



Strategic Plan

for Bus Maintenance Facilities



Submitted to:
Massachusetts Bay Transportation Authority
Michael H. Mulhem, General Manager

Submitted by:
Alternate Concepts Inc./Stone & Webster
Joint Venture

April 2003

***Final Strategic Plan
for Bus Maintenance Facilities***

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April 2003

Executive Summary

The Massachusetts Bay Transportation Authority (MBTA) initiated the Bus Maintenance Facilities Planning Study to develop a Strategic Plan for bus operations that identifies short, medium, and long-term facility needs based on changes in fleet size, technology and fleet composition; service delivery characteristics; and new service initiatives, specifically the Urban Ring. The *Bus Maintenance Facilities Strategic Plan* serves as a blueprint for future investments in bus maintenance facilities, by:

- Assessing the needs and capacity constraints at existing garages;
- Identifying older out-dated facilities to be phased-out;
- Identifying the proper equipment needed to service a modernized fleet of alternative-fueled buses;
- Guiding site selection for investments in new bus maintenance facilities; and
- Determining the most efficient use of space and equipment at maintenance facilities.

The needs assessment provided for:

- A comprehensive review of bus service characteristics including route structure and terminal points, service frequency, peak and off-peak vehicle requirements, vehicle types, including propulsion technology, wheelchair accessibility, AVL technology, and smart bus technology;
- An audit of conditions at existing bus facilities and an assessment of each facility and its capacity to maintain a modernized fleet; and
- An assessment of the operational impacts of service expansion projects, as well as the operational feasibility of candidate sites for bus maintenance facilities, based on changes in deadhead time and deadhead mileage by route and by facility, and for systemwide impacts.

In response to the needs assessment, the Authority and its consultant researched various sources for available sites for future bus maintenance facilities. Sites considered included MBTA-owned properties, properties available through municipalities, the Commonwealth of Massachusetts, and other state agencies, and privately owned properties available for sale or lease. The property searches were conducted in both the northern service area – Cambridge, Chelsea, Medford, Malden, Saugus, Lynn, Everett and Revere – and in the southern service area – South Boston, Dorchester, Mattapan, Watertown, Roxbury, Roslindale, and Newton. From these listings, the Authority and its consultant identified seven candidate sites for further analysis.

In the northern service area, the candidate sites include:

- Wellington Station, Medford
- One Acorn Park, Belmont / Cambridge Highlands
- Routes 1, 60, and 107, Revere

- 144, 170, and 184 Commercial Street, Malden
- Mishawum Station, Woburn

In the southern service area the sites include:

- Watertown Car Barn, Watertown
- Riverside Station, Newton

The feasibility and systemwide impacts of each site were evaluated across several criteria, including site configuration; operational efficiency (systemwide deadhead miles); community impacts; environmental considerations; cost; and other information as available for the site, including current plans for future use/development.

Based on this analysis, Wellington, in the northern service area, and Riverside, in the southern service area, are recommended as the most promising sites.

Wellington presents a unique opportunity for the MBTA to accommodate the service expansion required by the Urban Ring Program and eliminate two very old, costly, and inefficient maintenance facilities, one of which has been a consistent source of resident complaints, with the construction of a single modern maintenance facility. The Wellington option has the following very desirable characteristics:

- The MBTA owns the property, and would not need to take property, thereby not effecting the tax base of the town.
- The Fellsway Garage could be demolished, and the land made available for development of a type more compatible with the needs and desires of the surrounding community.
- The Lynn Garage would be converted to a layover facility for bus storage, fueling, and washing, with only "pullout repairs" performed at the sight.
- All the anticipated requirements of the Urban Ring are served effectively and efficiently.
- The Wellington site has no abutters, with the Kiss 108 Radio Station as its nearest neighbor.
- The vehicular access and road connections that characterize this site are efficient, and are not intrusive on residential streets.
- The net change in deadhead mileage over the current distribution of routes is near zero.
- Commuters would have the same or greater parking capacity, conveniently located. The commuter parking structure presents an opportunity for business development as a joint development project.

Of the two southern options, Riverside has superior traffic flow characteristics, is less intrusive on the neighborhood, and has greater fleet storage capacity. The construction of a bus maintenance facility at Riverside would allow the MBTA to satisfy the needs of the Urban Ring in the south service area, while continuing to provide the excellent quality of service to it's current express route commuters. Implicit in this plan is the upgrade of the

Albany Garage to increase its maintenance capacity as described earlier in this report. The benefits of this plan are:

- All the Urban Ring requirements would be effectively and efficiently met by operations out of the Albany Garage, while express bus service would be easily displaced to the new Riverside facility.
- The MBTA owns the property, and would not need to take property, thereby not affecting the tax base of the town.
- The only abutter is the Holiday Inn.
- Commuter parking will, at a minimum, remain at current levels, and the commuter parking facility will be designed to accommodate an increase in commuter parking capacity.
- The vehicular access and road connections that characterize this site are efficient, and are, for the most part, not intrusive on residential streets.
- The deadhead mileage incurred by this scenario is somewhat greater than in the current route distribution. An administrative modification to the schedules could significantly reduce or eliminate the difference. An opportunity may exist for total mileage reduction by considering a mid-day layover of express buses at Albany and/or Cabot.
- The commuter parking structure presents an opportunity for business development as a joint development project.

The Plan as proposed would accommodate all the needs of the Urban Ring with no increase in the number of bus maintenance facilities (although there would be one additional Transportation Rating Station, e.g. bus storage location). The 77-year-old Fellsway garage, a constant source of disruption to residential neighbors, would be decommissioned. The Fellsway garage is currently operating as a maintenance facility, with the associated overhead, for a fleet of 63 buses. The net operating efficiency (total deadhead mileage) would remain approximately unchanged from the current distribution of routes. The plan would increase the total tax base if the Fellsway Garage land were privately developed. Commuters would suffer no reduction in parking, and may enjoy an increase, and will also find parking more conveniently located. Private business may have the opportunity to participate in joint development of areas that are publicly owned. And finally, bus maintenance capability would, by this plan, be made adequate to accept and maintain the new technology rolling stock that will enter the MBTA fleet over the coming decades.

The Plan will alleviate crowded conditions at the Charlestown bus maintenance facility, and to address the diversity of needs presented by the incorporation of new fuel and smart bus technologies. By conservative and creative use of existing MBTA facilities, this Strategic Plan accomplishes those service needs while improving its relation to the communities it serves and permitting business opportunities and a possible increased tax base.

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Goals and Objectives

The Massachusetts Bay Transportation Authority (MBTA) initiated the Bus Maintenance Facilities Planning Study to develop a Strategic Plan for bus operations that identifies the short, medium, and long-term facility needs based on changes in fleet size, technology and composition; fleet maintenance requirements; service delivery characteristics; and new service initiatives, specifically the Urban Ring. The *Bus Maintenance Facilities Strategic Plan*, as provided herein, will serve as a blueprint for future investments in bus maintenance facilities. The *Bus Maintenance Facilities Strategic Plan* was designed and developed to address the following key goals and objectives of the MBTA:

- **Support the implementation of the Urban Ring Service.** The Urban Ring Project is a transit initiative designed to connect the existing radial transit lines with a multimodal circumferential transit system bringing much improved access to and reducing congestion within the radial travel corridors. The Urban Ring bus services will be implemented over two phases. The first implementation phase of the Urban Ring will provide service on two (2) new express routes, eight (8) new cross-town (CT) routes, and the expansion of three (3) existing CT routes. The second implementation phase of the service will require 60-foot articulated buses to provide service on seven (7) overlapping Bus Rapid Transit (BRT) routes and approximately ten (10) miles of separate busways on existing right-of-way. It is estimated that this service will, at its peak, introduce approximately 100 buses to the MBTA's bus fleet. It is the goal of this strategic plan to ensure that the operations and maintenance needs of the Urban Ring initiative are met through the Bus Maintenance Facilities Strategic Planning effort.
- **Support Community Needs and Desires regarding Site Locations.** The MBTA currently owns and operates facilities within residential neighborhoods in and around Boston, and seeks to be a "Good Neighbor" within these communities. As a regular course of business, the Authority participates in public outreach for its capital investment program, and employs operating procedures for public outreach in the development of all capital projects. Through its community outreach programs, the Authority seeks to make transportation decisions that meet the needs of all people; construct facilities that fit more harmoniously into communities; and minimize and/or mitigate unavoidable impacts by working with communities to identify concerns and develop mitigation strategies that benefit the affected communities. In keeping with this tradition, it is the MBTA's desire to move bus maintenance facilities out of residential neighborhoods and into areas with compatible land uses. Specifically, it is the goal of this strategic plan to solely consider commercial or industrially zoned sites for future bus maintenance facility construction, specifically those sites in areas where the adjacent land is of a more compatible use.
- **Support bus operations and maintenance policy directives.** As part of its continued reinvestment in the bus fleet, the MBTA plans to purchase 354 40-foot CNG buses, thirty-two (32) 60-foot articulated dual-mode diesel/electric buses, and 145 40-foot and 30 35-foot low floor Environmentally Clean Diesel (ECD) buses.

The MBTA is designing and constructing new bus maintenance facilities at Southamptton and Arborway and has plans to renovate the Everett, Cabot and Charlestown facilities to address the diversity of needs presented by the incorporation of these technologies. It is the goal of this strategic plan to support operations and maintenance policy directives to improve the quality, safety, operating efficiency and accessibility of bus services by ensuring all future facility designs accommodate a modernized fleet of accessible, alternative fueled buses.

- **Minimize Operations and Maintenance Costs.** Changes in service plans, especially those that expand the bus system, may present significant operations and maintenance costs to the Authority. For example, if maintenance facilities are located farther away from services, vehicle miles traveled will increase, causing increases in all associated cost factors, including the number of operators needed to provide services; consumption of fuel; frequency of maintenance inspections; use of consumables; and the number of mechanics required to maintain the bus fleet. It is the goal of this strategic plan to improve cost-effectiveness and optimize operations within the MBTA's bus operations. As such, this strategic planning effort sought to minimize costs, by minimizing systemwide deadhead and maximizing the use of existing MBTA-owned property.

Introduction and Background

The Massachusetts Bay Transportation Authority (MBTA) faces unique challenges as a 105-year-old transit system that is seeking to carry-out a strategic approach to planning for the future of its bus operations. As public transit in Boston evolved from the Boston Elevated Railway Company (1897) to the Metropolitan Transit Authority (1947) to the MBTA (1964), many of the surface line carhouses used by streetcars and trackless trolleys were publicly acquired and later converted to bus garages. Boston's first bus route opened in 1922, and the first trackless trolley line in Boston soon followed in 1936. To accommodate the maintenance needs of the new bus system, trolley carhouses in Allston (1922) and Medford (Fellsway 1925) were converted to bus garages. The growing demand for bus service to the south of Boston necessitated the conversion of carhouses in Quincy (1930) and Roxbury (Bartlett 1931) to bus garages. This trend continued through the early 1970's with the bulk of today's bus system evolving from converted streetcar lines, and garage locations dictated by the location of old carhouses, including Lynn (1936), and Albany Street (1941). Of the MBTA's present-day bus garages, only the Cabot and Charlestown facilities were sited through modern-day planning processes in response to service for a specific geographic area.

Over the past century, Boston's public transit system has grown from a rail system serving fourteen (14) cities and towns to a complex multi-modal operating agency, providing bus and rail service to 175 communities throughout Eastern Massachusetts. While service characteristics have evolved to meet the changing transportation needs and growth in the region, the locations of bus maintenance facilities, by and large, have remained unchanged.

The MBTA's current bus operations are comprised of 1,022 buses and trackless trolleys, providing service on 159 routes over approximately 710 route miles. On an average weekday, the MBTA Bus Operations Division provides bus service to approximately 380,000 customers with buses traversing 88,000 service miles. The MBTA maintains the bus fleet from seven (7) existing bus maintenance facilities and has plans to construct two (2) new maintenance facilities, and renovate three (3) existing facilities to accommodate the acquisition of alternative-fueled – clean diesel, compressed natural gas (CNG), diesel electric hybrid, and dual-mode diesel/electric – vehicles.

The MBTA is in the process of designing and constructing two new maintenance facilities – Arborway and Southampton. The Arborway facility will provide for the maintenance and storage of CNG and diesel buses. This new facility will replace the aging and undersized Bartlett Street garage. A recent decision to restore streetcar service on the Arborway line will result in a shared streetcar facility at the Arborway location. The Southampton facility, in South Boston, when complete, will provide for the maintenance and storage of CNG and dual-mode diesel/electric hybrid buses. These initiatives are supported through an investment of approximately \$90 million for the construction of the Arborway and Southampton facilities, and approximately \$20 million

for the conversion of existing facilities (Everett, Cabot and Charlestown) to fuel, store, and maintain CNG buses.

The current bus fleet is comprised of 978 diesel buses, two (2) CNG buses, two (2) diesel/electric hybrid buses, and forty (40) trackless trolley vehicles. The MBTA's capital investment program for FY 2002 to FY 2006 calls for the procurement of:

- Forty (40) 60-foot articulated CNG rapid transit buses to replace a portion of the retiring 1985 to 1987 RTS diesel buses;
- Three Hundred Fourteen (314) alternative-fueled buses to replace 280 1986-87 RTS buses and thirty-four (34) 1989 RTS diesel buses; and
- Twenty-eight (28) trackless trolleys to replace the existing fleet.

The MBTA has plans to retire all pre-1994 buses no later than December 2004.

As part of the MBTA's continued reinvestment in the bus fleet, the MBTA has in place procurements for a total of 354 CNG buses (314 to be purchased by 2004), and thirty-two (32) dual-mode diesel/electric buses. The MBTA recently awarded a contract to Neoplan for the procurement of 175 ECD buses. The alternative-fueled bus fleet will be comprised of:

- Fifteen (15) 40-foot New Flyer CNG buses;
- Two hundred ninety-five (295) 40-foot NABI CNG buses;
- Forty-four (44) 60-foot Neoplan articulated CNG buses;
- Thirty-two (32) 60-foot articulated dual-mode diesel/electric buses; and
- One hundred forty-five (145) 40-foot and thirty (30) 35-foot, Neoplan ECD buses.

To support future decisions regarding propulsion technologies, the MBTA conducted two studies – the *1999 Future Bus Prototype Study* and the *Roadway Powered Electric Transit Bus Demonstration Project*. As a result of the *1999 Future Bus Prototype Study*, the MBTA placed two (2) CNG and two (2) diesel/electric hybrid buses in revenue service. The *Roadway Powered Electric Transit Bus Demonstration Project* resulted in four (4) prototype buses for use by the MBTA and by Massport.

In July 2002, the MBTA assembled an expert panel to evaluate the available low emissions bus engine technologies and fuels, and recommend the most appropriate choice for the upcoming purchase of 200 buses to be delivered in 2004. The Panel, headed by Prof. John Heywood of the Massachusetts Institute of Technology, reviewed promising engine technologies and fuels, focusing especially on the two low-emission options currently available: CNG and emissions controlled diesel (ECD). In accordance with the MBTA's long-term plan to continue to reduce the total emissions from its bus fleet, the Panel concluded that, from a total systems perspective, it is in the best interest of the

MBTA and the communities it serves, to purchase 200 buses with the best available ECD engine, which use particulate filters and ultra low sulfur fuel.¹ The MBTA has accepted this guidance in its most recent procurement of 175 Neoplan ECD buses, which will enter service by the end of 2004. The expert panel also set forth a monitoring program to determine the actual performance of ECD buses over time compared to their predicted performance.

In addition to implementing new fuel technologies, the MBTA is aggressively seeking to implement improvements to its bus communications technology and transit Intelligent Transportation System (ITS) strategies. The MBTA plans to modernize the Bus Operations Control Center (Bus OCC) at the 45 High Street facility, which, when completed, will feature state-of-the-art technology permitting real-time monitoring and supervisory dispatch of the bus operations. This technology is currently implemented on the Silver Line Phase I.

The MBTA plans to improve and expand bus services over the short and long-term. Short-term service improvements are identified in the *Preliminary 2002 Service Plan: Proposed Bus Service and Service Policy Modifications*. This draft Service Plan presents a number of proposed major service changes, as well as proposed modifications to the MBTA's Service Delivery Policy. Expansion of the existing bus system will be achieved through the implementation of the Silver Line and the Urban Ring. The Silver Line is providing service along Washington Street and will be in service on the South Boston Piers Transitway in December 2003. Phase III of the Silver Line will be completed in 2010.

The Urban Ring is a proposed 15-mile circumferential transit corridor connecting the terminal stations of Boston's downtown-centered transit system in or near six (6) cities that form the urban core, including Boston, Chelsea, Everett, Somerville, Cambridge and Brookline. Service in the Urban Ring corridor will likely be implemented in three phases with the first two phases expanding the bus system. The first phase will consist of two (2) new express routes and eight (8) new cross-town (CT) routes. In addition, three (3) existing CT routes will be expanded. The second phase of the project is for seven (7) overlapping Bus Rapid Transit (BRT) routes and approximately ten miles of separate busways on existing right-of-way.

As the Authority plans for the expansion of bus service, the largest of which is the Urban Ring, and the incorporation of an accessible, modernized bus fleet, it recognizes the need to assess the capacity and location of existing facilities and to plan strategically for additional capacity at new facilities. The bus maintenance facilities strategic planning effort identified the short, medium and long-term facility needs based on changes in fleet size, technology and composition; fleet maintenance requirements; and service delivery

¹ *FY 2003 Two Hundred Bus Procurement*, Expert Panel Report to the Massachusetts Bay Transportation Authority, October 2, 2002.

characteristics. The *Bus Maintenance Facilities Strategic Plan* will serve as a blueprint for future investments in bus maintenance facilities by:

- Assessing the needs and capacity constraints at existing garages;
- Identifying older out-dated facilities to be phased-out;
- Identifying the proper equipment needed to service a modernized fleet of alternative-fueled buses;
- Guiding site selection for investments in new bus maintenance facilities; and
- Determining the most efficient use of space and equipment at maintenance facilities.

Needs Assessment

Approach

The bus maintenance facilities strategic planning process began with a full assessment of conditions at each of the existing bus garages – Fellsway, Lynn, Quincy, Albany, Charlestown, Everett, and Cabot. The maintenance, parking, transportation and fueling areas of each facility were assessed with respect to existing functions and service requirements. This analysis provided an inventory of general conditions of the structural, architectural, electrical, mechanical, site components and major equipment at each bus maintenance facility. Future maintenance requirements, as dictated by changes in the fleet size, technology and composition, as well as the fleet requirements of bus service expansion initiatives, were analyzed in light of these conditions.

A key component in determining capacity constraints and the need for additional capacity is the assignment of buses, as needed to cover all of the MBTA's bus routes, to specific garage locations. Primary considerations in achieving the optimum assignment of vehicles to specific garage locations include:

- Minimizing overall deadhead time and deadhead mileage between bus route revenue service points and garage locations;
- Composition of the fleet at each garage (in terms of vehicle type) and the matching of this composition to specific route requirements; and
- Existing conditions that already dictate assignments of vehicles to specific garages, such as the Silver Line service and the Arborway and Southampton facilities.

In determining the future bus maintenance facility needs, careful consideration was given to the maintenance requirements associated with existing service and service planning initiatives including the Urban Ring and major service modifications. Based on the anticipated implementation of the Urban Ring service, milestone years were defined to identify maintenance requirements necessitated by future service requirements and the anticipated fleet technology. The milestone years were defined by major changes to the bus system including the procurement of new equipment, the construction of new facilities and the implementation of new services. The milestone years are defined by major enhancements to services and facilities, as follows:

- **2004:** The new Southampton Garage is scheduled for completion in the Spring of 2004, and will be available for storage, fueling and maintenance of 60-foot articulated low floor CNG buses. The capacity of the facility will be seventy-six (76) vehicles, of which forty-four (44) are 60-foot articulated low floor CNG buses, and thirty-two are 60-foot articulated dual-mode diesel/electric low-floor buses to be operated on the South Boston Transitway. The Washington Street Silver Line is currently operating eleven (11) 40-foot low floor CNG buses, and four (4) 40-foot low floor CNG buses are available for spares. These vehicles are currently housed in the Cabot garage, maintained in the Charlestown garage, and fueled off-site at the Everett industrial

area CNG fueling station near the Charlestown bus garage. An additional thirty-two (32) low floor 60-foot articulated dual-mode diesel/electric vehicles would be required for the South Boston Transitway portion of the Silver Line. The Piers Transitway is scheduled to open by 2004.

- **2010:** The Arborway Garage, scheduled to be completed in June 2005, will have the capability of fueling, maintaining, and storing 60-foot articulated low floor CNG buses. The capacity of Arborway will be 118 vehicles. The Bartlett garage, which now stores 159 diesel buses, is scheduled for closure by Spring 2004. By 2010, the first round of improvements for the Urban Ring (Phase 1), which includes three (3) new express bus routes and eleven (11) cross-town routes, will be implemented. Phase III of the Silver Line should also be completed by 2010, when South Station and the New England Medical Center / Boylston Street Station are connected. The Silver Line will by then be providing service from Dudley Station to the World Trade Center via dual-mode vehicles.
- **2015:** Phase 2 of the Urban Ring Project will be implemented by 2015, and the peak demand for bus storage facilities will occur during this period, since Phase 2 of the Urban Ring will require more buses than Phase 1 and fewer than Phase 3.
- **2025:** The Phase 3 bus service on the Urban Ring is the same as the bus service provided in during Phase 2, less the Bus Rapid Transit Route 5, New Lechmere-Longwood Medical Area. This reduction in service would only reduce peak bus requirements by four (4) vehicles at the Albany garage. Other CT, BRT and local routes may lose riders due to diversions to the new light or heavy rail lines. The time of complete implementation of the Phase 2 bus routes, therefore, represents the peak of bus storage needs for the next fifteen to twenty years.

The needs assessment included a full review of bus service characteristics including route structure and terminal points, service frequency, peak and off-peak vehicle requirements, vehicle types, including propulsion technology, wheelchair accessibility, AVL technology, and smart bus technology.

Using existing data and maps, the baseline, 2002, condition was defined by the location of bus routes, the location of existing bus maintenance facilities, and the existing assignment of buses (by vehicle type) and bus routes to maintenance facilities.

Building from the baseline condition, needs were identified through the evaluation of each milestone year, reflecting the implementation of major service modifications, the introduction of new vehicle types, changes to existing bus routes, and the implementation of new services through time, keeping facilities fixed. The needs assessment assumed that no additional maintenance facilities would be constructed in the future.

Within each milestone year, new bus routes were assigned to specific facilities in a manner that minimized system deadhead mileage and travel time, and also recognized the capacity constraints at existing facilities. This assignment of routes was then compared to the inventory and assessment of facility conditions and capacities so that the need for

renovations to existing facilities and the demand for additional facilities could be determined.

Once all vehicles were assigned to bus maintenance facilities, deadhead time and deadhead mileage were calculated for each route. These deadhead factors were summed for each facility and aggregated to calculate a systemwide deadhead time and mileage for each milestone year, thereby providing a metric to use in comparing proposed recommendations.

Opportunities for Enhancement

Through the needs assessment several opportunities to enhance the bus maintenance system were identified. These opportunities are categorized based on term:

- Short-term needs (or Phase I) includes retrofits and renovations to existing bus maintenance facilities;
- Medium-term needs (Phase II) includes phasing-out and replacing older, out-dated facilities with new bus maintenance facilities; and
- Long-term needs (or Phase III) addresses additional capacity at new facilities to accommodate operations and maintenance needs of the Urban Ring initiative.

Phase I

The Quincy, Albany, and Charlestown garages from capital cost point of view should be rehabilitated to provide more efficient and environmentally acceptable operations. Specific needs at each garage are noted below.

Quincy

Finding: Equipped with existing pits, the construction of usable roof level maintenance platforms is restricted by the low overhead clearance of the Quincy garage (12-feet, 3-inches). The installation of an overhead crane at this facility is problematic for the same reason. The use of lifts is also severely restricted by the height of the Quincy garage, presenting a problem in the maintenance of low floor – CNG and 60-foot articulated – buses. Maintaining low floor buses at Quincy would be impractical without height modifications as well as rehabilitation/updating of the facility. The height restriction in the Quincy maintenance facility is a problem for CNG bus maintenance, as the normal installation of gas tanks on the roof (required with low floor buses) adds to the height of the bus. In addition to restrictions on lifting, the presence of the tanks and part of the fuel delivery system on the roof necessitates rooftop maintenance, which would also be constrained for a mechanic on a platform. The Quincy garage can be nominally adapted to maintain articulated 60- foot buses in that it has one 70-foot pit in place, and each of the existing four (4) pits can be extended. Three post hoists could not, however, be installed for use in the remaining floor area of the shop, as there is insufficient clearance to lift the entire bus to a useful height.

Immediate Need: The garage roof consists of wood planks, timber stringers, timber girders and steel trusses. The steel roof trusses are about 15-feet on-center and support the timber roof girders at the truss third points. These trusses are supported by the east and west walls of the garage. If the two northern most trusses are cut in the maintenance area (eastern third of the trusses), the vertical clearance in the maintenance area may be increased from approximately 12-feet, 6-inches to approximately 16-feet, 6-inches. This solution would provide for a better and safer maintenance operation by allowing a 40-foot bus to be lifted to a usable height.

The estimated cost to complete the structural modifications to the Quincy bus garage is approximately \$300,000. This estimate is comprised of \$30,000 in engineering costs; \$110,000 in materials, and \$160,000 in labor – this is a labor-intensive effort. This cost estimate provides a ballpark figure for the proposed structural modifications; a detailed design would provide refined cost estimates.

Mid-Term Need: Raise the roof of the garage and install two lifts and roof level platforms for each pit, and install one overhead crane.

Albany

Finding: The maintenance area of the Albany garage was originally equipped with one pit, which has been decommissioned. Currently, the building is configured with four (4) herringbone workstations, three (3) with lifts and one (1) flat floor. The total maintenance capacity at the Albany garage is currently stretched to the limits for the existing fleet. The introduction of low floor buses would create the need for the pit/platform positions, which should be an addition to the current lift and flat floor capacity. This would necessitate the redeployment of indoor storage space, building expansion, or other significant remodeling.

The current maintenance area of Albany bus garage could not be easily adapted to maintain a fleet of 60-foot articulated buses. The long, narrow shape of the shop does not permit 70-foot work bays as currently laid out. The removal of the herringbone positions, and replacement with longitudinal positions would result in two (2) work positions or at best three (3) work positions, if two were in series. This configuration would be inadequate for the fleet size. Three (3) positions would require a new garage door entry, and would require that buses routinely back into or out of the maintenance bays.

To effectively maintain a fleet of 60-foot articulated buses at Albany, a major renovation of the facility would be required. This must include a reallocation of indoor space, changing some of the indoor storage to maintenance shop space. Other aspects of this facility could be adapted with reasonable ease to accept a fleet of 60-foot articulated buses.

The capacity of the Albany garage is limited for the size of the diesel fleet currently operating out of this facility. CNG buses typically require a greater maintenance effort per bus than diesel buses. This necessitates the requirement to reallocate space within the

Albany facility so as to increase the size and capacity of the shop to the extent necessary to accommodate a CNG fleet of the size limited by the physical storage space available on the site.

This having been done, the fueling system would need to be designed and located so as to create more than a single servicing line.

Need: Albany can be made adequate to maintain 40-foot or 60-foot clean diesel buses by converting some of the indoor storage space adjacent to the maintenance shop such that the resulting shop is approximately twice the current size. Two (2) bays should be made 70 feet long to accommodate articulated buses, and approximately three (3) positions should be converted to pit/platform configuration for the efficient maintenance of low floor buses. One position should have an overhead crane.

Charlestown

Finding: The Charlestown bus garage, the largest and amongst the newest of the MBTA maintenance facilities, requires imperative repairs to the roof, garage doors, and air handling units in the maintenance building. At the time of inspection, April 2002, the most important operational constraint is the repair and replacement of the maintenance garage roof, make-up air units, and overhead doors. Additionally, a critical safety issue that should be corrected immediately is the replacement of the overhead doors that are propped open with wood in the door track.

To accommodate low-floor vehicles, as currently planned for 2004, the Charlestown bus garage will require some modifications to the maintenance area. The Charlestown facility can be easily remodeled to accommodate 40-foot low floor buses by converting some of the flat floor positions to pit/platform positions, and adapting the existing pits to the pit/platform configuration. Lift positions will be required, and those should be upgraded to accommodate the weight of the busses that might be maintained at this location.

Need: The Charlestown garage could be made adequate to store and maintain a fleet of over 200 clean diesel buses. The status as of April 2003 is that the make up air units and the overhead garage doors have been repaired. Only the repair of the roof remains to be completed.

To accommodate 40-foot low floor buses, pit/platform positions should be created, and lifts upgraded to the capacity necessary to lift the buses to be stored their. At least one overhead crane will be necessary.

Phase II-A

Based on the site configuration, size, and bus circulation restrictions; the condition of existing facilities and building systems; the deterioration of maintenance equipment; and

the capital cost expenditure for the rehabilitation and retrofit, the Fellsway and Lynn garages should be phased-out.

Fellsway

Finding: The Fellsway bus garage, a converted trolley barn, has six (6) workstations, of which five (5) are lift positions and one (1) is flat floor. The Fellsway facility would require significant modification to accept and maintain low floor and/or CNG technologies, requiring at least two (2) of the lift positions to be converted to pit/platform positions. The existence of ground contamination would likely make the construction of pits problematic. The exterior pavement and the slab in the service lane (bus wash area) would need to be leveled due to the floor clearance issues associated with low floor buses as well as the general problem of suspension and alignment damage caused on any bus stored on this pavement.

The Fellsway garage is located among both commercial and residential uses, with the residential uses located along one side and rear of the property. The Authority installed a tall wood fence to obstruct the view into the yard; however, residential neighbors have complained about the noise and odor disturbances caused by yard and shop activities. In addition, ground contamination caused by diesel fuel is of concern to the residential community at-large.

The prospect of retrofitting the Fellsway garage for CNG is the least advisable. The cost per bus serviced would be higher than any other garages. The need to operate a large compressor frequently in a location that continues to suffer neighbor complaints about noise would certainly be problematic. The age and condition of the structure add further questions to the desirability of considering this facility for any significant investment needed to accommodate future technologies.

Need: In place of the Fellsway facility, new bus maintenance capacity should be constructed in this area to service those vehicles currently maintained at Fellsway; accommodate the existing overflow from the Charlestown facility; and support some of the Urban Ring routes.

Lynn

Finding: The bus garage is located between Camden Street and Western Avenue in Lynn. To the southeast of the facility are industrial uses; northwest of the facility are residential neighborhoods; and northeast are commercial uses. The primary neighborhood concern is the traffic impacts, as bus circulation movements require the use of Western Avenue, which has substantial traffic.

There are six (6) pits and four (4) lifts at the Lynn garage; however, the usefulness of the facility is reduced due to its layout. The pits can be converted to pit/platform positions, but the lifts need to be segregated from the bus storage area in order to be useful for maintenance of low-floor and alternative-fuel technologies. Currently there is no

separation between the maintenance area and the bus storage area, at the time of bus pullout the fumes are present at the maintenance lift workstations. This would be true for any internal combustion propulsion technology considered.

The north yard of the Lynn garage is small, and the utilization of this area for pre-trip inspection and lift and/or ramp deployment is problematic – the current logistics for 40-foot buses are strained and limiting.

The age, configuration, and capacity of the Lynn garage lead to the same conclusions as drawn for Fellsway. That is, the cost per bus of the investment necessary to retrofit Lynn for low-floor or alternative-fuel technologies, and make it a functional garage would be substantial. Being located adjacent to a residential neighborhood makes it a potential problem for noise disturbances, especially if high capacity compressors are installed. Further, renovations would not alleviate one of the most disruptive problems to operations, which is the traffic logistics dictated by the geometry of the available space.

Need: In place of the Fellsway facility, new bus maintenance capacity should be constructed in this area to service those vehicles currently maintained at Fellsway; accommodate the existing overflow at the Charlestown facility; and support some of the Urban Ring routes.

Phase II-B

Finding: Future maintenance facility requirements are based on the estimated number of vehicles necessary to operate peak period service for all existing and planned bus services. Specifically, Phase 1 of the proposed Urban Ring Transit program consists of eleven (11) circumferential local routes and three (3) express commuter (EC) routes. CT routes 1, 2, and 3 have been partially implemented and will be expanded during the Phase 1 improvements. The Urban Ring Phase I routes and their proposed operating characteristics require an additional 104 vehicles (approximately) to operate the specified service during the peak period.

The Phase 2 bus service would include CT routes 1, 6, 7, 9, 10 and 11; EC routes 2 and 3; and bus rapid transit routes 1-7. It is estimated that only an additional 5 vehicles would be required for the Phase 2 routes. The Albany garage would require storage of four (4) more vehicles and the Charlestown garage would require six (6) under the Phase 2 implementation, modest increases over the Phase 1 forecasts.

Need: Open a new facility to accommodate the Urban Ring service needs in the vicinity of Routes I-90 or I-93 and inside Route 128 for the provision of service to many of the current and proposed (Urban Ring) express routes. The relocation of this service would free-up space at Albany garage for the introduction of some of the Urban Ring service.

Phase III

Finding: In evaluating the facility impacts of other possible technologies that may come into use in the outer years, only hydrogen-based systems are potentially significant at this time.

Need: Any new facility constructed by the MBTA should be constructed so as to accommodate the use of CNG, which would also allow for hydrogen-based systems.