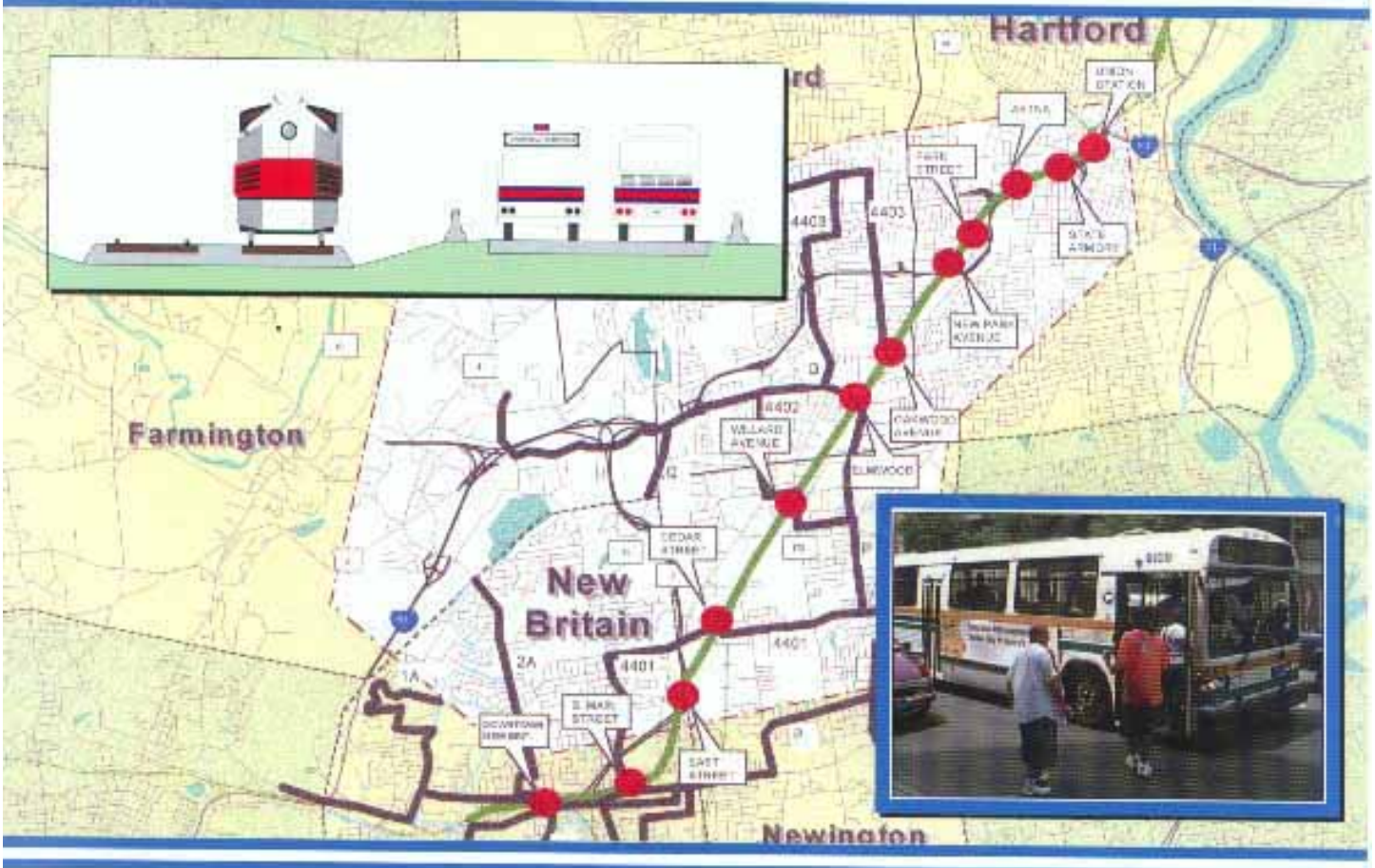
Final Report

Hartford West Major Investment Study



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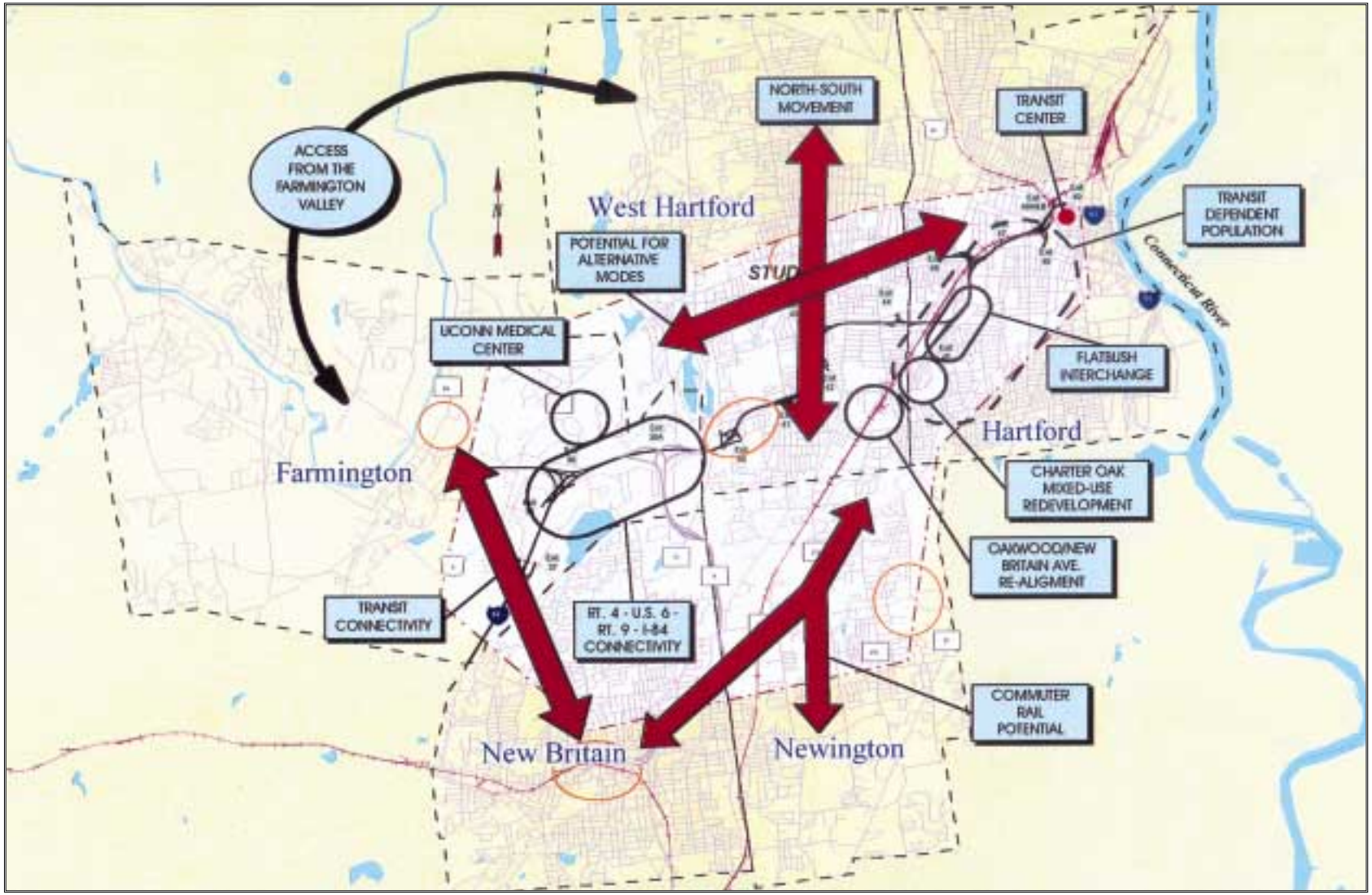
State Project #170-1493



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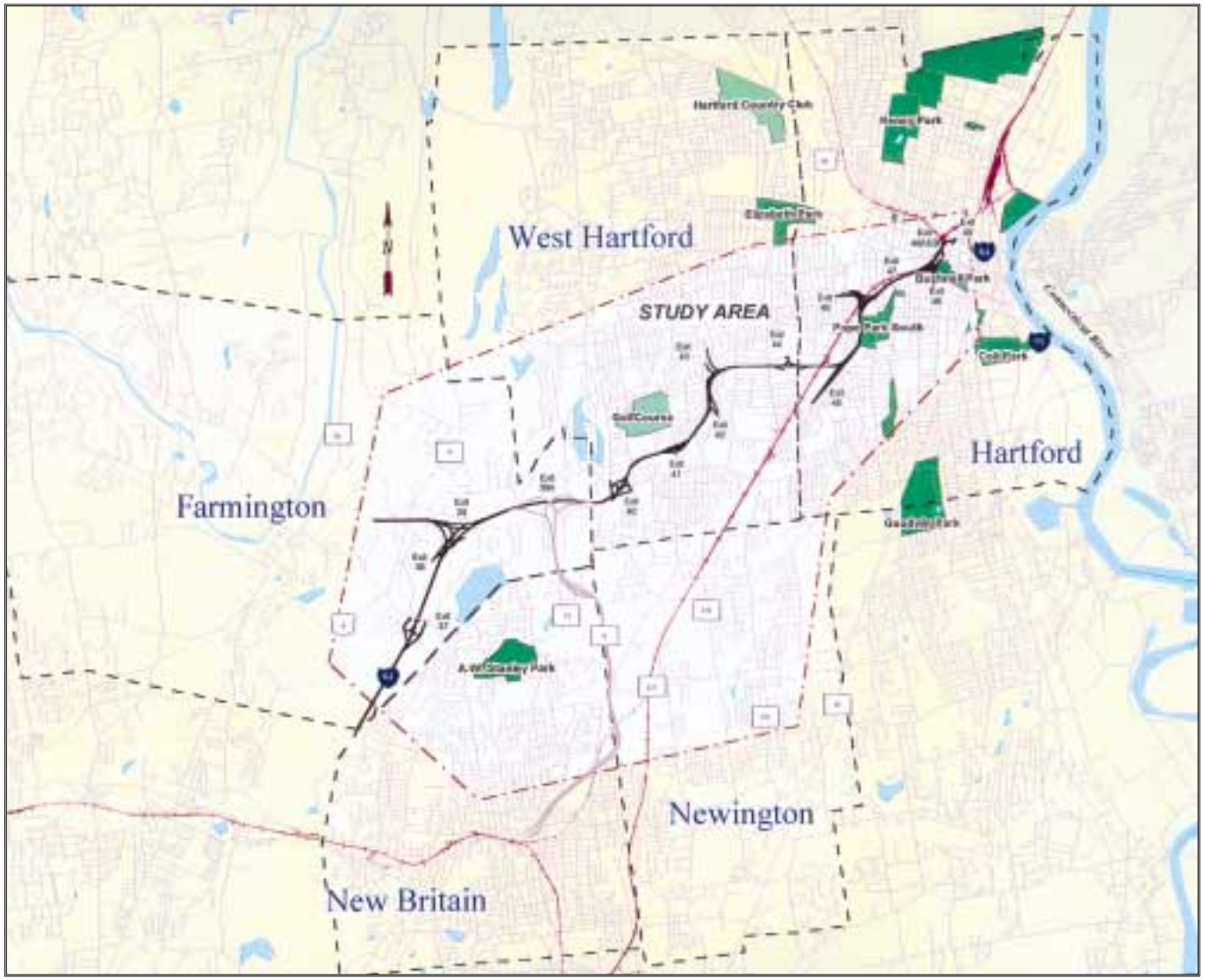
CORRIDOR-WIDE TRANSPORTATION ISSUES

HARTFORD WEST MIS

FIGURE 1-2



STUDY AREA MAP

HARTFORD WEST MIS

FIGURE 1-1

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EXECUTIVE SUMMARY

The Connecticut Department of Transportation (ConnDOT), the Capitol Region Council of Governments (CRCOG) and the Central Connecticut Regional Planning Agency (CCRPA) have identified peak hour traffic congestion and safety deficiencies as major concerns for the Hartford West corridor between Downtown Hartford and the Fienemann Road interchange in Farmington. To address these concerns and to evaluate the effectiveness of different transportation system improvement alternatives, these agencies undertook a Major Investment Study (MIS) for the Hartford West corridor.

The Hartford West Corridor. The Hartford West study corridor has been broadly defined to include not only I-84 itself, but also the neighborhoods surrounding the highway right-of-way, the parallel arterial roadways, and two rail lines, the Bristol-Hartford line and the New Haven-Hartford line. The study area, shown in Figure ES-1, encompasses portions of five communities: Hartford, West Hartford, Farmington, Newington and New Britain.

Technical and Final Reports. Three technical reports have previously been prepared in conjunction with this MIS. The first report established local goals and objectives, identified existing and future transportation conditions and developed the purpose and need for improvements. The second report identified alternatives that were intended to meet the purpose and need. Six Reasonable Alternative Packages (RAPs) were formulated for evaluation. Packages included highway, transit, Transportation System Management, and Transportation Demand Management strategies. In report three, the six RAPs were assessed to determine how well they functioned, and a Hybrid package of improvements was proposed. The Final Report presents an overview of the recommended improvements and their performance.

Policy and Technical Advisory Committees. To provide support for the MIS, a Policy Advisory Committee (PAC) and a Technical Advisory Committee (TAC) were formed with membership drawn from corridor municipalities, regional, state, federal, and other agencies and organizations. Based on the technical analysis and discussions that took place, the members of the PAC and TAC expressed their support of a recommended package of improvements. Subsequently, the Transportation and Policy Committees and Boards of the CRCOG and CCRPA supported the further study and refinement of the strategies contained in the recommended package. The recommended package is illustrated in Figure ES-2.

RECOMMENDED PACKAGE OF TRANSPORTATION IMPROVEMENTS

The principle transportation improvement recommendation to result from this study process is the **New Britain-Hartford Busway**. This facility will support the concept of Bus Rapid Transit (BRT) and is the first of its kind in the state. Other enhancements to the Busway will be studied such as the feasibility of including a Multi-Use Trail for the corridor and the role for Transportation Demand Management components of an integrated transportation package. An Environmental Impact Statement (EIS) will be prepared for this busway to specifically assess the impacts associated with it. Work on developing the EIS has begun.

Other recommended improvements are:

- **Reconstruction of Prospect, Flatbush, Sisson, and Sigourney Interchanges on I-84.** This area will require further study to determine the appropriate interchange configuration. It is anticipated that an Environmental Assessment (EA) will be prepared for the interchange proposals developed as part of the West Side Access Study;
- **Reconstruction of Routes 4, 6 and 9 Interchanges on I-84.** The suggested layout of this interchange is supported by towns and CRCOG, and will be advanced into the design phase. Because improvements will be made within existing right-of-way and impacts are limited, it is anticipated that a Categorical Exclusion (CE) will be granted for this improvement;
- **Auxiliary Lanes in West Hartford.** These safety improvements between Exits 40 and 42 on I-84 are supported by the town and CRCOG, and will be advanced into the design phase. Because improvements

CHAPTER 1

Existing and Future Conditions

1.1 STUDY BACKGROUND

The Connecticut Department of Transportation (ConnDOT), the Capitol Region Council of Governments (CRCOG) and the Central Connecticut Regional Planning Agency (CCRPA) have identified peak hour traffic congestion and safety deficiencies as major concerns for the Interstate 84 (I-84) corridor between Downtown Hartford and the Fienemann Road interchange in Farmington. This corridor forms a critical link between major activity centers, such as Downtown Hartford, the Westfarms Mall in West Hartford, the University of Connecticut Health Center in Farmington, Downtown New Britain, and the growing Farmington River Valley.

To address these concerns and to evaluate the effectiveness of different transportation system improvement alternatives, these agencies jointly undertook a Major Investment Study (MIS) for the Hartford West corridor. The Hartford West study corridor has been broadly defined to include not only I-84 itself, but the neighborhoods surrounding the highway right-of-way, the parallel arterial roadways, and two rail lines, the Bristol-Hartford line and the New Haven-Hartford line.

The majority of the study area is located within the Capitol Region, a metropolitan area composed of Hartford and the 28 towns surrounding it. The Capitol Region's communities have a combined population of 709,404. A portion of the study area (New Britain) is located in the Central Connecticut Region. The study area encompasses portions of five communities: Hartford, West Hartford, Farmington, Newington and New Britain.

This study meets the requirements of an MIS process specified by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). It conforms to FHWA Regulation 23, CFR 771, and complies with all applicable Federal and State policies, protocols and procedures, including those outlined in FHWA Technical Advisory T6640.8A.

1.2 STUDY AREA DEFINITION

The study corridor limits are illustrated in Figure 1.1. These limits can be generally described as:

- **South to North on I-84** — from the Fienemann Road interchange in Farmington to the High Street ramps in Downtown Hartford, including those areas located south of Farmington Avenue in Hartford and West Hartford and north of Route 175 (Cedar Street) in Newington.
- **East to West** — from the High Street ramps in Downtown Hartford to a line extending one mile west of Farmington Avenue in the Town of Farmington, including only those areas north and west of New Britain Avenue in Hartford.

1.3 STUDY AREA CHARACTERISTICS

The study area communities can be divided into three general patterns of population, land use and housing character. These are:

- Urban Areas;
- Inner Suburban Areas; and
- Outer Suburban Areas.

Urban Areas - Hartford and New Britain

The two urban areas - the Cities of Hartford and New Britain - have experienced substantial population loss during the period between 1970 and 1980, and a slight gain in population after 1980. They possess a substantial portion of their respective regions' multi-family housing stock, and a far greater proportion of residents living below the poverty line. The combination of dense housing conditions and low-income households leads to a substantially greater number of households being without a vehicle available to them. In the City of Hartford, nearly forty percent of households have no vehicle available, and can therefore be considered as "transit-dependent" for their mobility needs. In New Britain, the proportion of "transit-dependent" households is approximately sixteen percent.

In Hartford, structures containing five or more units comprise almost half of the residential buildings in the City. Hartford's housing stock is largely renter-occupied housing (75 percent of all units), with a significant portion (16 percent of the City's total housing stock) consisting of Hartford Housing Authority low-income and senior citizen units. The Charter Oak Terrace and Rice Heights housing projects, located within the study area, are sched-

CHAPTER 2

Reasonable Alternative Packages

This chapter presents the Reasonable Alternative Packages (RAPs) formulated for the initial evaluation within the Hartford West MIS. The RAPs were intended to present broad themes for future transportation improvement strategies within the corridor. The themes adopted for this round of evaluation included:

- RAP 1- No Build (Existing and Committed);
- RAP 2 - Transportation System Management, Transportation Demand Management, and Transit Operations;
- RAP 3- Freeway Reconstruction and Operations;
- RAP 4- Transit Fixed Guideway - Light Rail, Commuter Rail and Busway;
- RAP 5- Freeway HOV Lane; and
- RAP 6- Freeway Additional General Purpose Lane.

However, due to the complexity of transportation issues within the study area, it is likely that no single package would satisfy all future travel demands. Following this round of evaluations, elements from several of the RAPs were combined to create a hybrid package for further environmental and engineering evaluation.

2.1 RAP 1 – FUTURE NO BUILD (EXISTING AND COMMITTED)

The No Build package (RAP 1) constitutes the base case condition for the evaluation of transportation improvements. No Build generally includes existing and committed projects, along with the normal maintenance and operation of the transportation system over the forecast period. The details of RAP 1 were presented in Technical Report #1, the Preliminary Purpose and Needs Report, which analyzed the future performance of this RAP.

Volume Increase. The increase in the trip ends and thus travel demand from 1995 to 2020 during the A.M. peak hour was approximately 33% and in the P.M. peak hour increase in trip ends was approximately 32%. Trip ends to and from Farmington show a maximum increase of over 45% between 1995 and 2020, and trip ends to and from West Hartford show a minimum increase of approximately 20% between 1995 and 2020.

Intersections. Analysis of the Peak Hour 2020 Levels of Service for the Intersections within the study area indicates that 19 intersections will have a LOS F during the A.M. peak and 24 intersections will have a LOS F during the P.M. peak. This compares to 5 intersections in the 1995 A.M. peak and 9 intersections in the 1995 P.M. peak.

I-84 Westbound. During the A.M. peak, I-84 westbound segments are expected to degrade slightly. Segments with LOS "C" are projected to become LOS "D" and those with "D" are projected to become "E" by 2020). Travel speeds, which are currently between 50 and 52 miles per hour, will be reduced to between 47 and 51 miles per hour.

Performance of the peak direction during the evening P.M. peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals additional degradation. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds reduced to below 25 miles per hour.

I-84 Eastbound. Although the morning A.M. peak eastbound I-84 currently receives LOS "F" on the most easterly segment of the freeway between Exits 46 through 49, the situation by 2020 will become much worse as the LOS "F" segments continue from Exit 39A through 49. Average speeds will drop below twenty miles per hour with volumes exceeding 7,400 on the easterly end of the freeway.

The evening P.M. peak is projected to experience a generally failing Level of Service from Exit 39A through the east end of the corridor. Speeds will drop to twenty miles per hour by 2020.

2.2 RAP 2 - TRANSPORTATION SYSTEM MANAGEMENT, TRANSIT OPERATIONS, & TRANSPORTATION DEMAND MANAGEMENT

Transportation System Management (TSM) is a name given to a broad range of strategy types whose purpose is to get the most out of existing transportation infrastructure without major capital investment. Transit Operations includes methods to improve the ability of existing bus systems in the study corridor to attract riders and meet

mobility needs. Transportation Demand Management (TDM) is a generic term that encompasses a wide range of strategies that have been employed to reduce peak hour vehicular travel and increase overall mobility. A complementary package of TSM, TDM and Transit Operations provides the potential for the most efficient system operation. Technical Report #2 provides background information on TSM, TDM and Transit Operations.

Given the small-scale, localized nature of RAP 2 improvements, a definitive list of improvement sites can not be defined to this stage. Instead, typical locations and improvements have been identified for comparative evaluation. Final improvements may vary from those targeted in this analysis.

TSM, TDM, and Transit Operations strategies can work effectively together to enhance the current effectiveness of the total transportation system. These improvements are usually implemented within the right-of-way and are less capital intensive than other transportation improvement alternatives, but taken in aggregate, the cost associated with RAP 2 would be less than the build alternatives in RAPs 3 through 6. The success of the program especially the TDM segment depends on the voluntary cooperation of the public and private sector.

Safety Enhancements

Safety improvements are an important part of the overall approach to transportation systems management. The top four high accident locations were:

Route 4 approaching the jug handle - The segment of Route 4 west of the jug handle experiences a high percentage of rear end accidents. This is an area in which frequent traffic queuing in the westbound direction occurs due to the geometric constraint of Farmington Center. Sideswipes and turning movement incidents also make up a major portion of the total accidents.

Route 71 south of Corbins Corner - The segment of Route 71 south of Corbins Corner witnesses a high percentage of rear end and turning movement accidents due to the many access points to shopping and restaurants along this road. Driver inattentiveness and sudden stopping to turn may be prime reasons for these types of accidents. One third of all accidents in this area occur at night according to the records. Also, this segment of roadway is responsible for some pedestrian accidents. Since this is a heavy retail and food service orientated area, heavy pedestrian traffic is to be expected. Possible solutions to this problem might involve installing sidewalks and crosswalks, improving lighting, and installing warning signs for both pedestrians and motorists. Another approach to reducing some of these accidents might involve employing access (or curb cut) management techniques. This could involve consolidating some of the many driveways leading to parking lots or adding exclusive left turn lanes for heavily used lots.

Route 175 from Route 9 to Route 176 - Route 175 is a principal arterial with two lanes in each direction. The majority of accidents are rear end, but there is also a high percentage of head-on collisions. Since head on accidents tend to be the most severe, this segment of roadway is of concern and necessitates some improvement. Improvements to Route 175 were analyzed in a study by CRCOG.

Interstate 84 from Sigourney St. to High St. - Interstate 84 near downtown Hartford experiences numerous rear end accidents. Naturally, the huge volume of traffic which utilizes this segment of roadway each day is the cause of the high number of accidents. This portion of highway is at breakdown condition during most of the morning and afternoon peak periods, and the frequent stop and go of traffic is responsible for the 48 percent of rear end incidents. But the magnitude of volume is not the only culprit for these accidents. This segment is prone to complex weaving patterns due to the many ramps, some of which are left hand on and off, which compound the traffic flow problem. Some possible solutions to this problem could involve realignment of I-84 or to remove the left hand exits. Another idea is to install overhead variable message signs to alert traffic to peak hour congestion.

Intersection Operational Improvements

Several intersections in the Hartford West study area have been identified as having severe operational deficiencies. These intersection have been analyzed as having a Level of Service F under current conditions and are impeding the overall performance of the transportation system. As part of the TSM strategy each intersection will need to be upgraded to meet acceptable standards for handling traffic. While each intersection will need further analysis some of the potential improvement solutions may include adding exclusive left turn lanes and phases, improving signal timing and coordination, adding lanes, grade separation, updating of signal and improving stripping and signing. The intersections analyzed included:

- Hartford Avenue at New Britain Avenue;
- New Park Avenue at Flatbush;
- Park Road at I-84 Off-Ramp;
- Park Road at I-84 On-Ramp;
- Park Road at So. Main;
- Park Road at Trout Brook;
- Rt. 173 at New Britain Avenue;
- Route 4 at I-84 Ramps (Jug Handle);
- Route 4 at Old Mountain/Talcott Notch; and
- South Main Street at New Britain Avenue.

Other examples of TSM improvements include:

- **Access Control and Management (Curb-cut Control)** – Farmington Ave., New Britain Ave., Park Ave., and Cedar Street;
- **Intersection Widening/Channelization** – Boulevard and Capital Ave.; Farmington Ave. and Sisson Ave., and Farmington Ave. and Trout Brook Dr.;
- **Traffic Signal Systems (Isolated or Corridor Coordination)** – Farmington Ave., New Britain Ave, and Cedar Street;
- **On-Street Parking Regulation** – Farmington Ave., New Britain Ave., and Cedar Street;
- **Spot Widening** – Throughout the Study Area;
- **Goods Movement (Truck) Regulation** – South Road, Route 4, Route 9; and
- **Pedestrian** – Crosswalks, Signal, and Facilities.

Park & Ride Lots

Park and Ride Lots are important elements in transportation system because they provide a convenient location for carpooling, vanpooling, and express and local transit stops. They are important adjuncts to transit and rideshare strategies. While several lots are currently in operation within the Hartford West corridor, opportunities exist for their expansion or construction at new locations. Several of these locations include:

- Plainville - I-84 at Crooked Street (Exit 34);
- Farmington - Additional Parking at Fienemann Road (Exit 37);
- Farmington - Route 6 at I-84 (Exit 38);
- Farmington - Expand parking at Route 4 (Exit 39); and
- West Hartford - I-84 at New Britain Avenue (Exit 40).

Transit Operations

The following are details of transit operations improvements that are included in RAP #2. Route concepts presented here are conceptual in nature oriented toward promoting improved mobility in the corridor via a transit center approach to service design. These services would be overlaid on the existing route structures with details on coordination, schedules and costs to be determined at later phases of this project if necessary.

Express Bus Improvements. New express or limited bus services could be considered:

- **Hartford-New Britain Express** - The transit hubs in downtown Hartford and New Britain would be linked via a Route 9/I-84 Express link that provide attractive mobility between the two largest population concentrations in the study area and allow for connections between the independent Hartford and New Britain transit networks.
- **New Britain-Westfarms - West Hartford Limited** - The transit hubs in New Britain and West Hartford would be linked via a limited service that would operate in express mode along limited access highways but also provide pick up and distribution services near transit hubs.
- **UConn Medical Center Express** - A route connecting the University of Connecticut Health Center with Hartford via Routes 4 and I-84 would link a major employment center with Hartford, and also provide the possibilities of another park/ride facility for Farmington residents to travel to Hartford.

Local Service. Local Transit service could be expanded to include:

- **UConn Medical Center - New Britain**
- **Local Farmington Bus** - A local bus serving the transit hubs at UConn and Westfarms Mall.
- **Newington - West Hartford Service** - A new route operated along the SR 173 corridor.
- **Newington - Westfarms - Farmington Service** - A route from Market Square Newington via Central Connecticut State University, Westfarms Mall, and UConn Medical Center.
- **W-Route Extension** – Extend the W-Route from Hartford to Newington to run to Downtown New Britain via East Street, Allen Street and ML King Street. This would provide access to New Britain from Northwest Newington and Downtown West Hartford.
- **Stanley Street - New Britain Ave Service** - Interline the New Britain Transit Westfarms Service with the Connecticut Transit Q Route service to Westfarms Mall to provide one seat ride for local passengers between the transit dependent neighborhoods in Hartford, Elmwood and New Britain while also provid-

ing an additional local service other than the P Route to provide for travel between Hartford and New Britain.

- **East Street Extension** - The Dattco East Street Route could be extended via Cedar Street to downtown Newington providing an additional more direct path between the two transit hubs. This crosstown route could be further extended if desired to downtown Wethersfield via a eastward extension on Route 175.
- **E-Route Limited** - Improve the bus travel times by offering "limited" service to some passengers boarding west, north or south of LaSalle Road. The shorter Farmington Ave route variations could make every stop for which there is a demand. However, the longer E route variations, such as Unionville, the Medical Center, and Westfarms Mall would provide "limited" service, making few or no stops between West Hartford center and downtown Hartford.

Transportation Demand Management

In most portions of the Hartford West study area, the existing pattern of land use and the relative availability of parking (in comparison with larger metropolitan areas) favor the use of single-occupant vehicles (SOV's). Even workers within the regional core - Downtown Hartford - utilize an SOV more commonly than any other mode. The 1990 census reports that 70 percent of Hartford workers drove alone, while only 15 percent utilized carpools, or vanpools and ten percent used a bus. The remaining five percent either walked or bicycled to work, or worked at home. For outlying employment centers the proportion of commuters driving alone is even greater, reaching a high of 88 percent in Farmington and 84 percent in Newington. In no other community within the study area, including New Britain, do more than five percent of workers utilize bus service.

Market rate parking costs in Downtown Hartford range from over $100 per month for parking garages in the immediate vicinity of the Civic Center and Constitution Plaza to a low of approximately $40-60 for parking lots in the Asylum Hill and South Green areas depending on location. However, well over half of Downtown employees, including most State of Connecticut employees, have free parking provided to them. In Downtown New Britain, most employers pay for their employees' parking, while visitor parking is provided by the City's extensive inventory of off-street garages. Elsewhere within the study area, almost all employee parking is provided for free. Within West Hartford Center, municipal lots charge for long-term visitor parking, but outside of these very limited instances all of the suburban activity centers offer visitors and employees an abundance of free parking.

TDM Strategies. TDM strategies work most effectively as complements to transit service enhancements. In Technical Report #3, three TDM strategies were tested - Financial Incentives for Transit Use; Parking Pricing; and Congestion Pricing. The Financial Incentives were the most successful in increasing transit ridership. Both Parking Pricing and Congestion Pricing performed about half as well as Financial Incentives.

Based on past regional and nationwide experience, the adoption of a high-profile TDM initiative at an individual employer can result in an increase in use of High Occupancy modes of up to 20 percent. Because HOV travel still represents a minority of travel in most work sites (especially for suburban and non-CBD locations), the total impact on congestion or modal split would be proportionately lower. A voluntary employer-based program implies that participation will be substantially less than 100 percent. Current corporate participation rates (the number of firms participating versus the total number of area businesses) are in the range of one percent of all employers and ten percent of all employees.

For Downtown Hartford work sites an increase of 20 percent in the mode share to ridesharing and transit would actually mean a less than five percent increase in number of people using these modes, and a corresponding (but lower) decrease in vehicular travel due to the fact that most carpools consist of two - the driver plus one passenger, so that vehicle miles of travel decrease by half, not by 100 percent. In suburban locations, where current carpool and transit participation rates are lower, the estimated decrease in vehicular travel would be in the range of two percent.

2.3 RAP 3 - FREEWAY OPERATIONS AND RECONSTRUCTION

Reconstruction improvements will be directed at reconstruction of left entrance and exit ramps, partial interchanges, and locations where auxiliary lanes will relieve spot congestion. RAP 3 also included Intelligent Transportation System (ITS) strategies such Arterial Signal Coordination, Incident Management, and Traffic Operations Centers. These locations include:

- **Route 4, Route 6, and Route 9 interchange areas** - The construction of a collector- distributor road on the south side of I-84 and the elimination of left hand exit and entrance from eastbound I-84 to Route 4 and eastbound Route 4 to I-84.
- **Trout Brook to Kane and Caya Interchanges** - Construction of collector-distributor (C-D) roads on both sides of I-84, and the elimination of left entrance (Trout Brook to I-84 east bound);
- **Prospect and Flatbush Interchanges** - Construction of C-D roads and a diamond interchange at Prospect, elimination of left exit (I-84 westbound to Flatbush), and the construction of eastbound exit and westbound entrance to the Flatbush exit.
- **Sisson Avenue Interchange** - Elimination of left hand eastbound exit and construction of right hand exit.
- **Sigourney Avenue Interchange** - Construction of ramps to and from the west at I-84.
- **Auxiliary Lane in West Hartford** - Construction of auxiliary operational lanes between Exits 40 and 42 in West Hartford.

Intelligent Transportation Systems (ITS)

In the Hartford West corridor, ITS Strategies could consist of Arterial Signal Coordination, Incident Management Techniques, and Traffic Operations Center. RAP 3 includes the following ITS strategies:

Arterial Signal Coordination. This technique will improve travel times on principal arterial streets. Through coordinated traffic signal timing vehicles will maintain a uniform speed and minimize stopping. The result is that motorists will experience fewer delays and reduce auto emissions and energy consumption. To achieve optimal performance on a given arterial street, all signalized intersections must be equipped with sensors, and communications needs to be established between the intersections and a central Traffic Operations Center (TOC), where a computer will use input from the sensors to determine optimal signal timings and offsets for each signalized intersection.

Routes suggested for coordination include the following:

- Farmington Avenue;
- Route 6/Old South Road/New Britain Avenue;
- Fenn Road/West Hill Road/Newington Road;
- Route 175 (Cedar Street);
- Route 176 (Newington's Main Street);
- New Park Avenue/Prospect Avenue; and
- Sedgwick Road/Park Road.

Incident Management. Incident management is the rapid detection and response to any incident with the potential to reduce traffic flow. A common means of incident detection is cellular phone calls from motorists who observe an incident. According to the *ITS Strategic Plan*, this system works well. However, in order to confirm these reports, and help determine the appropriate response, an additional system is proposed. The surveillance of I-84 by a set of Closed Circuit Television (CCTV) cameras would fulfill this function. These cameras would be connected to monitors at a Traffic Operations Center (TOC), where an operator can confirm that an incident has taken place, determine what is needed to clear the incident, and dispatch appropriate personnel and equipment to deal with it. The operator can then use the Advanced Traveler Information Systems to quickly notify motorists of the incident, so that they can choose alternate routes.

Another Incident Management facet recommended by the *ITS Strategic Plan* is the Connecticut Highway Assistance Motorist Patrols, or CHAMP. These are light trucks, staffed by Department of Transportation employees, equipped to handle minor traffic incidents without the dispatch of additional equipment. They can provide a motorist with gasoline, jump start a battery, push a stalled auto out of the traffic stream, or assist in changing a tire. They can remove debris from the right-of-way, and set up signs for accident and detour routes. Additionally, they observe traffic conditions and report to the operators at the TOC. CHAMP patrols already exist on I-95 and on I-91, and the *ITS Strategic Plan* urges their expansion to I-84 in the Hartford area. Nationwide, Highway Service Patrols have proven to be extremely popular in many urban areas, and have proven invaluable in building public support for ITS projects.

Traffic Operations Centers. All of the ITS components described above require control by computers and experienced operators. This is the purpose of a TOC. Currently, two TOCs exist in the Greater Hartford area. A TOC at ConnDOT Headquarters, in Newington, currently controls ITS freeway operations on I-91. This would be the logical place to control the Traveler Information Systems, the Ramp Metering, and the Incident Management surveillance and dispatching. A smaller TOC exists in Downtown Hartford, to control the City of Hartford's computerized traffic signals. This is a possible location for the Arterial Signal Coordination systems. Other options might include use of existing City of West

Hartford traffic engineering facilities, the construction of a new TOC in West Hartford or New Britain, or locating this function in the Newington TOC.

2.4 RAP 4 - FIXED GUIDEWAY TRANSIT

This RAP consists of a variety of different transit related alternatives. The fixed guideway alternatives have been divided into Light Rail, Busway, and Commuter Rail alternatives.

Light Rail technology is an advanced form of the traditional streetcar. Typical LRT systems can include both grade-separated (off-street) and on-street operation. LRT vehicles are powered by electric motors and draw power form electric cable overhead. They are approximately 75-90 feet long (twice the length of a bus) and can run in either single-car or two to four-car (multiple unit) trains.

Busways consist of a designated or grade-separated bus facility. The busway offers greater flexibility than an LRT in that buses can enter and exit the exclusive bus facility from existing bus routes as well as serve station locations. Buses operating on a busway may either be driven by a driver as on-street, o r guided similar to a rail car on steel rails. Guided bus operations allow for buses to operate at higher maximum speeds than may otherwise be desirable with an unguided bus.

The commuter rail mode is distinguished from Light Rail by the greater speed and capacity of the equipment, greater distance between stations, and the orientation of services to park-and-ride or drop-off access versus pedestrian access. In keeping with the overall direction to restrict improvements to existing transportation corridors, the following rights of way were suggested for each alternative:

- **Interstate 84 Right-of-Way** - Light Rail or Busway;
- **New Britain to Hartford Rail Right of Way** - Commuter Rail, Light Rail, or Busway; and
- **Farmington Avenue** - Light Rail or Busway.

Service Objectives. While each of the fixed guideway alternatives is unique, there are similarities in planning and designing these transit services. The following service objectives have been defined:

- Maximize ridership on the fixed guideway line to achieve transit service efficiency and to maximize transit service frequency;
- Eliminate redundant or competitive through bus services in the corridor;
- Provide a reasonable commuter shed for the transit corridor by using feeder bus, park and ride, and pedestrian linkages.

Right-of-Way Width. Twenty-four feet is the normal standard for two straight tracks or for two busway lanes. With a 11' 2" centerline distance between the two tracks, this allows slightly more than two feet nominal clearance between light rail vehicles on the two tracks and between the light rail vehicles and adjacent road traffic (not allowing for vehicle tilt, catenary poles, signal masts, fences, other structures, or roadway traffic overhanging its wheelbase).

Twenty-two feet appears the practical minimum width of a two-track dedicated light rail right-of way. With a 22-foot right of way, these nominal clearances drop below 1.5 feet. Slightly narrower rights-of-way are possible, but probably involve unacceptable and non-cost-effective vehicles. The Washington Boulevard section of the Los Angeles to Long Beach "Blue Line" was the only North American example found less than twenty-four feet wide. The 22-foot trackway was part of a "share the misery" program where traffic lanes and sidewalks were also reduced in width so that 112 feet of total desired width could be squeezed into 100 feet of available right-of-way.

Similar standards seem appropriate for busways. In New Jersey, on the Rt. 495 XBL land widths are sometimes reduced to less than 10 feet nine inches. Safety records are excellent because of the use and training of professional drivers. Similar programs would be important adjuncts to the safe operation of the New Britain-Hartford Busway.

Station Areas and Platforms. Station areas will require wider right-of-way to accommodate stopped and through vehicles as well as the station platform and building. Even with a minimum of two through lanes and two stopping lanes 44 feet to 48 feet would be appropriate. Station platforms increase right-of-way width typically by another ten to fourteen feet. Ten feet is the usual minimum for a center platform serving both tracks. Six feet appears to be the usual minimum for a side platform serving one track. Side platforms serving both tracks add twelve feet to the right of way. The total width needed for a station could be mitigated by staggering the inbound and outbound stations.

An ADA-compliant high center platform also requires that the track be tangent (straight) for fifty feet in both directions beyond the platform. Beyond that, it typically takes another thirty feet for the tracks to move back together.

Feeder and Connecting Bus Services. Each of the potential fixed guideway investments described in the balance of this section include a package of recommended feeder and connecting bus services. In some cases existing bus routes are slightly modified to provide connectivity to the fixed guideway investment. In other cases new bus services are proposed which would be overlaid on existing service. In only a few cases are existing transit services radically altered. In any event, all bus route proposals are oriented toward expanding the range and reach of the proposed fixed guideway investment by improving transit mobility options available for all trips in the corridor.

In later planning stages associated with any fixed guideway transit RAPs more detailed analysis of the feeder and connecting bus network design will be required. This analysis should focus on maximizing transit effectiveness and efficiency but must also evaluate impacts on existing transit riders and other transit constituencies.

RAP 4A-1 Hartford/New Britain Light Rail Transit Line

A rapid transit service using electric light rail technology could be located in the existing rail rights of way linking Hartford with New Britain via Newington. The line would run from downtown New Britain to Union Station. The line would operate in an exclusive right of way with minimal grade crossings allowing for a higher average service velocity. It is possible that the rail line could then run as a street railway from Union Station to the Old State House. Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. In comparison to the proposed service in RAP 4B, Commuter Rail, the LRT system will have more frequent station stops.

Peak period service velocity for this line would be in the neighborhood of 25 mph. Off peak service velocity could be slightly higher. End to end running time from downtown New Britain to Union Station would average 23 minutes. Running time from Crooked Street in Plainville to Union Station would average 30 minutes. Service frequencies would be approximately 10 minutes or less during the peak and 15 minutes off-peak.

RAP 4A-2 I-84 Median Rapid Transit Line

A rapid transit service using light rail technology with level boarding could be located in I-84 right of way as a grade-separated "high speed" line. The line could run from the I-84 Stack (Exit 39A) to Prospect in the I-84 right of way, then would shift to the rail line where it crosses below near the former Heublein plant on New Park Avenue. The rail line would use the unused western portion of the rail right of way continuing parallel to New Park Avenue and Capitol Avenue to Union Station. The line would operate in an exclusive right of way with minimal grade crossings allowing for a higher average service velocity. It is possible that the rail line could then run as a street railway from Union Station to the Old State House. Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor.

Proposed station spacing in come cases increases to exceed 5000 feet in keeping the rapid design for similar highway median rail lines but is generally less. Peak period service velocity for this line would be in the neighborhood of 25 mph. Off peak service velocity could be slightly higher. End to end running times from the I-84 Stack to Union Station would be approximately 21 minutes. An alternative to a terminal station on the stack is a shared right-of-way loop serving the UConn Medical Center and other employers in this growing part of the region.

RAP 4A-3 Farmington Avenue Light Rail

This light rail line would be located in the median of the Asylum/Farmington Avenue corridor from Old State House in Hartford to La Salle Road in West Hartford-a distance somewhat greater than 3 miles. A possible extension of this segment could run from West Hartford Center to South Road in Farmington just west of the UConn Medical Center.

Proposed station spacing would be generally 2500 feet as per designs of other successful U.S. street railways (e.g. Boston's Green Line). Stations could be more closely spaced where conditions warrant. Stations would be median islands in the roadway. Stations would generally be located mid block to the west of the north/south cross street.

Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. The two center lanes as shared lanes with general purpose auto traffic. A twelve foot wide center platform location is considered for stations at mid-block.

RAP 4B - Plainville to Hartford Commuter Rail

A commuter rail service using Diesel Multiple Unit (DMU) technology or standard rail cars and diesel locomotive push-pull sets such as the Shoreline East service could be operated in existing rail right of way largely on existing track between Crooked Street in Plainville and Union Station in downtown Hartford. In keeping with commuter rail service designs, station spacing would tend to exceed 10,000 feet between stations. Service would be operated at frequencies of not less than fifteen minutes with off peak service on an hourly (or half-hourly) headway.

Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. In comparison to the proposed service in RAP 4A-1, New Britain-Hartford LRT, the Commuter Rail system will have less frequent station stops and be able to maintain higher travel speeds.

Service could be operated with traditional diesel locomotive drawn push-pull equipment sets, but the potential also exists to use innovative lower cost rolling stock technology. Many rail transit agencies are currently considering the use of light weight self propelled diesel rail coaches to provide passenger service on lightly used branch lines. Since large portions of the Plainville to Hartford line is only lightly used for freight service, the option arises to employ lighter weight more efficient high performance rolling stock that does not necessarily comply with Federal Railroad Administration standards for joint use with other US standard rail equipment. A range of these self-propelled cars are currently being demonstrated in the North American market.

Using quiet low emissions modern DMU technology it is conceivable that the rail cars could then run as a street railway from Union Station to the Old State House providing improved door step service for many more potential passengers. As noted above, the lightest units do not comply with FRA crash-worthiness regulations and would need to be segregated from other rail traffic (e.g. Amtrak and Guilford Railway System (GRS) trains on the same tracks.) Heavier DMU's and conventional locomotive hauled equipment could share tracks with other heavy trains belonging to Amtrak and freight carriers.

Taking advantage of the high speed Amtrak track between Newington and Hartford and the longer station spacing, the commuter service would operate at an average velocity in excess of 30 mph. Running time from Crooked Street to Union Station using diesel locomotive hauled equipment would be approximately 25 minutes. DMU service velocities would be somewhat faster with even more attractive travel times.

RAP 4C-1 – New Britain - Hartford Busway Alignment and Stations

The busway would follow the same alignment as the RAP 4A-1 and 4B light rail and commuter alternatives. It would pass through the communities of New Britain, Newington, West Hartford and Hartford. The busway would use the same stations as the light rail alternative between New Britain and Hartford.

- Downtown New Britain;
- South Main Street;
- East Street;
- Cedar Street;
- Willard Avenue;
- Elmwood;
- Oakwood Avenue;
- New Park Avenue at I-84;
- Park Street;
- Aetna;
- State Armory; and
- Union Station.

Bus routes will be able to enter and exit the busway at intermediate locations. The busway will also serve activity centers in the New Park Avenue corridor in Hartford, the Elmwood community in West Hartford, the future business center anticipated at the junction of Route 9 and Route 175, and Central Connecticut State University located in New Britain. While final location studies will be necessary, access points will be located at:

- New Britain – Downtown (End Point);
- East Street;
- Willard Avenue;
- Oakwood Avenue;
- New Park Avenue;
- State Armory; and
- Union Station (End Point).

Connecting bus routes and van services will link passengers with off-line destinations at station locations. Bus terminal access in New Britain would include a direct connection to the limited-access Route 72 freeway, while in Downtown Hartford buses would leave the busway between Broad and Church streets and circulate through the CBD to Main Street. Park-and-ride lots would offer further flexibility in meeting passenger needs.

Major Differences Between Busway and Rail Alternatives. The bus services that would be operated with this alternative would be similar to those be provided with light rail or commuter rail. However, there would be four major exceptions:

1. The first is obvious - buses, rather than light rail or commuter rail, would provide the trunk service along the railroad right-of-way between Plainville and downtown Hartford.
2. By definition, rail services are restricted to the rail right-of-way. Buses, however, would not be restricted to the rail right-of-way. As a result, many of the routes that would act as feeder services for light rail or commuter rail could be through-routed with the busway services to provide one-seat service to downtown Hartford and intermediate stations.
3. The frequency of service offered by the busway would be much more attractive than light rail or commuter rail. Using 40 foot buses with 40 seats, trunk line service would have to be provided every 3 minutes to carry the demand indicated in the initial RAP 4A-1 and 4B forecasts. (The services described below would provide that level of service.)
4. The western terminus of the busway would be downtown New Britain because the rail right of way west of downtown New Britain has insufficient width to accommodate continued rail freight traffic and a busway, and because congestion on Route 72 is not great enough to warrant a separated guideway. From New Britain to Newington Junction, the right of way is generally wide enough to allow for the development of a two lane busway parallel to the existing active tracks.

Because the busway alternative would provide more direct services and more frequent services at comparable speeds, it is likely that this alternative could attract higher ridership than the rail alternatives.

RAP 4C-2 – I-84 Median Busway Alignment and Stations

The busway would follow a similar alignment as the RAP 4A-2 light rail alternative, except that the Stack terminal would be replaced by a new terminal at the Exit 39/Route 4 interchange. It would pass through the communities of Farmington, West Hartford and Hartford.

2.5 RAP 5 - ADDITIONAL LANE - HIGH OCCUPANCY VEHICLE (HOV)

The High Occupancy Vehicle (HOV) system (RAP 5) proposed for the Hartford West corridor would operate similarly to those in the Capitol Region on Interstate 91 and Interstate 84 east of the Connecticut River. Access to the interstate would be provided at designated on-ramps, and would be open for use by vehicles with two or more occupants (HOV 2+). In addition to HOV 2+ automobile traffic, the HOV lane would also enable express buses to enhance travel time and build ridership. Another key element in building use of the lane is the implementation of park and ride lots. While they may be open for general carpooling and ridesharing operations, these lots are also frequently served by express and local transit service.

The improvement would consist of a twelve foot HOV lane, a four foot shoulder separation, and a ten foot inside shoulder. The proposed alignment for the HOV lane is illustrated in Technical Report #2. At the east end of the corridor right-of-way restrictions may require that shoulders and separations be reduced to minimize or eliminate impacts on adjoining property.

In addition an alternative exists for access to the downtown area. It would be possible to use the busway proposal from RAP 4A-2 from Prospect Ave. to Union Station for circulation downtown. The geometrics of the bus way are too tight to allow general purpose HOV 2+ traffic to use as an access path. However, transit buses could effectively use this as an alternative path.

Express Bus Routes. The bus routes that will use the proposed High Occupancy Vehicle (HOV) lane for I-84, extending from Exit 39A to downtown Hartford are discussed in this section. Express buses will enter and exit the HOV lane at Exit 39A, "The Stack", Exit 40, Westfarms Mall, Exit 41, South Main Street, Exit 42, Trout Brook, and Exit 45, Flatbush Avenue. The bus services that will use the HOV lane include both existing express routes and several new "limited" routes designed to take advantage of the time savings possible with faster bus travel speeds on the HOV lane.

2.6 RAP 6 - ADDITIONAL LANE - GENERAL PURPOSE

RAP 6 is similar in geometric configuration to the RAP 5 HOV improvement. The improvement would consist of a twelve foot lane in each direction and a twelve foot inside shoulder. Every effort would be made to achieve and maintain a twelve foot outside shoulders for safety reasons. The proposed alignment for RAP 6 is illustrated in Technical Report #2. At the east end of the corridor right-of-way restrictions may require that inside and out-

side shoulders be reduced to minimize or eliminate impacts on adjoining property.

The improvements proposed for this alternative would include the elimination of left entrance and exit ramps as proposed in RAP 3 Freeway reconstruction. While the additional Interstate capacity would relieve traffic pressure on parallel arterials, it would still be important to coordinate ITS and arterial signal systems to assure optimum operation.

The Connecticut Department of Transportation (ConnDOT) and the Capitol Regional Council of Governments (CRCOG) agreed to drop further consideration of RAP 6 after publication of Technical Report #2. In the body of this chapter, as a point of comparison, selected elements associated with RAP 6 are presented to facilitate comparative analysis of the RAPs and their transportation components that remain in consideration.

2.7 ASSESSMENT OF REASONABLE ALTERNATIVE PACKAGES

This Section presents the results of evaluations conducted for highway-related and transit-related Reasonable Alternative Packages (RAPs). Taken in conjunction with the impact evaluations contained in Chapter 3, these results present a profile of potential success in meeting the Goals and Objectives developed to guide investment decisions in the corridor.

Transit-Related Performance Measures

New Service Transit Users. There are several ways to measure the relative success of transit related RAPs. In terms of riders that will use transit services, routes structured to take advantage of busways in the New Britain and I-84 corridor attract more daily riders, 13,290 and 11,540, respectively, than other RAPs (Table 2.1). In reality many users of the new route structure would not necessarily use the busway to downtown, but because buses circulate on streets, riders would use the buses as tradition local bus service. This tendency is illustrated in that ridership on existing bus routes for the New Britain busway dips from 19,870 in the 2020 Base Case to 15,400 for RAP 4C-1.

After the busways, the Light Rail to New Britain will attract the most service oriented riders. Fourth in rank is the New Britain Commuter Rail service, and fifth, Light Rail in the Interstate 84 corridor. The strategy least effective in attracting new riders is bus routes implemented to support RAP 5, I-84 HOV Lane. This is probably because of the competitive travel times and attractiveness of shared ride auto trips.

Total Transit Riders/New Transit Riders. Total transit trips in the corridor (and therefore new transit riders) are a good measure of RAP effectiveness. The New Britain - Hartford Busway ranks first in this category handling a total of 28,690 transit riders - 8,820 riders above the 2020 Base Case number. Light Rail in the I-84 corridor, either terminating at Route 9 or at Fienemann Road, ranks second in Total Transit Riders at 27,520 and 27,480, respectively. The only other RAP with more than 27,000 daily riders is the New Britain Light Rail service.

With the exception of the HOV alternative, all RAPs outperform the transit service alternatives proposed for RAP 2. Implementation of the transit service will nearly return the 2020 Base Case ridership to the current 1995 ridership levels. Clearly, some of the RAP 2 service proposals could generally be implemented without large capital investments.

Peak Period Transit Ridership. Transit ridership during peak periods will do the most to reduce roadway congestion within the Hartford West corridor by diverting person trips from drive alone to transit based modes. The highest level of peak hour transit ridership will be achieved by the New Britain - Hartford Busway service, RAP 4C-1 (Table 2.2). The second ranked service will be the I-84 Busway followed closely by the I-84 and New Britain Light Rail alternatives. The relative ranking for New Service ridership is similar. As noted for daily ridership, New Bus Routes and New Britain Service are grouped together under one category.

Impact on Mode Share Transit-Related RAPs. Of the transit-related RAPs, only the Busway alternatives reduce the Drive Alone Mode share to less than 70% at 69.1% and 69.37%. In all cases Shared Ride mode share is also reduced below the 2020 Base Case level of 8.6%. In the busway alternatives in both the New Britain and I-84 corridors, buses operate in local service on state and town roads as well as in express service on the busway alternative. As such buses riders are able to take advantage of new bus routes for local bus trips as well as for trips to and from downtown. Of the alternatives, only the New Britain Light Rail service and Farmington Avenue Light Rail have the impact of reducing bus mode share below the 2020 Base Case level.

Table 2.2

PEAK PERIOD COMPARISON OF TRANSIT-RELATED RAPS

Hartford West MIS

Passenger Trips Base Case/RAP	Existing Bus Routes	New Bus Routes	New Service	Total Transit	New Riders
2020 Base Case	7,360			7,360	
RAP 2 - Transit Operations	7,330	550	-	7,880	520
RAP 4A-1 - New Britain LIght Rail	7,400	500	2,300	10,200	2,840
RAP 4A-2 - I-84 Light Rail	7,960	340	1,940	10,240	2,880
RAP 4A-3 - Farmington Ave. Light Rail	6,240	2,040	1,410	9,690	2,330
RAP 4A-4 - I-84 Light Rail Extended	7,820	650	1,870	10,340	2,980
RAP 4B - New Britain Commuter Rail	7,400	500	2,200	10,100	2,740
RAP 4C-1 - New Britain-Hartford Busway	4,940	-	6,690	11,630	4,270
RAP 4C-2 - I-84 Busway	6,090	-	4,290	10,380	3,020
RAP 5 - I-84 HOV Lane	7,220	-	120	7,340	(20)

Source: Hartford West MIS Technical Report #3

Highway Performance Measures

Table 2.3 presents the results of the Highway Performance analysis for all RAPs both transit and highway related. During the AM Peak Period, the greatest reduction in VMT is achieved by RAP 4C-1, New Britain-Hartford. Both RAP 3, Freeway Reconstruction, and RAP 5, HOV Lane, experience an increase in VMT because of the increase in operating speed over the set one hour evaluation period.

The performance of the RAP 2 package includes implementation of all strategies including TSM, TDM, and Transit Operations. Overall vehicle trips are reduced 1.3% during the AM peak period and 4.7% in the PM period. Speeds increase on both the freeway and arterial roadways as traffic demand during the peak period is reduced. It is important to remember that transportation demand management (TDM) strategies such as parking pricing, congestion pricing, and transit incentives depend on voluntary participation that may not be politically attractive.

During the PM Peak period, the greatest reduction in VMT was also achieved by the New Britain - Hartford Busway at 5.2%. The second largest reduction in system wide VMT was achieved by the New Britain Commuter Rail, RAP 4B at 4.4 %. The I-84 Busway follows closely behind with a 4.3 % reduction.

The largest percentage increase in AM average vehicle speed was achieved by RAP 3, Freeway Reconstruction. Of the transit-related alternatives, the best results were achieved by the I-84 Light Rail and New Britain Light Rail with 9.4 % and 8.5%, respectively. Trends are similar for PM average vehicle travel speeds with the best improvement achievement of a 4.9% increase in speed. The second ranked improvement is the I-84 Busway with a 3.1 % increase in average speed.

Because freeway speeds increase, vehicle trips may be attracted from arterial roads with slower overall speeds. As such VMT on freeways may in some cases increase even though overall demand for vehicle trips will decrease. Of all alternatives, RAP 3, Freeway Reconstruction, will achieve an increase in speeds of 19.1 % and 34.4 % for the AM and PM Peak Periods, respectively. RAP 4C-1, New Britain - Hartford Busway, results in the greatest increase for AM average speed, and RAP 4C-2, I-84 Busway, results in the greatest increase for PM speeds.

Arterial Roadway Performance. Concerning highway performance measures on arterial roadways, the New Britain corridor alternatives perform similarly with reductions in VMT during both the AM and PM peak periods of about 4.0 %. The alternatives in the I-84 corridor perform somewhat less well for arterial VMT reduction. Speed increases are similar under each of the transit-related alternatives.

The most congested roadways are those that experience a volume capacity ratio greater than 1. As noted in Table 2.4, the New Britain Commuter Rail achieved the greatest reduction in arterial congestion eliminating 6.35 miles of arterial with V/C ratio greater than 1 during the AM peak hour. Following in second place is New Britain - Hartford Busway, reducing arterial roadway mileage by 4.95. The I-84 Light Rail alternative results in 3.03 fewer miles of highly congested roadway.

During the PM Peak Period, the I-84 Busway achieves the greatest reduction in congested mileage with 5.21 miles eliminated. New Britain Commuter Rail strategies result in a reduction of 4.99 miles of arterial with a V/C ratio greater than 1. RAP 3, Freeway Reconstruction, also has a favorable impact eliminating 4.5 miles of congested roadway.

Capital Construction Cost

Of the Transit Related RAPs evaluated, the least expensive alternative is the New Britain Busway at $75.3 million followed closely by Farmington Avenue Light Rail at $97.1 million (Table 2.5). The New Britain Commuter Rail is estimated to cost $98.3 million to implement.

The Transit-related RAPs will include not only the construction of roadbed, tracks, pavement, and stations, but also the acquisition of light rail vehicles, commuter rail vehicles, or buses, and the construction of maintenance and storage facilities and yards. These costs vary dramatically. The transit vehicle and facility capital costs are in Table 2.6.

The most expensive overall RAP would be reconstruction of the freeway at $527.3 million. The most expensive element of this plan would be the reconstruction of the downtown segment of I-84 due to the extensive structure work that would be a key element. Reconstruction of Flatbush, Prospect, and Sisson interchanges would be the second most expensive at $102.4 million.

Transit Operating Costs

The transit services associated with RAPs 2, 4, and 5 would operate as described in Technical Report #2, "Preliminary Screening and Scoping Report." For weekdays, peak and off-peak service levels were defined for all of the services associated with each RAP in terms of average headways. For the span of service, an 18 hour service day was assumed for major services, from approximately 6:00 am until midnight. Most other routes (for example, feeder routes) would operate for shorter spans, generally corresponding to the span of service for similar current services.

Frequent peak period service would be provided during a two hour AM peak and a two hour PM peak, with less frequent service being provided in the off-peak, which is the remainder of the day. For weekends and holidays, specific service plans were not developed. Instead, it was assumed that similar services would be provided, but less frequently and over a shorter span of service. At the present time, in terms of vehicle service hours, Saturday service levels in the Hartford West corridor are approximately 47 percent of weekday levels, and Sunday service levels only 9 percent of weekday levels.

By RAP, total annual operating cost estimates are summarized in Table 2.7. These costs are for operations within the corridor only and do not include other region wide costs. The highest annual operating cost would be experienced by New Britain Light Rail (RAP 4A-1) at $22.3 million.

Fare to Operating Cost Ratio - Within the Hartford West corridor, it is estimated that in the Base Case (No-Build) Scenario farebox revenues would cover approximately 37 percent of the operating costs for the bus services (Table 2.8). Under the build alternatives, the coverage ratio will vary from a low of 26 percent for the Farmington Ave. Light Rail to 39 percent for New Britain Commuter Rail. These estimates may change in a subsequent study will refine bus routing options and new service operations plans and costs. However, the positive performance of the Commuter Rail and Busway alternatives suggests that transit operations may be affordable.

Transit Subsidies - Comparing Operating Cost and Annual Fare receipts within the Hartford West corridor, the largest total subsidy will be necessary for the Farmington Ave. Light Rail and the New Britain Light Rail with $16.2 million and $16.0 million, respectively (Table 2.9). This compares to a base case projected subsidy of $7.7 million for corridor transit operations. In the base case, subsidies per rider are projected at $1.33, and RAP 2 TSM/TDM/Transit Operations will experience $1.44 per rider. Of the Build alternatives, the New Britain - Hartford Busway and I-84 Busway will experience subsidies of $1.60 and $1.53 per rider, respectively.

uled for selective demolition and reconfiguration as mixed use complexes during the next three years as part of a U.S. Department of Housing and Urban Development (HUD)-funded initiative. Industrial development opportunities for these properties are currently being pursued.

Three to four unit houses (many of these being "three deckers") are the next most common type of housing within Hartford, accounting for 22 percent of the housing stock. Two-, three- and four-family houses are the most common housing type within the City of New Britain, constituting 45 percent of that city's housing inventory.

The urban portions of the study area also exhibit a substantially greater population density and share of minority (i.e. African-American, Hispanic, or Asian) population than either the inner suburban or outer suburban areas. Sixty-nine percent of Hartford's population are members of minority groups, with African-Americans constituting the single largest segment. The study area contains a substantial concentration of Hispanic residents in the Parkville, Frog Hollow and Charter Oak neighborhoods. Park Street contains a region-serving Latino-oriented shopping district. The City of Hartford contains 65 percent of the Capitol Region's minority population. New Britain's population is 24 percent minority. Hispanics represent two-thirds of the minority population citywide. The study area on New Britain's West Side is largely non-minority, with Ukrainian- and Polish-Americans, including a sizable percentage of non-English proficient immigrants representing a major portion of study area residents within New Britain.

Inner Suburban Areas - West Hartford and Newington

The inner suburban areas within the study area include portions of the Towns of West Hartford and Newington. Both communities are largely developed, especially within the defined study area. Single-family residences and auto-oriented shopping centers constitute the two most common land uses within these towns. Retail facilities are located along Farmington Avenue, Park Road, Prospect Street, and New Britain Avenue in West Hartford and along Route 175, Main Street and the Berlin Turnpike in Newington. The Westfarms Mall in West Hartford is the single largest shopping center within the study area. It serves a regional customer base from the entire study area, as well as all portions of the study area towns.

Much of the residential and commercial development within these communities, especially in West Hartford, dates from the period between 1930 and 1960, when these inner suburban communities experienced their greatest growth. In comparison to many outer suburban communities, the housing within inner suburban communities tends to be older, and to be sited on smaller lots (less than one-half acre). The inner suburbs as a group also contain a greater share of multi-family or attached units. In this last category, Farmington is the exception to the regional pattern, due in part to the presence of the University of Connecticut Health Center. Thirty-nine percent of Farmington's housing stock in multi-family or attached units, while in West Hartford the percentage is 32 percent and for Newington it is 21 percent.

Both Newington and West Hartford offer more affordable single family housing prices than the outlying suburban areas to the west. The 1994 median single-family home price in Newington was $134,100 and in West Hartford, $159,500. Both of these figures are closer to the regional median sales price of $143,000 for single-family homes (CRCOG, 1994) than the Town of Farmington, where the median was $203,000.

The study area population of these two towns has been relatively stable over the last two decades, as the first post-war generation of suburban families has remained in place. The southern portion of Newington which experienced additional residential development during the 1970-1990 period is located outside the Hartford West MIS study area. Both West Hartford and Newington, therefore, have a population that includes a higher than average proportion of senior citizens. For the Capitol Region as a whole, the percentage of population over 64 years old is 13 percent. In West Hartford, 23 percent of the population is over 65, while in Newington, 17 percent of the population is over 65. While it is considered an Outer Suburban community based on other characteristics, Farmington also has a larger than average share of senior citizens, with 15 percent of its 1990 population over 65. These proportions may change over time as younger families are now moving into both of these towns.

Outer Suburban Area - Farmington

The Town of Farmington had the third highest rate of growth (26 percent) within the Capitol Region between 1980 and 1990. Only the towns of Hebron and South Windsor grew at a faster rate during this decade. During the peak years of Farmington's development boom, 1985-1988, over 1,500 building permits were issued, representing a 38 percent growth in Farmington's housing supply.

Key factors in this growth have been: the availability of land zoned for multi-family (condominium) housing and office development; the growth of the University of Connecticut Medical Center; and the continuing development of large-lot (1-2 acre) subdivisions in the western portion of the town (outside the study area).

Study Area Land Use and Neighborhood Characteristics. Neighborhood characteristics, such as predominant household type and size, land use, per capita and median family income, availability of vehicles, and predominant housing density are all important determinants of travel demand. These characteristics are reviewed in the following section.

Hartford. For the City of Hartford, the key transportation concern for the Hartford West study area is that future improvement plans be made to support other urban re-development initiatives. The Hartford portion of the I-84 West MIS study area incorporates a broad mix of uses. It encompasses all or portions of the following designated planning areas: Downtown, Asylum Hill, West End, South Green, Frog Hollow, Parkville, Barry Square, Charter Oak - Zion (also known as Behind the Rocks), and a small portion of the Southwest neighborhood. These areas have distinct economic, land use and housing characteristics which are noted in the 1995 *Plan of Development for the City of Hartford*. For detailed descriptions of these areas, please see Technical Report #1.

New Britain. There are no formal neighborhood associations within the City of New Britain. The four planning areas defined by the 1984 *New Britain Master Plan* lie outside the study area. Based on the housing and economic data contained in the 1994 *Plan of Development, Housing Analysis,* it can be concluded that the characteristics for the City of New Britain differ significantly from the north and northwest portions of the city that lie within the defined Hartford West MIS study area. The distinctive land use and socio-economic characteristics of these areas are described in Technical Report #1.

Newington. Newington can be identified as a suburb of both Hartford and New Britain, with three- quarters of its workforce employed outside the town. Newington's Planning Director describes the town as being largely built out with limited areas for new development. The 1995 *Newington Plan of Development* projects a modest increase in population over the next ten years, from 29,208 to approximately 30,000. The most pressing transportation concerns within the study area are related to Route 175 (Cedar Street) and its intersection with major north-south arterials, such as Main Street, as well as the Route 9 Expressway. There are no formal neighborhood associations within Newington. Its development pattern is typified by residential subdivisions of 50-200 homes. However, the neighborhood areas of North Newington and Newington Center, identified by their land use characteristics, are described in detail in Technical Report #1.

West Hartford. West Hartford is an established suburban area, with a solid base of both retail and manufacturing employment. Nonetheless, only 25 percent of West Hartford's resident workers are employed within the town. The remaining 75 percent commute to other locations, with the greatest flow being toward Downtown Hartford. At the same time, West Hartford's employers attract an even larger number of incoming commuters from other towns and cities, predominantly the City of Hartford and the towns of Newington and Bloomfield.

West Hartford's 1996 *Draft Town Plan of Conservation and Development* does not identify neighborhood areas. The Town's Planning Director has identified two neighborhood associations within the study area; however, some additional areas can be identified based on the 1986 *Plan of Development* and general land use characteristics. Descriptions of Wolcott, Elmwood, Webster Hill/Duffy/Braeburn, and West Hartford Town Center are available in Technical Report #1.

Farmington. Employment within the Town of Farmington now exceeded 25,000, so that there are more jobs located within the town than there are residents. Service industries, such as health care and education, as well as the FIRE cluster, represent 78 percent of the town's employment, while manufacturing accounts for 22 percent. Currently, the town contains some 2.5 million square feet of commercial office space, with a 16 percent vacancy rate. Much of the town's office space inventory is located within the Hartford West study area. The primary industrial area is the Farmington Industrial Park located well to the west of the study area boundary. Farmington is one of the few towns in the Capitol Region which has experienced growth in its manufacturing employment during the 1980's and 1990's.

The Hartford West MIS study area within Farmington lies east of Route 10 (Main Street) and south of Old Mountain Road. The Town's 1995 *Plan of Conservation and*

Development maps out distinctive neighborhoods, including six which are entirely or partially within the study area boundaries. The study area encompasses the Oakland Gardens, Health Center, East Farms, Robbins, and Batterson Park neighborhoods, along with the southern portion of the Talcott neighborhood. Both Oakland Gardens and East Farms have formal neighborhood associations. The distinctive land use and socio-economic characteristics for the study area neighborhoods are summarized in Technical Report #1.

1.4 CORRIDOR TRANSPORTATION ISSUES

The issues and problems defined for the Hartford West corridor are interrelated. For example, problems with highway connectivity create peak hour congestion on arterial segments where the primary travel demands are not directly served. In other cases, problems may represent the symptom rather than the cause.

The regional issues are presented conceptually in Figure 1.2. The regional issues and problem areas may be summarized as:

- Peak Hour Congestion on I-84 and Parallel Arterials;
- I-84 Highway Connectivity;
- Access from the Farmington Valley to the Hartford CBD;
- Transportation Needs for Improved Transit Service; and
- Opportunities for Alternative Modes.

In addition to these components of needs, there are other equally pressing matters of localized concern. As noted above, support for economic redevelopment initiatives in Hartford, or undesirable traffic volumes in neighborhoods abutting the Interstate or busy arterials are important issues for local decision makers.

Peak Hour Congestion on I-84 and Parallel Arterials

The I-84 Hartford West corridor has been determined by CRCOG to be the most congested within the Capitol Region with an ADT of 154,000. For the future year 2020, the total demand for I-84 could exceed 190,000 vehicles per day. As confirmed by CORFLO and FRESIM models, congested routes include I-84 and parallel arterials, such as Route 4, Farmington Avenue and Park Street. This congestion is projected to grow significantly to the year 2020. Peak hour average travel speed will drop and hours of delay will increase especially in the eastbound direction during both morning and evening periods.

Commutation to the Hartford CBD and reverse commutation to suburban locations constitute a large component of morning and afternoon peak period travel. Growth projections for the region reinforce this trend as employment in Hartford's CBD will increase dramatically. The increasing volume of travel to other major activity centers including the UConn Health Center, Westfarms Mall and Downtown New Britain, can also be identified as the source of both corridor wide and localized congestion problems. Reverse commutation, coupled with regional travel, increases traffic volumes in what is normally thought of as the "off-peak" direction.

Travel Time Runs and Average Travel Speed. Travel speeds are a direct indicator of Level of Service (LOS) and congestion. Average travel speeds on Route 4 during the P.M. peak period are less than 35 mph, with travel speeds of less than 25 mph on some sections. These indicate areas of congestion and poor Levels of Service. Although overall eastbound and westbound travel speed on I-84 was recorded at 49.1 mph and 42.8 mph, respectively, on certain segments speeds were experienced as low as 25 mph. These segments were typically near the CBD in the peak direction of travel.

Accident Data Analysis. Interstate 84 and Route 9 display the lowest accident rates. This is generally reflective of a higher design standard and more access control. In contrast, Route 173 which carries lower volumes than Route 9 experienced more accidents per mile and therefore a higher accident rate. A detailed breakdown of accidents by route number and town is included in Technical Report #1.

Modeling of Current and Future Performance

A set of computer-based models was used to quantify the current and future performance of the roadway network within the Hartford West corridor. ConnDOT's statewide travel demand model was used to relate current and future population and employment to projected future travel demand. A network simulation model (CORFLO) was used to approximate the movement of vehicles along the highways for both current and future traffic conditions. The FRESIM simulation model allowed a more detailed analysis of Interstate 84.

Daily and peak period trip tables for 1995 and 2020 were developed from the travel demand model using the traffic analysis zone (TAZ) definition and highway network developed for CORFLO. Between 1995 and 2020, the overall increase in the vehicle trip ends during the A.M. peak hour will be approximately 33% and in the P.M. peak

hour increase in trip ends approximately 32%.

Both now and in the future, peak hour vehicle trips through the region (ie. with neither origin or destination in the corridor) are not only a portion of total traffic on I-84, but also show a dominant flow in the reverse direction. (Figure 1.3) In the A.M. peak hour more through vehicles flow in the westbound direction, and in the P.M. the eastbound direction.

The traffic flows from close-in suburbs (Newington and West Hartford) toward Hartford are higher than from Farmington and New Britain. In a similar manner, greater traffic movement occurs between the cities south of the I-84 corridor (New Britain, Newington) to and from Hartford than between the cities north of the I-84 corridor (West Hartford and Farmington) to and from Hartford.

Based on the CORFLO and FRESIM model results, travelers on future corridor roads can expect the following:

- Decrease in travel speeds;
- Increase in vehicle density i.e., more vehicles per mile of highway;
- Decreased levels of service;
- Capacity constraints;
- Increased vehicle delays; and
- Increased fuel consumption.

Freeway Performance

Both now and in the future I-84 will carry the greatest portion of person trips in the Hartford West corridor. However, the capacity of the Interstate will inhibit its ability to perform successfully. FRESIM model results for 1995 and 2020 are illustrated in Figures 1.4 and 1.5.

I-84 Westbound. Even though this is considered the "off-peak" direction during the morning A.M. peak, I-84 westbound still carries high traffic volumes during this time. While currently no LOS is below "E," the segments with a "C" are projected to become "D" and segments with a "D" are projected to become "E" by 2020. Travel speeds, which are currently between 50 and 52 miles per hour, will be reduced to between 47 and 51 miles per hour. Continued growth in employment at the west end of the corridor (Farmington) will exacerbate the poor performance of Exits 39A, 39, 38, and 37 and their related roadway segments.

Performance in the peak direction during the evening P.M. peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals degradation in service. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds will reduce to below 25 miles per hour as compared to 50 miles per hour during the A.M. peak.

I-84 Eastbound. Currently, in the morning A.M. peak, eastbound I-84 reaches LOS "F" on the most easterly segment of the freeway between Exits 46 through 49. Average speeds on these segments will drop below thirty miles per hour as peak volumes approach 6,500. The situation by 2020 will become much worse as the segments from Exit 39A through 49 will experience a LOS "F" with average speeds dropping below twenty miles per hour and volumes exceeding 7,400.

Interestingly, the evening P.M. peak which is generally thought of as the off-peak period in the eastbound direction, is projected to experience a generally failing Level of Service from Exit 39A through the east end of the corridor. Speeds will drop to twenty miles per hour by 2020.

Arterial Roadways. The percentage of roadway mileage operating at a volume/capacity ratio greater than 0.75 will increase substantially in the year 2020. Figure 1.6 illustrates the existing 1995 and anticipated 2020 P.M. peak hour volume to capacity ratios for key arterial roadways in the network.

On arterials, intersections are often the locations where congestion most frequently occurs. Several of the intersections, which are currently operating at or near capacity, will fail under future anticipated traffic volumes. Figure 1.7 illustrates the existing 1995 and 2020 P.M. peak hour LOS results for intersections. Many unsignalized intersections will require signalization in the future.

Hourly Variation in Peak Period Traffic. The analysis above has demonstrated that by the year 2020, a number of highway segments in the corridor will experience failing or unsatisfactory levels of service. The peak periods will become more congested, and an amount of peak period travel will occur immediately before and after the peak period. This tendency is referred to as peak spreading.

The analysis has shown that in the future no-build condition demand for travel will clearly out strip the ability, or capacity, of the highway corridors to handle the traffic during the peak periods. Motorists will adopt one of four strategies to avoid the congestion. They could:

- Take an alternative less traveled route - Interstate to arterial or arterial to local road;
- Change their hours of travel - begin earlier or arrive later;

- Travel by an alternative mode - rideshare or public transit; or,
- Not make the trip at all - change job location or work at home.

In the case of the last two alternatives, there would be a "net" reduction in peak period automobile vehicle trips. Generally, an alternative mode will be attractive only if it reduces travel time, or reduces costs. In the final case, the reduction in the number of trips represents a reduction in "mobility" unless an alternative such as telecommuting may be substituted. Technical Report #1 offers a further look at the spreading of peak periods.

I-84 Highway Connectivity

Some congestion may be caused by indirectness of travel introduced on the network by poor connectivity. Poor connectivity may be one of two types - lack of connectivity or poorly designed or substandard connection. An example of lack of connectivity would be when interchange serve only one direction of travel (e.g., Flatbush Avenue - Exit 45, or Sigourney Avenue - Exit 47). Poorly designed connections would include left-hand entrance or exit ramps (e.g., Route 4 - Exit 39). In many cases this may induce lane changing or mixing of higher speed and slower speed traffic that disrupts flow and creates hazards resulting in severe accidents.

While the expressway network in the study area is considered "complete" according to current plans, many connections between arterials and between arterials and expressways are either absent, or are physically or functionally obsolete. In several cases improved ramp connections could provide more direct access to key areas of potential economic development. The construction of identified "missing links' could reduce indirect vehicle travel through residential neighborhoods, reroute truck traffic, and better balance the locations of transportation capacity and the locations of transportation demand. Several of the existing I-84 interchanges could be modified to reduce or eliminate substandard exiting or merging areas. They include:

- **Route 4 to Route 9** - Eastbound access from Route 4 to Route 9 is only possible through a circuitous path along two lane roads in Farmington;
- **U.S. 6 & Route 4** - In CRCOG's Route 4 Corridor Study, it was suggested that better connections between U S. 6, Route 4 and I-84 could relieve the congestion through Farmington Town Center by providing alternative travel paths;
- **Flatbush Avenue Ramps, Connection to Charter Oak and Parkville Redevelopment** - As plans progress for the Charter Oak Redevelopment and renewed development in Parkville, the desire for more direct I-84 eastbound access to Flatbush Avenue as well as the return movement will be more important to accommodate commercial traffic and employee and customer access;
- **Sigourney Street Ramps** - Similar to the Flatbush interchange, the partial interchange at Sigourney causes motorists from the west headed to Aetna, The Hartford, and other insurance companies to use arterial streets resulting in unnecessary congestion in the morning and evening peak periods;
- **Left Hand Ramp Connections** - Interstate entrance ramps and left exits in Hartford and West Hartford create potentially hazardous situations and may contribute to congestion on selected arterials.

Lefthand ramps at the interchanges along Interstate 84 create a special problem. Current design standards for new construction of Interstate-type roads require that all exits and entrances be made from the right side of the traveled way. This standard is intended to be consistent with driver expectation and to assure that slower moving vehicles seeking to exit or enter the freeway will do so from the slower moving lanes. Right hand ramps also limit the number of lane changes that must be made prior to or following a ramp.

Access from the Farmington Valley to the Hartford CBD

Travel models project the continued future growth of population in suburban locations and the growth of employment throughout the region. Both population and employment growth have occurred in the Farmington Valley communities of Farmington, Simsbury, Avon and Canton causing increasing numbers of commuters to utilize the I-84 corridor, as well as parallel arterial routes, such as Route 44 and Route 4 (Farmington Avenue).

Not only is the capacity of the existing roadway network inadequate to handle current and projected traffic, but roadway expansion is severely constrained by the adjacent land uses and environmentally sensitive areas. The steep topography of the Talcott Mountain ridge and the barrier of the Farmington River and associated wetlands pose a

further limitation on available right-of-way.

Arterials pass through residential areas or are lined with business establishments. As congestion grows on the limited number of arterial routes, traffic often seeks alternative less congested routes through residential or other neighborhood areas. This trend adversely impacts the safety of the local roadway network for all users, including bicyclists and pedestrians. It also diminishes the quality of life of these communities.

Transportation Needs for Improved Transit Service

The review of existing transit conditions in the study area found that a network of fixed route bus services of 21 routes using a daily peak requirement of 69 buses serves a daily ridership of approximately 21,000 person trips in the corridor. Most service in the corridor is offered in the towns of Hartford, West Hartford and New Britain. Newington is served by only three routes. Farmington is served by only two routes.

Approximately 10% of the state's population and 15% of its employment, is located in the study area. Transit usage for commuting in the corridor communities far exceeds the statewide average, with approximately 7% of all persons working at area firms and 8% of all study area residents commuting by bus.

Transit mode share in the study area is higher than in the balance of the state. The higher mode share may be attributed to the socio demographics of the Hartford workforce. The data suggests that the quality of the transit services offered to more affluent commuters, who can chose to drive to work, is not sufficient to attract many riders. The data also suggests that New Britain has a more self-contained labor market where local residents walk to local jobs. West Hartford's relatively high transit mode share appears to reflect the high level of transit service offered in that community. Improvements in coverage, frequency, velocity and hours of service elsewhere in the study area could yield similar results.

Transit Providers. The area is served by CTTransit; New Britain Transportation, and DATTCO. In addition there is a network of 15 park and ride lots with 1,800 spaces served by six express routes carrying 937 daily passengers on I-84 to/from Hartford.

Within Hartford, a local downtown Hartford circulator bus network is operated by Greater Hartford Transit District with a fleet of ten buses and 3,000 daily passengers. The Greater Hartford Ridesharing Corporation provides ridesharing brokerage services for the region. It is reported that 18,600 commuters living the study area communities carpool or vanpool to work; The rate of commuting shared ride modes is approximately twice that for fixed route transit services.

Three major intercity bus companies provide 52 daily bus trips between Hartford and points south and west of the city. An intercity rail passenger carrier, Amtrak, offers 14 daily trips to/from New Haven, New York and Washington D.C.

Connecticut Transit. Connecticut Transit (CTTransit) is the principal public transit bus operator in the State of Connecticut. CTTransit is owned by the State and has operating divisions in Hartford, New Haven and Stamford. The CTTransit - Hartford Division operates local fixed route service in both local and commuter express service. According to the FTA's national transit database for 1994, CTTransit operates with a peak vehicle requirement of 185 buses, 477 employees and an annual budget of approximately $29.7 million. Its annual ridership in 1994 was 17.9 million with fare revenues of $11.3 million, with a fare recovery ratio of approximately 38%. According to CTTransit, ridership on the Hartford division has dropped 12.5% in the last four years but appeared to be rebounding in 1997. Systemwide ridership is approximately 50,000 passenger trips per day.

CTTransit operates 30 local routes and 15 express routes in the Greater Hartford Area. Eight (8) of the local routes, one (1) crosstown route and four (4) of the express routes service Hartford's West corridor neighborhoods. Together the West Corridor routes carry 40% of the entire system's daily ridership. Within the study corridor, CTTransit operates twelve routes, serving approximately 19,000 daily passengers using a peak requirement of approximately 52 buses.

New Britain Transportation. New Britain Transportation provides local service on five routes in the City of New Britain and two express routes to downtown Hartford under contract with Connecticut DOT. According to the FTA's national transit database for 1994, the New Britain Transportation Company Service operates with ten (10) buses, 17.4 employees and an annual budget of approximately $1 million. Its annual ridership in 1994 was 561,800 with fare revenues of $328,200 for a fare recovery ratio of approximately 33%. Local routes providing mobility in the corridor, connections to Connecticut Transit service in Hartford, and express service to Hartford.

Greater Hartford Transit District. The Greater Hartford Transit District is responsible for the development and renewal of transportation centers and parking facilities and regulation of private transportation companies, such as taxis and motor coach services, for trips falling entirely within the district's boundaries. In addition to its planning and regulatory activities, GHTD is a local transportation provider that operates a downtown shuttle in the Hartford known as the "Scooter" and operates the Greater Hartford area paratransit service.

The "Scooter" shuttle is a cooperative effort of several downtown employers who formerly operated separate bus/van shuttles among their downtown work sites and various public and private parking lots. The Scooter fleet includes ten (10) motor coach buses. Daily Scooter ridership is estimated at 3,000 daily trips. Scooter service is free to employees of sponsoring companies and is available to the general public for a $1.00 fare.

Paratransit service in the Greater Hartford area includes services as mandated by the Americans with Disabilities Act (ADA) as well as dial-a-ride taxi and van service available to a broader population of senior citizens. The ADA paratransit service will take an individual to and from any locations that fall within 3/4 mile from any fixed route bus service for double the regular fare. Within the Connecticut Transit service area, that results in a $2 - $5 one-way fare for the ADA paratransit service. GHTD runs 16,000-17,000 paratransit trips per month, of which approximately 25% are ADA service. GHTD uses nearly 50 vehicles to provide its paratransit service. The dial-a-ride service is a free service for those aged 65+, or who have a disability, and reside in the communities of Hartford, East Hartford, Manchester or Wethersfield.

Amtrak and Other Rail Services. The only passenger rail service operating in the corridor is Amtrak's Springfield-Hartford-New Haven main line. The line owned and operated by the National Rail Passenger Corporation (trade name: Amtrak) offers direct service to New York, Philadelphia, Baltimore, Washington D.C., Richmond, Boston, and Vermont. The service features seven daily southbound passenger trains and six daily northbound trains. Amtrak also operates a daily southbound express mail train that does not carry passengers.

The Amtrak line through Hartford is largely single track with passing sidings, but is double tracked with a long (2 mile) high speed siding in Newington and West Hartford and an equally long industrial track between West Hartford and Hartford. The rail right of way was originally designed to accommodate four (4) main tracks south to Newington Junction immediately west of Willard Avenue (Route 173). At Newington Junction the right of way splits. A two track right of way crosses Piper Brook headed for New Haven while another two track right of way breaks east towards New Britain.

Today, rail service on the line to New Britain has been abandoned and the line to New Haven is largely single track with only modest levels of local and through freight activity. The remaining main track is in the position that would have been the southbound track to New Haven (the second main track from the eastern edge of the right of way). Between Newington Junction and Hartford the right of way west of the two remaining tracks in is largely vacant (but intact) occupied by a single industrial turnout in West Hartford to a Heublein facility. The now unused western most track on the right of way is the remains of former New Britain Secondary Track which provided a dedicated line between Hartford Yard and industrial activity in downtown New Britain. Some of this abandoned track remains in right of way in Newington and West Hartford but is in decrepit condition and completely unusable.

New Britain Secondary Track. In Newington, the Amtrak line is joined by a branch line leading to downtown New Britain. This line was acquired by the State of Connecticut in the early 1990's for potential use as a passenger rail right of way. Conrail formally retired the 3.5 mile line segment from freight service in 1992. It is not in operable condition at this time. The New Britain Secondary connects with the Amtrak New Haven-Springfield main line at Newington Junction immediately south of Willard Avenue (Route 173) in Newington. According to reports by the Connecticut DOT, this line segment would need to be completely rebuilt before any attractive rail passenger service could be operated on this line. The field inspection of the line in February 1997 supports this finding.

Over most its length, the New Britain Secondary has a single track remaining from the 1980's. The right of way is wide enough at almost every point in New Britain to support four parallel tracks. The useable right of way has been narrowed to a one or two track capacity where highway building activities have encroached on the former rail right of way.

Inspection of the right of way found the road bed is

largely in good shape with minor drainage problems. No serious engineering obstacles to use of the line for transportation purposes were noted. With respect to environmental concerns, the rail embankment in some areas passes through wetlands or adjacent to some single and multi-family homes.

Opportunities for Alternative Modes

Members of the Policy and Technical Advisory Committees expressed strong interest in providing Hartford West commuters with alternatives to conventional highway transportation. Because of the importance placed on livable communities and quality of life, accommodation of safe bicycle and pedestrian movement will be an important enhancement to the recommended transportation improvements. Strategies developed must not merely protect pedestrians, but must also serve to improve and enhance their ability to move freely throughout the study corridor and the larger region. Health consciousness and environmental awareness have increased the use of the bicycle as a mode of transportation and for recreational purposes. Bicycle accommodation or planning for separated bike only facilities is important to the community's residents.

Greater Hartford Ridesharing Corporation. The Greater Hartford Ridesharing Corporation (GHRC), known as the "Rideshare Company," is the Capitol Region's Transportation Management Organization (TMO). GHRC is a private, non-profit organization acting as a transportation facilitator and service provider for commuters and employers in both the public and private sectors. In 1990, an estimated 18,600 commuters residing in the study area communities regularly used either a carpool or vanpool as their principal means of traveling to and from work. This comprises approximately 11% of work trips made by study area residents. Approximately 13% of the 240,000 persons working in the study area communities use a carpool or vanpool to get to and from work. GHRC estimates 16 "Easy Street" vanpools currently originate within the study area.

Park and Ride Facilities. The Connecticut Department of Transportation maintains a statewide system of Park and Ride lots for commuters who want to avoid traffic congestion and save on commuting costs. These commuters can leave their cars at any of the 227 lots across the state while they use carpools, vanpools, buses or trains for their trips to work. Within the Hartford West commuter shed, ConnDOT maintains 15 lots with a capacity of 1,839 spaces. Nine of the lots are served by express buses to downtown Hartford.

Interregional Transit Service. Analysis of the existing transit service provided by CTTransit and others in the corridor reveals a focused and efficient service. In the light of projected increases in population, employment, and travel demand, the role of public transit - especially local and express bus - needs to be reassessed. The following are two market niches that could be served by transit.

- **Reverse Commutation to Suburban Employment Centers** - A major portion of employment growth in the Greater Hartford region is increasingly focused on its outlying suburban towns, while the traditional regional core, Downtown Hartford, has experienced loss of 12,520 jobs (10 percent of its total employment) between 1993 and 1995. Newington, Simsbury and Granby all reported employment gains of over 500 jobs each. Farmington now has more workers commuting to its employment centers than it has outbound commuting residents. Regional models project continued growth in the vicinity of the UConn Health Center and Westfarms Mall.

  These trends have caused an increase in reverse commuting (e.g. center city to suburb) and it also presents an obstacle to those without access to a private vehicle. New transit initiatives, in the form of work-oriented shuttle services, vanpools, and other alternatives, may be required to adequately and efficiently service this demand.

- **Farmington/West Hartford - New Britain Transit Connection** - The conventional radial orientation of many public transit routes means that some types of trips for education, shopping, and personal business are poorly served. Within the study corridor, shopping areas in Farmington for example are inaccessible by public transit from New Britain. In this case the same is true of employment destinations. Looking at the travel demands that are not core oriented will provide the potential of increasing transit utility in the corridor.

  Data from regional transit providers also reveals that not only are the low income, transit dependent served, but also travel markets composed of more affluent residents. Especially in conjunction with other transporta-

tion demand management strategies such as congestion or parking pricing, public transit may serve a viable alternative by increasing mode choice.

Pedestrian Needs

National travel surveys indicate that most pedestrian trips do not exceed two miles. However, a great deal of travel within the I-84 study area is actually made over much shorter distances, such as shopping trips, trips to school or to visit friends. For these trips, walking is an enjoyable and healthy alternative to using the car.

In addition, all travel whether by auto or by transit with the possible exception of trips to drive-through fast food and banking involves a segment of pedestrian travel at the beginning and end of the trip. The "intermodal" segment (ingress) serves as access to the automobile or transit vehicle and the access (egress) to the final destination walking out to the street, driveway or parking lot.

For auto trips within an urban or more intensively developed suburban setting, for example Hartford CBD, West Hartford Town Center and the University of Connecticut Health Center campus, this travel component becomes more significant, since parking facilities are typically larger and are located at greater distance from the actual activity center. It is in these locations that pedestrian facilities — sidewalks, signals, crosswalks, signage, benches, planters and other amenities — are often provided. With appropriate security, a walkable environment can be a distinguishing feature of urban or town centers. However, in an urban setting, concern for personal security can act as a deterrent to pedestrian travel.

Pedestrian-oriented shopping districts attract customers from throughout the region. This is the urban design objective for areas such as Farmington Avenue in Hartford and West Hartford, West Hartford Town Center, Downtown New Britain, and Farmington Center (outside the study area). Newington Center does not have the commercial diversity to attract large numbers of visitors from outside the town, but it does provide a destination for pedestrian trips from adjacent residential areas. Other commercial corridors within the study area are likely to retain their auto orientation due to existing land use and density characteristics.

The City of Hartford provides sidewalks and street lighting on almost all of its streets, and in New Britain about three-quarters of the street network has these amenities provided. These features are characteristic of the pedestrian-oriented pattern of urban design that prevailed, from 1850 to 1950. Today, approximately ten percent of Hartford residents, and six percent of New Britain residents walk to work. These are high percentages for cities of their respective sizes.

In older suburban area, sidewalks are provided on West Hartford's arterials and collectors, as well as the majority of its local residential streets. The Town's Planning Director notes the high proportion of senior citizens as a factor encouraging pedestrian travel, especially for exercise/recreation. There are also off-street walking paths along Trout Brook in the block between the Boulevard and Farmington Avenue and for one block along the Park River.

In Newington, sidewalks occur primarily along major arterials. While most of Route 175 has sidewalks on both sides of the street, there are some limited segments where the roadway right-of-way does not allow adequate room to provide sidewalks.

For Farmington, sidewalks are provided along some segments of the arterials, and along a number of collectors. Many local streets do not have sidewalks and pedestrian travel tends to be focused on those limited areas of the town that have a more urban development pattern, such as Farmington Center and Unionville. Recreational walking occurs throughout the community, but there is no particular accommodation of this activity except within town parks.

Bicyclist Needs

For transportation-oriented bicycle travel (as opposed to recreational), the primary routes are along the study area's major and minor arterials, such as Farmington Avenue, the Boulevard, Park Street/Park Road, Route 175, New Park Avenue, and New Britain Avenue. No alternative off-road paths have been constructed within the study area, and existing traffic volumes along many routes make them unappealing and hazardous for bicycle use.

The City of Hartford's *Plan of Development* identifies the potential for several on-street bicycle routes within the study area including in the vicinity of Colt Park, in the South Green neighborhood, in the area adjacent to Pope Park, and in the West End.

The conceptual alignments for two off-street paths are also identified. One of these would utilize the ridge line extending through Rocky Ridge Park south to Thomas Hyland Memorial Park. The other would be developed along the Park River west of Pope Park. Ultimately, the City intends to link this system with the Connecticut

Riverwalk being developed by the Riverfront Recapture program. According to the City's Chief Staff Planner, a proposal has also been made to construct a velodrome (a banked bicycle track for Olympic-type competitive racing) within the Charter Oak area.

Bicycle accommodation outside the City of Hartford is equally limited. Several towns have bicycle or mixed use paths in their parks, including MDC properties in West Hartford, but no designated, signed or marked bike routes have been created. Proposals for more extensive bicycle facilities are typically in the initial planning stages for all the study area towns.

Goods Movement

Interstate 84 provides a key link between the New York Metropolitan Area and Boston. Through its connection to Interstate 80 in northeastern Pennsylvania, it also offers long distance commercial traffic an alternative to congestion in the New York area by allowing them to access New England destinations via the Newburg-Beacon Bridge located some 50 miles north of New York City.

Given these characteristics, it is reasonable to assume that most truck traffic on I-84 is not local to Connecticut (i.e. it neither originates nor terminates within the state). According to the most recent ConnDOT classification counts for I-84, there were approximately 6,500 heavy vehicles counted at the station closest to the New York State line (Danbury) and 6,100 heavy vehicles counted at the station closest to the Massachusetts line (Tolland). Approximately 65 percent of these vehicles were tractor-trailers (5+ axle vehicles). In the Hartford area, the volume of truck traffic on I-84 dips to approximately 5,000 as traffic destined for Hartford area businesses exits for local routes to make pick-ups and deliveries.

Major generators of truck activity within the Hartford West study area include the University of Connecticut Health Center, Westfarms Mall, Colt Industries (West Hartford), Chandler Evans (West Hartford), Sears Distribution Center (Fenn Road - Newington), and Stanley Works (New Britain).

The reuse of several other industrial properties, including the Torrington and Loctite properties in Newington, and the Veeder-Root building in Hartford, can be anticipated to add a small number of additional trucks to the existing baseline volumes. Also, the development of Charter Oak Terrace as a light industrial complex would contribute some additional truck volume.

Outside the Hartford West study area, numerous manufacturing and distribution operations contribute a portion of local truck traffic to I-84 and parallel arterials. These include Farmington Industrial Park, U.S. Postal Service Mail Processing Center (Hartford), UPS Distribution Center (Hartford), Hartford Regional Market (Hartford), Pratt and Whitney Aircraft (East Hartford), J.C. Penney Distribution Center (Manchester), and Buckland Hills Mall (Manchester).

CHAPTER 1

Existing and Future Conditions

1.1 STUDY BACKGROUND

The Connecticut Department of Transportation (ConnDOT), the Capitol Region Council of Governments (CRCOG) and the Central Connecticut Regional Planning Agency (CCRPA) have identified peak hour traffic congestion and safety deficiencies as major concerns for the Interstate 84 (I-84) corridor between Downtown Hartford and the Fienemann Road interchange in Farmington. This corridor forms a critical link between major activity centers, such as Downtown Hartford, the Westfarms Mall in West Hartford, the University of Connecticut Health Center in Farmington, Downtown New Britain, and the growing Farmington River Valley.

To address these concerns and to evaluate the effectiveness of different transportation system improvement alternatives, these agencies jointly undertook a Major Investment Study (MIS) for the Hartford West corridor. The Hartford West study corridor has been broadly defined to include not only I-84 itself, but the neighborhoods surrounding the highway right-of-way, the parallel arterial roadways, and two rail lines, the Bristol-Hartford line and the New Haven-Hartford line.

The majority of the study area is located within the Capitol Region, a metropolitan area composed of Hartford and the 28 towns surrounding it. The Capitol Region's communities have a combined population of 709,404. A portion of the study area (New Britain) is located in the Central Connecticut Region. The study area encompasses portions of five communities: Hartford, West Hartford, Farmington, Newington and New Britain.

This study meets the requirements of an MIS process specified by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). It conforms to FHWA Regulation 23, CFR 771, and complies with all applicable Federal and State policies, protocols and procedures, including those outlined in FHWA Technical Advisory T6640.8A.

1.2 STUDY AREA DEFINITION

The study corridor limits are illustrated in Figure 1.1. These limits can be generally described as:

- **South to North on I-84** — from the Fienemann Road interchange in Farmington to the High Street ramps in Downtown Hartford, including those areas located south of Farmington Avenue in Hartford and West Hartford and north of Route 175 (Cedar Street) in Newington.
- **East to West** — from the High Street ramps in Downtown Hartford to a line extending one mile west of Farmington Avenue in the Town of Farmington, including only those areas north and west of New Britain Avenue in Hartford.

1.3 STUDY AREA CHARACTERISTICS

The study area communities can be divided into three general patterns of population, land use and housing character. These are:

- Urban Areas;
- Inner Suburban Areas; and
- Outer Suburban Areas.

Urban Areas - Hartford and New Britain

The two urban areas - the Cities of Hartford and New Britain - have experienced substantial population loss during the period between 1970 and 1980, and a slight gain in population after 1980. They possess a substantial portion of their respective regions' multi-family housing stock, and a far greater proportion of residents living below the poverty line. The combination of dense housing conditions and low-income households leads to a substantially greater number of households being without a vehicle available to them. In the City of Hartford, nearly forty percent of households have no vehicle available, and can therefore be considered as "transit-dependent" for their mobility needs. In New Britain, the proportion of "transit-dependent" households is approximately sixteen percent.

In Hartford, structures containing five or more units comprise almost half of the residential buildings in the City. Hartford's housing stock is largely renter-occupied housing (75 percent of all units), with a significant portion (16 percent of the City's total housing stock) consisting of Hartford Housing Authority low-income and senior citizen units. The Charter Oak Terrace and Rice Heights housing projects, located within the study area, are sched-

uled for selective demolition and reconfiguration as mixed use complexes during the next three years as part of a U.S. Department of Housing and Urban Development (HUD)-funded initiative. Industrial development opportunities for these properties are currently being pursued.

Three to four unit houses (many of these being "three deckers") are the next most common type of housing within Hartford, accounting for 22 percent of the housing stock. Two-, three- and four-family houses are the most common housing type within the City of New Britain, constituting 45 percent of that city's housing inventory.

The urban portions of the study area also exhibit a substantially greater population density and share of minority (i.e. African-American, Hispanic, or Asian) population than either the inner suburban or outer suburban areas. Sixty-nine percent of Hartford's population are members of minority groups, with African-Americans constituting the single largest segment. The study area contains a substantial concentration of Hispanic residents in the Parkville, Frog Hollow and Charter Oak neighborhoods. Park Street contains a region-serving Latino-oriented shopping district. The City of Hartford contains 65 percent of the Capitol Region's minority population. New Britain's population is 24 percent minority. Hispanics represent two-thirds of the minority population citywide. The study area on New Britain's West Side is largely non-minority, with Ukrainian- and Polish-Americans, including a sizable percentage of non-English proficient immigrants representing a major portion of study area residents within New Britain.

Inner Suburban Areas - West Hartford and Newington

The inner suburban areas within the study area include portions of the Towns of West Hartford and Newington. Both communities are largely developed, especially within the defined study area. Single-family residences and auto-oriented shopping centers constitute the two most common land uses within these towns. Retail facilities are located along Farmington Avenue, Park Road, Prospect Street, and New Britain Avenue in West Hartford and along Route 175, Main Street and the Berlin Turnpike in Newington. The Westfarms Mall in West Hartford is the single largest shopping center within the study area. It serves a regional customer base from the entire study area, as well as all portions of the study area towns.

Much of the residential and commercial development within these communities, especially in West Hartford, dates from the period between 1930 and 1960, when these inner suburban communities experienced their greatest growth. In comparison to many outer suburban communities, the housing within inner suburban communities tends to be older, and to be sited on smaller lots (less than one-half acre). The inner suburbs as a group also contain a greater share of multi-family or attached units. In this last category, Farmington is the exception to the regional pattern, due in part to the presence of the University of Connecticut Health Center. Thirty-nine percent of Farmington's housing stock in multi-family or attached units, while in West Hartford the percentage is 32 percent and for Newington it is 21 percent.

Both Newington and West Hartford offer more affordable single family housing prices than the outlying suburban areas to the west. The 1994 median single-family home price in Newington was $134,100 and in West Hartford, $159,500. Both of these figures are closer to the regional median sales price of $143,000 for single-family homes (CRCOG, 1994) than the Town of Farmington, where the median was $203,000.

The study area population of these two towns has been relatively stable over the last two decades, as the first post-war generation of suburban families has remained in place. The southern portion of Newington which experienced additional residential development during the 1970-1990 period is located outside the Hartford West MIS study area. Both West Hartford and Newington, therefore, have a population that includes a higher than average proportion of senior citizens. For the Capitol Region as a whole, the percentage of population over 64 years old is 13 percent. In West Hartford, 23 percent of the population is over 65, while in Newington, 17 percent of the population is over 65. While it is considered an Outer Suburban community based on other characteristics, Farmington also has a larger than average share of senior citizens, with 15 percent of its 1990 population over 65. These proportions may change over time as younger families are now moving into both of these towns.

Outer Suburban Area - Farmington

The Town of Farmington had the third highest rate of growth (26 percent) within the Capitol Region between 1980 and 1990. Only the towns of Hebron and South Windsor grew at a faster rate during this decade. During the peak years of Farmington's development boom, 1985-1988, over 1,500 building permits were issued, representing a 38 percent growth in Farmington's housing supply.

Key factors in this growth have been: the availability of land zoned for multi-family (condominium) housing and office development; the growth of the University of Connecticut Medical Center; and the continuing development of large-lot (1-2 acre) subdivisions in the western portion of the town (outside the study area).

Study Area Land Use and Neighborhood Characteristics. Neighborhood characteristics, such as predominant household type and size, land use, per capita and median family income, availability of vehicles, and predominant housing density are all important determinants of travel demand. These characteristics are reviewed in the following section.

Hartford. For the City of Hartford, the key transportation concern for the Hartford West study area is that future improvement plans be made to support other urban re-development initiatives. The Hartford portion of the I-84 West MIS study area incorporates a broad mix of uses. It encompasses all or portions of the following designated planning areas: Downtown, Asylum Hill, West End, South Green, Frog Hollow, Parkville, Barry Square, Charter Oak - Zion (also known as Behind the Rocks), and a small portion of the Southwest neighborhood. These areas have distinct economic, land use and housing characteristics which are noted in the 1995 *Plan of Development for the City of Hartford*. For detailed descriptions of these areas, please see Technical Report #1.

New Britain. There are no formal neighborhood associations within the City of New Britain. The four planning areas defined by the 1984 *New Britain Master Plan* lie outside the study area. Based on the housing and economic data contained in the 1994 *Plan of Development, Housing Analysis,* it can be concluded that the characteristics for the City of New Britain differ significantly from the north and northwest portions of the city that lie within the defined Hartford West MIS study area. The distinctive land use and socio-economic characteristics of these areas are described in Technical Report #1.

Newington. Newington can be identified as a suburb of both Hartford and New Britain, with three- quarters of its workforce employed outside the town. Newington's Planning Director describes the town as being largely built out with limited areas for new development. The 1995 *Newington Plan of Development* projects a modest increase in population over the next ten years, from 29,208 to approximately 30,000. The most pressing transportation concerns within the study area are related to Route 175 (Cedar Street) and its intersection with major north-south arterials, such as Main Street, as well as the Route 9 Expressway. There are no formal neighborhood associations within Newington. Its development pattern is typified by residential subdivisions of 50-200 homes. However, the neighborhood areas of North Newington and Newington Center, identified by their land use characteristics, are described in detail in Technical Report #1.

West Hartford. West Hartford is an established suburban area, with a solid base of both retail and manufacturing employment. Nonetheless, only 25 percent of West Hartford's resident workers are employed within the town. The remaining 75 percent commute to other locations, with the greatest flow being toward Downtown Hartford. At the same time, West Hartford's employers attract an even larger number of incoming commuters from other towns and cities, predominantly the City of Hartford and the towns of Newington and Bloomfield.

West Hartford's 1996 *Draft Town Plan of Conservation and Development* does not identify neighborhood areas. The Town's Planning Director has identified two neighborhood associations within the study area; however, some additional areas can be identified based on the 1986 *Plan of Development* and general land use characteristics. Descriptions of Wolcott, Elmwood, Webster Hill/Duffy/Braeburn, and West Hartford Town Center are available in Technical Report #1.

Farmington. Employment within the Town of Farmington now exceeded 25,000, so that there are more jobs located within the town than there are residents. Service industries, such as health care and education, as well as the FIRE cluster, represent 78 percent of the town's employment, while manufacturing accounts for 22 percent. Currently, the town contains some 2.5 million square feet of commercial office space, with a 16 percent vacancy rate. Much of the town's office space inventory is located within the Hartford West study area. The primary industrial area is the Farmington Industrial Park located well to the west of the study area boundary. Farmington is one of the few towns in the Capitol Region which has experienced growth in its manufacturing employment during the 1980's and 1990's.

The Hartford West MIS study area within Farmington lies east of Route 10 (Main Street) and south of Old Mountain Road. The Town's 1995 *Plan of Conservation and*

Development maps out distinctive neighborhoods, including six which are entirely or partially within the study area boundaries. The study area encompasses the Oakland Gardens, Health Center, East Farms, Robbins, and Batterson Park neighborhoods, along with the southern portion of the Talcott neighborhood. Both Oakland Gardens and East Farms have formal neighborhood associations. The distinctive land use and socio-economic characteristics for the study area neighborhoods are summarized in Technical Report #1.

1.4 CORRIDOR TRANSPORTATION ISSUES

The issues and problems defined for the Hartford West corridor are interrelated. For example, problems with highway connectivity create peak hour congestion on arterial segments where the primary travel demands are not directly served. In other cases, problems may represent the symptom rather than the cause.

The regional issues are presented conceptually in Figure 1.2. The regional issues and problem areas may be summarized as:

- Peak Hour Congestion on I-84 and Parallel Arterials;
- I-84 Highway Connectivity;
- Access from the Farmington Valley to the Hartford CBD;
- Transportation Needs for Improved Transit Service; and
- Opportunities for Alternative Modes.

In addition to these components of needs, there are other equally pressing matters of localized concern. As noted above, support for economic redevelopment initiatives in Hartford, or undesirable traffic volumes in neighborhoods abutting the Interstate or busy arterials are important issues for local decision makers.

Peak Hour Congestion on I-84 and Parallel Arterials

The I-84 Hartford West corridor has been determined by CRCOG to be the most congested within the Capitol Region with an ADT of 154,000. For the future year 2020, the total demand for I-84 could exceed 190,000 vehicles per day. As confirmed by CORFLO and FRESIM models, congested routes include I-84 and parallel arterials, such as Route 4, Farmington Avenue and Park Street. This congestion is projected to grow significantly to the year 2020. Peak hour average travel speed will drop and hours of delay will increase especially in the eastbound direction during both morning and evening periods.

Commutation to the Hartford CBD and reverse commutation to suburban locations constitute a large component of morning and afternoon peak period travel. Growth projections for the region reinforce this trend as employment in Hartford's CBD will increase dramatically. The increasing volume of travel to other major activity centers including the UConn Health Center, Westfarms Mall and Downtown New Britain, can also be identified as the source of both corridor wide and localized congestion problems. Reverse commutation, coupled with regional travel, increases traffic volumes in what is normally thought of as the "off-peak" direction.

Travel Time Runs and Average Travel Speed. Travel speeds are a direct indicator of Level of Service (LOS) and congestion. Average travel speeds on Route 4 during the P.M. peak period are less than 35 mph, with travel speeds of less than 25 mph on some sections. These indicate areas of congestion and poor Levels of Service. Although overall eastbound and westbound travel speed on I-84 was recorded at 49.1 mph and 42.8 mph, respectively, on certain segments speeds were experienced as low as 25 mph. These segments were typically near the CBD in the peak direction of travel.

Accident Data Analysis. Interstate 84 and Route 9 display the lowest accident rates. This is generally reflective of a higher design standard and more access control. In contrast, Route 173 which carries lower volumes than Route 9 experienced more accidents per mile and therefore a higher accident rate. A detailed breakdown of accidents by route number and town is included in Technical Report #1.

Modeling of Current and Future Performance

A set of computer-based models was used to quantify the current and future performance of the roadway network within the Hartford West corridor. ConnDOT's statewide travel demand model was used to relate current and future population and employment to projected future travel demand. A network simulation model (CORFLO) was used to approximate the movement of vehicles along the highways for both current and future traffic conditions. The FRESIM simulation model allowed a more detailed analysis of Interstate 84.

Daily and peak period trip tables for 1995 and 2020 were developed from the travel demand model using the traffic analysis zone (TAZ) definition and highway network developed for CORFLO. Between 1995 and 2020, the overall increase in the vehicle trip ends during the A.M. peak hour will be approximately 33% and in the P.M. peak

hour increase in trip ends approximately 32%.

Both now and in the future, peak hour vehicle trips through the region (ie. with neither origin or destination in the corridor) are not only a portion of total traffic on I-84, but also show a dominant flow in the reverse direction. (Figure 1.3) In the A.M. peak hour more through vehicles flow in the westbound direction, and in the P.M. the eastbound direction.

The traffic flows from close-in suburbs (Newington and West Hartford) toward Hartford are higher than from Farmington and New Britain. In a similar manner, greater traffic movement occurs between the cities south of the I-84 corridor (New Britain, Newington) to and from Hartford than between the cities north of the I-84 corridor (West Hartford and Farmington) to and from Hartford.

Based on the CORFLO and FRESIM model results, travelers on future corridor roads can expect the following:

- Decrease in travel speeds;
- Increase in vehicle density i.e., more vehicles per mile of highway;
- Decreased levels of service;
- Capacity constraints;
- Increased vehicle delays; and
- Increased fuel consumption.

Freeway Performance

Both now and in the future I-84 will carry the greatest portion of person trips in the Hartford West corridor. However, the capacity of the Interstate will inhibit its ability to perform successfully. FRESIM model results for 1995 and 2020 are illustrated in Figures 1.4 and 1.5.

I-84 Westbound. Even though this is considered the "off-peak" direction during the morning A.M. peak, I-84 westbound still carries high traffic volumes during this time. While currently no LOS is below "E," the segments with a "C" are projected to become "D" and segments with a "D" are projected to become "E" by 2020. Travel speeds, which are currently between 50 and 52 miles per hour, will be reduced to between 47 and 51 miles per hour. Continued growth in employment at the west end of the corridor (Farmington) will exacerbate the poor performance of Exits 39A, 39, 38, and 37 and their related roadway segments.

Performance in the peak direction during the evening P.M. peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals degradation in service. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds will reduce to below 25 miles per hour as compared to 50 miles per hour during the A.M. peak.

I-84 Eastbound. Currently, in the morning A.M. peak, eastbound I-84 reaches LOS "F" on the most easterly segment of the freeway between Exits 46 through 49. Average speeds on these segments will drop below thirty miles per hour as peak volumes approach 6,500. The situation by 2020 will become much worse as the segments from Exit 39A through 49 will experience a LOS "F" with average speeds dropping below twenty miles per hour and volumes exceeding 7,400.

Interestingly, the evening P.M. peak which is generally thought of as the off-peak period in the eastbound direction, is projected to experience a generally failing Level of Service from Exit 39A through the east end of the corridor. Speeds will drop to twenty miles per hour by 2020.

Arterial Roadways. The percentage of roadway mileage operating at a volume/capacity ratio greater than 0.75 will increase substantially in the year 2020. Figure 1.6 illustrates the existing 1995 and anticipated 2020 P.M. peak hour volume to capacity ratios for key arterial roadways in the network.

On arterials, intersections are often the locations where congestion most frequently occurs. Several of the intersections, which are currently operating at or near capacity, will fail under future anticipated traffic volumes. Figure 1.7 illustrates the existing 1995 and 2020 P.M. peak hour LOS results for intersections. Many unsignalized intersections will require signalization in the future.

Hourly Variation in Peak Period Traffic. The analysis above has demonstrated that by the year 2020, a number of highway segments in the corridor will experience failing or unsatisfactory levels of service. The peak periods will become more congested, and an amount of peak period travel will occur immediately before and after the peak period. This tendency is referred to as peak spreading.

The analysis has shown that in the future no-build condition demand for travel will clearly out strip the ability, or capacity, of the highway corridors to handle the traffic during the peak periods. Motorists will adopt one of four strategies to avoid the congestion. They could:

- Take an alternative less traveled route - Interstate to arterial or arterial to local road;
- Change their hours of travel - begin earlier or arrive later;

- Travel by an alternative mode - rideshare or public transit; or,
- Not make the trip at all - change job location or work at home.

In the case of the last two alternatives, there would be a "net" reduction in peak period automobile vehicle trips. Generally, an alternative mode will be attractive only if it reduces travel time, or reduces costs. In the final case, the reduction in the number of trips represents a reduction in "mobility" unless an alternative such as telecommuting may be substituted. Technical Report #1 offers a further look at the spreading of peak periods.

I-84 Highway Connectivity

Some congestion may be caused by indirectness of travel introduced on the network by poor connectivity. Poor connectivity may be one of two types - lack of connectivity or poorly designed or substandard connection. An example of lack of connectivity would be when interchange serve only one direction of travel (e.g., Flatbush Avenue - Exit 45, or Sigourney Avenue - Exit 47). Poorly designed connections would include left-hand entrance or exit ramps (e.g., Route 4 - Exit 39). In many cases this may induce lane changing or mixing of higher speed and slower speed traffic that disrupts flow and creates hazards resulting in severe accidents.

While the expressway network in the study area is considered "complete" according to current plans, many connections between arterials and between arterials and expressways are either absent, or are physically or functionally obsolete. In several cases improved ramp connections could provide more direct access to key areas of potential economic development. The construction of identified "missing links' could reduce indirect vehicle travel through residential neighborhoods, reroute truck traffic, and better balance the locations of transportation capacity and the locations of transportation demand. Several of the existing I-84 interchanges could be modified to reduce or eliminate substandard exiting or merging areas. They include:

- **Route 4 to Route 9** - Eastbound access from Route 4 to Route 9 is only possible through a circuitous path along two lane roads in Farmington;
- **U.S. 6 & Route 4** - In CRCOG's Route 4 Corridor Study, it was suggested that better connections between U S. 6, Route 4 and I-84 could relieve the congestion through Farmington Town Center by providing alternative travel paths;
- **Flatbush Avenue Ramps, Connection to Charter Oak and Parkville Redevelopment** - As plans progress for the Charter Oak Redevelopment and renewed development in Parkville, the desire for more direct I-84 eastbound access to Flatbush Avenue as well as the return movement will be more important to accommodate commercial traffic and employee and customer access;
- **Sigourney Street Ramps** - Similar to the Flatbush interchange, the partial interchange at Sigourney causes motorists from the west headed to Aetna, The Hartford, and other insurance companies to use arterial streets resulting in unnecessary congestion in the morning and evening peak periods;
- **Left Hand Ramp Connections** - Interstate entrance ramps and left exits in Hartford and West Hartford create potentially hazardous situations and may contribute to congestion on selected arterials.

Lefthand ramps at the interchanges along Interstate 84 create a special problem. Current design standards for new construction of Interstate-type roads require that all exits and entrances be made from the right side of the traveled way. This standard is intended to be consistent with driver expectation and to assure that slower moving vehicles seeking to exit or enter the freeway will do so from the slower moving lanes. Right hand ramps also limit the number of lane changes that must be made prior to or following a ramp.

Access from the Farmington Valley to the Hartford CBD

Travel models project the continued future growth of population in suburban locations and the growth of employment throughout the region. Both population and employment growth have occurred in the Farmington Valley communities of Farmington, Simsbury, Avon and Canton causing increasing numbers of commuters to utilize the I-84 corridor, as well as parallel arterial routes, such as Route 44 and Route 4 (Farmington Avenue).

Not only is the capacity of the existing roadway network inadequate to handle current and projected traffic, but roadway expansion is severely constrained by the adjacent land uses and environmentally sensitive areas. The steep topography of the Talcott Mountain ridge and the barrier of the Farmington River and associated wetlands pose a

further limitation on available right-of-way.

Arterials pass through residential areas or are lined with business establishments. As congestion grows on the limited number of arterial routes, traffic often seeks alternative less congested routes through residential or other neighborhood areas. This trend adversely impacts the safety of the local roadway network for all users, including bicyclists and pedestrians. It also diminishes the quality of life of these communities.

Transportation Needs for Improved Transit Service

The review of existing transit conditions in the study area found that a network of fixed route bus services of 21 routes using a daily peak requirement of 69 buses serves a daily ridership of approximately 21,000 person trips in the corridor. Most service in the corridor is offered in the towns of Hartford, West Hartford and New Britain. Newington is served by only three routes. Farmington is served by only two routes.

Approximately 10% of the state's population and 15% of its employment, is located in the study area. Transit usage for commuting in the corridor communities far exceeds the statewide average, with approximately 7% of all persons working at area firms and 8% of all study area residents commuting by bus.

Transit mode share in the study area is higher than in the balance of the state. The higher mode share may be attributed to the socio demographics of the Hartford workforce. The data suggests that the quality of the transit services offered to more affluent commuters, who can chose to drive to work, is not sufficient to attract many riders. The data also suggests that New Britain has a more self-contained labor market where local residents walk to local jobs. West Hartford's relatively high transit mode share appears to reflect the high level of transit service offered in that community. Improvements in coverage, frequency, velocity and hours of service elsewhere in the study area could yield similar results.

Transit Providers. The area is served by CTTransit; New Britain Transportation, and DATTCO. In addition there is a network of 15 park and ride lots with 1,800 spaces served by six express routes carrying 937 daily passengers on I-84 to/from Hartford.

Within Hartford, a local downtown Hartford circulator bus network is operated by Greater Hartford Transit District with a fleet of ten buses and 3,000 daily passengers. The Greater Hartford Ridesharing Corporation provides ridesharing brokerage services for the region. It is reported that 18,600 commuters living the study area communities carpool or vanpool to work; The rate of commuting shared ride modes is approximately twice that for fixed route transit services.

Three major intercity bus companies provide 52 daily bus trips between Hartford and points south and west of the city. An intercity rail passenger carrier, Amtrak, offers 14 daily trips to/from New Haven, New York and Washington D.C.

Connecticut Transit. Connecticut Transit (CTTransit) is the principal public transit bus operator in the State of Connecticut. CTTransit is owned by the State and has operating divisions in Hartford, New Haven and Stamford. The CTTransit - Hartford Division operates local fixed route service in both local and commuter express service. According to the FTA's national transit database for 1994, CTTransit operates with a peak vehicle requirement of 185 buses, 477 employees and an annual budget of approximately $29.7 million. Its annual ridership in 1994 was 17.9 million with fare revenues of $11.3 million, with a fare recovery ratio of approximately 38%. According to CTTransit, ridership on the Hartford division has dropped 12.5% in the last four years but appeared to be rebounding in 1997. Systemwide ridership is approximately 50,000 passenger trips per day.

CTTransit operates 30 local routes and 15 express routes in the Greater Hartford Area. Eight (8) of the local routes, one (1) crosstown route and four (4) of the express routes service Hartford's West corridor neighborhoods. Together the West Corridor routes carry 40% of the entire system's daily ridership. Within the study corridor, CTTransit operates twelve routes, serving approximately 19,000 daily passengers using a peak requirement of approximately 52 buses.

New Britain Transportation. New Britain Transportation provides local service on five routes in the City of New Britain and two express routes to downtown Hartford under contract with Connecticut DOT. According to the FTA's national transit database for 1994, the New Britain Transportation Company Service operates with ten (10) buses, 17.4 employees and an annual budget of approximately $1 million. Its annual ridership in 1994 was 561,800 with fare revenues of $328,200 for a fare recovery ratio of approximately 33%. Local routes providing mobility in the corridor, connections to Connecticut Transit service in Hartford, and express service to Hartford.

Greater Hartford Transit District. The Greater Hartford Transit District is responsible for the development and renewal of transportation centers and parking facilities and regulation of private transportation companies, such as taxis and motor coach services, for trips falling entirely within the district's boundaries. In addition to its planning and regulatory activities, GHTD is a local transportation provider that operates a downtown shuttle in the Hartford known as the "Scooter" and operates the Greater Hartford area paratransit service.

The "Scooter" shuttle is a cooperative effort of several downtown employers who formerly operated separate bus/van shuttles among their downtown work sites and various public and private parking lots. The Scooter fleet includes ten (10) motor coach buses. Daily Scooter ridership is estimated at 3,000 daily trips. Scooter service is free to employees of sponsoring companies and is available to the general public for a $1.00 fare.

Paratransit service in the Greater Hartford area includes services as mandated by the Americans with Disabilities Act (ADA) as well as dial-a-ride taxi and van service available to a broader population of senior citizens. The ADA paratransit service will take an individual to and from any locations that fall within 3/4 mile from any fixed route bus service for double the regular fare. Within the Connecticut Transit service area, that results in a $2 - $5 one-way fare for the ADA paratransit service. GHTD runs 16,000-17,000 paratransit trips per month, of which approximately 25% are ADA service. GHTD uses nearly 50 vehicles to provide its paratransit service. The dial-a-ride service is a free service for those aged 65+, or who have a disability, and reside in the communities of Hartford, East Hartford, Manchester or Wethersfield.

Amtrak and Other Rail Services. The only passenger rail service operating in the corridor is Amtrak's Springfield-Hartford-New Haven main line. The line owned and operated by the National Rail Passenger Corporation (trade name: Amtrak) offers direct service to New York, Philadelphia, Baltimore, Washington D.C., Richmond, Boston, and Vermont. The service features seven daily southbound passenger trains and six daily northbound trains. Amtrak also operates a daily southbound express mail train that does not carry passengers.

The Amtrak line through Hartford is largely single track with passing sidings, but is double tracked with a long (2 mile) high speed siding in Newington and West Hartford and an equally long industrial track between West Hartford and Hartford. The rail right of way was originally designed to accommodate four (4) main tracks south to Newington Junction immediately west of Willard Avenue (Route 173). At Newington Junction the right of way splits. A two track right of way crosses Piper Brook headed for New Haven while another two track right of way breaks east towards New Britain.

Today, rail service on the line to New Britain has been abandoned and the line to New Haven is largely single track with only modest levels of local and through freight activity. The remaining main track is in the position that would have been the southbound track to New Haven (the second main track from the eastern edge of the right of way). Between Newington Junction and Hartford the right of way west of the two remaining tracks in is largely vacant (but intact) occupied by a single industrial turnout in West Hartford to a Heublein facility. The now unused western most track on the right of way is the remains of former New Britain Secondary Track which provided a dedicated line between Hartford Yard and industrial activity in downtown New Britain. Some of this abandoned track remains in right of way in Newington and West Hartford but is in decrepit condition and completely unusable.

New Britain Secondary Track. In Newington, the Amtrak line is joined by a branch line leading to downtown New Britain. This line was acquired by the State of Connecticut in the early 1990's for potential use as a passenger rail right of way. Conrail formally retired the 3.5 mile line segment from freight service in 1992. It is not in operable condition at this time. The New Britain Secondary connects with the Amtrak New Haven-Springfield main line at Newington Junction immediately south of Willard Avenue (Route 173) in Newington. According to reports by the Connecticut DOT, this line segment would need to be completely rebuilt before any attractive rail passenger service could be operated on this line. The field inspection of the line in February 1997 supports this finding.

Over most its length, the New Britain Secondary has a single track remaining from the 1980's. The right of way is wide enough at almost every point in New Britain to support four parallel tracks. The useable right of way has been narrowed to a one or two track capacity where highway building activities have encroached on the former rail right of way.

Inspection of the right of way found the road bed is

largely in good shape with minor drainage problems. No serious engineering obstacles to use of the line for transportation purposes were noted. With respect to environmental concerns, the rail embankment in some areas passes through wetlands or adjacent to some single and multi-family homes.

Opportunities for Alternative Modes

Members of the Policy and Technical Advisory Committees expressed strong interest in providing Hartford West commuters with alternatives to conventional highway transportation. Because of the importance placed on livable communities and quality of life, accommodation of safe bicycle and pedestrian movement will be an important enhancement to the recommended transportation improvements. Strategies developed must not merely protect pedestrians, but must also serve to improve and enhance their ability to move freely throughout the study corridor and the larger region. Health consciousness and environmental awareness have increased the use of the bicycle as a mode of transportation and for recreational purposes. Bicycle accommodation or planning for separated bike only facilities is important to the community's residents.

Greater Hartford Ridesharing Corporation. The Greater Hartford Ridesharing Corporation (GHRC), known as the "Rideshare Company," is the Capitol Region's Transportation Management Organization (TMO). GHRC is a private, non-profit organization acting as a transportation facilitator and service provider for commuters and employers in both the public and private sectors. In 1990, an estimated 18,600 commuters residing in the study area communities regularly used either a carpool or vanpool as their principal means of traveling to and from work. This comprises approximately 11% of work trips made by study area residents. Approximately 13% of the 240,000 persons working in the study area communities use a carpool or vanpool to get to and from work. GHRC estimates 16 "Easy Street" vanpools currently originate within the study area.

Park and Ride Facilities. The Connecticut Department of Transportation maintains a statewide system of Park and Ride lots for commuters who want to avoid traffic congestion and save on commuting costs. These commuters can leave their cars at any of the 227 lots across the state while they use carpools, vanpools, buses or trains for their trips to work. Within the Hartford West commuter shed, ConnDOT maintains 15 lots with a capacity of 1,839 spaces. Nine of the lots are served by express buses to downtown Hartford.

Interregional Transit Service. Analysis of the existing transit service provided by CTTransit and others in the corridor reveals a focused and efficient service. In the light of projected increases in population, employment, and travel demand, the role of public transit - especially local and express bus - needs to be reassessed. The following are two market niches that could be served by transit.

- **Reverse Commutation to Suburban Employment Centers** - A major portion of employment growth in the Greater Hartford region is increasingly focused on its outlying suburban towns, while the traditional regional core, Downtown Hartford, has experienced loss of 12,520 jobs (10 percent of its total employment) between 1993 and 1995. Newington, Simsbury and Granby all reported employment gains of over 500 jobs each. Farmington now has more workers commuting to its employment centers than it has outbound commuting residents. Regional models project continued growth in the vicinity of the UConn Health Center and Westfarms Mall.

  These trends have caused an increase in reverse commuting (e.g. center city to suburb) and it also presents an obstacle to those without access to a private vehicle. New transit initiatives, in the form of work-oriented shuttle services, vanpools, and other alternatives, may be required to adequately and efficiently service this demand.

- **Farmington/West Hartford - New Britain Transit Connection** - The conventional radial orientation of many public transit routes means that some types of trips for education, shopping, and personal business are poorly served. Within the study corridor, shopping areas in Farmington for example are inaccessible by public transit from New Britain. In this case the same is true of employment destinations. Looking at the travel demands that are not core oriented will provide the potential of increasing transit utility in the corridor.

  Data from regional transit providers also reveals that not only are the low income, transit dependent served, but also travel markets composed of more affluent residents. Especially in conjunction with other transporta-

tion demand management strategies such as congestion or parking pricing, public transit may serve a viable alternative by increasing mode choice.

Pedestrian Needs

National travel surveys indicate that most pedestrian trips do not exceed two miles. However, a great deal of travel within the I-84 study area is actually made over much shorter distances, such as shopping trips, trips to school or to visit friends. For these trips, walking is an enjoyable and healthy alternative to using the car.

In addition, all travel whether by auto or by transit with the possible exception of trips to drive-through fast food and banking involves a segment of pedestrian travel at the beginning and end of the trip. The "intermodal" segment (ingress) serves as access to the automobile or transit vehicle and the access (egress) to the final destination walking out to the street, driveway or parking lot.

For auto trips within an urban or more intensively developed suburban setting, for example Hartford CBD, West Hartford Town Center and the University of Connecticut Health Center campus, this travel component becomes more significant, since parking facilities are typically larger and are located at greater distance from the actual activity center. It is in these locations that pedestrian facilities — sidewalks, signals, crosswalks, signage, benches, planters and other amenities — are often provided. With appropriate security, a walkable environment can be a distinguishing feature of urban or town centers. However, in an urban setting, concern for personal security can act as a deterrent to pedestrian travel.

Pedestrian-oriented shopping districts attract customers from throughout the region. This is the urban design objective for areas such as Farmington Avenue in Hartford and West Hartford, West Hartford Town Center, Downtown New Britain, and Farmington Center (outside the study area). Newington Center does not have the commercial diversity to attract large numbers of visitors from outside the town, but it does provide a destination for pedestrian trips from adjacent residential areas. Other commercial corridors within the study area are likely to retain their auto orientation due to existing land use and density characteristics.

The City of Hartford provides sidewalks and street lighting on almost all of its streets, and in New Britain about three-quarters of the street network has these amenities provided. These features are characteristic of the pedestrian-oriented pattern of urban design that prevailed, from 1850 to 1950. Today, approximately ten percent of Hartford residents, and six percent of New Britain residents walk to work. These are high percentages for cities of their respective sizes.

In older suburban area, sidewalks are provided on West Hartford's arterials and collectors, as well as the majority of its local residential streets. The Town's Planning Director notes the high proportion of senior citizens as a factor encouraging pedestrian travel, especially for exercise/recreation. There are also off-street walking paths along Trout Brook in the block between the Boulevard and Farmington Avenue and for one block along the Park River.

In Newington, sidewalks occur primarily along major arterials. While most of Route 175 has sidewalks on both sides of the street, there are some limited segments where the roadway right-of-way does not allow adequate room to provide sidewalks.

For Farmington, sidewalks are provided along some segments of the arterials, and along a number of collectors. Many local streets do not have sidewalks and pedestrian travel tends to be focused on those limited areas of the town that have a more urban development pattern, such as Farmington Center and Unionville. Recreational walking occurs throughout the community, but there is no particular accommodation of this activity except within town parks.

Bicyclist Needs

For transportation-oriented bicycle travel (as opposed to recreational), the primary routes are along the study area's major and minor arterials, such as Farmington Avenue, the Boulevard, Park Street/Park Road, Route 175, New Park Avenue, and New Britain Avenue. No alternative off-road paths have been constructed within the study area, and existing traffic volumes along many routes make them unappealing and hazardous for bicycle use.

The City of Hartford's *Plan of Development* identifies the potential for several on-street bicycle routes within the study area including in the vicinity of Colt Park, in the South Green neighborhood, in the area adjacent to Pope Park, and in the West End.

The conceptual alignments for two off-street paths are also identified. One of these would utilize the ridge line extending through Rocky Ridge Park south to Thomas Hyland Memorial Park. The other would be developed along the Park River west of Pope Park. Ultimately, the City intends to link this system with the Connecticut

Riverwalk being developed by the Riverfront Recapture program. According to the City's Chief Staff Planner, a proposal has also been made to construct a velodrome (a banked bicycle track for Olympic-type competitive racing) within the Charter Oak area.

Bicycle accommodation outside the City of Hartford is equally limited. Several towns have bicycle or mixed use paths in their parks, including MDC properties in West Hartford, but no designated, signed or marked bike routes have been created. Proposals for more extensive bicycle facilities are typically in the initial planning stages for all the study area towns.

Goods Movement

Interstate 84 provides a key link between the New York Metropolitan Area and Boston. Through its connection to Interstate 80 in northeastern Pennsylvania, it also offers long distance commercial traffic an alternative to congestion in the New York area by allowing them to access New England destinations via the Newburg-Beacon Bridge located some 50 miles north of New York City.

Given these characteristics, it is reasonable to assume that most truck traffic on I-84 is not local to Connecticut (i.e. it neither originates nor terminates within the state). According to the most recent ConnDOT classification counts for I-84, there were approximately 6,500 heavy vehicles counted at the station closest to the New York State line (Danbury) and 6,100 heavy vehicles counted at the station closest to the Massachusetts line (Tolland). Approximately 65 percent of these vehicles were tractor-trailers (5+ axle vehicles). In the Hartford area, the volume of truck traffic on I-84 dips to approximately 5,000 as traffic destined for Hartford area businesses exits for local routes to make pick-ups and deliveries.

Major generators of truck activity within the Hartford West study area include the University of Connecticut Health Center, Westfarms Mall, Colt Industries (West Hartford), Chandler Evans (West Hartford), Sears Distribution Center (Fenn Road - Newington), and Stanley Works (New Britain).

The reuse of several other industrial properties, including the Torrington and Loctite properties in Newington, and the Veeder-Root building in Hartford, can be anticipated to add a small number of additional trucks to the existing baseline volumes. Also, the development of Charter Oak Terrace as a light industrial complex would contribute some additional truck volume.

Outside the Hartford West study area, numerous manufacturing and distribution operations contribute a portion of local truck traffic to I-84 and parallel arterials. These include Farmington Industrial Park, U.S. Postal Service Mail Processing Center (Hartford), UPS Distribution Center (Hartford), Hartford Regional Market (Hartford), Pratt and Whitney Aircraft (East Hartford), J.C. Penney Distribution Center (Manchester), and Buckland Hills Mall (Manchester).

will be made within existing right-of-way and impacts are limited, it is anticipated that a Categorical Exclusion (CE) will be granted for this improvement. Special sensitivity will be given to noise impacts on adjoining neighborhoods;

- **Improved Bus Services along I-84/ Farmington Avenue.** Suggestions for improved transit routes and schedules have been referred to the bus studies presently underway by ConnDOT and CRCOG. The need for service enhancements has been supported by towns and CRCOG;
- **Support for Arterial Highways.** The intersections and park and ride lots targeted for improvement will be included as part of an overall strategy undertaken by CRCOG and CCRPA to address safety, operational, and transportation impacts on quality of life;
- **Transportation Demand Management (TDM).** As an adjunct to the New Britain-Hartford Busway, a TDM will be studied for the purpose of increasing transit ridership. TDM strategies work most effectively as complements to transit service enhancements. The most successful strategy in increasing transit ridership was "Financial Incentives;" just as "free" or "subsidized" parking reduces the cost of automobile use, Financial Incentives reduce the "cost" to the transit rider thus enhancing use;
- **Land Use Regulation to Support Transit Friendly Design.** Even though land use and its regulation is not directly under the control of ConnDOT, future land use is nonetheless a critical ingredient to the success of the BRT strategy. With the endorsement of towns, CCRPA, and CRCOG, appropriate land use regulations will be developed as an element of continuing busway implementation.
- **New Britain - Hartford Busway Service Area.** The New Britain - Hartford Busway will offer an excellent opportunity to serve travel demand between the two cities with a faster and more efficient alternative to conventional on-street bus operation. As shown in Figure ES-2, the proposed exclusive use busway would initially operate along nine (9) miles of inactive and active railroad right-of-way between Union Station at the western edge of Hartford's Central Business District (CBD) and Downtown New Britain. From the Hartford CBD to Newington Junction (Willard Avenue), the busway would share the right-of-way with existing Amtrak rail service. From Newington Junction to New Britain, the busway would operate on the abandoned New Britain Secondary right-of-way owned by the State of Connecticut. Beyond this point, express bus routes would operate to Plainville and other suburban locations via the existing Route 72 freeway.

Intermediate stations will be coordinated with development centers such as the Aetna Insurance corporate headquarters (employment center with over 10,000 employees), the New Park Road development area in Hartford's Parkville and Charter Oak neighborhoods, Central Connecticut State University (CCSU) with over 12,000 full-time and part-time students, and 1,200 full-time and part-time employees, and the East Main Street development area of the City of New Britain.

Stations would be sited at twelve locations, including:

- **Hartford:** Union Station, State Armory, Aetna Insurance, Park Street, New Park Avenue
- **West Hartford:** Oakwood/Flatbush Avenue, Elmwood (New Britain Avenue)
- **Newington:** Willard Avenue, Cedar Street
- **New Britain:** East Street, South Main Street, Downtown

GOALS AND OBJECTIVES FOR CORRIDOR IMPROVEMENTS

Transportation Goals and Objectives were the cornerstone for evaluating alternative transportation improvements. To evaluate the potential for success of the strategies, the Technical Advisory Committee (TAC) members defined a set of Goals and Objectives. The following five goals were supported by a comprehensive set of specific objectives and related performance measures:

- **Modal Choices** - The first goal of improvements to be implemented was to increase the modal choices available for the movement of people and goods.
- **Congestion Reduction** - The second goal was to reduce peak hour vehicular congestion.
- **Public Health and Safety** - The third goal was to improve public health and safety associated with transportation.
- **Economic Development** - The fourth goal was to increase opportunities for local and region-wide economic development by improving mobility.
- **Community Livability & Quality of Life** - The fifth goal was to enhance the livability and quality of life for corridor towns, neighborhoods and communities.

Alternative Modes. The busway offers a unique

opportunity to handle the travel demand among the corridor towns. New Britain, Newington, and Hartford experience a strong interchange of trips that requires a flexible public transit service. By implementing park and ride lots, developing feeder bus routes, and facilitating pedestrian connections, this busway will serve as a spine to more effectively connect and coordinate transit and other intermodal transportation services.

Congestion Reduction. The recommended package of improvements will reduce vehicle hours of travel during peak travel periods and therefore reduce peak hour vehicular congestion. The effect of this reduction in peak travel will be to reduce the volume of traffic that will remain on the arterials. By reducing peak period travel, the recommended strategies will reduce:

- Circuitous travel associated with partial interchanges;
- Emissions associated with mobile sources;
- Noise impact on sensitive receptors; and
- Accident potential and hazard.

Community Preservation. The reconstruction of I-84 interchanges and the implementation of the busway offer the potential to enhance neighborhood continuity and access patterns through pedestrian connections, open space, and feeder bus routes.

Economic Benefit. Two types of economic benefit will result from these recommendations. First, access to transit systems by minority and low income populations will increase, and "job-rich" areas will be connected with people in need of employment and opportunity. In addition, access to CCSU and other educational centers will be enhanced. Second, transportation access to areas designated for industrial and economic development will also increase. The New Britain - Hartford busway would increase the potential for growth and economic vitality in terms of regional and state productivity, jobs, and property tax base.

EXISTING AND FUTURE CONDITIONS

A critical relationship for any transportation system is its relationship to current and future land use. Not only does transportation support the land use function by providing access and mobility, but the land use also supports the transportation service by providing appropriate population and employment densities. The key land use and transportation issues for each study area town are described below:

Hartford. The Hartford portion of the MIS study area incorporates a broad mix of land uses. A key transportation concern for the Hartford West study area is that future improvement plans be made to support other urban re-development initiatives, such as the city's planned redevelopment of the Parkville and Flatbush Avenue industrial areas, the Charter Oak Terrace housing complex, and the proposed bicycle trail system.

West Hartford. West Hartford is an established suburban area, with a solid base of both retail and manufacturing employment. A key transportation issue for West Hartford is the congestion and reduced quality of life caused by through movement of traffic on local residential streets.

Farmington. Employment within the Town of Farmington now exceeds 25,000, so there are more jobs located within the town than there are residents. A key transportation issue for Farmington is alleviating traffic congestion on I-84 and in the Route 4 corridor.

Newington. Newington can be identified as a suburb of both Hartford and New Britain, with three- quarters of its workforce employed outside the town. The most pressing transportation concerns within the study area are related to Route 175 (Cedar Street) and its intersection with major north-south arterials, such as Main Street, as well as the Route 9 Expressway.

New Britain. The characteristics for the City of New Britain differ significantly from the north and northwest portions of the city that lie within the defined Hartford West MIS study area. A key transportation concern for New Britain is improving the accessibility of its Downtown area through highway improvements, and potentially through busway service to Hartford. A major activity center exists in the northern part of New Britain (CCSU).

The Future of Travel in the Corridor

The I-84 Hartford West corridor has been determined by CRCOG to be the most congested within the Capitol Region with an Average Daily Traffic (ADT) of 154,000. For the future year 2020, the total demand for I-84 could exceed 190,000 vehicles per day. As confirmed by CORFLO and FRESIM models, congested routes include I-84 and parallel arterials, such as Route 4, Farmington Avenue, and Park Street. This congestion is projected to grow sig-

nificantly to the year 2020. Peak hour average travel speed will drop and hours of delay will increase especially in the eastbound direction during both morning and evening periods.

Peak Period Congestion. Commutation to the Hartford CBD and reverse commutation to suburban locations constitute a large component of morning and afternoon peak period travel. Growth projections for the region reinforce this trend as employment in Hartford's CBD will increase dramatically. The increasing volume of travel to other major activity centers including the UConn Health Center, Westfarms Mall and Downtown New Britain, can also be identified as the source of both corridor wide and localized congestion problems. Reverse commutation, coupled with regional travel, increases traffic volumes in what is normally thought of as the "off-peak" direction.

Freeway Performance. Both now and in the future I-84 will carry the greatest portion of person trips in the Hartford West corridor. However, the capacity of the Interstate will inhibit its ability to perform successfully. Currently, in the morning (A.M.) peak, eastbound I-84 reaches Level of Service (LOS) "F" on the most easterly segment of the freeway between Exits 46 through 49. Average speeds on these segments will drop below thirty miles per hour as peak volumes approach 6,500. The situation by 2020 will become much worse as the segments from Exit 39A through 49 will experience a LOS "F" with average speeds dropping below twenty miles per hour and volumes exceeding 7,400.

Performance in the westbound peak direction during the evening (P.M.) peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals continued degradation in service. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds will reduce to below 25 miles per hour as compared to 50 miles per hour during the A.M. peak.

Arterial Roadways. The percentage of roadway mileage operating at a volume/capacity ratio greater than 0.75 will increase substantially in the year 2020. On arterials, intersections are often the locations where congestion most frequently occurs. Several of the intersections, which are currently operating at or near capacity, will fail under future anticipated traffic volumes. Many unsignalized intersections will require signalization in the future.

Hourly Variation in Peak Period Traffic. The analysis above has demonstrated that by the year 2020, a number of highway segments in the corridor will experience failing or unsatisfactory levels of service. The peak periods will become more congested, and an amount of peak period travel will occur immediately before and after the peak period. This tendency is referred to as peak spreading.

The analysis has shown that in the future, no-build condition demand for travel will clearly out strip the ability, or capacity, of the highway corridors to handle the traffic during the peak periods. Motorists will adopt one of four strategies to avoid the congestion. They could:

- Take an alternative less traveled route - Interstate to arterial or arterial to local road;
- Change their hours of travel - begin earlier or arrive later;
- Travel by an alternative mode - rideshare or public transit; or,
- Not make the trip at all - change job location or work at home.

In the case of the last two alternatives, there would be a "net" reduction in peak period automobile vehicle trips. Generally, an alternative mode will be attractive only if it reduces travel time, or reduces costs. In the final case, the reduction in the number of trips represents a reduction in "mobility" unless an alternative such as telecommuting may be substituted.

Highway Facilities

In the study area, Interstate 84 and Route 9 carry the highest functional designation of Interstate and Principal Arterial (Expressway), respectively. These facilities carry the highest volume of traffic within the study area, and are important routes for interstate and local truck traffic. Truck traffic on I-84 and Route 9 constitutes seven to ten percent of overall traffic volume. Route 4 and Route 175 are the only other Principal Arterials within the study area. Minor Arterials are important carriers of traffic within the study area especially for North-South travel demand. Collectors such as Route 173 not only channel traffic from local roads, but in this corridor also are called upon to handle through movements due to the lack of arterial highways.

Computer-based transportation simulation models were used to quantify the current and future performance of the study area roadway network. The results indicate the following:

- A substantial decrease in travel speeds as roadway congestion increases on arterial and the freeway alike;
- An increase in vehicle density i.e., more vehicles per mile of highway especially on I-84 as demands reaches saturation;
- Decreased LOS on all roadways and at intersections in the corridor; Capacity constraints cause diversion to residential roads and streets;
- Increased vehicle delays throughout the system; and
- Increased vehicular emissions.

Public Transportation

While the automobile currently serves the vast majority of travel needs in the Hartford West corridor, a variety of public transportation services also serve mobility needs. These services include:

- Fixed Route Local Transit and Express Bus Operations;
- Intercity Bus;
- Downtown Circulator/Shuttle;
- Rideshare Matching and Facilitation; and
- Intercity Passenger Rail Service.

Three fixed route bus operators, CT Transit, New Britain Transportation Co., and DATTCO, carry 21,000 daily passengers in the study area. Eight local bus routes, one crosstown route and four express bus routes service Hartford's West Side neighborhoods. ConnDOT provides fifteen park and ride lots in the study area. Three intercity bus companies, Greyhound, Peter Pan, and Bonanza, provide 52 daily bus trips between Hartford and other major cities. The Scooter, a downtown Hartford circulator bus network, serves 3,000 daily passengers with a fleet of ten buses. Greater Hartford Rideshare provides ridesharing brokerage services for the region. Amtrak provides 14 daily trips along the Northeast Corridor.

Pedestrian and Bicycle Modes of Travel

Approximately ten percent of Hartford residents, and six percent of New Britain residents walk to work - high proportions for cities of their size. Pedestrian-oriented shopping districts attract customers from throughout the region. This is the urban design objective for areas such as Farmington Avenue in Hartford, West Hartford Town Center, Parkville in Hartford, and Downtown New Britain. For transportation-oriented bicycle travel (as opposed to recreational), the primary routes are along the study area's major and minor arterials, such as Farmington Avenue, the Boulevard, Park Street/Park Road, Route 175, New Park Avenue, and New Britain Avenue. The City of Hartford's *Plan of Development* identifies the potential for several on-street bicycle routes within the study area.

Goods Movement

Interstate 84 provides a key link between the New York Metropolitan Area and Boston. Through its connection to Interstate 80 in northeastern Pennsylvania, it also offers long distance commercial traffic an alternative to congestion in the New York area by allowing them to access New England destinations via the Newburg-Beacon Bridge located some 50 miles north of New York City.

Corridor-wide Transportation Issues

The mobility and economic vitality of the Hartford West corridor is of critical importance to its communities, the Capitol Region, and the State as a whole. In addition, because the corridor includes Interstate 84, all of New England will be impacted by the transportation improvements proposed. The ability to move safely and efficiently through the corridor will influence the competitive position of businesses located in the region.

MIS transportation improvement alternatives must respond to a variety of regional and local needs. These needs include:

- Reduction in Peak Hour Congestion on I-84 and Parallel Arterials;
- Improved I-84 Highway Connectivity;
- Enhanced Access from the Farmington Valley to the Hartford CBD;
- Increased Opportunities for Alternative Modes; and
- Expanded Interregional Transit Service.

In addition to these regional issues, a variety of related-local concerns must be addressed. Not the least among them is the need to carefully plan and design transportation solutions that thoughtfully accommodate pedestrian and bicycles along with automobiles, buses, trucks, and other vehicles. Other local concerns relate to coordination with economic development initiatives, local activity centers, and protection and enhancement of the neighborhood environment.

REASONABLE ALTERNATIVE PACKAGES

Six Reasonable Alternative Packages (RAPs) were formulated for initial evaluation. These RAPs were intended to present broad themes for future transportation improvement strategies within the corridor. They were not intended to represent the final solution or for that matter to limit future consideration of additional strategies. The themes were:

- **RAP 1 - No Build (Base Case) -** RAP 1 constitutes the base case condition for evaluation of transportation improvements, including existing and committed projects along with safety improvements and normal maintenance and operation.
- **RAP 2 - TSM, TDM and Transit Operations -** The TSM, TDM and Transit Operations Improvements are spread throughout the corridor with TDM improvements focused on Downtown Hartford. TSM improvements will include traffic operations and safety improvements. Transit Operations improvements would consist of local and express bus service modifications and intermodal transportation centers.
- **RAP 3 - Freeway Reconstruction and Operations -** Reconstruction improvements will be directed at areas containing left entrance and exit ramps, partial interchanges, and locations where auxiliary lanes will relieve spot congestion. RAP 3 also included Intelligent Transportation System (ITS) strategies such as Advanced Traveler Information Systems, Ramp Metering, Arterial Signal Coordination, Incident Management, and Traffic Operations Centers.
- **RAP 4 - Fixed Guideway Transit -** This RAP was subdivided into Light Rail, Busway and Commuter Rail alternatives. The following alignments were under evaluation for each of these modes:
- **New Britain/Plainville to Hartford Rail Right-of-Way** - Commuter Rail, Light Rail or Busway;
- **I-84 Right-of-Way** - Light Rail or Busway; and
- **Farmington Avenue** - Light Rail.

  The potential fixed guideway services were projected to include a package of recommended feeder and connecting bus routes. In some cases, existing bus routes were slightly modified to provide connectivity; while in other cases, new bus services were proposed which would be overlaid on existing services.
- **RAP 5 - Additional Lane - HOV** - The HOV system would operate similarly to those in the Capitol Region on Interstate 91 north and Interstate 84 east of the Connecticut River. Access to the Interstate would be provided at designated on-ramps and would be open for use by vehicles with two or more occupants (termed "HOV 2+"). In addition to HOV 2+ automobile traffic, the HOV lane would also enable express buses to enhance travel time and build ridership.
- **RAP 6 - Freeway Additional General Purpose Lane** - As a result of public outreach and consultation with corridor communities, the Connecticut Department of Transportation (ConnDOT) and the Capitol Regional Council of Governments (CRCOG) dropped consideration of RAP 6 from the study process.

A detailed, quantitative analysis of the transportation performance of the alternatives, their satisfaction of adopted goals and objectives, and the benefits and costs associated with each is presented in Technical Report Number 3. The performance measures evaluated include transit-related performance measures (new service transit users, total transit riders/new transit riders, peak period transit ridership, impact on mode share transit-related RAPs), highway performance measures, arterial roadway performance measures, and costs associated with the RAP (capital construction cost, transit operating costs, fare to operating cost ratio, and transit subsidies).

SOCIAL, ENVIRONMENTAL AND ECONOMIC EFFECTS

Based on readily available information, a preliminary evaluation of the Recommended Package was conducted as an indicator of the potential effect on the environmental, social and economic resource groups. Further detailed environmental studies will be undertaken for the recommendations on a project level.

Social Effects

The following were inventoried, mapped, and evaluated for potential impacts upon culturally and socially important resources:

- Land Use;
- Visual and Aesthetic Impacts;
- Public Facilities, Services and Utilities;
- Relocation Impacts;
- Neighborhood and Community Cohesion;
- Access Issues;
- Consistency with Plans for Conservation and Development;
- Historical/Archeological/Section 4(f)/Section 106 Evaluation; and
- Environmental Justice.

While improvements were slated for implementation in existing transportation corridors, at some locations, for example transit stations, additional right-of-way would be necessary. Even so, the Busway and other improvements will have little or no effect on these resources with the exception of Visual and Aesthetic Impacts and Relocation Impacts. The Busway and interchange improvements are expected to have Visual and Aesthetic Impacts, often times positive, as well as Relocation Impacts, especially in areas of station construction.

Environmental Effects

The development patterns within the Hartford West Corridor can vary between densely developed urban and lightly developed suburban. This development has displaced much of the natural environment of the subregion; however, that which remains is important to sustain the ecological and human quality of life. As a first step, from available sources of information, the natural resources have been identified and constraint maps developed. Environmental concerns inventoried and evaluated include:

- Prime Farmland;
- Hazardous/Contamination Risk;
- Wetlands;
- Natural Resources/Fish and Wildlife/Endangered Species;
- Stream Channel Encroachment;
- Wells;
- Stratified Drift Aquifers;
- Flood Plains;
- Public Water Supply;
- Noise; and
- Air Quality.

No impacts are expected to the natural resources and endangered species, wells, or public water supply. The Busway may impact wetlands, stream channels, and flood plains in the park River and Piper Brook areas. Similarly, the Busway will impact stratified drift aquifers. Minor impacts to prime farmland are expected, and although exact information is not known. The greatest potential for hazardous/contamination risk is in the New Britain - Hartford Rail Corridor. Noise and air quality impacts are expected with the Busway.

Economic Effects

Economic impacts are related to the financial resources of a community. Economic impacts evaluated include:

- Economic Trends and Local Tax Base;
- Secondary Economic Impact; and
- User Benefit.

The Recommended Package of improvements is not believed to have a negative impact on the economic trends, while the secondary impacts may be either partially negative or partially positive. The only improvements with a positive user benefit was the New Britain - Hartford Busway.

PERFORMANCE OF THE RECOMMENDED PACKAGE

The busway was selected as a major component of the preferred alternative for this corridor because it offers the travelers the greatest speed, flexibility of service, and ease of intermodal interface as compared with other modal alternatives. Both bus users and auto commuters would benefit from a busway, as would residents and business in the entire study corridor. By offering an attractive transit alternative, the busway can reduce travel demand on the congested I-84 roadway, thereby expanding the freeway's physical capacity.

Busway travel speed is enhanced by the exclusive use of the facility. Projected travel times, average travel speed and travel time savings for busway users are shown in Table ES.1.

Projected Ridership. The busway is projected to generate more daily transit ridership than any other fix guideway alternative. Daily ridership is also estimated to

Table ES-1

PROJECTED TRAVEL TIME SAVINGS - PEAK PERIOD

Hartford West MIS

Busway Performance Measures	*Current System (1995)*	*System Base Case (2020)*	*System with Busway (2020)*	*Busway Only (2020)*
Average Trip Time (minutes)	12.2	12.6	8.7	8.7
Average Trip Length (miles)	3.2	3.4	3.2	3.9
New Britain - Hartford transit Travel Time (minutes)*	34.6	33.8	24.8	20.1
Time Savings from Busway (minutes)	—	—	9.0	13.7
Percent Savings	—	—	26.6%	40.5%

**Analysis assumes all stops for buses. In operation, through buses will average 45 mph*
Source: Technical Report #3, Hartford West Major Investment Study

increase from 19,870 riders in the base conditions to 28,690 riders in the Recommended scenario. This equates to 8,820 new riders per average weekday and an increase of 58.0% over the Future Base Case.

CAPITAL & OPERATING COSTS

The Recommended RAP is estimated to have a total cost of approximately $230 million dollars, including right of way, engineering, and construction. Table ES-2 lists the costs for each of the improvement elements of the Recommended RAP.

Operating Costs & Subsidies. In addition to the costs associated with the construction and maintenance of the new improvements, there are additional costs to consider when implementing a transit service. Transit subsidy, or money spent by a public agency to partially fund the operation of the service, must be considered by policy makers in the decision to adopt a new transit service. This transit subsidy is not a one time cost, but rather an annual cost that is required to offset the cost of operating the service after fare box revenues are included. Based on data provided by CT Transit, the State of Connecticut currently pays about $7.7 million dollars a year on the existing transit services in the Hartford West corridor. This equates to roughly $1.33 per person per trip. If the decision is made to build a dedicated busway as part of the Recommended Package of Improvements, an additional $5.7 million dollars per year would be required to support the new service.

ISSUES FOR FURTHER ANALYSIS

During the MIS Study, a number of issues were raised that will require further study during subsequent study phases, these include:

Coordination with the CRCOG Regional Transit Strategy (RTS). Issues to be resolved by the RTS include finance and operations of the busway. Region-wide route planning for the long term must consider the potential for travel time savings associated with the busway.

Downtown Bus Circulation. Buses using the New Britain - Hartford Busway will either pick-up and discharge riders from stations along the busway **or** leave the busway to circulate on city streets. Especially in downtown Hartford, it will be important to plan for the circulation of buses using traffic signal preemption or dedicated bus lanes.

Busway Stations. Preliminary locations have been defined for twelve (12) stations to be located along the busway. Factors to be considered will include:

Table ES-2

CAPITAL COSTS OF RECOMMENDED IMPROVEMENTS

Hartford West MIS

Recommended Improvements	Millions of Dollars
New Britain-Hartford Busway	$75.3
Reconstruction of Flatbush, Prospect, Sisson and Sigourney Avenue Interchanges (West Side Access)	$102.3
Reconstruction of Routes 4, 6 and 9 Interchanges	$37.7
Auxiliary Lanes on I-84	$3.6
Improved Bus Services along I-84 / Farmington Avenue	Unknown
Support for Arterial Highways (TSM Improvements)	$10.8
Transportation Demand Management - Transit Financial Incentives (Annual Expense)	$3.0
Land Use Regulation to Support Transit Friendly Design (Local Costs)	Unknown
TOTAL COST	**$232.7**

- **Bus Routing;**
- **Park and Ride Locations;**
- **Station Aesthetics;**
- **Joint Development; and**
- **Pedestrian and Modal Linkages.**

Community Participation in Advisory Groups. Community participation and support will be important in the continuing implementation of the Hartford West MIS recommendations. It would be appropriate to include neighborhood and community representation on Advisory Groups that contribute to project development.

Multi Use Pathways. The potential for multi-use pathways - pedestrian and bicycle - should be considered in each of the MIS recommendations. For the busway and the West Side Access Study, the potential exists to coordinate with the Park River Greenway and Pope Park restoration. Other links in the pathway system could either be part of the rail right-of-way or routed along existing streets.

Adrian's Landing & Downtown Development. Proposals to develop Adrian's Landing in concert with other development proposals in Downtown Hartford were made late in the study process. However, these proposals will reinforce the viability of a successful busway project. In fact, the flexibility of bus operations will ideally suit the special needs of these developments. It will be important to study the special routing needs to assure expeditious routing from the busway to the development sites.

Other Issues and Concerns. In addition to the above issues, the following are additional topics of concern:

- Negotiations with Amtrak to operate the planned services between Newington Junction and Union Station;
- Entering and exiting points for buses along the busway;
- Reevaluation of bus routes that may use all or part of the busway for service especially those that provide for reverse commutation to suburban job locations;
- Evaluation of structures along the busway to determine the need for rehabilitation or reconstruction;
- Integration with development plans in Parkville, Charter Oak, Elmwood, and other areas in Hartford and West Hartford; and
- Development of a signal system for grade crossing control.

CHAPTER 1

Existing and Future Conditions

1.1 STUDY BACKGROUND

The Connecticut Department of Transportation (ConnDOT), the Capitol Region Council of Governments (CRCOG) and the Central Connecticut Regional Planning Agency (CCRPA) have identified peak hour traffic congestion and safety deficiencies as major concerns for the Interstate 84 (I-84) corridor between Downtown Hartford and the Fienemann Road interchange in Farmington. This corridor forms a critical link between major activity centers, such as Downtown Hartford, the Westfarms Mall in West Hartford, the University of Connecticut Health Center in Farmington, Downtown New Britain, and the growing Farmington River Valley.

To address these concerns and to evaluate the effectiveness of different transportation system improvement alternatives, these agencies jointly undertook a Major Investment Study (MIS) for the Hartford West corridor. The Hartford West study corridor has been broadly defined to include not only I-84 itself, but the neighborhoods surrounding the highway right-of-way, the parallel arterial roadways, and two rail lines, the Bristol-Hartford line and the New Haven-Hartford line.

The majority of the study area is located within the Capitol Region, a metropolitan area composed of Hartford and the 28 towns surrounding it. The Capitol Region's communities have a combined population of 709,404. A portion of the study area (New Britain) is located in the Central Connecticut Region. The study area encompasses portions of five communities: Hartford, West Hartford, Farmington, Newington and New Britain.

This study meets the requirements of an MIS process specified by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). It conforms to FHWA Regulation 23, CFR 771, and complies with all applicable Federal and State policies, protocols and procedures, including those outlined in FHWA Technical Advisory T6640.8A.

1.2 STUDY AREA DEFINITION

The study corridor limits are illustrated in Figure 1.1. These limits can be generally described as:

- **South to North on I-84** — from the Fienemann Road interchange in Farmington to the High Street ramps in Downtown Hartford, including those areas located south of Farmington Avenue in Hartford and West Hartford and north of Route 175 (Cedar Street) in Newington.
- **East to West** — from the High Street ramps in Downtown Hartford to a line extending one mile west of Farmington Avenue in the Town of Farmington, including only those areas north and west of New Britain Avenue in Hartford.

1.3 STUDY AREA CHARACTERISTICS

The study area communities can be divided into three general patterns of population, land use and housing character. These are:

- Urban Areas;
- Inner Suburban Areas; and
- Outer Suburban Areas.

Urban Areas - Hartford and New Britain

The two urban areas - the Cities of Hartford and New Britain - have experienced substantial population loss during the period between 1970 and 1980, and a slight gain in population after 1980. They possess a substantial portion of their respective regions' multi-family housing stock, and a far greater proportion of residents living below the poverty line. The combination of dense housing conditions and low-income households leads to a substantially greater number of households being without a vehicle available to them. In the City of Hartford, nearly forty percent of households have no vehicle available, and can therefore be considered as "transit-dependent" for their mobility needs. In New Britain, the proportion of "transit-dependent" households is approximately sixteen percent.

In Hartford, structures containing five or more units comprise almost half of the residential buildings in the City. Hartford's housing stock is largely renter-occupied housing (75 percent of all units), with a significant portion (16 percent of the City's total housing stock) consisting of Hartford Housing Authority low-income and senior citizen units. The Charter Oak Terrace and Rice Heights housing projects, located within the study area, are sched-

uled for selective demolition and reconfiguration as mixed use complexes during the next three years as part of a U.S. Department of Housing and Urban Development (HUD)-funded initiative. Industrial development opportunities for these properties are currently being pursued.

Three to four unit houses (many of these being "three deckers") are the next most common type of housing within Hartford, accounting for 22 percent of the housing stock. Two-, three- and four-family houses are the most common housing type within the City of New Britain, constituting 45 percent of that city's housing inventory.

The urban portions of the study area also exhibit a substantially greater population density and share of minority (i.e. African-American, Hispanic, or Asian) population than either the inner suburban or outer suburban areas. Sixty-nine percent of Hartford's population are members of minority groups, with African-Americans constituting the single largest segment. The study area contains a substantial concentration of Hispanic residents in the Parkville, Frog Hollow and Charter Oak neighborhoods. Park Street contains a region-serving Latino-oriented shopping district. The City of Hartford contains 65 percent of the Capitol Region's minority population. New Britain's population is 24 percent minority. Hispanics represent two-thirds of the minority population citywide. The study area on New Britain's West Side is largely non-minority, with Ukrainian- and Polish-Americans, including a sizable percentage of non-English proficient immigrants representing a major portion of study area residents within New Britain.

Inner Suburban Areas - West Hartford and Newington

The inner suburban areas within the study area include portions of the Towns of West Hartford and Newington. Both communities are largely developed, especially within the defined study area. Single-family residences and auto-oriented shopping centers constitute the two most common land uses within these towns. Retail facilities are located along Farmington Avenue, Park Road, Prospect Street, and New Britain Avenue in West Hartford and along Route 175, Main Street and the Berlin Turnpike in Newington. The Westfarms Mall in West Hartford is the single largest shopping center within the study area. It serves a regional customer base from the entire study area, as well as all portions of the study area towns.

Much of the residential and commercial development within these communities, especially in West Hartford, dates from the period between 1930 and 1960, when these inner suburban communities experienced their greatest growth. In comparison to many outer suburban communities, the housing within inner suburban communities tends to be older, and to be sited on smaller lots (less than one-half acre). The inner suburbs as a group also contain a greater share of multi-family or attached units. In this last category, Farmington is the exception to the regional pattern, due in part to the presence of the University of Connecticut Health Center. Thirty-nine percent of Farmington's housing stock in multi-family or attached units, while in West Hartford the percentage is 32 percent and for Newington it is 21 percent.

Both Newington and West Hartford offer more affordable single family housing prices than the outlying suburban areas to the west. The 1994 median single-family home price in Newington was $134,100 and in West Hartford, $159,500. Both of these figures are closer to the regional median sales price of $143,000 for single-family homes (CRCOG, 1994) than the Town of Farmington, where the median was $203,000.

The study area population of these two towns has been relatively stable over the last two decades, as the first post-war generation of suburban families has remained in place. The southern portion of Newington which experienced additional residential development during the 1970-1990 period is located outside the Hartford West MIS study area. Both West Hartford and Newington, therefore, have a population that includes a higher than average proportion of senior citizens. For the Capitol Region as a whole, the percentage of population over 64 years old is 13 percent. In West Hartford, 23 percent of the population is over 65, while in Newington, 17 percent of the population is over 65. While it is considered an Outer Suburban community based on other characteristics, Farmington also has a larger than average share of senior citizens, with 15 percent of its 1990 population over 65. These proportions may change over time as younger families are now moving into both of these towns.

Outer Suburban Area - Farmington

The Town of Farmington had the third highest rate of growth (26 percent) within the Capitol Region between 1980 and 1990. Only the towns of Hebron and South Windsor grew at a faster rate during this decade. During the peak years of Farmington's development boom, 1985-1988, over 1,500 building permits were issued, representing a 38 percent growth in Farmington's housing supply.

Key factors in this growth have been: the availability of land zoned for multi-family (condominium) housing and office development; the growth of the University of Connecticut Medical Center; and the continuing development of large-lot (1-2 acre) subdivisions in the western portion of the town (outside the study area).

Study Area Land Use and Neighborhood Characteristics. Neighborhood characteristics, such as predominant household type and size, land use, per capita and median family income, availability of vehicles, and predominant housing density are all important determinants of travel demand. These characteristics are reviewed in the following section.

Hartford. For the City of Hartford, the key transportation concern for the Hartford West study area is that future improvement plans be made to support other urban re-development initiatives. The Hartford portion of the I-84 West MIS study area incorporates a broad mix of uses. It encompasses all or portions of the following designated planning areas: Downtown, Asylum Hill, West End, South Green, Frog Hollow, Parkville, Barry Square, Charter Oak - Zion (also known as Behind the Rocks), and a small portion of the Southwest neighborhood. These areas have distinct economic, land use and housing characteristics which are noted in the 1995 *Plan of Development for the City of Hartford*. For detailed descriptions of these areas, please see Technical Report #1.

New Britain. There are no formal neighborhood associations within the City of New Britain. The four planning areas defined by the 1984 *New Britain Master Plan* lie outside the study area. Based on the housing and economic data contained in the 1994 *Plan of Development, Housing Analysis,* it can be concluded that the characteristics for the City of New Britain differ significantly from the north and northwest portions of the city that lie within the defined Hartford West MIS study area. The distinctive land use and socio-economic characteristics of these areas are described in Technical Report #1.

Newington. Newington can be identified as a suburb of both Hartford and New Britain, with three- quarters of its workforce employed outside the town. Newington's Planning Director describes the town as being largely built out with limited areas for new development. The 1995 *Newington Plan of Development* projects a modest increase in population over the next ten years, from 29,208 to approximately 30,000. The most pressing transportation concerns within the study area are related to Route 175 (Cedar Street) and its intersection with major north-south arterials, such as Main Street, as well as the Route 9 Expressway. There are no formal neighborhood associations within Newington. Its development pattern is typified by residential subdivisions of 50-200 homes. However, the neighborhood areas of North Newington and Newington Center, identified by their land use characteristics, are described in detail in Technical Report #1.

West Hartford. West Hartford is an established suburban area, with a solid base of both retail and manufacturing employment. Nonetheless, only 25 percent of West Hartford's resident workers are employed within the town. The remaining 75 percent commute to other locations, with the greatest flow being toward Downtown Hartford. At the same time, West Hartford's employers attract an even larger number of incoming commuters from other towns and cities, predominantly the City of Hartford and the towns of Newington and Bloomfield.

West Hartford's 1996 *Draft Town Plan of Conservation and Development* does not identify neighborhood areas. The Town's Planning Director has identified two neighborhood associations within the study area; however, some additional areas can be identified based on the 1986 *Plan of Development* and general land use characteristics. Descriptions of Wolcott, Elmwood, Webster Hill/Duffy/Braeburn, and West Hartford Town Center are available in Technical Report #1.

Farmington. Employment within the Town of Farmington now exceeded 25,000, so that there are more jobs located within the town than there are residents. Service industries, such as health care and education, as well as the FIRE cluster, represent 78 percent of the town's employment, while manufacturing accounts for 22 percent. Currently, the town contains some 2.5 million square feet of commercial office space, with a 16 percent vacancy rate. Much of the town's office space inventory is located within the Hartford West study area. The primary industrial area is the Farmington Industrial Park located well to the west of the study area boundary. Farmington is one of the few towns in the Capitol Region which has experienced growth in its manufacturing employment during the 1980's and 1990's.

The Hartford West MIS study area within Farmington lies east of Route 10 (Main Street) and south of Old Mountain Road. The Town's 1995 *Plan of Conservation and*

Development maps out distinctive neighborhoods, including six which are entirely or partially within the study area boundaries. The study area encompasses the Oakland Gardens, Health Center, East Farms, Robbins, and Batterson Park neighborhoods, along with the southern portion of the Talcott neighborhood. Both Oakland Gardens and East Farms have formal neighborhood associations. The distinctive land use and socio-economic characteristics for the study area neighborhoods are summarized in Technical Report #1.

1.4 CORRIDOR TRANSPORTATION ISSUES

The issues and problems defined for the Hartford West corridor are interrelated. For example, problems with highway connectivity create peak hour congestion on arterial segments where the primary travel demands are not directly served. In other cases, problems may represent the symptom rather than the cause.

The regional issues are presented conceptually in Figure 1.2. The regional issues and problem areas may be summarized as:

- Peak Hour Congestion on I-84 and Parallel Arterials;
- I-84 Highway Connectivity;
- Access from the Farmington Valley to the Hartford CBD;
- Transportation Needs for Improved Transit Service; and
- Opportunities for Alternative Modes.

In addition to these components of needs, there are other equally pressing matters of localized concern. As noted above, support for economic redevelopment initiatives in Hartford, or undesirable traffic volumes in neighborhoods abutting the Interstate or busy arterials are important issues for local decision makers.

Peak Hour Congestion on I-84 and Parallel Arterials

The I-84 Hartford West corridor has been determined by CRCOG to be the most congested within the Capitol Region with an ADT of 154,000. For the future year 2020, the total demand for I-84 could exceed 190,000 vehicles per day. As confirmed by CORFLO and FRESIM models, congested routes include I-84 and parallel arterials, such as Route 4, Farmington Avenue and Park Street. This congestion is projected to grow significantly to the year 2020. Peak hour average travel speed will drop and hours of delay will increase especially in the eastbound direction during both morning and evening periods.

Commutation to the Hartford CBD and reverse commutation to suburban locations constitute a large component of morning and afternoon peak period travel. Growth projections for the region reinforce this trend as employment in Hartford's CBD will increase dramatically. The increasing volume of travel to other major activity centers including the UConn Health Center, Westfarms Mall and Downtown New Britain, can also be identified as the source of both corridor wide and localized congestion problems. Reverse commutation, coupled with regional travel, increases traffic volumes in what is normally thought of as the "off-peak" direction.

Travel Time Runs and Average Travel Speed. Travel speeds are a direct indicator of Level of Service (LOS) and congestion. Average travel speeds on Route 4 during the P.M. peak period are less than 35 mph, with travel speeds of less than 25 mph on some sections. These indicate areas of congestion and poor Levels of Service. Although overall eastbound and westbound travel speed on I-84 was recorded at 49.1 mph and 42.8 mph, respectively, on certain segments speeds were experienced as low as 25 mph. These segments were typically near the CBD in the peak direction of travel.

Accident Data Analysis. Interstate 84 and Route 9 display the lowest accident rates. This is generally reflective of a higher design standard and more access control. In contrast, Route 173 which carries lower volumes than Route 9 experienced more accidents per mile and therefore a higher accident rate. A detailed breakdown of accidents by route number and town is included in Technical Report #1.

Modeling of Current and Future Performance

A set of computer-based models was used to quantify the current and future performance of the roadway network within the Hartford West corridor. ConnDOT's statewide travel demand model was used to relate current and future population and employment to projected future travel demand. A network simulation model (CORFLO) was used to approximate the movement of vehicles along the highways for both current and future traffic conditions. The FRESIM simulation model allowed a more detailed analysis of Interstate 84.

Daily and peak period trip tables for 1995 and 2020 were developed from the travel demand model using the traffic analysis zone (TAZ) definition and highway network developed for CORFLO. Between 1995 and 2020, the overall increase in the vehicle trip ends during the A.M. peak hour will be approximately 33% and in the P.M. peak

hour increase in trip ends approximately 32%.

Both now and in the future, peak hour vehicle trips through the region (ie. with neither origin or destination in the corridor) are not only a portion of total traffic on I-84, but also show a dominant flow in the reverse direction. (Figure 1.3) In the A.M. peak hour more through vehicles flow in the westbound direction, and in the P.M. the eastbound direction.

The traffic flows from close-in suburbs (Newington and West Hartford) toward Hartford are higher than from Farmington and New Britain. In a similar manner, greater traffic movement occurs between the cities south of the I-84 corridor (New Britain, Newington) to and from Hartford than between the cities north of the I-84 corridor (West Hartford and Farmington) to and from Hartford.

Based on the CORFLO and FRESIM model results, travelers on future corridor roads can expect the following:

- Decrease in travel speeds;
- Increase in vehicle density i.e., more vehicles per mile of highway;
- Decreased levels of service;
- Capacity constraints;
- Increased vehicle delays; and
- Increased fuel consumption.

Freeway Performance

Both now and in the future I-84 will carry the greatest portion of person trips in the Hartford West corridor. However, the capacity of the Interstate will inhibit its ability to perform successfully. FRESIM model results for 1995 and 2020 are illustrated in Figures 1.4 and 1.5.

I-84 Westbound. Even though this is considered the "off-peak" direction during the morning A.M. peak, I-84 westbound still carries high traffic volumes during this time. While currently no LOS is below "E," the segments with a "C" are projected to become "D" and segments with a "D" are projected to become "E" by 2020. Travel speeds, which are currently between 50 and 52 miles per hour, will be reduced to between 47 and 51 miles per hour. Continued growth in employment at the west end of the corridor (Farmington) will exacerbate the poor performance of Exits 39A, 39, 38, and 37 and their related roadway segments.

Performance in the peak direction during the evening P.M. peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals degradation in service. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds will reduce to below 25 miles per hour as compared to 50 miles per hour during the A.M. peak.

I-84 Eastbound. Currently, in the morning A.M. peak, eastbound I-84 reaches LOS "F" on the most easterly segment of the freeway between Exits 46 through 49. Average speeds on these segments will drop below thirty miles per hour as peak volumes approach 6,500. The situation by 2020 will become much worse as the segments from Exit 39A through 49 will experience a LOS "F" with average speeds dropping below twenty miles per hour and volumes exceeding 7,400.

Interestingly, the evening P.M. peak which is generally thought of as the off-peak period in the eastbound direction, is projected to experience a generally failing Level of Service from Exit 39A through the east end of the corridor. Speeds will drop to twenty miles per hour by 2020.

Arterial Roadways. The percentage of roadway mileage operating at a volume/capacity ratio greater than 0.75 will increase substantially in the year 2020. Figure 1.6 illustrates the existing 1995 and anticipated 2020 P.M. peak hour volume to capacity ratios for key arterial roadways in the network.

On arterials, intersections are often the locations where congestion most frequently occurs. Several of the intersections, which are currently operating at or near capacity, will fail under future anticipated traffic volumes. Figure 1.7 illustrates the existing 1995 and 2020 P.M. peak hour LOS results for intersections. Many unsignalized intersections will require signalization in the future.

Hourly Variation in Peak Period Traffic. The analysis above has demonstrated that by the year 2020, a number of highway segments in the corridor will experience failing or unsatisfactory levels of service. The peak periods will become more congested, and an amount of peak period travel will occur immediately before and after the peak period. This tendency is referred to as peak spreading.

The analysis has shown that in the future no-build condition demand for travel will clearly out strip the ability, or capacity, of the highway corridors to handle the traffic during the peak periods. Motorists will adopt one of four strategies to avoid the congestion. They could:

- Take an alternative less traveled route - Interstate to arterial or arterial to local road;
- Change their hours of travel - begin earlier or arrive later;

- Travel by an alternative mode - rideshare or public transit; or,
- Not make the trip at all - change job location or work at home.

In the case of the last two alternatives, there would be a "net" reduction in peak period automobile vehicle trips. Generally, an alternative mode will be attractive only if it reduces travel time, or reduces costs. In the final case, the reduction in the number of trips represents a reduction in "mobility" unless an alternative such as telecommuting may be substituted. Technical Report #1 offers a further look at the spreading of peak periods.

I-84 Highway Connectivity

Some congestion may be caused by indirectness of travel introduced on the network by poor connectivity. Poor connectivity may be one of two types - lack of connectivity or poorly designed or substandard connection. An example of lack of connectivity would be when interchange serve only one direction of travel (e.g., Flatbush Avenue - Exit 45, or Sigourney Avenue - Exit 47). Poorly designed connections would include left-hand entrance or exit ramps (e.g., Route 4 - Exit 39). In many cases this may induce lane changing or mixing of higher speed and slower speed traffic that disrupts flow and creates hazards resulting in severe accidents.

While the expressway network in the study area is considered "complete" according to current plans, many connections between arterials and between arterials and expressways are either absent, or are physically or functionally obsolete. In several cases improved ramp connections could provide more direct access to key areas of potential economic development. The construction of identified "missing links' could reduce indirect vehicle travel through residential neighborhoods, reroute truck traffic, and better balance the locations of transportation capacity and the locations of transportation demand. Several of the existing I-84 interchanges could be modified to reduce or eliminate substandard exiting or merging areas. They include:

- **Route 4 to Route 9** - Eastbound access from Route 4 to Route 9 is only possible through a circuitous path along two lane roads in Farmington;
- **U.S. 6 & Route 4** - In CRCOG's Route 4 Corridor Study, it was suggested that better connections between U S. 6, Route 4 and I-84 could relieve the congestion through Farmington Town Center by providing alternative travel paths;
- **Flatbush Avenue Ramps, Connection to Charter Oak and Parkville Redevelopment** - As plans progress for the Charter Oak Redevelopment and renewed development in Parkville, the desire for more direct I-84 eastbound access to Flatbush Avenue as well as the return movement will be more important to accommodate commercial traffic and employee and customer access;
- **Sigourney Street Ramps** - Similar to the Flatbush interchange, the partial interchange at Sigourney causes motorists from the west headed to Aetna, The Hartford, and other insurance companies to use arterial streets resulting in unnecessary congestion in the morning and evening peak periods;
- **Left Hand Ramp Connections** - Interstate entrance ramps and left exits in Hartford and West Hartford create potentially hazardous situations and may contribute to congestion on selected arterials.

Lefthand ramps at the interchanges along Interstate 84 create a special problem. Current design standards for new construction of Interstate-type roads require that all exits and entrances be made from the right side of the traveled way. This standard is intended to be consistent with driver expectation and to assure that slower moving vehicles seeking to exit or enter the freeway will do so from the slower moving lanes. Right hand ramps also limit the number of lane changes that must be made prior to or following a ramp.

Access from the Farmington Valley to the Hartford CBD

Travel models project the continued future growth of population in suburban locations and the growth of employment throughout the region. Both population and employment growth have occurred in the Farmington Valley communities of Farmington, Simsbury, Avon and Canton causing increasing numbers of commuters to utilize the I-84 corridor, as well as parallel arterial routes, such as Route 44 and Route 4 (Farmington Avenue).

Not only is the capacity of the existing roadway network inadequate to handle current and projected traffic, but roadway expansion is severely constrained by the adjacent land uses and environmentally sensitive areas. The steep topography of the Talcott Mountain ridge and the barrier of the Farmington River and associated wetlands pose a

further limitation on available right-of-way.

Arterials pass through residential areas or are lined with business establishments. As congestion grows on the limited number of arterial routes, traffic often seeks alternative less congested routes through residential or other neighborhood areas. This trend adversely impacts the safety of the local roadway network for all users, including bicyclists and pedestrians. It also diminishes the quality of life of these communities.

Transportation Needs for Improved Transit Service

The review of existing transit conditions in the study area found that a network of fixed route bus services of 21 routes using a daily peak requirement of 69 buses serves a daily ridership of approximately 21,000 person trips in the corridor. Most service in the corridor is offered in the towns of Hartford, West Hartford and New Britain. Newington is served by only three routes. Farmington is served by only two routes.

Approximately 10% of the state's population and 15% of its employment, is located in the study area. Transit usage for commuting in the corridor communities far exceeds the statewide average, with approximately 7% of all persons working at area firms and 8% of all study area residents commuting by bus.

Transit mode share in the study area is higher than in the balance of the state. The higher mode share may be attributed to the socio demographics of the Hartford workforce. The data suggests that the quality of the transit services offered to more affluent commuters, who can chose to drive to work, is not sufficient to attract many riders. The data also suggests that New Britain has a more self-contained labor market where local residents walk to local jobs. West Hartford's relatively high transit mode share appears to reflect the high level of transit service offered in that community. Improvements in coverage, frequency, velocity and hours of service elsewhere in the study area could yield similar results.

Transit Providers. The area is served by CTTransit; New Britain Transportation, and DATTCO. In addition there is a network of 15 park and ride lots with 1,800 spaces served by six express routes carrying 937 daily passengers on I-84 to/from Hartford.

Within Hartford, a local downtown Hartford circulator bus network is operated by Greater Hartford Transit District with a fleet of ten buses and 3,000 daily passengers. The Greater Hartford Ridesharing Corporation provides ridesharing brokerage services for the region. It is reported that 18,600 commuters living the study area communities carpool or vanpool to work; The rate of commuting shared ride modes is approximately twice that for fixed route transit services.

Three major intercity bus companies provide 52 daily bus trips between Hartford and points south and west of the city. An intercity rail passenger carrier, Amtrak, offers 14 daily trips to/from New Haven, New York and Washington D.C.

Connecticut Transit. Connecticut Transit (CTTransit) is the principal public transit bus operator in the State of Connecticut. CTTransit is owned by the State and has operating divisions in Hartford, New Haven and Stamford. The CTTransit - Hartford Division operates local fixed route service in both local and commuter express service. According to the FTA's national transit database for 1994, CTTransit operates with a peak vehicle requirement of 185 buses, 477 employees and an annual budget of approximately $29.7 million. Its annual ridership in 1994 was 17.9 million with fare revenues of $11.3 million, with a fare recovery ratio of approximately 38%. According to CTTransit, ridership on the Hartford division has dropped 12.5% in the last four years but appeared to be rebounding in 1997. Systemwide ridership is approximately 50,000 passenger trips per day.

CTTransit operates 30 local routes and 15 express routes in the Greater Hartford Area. Eight (8) of the local routes, one (1) crosstown route and four (4) of the express routes service Hartford's West corridor neighborhoods. Together the West Corridor routes carry 40% of the entire system's daily ridership. Within the study corridor, CTTransit operates twelve routes, serving approximately 19,000 daily passengers using a peak requirement of approximately 52 buses.

New Britain Transportation. New Britain Transportation provides local service on five routes in the City of New Britain and two express routes to downtown Hartford under contract with Connecticut DOT. According to the FTA's national transit database for 1994, the New Britain Transportation Company Service operates with ten (10) buses, 17.4 employees and an annual budget of approximately $1 million. Its annual ridership in 1994 was 561,800 with fare revenues of $328,200 for a fare recovery ratio of approximately 33%. Local routes providing mobility in the corridor, connections to Connecticut Transit service in Hartford, and express service to Hartford.

Greater Hartford Transit District. The Greater Hartford Transit District is responsible for the development and renewal of transportation centers and parking facilities and regulation of private transportation companies, such as taxis and motor coach services, for trips falling entirely within the district's boundaries. In addition to its planning and regulatory activities, GHTD is a local transportation provider that operates a downtown shuttle in the Hartford known as the "Scooter" and operates the Greater Hartford area paratransit service.

The "Scooter" shuttle is a cooperative effort of several downtown employers who formerly operated separate bus/van shuttles among their downtown work sites and various public and private parking lots. The Scooter fleet includes ten (10) motor coach buses. Daily Scooter ridership is estimated at 3,000 daily trips. Scooter service is free to employees of sponsoring companies and is available to the general public for a $1.00 fare.

Paratransit service in the Greater Hartford area includes services as mandated by the Americans with Disabilities Act (ADA) as well as dial-a-ride taxi and van service available to a broader population of senior citizens. The ADA paratransit service will take an individual to and from any locations that fall within 3/4 mile from any fixed route bus service for double the regular fare. Within the Connecticut Transit service area, that results in a $2 - $5 one-way fare for the ADA paratransit service. GHTD runs 16,000-17,000 paratransit trips per month, of which approximately 25% are ADA service. GHTD uses nearly 50 vehicles to provide its paratransit service. The dial-a-ride service is a free service for those aged 65+, or who have a disability, and reside in the communities of Hartford, East Hartford, Manchester or Wethersfield.

Amtrak and Other Rail Services. The only passenger rail service operating in the corridor is Amtrak's Springfield-Hartford-New Haven main line. The line owned and operated by the National Rail Passenger Corporation (trade name: Amtrak) offers direct service to New York, Philadelphia, Baltimore, Washington D.C., Richmond, Boston, and Vermont. The service features seven daily southbound passenger trains and six daily northbound trains. Amtrak also operates a daily southbound express mail train that does not carry passengers.

The Amtrak line through Hartford is largely single track with passing sidings, but is double tracked with a long (2 mile) high speed siding in Newington and West Hartford and an equally long industrial track between West Hartford and Hartford. The rail right of way was originally designed to accommodate four (4) main tracks south to Newington Junction immediately west of Willard Avenue (Route 173). At Newington Junction the right of way splits. A two track right of way crosses Piper Brook headed for New Haven while another two track right of way breaks east towards New Britain.

Today, rail service on the line to New Britain has been abandoned and the line to New Haven is largely single track with only modest levels of local and through freight activity. The remaining main track is in the position that would have been the southbound track to New Haven (the second main track from the eastern edge of the right of way). Between Newington Junction and Hartford the right of way west of the two remaining tracks in is largely vacant (but intact) occupied by a single industrial turnout in West Hartford to a Heublein facility. The now unused western most track on the right of way is the remains of former New Britain Secondary Track which provided a dedicated line between Hartford Yard and industrial activity in downtown New Britain. Some of this abandoned track remains in right of way in Newington and West Hartford but is in decrepit condition and completely unusable.

New Britain Secondary Track. In Newington, the Amtrak line is joined by a branch line leading to downtown New Britain. This line was acquired by the State of Connecticut in the early 1990's for potential use as a passenger rail right of way. Conrail formally retired the 3.5 mile line segment from freight service in 1992. It is not in operable condition at this time. The New Britain Secondary connects with the Amtrak New Haven-Springfield main line at Newington Junction immediately south of Willard Avenue (Route 173) in Newington. According to reports by the Connecticut DOT, this line segment would need to be completely rebuilt before any attractive rail passenger service could be operated on this line. The field inspection of the line in February 1997 supports this finding.

Over most its length, the New Britain Secondary has a single track remaining from the 1980's. The right of way is wide enough at almost every point in New Britain to support four parallel tracks. The useable right of way has been narrowed to a one or two track capacity where highway building activities have encroached on the former rail right of way.

Inspection of the right of way found the road bed is

largely in good shape with minor drainage problems. No serious engineering obstacles to use of the line for transportation purposes were noted. With respect to environmental concerns, the rail embankment in some areas passes through wetlands or adjacent to some single and multi-family homes.

Opportunities for Alternative Modes

Members of the Policy and Technical Advisory Committees expressed strong interest in providing Hartford West commuters with alternatives to conventional highway transportation. Because of the importance placed on livable communities and quality of life, accommodation of safe bicycle and pedestrian movement will be an important enhancement to the recommended transportation improvements. Strategies developed must not merely protect pedestrians, but must also serve to improve and enhance their ability to move freely throughout the study corridor and the larger region. Health consciousness and environmental awareness have increased the use of the bicycle as a mode of transportation and for recreational purposes. Bicycle accommodation or planning for separated bike only facilities is important to the community's residents.

Greater Hartford Ridesharing Corporation. The Greater Hartford Ridesharing Corporation (GHRC), known as the "Rideshare Company," is the Capitol Region's Transportation Management Organization (TMO). GHRC is a private, non-profit organization acting as a transportation facilitator and service provider for commuters and employers in both the public and private sectors. In 1990, an estimated 18,600 commuters residing in the study area communities regularly used either a carpool or vanpool as their principal means of traveling to and from work. This comprises approximately 11% of work trips made by study area residents. Approximately 13% of the 240,000 persons working in the study area communities use a carpool or vanpool to get to and from work. GHRC estimates 16 "Easy Street" vanpools currently originate within the study area.

Park and Ride Facilities. The Connecticut Department of Transportation maintains a statewide system of Park and Ride lots for commuters who want to avoid traffic congestion and save on commuting costs. These commuters can leave their cars at any of the 227 lots across the state while they use carpools, vanpools, buses or trains for their trips to work. Within the Hartford West commuter shed, ConnDOT maintains 15 lots with a capacity of 1,839 spaces. Nine of the lots are served by express buses to downtown Hartford.

Interregional Transit Service. Analysis of the existing transit service provided by CTTransit and others in the corridor reveals a focused and efficient service. In the light of projected increases in population, employment, and travel demand, the role of public transit - especially local and express bus - needs to be reassessed. The following are two market niches that could be served by transit.

- **Reverse Commutation to Suburban Employment Centers** - A major portion of employment growth in the Greater Hartford region is increasingly focused on its outlying suburban towns, while the traditional regional core, Downtown Hartford, has experienced loss of 12,520 jobs (10 percent of its total employment) between 1993 and 1995. Newington, Simsbury and Granby all reported employment gains of over 500 jobs each. Farmington now has more workers commuting to its employment centers than it has outbound commuting residents. Regional models project continued growth in the vicinity of the UConn Health Center and Westfarms Mall.

  These trends have caused an increase in reverse commuting (e.g. center city to suburb) and it also presents an obstacle to those without access to a private vehicle. New transit initiatives, in the form of work-oriented shuttle services, vanpools, and other alternatives, may be required to adequately and efficiently service this demand.

- **Farmington/West Hartford - New Britain Transit Connection** - The conventional radial orientation of many public transit routes means that some types of trips for education, shopping, and personal business are poorly served. Within the study corridor, shopping areas in Farmington for example are inaccessible by public transit from New Britain. In this case the same is true of employment destinations. Looking at the travel demands that are not core oriented will provide the potential of increasing transit utility in the corridor.

  Data from regional transit providers also reveals that not only are the low income, transit dependent served, but also travel markets composed of more affluent residents. Especially in conjunction with other transporta-

tion demand management strategies such as congestion or parking pricing, public transit may serve a viable alternative by increasing mode choice.

Pedestrian Needs

National travel surveys indicate that most pedestrian trips do not exceed two miles. However, a great deal of travel within the I-84 study area is actually made over much shorter distances, such as shopping trips, trips to school or to visit friends. For these trips, walking is an enjoyable and healthy alternative to using the car.

In addition, all travel whether by auto or by transit with the possible exception of trips to drive-through fast food and banking involves a segment of pedestrian travel at the beginning and end of the trip. The "intermodal" segment (ingress) serves as access to the automobile or transit vehicle and the access (egress) to the final destination walking out to the street, driveway or parking lot.

For auto trips within an urban or more intensively developed suburban setting, for example Hartford CBD, West Hartford Town Center and the University of Connecticut Health Center campus, this travel component becomes more significant, since parking facilities are typically larger and are located at greater distance from the actual activity center. It is in these locations that pedestrian facilities — sidewalks, signals, crosswalks, signage, benches, planters and other amenities — are often provided. With appropriate security, a walkable environment can be a distinguishing feature of urban or town centers. However, in an urban setting, concern for personal security can act as a deterrent to pedestrian travel.

Pedestrian-oriented shopping districts attract customers from throughout the region. This is the urban design objective for areas such as Farmington Avenue in Hartford and West Hartford, West Hartford Town Center, Downtown New Britain, and Farmington Center (outside the study area). Newington Center does not have the commercial diversity to attract large numbers of visitors from outside the town, but it does provide a destination for pedestrian trips from adjacent residential areas. Other commercial corridors within the study area are likely to retain their auto orientation due to existing land use and density characteristics.

The City of Hartford provides sidewalks and street lighting on almost all of its streets, and in New Britain about three-quarters of the street network has these amenities provided. These features are characteristic of the pedestrian-oriented pattern of urban design that prevailed, from 1850 to 1950. Today, approximately ten percent of Hartford residents, and six percent of New Britain residents walk to work. These are high percentages for cities of their respective sizes.

In older suburban area, sidewalks are provided on West Hartford's arterials and collectors, as well as the majority of its local residential streets. The Town's Planning Director notes the high proportion of senior citizens as a factor encouraging pedestrian travel, especially for exercise/recreation. There are also off-street walking paths along Trout Brook in the block between the Boulevard and Farmington Avenue and for one block along the Park River.

In Newington, sidewalks occur primarily along major arterials. While most of Route 175 has sidewalks on both sides of the street, there are some limited segments where the roadway right-of-way does not allow adequate room to provide sidewalks.

For Farmington, sidewalks are provided along some segments of the arterials, and along a number of collectors. Many local streets do not have sidewalks and pedestrian travel tends to be focused on those limited areas of the town that have a more urban development pattern, such as Farmington Center and Unionville. Recreational walking occurs throughout the community, but there is no particular accommodation of this activity except within town parks.

Bicyclist Needs

For transportation-oriented bicycle travel (as opposed to recreational), the primary routes are along the study area's major and minor arterials, such as Farmington Avenue, the Boulevard, Park Street/Park Road, Route 175, New Park Avenue, and New Britain Avenue. No alternative off-road paths have been constructed within the study area, and existing traffic volumes along many routes make them unappealing and hazardous for bicycle use.

The City of Hartford's *Plan of Development* identifies the potential for several on-street bicycle routes within the study area including in the vicinity of Colt Park, in the South Green neighborhood, in the area adjacent to Pope Park, and in the West End.

The conceptual alignments for two off-street paths are also identified. One of these would utilize the ridge line extending through Rocky Ridge Park south to Thomas Hyland Memorial Park. The other would be developed along the Park River west of Pope Park. Ultimately, the City intends to link this system with the Connecticut

Riverwalk being developed by the Riverfront Recapture program. According to the City's Chief Staff Planner, a proposal has also been made to construct a velodrome (a banked bicycle track for Olympic-type competitive racing) within the Charter Oak area.

Bicycle accommodation outside the City of Hartford is equally limited. Several towns have bicycle or mixed use paths in their parks, including MDC properties in West Hartford, but no designated, signed or marked bike routes have been created. Proposals for more extensive bicycle facilities are typically in the initial planning stages for all the study area towns.

Goods Movement

Interstate 84 provides a key link between the New York Metropolitan Area and Boston. Through its connection to Interstate 80 in northeastern Pennsylvania, it also offers long distance commercial traffic an alternative to congestion in the New York area by allowing them to access New England destinations via the Newburg-Beacon Bridge located some 50 miles north of New York City.

Given these characteristics, it is reasonable to assume that most truck traffic on I-84 is not local to Connecticut (i.e. it neither originates nor terminates within the state). According to the most recent ConnDOT classification counts for I-84, there were approximately 6,500 heavy vehicles counted at the station closest to the New York State line (Danbury) and 6,100 heavy vehicles counted at the station closest to the Massachusetts line (Tolland). Approximately 65 percent of these vehicles were tractor-trailers (5+ axle vehicles). In the Hartford area, the volume of truck traffic on I-84 dips to approximately 5,000 as traffic destined for Hartford area businesses exits for local routes to make pick-ups and deliveries.

Major generators of truck activity within the Hartford West study area include the University of Connecticut Health Center, Westfarms Mall, Colt Industries (West Hartford), Chandler Evans (West Hartford), Sears Distribution Center (Fenn Road - Newington), and Stanley Works (New Britain).

The reuse of several other industrial properties, including the Torrington and Loctite properties in Newington, and the Veeder-Root building in Hartford, can be anticipated to add a small number of additional trucks to the existing baseline volumes. Also, the development of Charter Oak Terrace as a light industrial complex would contribute some additional truck volume.

Outside the Hartford West study area, numerous manufacturing and distribution operations contribute a portion of local truck traffic to I-84 and parallel arterials. These include Farmington Industrial Park, U.S. Postal Service Mail Processing Center (Hartford), UPS Distribution Center (Hartford), Hartford Regional Market (Hartford), Pratt and Whitney Aircraft (East Hartford), J.C. Penney Distribution Center (Manchester), and Buckland Hills Mall (Manchester).

CHAPTER 2

Reasonable Alternative Packages

This chapter presents the Reasonable Alternative Packages (RAPs) formulated for the initial evaluation within the Hartford West MIS. The RAPs were intended to present broad themes for future transportation improvement strategies within the corridor. The themes adopted for this round of evaluation included:

- RAP 1- No Build (Existing and Committed);
- RAP 2 - Transportation System Management, Transportation Demand Management, and Transit Operations;
- RAP 3- Freeway Reconstruction and Operations;
- RAP 4- Transit Fixed Guideway - Light Rail, Commuter Rail and Busway;
- RAP 5- Freeway HOV Lane; and
- RAP 6- Freeway Additional General Purpose Lane.

However, due to the complexity of transportation issues within the study area, it is likely that no single package would satisfy all future travel demands. Following this round of evaluations, elements from several of the RAPs were combined to create a hybrid package for further environmental and engineering evaluation.

2.1 RAP 1 – FUTURE NO BUILD (EXISTING AND COMMITTED)

The No Build package (RAP 1) constitutes the base case condition for the evaluation of transportation improvements. No Build generally includes existing and committed projects, along with the normal maintenance and operation of the transportation system over the forecast period. The details of RAP 1 were presented in Technical Report #1, the Preliminary Purpose and Needs Report, which analyzed the future performance of this RAP.

Volume Increase. The increase in the trip ends and thus travel demand from 1995 to 2020 during the A.M. peak hour was approximately 33% and in the P.M. peak hour increase in trip ends was approximately 32%. Trip ends to and from Farmington show a maximum increase of over 45% between 1995 and 2020, and trip ends to and from West Hartford show a minimum increase of approximately 20% between 1995 and 2020.

Intersections. Analysis of the Peak Hour 2020 Levels of Service for the Intersections within the study area indicates that 19 intersections will have a LOS F during the A.M. peak and 24 intersections will have a LOS F during the P.M. peak. This compares to 5 intersections in the 1995 A.M. peak and 9 intersections in the 1995 P.M. peak.

I-84 Westbound. During the A.M. peak, I-84 westbound segments are expected to degrade slightly. Segments with LOS "C" are projected to become LOS "D" and those with "D" are projected to become "E" by 2020). Travel speeds, which are currently between 50 and 52 miles per hour, will be reduced to between 47 and 51 miles per hour.

Performance of the peak direction during the evening P.M. peak is worse than the A.M. peak with a LOS in the "E" range. A comparison of 1995 and 2020 reveals additional degradation. The freeway segments associated with Exits 49 through 46 will routinely fail (i.e., LOS "F") and average speeds reduced to below 25 miles per hour.

I-84 Eastbound. Although the morning A.M. peak eastbound I-84 currently receives LOS "F" on the most easterly segment of the freeway between Exits 46 through 49, the situation by 2020 will become much worse as the LOS "F" segments continue from Exit 39A through 49. Average speeds will drop below twenty miles per hour with volumes exceeding 7,400 on the easterly end of the freeway.

The evening P.M. peak is projected to experience a generally failing Level of Service from Exit 39A through the east end of the corridor. Speeds will drop to twenty miles per hour by 2020.

2.2 RAP 2 - TRANSPORTATION SYSTEM MANAGEMENT, TRANSIT OPERATIONS, & TRANSPORTATION DEMAND MANAGEMENT

Transportation System Management (TSM) is a name given to a broad range of strategy types whose purpose is to get the most out of existing transportation infrastructure without major capital investment. Transit Operations includes methods to improve the ability of existing bus systems in the study corridor to attract riders and meet

mobility needs. Transportation Demand Management (TDM) is a generic term that encompasses a wide range of strategies that have been employed to reduce peak hour vehicular travel and increase overall mobility. A complementary package of TSM, TDM and Transit Operations provides the potential for the most efficient system operation. Technical Report #2 provides background information on TSM, TDM and Transit Operations.

Given the small-scale, localized nature of RAP 2 improvements, a definitive list of improvement sites can not be defined to this stage. Instead, typical locations and improvements have been identified for comparative evaluation. Final improvements may vary from those targeted in this analysis.

TSM, TDM, and Transit Operations strategies can work effectively together to enhance the current effectiveness of the total transportation system. These improvements are usually implemented within the right-of-way and are less capital intensive than other transportation improvement alternatives, but taken in aggregate, the cost associated with RAP 2 would be less than the build alternatives in RAPs 3 through 6. The success of the program especially the TDM segment depends on the voluntary cooperation of the public and private sector.

Safety Enhancements

Safety improvements are an important part of the overall approach to transportation systems management. The top four high accident locations were:

Route 4 approaching the jug handle - The segment of Route 4 west of the jug handle experiences a high percentage of rear end accidents. This is an area in which frequent traffic queuing in the westbound direction occurs due to the geometric constraint of Farmington Center. Sideswipes and turning movement incidents also make up a major portion of the total accidents.

Route 71 south of Corbins Corner - The segment of Route 71 south of Corbins Corner witnesses a high percentage of rear end and turning movement accidents due to the many access points to shopping and restaurants along this road. Driver inattentiveness and sudden stopping to turn may be prime reasons for these types of accidents. One third of all accidents in this area occur at night according to the records. Also, this segment of roadway is responsible for some pedestrian accidents. Since this is a heavy retail and food service orientated area, heavy pedestrian traffic is to be expected. Possible solutions to this problem might involve installing sidewalks and crosswalks, improving lighting, and installing warning signs for both pedestrians and motorists. Another approach to reducing some of these accidents might involve employing access (or curb cut) management techniques. This could involve consolidating some of the many driveways leading to parking lots or adding exclusive left turn lanes for heavily used lots.

Route 175 from Route 9 to Route 176 - Route 175 is a principal arterial with two lanes in each direction. The majority of accidents are rear end, but there is also a high percentage of head-on collisions. Since head on accidents tend to be the most severe, this segment of roadway is of concern and necessitates some improvement. Improvements to Route 175 were analyzed in a study by CRCOG.

Interstate 84 from Sigourney St. to High St. - Interstate 84 near downtown Hartford experiences numerous rear end accidents. Naturally, the huge volume of traffic which utilizes this segment of roadway each day is the cause of the high number of accidents. This portion of highway is at breakdown condition during most of the morning and afternoon peak periods, and the frequent stop and go of traffic is responsible for the 48 percent of rear end incidents. But the magnitude of volume is not the only culprit for these accidents. This segment is prone to complex weaving patterns due to the many ramps, some of which are left hand on and off, which compound the traffic flow problem. Some possible solutions to this problem could involve realignment of I-84 or to remove the left hand exits. Another idea is to install overhead variable message signs to alert traffic to peak hour congestion.

Intersection Operational Improvements

Several intersections in the Hartford West study area have been identified as having severe operational deficiencies. These intersection have been analyzed as having a Level of Service F under current conditions and are impeding the overall performance of the transportation system. As part of the TSM strategy each intersection will need to be upgraded to meet acceptable standards for handling traffic. While each intersection will need further analysis some of the potential improvement solutions may include adding exclusive left turn lanes and phases, improving signal timing and coordination, adding lanes, grade separation, updating of signal and improving stripping and signing. The intersections analyzed included:

- Hartford Avenue at New Britain Avenue;
- New Park Avenue at Flatbush;
- Park Road at I-84 Off-Ramp;
- Park Road at I-84 On-Ramp;
- Park Road at So. Main;
- Park Road at Trout Brook;
- Rt. 173 at New Britain Avenue;
- Route 4 at I-84 Ramps (Jug Handle);
- Route 4 at Old Mountain/Talcott Notch; and
- South Main Street at New Britain Avenue.

Other examples of TSM improvements include:

- **Access Control and Management (Curb-cut Control)** – Farmington Ave., New Britain Ave., Park Ave., and Cedar Street;
- **Intersection Widening/Channelization** – Boulevard and Capital Ave.; Farmington Ave. and Sisson Ave., and Farmington Ave. and Trout Brook Dr.;
- **Traffic Signal Systems (Isolated or Corridor Coordination)** – Farmington Ave., New Britain Ave, and Cedar Street;
- **On-Street Parking Regulation** – Farmington Ave., New Britain Ave., and Cedar Street;
- **Spot Widening** – Throughout the Study Area;
- **Goods Movement (Truck) Regulation** – South Road, Route 4, Route 9; and
- **Pedestrian** – Crosswalks, Signal, and Facilities.

Park & Ride Lots

Park and Ride Lots are important elements in transportation system because they provide a convenient location for carpooling, vanpooling, and express and local transit stops. They are important adjuncts to transit and rideshare strategies. While several lots are currently in operation within the Hartford West corridor, opportunities exist for their expansion or construction at new locations. Several of these locations include:

- Plainville - I-84 at Crooked Street (Exit 34);
- Farmington - Additional Parking at Fienemann Road (Exit 37);
- Farmington - Route 6 at I-84 (Exit 38);
- Farmington - Expand parking at Route 4 (Exit 39); and
- West Hartford - I-84 at New Britain Avenue (Exit 40).

Transit Operations

The following are details of transit operations improvements that are included in RAP #2. Route concepts presented here are conceptual in nature oriented toward promoting improved mobility in the corridor via a transit center approach to service design. These services would be overlaid on the existing route structures with details on coordination, schedules and costs to be determined at later phases of this project if necessary.

Express Bus Improvements. New express or limited bus services could be considered:

- **Hartford-New Britain Express** - The transit hubs in downtown Hartford and New Britain would be linked via a Route 9/I-84 Express link that provide attractive mobility between the two largest population concentrations in the study area and allow for connections between the independent Hartford and New Britain transit networks.
- **New Britain-Westfarms - West Hartford Limited** - The transit hubs in New Britain and West Hartford would be linked via a limited service that would operate in express mode along limited access highways but also provide pick up and distribution services near transit hubs.
- **UConn Medical Center Express** - A route connecting the University of Connecticut Health Center with Hartford via Routes 4 and I-84 would link a major employment center with Hartford, and also provide the possibilities of another park/ride facility for Farmington residents to travel to Hartford.

Local Service. Local Transit service could be expanded to include:

- **UConn Medical Center - New Britain**
- **Local Farmington Bus** - A local bus serving the transit hubs at UConn and Westfarms Mall.
- **Newington - West Hartford Service** - A new route operated along the SR 173 corridor.
- **Newington - Westfarms - Farmington Service** - A route from Market Square Newington via Central Connecticut State University, Westfarms Mall, and UConn Medical Center.
- **W-Route Extension** – Extend the W-Route from Hartford to Newington to run to Downtown New Britain via East Street, Allen Street and ML King Street. This would provide access to New Britain from Northwest Newington and Downtown West Hartford.
- **Stanley Street - New Britain Ave Service** - Interline the New Britain Transit Westfarms Service with the Connecticut Transit Q Route service to Westfarms Mall to provide one seat ride for local passengers between the transit dependent neighborhoods in Hartford, Elmwood and New Britain while also provid-

ing an additional local service other than the P Route to provide for travel between Hartford and New Britain.

- **East Street Extension** - The Dattco East Street Route could be extended via Cedar Street to downtown Newington providing an additional more direct path between the two transit hubs. This crosstown route could be further extended if desired to downtown Wethersfield via a eastward extension on Route 175.
- **E-Route Limited** - Improve the bus travel times by offering "limited" service to some passengers boarding west, north or south of LaSalle Road. The shorter Farmington Ave route variations could make every stop for which there is a demand. However, the longer E route variations, such as Unionville, the Medical Center, and Westfarms Mall would provide "limited" service, making few or no stops between West Hartford center and downtown Hartford.

Transportation Demand Management

In most portions of the Hartford West study area, the existing pattern of land use and the relative availability of parking (in comparison with larger metropolitan areas) favor the use of single-occupant vehicles (SOV's). Even workers within the regional core - Downtown Hartford - utilize an SOV more commonly than any other mode. The 1990 census reports that 70 percent of Hartford workers drove alone, while only 15 percent utilized carpools, or vanpools and ten percent used a bus. The remaining five percent either walked or bicycled to work, or worked at home. For outlying employment centers the proportion of commuters driving alone is even greater, reaching a high of 88 percent in Farmington and 84 percent in Newington. In no other community within the study area, including New Britain, do more than five percent of workers utilize bus service.

Market rate parking costs in Downtown Hartford range from over $100 per month for parking garages in the immediate vicinity of the Civic Center and Constitution Plaza to a low of approximately $40-60 for parking lots in the Asylum Hill and South Green areas depending on location. However, well over half of Downtown employees, including most State of Connecticut employees, have free parking provided to them. In Downtown New Britain, most employers pay for their employees' parking, while visitor parking is provided by the City's extensive inventory of off-street garages. Elsewhere within the study area, almost all employee parking is provided for free. Within West Hartford Center, municipal lots charge for long-term visitor parking, but outside of these very limited instances all of the suburban activity centers offer visitors and employees an abundance of free parking.

TDM Strategies. TDM strategies work most effectively as complements to transit service enhancements. In Technical Report #3, three TDM strategies were tested - Financial Incentives for Transit Use; Parking Pricing; and Congestion Pricing. The Financial Incentives were the most successful in increasing transit ridership. Both Parking Pricing and Congestion Pricing performed about half as well as Financial Incentives.

Based on past regional and nationwide experience, the adoption of a high-profile TDM initiative at an individual employer can result in an increase in use of High Occupancy modes of up to 20 percent. Because HOV travel still represents a minority of travel in most work sites (especially for suburban and non-CBD locations), the total impact on congestion or modal split would be proportionately lower. A voluntary employer-based program implies that participation will be substantially less than 100 percent. Current corporate participation rates (the number of firms participating versus the total number of area businesses) are in the range of one percent of all employers and ten percent of all employees.

For Downtown Hartford work sites an increase of 20 percent in the mode share to ridesharing and transit would actually mean a less than five percent increase in number of people using these modes, and a corresponding (but lower) decrease in vehicular travel due to the fact that most carpools consist of two - the driver plus one passenger, so that vehicle miles of travel decrease by half, not by 100 percent. In suburban locations, where current carpool and transit participation rates are lower, the estimated decrease in vehicular travel would be in the range of two percent.

2.3 RAP 3 - FREEWAY OPERATIONS AND RECONSTRUCTION

Reconstruction improvements will be directed at reconstruction of left entrance and exit ramps, partial interchanges, and locations where auxiliary lanes will relieve spot congestion. RAP 3 also included Intelligent Transportation System (ITS) strategies such Arterial Signal Coordination, Incident Management, and Traffic Operations Centers. These locations include:

- **Route 4, Route 6, and Route 9 interchange areas** - The construction of a collector- distributor road on the south side of I-84 and the elimination of left hand exit and entrance from eastbound I-84 to Route 4 and eastbound Route 4 to I-84.
- **Trout Brook to Kane and Caya Interchanges** - Construction of collector-distributor (C-D) roads on both sides of I-84, and the elimination of left entrance (Trout Brook to I-84 east bound);
- **Prospect and Flatbush Interchanges** - Construction of C-D roads and a diamond interchange at Prospect, elimination of left exit (I-84 westbound to Flatbush), and the construction of eastbound exit and westbound entrance to the Flatbush exit.
- **Sisson Avenue Interchange** - Elimination of left hand eastbound exit and construction of right hand exit.
- **Sigourney Avenue Interchange** - Construction of ramps to and from the west at I-84.
- **Auxiliary Lane in West Hartford** - Construction of auxiliary operational lanes between Exits 40 and 42 in West Hartford.

Intelligent Transportation Systems (ITS)

In the Hartford West corridor, ITS Strategies could consist of Arterial Signal Coordination, Incident Management Techniques, and Traffic Operations Center. RAP 3 includes the following ITS strategies:

Arterial Signal Coordination. This technique will improve travel times on principal arterial streets. Through coordinated traffic signal timing vehicles will maintain a uniform speed and minimize stopping. The result is that motorists will experience fewer delays and reduce auto emissions and energy consumption. To achieve optimal performance on a given arterial street, all signalized intersections must be equipped with sensors, and communications needs to be established between the intersections and a central Traffic Operations Center (TOC), where a computer will use input from the sensors to determine optimal signal timings and offsets for each signalized intersection.

Routes suggested for coordination include the following:

- Farmington Avenue;
- Route 6/Old South Road/New Britain Avenue;
- Fenn Road/West Hill Road/Newington Road;
- Route 175 (Cedar Street);
- Route 176 (Newington's Main Street);
- New Park Avenue/Prospect Avenue; and
- Sedgwick Road/Park Road.

Incident Management. Incident management is the rapid detection and response to any incident with the potential to reduce traffic flow. A common means of incident detection is cellular phone calls from motorists who observe an incident. According to the *ITS Strategic Plan*, this system works well. However, in order to confirm these reports, and help determine the appropriate response, an additional system is proposed. The surveillance of I-84 by a set of Closed Circuit Television (CCTV) cameras would fulfill this function. These cameras would be connected to monitors at a Traffic Operations Center (TOC), where an operator can confirm that an incident has taken place, determine what is needed to clear the incident, and dispatch appropriate personnel and equipment to deal with it. The operator can then use the Advanced Traveler Information Systems to quickly notify motorists of the incident, so that they can choose alternate routes.

Another Incident Management facet recommended by the *ITS Strategic Plan* is the Connecticut Highway Assistance Motorist Patrols, or CHAMP. These are light trucks, staffed by Department of Transportation employees, equipped to handle minor traffic incidents without the dispatch of additional equipment. They can provide a motorist with gasoline, jump start a battery, push a stalled auto out of the traffic stream, or assist in changing a tire. They can remove debris from the right-of-way, and set up signs for accident and detour routes. Additionally, they observe traffic conditions and report to the operators at the TOC. CHAMP patrols already exist on I-95 and on I-91, and the *ITS Strategic Plan* urges their expansion to I-84 in the Hartford area. Nationwide, Highway Service Patrols have proven to be extremely popular in many urban areas, and have proven invaluable in building public support for ITS projects.

Traffic Operations Centers. All of the ITS components described above require control by computers and experienced operators. This is the purpose of a TOC. Currently, two TOCs exist in the Greater Hartford area. A TOC at ConnDOT Headquarters, in Newington, currently controls ITS freeway operations on I-91. This would be the logical place to control the Traveler Information Systems, the Ramp Metering, and the Incident Management surveillance and dispatching. A smaller TOC exists in Downtown Hartford, to control the City of Hartford's computerized traffic signals. This is a possible location for the Arterial Signal Coordination systems. Other options might include use of existing City of West

Hartford traffic engineering facilities, the construction of a new TOC in West Hartford or New Britain, or locating this function in the Newington TOC.

2.4 RAP 4 - FIXED GUIDEWAY TRANSIT

This RAP consists of a variety of different transit related alternatives. The fixed guideway alternatives have been divided into Light Rail, Busway, and Commuter Rail alternatives.

Light Rail technology is an advanced form of the traditional streetcar. Typical LRT systems can include both grade-separated (off-street) and on-street operation. LRT vehicles are powered by electric motors and draw power form electric cable overhead. They are approximately 75-90 feet long (twice the length of a bus) and can run in either single-car or two to four-car (multiple unit) trains.

Busways consist of a designated or grade-separated bus facility. The busway offers greater flexibility than an LRT in that buses can enter and exit the exclusive bus facility from existing bus routes as well as serve station locations. Buses operating on a busway may either be driven by a driver as on-street, o r guided similar to a rail car on steel rails. Guided bus operations allow for buses to operate at higher maximum speeds than may otherwise be desirable with an unguided bus.

The commuter rail mode is distinguished from Light Rail by the greater speed and capacity of the equipment, greater distance between stations, and the orientation of services to park-and-ride or drop-off access versus pedestrian access. In keeping with the overall direction to restrict improvements to existing transportation corridors, the following rights of way were suggested for each alternative:

- **Interstate 84 Right-of-Way** - Light Rail or Busway;
- **New Britain to Hartford Rail Right of Way** - Commuter Rail, Light Rail, or Busway; and
- **Farmington Avenue** - Light Rail or Busway.

Service Objectives. While each of the fixed guideway alternatives is unique, there are similarities in planning and designing these transit services. The following service objectives have been defined:

- Maximize ridership on the fixed guideway line to achieve transit service efficiency and to maximize transit service frequency;
- Eliminate redundant or competitive through bus services in the corridor;
- Provide a reasonable commuter shed for the transit corridor by using feeder bus, park and ride, and pedestrian linkages.

Right-of-Way Width. Twenty-four feet is the normal standard for two straight tracks or for two busway lanes. With a 11' 2" centerline distance between the two tracks, this allows slightly more than two feet nominal clearance between light rail vehicles on the two tracks and between the light rail vehicles and adjacent road traffic (not allowing for vehicle tilt, catenary poles, signal masts, fences, other structures, or roadway traffic overhanging its wheelbase).

Twenty-two feet appears the practical minimum width of a two-track dedicated light rail right-of way. With a 22-foot right of way, these nominal clearances drop below 1.5 feet. Slightly narrower rights-of-way are possible, but probably involve unacceptable and non-cost-effective vehicles. The Washington Boulevard section of the Los Angeles to Long Beach "Blue Line" was the only North American example found less than twenty-four feet wide. The 22-foot trackway was part of a "share the misery" program where traffic lanes and sidewalks were also reduced in width so that 112 feet of total desired width could be squeezed into 100 feet of available right-of-way.

Similar standards seem appropriate for busways. In New Jersey, on the Rt. 495 XBL land widths are sometimes reduced to less than 10 feet nine inches. Safety records are excellent because of the use and training of professional drivers. Similar programs would be important adjuncts to the safe operation of the New Britain-Hartford Busway.

Station Areas and Platforms. Station areas will require wider right-of-way to accommodate stopped and through vehicles as well as the station platform and building. Even with a minimum of two through lanes and two stopping lanes 44 feet to 48 feet would be appropriate. Station platforms increase right-of-way width typically by another ten to fourteen feet. Ten feet is the usual minimum for a center platform serving both tracks. Six feet appears to be the usual minimum for a side platform serving one track. Side platforms serving both tracks add twelve feet to the right of way. The total width needed for a station could be mitigated by staggering the inbound and outbound stations.

An ADA-compliant high center platform also requires that the track be tangent (straight) for fifty feet in both directions beyond the platform. Beyond that, it typically takes another thirty feet for the tracks to move back together.

Feeder and Connecting Bus Services. Each of the potential fixed guideway investments described in the balance of this section include a package of recommended feeder and connecting bus services. In some cases existing bus routes are slightly modified to provide connectivity to the fixed guideway investment. In other cases new bus services are proposed which would be overlaid on existing service. In only a few cases are existing transit services radically altered. In any event, all bus route proposals are oriented toward expanding the range and reach of the proposed fixed guideway investment by improving transit mobility options available for all trips in the corridor.

In later planning stages associated with any fixed guideway transit RAPs more detailed analysis of the feeder and connecting bus network design will be required. This analysis should focus on maximizing transit effectiveness and efficiency but must also evaluate impacts on existing transit riders and other transit constituencies.

RAP 4A-1 Hartford/New Britain Light Rail Transit Line

A rapid transit service using electric light rail technology could be located in the existing rail rights of way linking Hartford with New Britain via Newington. The line would run from downtown New Britain to Union Station. The line would operate in an exclusive right of way with minimal grade crossings allowing for a higher average service velocity. It is possible that the rail line could then run as a street railway from Union Station to the Old State House. Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. In comparison to the proposed service in RAP 4B, Commuter Rail, the LRT system will have more frequent station stops.

Peak period service velocity for this line would be in the neighborhood of 25 mph. Off peak service velocity could be slightly higher. End to end running time from downtown New Britain to Union Station would average 23 minutes. Running time from Crooked Street in Plainville to Union Station would average 30 minutes. Service frequencies would be approximately 10 minutes or less during the peak and 15 minutes off-peak.

RAP 4A-2 I-84 Median Rapid Transit Line

A rapid transit service using light rail technology with level boarding could be located in I-84 right of way as a grade-separated "high speed" line. The line could run from the I-84 Stack (Exit 39A) to Prospect in the I-84 right of way, then would shift to the rail line where it crosses below near the former Heublein plant on New Park Avenue. The rail line would use the unused western portion of the rail right of way continuing parallel to New Park Avenue and Capitol Avenue to Union Station. The line would operate in an exclusive right of way with minimal grade crossings allowing for a higher average service velocity. It is possible that the rail line could then run as a street railway from Union Station to the Old State House. Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor.

Proposed station spacing in come cases increases to exceed 5000 feet in keeping the rapid design for similar highway median rail lines but is generally less. Peak period service velocity for this line would be in the neighborhood of 25 mph. Off peak service velocity could be slightly higher. End to end running times from the I-84 Stack to Union Station would be approximately 21 minutes. An alternative to a terminal station on the stack is a shared right-of-way loop serving the UConn Medical Center and other employers in this growing part of the region.

RAP 4A-3 Farmington Avenue Light Rail

This light rail line would be located in the median of the Asylum/Farmington Avenue corridor from Old State House in Hartford to La Salle Road in West Hartford-a distance somewhat greater than 3 miles. A possible extension of this segment could run from West Hartford Center to South Road in Farmington just west of the UConn Medical Center.

Proposed station spacing would be generally 2500 feet as per designs of other successful U.S. street railways (e.g. Boston's Green Line). Stations could be more closely spaced where conditions warrant. Stations would be median islands in the roadway. Stations would generally be located mid block to the west of the north/south cross street.

Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. The two center lanes as shared lanes with general purpose auto traffic. A twelve foot wide center platform location is considered for stations at mid-block.

RAP 4B - Plainville to Hartford Commuter Rail

A commuter rail service using Diesel Multiple Unit (DMU) technology or standard rail cars and diesel locomotive push-pull sets such as the Shoreline East service could be operated in existing rail right of way largely on existing track between Crooked Street in Plainville and Union Station in downtown Hartford. In keeping with commuter rail service designs, station spacing would tend to exceed 10,000 feet between stations. Service would be operated at frequencies of not less than fifteen minutes with off peak service on an hourly (or half-hourly) headway.

Conceptual alignments and station locations are illustrated in Technical Report #2. The proposed alignment conforms to the existing rail corridor. In comparison to the proposed service in RAP 4A-1, New Britain-Hartford LRT, the Commuter Rail system will have less frequent station stops and be able to maintain higher travel speeds.

Service could be operated with traditional diesel locomotive drawn push-pull equipment sets, but the potential also exists to use innovative lower cost rolling stock technology. Many rail transit agencies are currently considering the use of light weight self propelled diesel rail coaches to provide passenger service on lightly used branch lines. Since large portions of the Plainville to Hartford line is only lightly used for freight service, the option arises to employ lighter weight more efficient high performance rolling stock that does not necessarily comply with Federal Railroad Administration standards for joint use with other US standard rail equipment. A range of these self-propelled cars are currently being demonstrated in the North American market.

Using quiet low emissions modern DMU technology it is conceivable that the rail cars could then run as a street railway from Union Station to the Old State House providing improved door step service for many more potential passengers. As noted above, the lightest units do not comply with FRA crash-worthiness regulations and would need to be segregated from other rail traffic (e.g. Amtrak and Guilford Railway System (GRS) trains on the same tracks.) Heavier DMU's and conventional locomotive hauled equipment could share tracks with other heavy trains belonging to Amtrak and freight carriers.

Taking advantage of the high speed Amtrak track between Newington and Hartford and the longer station spacing, the commuter service would operate at an average velocity in excess of 30 mph. Running time from Crooked Street to Union Station using diesel locomotive hauled equipment would be approximately 25 minutes. DMU service velocities would be somewhat faster with even more attractive travel times.

RAP 4C-1 – New Britain - Hartford Busway Alignment and Stations

The busway would follow the same alignment as the RAP 4A-1 and 4B light rail and commuter alternatives. It would pass through the communities of New Britain, Newington, West Hartford and Hartford. The busway would use the same stations as the light rail alternative between New Britain and Hartford.

- Downtown New Britain;
- South Main Street;
- East Street;
- Cedar Street;
- Willard Avenue;
- Elmwood;
- Oakwood Avenue;
- New Park Avenue at I-84;
- Park Street;
- Aetna;
- State Armory; and
- Union Station.

Bus routes will be able to enter and exit the busway at intermediate locations. The busway will also serve activity centers in the New Park Avenue corridor in Hartford, the Elmwood community in West Hartford, the future business center anticipated at the junction of Route 9 and Route 175, and Central Connecticut State University located in New Britain. While final location studies will be necessary, access points will be located at:

- New Britain – Downtown (End Point);
- East Street;
- Willard Avenue;
- Oakwood Avenue;
- New Park Avenue;
- State Armory; and
- Union Station (End Point).

Connecting bus routes and van services will link passengers with off-line destinations at station locations. Bus terminal access in New Britain would include a direct connection to the limited-access Route 72 freeway, while in Downtown Hartford buses would leave the busway between Broad and Church streets and circulate through the CBD to Main Street. Park-and-ride lots would offer further flexibility in meeting passenger needs.

Major Differences Between Busway and Rail Alternatives. The bus services that would be operated with this alternative would be similar to those be provided with light rail or commuter rail. However, there would be four major exceptions:

1. The first is obvious - buses, rather than light rail or commuter rail, would provide the trunk service along the railroad right-of-way between Plainville and downtown Hartford.
2. By definition, rail services are restricted to the rail right-of-way. Buses, however, would not be restricted to the rail right-of-way. As a result, many of the routes that would act as feeder services for light rail or commuter rail could be through-routed with the busway services to provide one-seat service to downtown Hartford and intermediate stations.
3. The frequency of service offered by the busway would be much more attractive than light rail or commuter rail. Using 40 foot buses with 40 seats, trunk line service would have to be provided every 3 minutes to carry the demand indicated in the initial RAP 4A-1 and 4B forecasts. (The services described below would provide that level of service.)
4. The western terminus of the busway would be downtown New Britain because the rail right of way west of downtown New Britain has insufficient width to accommodate continued rail freight traffic and a busway, and because congestion on Route 72 is not great enough to warrant a separated guideway. From New Britain to Newington Junction, the right of way is generally wide enough to allow for the development of a two lane busway parallel to the existing active tracks.

Because the busway alternative would provide more direct services and more frequent services at comparable speeds, it is likely that this alternative could attract higher ridership than the rail alternatives.

RAP 4C-2 – I-84 Median Busway Alignment and Stations

The busway would follow a similar alignment as the RAP 4A-2 light rail alternative, except that the Stack terminal would be replaced by a new terminal at the Exit 39/Route 4 interchange. It would pass through the communities of Farmington, West Hartford and Hartford.

2.5 RAP 5 - ADDITIONAL LANE - HIGH OCCUPANCY VEHICLE (HOV)

The High Occupancy Vehicle (HOV) system (RAP 5) proposed for the Hartford West corridor would operate similarly to those in the Capitol Region on Interstate 91 and Interstate 84 east of the Connecticut River. Access to the interstate would be provided at designated on-ramps, and would be open for use by vehicles with two or more occupants (HOV 2+). In addition to HOV 2+ automobile traffic, the HOV lane would also enable express buses to enhance travel time and build ridership. Another key element in building use of the lane is the implementation of park and ride lots. While they may be open for general carpooling and ridesharing operations, these lots are also frequently served by express and local transit service.

The improvement would consist of a twelve foot HOV lane, a four foot shoulder separation, and a ten foot inside shoulder. The proposed alignment for the HOV lane is illustrated in Technical Report #2. At the east end of the corridor right-of-way restrictions may require that shoulders and separations be reduced to minimize or eliminate impacts on adjoining property.

In addition an alternative exists for access to the downtown area. It would be possible to use the busway proposal from RAP 4A-2 from Prospect Ave. to Union Station for circulation downtown. The geometrics of the bus way are too tight to allow general purpose HOV 2+ traffic to use as an access path. However, transit buses could effectively use this as an alternative path.

Express Bus Routes. The bus routes that will use the proposed High Occupancy Vehicle (HOV) lane for I-84, extending from Exit 39A to downtown Hartford are discussed in this section. Express buses will enter and exit the HOV lane at Exit 39A, "The Stack", Exit 40, Westfarms Mall, Exit 41, South Main Street, Exit 42, Trout Brook, and Exit 45, Flatbush Avenue. The bus services that will use the HOV lane include both existing express routes and several new "limited" routes designed to take advantage of the time savings possible with faster bus travel speeds on the HOV lane.

2.6 RAP 6 - ADDITIONAL LANE - GENERAL PURPOSE

RAP 6 is similar in geometric configuration to the RAP 5 HOV improvement. The improvement would consist of a twelve foot lane in each direction and a twelve foot inside shoulder. Every effort would be made to achieve and maintain a twelve foot outside shoulders for safety reasons. The proposed alignment for RAP 6 is illustrated in Technical Report #2. At the east end of the corridor right-of-way restrictions may require that inside and out-

side shoulders be reduced to minimize or eliminate impacts on adjoining property.

The improvements proposed for this alternative would include the elimination of left entrance and exit ramps as proposed in RAP 3 Freeway reconstruction. While the additional Interstate capacity would relieve traffic pressure on parallel arterials, it would still be important to coordinate ITS and arterial signal systems to assure optimum operation.

The Connecticut Department of Transportation (ConnDOT) and the Capitol Regional Council of Governments (CRCOG) agreed to drop further consideration of RAP 6 after publication of Technical Report #2. In the body of this chapter, as a point of comparison, selected elements associated with RAP 6 are presented to facilitate comparative analysis of the RAPs and their transportation components that remain in consideration.

2.7 ASSESSMENT OF REASONABLE ALTERNATIVE PACKAGES

This Section presents the results of evaluations conducted for highway-related and transit-related Reasonable Alternative Packages (RAPs). Taken in conjunction with the impact evaluations contained in Chapter 3, these results present a profile of potential success in meeting the Goals and Objectives developed to guide investment decisions in the corridor.

Transit-Related Performance Measures

New Service Transit Users. There are several ways to measure the relative success of transit related RAPs. In terms of riders that will use transit services, routes structured to take advantage of busways in the New Britain and I-84 corridor attract more daily riders, 13,290 and 11,540, respectively, than other RAPs (Table 2.1). In reality many users of the new route structure would not necessarily use the busway to downtown, but because buses circulate on streets, riders would use the buses as tradition local bus service. This tendency is illustrated in that ridership on existing bus routes for the New Britain busway dips from 19,870 in the 2020 Base Case to 15,400 for RAP 4C-1.

After the busways, the Light Rail to New Britain will attract the most service oriented riders. Fourth in rank is the New Britain Commuter Rail service, and fifth, Light Rail in the Interstate 84 corridor. The strategy least effective in attracting new riders is bus routes implemented to support RAP 5, I-84 HOV Lane. This is probably because of the competitive travel times and attractiveness of shared ride auto trips.

Total Transit Riders/New Transit Riders. Total transit trips in the corridor (and therefore new transit riders) are a good measure of RAP effectiveness. The New Britain - Hartford Busway ranks first in this category handling a total of 28,690 transit riders - 8,820 riders above the 2020 Base Case number. Light Rail in the I-84 corridor, either terminating at Route 9 or at Fienemann Road, ranks second in Total Transit Riders at 27,520 and 27,480, respectively. The only other RAP with more than 27,000 daily riders is the New Britain Light Rail service.

With the exception of the HOV alternative, all RAPs outperform the transit service alternatives proposed for RAP 2. Implementation of the transit service will nearly return the 2020 Base Case ridership to the current 1995 ridership levels. Clearly, some of the RAP 2 service proposals could generally be implemented without large capital investments.

Peak Period Transit Ridership. Transit ridership during peak periods will do the most to reduce roadway congestion within the Hartford West corridor by diverting person trips from drive alone to transit based modes. The highest level of peak hour transit ridership will be achieved by the New Britain - Hartford Busway service, RAP 4C-1 (Table 2.2). The second ranked service will be the I-84 Busway followed closely by the I-84 and New Britain Light Rail alternatives. The relative ranking for New Service ridership is similar. As noted for daily ridership, New Bus Routes and New Britain Service are grouped together under one category.

Impact on Mode Share Transit-Related RAPs. Of the transit-related RAPs, only the Busway alternatives reduce the Drive Alone Mode share to less than 70% at 69.1% and 69.37%. In all cases Shared Ride mode share is also reduced below the 2020 Base Case level of 8.6%. In the busway alternatives in both the New Britain and I-84 corridors, buses operate in local service on state and town roads as well as in express service on the busway alternative. As such buses riders are able to take advantage of new bus routes for local bus trips as well as for trips to and from downtown. Of the alternatives, only the New Britain Light Rail service and Farmington Avenue Light Rail have the impact of reducing bus mode share below the 2020 Base Case level.

Table 2.2

PEAK PERIOD COMPARISON OF TRANSIT-RELATED RAPS

Hartford West MIS

Passenger Trips Base Case/RAP	Existing Bus Routes	New Bus Routes	New Service	Total Transit	New Riders
2020 Base Case	7,360			7,360	
RAP 2 - Transit Operations	7,330	550	-	7,880	520
RAP 4A-1 - New Britain LIght Rail	7,400	500	2,300	10,200	2,840
RAP 4A-2 - I-84 Light Rail	7,960	340	1,940	10,240	2,880
RAP 4A-3 - Farmington Ave. Light Rail	6,240	2,040	1,410	9,690	2,330
RAP 4A-4 - I-84 Light Rail Extended	7,820	650	1,870	10,340	2,980
RAP 4B - New Britain Commuter Rail	7,400	500	2,200	10,100	2,740
RAP 4C-1 - New Britain-Hartford Busway	4,940	-	6,690	11,630	4,270
RAP 4C-2 - I-84 Busway	6,090	-	4,290	10,380	3,020
RAP 5 - I-84 HOV Lane	7,220	-	120	7,340	(20)

Source: Hartford West MIS Technical Report #3

Highway Performance Measures

Table 2.3 presents the results of the Highway Performance analysis for all RAPs both transit and highway related. During the AM Peak Period, the greatest reduction in VMT is achieved by RAP 4C-1, New Britain-Hartford. Both RAP 3, Freeway Reconstruction, and RAP 5, HOV Lane, experience an increase in VMT because of the increase in operating speed over the set one hour evaluation period.

The performance of the RAP 2 package includes implementation of all strategies including TSM, TDM, and Transit Operations. Overall vehicle trips are reduced 1.3% during the AM peak period and 4.7% in the PM period. Speeds increase on both the freeway and arterial roadways as traffic demand during the peak period is reduced. It is important to remember that transportation demand management (TDM) strategies such as parking pricing, congestion pricing, and transit incentives depend on voluntary participation that may not be politically attractive.

During the PM Peak period, the greatest reduction in VMT was also achieved by the New Britain - Hartford Busway at 5.2%. The second largest reduction in system wide VMT was achieved by the New Britain Commuter Rail, RAP 4B at 4.4 %. The I-84 Busway follows closely behind with a 4.3 % reduction.

The largest percentage increase in AM average vehicle speed was achieved by RAP 3, Freeway Reconstruction. Of the transit-related alternatives, the best results were achieved by the I-84 Light Rail and New Britain Light Rail with 9.4 % and 8.5%, respectively. Trends are similar for PM average vehicle travel speeds with the best improvement achievement of a 4.9% increase in speed. The second ranked improvement is the I-84 Busway with a 3.1 % increase in average speed.

Because freeway speeds increase, vehicle trips may be attracted from arterial roads with slower overall speeds. As such VMT on freeways may in some cases increase even though overall demand for vehicle trips will decrease. Of all alternatives, RAP 3, Freeway Reconstruction, will achieve an increase in speeds of 19.1 % and 34.4 % for the AM and PM Peak Periods, respectively. RAP 4C-1, New Britain - Hartford Busway, results in the greatest increase for AM average speed, and RAP 4C-2, I-84 Busway, results in the greatest increase for PM speeds.

Arterial Roadway Performance. Concerning highway performance measures on arterial roadways, the New Britain corridor alternatives perform similarly with reductions in VMT during both the AM and PM peak periods of about 4.0 %. The alternatives in the I-84 corridor perform somewhat less well for arterial VMT reduction. Speed increases are similar under each of the transit-related alternatives.

The most congested roadways are those that experience a volume capacity ratio greater than 1. As noted in Table 2.4, the New Britain Commuter Rail achieved the greatest reduction in arterial congestion eliminating 6.35 miles of arterial with V/C ratio greater than 1 during the AM peak hour. Following in second place is New Britain - Hartford Busway, reducing arterial roadway mileage by 4.95. The I-84 Light Rail alternative results in 3.03 fewer miles of highly congested roadway.

During the PM Peak Period, the I-84 Busway achieves the greatest reduction in congested mileage with 5.21 miles eliminated. New Britain Commuter Rail strategies result in a reduction of 4.99 miles of arterial with a V/C ratio greater than 1. RAP 3, Freeway Reconstruction, also has a favorable impact eliminating 4.5 miles of congested roadway.

Capital Construction Cost

Of the Transit Related RAPs evaluated, the least expensive alternative is the New Britain Busway at $75.3 million followed closely by Farmington Avenue Light Rail at $97.1 million (Table 2.5). The New Britain Commuter Rail is estimated to cost $98.3 million to implement.

The Transit-related RAPs will include not only the construction of roadbed, tracks, pavement, and stations, but also the acquisition of light rail vehicles, commuter rail vehicles, or buses, and the construction of maintenance and storage facilities and yards. These costs vary dramatically. The transit vehicle and facility capital costs are in Table 2.6.

The most expensive overall RAP would be reconstruction of the freeway at $527.3 million. The most expensive element of this plan would be the reconstruction of the downtown segment of I-84 due to the extensive structure work that would be a key element. Reconstruction of Flatbush, Prospect, and Sisson interchanges would be the second most expensive at $102.4 million.

Transit Operating Costs

The transit services associated with RAPs 2, 4, and 5 would operate as described in Technical Report #2, "Preliminary Screening and Scoping Report." For weekdays, peak and off-peak service levels were defined for all of the services associated with each RAP in terms of average headways. For the span of service, an 18 hour service day was assumed for major services, from approximately 6:00 am until midnight. Most other routes (for example, feeder routes) would operate for shorter spans, generally corresponding to the span of service for similar current services.

Frequent peak period service would be provided during a two hour AM peak and a two hour PM peak, with less frequent service being provided in the off-peak, which is the remainder of the day. For weekends and holidays, specific service plans were not developed. Instead, it was assumed that similar services would be provided, but less frequently and over a shorter span of service. At the present time, in terms of vehicle service hours, Saturday service levels in the Hartford West corridor are approximately 47 percent of weekday levels, and Sunday service levels only 9 percent of weekday levels.

By RAP, total annual operating cost estimates are summarized in Table 2.7. These costs are for operations within the corridor only and do not include other region wide costs. The highest annual operating cost would be experienced by New Britain Light Rail (RAP 4A-1) at $22.3 million.

Fare to Operating Cost Ratio - Within the Hartford West corridor, it is estimated that in the Base Case (No-Build) Scenario farebox revenues would cover approximately 37 percent of the operating costs for the bus services (Table 2.8). Under the build alternatives, the coverage ratio will vary from a low of 26 percent for the Farmington Ave. Light Rail to 39 percent for New Britain Commuter Rail. These estimates may change in a subsequent study will refine bus routing options and new service operations plans and costs. However, the positive performance of the Commuter Rail and Busway alternatives suggests that transit operations may be affordable.

Transit Subsidies - Comparing Operating Cost and Annual Fare receipts within the Hartford West corridor, the largest total subsidy will be necessary for the Farmington Ave. Light Rail and the New Britain Light Rail with $16.2 million and $16.0 million, respectively (Table 2.9). This compares to a base case projected subsidy of $7.7 million for corridor transit operations. In the base case, subsidies per rider are projected at $1.33, and RAP 2 TSM/TDM/Transit Operations will experience $1.44 per rider. Of the Build alternatives, the New Britain - Hartford Busway and I-84 Busway will experience subsidies of $1.60 and $1.53 per rider, respectively.

CHAPTER 3

Social, Environmental, and Economic Effects

The Recommended Package defined in Chapter 2 was compared to the constraints mapping prepared and reported in Technical Report #1. In general impacts were found to be minimal because alternatives have been limited to existing transportation corridors - Interstate 84, Amtrak and freight rail corridors. Social, environmental, and economic impacts were considered both within the right-of-way and in areas adjacent to existing corridors.

Information relative to each of these topics was gathered from the Department of Environmental Protection (DEP), Metropolitan District Commission (MDC), municipal staff, the Capitol Region Council of Governments (CRCOG), a review of current aerial photographs of the study area and from field evaluations of some study area locales. The analysis was conducted at a 'planning level' as opposed to involving an in-depth analysis of socioeconomic conditions in the study area communities. The following is a summary of effects associated with the Recommended Package of improvements.

3.1 SOCIAL EFFECTS

Social effects, including land use, public facilities and services, relocation impacts, community cohesion, access issues, aesthetic impacts, and conservation development plans, are those impacts which effect the livability and characteristics of the community.

Land Use

Impacts to land use resulting from the Recommended Package can be measured in terms of the degree to which they may induce a change to the predominant land use patterns within the communities and neighborhoods of the study area. Change to predominant land use patterns in a community may be caused by land acquisition for a project which reduces existing land use or the availability of land for a future use. Impacts to local land use patterns may also result indirectly, over time, not from changes in land use, but from change in the economy or business and real estate climate of a community. These indirect changes may be positive in that they support land use plans, or they may be negative by resulting in an undesirable result. None of the proposed improvements is anticipated to have an adverse impact on predominant land use patterns within the study area. The improvements are not anticipated to require any substantial land takings to accommodate construction. Opportunities exist to define opportunities for joint development melding public and private resources to achieve defined goals and objectives.

Visual and Aesthetic Impacts

Impacts to the visual and aesthetic quality of an area as caused by Recommended Improvements cannot be quantitatively measured. Aesthetics is a subject concerned with the quality of the visual experience, both the visual resource and the response of the viewer. Visual and aesthetic impacts were considered in terms of potential changes to the existing visual setting of study area communities.

Important visually aesthetic features in the study area are limited. They occur primarily as parks, ridge lines, and scenic community neighborhoods, particularly historic neighborhoods. Neither freeway reconstruction nor the Busway are not anticipated to have any impact on visual and aesthetic features within the study area. In fact West Side access improvements hold the potential of improving the visual quality of the communities by reducing the number of structures at the Sisson and Flatbush Avenue interchanges.

Visually aesthetic features which may effected by the Busway include the view of Pope Park in Hartford, the Park River, and the Elmwood neighborhood in West Hartford. Pope Park in Hartford abuts the I-84 ROW, although the two occur at different elevations. Hartford Public High School property abuts the freeway and rail right-of-way at this locale. The visual and aesthetic qualities of the new athletic facilities which are under construction at the high school may be adversely effected by greater proximity to highway elements under these alternatives.

Public Facilities, Services and Utilities

Public facilities, services and utilities include such community assets as hospitals, libraries, municipal buildings, parks, paratransit services and water and sewer service. No adverse impact is anticipated to public facilities, services and utilities with any of the Recommendations. No land takings from any community facility is anticipated and

no permanent interruption or impairment of the delivery of services can be expected.

There are a number of schools, parks and community centers within the study area. These include the following: Trinity College, Pope Park and state government buildings in Hartford, University of Connecticut (UCONN) Health Center in Farmington, Central Connecticut State University (CCSU) in New Britain, the Newington High School and the town offices and Elmwood Community Center in West Hartford. The Hartford Public High School property is potentially in the most direct proximity as it abuts I-84 near exit 46 in the study area.

Relocation Impacts

Relocation impacts are those impacts resulting from the taking of land or elimination of access to a property and thus requiring a family or business to relocate. Important considerations are the socio-economic status of the families or businesses being moved, the availability of suitable locations for the family or business to move to and whether the relocation will impact a businesses with neighborhood and/or regional significance. The relocation of a business with neighborhood and/or regional significance could result in secondary impacts to the economy of the area over time. While there may be some incidental property takings as a result of the Recommended Improvements, they will be minor and only involving isolated properties. The West Side Access Improvements hold the biggest potential for substantial impacts, and these will be viewed in more detail prior to implementation.

Neighborhoods and Community Cohesion

Neighborhoods within a community are defined by unifying physical attributes of the area and by residents perceptions of their neighborhood boundaries. Adverse impacts to neighborhood or community cohesion can result from a project which creates a physical and/or visual barrier inside neighborhood boundaries or which inhibits travel from one portion of a neighborhood or community to another. The No-Build Base Case Scenario could have an adverse impact to many of the study area neighborhoods or to community cohesion over time. Congestion may be expected to increase on major arterials within the study area, creating, in effect, a barrier to residents sense of connection to their neighborhood. Ease of travel within the neighborhood or community may also be inhibited by increased through traffic forced by congestion on major arterials onto minor arterial roads which traverse the area.

The majority of land uses in the immediate vicinity of the Busway are industrial or commercial. The only area of significant residential development is in New Britain. While the rail corridor has been a part of neighborhood life for some time, the noise impacts of returning the corridor to active service will be assessed as part of the development of the EIS.

The reconstruction of interchanges in Farmington, West Hartford, and Hartford will reduce the amount of traffic through residential neighborhoods due to partial interchanges at Routes 4 and 6 and at Flatbush and Sigourney. Similarly, reconstruction may reduce visual and aesthetic impacts on these neighborhoods. The New Britain-Hartford Busway offers the opportunity to hold congestion in check by providing alternatives to the private automobile.

Access Issues

Access issues arise from proposed transportation projects when there would be a change induced in local travel patterns because current access points are eliminated, altered, or made more difficult to reach. The Recommended Package will have a beneficial impact on the ability of travelers to reach their destinations. Access to the major activity centers and major employers, especially along the New Britain - Hartford Busway, would be improved. These improvements would address the need for transit dependent Hartford and New Britain residents to access job opportunities in the suburban portions of the study area.

Consistency with Plans for Conservation and Development

The Plans for Conservation and Development (PCD) in a community represent local goals, objectives and programs for the community's future. The PCDs in the study area communities were reviewed to determine whether the Recommended Package would conflict with the stated goals, objectives and implementation programs. The Busway would address the goal for the City of Hartford to provide mobility for transit dependent City residents who work at suburban locations. The construction of Auxiliary Lanes on I-84 would support the goal expressed in the West Hartford PCD of supporting effective traffic improvements to I-84. It should be noted that the PCD for Newington calls for intersection improvements at some locations along Route 175 (Cedar Street). While the intersection improvements for Route 175 were

addressed as part of a separate corridor study by CRCOG, a BRT station along Route 175 will require careful study especially with respect to vehicular, pedestrian, and transit accessibility.

Historical/Archaeological/Section 4(f)/Section 106 Evaluation

Because improvements will be located within existing transportation corridors, there would not be any sites on or eligible for the National Register of Historic Places and Town Historic Surveys directly impacted. However, there would be several sites in proximity to the system.

Environmental Justice

The concern for "Environmental Justice" springs from Executive Order (EO) 12898, Federal Action to Address Environmental Justice in Minority Population and Low-Income Populations, signed by President William Clinton on February 11, 1994. Specifically, this EO calls attention to requirements contained in other regulations such as the National Environmental Policy Act, the Uniform Relocation Assistance and Real Property Acquisition Policies Act, the Intermodal Surface Transportation Efficiency Act, and Title VI of the Civil Rights Act of 1964. In brief, the EO calls for methods and techniques to identify, measure, and resolve disproportionately high and adverse impacts (disparate impacts) resulting from transportation projects. In addition to adverse impacts, the EO requires that all segments of the population should receive an equality of benefit from the investment of Federal funds. Along with technical analysis, public outreach and consultative decision making were used in the study process.

The consideration of Environmental Justice in terms of the Recommended Package was made by examining census data regarding socioeconomic status of residents within the study area as compared with the effected communities as a whole. As shown in Table 3-1, the four service area communities have a combined population of 305,000. Both Hartford and New Britain have experienced significant population loss since 1980. They have a substantial portion of their respective regions' multi-family housing stock, as well as a far greater proportion of residents living below the poverty line. The combination of dense housing conditions and low-income households also leads to a substantially greater number of households not having a vehicle available to them. In the City of Hartford, nearly forty percent of households have no vehicle available. In New Britain, the proportion of transit-dependent households is approximately sixteen percent.

The urban portions of the study area also house a greater share of minority (i.e. African-American, Hispanic, or Asian) population than adjacent suburban areas. Sixty-nine percent of Hartford's population are members of minority groups, with African Americans constituting the single largest segment. The City of Hartford contains 65 percent of the Capitol Region's minority population. New Britain's population is 24 percent minority.

Table 3.2 compares disadvantaged population groups within the study area to those in the communities at large. However, in general, the census tracts which fall within the study area cover large geographic areas. The impacts are anticipated to be more localized.

Hartford and New Britain have a much larger non-white and poverty level population than the remainder of the

Table 3.1

COMMUNITY POPULATION CHARACTERISTICS

Hartford West MIS

Corridor Community	TOTAL POPULATION	POPULATION DENSITY (per sq. mi.)	PERCENTAGE MINORITY	PERCENT CHANGE (1980-90)
Hartford	139,700	8,100	69%	-13.6%
New Britain	75,500	5,600	345	-11.5%
West Hartford	60,100	2,700	8%	-9.9%
Newington	29,200	2,200	6%	11.0%

Source: US Census Bureau

Table 3.2

ENVIRONMENTAL JUSTICE EVALUATION

Hartford West MIS

Census Tract or Area	Total Population	Percent Non-White	Percent Over 65	Percent Below Poverty Level
Farmington	20,600	4%	1.5%	1.0%
Study Area Census Tracts	5,500	3.9%	11.0%	1.0%
Hartford	139,700	96%	11.8%	25.7%
Study Area Census Tracts	56,500	37.1%	13.7%	30.1%
New Britain	75,500	18.1%	16.9%	10.7%
Study Area Census Tracts	38,100	17.9%	18.4%	10.4%
Newington	29,200	4.5%	20.7%	1.0%
Study Area Census Tracts	16,600	2.6%	9.2%	.05%
West Hartford	60,100	6%	22.0%	2.1%
Study Area Census Tracts	37,500	7.3%	21.1%	3.0%

Source: 1990 Census

study area communities. Yet, the percentage of disadvantaged populations is, in general, comparable between the study area and the communities at large.

Five of Hartford's neighborhoods within the study area (each as represented by a consolidation of several census tracts) have lower median income and a higher percentage of non-white population than the city as a whole. These are South Green, Parkville, Flatbush, Frog Hollow and Asylum Hill. The Recommended Package would specifically benefit the Parkville, Flatbush, Frog Hollow , and Charter Oak neighborhoods in Hartford.

The Busway would improve access for residents of these neighborhoods for commuting to work and shopping, both within Hartford and throughout the study area, such that impacts are expected to be primarily beneficial. In general, the Recommendations would not have an adverse impact on any concentration of disadvantaged populations. The highway modifications that are likely to result from the West Side Access improvements will most directly benefit the Parkville, Frog Hollow, Charter Oak, and Elmwood neighborhoods without major property takings. This benefit will be caused by improved accessibility from the Interstate especially for truck traffic and goods movement. The direct linkage of New Britain and Hartford via the Busway will provide a significant benefit to transit dependent residents of New Britain. In addition to access to employment, the Busway will also provide access to educational opportunities at Central Connecticut State University.

3.2 ENVIRONMENTAL EFFECTS

A planning level analysis has been undertaken for the environmental resources, with detailed descriptions to follow.

Active Farms and Prime Farmland Soils

Active farms were identified using color aerial photographs taken by the US Department of Agriculture during the summer of 1996. It was determined from these aerials that no active farms will be impacted by the Recommended Package.

Prime farmland soils were identified using Natural Resources Conservation Service soil survey maps of Hartford County (1962). Those prime farmland soils which have been converted to developed land were determined using the most recent U.S.G.S. topographic quad maps of the study area. Since the potential benefit of prime farmland soils is lost when the land is developed, only impacts to undeveloped prime farmland soils were

considered. Encroachment to a minor amount of undeveloped prime farmland soils could occur for the Recommended Package even though construction will take place within existing transportation corridors.

Hazardous/Contamination Risk

No information is available on the exact location of the hazardous/contamination risk within given sites, thus, only proximity impacts can be listed. Most of the environmental risk sites are located along the existing rail right-of-way, as shown in Figure 3.1. The Busway would have the greatest potential for proximity to identified hazardous waste sites due to the location of contemporary and historic industrial facilities adjacent to the railroad right-of-way.

Wetlands

Planning level assessment of documented wetlands locations indicates that wetlands impacts will potentially occur adjacent to the rail right-of-way. Wetlands impacts may also occur in the vicinity of the Route 4 interchange in a forested area. Another area of significant wetland is adjacent to the rail right-of-way in Newington north of Route 175 - the Piper Brook area. Assessment of wetland impacts have been made primarily from Soil Survey and National Wetland Inventory maps, and have not been assessed in the field.

Natural Resources/Fish and Wildlife/Endangered Species

According to information obtained from both the U.S. Fish and Wildlife Service and the Connecticut Department of Environmental Protection Natural Resources Data Base, no State or Federally-listed plant, animal or habitat will be effected by any of the Recommended Package. There is a known pair of State and Federally-listed Endangered peregrine falcons (Falco peregrinus) just outside the northeast edge of the project study area. Initial coordination with the DEP has indicated that the falcons would not be effected by the improvements. ConnDOT will continue to coordinate with the DEP and U.S. Fish and Wildlife Service throughout this planning process regarding the falcons and any other State and Federally listed species.

Stream Channel Encroachment

Construction of the Busway and stations could impact stream channel encroachment lines in Piper Brook in Newington.

Wells

According to the CT DEP Atlas of the Public Water Supply Sources and Drainage Basins of Connecticut, Bulletin No. 4 (1982) two public water supply wells are located in the study area. Neither of these wells will be impacted by any of the Recommended strategies. Individual household wells are not reported. Impact to individual wells would be assessed later in the study process.

Stratified Drift Aquifers

Two types of aquifers are located in the study area: coarse-grained stratified drift (having a potential water yield of more than 700 gallons per minute) and fine-grained stratified drift (having a potential water yield of generally less than 20 gallons per minute). The Recommended alternatives would cross stratified drift aquifers. The majority of this impact for these alternatives would be adjacent to existing highway and rail rights-of-way and therefore minimal.

Flood Plains

In general minor encroachment within the 100-year flood plain boundary may occur in the vicinity of the South Branch of the Park River; in areas currently impacted by the railroad; and in association with a tributary to the south branch of the Park River. These flood plain impacts are expected to be negligible, as they are associated with minor amounts of fill required primarily along previously disturbed areas.

Public Water Supply Watersheds

Information regarding public water supply areas was obtained from the CT DEP Atlas of the Public Water Supply Sources and Drainage Basins of Connecticut, Bulletin No. 4 (1982) and the Metropolitan District Commission. According to these sources, no public water supply watersheds or public water supply areas are located in the study area.

Noise

Heavily utilized transportation corridors, both rail and highway, have the potential to create noise impacts to nearby sensitive land uses. The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) have established noise impact assessment guidelines and procedures for federally funded highway and transit projects, respectively.

The project study area was reviewed to locate potential

noise-sensitive areas. Sensitive land uses that abut a project alignment (e.g., the Railway) or are located near a potential corridor for a project alternative should be considered in the environmental assessment of the project. Relatively dense concentrations of sensitive land uses or facilities in a small area would indicate high sensitivity for that area as a whole. The Busway corridor would also have limited effect on sensitive receptors due to the absence of sensitive receptors in this corridor.

Air Quality

The Clean Air Act of 1970 (as amended in 1977 and 1990) was promulgated by Congress to preserve air quality and to protect the public's health and welfare. Under the authority of the Act, the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for six pollutants: carbon monoxide (CO), hydrocarbons (also known as volatile organic compounds or VOC), oxides of nitrogen (NOx), respirable particulate matter (PM10), sulfur dioxide (SO2), and lead (Pb). These standards are applied equally everywhere throughout the country and must be complied with at any location where the general public has reasonable access.

Air quality standards define allowable limits for atmospheric concentrations of air pollutants. States can develop and implement such standards as long as they are at least as stringent as the prevailing national standards. The Connecticut Ambient Air Quality Standards, as described in Regulation Section 22a-174-24 are similar to the NAAQS. Primary standards are established to protect public health; and Secondary standards are established at levels designed to protect the public welfare by accounting for the effects of air pollution on vegetation, soil, materials, visibility, and other aspects of the general welfare. Compliance with these standards must be achieved by any proposed project being constructed in the State of Connecticut. The Air Quality Conformity Report produced by ConnDOT in February 1999 demonstrates that all elements of ConnDOT's transportation program and the Regional Long Range plans conform with applicable SIP and 1990 Clean Air Act Amendment (CAAA) conformity guidance criteria.

Relevant Pollutants. Public awareness of the effects of air pollution has increased noticeably in recent years with the passage of the Clean Air Act. Air pollution is of concern because of its potential adverse effects on human health. Of special concern are the respiratory effects of the pollutants, as well as their general toxic effects. Transportation sources primarily emit these pollutants:

- **Carbon Monoxide** (CO)
- **Volatile Organic Compounds** (VOC)
- **Oxides of Nitrogen** (NOx)
- **Particulate Matter - 10 Micrometers** (PM10)
- **Sulfur Dioxide** (SO2)

Mobile Source Emissions. The air pollutants of most concern in the assessment of impacts from this project are associated with emissions from mobile sources (motor vehicles, buses and locomotives), and include VOC, NOx, and CO. VOC and NOx are the only pollutants for which a detailed regional analysis is required for compliance with the Connecticut State Implementation Plan (SIP). CO impacts tend to be localized and are associated with intersections and roadways that experience severe levels of traffic congestion. Therefore, any necessary assessment of CO impacts will be conducted as part of site-specific environmental studies after the project alternatives are defined in sufficient detail to identify locations where excessive CO concentrations might occur. There are no regulatory requirements to perform an assessment of PM10 or SO2 for this project, as transportation sources generally do not emit these pollutants in notable amounts.

Relationship of the Project to Air Quality Regulations. The 1990 CAAA established timetables and requirements for attaining the NAAQS, and also included provisions for the EPA to review transportation projects to determine whether they conform with the SIP. The conformity provision states that no federal agency may approve, accept or fund any transportation plan, program or project unless the plan, program or project has been found to conform to an applicable SIP. (Title I, Section 101, Paragraph F of the 1990 CAAA). The 1990 CAAA established levels and timetables related to ozone and CO for each region not in attainment of the standards and directed these regions to develop revised SIPs. A SIP must demonstrate how a region plans to reach its attainment levels and timetables.

Pursuant to the 1990 CAAA, Hartford, West Hartford, Farmington, New Britain, and Newington are located in an ozone non-attainment area identified as "Serious." Serious ozone non-attainment areas are defined as geographical areas with the fourth highest ozone concentration (known as the average hourly design value) ranging from 0.160 parts per million (ppm) to 0.180 ppm based on

three consecutive years of monitoring data. The NAAQS for ozone is 0.12 ppm which is not to be exceeded more than once per year. This area of Connecticut is required to reach attainment of the ozone standards by the year 1999. With respect to CO, the entire project study area is designated as being in attainment of the CO standards.

Conformity is defined as meeting a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. To achieve conformity, projects must not cause or contribute to any new violation of the NAAQS, increase the frequency or severity of any existing violations of the NAAQS, or delay the timely attainment of the NAAQS (or any interim emission reduction standard or milestone).

Emission Inventory and Analysis. Air quality analysis for the Hartford West MIS was conducted to evaluate the 1995 Existing Condition, the 2020 No-Build Alternative (Base Case), 2020 Build Alternatives. Analysis were performed based on U.S. Environmental Protection Agency (EPA) procedures and guidance from Connecticut Department of Environmental Protection (CT DEP). Emission inventories of VOC and NOx were estimated for the 1995 Existing Condition, 2020 No-Build Alternative (Base Case), and 2020 Build Alternatives.

Emissions of VOC and NOx for the 1995 Existing Condition are 3,170 Kg/day and 9,440 Kg/day, respectively. For the 2020 No-Build Alternative, VOC emissions were estimated to be 1,340 Kg/day and NOx emissions were 4,520 Kg/day. Reductions from 1995 to 2020 are due to emissions reductions in motor vehicle exhaust required by the Federal Motor Vehicle Emissions Control Program and the Connecticut vehicle inspection and maintenance program. These reductions more than offset the 17 percent increase in VMT projected to occur from 1995 to the 2020 No-Build Alternative.

The New Britain - Hartford Busway will result in an additional reduction in VOC emissions due to decreases in VMT. Also, due to the reduction in VMT, the Busway would result in a reduction in NOx emissions.

3.3 ECONOMIC EFFECTS

Economic Impacts are related to the financial resources of a community, such as economic trends, secondary economic impacts and user benefit.

Economic Trends and the Local Tax Base

The impact of the Recommended Package in terms of economic trends in each community and local tax base was evaluated by a review of the town and city plans of development and/or by interviews with the town and city planning departments. An adverse impact to the economy of a community can be considered to occur if the desired trend in economic development in the community is substantially inhibited by the recommendation. The local tax base can be considered to be impacted where an improvement would include substantial land takings that would decrease tax revenue and effect the provision of community services.

The no-build alternative would not support the economic development goals of the communities in the study area. Congestion is anticipated to increase both on I-84 and major arterials in the region, thus discouraging travel and perhaps frustrating attempts to encourage new employers and businesses to locate in the area.

In general, all of the study area communities with the exception of Farmington are almost fully developed in terms of land use. Land available for new business and industry will come primarily from redevelopment of existing parcels. Relevant economic development concerns or goals in each community can be briefly summarized as follows:

- Farmington has a goal to retain its small community character while discouraging development of new sites for large scale retail centers and improving its manufacturing base.
- Hartford and New Britain both have a goal to aggressively market their city for new business and to revitalize the downtown as well as to increase the employability of residents.
- Newington has a goal to promote the use of the former Route 291 land and encourage the location of new retail uses along the Berlin Turnpike as well as to revitalize the downtown for specialized retail and professional office space. In addition both Newington and New Britain are concerned with the continued vitality and accessibility of the CCSU campus as contributing to the economic strength of each community.
- West Hartford has a goal to continue to minimize the impacts of non-residential land uses on residential areas and to broaden the economic tax base by enhancing existing business and industrial districts and maintaining the economic health of existing businesses.

As noted above, the anticipated land takings would be minimal in the context of the total tax generating land use in the study area municipalities. Therefore, no negative impact to the local tax base is anticipated.

Secondary Economic Impacts

Secondary economic impacts - both positive and negative - consist of those impacts caused indirectly by the transportation alternative selected. These impacts are the result of a changed economic climate based on the operational characteristics of the individual modal alternative or alternatives. Examples of potential secondary economic impacts include:

Potential Positive Secondary Economic Impacts

- Increased investment in residential and commercial real estate;
- Improvement and repair to existing residential and commercial properties;
- Improvement in market position for retailers and other businesses based on improved access;
- New demand for retail facilities due to proximity to transportation access points; and
- Redevelopment in accordance with community Master Plan or Plan of Development.

Potential Negative Economic Impacts

- Displacement of corridor residents and existing businesses due to speculation or rising rents (i.e. "Gentrification"); and
- Changes in neighborhood character;

The listing of these potential impacts does not imply that they would all occur within the Hartford West study area. Instead, they are provided as factors that should be evaluated to determine whether they can be expected or not within a given analysis area.

It should also be noted that the Busway is anticipated to produce greater secondary economic impact, because it would offer a transportation alternative which is different in type and scope from what is presently available within the corridor. And, furthermore, the Busway would offer locations of increased activity around stations located along the corridor.

The town and city Planning Departments for each of the effected jurisdictions have been contacted to obtain their views on the potential for secondary economic impacts associated with the improvements. The following comments have been made relative to the five communities of the Hartford West study corridor.

New Britain. The City of New Britain Planning Department has identified the Busway as conforming most closely to its goal of developing Downtown New Britain as a regional center for "back office" information processing functions. The secondary economic impacts which would serve Downtown New Britain via the existing railroad right-of-way, would include:

- Strengthening the proposed redevelopment of the Landmark Center/"Greenfield" development parcel - the site of the current weekly farmers market;
- Generating additional revenue for both existing and proposed off-street parking facilities within the Downtown area;
- Offering opportunities for the development of convenience retail facilities to serve commuters; and
- Increasing opportunities for residential redevelopment in the surrounding neighborhoods, including Walnut Park and North Avenue.

The impact of busway station locations are illustrated in Figure 3.2. These stations facilitate walking accessibility to downtown employment centers as well as residential areas within the city. Accessibility to Central Connecticut State University would also be an important element of this Recommendation.

Hartford. The Busway and West Side Access improvements would support the continuing Regional Core role for Downtown Hartford by providing easier, less congested access to Downtown employment and cultural centers. Because Hartford offers the type of high-density, pedestrian-oriented setting, a Bus Rapid Transit (BRT) concept could be very successful. The concentration of major employment generators in the vicinity of potential BRT station stops is shown in Figure 3.3 provided by the City of Hartford 's Department of City Planning. As can be seen, the BRT stations offer access within walking distance (i.e. 1,000 feet) to the State Capitol complex, the Aetna campus, and other major insurance offices located in Asylum Hill. Based on the City of Hartford's analysis an estimated 49,000 employees and 20,000 residents are located within the service areas of this rail corridor.

The experience of other major North American metropolitan areas, such as Ottawa, Portland, Pittsburgh and San Diego, which have invested in fixed guideway systems, has been that transit investment of this type has led to a renaissance of Downtown office occupancy, development and retailing. It should be noted, however, that other economic factors, such as the overall vitality of the financial, governmental, and defense industry sectors, will play a more important role in determining the future economic health of Downtown Hartford.

Newington. Newington's two station locations along the Busway are located along the railroad right-of-way at Cedar Street (Route 175) and at Willard Avenue - Newington Junction. The Cedar Street area is characterized by low density industrial use in combination with substantial amounts of undeveloped land, as well as wetlands along Piper Brook. The potential exists for commercial/ office development, with a retail component, in connection with high capacity transit service associated with the BRT. However, the Town's current Plan of Development suggests an emphasis on the Berlin Turnpike and Town Center area's for retail investment and other types of development.

The Willard Avenue station area is surrounded primarily by developed residential land and a few isolated industrial properties (i.e. J.C. Penney warehouse on Fenn Road). It therefore offers few opportunities for further development and will likely not experience positive secondary economic impacts.

West Hartford. The Town of West Hartford has a great potential for secondary economic impact from the Busway. The selection of the railroad corridor would support the Town's initiative to redevelop the southeastern part of town. The Elmwood station would increase accessibility to this section of the Town, and would possibly have a modest positive impact on residential property values in the surrounding neighborhood.

CHAPTER 4

Recommended Package of Improvements

4.1 RECOMMENDED IMPROVEMENTS

The future needs and deficiencies of the Hartford West corridor suggest that no single improvement will satisfy all of the Goals and Objectives defined for the study. Similarly, comments received on the Reasonable Alternative Packages (RAPs) from corridor municipalities suggest that some of the RAPs enjoy greater support than others. It was appropriate therefore to formulate a Hybrid Package of improvements that will achieve the best overall performance and support from local, regional, and state agencies. The Hybrid Package was then reviewed with PAC and TAC members and presented at public meetings. Following this process, a Recommended Package of improvements was endorsed by the participants of the study.

The Recommended Package presented in this chapter is based on the detailed analysis presented in earlier chapters and the discussions held among study participants. The Recommended Package of Transportation Improvements (Figure 4.1) would consist of elements of some of the higher performing alternatives, including:

- New Britain-Hartford Busway;
- Reconstruction of Flatbush, Prospect, Sisson and Sigourney Avenue Interchanges (Westside Access);
- Reconstruction of Routes 4, 6 and 9 Interchanges;
- Auxiliary Lanes between I-84 Exits 40 and 42;
- Improved Bus Services along I-84/Farmington Avenue;
- Support for Arterial Highways;
- Transportation Demand Management; and
- Land Use Regulation to Support Transit Friendly Design.

4.2 NEW BRITAIN-HARTFORD BUSWAY

The busway alternative along this corridor performed exceedingly well. It not only provided cost effective transit service that was attractive to new riders, but also the resultant impact on arterial roadways and the Interstate was positive. An Environmental Impact Statement (EIS) will be prepared for this project.

The nine (9) mile long New Britain - Hartford Busway would link Hartford's Union Station with Downtown New Britain. While the exclusive busway would terminate in Downtown New Britain, express bus services would continue via the freeway to Plainville at I-84 and beyond.

The right-of-way from Hartford to Newington Junction is currently owned by Amtrak, and is wide enough to accommodate busway construction and operation with no impact on passenger or freight rail operations (Figure 4.2). From Newington Junction to New Britain, the right-of-way is state owned and will accommodate a two lane busway. Intermediate station stops would be sited at eleven locations, including the Aetna corporate headquarters (employment center with over 10,000 employees), the New Park Road development area in Hartford's Charter Oak neighborhood, Central Connecticut State University (over 12,000 full-time and part-time students), and the East Main Street development area of the City of New Britain.

Busway Service Plan. The primary busway service would operate 18 hours per day, from approximately 6:00 A.M. until midnight. Most other routes (for example, feeder routes) would operate for shorter spans, generally corresponding to the span of service for similar current services. Frequent peak period service would be provided during a two hour A.M. peak and a two hour P.M. peak, with less frequent service being provided in the off-peak, which is the remainder of the day. For weekends and holidays, specific service plans were not developed. Instead, it was assumed that similar services would be provided, but less frequently and over a shorter span of service.

Busway Vehicles. The primary busway service will be operated with a mix of standard buses and 60-foot articulated buses. The capital cost of expanding the current fleet to include articulated buses and modifying the current maintenance facility to accommodate the articulated buses has been incorporated into the cost estimates prepared for the MIS. Further evaluation of fleet mix and alternate propulsion/fuel options will be done during the EIS.

Busway Routes & Services. Existing bus routes were used whenever possible to provide service to sta-

tions. However, as is also the case with the other alternatives, several new routes are proposed to expand accessibility to the rail service. Bus services were designed so that busway services would provide much of their own feeder services. In other words, rather than one set of bus services that operated exclusively within the busway, and another set of bus services that provided feeder services, most of the busway services were designed to operate beyond the guideway to provide their own feeder services.

Only two routes would operate along the entire length of the busway:

1. The Bristol Commuter Express, which would enter the busway at Crooked Street.
2. A new New Britain-Hartford Busway Express, which would operate entirely within the busway.

All other routes would begin off of the busway, and then enter it at various locations along the busway between downtown New Britain and Elmwood.

Speed Assumptions. In developing the busway services, the following speed assumptions were used:

- **Busway**
  West of East Street Station, where there are a number of grade crossings, speeds would average 25 mph. East of East Street Station, where the right-of-way is largely grade separated, speeds would average 30 mph.

- **Local Service**
  In Hartford and West Hartford, local buses would travel at an average speed of 11 mph (based on average speeds of existing routes).
  In Newington, Farmington, and New Britain, buses in local service would travel at an average speed of 15 mph (based on average speeds of existing routes in New Britain).

- **Express Service on Outer Highways**
  40 mph (applies to Bristol Commuter Express on Route 72 and Cheshire/Southington Express on I-84 south of Route 72).

As described below, most routes would provide a combination of busway and local service. Where this would be the case, the average speed for the route is a weighted average based on the speeds and distances in each of the operating environments.

Station & Bus Access Locations. Stations are critical elements in the acceptance of and success of Bus Rapid Transit (BRT) operations. Stations must display a high degree of amenity and traveler convenience. The station itself must be enclosed, all weather, and secure providing a comfortable waiting area. Rider conveniences such as coffee shops, news stands, cleaners, etc. will enhance the desirability of the transit service. Joint development with office, residential, retail, or other commercial uses will further strengthen system ridership. The final element of transit friendly design will include connectivity for pedestrians, transit riders, park & ride, bicyclists, and others using Busway services.

Twelve stations would be provided in four communities along the busway (Table 4.1).

Table 4.1

STATIONS BY MUNICIPALITIES

Hartford West MIS

Hartford	*West Hartford*	*Newington*	*New Britain*
Union Station	Oakwood/Flatbush Ave.	Willard Avenue	East Street
State Armory	Elmwood (New Britain Ave.)	Cedar Street	So. Main Street
Aetna Insurance			Downtown
Park Street			
New Park Ave.			

Source: Technical Report #3, Hartford West Major Investment Study

In addition to stations constructed on the busway, stations may also be built along routes that feed the busway. For example, a station location at Crooked Street in Plainville next to I-84 would increase ridership on an express route that would utilize the busway.

Bus routes will be able to enter and exit the busway at intermediate locations. The busway will also serve activity centers in the New Park Avenue corridor in Hartford, the Elmwood community in West Hartford, the future business center anticipated at the junction of Route 9 and Route 175 and Central Connecticut State University located in New Britain.

While final location studies will be necessary, access points could be located at:

- New Britain - Downtown (End Point)
- East Street
- Willard Avenue
- Oakwood Avenue
- New Park Avenue
- State Armory
- Union Station (End Point)

Connecting bus routes and van services will link passengers with off-line destinations at station locations. Bus terminal access in New Britain could include a direct connection to the limited-access Route 72 freeway, while in Downtown Hartford buses could leave the busway between Broad and Church Streets and circulate through the CBD to Main Street. Park-and-ride lots would offer further flexibility in meeting passenger needs.

New bus routes designed to take advantage of the busway will be able to offer Hartford residents greater access to suburban employment centers in the towns of West Hartford, Newington, New Britain, Farmington and Plainville. The flexibility of busway operation would allow the transit system to more effectively respond to changing ridership demand and future development within the corridor.

Travel Time Savings. The busway was selected as the preferred alternative for this corridor because it offers the travelers the greatest speed, flexibility and ease of interface as compared with other modal alternatives. Busway travel speed is enhanced by the exclusive use of the facility. In portions of New Britain, where there are a number of grade crossings, bus travel speeds would average 25 mph, while the exclusive grade-separated right-of-way through Newington, West Hartford and Hartford will allow buses to travel at an average of 30 mph or more. Projected travel times, average travel speed and travel time savings for busway users are shown in Table 4.2.

Both bus users and auto commuters would benefit from a busway, as would residents and businesses in the entire study corridor. By offering an attractive transit alternative, the busway can reduce travel demand on the congested I-84 roadway, thereby expanding the freeway's physical capacity.

Projected Ridership. The busway is projected to generate 6,690 peak period trips, more than any of the other modal alternatives (i.e. light rail and commuter rail) studied in the Hartford West MIS. As shown in Table 4.3,

Table 4.2

PROJECTED TRAVEL TIME SAVINGS - PEAK PERIOD

Hartford West MIS

Busway Performance Measures	*Current System (1995)*	*System Base Case (2020)*	*System with Busway (2020)*	*Busway Only (2020)*
Average Trip Time (minutes)	12.2	12.6	8.7	8.7
Average Trip Length (miles)	3.2	3.4	3.2	3.9
New Britain - Hartford Transit Travel Time (minutes)*	34.6	33.8	24.8	20.1
Time Savings from Busway (minutes)	—	—	9.0	13.7
Percent Savings	—	—	26.6%	40.5%

**Analysis assumes all stops for buses. In operation, through buses will average 45 mph*
Source: Technical Report #3, Hartford West Major Investment Study

Table 4.3

BUSWAY PASSENGER RIDERSHIP

Hartford West MIS

Busway Performance Measures	*Current System (1995)*	*System Base Case (2020)*	*System with Busway (2020)*	*Busway Only (2020)*
Peak Period Passenger Trips	8,380	7,360	11,630	6,690
Peak Period Passenger Miles	26,580	24,700	36,760	26,040
Average Travel Speed (MPH)	15.6	16.0	21.8	26.8

Source: Technical Report #3, Hartford West Major Investment Study

an increase of 4,270 new peak period trips by the Year 2020 was forecast for the regional transit system with the busway alternative, as compared to the 2020 Base Case. Daily ridership is also estimated to increase from 19,870 riders in the base conditions to 28,690 riders in the Recommended Package. This equates to 8,820 new riders per average weekday and an increase of 58.0% over the Base.

Issues Related to Implementation Additional issues remain to be resolved regarding this alternative:

- Negotiations with Amtrak to operate the planned services between Newington Junction and Union Station;
- The location, planning and design of fixed station locations along the busway;
- Entering and exiting points for buses along the busway;
- Bus Circulation on Downtown Streets;
- Coordination and joint development opportunities with Central Connecticut State University;
- Reevaluation of bus routes that may use all or part of the busway for service;
- Evaluation of structures along the busway to determine the need for rehabilitation or reconstruction;
- Integration with development plans in Parkville, Charter Oak, Elmwood, and other areas in Hartford and West Hartford; and
- Development of a signal system for grade crossing control.

4.3 RECONSTRUCTION OF FLATBUSH, PROSPECT, SISSON AND SIGOURNEY AVENUE INTERCHANGES (WEST SIDE ACCESS)

Reconstruction of the four interchanges are important from two perspectives. Interstate access to the west side of Hartford and areas of West Hartford will be critical to the economic vitality of this part of the Capitol region. Clearly, Interstate 84 will continue to be the dominant provider of transportation service for the next two decades handling auto, bus and truck traffic.

It will be important to Hartford and West Hartford to provide accessibility from the west to the Flatbush Avenue area to support economic redevelopment initiatives. The provision of full east-west movements from and to the freeway is important to facilitate development of area business and industry. In addition, this section of Interstate 84 consists of several left hand entrance and exit ramps, making the weaving hazard more severe especially as traffic volumes increase.

Combining these four interchange areas as a unified whole through the construction of Collector - Distributor (C-D) Roads on both sides of the Interstate will remove merging and diverging movements from the mainline. The increase in accessibility to area development and the enhanced safety of operations suggest the importance of implementing this reconstruction of Interstate 84. Further study will be undertaken to refine the interchange scheme and to complete an Environmental Assessment (EA).

4.4 RECONSTRUCTION OF ROUTES 4, 6 AND 9 INTERCHANGES

As noted in the report, this segment of the Interstate is the site of roadway congestion and is the key to accessibility in this area of the Hartford West corridor. To briefly summarize the deficiencies in this area:

- The eastbound left hand entrance ramp from Route 4 to Interstate 84 creates unsafe merging and congestion;
- Eastbound lanes on the I-84 mainline are reduced from

three to two lanes creating a choke point exacerbating congestion;
- It is not possible to move directly from eastbound Route 4 to southbound Route 9 without circulating on local roads;
- From eastbound I-84, the westbound exit on Route 4 is a left-hand exit ramp;
- From westbound I-84, the Route 6 exit does not offer a visible alternative to Route 4 in accessing southern and western areas of Farmington; and
- From the Route 6 interchange, it is not possible to move westbound on I-84.

The realignment of the eastbound lanes of I-84 and construction of a Collector - Distributor (C-D) Road along eastbound I-84 would eliminate the left hand on and off ramps and enable a direct connection from Route 4 to southbound Route 9. The proposed new interchange would also enable the development of a full interchange for Route 6 and I-84. This proposal will be advanced to the design phase. It is anticipated that a Categorical Exclusion (CE) will be granted for this study.

4.5 AUXILIARY LANES IN WEST HARTFORD.

Auxiliary lanes would be constructed between entrance and exit ramps providing an additional margin of safety in merging and exiting the Interstate. Auxiliary lanes are needed because of the continued increase in traffic brought about by development in this area of the corridor. These safety improvements between Exits 40 and 42 on I-84 are supported by the town and CRCOG to be advanced into the design phase. Because improvements will be made within existing right-of-way and impacts are limited, it is anticipated that a Categorical Exclusion (CE) will be granted for this improvement. Special sensitivity will be given to noise impacts on adjoining neighborhoods.

4.6 IMPROVED BUS SERVICES ALONG I-84/FARMINGTON AVENUE

The reconstruction of the two interchange areas and the implementation of transit services in the rail corridor will provide substantial benefits to these communities; however, other needs exist. The continued increase of traffic along the I-84/Farmington Avenue corridor will be real and will result in continued congestion and environmental degradation. The Recommended package RAP should include those components of RAP 2 (Transit Operations) that would provide enhanced transit routes and services along this area of the corridor.

New express or limited bus services could be considered:

- **Hartford-New Britain Express** - The transit hubs in downtown Hartford and New Britain would be linked via a Route 9/I-84 Express link that provide increased mobility between the two largest population concentrations in the study area and allow for connections between the independent Hartford and New Britain transit networks.
- **New Britain-Westfarms-West Hartford Limited** - The transit hubs in New Britain and West Hartford would be linked via a limited service that would operate in express mode along limited access highways but also provide pick up and distribution services near transit hubs.
- **UConn Medical Center Express** - A route connecting the University of Connecticut Health Center with Hartford via Routes 4 and I-84 would link a major employment center with Hartford, and also provide the possibilities of another park/ride facility for Farmington residents to travel to Hartford.

Local Transit service could be expanded to include:
- **UConn Medical Center - New Britain**
- **Local Farmington Bus** - A local bus serving the transit hubs at UConn and Westfarms Mall.
- **Newington-West Hartford Service** - A new route operated along the SR 173 corridor.
- **Newington-Westfarms-Farmington Service** - A route from Market Square Newington via Central Connecticut State University, Westfarms Mall, and UConn Medical Center.
- **W-Route Extension** - Extend the W-Route from Hartford to Newington to run to Downtown New Britain via East Street, Allen Street and ML King Street. This would provide access to New Britain from Northwest Newington and Downtown West Hartford.
- **Stanley Street - New Britain Ave Service** - Interline the New Britain Transit Westfarms Service with the Connecticut Transit Q Route service to Westfarms Mall to provide one seat ride for local passengers between the transit dependent neighborhoods in Hartford, Elmwood and New Britain while also providing an additional local service other than the P Route to provide for travel between Hartford and New Britain.
- **East Street Extension** - The Dattco East Street Route could be extended via Cedar Street to downtown Newington providing an additional more direct path

between the two transit hubs. This crosstown route could be further extended if desired to downtown Wethersfield via an eastward extension on Route 175.

- **E-Route Limited** - Improve the bus travel times by offering "limited" service to some passengers boarding west, north or south of LaSalle Road. The shorter Farmington Ave route variations could make every stop for which there is a demand. However, the longer E route variations, such as Unionville, the Medical Center, and Westfarms Mall would provide "limited" service, making few or no stops between West Hartford center and downtown Hartford.

The transit service improvements will be considered in the context of the statewide bus transit study being undertaken by ConnDOT and the Regional Transit Strategy undertaken by CRCOG. The ConnDOT study is actually being undertaken in two parts. One part considers the routing, scheduling, and ridership associated with existing routes and recommended modifications. The second part examines organization, management, and funding associated with bus operations. Because changes in bus routing may be implemented without major capital investment, these alternatives may be able to be implemented within a relatively short planning horizon.

4.7 SUPPORT FOR ARTERIAL ROADWAYS

Based on the previous analysis, data revealed that arterial highways would become increasingly congested if capacity improvements were not made on Interstate 84 or the New Britain Rail Line. Improvements on arterial highways are difficult because additional lanes may impact roadside property - businesses and residencies - therefore meeting community resistance. Increased congestion resulting from growing traffic volumes results in negative impacts on the communities quality of life - air quality, pedestrian movements, highway safety, and related impacts.

Hartford, West Hartford, and other municipalities experiencing these problems should seek the support in developing arterial improvements that are both responsive to transportation needs and sensitive to the concerns of communities through which the highways traverse. The intersections and park and ride lots targeted for improvement will be included as part of an overall strategy undertaken by CRCOG and CCRPA to address safety, operational, and transportation impacts on quality of life.

Locations in need of safety improvements included:

- Route 4 approaching the jug handle;
- Route 71 south of Corbins Corner;
- Route 175 from Route 9 to Route 176; and
- Interstate 84 from Sigourney St. to High St.

The intersections in need of further investigation for operational improvement include:

- Hartford Avenue at New Britain Avenue;
- New Park Avenue at Flatbush;
- Park Road at I-84 Off-Ramp;
- Park Road at I-84 On-Ramp;
- Park Road at So. Main;
- Park Road at Trout Brook;
- Rt. 173 at New Britain Avenue
- Route 4 at I-84 Ramps (Jug Handle);
- Route 4 at Old Mountain/Talcott Notch; and
- South Main Street at New Britain Avenue.

Park and Ride Lots are an important element in the transportation system because they provide a convenient location for carpooling, vanpooling, and express and local transit stops. There are opportunities for the expansion or the construction at new locations. Several of these locations include:

- Plainville - I-84 at Crooked Street (Exit 34);
- Farmington - Additional Parking at Fienemann Road (Exit 37);
- Farmington - Route 6 at I-84 (Exit 38);
- Farmington - Expand parking at Route 4 (Exit 39); and
- West Hartford - I-84 at New Britain Avenue (Exit 40).

4.8 TRANSPORTATION DEMAND MANAGEMENT

This analysis and others performed have shown that Transportation Demand Management (TDM) strategies are successful in enhancing transit use when implemented in concert with major transit improvements. Some strategies such as parking pricing and congestion pricing may meet with resistance; yet, transit financial incentives are a positive adjunct that would increase transit ridership. This TDM strategy should be implemented along with the New Britain-Hartford Busway bus operations strategies.

4.9 LAND USE REGULATION TO SUPPORT TRANSIT FRIENDLY DESIGN

The corridor communities, that have participated in the Hartford West MIS study want a new future for the Hartford West corridor. Almost without exception they have sought transportation investments that do not rely on the single occupant vehicle for success. They have

asked ConnDOT and CRCOG to make investments that encourage alternative forms of transportation whether light rail, commuter rail, or busway.

To succeed, Hartford, Farmington, West Hartford, Newington, and New Britain must enact land use plans and regulations that encourage transit supportive development. Some of the critical elements of such a plan would include:

- Providing incentives for high density development along transit corridors (e.g. New Britain Busway);
- Requiring new development support for transit services just as development support off-site roadway improvements;
- Enacting site planning requirements that limit parking and encourage transit use;
- Require transit stops and pedestrian accessibility for all new developments;
- Coordination of transit feeder/distribution with new high volume services such as busways;
- Cessation of construction of parking garages and capacity as an answer to urban development; and
- Limitations on continued auto dependent suburban development of office and industrial sites applying the same requirements for transit service and accessibility as in the urban core.

4.10 EFFECT ON HIGHWAY PERFORMANCE

Several factors contribute to improved freeway and arterial operations under the Recommended RAP scenario. First, the busway creates a modal shift from automobiles to transit, which reduces the number of vehicles within transportation system. In addition to the busway, the reconstruction of the Routes 4/6/9 and the Prospect/Flatbush/Sisson/Sigourney interchanges improves the operations of the mainline freeway lanes by removing conflicting entering and exiting traffic to specially designed Collector-Distributor (C-D) roads. The increase in average speed for the freeway after these improvements are made is projected to increase from 38 to 43 mph in the A.M. Peak and from 34 to 41 mph in the P.M. Peak.

In both peak period analysis periods, the freeway VMT decreases due to vehicles using the C/D road to access network arterial roads rather than using the freeway to complete their trip. This also causes VHT to decrease since traffic is less congested and is not waiting in delay. The overall result is an increase in average speed and improved Levels of Service. Table 4.4 gives a detailed breakdown of the Recommended RAP performance measure of effectiveness. Figures 4.3 and 4.4 graphically depict the Levels of Service as measured by lane density for both eastbound and westbound I-84 for both the A.M. and P.M. Peak Periods.

Arterial Operations

As the ability of the freeway to handle greater volumes is enhanced, the traffic burden placed on the arterial roads is reduced. Also, the shift of modes of transportation from automobile to bus transit contributes to congestion reduction on the arterial system. As noted in Table 4.5, the total miles of congestion as measured by volume to capacity ratios (V/C) greater than 1.00 is reduced. The mileage reduction in the A.M. Peak is 2.97 while the reduction in the P.M. Peak is 5.29. The changes in V/C ratio ranges for each of the network arterial are graphically illustrated in Figures 4.5 and 4.6.

4.11 CAPITAL & OPERATING COSTS

The Recommended Package is estimated to have a total cost of approximately $230 million dollars, including right-of-way, engineering, and construction. Of the various all of the recommendations, the reconstruction of I-84 in the vicinity of the Flatbush Avenue interchange is the most expensive due to the addition of the C-D road and its associated structures cost. The second most expensive element is the construction of the New Britain-Hartford Busway at $75.3 million. Table 4.6 lists the costs for each of the improvement elements of the Recommended Package.

Operating Costs & Subsidies. In addition to the costs associated with the construction and maintenance of the new improvements, there are additional costs to consider when implementing a transit service. Transit subsidy, or money spent by a public agency to partially fund the operation of the service, must be considered by policy makers in the decision to adopt a new transit service. This transit subsidy is not a one time cost, but rather an annual cost that is required to offset the cost of operating the service after fare box revenues are included. Based on data provided by CTTransit, the State of Connecticut currently pays about $7.7 million dollars a year subsidy on the existing fixed route transit services in the corridor. This equates to roughly $1.33 per person per trip. If the decision is made to build a dedicated busway as part of the Recommended Package of Improvements, an additional $5.7 million dollars per year would be necessary to support the new service.

CRCOG is currently developing a Regional Transit Strategy (RTS) that will provide a blue print for the future of public transit in the region. Among other topics the RTS will provide an approach by which additional financial resources for operating costs will be made available to innovative transit operations such as the New Britain-Hartford Busway.

Table 4.6

CAPITAL COSTS OF RECOMMENDED IMPROVEMENTS

Hartford West MIS

Recommended Improvements	Millions of Dollars
New Britain-Hartford Busway	$75.3
Reconstruction of Flatbush, Prospect, Sisson and Sigourney Avenue Interchanges (West Side Access)	$102.3
Reconstruction of Routes 4, 6 and 9 Interchanges	$37.7
Auxiliary Lanes on I-84	$3.6
Improved Bus Services along I-84 / Farmington Avenue	Unknown
Support for Arterial Highways (TSM Improvements)	$10.8
Transportation Demand Management - Transit Financial Incentives (Annual Expense)	$3.0
Land Use Regulation to Support Transit Friendly Design (Local Costs)	Unknown
TOTAL COST	**$232.7**

CHAPTER 5

Public Involvement

Public involvement and outreach were key elements of this study. The public involvement program has incorporated the following elements:

- Five Public Informational Meetings;
- Cable Broadcast of Videotaped Informational Meetings on Public Access;
- Network Television Coverage of the Informational Meetings (Channels 3 and 61);
- Twenty Meetings of the Advisory Committees;
- Publication of three newsletters describing study efforts and progress;
- Operation of a toll-free information number (1-800-786-2191);
- Maintenance of a 200-person mailing list; and
- Presentations to the study area towns and their elected officials.

5.1 Public Informational Meetings and Newsletters

Public Informational Meetings were held on May 15, 1997 (West Hartford Town Hall), October 29, 1997 (West Hartford Town Hall), December 8, 1998 (Central Connecticut State University), December 16, 1998 (Asylum Avenue Congregational Church), and December 17, 1998 (UConn Medical Center).

The Public Informational Meetings were advertised in the two major daily papers and twelve weekly publications serving the study area. Meeting announcements were placed on bus routes serving the study area. Press releases were provided to more than forty broadcast and print media for their use, and the meetings were videotaped for future re-broadcast on public access channels in each study area community. The meetings consisted of a brief presentation by the study team, followed by a question and comment period. Display boards were utilized to focus discussion and survey forms were available as an additional vehicle for public comment.

- **May 15, 1997 (West Hartford Town Hall)** - The first public meeting focused on existing and future transportation needs and deficiencies associated. Emphasis was placed on the presenting the background of data associated with the MIS. Several questions were asked about the population and employment projections utilized for the study. Comments were offered concerning the level of congestion in the corridor, especially its impact on corridor towns. The need for alternative modes of transportation was also highlighted by many who commented. The videotape was aired on public access channels including the City of Hartford.
- **October 29, 1997 (West Hartford Town Hall)** - The second public meeting focused on the alternatives being studied for the corridor. The alternatives presented included all six RAPs outlined in Chapter 3. Comments were mixed, but generally commentors suggested the need for alternative modes of transportation. Several participants talked about the problems associated with residing next to I-84 in West Hartford.
- **December 8, 1998 (CCSU), December 16, 1998 (Asylum Avenue Congregational Church), and December 17, 1998 (UConn Medical Center)** - Each of these three public meetings presented the Hybrid Package and sought reaction from the public. The presentations were tailored to focus on issues of concern in the area where the meeting was held. Comments varied. Participants from New Britain who live next to the Busway Right-of-Way expressed concern about the potential for noise and air quality impacts. In Hartford skepticism was expressed regarding the potential for success of the busway as compared to the light rail alternative. Some expressed concern about the balance of highway related improvement recommendations versus public transit related. In Farmington, the realization of growing congestion as related to development was acknowledged by participants. The concept of a busway was endorsed during comments.

Hartford West Newsletters. Editions of the Hartford West Newsletter were issued in May 1997, October 1997, and December 1998. The May 1997 Newsletter contained a description of the MIS process, descriptions of preliminary issues which have been identified, notice of the May 15 public information meeting, and publicity for the Hotline number. The October 1997 Newsletter contained a definition of the six reasonable alternative packages (RAPs), preliminary concept draw-

ings, and notice of the October 29 public informational meeting. The December 1998 Newsletter contained the hybrid package of recommendations made as a result of the study, information about the proposed busway and notice of the December public informational meetings. The Newsletters and Display Advertising are included in the Appendix of this report.

Supplemental Public Meetings. In addition to the public informational meetings, the following meetings were held with study area interest groups:

- West End Civic Association;
- Parkville/Asylum Group at Hartford Seminary;
- West End, West Hartford Vision (Elmwood) at West Hartford;
- West Hartford Home Owners Group;
- New Britain Chamber of Commerce;
- Newington Business Leaders;
- City of Hartford Transportation Committee meetings (3);
- Parkville Revitalization Committee meetings (3);
- Town of West Hartford Department Heads and Directors;
- City of Hartford Department Heads and Directors;
- Central Connecticut Regional Planning Agency; and
- Capitol Region Council of Governments.

5.2 ADVISORY COMMITTEE MEETINGS

At the outset of the study, a Technical Advisory Committee (TAC) and a Policy Advisory Committee (PAC) were established by ConnDOT to provide input from study area residents and their representatives, as well as other state and federal agencies. The TAC and PAC include representatives from each of the cities and towns within the study area and other public agencies. Participating agencies and municipalities include:

- Capitol Region Council of Governments;
- Central Connecticut Regional Planning Agency;
- Town of Farmington;
- Town of Newington;
- Town of West Hartford;
- City of Hartford;
- City of New Britain;
- Greater Hartford Transit District;
- CT Transit;
- New Britain Transportation Company;
- Connecticut Office of Policy and Management;
- State Historic Preservation Office;
- U.S. Environmental Protection Agency;
- Greater Hartford Rideshare Corporation;
- Connecticut Department of Economic Development;
- Connecticut Department of Environmental Protection;
- U.S. Army Corps of Engineers;
- Federal Highway Administration;
- Federal Transit Administration; and
- Amtrak.

The twenty Advisory Committee meetings are described below.

October 29, 1996 – PAC This first PAC meeting at the South Congregational Church discussed the background of the Major Investment Study, along with the study scope of work and the role of the PAC and TAC.

November 12, 1996 – TAC At the first TAC meeting, held at the ConnDOT Main Office, participants discussed the study area definition, background of the Major Investment Study, the study scope of work and the role of the PAC and TAC.

January 17, 1997 – TAC The second TAC meeting at ConnDOT was an overview of the data collection process, and a briefing on CORFLO modeling and study outreach initiatives.

February 19, 1997 – TAC This meeting at West Hartford Town Hall was a workshop on goals, objectives, and performance measures and a discussion of preliminary issues.

March 18, 1997 – TAC At this TAC meeting, held at Farmington Town Hall, the draft goals, objectives and performance measures, and draft issues and problem areas were distributed and discussed further.

April 28, 1997 – TAC Held at the Hartford City Hall, this TAC meeting consisted of a presentation of current and future deficiencies report, an overview of alternative strategies, and an initial screening of strategies.

May 21, 1997 – TAC The Statement of Purpose and Needs document, Technical Report #1, was distributed for comment at this meeting at Newington Town Hall.

June 5, 1997 – PAC The second PAC meeting held was also held at South Congregational Church. Participants reviewed the first Technical Report, the Purpose and Needs Statement. They also discussed employment and population changes and general Reasonable Alternative Package (RAP) themes, and were briefed on computer modeling results.

June 26, 1997 – TAC The purpose of this TAC meeting, held at ConnDOT, was to discuss general RAP themes.

July 24, 1997 – TAC This TAC meeting, at the New Britain City Hall, served as an overview of the RAPs and an update on specific strategy elements.

September 8, 1997 – TAC This discussion of the detailed RAPs was at a TAC meeting at West Hartford Town Hall.

October 16, 1997 – PAC At the third PAC meeting, also held at South Congregational Church, the study team gave a presentation of the detailed RAPs.

October 22, 1997 – TAC At this TAC meeting, held at the Farmington Public Library, the study team gave a presentation of the detailed RAPs.

November 21, 1997 – TAC Held at Hartford City Hall, this TAC meeting consisted of a review of the second Technical Report, Screening and Scoping, with a discussion on demand modeling.

December 2, 1997 – PAC The fourth PAC meeting, at South Congregational Church, was a review of the second Technical Report, Screening and Scoping, with a detailed discussion on modeling and ridership projections.

March 11, 1998 – TAC Held at Newington Town Hall, this TAC meeting was a discussion of the results of the alternative's performance analysis and baseline traffic and ridership forecasts.

April 14, 1998 – PAC This PAC meeting, also held at South Congregational Church, was a discussion of issues such as HOV lanes, a transit station at Route 9 and I-84, rail versus busway transit operations, and the role of arterials for future traffic.

November 13, 1998 – TAC This TAC meeting at ConnDOT served as an overview of the third Technical Report, Assessment of Transportation Performance, and a discussion of the proposed hybrid package.

November 19, 1998 – PAC This PAC meeting at the South Congregational Church was a recap of the preferred alternative and an introduction of the hybrid package.

January 13, 1999 – PAC At the final PAC meeting, also held at South Congregational Church, the participants reviewed recommendations for the Action Plan for Implementation of the Hybrid Reasonable Alternatives Package.

5.3 UPDATE OF LONG RANGE TRANSPORTATION PLAN

Once the Hartford West PAC selected a Recommended package of Improvements, the Capital Region Council of Governments (CRCOG) and the Central Connecticut Regional Planning Agency (CCRPA) each voted to adopt the recommendations and approve further study. In early 1999, CRCOG underwent the process of updating the Long Range Transportation Plan to include the recommendations outlined in Chapter 4. These recommendations included constructing a dedicated busway between Hartford and New Britain, rebuilding the I-84/Flatbush interchange, and revising the I-84/Route 4/Route 6 interchange. The following steps were taken by CRCOG to update the plan:

- February 3 – Notice of new plan mailed to town clerks and libraries and printed in the Hartford Courant – announced opening of public comment period, how to obtain a copy, and dates of the public information meetings and CRCOG meetings;
- February 16 – Notice of Public Meeting printed in the Hartford Courant;
- February 22 – CRCOG Transportation Committee Meeting – public comment received;
- February 23 – Public Information Meeting held;
- February 24 – CRCOG Policy Board Meeting – public comment received;
- March 4 – Notice of public meeting printed in Hartford Courant;
- March 11 – Public Information Meeting held;
- March 15 – CRCOG Transportation Committee Meeting – public comment received; and
- March 31 – Policy Board adopted the Regional Transportation Plan.

The process employed by the CCRPA involved meeting with the Transportation Committee and the Policy Board at the Annual Meeting. On December 3, 1998, the Transportation Committee was briefed on the results of the MIS and the potential for impact on New Britain and the Central Connecticut Region. At the Annual Meeting, questions and comments were received from representatives of member towns. Following discussion the CCRPA voted to support the environmental study required for the next step in implementing the New Britain-Hartford Busway.

5.4 ISSUES FOR FURTHER ANALYSIS

During the public outreach phase, a number of issues were raised that will require further study during subsequent study phases, these include:

Coordination with the CRCOG Regional Transit Strategy. While the busway has been selected by CRCOG and CCRPA as the preferred transportation alternative, there is a continuing need to coordinate with the on-going CRCOG Regional Transit Strategy (RTS) and ConnDOT's statewide transit studies. Issues to be resolved by the RTS include finance and operations of the busway. Region-wide route planning for the long term must consider the potential for travel time savings associated with the busway.

Downtown Bus Circulation. Buses using the New Britain - Hartford Busway will either pick-up and discharge riders from stations along the busway **or** leave the busway to circulate on city streets. Especially in downtown Hartford, it will be important to plan for the circulation of buses using traffic signal preemption or dedicated bus lanes. Impacts on on-street parking, pedestrian accessibility, and business operations should be considered.

Busway Stations. Preliminary locations have been defined for twelve (12) stations to be located along the busway. More detailed site specific analysis should be performed considering social, environmental, and economic analysis. Bus routing and park and ride opportunities will be important elements in a comprehensive analysis of traffic impacts. Other factors to be considered will include:

- **Station Aesthetics** - Opportunities to highlight the unique qualities of stations and the communities in which they reside will be an important element in the acceptance of the Busway and its station locations.
- **Joint Development** - Several station locations offer unique opportunities for joint development. In addition to sites in Downtown New Britain or Hartford, stations near Central Connecticut State University, Elmwood, Parkville, and Aetna offer a unique opportunity for joint development. Public - private partnerships can level private capital and increase economic vitality.
- **Pedestrian and Modal Linkages** - A major ingredient in station planning and design will be defining pedestrian and other modal linkages to the neighboring communities. Whether pedestrian, transit, bicycle, or auto, effective linkages will be a critical element in busway success.

Community Participation in Advisory Groups. Community participation and support will be important in the continuing implementation of the Hartford West MIS recommendations. It would be appropriate to include neighborhood and community representation on Advisory Groups that contribute to project development.

Multi use Pathways. The potential for multi-use pathways - pedestrian and bicycle - should be considered in each of the MIS recommendations. For the busway, the potential exists to coordinate with the Park River Greenway and Pope Park restoration. Other links in the pathway system could either be part of the rail right-of-way or routed along existing streets. The West Side Access Study also offers the potential to blend pedestrian and bicycle improvements with roadway reconstruction.

Adrian's Landing & Downtown Development. Proposals to develop Adrian's Landing in concert with other development proposals in Downtown Hartford were made late in the study process. However, the proposals will reinforce the viability of a successful busway project. In fact, the flexibility of bus operations will ideally suit the special needs of the developments. It will be important to study the special routing needs to assure expeditious routing from the busway to the development sites.

Other Issues and Concerns. In addition to the above issues, the following are additional topics of concern:

- Negotiations with Amtrak to operate the planned services between Newington Junction and Union Station;
- Entering and exiting points for buses along the busway;
- Reevaluation of bus routes that may use all or part of the busway for service especially those that provide for reverse commutation to suburban job locations;
- Evaluation of structures along the busway to determine the need for rehabilitation or reconstruction;
- Integration with development plans in Parkville, Charter Oak, Elmwood, and other areas in Hartford and West Hartford; and
- Development of a signal system for grade crossing control.

TABLE 2.1

DAILY RIDERSHIP FOR TRANSIT-RELATED RAPs

HARTFORD WEST MIS

		1995 Current	2020 Base Case	RAP2 Transit Operations	RAP 4A-1 New Britain LRT	RAP 4A-2 I-84 LRT-Route 9 Terminus	RAP 4A-3 Farmington Ave, LRT	RAP 4A-4 I-84 LRT-Fienemann Rd. Terminus	RAP 4B New Britain Commuter Rail	RAP 4C-1 New Britain Busway	RAP 4C-2 I-84 Busway	RAP 5 I-84 HOV
	Length (Miles)	N/A	N/A	N/A	12.4	6.0	7.4	8.4	12.4	12.4	8.4	6.0
New Service Rides	**Daily Riders**	N/A	N/A	1,710	7,110	6,020	4,380	5,800	6,690	13,290	11,540	360
Existing Bus Rides	**Daily Riders**	21,390	19,870	19,570	20,050	21,500	21,220	21,680	20,060	15,400	14,010	19,090
Total Transit Rides	**Daily Riders**	N/A	N/A	21,280	27,160	27,520	25,600	27,480	26,750	28,690	25,550	19,450
	New Riders	N/A	N/A	1,410	7,290	7,650	5,730	7,610	6,880	8,820	5,680	(420)

Source: Hartford West MIS Technical Report #3

TABLE 2.3

HIGHWAY PERFORMANCE MEASURES FOR ALL RAPs

HARTFORD WEST MIS

Performance Measure by Roadway Class		2020 Base		RAP 2 TSM/TDM/T.Ops.				RAP 3 Freeway			
		AM	PM	AM	Percent Change	PM	Percent Change	AM	Percent Change	PM	Percent Change
System Measures											
	Vehicle Trips (VT)	46,080	50,890	45,480	-1.3%	48,480	-4.7%	46,080	0.0%	50,890	0.0%
	VMT	196,910	189,200	196,870	0.0%	186,460	-1.4%	206,830	5.0%	193,870	2.5%
	VHT	8,420	11,580	7,840	-6.9%	10,960	-5.4%	8,050	-4.4%	11,320	-2.2%
	Average Speed	23.4	16.3	25.1	7.3%	17.0	4.3%	25.7	9.8%	17.1	4.9%
Route Measures											
Freeway Total	VMT	108,230	101,400	109,540	1.2%	99,800	-1.6%	118,500	9.5%	106,740	5.3%
	VHT	2,870	2,910	2,480	-13.6%	2,710	-6.9%	2,649	-7.7%	2,330	-19.9%
	Average Speed	37.7	34.0	44.1	17.0%	36.9	8.5%	44.9	19.1%	45.7	34.4%
Arterial	VMT	88,680	87,800	87,330	-1.5%	86,660	-1.3%	88,330	-0.4%	87,130	-0.8%
	VHT	5,540	8,670	5,350	-3.4%	8,250	-4.8%	5,410	-2.3%	8,990	3.7%
	Average Speed	16.0	10.1	16.3	1.9%	10.5	4.0%	16.3	1.9%	9.7	-4.0%

TABLE 2.4

IMPACT ON ARTERIAL ROUTE MILES BY V/C RATIO

HARTFORD WEST MIS

Volume/ Capacity Ratio	2020 Base Case	RAP 2 TSM/TDM/Transit Ops.	Change	RAP 3 Freeway Reconstruction	Change	RAP 4A-2 I-84 LRT Route 9	Change	RAP 4B New Britain Com. Rail	Change	RAP 4C-1 New Britain Busway	Change	RAP 4C-2 I-84 Busway	Change
	AM Peak Hour (Route Miles)												
0 to 0.50	20.95	20.55	(0.40)	22.29	1.34	22.4	1.45	22.95	2.00	22.35	1.40	21.76	0.81
0.50 to 0.75	22.27	23.72	1.45	22.85	0.58	24.68	2.41	24.27	2.00	24.40	2.13	24.04	1.77
0.75 to 1.00	19.01	18.65	(0.36)	18.25	(0.76)	18.18	(0.83)	21.36	2.35	20.43	1.42	19.15	0.14
>1.00	34.58	32.89	(1.69)	33.42	(1.16)	31.55	(3.03)	28.23	(6.35)	29.63	(4.95)	31.86	(2.72)
Total	96.81	96.81	—	96.81		96.81		96.81		96.81		96.81	
	PM Peak Hour (Route Miles)												
0 to 0.50	10.65	10.9	0.25	13.10	2.45	10.42	(0.23)	11.16	0.51	11.30	0.65	13.17	2.52
.50 to 0.75	20.20	17.65	(2.55)	18.26	(1.94)	20.22	0.02	19.61	(0.59)	19.21	(0.99)	22.95	2.75
0.75 to 1.00	19.57	25.2	5.63	23.56	3.99	22.76	3.19	24.64	5.07	23.91	4.34	19.51	(0.06)
>1.00	46.39	43.06	(3.33)	41.89	(4.50)	43.41	(2.98)	41.40	(4.99)	42.39	(4.00)	41.18	(5.21)
Total	96.81	96.81	—	96.81		96.81		96.81		96.81		96.81	

TABLE 2.5

CONSTRUCTION COST ESTIMATE

HARTFORD WEST MIS

	I-84 Reconstruction RAP3	New Britain-Plainville LRT RAP 4A-1	LRT I-84 to Route 9 RAP 4A-2	Farm Ave. LRT RAP 4A-3	LRT I-84 to Fienemann RAP 4A-4	New Britain-Plainville Commuter Rail RAP 4B	New Britain Busway RAP 4C-1	I-84 Busway RAP 4C-2	I-84 HOV Lane RAP 5
Major Contract Items	$323.3	$113.9	$178.0	$71.4	$209.4	$72.0	$50.0	$107.2	$255.9
Contingencies	$100.2	$20.9	$46.0	$12.6	$52.4	$12.9	$12.4	$32.6	$78.3
Incidental, etc.	$103.8	$21.6	$47.6	$13.1	$54.3	$13.4	$12.9	$33.7	$81.1
GRAND TOTAL	**$527.3**	**$156.5**	**$271.6**	**$97.1**	**$316.1**	**$98.3**	**$75.3**	**$173.5**	**$415.3**

In 1995 millions of dollars
SOURCE: Hartford West MIS Technical Report #3

Table 2.6

TRANSIT VEHICLE AND FACILITY CAPITAL COSTS

Hartford West MIS

New Britain Light Rail (RAP 4A-1)	$46.5 million
I-84 Light Rail at Route 9 (RAP 4A-2)	$36.5 million
Farmington Ave. Light Rail (RAP 4A-3)	$30.7 million
I-84 Light Rail at Fienemann Rd. (RAP 4A-4)	$40.2 million
New Britain Commuter Rail (RAP 4B)	$30.4 million
New Britain - Hartford Busway (RAP 4C-1)	$9.9 million
I-84 Busway (RAP 4C-2)	$2.0 million
I-84 HOV Lane (RAP 5)	$3.4 million

Source: Hartford West MIS Technical Report #3

Table 2.9

TRANSIT SUBSIDY

Hartford West MIS

	Total Annual Cost *millions*	Total Annual Fare *millions*	Total Annual Subsidy *millions*	Additional Subsidy from Base *millions*	Annual Riders *millions*	Subsidy Per Rider
Base Case	$12.2	$4.5	$7.7	—	5.8	$1.33
RAP 2 TSM	$15.8	$4.8	$9.0	$1.3	6.2	$1.44
RAP 4A-1 New Britain LRT	$22.3	$6.3	$16.0	$8.3	7.9	$2.01
RAP 4A-2 I-84 LRT	$21.0	$6.2	$14.8	$7.1	8.0	$1.84
RAP 4A-3 Farmington Avenue	$22.0	$5.8	$16.2	$8.5	7.5	$2.17
RAP 4B - New Britain Commuter Rail	$21.4	$6.2	$15.2	$7.5	7.8	$1.95
RAP 4C-1 - New Britain Hartford Busway	$20.0	$6.6	$13.4	$5.7	8.4	$1.60
RAP 4C-2 I-84 Busway	$17.1	$5.7	$11.4	$3.7	7.5	$1.53
RAP 5 - I-84 HOV	$14.4	$4.5	$9.9	$2.2	5.8	$1.71

Source: Hartford West MIS Technical Report #3

Table 2.7

ANNUAL OPERATING COSTS

Hartford West MIS

	Bus Operations *millions*	Rail Operations *millions*	Total All Modes *millions*	Difference from Base *millions*
Base Case	$12.2	$0.0	$12.2	
RAP 2 TSM	$15.8	$0.0	$15.8	$3.6
RAP 4A-1 New Britain LRT	$15.0	$7.3	$22.3	$10.1
RAP 4A-2 I-84 LRT	$14.1	$6.9	$21.0	$8.8
RAP 4A-3 LRT - Farmington Ave.	$13.6	$8.4	$22.0	$9.8
RAP 4B New Britain Commuter Rail	$15.0	$6.4	$21.4	$9.2
RAP 4C-1 New Britain-Hartford Busway	$20.0	$0.0	$20.0	$7.8
RAP 4C-2 I-84 Busway	$17.1	$0.0	$17.1	$4.9
RAP 5 I-84 HOV Lane	$14.4	$0.0	$14.4	$2.2

Source: Hartford West MIS Technical Report #3

Table 2.8

ANNUAL FARE/OPERATING RATIO

Hartford West MIS

	Annual Operating *millions*	Annual Farebox *millions*	Fare-Cost Ratio
Base Case	$12.2	$4.5	37%
RAP 2 TSM	$15.8	$4.8	30%
RAP 4A-1 New Britain LRT	$122.3	$6.3	28%
RAP 4A-2 I-84 LRT	$21.0	$6.2	30%
RAP 4A-3 LRT - Farmington Ave.	$22.0	$5.8	26%
RAP 4B New Britain Commuter Rail	$21.04	$6.2	39%
RAP 4C-1 New Britain-Hartford Busway	$20.0	$6.6	33%
RAP 4C-2 I-84 Busway	$17.1	$5.7	33%
RAP 5 I-84 HOV Lane	$14.4	$4.5	31%

Source: Hartford West MIS Technical Report #3

Table 4.4
RECOMMENDED RAP PERFORMANCE MEASURES
Hartford West MIS

Performance Measure		2020 Base		Recommended Package			
	SYSTEM MEASURES	AM	PM	AM	Percent Change	PM	Percent Change
	Vehicle Trips (VT)	46,080	50,890	44,680	-3.0%	49,490	-2.8%
	VMT	196,910	189,200	191,320	-2.8%	181,570	-4.0%
	VHT	8,420	11,580	7,710	-8.4%	10,650	-8.0%
	Average Speed	23.4	16.3	24.8	6.0%	17.0	4.3
	ROUTE MEASURES						
Freeway Eastbound	VMT	56,120	42,030	56,100	0.0%	42,840	1.9%
	VHT	1,810	1,500	1,470	-18.8%	1,250	-16.7%
	Average Speed	31.0	28.0	38.2	23.2%	34.2	22.1%
Freeway Westbound	VMT	52,110	59,370	50,680	-2.7%	54,820	-7.7%
	VHT	1,060	1,410	1,020	-3.8%	1,120	-20.6%
	Average Speed	49.0	42.0	49.8	1.6%	48.8	16.2%
Freeway Total	VMT	108,230	101,400	106,780	-1.3%	97,660	-3.7%
	VHT	2,870	2,910	2,490	-13.2%	2,380	-18.2%
	Average Speed	37.7	34.0	42.9	13.8%	41.1	20.9%
Arterial	VMT	88,680	87,800	89,270	0.7%	87,270	-0.6%
	VHT	5,540	8,670	5,510	-0.5%	8,610	-0.7%
	Average Speed	16.0	10.1	16.2	1.3%	10.1	0.0%

Table 4.5
ARTERIAL ROUTE MILES BY V/C RATIO
Hartford West MIS

Volume / Capacity Ratio	2020 Base	Recommended	Change
	A.M. Peak Hour (Route Miles)		
0 to 0.50	20.95	22.95	2.00
0.50 to 0.75	22.27	23.10	0.83
0.75 to 1.00	19.01	19.15	0.14
>1.00	34.58	31.61	(2.97)
Total	96.81	96.82	—
	P.M. Peak Hour (Route Miles)		
0 to 0.50	10.65	13.75	3.10
0.50 to 0.75	20.20	21.65	1.45
0.75 to 1.00	19.57	21.31	1.74
>1.00	46.39	41.10	(5.29)
Total	96.81	96.81	—

1995	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	4,280	4,210	6,130	6,300	6,320	5,970	6,100	6,670	7,430	7,430
	Mainline LOS (Passenger Cars Per Lane Mile)	D (24.2)	D (28.8)	E (32.9)	E (43.1)	F (48.1)	F (46.2)	E (43.7)	E (43.9)	E (41.9)	E (35.6)
	Mainline Speed (Miles Per Hour)	51	49	48	45	44	43	47	46	44	47
2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	5,440	5,020	6,230*	6,360*	6,400*	6,140*	6,320*	6,810*	8,130	8,160
	Mainline LOS (Passenger Cars Per Mile Per Lane)	D (31.0)	E (32.6)	E (32.7)	F (46.2)	F (77.9)	F (79.8)	F (52.2)	F (59.5)	F (66.1)	F (68.0)
	Mainline Speed (Miles Per Hour)	48	50	49	46	27	26	40	29	25	27

WESTBOUND P.M. PEAK HOUR

1995	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	2,790	3,570	4,490	4,380	4,390	4,260	4,220	4,650	5,820	6,410
	Mainline LOS (Passenger Cars Per Lane Mile)	C (17.4)	C (17.1)	D (28.0)	D (27.2)	D (26.2)	D (27.7)	D (27.0)	E (43.0)	F (97.2)	F (90.3)
	Mainline Speed (Miles Per Hour)	53	52	51	51	51	50	51	26	10	15
2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	3,520	4,640	4,990	4,420	4,430	4,160*	4,060*	4,270*	5,970*	6,400*
	Mainline LOS (Passenger Cars Per Mile Per Lane)	C (22.5)	C (23.2)	D (31.1)	D (28.1)	D (25.7)	D (27.3)	F (62.5)	F (81.6)	F (113.5)	F (93.9)
	Mainline Speed (Miles Per Hour)	52	50	50	51	51	50	21	12	7	12

EASTBOUND P.M. PEAK HOUR

WSA

PERFORMANCE MEASURES — I-84

HARTFORD WEST MIS

FIGURE 1-4

1995	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	2,810	3,250	4,520	4,530	4,450	4,140	4,360	5,070	6,540	6,550
	Mainline LOS (Passenger Cars Per Lane Mile)	C (16.3)	C (21.3)	D (24.5)	D (26.5)	D (29.3)	D (27.4)	D (28.0)	D (28.8)	E (33.3)	E (43.6)
	Mainline Speed (Miles Per Hour)	53	51	50	50	51	50	51	50	48	44
2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	4,010	4,290	5,890	5,890	5,630	5,450	4,950	5,660	7,470	7,470
	Mainline LOS (Passenger Cars Per Mile Per Lane)	C (23.6)	D (29.0)	E (34.4)	E (38.0)	E (39.0)	E (42.8)	E (34.1)	E (32.8)	E (38.3)	F (57.9)
	Mainline Speed (Miles Per Hour)	51	49	48	47	48	42	48	49	45	39

WESTBOUND A.M. PEAK HOUR

1995	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	4,050	4,380	6,200	6,010	6,000	6,320	6,320	6,820	7,170	7,170
	Mainline LOS (Passenger Cars Per Lane Mile)	D (21.4)	C (22.1)	(41.6)	E (40.8)	E (38.9)	E (41.8)	F (53.9)	F (53.5)	F (70.9)	E (39.5)
	Mainline Speed (Miles Per Hour) From Model	52	50	47	48	49	43	39	32	24	47
2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	5,560	4,850	6,600	6,140*	6,140*	5,710*	5,810*	6,590*	7,440	7,410
	Mainline LOS (Passenger Cars Per Mile Per Lane)	F (53.7)	F (76.7)	F (88.2)	E (40.6)	E (43.0)	F (58.0)	F (85.0)	F (74.3)	F (86.0)	F (67.1)
	Mainline Speed (Miles Per Hour)	30	17	18	48	40	22	20	22	19	28

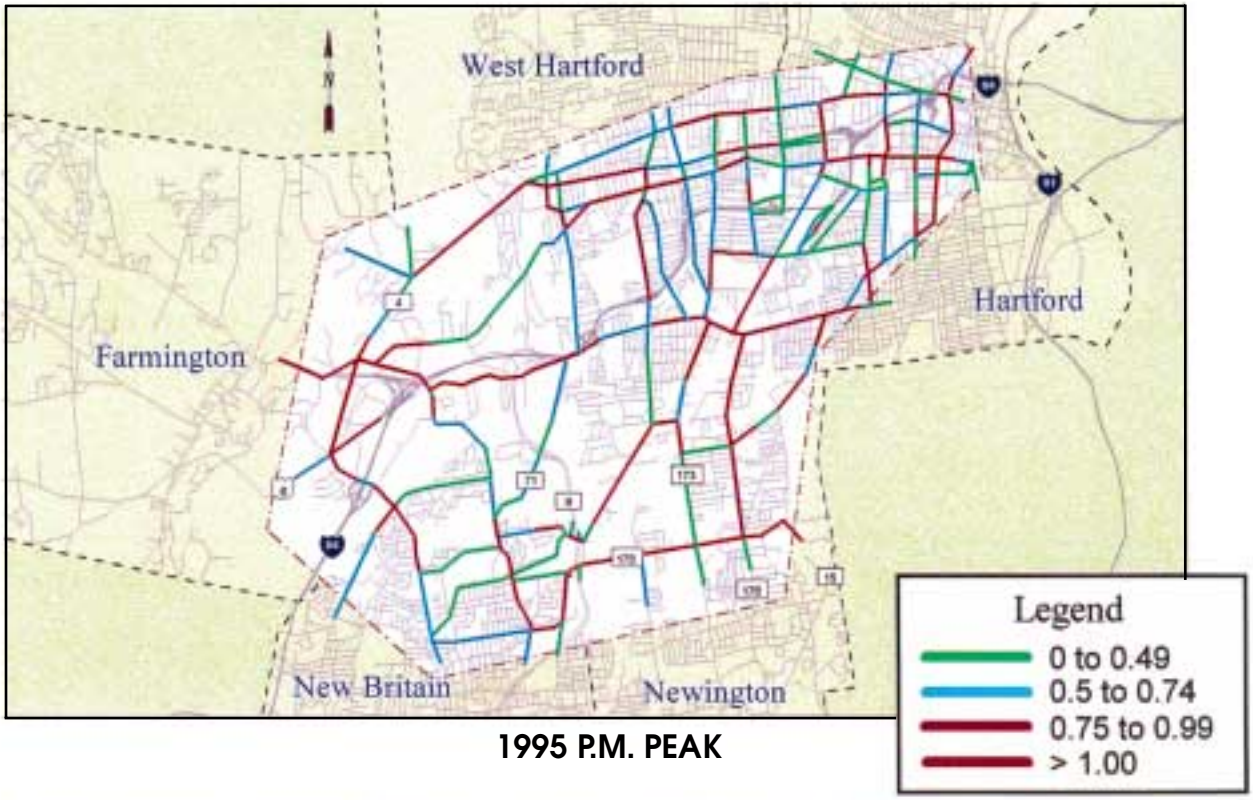
EASTBOUND A.M. PEAK HOUR

WSA

PERFORMANCE MEASURES — I-84

HARTFORD WEST MIS

FIGURE 1-5



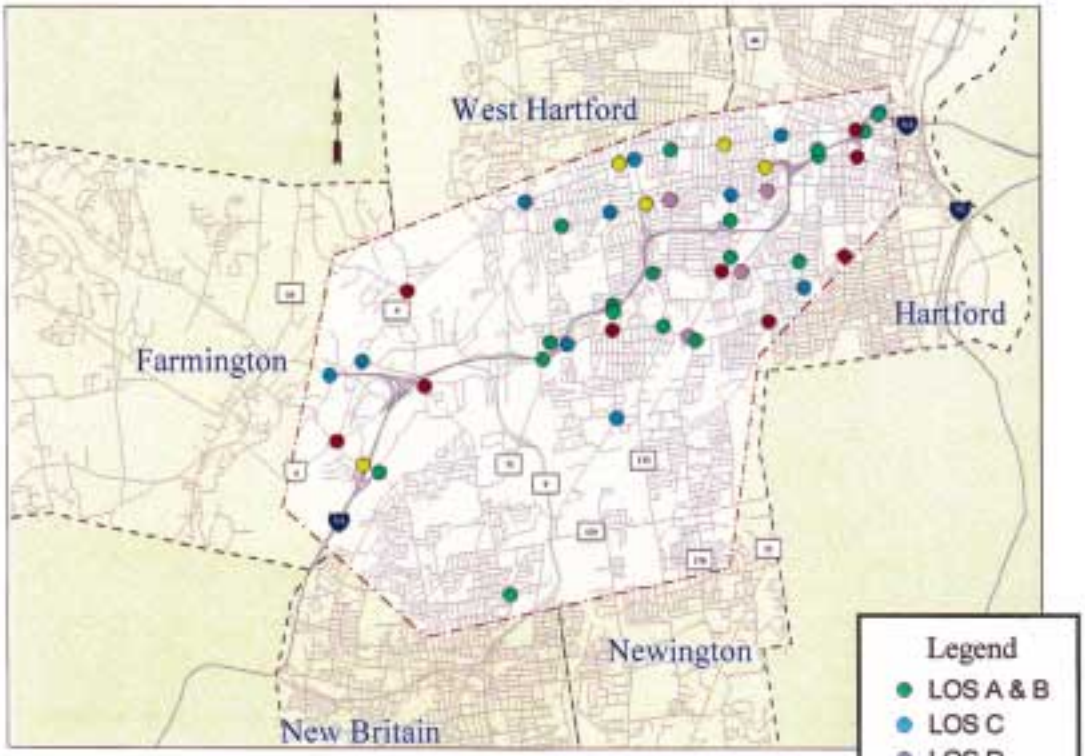
1995 P.M. PEAK

2020 P.M. PEAK

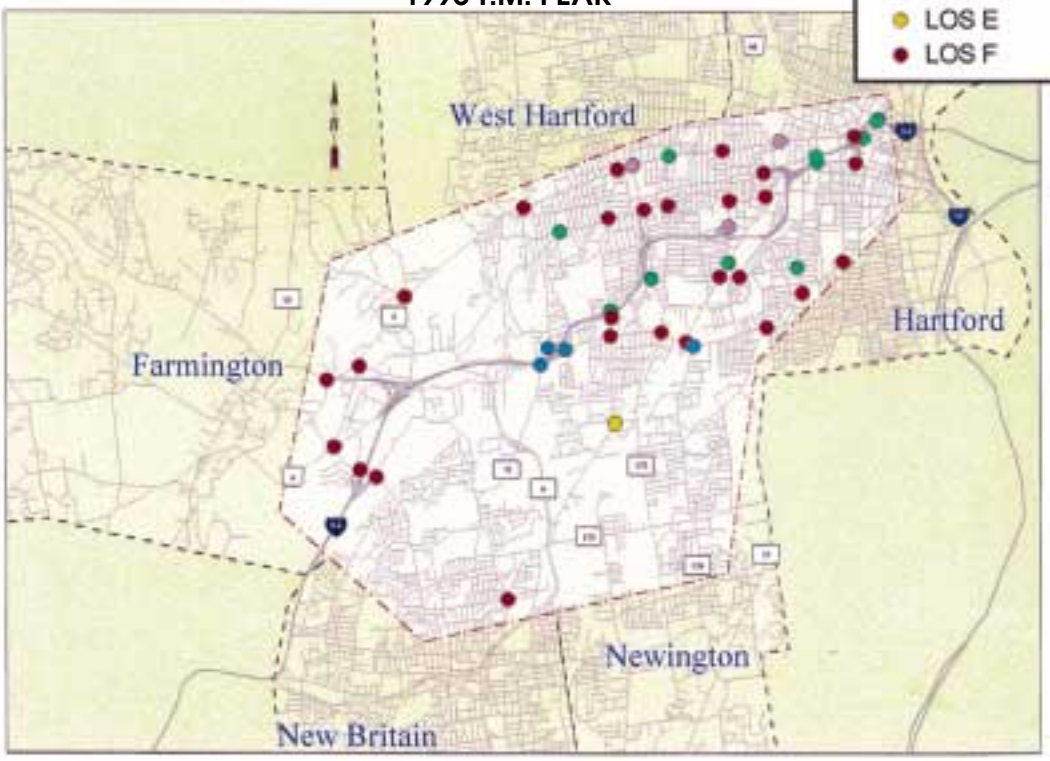
VOLUME TO CAPACITY RATIO ON ARTERIAL NETWORK

HARTFORD WEST MIS

FIGURE 1-6



1995 P.M. PEAK

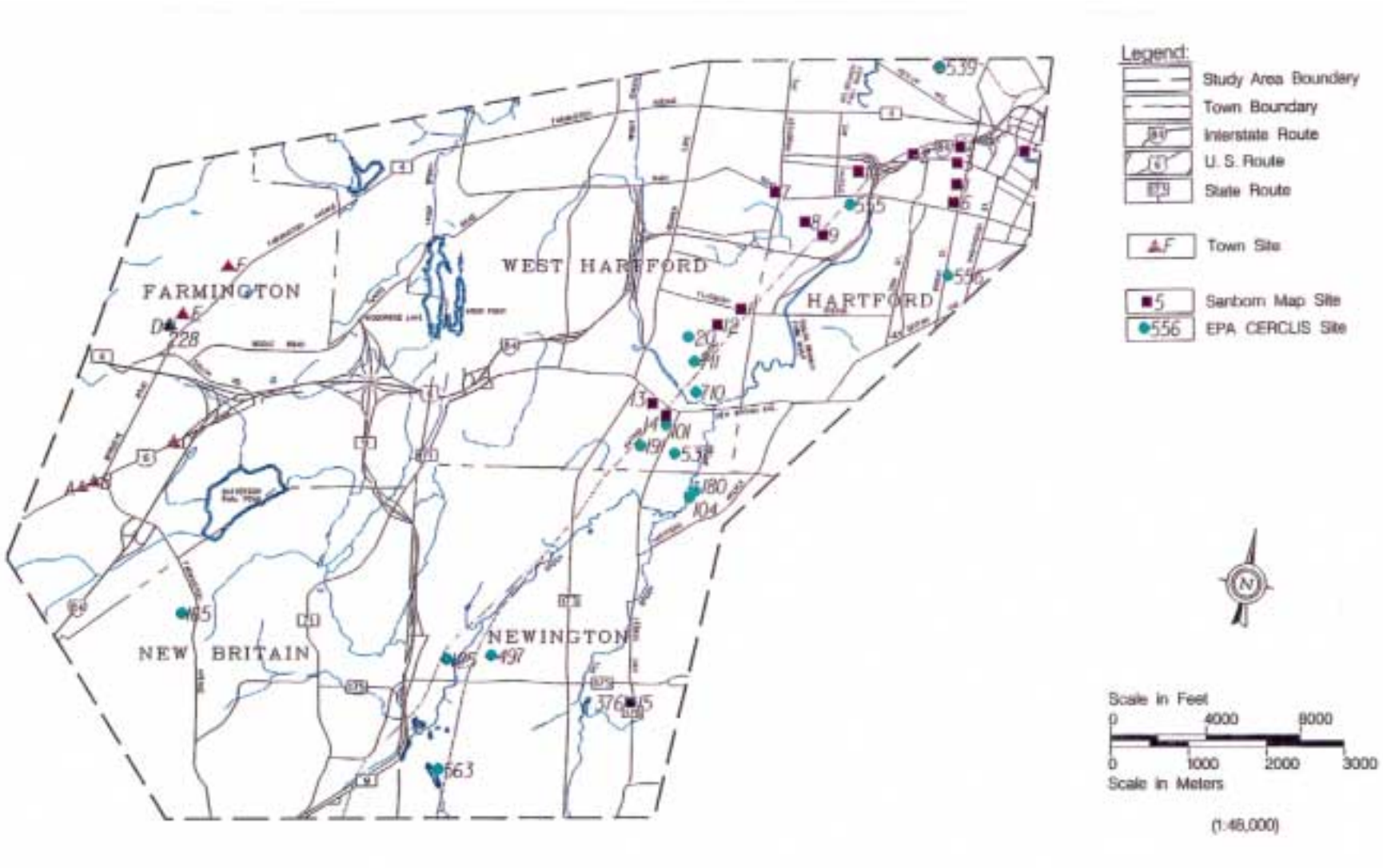


2020 P.M. PEAK

INTERSECTION LEVELS OF SERVICE (LOS)

HARTFORD WEST MIS

FIGURE 1-7

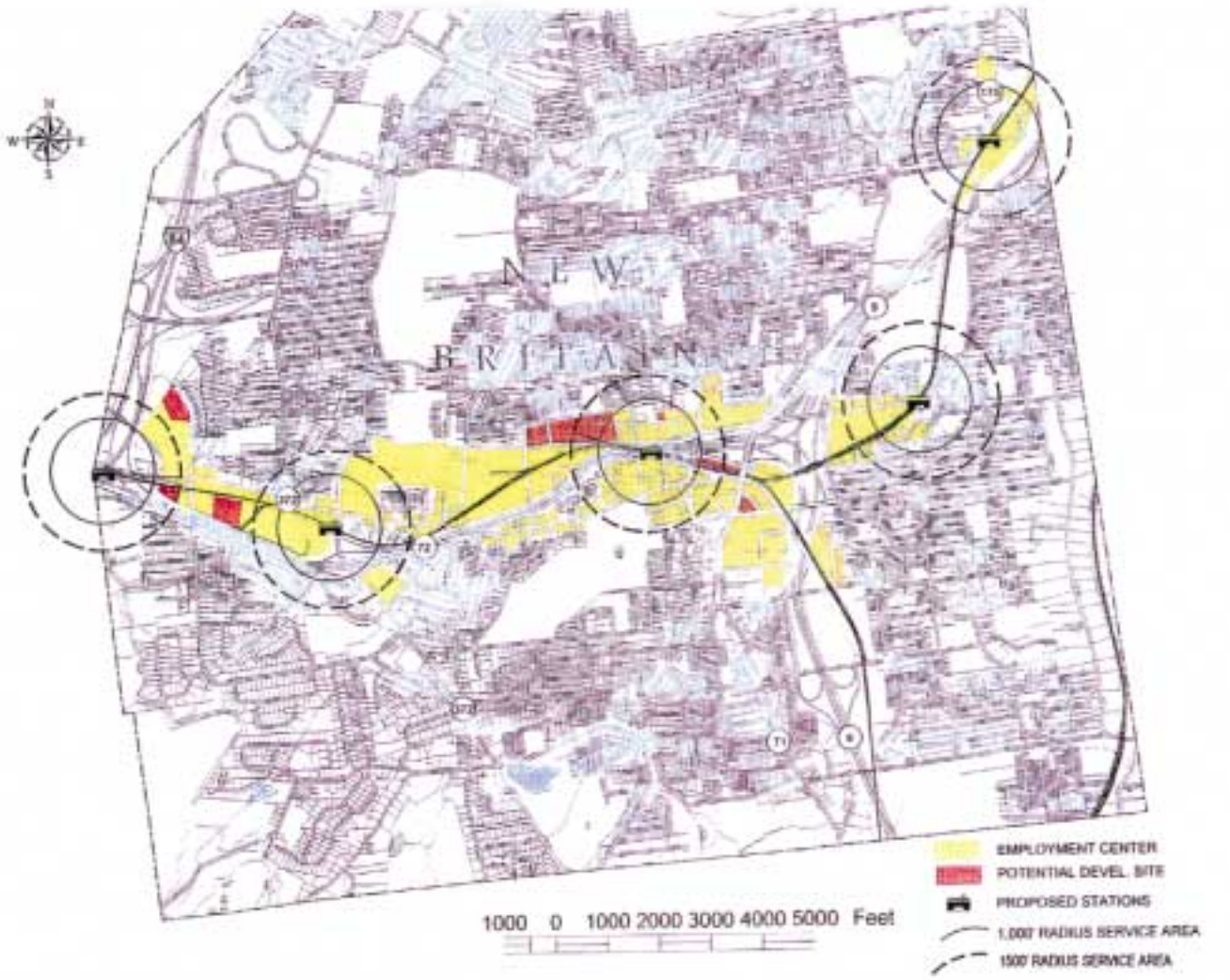


Source: Hartford West Technical Report #2

ENVIRONMENTAL RISK SITES

HARTFORD WEST MIS

FIGURE 3-1

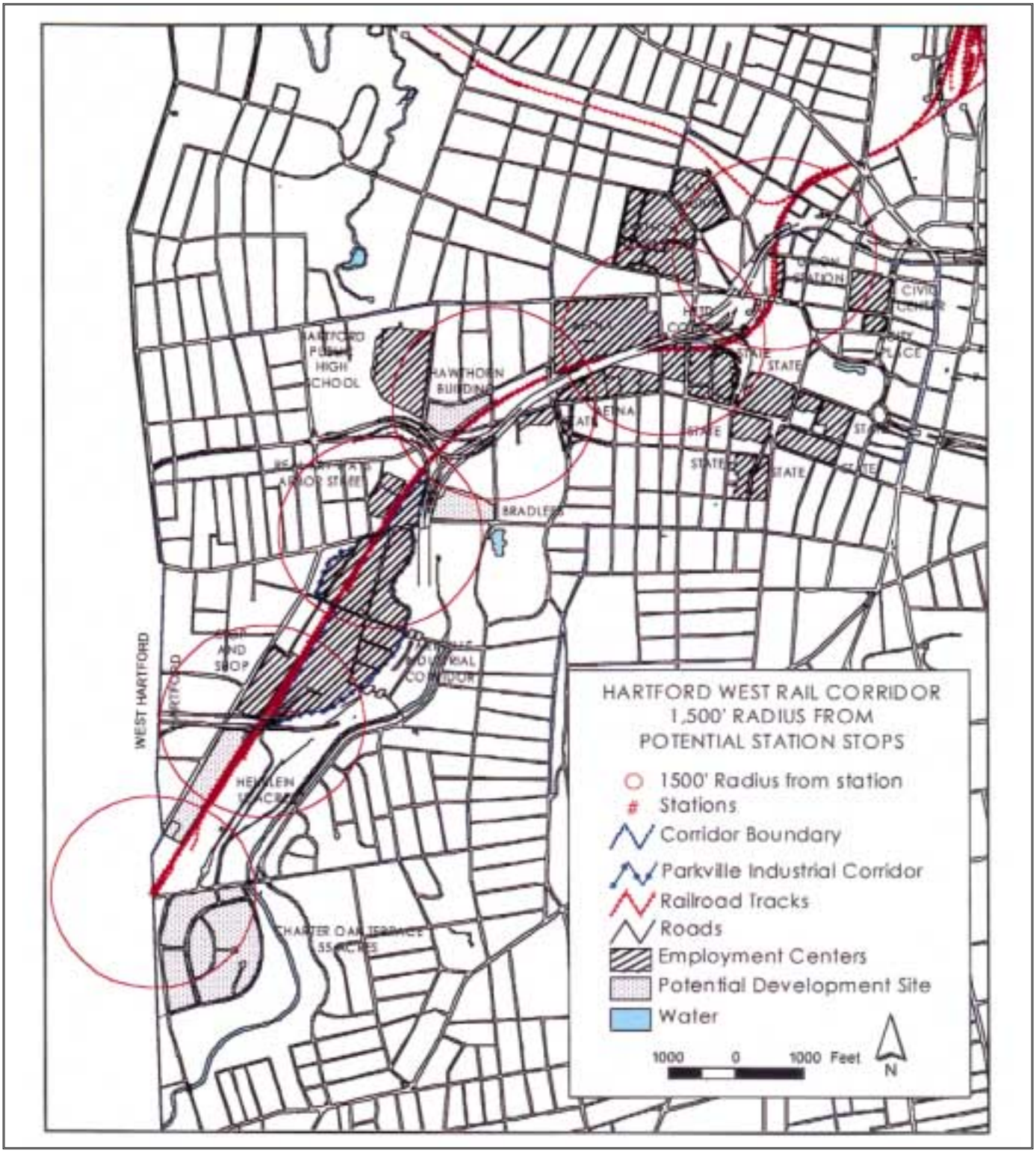


Source: Central Connecticut Regional Planning Agency

SECONDARY ECONOMIC IMPACTS - NEW BRITAIN

HARTFORD WEST MIS

FIGURE 3-2

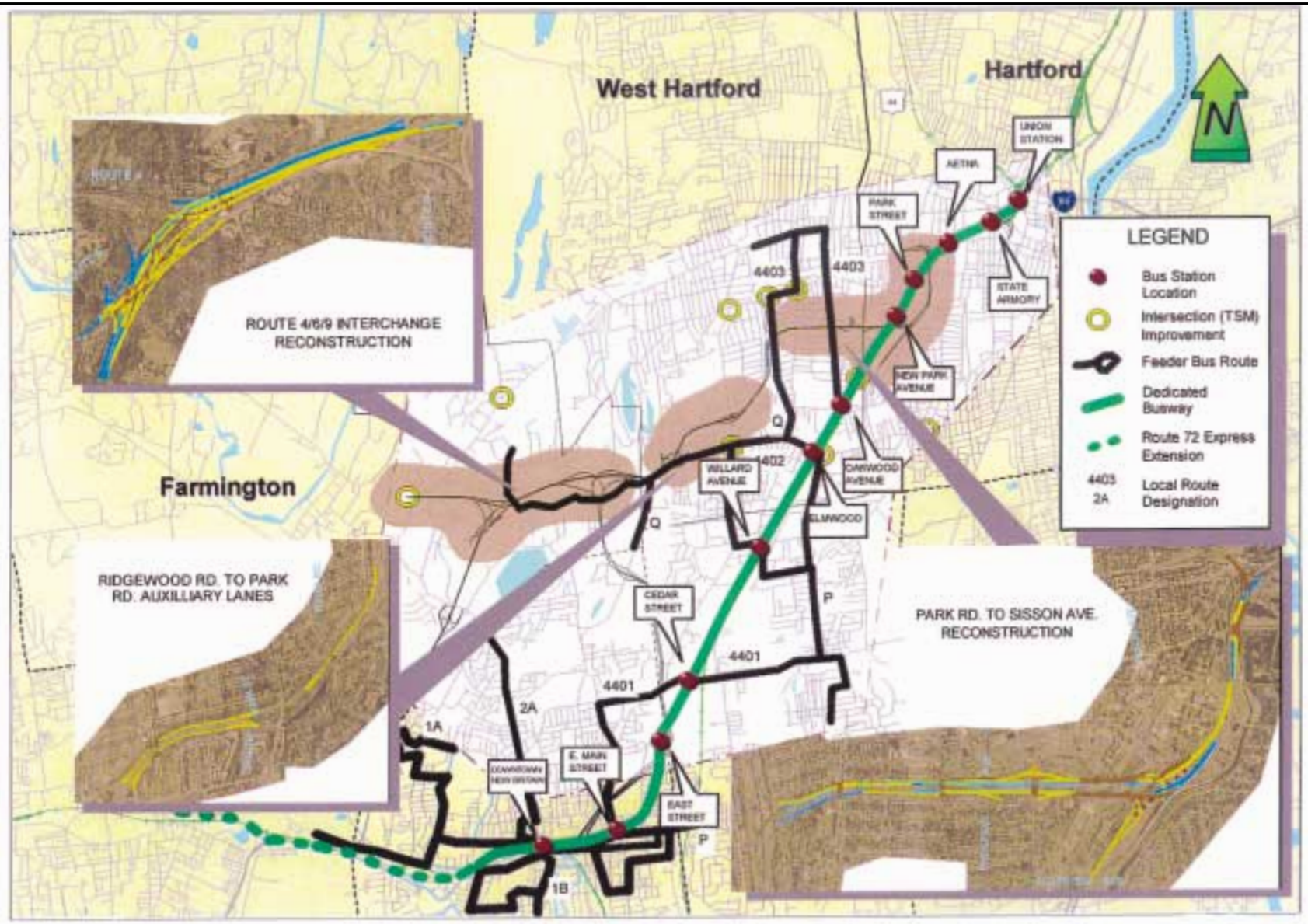


Source: City of Hartford Planning Division

SECONDARY ECONOMIC IMPACTS - HARTFORD

HARTFORD WEST MIS

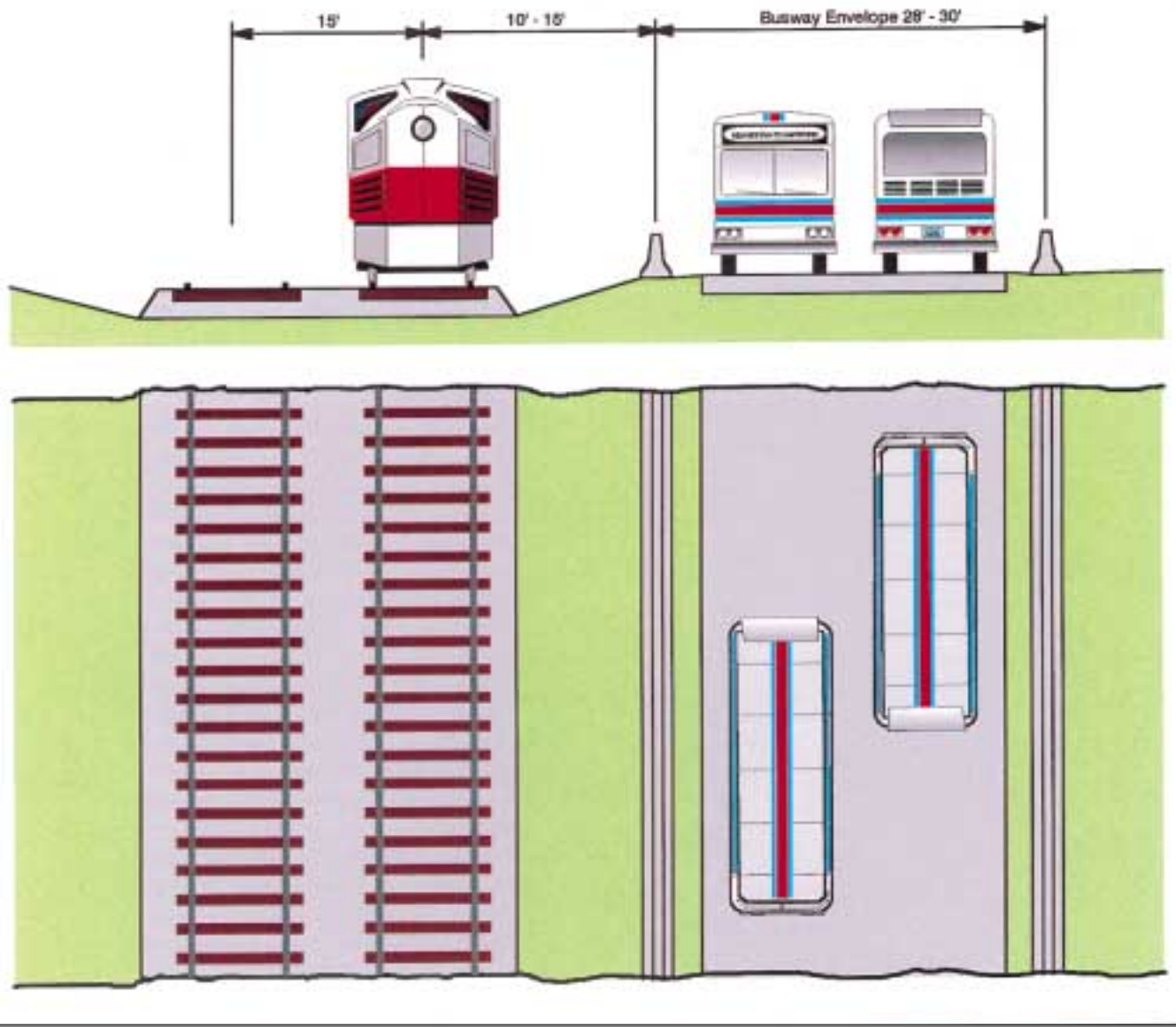
FIGURE 3-3



RECOMMENDED PACKAGE OF IMPROVEMENTS

HARTFORD WEST MIS

FIGURE 4-1



TYPICAL CROSS SECTION FOR BUSWAY HARTFORD TO NEWINGTON JUNCTION

HARTFORD WEST MIS

FIGURE 4-2

BASE 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	5,560	4,850	6,600	6,140*	6,140*	5,710*	5,810*	6,590*	7,440	7,410
	Mainline LOS (Passenger Cars Per Lane Mile)	F (53.7)	F (76.7)	F (88.2)	E (40.6)	E (43.0)	F (58.0)	F (85.0)	F (74.3)	F (86.0)	F (67.1)
	Mainline Speed (Miles Per Hour)	30	17	18	48	40	22	20	22	19	28
RECOMMENDED 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	5,560	5,730	6,890	6,500	6,490	6,260	5,400	6,710	7,260	7,230
	Mainline LOS (Passenger Cars Per Mile Per Lane)	E (34.7)	E (32.2)	E (38.3)	E (45.3)	E (39.1)	F (48.6)	F (61.8)	F (67.0)	F (81.0)	F (68.2)
	Mainline Speed (Miles Per Hour)	49	50	45	46	45	32	28	25	20	24

A.M. PEAK HOUR

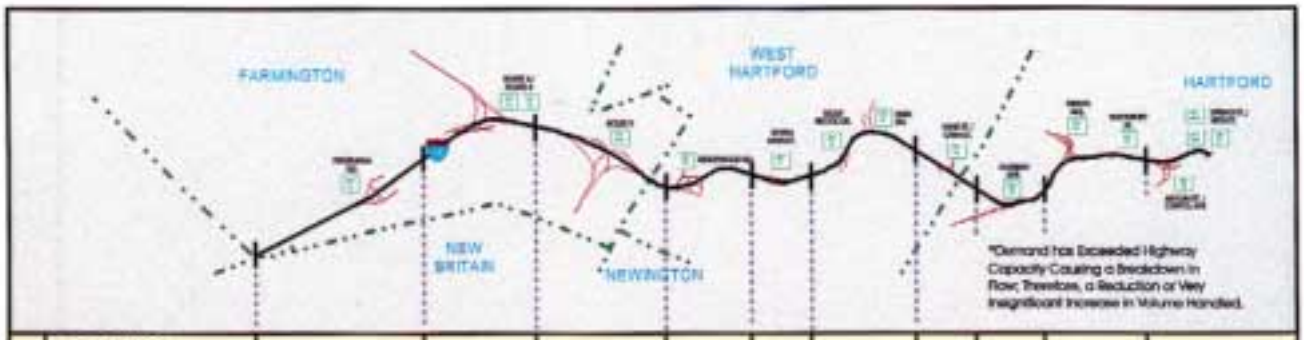
BASE 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	3,530	4,640	4,990	4,420	4,430	4,160*	4,060*	4,270	5,970*	6,400*
	Mainline LOS (Passenger Cars Per Lane Mile)	C (22.5)	C (23.2)	D (31.1)	D (28.1)	D (25.7)	D (27.3)	F (62.5)	F (81.6)	F (113.5)	F (93.9)
	Mainline Speed (Miles Per Hour) From Model	52	50	50	51	51	50	21	12	7	12
RECOMMENDED 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	3,570	4,340	5,220	4,760	4,760	4,640	3,900*	5,700*	5,880*	6,520
	Mainline LOS (Passenger Cars Per Mile Per Lane)	C (23.6)	C (23.5)	D (28.1)	D (30.6)	D (29.1)	D (30.7)	D (24.9)	E (34.3)	F (110.3)	F (88.0)
	Mainline Speed (Miles Per Hour)	52	50	50	50	50	50	52	37	7	14

P.M. PEAK HOUR

PERFORMANCE MEASURES - 1-84 EASTBOUND

HARTFORD WEST MIS

FIGURE 4-3



BASE 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	4,010	4,290	5,890	5,890	5,630	5,450	4,950*	5,660	7,440	7,470
	Mainline LOS (Passenger Cars Per Lane Mile)	C (23.6)	D (29.0)	E (34.4)	E (38.0)	E (39.0)	E (42.8)	E (34.1)	E (32.8)	F (86.0)	F (57.9)
	Mainline Speed (Miles Per Hour)	51	49	48	47	45	42	48	49	19	39
RECOMMENDED 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	3,360	4,080	5,700	5,710	5,280	5,110	4,560*	5,580	7,260	7,280
	Mainline LOS (Passenger Cars Per Mile Per Lane)	C (17.1)	C (22.1)	D (32.7)	E (36.5)	D (31.3)	D (27.0)	D (25.2)	D (24.8)	F (81.0)	F (52.5)
	Mainline Speed (Miles Per Hour)	52	50	48	49	49	50	50	51	45	42

A.M. PEAK HOUR

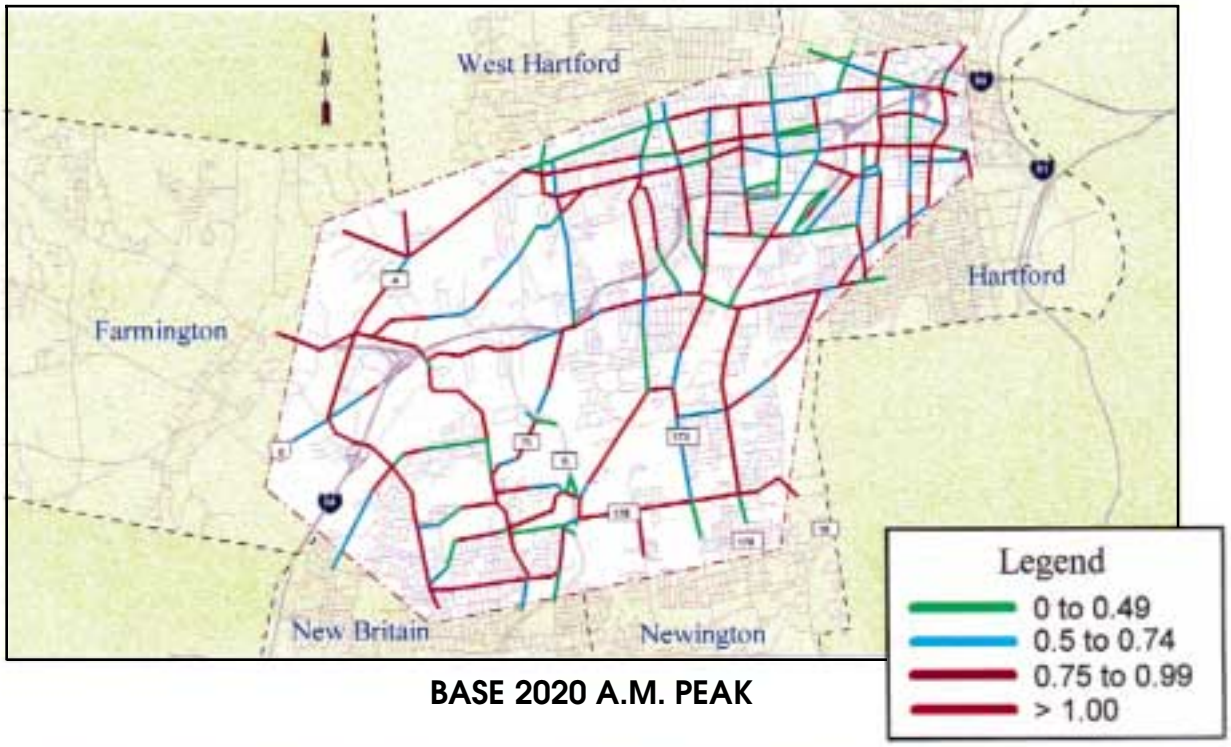
BASE 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	5,440	5,020	6,230*	6,360*	6,400*	6,140*	6,320*	6,810*	8,130	8,160
	Mainline LOS (Passenger Cars Per Lane Mile)	D (31.0)	E (32.6)	E (32.7)	F (46.2)	F (77.9)	F (79.8)	F (52.2)	F (59.5)	F (66.1)	F (68.0)
	Mainline Speed (Miles Per Hour) From Model	48	50	49	46	27	26	40	29	25	27
RECOMMENDED 2020	Simulated Model Mainline Volumes (Passenger Cars Per Hour)	4,780	4,540	5,670*	6,310	6,330	6,120	5,900*	6,580*	7,760	7,760
	Mainline LOS (Passenger Cars Per Mile Per Lane)	C (22.9)	C (21.6)	D (28.2)	D (36.0)	E (37.2)	E (36.3)	E (32.8)	D (31.8)	F (67.8)	F (61.7)
	Mainline Speed (Miles Per Hour)	51	51	49	49	49	47	48	50	23	25

P.M. PEAK HOUR

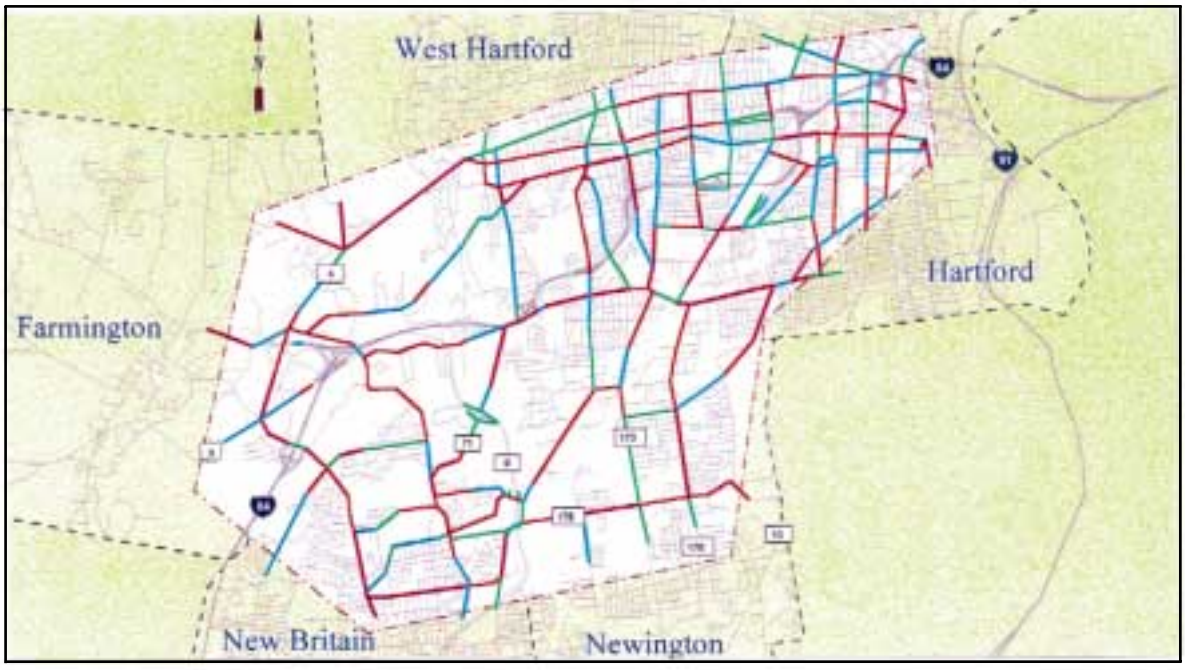
PERFORMANCE MEASURES - I-84 WESTBOUND

HARTFORD WEST MIS

FIGURE 4-4



BASE 2020 A.M. PEAK

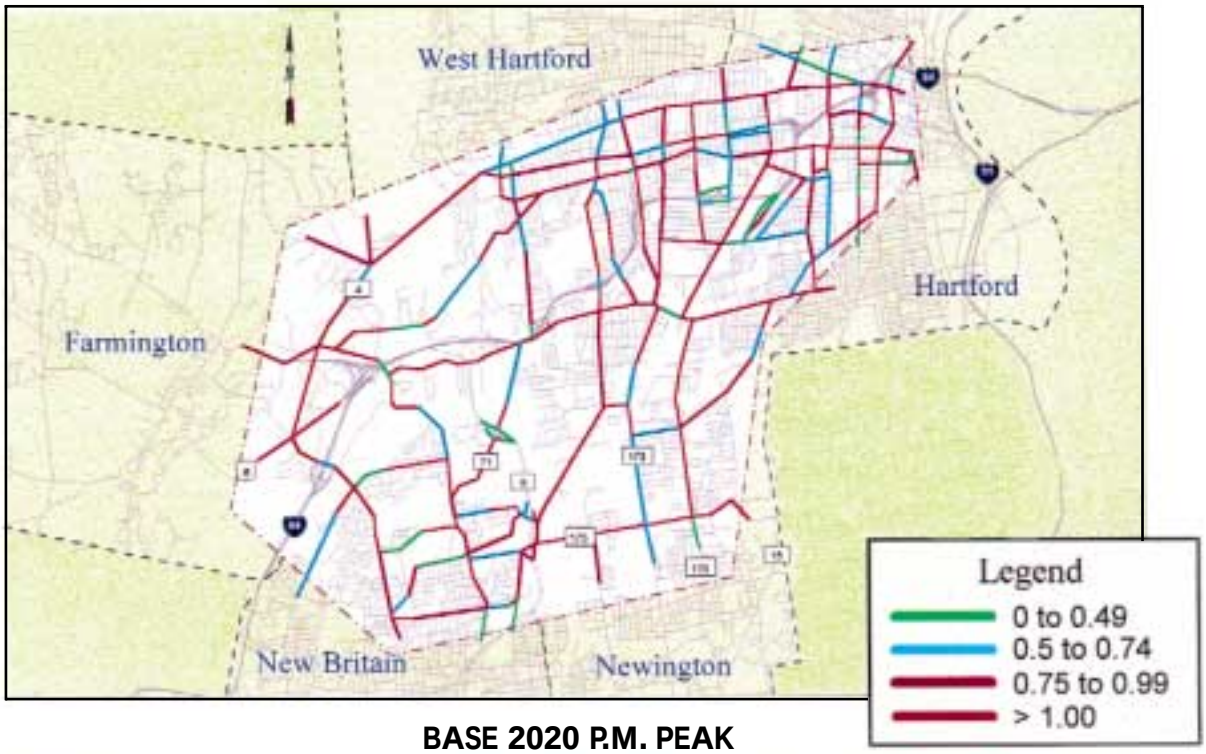


RECOMMENDED RAP A.M. PEAK

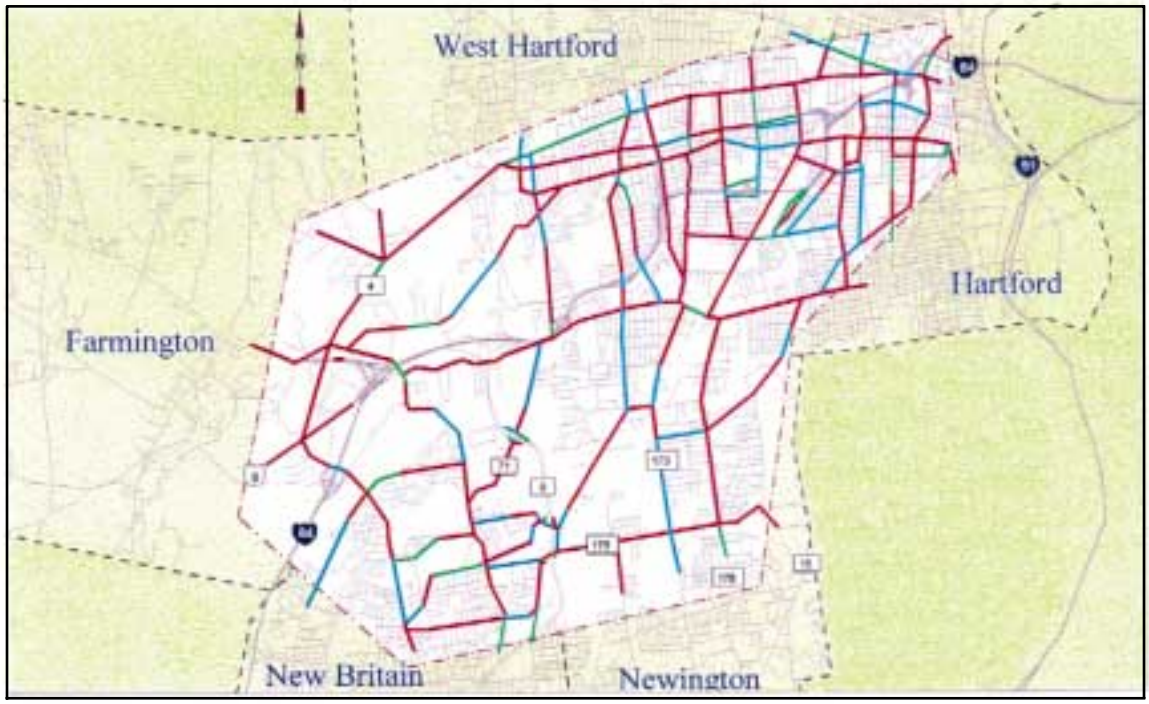
VOLUME TO CAPACITY RATIO ON ARTERIAL NETWORK

HARTFORD WEST MIS

FIGURE 4-5



BASE 2020 P.M. PEAK



RECOMMENDED RAP P.M. PEAK

VOLUME TO CAPACITY RATIO ON ARTERIAL NETWORK

HARTFORD WEST MIS

FIGURE 4-6