Appendix F Conceptual Costs of Transit and TDM Components

I-93/I-95 INTERCHANGE TRANSPORTATION STUDY Conceptual Costs of Transit/TDM Components

TO: ITF Members

FROM: Robert Swierk and Jim Wensley

DATE: October 4, 2006 – REVISED February 26, 2007 RE: Conceptual Costs of Transit/TDM Components

As a part of the I-93/I-95 Interchange Study, a set of Transit and Transportation Demand Management (TDM) components has been developed. These alternatives were developed and discussed in May and June 2006 by the ITF and the TDM Subcommittee. During the summer of 2006, the Study Team performed an analysis of these components using the CTPS regional travel demand model; the results of this analysis were presented to the ITF and TDM Subcommittee in August and September 2006. At the suggestion of the ITF, conceptual cost estimates for these Transit and TDM components have been developed, as a way to gauge their rough costs in relation to each other and to the proposed roadway alternatives.

This handout provides a brief summary of the conceptual cost estimates for the Transit and TDM components, which include Capital Costs, Operating Costs, and Total Annual Costs, followed by a discussion of the cost estimates in each area. The cost figures for Transit Components 11A and 11B have been updated to reflect the increase in Lowell Line commuter rail service by the MBTA on October 30, 2006, and the cost figures for TDM Components 2A and 2B have been updated to reflect the outcome of the TDM Subcommittee meeting on February 16, 2007.

Summary of Conceptual Costs

The following is a summary of the conceptual cost estimates for the Transit and TDM Components developed for the study. Note that costs have not been estimated for several components because they are either currently being explored in separate efforts or they require further study.

Transit Component	Conceptual Total Annual Cost (2006\$)	TDM Component	Conceptual Total Annual Cost (2006\$)
Expanded Anderson shuttle service	\$1.2 million	1. On-line carpool sign-up	\$0 (underway)
Off-peak Anderson shuttle service	\$300,000	2A. Formal Park-and-Ride program at Anderson	\$0 (underway)
7. Park-and-Ride shuttle from Peabody	\$950,000	2B. Improved pedestrian/ vehicle access to Anderson	\$170,000
10. Increased MBTA reverse- peak, local bus service	\$740,000	Expanded marketing of transit	\$700,000
11A. Frequent commuter rail - Anderson to Boston	\$2.2 million (originally \$3.9 million)	Expanded outreach and incentives for carpooling	\$2,200,000
11B. Frequent commuter rail - Lowell and Haverhill to Boston	\$200,000 (originally \$1.4 million)	8. Cross-ticketing/fare payment on private shuttles	Requires Further Study
		9. Improved signage and information	\$240,000
TRANSIT TOTAL	\$5.6 million (originally \$8.5 million)	TDM TOTAL	At least \$3.3 million

Capital Costs – Transit Components:

Conceptual, order-of-magnitude capital costs were estimated for the Transit Components in the following way:

- Types and quantities of capital cost items were estimated: For instance, some components require the purchase of new buses or commuter rail equipment, and others involve the construction of new infrastructure (such as a Park-and-Ride facility in Component 7).
- Approximate unit costs were identified: Unit costs were identified for cost items including transit buses, commuter rail locomotives and coaches, surface parking spaces, and a commuter rail storage track. These unit costs were developed based on past studies (such as the MBTA Commuter Rail Infrastructure Needs Assessment Study, April 2004) and the American Public Transportation Association (APTA) bus and rail vehicle database. Unit costs were escalated to 2006 dollars by 3.5%/year where necessary.
- Cost estimates were developed: Conceptual capital costs were calculated by multiplying quantities by unit costs for each cost item, and applying a contingency factor appropriate to the conceptual level of development of these components.

The following table summarizes the conceptual capital costs of the proposed Transit Components:

Component	Conceptual Capital Cost (2006\$)	Notes
Expanded Anderson shuttle service	\$0	Vehicle costs included in Operating Costs (assume contracted service)
Off-peak Anderson shuttle service	\$0	Vehicle costs included in Operating Costs (assume contracted service)
7. Park-and-Ride shuttle from Peabody	\$1.8 million	Includes 500-space surface parking facility, basic amenities (no building); vehicle costs included in Operating Costs
10. Increased MBTA reverse- peak, local bus service	\$1.1 million	Cost is for three standard transit buses
11A. Frequent commuter rail - Anderson to Boston	\$14 million (originally \$27 million)	Cost is for one trainset (1 locomotive + 3 bi-level coaches each) and a storage track near Anderson RTC
11B. Frequent commuter rail - Lowell and Haverhill to Boston	\$0 (originally \$13 million)	Included above
TOTAL	\$16.9 million (originally \$43 million)	

- 1. All costs are in 2006 dollars.
- 2. Park-and-Ride facility cost in Component 7 assumes facility is located on State-owned land, so there is no capital cost for land.
- 3. Commuter rail equipment costs in Components 11A and 11B represent the equipment that is likely to be required to operate the enhanced services, taking into account current equipment constraints and projected future equipment needs from the MBTA Commuter Rail Infrastructure Needs Assessment Study, April 2004, as well as the Lowell Line service in crease by the MBTA on October 30, 2006.
- 4. The State of New Hampshire is currently studying transit improvements on the I-93 corridor, which could include commuter rail extensions. The outcome of this study could affect service plans, ridership, and costs for the commuter rail components proposed, here.
- 5. An operations analysis would need to be done on both North Station and the Lowell Line to determine whether any other infrastructure would be necessary.

Capital Costs – TDM Components:

Conceptual, order-of-magnitude capital costs were estimated for the TDM Components in the following way:

- Types and quantities of capital cost items were estimated: The main cost items identified were a pedestrian bridge across the tracks at Anderson RTC in Component 2B, and static signs and Variable Message Signs in Component 9. Other components were assumed to involve no capital costs (only operating costs).
- Approximate unit costs were identified: Unit costs were identified for cost items including static signs and Variable Message Signs to be placed along approaches to the interchange. Sources included the MassHighway Weighted Average Bid Price database and the U.S. Department of Transportation Intelligent Transportation Systems (ITS) cost database. Unit costs were escalated to 2006 dollars by 3.5%/year where necessary.
- Cost estimates were developed: Conceptual capital costs were calculated by multiplying quantities by unit costs for each cost item, and applying a contingency factor appropriate to the conceptual level of development of these components.

The following table summarizes the conceptual capital costs of the proposed TDM Components:

Component	Conceptual Capital Cost (2006\$)	Notes	
1. On-line carpool sign-up	\$0	Assume no new capital cost (MassRIDES in the process of implementing)	
2A. Formal Park-and-Ride program at Anderson	\$0	Assume no new capital cost (MassRIDES in the process of implementing)	
2B. Improved pedestrian/vehicle access to Anderson	\$2 million	Conceptual cost for a pedestrian bridge across tracks at Anderson RTC	
3. Expanded marketing of transit	\$0	Assume no capital cost (work with existing agencies to implement)	
Expanded outreach and incentives for carpooling	\$0	Assume no capital cost (work with existing agencies and employers to implement)	
8. Cross-ticketing/fare payment on private shuttles	\$0	Assume that this uses existing fare media, and therefore little or no capital investment	
9. Improved signage and information	\$1.3 million	Includes 20 static signs (6' x 4'), 5 permanent roadside Variable Message Signs and 5 portable Variable Message Signs	
TOTAL	\$3.3 million		

- 1. All costs are in 2006 dollars.
- 2. Conceptual capital cost of TDM Component 9 assumes that 20 static signs would be placed on five approaches to the study interchange: I-93 southbound, I-95 southbound, Route 128 southbound, Route 3 southbound, and I-95 northbound.
- 3. Capital cost of TDM Component 9 assumes that other infrastructure (electric lines, data lines, control center to control signs) is already in place.
- 4. Capital cost of TDM Component 9 addresses only the static signage and Variable Message Sign elements; no costs have been estimated for the real-time information element due to the wide variety of technologies available and the uncertainty about what will be available (and possibly commonplace) over the study horizon.

Operating Costs - Transit Components:

Conceptual, order-of-magnitude operating costs were estimated for the Transit Components in the following way:

- Estimates of the amount of new or added service were developed: These estimates were based on the proposed routing, headways, and the span of service (i.e., peak periods, midday and evenings, or full day) for each component.
- Conceptual unit costs were identified: These unit costs were developed based on unit costs in past studies, such as the Beyond Lechmere Northwest Corridor Major Investment Study/Alternatives Analysis (MIS/AA), and approximate industry costs. An assumption was made about who would operate each service (i.e., the MBTA or a private contractor) which determined the unit cost that was used.
- Cost estimates were developed: Conceptual operating costs were calculated by multiplying the amount of service added per day by the unit costs for each type of service, then multiplying by 250 weekdays to obtain annual figures.

The following table summarizes the conceptual operating costs of the proposed Transit Components:

Component	Conceptual Annual Operating Cost (2006\$)	Notes
Expanded Anderson shuttle service	\$1.2 million	Assume operated by a private contractor (figure includes vehicle costs)
Off-peak Anderson shuttle service	\$300,000	Assume operated by a private contractor (figure includes vehicle costs)
7. Park-and-Ride shuttle from Peabody	\$800,000	Assume operated by a private contractor, off- peak service combined with Component 6
10. Increased MBTA reverse- peak, local bus service	\$600,000	Operated by the MBTA as a modification of existing routes
11A. Frequent commuter rail - Anderson to Boston	\$1.0 million (originally \$1.6 million)	Assumes 1 new trainset in operation during peak periods (6 hours per day)
11B. Frequent commuter rail - Lowell and Haverhill to Boston	\$200,000 (originally \$300,000)	Assumes that 30-minute headways can be achieved by adding 1 round trip to each line
TOTAL	\$4.1 million (originally \$4.8 million)	

^{1.} All costs are in 2006 dollars.

^{2.} Cost estimated assume unit costs of \$75 per revenue-vehicle-hour for private contracted shuttle service (including vehicle costs), \$80 per revenue-vehicle hour marginal cost for changes to MBTA bus routes, and \$310 per revenue-vehicle-hour for additional MBTA commuter rail service.

Operating Costs - TDM Components:

Conceptual, order-of-magnitude operating costs for the TDM Components were estimated in different ways depending on the type of component. The following is a brief summary:

- TDM Components 3 and 4 Expanded Marketing and Incentives for Transit and Carpooling: The cost of trial passes, incentives and marketing materials was estimated by taking the anticipated number of new transit riders or carpoolers and dividing it by an assumed effectiveness rate of 50% (meaning that one out of every two commuters who redeems an incentive becomes a return user). This figure was then divided by an assumed mailing/outreach penetration rate of 10% (which assumes that one out of every 10 commuters who receives outreach materials redeems an incentive). These rates are approximate based on information about the effectiveness of commuter incentives in other metropolitan areas. The unit cost of the incentives was assumed to be \$3 per day for 3 months, or a total of \$180 per user. The unit cost of the outreach materials was assumed to be \$2. These costs are approximate based on information in Transit Cooperative Research Program Report 50 (Marketing Strategies for Public Transit) and the Victoria Transport Policy Institute's online TDM Encyclopedia. An allowance of 10% was added to account for administrative costs and outreach efforts.
- TDM Component 9 Improved Signage and Information: Operating costs (in this case, primarily maintenance costs) for the proposed static signs were assumed to be minimal. Maintenance costs for the Variable Message Signs were estimated based on unit costs in the USDOT ITS Cost database.

The following table summarizes the conceptual operating costs of the proposed TDM Components:

Component	Conceptual Annual Operating Cost (2006\$)	Notes
1. On-line carpool sign-up	\$0	Assume no new operating cost (MassRIDES in the process of implementing)
2A. Formal Park-and-Ride program at Anderson	\$0	Assume no new operating cost (MassRIDES in the process of implementing)
2B. Improved pedestrian/vehicle access to Anderson	Minimal	Only the incremental cost of snow removal, maintenance of the proposed pedestrian bridge.
3. Expanded marketing of transit	\$700,000	Assume 3,000 trial passes and 30,000 outreach packets to generate 1,500 new riders
Expanded outreach and incentives for carpooling	\$2,200,000	Assume 10,000 incentives and 100,000 outreach packets to generate 5,000 new users
Cross-ticketing/fare payment on private shuttles	Requires Further Study	Will equal a portion of revenue on Anderson and Peabody shuttles; not estimated yet
Improved signage and information	\$50,000	Minimal costs for static sign maintenance; costs are for VMS maintenance
TOTAL	Approx. \$3 million	

General Notes:

1. All costs are in 2006 dollars.

Total Annual Costs:

Conceptual, order-of-magnitude total annual costs for both the Transit and TDM Components were in the following way:

- Capital costs were annualized: The capital cost figures summarized earlier in this memo were converted to annualized figures by making assumptions about the life span of the items and the discount rate in future years (listed below). These assumptions allow the capital cost of an item, which is generally incurred in a lump sum at the start of a project, to be spread over the life of the item, taking into account the time value of money.
- Total annual costs were estimated. The annualized capital cost figures derived as described above were added to the annual operating cost estimates to produce total annual costs for each component.

The following table summarizes the conceptual total annual costs of the proposed Transit Components:

Component	Conceptual Annualized Capital Cost (2006\$)	Conceptual Annual Operating Cost (2006\$)	Conceptual Total Annual Cost (2006\$)
Expanded Anderson shuttle service	\$0	\$1.2 million	\$1.2 million
Off-peak Anderson shuttle service	\$0	\$300,000	\$300,000
7. Park-and-Ride shuttle from Peabody	\$150,000	\$800,000	\$950,000
10. Increased MBTA reverse- peak, local bus service	\$140,000	\$600,000	\$740,000
11A. Frequent commuter rail - Anderson to Boston	\$1.2 million (originally \$2.3 million)	\$1.6 million	\$3.9 million
11B. Frequent commuter rail - Lowell and Haverhill to Boston	\$0 (originally \$1.1 million)	\$300,000	\$1.4 million
TOTAL	\$1.5 million (originally \$3.7 million)	\$4.1 million (originally \$4.8 million)	\$5.6 million (originally \$8.5 million)

- 1. All costs are in 2006 dollars.
- 2. Conceptual annualized capital costs assume a discount rate of 7% per year.
- 3. The following life spans for key capital cost items were assumed in the annualized cost calculations:
 - -Rail vehicles: 25 years
 - -Buses: 12 years
 - -Peabody park-and-ride lot: 30 years
 - -Variable Message Signs (VMSs): 10 years

The following table summarizes the conceptual total annual costs of the proposed TDM Components:

Component	Conceptual Annualized Capital Cost (2006\$)	Conceptual Annual Operating Cost (2006\$)	Conceptual Total Annual Cost (2006\$)
On-line carpool sign-up	\$0	\$0	\$0
2A. Formal Park-and-Ride program at Anderson	\$0	\$0	\$0
2B. Improved pedestrian/vehicle access to Anderson	\$170,000	Minimal	\$170,000
3. Expanded marketing of transit	\$0	\$700,000	\$700,000
Expanded outreach and incentives for carpooling	\$0	\$2,200,000	\$2,200,000
Cross-ticketing/fare payment on private shuttles	\$0	Requires Further Study	Requires Further Study
Improved signage and information	\$190,000	\$50,000	\$240,000
TOTAL	\$360,000	At least \$3 million	At least \$3.2 million

^{1.} All costs are in 2006 dollars.

^{2.} Conceptual annualized capital costs assume a discount rate of 7% per year.