



# Chapter 6

## Operating Plan Costs and Performance Measures

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Using the service plan outlined in Chapter 4, the following chapter describes the operating plan, including capital costs, operating costs, fares and revenues. The estimated capital cost for the start-up service, described in more detail in Section 6.1 is \$296.3 million. The estimated operating cost for the start-up rail service, described in more detail in Section 6.2, is \$10,079,000. The estimated revenue for the start-up rail service, described in more detail in Section 6.4, is \$1,117,600. The annual deficit from the operation of the start-up rail service would be \$8,960,400.

### **6.1 Capital Costs**

Capital costs for the Recommended Action consist of five rail-related components: train set equipment (locomotives and cars), a maintenance facility for the equipment, parking and station costs, cost to double track portions of the line, and bridge costs.

#### **6.1.1 Train Set Equipment**

For New Haven-Hartford-Springfield service, there are two types of anticipated train set equipment. One would consist of conventional commuter rail equipment, i.e. a locomotive and three passenger cars. The other would consist of a set of three self-propelled rail cars (Diesel Multiple Units, or DMUs). The specific equipment required is discussed in this section, along with estimated costs using conventional equipment. Specifics of potential equipment, including both conventional equipment and DMU are discussed in Chapter 8.

The amount of equipment necessary for service on the line differs under two possible scenarios. In the first scenario, Amtrak and ConnDOT would maintain separate equipment pools. In the second, there would be a single combined equipment pool used for all trains. The Amtrak Vermonter (train 55 and 56) and the through train to and from Washington (train 141 and 148) are not included in these equipment turns, since they use equipment from a different pool. With separate pools, ConnDOT would need a minimum of 6 sets plus 2 spare sets, and Amtrak would need 3 sets plus a spare set, for a total of 11



equipment sets. With a combined pool, 8 sets plus two spares, or a total of 10 sets, would be required. The equipment turns with separate Amtrak and ConnDOT services would be as shown in Table 6-1.

**Table 6-1  
Train Set Equipment Needs**

Scenario 1	Scenario 2
<p><b>ConnDOT</b> SPG-1-8-13-NHV SPG-3-10-15-NHV SPG-5-12-SPG NHV-2-7-14-SPG NHV-4-9-16-SPG NHV-6-11-NHV = 6 sets total for ConnDOT</p> <p><b>Amtrak</b> SPG-495-470-437-476-SPG SPG-471-474-475-494-SPG NHV-490-493-486-477-NHV = 3 sets total for Amtrak shuttles</p>	<p><b>Combined</b> SPG-1-8-9-14-SPG SPG-3-490-475-16-SPG SPG-5-470-11-494-SPG SPG-495-474-13-NHV SPG-7-10-15-NHV NHV-2-471-486-477-NHV NHV-4-493-12-SPG NHV-6-437-476-SPG = 8 sets total for common pool</p>
9 sets equipment	8 sets of equipment
3 spare sets (2 ConnDOT, 1 Amtrak)	2 spare sets for total service
12 sets of equipment	10 sets of equipment

Under the combined plan, Amtrak or CDOT could own all the equipment, with the non-owner paying a "usage fee" as an operating cost in lieu of ownership. It would also work if each entity owned some of the equipment, with usage charges being worked out as a contractual matter between the parties. In California's Surfliner corridor, for example, Amtrak owns some cars and Caltrans owns others. They are operated interchangeably in a single unified service in which Amtrak supports 40% of the net cost and Caltrans supports 60%. A common equipment pool would enable any equipment to be used on any schedule and would be more flexible from an operating standpoint, in addition to requiring less equipment in total.

For this analysis, it is assumed that ConnDOT would require a minimum of 6 train sets, plus two spare locomotives, trailer coaches and cab coaches. Costs for the train sets required, assuming conventional commuter rail equipment, i.e. a locomotive and three passenger cars are used in this analysis. Specifics of potential equipment sources are discussed in Chapter 8.

**Locomotives** - An appropriate locomotive type for the New Haven-Hartford-Springfield service would be a diesel electric locomotive used in commuter rail service today. One locomotive can typically haul five or six commuter cars, but in the Recommended Action, it would only haul three. The estimated costs of a locomotive come in a range of



about \$2.8 million for a basic “no frills” passenger locomotive<sup>7</sup> to about \$4.5 million for a high-end AC power locomotive<sup>8</sup>. Delivery costs would be a negligible percentage of the purchase price.

*Cars* - Assuming the traditional train sets, the New Haven-Hartford-Springfield service would use two car types: a cab car and a trailer car or coach. The cab car has an engineer’s compartment, which the coach does not. Cab cars are used in a “push pull” configuration. With a cab car on the opposite end of the train from the locomotive, the train set can be operated in either direction, obviating the need to reposition the locomotive from front to back. An average cost of \$1.37 million is assumed for a coach car and \$1.87 million is assumed for a cab car.<sup>9</sup> Delivery costs would be a negligible percentage of the purchase price.

Table 6-2 below presents the two rolling stock options and their likely costs. A cost for two spare sets is included.

**Table 6-2**  
**Minimum Rolling Stock Summary**

Type	Number	Spares	Total Units	Unit Cost	Total Cost
Locomotives	6	2	8	\$4,500,000	\$36,000,000
Coaches	12	2	14	\$1,370,000	\$19,180,000
Cab cars	6	2	8	\$1,870,000	\$14,960,000
<b>Total</b>					<b>\$70,140,000</b>

Source: Wilbur Smith Associates per sources described in text

### 6.1.2 Maintenance Facility / Storage

The cost for the maintenance facility described in Chapter 4 would be approximately \$13 million, inclusive of engineering and construction, but not including land acquisition or environmental clean-up. Land requirements would be in the range of 12 acres, estimated at about \$8 million, including an allowance of \$4 million for property purchase and \$4 million for environmental clean-up that may be required due to the necessary location along the rail right-of-way. Purchase of a site would require assumption of environmental issues on the site, the extent of which would be addressed further in the Environmental Assessment phase of this project, once a specific site is identified. Therefore the total cost would be approximately \$21 million, including only an allowance for environmental costs. The costs for a maintenance facility are broken down in Table 6-3.

<sup>7</sup> Per conversation with Preston Cook of Engine Systems Inc. (ESI), distributor for EMD.

<sup>8</sup> Per conversation with Peter Richter of the Connecticut Department of Transportation.

<sup>9</sup> Per Connecticut Department of Transportation study entitled *New Haven Line Fleet Configuration Analysis*, Task 5: Lifecycle Cost Analysis, page 102.



**Table 6-3  
Maintenance Facility Costs**

Item	Quantity	Cost per unit	Cost
Building (complete) [1]	125,000 sq ft	\$25 / sq ft	\$3,125,000
Excavation	52,000 cub yd	\$10 / cub yd	\$520,000
Pavement	6200 tons	\$50 / ton	\$310,000
Fencing	1636 ft	\$20 / ft	\$33,000
Subballast	9534 sq yd	\$10 / sq yd	\$96,000
Trackwork	4400 ft	\$150 / ft	\$660,000
Switches	8	\$215,000 each	\$1,720,000
Shop Machinery			\$250,000
Generator			\$8,000
<b>Subtotal</b>			<b>\$6,722,000</b>
Electrical (20%)			\$1,345,000
Minor Items / Contingency (30%)			\$2,017,000
<b>Subtotal</b>			<b>\$10,084,000</b>
Engineering (15%)			\$1,311,000
Construction (15%)			\$1,311,000
Fueling Facility			\$50,000
Washing Facility			\$100,000
Property Maintenance Equipment			\$40,000
Land Acquisition with Cleanup Allowance	12 acres	\$650,000 / acre	\$7,800,000
<b>TOTAL</b>			<b>\$20,696,000</b>

Notes:

Building is pre-fabricated structure with a typical footing design, has basic finished interior, wide enough for three tracks, utilities supplied by local comp. Pavement is standard asphalt mix, access rd is 300 ft long and 24 ft wide. Area inside fence and outside of building is asphalt, fencing is chain link. Trackwork price includes rail, ties, ballast and other track materials. Switches are power operated. Land Acquisition based average unit price for ROW acquisition, including an allowance for environmental clean-up likely associated with a site. Assume site soils are suitable for building and track construction. Property Maintenance Equipment will be leased or subcontracted.



### **6.1.3 Station Costs**

For the Recommended Action, the stations are envisioned to be slightly less substantial than the Maximum Build Scenario, but would still have covered platforms in both directions, bridge walkways over the tracks, and parking as required by ridership. The following costs include these items broken down into categories for each existing and new station. Plan-level drawings of each of the stations are presented in Chapter 4. The total station area costs, including parking and stations are shown in Table 6-4. The total start-up service station cost is anticipated to be \$81 million.

*Parking and Site Work Costs* – Parking costs include surface parking or parking garage construction with applicable site work. Costs were estimated based on advisement from ConnDOT at \$5,000 per parking space for surface parking and \$15,000 per space for parking garage construction, based on previous experience with similar projects. No additional parking is anticipated at this time for New Haven Union Station, New Haven State Street Station or Hartford Union Station.

For Hartford Union Station, \$2,000,000 has been included for construction of a covered walkway from Union Station to the back entrance of the Legislative Office Building Parking Garage with related lighting and landscaping.

Springfield Union Station costs were provided by the Pioneer Valley Planning Commission to account for improvement not currently planned with the renovations taking place at the station. They include an estimated 130 parking spaces dedicated to commuter rail to be provided in one of the planned Union Station garages at an estimated cost of \$18,500 per space.

*Platform and Amenities Costs* – Costs include 200 foot by 10 foot platforms, 100 foot by 10 foot canopies, elevators, stair towers and pedestrian bridges as shown on site plans. The estimated cost for each platform is \$1,375,000. The estimated cost for the elevators, stair towers and pedestrian bridge is \$2,750,000.

North Haven, Meriden, Newington, Windsor and Enfield Stations include costs for two platforms, two canopies, elevators, stair towers and pedestrian bridges. Wallingford, Berlin and Windsor Locks Stations will only require single track for the start-up service proposed for the Recommended Action, therefore costs include only one 200 foot by 10 foot platform and one 100 foot by 10 foot canopy. No station costs were included for New Haven Union Station.

The use of the State Street station requires Springfield line trains to use different tracks into the New Haven station than current operations allow. An allowance of \$4,000,000 for platform improvements is estimated based on the contractor bids for the current Shore Line East station construction. This study did not include a detailed analysis of track occupancy and train movements at New Haven.

**Table 6-4  
Station Area Costs**

	New Parking Spaces	Surface Parking and Site Work	Parking Garage and Site Work	Platform and Amenities	Survey, Design, Construction Services [1]	Right-of-way Acquisitions	Estimated Total Site Development Costs [2]
New Haven State Street	--	--	--	\$4,000,000	\$1,040,000	--	\$5,040,000
North Haven	205	\$1,025,000	--	\$5,500,000	\$1,700,000	--	\$8,225,000
Wallingford [3]	200	\$1,000,000	--	\$1,375,000	\$620,000	\$840,000	\$3,835,000
Meriden	200	\$1,000,000	--	\$5,500,000	\$1,690,000	\$846,000	\$9,036,000
Berlin (Alternative A)	147	\$735,000	--	\$1,375,000	\$550,000	\$390,000	\$3,050,000
Newington	200	\$1,000,000	--	\$5,500,000	\$1,690,000	\$675,000	\$8,865,000
Hartford	--	\$2,000,000 [4]	--	\$2,000,000	\$1,040,000	--	\$5,040,000
Windsor	266	--	\$3,990,000	\$5,500,000	\$2,470,000	\$417,000	\$12,377,000
Windsor Locks	125	\$625,000	--	\$4,250,000	\$1,270,000	--	\$6,145,000
Enfield (Alternative B)	117	\$585,000	--	\$5,500,000	\$1,590,000	\$453,000	\$8,128,000
Springfield [5]	130	--	\$2,405,000	\$6,500,000	\$2,320,000	--	\$11,225,000
<b>Start-up Service Totals [6]</b>	<b>1,590</b>	<b>\$7,970,000</b>	<b>\$6,395,000</b>	<b>\$47,000,000</b>	<b>\$15,980,000</b>	<b>\$3,621,000</b>	<b>\$80,966,000</b>
Wharton Brook Station	112	\$560,000	--	\$5,500,000	\$1,580,000	\$720,000	\$8,360,000
Wallingford Second Platform and Ped Crossing	--	--	--	\$4,125,000	\$1,080,000	--	\$5,205,000
Meriden Parking Garage	200	--	\$3,000,000	--	\$780,000	--	\$3,780,000
Berlin Second Platform and Pedestrian Crossing	--	--	--	\$4,125,000	\$1,080,000	--	\$5,205,000
Windsor Locks Second Platform and Ped Crossing	--	--	--	\$2,750,000	\$720,000	--	\$3,470,000
<b>Additional Full-build Items Totals [6]</b>	<b>312</b>	<b>\$560,000</b>	<b>\$3,000,000</b>	<b>\$16,500,000</b>	<b>\$5,240,000</b>	<b>\$720,000</b>	<b>\$26,020,000</b>
<b>Total [6]</b>	<b>1,902</b>	<b>\$8,530,000</b>	<b>\$9,395,000</b>	<b>\$63,500,000</b>	<b>\$21,220,000</b>	<b>\$4,341,000</b>	<b>\$106,986,000</b>

Notes: [1] Reflect survey (3%), design (10%), construction staking (1%), and construction admin (12%) of parking and station costs. [2] Does not include costs for public involvement, site plan approvals; hazardous materials studies or remediation; environmental studies or mitigation; geotechnical studies, regulatory permitting, project financing, property appraisals, relocations, program administration costs, or other costs not explicitly included. [3] Costs based on an ideal number of parking spaces constructed and not on site plans shown. [4] Cost for walkway. [5] Costs obtained from PVPC. [6] All costs are in 2004 dollars.



For Hartford Union Station, a cost of \$2,000,000 has been included for conversion of one section of the existing platform to a high level platform with canopy and other related station area improvements.

Springfield Union Station costs were provided by the Pioneer Valley Planning Commission to account for improvement not currently planned with the renovations taking place at the station. Springfield station related costs are expected to be \$6,500,000 for four elevators, four stair towers, related tunnel work, platforms, canopies, station related signage and station related lighting.

*Right-of-way Acquisitions Costs* - Costs for right-of-way acquisitions are estimated based on concept-level determinations of property acquisition needs. A unit cost of \$300,000 per acre has been used based on information provided by ConnDOT and a limited internet-based review of commercial property values. Parcel limits estimated based on a review of aerial photography.

*Full-build Station Costs* – In addition to the start-up service Recommended Action costs, Table 6-4 lists additional costs that would be incurred with the future double-tracking of the entire Springfield line, as outlined in Chapter 4 for a full-build. An additional station at Wharton Brook, anticipated with the development of the Pratt and Whitney property in North Haven is estimated at \$8.36 million. Second platforms and overhead pedestrian crossings that would be required in Wallingford, Berlin and Windsor Locks with the addition of double track are estimated at \$5.2 million for Wallingford and Berlin and \$3.47 million for Windsor Locks, where the elevators and stairways are already in place with the overhead pedestrian crossing from the parking area. In addition, a cost has been included for the future provision of 200 parking spaces in a parking garage envisioned in Meriden with future development. The additional station costs for the full-build are \$26 million.

#### **6.1.4 Double Track Extension and Related Signal System Costs**

For the Start-up Service, the Springfield Line would essentially remain a single-track railroad with a bi-directional signaling / train control system and multiple controlled passing sidings similar to the existing configuration. However, five existing double track sections would require a minimum of approximately 18-miles of track extensions to provide additional double track on the Springfield Line to accommodate the increase in train movements without impacting planned service trip times.

The Bi-State Alternative called for approximately 15.4 miles of extended track. With the addition of three new stations in the alternative, additional double track would permit more flexibility in scheduling and operations. The Recommended Action further improves service flexibility by adding approximately 2.6 more miles of new track for a total of a minimum of 18 miles and ten new #20 track turnouts (switches) that will connect the ends of the new double track sections to the single track.



The recommended Start-up Service would require (at a minimum) the following major track changes (see Figure 6-1):

- Extend existing double track from MP 7.3 (Cedar) to MP 11.0 (south of Wallingford) with a new interlocking at MP 11.0. This requires double track across the Quinnipiac River and differs from the Bi-State 1 Alternative.
- Extend existing double track from MP 20.6 (Quarry) through the industrial track to MP 22.5 with a new interlocking at MP 22.5.
- Extend existing double track from MP 28.2 to 31.1 (New), and from MP 33.4 (Wood) to MP 35.2 (Parkville) with a new interlockings at MP 28.2. Some track through Hartford may be redesignated as a running track instead of a passing track, however this issue requires further study and coordination with Amtrak operations staff.
- Extend existing double track from MP 38.9 (Fry) to MP 43.0 (Windsor) with a new interlocking at MP 38.9 (Fry).
- Extend existing double track from MP 51.5 (east side of Connecticut River) to MP 54.7 (Field) with a new interlocking at MP 51.5.

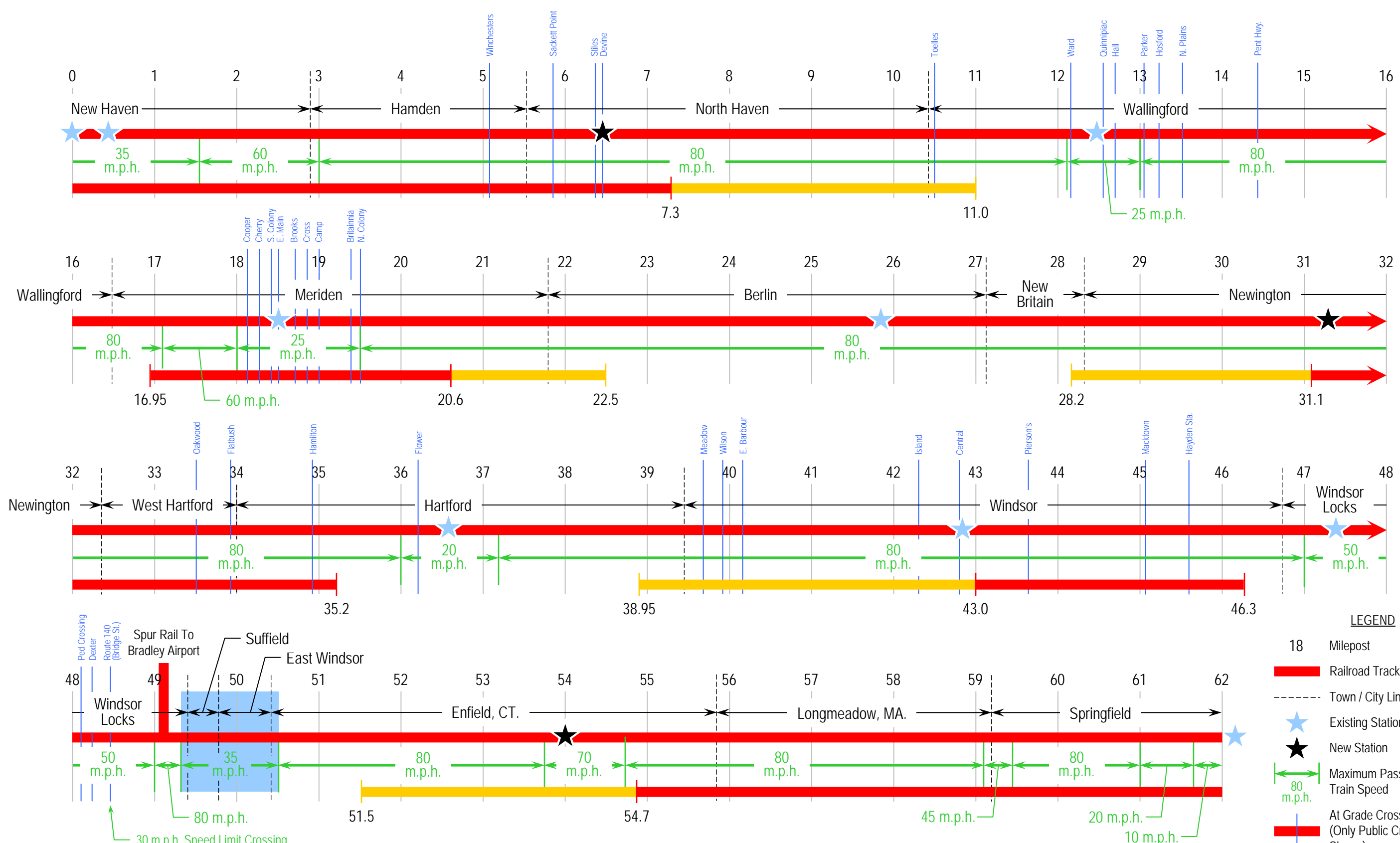
Each double track extension will require modifications to the existing and/or new signal system “interlockings” to control the new #20 track switch connection from the new (extended) end of double track to the existing single track. For conceptual planning purposes, it was assumed that existing interlockings and switches will be retained. Therefore, the signal system costs include additional all electric switch machines, track circuits, interlocking signals and other signal system equipment required to accommodate the double track extensions.

Each new interlocking will require tie-in to Amtrak’s Centralized Electrification and Traffic Control (CETC) facility in South Station, Boston which houses Amtrak’s Train Dispatchers for remote supervision of the Springfield Line. Appropriate interlocking signals, track circuits and other signal equipment will be required to allow bi-directional train movements on either track. Each interlocking will also be equipped with a “Local Control Panel” to allow for onsite control of signals and track switches for routine testing, a failure within the CETC control center or connecting communications equipment, or as a contingency to respond to any unforeseen operational problem affecting normal train movements. Amtrak forces will make CETC software database changes to facilitate the track and signal changes in the Recommended Action. The costs for additional code system equipment and CETC database work are included in the various conceptual cost estimates below.

The track and signal system related costs for the Start-up Service Recommended Action were conceptually estimated to include the following major work items and assumptions:

- A minimum of 18 miles of new track at approximately \$800,000 per mile or approximately \$150 per track foot installed (\$14,400,000). Rail would be minimum 132-lb. (or currently available 136-lb) with double shoulder tie plates secured to main line ties with standard cut spikes. The new track would be fully anchored in accordance with the Amtrak MW-1000 track standards manual. Grading and drainage remains in place along the line.





- LEGEND**
- 18 Milepost
  - Railroad Tracks
  - Town / City Line
  - ★ Existing Station
  - ★ New Station
  - 80 m.p.h. Maximum Passenger Train Speed
  - At Grade Crossing (Only Public Crossings Shown)
  - New Second Track
  - Connecticut River Bridge

**SCHEMATIC OF FUTURE TRACK LAYOUTS, SPRINGFIELD LINE  
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- 10 new #20 track turnouts or “switches” of the same weight and rail section as the new track; 2 new switches (one at each end) are required for each additional double-track section; estimated cost \$150,000 for each #20 turnout (track material and installation); assumed no movable point frogs; standard AREMA #20 pattern turnout on wood ties. (\$1,500,000)
- 5 new Interlocking control points at \$1.5 million each. (\$7,500,000); additional track circuits, code system equipment, Signals, “cut-section” signal locations and other required signal equipment for the new track is included; Adequate roadway maintenance access to the new Interlockings should be confirmed during Preliminary Engineering.
- Modifications to the 5 existing interlockings to accommodate double track extensions are estimated to cost approximately \$750,000 each. (\$3,750,000)
- Grade crossing signal modifications (6 @ \$100,000 each) to accommodate double track changes (Toelles, Meadow, Wilson, East Barber, Island, Central St); other miscellaneous grade crossing work - \$150,000; (total \$750,000). It is also assumed Oakwood Ave, Flatbush Ave and Hamilton St crossings are in existing double track section. Several existing signal instrument houses may require relocation – TBD during Preliminary Engineering.
- AC Power Distribution modifications to accommodate new interlockings, new signal cut-sections, and other locations where signal power distribution changes are required- \$1,000,000.

These costs are summarized in Table 6-5. The total conceptual engineering track and signal system costs are therefore estimated at approximately \$33.235 million for the Start-Up Service Recommended Action.

**Table 6-5**  
**Start-up Service Double Track Extension and Signal System Costs**

Item	Quantity	Cost per Unit	Cost
New Track	18 miles	\$800,000 / mile	\$14,400,000
Switches	10	\$150,000 each	\$1,500,000
New Interlocking Control Points	5	\$1,500,000 each	\$7,500,000
Modified Interlocking Control Points	5	\$750,000 each	\$3,750,000
Grade Crossing Signal Modifications	6	\$100,000 each plus misc.	\$750,000
AC Power Modifications			\$1,000,000
Subtotal			\$28,900,000
Design, Inspection, Testing, and Cut-over		15%	\$4,335,000
<b>Start-up Service Total</b>			<b>\$33,235,000</b>

In addition to the 18 miles of track and signal system costs for the Recommended Action, the “Full Build” double-tracking of the entire Springfield line will require another 20.5 miles of track, plus signal system, power distribution, and grade-crossing changes.



The conceptual cost for 20.5 miles of new track is approximately \$800,000 per mile or approximately \$150 per track foot installed (\$16,000,000) including the following major work items and assumptions:

- Extend the Recommended Action double track approximately 5.9 miles from MP 11.0 (south of Wallingford) to the double track section at MP 16.95 (Meriden).
- Extend the Recommended Action double track approximately 5.7 miles from MP 22.5 to the double track section at MP 28.2.
- Extend Recommended Action double track approximately 3.7 miles from MP 35.2 to the double track section at MP 38.9 (Fry).
- Extend Recommended Action double track approximately 5.2 miles from MP 46.3 to the double track section at MP 51.5 (east side of Connecticut River).

The track and signal system related costs for the Full-Build were conceptually estimated to include the following major work items and assumptions:

- 20.5 miles of new track at approximately \$800,000 per mile or approximately \$150 per track foot installed (\$16,400,000). Rail would be minimum 132-lb. (or currently available 136-lb) with double shoulder tie plates secured to main line ties with standard cut spikes. The new track would be fully anchored in accordance with the Amtrak MW-1000 track standards manual. Grading and drainage remains in place along the line.
- 8 new #20 track turnouts or “switches” of the same weight and rail section as the new track; 2 new switches (one at each end) are required for each double-track section; estimated cost \$150,000 for each #20 turnout (track material and installation); assumed no movable point frogs; standard AREMA #20 pattern turnout on wood ties. (Total \$1,200,000)
- Modifications to the 8 existing interlockings to accommodate double track extensions are estimated to cost approximately \$750,000 each. (\$6,000,000); Additional track circuits, code system equipment, signals, “cut-section” signal locations and other required equipment in new track included; Adequate roadway maintenance access to the new interlockings should be confirmed during Preliminary Engineering.
- Grade crossing signal modifications (11 @ \$100,000 each) to accommodate double track changes (Ward, Quinnipiac, Hall, Parker, Hosford, N. Plains, Pent Hwy, Flower, Ped Crossing, Dexter, Bridge St); other miscellaneous grade crossing work - \$275,000; (total \$1,375,000). Several existing signal instrument houses may require relocation to be determined during Preliminary Engineering.
- AC Power Distribution modifications to accommodate existing Interlocking, new signal cut-sections, and other locations where signal power distribution changes are required- \$1,250,000.

These costs are summarized in Table 6-6. The total conceptual engineering track and signal system costs are therefore estimated at approximately \$30.235 million in addition to the Start-up Service costs for an estimated total of \$63.394 million for the Full-build with double tracking of the entire line.



**Table 6-6**  
**Full-build Double Track Extension and Signal System Costs**

Item	Quantity	Cost per Unit	Cost
New Track	20.5 miles	\$800,000 / mile	\$16,400,000
Switches	8	\$150,000 each	\$1,200,000
Modified Existing Interlocking Control Points	8	\$750,000 each	\$6,000,000
Grade Crossing Signal Modifications	11	\$100,000 each plus misc.	\$1,375,000
AC Power Modifications			\$1,250,000
Subtotal			\$26,225,000
Design, Inspection, Testing, and Cut-over		15%	\$3,934,000
<b>Additional Full-build Items Total</b>			<b>\$30,159,000</b>
<b>Full-build Total</b>			<b>\$63,394,000</b>

It is of note that for maximum flexibility, additional switches configured as a “double-crossover” should be installed at various locations throughout the Springfield Line to facilitate continuous train movements from either track to either track without requiring some train movements to stop and back through a crossover before proceeding. For both the Recommended Action and Full Build scenarios, this conceptual estimate does not include any costs for double crossovers as the final locations and configuration (facing point / trailing point) of crossovers, interlocking limits, and other important operating characteristics should be undertaken as part of Preliminary Engineering and Design.

Actual locations of signals and switches (including universal crossovers) must meet the safety and operational requirements of a detailed Signal Block Design and be validated during Preliminary Engineering through revised operations modeling.

### 6.1.5 Bridge Costs

Bridge costs were evaluated in the Alternatives Report as part of the maximum build scenario. For a start-up service, it is assumed that bridge rehabilitation costs would be encountered only where a new second main track is to be constructed, and that all other bridge costs would be considered maintenance costs to renew the existing infrastructure, owned and maintained by Amtrak. Therefore, of the bridge costs presented in the Maximum Build section of the Alternatives Report, only the short-term costs apply and only for bridges listed in Table 6-7. On this basis, the bridge costs assumed for the initial commuter service is \$505,000. The bridge costs assumed for the double-tracking of the entire line are listed as well.



**Table 6-7**  
**Bridge Costs**

AMTRAK Bridge No.	Description	Short Term Rehabilitation / Replacement Cost
30.99 (Newington)	74 ft Encased I-Beam over Newington River	\$86,000
35.15 (Hartford)	79 ft Through Girder over Park Ave.	\$176,000
42.65 (Windsor)	29 ft Deck Girder over Batchelder Rd.	\$123,000
53.98 (Thompsonville)	35 ft Encased I-Beam over Main St.	\$36,000
Subtotal		\$421,000
Design and Construction Services (20%)		84,000
<b>Start-up Service Total</b>		<b>\$505,000</b>
15.26 (Yalesville)	58 ft Conc. Box Beam over Falls Brook	\$31,000
16.78 (Meriden)	28 ft I-Beam over Gypsy Lane	\$2,599,000
25.52 (Berlin)	170 ft Stone Arch over Mill River	\$44,000
25.76 (Berlin)	35 ft Through Girder over Farmington Ave.	\$1,150,000
26.39 (Berlin)	56 ft Stone Arch over Willow Brook	\$84,000
35.41 (Hartford)	50 ft Conc/Stone Arch over Park River	\$107,000
35.51 (Hartford)	103 ft Through Girder over Capitol Ave.	\$288,000
36.38 (Hartford)	85 ft Through Girder over Roadway B	\$29,000
36.53 (Hartford)	77 ft Through Girder over Asylum St.	\$182,000
36.55 (Hartford)	637 ft Deck Girder over Station Viaduct	\$762,000
36.66 (Hartford)	36 ft Deck Girder over Church Street	\$1,029,000
37.35 (Hartford)	93 ft Conc. Arch and Encased I-Beam over Windsor St.	\$188,000
49.73 (Windsor Locks)	1541ft Through Truss & Deck Girder over Connecticut Riv	\$1,844,000
Subtotal		\$8,337,000
Design and Construction Service (20%)		1,668,000
<b>Additional Full-build Items Total</b>		<b>\$10,005,000</b>
<b>Full-build Total</b>		<b>\$10,510,000</b>

Source: URS Corporation

### 6.1.6 Airport Connection

In the recommended action, the airport connection will initially be handled via a shuttle bus from Windsor Locks station. Therefore, no capital construction costs are necessary, aside from those shown at Windsor Locks station. It is anticipated that a minor cost will be incurred for the purchase of an additional airport shuttle bus, including in the bus cost estimates in Chapter 5.



### 6.1.7 Total Start-up Service Recommended Action Capital Costs

A summary of total capital costs for the Start-up commuter rail service appears in Table 6-8. The cost estimate includes necessary train sets, spares, the maintenance facility, parking and station costs, double track costs, and bridge rehabilitation or replacement costs. Design, construction service (including Amtrak flagmen) and inspection costs have been applied to each individual estimate. The estimate also includes right-of-way and environmental cost allowances that may be associated with station and maintenance facility construction; however these costs will require refinement in the next phase of implementation. Therefore, to be conservative, a contingency of 40% has been used to reflect unforeseen costs, per Federal Transit Administration guidelines at this phase of implementation. The estimated total capital cost for the Start-up commuter rail service is \$291.3 million.

**Table 6-8**  
**Commuter Rail Start-up Service Recommended Action Capital Costs**

<b>Element</b>		<b>Cost</b>
Train Equipment		\$70,140,000
Maintenance facility		20,696,000
Stations		80,966,000
Double Track		33,235,000
Bridges		505,000
Amtrak Flagmen		2,500,000
<b>Subtotal</b>		<b>\$208,042,000</b>
Contingency	40%	\$83,217,000
<b>Total</b>		<b>\$291,259,000</b>

Source: Wilbur Smith Associates, URS Corporation, Washington Group International

### 6.1.8 Total Full-build Capital Costs

In addition to the capital costs for the Start-up Service Recommended Action, the long term recommendation is to complete double-tracking the entire Springfield corridor. The additional costs associated with the double-tracking are presented in each of the sections above and a summary of these costs appear in Table 6-9. The cost estimate includes additional parking and station costs, double track costs, and bridge rehabilitation or replacement costs. Design, construction service (including Amtrak flagmen) and inspection costs have been applied to each individual estimate. A contingency of 40% has been used to reflect unforeseen costs, per Federal Transit Administration guidelines at this phase of implementation. The estimated total additional capital costs for the future Full-build are \$96 million.



**Table 6-9**  
**Additional Full-build Capital Costs**

<b>Element</b>		<b>Cost</b>
Stations		\$26,020,000
Double Track		\$30,159,000
Bridges		\$10,005,000
Amtrak Flagmen		\$2,500,000
<b>Subtotal</b>		<b>\$68,684,000</b>
Contingency	40%	\$27,474,000
<b>Total</b>		<b>\$96,158,000</b>

## 6.2 Commuter Rail Operating Costs

This analysis calculates annual operating costs by multiplying the Springfield Line service’s projected annual train miles for its Start-up Service times a representative cost per train mile.

### 6.2.1 Train Miles

A train mile measures the distance a train travels. That is, a train set traveling one mile equals one train mile. The Recommended Action schedule would have 8 round trips per day or 16 one-way trips each weekday. A run between New Haven and Springfield is 62 miles; using 8 round trips or 16 one way trips would generate 992 revenue train miles per weekday. Fifty-two weeks at 5 days per week totals to 260 days of operation, less some holidays on which New Haven-Hartford-Springfield service would not run. (Note that Shore Line East and most commuter rail systems in the US have approximately 254 operating weekdays per year). Annual train miles are thus calculated: 992 train miles multiplied by 254 days produces 251,968 annual train miles, exclusive of any shop moves or deadheading for maintenance purposes.

### 6.2.2 Cost per Train Mile

In order to refine the operating cost estimate for the new commuter rail service, the study team looked at the experience of commuter rail operators nationally with a focus on Shore Line East (SLE). For various reasons, SLE appears to offer a model which most closely resembles how the New Haven-Hartford-Springfield service would operate. These are:

- SLE uses Amtrak for train and engine crews. While not a certainty, Amtrak appears the most likely candidate to operate the service. This is because Amtrak owns the Springfield Line, and it has expressed a desire to operate the service.
- SLE operates over Amtrak’s Northeast Corridor between New London and New Haven. The new service would operate over Amtrak infrastructure as well.



- Amtrak maintains SLE rolling stock in New Haven. Amtrak could expand its maintenance pool there to provide resources for the new service, albeit at a separate facility.

All things being equal, Shore Line East per train-mile operating costs should hold true for the New Haven-Hartford-Springfield service. Similar to SLE, Amtrak owns the right-of-way along this corridor. Therefore, a track usage fee must be negotiated between the operator and Amtrak and the cost can vary with each agreement renewal. For this analysis, it is assumed that the current per train mile track usage fee charged by Amtrak for SLE service would be applied to the New Haven to Springfield corridor.

SLE operating costs, revenue train miles, and operating costs per train mile for three recent years appear below in Table 6-10.

**Table 6-10**  
**Shore Line East Operating Costs per Train Mile**

Year	Operating Cost	Train Miles	Cost/ Train Mile
1999	\$5,702,061	160,160	\$35.60
2000	\$6,081,910	132,117	\$46.03
2001	\$7,486,284	197,314	\$37.94

Source: ConnDOT

A unit cost estimate of \$40 per train mile has been applied, based upon Shore Line East commuter rail experience. Accordingly, an annual operating cost for the recommended Start-up service would be derived as follows: 251,968 annual train miles at \$40 per train mile totals to \$10,079,000. In addition, the operating costs for the bus services in the study area would increase by \$3,757,000 to account for additional connecting bus service.

### **6.3 Fare Policy and Collection Method**

The fare policy and collection method for Shore Line East are assumed for the New Haven-Hartford-Springfield service. There are four ticket and pass categories. These are in descending price order: One-Way, Ten-Trip, Monthly, and Monthly Plus. Monthly Plus allows transfers to bus transit. These categories offer discounts off the One-Way fare for riders who purchase multiple ride tickets or passes. For example, the One-Way fare between Old Saybrook and New Haven is \$5.75, while the Ten-Trip ticket provides for a \$5.20 per-trip fare for the same trip. A similar fare structure is assumed for the new Springfield Line service. SLE offers the Uni-Rail pass, which allows for travel on both SLE and Metro-North. Conceivably, the Springfield Line service could offer this pass as well.





SLE riders can purchase tickets and passes in various ways. One-Way tickets are sold on board trains. They are available at the New London, Old Saybrook, and New Haven ticket windows. They are valid for 90 days. Ten-Trip tickets and Monthly and Monthly Plus passes can be purchased at the staffed station ticket windows, through the mail, and by phone (1-800-All-Ride in Connecticut). Ten-Trip tickets are valid for 90 days. Monthly and Monthly Plus passes are valid for the calendar month shown and may be used for unlimited travel between stations specified. The bus portion of the Monthly Plus pass is honored for travel on all CTTRANSIT bus routes including Commuter Connection buses in New Haven. The Springfield Line service tickets would be obtain in the same ways - on board trains, at ticket windows, through the mail, and over the phone.

SLE conductors check all tickets on board trains, as would conductors on the Springfield Line service.

## **6.4 Commuter Rail Revenue**

To calculate fare box revenue for the Recommended Action, a similar fare structure was developed to that being put in place for 2005 on Shore Line East. Table 6-11 shows the suggested One-Way fare matrix for service on the line using the formula  $\$2.419 + \$.146$  per mile greater than 10 miles, rounded to the nearest quarter dollar. Monthly fares, shown in Table 6-12, are 50% of the One-Way fares and the per trip cost is based on 42 trips per month. It was assumed that commuter ridership would be using a Monthly pass and non-commuter would pay a One-Way fare.

Based on the fare structure and weekday ridership presented, revenue for the State-up commuter rail service would be \$4,400 per day. Using 254 days of weekday service per year, the annual revenue would be \$1,117,600.

The ridership projections developed for this implementation plan are based upon a rigorous evaluation process and a customized application of ConnDOT's Statewide Travel Model. However, some stakeholders have suggested that these ridership projections may be conservative. To obtain an indication of a possible upper projection for this implementation plan, the Department performed a further review of the 2000 Census Journey to Work data for towns being served by the Shore Line East (SLE) commuter rail service. The SLE service is a peak-period commuter rail service, which has been operating since 1990 along Amtrak's northeast corridor, between New Haven and Old Saybrook, with through service to Stamford and connections with New Haven Line (New Haven - New York Grand Central Terminal) commuter rail service.

This review indicated that the SLE service capture rate of the potential commuter market is approximately 5 percent, which is more than double the projection from the Statewide Travel Model application for the New Haven-Hartford-Springfield (NHHS) rail service plan. While the two systems are not directly comparable, the higher captured rate experienced by SLE could be considered the higher end of a range for the NHHS plan.



**Table 6-11**  
**Recommended Action One-Way Fare Matrix**

Station Pair	New Haven	State Street	North Haven	Wallingford	Meriden	Berlin	Newington	Hartford	Windsor	Windsor Locks	Enfield	Springfield
New Haven	-											
State Street	\$2.25	-										
North Haven	\$2.25	\$2.25	-									
Wallingford	\$2.75	\$2.50	\$2.25	-								
Meriden	\$3.50	\$3.50	\$2.50	\$2.25	-							
Berlin	\$4.50	\$4.50	\$3.50	\$2.75	\$2.25	-						
Newington	\$5.25	\$5.25	\$4.25	\$3.50	\$2.75	\$2.25	-					
Hartford	\$6.00	\$6.00	\$5.00	\$4.25	\$3.50	\$2.25	\$2.25	-				
Windsor	\$6.75	\$6.75	\$6.00	\$5.00	\$4.25	\$3.25	\$2.50	\$2.25	-			
Windsor Locks	\$7.50	\$7.25	\$6.50	\$5.75	\$4.75	\$3.75	\$3.00	\$2.25	\$2.25	-		
Enfield	\$8.25	\$8.25	\$7.50	\$6.75	\$5.75	\$4.75	\$4.00	\$3.25	\$2.50	\$2.25	-	
Springfield	\$9.50	\$9.50	\$8.50	\$7.75	\$7.00	\$6.00	\$5.00	\$4.50	\$3.50	\$3.00	\$2.25	-

Source: Wilbur Smith Associates, based on ConnDOT formula for SLE

Note: Fare calculated at \$2.293 + \$.138 per mile greater than 10 miles, then rounded to nearest quarter dollar.



**Table 6-12**  
**Recommended Action Approximate Monthly Fare Matrix**

Station Pair	New Haven	State Street	North Haven	Wallingford	Meriden	Berlin	Newington	Hartford	Windsor	Windsor Locks	Enfield	Springfield
New Haven	-											
State Street	\$51	-										
North Haven	\$51	\$51	-									
Wallingford	\$58	\$57	\$51	-								
Meriden	\$77	\$75	\$57	\$51	-							
Berlin	\$100	\$98	\$80	\$62	\$51	-						
Newington	\$117	\$115	\$97	\$78	\$60	\$51	-					
Hartford	\$132	\$131	\$112	\$94	\$75	\$52	\$51	-				
Windsor	\$152	\$150	\$132	\$114	\$95	\$72	\$55	\$51	-			
Windsor Locks	\$164	\$163	\$144	\$126	\$108	\$85	\$68	\$52	\$51	-		
Enfield	\$186	\$184	\$166	\$147	\$129	\$106	\$89	\$74	\$54	\$51	-	
Springfield	\$210	\$209	\$190	\$172	\$154	\$131	\$114	\$98	\$78	\$66	\$51	-

Source: Wilbur Smith Associates, based on ConnDOT formula for SLE

Note: Fare calculated at 50% of one-way fare times 42 trips, then rounded to nearest dollar.



The resulting high range in ridership is 5,000 daily trips. This higher range is anecdotal and so would be viewed as an optimistic figure. Although there is a range in projected capture, the anticipated NHHS ridership and cost analysis in this plan is based upon the evaluation process derived from application of the ConnDOT Statewide Travel Model. It should be noted that this recommended service is to initiate commuter rail along this corridor and that the opportunity remains to enhance the initial service (with additional scheduled trains and stations) as the demand warrants

### ***Ridership and Revenue Variables***

This analysis of initial implementation alternatives has treated the added commuter rail service separately for the purposes of projecting ridership and resulting revenue. However, the service is envisioned as co-existing with Amtrak's current service on the Springfield line. Ideally, the Amtrak schedules during the peak hours could be adjusted to make the same station stops as the commuter trains, and subject to seating availability, the Amtrak trains could serve commuter needs. Similarly, the commuter schedules provide added opportunities for connections at New Haven with Amtrak intercity trains as well as connecting travel via Metro North and Shore Line East.

Metrolink, the commuter rail service in the Los Angeles area, shares routes both north and south from Los Angeles with Amtrak's Surfliner route, a state-supported corridor service with up to 12 round trips per day on some days. Metrolink and Amtrak initiated a "Rail 2 Rail" program, which allows Metrolink monthly pass holders to ride Amtrak's Surfliner trains. The fares on Amtrak are typically higher than Metrolink, and the Amtrak trains serve fewer stations. A funding transfer agreement between Metrolink and Amtrak reimburses Amtrak for a portion of the "loss" incurred because of the lower commuter fares. The program has been extremely successful, producing annual ridership gains on both services because of the greater number of trip opportunities.

A cooperative effort between a ConnDOT service and Amtrak service on the Springfield line would likely have similar results. Amtrak's mid-day trains could be used for one direction of a round trip outside the peak hours, inducing more travel than would be expected if the systems were operated independently. No attempt is made here to project the ridership levels that such a synergy would produce, or to project the resulting revenue increases. At such time as commuter service is initiated, it would be appropriate to test the concept by accepting commuters on selected Amtrak trains, and expanding the program if it proves beneficial to both agencies.

## **6.5 Cost Summary**

A summary of the performance revenue calculations is shown in Table 6-13. Given the Start-up Service Recommended Action is projected to cost \$10,078,000 to operate using conventional rolling stock with revenues at \$1,117,600, the annual operating deficit would be at \$8,960,000 annually. This is in addition to the capital costs of \$291.3



million. Using a total of 4,215,384 passenger miles estimated by the ConnDOT model, the revenue per passenger mile was calculated to be \$0.26, the fare box recovery was calculated to be 11.0% and the productivity (passenger miles per vehicle miles) was calculated to be 16.73. Productivity, a calculation of passenger miles per vehicle miles, is often used to determine the efficiency of the service.

**Table 6-13**  
**Ridership, Costs, Revenue and Performance Measures**

Total Weekday Trips	2,428
Annual Passenger Miles	4,215,384
Annual Revenue	\$ 1,117,600
Annual Rail Operating Cost	\$ 10,079,000
Annual Rail Operating Deficit	\$ 8,960,400
Revenue per Passenger Mile	\$0.26
Fare box Recovery	11.0%
Productivity (Passenger Miles per Vehicle Miles)	16.73

Connecting bus capital (\$3.6 million) and annual operating costs (\$3.8 million) would be in addition to the commuter rail capital and annual operating costs. Applying the 2004 CTTransit farebox recovery rates, the annual operating deficit for the connecting bus service, as a component of the commuter rail implementation plan would be approximately \$2.75 million.