



Chapter 3

Alternatives Evaluation

As a first step in determining the alternatives to be evaluated for implementation of commuter rail along the Springfield Line, a "minimum" and "maximum" build, were identified as the initial two base scenarios to be considered. Upon evaluation of the minimum and maximum build scenarios, both were found to have a number of issues related to implementation. The minimum build schedule was found to be unreliable without double tracking at least some additional segments of the rail line. The maximum build was found to have a number of costly elements that may not be necessary for the initial implementation of the line, especially 15 minute peak hour service headways. Therefore, using the costs, ridership, and other analysis from the minimum and maximum build scenarios, four additional possible service implementation alternatives were created for consideration. The following section is a description of the minimum build, maximum build and each of the implementation service alternatives. The entire Alternatives Report can be found in Appendix C of this report.

3.1 Minimum and Maximum Build Scenarios

The initial vision of a minimum build scenario was to begin service with minimal capital investment. Therefore, an attempt was made to develop a bi-directional schedule with service every 30 minutes using only existing stations and no additional tracks. The initial vision of a maximum build scenario was to provide service that would attract the highest possible ridership. Therefore, a frequent 15 minute schedule, several additional stations and double track on the entire line were included in the scenario. The complete analysis of these two scenarios is available in the Alternatives Technical Report. Table 3-1 is a summary of the minimum and maximum build scenario service and results.

As discussed above, upon evaluation of the minimum and maximum build scenarios, both were found to have a number of issues of concern. The minimum build schedule was found to be unreliable due to the high degree of schedule adherence necessary. Reliable bi-directional service can only be provided by double tracking at least some additional segments of the rail line. The maximum build was found to have a number of costly elements that may not be necessary for the initial implementation of commuter service, including 15 minute peak hour service frequency, weekend service, and a number of additional new stations.



Table 3-1
Minimum and Maximum Build Scenarios

	Min Build	Max Build
Scenario	No additional tracks	Double track entire line
Stations	Nine Existing with limited additional parking	Existing plus Seven New – all improved with high-level platforms, pedestrian crossing and buildings
Peak Hour Train Frequency	30 – 35 minute	15 minute
Off-Peak Service	No - Only Amtrak	Hourly Weekday plus Weekend
Estimated Daily Trips	1,767 (not including Amtrak)	4,983 (including Amtrak)
Capital Cost	\$86 million	\$558 million
Operating Cost	\$7.1 million	\$48.3 million
Operating Deficit	\$6.2 million	\$44.7 million
Per Passenger Subsidy	\$13.81	\$32.56

Using the costs, ridership, and other analysis from the minimum and maximum build scenarios, four implementation alternatives were derived with varying service plans. Other elements of the maximum build scenario were broken down into a menu of additional elements that can be added initially or in the future as funding or other benchmarks are in place. The following is a summary of each of the alternatives considered to be feasible for initial service implementation. All implementation alternatives use only existing stations along the line.

3.2 Implementation Alternatives

The following four subsections describe the four implementation alternatives. Schedules for the proposed service follow in Table 3-2 through Table 3-5.

3.2.1 Alternative CT1

The CT1 alternative is an attempt to minimize the initial capital expenditures by adding no additional double track segments while providing a reliable service within the context of existing Amtrak service and using existing stations. As found in the minimum build, reliable two-directional service is not possible with 30 minute headways and existing track configuration. Rather than provide only 60 minute peak hour service or unreliable 30 minute service, reliable service with approximately 35 minute headways will be



accomplished by providing directional service on the line, southbound in the morning peak commute hours and northbound in the afternoon peak commute hours. The CT1 alternative includes the following:

- No new double track will be added;
- The existing Amtrak schedule would experience minor alterations;
- Six one-way trips per weekday, with no off-peak or weekend service;
- The new service will only go to the furthest north station in CT (Windsor Locks);
- The following stations are included;
 - Union Station (New Haven)
 - State Street (New Haven)
 - Wallingford
 - Meriden
 - Berlin
 - Union Station (Hartford)
 - Windsor
 - Windsor Locks (with bus connection to Bradley Airport)
- The service is designed to be reliable and fit within the existing Amtrak schedule;
- Amtrak trains fares would be adjusted to be compatible with the commuter train fares;
- Visual and audio announcement at stations;
- Local bus service will be modified to provide appropriate service to the stations (adding Commuter Connection service at New Haven, etc); and
- Stations will be ADA compliant with either level boarding or on board lifts.

3.2.2 Alternative CT2

The operating assumptions under Alternative CT2 are that the existing Amtrak service would be maintained using existing stations. Furthermore, the new commuter service would be designed for approximately 30 minute headways timed for critical time periods for bi-directional service into New Haven and Hartford (as opposed to only one direction in Alternative CT1). This is essentially the bi-directional 30 minute service envisioned for the minimum build, but in order to provide reliable service, either new or lengthened double track sections would be required. The CT2 alternative includes the following:

- 12.4 miles of new or extended double track sections will be added to improve reliability and provide approximate 30 minute headways meeting critical times in New Haven and Hartford;
- The existing Amtrak schedule would experience minor alterations;
- Fourteen one-way trips per weekday, with no off-peak or weekend service;
- The new service will only go to the furthest north station in CT (Windsor Locks);
- The following stations are included;
 - Union Station (New Haven)
 - State Street (New Haven)



- Wallingford
- Meriden
- Berlin
- Union Station (Hartford)
- Windsor
- Windsor Locks (with bus connection to Bradley Airport)
- The service is designed to be reliable and fit within the existing Amtrak schedule;
- Amtrak trains fares would be adjusted to be compatible with the commuter train fares;
- Visual and audio announcement at stations;
- Local bus service will be modified to provide appropriate service to the stations; and
- Stations will be ADA compliant with either level boarding or on board lifts.

3.2.3 Alternative Bi-State1

In an attempt to save operating costs, Alternatives CT1 and CT2 provided service only to Windsor Locks as the northern-most existing station in Connecticut. Alternative Bi-State1 is similar to Alternative CT2 in that the existing Amtrak service would be maintained and the new commuter service designed for approximately 30 minute headways timed for critical time periods for bi-directional service. The difference is this critical time period service would be provided into New Haven and Hartford, as well as Springfield, Massachusetts. This would once again require either new or lengthened double track sections. The Bi-State1 alternative includes the following:

- 15.6 miles of new or extended double track sections will be added to improve reliability and provide 30 minute headways meeting critical times in New Haven, Hartford and Springfield;
- The existing Amtrak schedule would experience minor alterations;
- Fourteen one-way trips per weekday, with no off-peak or weekend service;
- The new service will go to Springfield;
- The following stations are included;
 - Union Station (New Haven)
 - State Street (New Haven)
 - Wallingford
 - Meriden
 - Berlin
 - Union Station (Hartford)
 - Windsor
 - Windsor Locks (with bus connection to Bradley Airport)
 - Springfield
- The service is designed to be reliable and fit within the existing Amtrak schedule;
- Amtrak trains fares would be adjusted to be compatible with the commuter train fares;



- Visual and audio announcement at stations;
- Local bus service will be modified to provide appropriate service to the stations;
and
- Stations will be ADA compliant with either level boarding or on board lifts.

3.2.4 Alternative Bi-State2

Alternative Bi-State2 builds upon Alternative Bi-State1 by redesigning Amtrak's service to provide optimal commuter operations with uniform 30 minute headways timed for critical time periods for bi-directional service into New Haven, Hartford and Springfield. By shifting Amtrak's service that falls in the peak commuter hours, improved arrival times into New Haven, Hartford and Springfield can be scheduled, as well as better connections with Metro North. The Bi-State2 alternative includes the following:

- 15.6 miles of new or extended double track sections will be added to improve reliability and provide 30 minute headways meeting critical times in New Haven, Hartford and Springfield;
- The existing Amtrak schedule will be adjusted to provide optimal times with reliable service;
- Fourteen one-way trips per weekday, with no off-peak or weekend service;
- The new service will go to Springfield;
- The following stations are included;
 - Union Station (New Haven)
 - State Street (New Haven)
 - Wallingford
 - Meriden
 - Berlin
 - Union Station (Hartford)
 - Windsor
 - Windsor Locks (with bus connection to Bradley Airport)
 - Springfield
- Amtrak trains fares would be adjusted to be compatible with the commuter train fares;
- Visual and audio announcement at stations;
- Local bus service will be modified to provide appropriate service to the stations;
and
- Stations will be ADA compliant with either level boarding or on board lifts.

**Table 3-2
Alternative CT1 Illustrative Schedules**

Southbound

Station	AM							PM			
	CDOT #1	Amtrak #141	CDOT #3	Amtrak #495	CDOT #5	Amtrak #471	Amtrak #493	Amtrak #55	Amtrak #437	Amtrak #475	Amtrak #477
Springfield		6:00		7:15		8:40	10:40	12:55	2:10	4:05	6:25
Windsor Locks	5:45	6:20	6:55	7:33	8:10	8:58	10:58		2:28	4:23	6:43
Windsor	5:50	6:26	7:00	7:38	8:15	9:06	11:06		2:33	4:28	6:48
Hartford	5:59	6:38	7:09	7:49	8:24	9:17	11:17	1:30	2:44	4:38	6:59
Berlin	6:11	6:51	7:21	8:00	8:36	9:38	11:28	1:45	2:55	4:53	7:10
Meriden	6:20	7:01	7:30	8:08	8:45	9:36	11:36	1:56	3:03	5:01	7:18
Wallingford	6:28	7:09	7:38	8:15	8:53	9:43	11:43		3:10	5:08	7:25
State Street	6:40	7:24	7:50	8:31	9:05	9:56	11:56		3:26	5:26	7:41
New Haven	6:44	7:28	7:54	8:35	9:09	10:00	12:00	2:23	3:30	5:30	7:45

Northbound

Station	AM			PM							
	Amtrak #490	Amtrak #470	Amtrak #56	Amtrak #474	Amtrak #486	CDOT #2	Amtrak #476	CDOT #4	CDOT #6	Amtrak #494	Amtrak #148
New Haven	8:50	10:15	12:55	2:15	4:10	4:45	5:15	5:55	6:30	7:25	8:30
State Street	8:53	10:18		2:18	4:13	4:48	5:18	5:58	6:33	7:28	8:33
Wallingford	9:03	10:27		2:28	4:23	5:00	5:28	6:10	6:45	7:38	8:44
Meriden	9:10	10:35	1:16	2:35	4:29	5:09	5:34	6:19	6:54	7:45	8:52
Berlin	9:19	10:44	1:26	2:44	4:38	5:18	5:43	6:28	7:03	7:54	9:02
Hartford	9:32	10:57	1:45	2:59	4:52	5:30	5:59	6:40	7:15	8:07	9:16
Windsor	9:40	11:04		3:07	4:59	5:38	6:07	6:48	7:23	8:15	9:24
Windsor Locks	9:45	11:10		3:12	5:05	5:44	6:12	6:54	7:29	8:20	9:30
Springfield	10:10	11:35	2:20	3:35	5:30		6:40			8:45	9:55

Notes: Commuter schedules are illustrative, based on RTC simulation of train operations. Amtrak schedules are March 2004 schedules, with assumed additional stops. Source: Amtrak, Wilbur Smith Associates

**Table 3-3
Alternative CT2 Illustrative Schedules**

Southbound

Station	AM								PM						
	CDOT #1	Amtrak #141	CDOT #3	CDOT #5	Amtrak #495	CDOT #7	Amtrak #471	Amtrak #493	Amtrak #55	Amtrak #437	CDOT #9	Amtrak #475	CDOT #11	CDOT #13	Amtrak #477
Springfield		6:00			7:15		8:40	10:40	12:55	2:10		4:05			6:25
Windsor Locks	5:55	6:20	6:50	7:20	7:33	8:15	8:58	10:58		2:28	3:55	4:23	4:55	5:25	6:43
Windsor	6:01	6:26	6:56	7:26	7:38	8:21	9:06	11:06		2:33	4:01	4:28	5:01	5:31	6:48
Hartford	6:10	6:38	7:05	7:35	7:49	8:30	9:17	11:17	1:30	2:44	4:10	4:38	5:10	5:40	6:59
Berlin	6:23	6:51	7:18	7:48	8:00	8:43	9:38	11:28	1:45	2:55	4:23	4:53	5:23	5:53	7:10
Meriden	6:32	7:01	7:27	7:57	8:08	8:52	9:36	11:36	1:56	3:03	4:32	5:01	5:32	6:02	7:18
Wallingford	6:40	7:09	7:35	8:05	8:15	9:00	9:43	11:43		3:10	4:40	5:08	5:40	6:10	7:25
State Street	6:52	7:24	7:47	8:17	8:31	9:12	9:56	11:56		3:26	4:52	5:26	5:52	6:22	7:41
New Haven	6:56	7:28	7:51	8:21	8:35	9:16	10:00	12:00	2:23	3:30	4:56	5:30	5:56	6:26	7:45

Northbound

Station	AM					PM									
	CDOT #2	CDOT #4	CDOT #6	Amtrak #490	Amtrak #470	Amtrak #56	Amtrak #474	CDOT #8	Amtrak #486	CDOT #10	Amtrak #476	CDOT #12	CDOT #14	Amtrak #494	Amtrak #148
New Haven	6:05	6:40	7:20	8:50	10:15	12:55	2:15	3:35	4:10	4:45	5:15	5:50	6:20	7:25	8:30
State Street	6:08	6:43	7:23	8:53	10:18		2:18	3:38	4:13	4:48	5:18	5:53	6:23	7:28	8:33
Wallingford	6:20	6:55	7:35	9:03	10:27		2:28	3:50	4:23	5:00	5:28	6:05	6:35	7:38	8:44
Meriden	6:28	7:03	7:43	9:10	10:35	1:16	2:35	3:58	4:29	5:08	5:34	6:13	6:43	7:45	8:52
Berlin	6:37	7:12	7:52	9:19	10:44	1:26	2:44	4:07	4:38	5:17	5:43	6:22	6:52	7:54	9:02
Hartford	6:50	7:25	8:05	9:32	10:57	1:45	2:59	4:20	4:52	5:30	5:59	6:35	7:05	8:07	9:16
Windsor	6:59	7:34	8:14	9:40	11:04		3:07	4:29	4:59	5:39	6:07	6:44	7:14	8:15	9:24
Windsor Locks	7:06	7:41	8:21	9:45	11:10		3:12	4:36	5:05	5:46	6:12	6:51	7:21	8:20	9:30
Springfield				10:10	11:35	2:20	3:35		5:30		6:40			8:45	9:55

Notes: Commuter schedules are illustrative, based on RTC simulation of train operations. Amtrak schedules are March 2004 schedules, with assumed additional stops. Source: Amtrak, Wilbur Smith Associates

**Table 3-4
Alternative Bi-State1 Illustrative Schedules**

Southbound

Station	AM								PM						
	CDOT #1	Amtrak #141	CDOT #3	CDOT #5	Amtrak #495	CDOT #7	Amtrak #471	Amtrak #493	Amtrak #55	Amtrak #437	Amtrak #475	CDOT #9	CDOT #11	CDOT #13	Amtrak #477
Springfield	5:30	6:00	6:25	6:55	7:15	7:50	8:40	10:40	12:55	2:10	4:05	4:35	5:10	5:40	6:25
Windsor Locks	5:50	6:20	6:45	7:15	7:33	8:10	8:58	10:58		2:28	4:23	4:55	5:30	6:00	6:43
Windsor	5:56	6:26	6:51	7:21	7:38	8:16	9:06	11:06		2:33	4:28	5:01	5:36	6:06	6:48
Hartford	6:05	6:38	7:00	7:30	7:49	8:25	9:17	11:17	1:30	2:44	4:38	5:10	5:45	6:15	6:59
Berlin	6:17	6:51	7:12	7:42	8:00	8:37	9:38	11:28	1:45	2:55	4:53	5:22	5:57	6:27	7:10
Meriden	6:26	7:01	7:21	7:51	8:08	8:46	9:36	11:36	1:56	3:03	5:01	5:31	6:06	6:36	7:18
Wallingford	6:34	7:09	7:29	7:59	8:15	8:54	9:43	11:43		3:10	5:08	5:39	6:14	6:44	7:25
State Street	6:46	7:24	7:41	8:11	8:31	9:06	9:56	11:56		3:26	5:26	5:51	6:26	6:56	7:41
New Haven	6:50	7:28	7:45	8:15	8:35	9:10	10:00	12:00	2:23	3:30	5:30	5:55	6:30	7:00	7:45

Northbound

Station	AM					PM									
	CDOT #2	CDOT #4	CDOT #6	Amtrak #490	Amtrak #470	Amtrak #56	Amtrak #474	CDOT #8	Amtrak #486	CDOT #10	Amtrak #476	CDOT #12	CDOT #14	Amtrak #494	Amtrak #148
New Haven	6:05	6:50	7:30	8:50	10:15	12:55	2:15	3:35	4:10	4:40	5:15	5:45	6:15	7:25	8:30
State Street	6:08	6:53	7:33	8:53	10:18		2:18	3:38	4:13	4:43	5:18	5:48	6:18	7:28	8:33
Wallingford	6:20	7:05	7:45	9:03	10:27		2:28	3:50	4:23	4:55	5:28	6:00	6:30	7:38	8:44
Meriden	6:28	7:13	7:53	9:10	10:35	1:16	2:35	3:58	4:29	5:03	5:34	6:08	6:38	7:45	8:52
Berlin	6:37	7:22	8:02	9:19	10:44	1:26	2:44	4:07	4:38	5:12	5:43	6:17	6:47	7:54	9:02
Hartford	6:50	7:35	8:15	9:32	10:57	1:45	2:59	4:20	4:52	5:25	5:59	6:30	7:00	8:07	9:16
Windsor	6:59	7:44	8:24	9:40	11:04		3:07	4:29	4:59	5:34	6:07	6:39	7:09	8:15	9:24
Windsor Locks	7:05	7:50	8:30	9:45	11:10		3:12	4:35	5:05	5:40	6:12	6:45	7:15	8:20	9:30
Springfield	7:25	8:10	8:50	10:10	11:35	2:20	3:35	4:55	5:30	6:00	6:40	7:05	7:35	8:45	9:55

Notes: Commuter schedules are illustrative, based on RTC simulation of train operations. Amtrak schedules are March 2004 schedules, with assumed additional stops. Source: Amtrak, Wilbur Smith Associates

**Table 3-5
Alternative Bi-State2 Illustrative Schedules**

Southbound

Station	AM								PM						
	CDOT #1	Amtrak #141	CDOT #3	CDOT #5	Amtrak #495	CDOT #7	Amtrak #471	Amtrak #493	Amtrak #55	Amtrak #437	Amtrak #475	CDOT #9	CDOT #11	CDOT #13	Amtrak #477
Springfield	5:30	6:00	6:30	7:00	7:30	8:00	8:40	10:40	12:55	2:10	4:05	4:35	5:10	5:40	6:15
Windsor Locks	5:50	6:20	6:50	7:20	7:50	8:20	9:00	11:00		2:30	4:25	4:55	5:30	6:00	6:35
Windsor	5:56	6:26	6:56	7:26	7:56	8:26	9:06	11:06		2:36	4:31	5:01	5:36	6:06	6:41
Hartford	6:05	6:35	7:05	7:35	8:05	8:35	9:15	11:15	1:30	2:45	4:40	5:10	5:45	6:15	6:50
Berlin	6:17	6:47	7:17	7:47	8:17	8:47	9:27	11:27	1:45	2:57	4:52	5:22	5:57	6:27	7:02
Meriden	6:26	6:56	7:26	7:56	8:26	8:56	9:36	11:36	1:56	3:06	5:01	5:31	6:06	6:36	7:11
Wallingford	6:34	7:04	7:34	8:04	8:34	9:04	9:44	11:44		3:14	5:09	5:39	6:14	6:44	7:19
State Street	6:46	7:16	7:46	8:16	8:46	9:16	9:56	11:56		3:26	5:21	5:51	6:26	6:56	7:31
New Haven	6:50	7:20	7:50	8:20	8:50	9:20	10:00	12:00	2:23	3:30	5:25	5:55	6:30	7:00	7:35

Northbound

Station	AM					PM									
	CDOT #2	CDOT #4	CDOT #6	Amtrak #490	Amtrak #470	Amtrak #56	Amtrak #474	CDOT #8	Amtrak #486	CDOT #10	Amtrak #476	CDOT #12	CDOT #14	Amtrak #494	Amtrak #148
New Haven	6:05	6:40	7:10	8:45	10:15	12:55	2:15	3:35	4:10	4:40	5:10	5:40	6:10	7:25	8:30
State Street	6:08	6:43	7:13	8:48	10:18		2:18	3:38	4:13	4:43	5:13	5:43	6:13	7:28	8:33
Wallingford	6:20	6:55	7:25	9:00	10:30		2:30	3:50	4:25	4:55	5:25	5:55	6:25	7:40	8:45
Meriden	6:28	7:03	7:33	9:08	10:38	1:16	2:38	3:58	4:33	5:03	5:33	6:03	6:33	7:48	8:53
Berlin	6:37	7:12	7:42	9:17	10:47	1:26	2:47	4:07	4:42	5:12	5:42	6:12	6:42	7:57	9:02
Hartford	6:50	7:25	7:55	9:30	11:00	1:45	3:00	4:20	4:55	5:25	5:55	6:25	6:55	8:10	9:15
Windsor	6:59	7:34	8:04	9:39	11:09		3:09	4:29	5:04	5:34	6:04	6:34	7:04	8:19	9:24
Windsor Locks	7:05	7:40	8:10	9:45	11:15		3:15	4:35	5:10	5:40	6:10	6:40	7:10	8:25	9:30
Springfield	7:25	8:00	8:30	10:05	11:35	2:20	3:35	4:55	5:30	6:00	6:30	7:00	7:30	8:45	9:50

Notes: Commuter and Amtrak schedules are illustrative, based on RTC simulation of train operations. Amtrak schedules are variations on March 2004 schedules, with assumed additional stops and departure times adjusted for optimum coordination with commuter schedules.
Source: Amtrak, Wilbur Smith Associates



The difference in the level of service provided by the implementation alternatives is described in Table 3-6.

**Table 3-6
 Implementation Alternatives Service Characteristics**

Alternative	CT1	CT2	Bi-State1	Bi-State2
Service Area	Windsor Locks to New Haven	Windsor Locks to New Haven	Springfield to New Haven	Springfield to New Haven
Headways	30 minute peak hr one-directional service (SB AM, NB PM)	30 minute peak hr bi-directional service	30 minute peak hr bi-directional service	30 minute peak hr bi-directional service
Double Track	No new double track	Double track sections added where needed	Double track sections added where needed	Double track sections added where needed
Amtrak Schedule Adjustment	No adjustments to Amtrak schedule, but fares would be adjusted for commuter use	No adjustments to Amtrak schedule, but fares would be adjusted for commuter use	No adjustments to Amtrak schedule, but fares would be adjusted for commuter use	Amtrak schedule adjusted to accommodate ideal meet times in urban centers

3.3 Service Alternative Evaluation

3.3.1 Ridership Comparison

Ridership for the four alternatives is estimated as follows:

- Alternative CT1 = 872 daily trips (+Amtrak)
- Alternative CT2 = 1485 daily trips (+Amtrak)
- Alternative Bi-State1 = 1767 daily trips (+Amtrak)
- Alternative Bi-State2 = 1767 daily trips (+Amtrak)

The major difference between Alternative CT1 and CT2 is the improved headways/increased number of trains because of double tracking. The difference between Alternative CT2 and Bi-State1 is the inclusion of Springfield in Alternative Bi-State1. The reason there is no difference between Alternative Bi-State1 and Bi-State2 is the modeling methodology is not able to respond to the differences in the timing of service.



3.3.2 Capital Cost Comparison

Capital costs for the alternative service patterns vary, because the alternatives provide differing levels of service, require different track and facility improvements, and attract different levels of ridership. The common cost elements are stations and parking, layover and maintenance facilities, and rolling stock.

Capital costs were identified initially for a minimum build service scenario (\$86 million) and a maximum build scenario (\$558 million). These costs represented probable outside ranges for minimum and maximum service levels. The costs calculated for these scenarios have been reviewed and adapted to determine estimated costs for the four potential implementation alternatives. These projected costs are summarized and discussed below in Table 3-7.

Platform improvements at stations on the Springfield line are minimal at most stations. An allowance of \$25,000 per station is included to renew or improve paving, curbs, lighting, pedestrian walkways, and signage at each of the 6 stations from Wallingford north to Windsor Locks.

Table 3-7
Summary of Capital Costs

	Alt CT1	Alt CT2	Alt Bi-State1	Alt Bi-State2
Station Improvements	\$4,200,000	\$4,200,000	\$4,200,000	\$4,200,000
Parking Improvements	\$1,925,000	\$3,395,000	\$3,570,000	\$3,570,000
Windsor Locks Layover	\$2,500,000	\$2,500,000	\$2,500,000	\$2,500,000
New Haven Maintenance	\$16,000,000	\$16,000,000	\$16,000,000	\$16,000,000
Track Extensions	\$0	\$9,920,000	\$12,480,000	\$12,480,000
Control Points	\$0	\$6,000,000	\$7,500,000	\$7,500,000
Bridges	\$0	\$3,015,000	\$3,051,000	\$3,051,000
Train Sets	\$33,070,000	\$41,680,000	\$50,290,000	\$50,290,000
<i>Subtotal</i>	<i>\$57,695,000</i>	<i>\$86,710,000</i>	<i>\$99,591,000</i>	<i>\$99,591,000</i>
Contingency – 40%	\$23,078,000	\$34,684,000	\$39,836,400	\$39,836,400
Total Capital Costs	\$80,773,000	\$121,394,000	\$139,427,400	\$139,427,400

Station Improvements

There is currently double track through the Meriden station, but a passenger platform is provided only on the east side, adjacent to the station building. This requires all trains stopping at Meriden to use the easterly track. The greater frequency of service on the line will require some trains to meet another train at this location, forcing some trains to operate on the westerly track where there is no platform. A second platform will be required at Meriden, at a minimum estimated cost of \$50,000. However, a high-level platform may be required if new platforms are constructed due to ADA regulations.



Ideally, all commuter trains and all Amtrak trains on the Springfield line should stop at the State Street station in New Haven. Passenger volumes at State Street may require adjustments or improvements to the platform layout. Alternatively, use of the State Street station may require Springfield line trains to use different tracks into the New Haven station than current operations allow. An allowance of \$4,000,000 for platform and track 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).

Parking Facilities

Expansion or provision of station parking was analyzed for the four implementation alternatives based on station ridership. There are currently 360 parking spaces available at the Wallingford, Meriden, Berlin, Windsor and Windsor Locks stations. At New Haven, Hartford and Springfield stations, no additional parking would be constructed in conjunction with this project. Of these 360 spaces, utilization rates show that 240 spaces would typically be available for commuter rail service. Therefore, in order to accommodate the predicted station ridership, approximately 275 to 510 additional parking spaces are needed. The cost per space was estimated at \$7,000, including land acquisition for surface parking. At comparable ratios, parking costs for the four implementation alternatives would range from \$1.93 million to \$3.6 million, as shown in Table 3-8.

**Table 3-8
Parking Costs**

Alternative	Daily Trips	Total Spaces	Spaces to be Constructed	Cost
CT1	872	515	275	\$1,925,000
CT2	1,485	725	485	\$3,395,000
Bi-State1	1,767	750	510	\$3,570,000
Bi-State2	1,767	750	510	\$3,570,000

Maintenance and Layover Facilities

Under Alternatives CT1 and CT2, commuter service would operate only between Windsor Locks and New Haven. A small facility, sufficient for storing 2 trains sets overnight or during mid-day layovers, would be required north of the Windsor Locks Station. The facility should provide about 800 feet of track, electric power connections, and a small building for storing cleaning and overnight servicing supplies. The facility should be fenced and lighted for security purposes, and needs to be accessible from a nearby roadway. Including a power switch into the main track, the facility would cost approximately \$2.5 million.



The primary maintenance and storage facility for the system would be in New Haven. The maintenance facility would cost approximately \$16.0 million, inclusive of land, to handle the maintenance requirements for any minimum build option under Alternatives CT1 through Bi-State2.

Track Extensions

The limited operation of only 6 trains per day under Alternative CT1 would not require additional double track segments, based on the Rail Traffic Controller (RTC) simulations performed for this study. Therefore, there would be no capital cost for new mainline trackage. Alternatives CT2, Bi-State1, and Bi-State2 provide for reverse direction commuter service (running northbound from New Haven at the same time the primary service is operating southbound). To provide sufficient double trackage for dependable operation, several extensions of the current double track would be needed. These include:

- Extend 2nd track from milepost 17.0 (Holt) to milepost 13.3 (Wall), and provide a new control point at Wall.
- Extend 2nd track from milepost 31.1 (New) to milepost 28.2, and provide a new control point at milepost 28.2.
- Extend 2nd track from milepost 33.4 (Wood) to milepost 35.2, and provide a new control point at milepost 35.2.
- Extend 2nd track from milepost 43.0 (Windsor) to milepost 39.0 (Fry) and provide a new control point at Fry.
- Extend 2nd track from milepost 54.7 (Field) to milepost 51.5, and provide a new control point at milepost 51.5. (This extension required only for Alternatives Bi-State1 and Bi-State2, which envision service to Springfield).

Alternative CT2 would involve 12.4 miles of new track at \$800,000 per mile, plus 4 new control points at \$1.5 million each. The total cost would be \$15.92 million. Alternatives Bi-State1 and Bi-State2 would add 3.2 additional track miles and one control point, bringing the total to \$19.98 million. Control point costs include related signal system improvements.

Bridge Costs

Bridge costs were evaluated as part of the maximum build scenario. The costs are presented in Table 3-9. For a start-up service, it is assumed that short-term bridge costs would be encountered only where a new second main track is to be constructed, and that all other bridge costs would be considered long term maintenance costs to renew the existing infrastructure. On this basis, the bridge costs shown in Table 3-9 could be assigned to the initial commuter service.



**Table 3-9
Bridge Costs**

Bridge Number	Description	Short Term Cost
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
30.99 Newington	74 ft Encased I-Beam over Newington River	\$86,000
35.15 Hartford	79 ft Through Girder over Park Avenue	\$176,000
42.65 Windsor	29 ft Deck Girder over Batchelder Road	\$123,000
Total for Alternative CT2		\$3,015,000
53.98 Thompsonville	35 ft Encased I-Beam over Main Street	\$36,000
Total for Bi-State Alternatives		\$3,051,000

Train Sets

For Alternative CT1, the commuter service would require 3 train sets plus a spare locomotive, trailer coach, and cab coach. Alternative CT2 would require 4 train sets plus spare equipment, while Alternatives Bi-State1 and Bi-State2 (operating to Springfield instead of Windsor Locks) require 5 train sets plus spare equipment. Rolling stock costs for the four alternatives are shown in Table 3-10. It is of note that these costs were refined for the final estimate.

**Table 3-10
Rolling Stock Costs**

	Cost/Unit	Alt. CT1		Alt. CT2		Bi-State Alt.	
		Units	Cost	Units	Cost	Units	Cost
Locomotive	\$4,500,000	4	\$18,000,000	5	\$22,500,000	6	\$27,000,000
Coach	\$1,370,000	7	\$9,590,000	9	\$12,330,000	11	\$15,070,000
Cab Car	\$1,370,000	4	\$5,480,000	5	6,850,000	6	8,220,000
Total Cost			\$33,070,000		41,680,000		\$50,290,000

Note: Per unit costs revised for final estimate in Chapter 6

3.3.3 Operating Cost Comparison

Operating costs for the minimum and maximum build scenarios were based on a typical unit cost of \$40 per train mile, derived from examination of current costs of the Shore Line East commuter service. The same cost factor was applied to the four start-up alternatives. The resulting annual operating costs are projected in Table 3-11.



Table 3-11
Operating Cost Comparisons

	Alternative CT1	Alternative CT2	Bi-State Alternatives
Service Limits	Windsor Locks To New Haven	Windsor Locks To New Haven	Springfield To New Haven
Service Level	3 Southbound AM 3 Northbound PM	4 Southbound AM 3 Southbound PM 3 Northbound AM 4 Northbound PM	4 Southbound AM 3 Southbound PM 3 Northbound AM 4 Northbound PM
Annual Train Miles	74,676	174,244	220,472
Cost/Train Mile	\$40.00	\$40.00	\$40.00
Annual Operating Cost	\$2,987,040	\$6,969,760	\$8,818,880

3.3.4 Revenue Comparison

Revenue for Alternatives CT1 through Bi-State2 was calculated in the same manner as for the minimum and maximum build scenarios discussed earlier in this chapter. A fare structure similar to Shore Line East and Metro North was developed by ConnDOT. As for the two original scenarios, it was assumed that 80 percent of the riders would use monthly passes. Annual revenue was based on a typical 254 days of weekday operation, excluding holidays.

Forecasts for each of the four alternatives are shown below in Table 3-12. Alternatives Bi-State1 and Bi-State2 are identical because they would attract the same ridership volume. (Alternative Bi-State2 would have more uniform headways between trains by adjusting current Amtrak schedules).

Table 3-12
Revenue Comparison

	Alternative CT1	Alternative CT2	Bi-State Alternatives
Total Weekday Trips	872	1,485	1,767
Annual Revenue	\$ 367,930	\$ 667,121	\$ 868,903
Annual Operating Cost	\$ 2,987,000	\$ 6,970,000	\$ 8,819,000
Fare box Recovery	12.3%	9.6%	9.9%

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 over a year ago, 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 similar program was recently instituted in the Shore Line East corridor to cut costs.

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.

3.3.5 Summary

The resulting service characteristics, ridership, costs and performance measures are summarized in Table 3-13. All of these implementation alternatives include only existing stations on the line with existing low level platforms and at-grade pedestrian crossings. These alternatives include peak hour service only and a shuttle bus connection with Bradley Airport at Windsor Locks Station. Enhancements such as high level platforms, new station locations and off-peak service can be added to any implementation alternative from the menu of additional options as described in the next section.



Table 3-13
Implementation Alternatives Results

	CT1	CT2	Bi-State1 & 2
One-way train trips	6	14	14
New track required	None	12.4 miles	15.6 miles
Capital cost	\$80.8 million	\$121.4 million	\$139.4 million
Annual Operating cost	\$3.0 million	\$7.0 million	\$8.8 million
Annual Revenue	\$368,000	\$667,000	\$869,000
Annual Operating deficit	\$2.6 million	\$6.3 million	\$7.9 million
Projected Ridership (new daily trips)	872	1,485	1,767
Per passenger subsidy	\$11.82	\$16.71	\$17.71
Farebox recovery	12.3%	9.6%	9.9%

3.4 Menu of Additional Elements

The alternatives described in the previous section are considered the first phase of implementation of a new commuter service in the New Haven Hartford Springfield corridor. There are, however, a number of other elements that can be included in the initial implementation or at a later time. These additional elements include:

- Off-peak service
- Weekend service
- New Stations including:
 - Enfield Station
 - Newington Junction Station
 - North Haven Station
 - Wharton Brook Station
- Rail connection to Bradley International Airport
- Full high-level platforms at all stations
- Grade separated pedestrian facilities at all stations
- Station buildings at all stations



- Access Walkway to the Legislative Office Building in Hartford

Each of these additional elements is described in this section with associated costs and ridership.

3.4.1 Off-peak Service

Capital Cost – There is no capital cost associated with off-peak service as the peak service train sets can be used to provide the service.

Operating Cost – For the Bi-State Alternatives using an estimate of \$40 per train mile, each round-trip run would cost \$4,960 for 124 miles. Therefore, for each round-trip added to the schedule 254 non-holiday weekdays per year, the cost would be \$1.3 million per year. 8 round-trips to provide approximately hourly off-peak service would cost \$10.1 million per year in operating costs. For Alternative CT2, with service only to Windsor Locks, the comparable cost would be \$8 million.

Ridership – Ridership for off-peak service will depend on the amount and hours of the service. In the minimum build alternative, approximately 160 off-peak boardings were expected with the limited schedule. In the maximum build, 577 off-peak boardings were expected. The existing Amtrak schedule provides off-peak service at approximately two-hour intervals midday and one southbound and two northbound later evening trains. Airport ridership can also be considered off-peak ridership. In order to accurately serve the airport, service must be provided throughout the entire day, including off-peak times. The expected 350 weekday airport boardings will only be realized with adequate all-day service, especially during the peak air travel windows.

Revenue – The revenue for off-peak service would depend on the ridership experienced on the line. Using the assumed service level, fares and resulting ridership from the maximum build, annual revenue for off-peak service would be about \$1,783,080 per year.

3.4.2 Weekend and Holiday Service

Capital Cost – There is no capital cost associated with weekend service as the peak service train sets can be used to provide the service.

Operating Cost – For the Bi-State Alternatives, using an estimate of \$40 per train mile, each round-trip run would cost \$4,960 for 124 miles. Assuming each trip was added 111 days per year (Saturday, Sunday and holidays), for each round-trip run, the cost would be \$550,560 per year. The weekend schedule presented in the maximum build with 10 trains at approximately two hour intervals would cost \$5.5 million per year in operating costs. Alternative CT2 service only to Windsor Locks would have a comparable cost of \$4.3 million.



Ridership – Ridership for weekend service will depend on the amount and hours of the service. No weekend service was provided in the minimum build. In the maximum build, weekend service every two hours, including Amtrak ridership, was expected to yield approximately 1,964 trips. The current Amtrak schedule provides seven trains in each direction on both Saturday and Sunday. Weekend service would also affect airport ridership, although to a lesser degree than weekday off-peak service.

Revenue – The revenue for weekend service would depend on the ridership experienced on the line. Using the assumed service level, fares and resulting ridership from the maximum build, annual revenue for weekend service would be about \$326,000 per year.

3.4.3 Possible New Stations

The alternatives presented in this chapter would utilize existing stations, with only essential improvements to provide adequate parking and meet passenger service requirements. Analysis of the maximum build scenario identified potential additional stations that would contribute additional riders to the service. Station locations were identified to serve Enfield, Newington Junction, Wharton Brook, and North Haven. At a minimum, each station would require parking, auto and transit access, two low-level platforms to accommodate double track operation, and related canopies, lighting, and signage. Mini-high level platforms may be required at new stations to accommodate handicapped access. The maximum development of each station potential could involve full length high-level platforms and a grade-separated pedestrian crossing, plus a station building with enclosed waiting area.

Table 3-14 presents the probable range of costs for these new stations.

**Table 3-14
Possible New Station Costs**

Station	Enfield	Newington Jct	Wharton Brook	North Haven
Parking Spaces	175	225	150	125
Parking Cost	\$ 1,427,000	\$ 1,821,000	\$ 1,232,000	\$ 1,033,000
Low-Level Platforms	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000
Minimum Cost	\$ 1,827,000	\$ 2,221,000	\$ 1,632,000	\$1,433,000
High-Level Platforms with Canopy & Lighting	\$ 3,850,000	\$ 3,850,000	\$ 3,850,000	\$ 3,850,000
Pedestrian Crossing	\$ 3,850,000	\$ 3,850,000	\$ 3,850,000	\$ 3,850,000
Station Building	\$ 800,000	\$ 800,000	\$ 800,000	\$ 800,000
Maximum Cost	\$ 9,927,000	\$ 10,321,000	\$ 9,732,000	\$ 9,533,000
Weekday Boardings (Maximum Build)	210	250	156	138

Note: Costs include 10% design and 40% contingency costs



These potential new stations present no significant increases in operating costs of the rail service, but would incur some costs for routine maintenance, trash collection, and policing. Each additional passenger stop would add approximately 2 minutes to the overall running time of each train. Relative ridership potential, based on the original maximum build scenario, is shown in terms of weekday boardings.

3.4.4 Rail Connection to Bradley International Airport

Capital Cost – As estimated in the maximum build scenario, the cost to improve the Suffield Industrial Spur and construct an airport station is \$28 million, including 10% design and 40% contingency.

Operating Cost – Train operations would incur a cost of about \$40 per train mile. Total amount would depend on the number of trains operated. Since initial ridership volumes can be handled by low-cost bus shuttle, no attempt is made to project train costs.

Ridership and Revenue - No appreciable difference in ridership or revenue is expected with a rail connection to the airport due to the similar travel time experienced by the shuttle bus. As congestion builds on the airport connector road, and the travel time required by the rail connection becomes better than the shuttle bus connection, a rail connection is expected to be beneficial to airport ridership.

3.4.5 Full High-Level Platforms at All Stations

Capital Cost – The estimated cost for a full high-level platform is \$3.85 million per station, including 10% design and 40% contingency costs.

Ridership and Revenue – Although there is no estimated difference in ridership from the modeling results or revenue with the implementation of high level platforms, many industry leaders believe that there are ties between station amenities and ridership. Attractive and user-friendly stations give the impression of a higher-level service and therefore attract more ridership. In addition, high level platforms can make boarding faster and more efficient, which may save travel time on the line, thus increasing ridership by providing more prompt service.

3.4.6 Grade Separated Pedestrian Crossing Facilities at All Stations

Capital Cost – The estimated cost for grade-separated pedestrian crossing facilities \$3.85 million per station, including 10% design and 40% contingency costs.

Ridership and Revenue – Although there is no estimated difference in ridership from the modeling results or revenue with grade-separated pedestrian facilities, as with full high-level platforms, any station amenities can have a positive effect on ridership by improving the perception of the station in the eyes of riders.



3.4.7 Station Buildings at All Stations

Capital Cost – The estimated construction cost for a new station building is \$0.8 million per station, not including property costs. Many stations along the line have existing buildings that are currently serving another purpose, the purchase or lease of these buildings back from the current user would have to be negotiated.

Ridership and Revenue – Although there is no estimated difference in ridership from the modeling results or revenue with station buildings, as with full high-level platforms, any station amenities can have a positive effect on ridership by improving the perception of the station in the eyes of riders. This is especially true with station buildings, which often contain restrooms and heated / cooled waiting areas.

3.4.8 Access Walkway to the Legislative Office Building

Capital Cost – The direct accessibility of the Hartford Union Station to the Legislative Office Building has been of great interest to potential users of the NHHS service. Due to the close proximity of these two locations, an additional rail station at the Legislative Office Building is not feasible. Both the economics of constructing the \$7 million facility on a curved section of track, and the operational disadvantages in time, speed, and perception for stopping twice within 800 yards, make improving access from Hartford Union station preferable. To enhance access and ensure a safe pedestrian-friendly environment between the two locations, improvements ranging from lighting, landscaping, and walkway pavement architecture to a covered walkway with road-crossing signaling could be constructed. The estimated construction cost for these improvements ranges from \$250,000 for enhanced lighting and landscaping to \$2.0 million for these improvements with the addition of a covered walkway.

Ridership and Revenue – Similar to other station enhancements, there is no estimated difference in ridership or revenue from the modeling results, however such improvements will have a positive effect on ridership by improving the perception of the station in the eyes of riders. The LOB location could also fill the function of an overflow garage for Union Station.