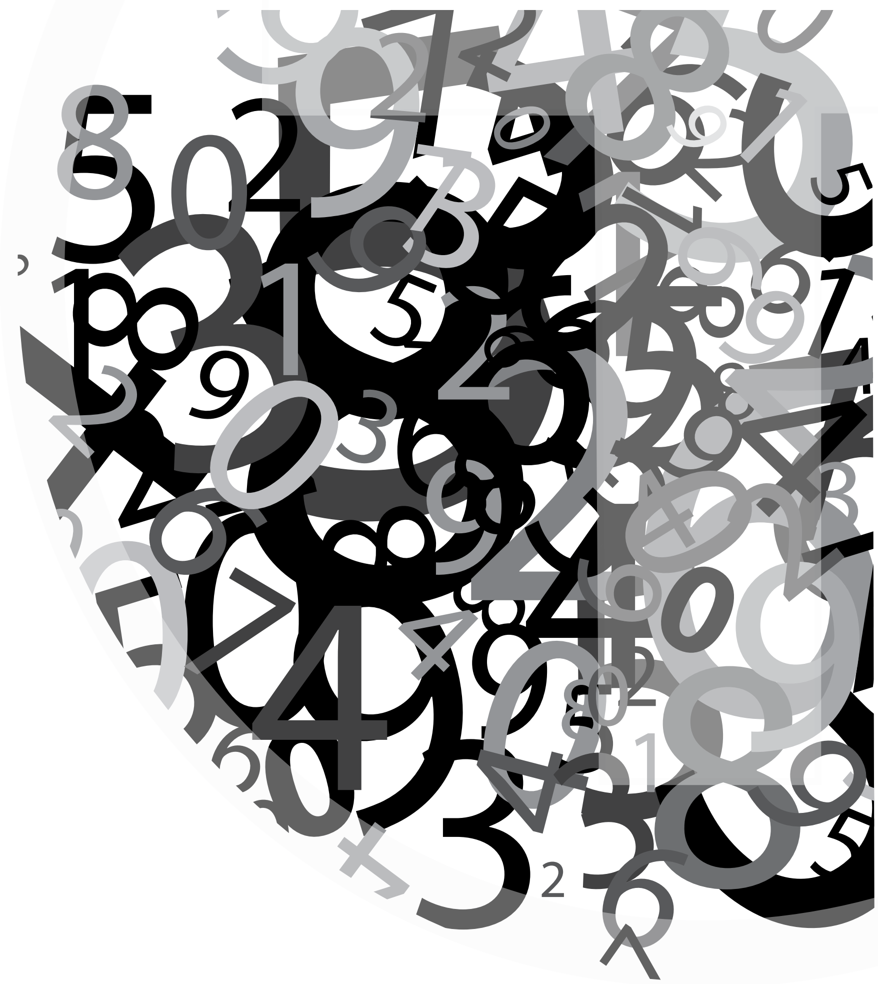
CHAPTER 7

Illustrative Scenarios



As mentioned in Chapter 3, this PMT presents and evaluates three scenarios—state-of-good-repair (SGR), enhancement, and expansion—that illustrate possible capital investment strategies based on different approaches to future transit infrastructure improvements and different levels of investment. The nature of these scenarios and the evaluation results are set forth in this chapter. As an illustrative exercise, the scenarios, although they include specific projects, do not represent a recommendation of specific projects. Rather, they show how progress toward meeting the stated objectives of the PMT, as measured through the evaluation criteria, might be achieved by 2030. The comparison of the three scenarios is intended as a guide to decision makers in defining the anticipated trade-offs involved in selecting among alternative future investments.

All three scenarios are evaluated using the Boston Region Metropolitan Planning Organization (MPO) regional travel demand model. This computer model incorporates the demographic and land use projections that were developed by the Metropolitan Area Planning Council (MAPC). These projections assume that, by 2030, development has been concentrated in urban hubs to support the use of transit and other alternative transportation modes. For the 63 municipalities that are in the MBTA sevice area, but outside of the 101 cities and towns in the MAPC region, demographic and land use projections from neighboring MPO's and regional planning agencies are used in the model. Factors such as future changes in gasoline prices or technology advances cannot be reliably known and hence are not incorporated into travel model projections, adding a degree of uncertainty to the projections. However, even allowing for a wide range of future outcomes, the demands placed on the MBTA in 2030 are anticipated to be substantially greater than they are today.

In addition to the illustrative scenarios discussed in this chapter, project-level analysis was also completed for enhancement and expansion projects. The results of this project-level analysis can be found in Appendix I. It is hoped that the project-level analysis will be of use to decision makers when weighing the pros and cons of specific projects.

DESCRIPTION OF SCENARIOS

The SGR Scenario

The 2030 state-of-good-repair illustrative scenario assumes that any deficiencies in the current capital plant, both fixed and mobile, would be corrected, and that any capital element that reaches end-of-life between 2008 and 2030 would be replaced (the requirements for achieving SGR are discussed in Chapter 5). This scenario also assumes that all station accessibility projects have been completed, removing barriers to persons with disabilities. In addition, when making future SGR projections using the travel demand model, it is assumed that the existing system would provide the capacity required to handle projected future ridership without service enhancement or expansion.

The Enhancement Scenario

The enhancement illustrative scenario assumes that all of the work included in the SGR scenario has been performed. Beyond achieving a state of good repair, this scenario also includes a package of infrastructure investments that would enhance existing transportation assets to achieve better speeds, frequencies, and reliability (see Table 7-1). This scenario incorporates some, but not all, of the enhancement project proposals discussed in Chapter 6; all of the corridors receive benefit from its package of projects.

TABLE 7-1
Enhancement Illustrative Scenario: Component Projects

Project	Corridor
BRT elements on Route 1: Harvard–Dudley	Northwest
BRT elements on Route 22: Ashmont–Ruggles	Circumferential
BRT elements on Route 31: Mattapan–Forest Hills	Southwest
BRT elements on Route 32: Wolcott–Forest Hills	Southwest
BRT elements on Route 39: Forest Hills–Back Bay	Southwest
BRT elements on Route 57: Watertown–Kenmore	West
BRT elements on Route 66: Harvard – Dudley	Circumferential
BRT elements on Route 71: Watertown–Harvard	Northwest
BRT elements on Route 73: Waverley–Harvard	Northwest
BRT elements on Route 77: Arlington Heights–Harvard	Northwest
BRT elements on Route 111: Woodlawn–Haymarket	Northeast
Alewife access busways	Northwest
Assembly Square Orange Line station	North
Improved Orange Line frequencies	North
Fitchburg Line improvements	Northwest
Worcester Line service expansion	West
Yawkey Station upgrade	West
Ruggles Station platform expansion	Southwest
1,000 new park-and-ride spaces	Systemwide

MBTA Park-and-Ride lot at Oak Grove Station

A primary focus of the enhancement scenario is implementation of bus rapid transit (BRT) elements in major travel corridors that are currently served by MBTA Key Routes. These projects are designed to improve service for the MBTA's core constituents, who live in the most densely developed parts of the service area and rely on bus service for mobility, as explained in Chapter 6.[1]

The Expansion Scenario

The expansion illustrative scenario assumes both that all of the components of the SGR and enhancement scenarios have been fully implemented. In addition, the expansion scenario assumes enlargement of the system through investment in a number of major expansion projects—BRT, rapid transit, and commuter rail—that would improve connectivity and capacity, and would enhance mobility in the region by filling gaps in existing transit services (see Table 7-2). This scenario incorporates some, but not all, of the expansion project proposals discussed in Chapter 6; all of the corridors receive benefit from its package of projects.

TABLE 7-2
Expansion Projects in Illustrative Scenario

Project	Corridor
Dudley South BRT on Routes 23 and 28	Southeast
Silver Line Phase III	Central
Urban Ring	Circumferential
Green Line to Medford	Northwest
Red–Blue Connector	Central
Blue Line extension to Lynn	Northeast
Plaistow extension of Haverhill Line	North
Nashua/Manchester extension of Lowell Line	North
Fairmount Line improvements	Southwest
T.F. Green extension of Providence Line	Southwest
South Coast Rail to Fall River and New Bedford	Southwest

MODELING RESULTS FOR ILLUSTRATIVE SCENARIOS

Meeting anticipated 2030 demand for transit poses a significant challenge for the MBTA. Today, it is estimated that transit vehicles are boarded approximately 1,220,000 times each day in the region. Accounting for transfers, this translates to about 870,000 daily person-trips (linked trips) and a current transit mode share of 7%. Table 7-3 compares the performance of the existing transit system with the model projections for the three illustrative scenarios. For the enhancement and expansion scenarios, results are presented as a range of outcomes, due to uncertainty regarding the final alignments and service plans for some of the projects included.

1 As discussed in Chapter 6, routes that would duplicate Urban Ring or other expansion projects are modeled at their current service levels in the enhancement scenario. These include Key Routes 15, 23, 28, and 116/117, as well as non–Key Routes 86 and 89. See the Systemwide Projects section of Chapter 6 for full discussion.

TABLE 7-3
Comparison of Illustrative Scenarios

Measures	2008 Base Year	2030 SGR Scenario	2030 Enhancement Scenario Change from SGR		2030 Expansion Scenario Change from SGR	
			Lower Range	Upper Range	Lower Range	Upper Range
Passengers systemwide (linked trips)	871,250	1,332,500	32,300	43,700	97,800	132,300
Boardings systemwide (unlinked trips)	1,219,750	1,742,500	48,450	65,660	146,700	198,450
Trips diverted from auto mode			27,200	36,800	83,100	112,500
Transit mode share	7.00%	7.50%	0.19%	0.25%	0.54%	0.73%
Weekday vehicle miles travelled (VMT) on the transportation system (transit + auto)	104,655,000	125,655,000	136,940	185,270	-425,000	-575,000
Average transit trip travel time (in hours)		0.20	-0.0030	-0.0041	0.0025	0.0033
Kilograms of CO_2 (transit + auto)	59,590,557	71,547,957	-140,470	-190,050	-218,370	-295,440
Kilograms of CO (transit + auto)	315,250	378,270	-2,200	-2,980	-3,410	-4,610
Kilograms of VOC (transit + auto)	21,256	25,414	-70	-90	-100	-140
Kilograms of NOx (transit + auto)	20,988	24,159	-100	-130	230	310
Kilograms of PM 2.5 (transit + auto)	1,329	1,596	-5	-7	-6	-8
Kilograms of PM 10 (transit + auto)	2,868	3,443	-11	-15	-14	-18

Under the SGR scenario the travel demand model projects about 1,330,000 daily person-trips on the MBTA in 2030, an increase of over 50% (about 460,000 daily person-trips) from 2008 levels. This increase in ridership is accompanied by an increase in transit mode share from 7% in 2008 to 7.5% in 2030. Although transit ridership and mode share would increase, total VMT on the transportation system would also increase, causing increases in air pollutants, including a 20% increase in CO_2 emissions.

Under the enhancement illustrative scenario the travel demand model estimates a 2030 transit ridership increase of 2.4% to 3.3% over the level projected for the SGR scenario. The average length of a transit trip would decrease between 1% and 2%, and transit mode share would increase by between 0.19% and 0.25% to as high as 7.75% in 2030. Weekday vehicle miles traveled (VMT) would decline by between 0.11% and

0.15% below SGR levels as drivers switched to the improved transit system. Levels of air emissions would also decrease in proportion to the lower levels of VMT, as compared to the SGR scenario. Although VMT and emissions would be lower than projected in the SGR scenario, they would increase substantially above 2008 levels due to growth in auto trips.

The model predicts that, as compared with the SGR scenario, the expansion scenario would have a significantly greater impact on the transportation system than the enhancement scenario alone. It is estimated that if the expansion scenario (which includes all the enhancement projects) were implemented, transit ridership would increase by 7.4% to 9.9% above projected SGR levels. It should be noted that the Red-Blue connector, the Green Line extension to Medford, and the Routes 23 and 28 Silver Line extension all attract significant new transit ridership, yet actually reduce total transit boardings. This is because these projects improve connectivity and greatly reduce transfers. Unlike the enhancement scenario, the expansion scenario shows average transit trip travel times increasing above SGR levels. This is not necessarily a negative result, as the improved transit connections might allow riders to make longer trips.

Under the expansion scenario, transit mode share would increase over SGR levels by between 0.54% and 0.73% to a potential high of 8.23% in 2030. Weekday VMT would decline by between 0.34% and 0.46% below SGR levels, and air emissions would decrease accordingly. However, as with the enhancement scenario the resulting levels of VMT and emissions would still increase substantially above 2008 levels due to growth in auto trips. In the SGR scenario, CO_2 emissions are projected to rise by 20% above 2008 levels; in both the enhancement and expansion scenarios, CO_2 levels would increase by slightly less than 20%.

As discussed in Chapter 3, the PMT is being coordinated with “You Move Massachusetts,” the long-range transportation-planning process of EOT, which is currently underway. Owing to the MBTA’s current fiscal constraints, in order to support and advance implementation of major expansion projects in the future, the Authority will rely on discretionary federal grant funding and Commonwealth funding administered through EOT. Therefore, additional analysis of expansion projects that will be completed by the state, including cost estimation, will be performed in the context of the EOT planning process.

MEETING THE EVALUATION TARGETS

Chapter 3 presented the evaluation targets established for quantifiable PMT objectives. These included targets for increased ridership, decreased transit trip travel time, and reduced levels of CO_2 emissions from the transportation sector. All three of the illustrative modeling scenarios show ridership increasing significantly more than the target level of 1% per year growth, or 250,000 additional boardings per day in 2030. The goal of a 2% reduction in average travel time per transit trip was achieved in the enhancement scenario, but not in the expansion scenario. However, as explained above, longer trips might be attributed to better transit connections under the expansion scenario.

The SGR scenario shows a large increase in CO_2 emissions over current levels. Although the enhancement and expansion scenarios show lower CO_2 emissions than the SGR scenario, the contribution of the transportation sector to CO_2 emissions would remain significantly higher than 2008 levels. As discussed in Chapter 3, transit improvements alone, in isolation from the regional transportation network, cannot achieve the very ambitious greenhouse gas reduction targets adopted by the Commonwealth. Transit improvements must be implemented in the context of an overall land use–transportation strategy that fosters changes in travel behaviors, improves intermodal connections, increases system capacity, and puts in place incentives for energy conservation and green technology.