List of Appendices

I-93/I-95 INTERCHANGE TRANSPORTATION STUDY
Transit/TDM Modeling Process and Inputs

TO: **ITF Members**
FROM: **Robert Swierk and Jim Wensley**
DATE: **August 21, 2006**
RE: **Transit/TDM Model Process and Inputs**

In late May 2006 at a TDM Subcommittee meeting and an ITF meeting, a list of transit and TDM components to be analyzed in the travel demand model was developed. At the June 28th ITF meeting, preliminary results of one model run, including just the Transit components, were presented. Since the last ITF meeting, the Study Team has been working to perform the remaining model runs and interpret the results. This handout summarizes the process and inputs used in the modeling effort.

Summary of Transit/TDM Modeling Process and Inputs

The process of modeling the Transit/TDM Components of the I-93/I-95 Interchange Study involved four main steps:

1. Identify how each component is to be analyzed
2. Define the inputs
3. Perform the model analysis
4. Summarize and interpret the results
5. Integrate the Transit/TDM results with the analysis of roadway alternatives

Step 1: Identify How Each Component is to be Analyzed

Discussions between CTPS and TranSystems on the capabilities of the regional travel demand model indicated that these components can be analyzed in one of two ways:

1. Directly within the model, by specifying inputs and letting the model run
2. Alongside the model, with manual adjustments to trip tables

The refined list of Transit/TDM components agreed upon by the TDM Subcommittee and the ITF was then grouped according to how each component would be analyzed. The components fell into two groups as follows:

- **Transit Service Components:** includes components 5, 6, 7, 10, and 11 (formerly called "Requiring Further Development"); these were analyzed directly within the model
- **TDM/Incentive Components:** includes components 1, 2, 3, 4, 8 and 9 (formerly called "Ready to be Evaluated"); these were analyzed alongside the model

Step 2: Define the Inputs

In order for CTPS to analyze the Transit and TDM components, specific inputs were developed. Examples of inputs include start and end points, headways, and fares for the Transit components, and the target mode and target market for the TDM components. These inputs are described further in the following sections.

Step 2a. Inputs for Transit Service Components

The following table presents a summary of the inputs for the Transit Service Components.

Component	Description/Model Inputs
5. Expanded shuttle service from Anderson RTC	Restructure and expand shuttle service from Anderson RTC as follows: 1. Establish separate Woburn circulator -Start and end at Anderson RTC -Intermediate routing: through commercial areas both sides of I-95 -Headways: Meet every train at Anderson during AM peak and PM peak (see Components 11A and 11B for new Lowell Line headways) -Fare: $1.00 one way, free transfer from MBTA commuter rail or MBTA bus 2. Establish separate route to Burlington and Lexington -Start and end points: Anderson RTC-Lexington -Intermediate routing: along I-95 to Burlington Mall Rd and Middlesex Turnpike, then along I-95 to Hartwell Ave in Lexington -Headways: Meet every train at Anderson during AM peak and PM peak (see Components 11A and 11B for new Lowell Line headways) -Fare: $1.75 one way, free transfer from MBTA commuter rail or MBTA bus
6. Off-peak shuttle service from Anderson RTC	Improve headways on the routes in Component 5 to 60 minutes midday and 60 minutes evening, with stops by request only. (Off-peak service on Peabody shuttle is provided through Component 7 below.)
7. New Park-and-Ride in Peabody with shuttle service to Woburn and Burlington	Park-and-Ride characteristics: -Assume directly connected to highway near I-95/128 split -Assume 500 space capacity, free parking New Park-and-Ride shuttle from Peabody -Start and end points: Peabody-Burlington -Intermediate routing: I-95 to commercial areas in Woburn, then to Burlington Mall Rd and Middlesex Turnpike -Headways: Peak-direction headways of 15 minutes in AM and PM peak periods, 60 minutes midday, 60 minutes evening (stops by request only) -Travel time: Tested without HOV lane (congested roadway time) and with HOV lane -Fare: $1.75 one-way; free transfer from MBTA bus routes to shuttle Improved connections from MBTA Route 436 and 465 to new Park-and-Ride -Same start and end points, headways, and fare, but add stop at new Park-and-Ride:
10. Increased MBTA reverse-peak and local bus service	Two service improvements: 1. Improved reverse-peak headways on MBTA Route 354: -Routing and Fare: Same as current -Headways: Improve reverse-peak headways to 20 minutes in AM and PM peak, midday and evening same as current 2. Extension of MBTA Route 132 to Reading and Woburn: -Start point: Same as current (Malden Station) -End point: Anderson RTC -Intermediate routing: Same as current, but after Redstone Shopping Center, travel up

Component	Description/Model Inputs
	Main Street to Reading Depot, then to commercial areas both sides of I-95, ending at Anderson -Headways: Same as current, except improve PM peak to 30 minutes; assume schedule adjusted to meet Haverhill Line trains at Reading Depot -Fare: Same as current
11A. Frequent commuter rail – Anderson to Boston	-Start and end points: Anderson RTC-North Station -Intermediate stops: All stops -Headways: Provide service on 30-minute headways in AM and PM peak periods, 60 minutes midday, 60 minutes evening (both inbound and outbound directions) -Fare: Same as current *[Note: This service and the Lowell-Boston service in 11B work together to produce 15-mintue peak-period headways between Anderson and Boston.]*
11B. Frequent commuter rail - Lowell and Haverhill to Boston	Two service improvements: 1. Lowell Line (Lowell to North Station): -Stops and Fare: Same as current -Headways: Improve peak-direction headways to 30 minutes in AM and PM peak periods; midday and evening same as current 2. Haverhill Line (Haverhill to North Station): -Stops and Fare: Same as current -Headways: Improve peak-direction headways to 30 minutes in AM and PM peak periods; midday and evening same as current No additional commuter rail trips would be added to the Wildcat Branch (Haverhill-Anderson-Boston); instead, this market would be served by the extended MBTA Route 132.

Step 2b. Inputs for TDM/Incentive Components

As noted above, the characteristics of the regional travel demand model require that analysis of the effects of the TDM/Incentive Components be done alongside the model, using manual adjustments. This is primarily because the mode choice portion of the model has a limited number of parameters (e.g., in-vehicle travel times, wait times, parking costs), which the TDM components would generally not directly affect.

The general approach to analyzing the affect of the TDM/Incentive Components is as follows:

1. **Specify Target Mode:** Specify whether each component affects Transit mode share, HOV mode share, or both
2. **Specify Target Market:** Specify the target market that the component will affect. Markets can be identified both geographically and in terms of whether the measures would focus on the production end (i.e., residence) or the attraction end (i.e., workplace) of the trip. Two target markets were identified:
    - Boston Oriented Market: Trips produced in target zones (the I-93 corridor north, the Route 3 corridor north, I-95 between Route 3 and Route 128) whose attraction end is employment in Boston, Cambridge, Somerville, or Medford. Measures directed at this market would focus on the residence end of trips.

- I-95 Oriented Market. Trips attracted to target employment zones along I-95 in Woburn, Lexington, and Burlington, regardless of their production zone. Measures directed at this market would focus on the workplace end of trips.

3. **Develop Parameters:** Estimate the combined effect of all the components on the Transit and HOV mode shares for each of the target markets; this produces parameters to be used to adjust tables produced by the regional travel demand model. For the Boston-Oriented Market, this was done for Home-Based Work trips in the AM Peak, Midday, and PM Peak periods. For the I-95 Oriented Market, this was done for Home-Based Work trips in the AM and PM Peak.

Rather than specify a specific model parameter for each of the above components (e.g., Component 1 increases HOV use in its Target Market by 25 percent), impacts of the components were estimated in combination. While data on the impacts of TDM and incentive programs is fairly limited, parameters can be chosen that represent high-end but realistic improvements in HOV and Transit usage.

The following table summarizes where each of the TDM Components falls in terms of Target Market and Target Mode, as well as the parameters used in the analysis of the TDM/Incentive Components:

Target Market	Target Mode	
	HOV	Transit
Boston Oriented	Contributing Components: 1. Online carpool sign-up 2A. Formal Park-and-Ride at Anderson 2B. Improved access to Anderson 9. Improved signage and information Parameter: Increase HOV volume in Target Market by 10%	Contributing Components: 2B. Improved access to Anderson 3. Expanded marketing of transit 9. Improved signage and information Parameter: Increase Transit volume in Target Market by 10%
I-95 Oriented	Contributing Components: 1. Online carpool sign-up 4. Expanded carpool outreach/incentives Parameter: Increase HOV volume in Target Market by 50%	Contributing Components: 3. Expanded marketing of transit 8. Cross-ticketing/payment on shuttles Parameter: Increase Transit volume in Target Market by 50%

In addition to the above parameters, the effect of Component 8 (Cross-ticketing/fare payment on private shuttles) was incorporated directly into the model. As described earlier in this memo, free transfers were assumed from MBTA commuter rail and MBTA buses to the shuttle at Anderson RTC, and from MBTA buses to the proposed Peabody Park-and-Ride shuttle in Peabody.

Step 3: Perform the Model Analysis

Based on the analysis methods and model inputs summarized above, CTPS performed four analyses of Transit and TDM Components. These scenarios included:

1. Transit Service Components only
2. TDM Components only
3. Transit + TDM Components (two scenarios):
    a. "Low Shift" scenario – assuming the effects of the components are additive (the Transit and TDM Components both operate on the 2025 No-Action trip volumes)
    b. "High Shift" scenario – assuming the components produce a compounded effect (the TDM Components operate on the already-enhanced transit network/volumes) and an HOV lane improves transit travel times between study interchange and Peabody
4. Transit + TDM Components (sensitivity analysis of HOV lane between interchange and Peabody)

The first two analyses showed the effects of the sets separately. The third and fourth analyses showed the effects of the components when combined. Two different assumptions were made regarding the effect of combining the components, to produce an upper-bound and lower-bound estimate. The purpose of the last analysis was to test the sensitivity of the projected ridership on the Peabody shuttle to the travel times on I-95.

Step 4: Summarize and Interpret the Results

The model analyses performed in Step 3 produce a number of outputs, including projected transit ridership, projected HOV trips, and projected reductions of trips by Single-Occupant Vehicles. These results are summarized in a separate handout. The results handout also includes observations regarding the significance of the trip reductions generated by the Transit and TDM Components in the context of the I-93/I-95 interchange and the regional roadway network.

Step 5: Integrate Transit/TDM Results with Roadway Analysis

A final step will be necessary to integrate the results of the Transit/TDM modeling described in this handout with the analysis of roadway improvement alternatives being considered for the study interchange. This integration will take place after the review of the Transit/TDM modeling results by the TDM Subcommittee and further discussions about analysis methodology.

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I93-I95 Interchange Study
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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	Transit only, No HOV Lanes: Transit Service Improvements	Change	% Change
Person Trips	**14,385,000**	**16,065,750**	**16,065,750**	**-**	**0.0%**
Linked Transit Person Trips	**775,000**	**966,050**	**966,880**	**830**	**0.1%**
Auto Person Trips	**11,225,600**	**12,322,000**	**12,321,260**	**-740**	**0.0%**
SOV	7,296,600	8,132,500	8,132,000	-600	0.0%
HOV	3,929,000	4,189,500	4,189,260	-140	0.0%
Non-motorized Trips	**2,384,400**	**2,777,700**	**2,777,610**	**-90**	**0.0%**
Unlinked Person Trips	1,023,000	1,323,490	1,324,640	1,150	0.1%
Ratio of Unlinked to Linked Trips	1.32	1.37	1.37	0	0.0%
Transit Mode Share	5.4%	6.0%	6.0%	0.0%	0%
Auto Mode Share	78.0%	76.7%	76.7%	0.0%	0%
Non-motorized Share	16.6%	17.3%	17.3%	0.0%	0%
Commuter Rail Line Boardings	**39,600**	**44,560**	**46,860**	**2,300**	**5%**
Inbound	19,800	22,280	23,430	1,150	5%
Outbound	19,800	22,280	23,430	1,150	5%
Haverhill Line	**10,400**	**12,500**	**12,800**	**300**	**2%**
Inbound	5,200	6,250	6,400	150	2%
Outbound	5,200	6,250	6,400	150	2%
Lowell Line	**11,200**	**12,900**	**14,900**	**2,000**	**16%**
Inbound	5,600	6,450	7,450	1,000	16%
Outbound	5,600	6,450	7,450	1,000	16%
Rockport/Newburyport Line	**18,000**	**19,160**	**19,160**	**-**	**0%**
Inbound	9,000	9,580	9,580	-	0%
Outbound	9,000	9,580	9,580	-	0%
Anderson RTC Station	900	1,380	1,860	480	35%
Bus Boardings	**7,230**	**8,260**	**8,420**	**160**	**2%**
Inbound	3,630	4,120	4,180	60	1%
Outbound	3,600	4,140	4,240	100	2%
Rte 132	**510**	**610**	**650**	**40**	**7%**
Inbound	290	340	360	20	6%
Outbound	220	270	290	20	7%
Rte 134	**1,630**	**1,770**	**1,630**	**-140**	**-8%**
Inbound	820	880	810	-70	-8%
Outbound	810	890	820	-70	-8%
Rte 136	**880**	**1,020**	**1,080**	**60**	**6%**
Inbound	480	550	580	30	5%
Outbound	400	470	500	30	6%
Rte 137	**830**	**950**	**980**	**30**	**3%**
Inbound	410	450	460	10	2%
Outbound	420	500	520	20	4%
Rte 350	**1,540**	**1,630**	**1,510**	**-120**	**-7%**
Inbound	700	750	690	-60	-8%
Outbound	840	880	820	-60	-7%

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	Transit only, No HOV Lanes: Transit Service Improvements	Change	% Change
Rte 354	**800**	**1,060**	**1,010**	**-50**	**-5%**
Inbound	420	550	520	-30	-5%
Outbound	380	510	490	-20	-4%
Rte 355	**20**	**20**	**-**	**-20**	**-100%**
Inbound	10	10	0	-10	-100%
Outbound	10	10	0	-10	-100%
Rte 436	**680**	**750**	**790**	**40**	**5%**
Inbound	360	400	410	10	3%
Outbound	320	350	380	30	9%
Rte 465	**300**	**350**	**350**	**0**	**0%**
Inbound	120	140	140	0	0%
Outbound	180	210	210	0	0%
Peabody Shuttle	**-**	**-**	**200**	**200**	**na**
Eastbound	-	-	100	100	na
Westbound	-	-	100	100	na
Metro North Shuttle (Woburn, Burlington, & Lexington)	**40**	**100**	**220**	**120**	**120%**
Eastbound	20	50	110	60	120%
Westbound	20	50	110	60	120%
Orange Line Station Boardings "Northern Market"	**28,280**	**43,770**	**43,170**	**-600**	**-1%**
Oak Grove	4,790	5,750	5,670	-80	-1%
Malden	8,550	10,400	10,390	-10	0%
Wellington	7,420	9,830	9,650	-180	-2%
Assembly Square	-	7,580	7,540	-40	-1%
Sullivan Square	7,520	10,210	9,920	-290	-3%
Red Line Station Boardings "Northern Market"	**9,500**	**8,100**	**8,050**	**-50**	**-1%**
Alewife	9,500	8,100	8,050	-50	-1%
Study Area Unlinked Trips: Transit Boardings & Alightings	**122,390**	**156,560**	**157,720**	**1,160**	**1%**

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	TDM only, No HOV Lanes: Transit Service Improvements	Change	% Change
Person Trips	**14,385,000**	**16,065,750**	**16,065,750**	**-**	**0.0%**
Linked Transit Person Trips	**775,000**	**966,050**	**969,000**	**2,950**	**0.3%**
Auto Person Trips	**11,225,600**	**12,322,000**	**12,319,050**	**2,950**	**0.0%**
SOV	7,296,600	8,132,500	8,119,210	-13,290	-0.2%
HOV	3,929,000	4,189,500	4,199,840	10,340	0.2%
Non-motorized Trips	**2,384,400**	**2,777,700**	**2,777,700**	**-**	**0.0%**
Unlinked Person Trips	1,023,000	1,323,490	1,328,020	4,530	0.3%
Ratio of Unlinked to Linked Trips	1.32	1.37	1.37	0	0.0%
Transit Mode Share	5.4%	6.0%	6.0%	0.0%	0.3%
Auto Mode Share	78.0%	76.7%	76.7%	0.0%	0.0%
Non-motorized Share	16.6%	17.3%	17.3%	0.0%	0.0%
Commuter Rail Line Boardings	**39,600**	**44,560**	**46,060**	**1,500**	**3%**
Inbound	19,800	22,280	23,030	750	3%
Outbound	19,800	22,280	23,030	750	3%
Haverhill Line	**10,400**	**12,500**	**13,200**	**700**	**6%**
Inbound	5,200	6,250	6,600	350	6%
Outbound	5,200	6,250	6,600	350	6%
Lowell Line	**11,200**	**12,900**	**13,400**	**500**	**4%**
Inbound	5,600	6,450	6,700	250	4%
Outbound	5,600	6,450	6,700	250	4%
Rockport/Newburyport Line	**18,000**	**19,160**	**19,460**	**300**	**2%**
Inbound	9,000	9,580	9,730	150	2%
Outbound	9,000	9,580	9,730	150	2%
Anderson RTC Station	900	1,380	1,600	220	16%
Bus Boardings	**7,230**	**8,260**	**8,970**	**710**	**9%**
Inbound	3,630	4,120	4,430	310	8%
Outbound	3,600	4,140	4,540	400	10%
Rte 132	**510**	**610**	**660**	**50**	**8%**
Inbound	290	340	370	30	9%
Outbound	220	270	290	20	7%
Rte 134	**1,630**	**1,770**	**1,880**	**110**	**6%**
Inbound	820	880	940	60	7%
Outbound	810	890	940	50	6%
Rte 136	**880**	**1,020**	**1,120**	**100**	**10%**
Inbound	480	550	600	50	9%
Outbound	400	470	520	50	11%
Rte 137	**830**	**950**	**1,040**	**90**	**9%**
Inbound	410	450	490	40	9%
Outbound	420	500	550	50	10%
Rte 350	**1,540**	**1,630**	**1,710**	**80**	**5%**
Inbound	700	750	790	40	5%
Outbound	840	880	920	40	5%

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	TDM only, No HOV Lanes: Transit Service Improvements	Change	% Change
Rte 354	**800**	**1,060**	**1,140**	**80**	**8%**
Inbound	420	550	580	30	5%
Outbound	380	510	560	50	10%
Rte 355	**20**	**20**	**20**	**0**	**0%**
Inbound	10	10	10	0	0%
Outbound	10	10	10	0	0%
Rte 436	**680**	**750**	**830**	**80**	**11%**
Inbound	360	400	380	-20	-5%
Outbound	320	350	450	100	29%
Rte 465	**300**	**350**	**370**	**20**	**6%**
Inbound	120	140	170	30	21%
Outbound	180	210	200	-10	-5%
Peabody Shuttle	**-**	**-**	**-**	**0**	**na**
Eastbound	-	-	0	0	na
Westbound	-	-	0	0	na
Metro North Shuttle (Woburn, Burlington, & Lexington)	**40**	**100**	**200**	**100**	**100%**
Eastbound	20	50	100	50	100%
Westbound	20	50	100	50	100%
Orange Line Station Boardings "Northern Market"	**28,280**	**43,770**	**45,700**	**1,930**	**4%**
Oak Grove	4,790	5,750	6,430	680	12%
Malden	8,550	10,400	10,950	550	5%
Wellington	7,420	9,830	10,460	630	6%
Assembly Square	-	7,580	7,620	40	1%
Sullivan Square	7,520	10,210	10,240	30	0%
Red Line Station Boardings "Northern Market"	**9,500**	**8,100**	**8,360**	**260**	**3%**
Alewife	9,500	8,100	8,360	260	0
Study Area Unlinked Trips: Transit Boardings & Alightings	**122,390**	**156,560**	**163,150**	**6,590**	**4%**

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	TDM & Transit, No HOV Lanes: Transit Service Improvements	Change	% Change
Person Trips	**14,385,000**	**16,065,750**	**16,065,750**	**-**	**0.0%**
Linked Transit Person Trips	**775,000**	**966,050**	**969,580**	**3,530**	**0.4%**
Auto Person Trips	**11,225,600**	**12,322,000**	**12,318,560**	**-3,440**	**0.0%**
SOV	7,296,600	8,132,500	8,118,310	-14,190	-0.2%
HOV	3,929,000	4,189,500	4,200,250	10,750	0.3%
Non-motorized Trips	**2,384,400**	**2,777,700**	**2,777,610**	**-90**	**0.0%**
Unlinked Person Trips	1,023,000	1,323,490	1,329,830	6,340	0.5%
Ratio of Unlinked to Linked Trips	1.32	1.37	1.37	0	0.1%
Transit Mode Share	5.4%	6.0%	6.0%	0.0%	0%
Auto Mode Share	78.0%	76.7%	76.7%	0.0%	0%
Non-motorized Share	16.6%	17.3%	17.3%	0.0%	0%
Commuter Rail Line Boardings	**39,600**	**44,560**	**47,540**	**2,980**	**7%**
Inbound	19,800	22,280	23,770	1,490	7%
Outbound	19,800	22,280	23,770	1,490	7%
Haverhill Line	**10,400**	**12,500**	**13,150**	**650**	**5%**
Inbound	5,200	6,250	6,575	325	5%
Outbound	5,200	6,250	6,575	325	5%
Lowell Line	**11,200**	**12,900**	**15,050**	**2,150**	**17%**
Inbound	5,600	6,450	7,525	1,075	17%
Outbound	5,600	6,450	7,525	1,075	17%
Rockport/Newburyport Line	**18,000**	**19,160**	**19,340**	**180**	**1%**
Inbound	9,000	9,580	9,670	90	1%
Outbound	9,000	9,580	9,670	90	1%
Anderson RTC Station	900	1,380	1,970	590	43%
Bus Boardings	**7,230**	**8,260**	**9,090**	**830**	**10%**
Inbound	3,630	4,120	4,510	390	9%
Outbound	3,600	4,140	4,580	440	11%
Rte 132	**510**	**610**	**730**	**120**	**20%**
Inbound	290	340	410	70	21%
Outbound	220	270	320	50	19%
Rte 134	**1,630**	**1,770**	**1,730**	**-40**	**-2%**
Inbound	820	880	870	-10	-1%
Outbound	810	890	870	-20	-2%
Rte 136	**880**	**1,020**	**1,170**	**150**	**15%**
Inbound	480	550	630	80	15%
Outbound	400	470	540	70	15%
Rte 137	**830**	**950**	**1,020**	**70**	**7%**
Inbound	410	450	480	30	7%
Outbound	420	500	540	40	8%
Rte 350	**1,540**	**1,630**	**1,480**	**-150**	**-9%**
Inbound	700	750	680	-70	-9%
Outbound	840	880	800	-80	-9%

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	TDM & Transit, No HOV Lanes: Transit Service Improvements	Change	% Change
Rte 354	**800**	**1,060**	**1,190**	**130**	**12%**
Inbound	420	550	610	60	11%
Outbound	380	510	580	70	14%
Rte 355	**20**	**20**	**30**	**10**	**50%**
Inbound	10	10	10	0	0%
Outbound	10	10	20	10	100%
Rte 436	**680**	**750**	**840**	**90**	**12%**
Inbound	360	400	390	-10	-3%
Outbound	320	350	450	100	29%
Rte 465	**300**	**350**	**370**	**20**	**6%**
Inbound	120	140	170	30	21%
Outbound	180	210	200	-10	-5%
Peabody Shuttle	**-**	**-**	**220**	**220**	**na**
Eastbound	-	-	110	110	na
Westbound	-	-	110	110	na
Metro North Shuttle (Woburn, Burlington, & Lexington)	**40**	**100**	**300**	**200**	**200%**
Eastbound	20	50	150	100	200%
Westbound	20	50	150	100	200%
Orange Line Station Boardings "Northern Market"	**28,280**	**43,770**	**45,430**	**1,660**	**4%**
Oak Grove	4,790	5,750	6,290	540	9%
Malden	8,550	10,400	10,980	580	6%
Wellington	7,420	9,830	10,370	540	5%
Assembly Square	-	7,580	7,600	20	0%
Sullivan Square	7,520	10,210	10,190	-20	0%
Red Line Station Boardings "Northern Market"	**9,500**	**8,100**	**8,070**	**-30**	**0%**
Alewife	9,500	8,100	8,070	-30	0%
Study Area Unlinked Trips: Transit Boardings & Alightings	**122,390**	**156,560**	**163,630**	**7,070**	**5%**

I93-I95 Interchange Study
Woburn, Reading, and Stoneham

Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	Low TDM & Transit, With HOV Lanes: Transit Service Improvements	Change	% Change
Person Trips	**14,385,000**	**16,065,750**	**16,065,750**	**0**	**0.0%**
Linked Transit Person Trips	**775,000**	**966,050**	**969,740**	**3,690**	**0.4%**
Auto Person Trips	**11,225,600**	**12,322,000**	**12,318,400**	**-3,600**	**0.0%**
SOV	7,296,600	8,132,500	8,118,180	-14,320	-0.2%
HOV	3,929,000	4,189,500	4,200,220	10,720	0.3%
Non-motorized Trips	**2,384,400**	**2,777,700**	**2,777,610**	**-90**	**0.0%**
Unlinked Person Trips	1,023,000	1,323,490	1,330,050	6,560	**0.5%**
Ratio of Unlinked to Linked Trips	1.32	1.37	1.37	0	0.1%
Transit Mode Share	5.4%	6.0%	6.0%	0%	0%
Auto Mode Share	78.0%	76.7%	76.7%	0%	0%
Non-motorized Share	16.6%	17.3%	17.3%	0%	0%
Commuter Rail Line Boardings	**39,600**	**44,560**	**47,540**	**2,980**	**7%**
Inbound	19,800	22,280	23,770	1,490	7%
Outbound	19,800	22,280	23,770	1,490	7%
Haverhill Line	**10,400**	**12,500**	**13,150**	**650**	**5%**
Inbound	5,200	6,250	6,575	325	5%
Outbound	5,200	6,250	6,575	325	5%
Lowell Line	**11,200**	**12,900**	**15,050**	**2,150**	**17%**
Inbound	5,600	6,450	7,525	1,075	17%
Outbound	5,600	6,450	7,525	1,075	17%
Rockport/Newburyport Line	**18,000**	**19,160**	**19,340**	**180**	**1%**
Inbound	9,000	9,580	9,670	90	1%
Outbound	9,000	9,580	9,670	90	1%
Anderson RTC Station	900	1,380	1,970	590	43%
Bus Boardings	**7,230**	**8,260**	**9,370**	**1,110**	**13%**
Inbound	3,630	4,120	4,645	525	13%
Outbound	3,600	4,140	4,725	585	14%
Rte 132	**510**	**610**	**730**	**120**	**20%**
Inbound	290	340	410	70	21%
Outbound	220	270	320	50	19%
Rte 134	**1,630**	**1,770**	**1,760**	**-10**	**-1%**
Inbound	820	880	880	0	0%
Outbound	810	890	880	-10	-1%
Rte 136	**880**	**1,020**	**1,170**	**150**	**15%**
Inbound	480	550	630	80	15%
Outbound	400	470	540	70	15%
Rte 137	**830**	**950**	**1,020**	**70**	**7%**
Inbound	410	450	480	30	7%
Outbound	420	500	540	40	8%
Rte 350	**1,540**	**1,630**	**1,510**	-120	-7%
Inbound	700	750	690	-60	-8%
Outbound	840	880	820	-60	-7%

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Woburn, Reading, and Stoneham

Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	Low TDM & Transit, With HOV Lanes: Transit Service Improvements	Change	% Change
Rte 354	**800**	**1,060**	**1,190**	**130**	**12%**
Inbound	420	550	610	60	11%
Outbound	380	510	580	70	14%
Rte 355	**20**	**20**	**30**	**10**	**50%**
Inbound	10	10	10	0	0%
Outbound	10	10	20	10	100%
Rte 436	**680**	**750**	**840**	**90**	**12%**
Inbound	360	400	390	-10	-3%
Outbound	320	350	450	100	29%
Rte 465	**300**	**350**	**370**	**20**	**6%**
Inbound	120	140	170	30	21%
Outbound	180	210	200	-10	-5%
Peabody Shuttle	**-**	**-**	**410**	**410**	**na**
Eastbound	-	-	205	205	na
Westbound	-	-	205	205	na
Metro North Shuttle (Woburn, Burlington, & Lexington)	**40**	**100**	**340**	**240**	**240%**
Eastbound	20	50	170	120	240%
Westbound	20	50	170	120	240%
Orange Line Station Boardings "Northern Market"	**28,280**	**43,770**	**45,430**	**1,660**	**4%**
Oak Grove	4,790	5,750	6,290	540	9%
Malden	8,550	10,400	10,980	580	6%
Wellington	7,420	9,830	10,370	540	5%
Assembly Square	-	7,580	7,600	20	0%
Sullivan Square	7,520	10,210	10,190	-20	0%
Red Line Station Boardings "Northern Market"	**9,500**	**8,100**	**8,070**	**-30**	**0%**
Alewife	9,500	8,100	8,070	-30	0
Study Area Unlinked Trips: Transit Boardings & Alightings	**122,390**	**156,560**	**163,910**	**7,350**	**5%**

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Woburn, Reading, and Stoneham

Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	High TDM & Transit, With HOV Lanes: Transit Service Improvements	Change	% Change
Person Trips	**14,385,000**	**16,065,750**	**16,065,750**	**0**	**0.0%**
Linked Transit Person Trips	**775,000**	**966,050**	**969,950**	**3,900**	**0.4%**
Auto Person Trips	**11,225,600**	**12,322,000**	**12,318,190**	**-3,810**	**0.0%**
SOV	7,296,600	8,132,500	8,117,760	-14,740	-0.2%
HOV	3,929,000	4,189,500	4,200,430	10,930	0.3%
Non-motorized Trips	**2,384,400**	**2,777,700**	**2,777,610**	**-90**	**0.0%**
Unlinked Person Trips	1,023,000	1,323,490	1,330,330	6,840	0.5%
Ratio of Unlinked to Linked Trips	1.32	1.37	1.37	0	0.1%
Transit Mode Share	5.4%	6.0%	6.0%	0%	0%
Auto Mode Share	78.0%	76.7%	76.7%	0%	0%
Non-motorized Share	16.6%	17.3%	17.3%	0%	0%
Commuter Rail Line Boardings	**39,600**	**44,560**	**48,070**	**3,510**	**7.9%**
Inbound	19,800	22,280	24,035	1,755	7.9%
Outbound	19,800	22,280	24,035	1,755	7.9%
Haverhill Line	**10,400**	**12,500**	**13,390**	**890**	**7%**
Inbound	5,200	6,250	6,695	445	7%
Outbound	5,200	6,250	6,695	445	7%
Lowell Line	**11,200**	**12,900**	**15,330**	**2,430**	**19%**
Inbound	5,600	6,450	7,665	1,215	19%
Outbound	5,600	6,450	7,665	1,215	19%
Rockport/Newburyport Line	**18,000**	**19,160**	**19,350**	**190**	**1%**
Inbound	9,000	9,580	9,675	95	1%
Outbound	9,000	9,580	9,675	95	1%
Anderson RTC Station	900	1,380	2,400	1,020	74%
Bus Boardings	**7,230**	**8,260**	**9,840**	**1,580**	**19.1%**
Inbound	3,630	4,120	4,880	760	18.4%
Outbound	3,600	4,140	4,960	820	19.8%
Rte 132	**510**	**610**	**780**	**170**	**28%**
Inbound	290	340	440	100	29%
Outbound	220	270	340	70	26%
Rte 134	**1,630**	**1,770**	**1,840**	**70**	**4%**
Inbound	820	880	920	40	5%
Outbound	810	890	920	30	3%
Rte 136	**880**	**1,020**	**1,240**	**220**	**22%**
Inbound	480	550	670	120	22%
Outbound	400	470	570	100	21%
Rte 137	**830**	**950**	**1,060**	**110**	**12%**
Inbound	410	450	500	50	11%
Outbound	420	500	560	60	12%
Rte 350	**1,540**	**1,630**	**1,380**	-250	-15%
Inbound	700	750	630	-120	-16%
Outbound	840	880	750	-130	-15%

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Daily Modal Breakdown	2005 Existing Conditions	2025 No-Build	High TDM & Transit, With HOV Lanes: Transit Service Improvements	Change	% Change
Rte 354	**800**	**1,060**	**1,150**	**90**	**8%**
Inbound	420	550	590	40	7%
Outbound	380	510	560	50	10%
Rte 355	**20**	**20**	**10**	**-10**	**-50%**
Inbound	10	10	0	-10	-100%
Outbound	10	10	10	0	0%
Rte 436	**680**	**750**	**900**	**150**	**20%**
Inbound	360	400	410	10	3%
Outbound	320	350	490	140	40%
Rte 465	**300**	**350**	**400**	**50**	**14%**
Inbound	120	140	180	40	29%
Outbound	180	210	220	10	5%
Peabody Shuttle	**-**	**-**	**600**	**600**	**na**
Eastbound	-	-	300	300	na
Westbound	-	-	300	300	na
Metro North Shuttle (Woburn, Burlington, & Lexington)	**40**	**100**	**480**	**380**	**380%**
Eastbound	20	50	240	190	380%
Westbound	20	50	240	190	380%
Orange Line Station Boardings "Northern Market"	**28,280**	**43,770**	**45,700**	**1,930**	**4%**
Oak Grove	4,790	5,750	6,410	660	11%
Malden	8,550	10,400	11,090	690	7%
Wellington	7,420	9,830	10,410	580	6%
Assembly Square	-	7,580	7,610	30	0%
Sullivan Square	7,520	10,210	10,180	(30)	0%
Red Line Station Boardings "Northern Market"	**9,500**	**8,100**	**8,200**	**100**	**1%**
Alewife	9,500	8,100	8,200	100	0
Study Area Unlinked Trips: Transit Boardings & Alightings	**122,390**	**156,560**	**165,710**	**9,150**	**6%**