand new Downtown Trolley service, introduce Downtown curbside enhancements and make a low cost or "free fare" zone in Downtown New Haven possible—linking the waterfront, Union Station, Yale-New Haven Hospital, Broadway and Yale's North Campus with regular routes. Limited Connecticut Transit route adjustments, a strong "first class" transit presence and new central area fare policies can make a strong statement about transit's long-term regional role while fostering regionally important central area development goals.

New Haven-Hartford-Springfield Rail Commuter Service. Pursue mid-level *New Haven-Hartford-Springfield Commuter Rail Implementation Plan* proposals expected in early 2004—proposals that provide reasonable peak hour service.

Planning Options
Inland Commuter Rail

	Operating Scenario	
	Minimum	*Maximum*
Weekday Riders (Boardings with Current Amtrak Service)		
no Bradley service	1,800	3,400
with Bradley service	n/a	5,000
Capital Costs ($ Millions)		
Train Sets	42	146
Maintenance Facility	12	17
Stations & Parking	4	45
Right-of-Way	0	114
Other (including design and contingency)	23	162
Total	81	484
Annual Cost/Revenue ($Millions)		
operating	7.5	39.9
revenue	0.9	3.6
deficit	6.6	36.3

Key Elements
Mid-Level Program
Inland Commuter Rail

Stations	existing stations including a former North Haven/Hamden Devine Street stop adjacent to the US5/Route 40 interchange. simple design; similar to new Shore Line East stations.
Parking	expanded parking including Wallingford and Meriden stations.
Frequency	initial 30 minute peak period headways to offer an attractive product.
Right-of-Way	limit double tracking (given 10-year-old elimination of second track); use sidings/turnouts to limit capital cost.
Bradley Airport	serve Airport via a rail shuttle bus to limit capital cost; per Bradley Board of Directors' goal.

Table 5: Inland Rail Commuter Planning. ConnDOT's *New Haven-Hartford-Springfield Commuter Rail Implementation Plan* will offer programming guidance later this winter (early 2004). A mid-level option that offers reasonably frequent service may be emerging. (Source: Planning options per Wilbur Smith Associates, "New Haven Hartford Springfield Commuter Rail: Minimum Build Scenario" and "Maxium Build Scenario, Revised", prepared for ConnDOT (New Haven: WSA, October, 2003) at http://www.nhhsrail.com/RS.htm.

Highways

Build Key Elements of the Regional Trail System. Seek new support to create the backbone of a regional trail system now (Figure 10). Recognize that a relatively small investment can extend the Quinnipiac River Trail north from the Wilbur Cross Parkway (Wallingford) through southern Meriden and establish a 10-mile-long New Haven Harbor Trail that extends West Haven's 25-year-old Savin Rock Trail.[14]

New Haven. Bring the Farmington Canal Trail south from Hamden along newly constructed sections (left), through Yale University (right) and past the Audubon Arts Center to the Downtown.

Wallingford. Extend the Quinnipiac River Linear Trail trail north from an initial link near Center Street (left) and soon-to-be constructed sections north of the Quinnipiac River (right).

Hamden. Link Farmington Canal Trail segments south of the Wilbur Cross Parkway (lower right) with Cheshire (upper left) and completed portions of the Trail in Hamden.

West Haven. Extend the 25-year-old Savin Rock Trail north and east around New Haven Harbor to New Haven's Lighthouse Point Park.

Figure 10: Trail Development. Twenty-five (25) years of multi purpose trail development experience, originating with West Haven's Savin Rock Trail, suggests that a relatively small investment can make a very significant impact.

I-95 East Corridor Management. Make the 2004-2012 central I-95 construction period a model of how an aggressive multi-dimensional freeway-arterial management program can work. Employ a mix of good transit service, contemporary traffic operations capabilities, enhanced public information tools and good organization to mitigate an otherwise-difficult commuting experience.

Improve the Quality of Highway Design. Translate generalizations about community goals and highway design now termed "context sensitive design" into tangible products.

New Freight System Responses. Support public-private sector investment that accelerates introduction of Port Newark (Elizabeth)-to-Port of New Haven container barge service in cooperation with the Port Authority of New York and New Jersey—providing a more cost-effective freight distribution option than truck movement from Port Newark along difficult I-95 (Figure 11).[15]

Opportunity: Beyond the Current Plan

Key investment decisions need clear guidelines and broad support. Planning, preliminary design attention and clear proposals through the next three years can assess new freeway management, transit, ITS deployment and airport improvement options—providing background for the year 2007 *Plan* review (Figure 12 and Table 6).

Freeway Management. Determine whether, where and how ramp metering and/or closure should become part of the region's long-term freeway traffic management program—building on early limited I-95 east shore proposals and helping maintain reasonable main line peak hour movement.

Adapting New Technology. Set new mid-range ITS goals.[16] . Determine whether and how ConnDOT and the region can move beyond incident management and limited real time highway traveler information systems (Table 3).

Tweed-New Haven Airport. Help the Tweed-New Haven Airport Authority review, adjust and pursue elements of its *2002 Master Plan Update*—allowing the region to gain the advantages of improved close-in air service within the airport's current foot print (Figure 13).

Transit Initiatives. A broad assessment of opportunities to make South Central Connecticut transit more useful to more people—identifying new service, service change, operations and policy (Table 7). Accompanied by substantial outreach. In progress with expected early 2005 proposals.

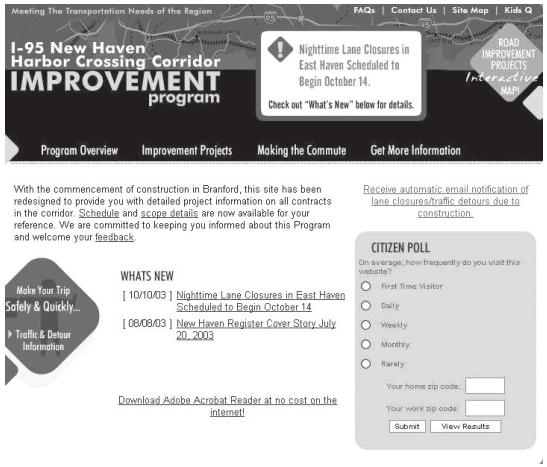
Opportunity *Beyond the Current Plan*	
Freeway Management	Assess ramp metering strategies that keep the main line moving without congesting arterials. Build on national experience.
Intelligent Transportation Sytstems	Adapt national experience to the South Central Connecticut environment. Accelerate introduction of basic monitoring/information systems in context of a statewide program.
Tweed-New Haven Airport	Implement a clear comprehensive mid-range plan that addresses both airport and neighborhood needs.

Table 6: Opportunity. Near-term attention can look beyond the current *Plan*—defining new opportunities that help adjust priorities and programming.

New Haven Harbor

Figure 11: Feeder Barge Service. A 35-foot deep, five-mile-long federally-maintained channel, new Tomlinson Bridge cross-harbor rail freight capabilities, a final $12 million east shore rail connection and soon-to-be improved I-95 access make intermodal freight movement a real prospect for the first time since the 1950's.The Port can accommodate regionally-oriented containers now moving through Port (Newark) Elizabeth by truck notwithstanding the 2003 General Assembly's decision to begin Connecticut barge service in Bridgeport. Private parties and the new Port of New Haven Authority need limited help to begin service now.

Adapting New Technology. Build on experience gained developing ConnDOT's Central I-95 website—a comprehensive constructon-operations-public transit information resource



Ramp Metering Ramp metering can help manage freeways here as in over 50 other urban areas. Recent SCRCOG work suggested how a mix of late-afternoon eastbound I-95 ramp closure at the US1 Frontage Road and metering at exit 52 (North High Street) might have improved flow during the I-95 construction period. See SCRCOG, *An I-95 Choke Point* (North Haven: SCRCOG, 2000). Modeling I-95 eastbound ramp metering at North High Street (above) and I-5 southbound metering in San Diego (right).

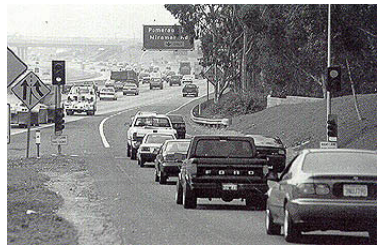


Figure 12: New Opportunity. Ramp metering and enhanced information sharing have signficant roles here.

Transit Initiatives Opportunity and Options
Routes/Service
shorter headways on existing routes
alternate routes and/or branching
express/semi-express services and outlying activity centers
shedding relatively unproductive existing service
a new central area bus circulation pattern
new non-central-to-non-central service
Connecticut DOT Statewide Bus System Study proposals
paratransit (many-to-one, many-to-few, many-to-many)
shared ride taxi
Service Policies
pricing options (premium service/premium prices)
minimum peak period headways
seamless mode-to-mode transfers
more peak period service/stable off-peak service
free fare zone
Operations
bus only streets
queue jumpers (short bus lane combined with traffic signal priority)
more routes on fewer streets
busways
high occupancy vehicle lanes including limited peak period shoulder use
bus stop spacing adjustments
bus-oriented traffic signal preemption (passive or active bus priority)
reserved bus lanes

Table 7: Transit Initiatives Study. An 18-month-long Study undertaken for the Council by New Haven-based Wilbur Smith Associates began in late 2004. Consultants will begin to screen a broad array of options this winter and undertake signfiicant outreach before advancing proposals in early 2005.

Figure 13: Tweed-New Haven Airport—An Opportunity.

2. Growth, Change and Commitment

Growth, an aging freeway system and moderate density focus attention on major highway investment—investment that will not be overwhelmed by new demand.[17] Slow growth without major new investment will thoroughly congest key highway links for extended periods and make cost effective transit responses that depend upon freeways impossible.

Development and Transportation

Modest Growth

Slow-to-modest growth will shape travel demand through most of the region.

Population Growth. Population growth at less than one-half of one percent (0.3%) per year will push the region's population to about 600,000 persons by the year 2025 (Table 7).[18] Population gains will largely mirror post-1970 trends. Most growth will be spread through the 15-town region while limited new gains are expected in New Haven after a 50-year (1950-2000) decline.

Auto Availability. Even slow population growth will move auto availability almost 15 percent beyond current levels as middle-to-lower income household auto availability rates rise (Figure 14).

Planning Estimates (000s)

	Population			Employment		
	1970	*2000*	*2025*	*1970*	*2000*	*2025*
New Haven	137.7	123.6	140.6	95.7	76.4	86.8
Meriden	56.0	58.2	63.8	20.9	24.3	29.8
Central Cities	193.7	181.8	204.4	116.6	100.7	116.6
Inner Suburbs	127.4	137.5	150.6	33.1	40.9	54.8
East Haven	25.1	28.2	33.3	2.9	6.3	9.7
Hamden	49.4	56.9	62.1	16.6	18.8	25.2
West Haven	52.9	52.4	55.2	13.6	15.8	19.9
Outer Suburbs	186.9	227.3	250.8	64.3	111.3	140.5
Bethany	3.9	5.0	5.3	0.5	1.1	1.4
Branford	20.4	28.7	33.2	5.6	12.9	16.9
Guilford	12.0	21.4	23.8	2.5	5.5	7.4
Madison	9.8	17.9	22.1	1.8	4.5	6.2
Milford	50.9	52.3	53.8	17.7	27.7	32.3
North Branford	10.8	13.9	18.0	1.5	2.9	5.7
North Haven	22.2	23.0	23.0	15.1	22.8	25.8
Orange	13.5	13.2	13.2	5.2	8.3	10.5
Wallingford	35.7	43.0	47.5	13.5	22.8	30.3
Woodbridge	7.7	8.9	10.9	0.9	2.8	4.0
The Region	508.0	546.6	605.8	214.0	252.9	311.9

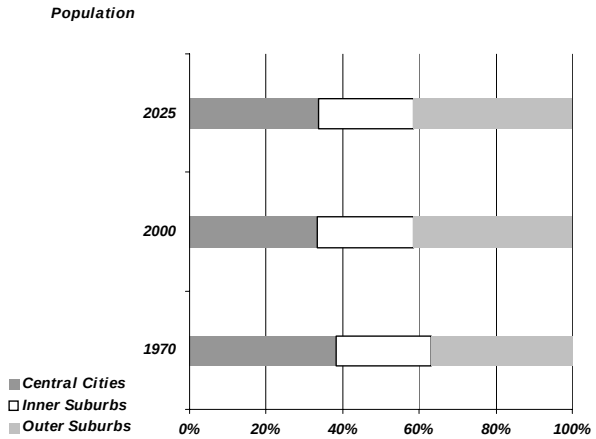


Table 7: Planning Estimates. The suburbs will absorb most of the region's limited population growth.

Transit Markets. Residential growth will not appreciably improve the climate for public transit. Few new areas will reach densities of at least 2,000 persons per square mile that make traditional walk on transit work or provide reasonable service at reasonable fare with reasonable subsidy (Figure 15). Traditional central walk on markets will continue to erode as auto ownership increases and travel destinations become more diverse (Figure 16). High-speed core-suburban links will become more important elements of a year 2025 transit network.

Suburban Jobs. Many new jobs will follow lower density population growth to the suburbs—tending to locate beyond the range of effective bus service. Selected new fixed route commitments and strong public-private sector ridesharing programs can offer a reasonable alternative to drive-alone commuting beyond the central corridor.

Demand

Forty thousand new people and 50,000 new jobs will help add about 350,000 daily trips to the region's transportation system—adding almost 70,000 new trips in peak morning and late-afternoon periods (Table 8). New demand will:

- stem from suburban areas where 60 percent of the region's new households and 70 percent of its new jobs will locate.

- attract 20 percent more peak hour trips to Downtown New Haven as redevelopment in and near the core continues and New Haven's job market consolidates around the Downtown.

- raise vehicle miles traveled by almost 30 percent. More trips and slightly longer trip distances will drive VMT, the number of miles autos and trucks drive in the region each day, well above current levels.[19]

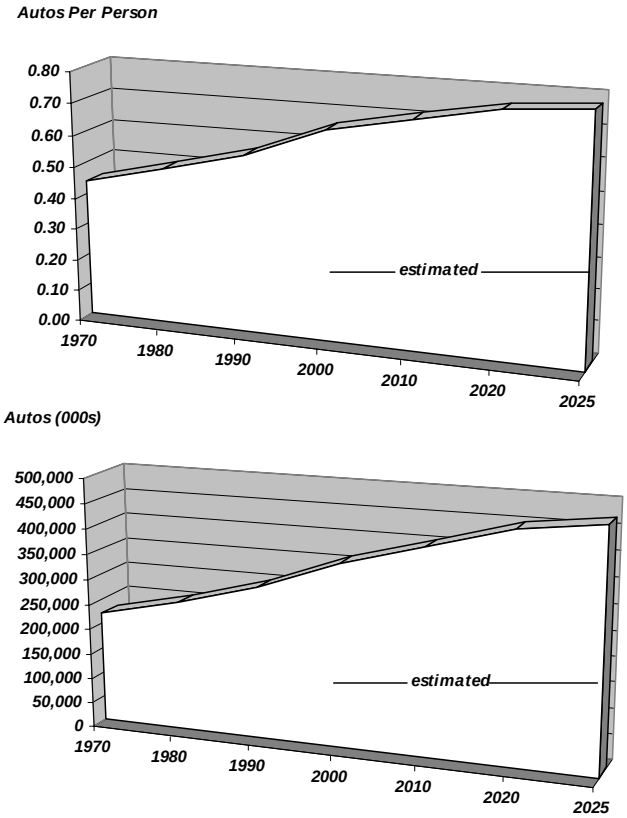


Figure 14: Auto Ownership. Even slow population growth will push auto availability almost 30 percent beyond current levels. (Post-2000 estimates per Connecticut Department of Transportation Series 27A data base.)

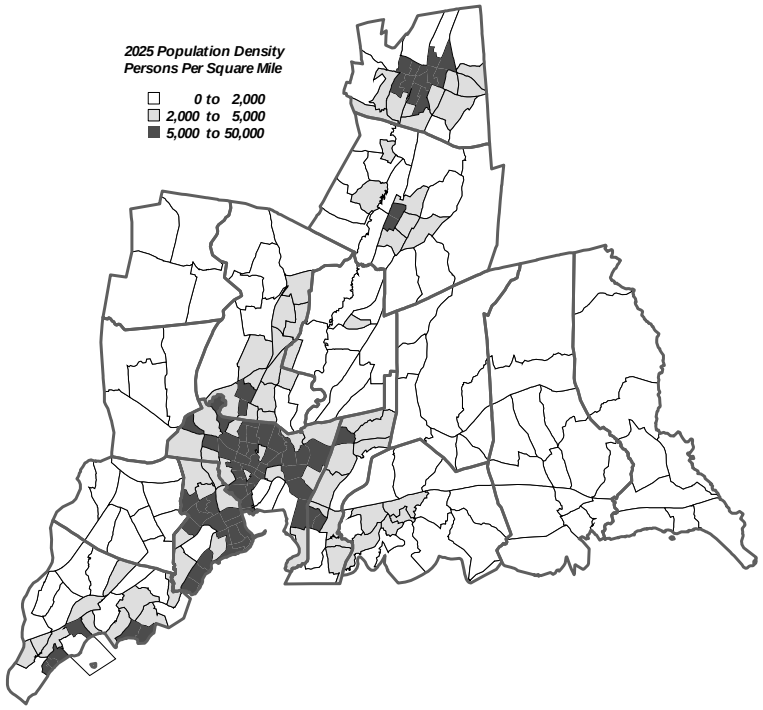


Figure 15: Year 2025 Transit Supporting Density. Limited "walk on" 2,000 person square mile residential densities are expected—densities that tend to permit reasonable service at reasonable fare with reasonable subsidy. Expected year 2025 populations provide a fairly narrow and well-defined market for traditional bus service—including portions of Meriden, Milford and Wallingford now receiving local bus service. (Residential density guidelines per Boris Pushkarev and Jeffrey Zupan, *Public Transportation and Land Use Policy* (Bloomington, Ind.: Indiana University Press, 1977). Year 2025 population per Connecticut Department of Transportation Series 27A data base).

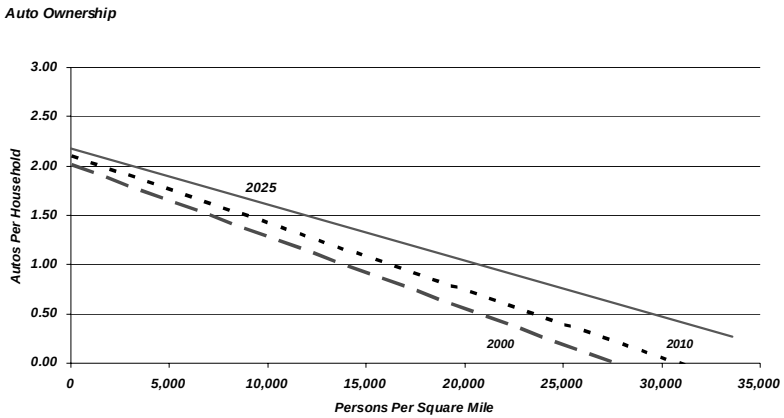


Figure 16: Autos and Density. Traditional walk on transit markets will tend to erode through the 2000-2025 period as auto ownership increases and destinations become more diverse. Households in relatively dense areas will have more cars. (Post 2000 estimates per Connecticut Department of Transportation Series 27A data base.)

Commitment

Regional highway and transit commitments begin to change the freeway and transit environment but leave major gaps between need and response (Figure 17 and Table 9). Major new commitments must be shaped and pursued now.

Transit

Rising transit costs and hold-the-line state budgets make the outlook for more transit here dim.

Service and Use. Connecticut Transit service and patronage are well below mid-1980's levels after reaching a near-term high in 1983, falling by 20 percent through the late-1980's and stabilizing in the 1990's (Figure 18). Twelve of 23 routes carry about 80 percent of New Haven Division riders (Figure 19).

Little New Service Is Likely. Service planning is in a holding pattern—generally limited by state budgets that make multi-year programming difficult.[20]

Sparse Bus Service Beyond the Core. Rider response falls off as peak hour headways move much beyond 15 minutes (Figure 20). Equipment levels, operating budgets and subsidies are too low to offer an attractive product in major suburban corridors without adversely impacting core area service.

Marginal Local Bus Service. Twenty-five-year-old fixed route bus commitments sustain limited service in Milford, Meriden and Wallingford for people with limited travel options. Local fixed route service remains a good choice in the moderate density environments (Figure 21).[21]

Travel Demand
Weekdays

	2000	2025
all trips (persons)	1,590,000	1,935,000
trips to and from work (persons)	398,000	468,000
daily trips remaining in the region (% persons)	78	75
vehicles traveling thru the region (daily)	56,000	65,000
vehicle miles traveled (am peak hour)	911,000	1,167,000
vehicle miles traveled (daily)	9,589,000	12,314,000

Table 8: Weekday Travel Demand. Travel demand will grow far faster than population and jobs—moving about 20 percent beyond current levels. More autos, more travel and slightly longer trips will generate almost three million more vehicle miles traveled each day. (Source: Appendix A and Appendix B.)

New Capacity and Improvements

Project	*Improvement*	*$Mil*	*Complete*
Clear Commitments			
I-95	widen from 4 to 6 lanes, East Haven	44	2005
I-95	new 10 lane 'Q' bridge and central interchange	660	2012
I-95	widen to 8 lanes between Q Bridge and East Haven	80	2007
I-95	long wharf stabiization and boat house	34	2006
I-91/80	reconstruct interchange	13	2006
I-95/Housatonic River	replace Housatonic River Bridge	124	2005
I-95/Sawmill Road	reconstruct interchange (West Haven)	27	2006
Route 15 (Wilbur Cross Pky)	replace Housatonic River Bridge; widen from 4 to 6 lanes (Milford)	87	2004
Conn Transit Garage	replace/relocate from New Haven to Hamden	64	2008
Shore Line East	new Guilford, Madison, Branford stations	22	2006

Table 9: Key Commitments. Major new highway commitments begin to compensate for a 40-year freeway spending gap.

I-95/Sawmill Road (West Haven). Construction began in late-2003 after an extended design period.

I-95/Frontage Road (East Haven). Work at I-95 and the Frontage Road (Project C1, New Haven City Line to Lake Saltonstall) began in October, 2003. Completion is expected in late-2005.

I-95 East of Lake Saltonstall (Branford). Concrete pavement placement for the third northbound lane opened in December, 2003 (Contract D). Courtesy of ConnDOT.

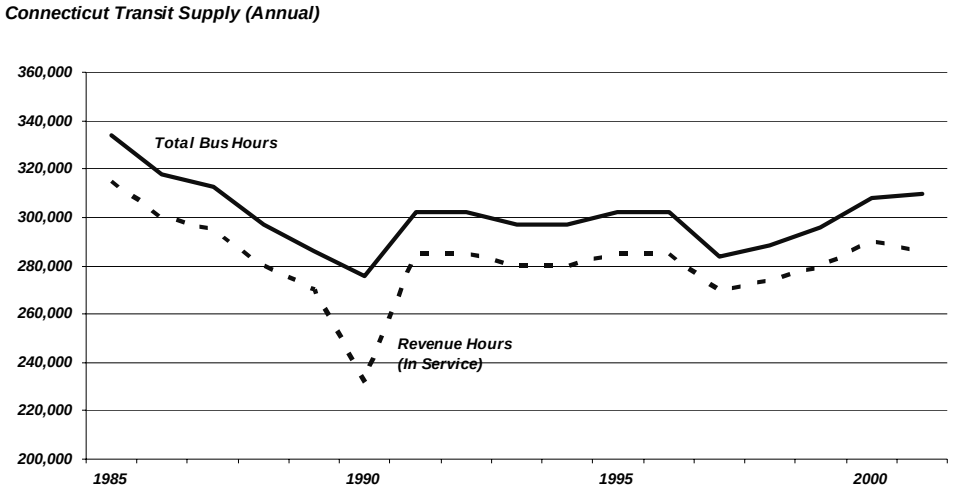
Figure 17: New Commitments. Regional highway and transit commitments are beginning to change the freeway and transit environment.

Guilford. An overhead station serving eastbound and westbound tracks and providing access to potential north side parking.

Madison. A single south side platform serving both eastbound and westbound trains.

State Street (New Haven)

New Shore Line East Stations. Stations in Branford and Guilford moved to construction early in 2004—complementing the year-old State Street station. Construction in Madison will begin in later in 2004. Guilford and Madison renderings courtesy of ConnDOT and Baker Engineering.



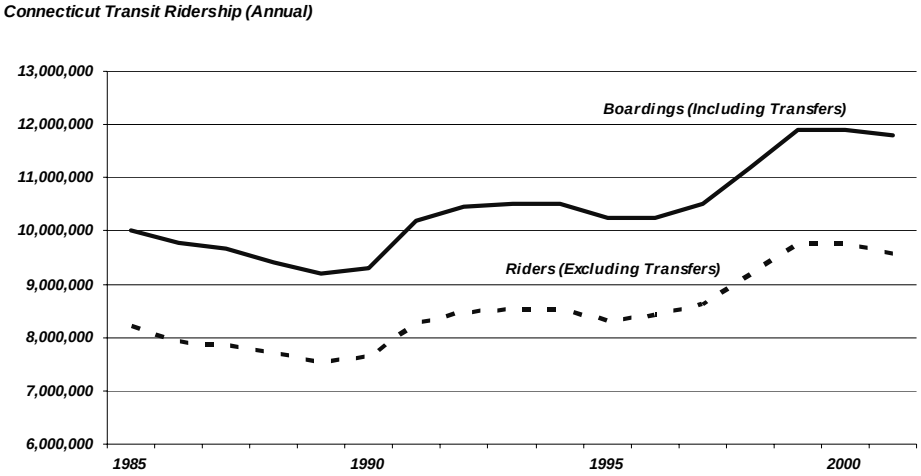


Figure 18: New Haven Division Transit Service. Connecticut Transit has become more efficient through the 1990's as the Division fine tunes operations—carrying more riders with less service. Transfers (the difference between boardings and riders or linked trips) have always been an important element in the local system—traditionally accounting for between 18 and 20 percent of boardings per Uritran Associates, Connecticut DOT Statewide Bus System Study: CT Transit New Haven Division, prepared for ConnDOT (Newington: ConnDOT, 2000).

Connecticut Transit New Haven Division
Weekday Boardings
September-October, 2003

Route	Boarding	Percent of System Route	Cumulative
D Dixwell	4,339	14	14
B Whalley	3,409	11	26
D Grand	3,085	10	36
B West Haven	2,911	10	45
O Sylvan Ave	2,030	7	52
J Kimberly Ave	1,674	6	58
F West Chapel	1,401	5	62
J Whitney Ave	1,318	4	67
M Washington Ave	1,283	4	71
C Wallingford	1,035	3	74
Z Sargent Drive	975	3	77
Q Lombard	948	3	81
M State St	922	3	84
O Winchester Ave	873	3	86
F East Haven	828	3	89
Q Edgewood Ave	762	3	92
Z Goffe St	726	2	94
G Lighthouse	719	2	97
G Shelton Ave	537	2	98
Miscellaneous	429	1	100
L North Branford	54	0	100
Commuter Conn-Downtown	29	0	100
Commuter Conn-Sargent	9	0	100
New Haven Divison	30,296	100	100

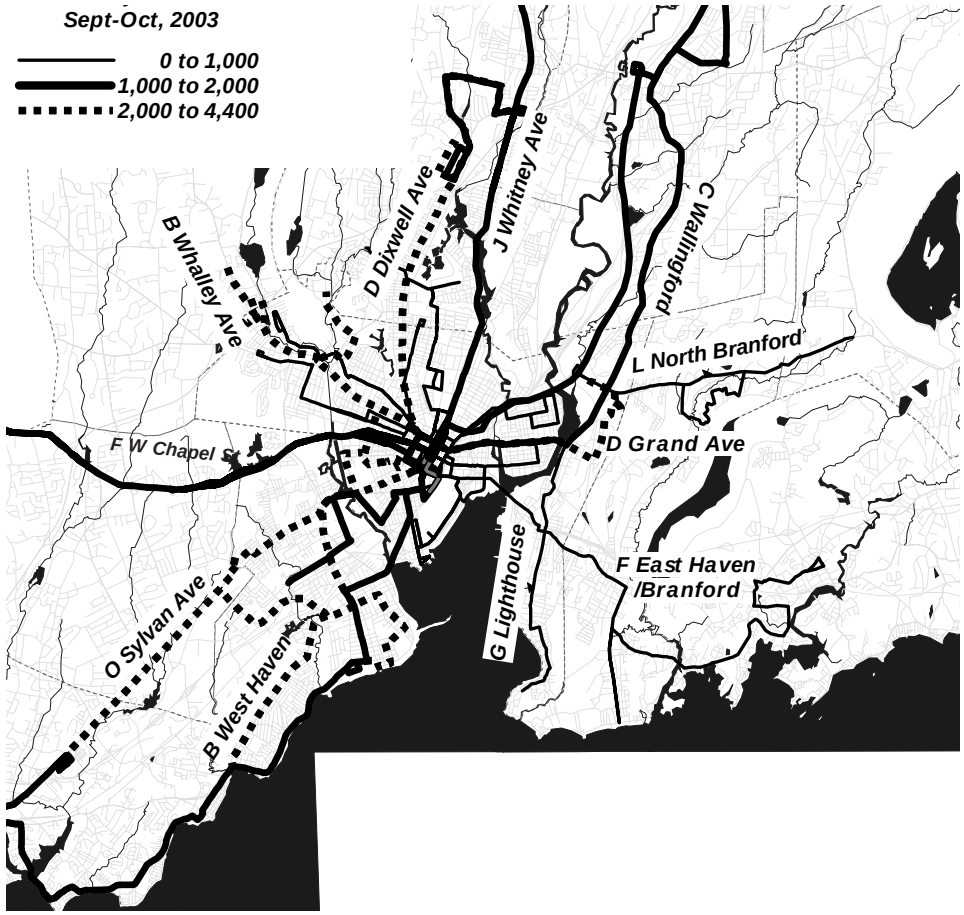


Figure 19: New Haven Division Ridership. Twelve of 23 routes carry about 80 percent of New Haven Division riders. (Source: Monthly Connecticut Transit New Haven Division farebox data excluding transfers.)

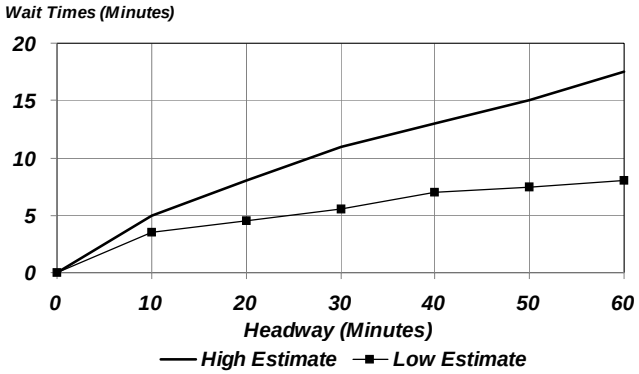
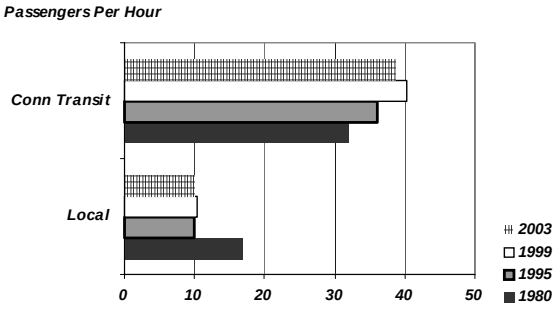


Figure 20: Transit Headway and Response. Riders tend to cluster around transit arrivals when headways are long. Schedules cannot begin to impact wait times until headways move inside of 15 minutes. (Source: Appendix A.)



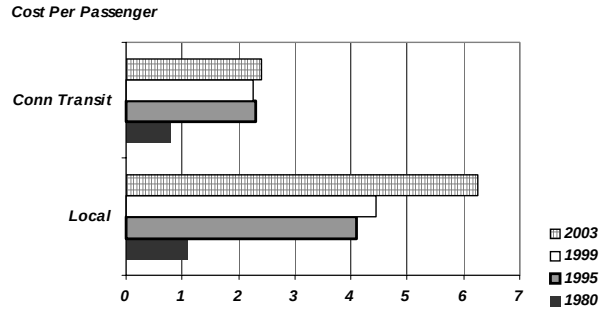


Figure 21: Transit Trends. Local fixed route responses remain a good choice despite rising operating costs and largely flat ridership. [Unlinked trips (including transfers) and all service hours (not just revenue hours).]

Paratransit for People with Disabilities: The Greater New Haven Transit District. Current 1,500 vehicle hour a week supply levels reflect growth and change through the 1990's as the District gradually expanded from a four-town elderly/ disability-oriented service to a full-fledged *ADA* carrier serving a 23-town area (Figure 22 and Table 10). Meeting basic *ADA* obligations and sustaining even limited elderly service in the urban core is becoming nearly impossible as available support shrinks (Table 11 and Figure 23). General Assembly commitments intended to compensate for the loss of federal operating support never met expectations. The District now finds itself cutting traditional elderly service to meet *ADA* responsibilities rather than expanding to meet the needs of an aging population.

GNHTD Fiscal Year Support
Thousands of Dollars

	FY96	*FY97*	*FY00*	*FY01*	*FY02*	*FY04*
Federal	2,100	2,064	0	0	0	0
ConnDOT (With General Assembly Earmark)	1,303	1,289	2,637	2,570	2,666	2,796
Municipal	25	20	36	40	47	54
Farebox	115	200	241	242	240	222
	3,543	3,573	2,914	2,852	2,953	3,072

Table 11: Greater New Haven Transit District ADA and Elderly Transportation Operating Support. Earmarked General Assembly support intended to offset federal operating assistance cutbacks, first introduced in 1998, never filled the gap. Recent ConnDOT-imposed vehicle replacement constraints that raise operating costs will further erode service capabilities.

Year 2000 District Service
Population Within 0.75 Miles of a Fixed Route Bus
Area in Square Miles

	Additional	*District (Total)*		
Service	*Municipalities*	*Persons*	*Area*	*Density*
Original District October, 1978	East Haven, Hamden, New Haven, West Haven	252,795	60.2	4,200
Pre-ADA Expansion July, 1989	Branford North Haven	289,090	86.5	3,341
First Phase ADA Expansion November, 1993	North Branford Orange Woodbridge	300,391	100.7	2,982
Second Phase ADA Expansion November, 1995	Cheshire, Meriden Milford Wallingford	361,748	132.6	2,727
Third Phase ADA Expansion July, 1996	Guilford Madison	372,113	144.8	2,571
Fourth Phase ADA Expansion November, 1996	Ansonia, Derby Seymour, Shelton	414,087	158.6	2,610
Final Full ADA Service	Prospect, Waterbury Wolcott	459,332	167.0	2,751

Table 10: Greater New Haven Transit District Expansion. The District now offers *Americans with Disabilities Act* door-to-door service in a 23-town service area with a 660,000 person population—serving almost 460,000 people who live near a Connecticut Transit or Dattco (Shoreline) route. Source: U.S. Bureau of the Census, *2000 Census of Population and Housing, Summary File 1 (SF1),* (Washington: BOC, 2001) block data and April, 2003 transit routes.

Figure 22: Greater New Haven Transit District Americans with Disabilities Act Service. The District offers service (trip origins and destinations) within 0.75 miles of Connecticut Transit and Dattco routes per *American Disabilities Act* requirements.

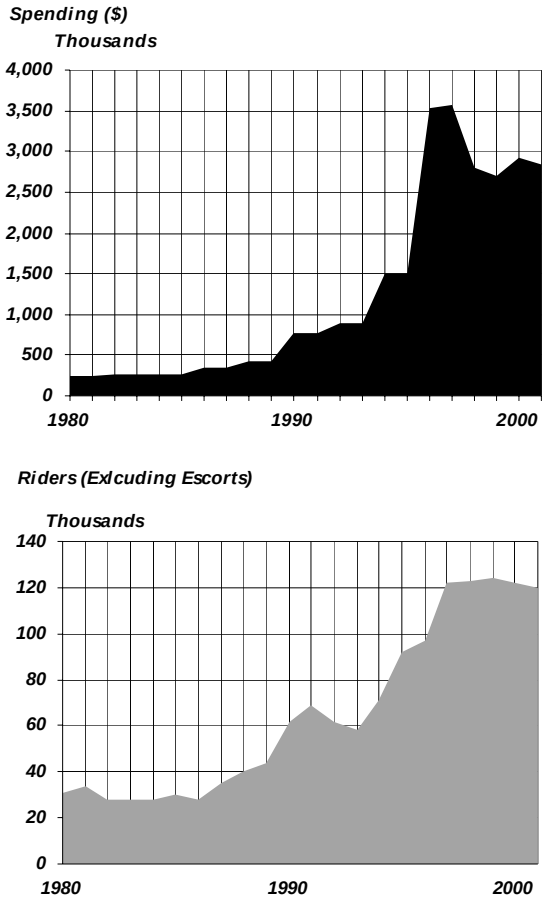


Figure 23: Transit for People with Disabilities. Spending and service reflect an *Americans with Disabilities Act of 1990* impetus. (Source: U.S. Federal Transit Administration, *National Transit Database*, http://www.ntdprogram.com/NTD/ and Greater New Haven Transit District.)

The Highway System

New central I-95 commitments are beginning to reshape the region's spending program after an extended environmental impact statement process. Capacity-oriented investment now comprises 25 percent of the region's three-year *Transportation Improvement Program (TIP)* and will rise through the next eight years as the 12-year-long central I-95 program takes hold.

The Year 2025 Highway System: No New Capacity

The region can readily move toward the kind of peak period gridlock common in larger urban areas without new spending. Performance on many now reasonably free flowing freeways and arterials will fall off rapidly with even limited new demand (Figure 24 and Table 12).

Freeways

Weekday traffic on key inner freeway links like I-95 at Long Wharf will rise to about 150,000 vehicles a day through the next 20 years—about 25 percent above their reasonable peak hour traffic capacity. Outlying I-95 links west of Boulevard and I-95 segments east of Branford will similarly experience 20 to 25 percent traffic gains despite recently reinforced commuter rail service. Now-intermittent peak period congestion will become a steady state experience. Congestion on high capacity freeway links will begin earlier and end later. Responses that blend new transit service, demand management and highway investment are basic.

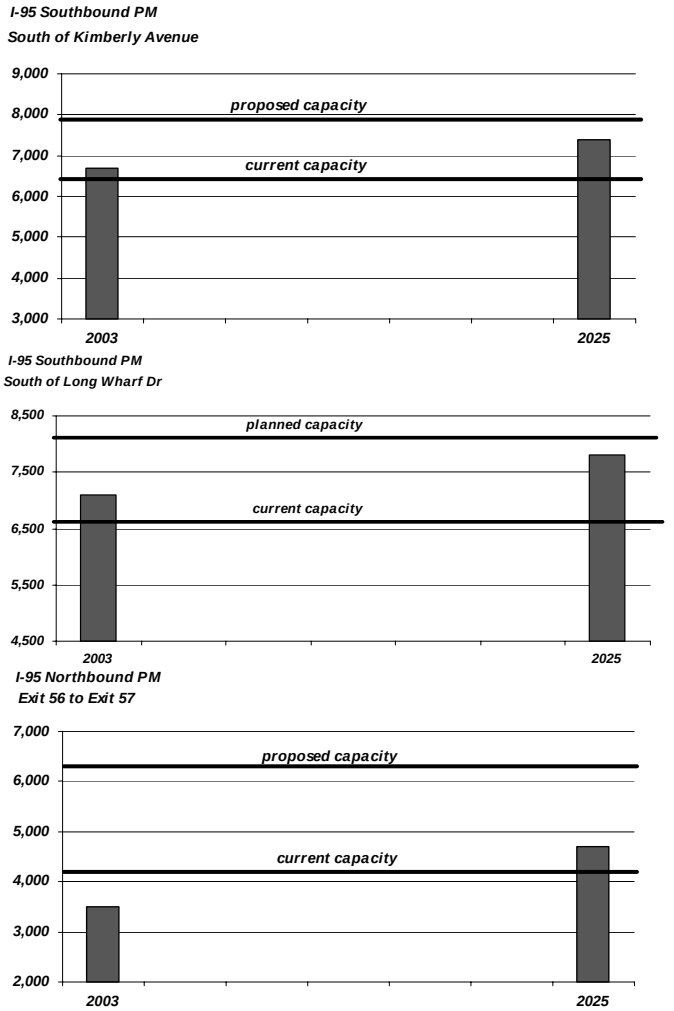


Figure 24: Mid-Term I-95 Demand. Important freeway links will seize up without new capacity. Current demand per ConnDOT continuous count stations and ramp counts except between exits 56 and 57 where data is drawn from Clough Harbour & Associates, *I-95 Branford to Rhode Island Feasibility Study: Existing Conditions Report*, prepared for ConnDOT (Newington: ConnDOT, 2003). 2025 estimates per SCRCOG traffic assignments.

2000 Performance

Freeway	*Link*	*Direction*	*Speed (mph)*	*Programmed Improvement*
AM Peak Hour (7:30 to 8:30)				
I-95	Exit 52 (N High St off) to Exit 49 (Stiles St on)	SB	25	yes
I-95	Exit 54 (Cedar St off) to Exit 52 (N. High St off)	SB	29	yes
I-91	Exit 5 (State St on) to Exit 3 (Trumbull St off)	SB	30	no
I-91	Exit 3 (Trumbull St off) to Exit 1(Rt 34 Off)	SB	34	no
I-95	Exit 49 (Stiles on) to Exit 46 (Long Whrf off)	SB	36	yes
I-95	Exit 55 (E Main St off) to Exit 54 (Cedar St off)	SB	40	no
I-91	Exit 7 (Ferry St off) to Exit 5 (State St on)	SB	43	no
Rt 15	Exit 55 (Wh Farm Rd off) to Exit 53 (Rt 110 off))	SB	43	no
I-95	Exit 46 (Long Wharf on) to Exit 49 (Stiles St)	NB	45	yes
Rt 15	Exit 53 (Rt 110 on)) to Exit 55 (Whl Farms Rd off)	NB	45	yes
Rt 15	Exit 63 (Rt 22 on) to Exit 61 (Whitney Av off)	SB	47	no
I-95	Exit 46 (Sargent Dr on to Exit 43 (1st Av off)	SB	49	yes
I-91	Exit 7 (Ferry St on) to Exit 8 (Rt 80 off)	NB	51	no
Rt 15	Exit 68W Off Ramp (I-691W offramp) to N. Colony St	NB	51	no
Rt 15	Exit 67 (E Main St off) to I-91 South on	SB	52	no
I-91	Exit 5 (State St off) to Exit 7 (Ferry St on)	NB	53	no
Rt 15	Exit 60 (Dixwell Av off)to Exit 61 (Whitne Av off)	NB	53	no
I-95	Ex 55 (E Main St off) to Ex 56 (Leetes Isl R off)	NB	53	no
Rt 15	N Colony St to Exit 67 (E Main St off)	SB	54	no
Rt 15	Exit 67 (EMain St off) to to Exit 68W (I-691W off)	NB	54	no
I-91	Exit 3 (Trumbull St off) to Exit 5 (State St off)	NB	54	no
I-91	Exit 1 (from Rt 34 on) to Exit 3 (Trumbull St off)	NB	55	no
Rt 15	Exit 55(Wh Farm Rd off) to Exit 56 (Gr Hill Rd off	NB	55	no
I-91	Exit 13 (Wharton Brk off) to Exit 14 (Rt 150 off)	NB	55	no
I-95	Exit 38 (Milf Pkwy off) to Exit 36 (Plains Rd off)	SB	55	no

Freeway	*Link*	*Direction*	*Speed (mph)*	*Programmed Improvement*
PM Peak Hour (4:45 to 5:45)				
Rt 15	Exit 53 (Rt 110 on)) to Exit 55 (Whl Farms Rd off)	NB	28	yes
I-95	Exit 46 (Long Wharf on) to Exit 49 (Stiles St)	NB	32	yes
I-95	Exit 49 (Stiles St off) to Exit 52 (High St on)	NB	37	yes
I-91	Exit 5 (State St on) to Exit 3 (Trumbull St off)	SB	42	no
I-95	Exit 46 (Sargent Dr on to Exit 43 (1st Av off)	SB	42	no
I-95	Exit 49 (Stiles on) to Exit 46 (Long Whrf off)	SB	44	yes
I-91	Exit 5 (State St off) to Exit 7 (Ferry St on)	NB	47	no
Rt 15	Exit 55 (Wh Farm Rd off) to Exit 53 (Rt 110 off))	SB	48	yes
I-91	Exit 3 (Trumbull St off) to Exit 1(Rt 34 Off)	SB	48	no
I-95	Ex 55 (E Main St off) to Ex 56 (Leetes Isl R off)	NB	51	no
Rt 15	Exit 60 (Dixwell Av off)to Exit 61 (Whitne Av off)	NB	52	no
I-95	Exit 36 (Plains Rd off) to Exit 38 (Mil Pkwy off)	NB	53	no
I-95	Exit 38 (Milf Pkwy off) to Exit 36 (Plains Rd off)	SB	53	yes
I-91	Exit 7 (Ferry St off) to Exit 5 (State St on)	SB	54	no
I-91	Exit 7 (Ferry St on) to Exit 8 (Rt 80 off)	NB	54	no
I-95	Exit 52 (High St on) to Exit 54 (Cedar St off)	NB	54	yes
Rt 15	Exit 67 (E Main St off) to I-91 South on	SB	54	no
Rt 15	Exit 61 (Whitney Av off) to Exit 63 (Rt 22 off)	NB	55	no

Table 12: Year 2000 Freeway Performance. Sluggish peak hour freeway performance is not limited to the central area. Emerging freeway choke points with speeds in the 40 to 50 mile per hour range are clear—speeds just above breakdown levels. (Source: South Central Regional Council of Governments, *Measuring Congestion: 2000* (North Haven: SCRCOG, 2000).)

I-95 East. Current morning east shore congestion between Cedar Street and the Quinnipiac River Bridge will become a pleasant memory as queues extend toward Guilford. Both westbound morning and eastbound afternoon congestion will become an everyday experience well into Guilford as the main line breaks down and heavily traveled interchanges fail to move traffic off the freeway. Meaningful ramp metering opportunities will have been left far behind.

I-95 West. Relatively free flowing west shore movement between the Housatonic River and New Haven will be a thing of the past. Slow driving will take over east of the River while steady-state congestion becomes the norm between the Milford Connector and I-91.

Interstate 91. New southbound demand will begin to slow riders at Montowese Avenue (exit 9) and congest the system at Route 80. Morning and evening back-ups from I-95 will make important weaving movements in the Willow Street area virtually impossible.

Major Arterials

New choke points will join long-standing regional bottlenecks like Amity Road-Litchfield Turnpike (New Haven and Woodbridge), Route 80 (New Haven), Route 69 (Woodbridge) and Campbell Avenue (West Haven) (Table 13). Travelers avoiding I-95 will overload US 1 and Route 80 unless freeway commitments are extended.

The Region's Key Arterial Choke Point. Litchfield Turnpike between Bradley Road and Whalley Avenue. Looking east on Litchfield Turnpike west of the Wilbur Cross Parkway.

The Region's Choke Points
Person Hours of Delay Per Mile
7-9AM and 4-6PM

	Arterial		*Limits*	*Delay (Hours) AM*	*PM*
1	Rt 69 (Woodbridge)	eb	Bradley Rd to Whalley Ave	21	47
2	Rt 63 (New Haven)	eb	Dayton St to Boulevard	28	26
3	Rt 63 (New Haven)	nb	Dayton St to Rt 69	7	40
4	Rt 63 (New Haven)	wb	Boulevard to York St	11	33
5	Rt 63 (New Haven)	wb	York St to Boulevard	11	33
6	Rt 10 (New Haven)	nb	Rt 34 (Derby Ave) to Rt 63 (Whalley Ave)	12	31
7	Rt 63 (New Haven)	eb	Rt 69 (Litchfield Tpke) to Dayton St	22	20
8	Campbell Ave (W Haven)	nb	Capt Thomas Blvd to US	8	29
9	Rt 80 (New Haven)	eb	Rt 17 (Middletown Ave) to Quinnpiac Ave	0	35
10	Rt 68 Wallingford)	wb	N. Main St to Rt 150 (Main St)	0	34
11	Church St (New Haven)	nb	Elm St to Trumbull St	0	33
12	Howard Ave (New Haven)	nb	Columbus Ave to Legion Ave	11	18
13	Dixwell Ave (Hamden)	wb	Ridge Rd to Whitney Ave	2	27
14	US1 (West Haven)	eb	Rt 122 (Forest Rd) to Boulevard	6	21
15	Rt 80 (North Branford)	wb	Rt 139 to Rt 22 (Forest Rd)	23	0
16	US5 (North Haven)	sb	I-91 x12 to Rt 22	4	18
17	Kimberly Ave (New Haven)	nb	1st Ave to Columbus Ave	13	10
18	Congress Ave (New Haven)	wb	College St to Boulevard	8	14

Table 13: Arterial Choke Points. Annual field data measures speed and volume—establishing delay against performance goals. See SCRCOG, *Measuring Congestion: 2000* (North Haven: SCRCOG, 2000).

3. The Plan

Major capital improvements and more effective management can help the region meet basic travel requirements and begin to move toward a more meaningful long-term transit commitment.

Strategies

Plan proposals build on four basic strategies.

Support Adopted Land-Use Plans. Connecticut's *Plan of Conservation and Development* and the region's *Vision for the Future* promote strong central corridors, moderate densities along the east shore and low density in upland areas—both recognize the region's key northeast corridor location (Figure 25).[22] Transit and highway proposals reinforce development guides—they support central development in New Haven and Meriden and accommodate more limited development along the freeway system.

Effective Use of Highways. Arterial programs presume good signal control systems, sustained system management and careful treatment at high density transit nodes.

Good Transit Service. Faster point-to-point travel times and more cost effective supply arrangements are basic if any significant amount of new service is to emerge. Transit must furnish an increasingly competitive and attractive product.

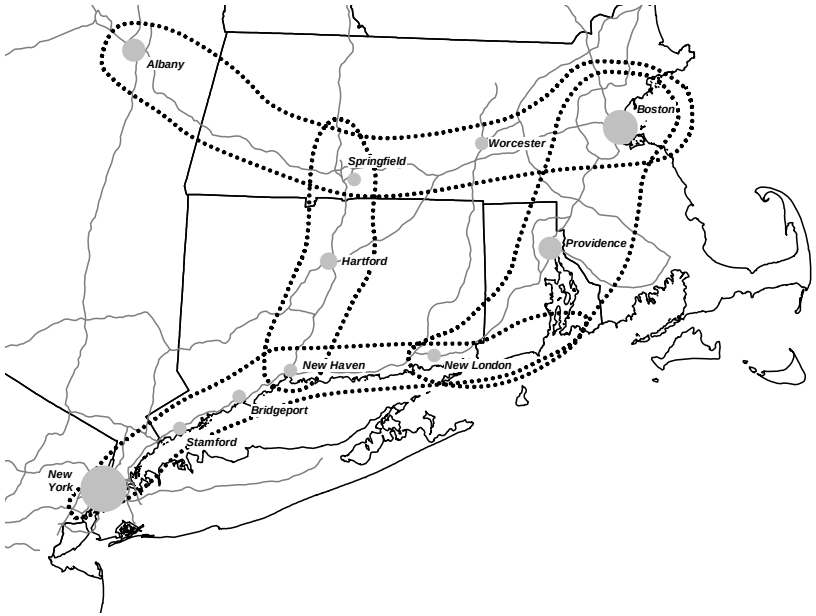


Figure 25: The Northeast Corridor. South Central Connecticut growth strategies build a on favorable Northeast Corridor location at the I-95/I-91 junction.

Clear Multi-Year Financial Commitments. Progress requires a reasonably reliable financial commitment. Fixed route, ridesharing and public door-to-door transit operators need clear multi-year service and financial guidelines to plan effectively. Highway programmers need clarity to make cost-effective investment decisions.

The Transit System

Transit Supply Guidelines

Density, existing infrastructure and broad regional development goals guide transit development programs.

Maintain Good Service on Central Bus Routes. Basic trunk routes including Dixwell Avenue, Grand Avenue, Whitney Avenue, Whalley Avenue and Derby Avenue continue to provide an alternative for people with limited travel choices—they remain among the New Haven Division's best performers (Figures 26 and 27 and Table 14).

Limit New "Walk On" Bus Service. Significant walk-on service should not extend beyond the Branford, East Haven, Hamden, Milford, New Haven and West Haven core. Extending current routes much beyond the core or starting new ones has a limited pay-off.

Build on Current Rail Commitments. Near-term attention and investment can gradually flesh out Metro North and Shore Line East local service—building a significant transit presence through the dense I-95 corridor. More parking, new stations and Downtown New Haven distribution improvements can make rail a more meaningful regional and interregional travel option.

Connecticut Transit Performance
New Haven Division Arterial Routes

Route		Weekday Riders (Boardings)	Deficit ($)	Deficit/ Passenger ($)	Percent of Systemwide Deficit
A	Orange Street	720	1,044	1.45	104
B	Whalley Ave	6,379	6,374	1.00	71
C	North Haven-Wallingford	966	2,352	2.43	174
DE	Grand Ave-Dixwell Ave	6,668	6,346	0.95	68
FN	Derby-Branford	2,396	4,783	2.00	143
G	Shelton Ave-Lighthouse	1,362	2,655	1.95	139
JU	Milford-Waterbury	2,892	6,567	2.27	162
L	North Branford	49	383	7.81	558
M	State Street	1,797	2,711	1.51	108
O	Milford-Winchester Ave	2,477	3,389	1.37	98
Q	Lombard-Edgewood	1,767	2,156	1.22	87
Z	Goffe St-Savin Rock	2,033	2,533	1.25	89
Total		29,506	41,293	1.40	100

Table 14: Arterial Bus Routes: 2000. Historically strong trunk routes tend to be among the most productive—they lend themselves to relatively efficient operation and attract relatively strong rideship. (Source: Urbitran Associates, *Connecticut Statewide Bus System Study: Connecticut Transit New Haven Division* (Newington: ConnDOT, 2000.), Table 11-4.

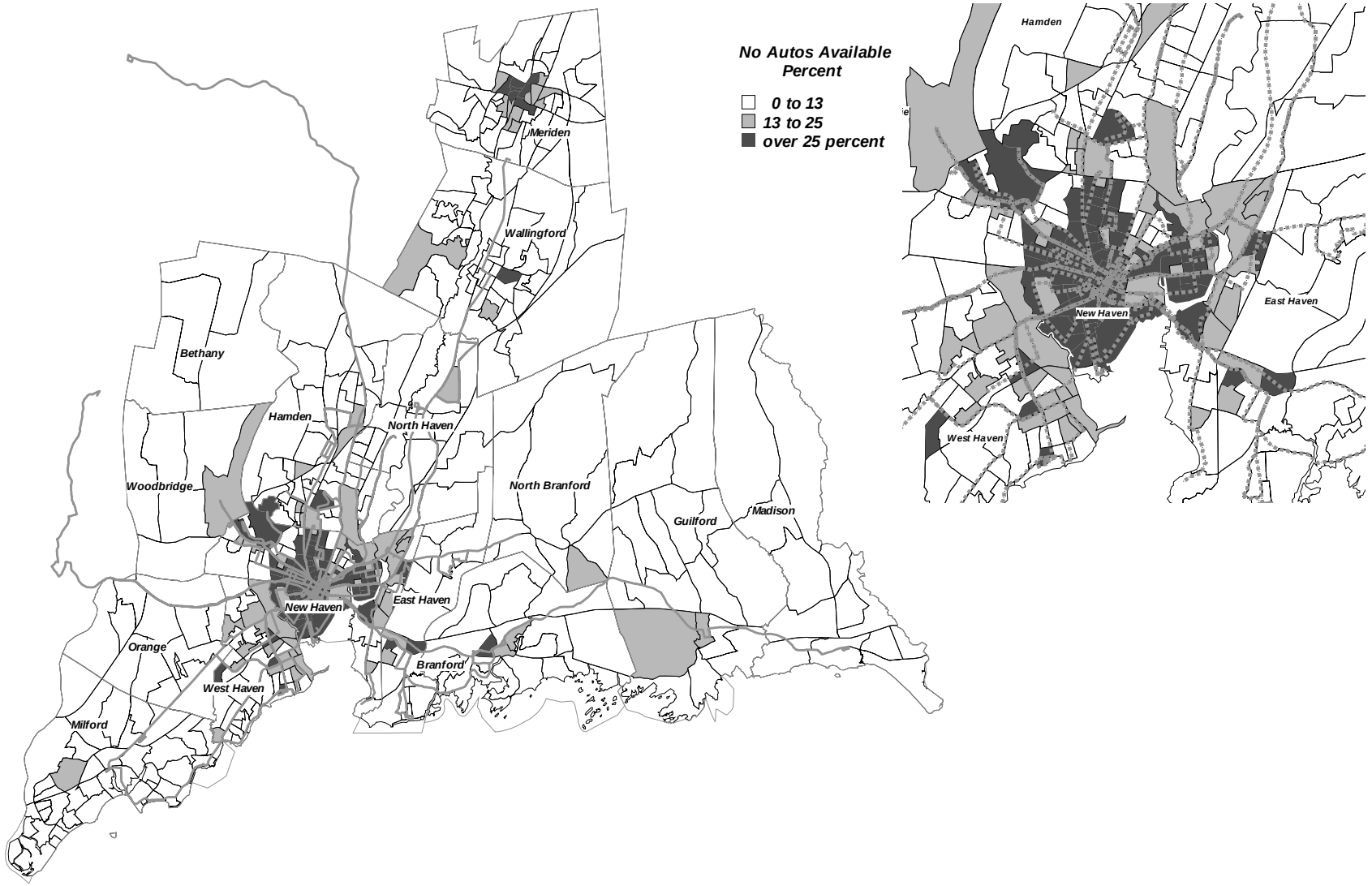


Figure 26: Auto Availability and Buses. Thirteen (13) percent of the region's households do not have an automobile. People without autos and people with lower incomes are reasonably well-served by historic bus routes. Source: Auto availability and income from U.S. Bureau of the Census, *2000 Census of Population and Housing, CD, SF3*, Connecticut (Washington: Bureau of the Census, 2002). Block group data are illustrated.

Figure 27: Poverty and Buses. Eleven percent (10.75 percent) of the region's population live in households with incomes below the federally-defined poverty level—up from an eight percent level in 1990. (Source: Figure 26 with block group data.)

Improve Bus Travel in Downtown New Haven. Faster bus movement and better links between downtown activity centers can be effected. Grouping or simplifying downtown routes in a more or less regular pattern can provide a favorable climate for bus priority treatments. More buses on fewer streets can make necessary roadway investment in a few strategic locations possible; help concentrate bus shelters and informational aides; focus necessary traffic enforcement efforts; and let riders more readily identify routes.

Keep Travel Times Short. Faster schedules that cut many suburban-to-core transit travel times in half can help double centrally bound ridership through the next 15 years (Figures 28 through 30 and Tables 15 and 16).

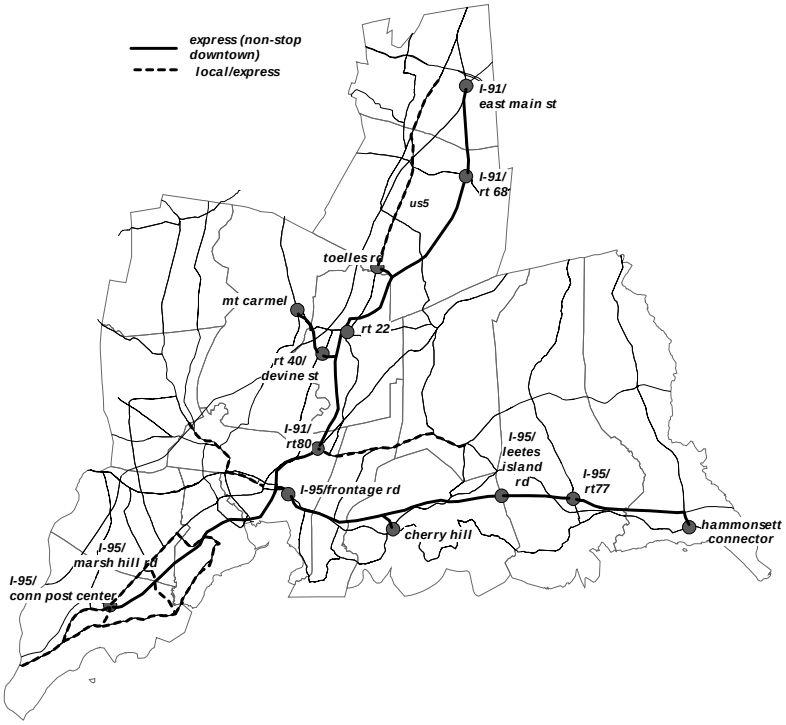
Responsibility and Finance

Thirty (30) years of Connecticut experience places fixed route transit support and management responsibility with the state. Current state budgets and policies define a hold the line service environment and catch up on overdue capital investment foster very limited change. New management and finance initiatives that meet 21st century needs and tie diverse transit services together will require a broad new commitment. Both the General Assembly and the two-year-old Transportation Strategy Board can lead.

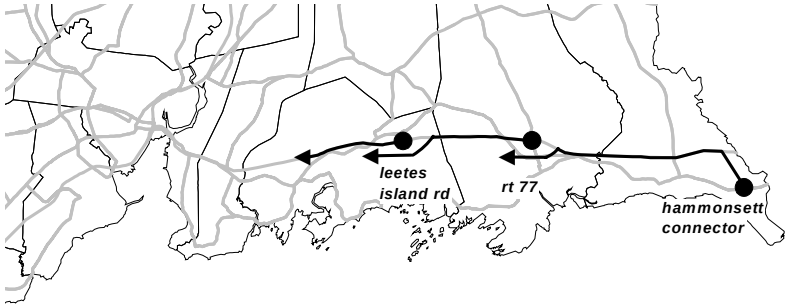
Sketch Planning
Service Elements

Freeway Service		
	Fast Point-to-Point Service	no stops en route to the Downtown. 65 mph on freeways.
	Good Downtown Circulation	common Church St, Grove St. Temple St. and South Frontage Rd. movement. 15 mph Downtown speed infers bus priority scheme.
	Low Fare	flat $1.00 one-way fare.
	Free Transfers	anywhere.
Arterial/Freeway Service		
	Point-to-Point Service	skip stop on arterials. non-stop on freeways as above
	Fast Line Haul Service	skip stop arterial service (25 mph). 65 mph on freeways.
	Good Downtown Circulation	as above.
	Low Fare	flat $1.00 one-way fare.

Table 15: Transit Sketch Planning: High Speed Bus Service Elements. Sketch planning suggests that a good high speed, low fare transit service might work. SCROG's new *Transit Initiatives Study* undertaken by Wilbur Smith Associates (New Haven) will review a broad array of transit improvement options and suggest mid-term priorities. *Study* proposals are due in early 2005.



A High Speed Year 2020 Transit Illustration



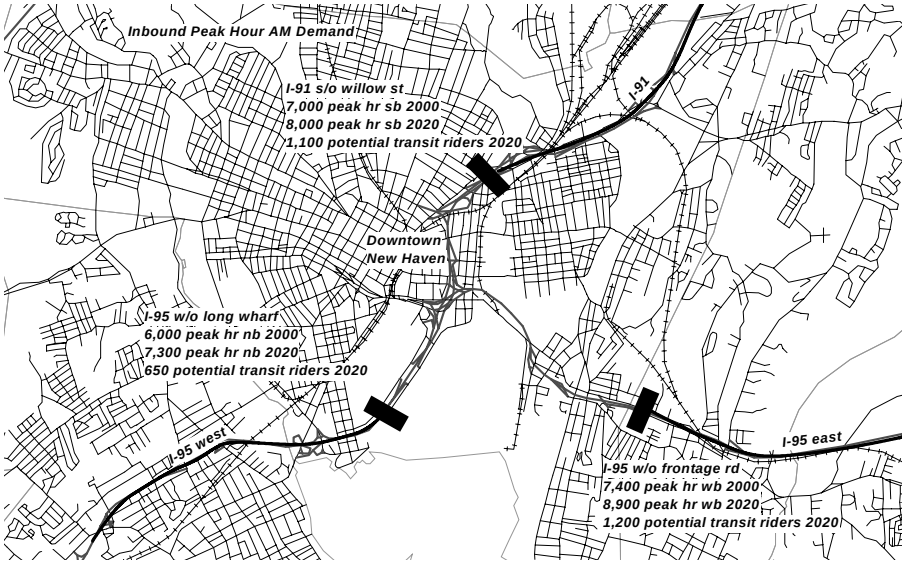


Figure 28: Faster Transit Service. Faster point-to-point travel times can make a difference in major corridors. Strategies that take advantage of the freeway system, move buses around choke points and/or offer reasonably frequent rail service are worth pursuing. Peak hour corridor transit demand in the 1,000 person per hour range is the equivalent of about one-half a freeway lane—often enough to forestall freeway congestion. [Year 2020 highway demand estimates exclude a new transit commitment. All transit demand estimates reflect boardings from within the region; e.g. east shore ridership might be as much as 40 percent above SCRCOG estimates per Shore Line East experience (60 percent of Shore Line East riders live within the region).] (Source: Appendices A and B and Table 15 service guidelines.)

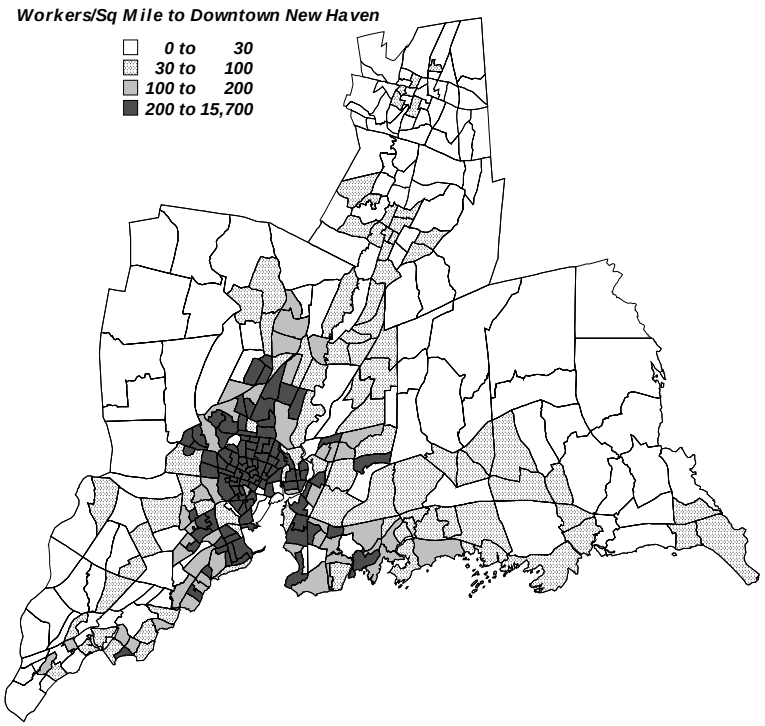


Figure 29: Downtown Corridor Movement. Strong home-to-work trip relationships between Downtown New Haven and major freeway corridors make good transit responses worth pursuing. (Source: U.S. Bureau of the Census, 1990 New Haven-Meriden Census Transportation Planning Program, CD 5480 (Washington: BOC, 1994), Table 3-1. Daily trips from home to Downtown New Haven—all modes to zones 82,83,92,93,102,103,112,113,114 and 133. Similar Year 2000 Census data will not be available until early 2004.).

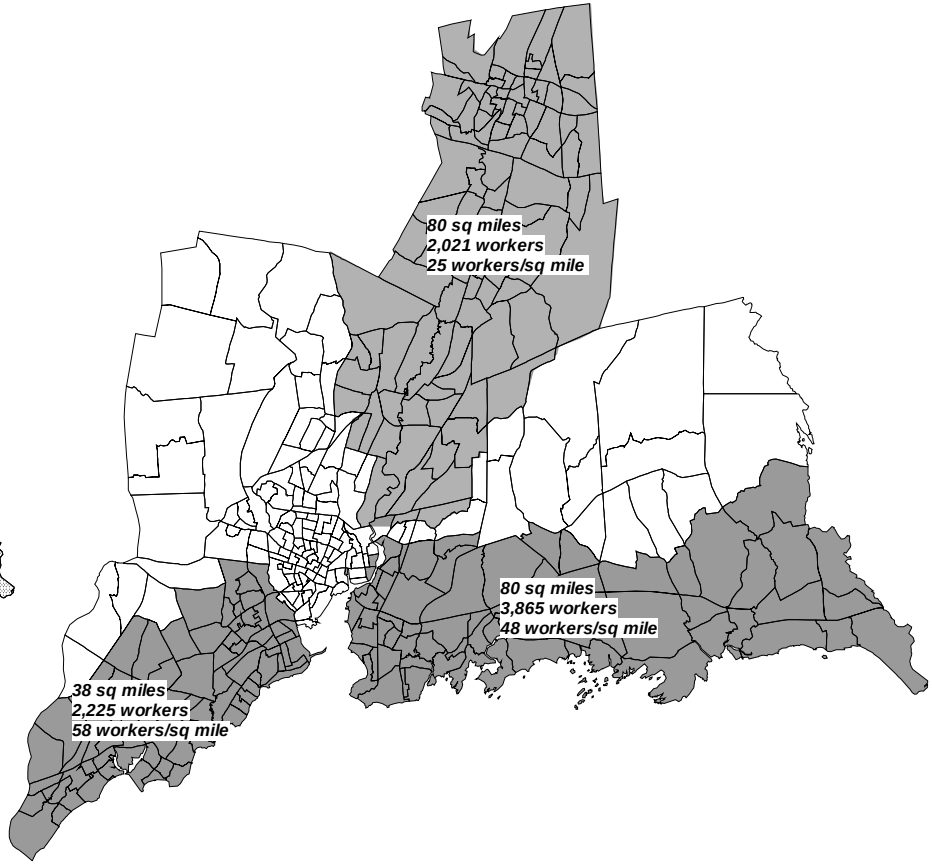


Figure 30: Corridor Movement to Downtown New Haven. Selected high speed transit responses deserve attention. (Source: Per Figure 29).

Sketch Planning
A Good Transit Response
Inbound to Downtown New Haven

		Peak Hour AM Weekday Boardings		
		Walk to Transit	*Drive to Transit*	*Total*
East Shore		130	1,090	1,220
Freeway Service				
board at	Madison (US1/Hamonassett Connector)	110	220	330
board at	Guilford (I-95/Rt 77)		160	160
board at	Leetes Island (I-95/Leetes Isld Road)		210	210
board at	Cherry Hill (US1/Cherry Hill Conn)	20	140	160
board at	Frontage Rd (US1 East Haven)		360	360
West Shore		110	530	640
Freeway Service				
board at	Milford (I-95/Conn Post Mall)	0	150	150
board at	Marsh Hill (I-95/Marsh Hill Rd)	0	360	360
Arterial/Freeway Service				0
	from stratford, via rt 162, gulf st, cherry st, I-95	20	0	20
	stratford, us1, s. lambert rd, marsh hill rd, I-95	10	10	20
	milford post mall, s. lambert rd, marsh hill rd, I-95	50	10	60
	milford hospital, rt 162, saw mill rd, I-95	30	0	30
North Corridor		140	950	1,090
Freeway Service				
board at	Meriden (I-91/E. Main St)	0	180	180
board at	Wallingford (I-91/Rt 68)	0	40	40
board at	Wallingford US5/Toelles Rd)	0	40	40
board at	North Haven (US5/Rt 22)	0	60	60
board at	Hamden (Whitney Ave/Rt 40)	10	90	100
board at	Hamden (Devine St/Rt 40)	0	70	70
board at	New Haven (I-91/Rt 80)	0	370	370
Arterial/Freeway Service				
	us5/e. main st, us5, w harton brook conn, I-91	60	50	110
	us5/rt 150, us5, w harton brook conn, I-91	40	40	80
	us5/w harton brook conn, us5, rt 22, I-91	10	0	10
	rt80/rt 22, rt 80, I-91	20	0	20
	rt17/rt 22, rt17, rt 80, I-91	0	10	10
Systemwide		380	2,570	2,950

Table 16: High Speed Transit Patronage: 2020. New or improved high speed services can bring almost 3,000 riders into the Downtown during the peak hour. Fast service from outlying locations should be a near-term planning focus. (Source: Demand estimates per Appendix A and B processes.)

A Financially Transit Constrained Program

A $660 million 25-year transit capital program largely maintains existing service and addresses deferred capital spending (Figure 32 and Tables 17 thru 20). Key elements renew rail infrastructure, add a new $64 million Connecticut Transit maintenance facility and continue regular vehicle turnover at both the regional Connecticut Transit property and at local Meriden, Milford and Wallingford properties. Proposals draw on "highway" support to build a new West Haven/ Orange Metro North Station and add parking at the Milford Railroad Station.[23]

Supply Choices: Beyond Current Financial Constraints

New low-cost commitments can begin to establish the framework of a more useful transit system despite a financially constrained or hold the line service environment. Higher cost options provide guidelines for a stronger state-federal commitment.

Downtown New Haven

Near-term change focuses on Downtown New Haven—the region's major transit hub. Minor route revisions can focus transit at major generators and simplify the Downtown route structure. New routes and related curbside improvements can work together to:

- *establish east-west and north-south "bus only curb lanes" that build on existing routes and bus stop locations.* Marking, enforcement and shelter siting can formalize and extend existing lanes and gradually extend stop distances from 500 feet toward 1,000 foot intervals—saving buses about five minutes on each run through the Downtown (Figure 31).

Church Street Near Chapel Street

Church Street Near Elm Street

Temple Street Near George Street

Chapel Street Near Temple Street

Downtown Shuttle Service (by the Greater New Haven Transit District)

Figure 31: Downtown Bus Routes. Focusing transit on selected streets and major generators can simplify the Downtown route structure, make Downtown bus priorities easier to accomplish and make curbside transit investment more effective.

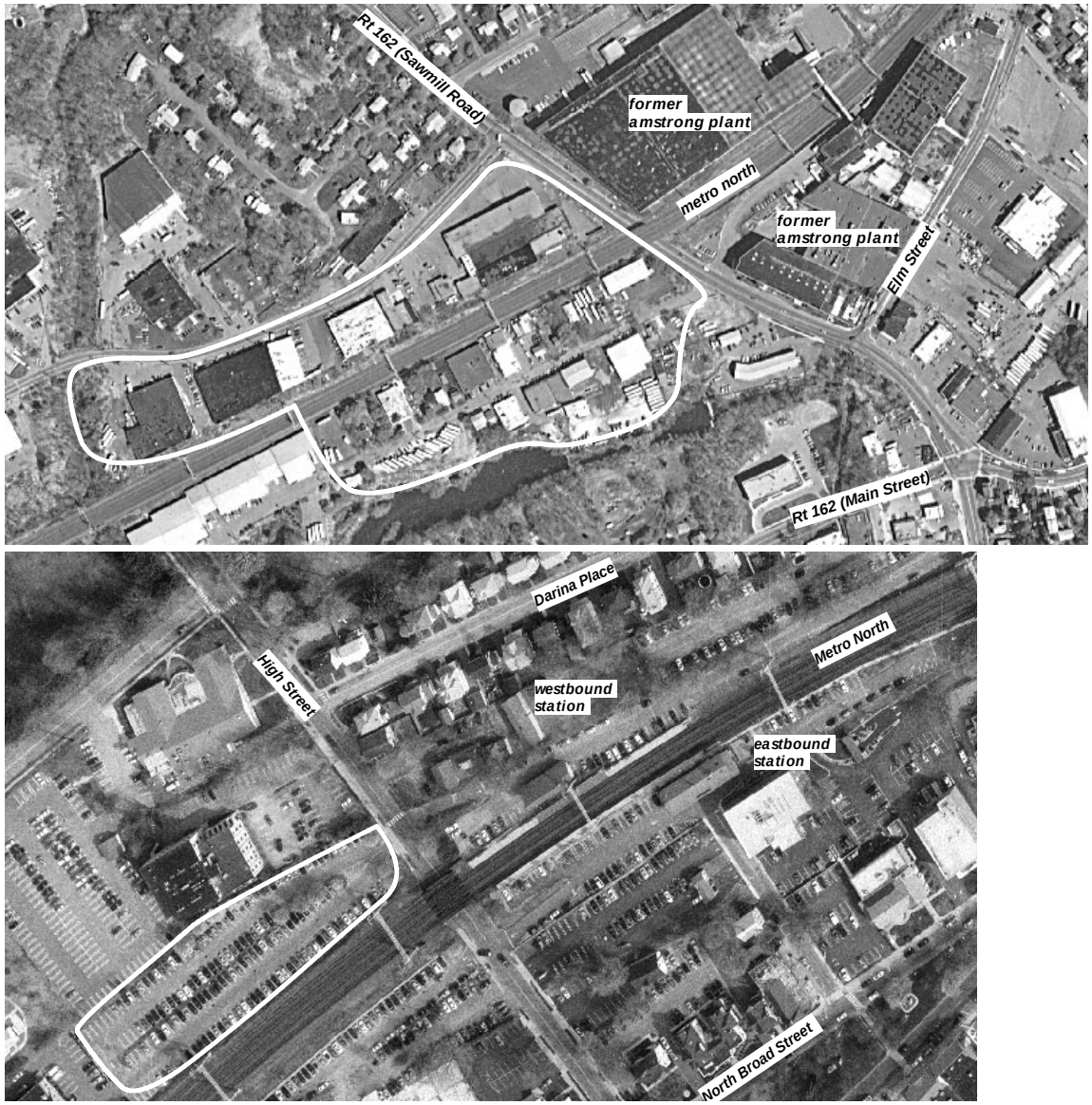


Figure 32: Metro North Stations. Plan proposals advance station investment with "highway" support per Table 36.

A West Haven Station. ConnDOT environmental-preliminary design work for a $36 million, 1,000 space station at Sawmill Road is in progress. Work similarly addresses a Marsh Hill Road (Orange) alternative. Looking east from just west of Sawmill Road above. Early proposals appear in DMJM Harris, *Site Study, New Train Station, Orange or West Haven, Connecticut*, prepared for ConnDOT (Newington: ConnDOT, 2001) and SCRCOG, *A Metro North Rail Station, Orange/ West Haven* (North Haven: SCRCOG, 2000).

More Parking at Milford Station. A deck on state property just west of High Street can expand the now fully utilized 510 space station-oriented parking supply. Looking west from from High Street above. See Harrall-Michalowski, Associates, *Plan of Conservation and Development: City of Milford* (Milford: Planning & Zoning Board, 2002).

A New Connecticut Transit Garage. Commitments include a new $64 million New Haven Division Garage on lower State Street (Hamden) at the old Detroit Steel site. Courtesy of ConnDOT and Baker Engineering.

25 Year Rail Program

Dollars in 000s

	2004 to 2016	*2017 to 2028*
Capital		
Metro North	345,296	164,000
right-of-way improvements (including bridges and power)	191,069	164,000
New Haven yards (maintenance facilities)	60,500	0
car replacement program	89,387	0
Milford Station	4,220	0
Union Station improvements	120	0
Shoreline East	7,500	0
Madison	7,000	0
Guilford (expand parking, north side)	500	0
Total Capital	*352,796*	*164,000*
Operating (Annual)		
Shoreline East: maintain service	7,000	7,000

Table 17: Maintaining Rail Service. Most state spending addresses deferred maintenance and is associated with Metro North as a whole—it preserves rather than improves the product. (Source: Connecticut Department of Transportation "2000-2020 Transit Capital Program" (November, 2003). Rail captial expenditures programmed only through 2020 by ConnDOT.)

25 Year Program Bus and Paratransit Program

Dollars in 000s

	2004 to 2016	*2017 to 2028*
Capital		
Bus		
Connecticut Transit	78,519	25,240
replace new haven garage [1]	43,222	0
other		
miscellaneous capital including administration	640	640
bus replacement	34,657	24,600
Greater New Haven Transit District		
curbside improvement program	1,500	0
Milford Transit District		
replace 30 foot buses	2,000	2,000
administrative capital	1,252	1,350
maintenance facility rehabilitation	1,000	0
Meriden		
replace 30 foot buses	1,200	1,200
Wallingford		
replace 30 foot buses	600	600
Paratransit		
Greater New Haven Transit District		
administrative capital	1,350	1,350
small vehicle acquisition program (ada and elderly)	8,600	6,550
maintenance facility rehabilitation	500	0
Milford Transit District		
small vehicle acquisition program (ada and elderly)	2,050	2,400
Meriden and Wallingford (ada)	540	540
Total Bus and Paratransit Capital	98,571	40,690

Table 18: Maintaining Bus and Paratransit Service: Captial Needs. About $95 million will be necessary to maintain the *status quo* through the next 25 years while another $43 million helps replace the Connecticut Transit Garage. [1] appoximately $21 million already committed (pre-FY03). (Source: Connecticut Department of Transportation, Bureau of Public Transportation, "2000-2020 Transit Capital Program" November , 2003. Recurring expenditures are extended to 2025 since the ConnDOT capital program extends only to 2020.)

Connecticut Transit
New Haven Division

	Current Service	
	2004	*2010*
Supply and Demand		
peak hour buses	93	93
peak-to-base ratio	1.60	1.60
weekday bus hours (revenue hours)	980	980
weekday bus miles (revenue miles)	11,400	11,400
Demand (Unlinked Trips, With Transfers)		
am peak hour trips	6,000	4,200
weekday trips	40,600	34,700
Annual Budget ($)		
annual operating cost	19,900,000	19,900,000
fare revenue	6,300,000	5,400,000
annual deficit	13,600,000	14,500,000
Performance (Linked Trips, No Transfers)		
pass./bus hour	31.21	26.66
cost/passenger ($)	2.06	2.41
subsidy/passenger ($)	1.41	1.76

Table 19: Maintaining Connecticut Transit Service—Operating Needs. Current subsidies are likely to increase against the background of a less favorable transit environment. Current service is likely to produce fewer riders. (Source: Appendix C.)

25 Year Program Bus and Paratransit Program
Dollars in 000s

		Annual
Operating Assistance (Annual Fixed Route and ADA)		
Maintain Existing Service		19,055
Fixed Route Service		15,950
Connecticut Transit New Haven Division	14,500	
Milford Transit District	851	
Meriden	485	
Wallingford	114	
Americans with Disabilities Act Paratransit		3,105
Greater New Haven Transit District	2,499	
Meriden, Milford, Wallingford	606	
Enhance Service		0

Table 20: Maintaining Bus and Paratransit Service—Summary. Maintaining current service will require a $19 million annual operating subsidy.

- *draw express buses into a common Church Street, Grove Street, College Street loop*. Better coverage and faster movement in curbside bus only lanes can offset slightly longer movement through the Downtown.

- *build on existing routes to establish a low or free fare Downtown zone*. Regular routes and existing commuter connections (shuttles) can link major activity centers beyond walking distance. Reasonably priced connections between major generators including Union Station, the waterfront, central commercial areas, Yale-New Haven Hospital, the Broadway shopping area and Yale's North Campus can be established.

- *transform major boarding areas into attractive, functional public space—space that complements the New Haven Green and Downtown development initiatives*. New investment that integrates transit and development should make buses an asset rather than a liability.

Connecticut Transit Supply Choices

Moderate density, existing highway facilities, limited public transit capabilities and diverse trip patterns make broad brush transit initiatives difficult, expensive and risky. Targeted incremental change correlate with the Downtown's expected 35,000 person year 2025 work force is basic—change that gradually builds transit ridership, increases ridesharing and avoids congesting newly improved highway facilities. A Connecticut Transit property that gradually moves toward a mid-range 130 unit peak hour fleet can begin to provide a more reasonable range of travel choice (Tables 21 and 22). New suburban-to-core links provide transit's mid-term growth market. New commitments can gradually:

- *replace still common 30-minute peak hour headways on major routes with 15 (approximate) minute service.* Shorter waiting periods remain important where trips are relatively short.

- *create a meaningful transit presence on US 1 west, US 1 east, US 5 and westerly segments of Route 80*. More vehicles and direct routes can provide good service to the core and to corridor-oriented activity centers.

- *offer new high-speed suburban-to-core routes.* Direct bus routing and a Downtown bus priority program can offer a more competitive transit product—relying on a series of freeway and limited stop arterial routes extending further into Milford, reaching into Wallingford and Meriden and extending toward Derby.

- *use the freeway system.* High speed runs to outlying activity centers can make bus travel more attractive. Freeway-arterial movement to major employment and job sites including the Connecticut Post Mall, Washington Avenue (North Haven), Marsh Hill Road (Orange), northern Wallingford and Meriden can replace relatively slow arterial movement that effectively puts major outlying generators beyond transit's reach.

- *link central city residents with suburban job sites.* Service to suburban job nodes over key arterials offers the single most cost-effective response to a national welfare to work thrust.

Cost and Subsidy. Change will be expensive. Annual subsidies for a mid-level regional fleet doubling peak period weekday ridership could rise to about $17,000,000 or about 25 percent above current levels.[24] Ridership gains decrease and subsidies increase as the peak hour fleet moves much beyond 130 buses.[25]

Equipment. Gradual growth toward a mid-level fleet 130 unit fleet would push capital needs toward $4.0 million a year through the 2004-2025 period as replacement and expansion needs coincide. Significant replacement requirements emerge between 2010 and 2016 when both existing (pre-expansion) and new equipment become unreliable for 12-to-14 hour a day on the road service.[26]

New service and capital needs could readily push annual bus commitments to $28 million—almost 30 percent beyond current levels (Table 23).

Rail and Ridesharing

Parallel elements can:

- *expand the region's rail system*. Creating a more appealing product is basic. Clear mid-range commitments that complement new State Street and Shore Line East station investment can pursue a mid-level New Haven-Hartford-Springfield "inland" commuter rail program expected to emerge in 2004.

- *enhance an already well-established rideshare development capability.* Modest new commitments can allow Rideworks of Greater New Haven to offer a full service product consistent with users' needs (Table 24). Extended employer outreach and enhanced Rideworks support capabilities can make the 19-year-old service an important catalyst for change.

Year 2010 Service Planning Options

Option	*Key Elements*
1 Maintain Current Service	maintain status quo
2 Shorter Headways	option 1 plus minimum 10 minute headway on top performing routes and those with current 20 minute or greater headways. top performing routes with at least 50 boardings per route mile. increase peak period orientation; add only peak period service.
3 Centrally-Oriented Express	option 2 plus seven new express routes with 20 minute headways. increase peak period orientation; add only peak period service.

Table 21: Bus Supply Options. Incremental change is basic. Broad-brush transit programs risk high costs and limited effectiveness. (Source: Appendix C.)

Year 2010 Bus Supply Options
Performance Indicators

	Option		
	1 Maintain Current Service	*2 Shorter Headways*	*3 Centrally Oriented Express*
Supply			
Peak Hour Conn Transit Buses	93	114	128
Peak-to-Base Ratio	1.60	1.97	2.21
Weekday Bus Hours (Revenue Hours)	980	1,200	1,170
Weekday Bus Miles (Revenue Miles)	11,400	13,100	15,400
Demand (Unlinked Trips, With Transfers)			
AM Peak Hour Trips	4,200	6,400	8,300
Weekday Trips	34,700	37,100	37,700
Cost			
Annual Operating Cost	19,900,000	23,600,000	25,500,000
Annual Deficit	13,500,000	16,300,000	17,100,000
Performance (Llinked Trips, No Transfers)			
Pass./Bus Hour	26.66	26.63	28.17
Cost/Passenger	2.41	2.64	2.65
Subsidy/Passenger	1.76	1.97	1.93

Table 22: Year 2010 Transit Performance. (Source: Appendix C.) SCRCOG's 18-month-long *Transit Initiatives Study* will offer clear near-term guidance early in 2005.

Table 23: Transit Shortfall. State commitments shape a financially-constrained transit plan. More service will be impossible without a major new state and federal initiatives. (See Appendix C.)

Annual Transit Need and Commitment ($000s)

	Year 2025		
	Now	*Goal*	*Shortfall*
Annual Operating Subsidy	19,400	24,800	5,400
fixed route bus systems	15,900	20,000	4,100
greater new haven transit district	2,500	3,400	900
americans with disabilities act (local bus systems)	600	800	200
ridesharing	400	600	200
Annual Capital Requirements (Thru 25 Year Period)	3,800	4,900	1,100
fixed route bus systems	2,800	3,600	800
greater new haven transit district (ada)	700	800	100
americans with disabilities act (local bus systems)	200	200	0
curbside improvements	100	300	200
Total	23,200	29,700	6,500

Table 24: A More Significant Rideshare Product. Modest new commitments can allow Rideworks to provide a better alternative to single occupancy vehicle travel.

A Full Service Rideworks Product

Rideworks	*Employer Response*
Major Continuing Outreach	transit pass. paid parking; employee parks or rides transit. preferential carpool/vanpool parking. flextime: flexible working hours. telecommuting: work at home.
Guaranteed Ride Home	major employer commute option plan
Real Time Carpool/Vanpool Matching	promote on site and per public inquiry.
Respond to General Rideshare Inquiries	promote on site and per public inquiry.

The Greater New Haven Transit District

Greater New Haven Transit District experience provides near-term service guidelines. Key program elements can:

- *more nearly meet basic Americans with Disabilities Act (ADA) needs*. Latent *ADA* demand far exceeds current supply capabilities (Table 25).

- *extend GNHTD service beyond an ADA focus.* Current commitments meet narrowly-defined *ADA*-related service needs.[27] New resources can gradually extend inter-town service to elderly people without meaningful travel alternatives and to people with disabilities whose trips lie beyond the range of fixed route transit. New support offers an opportunity to enhance service and promote effectiveness.

- *complement local elderly-oriented services.* A central, general purpose door-to-door transit supply oriented to people with disabilities allows municipal paratransit to support well-established local elderly social service programs. State and regional investment that supports *ADA* service can help municipalities focus attention on local elderly-related transportation needs.

- *improve public sector vehicle control capabilities.* The District's four-year-old move from private to public vehicle control can help build more effective scheduling skills.[28] Productivity gains that help offset rising supply costs and maintain quality are too important to ignore.

Greater New Haven Transit District
Population Within 0.75 Mile of a Bus Route

Weekday Demand	
total population (current 23 town service area)	460,000
persons with disability	33,000
persons with at least a moderate disability	17,000
daily trip need (with a moderate disability)	25,000
daily trips not met by family and friends	5,000
Weekday Supply	
vehicle service hours (weekdays)	256
daily trips (one-way including escorts)	704
daily trips at four/ vehicle hour (practical maximum with escorts)	1,020

Table 25: Transit for People with Disabilities: South Central Connecticut. Current commitments fail to close the gap between resources and need. (Source: Demand per U.S. Urban Mass Transportation Administration, *ADA Paratransit Handbook, prepared by the UMTA Task Force on the Americans with Disabilities Act* (Washington: UMTA, 1991).)

The Highway System

More effective management and selected new capacity can help meet the region's mid-range travel needs. Near-term attention focuses on difficult expensive central I-95 corridor capacity issues.

Management

Traffic management attention can have major near-term energy, air-quality and transportation payoffs.

Traffic Operations

Comprehensive regular signal operations review should become the rule rather than the exception. Routine review of phasing and timing can have major efficiency payoffs—even with old equipment.[29] New Caltrans-like (California Department of Transportation) programs that draw good field exposure, standard optimization software and post-installation adjustment together should become a permanent part of the region's Congestion Management System arsenal.[30]

Freeway Ramps

Peak hour ramp metering deserves more attention and initiative. Metering that gives the main line priority can help keep I-95 and I-91 from breaking down—allowing them to carry more traffic than possible once stop and go driving conditions set in (Tables 26 and 27). People with significant hands on metering experience can help the state and region establish whether ramp metering has a long-term role here.

Management and Information

Programming contemplates significant new surveillance investment along I-95 east and I-91 north—expanding an eleven-year-old Greenwich-to-Branford I-95 west incident management system. National "Intelligent Transportation System" (ITS) experience that adapts new technology to local travel needs can extend an early I-95 incident focus and begin to limit delay here. Early (1999) regional proposals deserve near-term review in a rapidly changing national environment.[31] New initiatives that improve traveler information systems, arterial traffic control, accident responses and emergency vehicle routing may well be within the region's grasp. All hinge on extended public sector surveillance and data sharing—providing consumers, operating agencies and the private sector with reliable real time highway, transit and parking information.

Safety

Targeted safety spending addresses difficult locations while state-local accident monitoring ensures that major captial improvements and overlay programs address basic safety needs (Figure 33 and Table 28).[32] A new, complementary Federal Highway Administration-ConnDOT-regional pedestrian safety emphasis screens accident locations and defines appropriate countermeasures.[33]

Major Highway Investment

Programming that extends well beyond paving, bridge renewal, signing and safety projects after a 40-year hiatus brings its own set of near-term problems and opportunities. Managing mobility through a 12-year central I-95 reconstruction program and looking ahead at major Interstate corridor needs demands clarity, creativity and a long-term design perspective.

Central I-95 Improvements

New Haven Harbor Environmental Impact Statement commitments and related year 2000-2012 programming set basic 50-year regional capacity parameters—as did earlier Q-Bridge design efforts in the early 1950's.[34] Commitments that provide a useful mid-range central travel environment will (Figures 34 and 35):

North American Experience

Urban Area	*First Installed*	*Ramps Metered*	*Planned Additions*
Chicago	1963	113	
Columbus	1973	10	6
Dallas	1971	35	planned
Denver	1981	28	
Detroit	1981	49	10
Fort Worth	1977	10	
Houston	1975	106	
Los Angeles/Orange County	1968	1,086	
Milwaukee	1969	43	
Minneapolis	1970	368	84
New York	1989	79	
Phoenix	1975	65	planned
Portland	1981	58	25
Sacramento	1983	19	
San Diego	1968	184	planned
San Francisco/San Jose	1974	103	planned
Seattle	1981	54	50
Toronto	1975	10	planned
Washington	1985	26	planned

Table 26: Selected North American Ramp Metering Experience. Twenty urban areas have learned that ramp metering works—most are planning or designing extended metering systems. (Source: The U.S. Federal Highway Administration's most recent national overview in *Ramp Metering Status in North America* (Washington: FHWA, 1995).)

Ramp Metering Benefits

	Portland Oregon	*Minneapolis*	*Seattle*	*Long Island*
Interstate	I-5	I-35W	I-5	I-495
length (miles)	6.0	n.a.	6.9	10.0
installed	1981	1974	1981	1988
Experience				
years after start	1	10	7	0.2
direction	nb	both	both	both
Peak Period	pm	pm	pm	pm
traffic gain (%)	n.a.	32	n.a.	n.a.
accident reduction (%)	43	27	39	15
speed before (mph)	16	34	19	29
speed after (mph)	41	46	36	35
travel time before (min)	23	n.a.	22	26
travel time after (min)	9	n.a.	12	21

Table 27: Ramp Metering Experience. Ramp metering provides significant benefits across the country. (Source: U.S. Federal Highway Administration, *Ramp Metering Status in North America* (Washington: FHWA, 1995) and Siemens Gardner Transportation Systems, *Freeway Management and Operations Handbook, Draft,* prepared for the U.S. Federal Highway Administration (Washington: FHWA, 2003), Chapter 7.)

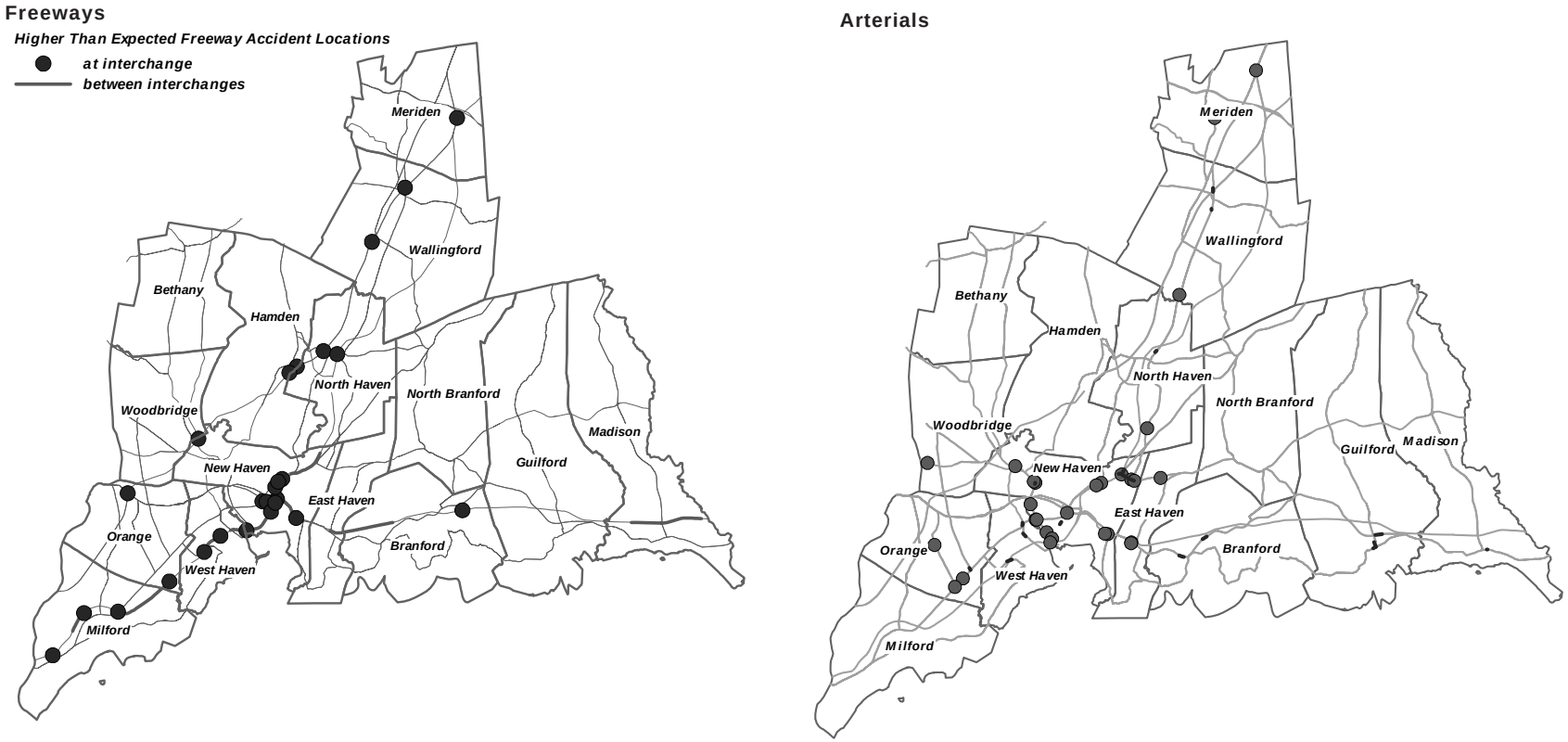


Figure 33: Higher Than Expected Accident Experience—1997 Through 1999. ConnDOT's "1997-1999 Traffic Accident Surveillance Report" ("TASR") overviews accident experience along the state highway system—its "SLOSS" list ("Suggested List of Surveillance Study Sites") targets areas with higher than expected accident experience. All freeway SLOSS locations and serious ("top 50") arterial locations illustrated. (Source: ConnDOT Bureau of Policy and Planning, *2002 ConnDOT Cartographic/Transportation Data, CD-ROM* (Newington: ConnDOT, 2002).)

Safety Spending
(Programmed)

Local Accident Reduction Program

Guilford	Little Meadow Road (2004)
New Haven	Grove Street-Ashmun Street
New Haven	West Park Avenue-Edgewood Avenue
Milford	Cherry Street-Gulf Street
Wallingford	Hartford Tpke-Mansion Road (2004)

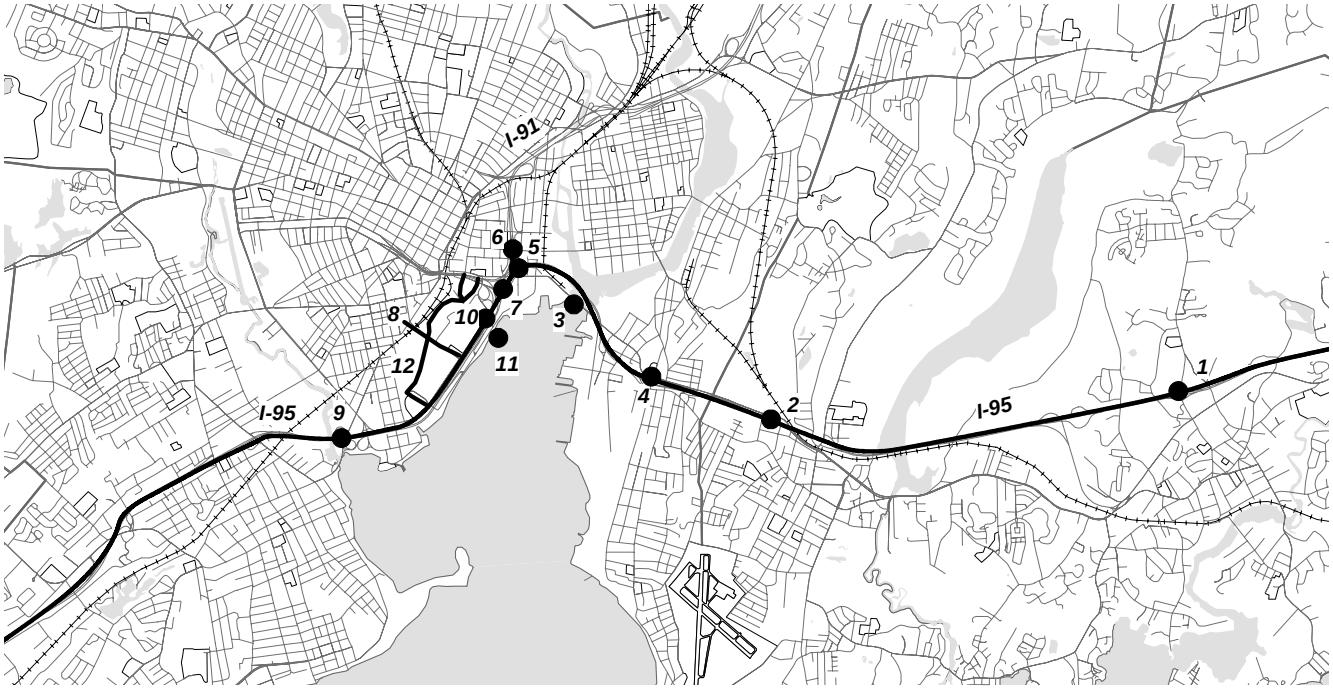
Surface Transportation Program Hazard Elimination

Branford	US1-Rt 740
Hamden	Rt 10-Bowen Street (2004)
Meriden	US5-Gypsy Lane (2004)
Meriden	US5-Liberty Street (2004)
Milford	US1-Rt 121 (North Street) (2004)
North Haven	US5-Rt 22
North Haven	Rt22-Pool Road (2006)
Orange	US1-Rt 162
Wallingford	Rt 71-Rt150
Wallingford	Rt 68-Durham Road (2005)
Woodbridge	Rt 243-Baldwin Avenue-Northrop Road

Railroad Crossing Improvements

Branford	Gould Lane (2004)
Branford	Totoket Road (2004)
Milford	Oronoque Road (2006)
New Haven	Grand Avenue (2004)
Wallingford	Hall Avenue
Wallingford	Toelles Road
Wallingford	Quinnipiac Street
Wallingford	Ward Street

Table 28: Safety Improvements. Targeted safety investment through the past 10 years has made a difference at 24 difficult locations



Central I-95 Program
Key Elements

1-	2	Cedar St to Frontage Rd: widen from 4 to 6 lanes	construction	9		consolidate Kimberly Ave-Boulevard interchange	programmed
2-	4	Frontage Rd to Main St: widen from 6 to 8 lanes	construction	9-	10	four directional through I-95 lanes between I-91	proposed
3		new 4 lane Tomlinson Bridge	complete			and Kimberly Ave and one operational lane	
4		move Stiles St access to Main St	programmed			between Rt 34 and westerly I-95 ramps at Long	
4-	5	Main St to I-91: 5 lanes in each direction	programmed			Wharf	
6		two lanes to/from I-91	programmed	11		new boathouse and stabilize shore along Long	programmed
7		two lanes to/from Route 34	programmed			Wharf Drive	
8		new Church St South Bridge	complete	12		new ring road; alternate to Sargent Drive	proposed

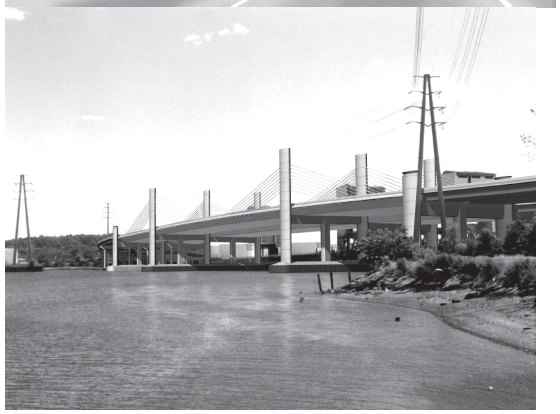
Figure 34: Central I-95 Program. Central freeway commitments set basic 50-year regional capacity parameters.

Lake Saltonstall-to-Cedar Street (Contract B, looking west)

Lake Saltonstall (East Haven)-to-New Haven City Line (Contract C1, looking west)

East Haven Line-to-Stiles Street (Contract C2, New Haven, looking east)

Central Interchange (Contract E, New Haven, looking north)



The 10-Lane Pearl Harbor Memorial Bridge—the United State's first extradosed bridge.

Figure 35: Cental I-95 Design. Design is translating *Environmental Impact Statement* commitments to reality. The nation's first extradosed bridge, a hybrid cable stay-box girder design, draws on 1995-2004 Far Eastern experience. Renderings courtesy of ConnDOT and Parsons Brinckerhoff.

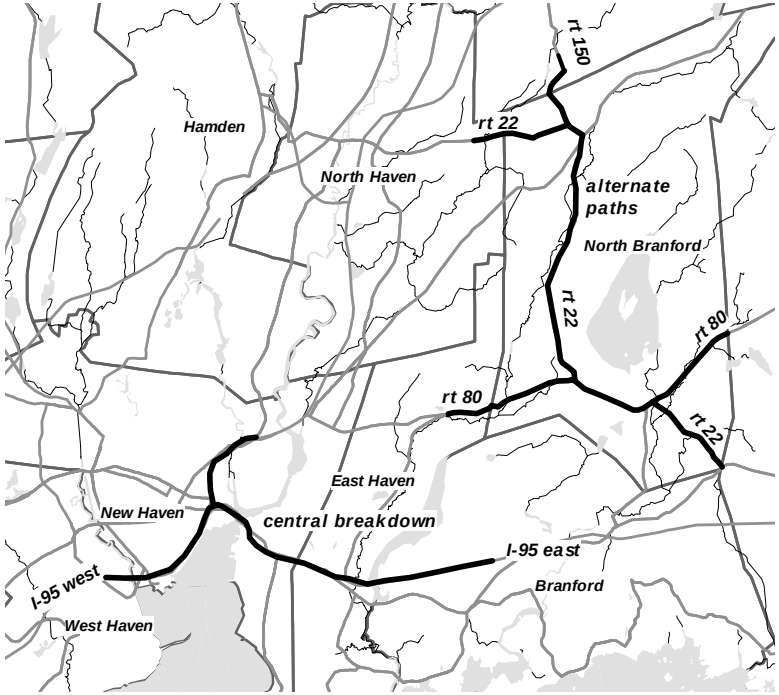


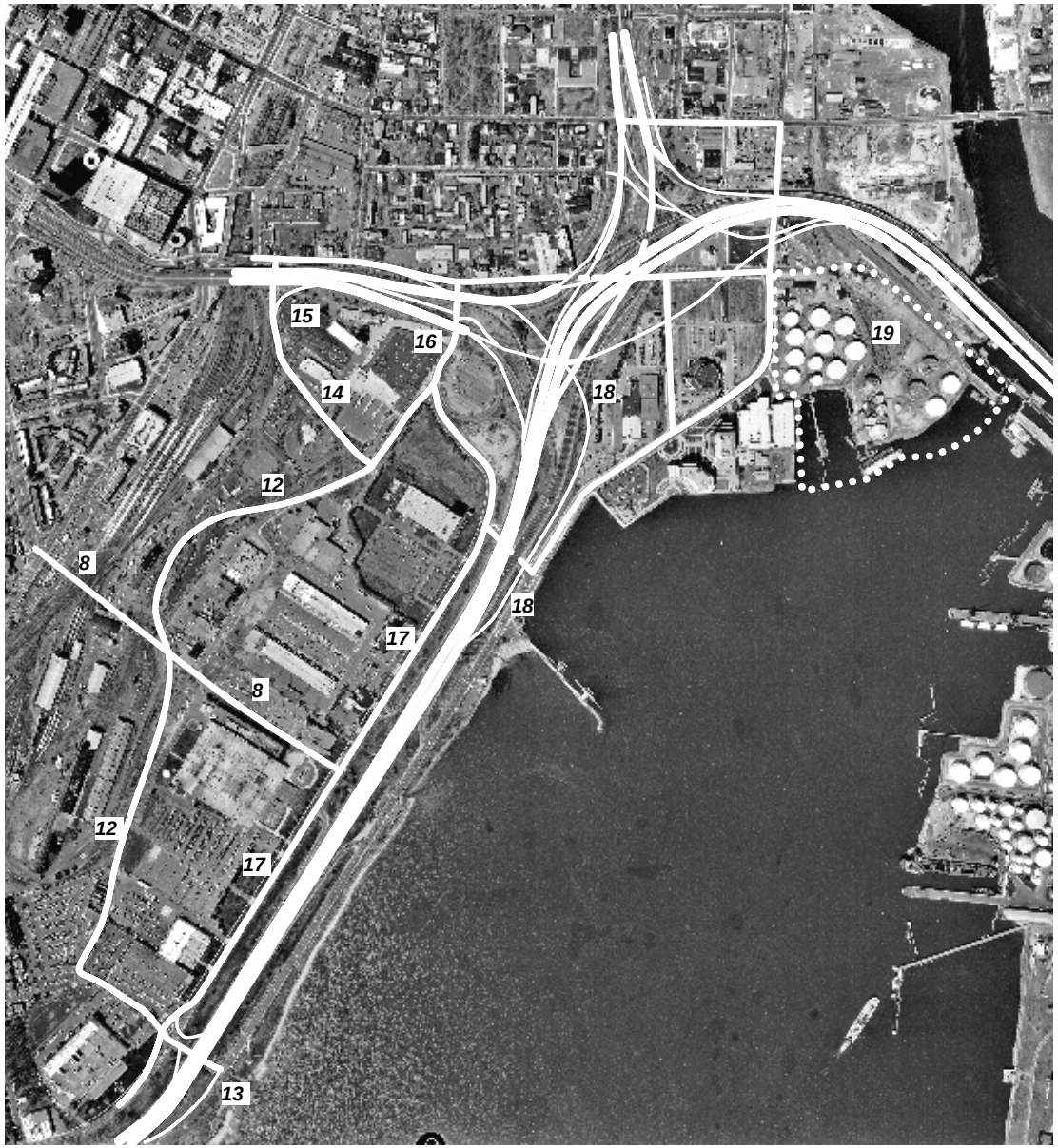
Figure 36: A Central Choke Point. Breakdowns in the core shift demand to peripheral arterials. Moving around the central bottleneck is becoming as difficult as moving through the I-91/I-91 interchange.

- *respond to system-wide needs between Trumbull Street, Cedar Street and the Boulevard.* Building new capacity in the center without improving adjacent sections simply moves the problem—guaranteeing that a new wider bridge becomes congested the day it opens.

- *provide five directional lanes across the harbor*. Only ten travel lanes can provide reasonable mid-term flexibility and establish lane balance for Route 34, I-95, and I-95 movement.[35]

- *relieve alternate routes.* Breakdown in the core now transfers demand and problems to peripheral arterials ill-equipped to accommodate heavier flow. Moving around the central bottleneck has come as difficult as moving through the over-saturated I-95—I-91 interchange (Figure 36).

- *continue to seek a viable Long Wharf solution.* Balancing environmental goals, cost and capacity remains a challenge as final design commitments emerge from ConnDOT's *New Haven Harbor Access Study.*[36] Eight-lane Route 34-to-Boulevard capacity main line needs are clear if improvements are to a relieve single lane southbound I-91 constraint and allow relatively smooth mid-term I-95 movement between the east and west shore. Near-term design responses seek to translate a financially-constrained at-grade freeway proposal to concrete terms that respect the waterfront and Long Wharf development goals—considering how the facility looks and how it improves the waterside environment (Figure 37).



I-95 at Long Wharf
Key Elements

8	new Church St South Bridge	complete
12	new ring road; alternate to Sargent Drive	proposed
13	new sb I-95 access; eliminate Long Wharf Drive	proposed
14	to new Rt 34 ramps and Water Street	proposed
15	new Rt 34 eb ramp to I-95 sb	proposed
16	maintain w b Rt 34 access; add new eb Rt 34 ramp to I-95 north (to Pearl Harbor Memorial Bridge)	proposed
17	w iden Sargent Dr per elimination of Long Wharf Drive	proposed
18	new I-95 nb ramp to w b Rt 34; ov	programmed
	Canal Dock Rd	
19	acquire Wyatt-Williams site for ferry-commerical development	proposed

Figure 37: I-95 at Long Wharf. Near-term programming can expand Veterans Memorial Park by eliminating Long Wharf Drive, establish a ring road alternative to Sargent Drive and provide new Route 34 access to encourage more intense development at Long Wharf.

I-95 West

Eight lane service west to the Housatonic River could become a basic regional need toward the year 2020. A revived *Southwestern Corridor Environmental Impact Statement*[37] process or a regionally relevant (New Haven-to-Milford) assessment can help define long-term South Central Connecticut direction by:

- putting options, performance and cost in a clear framework that encourages a broad dialogue.

- considering near-term (current geometry) and mid-range (an improved main line) ramp metering opportunities. Flow control at expected 7,200 to 8,000 vehicle peak hour directional volumes can smooth out peaking and keep the main line moving at reasonable freeway speed.

- ensuring good interchanges. Simple diamond interchanges are not going to work as volumes climb 30 to 40 percent above current levels—both the freeway and intersecting arterials will suffer. Transitional lanes and express-local separation on the main line can help maintain a good service at US 1 (Milford) and keep other important arterial connections from breaking down in peak hours (Figure 38).[38]

I-95 East

More through movement and heavier regional flows will begin to extend I-95 congestion east from Cedar Street beyond Leetes Island Road without new six lane capacity. Late afternoon eastbound commuters already experience a driving environment that makes lane changing difficult and restricts speed.[39] Peak hour congestion is likely to extend easterly toward Guilford through the next 10 years despite reinforced Shore Line East rail service. ConnDOT's *I-95*

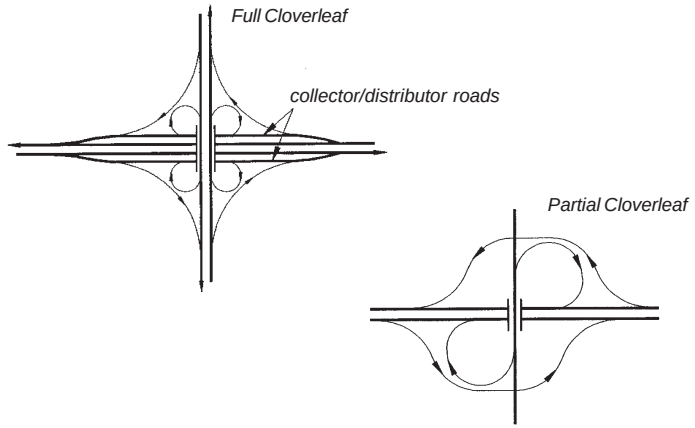


Figure 38: High Volume Interchanges. Simple diamond interchanges that favor freeways will not work at high volume locations—freeways and arterials must work together. Good design can avoid left turn arterial conflict while limiting main line weaving movements. A short one-to-two lane frontage road often accommodates weaving movements inherent in a full cloverleaf. Alternately, a partial cloverleaf moves high arterial volumes to and from the freeway without left turn conflicts. (Source: Texas Transportation Institute, *Texas Highway Operations Manual*, prepared for the Texas Department of Transportation (Austin: TDOT, 1992).)

Branford to the Rhode Island State Feasiblity Study marks a start.[40] Serious attention to main line Cedar Street-to-Madison needs, options and opportunity must begin soon.

I-91 in Meriden

Complex 40-year-old ramp and frontage road design at the I-91-Route 15 interchange can begin to break down as demand rises along the fast growth I-91 corridor (Figures 39 and 40).[41] Concerted attention through the next five-to-ten years can monitor slack in the system and, if relevant, begin to suggest how management and reconstruction can meet long-term needs.

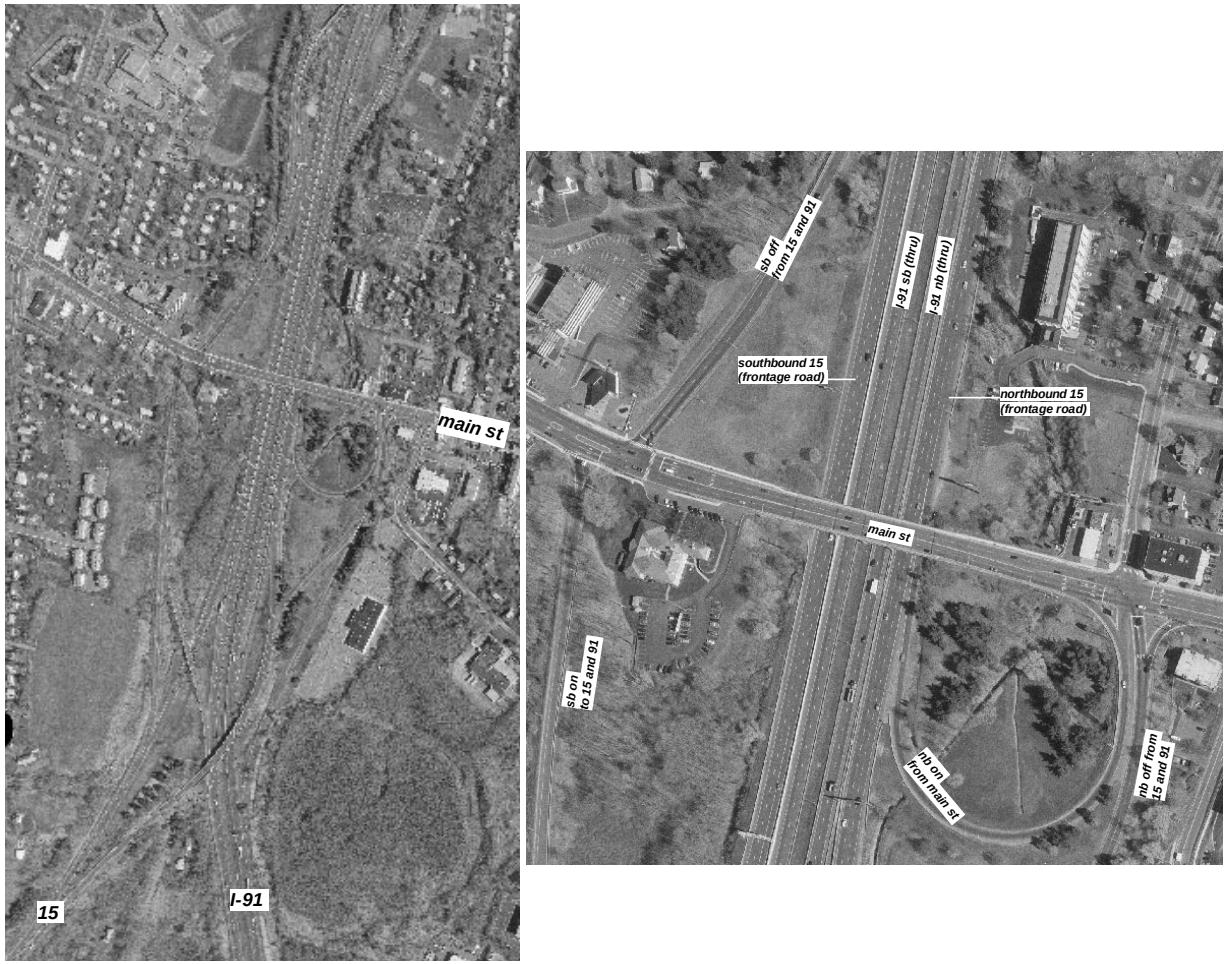
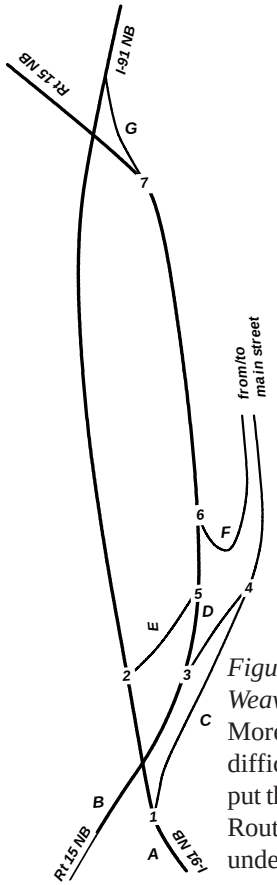


Figure 39: I-91 in Meriden. Route 15 serves as a frontage road near Main Street—accommodating important northbound Main Street-to-I-91, northbound Main Street-to-I-91 and southbound Route 15-to-I-91 weaves. High speed weaves occur in a short mile and one-half section—the section is susceptible to breakdown.



Year 2000 PM Peak Hour Traffic	
A	3,600
B	2,400
C	350
D	300
F	850
G	1,300

Distance	(Feet)
1 to 4	2,400
1 to 2	725
2 to 5	1,400
3 to 4	1,000
3 to 5	700
5 to 6	700
6 to 7	2,150

Figure 40: Short Weaving Sections. More traffic and difficult geometry can put the critical I-91—Route 15 interchange under pressure.

I-691 in Meriden

New westbound Interstate access from Chamberlain Highway (Route 71) can help nurture more dense development at an important central corridor development node, maintain good movement between the Interstate and Downtown Meriden and ensure good peak-period emergency vehicle access to the adjacent Mid-State Medical Center (Figure 41). [42]

An Arterial Plan

Major suburban arterials that provide a good travel environment can help keep short trips off freeways and improve the region's distribution system. New priorities framed through the next two-to-three years can look beyond US1 West—building a good long-term arterial framework consisting of three- and five-lane sections along key facilities in the remainder of the region (Figures 42 and Tables 29 and 30).

Clear and Complementary Circulation/Development Goals. Complementary density, land use control and arterial planning goals can reinforce one another. Arterial capacity and design features can advance development goals while development controls improve traffic operations and facilitate basic roadway improvements.

Continuity. Consistent sections with standard design features should become the norm. Key arterials including Route 80, US1 and US5 lose capacity or lanes on important links and at important intersections—they often fail to offer refuge to left-turning vehicles where demand is heavy.

Improve Safety. Priorities should reflect a mix of capacity, geometry and safety experience given strong relationships among the three.

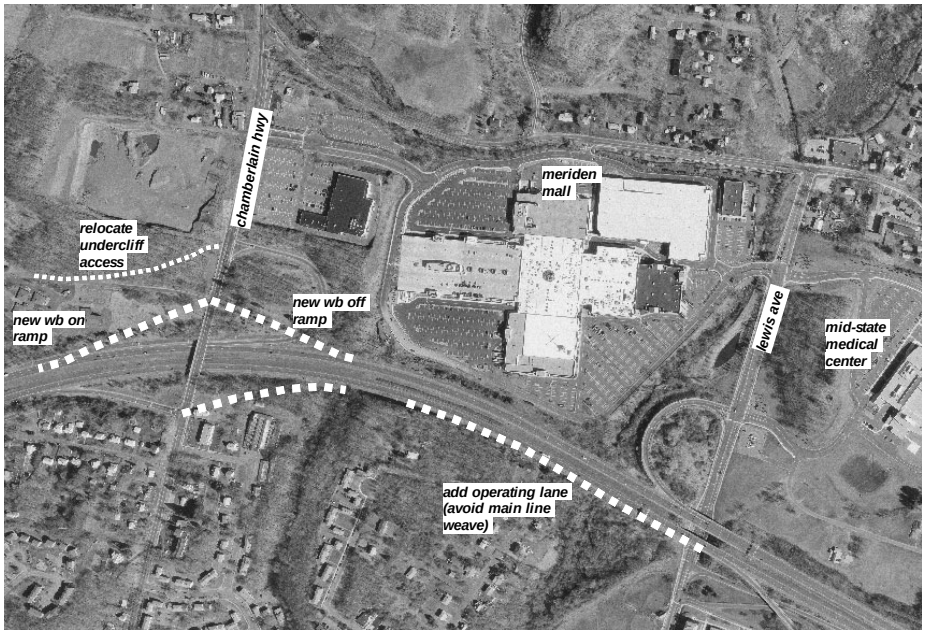


Figure 41: I-691 at Chamberlain Highway. Revised westbound Interstate access at Chamberlain Highway (Route 71) can help nurture more dense development at an important central corridor development node. Proposed work includes widening Route 71 over I-691.

Suburban Arterial Goals
High Volume-High Speed Facilities

	Six Lanes	*Four Lanes*
Four Lanes		
Lane Width (ft)	11-12	11-12
Median Width (ft) (for left turn lanes)	25-30	16
Left turn lane	double at signals	single
Right-of-way (ft)		
recommended	140	110
minimum necessary	120	110
Signal spacing (ft)	——————1/4 mile——————	

Table 29: Arterial Design Standards. Many South Central Connecticut zoning regulations now build in limited mid-block driveway spacing requirements that make good traffic operations difficult—some municipal regulations impose only 100 foot parcel requirements. (Source: See text.)

Good Design Standards. Arterials cannot perform up-to-par when burdened with misaligned cross streets and limited spacing between intersections. A basic reconstruction program that assures a good traffic carrying return on investment must provide good arterial alignment and adequate two lane approaches on important side streets.

State of the Art Signal Control. New signal equipment and good control should manage extended arterial segments as a whole—giving through movement priority by maintaining the best possible progression.

Raised Medians. Too many access points, rising volumes and long-term traffic carrying needs make median control important at selected locations. Design responses should offer raised medians where necessary and where "U-turn" needs can be met at alternate locations.

Control Access. Common 50 to 100 foot zoning frontage requirements along many suburban arterials make effective driveway spacing almost impossible. Good traffic flow and safe driving conditions need better driveway spacing. Many areas now build in 180 to 200 foot mid-block driveway spacing standards and require more significant clearance at corners.[43]

Figure 42: Major Arterials. Major arterials that provide a good travel environment can help keep short trips off freeways and improve the region's distribution system.

Candidate Arterials

Option

Route	Town	Limits	Distance (Feet)	Now	Widening Options (To) 3 lanes	Widening Options (To) 4 or 5 lanes	Year 2000 Weekday Traffic
Rt 10	Hamden	Washington Ave to Rt 40	3,500	4 lanes			16,600
Rt 10	Hamden	Rt 40 to Todd St	9,000	4 lanes			22,800
Rt 10	Hamden	Todd St to south of Shepard Ave	3,600	2 lanes			18,900
Rt 10	Hamden	River Rd to Cheshire TL	6,600	2 lanes			18,000
Rt 122	West Haven	US1 to Elm St	7,200	2 lanes			18,600
Rt 150	Wallingford	Rt 71 overpass	500	1 lane			9,900
Rt 150	Wallingford	South of Old Colony Rd to Rt 68	2,750	2 lanes			13,800
Rt 162	West Haven	Elm St to Greta St	2,750	2 lanes			15,900
Rt 162	West Haven	Bull Hill Ln to Orange TL	2,550	2 lanes			16,400
Rt 162	Orange	West Haven TL to US 1	1,450	variable			14,900
Rt 162	Milford	West of Old Gate Ln to Gulf St	4,200	2 lanes			14,500
Rt 162	Milford	Clark St to US1	3,100	2 lanes			14,000
Rt 17	No Branford	N & S of Rt 22 intersection	2,350	2 lanes			15,800
Rt 63	New Haven/Woodbridge	Dayton St (NH) to Landin St (Wdbg)	6,200	variable			15,900
Rt 68	Wallingford	Hanover St to N Main St	5,850	2 lanes			15,900
Rt 69	New Haven/Woodbridge	Rt 63 to Landin St	3,000	2 to 3			17,500
Rt 80	No Branford	East Haven TL to Doral Farms Rd	6,750	2 lanes			13,600
Rt 80	No Branford	Rt 22 to Guilford TL	8,500	2 lanes			15,700
US 1	Branford	East Haven TL to Echlin Rd	8,000	4 lanes			29,500
US 1	Branford	Rt 146 to Cedar St	3,800	2 lanes			18,000
US 1	Branford	Cedar St to E Main St	4,400	2 lanes			22,000
US 1	Branford	E. Main St to I-95 x 55	5,100	2 lanes			18,500
US 1	Branford	I-95 x 55 to Leetes Island Rd	5,500	2 lanes			18,000
US 1	West Haven	Campbell Ave to Orange TL	8,500	4 lanes			15,900
US 1	Guilford	State St to Tanner Marsh Rd	6,800	2 lanes			12,800
US 5	Wallingford	S Orchard St to Ward St	2,750	2 lanes			12,500
US 5	Wallingford	Christain St to Meriden City Line	9,800	2 to 4 lanes			19,900
US 5	Meriden	Wallingford TL to Olive St	9,400	2 to 4 lanes			14,500
US 5	Hamden/No Haven	Olds St (Hmdn) to Sackett Pt. Rd	3,700	2 to 3 lanes			16,000

Table 30: Arterial Planning. Traffic and capacity highlight early arterial widening candidates. Work through the next two-to-three years can begin to refine priorities and frame a balanced mid-term arterial improvement program. Arterial programming and design that complement development goals are fundamental.

Beyond Highways

Multipurpose Trails

Thirteen (13) years of flexibility built into the federal *Transportation Act* has reawakened interest in a broad spectrum of transportation enhancement activity (Tables 31 and 32). Early *ad hoc* project development can give way to more systematic regional programing that provides continuity and leaves a good long-term legacy. Near-term efforts focus on extending Hamden, New Haven, Wallingford and Meriden multi-purpose trail elements—gradually forming a meaningful network that extends along Long Island Sound and through inland communities (Figures 43 and 44).

Multimodal Freight in New Haven Harbor

A $12 million near-term Waterfront Street reconstruction commitment on New Haven's east shore can reestablish a meaningful rail-water freight connection for the first time in 40 years (Figures 45 and 46 and Table 33)[44]. Contemporary multicar train sets moving over the new Tomlinson Bridge between Belle Dock (west shore) and Waterfront Street docks will offer shippers new found flexibility—providing an alternative to difficult northeast corridor I-95 truck movement.

Needs and Resources

New commitments can begin to build on the region's three-year *Transportation Improvement Program* (Tables 34 and 35). The financially constrained capacity-oriented investment program can begin to advance important regional highway and transit projects. Key

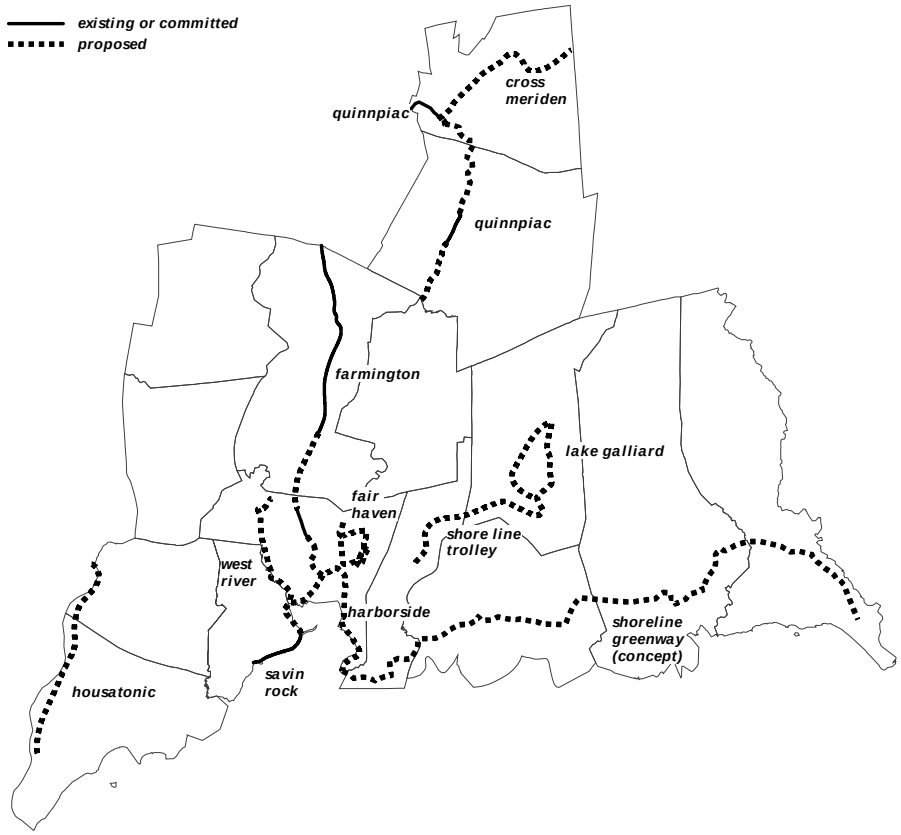


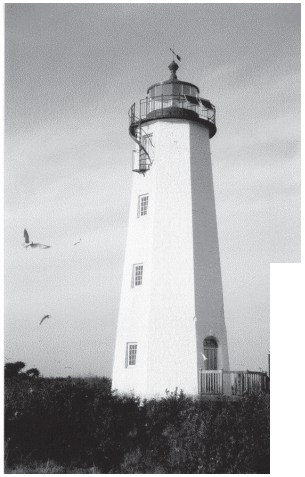
Figure 43: A Multi-Purpose Trail System—The Region. A regional trail system can extend the Savin Rock Bikeway around New Haven Harbor; look toward a northwesterly harbor-to-South Connecticut State University link; complete the Farmington Canal Rail-to-Trail network; extend a new Quinnipiac River Trail; and begin a 25-mile-long Shore Greenway Trail between City Point (New Haven) and Hammonasset State Park.

Transportation Enhancement

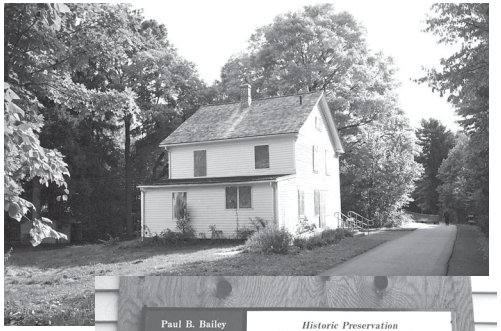
Eligible Activity

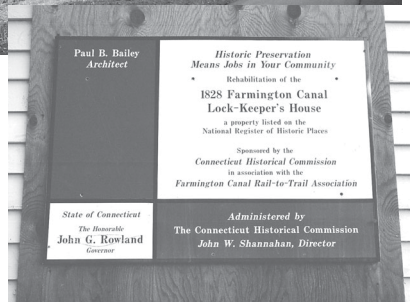
Highway-Related	Transit-Related
pedestrian and bicycle facilities	historic preservation, rehabilitation and operation of historic mass transportation buildings and facilities
pedestrian and bicyclist educational activities	bus shelters
scenic easements and scenic or historic sites	landscaping and scenic beautification
scenic or historic highway programs (including tourist and welcome centers.	public art
landscaping and scenic beautification	pedestrian access and walkways
preserve, rehabilitate and/or operate historic transportation buildings, structures or facilities	bicycle access, storage facilities and accomodation of mass transportation vehicles
preserve and/or reuse abandoned railroads	transit connections to parks
control and remove outdoor advertising	signage
archaeological planning and research	enhance access to mass transportation for people with disabilities
offset pollution due to highway runoff	
historic preservation	
reduce vehicle-caused wildlife mortality	
establish transportation museums	

Table 31: Enhancement. Federal enhancement commitments, originating in 1991, complement and extend the range of main stream highway and public transit investment. *TEA-21* brought new flexibility. The *Act* now requires that enhancement work "relate to surface transportation" versus a former requirement of a "direct link". See U.S. Federal Highway Administration, "Interim Guidance: Transportation Enhancement Activities, 23 USC and TEA-21" (June 17, 1999).



Faulkners Lighthouse (Guilford). The 1802 Lighthouse restored in 1999 (at left) and with the Lightkeeper's House prior to a 1976 fire.





Lock 14 Lockkeepers House (Hamden, South of Westwoods Road). Restored in 2002 and awaiting reuse as a police substation.

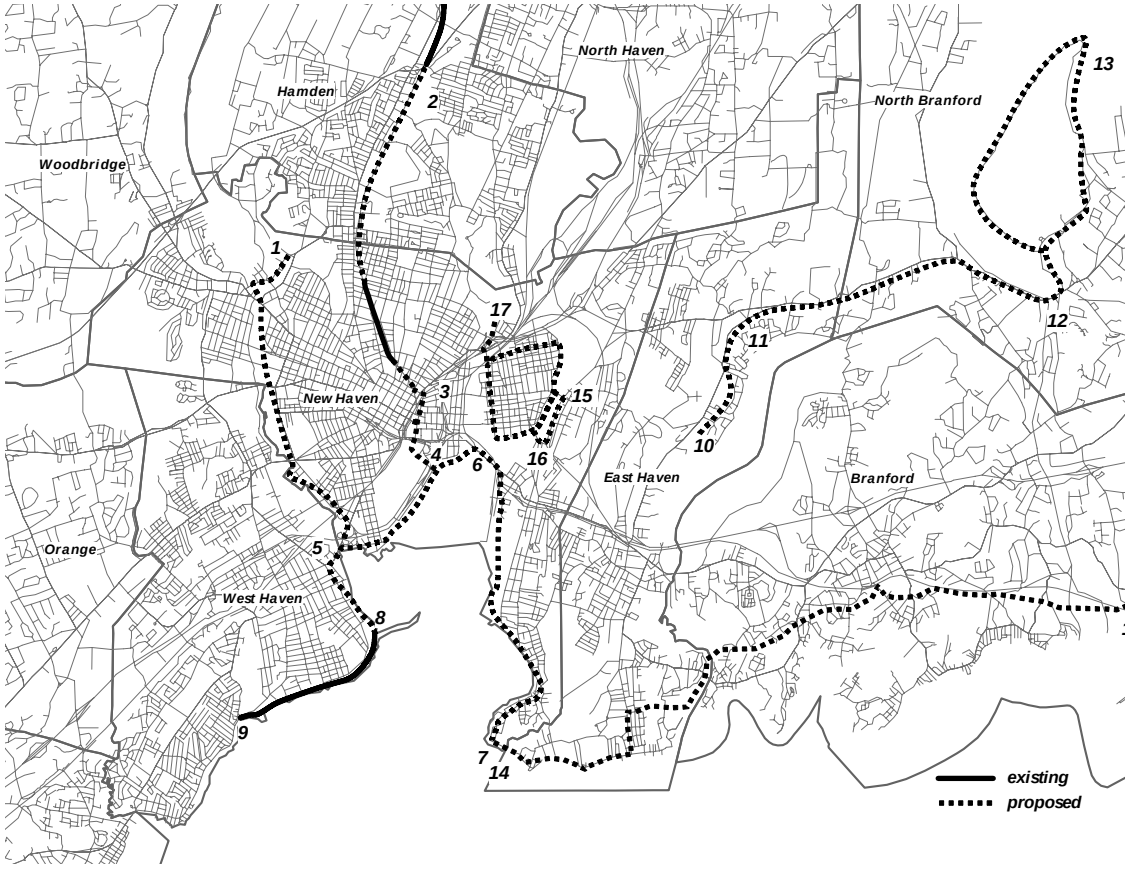
Railroad Row (Meriden). A new canopy and adjacent streetscape at Meriden's railroad station.

Eastbound Station (Milford). Restored in 1993 and now home to the Milford Arts Council.

Enhancement Commitments
1991-2003

Municipality	*Improvement*	*Cost ($000s)*	*Status*	*Notes*
Branford	restore Sybil Creek wetland along Rt 146	175	design	
Branford	streetscape improvements along Pine Orchard Rd/Damascus Rd	270	complete	
Branford	streetscape improvements along Rt 142 and Rt 740	764	complete	
Guilford	rehabilitate Faulkner's Island lighthouse	250	complete	
Hamden	acquire 2.5 miles of Farmington Canal Trail ROW south of Skiff St	938	in progress	congressional earmark
Hamden	construct Farmington Canal Trail between Todd St and Cheshire	1,373	complete	
Hamden	construct Farmington Canal Trail between Todd St and Hamden Hills Dr	1,440	complete	
Hamden	construct Farmington Canal between Hamden Hills Dr and Connolly Pkway	1,440	complete	
Hamden	acquire and rehabilitate Lock Keepers house along Farmington Canal Trail	200	complete	
Madison	construct Tuxis Pond Walkway; a downtown pedestrian path	330	complete	
Meriden	construct Railroad Row pedestrian facility	605	complete	includes $265,000 city funds
Meriden	construct Quinnipiac River trail along north bank west of Oregon Rd	879	design	
Milford	rehabilitate eastbound railroad station	493	complete	
Milford	restore Fletchers Creek in Silver Sands Park	65	complete	
New Haven	Church Street South Streetscape	203	complete	
New Haven	construct Farmington Canal Trail between Lock St and Munson St	638	complete	congressional earmark
New Haven	construct Farmington Canal Trail between Munson St and Starr St	828	design	congressional earmark
North Haven	town center streetscape	653	design	
West Haven	Allingtown streetscape improvements: Phase 1	258	complete	
West Haven	Allingtown streetscape improvements: Phase 2	304	complete	
West Haven	Old Field Creek wetlands restoration near Beach St	150	design	
West Haven	Cove River wetlands restoration	150	design	
Wallingford	construct Quinnipiac River Trail between Center St and Wilbur Cross Pkway	1,000	complete	municipal funds
Wallingford	construct Quinnipiac River Trail between Wilbur Cross Pkway and Hartford Tpke	1,450	design	congressional earmark
Woodbridge	Amity Road streetscape improvements	182	complete	

Table 32: South Central Connecticut Enhancement Commitments. About $15 million worth of enhancement work has been pursued since the inception of the program in 1991—all but about $3.9 million from a 10 percent Surface Transportation Program (STP) "setaside" mandated by federal law. New commitments since 1998 have been limited by *TEA-21* cutbacks that cut Connecticut's 1998-2003 U.S. Federal Highway Administration STP allocation (and the minimum amount that the state must spend) by about 50 percent. Another $500,00 of U.S. Federal Transit Administration enhancement support has been programmed via the Greater New Haven Transit District.



Key Elements

1-5 West River/Edgewood Park to Southern Conn State University: largely separate right-of-way
2-3 Farmington Canal Trail south to State Street (New Haven): separate right-of-way
3-4 Vision Trail: largely via city streets
4-5 New Haven Harbor Trail via Long Wharf/Veterans Memorial Park: largely separate right-of-way
4-6 New Harbor Trail via Tomlinson Bridge
6-7 New Harbor Trail to Lighthouse Point: largely separate right-of-way
5-8 New Haven Harbor Trail: via city streets
8-9 Savin Rock Bikeway (improve existing): separate right-of-way
10-11 Farm River Trail: separate right-of-way
11-12 Shore Line Trolley Trail: separate right-of-way
12-13 Lake Galliard Trail: via Water Authority right-of-way
14 Shoreline Greenway (concept)
15 Fair Haven Trail via Grand Street Bridge
16 Fair Haven Trail via Ferry Street Bridge
17 Fair Haven Trail to East Rock Park

Figure 44: A Multi-Purpose Trail System—The Core. Core trail elements provide a focus for the regional system.

highway elements can:

- continue to invest six to seven million dollars annually on important local roads. New Haven-Meriden area Federal Highway Administration allocations built into *TEA-21* guide project-by-project investment decisions.[45]

- direct at least $250,000 a year to help pursue transportation enhancement efforts.[46]

- support regionally-important projects that expand commuter rail parking, add transit service and make a regional trail system a reality.

A East Shore Rail Market
Ship to Rail and Rail to Ship

Generator	*Product/Rail Use*
Gatew ay Terminal	coal to Northeast Utilities' Mt. Tom generating facility.
Logistec/Coastline/ Westchester Motors	low cost return of empty import containers given northeast's trade imbalance and far east origin. Basic to development of long-term Port of New York-Port of New Haven container barge feeder service.
Logistec/Coastline	w ire rods coiled steel steel plate rail
Williams Energy/Gulf Oil	substitute ethanol for MTBE in gasoline effective January 1, 2004. Ethanol necessarily introduced close to point of distribution.
Wisvest	dispose of residual bottom ash from number 6 fuel oil; up to 600 tons a year now via truck.

Table 33: Intermodal Freight Opportunity. Opporutnities to move current freight by rail and tap new markets are clear—reducing reliance on truck movement to the Port along the Interstate system.

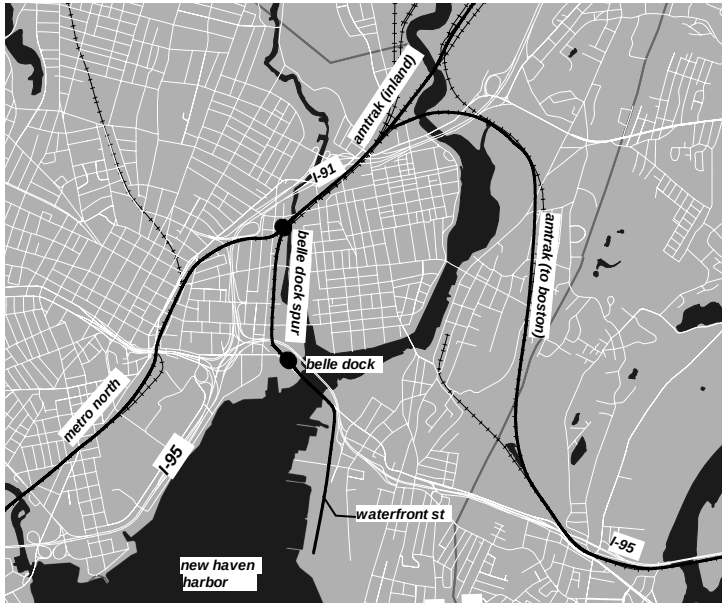
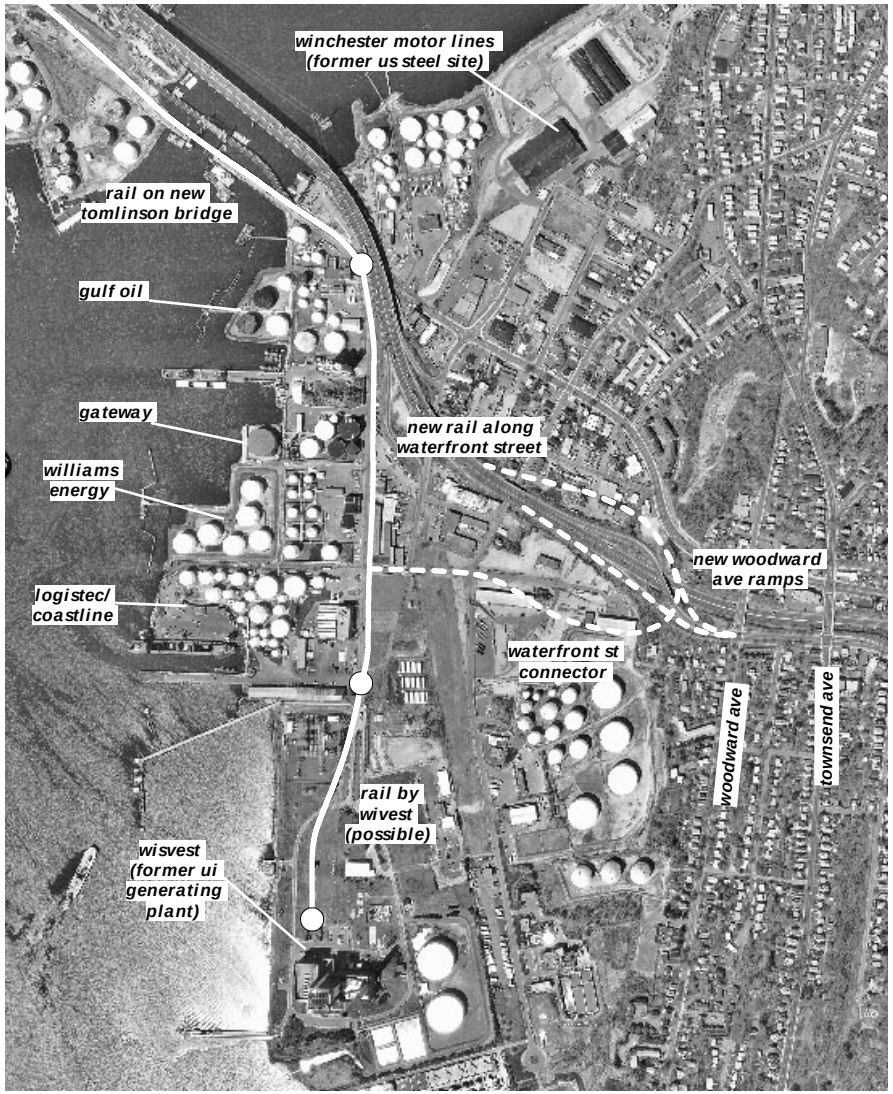


Figure 45: Rail Environment. A $12 million near-term Waterfront Street reconstruction commitment on New Haven's east shore can reestablish a meaningful rail-water freight connection for the first time since the 1960's when heavier, longer freight cars made the New Haven connection obsolete.

Figure 46: Intermodal Opportunity. Rail service restoration over the Tomlinson Bridge and Waterfront Street later this decade offers links to the national rail network via Providence & Worcester connections at Selkirk (south of Albany, moving west on the CSX system) and Worcester (P&W main yards). Near-term central I-95 investment similarly improves east shore truck access to the port—replacing a severe Stiles Street westbound ramp grade with a Waterfront Street Connector and a gentle grade at Woodward Avenue.



Transportation Improvement Program Commitments

		Dollars (Thousands)						*Percent*	
		FY03	*FY04*	*FY05*	*Three Years*	*After FY05*	*Total*	*Three Years*	*Total*
ADA Paratransit	Capital	952	750	600	2,302	0	2,302	0.2	0.1
ADA Paratransit	Operating Support	3,878	3,888	3,898	11,664	0	11,664	1.0	0.7
Other Paratransit	Operations	7,000	7,000	7,000	21,000	0	21,000	1.8	1.2
Other Paratransit	Capital	1,570	1,550	1,200	4,320	0	4,320	0.4	0.2
Bus	Capital	25,141	16,025	26,949	68,115	29,000	97,115	5.8	5.5
Bus	Enhancement	0	1,500	0	1,500	0	1,500	0.1	0.1
Bus	Operating Support	16,731	16,749	16,767	50,247	0	50,247	4.3	2.9
Freeways	Capacity	52,604	85,123	79,478	217,205	252,283	469,488	18.6	26.7
Freeways	Enhancement	750	5,250	24,000	30,000	0	30,000	2.6	1.7
Freeways	Maintain	413	400	531	1,344	6,434	7,778	0.1	0.4
Freeways	Operations	11,300	17,100	0	28,400	3,460	31,860	2.4	1.8
Freeways	Reconstruct	5,100	5,100	11,100	21,300	105,419	126,719	1.8	7.2
Highways	Capacity	19,389	20,093	10,250	49,732	44,653	94,385	4.3	5.4
Highways	Enhancement	3,977	2,347	3,200	9,524	0	9,524	0.8	0.5
Highways	Maintain	3,800	4,820	4,702	13,322	30,336	43,658	1.1	2.5
Highways	Operations	1,863	3,246	1,623	6,732	7,682	14,414	0.6	0.8
Highways	Reconstruct	95,615	102,478	104,672	302,765	10,048	312,813	26.0	17.8
Other	Operations	0	5,696	5,359	11,055	0	11,055	0.9	0.6
Rail	Capital	58,431	78,918	35,970	173,319	100,694	274,013	14.9	15.6
Rail	Operating	35,925	51,705	51,705	139,335	0	139,335	11.9	7.9
Ridesharing	Capital	812	0	0	812	0	812	0.1	0.0
Ridesharing	Operations	1,417	0	0	1,417	0	1,417	0.1	0.1
Transit	Capital	175	175	175	525	0	525	0.0	0.0
Transit	Operations	513	0	0	513	0	513	0.0	0.0
		347,356	429,913	389,179	1,166,448	590,009	1,756,457	100.0	100.0

Table 34: Transportation Improvement Program. The region's *TIP* suggests the flavor of spending—notably long overdue freeway capacity commitments and significant public transit commitments to overcome deferred maintenance. [Summaries necessarily reference statewide and multi-regional projects given the *TIP* adoption process.]

Project Name (Route)	Municipality	Nature	Cost			
			Total	Pre-FY03	FY03-05	After FY03
Greater New Haven Transit	Region	Vehicle needs basic to District's Americans with Disabilities Act door-to-door service.	5,352	3,741	1,611	1,000
Greater New Haven Transit District	Region	Vehicle needs basic to municipal elderly door-to-door service.	2,927	2,007	920	450
Milford Transit District	Milford	Vehicle needs basic to Milford Transit District's Americans with Disabilities Act transit service.	1,090	790	300	150
Bus Transfer Points	New Haven	Construct new bus transfer points/shelters.	1,500	0	1,500	1,500
Conn Transit Bus Replacement	Region	Replace Connecticut Transit Hartford, New Haven and Stamford Division units after 12-year lives.	52,054	15,000	37,054	12,500
Connecticut Transit Garage	Hamden	Construct new $64 million garage on former 23-acre Detroit Steel lower State St. site (Hamden).	64,315	8,966	26,349	55,349
Statewide Bus Replacement	Statewide	Replace vehicles in state-supported bus systems in 2004 after 12-year lives.	1,230	0	1,230	1,230
Transit Enhancement	Greater	Enhancement improvements in East Haven, Hamden, Meriden and at New Haven.	554	117	437	0
Job Access and Reverse Commute	Statewide	Statewide FTA support to effect "welfare to work" goals.	37,506	16,506	21,000	14,000
Branford Shore Line East Station	Branford	Relocate and construct new Branford Shore Line East station.	5,200	0	5,200	0
Guilford Shore Line East Station	Guilford	Construct new "up and over" station.	6,800	0	6,800	0
Madison Shore Line East Station	Madison	Construct new high level south side (single platform) station.	9,500	0	9,500	9,500
Metro North Variable Message Signs	Southwest	Install Americans with Disabilities Act compliant variable message signs.	2,000	0	2,000	2,000
Metro North Car Overhaul	Statewide	Overhaul 242 M-2 Metro North (entire fleet); costs pertain to 121 cars owned by Connecticut.	43,713	34,272	0	9,441
Metro North Catenary Replacement	Statewide	Metro North catenary replacement.	183,566	34,593	71,770	123,173
Metro North Devon Bridge	Milford	Rehabilitate Devon Bridge across Housatonic River.	11,750	0	0	11,750
Metro North Power	New Haven	Increase New Haven Line voltage levels relative to operating needs.	7,000	1,000	6,000	6,000
Metro North S-12 Bridge Repair Program	Statewide	Support continuing bridge maintenance program.	2,000	0	2,000	0
Metro North Storage Yard	New Haven	Construct a 100 rail car storage/service area.	72,009	68,509	3,500	3,500
Metro North Substation Improvements	Statewide	Electric substation safety program. Improve safety per FRA regulations.	4,000	0	4,000	4,000
Metro North Substations	Statewide	Replace five New Haven Line substations.	19,500	0	19,500	19,500
Metro North Track Program	Statewide	Support continuing track maintenance program with capital funds.	12,000	0	12,000	9,500
Metro North Transportation Building	New Haven	Construct communications and signals (catenary maintenance) crew building.	2,300	0	0	2,300
Metro North Wheel Truing Facility	New Haven	Expand/improve maintenance and repair capabilities.	8,000	0	8,000	8,000
Multiple Unit (MU) Fleet Replacement	Southwest	Replace Connecticut owned Metro North fleet subsequent to 2008. specifications in FY04.	4,918	0	4,918	4,918
New Haven Yard Fuel Facility	New Haven	Renovate existing locomotive fueling facility to meet current environmental and building requirements.	2,000	0	2,000	2,000

Table 35: Selected Transportation Improvement Program Commitments. Plan proposals build on Fiscal Year 2003-Fiscal Year 2005 *Transportation Improvement Program* commitments—relying on a mix of U.S. Federal Highway Administration, U.S. Federal Transit Administration, ConnDOT and municipal support. (Source: SCRCOG, FY03-FY05 *Transportation Improvement Program: Through Amendment 10* (North Haven: SCRCOG, November, 2003).

Selected Projects: Highways
Thousands of Dollars

Project Name (Route)	*Municipality*	*Cost*				*Project Description*	*Start (Year)*
		Total	*Pre-FY03*	*FY03-05*	*After FY03*		
Freeways							
I-91	New Haven	12,750	1,500	0	11,250	Reconstruct a new I-91 northbound exit at Route 80 (exit 8).	2006
I-91	Wallingford	15,766	9,750	6,016	0	Widen Route 68 bridge over I-91 to five lanes and improve termini of existing ramps (Ph 1)	in progress
I-91 Incident Management	Meriden	3,810	350	0	3,460	New I-91 incident management system from exit 16 to northbound exit 18.	2005
I-91 Incident Management	New Haven	1,700	0	1,700	1,700	New I-91 incident management system from I-95 to exit 8.	2004
I-95	West Haven	26,700	2,090	24,610	14,610	Relocate northbound on- and off-ramps at exit 42 (Route 162, Saw mill Road).	in progress
I-95 Central Program (D)	Branford	42,163	13,114	29,049	7,195	Widen I-95 from four to six lanes between east end of the Lake Saltonstall Bridge and Cedar St.	in progress
I-95 Central Program (C1)	East Haven	44,249	0	44,249	0	Widen I-95 from 6 to 8 lanes between East Haven/New Haven Line (west of westerly US1 ramps) and the US1 Frontage Rd and widen I-95 from 4 to 6 lanes between the Frontage Rd and Lake Saltonstall.	in progress
I-95 Central Program (C2)	New Haven	81,152	2,546	66,794	74,760	Widen I-95 to 10 lanes between Q Bridge and Woodward Ave and 8 lanes between Woodward Ave and the New Haven/East Haven Line (west of westerly US1 Frontage Rd ramps).	2004
I-95 Central Program (E)	New Haven	252,023	3,600	35,301	248,423	Reconstruct I-95/I-91/Rt 34 interchange to accommodate new 10-lane Quinnipiac River Bridge .	2004
I-95 Central Program (B)	New Haven	407,716	26,358	117,189	367,558	Construct a new 10-lane bridge across New Haven Harbor between Route 34/I-91 interchange and Stiles Street.	2005

Table 35 :Selected Transportation Improvement Program Commitments (Continued).

Selected Projects: Highways
Thousands of Dollars

Project Name (Route)	*Municipality*	*Cost*				*Project Description*	*Start (Year)*
		Total	*Pre-FY03*	*FY03-05*	*After FY03*		
Freeways							
Long Wharf Shoreline (I-95 Central Program)	New Haven	4,000	0	4,000	4,000	Restore shoreline adjacent to Long Wharf Drive between (approx) Canal Dock Rd and west end of Long Wharf Dr.	2005
Long Wharf Boathouse (I-95 Program)	New Haven	30,000	0	30,000	30,000	Construct deck structure and municipal Boathouse on Parcel H (Long Wharf Dr and Canal Dock Rd); incorporating architectural features salvaged from the former Yale Boathouse.	2005
I-95 Housatonic River Bridge	Stratford Millford	124,019	7,500	11,100	116,519	Replace the current six-lane bridge with a new structure to the north (west) of the existing bridge.	2005
I-95 Incident Management	Branford, Guilford Madison	7,700	0	7,700	7,700	Extend I-95 incident management system east from Leetes Island Road (Branford) to Rt 145 (exit 64, Westbrook).	2005
I-95 Incident Management	Statewide	27,470	13,970	13,500	4,500	Operate ConnDOT's Bridgeport incident management center 24 hours a day, seven days a week (New York State line to Branford).	ongoing
Highways							
Route 10	Hamden	873	0	50	823	Improve Whitney Avenue/Rt 22 intersection.	unclear
Route 10 (Whitney Ave)	Hamden	2,521	1,110	0	1,411	Realign Westwoods Road-Mt. Carmel Avenue at	unclear
Route 122 (First Ave) Culvert	West Haven	658	10	648	648	Replace culvert at base of I-95 sb off-ramp.	2005
Route 146	Guilford	761	180	581	581	Drainage improvements at five locations along	2004
Route 162 (Jones Hill Road)	West Haven	656	0	210	456	Improve Route 162 (Jones Hill Rd)-(Platt Ave) intersection.	unclear
Route 162 (Old Gate Lane)	Milford	1,353	130	1,223	0	Reconstruct, widen and realign Old Gate Lane from 500' north of the Metro North main line to Route 162 (New Haven).	2004
Route 34	West Haven	577	81	496	0	Add second Route 122 southbound left turn lane.	2004
Route 40	Hamden	289	0	289	0	Improve Route 40-Rt 10 (Whitney Avenue) intersection.	2004

Table 35 :Selected Transportation Improvement Program Commitments (Continued).

Selected Projects: Highways

Thousands of Dollars

Project Name (Route)	*Municipality*	*Cost*				*Project Description*	*Start (Year)*
		Total	*Pre-FY03*	*FY03-05*	*After FY03*		
Route 63	Woodbridge	1,829	169	35	1,660	Add nb Rt 63 left hand turn lane at Rt 67.	unclear
Route 63 (Whalley Ave)	New Haven	6,700	700	0	6,000	Widen Whalley Avenue to four full lanes between Emerson Street and Amity Road.	2006
Route 740 (Brushy Plains	Branford	3,028	100	0	2,928	Realign between Brookwood Dr. and Williams Rd.	unclear
Route 80	North Branford	5,994	2,700	0	3,294	Widen from two to four lanes from easterly leg of	2006
Route 80	North Branford	9,000	0	9,000	9,000	Widen from two to four lanes from west of railroad bridge w/o Rt 139 to Twin Lakes Road.	2004
US 1	Branford	32,800	2,800	15,000	30,000	Widen US1 under Amtrak main line between Cherry Hill Connector (SR794) and Route 142 from four to six lanes; replace bridge over US1.	2004
US 1	Branford	1,930	0	1,930	1,930	Improve Mill Plain Rd intersection and replace adjacent bridge over Branford Water Supply System.	unclear
US 1	Milford	700	0	700	0	US1 turn lane additions at Rivercliff Dr.	2004
US 1	Milford	3,755	0	0	3,755	US1 left turn lane additions between I-95 exit 34 and Silver Sands Parkway; provide 5 lane section where possible.	unclear
US 1	Milford	1,520	0	200	1,520	Add US1 left turn lanes at Meadow St and High St.	unclear
US 1	Milford	5,400	900	0	4,500	Selectively add US1 left hand turn lanes between Roses Mill Road and Orange Town Line.	unclear
US 1	Orange	7,000	1,400	0	5,600	Widen to five continuous lanes between Milford City Line and Rt 114.	unclear
US 1	Orange	3,520	950	2,570	2,570	Widen to five continuous lanes between Rt 114 and Rt 162.	2004
US 1	West Haven	2,739	350	600	1,789	Realign Route 122 northbound approach to US 1.	unclear
US 5	Wallingford	715	0	0	715	Widen US 5 to add opposing left hand turn lanes Toelles Road and Route 702 (I-91 connector)	unclear
US 5 Drainage Improvements	Meriden	3,945	655	10	3,280	Reconstruct US 5 between Gypsy Lane and Olive Street and between East Main Street and Camp Street.	unclear
US 1	Branford	3,250	50	3,200	3,200	Improve Cherry Hill Rd and Cedar St intersections.	2004

Table 35 :Selected Transportation Improvement Program Commitments (Continued).

Selected Projects: Highways
Thousands of Dollars

Project Name (Route)	*Municipality*	*Cost*				*Project Description*	*Start (Year)*
		Total	*Pre-FY03*	*FY03-05*	*After FY03*		
Key Local Roads							
Gulf Street Bridge	Milford	3,464		2,714	750	Replace bridge over Indian River.	2004
Farwell Street	West Haven	3,340		500	3,340	Reconstruct between US1 and Ardale St.	2006
Britannia Street	Meriden	5,646	4,750	896	0	Realign at North Colony Street.	in progress
Dodge Avenue	East Haven	2,664	15	2,649	2,649	Reconstruct between Tuttle Brook and Prospect Pl.	2004
Ferry Street Bridge (including $6.0 million state and $2.0 mil federal earmark)	New Haven	3,000	0	3,000	10,200	Replace bridge over Quinnipiac River	2005
Gravel Street-Baldwin Street	Meriden	3,389	250	3,139	3,139	Reconstruct between E. Main St and Baldwin St	2005
Hubbard Road	Guilford	1,633	0	1,633	1,633	Extend east from e/o Long Hill Rd across West River.	2005
Indian River Road	Orange	2,276	750	1,526	1,526	Widen between Marsh Hill Rd and Brindle Hill Rd	in progress
North Colony Street	Meriden	3,521	750	2,771	2,771	Reconstruct between Center St and Hill St.	2004
Shepherd Avenue	Hamden	1,308	50	1,262	1,262	Widen and realign between Whitney Ave and 1,700' w/o Whitney Ave.	in progress
State Street Bridge	New Haven	2,315	0	2,315	2,315	Replace Street Bridge over the Mill River.	2005
Traffic Signal Mast Arm	New Haven	105	0	105	0	Inspect 180 City of New Haven signal poles at 83 intersections per safety concerns.	2004
Waite Street Bridge	Hamden	1,111	0	1,111	1,111	Replace the 65 year-old Waite Street bridge over Lake Whitney.	2005
Waterfront Street	New Haven	5,625	0	5,625	5,625	Reconstruct Waterfront Street between US1 (Forbes Avenue) and the Harbor Generating Station and reestablish rail freight service. Project estimate now circa $11 million including right-of-way/relocation and incidentials/inspection/utilities.	2005-08
Whitney Avenue Signals	Hamden	1,248	0	197	1,248	Replace nine signals and extend coordination among Whitney Avenue intersections between the New Haven City Line and Glendower Road/Ridgewood Avenue.	2006

Table 35 :Selected Transportation Improvement Program Commitments (Continued).

25 Year Highway Program

Fiscal Year 2004 Thru Fiscal Year 2028 Obligations [1]

Thousands of Dollars

				25-Year Period [3]		
			Source [2]	Early Years	Later Years	Total
Freeways						
Current Transportation Improvement Program Commitments						
I-91	New Haven	revise Route 80 interchange: more capacity		11,250		11,250
I-91	Wallingford	revise Route 68 interchange and widen Route 68 bridge (Phase One, in progress)		0		0
I-91	Meriden	new incident management system between exit 16 and 18		3,460		3,460
I-91	New Haven	new incident management system between I-95 and exit 8 (Route 80)		1,700		1,700
I-95	West Haven	relocate northbound ramps at Sawmill Rd (Route 162)		14,610		14,610
I-95	Branford	extend incident management system east to Route 145 (Westbrook)		7,700		7,700
I-95	Milford	replace Moses Wheeler Bridge (Housatonic River, cost via "system preservation"); $117 of $124 million not yet obligated.		0		0
I-95	New Haven	replace bridge over West River, realign ramps and surface street ($82.5 million as system preservation)		0		0
I-95 Central Program [4]	New Haven	new Quinnipiac Bridge and approaches (Contract B)	statewide	367,558		367,558
I-95 Central Program [4]	Branford	widen between Lake Saltonstall and Cedar Street (Contract D)	statewide	7,195		7,195
I-95 Central Program [4]	East Haven	widen between New Haven Line and Lake Saltonstall (Contract C1, fully obligated)	statewide	0		0
I-95 Central Program [4]	New Haven	widen between Q Bridge and East Haven Line Contract (C2)	statewide	74,760		74,760
I-95 Central Program [4]	New Haven	reconstruct I-95/I-91/Rt 34 interchange (Contract E)	statewide	248,423		248,423
I-95 Central Program [4]	New Haven	long wharf shoreline restoration		4,000		4,000
I-95 Central Program [4]	New Haven	new boathouse near Canal Dock Road		30,000		30,000
New Plan Elements						
I-91	Wallingford	revise Route 68 interchange and widen Route 68 bridge (Phase Two) (1)			15,000	15,000
I-95 Central Program [5]	New Haven	widen to 8 thru lanes between Route 34 and Kimberly Avenue and associated local roadway improvements		90,000	20,000	110,000
I-95 Central Program [6]	New Haven	abandon Long Wharf Drive and expand Veterans Memorial Park		3,100		3,100
I-95 Central Program [6]	New Haven	new Long Wharf ring road; alternate to Sargent Drive		17,000		17,000
I-95 Central Program [6]	New Haven	new Long Wharf ramps to Route 34			41,800	41,800
I-95 Central Program [6]	New Haven	purchase Wyatt-Williams site for ferry-commercial development		23,800		23,800
I-95	East Shore	widen from four to six lanes east of cedar street per ConnDOT's emerging "I-95 Branford to Rhode Island Feasibility Study" and pre-Study ConnDOT $800 million project cost ($136 mil to this region).	statewide	136,000		136,000
I-95 Operations Study	West Shore	widen from six to eight lanes between boulevard and housatonic river; advanced planning-preliminary engineering-environmental assessment.		1,000		1,000
I-691	Meriden	add new westbound access at Chamberlain Highway (Rt 71)			12,000	12,000

Table 36: A Mid-Range Highway Program. A 25-year spending plan accomplishes important central area I-95 improvements and leaves considerable mid-term slack ("Later Years") to consider major new transit proposals expected in early 2005 and for significant new arterial commitments.

25 Year Highway Program
Fiscal Year 2004 Thru Fiscal Year 2028 Obligations
Thousands of Dollars

				25-Year Period	
			Source	*Early Years*	*Later Years*	*Total*
Arterials						
Current Transportation Improvement Program Commitments						
Route 10	Hamden	improve Whitney Avenue/Rt22 intersection		823		823
Route 10	Hamden	realign Westwoods Rd/Mt Carmel Ave intersection		1,411		1,411
Route 122 (First Ave)	West Haven	replace culvert (system preservation, $648,000)		0		0
Route 146	Guilford	drainage improvements at five locations (system preservation, $581,000)		0		0
Route 162	West Haven	improve Jones Hill Rd/Platt Ave intersection		456		456
Route 162	Milford	reconstruct/realign Old Gate Lane near Metro North		1,223		1,223
Route 34	West Haven	add second southbound turn lane (FY03 obligation)		0		0
Route 40	Hamden	improve Rt 40/Whitney Ave intersection (FY03 obligation)		0		0
Route 63	Woodbridge	add left turn lane at Rt 67		1,660		1,660
Route 63 (Whalley Ave)	New Haven	widen to four lanes between Emerson St and Amity Rd		6,000		6,000
Route 740 (Brushy Plains Road)	Branford	realign between Brookwood Dr and Williams Rd		2,928		2,928
Plains Road)						
Route 80	North Branford	widen from two to four lanes from easterly leg of Route 22 (North Branford		3,294		3,294
	Branford	Center) to west of (including) railroad bridge w/o Rt 139.				
Route 80	North Branford	widen from two to four lanes from west of railroad bridge w/o Rt 139 to Twin		9,000		9,000
	Branford	Lakes Rd				0
US 1	Branford	widen under Amtrak main line between Cherry Hill Connector and Rt 142		30,000		30,000
US 1	Branford	improve Mill Plain Rd intersection and replace adjacent US1 bridge		1,930		1,930
US 1	Milford	US1 turn lanes at Rivercliff Dr (obligated)		0		0
US 1	Milford	US1 left turn lane additions between I-95 exit 34 and Silver Sands Parkway		3,755		3,755
US 1	Milford	add US1 left turn lanes at Meadow St and High St.		1,520		1,520
US 1	Milford	selectively add US1 left hand turn lanes between Roses Mill Rd and Orange Line		4,500		4,500
US 1	Orange	widen to five continuous lanes between Milford City Line and Rt 114		5,600		5,600
US 1	Orange	Widen to five continuous lanes between Rt 114 and Rt 162		2,570		2,570
US 1	West Haven	realign Route 122 northbound approach to US 1		1,789		1,789
US 5	Wallingford	widen US 5 to add opposing left hand turn lanes at Toelles Rd and I-91 ramp		715		715
		Toelles Road and Route 702 (I-91 connector)				
US 5 Drainage Improvements	Meriden	reconstruct US 5 between Gypsy Lane and Olive St and between E. Main St and		0		0
		Camp St (system preservation, flooding, $3,280,000)				
US 1	Branford	Improve Cherry Hill Rd and Cedar St intersections.		3,200		3,200

Table 36: A Mid-Range Highway Program (Continued). A second 1,000 space Union Station (New Haven) garage will be built by the New Haven Parking Authority or by the private sector.

25 Year Highway Program
Fiscal Year 2004 Thru Fiscal Year 2028 Obligations
Thousands of Dollars

				25-Year Period [3]		
			Source [2]	*Early Years*	*Later Years*	*Total*
Major Transit Improvements (Beyond Current Program Commitment)						
Union Station Garage	New Haven	build second 1,000 space garage adjacent at Union Station to relieve shortfall (accomplish $25 million project per New Haven Parking Authority revenue bonds or private finance)		0		0
Orange/West Haven Rail Station	Orange/ West Haven	1,000 space metro north station (one of two preferred locations) (all costs including roadways)		36,000		36,000
Curbside Bus Enhancements	New Haven (largely)	major boarding area/curbside adjustments enhancing transit attractiveness and limiting bus/auto friction (beyond current commitments)		1,500	1,500	3,000
Milford Railroad Station	Milford	expand parking by 200-250 spaces via parking deck(s)		3,000		3,000
Shore Line East Stations	East Shore	expand Guilford, Madison and Branford parking beyond initial construction; up to 200 additional spaces each		6,000		6,000
Intelligent Transportation Systems (Beyond Programmed Commitments)						
Incident Management	Region	replace outmoded I-95 west system; 12 miles, $1 million/mile (via system preservation)		0		0
Incident Management	Region	manage Bridgeport control center (thru 02, one half cost) (via system preservation)		0		0
Traffic Control	Region	extend recent comprehensive signal review /adjustment program		1,000	1,000	2,000
Information Systems	Region	new short-term goals per national experience		100		100
Ramp Metering	Region	define/refine mid-range freeway role		250		250
Transportation Enhancement						
Committed						
Quinn River Trail	Wallingford	extend multipurpose trail north across River; $900,000 federal-local committed plus additional $512,000 local support beyond match		0		0
Quinn River Trail	Meriden	extend multipurpose trail west of Oregon Road:		744		
Farmington Canal	Hamden	extend multipurpose trail; $933,000 right-of-way committed		0		0
Farmington Canal	New Haven	extend multipurpose trail; Munson St to Starr St		728		
Town Center	North Haven	town center streetscape		569		569
Others	Various	stream-wetland improvements in West Haven and Branford		475		475
New Plan Elements						
Farmington Canal	Hamden	extend multipurpose trail from Starr St (New Haven) to Connolly Pkway (Hamden)		3,223		3,223
Farmington Canal	New Haven	extend multipurpose trail from Lock St to Orange St		3,089		3,089
Farmington Canal	New Haven	extend multipurpose trail from Orange St to Water St (bicycle lanes)			320	320
Farmington Canal	New Haven	extend multipurpose trail from Water St to Harbor (mix of lanes and exclusive row)			430	430
Harborside Trail	West Haven/ New Haven	multipurpose trail extending Savin Rock Trail around Harbor to Lighthouse Point Park (New Haven)			10,220	10,220

Table 36: A Mid-Range Highway Program (Continued).

25 Year Highway Program
Fiscal Year 2004 Thru Fiscal Year 2028 Obligations
Thousands of Dollars

				25-Year Period	
			Source	*Early Years*	*Later Years*	*Total*
Transportation Enhancement						
New Plan Elements (Continued)						
West River Trail	New Haven	multipurpose trail thru West River Park to Southern Conn State University (mix of lanes and exclusive right-of-way)			4,500	4,500
Fair Haven Trail	New Haven	multipurpose trail looping over Ferry St and Grand Ave bridges; includes exclusive right-of-way thru Front St-Criscuolo Park along Quinnipiac River			4,270	4,270
Quinn River Trail	Wallingford	senior center connector; to Quinn River Trail		696		696
Earmarked Support	Region	to be determined (via Surface Transportation Program setaside)		5,000		5,000
Municipal Roads and Bridges						
Committed	Region	surface transportation program "urban"; continue at allocated $5.0 million annual federal		30,893		
New Per Plan	Region	New Haven-Meriden area and $0.6 million annual federal Milford funding levels		50,232	87,500	137,732
New Per Plan	New Haven	Waterfront St reconstruction and rail service restoration. $12.0 mil total cost; $5.6 million committed (above)		6,375		6,375
Other						
Region		enhance Rideworks capacity to deliver a "full service" product: move beyond current annual commitment		2,000	2,000	4,000
SCRCOG Regional Spending Proposal				1,275,804	200,540	1,476,344
projects of statewide significance (for central I-95 program and I-95 East, current conndot estimate)				833,936	0	481,558
other				441,868	200,540	994,786
ConnDOT "New Capacity" Spending Guide (Total)				1,276,700	562,700	1,839,400
projects of statewide significance (for central I-95 program and I-95 East, 7/03 conndot estimate)				714,000	0	714,000
other				562,700	562,700	1,125,400

(1) Includes all FY04 and later costs associated with project's contained in the region's FY03-FY05 Transportation Improvement Program as of November, 2003 and reflected in "Selected Projects: Highways".
(2) "Statewide" indicating "major projects of statewide significance identified in a July 28, 2003 "Allocation of Anticipated Funds to Connecticut Planning Regions (2004-2025) from *Charles S. Barone, Transportation Planning Director, Bureau of Policy and Planning; period later revised to 2004-2028. Applicable only to highway funds.*
(3) Generally two 12 to 13 year periods.
(4) Per the region's FY03-FY05 Transportation Improvement Program and summarized for SCRCOG per an August 6, 2003 memo from ConnDOT's Office of Fiscal/Special Projects drawn from the Department's then-current "Central I-95 Financial Plan" required of all projects with an estimated cost of $1 billion or more per Section 1305 of TEA-21.
(5) Per Parsons Brinckerhoff, Preliminary Engineering Study, New Haven Harbor Access, State Project 92-525, prepared for ConnDOT (Newington: ConnDOT, 2002)
(6) PerCity of New Haven, "New Haven Harbor Access, December 11,2002 Presentation by Mayor John DeStefano to South Central Regional Council of Governments, PowerPoint.

Table 36: A Mid-Range Highway Program (Continued).

Appendix A: Demand and Performance

The Council's trip generation-distribution-assignment process brings expected land use change and transportation system capabilities into a common framework. Network-based capabilities and mode split estimates provide a reasonable quantitative dimension. Efforts focus on AM and PM peak hour highway and transit assignments to regional networks—assignments intended to produce reasonable order of magnitude performance estimates to guide decision-making. *Plan*-related estimates, framed through the 2000-01 period, necessarily draw on a pre-2000 Census Year 2000-2025 database and a MINUTP-based model chain—both being replaced through the 2003-2004 period.[1]

Highway and Transit Networks

"Base year" or year 2000 networks:

- *build on 378 internal traffic zones, 2,800 highway nodes and 6,000 directional highway links.* The standard directionally-oriented data base, comprehensively revised in 2000, defines link distance, travel lanes, coordinates, highway facility or type, area type and average daily traffic for each link.[2] Area type and highway class point to a free flow speed and "practical capacity" in an associated speed/capacity table (Table A-1).

- *reflect 13 external stations*. External stations along freeways and major arterials use ground counts to balance internal-external and external-internal trips generated during the trip distribution process.

- *reflect available regional transit service*. Networks reflect peak hour Connecticut Transit, Dattco (east shore bus), Amtrak (Hartford-to-New Haven) , Shore Line East (New Haven-to-Old Saybrook) and Metro North (west shore) service.[3] Local Meriden, Milford and Wallingford fixed routes are omitted due to their limited scale limited scale.

- provide supplementary pedestrian links and auto connectors that access the transit system. Auto connectors extend up to five miles from commuter rail stations and Connecticut Department of Transportation "park an ride" lots served by Connecticut Transit. Associated "out of vehicle time" impedances and mode split coefficients degrade patronage rather than imposing arbitrary "transit market" limits. "Walk to" rail opportunities are limited to a 0.50 mile station distance given observed travel behavior.

Trip Generation

Connecticut Department of Transportation "series 26" zonal data, SCRCOG zonal disaggregation, external station (cordon) ground counts and ConnDOT trip generation equations suggest daily or weekday person trips in the region.

Zonal Data: 2000-2025

Activity

SCRCOG disaggregates the Connecticut Department of Transportation's basic "1300 zone" system to complementary regionally-oriented highway and transit networks.[4] ConnDOT zonal level population, employment estimates, initially suggested by ConnDOT via a modified trend analysis, are revised to reflect anticipated development after consulting with municipalities and the Depart-

ment.[5] Resultant "series 26"growth patterns applied to smaller Council zones reflect a mix of *1990 Census Transportation Planning Package* data, vacant land, municipal development policies and a ConnDOT major generator file associated with State Traffic Commission permits.[6]

Related Trip Generation Data

Zonal automobile availability rates and income data basic to ConnDOT trip generation equations are drawn directly from the Department's estimates. Auto availability rates and income distributions in smaller COG-defined zones (disaggregated ConnDOT zones) reflect those of larger "parent" zones.[7]

Daily Person Trips

ConnDOT production and attraction equations originally developed from the state's now 25-year-old home interview survey and incrementally modified via a succession of national and Connecticut data are adopted for internal home-based work trips, home based other trips and non-home based trips per longstanding practice (Tables A-2 and A-4).[8]

External Trips

With One Internal Trip End. Council applications adopt a default MINUTP mode addressing external-internal (X-I)and internal-external (I-X) trips as unique trip purposes. 1990 Census Transportation Planning Package home-based work trip I-X/X-I data suggest the fraction of a zone's travel moving beyond the region (A-5). Non-home based and home based other "fractions" or factors are taken as 75 percent of the home-based work trip rate correlate with friction factor relationships. Directionally-oriented cordon station ground counts balance the distribution of I-X and X-I trips among external stations–outbound counts balancing I-X trips.[9]

Movement Through the Region. Connecticut Department of Transportation statewide trip tables and networks capture through or external-external daily movements along the freeway system as unique year 2000, 2010 and 2025 daily trip tables; tables eventually "split" by time of day and assigned to the Council's regional highway network.[10]

Trip Distribution

Standard gravity model applications and Connecticut Department of Transportation friction factors establish zone-to-zone "production and attraction" relationships for internal home-based work, home-based other and non-home based person trip tables.[11]

Peak Hour Trip Splitting

ConnDOT statewide home interview data help split or factor daily trip production and attraction tables relative to hour and direction (Table A-6). Council trip splitting equations draw on ConnDOT directional data and University of Texas peak period-to-peak hour travel research.[12] Texas Transportation Institute research suggests peak period-to-peak hour relationships apt to produce better assignments—notably associating about 45 percent of demand in the three hour peak period with the peak hour.

Assignment

A stochastic assignment loads the region's directionally-oriented peak hour trip tables on to standard regional highway and transit networks. Assignments usually produce "closure" or equilibrium within 20 iterations. Link-by-link highway calibration between base year directional volumes and assignments help adjust "future year" assignments.[13] Transit assignments follow an "all or nothing" (least impedance) path given available software.[14]

Capacity (Vehicles per Lane per Hour)
Speed (Miles per Hour)

Area	*Facility Type*									
Type	0	1	2	3	4	5	6	7	8	9
1	1,500	1,750	800	600	700	10,000	750	800	1,200	1,000
Dow ntow n New Haven	50	48	25	30	22	10	25	30	40	30
2	1,500	1,750	700	600	550	10,000	650	700	1,200	1,000
(Fringe)	50	48	30	35	25	15	30	35	40	30
3	1500	1750	750	600	550	10,000	700	800	1200	1000
Residential	50	67	35	35	28	15	35	40	40	30
4	1,500	1,750	750	600	550	10,000	700	750	1,200	1,000
Other Dow ntow ns	50	67	25	30	22	15	25	30	40	30
5	1,500	1,750	850	1,000	600	10,000	800	1,000	1,200	1,000
Rural	50	67	40	45	30	15	40	45	40	30

Table A-1: Speed/Capacity Table. Area and facility type "point to" free flow speed and practical capacity; they help "update" speeds via a modified "BPR" (Bureau of Public Roads) formula as iterations proceed. "Practical capacity" suggests reasonable service at about 75 percent of absolute capacity.

Code	***Facility Type***
0	Freew ay-to-freew ay ramps
1	Freew ay
2	Tw o-w ay arterial w ith left-turn lanes (no parking)
3	Tw o-w ay arterial w ith parking permitted
4	One-w ay arterial w ith parking permitted
5	Centroid Connector (All Other)
6	Tw o-w ay arterial w ith no parking permitted
7	One-w ay arterial w ith no parking permitted
8	On ramps
9	Off ramps

Household Income (1990 Dollars)

Household Income ($)			*Daily Home-Based Work Productions*			
			0 cars	*1 car*	*2 cars*	*3+ cars*
less than 13,740			1.00	1.00	1.00	1.65
13,740	to	18,318	1.00	1.15	1.40	2.13
18,319		22,898	1.00	1.25	1.60	2.32
22,899		27,478	1.12	1.37	1.80	2.50
22,479		34,348	1.13	1.50	2.07	2.80
34,349		57,248	1.13	1.62	2.15	3.13
57,249		114,500	1.13	1.62	2.15	3.25
over 114,500			1.13	1.62	2.15	3.25

Table A-2: Home-Based Work Trip Productions. *A cross-classification matrix generates daily home-based work productions. Zonal aggregates are adjusted by a split index suggesting the percentage of trips with destinations beyond the region (Table A-4).*

Home-Based Other Trips
Productions

Autos/ Household	*Daily Productions*
0	1.329
1	3.179
2	4.757
3	5.074

Table A-3: Home-Based Other Trips—Productions. Productions are aggregated from zonal data (households-auto relationship), "split" between internal and external trips and, per Connecticut Department of Transportation practice, a 1.19 inflation/correction factor is applied to account for under-reporting in the original ConnDOT household survey.

Other Productions and Attractions
Internal Trips
** times*

Daily Productions (Person Trips)

non-home based = (2.242564 * retail employment) * [correction for a town level internal/external split] +
(0.271 * non-retail employment) * [correction for a town level internal/external split] +
(.204 * population) * [correction for a town level internal/external split] +
92

Daily Attractions

home-based work = (1.5427 * total employment) * [correction for a town level internal/external split] +

home-based other = (.762 * population) * [correction for a town level internal/external split] +
(7.59198 * retail employment) * [correction for a town level internal/external split] +
(.393 * non-retail employment) * [correction for a town level internal/external split]

non-home based = (2.42564 * retail employment) * [correction for a town level internal/external split] +
(.271 * non-retail employment) * [correction for a town level internal/external split] +
.204 * population) * [correction for a town level internal/external split] +
92

Table A-4: Production and Attraction Equations. Connecticut Department of Transportation "production and attraction" equations guide COG internal trip generation.

Trips Beyond the Region
Home-Based Work Trips (Persons)
Percent

	Internal to External	External to Internal
Bethany	35	26
Branford	14	11
East Haven	13	10
Guilford	17	18
Hamden	17	17
Madison	29	31
Meriden	33	32
Milford	46	35
New Haven	11	15
North Branford	15	15
North Haven	16	18
Orange	30	22
Wallingford	21	23
West Haven	19	14
Woodbridge	21	20

Table A-5: External Trips. Internal-external and external-internal trips are estimated via reference to 1990 journey-to-work experience—they are scaled from each of the three basic trip purposes and directed to external stations ("balanced") via ground counts. Townwide averages are illustrated above.

Daily (Weekday) Traffic
Selected Movement

From/To	1990	2000	2010	2020
I-95 (Housatonic River) to to I-95 (Madison/Clinton Line)	11,600	15,300	19,300	21,000
I-95 (Madison/Clinton Line) to I-95 (Housatonic River)	11,600	15,300	19,300	21,000
I-95 (Housatonic River) to Route 15 (Meriden/Berlin Line)	400	500	600	700
Route 15 (Meriden/Middletown Line) to I-95 (Housatonic River)	400	500	600	700
I-95 (Housatonic River) to I-91 (Meriden/Middletown Line)	10,000	13,200	16,700	18,100
I-91 (Meriden/Middletown Line) to I-95 (Housatonic River)	10,000	13,200	16,700	18,100
I-95 (Madison/Clinton Line) to Route 15 (Housatonic River)	1,300	1,800	2,200	2,400
Route 15 (Housatonic River) to I-95 (Madison/Clinton Line)	1,300	1,800	2,200	2,400
Route 15 (Housatonic River) to Route 15 (Meriden/Middletown Line)	300	400	500	500
Route 15 (Meriden/Middletown Line) to Route 15 (Housatonic River)	300	400	500	500
Route 15 (Housatonic River) to I-91 (Meriden/Middletown Line)	3,000	3,900	5,000	5,400
I-91 (Meriden/Middletown Line) to Route 15 (Housatonic River)	3,000	3,900	5,000	5,400

Table A-6: Through Traffic. ConnDOT estimates of traffic simply passing through the region or "external-external" traffic captured from state assignments provide a final trip table before highway assignment. Even relatively conservative state estimates of growth in "thru" traffic, less than one percent per year, suggest substantial "year 2020" congestion in the absence of freeway improvements.

Trip Splitting
Connecticut Department of Transportation Home Interview Data

	AM Peak Period					PM Peak Period					
	5-6A	*6-7A*	*7-8A*	*8-9A*	*9-10A*	*2-3P*	*3--4P*	*4--5P*	*5-6P*	*6-7P*	*Daily*
Trips Starting at Home											
Home Based Work	179,191	376,302	235,244	62,957	16,242	165,954	298,167	231,646	64,896	17,900	1,935,280
from home	176,723	364,442	229,572	60,572	13,853	23,160	16,140	14,749	10,325	2,971	1,029,966
from w ork	2,468	11,860	5,672	2,385	2,389	142,794	282,027	216,897	54,571	14,929	905,314
percent from home	99	97	98	96	85	14	5	6	16	17	
percent of daily hbw trips (2 w ay)	9.3	19.4	12.2	3.3	0.8	8.6	15.4	12.0	3.4	0.9	
Total Home Based Other	28,185	94,064	138,831	212,903	259,199	300,585	320,903	284,320	318,760	320,720	3,829,184
Home Based Other: Originated at Home											
related business	1,883	3,006	6,947	2,764	1,713	2,400	369	614	1,292	2,948	31,721
shopping	895	3,151	11,746	57,623	101,396	40,699	36,733	30,357	54,971	59,255	582,586
personal business	4,605	19,693	35,259	68,929	56,563	39,082	38,555	36,181	57,335	61,238	591,191
social	263	1,372	5,849	9,776	17,921	10,219	15,539	9,840	28,101	39,867	219,365
recreation	2,179	2,695	5,874	10,855	4,423	8,556	4,621	12,103	34,612	30,519	157,885
serve passengers	12,430	43,591	42,256	17,466	5,927	23,948	22,599	17,585	19,022	11,931	277,397
Home Based Other: Originated Away from Home											
related business	0	113	141	558	1,240	5,299	10,492	7,327	2,085	3,030	44,609
shopping	1,085	1,675	1,922	11,633	32,615	73,235	75,372	62,131	54,535	44,895	716,574
personal business	372	2,115	7,007	20,447	30,336	52,415	56,796	51,021	31,329	31,864	586,713
social	0	0	187	946	1,850	16,918	20,534	17,423	12,290	13,542	231,657
recreation	0	928	0	669	1,779	5,950	8,195	10,920	8,289	11,218	156,584
serve passengers	4,473	15,725	21,643	11,237	3,436	21,864	31,098	28,818	14,899	10,413	232,902
Total Home-Based Other											
percent from home	79.0	78.1	77.7	78.6	72.5	41.6	36.9	37.5	61.3	64.2	
percent of daily hbo trips (2 w ay)	0.7	2.5	3.6	5.6	6.8	7.8	8.4	7.4	8.3	8.4	
Total Non-Home Based	6,585	32,885	70,754	91,854	108,652	141,869	136,180	91,481	61,669	54,719	1,369,896
w ork	4,262	20,230	25,310	11,535	6,103	11,176	9,507	6,216	1,825	1,674	172,991
related business	369	2,984	10,829	16,076	22,455	11,725	6,912	3,362	1,092	1,103	139,921
shopping	346	3,997	16,104	34,564	44,053	47,171	45,640	32,522	22,030	20,235	398,560
personal business	128	1,545	9,704	21,378	24,871	34,861	33,031	24,118	17,636	15,685	370,031
social	0	212	634	3,016	3,488	10,459	11,158	6,443	5,045	7,806	88,296
recreation	0	0	1,603	1,311	3,366	6,667	5,294	4,100	6,924	3,437	49,898
serve passengers	1,480	3,917	6,570	3,974	4,316	19,810	24,638	14,720	7,117	4,779	150,199
percent of daily nhb trips (2 way)	0.5	2.4	5.2	6.7	7.9	10.4	9.9	6.7	4.5	4.0	
Total in Period	213,961	503,251	444,829	367,714	384,093	608,408	755,250	607,447	445,325	393,339	7,134,360
Maximum Three Hour Period			1,162,041	1,315,794	1,196,636			1,971,105	1,808,022	1,446,111	

Table A-7: Trip Splitting. The Connecticut Department of Transportation's 1976-1977 statewide home interview survey provides time-of-day and directional "trip splitting" factors. Peak hour "origin-destination" trip tables stem from all day "production-attraction" tables and trip splitting factors.

Appendix B: Mode Split Model

Analyses mesh a nested logit mode split model with a basic trip generation, distribution and network analysis process.[1] A focus on travel utility or impedance allows the model to represent a reasonably wide array of travel options and policy variables at the same time; e.g. suggest the impact of increasing both bus fare and schedule frequency while adding a new route to the system. "Disaggregate" model features address impacts among a cross section of the region's households.[2]

The Work Trip

Modeling focuses on the work trip where reasonably objective relationships between alternatives, utility and behavior are well-established.[3] Relationships between "journey-to-work" behavior or choice necessarily "drive" basic South Central Connecticut model estimates—much as they do across the nation.[4]

Nesting

A "nested logit model" (Figure B-1):

- allocates all travel between auto and transit;
- distributes transit travelers between "walk to transit" and "drive to transit";
- splits auto travelers between "drive alone" and "shared ride" modes; and
- distributes shared ride travelers among two, three and four-plus person modes.

Four related or "nested" multinomial logit models suggest a hierarchical relationship that, for example, reflects a greater likelihood that new "four-plus" car pools will be formed from current two and three person car-poolers.[5] Models guide basic mode choice, transit access path assessment, transit access choice and auto occupancy choice (shared riding). Utility relationships drawn from other urban areas are calibrated against observed local travel behavior to define their relative impact (utility or disutility) (Table B-1).[6] Travel time impedances (skims) and basic model structure produce seven basic personal travel modes—output tables assigned by highway and transit networks.[7]

Impedance

Basic highway and transit networks furnish supply-side in-vehicle travel times, out-of-vehicle travel times and out-of-pocket costs basic to the logit model. Key network based impedance estimates (Table B-2):

- *establish park and ride auto access, auto travel and bus travel times from "loaded networks".* Mode choice and assignment occur twice (a feedback loop) to ensure that final impedances that help shape mode choice reflect "loaded" or congested highway networks.
- *define a "walk to" transit market with a common 2.5 mile per hour (3.5 feet per second) speed.* Walk links and model relationships (a relatively high "out of vehicle" disutility) rapidly decay or diminish the "walk to" transit

market located beyond one quarter mile of transit routes.[8]

- *reflect all reasonable mode-to-mode transfers.* Park and ride (drive to bus and drive to train), walk and ride (walk to bus and walk to train) and drive (with appropriate terminal times) options are available. Alternate skims shape minimum auto and transit paths. Transfers among modes mirror "real world" possibilities; e.g. a transfer between Shore Line East rail and a downtown New Haven shuttle bus or "timed" (no wait, limited walk distance) transfers between Shore Line East and Metro North at Union Station.

- *prevailing commuter transit fares*. Fares represent the least cost discount package available to commuters.

- *reasonable transit waits*. Network wide "defaults" cluster passenger arrivals around scheduled service times per "real world" experience. Maximum waits are limited to the lesser of 10 minutes or one-half the scheduled headway.[9]

- *suggest prevailing Downtown parking costs.* Average Downtown New Haven "base year" parking costs confronted by workers draw on representative data—data suggesting over a 50 percent increase in long-term parking costs through early 1990's.[10]

- *reflect possible "strategies" or plan alternatives*. Network adjustments simulate "high occupancy vehicle lanes" (available to 2-plus person, three-plus person or four-plus person vehicles and buses), parking supply constraints (iterating increased terminal times to balance or establish constraint strategies), higher driving costs likely to ensue via increased fuel taxes (mileage or link related costs), transit fare adjustments and new transit services.

Other Trips

Non-work transit trips reflect the off-peak transit supply, household ownership and trip distance. "Look up tables" reflecting national experience and locally-relevant adjustments derived via calibration establish home-based other and non-home based transit shares (Table B-3).[11]

Strategies

Model structure allows reasonably rapid assessment of individual strategies (services) and packages or joint strategies. Representative SCRCOG applications include:

- *a motor vehicle fuel tax or surcharge.* "Out-of-pocket costs" are increased as a function of the surcharge and fleet fuel efficency levels. Network "skims" accumulate zone-to-zone mileage.

- *significant new transit commitments including those in Appendix C.* Route level configurations are represented by wait time, on-board time, walk time and fare.

- *an average $2.00 daily Downtown New Haven parking surcharge (all persons).* Parking costs are assessed directly via "zonal" data.

- *site specific parking constraints.* Iterative addition of "terminal times" provides a proxy for a parking constraint. Terminal times are incremented until total peak hour vehicle arrivals "balance" or reach a specified constraint.

Model form and variables impose analysis limits. Policy representations involving broad-based or universal costs (or constraints) are

readily represented as are those with a distinct geographic focus (applicable only in a given zone or on a given link as a toll). Conversely, policies that “attach to” a subset of travelers are difficult if not impossible to represent; e.g. favoring all car-poolers with reduced parking costs.

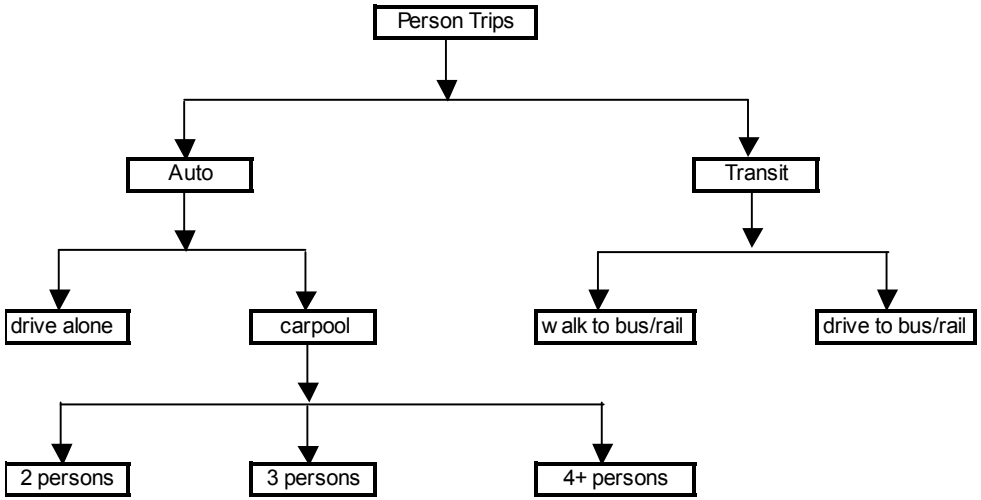


Figure B-1: A Nested Logit Model. Four related or "nested" multinomial logit models move beyond the notion of equally competing alternatives—suggesting a hierarchical relationship that, for example, reflects a higher likelihood that new "four-plus" carpools will be formed from present two and three persons carpoolers

Calibrated Values

Coefficients	
in vehicle travel time	-0.0250
out of vehicle travel time	-0.0500
parking cost	-0.0110
other cost	-0.0044
cbd (downtown) "flag"	0.5000
Log Sum Coefficients	
access model	0.60
path model	0.50
mode choice (auto/transit) model	0.80
auto occupancy model	0.35
Constants	
3 person carpool	-2.49
4 person carpool	-3.43
2+ shared ride	-2.84
drive access to transit, one car household	-0.50
drive access to transit, two plus household	-0.20
drive access to transit, all households (general)	-1.18
transit utility (disutility). zero car households	3.00
transit utility (disutility), one car household	-0.50
transit utility (disutility), two car household	-1.00
transit utility (disutility), all households	-1.51
home based other adjustment rate	0.95
non-home based other adjustment rate	2.45
out of pocket driving cost ($/mile)	0.12

Table B-1: Calibration. Coefficients and log sum coefficients are drawn from other areas. Local constants are recalibrated after each Census—derived from reported mode choice and the then-current transit system.

Impedance Inputs

Matrix	*Units*	*Notes*
Highway Terminal Time (Per Zone)		
origin time	minutes	
destination time	minutes	
Parking Cost (Per Zone)		
peak hour cost (per hour)	cents	identical peak and off
off-peak cost (per hour)	cents	peak values used
Walk Accessibility to Rail (Per Zone)		
accessible to bus at origin	percent	
accessible to bus at destination	percent	
Downtown CBD Indicator (Per Zone)		
dow ntow n New Haven location		yes or no
Transit Drive Acess Time		
total w alk time	minutes	to auto
total auto acess time	minutes	
total w ait time	minutes	max of 10 minutes or 1/2 headw ay
total transit run time	minutes	
total w alk time (at destination)	minutes	
Transit Walk Access Time		
total w alk time	minutes	
total w ait time	minutes	max of 10 minutes or 1/2 headw ay
total transit run time	minutes	
total w alk time (at destination)	minutes	
Transit Fare		
w alk access transit fare	cents	unique base fare per mode
drive access transit fare	cents	fare zones per mode
Highway Travel Time		
minimum travel time	minutes	
minimum travel distance	miles	

Table B-2: Impedance. Transit and highway networks generate impedances that reflect the "real world" travel environment

Adjustment Factors
Trip Length

Home-Based Other Trips

	Autos Per Household		
	0	1	2
0 to 1.0 mile	0.526	0.237	0.237
1.1 to 5 miles	0.642	0.181	0.181
5.1 to 10 miles	0.624	0.161	0.161
over 10 miles	0.516	0.151	0.151

Non-Home Based Trips

	All Households
0 to 1.0 mile	0.133
1.1 to 5 miles	0.133
5.1 to 10 miles	0.133
over 10 miles	0.127

Table B-3: Non-Work Shares. Work trip estimates "drive" national mode split models since more is known about the journey-to-work. "Look tables" reflecting national experience and locally-relevant adjustments derived by calibration compare work trip and non-work trip experience—they establish home-based and non-home-based transit shares.

Appendix C: Transit Supply, Response and Cost

Mode split estimates and current performance help establish the cost and effectiveness of mid-range transit options. Estimates address financially constrained, hold-the-line service; modest new commitments that move from a current 93 unit peak hour Connecticut Transit fleet to 114 buses; and a new 128 unit high speed centrally-oriented scenario intended to suggest how transit can utilize the region's freeway system.[1]

Supply and Demand

Fully allocated costs, current demand and current service arrangements establish a framework for near-term responses (Tables C-1 through C-9).[2] Maintaining current bus and paratransit commitments requires an $18 million a year operating subsidy and a $4 million annual capital budget. Shore Line East rail adds another $7 million a year to operating subsidy needs.

Year 2010: A New Connecticut Transit Commitment

Near-term service opportunities reflect alternate supply and service arrangements (Tables C-10 through C-21). Options that build on current (2001) transit supply costs:

- reflect varied peak-to-base service ratios. The "base" 2010 option (Option 1) maintains both current service and an existing 1.60 : 1 peak-to-off peak ratio. Option 2, offering limited arterial headway improvements, moves to a 2.00 : 1 relationship while Option 3, introducing seven new peak period, high speed, centrally-oriented routes, advances to a 2.25 : 1 peak-to-base ratio. Options 2 and 3 maintain off-peak service at current levels.

- continue a current 20 percent fixed route spare ratio. Current policies allow maintenance and back-up necessary to provide a reliable transit product.

- assume *status quo* supply and demand relationships in Milford, Meriden and Wallingford where *significant* passenger gains in low-to-moderate density environments are unlikely.

- suggest how difficult and expensive significant ridership gains can be. Moving beyond current 3,400AM/4,000 PM peak hour ridership (linked trips) maintains current productivity (riders per hour) in the face of a less favorable transit environment but pushes Connecticut Transit operating subsidies about 25 percent beyond current levels and increases capital commitments as peak hour fleets grow. Overall bus and paratransit budgets can readily rise to $29 million a year from current $25 million levels.

- highlight the importance of targeting transit investment. Improving service everywhere can become very expensive very fast. Targeted new service, curb side improvements and a favorable "on street" operating environment can offer a good competitive transit product.

Paratransit: The Year 2010

Regional ridesharing and door-to-door transportation commitments will require a $3.4 million a year capital and operating commitment just to maintain service through the next few years. Major budget elements reflect:

- a 29-town Greater New Haven Transit District *Americans with Disabilities Act* service. Current (2003) commitments (trips furnished) are nearly 80 percent above 1993 levels—reflecting District expansion through the period. A 1998 move to District dispatching followed by a 2000 shift from contractor to "in house" operations (drivers and maintenance) offers flexibility and a cost effective supply environment.[3]

- a 40 percent Greater New Haven Transit District spare ratio. Relatively high small vehicle maintenance requirements and shift change needs push paratransit spare ratios well beyond those of fixed route operators. Current four year turnover experience is reflected. Budget-drive ConnDOT policies that "stretch" replacement cycles beyond a four year norm will raise service costs (higher maintenance) and can compromise service.[3]

- limited new ridesharing commitments. Costs reflect a full service commitment that allows Rideworks of Greater New Haven to sustain employer-employee support, advance new "Telecommuting" initiatives, respond to individual inquiries, maintain an interactive web site and develop new transit marketing plans.

Fully Allocated Costs
Connecticut Transit New Haven Division
July 1, 2000 through June 30, 2001
Cost in Dollars

	Vehicle Hours	*Vehicle Miles*	*Peak Vehicles*	*Total Cost*
Cost				
Labor (Including Fringe)				
Operators	9,033,052			9,033,052
Maintenance		3,008,181		3,008,181
Other			3,350,841	3,350,841
Services			771,508	771,508
Materials & Supplies				
Fuel & Lubricants		1,205,224		1,205,224
Tires & Tubes		81,145		81,145
Other			1,550,046	1,550,046
Utilities			583,008	583,008
Taxes				
Vehicle Operations		725		725
General Administration				0
Casualty & Liability		50,402		50,402
Miscellaneous			241,804	241,804
Reconciling Items				
Interest Expense				0
Leases & Rentals				0
Depreciation				0
Total Cost	9,033,052	4,345,677	6,497,207	19,875,936
Service Units (Hours, Miles & Buses)	285,646	3,350,424	93	
Unit Cost (Rev Service)	31.62	1.30	69,862	

Table C-1: Connecticut Transit New Haven Division Fully Allocated Costs. Fully allocated costs establish a planning framework—they suggest the cost of providing new service. Connecticut Transit, Milford and Northeast Transportation allocated costs are drawn for FY01 National Transit Database reports—the latest NTD reports available.

Fully Allocated Costs
Northeast Transportation (Including Waterbury)
July 1, 2000 through June 30, 2001
Cost in Dollars

	Vehicle Hours	*Vehicle Miles*	*Peak Vehicles*	*Total Cost*
Cost				
Labor (Including Fringe)				
Operators	2,259,770			2,259,770
Maintenance		501,463		501,463
Other			533,785	533,785
Services			361,847	361,847
Materials & Supplies				
Fuel & Lubricants		382,820		382,820
Tires & Tubes		42,305		42,305
Other			171,183	171,183
Utilities			114,430	114,430
Taxes				
Vehicle Operations		381	44,098	44,479
General Administration				0
Casualty & Liability		19,830		19,830
Miscellaneous			(11,818)	(11,818)
Reconciling Items				
Interest Expense				0
Leases & Rentals				0
Depreciation				0
Total Cost	2,259,770	946,799	1,213,525	4,420,094
Service Units (Hours, Miles & Buses)	77,177	889,586	31	
Unit Cost (Rev Service)	29.28	1.06	39,146	

Table C-3: Northeast Transportation Company Fixed Route Fully Allocated Costs. Northeast provides local Wallingford, Meriden and Waterbury service under contract to ConnDOT. Only firm-wide costs are available.

Fully Allocated Costs
Milford Transit District
July 1, 2000 through June 30, 2001
Cost in Dollars

Table C-4: Milford Transit District Fully Allocated Costs.

	Vehicle Hours	*Vehicle Miles*	*Peak Vehicles*	*Total Cost*
Cost				
Labor (Including Fringe)				
Operators	710,206			710,206
Maintenance		63,075		63,075
Other			142,015	142,015
Services			33,639	33,639
Materials & Supplies				
Fuel & Lubricants		41,642		41,642
Tires & Tubes		7,350		7,350
Other			26,069	26,069
Utilities			42,457	42,457
Taxes				
Vehicle Operations		0	0	0
General Administration				0
Casualty & Liability		995		995
Miscellaneous			4,291	4,291
Reconciling Items				
Interest Expense				0
Leases & Rentals				0
Depreciation				0
Total Cost	710,206	113,062	248,471	1,071,739
Service Units (Hours, Miles & Buses)	24,719	288,133	6	
Unit Cost (Rev Service)	28.73	0.39	41,412	

Connecticut Transit
2001

		2001 Weekdays			
	Service	Each Weekday	Annual	Annual Other	Total Annual
Operations					
peak hour buses (1)		93			
off-peak buses		58			
peak/base ratio	1.60				
peak period/day (hrs) (1)	5.00				
peak period revenue bus hours		465	118,110		
off-peak per/day (hrs) (3)	13.00				
off-peak bus hours (3)		512	191,751		
total bus hours (4)		977	248,158	61,703	309,861
peak period system speed (mph)	11.06				
peak period bus miles (rev) (1)		5,144	1,306,576		
off-peak system speed	12.31				
off-peak bus miles (rev) (1)		6,301	1,600,454		
total bus miles		11,445	2,907,030	438,118	3,345,148
Unit Cost ($)					
per hour					31.62
per peak hour vehicle					69,862
per mile					1.30
Passengers (Linked Trips) (3)					
am peak hour (% of daily) (peak trips)	0.12	4,239			
am peak period (% of daily) (peak trips) (1)	0.18	6,401			
pm peak hour (% of daily) (peak trips)	0.14	4,946			
pm peak period (% of daily) (peak trips) (2)	0.24	8,474			
off peak period % of daily	0.58	20,455			
total passengers		35,329	8,973,556	1,288,133	10,261,689
Passengers (Unlinked Trips) (1)					
am peak hour (% of daily) (peak trips)	0.12	4,873			
am peak period (% of daily) (peak trips) (1)	0.18	7,357			
pm peak hour (% of daily) (peak trips)	0.14	5,685			
pm peak period (% of daily) (peak trips) (2)	0.24	9,740			
off peak period % of daily	0.58	23,511			
total passengers		40,608	10,314,432	1,480,613	11,795,045
Cost/Revenue ($)					
annual cost					19,875,936
revenue per passenger (linked trip)	0.61				
annual revenue					6,276,283
annual deficit					13,599,653
Performance (Annual) (Linked Trips)					
passengers per bus hour (linked trips)					33.12
cost/passenger ($)					1.94
subsidy per passenger ($)					1.33

(1) per FY01 National Transit Database report (bus miles and bus hours are revenue vehicle miles and hours)
(2) average weekday and annual totals per FY01 National Transit Database report
(3) off peak period weekdays 5:30-6:30A,9A-3:00PM and 6P-Midnight (approx)
(4) revenue bus hours per FY01 National Transit Database report

Table C-5: Connecticut Transit—2001 Experience. Current experience helps calibrate network and mode split estimates. Calibration includes current transfer experience. Approximately 18 percent of Connecticut Transit boardings (unlinked trips) now stem from transfers. See Urbitran Associates, *Connecticut DOT Statewide Bus System Study: CT Transit New Haven Division Study Report*, prepared for the Connecticut Department of Transportation (Newington: ConnDOT, 2000).

Local Bus Service
Milford
With Coastal Link (US1)

	2001	
	Each Day	Annual
Operations		
buses	6	
hours (all buses, revenue service)	81	24,729
Cost ($)		
per hour		43.34
annual cost		1,071,739
Passengers		
passengers per hour		13.5
annual passengers		333,897
Cost/Revenue ($)		
annual cost		1,071,739
revenue per passenger		0.66
annual revenue		220,549
annual deficit		851,190
Performance (Annual) ($)		
cost/passenger		3.21
subsidy per passenger		2.55

Local Bus Service
Meriden

	2001	
	Each Day	Annual
Operations		
buses	3	
hours (all buses, revenue service)	34	8,505
Cost ($)		
per hour		65.31
annual cost		555,474
Passengers		
passengers per hour		14.4
annual passengers		122,208
Cost/Revenue ($)		
annual cost		555,474
revenue per passenger		0.58
annual revenue		70,837
annual deficit		484,637
Performance (Annual) ($)		
cost/passenger		4.55
subsidy per passenger		3.97

Local Bus Service
Wallingford

	2001	
	Each Day	Annual
Operations		
buses	1	
hours (all buses, revenue service)	6.5	1,638
Cost ($)		
per hour		76.94
annual cost		126,030
Passengers		
passengers per hour		8.3
annual passengers		13,588
Cost/Revenue ($)		
annual cost		126,030
revenue per passenger		0.89
annual revenue		12,093
annual deficit		113,937
Performance (Annual) ($)		
cost/passenger		9.28
subsidy per passenger		8.39

Table C-6: Local Fixed Route Bus Performance.

Annual Operating Cost

Summary

	2001		
	Conn Transit	*Local*	*Total*
Fixed Route			
Peak Hour Buses	93	10	103
Annual			
vehicle hours	309,861	34,872	344,733
passengers	10,261,689	469,693	10,731,382
operating cost ($)	19,875,936	1,753,243	21,629,179
fare revenue ($)	6,276,283	303,480	6,579,763
operating deficit ($)	13,599,653	1,449,763	15,049,416

Paratransit (Actual or Revenue and Non-Revenue Miles and Hours)

	Daily	*Annual*
Greater New Haven		
Transit District		
Operations		
Peak Vehicle Need (Wkday)	32	
Weekday		
vehicle hours	256	66,816
vehicle miles	3,458	902,538
passengers/hour	2.75	2.75
passengers (including escorts)	704	183,744
Weekends/Holidays		
% of weekday service/day (hours)	0.39	
pass/hr weekends/holidays	1.15	
passengers per day	107	
Annual		
vehicle hours		77,216
passengers (including escorts)		195,652
passengers/hour		2.53
direct service cost/hr ($)		35.51
total operating cost ($)		2,741,637
cost/passenger ($)		14.01
revenue/passenger ($)		1.24
revenue ($)		242,500
operating deficit ($)		2,499,137
Milford, Wallingford, Meriden ADA		
cost ($)		810,005
passengers		77,188
hours (actual)		31,792
passengers/hour		2.43
revenue ($)		203,680
subsidy ($)		606,325
Rideshare Development		
annual cost ($) (basic service)		400,000
Total Transit Deficit ($)		18,554,878

Table C-7: South Central Connecticut Bus and Paratransit Operating Budget—Year 2001. ConnDOT underwrites virually all operating deficits. Exceptions include U.S. Federal Highway Administration "Congestion Mitigation and Air Quality" support used to offset Rideshare operating costs, a $60,000 Town of Wallingford fixed route bus payment and a $115,000 fixed route operating subsidy from the City of Milford.

Connecticut Transit: Current Service Levels
Fleet Age By Calendar Year

Model Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
1990	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	23	23	23	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2003	42	42	42	42	42	42	42	42	42	42	42	42	42	0	0	0	0	0	0	0	0	0	
2004	40	40	40	40	40	40	40	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	
2005		19	19	19	19	19	19	19	19	19	19	19	19	19	19	0	0	0	0	0	0	0	
2006			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2007				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2008					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2009						23	23	23	23	23	23	23	23	23	23	23	23	23	23	0	0	0	
2010							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2011								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2012									0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2013										3	3	3	3	3	3	3	3	3	3	3	3	3	
2014											0	0	0	0	0	0	0	0	0	0	0	0	
2015												0	0	0	0	0	0	0	0	0	0	0	
2016													0	0	0	0	0	0	0	0	0	0	
2017														42	42	42	42	42	42	42	42	42	
2018															40	40	40	40	40	40	40	40	
2019																19	19	19	19	19	19	19	
2020																	0	0	0	0	0	0	
2021																		0	0	0	0	0	
2022																			0	0	0	0	
2023																				23	23	23	
2024																					0	0	
2025																						0	
Buses																							
On Hand: Less Than 13 yrs	108	127	127	127	104	127	127	127	124	127	127	127	85	87	108	127	127	127	104	127	127	127	
Peak Need	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	
Total Need	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	
Purchase	19	0	0	0	23	0	0	0	3	0	0	0	42	40	19	0	0	0	23	0	0	0	169

*Table C-8: Connecticut Transit Bus Needs—Maintain Current Service. "C*atch up" investment in the late-1970's after public acquisition continues to generate an uneven replacement program. The Division will receive 42 units in January, 2004 (year 2003 units) and hopes to receive 40 units circa June, 2004 (year 2004 units). After receiving 82 units in 2004, the Division needs an average of seven units a year through the 2004-2025 to maintain current service.

Annual Budget

Current Service Levels

Operating Assistance ($)	18,554,914
Capital	
Vehicle Requirements	
fixed route	134
paratransit	44
Capital Cost, Average Annual Cost($)	
connecticut transit buses (12 year life)	2,536,000
local transit buses (12 year life)	275,000
paratransit van four year life)	439,000
curbside improvements	250,000
other (office/garage/support)	500,000
Annual Capital Budget ($)	4,000,000
Subtotal ($)	22,555,000
misc and contingencies (10%)	2,255,500
Total ($)	24,811,000
Vehicle Cost ($)	
fixed route bus	300,000
paratransit van	38,000
Spare Ratio (Percent of Peak Vehicles Needed)	
Fixed Route Service	30
Greater New Haven Transit District	38
Vehicle Replacement Policy	
Fixed Route Buses: replace before (years)	13
Paratransit Vehicles: replace after (years)	4

Table C-9: Annual Bus and Paratransit Operating Budget—Current Service Through the Next 20 Years. The region should be spending almost $25 million a year to maintain its fixed route bus and paratransit systems. Average annual capital costs through the 20 year period are reflected.

Year 2010 Connecticut Transit Options

Option 1 maintains current (2003) transit routes and headways.

Option 2 maintains current (2003) transit routes and headways.
reduce peak period headways on high performing Connecticut Transit routes (those with more than 50 boardings per mile) and those with headways of 20 minutes or more.

Option 3 maintains current (2003) transit routes and headways.
Adds seven express routes (20 minute headway) focused on Downtown New Haven; routes with a limited number of stops (often at park and ride lots) before running express on I-91 or I-95.
1: Cheshire/Hamden-via Rt 10 from Cheshire and, via Route 40, to I-91.
2: Meriden/Wallingford-US5 from Downtown Meriden to the Wharton Brook Connector and via I-91 to Downtown New Haven.
3: Meriden Square Mall-from Mall through Downtown Meriden and to I-91 via Main St.
4: North Branford (Northford)-via Rt 17 to Rt 80 and via I-91 to Downtown New Haven.
5: North Branford Center-via Rt 80 to Downtown New Haven via I-91.
6: Milford (via Conn Post Mall)-Milford Green to Mall via Cherry St and US1 and via I-95 to Downtown New Haven via East Town Rd and Old Gate Ln.
7: Milford (via Marsh Hill Rd)-Milford Green to US1 via Cherry St and via I-95 to Downtown New Haven via S. Lambert Rd and Marsh Hill Rd.

Table C-10: Near Term Connecticut Transit Service Planning Options.

Connecticut Transit
2010 Operations

	2010 Weekdays			Annual	Total
	Service	Each Weekday	Annual	Other	Annual
Operations					
peak hour buses (1)		93			
off-peak buses		58			
peak/base ratio	1.60				
peak period/day (hrs) (1)	5.00				
peak period revenue bus hours		465	118,110		
off-peak per/day (hrs) (3)	13.00				
off-peak bus hours (3)		512	191,751		
total bus hours (4)		977	248,158	61,703	309,861
peak period system speed (mph)	11.06				
peak period bus miles (rev) (1)		5,144	1,306,576		
off-peak system speed	12.31				
off-peak bus miles (rev) (1)		6,301	1,600,454		
total bus miles		11,445	2,907,030	438,118	3,345,148
Unit Cost ($)					
per hour					31.62
per peak hour vehicle					69,862
per mile					1.30
Passengers (Linked Trips) (3)					
am peak hour (% of daily) (peak trips)	0.12	3,411			
am peak period (% of daily) (peak trips) (1)	0.21	6,033			
pm peak hour (% of daily) (peak trips)	0.14	3,979			
pm peak period (% of daily) (peak trips) (2)	0.28	7,987			
off peak period % of daily	0.51	14,404			
total passengers		28,424	7,219,607	1,040,227	8,259,834
Passengers (Unlinked Trips) (1)					
am peak hour (% of daily) (peak trips)	0.12	4,160			
am peak period (% of daily) (peak trips) (1)	0.21	7,357			
pm peak hour (% of daily) (peak trips)	0.14	4,853			
pm peak period (% of daily) (peak trips) (2)	0.28	9,740			
off peak period % of daily	0.51	17,566			
total passengers		34,663	8,804,399	1,268,569	10,072,968
Cost/Revenue ($)					
annual cost					19,875,936
revenue per passenger (linked trip)	0.65				
annual revenue					5,368,892
annual deficit					14,507,044
Performance (Annual) (Linked Trips)					
passengers per bus hour (linked trips)					26.66
cost/passenger ($)					2.41
subsidy per passenger ($)					1.76

(1) per FY01 National Transit Database report (bus miles and bus hours are revenue vehicle miles and hours)
(2) average weekday and annual totals per FY01 National Transit Database report
(3) off peak period weekdays 5:30-6:30A,9A-3:00PM and 6P-Midnight (approx)
(4) revenue bus hours per FY01 National Transit Database report

Table C-11: Connecticut Transit Operations—Year 2010 Option 1 (Maintain Current Service). Current service is likely to prove less attractive by the end of the decade—attracting about 15 percent fewer riders and requiring about $1.0 million more a year in subsidy.

Annual Operating Cost
Summary: 2010 Current Service

	Conn Transit	Local	Total
Fixed Route			
Peak Hour Buses	93	10	103
Annual			
vehicle hours	309,861	34,872	344,733
passengers	8,259,834	469,693	8,729,527
operating cost ($)	19,875,936	1,753,243	21,629,179
fare revenue ($)	5,368,892	303,480	5,672,372
operating deficit ($)	14,507,044	1,449,763	15,956,807

Paratransit (Actual or Revenue and Non-Revenue Miles and Hours)	Daily	Annual
Greater New Haven		
Transit District		
Operations		
Peak Vehicle Need (Wkday)	32	
Weekday		
vehicle hours	256	66,816
vehicle miles	3,458	902,538
passengers/hour	2.75	2.75
passengers (including escorts)	704	183,744
Weekends/Holidays		
% of weekday service/day (hours)	0.39	
pass/hr weekends/holidays	1.15	
passengers per day	107	
Annual		
vehicle hours		77,216
passengers		195,652
passengers/hour		2.53
direct service cost/hr ($)		35.51
total operating cost ($)		2,741,637
cost/passenger ($)		14.01
revenue/passenger ($)		1.24
revenue ($)		242,500
operating deficit ($)		2,499,173
Milford, Wallingford, Meriden ADA		
cost ($)		810,005
passengers		77,188
hours (actual)		31,792
passengers/hour		2.43
revenue ($)		203,680
subsidy ($)		606,325
Rideshare Development		
annual cost ($) (basic service)		500,000
Total Transit Deficit ($)		19,562,305

Table C-12: Bus Patronage and Paratransit Operating Subsidy Year 2010 Option 1 (Maintain Current Service).

Annual Budget	
Current Service Levels	
Operating Assistance ($)	19,562,305
Capital	
Vehicle Requirements	
fixed route	134
paratransit	44
Capital Cost, Average Annual Cost($)	
connecticut transit buses (12 year life)	1,158,000
local transit buses (12 year life)	275,000
paratransit van four year life)	393,000
curbside improvements	250,000
other (office/garage/support)	500,000
Annual Capital Budget ($)	2,576,000
Subtotal ($)	22,139,000
misc and contingencies (10%)	2,213,900
Total ($)	24,353,000
Vehicle Cost ($)	
fixed route bus	300,000
paratransit van	38,000
Spare Ratio (Percent of Peak Vehicles Needed)	
Fixed Route Service	30
Greater New Haven Transit District	38
Vehicle Replacement Policy	
Fixed Route Buses: replace before (years)	13
Paratransit Vehicles: replace after (years)	4

Table C-13: Annual Bus and Paratransit Budget--Year 2010 Option 1 (Maintain Current Service).

Programmed 2003-04 capital commitments limit annual transit costs through the next seven years.

2010 Operations

Option 2: Maintain Existing Service (Option 1) and Reduce Selected Peak Hour Headways

	2010 Weekdays				
	Service	*Each Weekday*	*Annual*	*Annual Other*	*Total Annual*
Operations					
peak hour buses (1)		114			
off-peak buses		58			
peak/base ratio	1.97				
peak period/day (hrs) (1)	5.00				
peak period revenue bus hours		629	159,766		
off-peak per/day (hrs) (3)	10.00				
off-peak bus hours (3)		518	131,586		
total bus hours (4)		1,147	291,338	44,213	335,551
peak period system speed (mph)	10.88				
peak period bus miles (rev) (1)		6,841	1,737,614		
off-peak system speed	12.02				
off-peak bus miles (rev) (1)		6,227	1,581,658		
total bus miles		13,068	3,319,272	522,766	3,842,038
Unit Cost ($)					
per hour					31.62
per peak hour vehicle					69,862
per mile					1.30
Passengers (Linked Trips) (3)					
am peak hour (% of daily) (peak trips)	0.20	6,151			
am peak period (% of daily) (peak trips) (1)	0.25	7,688			
pm peak hour (% of daily) (peak trips)	0.19	5,843			
pm peak period (% of daily) (peak trips) (2)	0.25	7,688			
off peak period % of daily	0.50	15,376			
total passengers		30,753	7,811,240	1,125,367	8,936,607
Passengers (Unlinked Trips) (1)					
am peak hour (% of daily) (peak trips)	0.20	7,410			
am peak period (% of daily) (peak trips) (1)	0.25	9,263			
pm peak hour (% of daily) (peak trips)	0.19	7,040			
pm peak period (% of daily) (peak trips) (2)	0.25	9,263			
off peak period % of daily	0.50	18,526			
total passengers		37,052	9,411,132	1,355,864	10,766,996
Cost/Revenue ($)					
annual cost					23,558,854
revenue per passenger (linked trip)	0.67				
annual revenue					5,987,526
annual deficit					17,571,328
Performance (Annual) (Linked Trips)					
passengers per bus hour (linked trips)					26.63
cost/passenger ($)					2.64
subsidy per passenger ($)					1.97

(1) per FY01 National Transit Database report (bus miles and bus hours are revenue vehicle miles and hours)
(2) average weekday and annual totals per FY01 National Transit Database report
(3) off peak period weekdays 5:30-6:30A,9A-3:00PM and 6P-Midnight (approx)
(4) revenue bus hours per FY01 National Transit Database report

Table C-14: Connecticut Transit Operations—Year 2010 Option 2 (Decrease Selected Headays).

Annual Operating Cost

Summary

	2010		
	Conn Transit	Local	Total
Fixed Route			
Peak Hour Buses	114	10	124
Annual			
vehicle hours	335,551	34,872	370,423
passengers	8,936,607	469,693	9,406,300
operating cost ($)	23,558,854	1,753,243	25,312,097
fare revenue ($)	5,987,526	303,480	6,291,006
operating deficit ($)	17,571,328	1,449,763	19,021,091

Paratransit (Actual or Revenue and Non-Revenue Miles and Hours)

	Daily	Annual
Greater New Haven Transit District		
Operations		
Peak Vehicle Need (Wkday)	32	
Weekday		
vehicle hours	256	66,816
vehicle miles	3,458	902,538
passengers/hour	2.75	2.75
passengers (including escorts)	704	183,744
Weekends/Holidays		
% of weekday service/day (hours)	0.39	
pass/hr weekends/holidays	1.15	
passengers per day	107	
Annual		
vehicle hours		77,216
passengers		195,652
passengers/hour		2.53
direct service cost/hr ($)		35.51
total operating cost ($)		2,741,637
cost/passenger ($)		14.01
revenue/passenger ($)		1.24
revenue ($)		242,500
operating deficit ($)		2,499,173
Milford, Wallingford, Meriden ADA		
cost ($)		810,005
passengers		77,188
hours (actual)		31,792
passengers/hour		2.43
revenue ($)		203,680
subsidy ($)		606,325
Rideshare Development		
annual cost ($) (basic service)		500,000
Total Transit Deficit ($)		22,626,589

Table C-15: Bus and Paratransit Operating Subsidy — Year 2010 Option 2 (Decrease Selected Headays).

Annual Budget

Current Service Levels

Operating Assistance ($)	22,626,589
Capital	
Vehicle Requirements	
fixed route	161
paratransit	44
Capital Cost, Average Annual Cost($)	
connecticut transit buses (12 year life)	1,158,000
local transit buses (12 year life)	275,000
paratransit van (three year life)	393,000
curbside improvements	250,000
other (office/garage/support)	500,000
Annual Capital Budget ($)	2,576,000
Subtotal ($)	25,203,000
misc and contingencies (10%)	2,520,300
Total ($)	27,724,000
Vehicle Cost ($)	
fixed route bus	300,000
paratransit van	38,000
Spare Ratio (Percent of Peak Vehicles Needed)	
Fixed Route Service	30
Greater New Haven Transit District	38
Vehicle Replacement Policy	
Fixed Route Buses: replace before (years)	13
Paratransit Vehicles: replace after (years)	4

Table C-16: Annual Bus and Paratransit Budget-Year 2010 Option 2 (Decrease Selected Headays).

Connecticut Transit: Current Service Levels
Fleet Age By Calendar Year

Model Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
1990	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	23	23	23	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2003	42	42	42	42	42	42	42	42	42	42	42	42	42	0	0	0	0	0	0	0	0	0	
2004	40	40	40	40	40	40	40	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	
2005		48	48	48	48	48	48	48	48	48	48	48	48	48	48	0	0	0	0	0	0	0	
2006			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2007				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2008					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2009						23	23	23	23	23	23	23	23	23	23	23	23	23	23	0	0	0	
2010							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2011								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2012									0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2013										3	3	3	3	3	3	3	3	3	3	3	3	3	
2014											0	0	0	0	0	0	0	0	0	0	0	0	
2015												0	0	0	0	0	0	0	0	0	0	0	
2016													0	0	0	0	0	0	0	0	0	0	
2017														42	42	42	42	42	42	42	42	42	
2018															40	40	40	40	40	40	40	40	
2019																48	48	48	48	48	48	48	
2020																	0	0	0	0	0	0	
2021																		0	0	0	0	0	
2022																			0	0	0	0	
2023																				23	23	23	
2024																					0	0	
2025																						0	
Buses																							
On Hand: Less Than 13 yrs	108	156	156	156	133	156	156	156	153	156	156	156	114	116	108	156	156	156	133	156	156	156	
Peak Need	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	
Total Need	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	
Purchase	48	0	0	0	23	0	0	0	3	0	0	0	42	40	48	0	0	0	23	0	0	0	226

Table C-17: 20-Year Connecticut Transit Bus Needs—Option 2 (Decrease Selected Headays). Limited expansion adds less than a vehicle a year to 20-year acquisition needs.

2010 Operations

Option 3: Maintain Existing Service (Option 1), Reduce Selected Peak Hour Headways and Add High Speed S

		2010 Weekdays			
	Service	Each Weekday	Annual	Annual Other	Total Annual
Operations					
peak hour buses (1)		128			
off-peak buses		58			
peak/base ratio	2.21				
peak period/day (hrs) (1)	5.00				
peak period revenue bus hours		653	165,862		
off-peak per/day (hrs) (3)	10.00				
off-peak bus hours (3)		518	131,572		
total bus hours (4)		1,171	297,434	45,114	342,548
peak period system speed (mph)	14.02				
peak period bus miles (rev) (1)		9,158	2,326,132		
off-peak system speed	12.02				
off-peak bus miles (rev) (1)		6,227	1,581,658		
total bus miles		15,385	3,907,790	533,588	4,441,378
Unit Cost ($)					
per hour					31.62
per peak hour vehicle					69,862
per mile					1.30
Passengers (Linked Trips) (3)					
am peak hour (% of daily) (peak trips)	0.22	7,304			
am peak period (% of daily) (peak trips) (1)	0.27	8,964			
pm peak hour (% of daily) (peak trips)	0.22	7,304			
pm peak period (% of daily) (peak trips) (2)	0.27	8,964			
off peak period % of daily	0.46	15,273			
total passengers		33,202	8,433,191	1,215,157	9,648,348
Passengers (Unlinked Trips) (1)					
am peak hour (% of daily) (peak trips)	0.22	8,300			
am peak period (% of daily) (peak trips) (1)	0.27	10,187			
pm peak hour (% of daily) (peak trips)	0.22	8,300			
pm peak period (% of daily) (peak trips) (2)	0.27	10,187			
off peak period % of daily	0.46	17,355			
total passengers		37,729	9,583,172	1,380,860	10,964,032
Cost/Revenue ($)					
annual cost					25,535,572
revenue per passenger (linked trip)	0.72				
annual revenue					6,946,811
annual deficit					18,588,761
Performance (Annual) (Linked Trips)					
passengers per bus hour (linked trips)					28.17
cost/passenger ($)					2.65
subsidy per passenger ($)					1.93

(1) per FY01 National Transit Database report (bus miles and bus hours are revenue vehicle miles and hours)
(2) average weekday and annual totals per FY01 National Transit Database report
(3) off peak period weekdays 5:30-6:30A,9A-3:00PM and 6P-Midnight (approx)
(4) revenue bus hours per FY01 National Transit Database report

Table C-18: Connecticut Transit Operations—Year 2010 Option 3 (Shorter Headways and Express Service).

Annual Operating Cost

Summary

	2010		
	Conn Transit	Local	Total
Fixed Route			
Peak Hour Buses	128	10	138
Annual			
vehicle hours	342,548	34,872	377,420
passengers	9,648,348	469,693	10,118,041
operating cost ($)	25,535,572	1,753,243	27,288,815
fare revenue ($)	6,946,811	303,480	7,250,290
operating deficit ($)	18,588,761	1,449,763	20,038,525

Paratransit (Actual or Revenue and Non-Revenue Miles and Hours)

	Daily	Annual
Greater New Haven		
Transit District		
Operations		
Peak Vehicle Need (Wkday)	32	
Weekday		
vehicle hours	256	66,816
vehicle miles	3,458	902,538
passengers/hour	2.75	2.75
passengers (including escorts)	704	183,744
Weekends/Holidays		
% of weekday service/day (hours)	0.39	
pass/hr weekends/holidays	1.15	
passengers per day	107	
Annual		
vehicle hours		77,216
passengers		195,652
passengers/hour		2.53
direct service cost/hr ($)		35.51
total operating cost ($)		2,741,637
cost/passenger ($)		14.01
revenue/passenger ($)		1.24
revenue ($)		242,500
operating deficit ($)		2,499,173
Milford, Wallingford, Meriden ADA		
cost ($)		810,005
passengers		77,188
hours (actual)		31,792
passengers/hour		2.43
revenue ($)		203,680
subsidy ($)		606,325
Rideshare Development		
annual cost ($) (basic service)		500,000
Total Transit Deficit ($)		23,644,022

Table C-19: Bus and Paratransit Subsidy—Year 2010 Option 3 (Shorter Headways and Express Service).

Connecticut Transit: Current Service Levels
Fleet Age By Calendar Year

Table C-20: 20-Year Connecticut Transit Bus Needs—Option 3 (Shorter Headways and Express Service).

Model Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
1990	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	23	23	23	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1999	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2003	42	42	42	42	42	42	42	42	42	42	42	42	42	0	0	0	0	0	0	0	0	0	
2004	40	40	40	40	40	40	40	40	40	40	40	40	40	40	0	0	0	0	0	0	0	0	
2005		67	67	67	67	67	67	67	67	67	67	67	67	67	67	0	0	0	0	0	0	0	
2006			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2007				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2008					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2009						23	23	23	23	23	23	23	23	23	23	23	23	23	23	0	0	0	
2010							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2011								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2012									0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2013										3	3	3	3	3	3	3	3	3	3	3	3	3	
2014											0	0	0	0	0	0	0	0	0	0	0	0	
2015												0	0	0	0	0	0	0	0	0	0	0	
2016													0	0	0	0	0	0	0	0	0	0	
2017														42	42	42	42	42	42	42	42	42	
2018															40	40	40	40	40	40	40	40	
2019																67	67	67	67	67	67	67	
2020																	0	0	0	0	0	0	
2021																		0	0	0	0	0	
2022																			0	0	0	0	
2023																				23	23	23	
2024																					0	0	
2025																						0	
Buses																							
On Hand: Less Than 13 yrs	108	175	175	175	152	175	175	175	172	175	175	175	133	135	108	175	175	175	152	175	175	175	
Peak Need	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	
Total Need	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	
Purchase	67	0	0	0	23	0	0	0	3	0	0	0	42	40	67	0	0	0	23	0	0	0	265

Table C-21: Annual Bus and Paratransit Budget—Year 2010 Option 3 (Shorter Headways and Express Service). .

Annual Budget	
Current Service Levels	
Operating Assistance ($)	23,644,022
Capital	
Vehicle Requirements	
fixed route	179
paratransit	44
Capital Cost, Average Annual Cost($)	
connecticut transit buses (12 year life)	1,158,000
local transit buses (12 year life)	275,000
paratransit van (three year life)	393,000
curbside improvements	250,000
other (office/garage/support)	500,000
Annual Capital Budget ($)	2,576,000
Subtotal ($)	26,221,000
misc and contingencies (10%)	2,622,100
Total ($)	28,844,000
Vehicle Cost ($)	
fixed route bus	300,000
paratransit van	38,000
Spare Ratio (Percent of Peak Vehicles Needed)	
Fixed Route Service	30
Greater New Haven Transit District	38
Vehicle Replacement Policy	
Fixed Route Buses: replace before (years)	13
Paratransit Vehicles: replace after (years)	4

Appendix D: USDOT Planning Requirements

TEA-21 and its predecessor, *ISTEA* establish long-range plan development guidelines for metropolitan planning organizations. Seven "factors" now guide planning (Table D-1):[1]

- support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
- increase the safety and security of the transportation system for motorized and nonmotorized users;
- increase the accessibility and mobility options available to people and for freight;
- protect and enhance the environment, promote energy conservation, and improve quality of life;
- enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
- promote efficient system management and operation;
- emphasize preservation of the existing transportation system.

TEA-21 Planning Guidance

TEA-21		*Plan (Response and Page)*	
Economic Vitality	→	I-691 and higher north meriden density	12,61
		Port of New Haven container barge movement, intermodal freight	17,18,64
		reinforce central urban spine	5,6,39-48
		reinforce Downtown New Haven	39,43,47,76
Safety	→	build key regional trail elements	14,64-67
		good arterial geometry	59,61-62
		identify/meet highway safety needs	51,53
		invest at key transit stops	8,39,44,47,76
Increase Accessibility/Mobility Options People & Freight	→	build key regional trail elements	14,64-67
		enhance current ridesharing commitments	7,48,49
		expand commuter rail parking	12,36,44,45,76
		extend/explore ITS applications	1,4,17,18,76
		long-term Tweed-New Haven Airport role/plan	17,19
		maintain essential central bus service	35-39
		new highway/transit capacity	5,6,10-14,31-33,36-63
		Port of New Haven container barge movement, intermodal freight	17,18,64
		stabilize/expand Greater New Haven Transit District	29,30,49,50
Environment, Energy and Quality of Life	→	attractive freeway environment	8,10,11,12-13,56-58
		better freeway management	4,10,17,18,51,52
		build key regional trail elements	14,64-67
		extend/explore ITS applications	1,4,17,18,76
		more effective arterial operations	12,51,61-63,76
		Port of New Haven container barge movement, intermodal freight	17,18,64
		reinforce central urban spine	5,6,25,39-42,47
		reinforce Downtown New Haven	7,8,36,39,43,47,76
		environmental justice	1,3

Table D-1: USDOT Planning Factors.

TEA-21 Planning Guidance

TEA-21	*Plan (Response and Page)*	
Intermodal Integration →	expand commuter rail parking	12,36,44,45,76
	Dow ntow n New Haven bus priorities	39,43,47
	extend/explore ITS applications	1,4,17,18,76
	long-term Tw eed-New Haven Airport role/plan	17,19
	Port of New Haven container barge movement, intermodal freight	17,18,64
Efficiency →	cost effective transit responses	8,39-42
	extend/explore ITS applications	1,4,17,18,76
	I-95 central improvement program demand management	17
	more effective arterial operations	59,61-62
	Port of New Haven container barge movement, intermodal freight	17,18,64
Preserve the Current System →	build on current commuter rail commitments	25,39,45
	maintain rail and bus systems, regular replacement	43,45,48
	maintain reasonable freew ay movement	5,51-61
	new Connecticut Transit Garage	8,45
	protect arterial investment	5,61-63
	retrofit I-91 and I-95 interchanges	10,55-61

Table D-1: USDOT Planning Factors (Continued).

Notes

A Plan Perspective

[1] South Central Regional Council of Governments, *Mobility: A Transportation Plan for the Year 2020*, (North Haven: SCRCOG, 2001).
[2] South Central Regional Council of Governments, *Vision for the Future* (North Haven, November, 2000).
[3] A SCRCOG-initiated 18-month-long *Study* undertaken by Wilbur Smith Associates (New Haven).
[4] A statewide guideline shared per current and proposed federal transportation planning-programming regulations. See 23 *CFR* 450, 49 *CFR* 613, draft "Statewide Transportation Planning; Metropolitan Transportation Planning; Proposed Rule" in *Federal Register* (Volume 65, Number 1021, May 25, 2000) and a July 23, 2003 "Allocation of Anticipated Funds to Connecticut Planning Regions (2004-2028) for Long Range Planning Purposes", memorandum from Charles S. Barone, Transportation Planning Director, Bureau of Policy and Planning, Connecticut Department of Transportation to regional planning organization directors. Per ConnDOT guidance, commitments reflected in the Department's "20 Year Capital Program" (November, 2003) are equated with available transit resources.
[5] The three-year *Program* or *TIP* insures a collaborative state-regional surface transportation programming process. Local elected officials and ConnDOT must concur in both project-level programming and the *TIP* as a whole before U.S. Federal Highway Administration and U.S. Federal Transit Administration support that drives Connecticut's transportation system investment can flow to the region.
[6] Including the U.S. DOT's "Order on Environmental Justice to Address Environmental Justice in Minority Populations and Low-Income Populations" (Order 5610.2, April, 1997), FHWA's "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (DOT Order 6640.23, December, 1998) and FTA's "Memorandum Implementing Title VI Requirements in Metropolitan and Statewide Planning" (October, 1999).

1. The Twenty-Year Plan in Brief

[7] Largely rebuilding existing capacity in place (no new capacity) through the 1985-2000 period after the I-95 Mianus River Bridge collapse. See State of Connecticut, Office of the Governor, *Transportation Infrastructure Renewal Program* (Hartford: Office of the Governor, 1984).
[8] Station proposals that moved from concept to construction in three years suggest that clear concepts, consensus and sustained attention can advance important projects. See CTE Engineers, *Preliminary Design Study: State Street Railroad Station*, *New Haven,* prepared for the South Central Regional Council of Governments (SCRCOG: North Haven, 1997) and associated demand estimates in South Central Regional Council of Governments, "A Chapel Street Railroad Station" (1997).
[9] Per a ConnDOT EIS/preliminary design study undertaken by Vanasse Hagen Brustlin expected to be completed in late-2004—assessing both a SCRCOG-preferred West Haven site (at Sawmill Road) and an alternate Orange (Marsh Hill Road) location. Preceded

by DMJM-Harris, *Site Study, New Train Station, Orange or West Haven, Project 301-T099*, prepared for ConnDOT (Stamford: Harris, 2001) and South Central Regional Council of Governments, *A Metro North Rail Station: Orange/West Haven* (North Haven: SCRCOG, 2000). PA 98-119 established Connecticut's five percent travel reduction goal. See ConnDOT's annual Southwest Corridor progress report required by the Act in Connecticut Department of Transportation, Bureau of Public Transportation *Southwest Corridor Report: Year Five* (Newington: ConnDOT, 2003).

[10] Wilbur Smith Associates, *South Central Connecticut Signal Timing Project: Final Submission*, prepared for ConnDOT (New Haven: WSA, 2002)—a SCRCOG initiative utilizing New Haven-Meriden Surface Transportation Program funds to provide signal operations attention along both state and locally maintained arterials. Work addressed US1 (East Haven), Whalley Avenue (New Haven), North Main Street (Wallingford), Route 17/80 (New Haven), US1 (Orange-West Haven) and Route 10 (New Haven) signal groups.

[11] Parsons-Brinckerhoff, *New Haven Harbor Access, Preliminary Engineering Study, State Project 92-525, Volumes 1 and 2*, prepared for ConnDOT (Newington: ConnDOT, 2002) building on Parsons Transportation Group, *New Haven Harbor Access Feasibility and Reasonableness Report*, prepared for ConnDOT (Newington: ConnDOT, 1998).

[12] Clough, Harbour & Associates, *I-95 from Branford to the Rhode Island State Feasibility Study,* in progress with an anticipated mid-2004 completion date. See http://www.i95southeastct.org/.overview.htm. Building on ConnDOT's *Southeastern Connecticut Corridor Study* (Newington: ConnDOT, 1999) that suggested a general Branford-to-Rhode Island State Line widening in response to PA 97-214. Early ConnDOT cost estimates are contained in "Allocation of Anticipated Funds to Connecticut Planning Regions (2004-2028) for Long Range Planning Purposes" per note 4.

[13] New Haven-Hamden, New Haven and Wallingford proposals per South Central Regional Council of Governments, *Transportation Enhancement: 2004-2009 South Central Connecticut Opportunities* (North Haven: SCRCOG, 2003).

[14] Harbor Trail proposals per South Central Regional Council of Governments, *A New Haven Harbor Trail* (North Haven: SCRCOG, 1998).

[15] Per the PANYNJ's "Inland Distribution Network" (http://www.panynj.gov/commerce/pidn_fs.pdf). See DMJM-Harris. *Coastal Barge Feeder Service Study*, prepared for SCRCOG (North Haven: SCRCOG, 2001 initiated jointly by ConnDOT, SCRCOG and the private sector and SCRCOG, *Container Feeder Barge Operating Plan* (North Haven: SCRCOG, 2002) prepared in association with Logistec (New Haven), DMJM-Harris and Westchester Motors (New Haven).

[16] Expanding relatively limited commitments flowing from initial joint ConnDOT-SCRCOG ITS planning. See Transcore, *New Haven-Meriden ITS Strategic Deployment Plan*, prepared for ConnDOT and SCRCOG (Newington: ConnDOT, 1999).

2. Growth, Change and Commitment

[17] Network-based demand estimates are described in Appendix A and mode split estimates in Appendix B. Appendix C shares supplementary material. Current (2004) costs are used throughout.

[18] ConnDOT estimates framed in concert with regions and associated municipalities guide state and regional transportation demand modeling; estimates now reflected in ConnDOT's "series 27A" zonal data base. SCRCOG zones and zonal attributes aggregate to ConnDOT zones. Connecticut's Office of Policy and Management has abandoned its long-standing population projection series—last published as Office of Policy and Management, *Connecticut Population Projections*, 1995-2020, Series 95.1 (Hartford: OPM, 1995).

[19] Travel exclusive of "through trips"; i.e. for trips wholly within the region and trips having one end outside the region. Reflects current transit commitment. Average one-way work trips (vehicles) are expected to move from about 7.0 to 7.5 miles, average home-based

other trips move from 5.2 to 5.5 miles and non-home based vehicle trips shift from 3.5 to 4.0 miles. More trips, longer trips and slightly lower vehicle occupancy rates produce major VMT increases.

[20] Limited enhancements, in general, occur at the expense of existing service. Modest enhancement opportunities are identified in Urbitran Associates, *ConnDOT Statewide Bus System Study*, prepared for the Connecticut Department of Transportation (Newington: ConnDOT, 2000) initiated in response to General Assembly Transportation Committee concerns.

[21] Ten person per hour fixed route productivities are roughly twice those of a possible door-to-door ("many-to-many") paratransit alternative—one potentially offered at about two-thirds the fixed route cost .

3. The Plan

[22] Connecticut Office of Policy and Management, *Conservation and Development: Policies Plan for Connecticut 1998—2003, Recommended Plan* (Hartford: OPM, 1998). A new *2004-2009 Plan* will move to the General Assembly on March 15, 2004 after December, 2003-February, 2004 OPM outreach. Regional policies are shared in South Central Regional Council of Governments, *Vision for the Future: Regional Plan of Development* (North Haven: SCRCOG, 2000).

[23] Station costs are associated with highway spending due to a "Congestion Management and Air Quality" funding relationship and ConnDOT-defined transit spending constraint.

[24] Premised upon higher peak-to-base supply relationships and current fares. See Appendix C.

[25] Reflected in basic demand analysis (Appendix C).

[26] Replacement per Appendix C and an average of 11 new units through the 2004-2028 period to reach a 175 unit fleet necessary to field 128 peak hour buses. "Lumpy" replacement cycles reflect early public sector experience in the 1970's—replacing a largely obsolete private fleet in a short period of time.

[27] Trips by people physically eligible for the *ADA* service and with an origin and destination within 1.5 miles of a fixed route bus; i.e. within a 0.75 wide band on either side of route.

[28] Productivity in the absence of escorts.

[29] Benefits associated with aggressive areawide programs have been well-documented for at least 25 years. Travel times savings of up to 12 percent have been associated with periodic programs. See Frederick A. Wagner, *Overview of the Impacts and Costs of Traffic Control System Improvements*, prepared for the U.S. Federal Highway Administration (Washington: FHWA, 1980) for an early illustration.

[30] Patterned after the California Department of Transportation's "FETSIM " program; i.e. supplementing limited state and local staff with consultant resources, usually employing Transyt7-F (FHWA's "Traffic Network Study Tool" and extensive field observation. *TEA-21* "Congestion and Air Quality Management" support can extend an initial New Haven-Meriden Surface Transportation Program-supported initiative.

[31] Transcore, *New Haven-Meriden ITS Strategic Deployment Plan,* prepared for ConnDOT and SCRCOG (Newington: Transcore, 1999). SCRCOG's FY04 "Unified Planning Work Program" establishes an ITS goals review.

[32] Targeted spending accomplished through ConnDOT's local accident reduction program, Surface Transportation Program Hazard program and rail grade crossing elimination/improvement program.

[33] Initiated in fiscal year 2004 per a national U.S. Federal Highway Administration emphasis. See South Central Regional Council of Governments, *Transportation Planning Work Program, Unified Planning Work Program, Fiscal Year 2004: July, 2003-June, 2004* (North Haven: SCRCOG, 2003), Task 2.

[34] Connecticut Department of Transportation, *Final Environmental Impact Statement*, *Final Section 4(f) Evaluation: Interstate Route*

95-New Haven Harbor Crossing (Newington: ConnDOT, 1999) with May 25, 1999 Federal Highway Administration concurrence. The *EIS* is consistent with 13-year-old SCRCOG policies originally reflected in *Maintaining Mobility* (1991) and restated in a Council of Governments, January 31, 1997 letter from Edward Lynch (Council Chairman) to James Sullivan (Commissioner, ConnDOT) and attached "COG DEIS Position".

[35] Lane balance reflecting volumes and geometry (lanes) on adjacent freeway sections.

[36] Parsons-Brinckerhoff, *New Haven Harbor Access, Preliminary Engineering Study, State Project 92-525, Volumes 1 and 2*, prepared for ConnDOT (Newington: ConnDOT, 2002).

[37] Connecticut Department of Transportation, Bureau of Policy and Research, *Southwest Corridor Study Update* (Newington: ConnDOT, 1998)—begun as a Greenwich-to-Branford *EIS*.

[38] Limiting conflicts between vehicles entering and leaving the main line on adjacent ramps.

[39] Morning queues generated at the Frontage Road mask similarly constrained westbound operations.

[40] Clough, Harbour & Associates, *I-95 from Branford to the Rhode Island State Feasibility Study,* in progress with an anticipated mid-2004 completion date. See http://www.i95southeastct.org/.

[41] Particularly short weaving sections; e.g. northbound segments between the Route 15 ramp to Main Street, the I-91 ramp to Route 15 and the on-ramp from Main Street.

[42] See ConnDOT, Bureau of Policy and Planning, *Feasibility Study: Interchange 5, Interstate 691* (Newington: ConnDOT, 2001) in response to a General Assembly request.

[43] See Urbitran Associates, et al, *Access Management Manual,* prepared for the Transportation Research Board (Washington: TRB, 2003 and an earlier "best practice" summary in Urbitran Associates, et. al., *Impact of Access Management Techniques*, National Cooperative Highway Research Program Report 420 (Washington: Transportation Research Board, 1999). See City of Lakewood, Traffic Engineering Division, *Transportation Engineering Design Standards* (Lakewood, Colorado: 1985) for a comprehensive local application.

[44] ConnDOT-imposed bridge weight limits, relatively severe east shore (two percent) and west shore (2.3 percent) rail grades and track curvature at Waterfront Street began to limit rail utility by the early 1960's. By the mid-1980's, deteriorating bridge conditions imposed a one car at a time 200,000 pound car (car plus load) weight limit (versus prevalent national 263,000 pound limits) while limited curvature at Waterfront Street commonly occasioned derailments. Weight limits alone restricted individual cars to loads of between one-half to two-thirds of possible capacity. See South Central Region Council of Governments, "Waterfront Street Reconstruction, New Haven, Supplementary Support", memo to Council's Transportation Committee (April 10, 2002).

[45] Reflecting 80 percent Federal Highway Administration participation, a current $5.0 million annual New Haven-Meriden Urbanized Area (UA) federal apportionment available to the SCRCOG portion of the UA and a current $600,000 annual SCRCOG Bridgeport-Stamford UA apportionment largely available for work in Milford. Most federal-aid improvements on municipal roads are pursued via so-called "attributable" or allocated U.S. Federal Highway Administration Surface Transportation Program support.

[46] Via a Surface Transportation Program statewide 10 percent set aside reflected in *TEA-21* and long-term sub-state South Central Connecticut experience.

Appendix A: Demand and Performance

[1] Relying on The Seiders Group, *MINUTP: Technical Reference User's Manual*, January, 1997 (Palo Alto, California: Seiders, 1997) as a demand modeling tool. Mid-2003-to-early-2004 efforts are replacing MINUTP with TransCAD—a Caliper Corporation product.

See Caliper Corporation, *TransCAD Demand Modeling with TransCAD* (Newton, Mass.: 2002). Limited model chain improvements are to be effected by the Caliper Corporation on SCRCOG's behalf through the October, 2003-January, 2004 period while SCRCOG introduces a new 2000-2030 zonal data base reflecting *2000 Census Transportation Planning Program* (*CTPP*) material (Parts 1 thru 3) expected to become available in early 2004.

[2] Revision during 1992 refined (disaggregated) an existing zonal; similarly allowing the network to better "support" the zonal system. Zonal disaggregation reflected guidelines offered in U.S. Federal Highway Administration, *Calibration and Adjustment of System Planning Models* (Washington: FHWA, 1990). A still more disaggregate zonal system and corresponding network have been defined to support a new year *2000 Census Transportation Planning Package*-based data base to be introduced during 2004.

[3] Including Connecticut Transit "Commuter Connections" that complement Shore Line East rail service.

[4] Connecticut Office of Policy and Management (OPM) long-term municipal population projections that had historically guided (controlled) both ConnDOT and SCRCOG zonal level population estimates have been discontinued. SCRCOG now adopts ConnDOT estimates.

[5] Long-term population, retail employment and "other" employment basic to trip generation.

[6] Census block data and COG GIS capabilities establish base year "sub-zone" populations. Standard Industrial Code-based "base year" employment estimates are described in South Central Regional Council of Governments, "Creation of Zonal Employment Data" (November, 1992).

7 Applicable until a post-2000 Census data base is introduced. 2000 *CTPP* zones reflect fine-grained SCRCOG zones. ConnDOT now aggregates rather than SCRCOG disaggregating.

[8] See Connecticut Department of Transportation, *Person Forecasting Model: Trip Generation*, Staff Paper 00-1 (Newington: ConnDOT, 2000) describing the PERFORM cross classification and regression development/revision process drawing on *1990 National Personal Transportation Survey* data (including a Connecticut sample). Truck trips, modeled by ConnDOT, are not explicitly modeled by SCRCOG—a potential change per the Caliper Corporation model chain enhancement process suggested in note 1.

[9] Counts adjusted for a "thru" trip table generated by ConnDOT. See below.

[10] Neither X-I, I-X or X-X trips are addressed in mode split due to constrained regional networks that necessarily fail to offer impedance-related variables beyond the region—all trips are assigned to the highway network.

[11] Connecticut Department of Transportation, Bureau of Planning and Research, *Person Forecasting Model: Gravity Model Calibration*, Staff Paper 80-3 (Newington: ConnDOT, 1980).

[12] Texas A&M University, Texas Transportation Institute, *Development of a Peak Period Traffic Assignment Capability*, prepared for the Texas State Department of Highways and Public Transportation (College Station, Texas: TTI, 1989). Relationships address both "peak spreading" and problems inherent in the traditional "hour in which travel began" format of home interview surveys.

[13] Allowing all reasonable mode-to-mode transfer opportunities. TransCAD's transit stochastic user equilibrium capability will supplant a former "all or nothing" MINUTP transit assignment.

Appendix B: Mode Split Model

[1] Introduced by James Ryan, then with Parsons, Brinckerhoff, Quade and Douglas and now with the U.S. Federal Transit Administration, in early-1993. Structure and process drew heavily on 1991-92 model introduction/refinement experience at the Capitol Region Council of

Governments (Hartford).

[2] Using household auto availability as a proxy for socioeconomic condition; i.e. zero, one and two-plus vehicle households.

[3] Capitol Region Council of Governments, *Griffin Line Rail Corridor Pilot Study: Phase 2A, Technical Memorandum 1, Documentation of Demand Estimation Model Modifications*, prepared for the Greater Hartford Transit District (Hartford: CRCOG, 1992).

[4] Premised upon reasonably objective relationships between home based work trip mode choice and behavior. Other (home-based other and non-home based) mode split estimates "drive" off peak period home-based work trip relationships.

[5] Technically addressing the "IIA" issue—the independence of irrelevant alternatives issue which suggests "...that the probability of choice between any two alternatives is determined only by the characteristics of those two alternatives.... The assumption is violated when there are unincluded attributes of two or more of the alternatives that are highly correlated with each other...For example, reliability of travel time may be a key factor in choice among travel modes, but one that is so hard to measure that it is never found in mode choice models.... An improvement in one mode would, in the absence of nesting, draw travelers from all other modes in direct proportion to the shares formerly held by each mode." See Comsis Corporation, *Models of and Occupancy Choice in the Shirley Highway Corridor, Draft*. (Washington: Comsis, 1989), Appendix B.

[6] Notably work performed for the Maryland National Capitol Parks Planning Commission and Honolulu, Hawaii. See Comsis Corporation, "Hartford Mode Choice Model", prepared for the Capitol Region Council of Governments (Washington: Comsis, 1990)—an adaptation of Comsis Corporation, *Models of and Occupancy Choice in the Shirley Highway Corridor, Draft* (Washington: Comsis, 1989). South Central Connecticut calibration relies upon U.S. Bureau of the Census *Census Transportation Planning Program* material.

[7] Early (1992-93) needs and resources introduced a joint transit (bus-rail) mode split estimating capability. Assignment results in a choice between rail and bus service.

[8] Network and model relationships limiting the market in contrast to an arbitrarily defined set of "walk connectors".

[9] A balance between relatively pronounced clustering as headways reach 15 minutes (W.M. Pecknold, "An Empirical Demand Model for Evaluating Local Bus Service Modifications" in Cambridge Systematics, Inc., *State Energy Conservation Plans*, prepared for the Federal Energy Administration (Cambridge, Mass: CSI, 1976) and the Toronto Transit Commission which uses an experienced-based relationship (square root of the headway) to estimate wait time. See Herbert S. Levinson, *Bus Routing and Scheduling Guidelines,* Synthesis of Highway Planning 69 (Washington: Transportation Research Board, 1980) drawing on Toronto Transit Commission, "Standards for Evaluating Existing and Proposed Routes" (August, 1977).

[10] Council of Governments, "Parking Cost Estimation for the Region", (March, 1993) updating Greater New Haven Chamber of Commerce, The New Haven Parking Situation: An Employer's Perspective (New Haven: COG, 1989).

[11] Factors and adjustment factors are successively multiplied. Non-peak auto occupancy "shares" are not modeled.

[12] The equivalent of a 40 cent per gallon tax increase given current circa 20 mile per gallon fleet efficiency ratings.

Appendix C: Transit Supply, Response and Cost

[1] Regional-scale networks addressing only intra-regional transit trips inherently under estimate rail trips. Sketch planning and attendant mode split estimates are confined to bus options where both supply and demand can reasonably be addressed.

[2] Cost allocated per Price Waterhouse, *Fully Allocated Cost Analysis Guidelines for Public Transit Providers*, prepared for the U.S. Urban Mass Transportation Administration (Washington: UMTA, 1987).

[3] Local experience suggests that it is very difficult to provide private sector productivity incentives in a contractual context since quality/ quantity trade-offs are difficult to monitor.

Appendix D: USDOT Planning Requirements

[1] 23 *USC* 134(f).