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Bus Support Facilities: Conditions and Needs

Office of Policy
Federal Transit Administration
400 Seventh Street SW
Washington, DC 20590

Bus Support Facilities: Conditions and Needs

Final Report
January 1993

Prepared by

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Prepared for

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Federal Transit Administration
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U.S. Department of Transportation
Federal Transit Administration

Administrator

400 Seventh St., S.W.
Washington, D.C. 20590

C-93-05

Dear Colleague:

Enclosed for your information is a copy of a new report prepared for the Federal Transit Administration (FTA), entitled "Bus Support Facilities Conditions and Needs." This document is an assessment of the current condition and five-year capital need (FY 1993-1997) for transit operator bus support facilities. The report was prepared for the Office of Policy by ATE Management & Service Company, Incorporated, and is part of our on-going assessment of transit needs and conditions as reported biennially in the Section 308 Report to Congress: "Public Transportation in the United States: Performance and Condition."

Also enclosed is a "Foreword" to the report prepared by FTA, which describes in more detail the purpose of this report; analyzes current facility conditions; estimates capital cost for the facilities; and links these estimates to the transit capital needs estimates contained in the Section 308 Report to Congress.

The enclosed report estimates the capital needs for bus maintenance facilities at $2.1 billion for the next five years. This is the first time FTA has conducted a specific review of facilities and we intend to continue working with the industry to ensure that the estimates contained in the Section 308 report accurately represent transit needs as part of FTA's budget justifications.

If you have any questions on this report, or need additional copies, please contact Charlotte Adams, Director, Office of Policy at (202) 366-4060.

Sincerely,

Robert H. McManus
Acting Administrator

Enclosures

FOREWORD

This report represents one part of the effort by the Federal Transit Administration to develop information pursuant to the requirements of Section 308 of Title 49, United States Code. Section 308 requires the Secretary of Transportation to submit, in January of each even-numbered year, a report to Congress on the current performance and condition of public mass transportation systems. The Section 308 report, "Public Transportation in the United States: Conditions and Performance," provides an assessment of public transportation in the United States along with estimates of the future capital investments needed to support specified levels of service. An important part of this analysis is the Nation's bus maintenance facilities and their future capital requirements. In the past this analysis was limited in its scope because the only source of information available on such facilities was that from FTA's Section 15 program, which provided only a count of the number of facilities. Thus, FTA had no data on facilities' characteristics and conditions, and on the capital investment requirements which could be based on such information. The purpose of this report was therefore to obtain such information on bus maintenance facilities in order to close this gap.

Bus Maintenance Facility Conditions

Transit operators were asked to rate each of their facilities relative to how well it sustained the bus maintenance support function, and provide information on the age of each. The rating for each facility was along a spectrum of "excellent, good, adequate, substandard or poor." The definition for each rating is as follows:

Excellent - The facility meets or exceeds most reasonable requirements of a transit bus maintenance program.

Good - The facility meets most reasonable requirements of a transit bus maintenance program but may have some less than optimum characteristics.

Adequate - The facility has shortcomings in its ability to support a transit bus maintenance program. While these shortcomings hinder the department's effectiveness or efficiency, they are not deemed to significantly impact performance.

Substandard - The facility has shortcomings in its ability to support a transit bus maintenance program and these shortcomings are deemed by the operator to be below industry standards. These deficiencies impact the efficiency and/or effectiveness of the operation.

Poor - The facility has significant shortcomings in its ability to support a transit bus maintenance program.

According to the transit operators, more than half (57%) of the transit industry's bus support facilities are in "good" or better condition for their current mission. The remaining facilities are categorized as "adequate" (18%), "substandard" (14%), and "poor" (10%). Two-thirds of the facilities are less than twenty years old. The remainder range in age from 21 to 99, with the age range of 21-30 representing the next highest percent (7%).

<u>Capital Investment Programming</u>

Transit operators were asked to provide information on the amount of capital expenditures programmed for the next 5 years for bus facilities. In addition to the total capital expenditures planned, they were also asked to categorize the projected expenditures in the five following categories: rehabilitation; expansion; replacement; new facility construction; and other; defined as follows:

New-- Construction of a new facility which does not replace an existing facility.

Replacement-- Construction of a new facility to replace an existing facility.

Expansion-- Addition of capacity to an existing facility.

Rehabilitation-- Upgrading of an existing facility.

Other-- Miscellaneous expenditures, primarily underground storage tanks and alternative fuel projects.

The sum of the investments programmed by transit operators for 1993-1997 for the Nation's bus support facilities was $2.1 billion. However, the report indicates that this may be an underestimate due to uncertainties about the costs of meeting the requirements due to new technology (i.e., alternative fuels) and recent legislative requirements (i.e., Americans With Disabilities Act, underground storage tanks, and Clean Air).

FTA staff analysis of the reports submitted by transit operators indicates that, while some of the facilities may be new from an engineering standpoint, when considered in terms of the purpose of the investment, they in fact represented expansion of existing maintenance capabilities or replacement of existing facilities for the purpose of obtaining a facility of improved condition. Examples included new bus servicing facilities added to an existing maintenance facility or the demolition of an older building and construction of a new building on the same site.

Estimates of Bus Maintenance Facility Needs

To translate the capital programs of the transit operators into estimates of bus maintenance facility capital needs in terms of uniform definitions, FTA staff conducted further analysis of the data reported by the operators. The Section 308 Report to Congress categorizes annual mass transit capital investment needs in terms of the costs to achieve the following goals:

1) Maintain Condition & Performance

   a. maintain current physical condition

   b. maintain performance by meeting current growth trends

2) Improve Condition & Performance

   a. eliminate the backlog of investment needs because of past investment less than that required to keep facilities and equipment in good or better condition

   b. improve performance by expanding service to accommodate 10 percent of travel from foregone highway construction

In order to estimate the capital costs to achieve these goals related to bus maintenance facilities, the projects reported by the transit operators were classified as to their purpose, as follows:

Where new facility construction or facility expansion was programmed, additional information was obtained to determine whether the purpose of the project was to 1) improve maintenance capabilities while maintaining current service levels or 2) actually increase the level of transit service provided.

Maintain Performance. Those new or expansion projects whose purpose was to expand service were considered to be those needed to maintain current performance, by expanding transit service consistent with recent trends. Because of the limited number of projects programmed for the purpose of expanding service, the amount of increased service which would be supported by these facilities was well within the amount estimated in the 1992 Section 308 Report to maintain current performance levels. Therefore, none of the expenditures programmed in the report can be assumed to be for the purpose of improving performance.

<u>Improve Current Conditions.</u> Those new or expansion projects whose purpose was to improve maintenance capabilities at facilities considered to be in poor, substandard, or adequate condition were judged to be those needed to improve current conditions.

In addition, those projects which were for the purpose of rehabilitating or replacing existing facilities which were in less-than-good conditions were also judged to be those needed to improve current condition.

<u>Maintain Current Conditions.</u> Those new or expansion projects whose purpose was to improve maintenance capability at facilities judged to already be in good or better condition were judged to be those needed to maintain current conditions.

In addition, those projects which were for the purpose of rehabilitating or replacing existing facilities which were already in good or better condition were judged to be those needed to maintain those conditions.

<u>Expansion Factors.</u> An expansion factor was applied to take account of the fact that the facilities covered by the study represented 95 percent of the bus facility capacity in the United States.

An additional expansion factor was applied to account for those facilities in good or better condition for which no current capital investment is planned but which will need reinvestment at some time during the ten year period covered by the Section 308 analysis to maintain those conditions.

The results of this analysis in terms of annual capital investment required for bus support facilities are as follows:

Maintain current condition - $168 million

Maintain performance - $42 million

Improve conditions - $258 million

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EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

In 1991, the transit industry spent nearly $400 million on bus support facilities. As financial resources become more limited, it is increasingly important to direct available funds where they are most needed and to assure that funding is maximized to improve the operating efficiency of the nation's fleet of transit buses. Thus, in order to focus on the current condition of the nation's bus support facility infrastructure, the Federal Transit Administration (FTA) required more information pertaining to the physical adequacy of the grantees' existing bus support facilities, the grantees' plans for replacement and improvement of these facilities, and their annual projections of the federal assistance required to finance such plans. This project had two main aspects:

ASSESSMENT OF THE INDUSTRY'S PROJECTED CAPITAL NEEDS FOR BUS SUPPORT FACILITIES

This task involved the assessment of projected capital needs for bus support facilities for FY 1993-1997 inclusive. The purpose of the assessment was to supply FTA with appropriate information to formulate projections on the level of funding required for the next five years and to support appropriation requests to Congress.

Data for this assessment were collected through a series of survey instruments and follow-up phone calls. Based on the peak number of buses in revenue service, the collected data represents approximately 95 percent of the federally-supported transit industry.

Of the grantees surveyed, 76 percent graded their current facilities as adequate or better than adequate at meeting existing bus support requirements. Of the 426 bus support facilities which constituted the data base, 61.7 percent had projected capital expenditures over the next five years. **These five year projections call for a total of $2.1 billion in planned outlays.** The reported capital projects included facility rehabilitation efforts, expansion of existing facilities, replacement of existing facilities, all new facility construction, as well as various miscellaneous capital expenditures. From the collected data, capital expenditures were categorized by such factors as location, size of facility, project type and facility condition and age.

ASSESSMENT OF CURRENT CONDITIONS AT SPECIFIC BUS SUPPORT FACILITIES

The primary intent of this task was to address the question, "Are there lessons to be learned from case studies of specific bus support facilities that may help in the development of more effective facilities in the future?" Toward this goal, the study team visited and interviewed officials at nine selected transit bus support operating garages.

CASE STUDY RESULTS

A report was prepared detailing the findings and recommendations from each of the site visits along with a compilation of the overall findings and recommendations from the work. While Chapter III of this report provides the details of this work, a brief listing of the major findings and recommendations in relative order of importance follows.

Major Findings

- Capital Support Needed for Facilities

  While the survey found that more than $2.1 billion is projected for bus support facility capital needs, this may be understated because agencies find it difficult to project capital needs in emerging areas such as ADA and alternative fuels.

- Good Facilities Utilization and Life Span

  The industry is doing an **excellent job of extending the useful life of its facilities** and, based on the site observations, is **properly utilizing these assets** for public transportation support.

- Problems With Facility Site Selection and Utilization

  Facility configuration is more heavily influenced by **site constraints** than operating desires. However, **community acceptance problems** are a major influence in the selection of sites.

- Lack of Industry Consensus in Many Areas

  The industry lacks consensus on such areas as **indoor versus outdoor parking**, best approaches for **meeting underground storage tank requirements** (i.e., doubled walled tanks, tank vaults, piping, fuel drop points, etc.), **requirements for alternative fueled buses**, construction techniques, **optimal facility size**, use of **chassis dynamometers**, use of gantry type paint booths, **pit design**, etc. A wide mixture of portable wheel lifts, drive-on ramp lifts, pits and hoists are used as methods **for working under buses** and each has advantages and disadvantages. In general, experience is not adequately shared in the industry.

- Facility Life Span and Changing Requirements Impact Design

  Because of the extended lives and rapidly changing requirements of facilities, **flexibility and adaptability are very important** design characteristics. Also, **ongoing modifications and rehabilitations are needed** to keep facilities functional.

- Conserve Operating Cost Through Capital Projects

  Capital items that conserve operation cost (i.e., concrete versus asphalt parking lots, low maintenance walls in work areas, etc.) are often used.

- Greater Use of Environmental Conservation Measures

  More environmental conservation measures, such as water reclamation systems, are being used.

- Engine Exhaust Problems in Facilities

  Exhaust emission problems are particularly evident in facilities that house maintenance and bus parking under one roof and where bus parking garages have low ceiling heights. Most air exchangers are ineffective at addressing the resulting problem.

Major Recommendations

- Major Capital Expenditures Needed

  Major capital expenditures will be needed over the next five years to keep pace with current requirements. Expenditures above current projections will most likely be needed to accommodate alternative fueled vehicles and the requirements of the Americans with Disabilities Act. Along this same line, **more effort is needed in developing the requirements and cost for alternative fueled vehicle facility requirements.**

- Industry-wide Transit Facility Standards Needed

  More industry-wide facility standards are needed. Specifics include recommended **optimum fleet size** for a single facility, cost benefits analysis (**value engineering**) on such things as shop equipment/furnishings and energy conservation measures, recommended **design and construction approaches**, and recommended **underground storage tank plans.**

- Design Facilities For Extended Lives

  Based on the extended age of many facilities, bus support facilities should be designed for extended lives. This design consideration includes designing the facility systems (i.e., electrical systems, ventilation, parking, work bays, etc.) to **exceed minimum or current requirements.** The facilities should also be designed with **maximum flexibility** to meet changing needs.

- More Quantification and Sharing of Work Flow Process Information Needed

  Since efficient work flow processes are extremely important, more awareness of industry results concerning various approaches is needed. This type of information sharing and analysis includes parking configurations, pit use and design, various methods for working under buses (pits, post lifts, drive-on lifts, etc.) work bay layouts, and design and number of vehicle access doors to the facility.

- Improved Conservation Approaches Needed

  Improved conservation approaches for energy loss, water reclamation, etc., are needed.

CURRENT CONDITIONS AND CAPITAL NEEDS

II. CURRENT CONDITIONS AND CAPITAL NEEDS

A. STUDY APPROACH

A purpose of this study was to develop estimates of the current condition of the nation's transit bus maintenance facilities and the capital investments needed to assure that these facilities remain in good condition. To do so, staff members of all transit bus systems operating 25 or more vehicles in maximum service were asked to provide this information for each of their bus maintenance facilities. This chapter summarizes the results of the analysis of this information.

According to reports from transit operators to the Federal Transit Administration in accordance with Section 15 requirements, in 1990, a total of 413 transit systems required a total of 42,870 transit buses for maximum scheduled service. Of the 413 systems, 213 systems require more than 25 vehicles to provide maximum scheduled service. These 213 operators require 40,565 vehicles to provide maximum service and have a total of 426 bus maintenance facilities, and formed the basis for this study's review of capital facility conditions and needs. Thus, the operators surveyed for this analysis represent about 95 percent of all bus service. It is assumed that these operators are representative of the universe of bus operators and that the capital costs reported by these operators represent approximately 95 percent of the total capital costs required by all bus operators for their maintenance facilities.

Each operator in the sample was asked to provide information, for each of its bus maintenance facilities, on the purpose of the facility, the number of vehicles served, the current condition of the facility and the nature and cost of any capital investment plans for the facility. The information was gathered using a written questionnaire, followed up by telephone contacts to resolve any ambiguities. The written questionnaire was first tested on a sample of five percent of the operators and was modified slightly based on the initial results. A copy of the final questionnaire is provided as Appendix A. Once the data was entered into the data base, operators were given an opportunity to review and edit the data on their system.

To maximize industry input and support for the assessment of projected capital needs for bus support facilities, ATE established and maintained a liaison with the American Public Transit Association (APTA) throughout the term of the project. Specifics of this liaison include the following:

- At periodic times during the progress of the project, ATE contacted various APTA representatives to apprise them of the intent of the project, data collection approaches, progress of the project and findings. ATE actively solicited any insights, questions, suggestions or guidance. Personnel contacted as part of this effort included Mr. Robert Buchanan, Deputy Executive Vice President of APTA; Mr. Jeff McCormick, Chairman of APTA's Bus Maintenance Committee; Mr. Frank Cihak, APTA's Chief Engineer and Deputy Executive Vice President of Technical Services; and Mr. James Hathaway, Chairman of APTA's Bus Equipment and Maintenance Subcommittee on Maintenance Facilities.

- APTA published an industry update relative to this project in the April 27, 1992 edition of *Passenger Transport* as a result of a news release supplied by ATE. On behalf of FTA, ATE has submitted another news release, relative to the project and its findings, for suggested publication in an upcoming issue.

- On behalf of FTA, an ATE representative attended the May 17, 1992 meeting of the APTA Bus Equipment and Maintenance Committee. At that time, ATE met with the Maintenance Facility Subcommittee and with Mr. Val Elkinas who was filling in for the chairman, Mr. James Hathaway, to brief the committee on the progress of the study effort.

- ATE provided copies of the "Facility Adequacy Report" to APTA's Maintenance Facility Subcommittee for its review and comment.

- ATE conducted a presentation on bus support facilities at the November 1992 APTA Bus Maintenance Conference.

B. CURRENT CONDITIONS

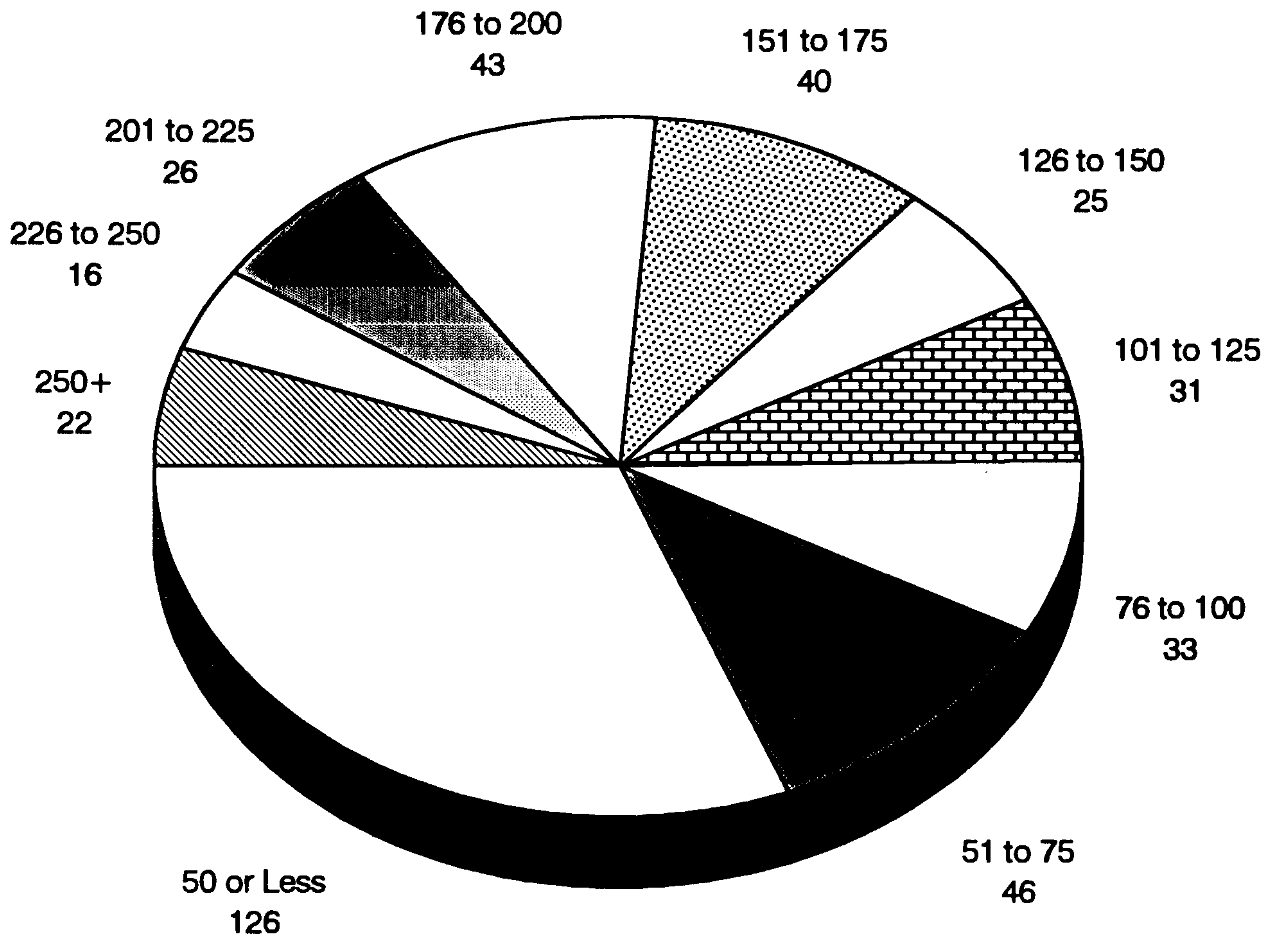
The 426 facilities covered in this study vary in size based on the number of vehicles they support which range from 25 vehicles served to 531 vehicles served. Exhibit II-1 shows the distribution of facility sizes.

In addition to the number of buses the facilities support, the facilities are also differentiated by their functions, which fall into three broad categories. Most facilities are stand-alone facilities that perform all bus support functions. In larger properties, there are often multiple bus support facilities or operating garages with much of the heavy or specialized work passed along to a central support garage. The data base consisted of 41 percent stand-alone garages, 52 percent operating garages, and seven percent central support garages.

Transit operators were asked to subjectively rate each of their maintenance facilities relative to how well the facility supported the bus maintenance support function. The operators were asked to rate each facility along a spectrum of "excellent, good, adequate, substandard or poor." The inference for each rating being as follows:

EXHIBIT II-1

GARAGE SIZE DISTRIBUTION BY FLEET SIZE



- Excellent - The facility meets or exceeds most reasonable requirements of a transit bus maintenance program.

- Good - The facility meets most reasonable requirements of a transit bus maintenance program but may have some less than optimum characteristics.

- Adequate - The facility has shortcomings in its ability to support a transit bus maintenance program. While these shortcomings hinder the department's effectiveness or efficiency, they are not deemed to significantly impact performance.

- Substandard - The facility has shortcomings in its ability to support a transit bus maintenance program, and these shortcomings are deemed by the operator to be below industry standards. These deficiencies impact the efficiency and/or effectiveness of the operation.

- Poor - The facility has significant shortcomings in its ability to support a transit bus maintenance program.

Exhibit II-2 displays the ratings of the current condition of the bus maintenance facilities as reported by the transit operators. Agency reports indicated that 76 percent of the facilities were in adequate or better condition.

Operators were also asked the age of the facilities. The resulting age distribution is shown in Exhibit II-3. Comparing age and condition indicates that, while most of the facilities are relatively new and in excellent condition, as would be expected, many of the older facilities are in at least adequate condition. Exhibit II-4 shows this comparison of facility age and condition.

EXHIBIT II-2

FACILITY BREAKDOWN BY CONDITION

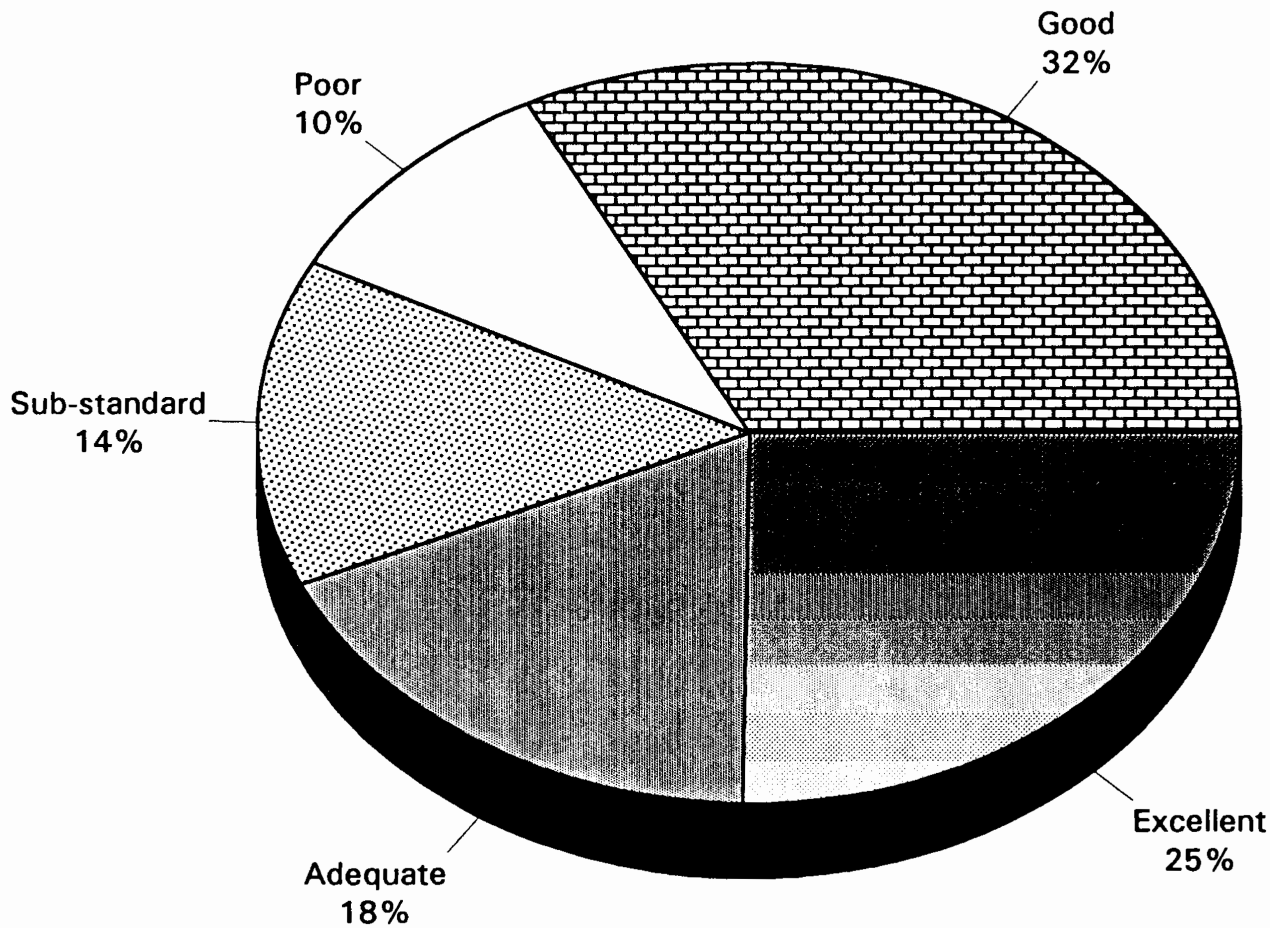


EXHIBIT II-3

FACILITY BREAKDOWN BY AGE

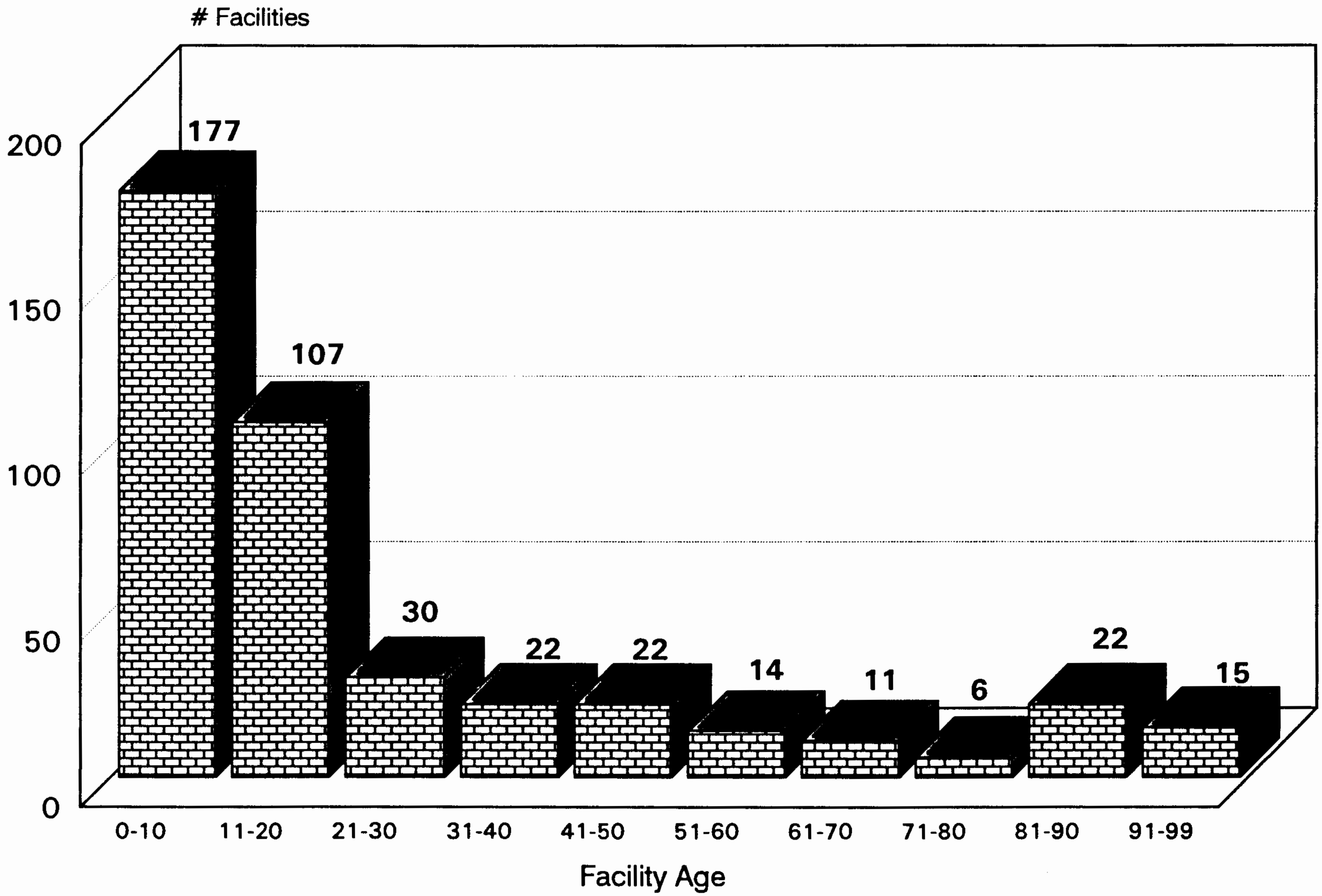
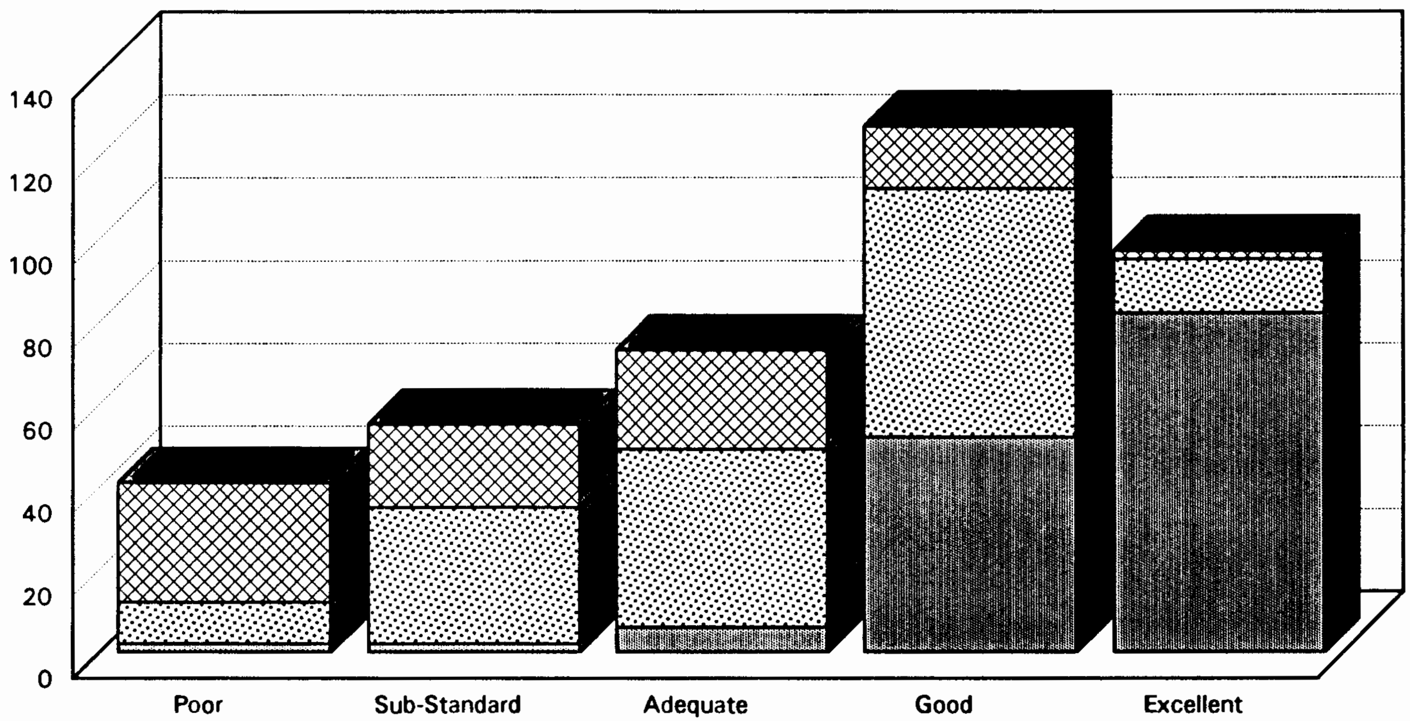


EXHIBIT II-4

FACILITY CONDITION BREAKDOWN BY AGE



	Poor	Sub-Standard	Adequate	Good	Excellent
Over 40 years old	29	20	24	15	2
11 to 40 years old	10	33	43	60	13
1 to 10 years old	2	2	6	52	82

Facility Condition

1 to 10 years old · 11 to 40 years old · over 40 years old

C. PLANNED CAPITAL EXPENDITURES

1. Total Planned Capital Expenditures

A total of 212 of the 213 operators which require more than 25 vehicles for maximum scheduled service provided information for this study. These 212 operators used a total of 426 facilities, and 61.7 percent of these facilities have expenditures planned over the next five years. Exhibit II-5 displays the number of facilities with and without expenditure plans. These plans total more than $2.1 billion and fall into the following categories:

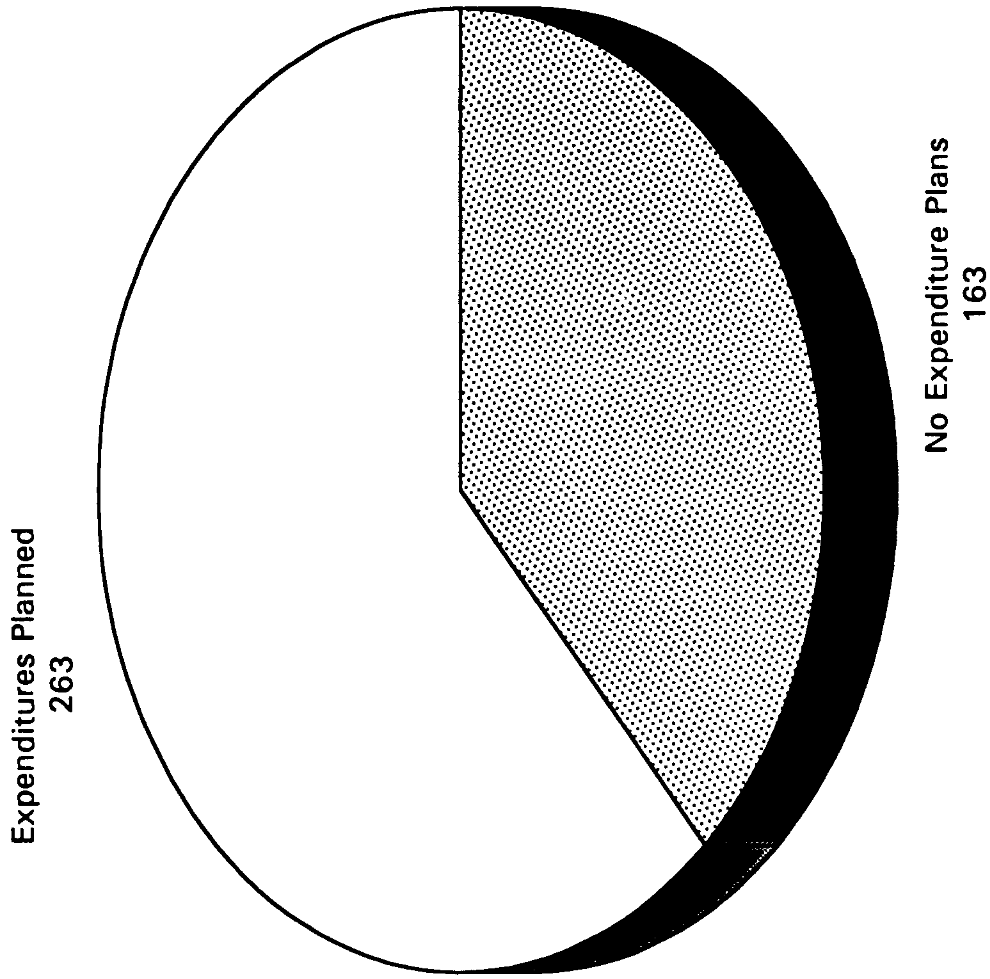
- Rehabilitation - Upgrading of an existing facility.
- Expansion - Addition of capacity to an existing facility (such as additional bus bays, parking, etc.).
- Replacement - Construction of a new facility to replace an existing facility.
- New Facility Construction - Construction of a new facility which does not replace an existing facility.
- Other - Miscellaneous expenditures, primarily underground storage tanks and alternative fuel projects.

Details of the reports provided by the operators are included in Appendix B. Table B-1 summarizes the results by state; Table B-2 provides detail for each operator within each state; and Table B-3 provides detail for each facility at each operator, grouped by state.

EXHIBIT II-5

TOTAL RESPONDENTS

Expenditures Planned vs. No Plans



2. Planned Capital Expenditures by Location

As shown in Exhibit II-6, the states with the largest share of the facility capital needs are California, New York and Illinois, together comprising 54 percent of the national totals. Exhibit II-7 shows how the facility capital needs are distributed by FTA Region. Regions II, V, and IX have the largest totals.

3. Planned Capital Expenditures by Size of Facility

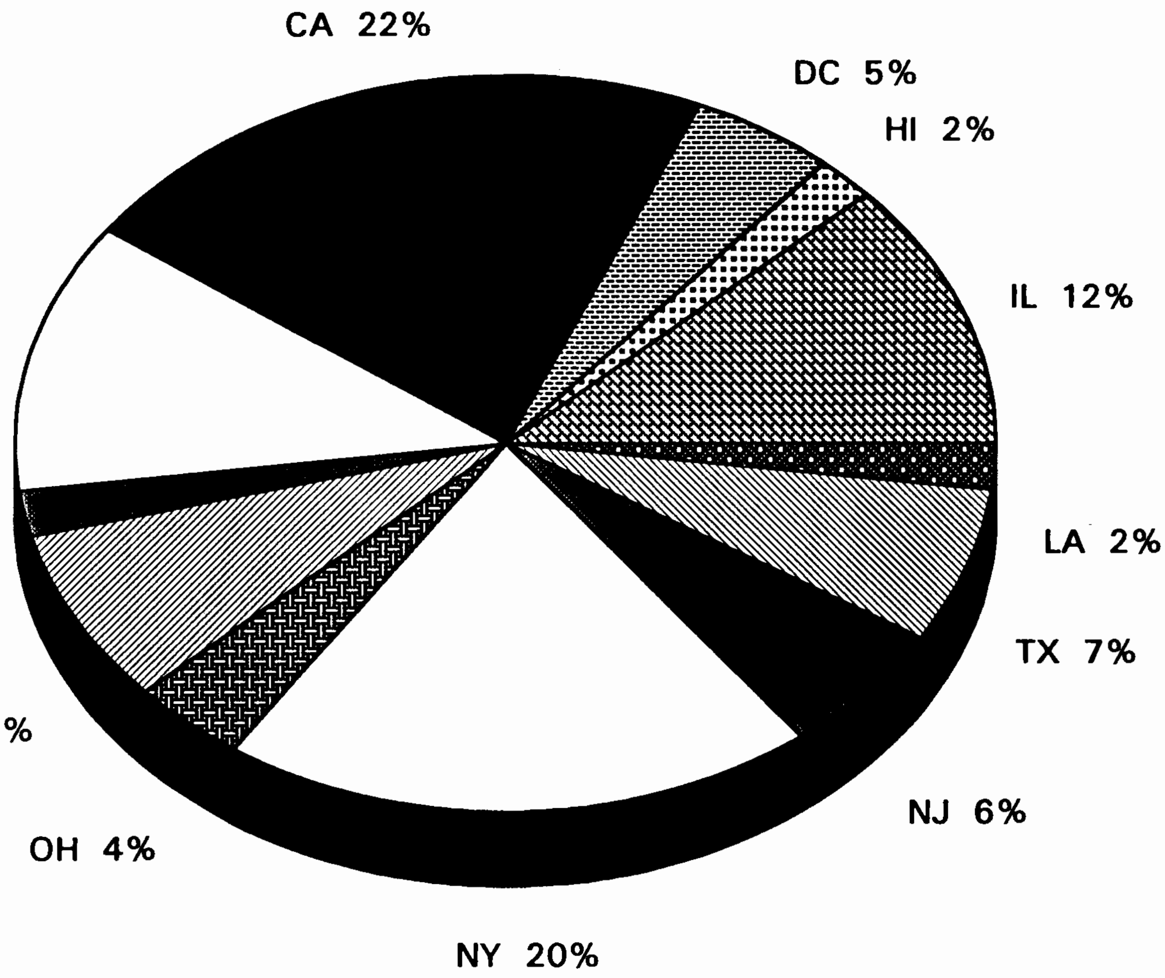
Exhibits II-8 and II-9 display the planned expenditures by size of facility. Exhibit II-8 shows that the single largest planned expenditure is for facilities housing between 150 and 200 vehicles. There are 83 facilities of this size. A total of $500 million is planned to be spent on these facilities, or 24 percent of the total. Exhibit II-9 shows the average amount of planned expenditure planned for each class of facility size. As expected, the average amount increases directly with the size of the facility. However, as shown in Exhibit II-10, the average amount of planned expenditure per vehicle served decreases for facilities serving more than 200 vehicles. This demonstrates some economies of scale in terms of capital needs for larger facilities, but, as covered later in this report, larger facilities may have the opposite effect on operating efficiencies.

4. Planned Capital Expenditure by Project Type

Exhibit II-11 shows the amount of planned expenditures by type of capital investment, as previously defined. Only five percent is planned for expansion of existing facilities, while 68 percent is planned for new or replacement facilities.

EXHIBIT II-6

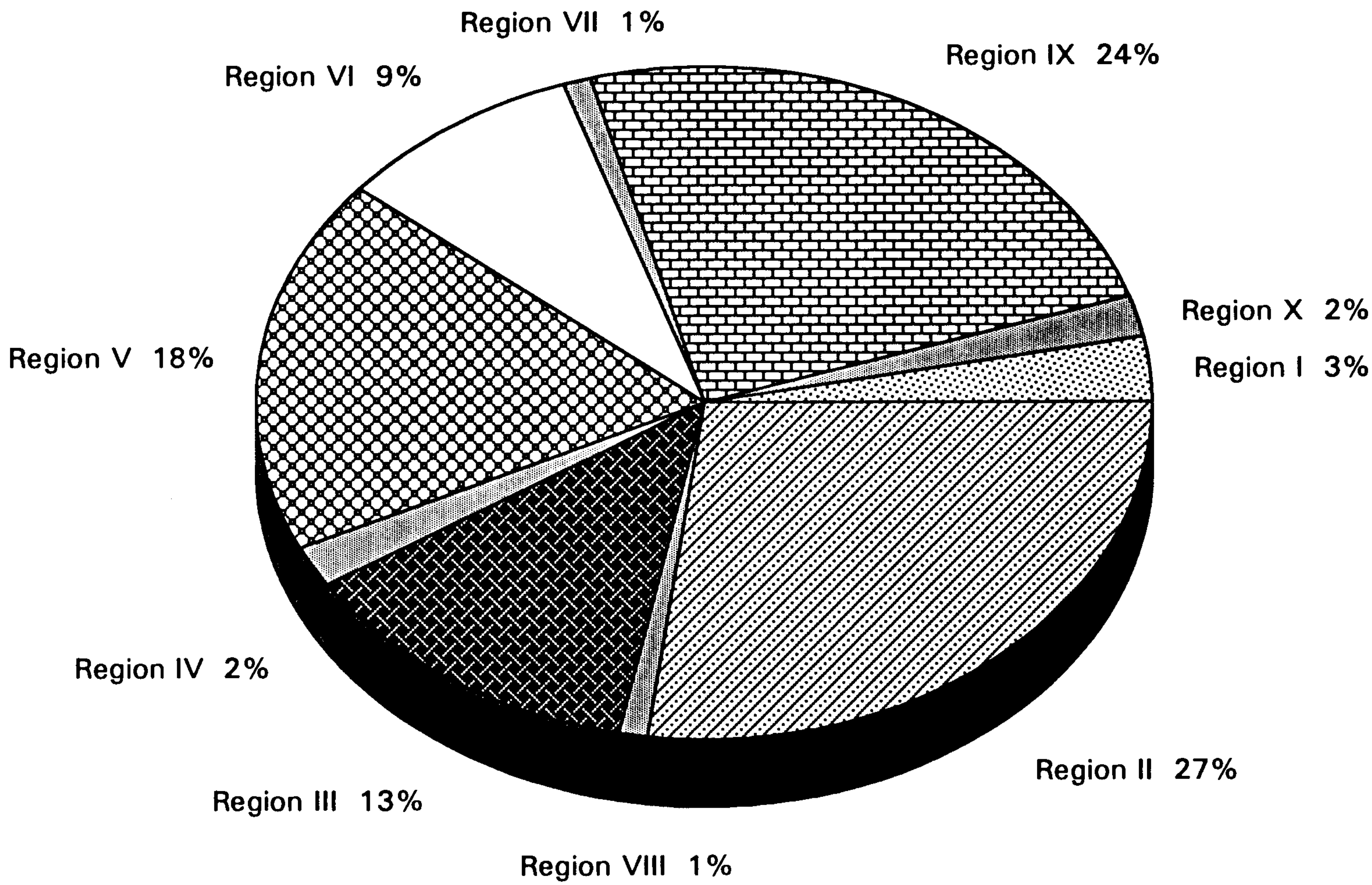
PLANNED EXPENDITURES BY STATE



% of total $2,102,800,236 expenditures

EXHIBIT II-7

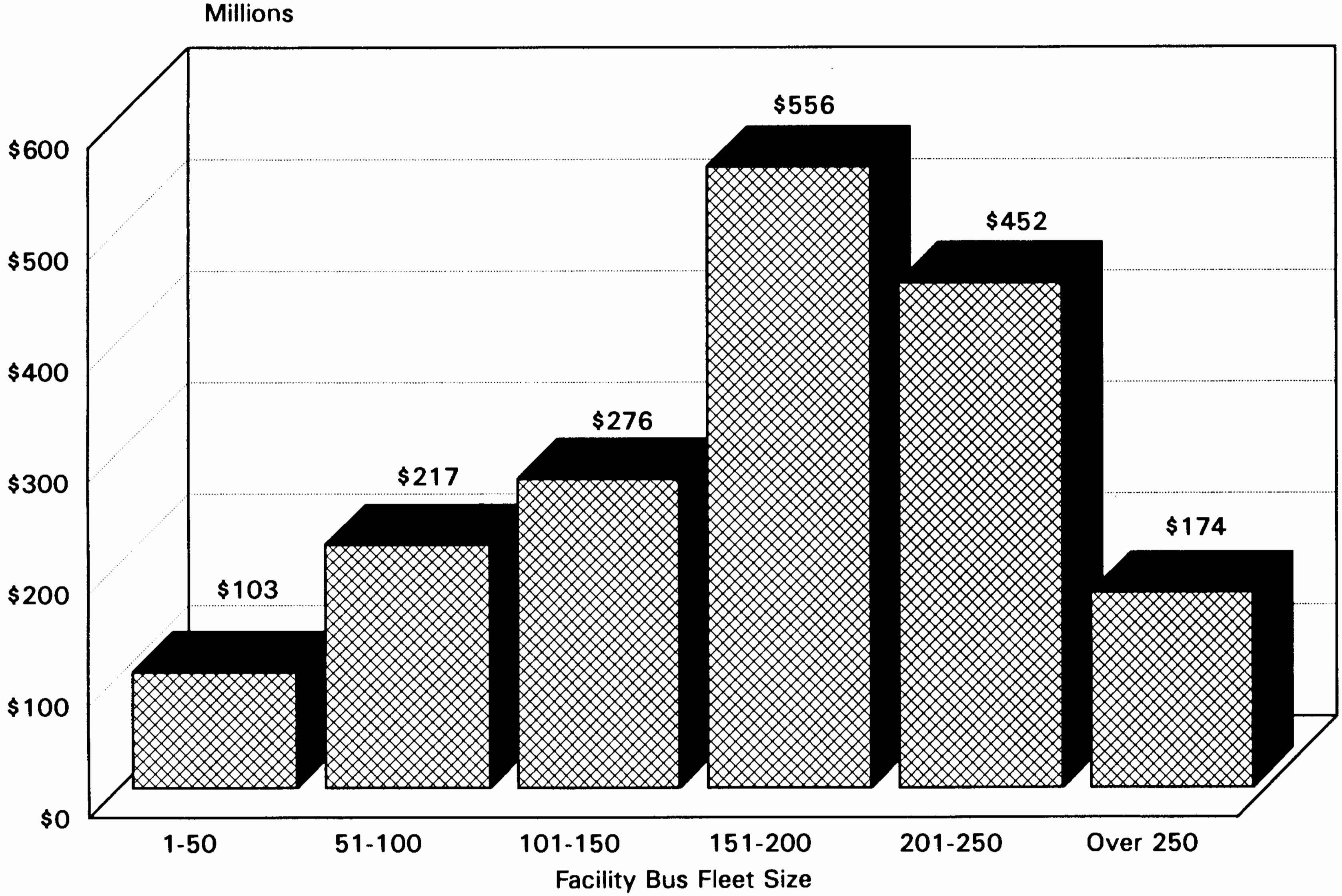
PLANNED EXPENDITURES BY FTA REGION



% of total $2,102,800,236 expenditures

EXHIBIT II-8

TOTAL FACILITY EXPENDITURE BY NUMBER OF BUSES HOUSED



Expenditures planned for the next five years

EXHIBIT II-9

AVERAGE PLANNED EXPENDITURE BY FACILITY FLEET SIZE

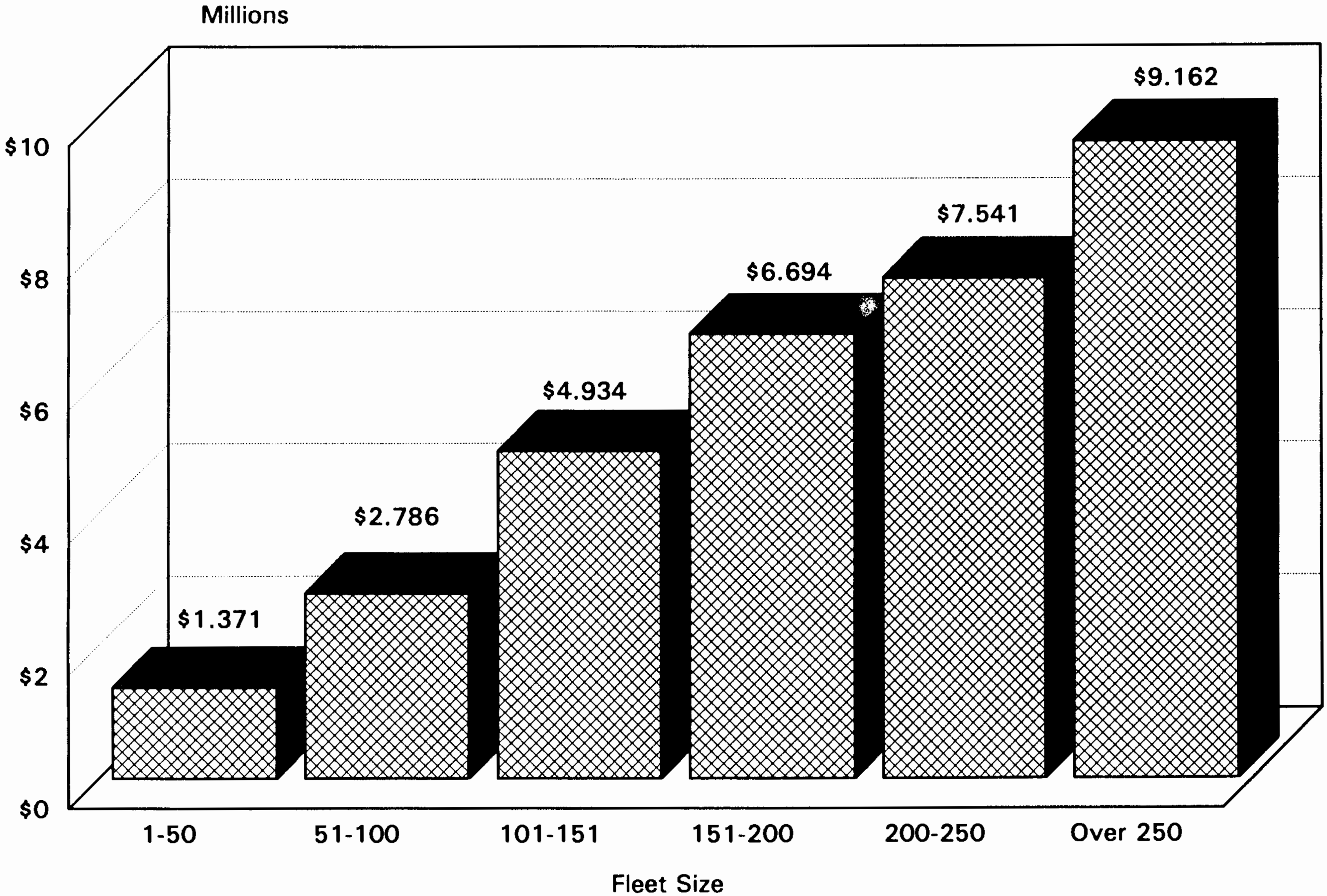


EXHIBIT II-10

AVERAGE PER BUS EXPENDITURE BY NUMBER OF BUSES HOUSED

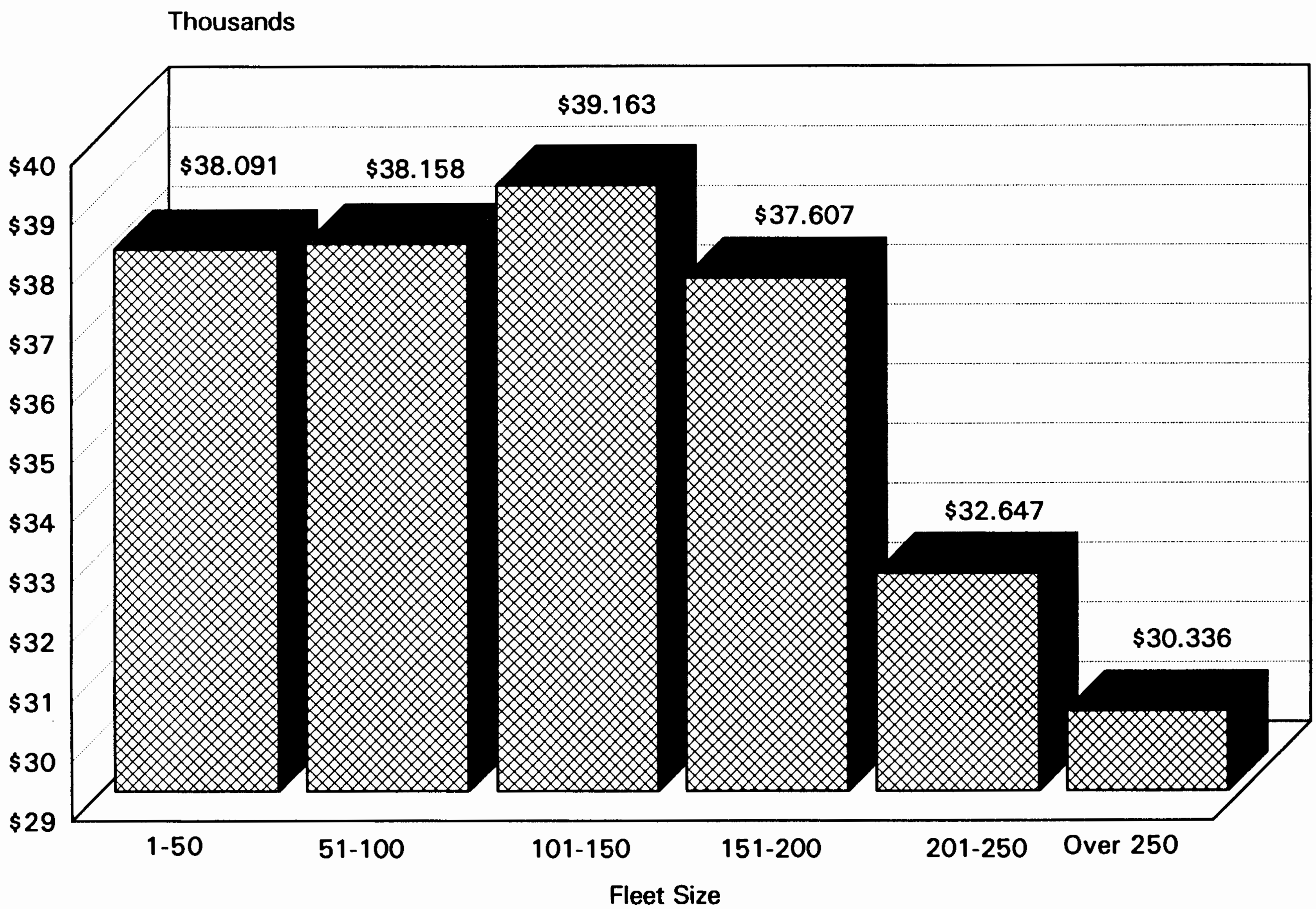
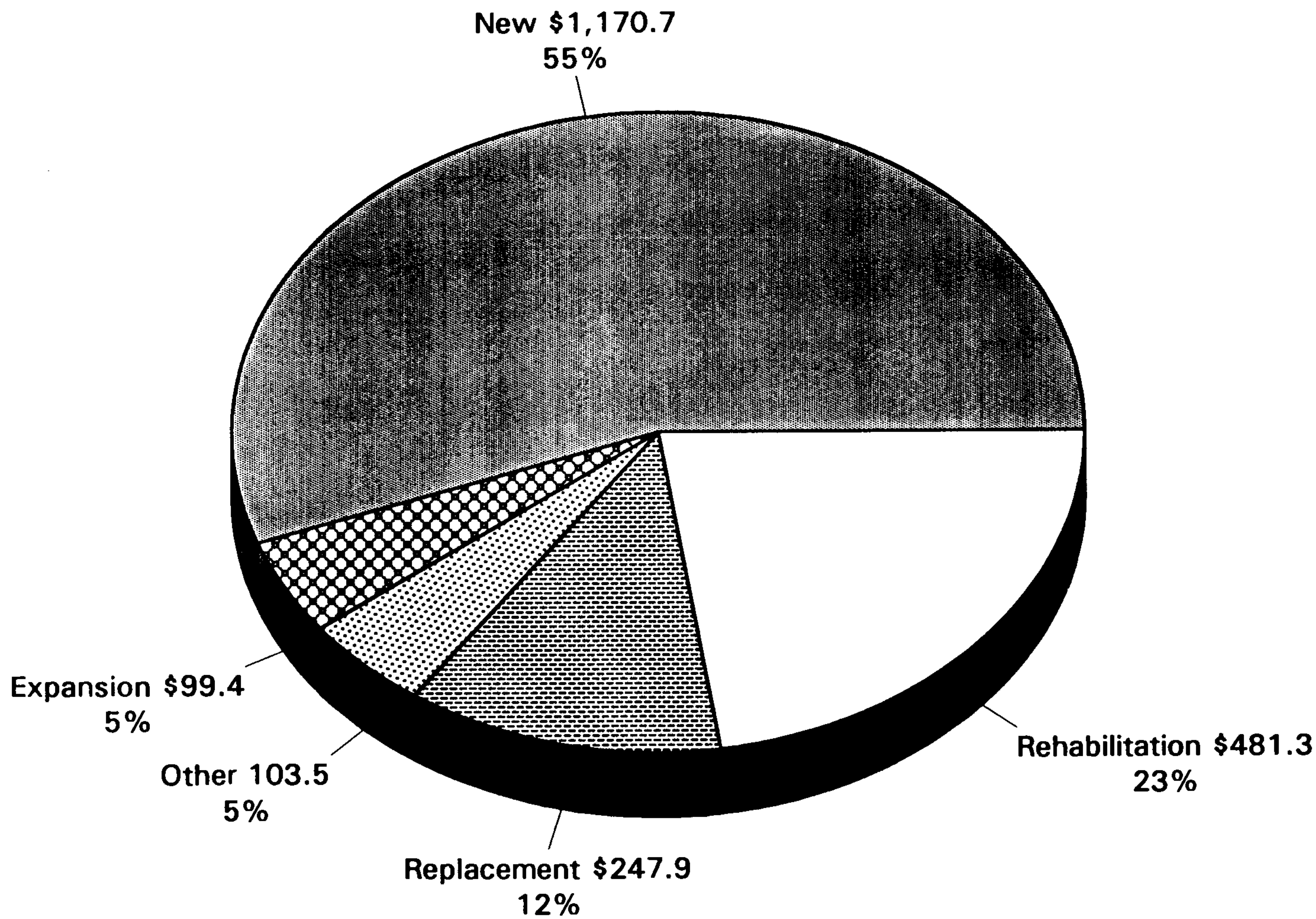


EXHIBIT II-11

EXPENDITURE BREAKDOWN BY PROJECT TYPE



Expenditures in millions of dollars

5. Planned Capital Expenditure by Facility Condition and Age

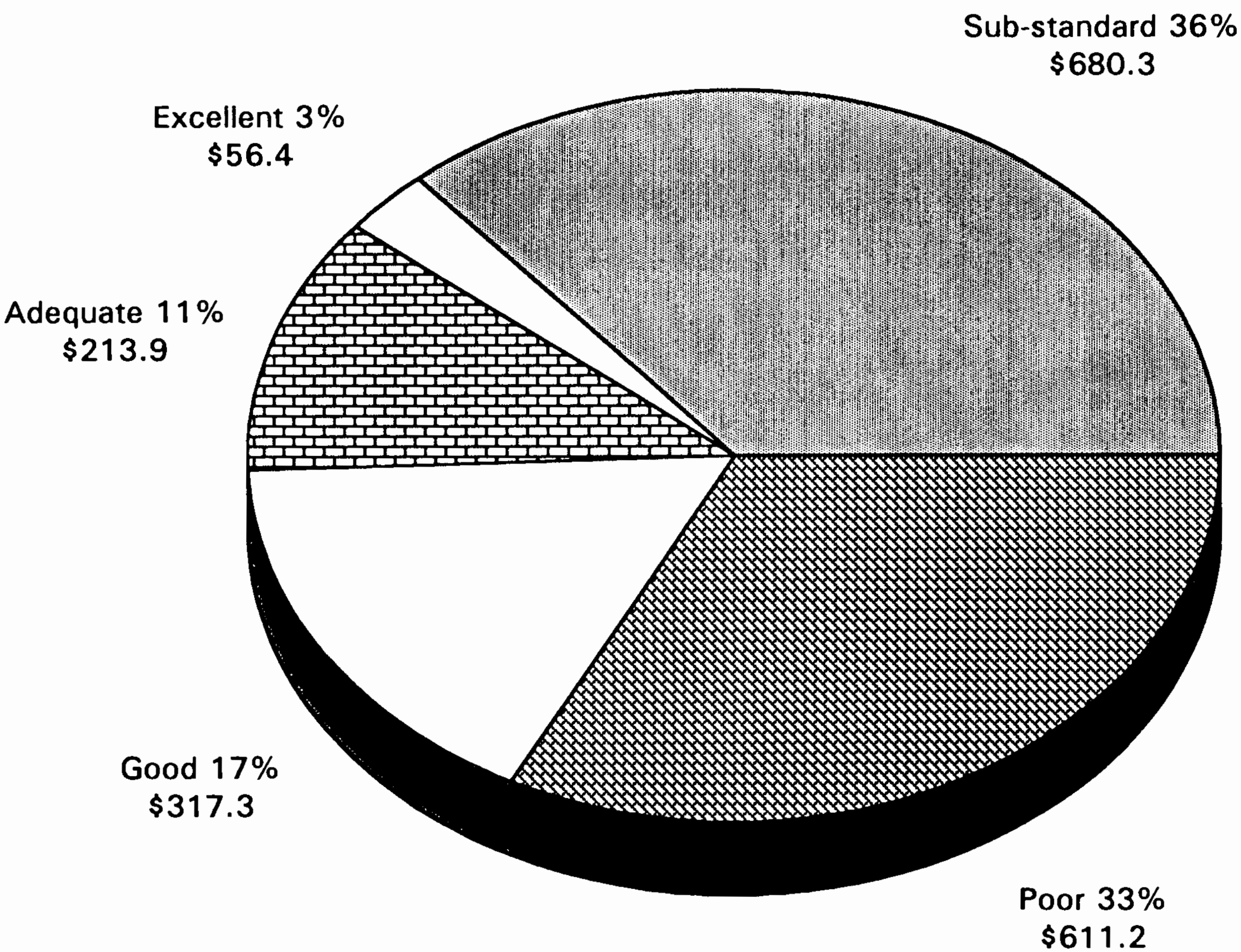
Exhibit II-12 shows the breakdown of planned expenditures according to facility condition. Costs included here do not include those associated with new facility construction, either planned or underway. As expected, the majority of expenditures (approximately 69 percent) are planned for facilities evaluated by their operators as being in poor or substandard condition. On the other hand, 20 percent of expenditures are planned for facilities in either good or excellent condition. Exhibit II-13 shows that the expenditures planned for such facilities are generally for rehabilitation and expansion. Closer examination of the data indicates that most of the costs of rehabilitating facilities already in good condition involve projects to update facilities to meet current environmental standards or to comply with new requirements.

Exhibit II-14 shows total planned expenditures by facility condition and age. As expected, the oldest facilities, those over 40 years of age, have the largest expenditures planned, with most of the expenditures proposed for facilities in poor condition. The other age groups (11 to 40 years old and less than 10 years old) actually show higher total costs for facilities already in adequate or better condition.

More detail on the costs by facility age is provided in Exhibits II-15, II-16 and II-17. Exhibit II-15 provides information on planned expenditures for facilities over 40 years of age. While these facilities represent a small percentage of the total number of facilities (90 out of 374 reporting facility age), they represent a large percentage of planned expenditures. Most of the planned expenditures are focused on facilities of this age in the lower condition categories. Exhibit II-16 provides more information on facilities 11 to 40 years old. This larger group (159 out of 374 reporting facility age) has a lower cost per

EXHIBIT II-12

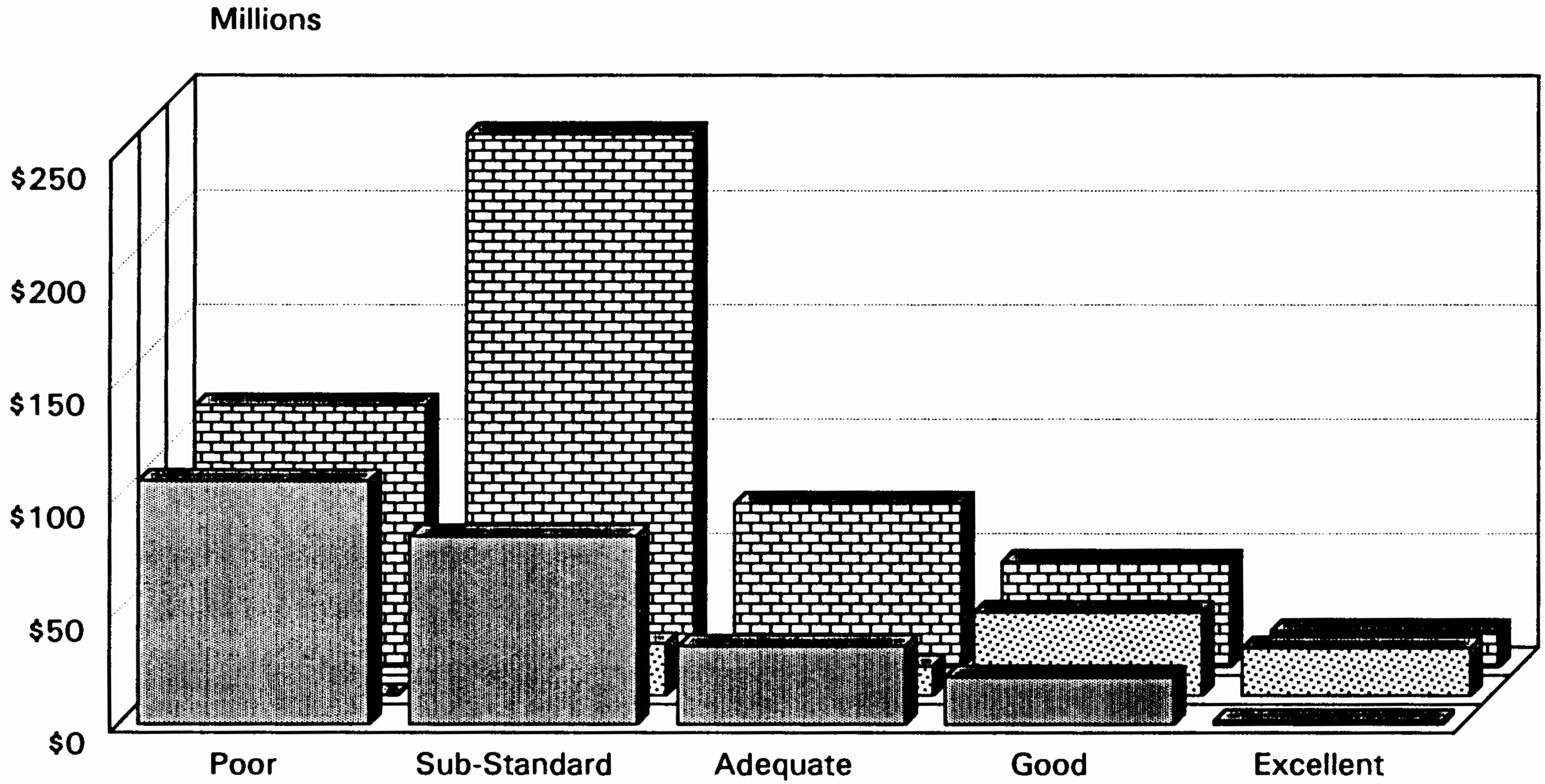
TOTAL PLANNED FACILITY EXPENDITURES BY FACILITY CONDITION



Expenditures in millions of dollars

EXHIBIT II-13

FACILITY CONDITION BY PROJECT TYPE

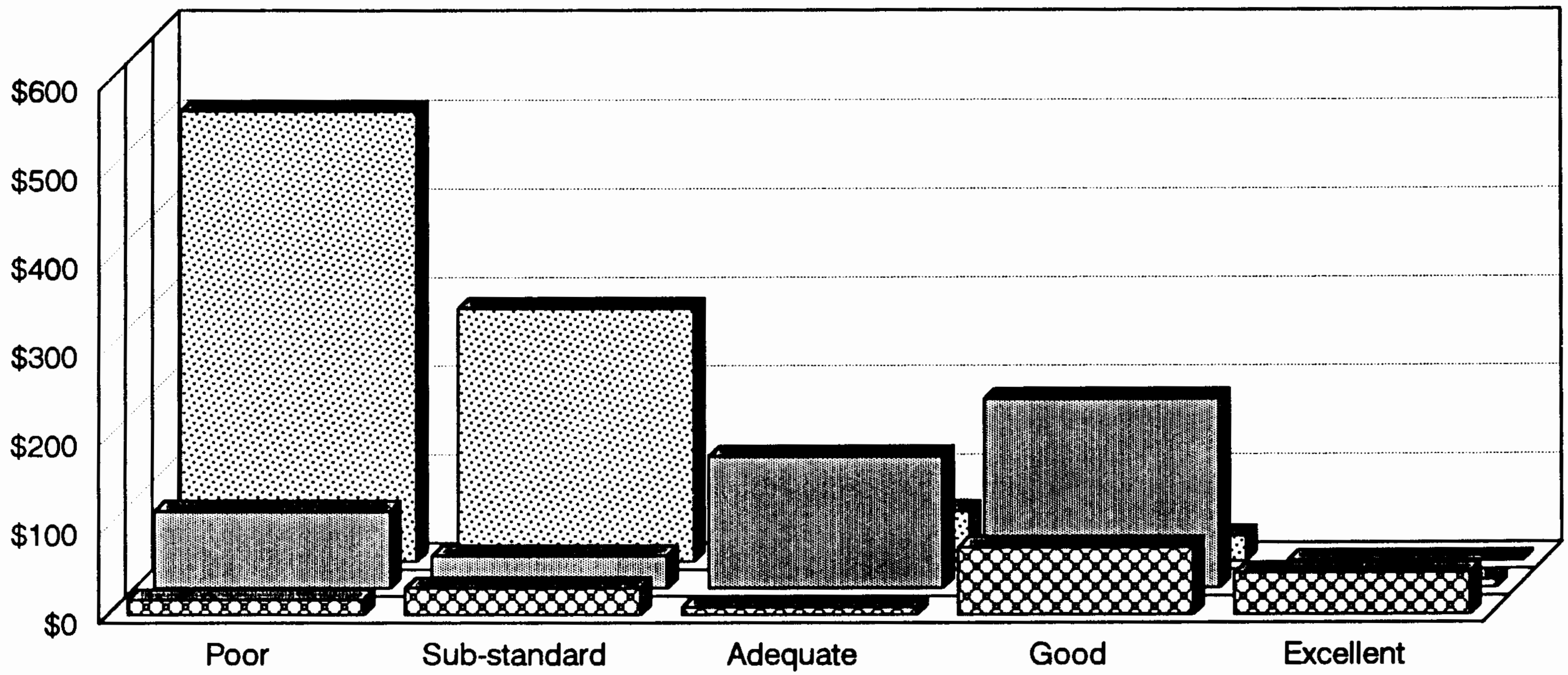


	Poor	Sub-Standard	Adequate	Good	Excellent
Replacement	106.50	82.25	34.10	20.56	1.53
Expansion	0.00	22.59	12.67	36.33	20.79
Rehabilitation	114.48	233.27	71.56	46.08	15.88

Facility Condition
Replacement Expansion Rehabilitation

EXHIBIT II-14

TOTAL PLANNED EXPENDITURE BY CONDITION

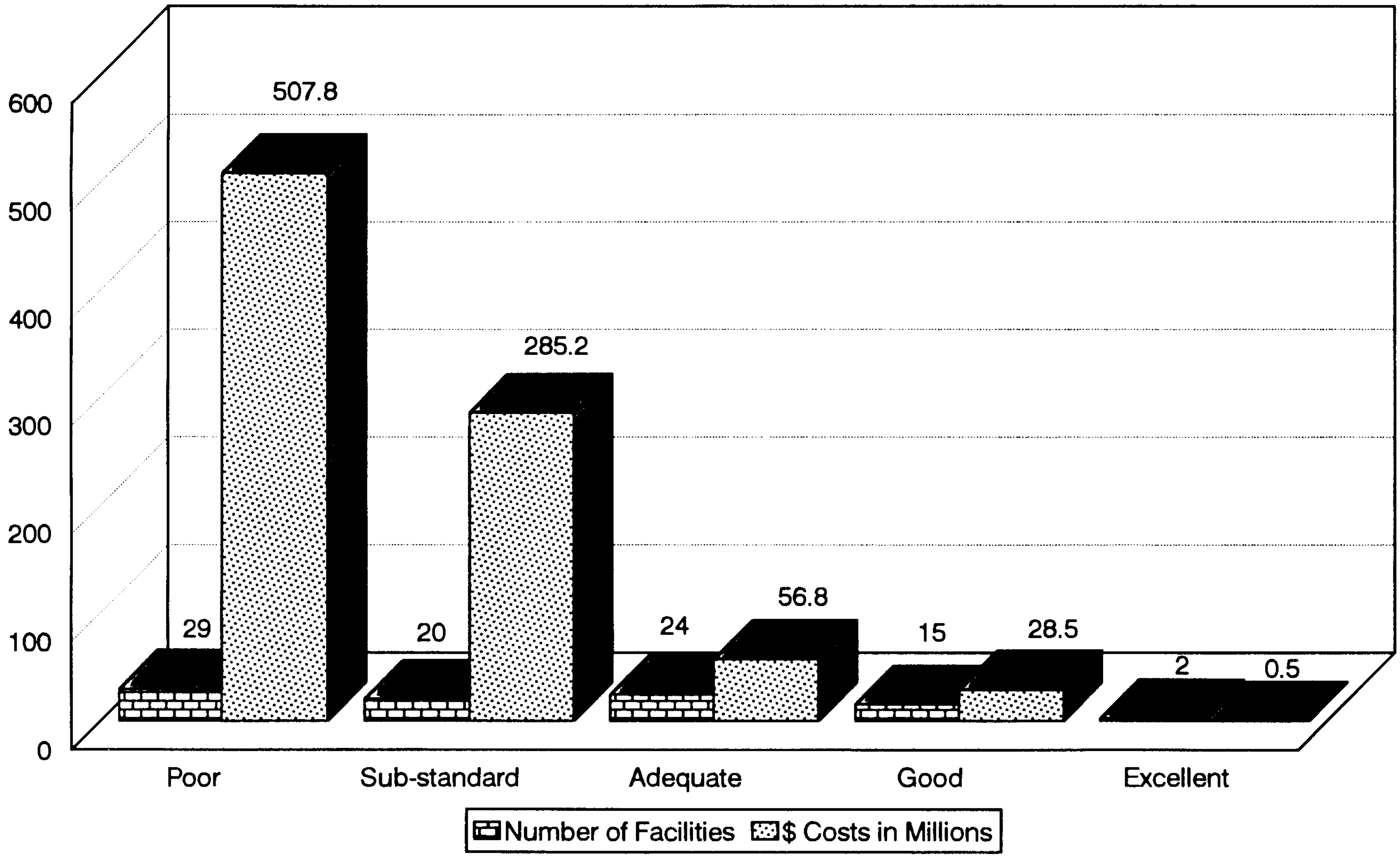


	Poor	Sub-standard	Adequate	Good	Excellent
Over 40	$507.8	$285.2	$56.8	$28.5	$0.5
11 to 40	$86.7	$36.5	$148.2	$213	$9.1
Less than 11	$16.7	$30.2	$8.9	$75.7	$46.9

Age Group
Less than 11 | 11 to 40 | Over 40

EXHIBIT II-15

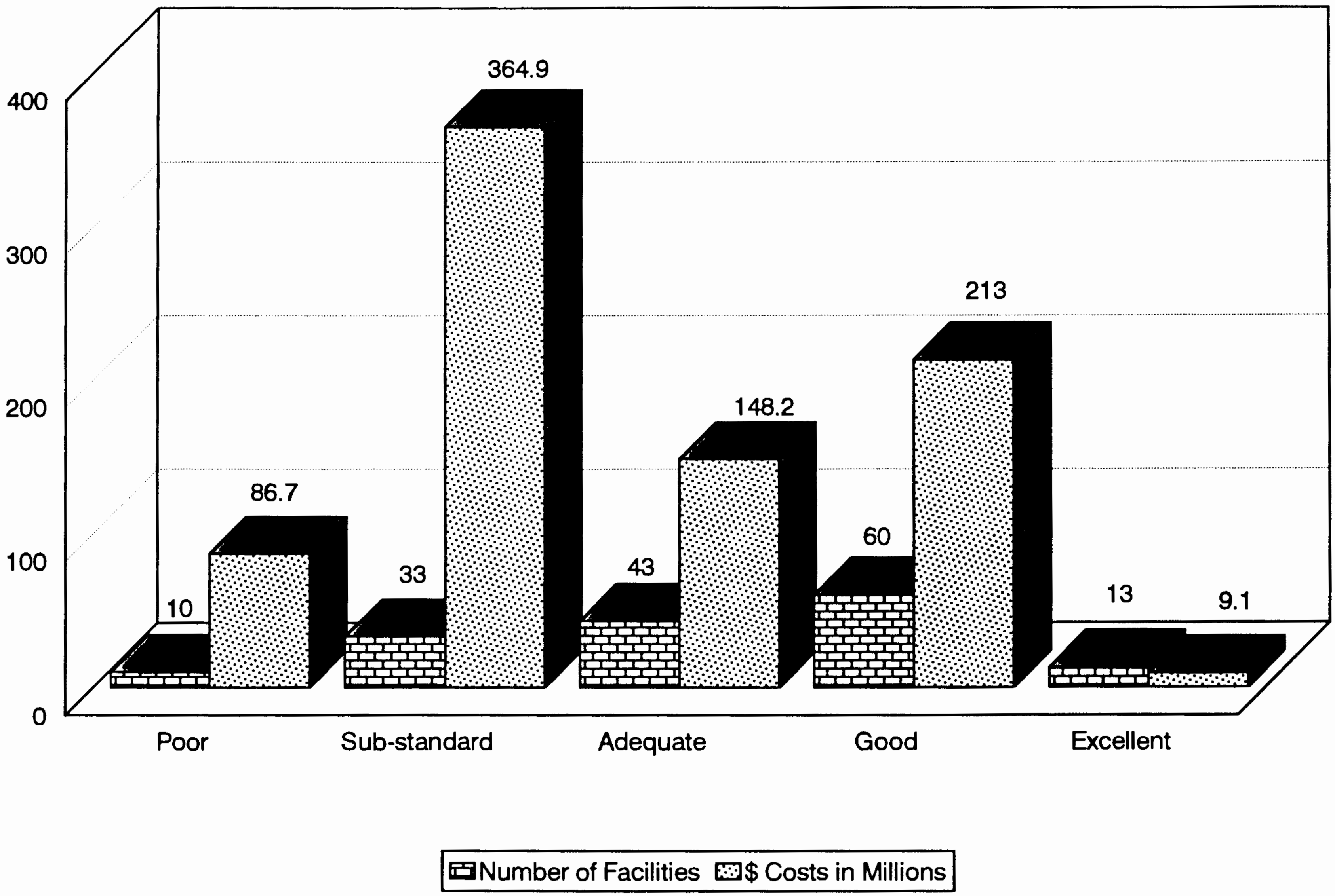
FACILITIES OVER 40 YEARS OLD



Expenditures planned for the next five years.

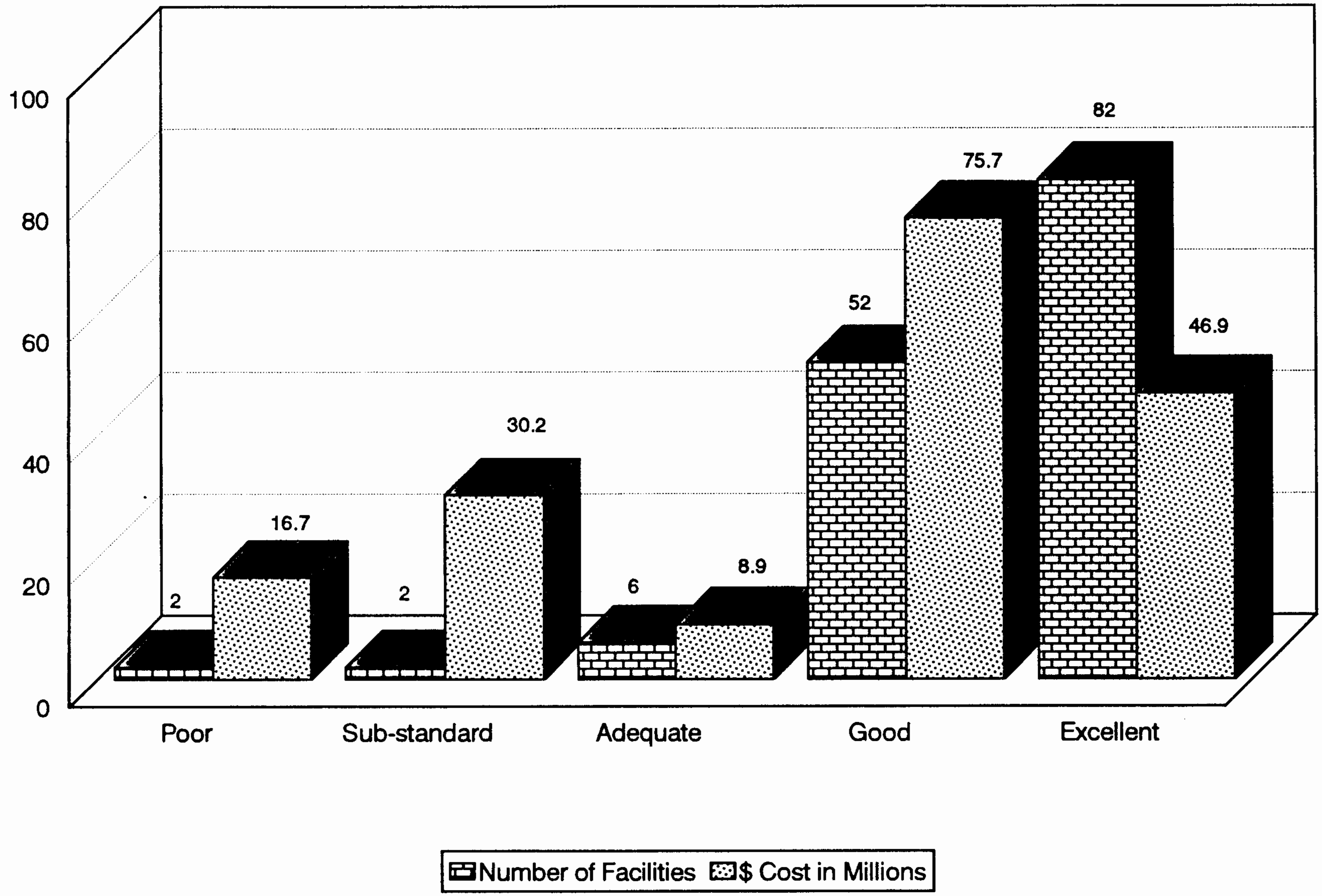
EXHIBIT II-16

FACILITIES 11 TO 40 YEARS OLD



Expenditures planned for the next five years

EXHIBIT II-17
FACILITIES LESS THAN 11 YEARS OLD



Expenditures planned for the next five years

facility compared with those over 40 years old. Exhibit II-17 provides details for the 177 newest facilities (those ten years old or less). These have an even lower cost per facility. Exhibit II-18 provides information on the newest facilities, displaying the type of improvement planned by current condition.

6. Planned Expenditures for Alternative Fuels

Planned expenditures for alternative fuels do not represent a complete picture of the total costs which would be incurred should alternative fuels be required for transit operators. Of the 426 facilities included in this study, plans for alternative fuels were reported for only 104. Exhibit II-19 indicates that, of those facilities for which plans for using alternative fuels exist, Compressed Natural Gas represents the single largest planned approach. The estimates made for the costs of equipping facilities ranged from $200,000 to $15 million. This large range suggests that the data is not yet reliable.

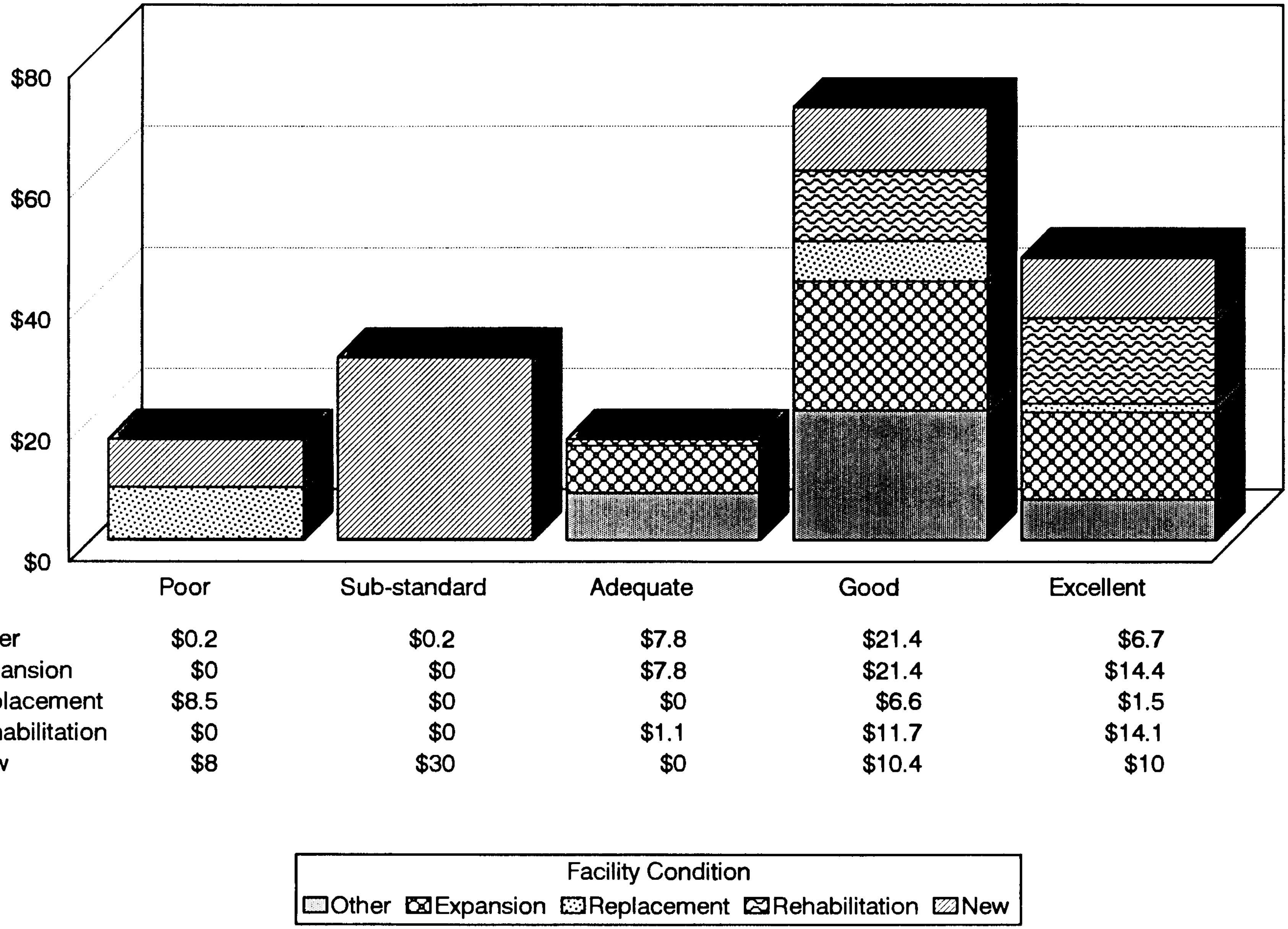
D. CONCLUSION

Most of the transit industry's bus support facilities (about three fourths) are adequate for their current mission. However, in excess of $2.1 billion will be needed over the next five years for expansion, maintenance and improvements.

Almost two-thirds of the estimated capital expenditures will be for new facilities or improving the quarter of the facilities that are judged to be less than adequate. The remaining third of the expenditures will be needed for maintaining the operating performance of the facilities that are judged to be adequate or better. This maintenance effort principally consists of modifications to meet changing operating and regulatory requirements.

EXHIBIT II-18

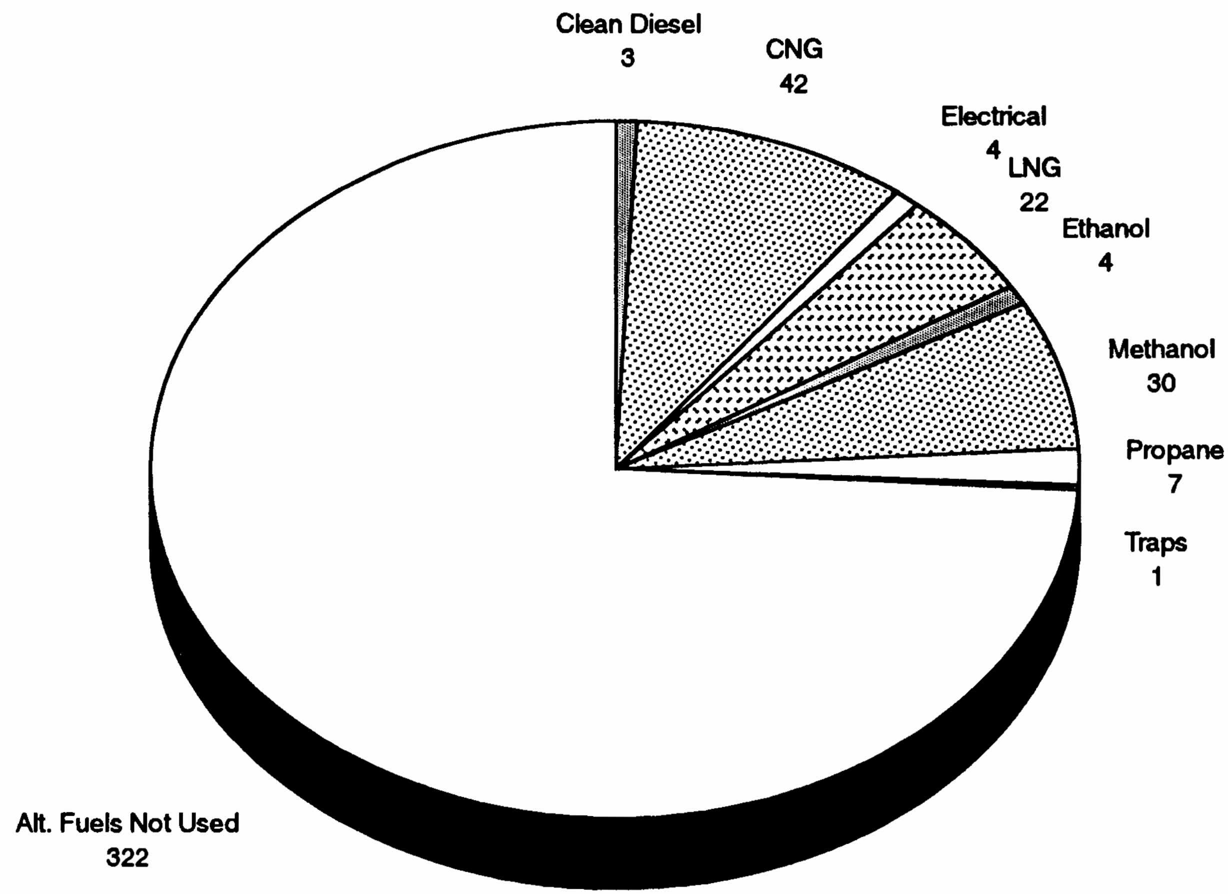
EXPENDITURES BREAKDOWN ON FACILITIES LESS THAN 11 YEARS OLD



	Poor	Sub-standard	Adequate	Good	Excellent
Other	$0.2	$0.2	$7.8	$21.4	$6.7
Expansion	$0	$0	$7.8	$21.4	$14.4
Replacement	$8.5	$0	$0	$6.6	$1.5
Rehabilitation	$0	$0	$1.1	$11.7	$14.1
New	$8	$30	$0	$10.4	$10

EXHIBIT II-19

ALTERNATIVE FUEL UTILIZATION



SITE VISITS

III. SITE VISITS

A. STUDY APPROACH

The purpose of this phase of the study was to assess the adequacy of a small sample of existing bus support facilities with a primary emphasis on understanding whether or not there are lessons to be learned, based on the experience of selected existing facilities, that may help in the development of more effective facilities in the future. The measure of this type of effectiveness is generally regarded as the degree to which the design or furnishings of a facility may limit or enhance the effectiveness of the work force.

To accomplish this, nine facilities were identified for actual site visits. The site visits focused on medium to large agencies which were geographically dispersed throughout the country. These agencies represent 25 percent of total fixed-route bus service. The approach to the site visits was to make physical observations and interview appropriate local staff relative to the design and functionality of the facilities visited. Appropriate background data concerning the unique operating, physical and institutional circumstances within which the particular facility conducts its business was also reviewed. From this information and the experience of the study team, findings and recommendations were developed in an effort to address the goal of learning from past experiences to increase transit bus support facility effectiveness.

The selected sites were as follows:

- Southern California Rapid Transit District (Los Angeles, CA), Division 10 Garage
- Milwaukee County Transit System (Milwaukee, WI), Fond du Lac Garage
- Central Ohio Transit Authority (Columbus, OH), McKinley Facility
- Mass Transit Administration of Maryland (Baltimore, MD), Bush Garage
- VIA Metropolitan Transit (San Antonio, TX)
- Metropolitan Atlanta Rapid Transit Authority (Atlanta, GA), Hamilton Garage
- Municipality of Metropolitan Seattle (Seattle, WA), North Base Garage
- Metropolitan Transit Commission (Minneapolis, MI), Snelling Garage
- New York City Transit Authority (New York City, NY), Gun Hill Garage

The following provides an overview of the sites visited and includes major findings and recommendations from each. More detailed information on each site visited is provided as Appendix C.

B. SUMMARY OF SITES VISITED

1. SCRTD's Division 10

Located in Los Angeles, California, SCRTD's Division 10 Garage was constructed in 1984. It is one of the system's 13 operating garages, and is located within a mile of the central overhaul and heavy repair facility. The work activities that are performed at this location include preventive maintenance, normal running repairs, brake relines, transmission replacements, some body work, and normal bus servicing. This facility was designed to support a mixture of 250 standard sized and articulated buses. It is now supporting 260 buses, many of which are the longer articulated buses. It also receives roadcall repair work from other SCRTD Divisions because of the long operating distances of many of the routes.

2. Milwaukee County Transit System's Fond Du Lac Garage

The Fond du Lac Garage is one of three in the Milwaukee County Transit System (MCTS). The main portion of this garage is 10 years old, while the area used for vehicle storage is 30 years old. A total of 254 buses, of nine different types, are supported at this facility. Work activities at this facility consist of preventive maintenance, normal running repairs, transmission replacements, some body work, and normal bus servicing. Heavier repairs such as engine rebuilds, component rebuilds, break relines, and major body work are sent to another facility.

3. Central Ohio Transit Authority's (COTA) McKinley Facility

Located in Columbus, Ohio, COTA's McKinley facility was built in 1980. It functions as the system's central garage including overhaul capabilities. The facility is designed to support 240 buses and includes a bus service area, body shop, heavy repair area, running repair area, inspections and an indoor bus storage area.

4. Mass Transit Administration (MTA) of Maryland's Bush Garage

The MTA's Bush Garage is located in the City of Baltimore. It is 83 years old and was originally built to support trolley vehicles. It is located on a site with several MTA buildings including the operating garage, bus servicing building, a newer storage building, and some buildings associated with the heavy repair facility. Some administrative offices are located in the operating garage.

5. VIA Metropolitan Transit (San Antonio, Texas)

VIA of San Antonio, Texas operates one bus support facility for its entire fleet of buses. This facility was built in 1948, expanded in 1968 and has been upgraded periodically. A full range of maintenance activities are performed at this facility including running repair, overhaul, body work, rebuilds, and preventive maintenance inspections.

6. MARTA's Hamilton Garage

Located in Atlanta, Georgia, MARTA's Hamilton Garage is one of three garages in the system. Maintenance activities performed at this facility include preventive maintenance, normal running repairs, and bus servicing. Heavy repairs are sent to another facility.

7. Metro's North Base Garage

In operation one year, Seattle Metro's North Base Garage is the newest of six facilities it uses. It was designed to service 225 buses, but because of the number of articulated buses it supports, the current capacity is less than 200. In addition, this facility has the capability to service electric-powered vehicles. The work activities performed at this location include preventive maintenance, normal running repairs, brake relines, transmission and engine replacements, some body work, and normal bus servicing. Heavy repairs such as major body work, engine rebuilds, and component rebuilds are sent to a heavy overhaul shop.

8. Metropolitan Transit Commission's Snelling Garage

The Metropolitan Transit Commission (MTC) of Minneapolis, Minnesota's Snelling Garage is the oldest of the five garages it uses. Initially constructed in 1905, the facility was first used for trolley cars. It currently supports 239 buses, most of which are standard 40 foot transit buses. Workers at the Snelling Garage perform preventive maintenance inspections, running repairs, transmission replacements, minor body work, and tire maintenance. Other work is done at the overhaul base.

9. NYCTA's Gun Hill Garage

The New York City Transit Authority's (NYCTA) Gun Hill Garage is one of the newest of its 19 operating garages, being open for three years. It was originally built to house only the Gun Hill operating depot, but it is currently shared with the non-revenue maintenance department and the central overhaul facility. Maintenance functions performed here include preventive maintenance inspections, HVAC repairs, running repairs, brake relines, and a minimal amount of body work. Major repairs are done at the central overhaul base. This garage supports 214 coaches.

C. FINDINGS AND RECOMMENDATIONS

Based on the observations and interviews conducted during the course of this study, review of the data collected, and the transit experience of the consultant team, this report has attempted to consolidate and present information concerning transit bus support facilities which could be of use to other transit operations and to the FTA. In this regard, the following section is divided into two parts. The first part details major findings from the site visits, while the second part details recommendations derived from the findings.

1. Findings

- Agencies have difficulty in projecting capital needs in emerging areas

  It was difficult for the properties to identify and project capital requirements to meet the needs of such things as emerging technology (i.e., alternative fuels) and recent legislative requirements (i.e., ADA, underground storage tanks, clean air). Part of this difficulty was in understanding the requirements because several of them were still changing, and part of the difficulty was in understanding the impacts of the requirements on selected aspects of the transit operations.

- Capital projections for ADA compliance appear to be understated

  The Americans with Disabilities Act (ADA) has many implications for the transit industry. To name a few, the Act affects both existing and new facilities, future bus procurement, paratransit service, and employee hiring. Because the law and FTA's resulting regulations are relatively new, few of the people interviewed were fully aware of the implications to the bus support functions. The following is a brief overview of the findings.

- Most of the newer bus support facilities are constructed with provisions that meet ADA accessibility requirements. However, it did not appear that the cost of adapting older facilities to meet the ADA accessibility requirements had been adequately incorporated into facility improvement projections. This could result in an understatement of capital need projections.

- Most of those interviewed were aware of the basic ADA requirement for wheelchair lifts and restraints on buses. As such, it is reasonable to assume that requirements for increased effort to support these features have been factored into existing plans. However, other resulting ADA provisions (i.e., stop signaling for the visually impaired, etc.) were not as uniformly understood. It is reasonable to assume that items of this type were not appropriately factored into existing plans and budgets. These additional costs should have minimal impact on bus support facility capital projections but should impact other costs (i.e., operating cost and bus capital cost). In recognition of these factors, some properties were projecting increases in operating support cost, relative to ADA, while others were projecting no appreciable increase.

- Of the sites visited, paratransit service was most often contracted out and not a responsibility of the staff interviewed for the bus support facility information. As such, the managers interviewed and the findings of this effort identified no appreciable increase in projections for facility support requirements for these vehicles. However, it is possible, if not probable, that ADA will result in an increase in this type of service and that this type of service may be performed internally instead of contracted out. If this scenario is realized, then the capital projections for bus support facilities may be understated.

- There was minimal indication of preparation for projecting the requirements of "reasonable accommodation" of the physically challenged workers into the shop work force as required under ADA. This could result in an understatement of capital need projections.

- Facilities utilization adequate at visited sites

  The nine facilities visited were found to be adequately designed and appropriately utilized.

- Transit systems do not adequately share their experiences

  All too often a transit property faces a problem, develops solutions and evaluates the results, while other transit properties are doing the same. A better system for evaluating these problems and sharing the results would reduce problems and save costs. One example of this problem is facility design and construction.

  Most properties do not construct transit support facilities on a regular basis and depend heavily on the ability of architects. Most architects have little experience with transit support facilities. As a result, some areas are over built and some are under built. The end result is that all too often a transit property "reinvents the wheel" when they build or rehabilitate a facility.

  Because most construction jobs go to local or regional firms and these firms have limited experience with transit, most facility design/construction shows this lack of transit familiarity. As a result, small things such as exhaust, heating and air conditioning, air movement, lighting, etc., are often inadequate. Also, many design problems are repeated around the country, while some solutions are missed. **In most cases, each facility becomes a "from the ground up" design process rather than an industry improvement process.**

Several of the interviewed properties mentioned a need for industry guidance in facility design and equipment. A few properties even mentioned examples of consolidation of local efforts (e.g., joint efforts between the transit system and other county agencies in addressing a fuel tank up-grade plan.)

- Facility configuration is heavily influenced by site constraints

Operational issues also include the ability to construct a facility that will optimize the bus support functions to be housed on the selected site. With the possible exception of VIA and COTA, most sites visited were heavily influenced by the constraints of the parcel of land that constituted the site. Many of the support functions and work flow procedures that exist in a bus support function are identical from one location to another. In fact, the RTD has standardized many of these aspects in some of its locations. However, due to site size or configuration constraints, most facilities are unique in nature in order to fit the operational needs onto the selected sites. In short, while a more efficient design could often be devised, placement of the desired functions (i.e., sufficient work bays, etc.) within the confines of the designated lot plan is often the driving influence.

- Crowded facilities and/or poor layouts lead to inefficiencies

One measure of the effectiveness of the design capacity is the efficiency it allows the work force. One general measure of this efficiency is the amount of staffing a fleet requires. In looking at the ratio of buses supported by a mechanic, the lowest ratios (i.e., least efficient) from the sites visited are the NYCTA (New York) at about 1.89 buses per mechanic and the RTD at 2.15. In both cases, the number of buses being supported by the facilities is greater than that called for in the original design. These facilities averaged one work bay for nine percent and 11 percent, respectively, of their peak bus commitment. It appears that the crowding of the facility leads to inefficiencies that must be offset by additional labor resources. On the other hand, the two properties with the highest ratio of buses to mechanics (i.e., most efficient) are COTA (Columbus) and MCTS (Minneapolis) with respective ratios of 4.62 and 4.3. These two facilities average one work bay for 14 percent and 12 percent, respectively, of their peak bus commitment.

Lastly, the one operation that appears the most pressed for adequate work space is the MTA (Baltimore). The MTA falls in the middle of the nine facilities with 3.07 buses per mechanic, but it has work bays for about 12 percent of its peak fleet (almost as many as COTA and MCTS). While again recognizing that there are many other factors that affect efficiency, the MTA's work bays had to be situated within an older building. As a result, many of the bays are difficult to access, have minimal work space between the bays and, in general, are not as optimally used as work bays which have a better layout. Extrapolating from this, it seems reasonable to conclude that if MTA's work bays had a more efficient layout or if they had more work bays, the mechanics would be more efficient and could further improve the ratio of the buses they support.

- Ventilation problems reported with most single roof facilities

  Single roof facilities have operations, maintenance, bus parking, etc. all assigned to separate areas but all in one enclosed building. However, a common problem seems to be that the engine exhaust from the parking area seeps into the general office area. Increasing exhaust capacity and installing a positive exhaust system have often proven relatively inadequate in addressing this problem.

- Facility furnishings varied markedly

  Support tools and furnishings varied markedly from one facility to another. This variation resulted from the types of buses being maintained, the emphasis of the maintenance program, climatic conditions, staffing, support functions, and other issues. However, none of the operations observed were judged to be adversely affected by any lack of furnishings.

  In selected areas (i.e., bus storage, diagnostic equipment, parts storage, painting equipment, washing equipment, exhaust equipment, fuel tanks, etc.), some operations were better equipped than others. No attempt was made to analyze the cost benefits of any of the furnishings observed. However, this type of effort is recommended and will be discussed later in this report.

  Many of the newer regulatory requirements are going to affect the adequacy of the furnishings. Specifically, many of the sites are in the process of upgrading their underground storage tanks to meet current requirements. As another example, few properties have a good idea of what fuels they are going to be using in the near future and the resulting facility requirements.

- Concrete parking lots reported to be more cost effective

  Concrete lots cost more initially, but are reported to last much longer. As a result, many systems recommend the use of concrete parking lots because of the improved life-cycle cost. Aspects of transit operations that tended to quickly degrade asphalt lots are as follows:

  - Petroleum product spills, such as those that occur with normal transit bus operations (e.g., leaking engines), help dissolve the asphalt.

  - Warm weather and the weight of buses quickly degrade the surface.

  - Large amounts of water runoff result after bus washing because of the flat roof design of most buses. The water is especially damaging to asphalt yards during freezing temperatures.

- Advantages and disadvantages were reported for both outdoor and indoor bus parking

  Outdoor bus parking creates problems because the buses are cold in the winter and hot in the summer, thus increasing the engine run time required to stabilize the interior temperatures. This creates passenger acceptance problems and operating inefficiencies. In addition to eliminating these problems, inside parking is also reported to reduce the need for some air conditioning repairs because some problems with the air conditioning systems were a function of the air conditioning system's inability to cool down the bus. The problems and cost of these conditions can be greatly reduced with indoor bus parking. However, indoor bus parking is a significant capital investment.

In some climates, covered but not enclosed bus parking represents a compromise. The capital costs are not as great, and it still provides some cover so that the buses are not as hot when they start, and the air conditioning system is better equipped to meet the lesser demand.

- Low ceilings in bus parking areas create exhaust emission problems

It is common to reduce the height of the ceiling in bus parking garages to as low a level as possible. This reduces construction cost and heating cost. However, low ceilings make it extremely difficult to move air in sufficient volume to create an acceptable environment during pull outs. Of the sites visited, the problems with engine exhaust emissions were directly proportional to the lower ceiling height of the parking garages.

- Portable wheel lifts appear to provide more flexibility

Several of the sites visited used portable wheel lifts. These lifts only require a solid level floor and electrical power to convert a normal work area into a lift/pit type work area. This provides considerably more flexibility in arranging work bays. The lifts do have some restrictions. They take more time in raising a bus, take up more floor space and limit access to the underside of buses.

- Drive-on ramp type lift appears to provide greater flexibility

One operation used a drive-on ramp type lift. To use the lift, a bus is driven onto the lift similar to a bus being driven onto a pit. The entire lift surface is then raised allowing access to a bus in the same manner as provided by a pit. This system takes slightly more time to get under a bus than a pit and less time than a post hoist. However, it is not permanently installed as is a pit or hoist. This provides more flexibility in modifying the work area over time (i.e., existing floor areas can be easily converted into a work bay that emulates a pit work area), the hydraulic lines/system is easy to access and maintain, and there are almost none of the safety problems associated with a pit.

- There is a lack of standardization in underground storage tank compliance

  The recent regulations surrounding underground storage tanks (UST) have resulted in many infrastructure modifications to accommodate the regulations. In most cases, each transit property has developed its own plan. In all too many cases, the same approach has been used many times across the country and aspects of these approaches led to other problems.

- There is a lack of consensus concerning alternative fueled engines

  Current regulations mandate a change to less polluting engines. Because of the stringent requirements of current regulations and the limits of diesel engine technology, a shift from the diesel engine power of the past 60 plus years to an as yet undecided new bus power source is in the making. Currently, there are many approaches, numerous tests being conducted, and some planning by transit authorities in response to these requirements. The study efforts identified a variety of directions being taken and numerous other reports have attempted to analyze the advantages and disadvantages of the various approaches. As a snapshot of where the transit industry stands in this area, two principal engine suppliers--Detroit Diesel Corporation and Cummins Engine--were contacted to learn their plans to comply with the new emission standards. These two manufacturers supply almost all of the engines found in heavy-duty transit vehicles. Recognizing that this focuses only on the internal combustion engine process and not the electric propulsion engine, the following provides an overview of the current findings.

Both engine suppliers state that they will be capable of meeting the 1993 emission requirement of .1 gram of particulate per brake horse-power hour with a diesel engine equipped with a particulate trap. However, Detroit Diesel Corporation reports that it is developing a new diesel engine for the transit market which will be better able to meet the new emission standards.

Through the use of low sulphur diesel fuel, as required under the amendments to the Clean Air Act, the use of particulate traps, and other engine modifications, both manufacturers are confident that they will be able to comply with the 1994 emission standards which the Environmental Protection Agency has yet to finalize. However, both manufacturers estimate the cost of operating the engines and the cost for purchasing these engines will be significantly higher than current engines. Also, there is concern from bus manufacturers in being able to adapt the buses to accommodate the size, weight and/or configurations of these engine packages.

Another major change in the emission standards will occur in 1997 when the nitrous oxide (NOX) emissions level is reduced. The engine manufacturers are unsure at this time how they will be able to meet this standard and whether a diesel engine can be designed to meet this standard. Both engine manufacturers noted the significant investment made to date in research and development to meet the current and future demands.

The California Air Research Board (CARB) is considering reducing the level of NOX to a level almost half of the amount allowed under the Clean Air Act. If this action occurs, transit coaches in California could not be equipped with an existing diesel engine. All new buses in California would have to be equipped with engines powered by alternative fuels.

To meet the requirements of different states and to respond to the NOX requirements in 1997, both engine manufacturers have been actively working on the engines which are powered by alternative fuels. Detroit Diesel currently has an engine certified to operate on methanol. Cummins Engine has engines in transit vehicles operating on natural gas. This engine has yet to be fully certified. The Detroit Diesel Corporation is designing and/or in the process of certifying engines operating on natural gas and ethanol.

Because the Environmental Protection Agency has yet to issue final regulations related to the rebuild, remanufacture, or replacement of diesel engines in urban transit buses after January 1, 1995, neither engine manufacturer knows how it or the transit agencies will respond to this aspect of the Clean Air Act.

It is likely that modification of existing maintenance facilities or construction of new facilities will be necessary to service and maintain vehicles designed to comply to these emission standards. This activity will impact the amount of funding which will be needed to support such transit maintenance facilities.

- Trade off factors used in site selections

Selection of a bus support facility site is affected by a variety of operational, economic, political, environmental and social issues.

Each of these becomes a trade off factor as site selection is considered.

Operationally, a facility that is located in close proximity to the service area is one that limits the costly and unproductive practice of deadheading buses. Deadheading is the practice of moving an empty bus to the beginning of a run or returning it from a completed run. The same practice is encountered whenever a bus is changed during its operational period (i.e., road called, etc.). In either case, the cost of the driver, wear and tear of the vehicles and use of consumables (oil, fuel, etc.) can be considerable.

Operational site proximity was the major factor that led METRO (Houston, Texas) to locate its North Base garage in a predominately residential area. This in turn led to considerable construction delays and additional cost. In retrospect, METRO feels the advantage of site location was not sufficient to justify the problems and costs encountered. MTC also felt that inefficiencies created by site constraints more than offset efficiencies in reduced deadhead miles. The issue was also raised concerning the long term operation of a site versus the manner in which many route structures change over time. This could negate the deadhead concerns that originally impacted the site selection process.

Other transit systems considered the effect of site location on deadhead miles but gave it relatively little concern. RTD stated that this was a concern but, because of previous problems, it does not pursue sites that appear to raise appreciable community concerns. VIA, MCTS, and MTA used longstanding operational sites which were deemed acceptable from a deadhead mile standpoint and thus avoided many site acquisition and approval problems.

- Community acceptance problems with bus support facilities

  Similar to the way an airport improves the viability of a community, a bus support function can improve the viability of a community. The addition of bus service usually results in reduced air pollution (even with the old technology engines) and less traffic congestion. However, while many people see the benefits of an airport, few if any want to live next to one. The same applies to a bus support facility.

  These type of environmental and social issues are receiving increased attention in bus support operations. Much of this has been initiated because of recently enacted regulations. However, it is obvious that much of it is a result of genuine environmental concern on the part of the operators and a desire to be good citizens.

  Already, many bus support facilities have almost eliminated any effect they have on the community due to solid or liquid waste. With the current mandate to cleaner burning engines, it will be only another few years before the most repugnant aspect of a bus operation to a community (i.e., air pollution) will be almost eliminated. Noise pollution, traffic congestion, and general appearance are factors which will remain but can be successfully minimized. In short, a transit bus support facility should no longer have a perception to a community that is any worse than the best commercial resident. However, it will take time and an education process to promote this new image.

  For the near future, it appears that most bus support locations will continue to be selected where an existing site or property is already being used, where the community sees the benefits of local jobs (bus drivers and mechanics), or where a bus site is perceived as an improvement over an existing function (i.e., existing commercial function).

In the interim, a nationwide problem with the inability to acquire sites to build new maintenance facilities and/or the excessive length of time required to gain approval to acquire such sites will continue. This will be most obvious in major cities where the benefits of transit are most obvious but where the land acquisition/approval will be the most difficult to obtain. The result will be increased cost because the operations are working from poorly located or sized facilities. There will also be environmental and social consequences because of more traffic congestion and environmental pollution from the lack of more efficient transit.

- Questions exist concerning construction techniques

In some cases, purpose-built facilities which are designed from the ground up for current and predicted operations appear to be the option of choice. However, VIA and MTA report success adapting older facilities. There was discussion during the site visits regarding the merits of more costly, less flexible facilities built to last and the less expensive, more flexible facilities that had a limited life expectancy. With the changes in transit demands/requirements (i.e., changes in service levels, population density, vehicle types, fuel types, etc.), some questioned whether a less expensive building design, such as a butler building, might not be more appropriate. However, most properties report a need for heavy duty construction (i.e., masonry or pre-cast concrete) to withstand the rigors of heavy duty transit operations, and several have even shown the advantages of the long term capitalization of some facilities. Almost all properties report a need for facilities that capitalize many of the facility upkeep areas in order to reduce life cycle cost.

- Flexibility/Adaptability needed in facility designs

  With changing regulations (ADA, yard run-off, alternative fuels, etc.), changing service demands, and changing vehicle types, it is difficult to make capacity or equipment projections for a facility that is intended to last for many years. Therefore, flexibility and the ability to adapt a facility are very important.

- Some older garages offer flexibility of space

  The open unrestricted trolley barn type design of some older garages offers greater flexibility than some newer more purpose-built garages. Based on the age of many of the facilities included in the capital projection assessment and their evaluation of the functionability of the facilities, many of the older transit facilities have been adapted effectively to changing needs.

- Ongoing rehabilitation cost expected for older facilities

  While older facilities offer some advantages, significant resources are needed to keep these garages operational. Asbestos abatement projects, plumbing deterioration, upgrades and rewiring of the electrical system, etc., are examples of the types of expenses that can be expected.

- Indoor, single roof, bus parking and maintenance area preferred

  Most operators preferred buildings which housed all operations under one roof. This means that the maintenance, servicing and parking areas are all under one continuous enclosed roof. Multiple buildings on one site become logistically complicated and difficult to manage. Inclement weather can also limit some applications, such as bus washing, for buildings that are not housed together. Interior bus circulation would also greatly reduce the energy costs of heating the bus parking area as buses leave and enter.

- Work bay access is important to productivity

  Where space permits, "drive in, drive out" work bays are reported to be the most efficient. Also, work bays that have individual access are preferred over those that must be accessed through another work area. This second aspect is even more important where vehicles frequently enter or exit the work bays (i.e., important for running repairs and less important for overhauls).

- Questions exist over optimal facility size

  Possibly heavily influenced by the UMTA *Bus Maintenance Facility Handbook* dated November 1975, most transit bus garages have been designed around an optimum size to support about 250 buses. Based on interviews of transit systems that operate multiple garages, they feel that an optimum size is more around the 150 to 200 bus level. According to these interviews, sites with more than 200 buses become difficult to manage and operational scales of economy may actually decline. Also, they offer less flexibility in adjusting to changing transit patterns.

- Storage tanks are put in vaults to improve leak containment

  Due to the problems with monitoring fuel tank leaks and correcting leaks if they occur, the placement of tanks in vaults or in walled in containment areas has many advantages over normal in-ground installations with sensors. While this is not a requirement, several properties are now going to this type of installation.

- Double walled fuel tanks often used

  Many properties are using double walled fuel tanks. With these tanks leaks can be easily detected. Also, since potential leaks are maintained in the area between the inner and outer tank, clean-up becomes much less costly.

- Above ground fuel piping used

  Because most fuel leaks occur in the piping which connects the fuel dispensers to the fuel tanks, most properties recommend keeping these lines above ground or as accessible/observable as possible. When the piping must be below ground level (bus movement area, etc.), most properties recommend that it be placed in sealed trenches or conduit. In this manner, leaks can be quickly identified, isolated and corrected before seeping into the ground.

- Some facilities use a single fuel drop point

  Because yard spills are a crucial problem with UST regulations, some operations have designed their facility with a single, separate station for truck deliveries. All of the underground tanks have manifolds that radiate from the single delivery point. This limits the amount of interference a fuel delivery truck presents on site. It also prevents any above ground spills from seeping into the ground and being sensed by in-ground sensors as a tank leak. Lastly, these areas are designed to control any spills that might result from this operation.

- Fuel tank monitors are often ineffective

  Some properties have automatic fuel level monitoring devices installed with the installation of the fuel tanks. Often, these devices have proven ineffective in properly monitoring the levels in the fuel tanks, and many properties have returned to physical stick readings.

- Some systems attempt to accommodate alternative fuels in facility designs

  As previously stated, there does not appear to be any consensus concerning which alternative fuels will be used in transit in the future. As such, some properties are attempting to build in the capabilities for retrofitting their facilities to accommodate different alternative fuels as they upgrade their fuel tanks to meet current regulations. This includes such things as detection sensors, explosion proof electrical fixtures, ventilation, etc.

- Accessible hydraulic hoist lines are beneficial

  Many applications for installation of hydraulic hoist lines are such that the post lifts and the line are buried by concrete. Other, more expensive approaches (i.e., placing hydraulic lines, etc., in troughs) minimize this less accessible approach. Because of leaking underground lines and servicing problems that tend to develop over time, many systems report that this added accessibility is more than cost effective.

- Mixed review concerning the need for chassis dynamometers

  Many transit systems have dynamometers for testing various components and in some cases a transit system will have an entire work bay devoted to a chassis dynamometer. The purpose of the chassis dynamometer is to simulate driving loads on a bus under controlled conditions. This allows for better diagnostics of engine, transmission and brake system problems.

The usefulness of these dynamometers received mixed reviews during the site visits. Several operating garages were equipped with them, but few were in operation. The reasons given for this were that the dynamometers were expensive to maintain, failed frequently, required too much training to operate, and had limited application in operating garages. The dynamometers seem to be used most often at central garage functions at larger operations.

While the previous use of chassis dynamometers received mixed reviews, there may arise a greater need for them in the near future. Chassis dynamometers and emission testing at operating garages are often used to keep engines running at their optimum level. With the new Clean Air Act requirements, the need for this type of equipment may intensify.

- More systems are investing in water reclamation systems

In addition to being ecologically sound, the scarcity of water during some periods and the potential cost savings from reduced water usage are incentives for recycling water in a bus washing process. Reflecting this view, many of the systems visited had tried or were trying water reclamation processes as part of their bus washing program. Unfortunately, many of these systems reported high maintenance cost, frequent breakdowns, and poor performance on these systems. In fact, several of the systems had stopped using the water reclamation systems.

- Most air exchangers found to be ineffective

The use of air exchange systems for removing particulates from the bus parking garage was often reported as ineffective due to the high level of maintenance the system requires. Major areas requiring attention were the fans, which are very expensive, and the filters, which quickly clog up.

- Both pits and hoists are favored in most shops

  Most operations favor a mixture of pits and hoists in a shop. The pits are better for quick pull-on, pull-off work, while the hoists are better for most other work.

- Pit design varies

  Some of the sites visited had pits which had interconnected, below floor grade, work areas. This gives the workers more space, provides ready access to storage areas, and makes it easier to ventilate the work area. One approach for pit construction is to design the pits such that the floor of the pit is even with the floor of the shop. To do this, the entrance and exit of the pit areas are usually elevated. Using this type of technique eliminates the need for many of the special safety features necessary for below ground pits.

- Problems exist with gantry type paint booths

  A gantry type paint booth is usually configured as a scaffolding type system with built-in air supply, etc., for supporting bus painting. The scaffolding system can travel back and forth, as well as up or down, to allow a painter to reach the bus conveniently as he or she paints. However, in addition to being very expensive, this system often limits the painter's ability to reach lower portions of the bus. More importantly, the system is very maintenance intensive to support.

- Non-slip floor surfaces preferred

  At one time many garages were using floor sealers to make shop floors easier to clean. However, this made the floors slippery and resulted in accidents and injuries. It appears that more operations are now concerned with improving safety over esthetics. As a result, the use of non-slip surfaces is becoming increasingly popular. This usually consists of textured, grooved or etched concrete.

- Ceramic wall tiles reduce cleaning and improve appearance

  Low maintenance ceramic tile walls in the maintenance area cost more but appear to reduce the cost and need for continuous cleaning and painting of standard walls. The ceramic wall tiles were used rather extensively in older facilities. One variation of this process is covering the lower wall area with an epoxy paint which emulates the sealed surface of a ceramic tile.

- Undercoating work bay used in one operation

  Because most transit buses are required to operate over an extended life and because more and more of these buses are being constructed with material which corrodes, the concept of equipping larger bus garages with an area equipped to perform periodic undercoating may be cost effective. Undercoating retards corrosion but wears off and needs periodic replacement.

- Some properties use individual bus parking spaces

  Operational and maintenance efficiencies can be achieved when each bus can be assigned an individual parking space that can be accessed without moving any other bus. However, this also requires more parking and maneuvering space. It seems difficult to justify the savings in efficiency when compared to the cost of the parking space. The one exception to this might be when using outdoor parking.

- Dual purpose parking area used in one operation

  Most systems feel that on-site employee parking is essential for employee morale and dependable attendance. This parking often competes for limited site space. One of the visited sites had designed a parking arrangement that utilizes designated bus parking spaces for employee automotive parking, during peak periods when the buses are not on the yard.

- More walled in lots are being used

  To reduce noise pollution, improve appearance and improve security, more transit systems are agreeing with the old adage that good walls make good neighbors. An eight foot to ten foot block wall is most frequently used.

- Use of four foot parts cabinets/shelves can be advantageous

  Most parts rooms use parts shelfs that are six foot high or higher in order to maximize the available floor space. However, some properties report that keeping most partitions, shelfs and cabinets below four feet in height increases visibility through-out the parts room. This extra visibility improves appearance, organization and supervision.

- Parts drawers/cabinets are sometimes used

  The use of drawers/cabinets with adjustable storage bins is increasing in popularity over the use of standard shelving. Many properties report that they can store the same amount of inventory in much lower drawers/cabinets that they were storing in eight foot shelves. This is due to the more efficient use of space in the drawers/cabinets. While these drawers/cabinets are more expensive than standard shelving, the improved utilization of floor space and other efficiencies are often felt to be worth the added expense.

- Automatic parts storage and retrieval system maximize storage space

  The SCRTD (Los Angeles) reports excellent results from its Automatic Supply Retrieval System. One component of this system consists of a computerized bin storage system that stores and retrieves parts in high ceiling, multi-leveled bins. At a minimum, this system maximizes the floor space and makes the best use of the high ceiling of most garages. This system could have applications at other transit garages which have storage space concerns.

- There are advantages to the use of ten-foot or higher parts room ceilings

  Most garages have high ceilings to accommodate buses on lifts. Since most parts rooms share a common roof with the garage, the parts rooms often have a ceiling height of well over ten feet. It is possible to take advantage of this ceiling height to minimize floor space or increase expansion capability.

This height allows for converting the parts room into an automated parts retrieval system similar in approach to that used by the RTA of Los Angeles. Another variation of the same approach is to add a steel decking mezzanine level.

- Central core administrative area often preferred

  A central core administrative area reduces travel time from work bays and provides better supervision. As a result, it is often a preferred design criteria.

- Use of low maintenance floors in the garage administrative areas preferred

  Because of the normal grime, dirt, etc., associated with bus garages, many operations recommend easy to clean floors (i.e., tile, linoleum, concrete, etc.) rather than carpeting in garage administrative areas.

- APTA's role in the project

  As previously mentioned, through a number of channels, ATE attempted to keep APTA apprised of the project's approach, progress and findings. Through the course of the project, APTA was approachable and supportive of the efforts of the project.

2. Recommendations

- Facility design and construction recommendations needed

  All too often transit properties face a problem, develop solutions and evaluate the results, while other transit properties are doing the same. Since most systems do not construct transit support facilities on a regular basis, they depend heavily on the ability of architects, many of whom have little experience with transit support facilities. As a result, some areas are over built and some are under built. The end result is that all too often a transit property "reinvents the wheel" when they build or rehabilitate a facility.

  Recognizing that operations have local constraints and that the site itself presents a major design criterion, more collective guidance is needed for systems going through this process. The industry could benefit from more consistent direction on successful design features in transit bus support facilities.

- Identify optimum number of buses for a single support facility

  Considerable discussion was given to the optimum bus fleet size for a single facility, but no definitive data supports the assumptions. Since this has a substantial implication for operations, maintenance cost and capital cost, further study in this area is needed.

- More value engineering is needed

  Value engineering is the process of evaluating the cost of something and its expected return to determine if the investment is warranted. Insufficient analysis is given to currently value engineering as it relates to bus support facilities and equipment. Examples of such lack of value engineering include the following:

- Some systems did not build in chassis dynamometers, some did but did not use them, and some systems built them in and used them.

- Some systems built in automated painting equipment but now do not believe it is cost effective.

- In the same climate zone, some systems feel that indoor parking is cost effective, but others do not.

- Most systems build facilities for extended service periods even though they often have to be modified within a short period of time to meet changing demands, while some systems believe a more disposable, shorter life building, might be more appropriate.

There exists a need to perform value analyses, conduct them in such a fashion that they are accepted by the industry, and share the information so that it can be used in decision making.

- Industry UST and spill containment plans needed

An industry-wide underground storage tank (UST) compliance and spill containment plan would assist transit systems in planning and implementing compliance efforts. Several different interpretations of regulations have resulted in several different approaches to attain the same end. Worst yet, many of the upgrades have already had to be redone because they did not adequately plan for probable eventualities. The development of an industry standard and guideline would help minimize planning efforts, expedite compliance efforts and reduce rework efforts.

- Increased capital needed for accommodation of alternative fuels

  Increased capital expenditures will be needed to accommodate alternative fuels into existing or proposed facilities over the next few years. Because such capital projections should be planned as far in advance as possible, it is obvious that current projections should include these costs. Unfortunately, because there is no clear preference in alternative fuels or approaches for meeting the Clean Air Act requirements (in some cases the Clean Air Act requirements are not even set at this time), the industry is at a loss when it comes to projecting such needs. As reflected in the survey work, few systems have included capital projections for such items in their current facility plans, and those which did include them had widely differing projections.

- More efforts needed to develop alternative fuels facility requirements and cost

  It appears that more time will be needed to identify the principal bus propulsion systems of the future and to determine the industry's facility support requirement for such vehicles. Some systems expressed a desire for an industry standard for the use, handling, tooling, facilities, etc., needed for the various alternative fueled vehicles.

- Many aspect of facilities should be designed to exceed minimum building codes

  Most architectural aspects of transit buildings (i.e, ventilation, battery room exhaust, electrical capacity, etc.) are designed close to the minimum code requirements. However, in heavy duty applications, such as a transit garage, these are often found to be inadequate. Over time, capacity often has to be increased at considerably more expense.

This was found to be particularly true of electrical capacity. Over time, tooling and fixtures are added which require additional electrical power. The cost of providing the necessary capacity initially is much less than having to increase capacity at a later date.

- Improved water reclamation systems are needed

In the past, considerable effort was devoted to developing a basic bus washer design that best served the transit industry. The same process is currently taking place with water reclamation systems. From a conservation standpoint and a cost saving standpoint this appears to be a good option for a transit operation to pursue. Unfortunately, many operators that have tried these systems are seeing mixed results. Some systems have had high failure rates. Some systems have not properly filtered the contaminants out of the water, and this has resulted in considerable damage to painted surfaces on buses. In short, some operators are using them and are satisfied, some operators have stopped using them, and other operators do not want to try them.

Suggestions for improving water reclamation systems include the addition of a substantial water holding tank before running the water through the filtering process. Many of the solids would drop out of suspension, thus reducing the demands on the filters. A diaphragm type pump is also suggested for movement of the water. This type pump creates less turbulence, and the soap and water are less likely to emulsify with the petroleum products.

Further investigation into such areas and more uniform water reclamation specifications based on these results could help the industry.

- Consider functionality as well as deadhead miles

  Many site selections are heavily influenced by proximity to existing route designs in order to limit deadhead operation miles and the resulting expense. This often occurs at the expense of selecting a site that can best be configured functionally. In addition, some systems have route structures which change fairly quickly, yet their operating facilities have extended lives. The selection of a site of the appropriate size for support facility efficiencies may help offset operating inefficiencies which occur due to deadhead miles.

- Increased consideration should be given to future needs as part of site selection process

  With changing regulations (ADA, yard run off, alternative fuels, etc.), changing service demands, and changing vehicle types, it is difficult to make capacity or equipment projections for a facility that is intended to last for many years. Therefore, flexibility and the ability to adapt a facility to changing demands are very important.

- More energy conservation measures needed

  There are several private companies that offer to analyze and equip transit facilities with more energy efficient equipment/processes. These companies charge nothing and only share in the utility savings. Typical examples of approaches used in such conservation efforts are light timers and zoned heat/air conditioning. It is obvious from these examples that more operating efficiencies could be gained in most transit facilities through the efficient use of energy.

- Pit use and design needs re-evaluation

  There are a number of changes occurring in bus support facilities that may have an effect on pit usage and design. To begin with, some of the alternative fuels which may be used require extra safety measures. This would include such things as explosion proof and no spark type tools and equipment, ventilation for heavier than air gases, and more. While most transit agencies are exempt from OSHA requirements, many are not. OSHA penalties have been raised significantly and most transit pits could not pass an OSHA inspection. In light of these and other such concerns, a re-examination of pit construction, equipment and usage seems prudent.

- Flexibility needed in adapting locker rooms to the needs of a changing work force

  The gender of the shop workforce has changed rapidly over the past few years and will continue to fluctuate. Because it is difficult to design facilities that are sized appropriately for this changing workforce, one solution is to design adjacent locker rooms with walls that can adjust the available space to allow more or less space proportional to the gender of the work force.

- Consider site's "historic aspects" in making decisions

  Some transit facilities or the locations of transit facilities fall under historic preservation programs. These have often been found to hinder plans for modifying or rehabilitating garages. Consequently, historic districts' land and site usage requirements need to be fully understood before transit properties utilize such sites.

- Insure adequate paint booth size

  Unless the paint booth is equipped with a drop table or some other means of reaching all levels of a bus when painting it, the work bay should be sufficiently sized to allow for scaffolds.

- Provide appropriate number of doors

  Too many or too few doors present problems. To conserve heat and maintenance cost, many facilities limit the number of bus exit doors. However, due to facility layouts too few doors create congestion and reduce efficiency. In facilities where the maintenance, parking and/or service take place inside one building, consideration should be given to providing auxiliary doors in case the primary doors become inoperable or unaccessible.

- Use prevailing winds in placement of bay doors

  Many areas of the country have prevailing winds. If the site arrangement is flexible, these prevailing winds should be considered. In the warmer climates, the bay doors should be configured in line with the prevailing winds to use the winds as a ventilation assist. In colder climates, the reverse should be used.

- More lighting needed in body shops versus normal work bays

  By the nature of the work, a body shop needs as good as or better lighting than most maintenance functions. However, many body shops are initially configured with the same lighting system as the other maintenance areas and later have to be upgraded. The special needs of a body shop work area should be factored in as plans are created for such areas.

- Consider placement of work in work bays

  Most maintenance functions are performed at the rear of buses and this is where work room and support fixtures (electrical outlets, oil dispensing, etc.) are needed. It is also advantageous to have this work area visible from the foreman's station. As a result, most work bays should be set up to have the rear of the bus toward the end of the work bay (the area where the work benches are located). An exception to this approach might be the body shop.

- Tool box storage areas needed

  The size of mechanics' tool boxes has increased dramatically over the past few years. This is partially a result of a more specialized tool requirement, more power tools and the availability of larger tool boxes. The end result is that increased shop space is needed to secure these boxes when not in use.

- Use overhead, color coded utilities

  For ease of trouble shooting and building maintenance, some operations recommend that, to the maximum extent possible, all building utilities be installed overhead and that they be color coded.

- Better location and construction of floor drains needed in some parking and service areas

  Floor drainage, especially around bus wash areas and where vehicle operators must walk, should preclude standing water. In addition to being tracked into the buses where it soils the floors, this water often presents a slipping hazard. Several examples of this problem were observed and needed correction.

- Use uniform pipe size with tank piping

  It is important to use the same size connecting and siphoning pipes with fuel tanks. This allows the same flow of liquids as the fill pipe allows. In the absence of this uniformity, it is possible to have fuel backups which may lead to fuel spills.

- Insure proper placement of body straightening tie downs

  A body shop operation often needs anchor points in which a bus can be pulled in order to straighten frames or other body parts. Most times these pull points are anchored into the concrete as the shop floor is constructed. Careful attention should be given to the strength and placement of these points before the floor is poured.

- Consider type and placement of fire suppression systems

  The proper type and placement of fire suppression systems is critical. In one incident an architect placed a water type fire suppression system over the main electrical junction boxes for the entire facility. This could have resulted in a major accident if the water had gotten into the junction boxes.

- Isolate pump rooms

  A bus support facility requires several pumps, such as air compressors, grease pumps, coolant pumps, etc. Because these generate a great deal of noise, they should be isolated from other work areas as much as possible.

- Limit access to antifreeze/coolant and refrigerant

  Antifreeze and refrigerants should be controlled and recycled when possible. Most of the operations visited had antifreeze and refrigerant recycling equipment and processes in place. However, it is often easier to release these commodities than to go through the process of recycling them. If the commodities are too accessible or not properly controlled, the work force may be less inclined to go to the trouble of properly recycling them. Since the transit system is ultimately responsible for meeting regulator compliance, accessibility of these commodities should be limited and dispensing should be carefully controlled.

D. CONCLUSION

While the visited sites constitute a small percentage of the transit industry's bus support facility population, the findings demonstrates many different approaches used for bus support facilities. It appears that there is a general lack of quantitative information or information sharing. In some cases, this results in expenditures in areas where other properties have evaluated and discarded a concept. In other cases, positive results are missed because they are not known or have not been properly considered.

The transit bus support industry is also faced with an unprecedented number of changes. Included in these changes are the general technological changes occurring on buses, new regulatory requirements (i.e., ADA, yard run off, alternative fuels, etc.) and many support facility options. Only the very largest properties can hope to have sufficient staff to stay abreast of these changes and respond in the most appropriate fashion. In any event, all of the affected properties have to make ongoing modifications and capital expenditures to their facilities to stay abreast of changes.

In light of these challenges and the scarcity of resources, the transit industry needs capital support and assistance in identifying the most effective use of the capital support that is available.

APPENDICES

APPENDIX A
SURVEY QUESTIONNAIRE

Property/Transit Agency: ______________________________

Bus Support Facility Name or Address: ______________________________

	Poor	Sub-Standard	Adequate	Good	Excellent
General condition of facility (circle one):	1	2	3	4	5

Age of facility: _____ Years

Overhaul or central shop? Yes or No

Operating garage? Yes or No

If yes, how many buses are supported at this facility? __________

Do five year projections (1993-1997) call for

bus support facility capital expenditures? Yes or No

If yes:

Nature of project	New	Replace Existing	Expand Existing	Rehab Existing	Projected Capital Expense
Bus Maintenance Facility	☐	☐	☐	☐	$ __________
Central Shop or Rebuild Facil.	☐	☐	☐	☐	$ __________
Bus Parts Storage Facility	☐	☐	☐	☐	$ __________
Bus Parking Facility	☐	☐	☐	☐	$ __________
Bus Parking Area	☐	☐	☐	☐	$ __________
Bus Servicing Facility	☐	☐	☐	☐	$ __________
Other (describe): ______________________________					$ __________

Has the site been selected? Yes or No

Has all site construction, usage, EIS's been approved? Yes or No

If not, are any problems anticipated? Yes or No

Does the capital plan incorporate provisions for:

ADA requirements? Yes or No

Underground storage tank requirements? Yes or No

Alternative fuel usage? Yes or No

Type of fuel: CNG LNG Methanol Propane

Other types: ______________________________

If we have additional questions, we should contact:

Name: ______________________ Phone: (   ) ___-______

If you have any questions please contact Jim Hanson at (800) 283-1944

When completed, please forward to:
Mr. Jim Hanson
ATE Management and Service Company, Inc.
49 East Fourth St., Suite 700
Cincinnati, Ohio 45202-3803

APPENDIX B
SUMMARY OF DATA

TABLE B-1
SUMMARIZED DATA PROJECTIONS BY STATE

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS BY STATE

STATE	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
AL TOTALS	350,000	0	0	3,500,000	0	3,850,000
AR TOTALS	0	0	0	750,000	0	750,000
AZ TOTALS	4,700,000	7,000,000	0	25,000	500,000	12,225,000
CA TOTALS	69,500,658	25,682,000	54,680,000	262,828,000	47,667,000	460,357,658
CO TOTALS	7,532,000	0	0	0	0	7,532,000
CT TOTALS	17,000,000	1,000,000	0	1,400,000	0	19,400,000
DC TOTALS	6,450,000	750,000	3,500,000	89,000,000	1,000,000	100,700,000
DE TOTALS	365,000	125,000	0	2,500,000	0	2,990,000
FL TOTALS	7,574,000	5,350,000	5,000,000	12,000,000	500,000	30,424,000
GA TOTALS	0	0	0	2,500,000	50,000	2,550,000
HI TOTALS	0	0	0	36,000,000	0	36,000,000
IA TOTALS	248,600	0	0	0	0	248,600
IL TOTALS	81,710,000	7,620,000	9,000,000	148,500,000	0	246,830,000
IN TOTALS	670,000	1,125,000	0	0	0	1,795,000
KS TOTALS	11,500	0	0	5,000,000	0	5,011,500
KY TOTALS	70,000	0	0	0	0	70,000
LA TOTALS	0	0	24,000,000	12,466,940	0	36,466,940
MA TOTALS	3,525,000	0	31,000,000	0	250,000	34,775,000
MD TOTALS	1,520,000	0	0	0	3,700,000	5,220,000
MI TOTALS	21,765,000	11,786,800	2,800,000	0	500,000	36,851,800
MO TOTALS	5,967,000	0	0	0	0	5,967,000
MS TOTALS	0	0	0	750,000	0	750,000
NC TOTALS	300,000	2,400,000	0	2,000,000	0	4,700,000
NJ TOTALS	87,000,000	0	47,000,000	0	0	134,000,000
NM TOTALS	0	0	0	6,000,000	1,800,000	7,800,000
NV TOTALS	0	0	0	0	0	0
NY TOTALS	41,102,892	1,123,584	0	353,200,000	15,130,650	410,557,126
OH TOTALS	52,365,000	0	0	33,075,000	2,950,000	88,390,000
OK TOTALS	0	0	8,000,000	0	0	8,000,000
OR TOTALS	0	220,000	2,156,000	25,000,000	0	27,376,000
PA TOTALS	58,600,000	15,500,000	40,100,000	50,000,000	475,000	164,675,000
PR TOTALS	3,500,000	0	0	0	0	3,500,000
RI TOTALS	0	0	20,000,000	4,500,000	0	24,500,000
TN TOTALS	2,000,000	0	0	250,000	0	2,250,000
TX TOTALS	3,900,000	10,210,000	700,000	99,600,000	28,800,000	143,210,000
UT TOTALS	0	0	0	8,000,000	0	8,000,000
VA TOTALS	1,360,000	0	0	350,000	0	1,710,000
WA TOTALS	267,500	9,483,062	0	4,500,000	0	14,250,562
WI TOTALS	1,922,050	0	0	0	195,000	2,117,050
WV TOTALS	0	0	0	7,000,000	0	7,000,000
GRAND TOTALS	481,276,200	99,375,446	247,936,000	1,170,694,940	103,517,650	2,102,800,236

TABLE B-2
SUMMARIZED DATA PROJECTIONS BY AGENCY AND STATE

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: AL						
Mobile Transit Authority	350,000	0	0	0	0	350,000
Montgomery Area Transit	0	0	0	3,500,000	0	3,500,000
STATE: AL TOTALS	350,000	0	0	3,500,000	0	3,850,000
STATE: AR						
Central Arkansas Transit	0	0	0	750,000	0	750,000
STATE: AR TOTALS	0	0	0	750,000	0	750,000
STATE: AZ						
Regional Public Transport	4,450,000	7,000,000	0	0	500,000	11,950,000
Sun Tran	250,000	0	0	25,000	0	275,000
STATE: AZ TOTALS	4,700,000	7,000,000	0	25,000	500,000	12,225,000
STATE: CA						
Golden Empire Transit	500,000	0	0	0	0	500,000
Fresno Transit	825,000	0	0	5,000,000	0	5,825,000
Orange County Transit	0	0	4,930,000	11,000,000	0	15,930,000
Gardena Municipal Bus	0	2,000,000	0	4,000,000	0	6,000,000
Long Beach Transit	0	0	0	18,000,000	1,000,000	19,000,000
Los Angeles Cnty Transit	7,427,658	0	0	20,000,000	0	27,427,658
SCRTD	8,500,000	3,650,000	4,750,000	47,428,000	20,492,000	84,820,000
Montebello Municipal Bus	200,000	2,500,000	3,750,000	0	0	6,450,000
Monterey-Salinas Transit	360,000	0	0	0	75,000	435,000
AC Transit	3,750,000	1,875,000	3,750,000	0	0	9,375,000
Riverside Transit Agency	0	6,000,000	0	0	0	6,000,000
Sacramento RTD	2,000,000	0	0	98,000,000	0	100,000,000
OMNITRANS	0	0	9,000,000	0	0	9,000,000
San Mateo County Transit	1,500,000	2,200,000	0	0	0	3,700,000
San Diego Metro	3,500,000	0	0	3,000,000	0	6,500,000
San Fran. Muni. Railway	40,350,000	0	20,000,000	50,000,000	0	110,350,000
Santa Clara County Trans.	0	0	0	0	24,600,000	24,600,000
Golden Gate Transit	0	1,000,000	0	0	0	1,000,000
Santa Barbara Transit	0	0	0	6,000,000	0	6,000,000
Santa Cruz Transit	0	0	8,500,000	0	0	8,500,000
Santa Monica Municpal Bus	500,000	2,500,000	0	0	0	3,000,000
Sonoma County Transit	0	2,800,000	0	0	0	2,800,000
Stockton Metro Transit	23,000	642,000	0	0	0	665,000
Sunline Transit Agency	15,000	15,000	0	400,000	1,500,000	1,930,000
Vallejo Transit Lines	50,000	500,000	0	0	0	550,000
STATE: CA TOTALS	69,500,658	25,682,000	54,680,000	262,828,000	47,667,000	460,357,658
STATE: CO						
RTD	7,532,000	0	0	0	0	7,532,000
STATE: CO TOTALS	7,532,000	0	0	0	0	7,532,000
STATE: CT						
NE Connecticut Transit	0	0	0	1,400,000	0	1,400,000
Connecticut Transit 1	17,000,000	1,000,000	0	0	0	18,000,000
STATE: CT TOTALS	17,000,000	1,000,000	0	1,400,000	0	19,400,000

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: DC						
WMATA	6,450,000	750,000	3,500,000	89,000,000	1,000,000	100,700,000
STATE: DC TOTALS	6,450,000	750,000	3,500,000	89,000,000	1,000,000	100,700,000
STATE: DE						
Delaware Regional Transit	365,000	125,000	0	2,500,000	0	2,990,000
STATE: DE TOTALS	365,000	125,000	0	2,500,000	0	2,990,000
STATE: FL						
Lee County Transit	0	0	0	0	500,000	500,000
Metro-Dade Transit Agency	6,109,000	0	0	0	0	6,109,000
Tri County Transit	0	5,000,000	0	12,000,000	0	17,000,000
East Volusia Transit	475,000	350,000	0	0	0	825,000
Hillsborough Area Transit	990,000	0	0	0	0	990,000
Palm Beach County Trans.	0	0	5,000,000	0	0	5,000,000
STATE: FL TOTALS	7,574,000	5,350,000	5,000,000	12,000,000	500,000	30,424,000
STATE: GA						
Cobb Community Transit	0	0	0	2,500,000	0	2,500,000
Chatham Area Transit Auth	0	0	0	0	50,000	50,000
STATE: GA TOTALS	0	0	0	2,500,000	50,000	2,550,000
STATE: HI						
Honolulu Transit	0	0	0	36,000,000	0	36,000,000
STATE: HI TOTALS	0	0	0	36,000,000	0	36,000,000
STATE: IA						
Des Moines Metro Transit	248,600	0	0	0	0	248,600
STATE: IA TOTALS	248,600	0	0	0	0	248,600
STATE: IL						
Pace Suburban Bus	600,000	7,000,000	5,500,000	8,000,000	0	21,100,000
Chicago Transit Authority	80,950,000	0	0	140,500,000	0	221,450,000
Rock Island Metro	160,000	120,000	0	0	0	280,000
Champaign-Urban Transit	0	500,000	3,500,000	0	0	4,000,000
STATE: IL TOTALS	81,710,000	7,620,000	9,000,000	148,500,000	0	246,830,000
STATE: IN						
Gary Public Transit	255,000	0	0	0	0	255,000
Greater Lafayette Transit	375,000	1,125,000	0	0	0	1,500,000
South Bend Public Transit	40,000	0	0	0	0	40,000
STATE: IN TOTALS	670,000	1,125,000	0	0	0	1,795,000

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: KS						
Johnson County Transit	11,500	0	0	0	0	11,500
Wichita Metro Transit	0	0	0	5,000,000	0	5,000,000
STATE: KS TOTALS	11,500	0	0	5,000,000	0	5,011,500
STATE: KY						
TANK	10,000	0	0	0	0	10,000
Lexington Transit	60,000	0	0	0	0	60,000
STATE: KY TOTALS	70,000	0	0	0	0	70,000
STATE: LA						
Capitol Transportation	0	0	0	5,466,940	0	5,466,940
Regional Transit	0	0	24,000,000	7,000,000	0	31,000,000
Shreveport Transit System	0	0	0	0	0	0
STATE: LA TOTALS	0	0	24,000,000	12,466,940	0	36,466,940
STATE: MA						
Massachusetts Bay Trans.	0	0	21,000,000	0	0	21,000,000
Brockton Area Transit	25,000	0	0	0	250,000	275,000
Merrimack Valley RTA	3,500,000	0	0	0	0	3,500,000
New Bedford SERTA	0	0	10,000,000	0	0	10,000,000
STATE: MA TOTALS	3,525,000	0	31,000,000	0	250,000	34,775,000
STATE: MD						
Mass Transit Admin.	1,520,000	0	0	0	3,700,000	5,220,000
Montgomery County Ride-On	0	0	0	0	0	0
STATE: MD TOTALS	1,520,000	0	0	0	3,700,000	5,220,000
STATE: MI						
Detroit Dept. of Transit	21,765,000	4,445,000	0	0	0	26,210,000
SMART	0	3,500,000	2,300,000	0	0	5,800,000
MTA	0	3,200,000	0	0	0	3,200,000
Grand Rapids Area Transit	0	0	0	0	500,000	500,000
Kalamazoo Dept. of Trans.	0	641,800	0	0	0	641,800
Saginaw Transit System	0	0	500,000	0	0	500,000
STATE: MI TOTALS	21,765,000	11,786,800	2,800,000	0	500,000	36,851,800
STATE: MO						
Kansas City Area Transit	1,687,000	0	0	0	0	1,687,000
Bi-State Development	4,280,000	0	0	0	0	4,280,000
STATE: MO TOTALS	5,967,000	0	0	0	0	5,967,000

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: MS						
Jackson Transit	0	0	0	750,000	0	750,000
STATE: MS TOTALS	0	0	0	750,000	0	750,000
STATE: NC						
Chapel Hill Transit	0	900,000	0	0	0	900,000
Charlotte Transit System	0	1,500,000	0	0	0	1,500,000
Triangle Transit	0	0	0	2,000,000	0	2,000,000
Winston-Salem Transit	300,000	0	0	0	0	300,000
STATE: NC TOTALS	300,000	2,400,000	0	2,000,000	0	4,700,000
STATE: NJ						
New Jersey Transit	87,000,000	0	47,000,000	0	0	134,000,000
STATE: NJ TOTALS	87,000,000	0	47,000,000	0	0	134,000,000
STATE: NM						
Sun Tran of Albuquerque	0	0	0	6,000,000	1,800,000	7,800,000
STATE: NM TOTALS	0	0	0	6,000,000	1,800,000	7,800,000
STATE: NV						
Las Vegas Transit System	0	0	0	0	0	0
STATE: NV TOTALS	0	0	0	0	0	0
STATE: NY						
Capital District Transit	1,180,000	0	0	0	820,000	2,000,000
New York City Transit	36,900,000	0	0	337,500,000	13,980,000	388,380,000
Niagara Frontier Transit	454,142	0	0	0	0	454,142
County of Rockland Dept.	0	0	0	0	0	0
Rochester-Genesse Transit	2,500,000	0	0	0	0	2,500,000
Central New York Transit	68,750	0	0	0	330,650	399,400
Utica Transit Authority	0	1,123,584	0	0	0	1,123,584
Westchester Co. Transit	0	0	0	15,700,000	0	15,700,000
STATE: NY TOTALS	41,102,892	1,123,584	0	353,200,000	15,130,650	410,557,126
STATE: OH						
Canton Regional Transit	60,000	0	0	0	200,000	260,000
SORTA	2,800,000	0	0	0	2,750,000	5,550,000
Greater Cleveland Transit	44,155,000	0	0	30,000,000	0	74,155,000
Central Ohio Transit	3,500,000	0	0	0	0	3,500,000
Miami Valley Transit	0	0	0	3,075,000	0	3,075,000
Toledo Area Transit	650,000	0	0	0	0	650,000
Western Reserve Transit	1,200,000	0	0	0	0	1,200,000
STATE: OH TOTALS	52,365,000	0	0	33,075,000	2,950,000	88,390,000

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: OK						
Central Oklahoma Transit	0	0	8,000,000	0	0	8,000,000
STATE: OK TOTALS	0	0	8,000,000	0	0	8,000,000
STATE: OR						
Lane Transit District	0	220,000	0	0	0	220,000
Tri-County Metro	0	0	2,156,000	25,000,000	0	27,156,000
STATE: OR TOTALS	0	220,000	2,156,000	25,000,000	0	27,376,000
STATE: PA						
Lehigh & Northampton	250,000	500,000	0	0	0	750,000
Erie Metro Transit	300,000	0	0	0	0	300,000
Transit Authority	750,000	0	100,000	0	0	850,000
Red Rose Transit	100,000	0	0	0	0	100,000
SEPTA	0	15,000,000	40,000,000	50,000,000	0	105,000,000
Port Authority Transit	57,100,000	0	0	0	0	57,100,000
Berks Area Reading Transp	100,000	0	0	0	0	100,000
COLTS	0	0	0	0	475,000	475,000
STATE: PA TOTALS	58,600,000	15,500,000	40,100,000	50,000,000	475,000	164,675,000
STATE: PR						
Metropolitan Bus Auth.	3,500,000	0	0	0	0	3,500,000
STATE: PR TOTALS	3,500,000	0	0	0	0	3,500,000
STATE: RI						
Rhode Island Public Trans	0	0	20,000,000	4,500,000	0	24,500,000
STATE: RI TOTALS	0	0	20,000,000	4,500,000	0	24,500,000
STATE: TN						
Chattanooga Area Transit	0	0	0	250,000	0	250,000
Memphis Area Transit	2,000,000	0	0	0	0	2,000,000
STATE: TN TOTALS	2,000,000	0	0	250,000	0	2,250,000
STATE: TX						
Capital Metro	1,200,000	0	0	0	0	1,200,000
Corpus Christi Transit	1,400,000	0	0	0	1,000,000	2,400,000
Dallas Area Rapid Transit	0	0	0	60,000,000	0	60,000,000
El Paso Mass Transit Dept	0	0	0	0	600,000	600,000
Fort Worth Transit	0	0	0	11,000,000	0	11,000,000
Metro Transit	0	8,110,000	0	27,900,000	11,700,000	47,710,000
City Transit Mgt Company	100,000	0	700,000	700,000	0	1,500,000
VIA Metropolitan Transit	1,200,000	2,100,000	0	0	15,500,000	18,800,000
STATE: TX TOTALS	3,900,000	10,210,000	700,000	99,600,000	28,800,000	143,210,000

FTA BUS MAINTENANCE FACILITY DATA SUMMARY ANALYSIS

LOCATION	REHABILITATION PROJECT COSTS	EXPANSION PROJECT COSTS	REPLACEMENT PROJECT COSTS	NEW PROJECT COSTS	OTHER PROJECT COSTS	TOTAL PROJECT COSTS
STATE: UT						
Utah Transit Authority	0	0	0	8,000,000	0	8,000,000
STATE: UT TOTALS	0	0	0	8,000,000	0	8,000,000
STATE: VA						
Tidewater Transit	0	0	0	350,000	0	350,000
Greater Richmond Transit	1,360,000	0	0	0	0	1,360,000
STATE: VA TOTALS	1,360,000	0	0	350,000	0	1,710,000
STATE: WA						
Kitsap Transit	0	1,000,000	0	4,000,000	0	5,000,000
Everett Transit	0	555,000	0	0	0	555,000
Intercity Transit	0	5,000,000	0	0	0	5,000,000
Ben Franklin Transit	0	82,000	0	0	0	82,000
Spokane Transit	267,500	96,062	0	0	0	363,562
Pierce Cty Public Transit	0	250,000	0	500,000	0	750,000
Clark Cty Public Transit	0	2,500,000	0	0	0	2,500,000
STATE: WA TOTALS	267,500	9,483,062	0	4,500,000	0	14,250,562
STATE: WI						
Valley Transit	100,000	0	0	0	0	100,000
Green Bay Transit	440,000	0	0	0	0	440,000
Kenosha Transit Comm.	300,000	0	0	0	115,000	415,000
Madison Metro Transit	873,000	0	0	0	0	873,000
Belle Urban System	0	0	0	0	80,000	80,000
Sheboygan Transit System	209,050	0	0	0	0	209,050
STATE: WI TOTALS	1,922,050	0	0	0	195,000	2,117,050
STATE: WV						
Kanawha Valley Transit	0	0	0	7,000,000	0	7,000,000
STATE: WV TOTALS	0	0	0	7,000,000	0	7,000,000
GRAND TOTALS	481,276,200	99,375,446	247,936,000	1,170,694,940	103,517,650	2,102,800,236

TABLE B-3
SUMMARIZED DATA PROJECTIONS BY FACILITY, AGENCY AND STATE

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
STATE: AL												
Mobile Transit Authority												
Mobile	45	MAINT. FACILITY	100,000									100,000
Mobile	45	PARKING AREA	250,000									250,000
SUB-TOTAL			350,000		0		0		0		0	350,000
Montgomery Area Transit												
N McDonough	40							MAINT. FACILITY	3,500,000			3,500,000
SUB-TOTAL			0		0		0		3,500,000		0	3,500,000
STATE: AL TOTALS			350,000		0		0		3,500,000		0	3,850,000
STATE: AR												
Central Arkansas Transit												
901 Maple	60							SERVICING FACIL.	750,000			750,000
SUB-TOTAL			0		0		0		750,000		0	750,000
STATE: AR TOTALS			0		0		0		750,000		0	750,000
STATE: AZ												
Regional Public Transport												
South	200			MAINT. FACILITY	7,000,000							7,000,000
South	200	PARKING AREA	2,000,000									2,000,000
North	130	MAINT. FACILITY	1,750,000									1,750,000
North	130	PARKING AREA	700,000									700,000
Dave Systems	44									ALT FUEL FACILITY	500,000	500,000
SUB-TOTAL			4,450,000		7,000,000		0		0		500,000	11,950,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS →		← EXPANSION PROJECTS →		← REPLACEMENT PROJECTS →		← NEW PROJECTS →		← OTHER PROJECTS →		TOTAL COST
		PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	
Sun Tran												
S. Park Av	196	PARKING FACILITY	250,000									250,000
S. Park Av	196							SERVICING FACIL.	25,000			25,000
SUB-TOTAL			250,000		0		0		25,000		0	275,000
STATE: AZ TOTALS			4,700,000		7,000,000		0		25,000		500,000	12,225,000
STATE: CA												
Golden Empire Transit												
Golden Empire	70	MAINT. FACILITY	500,000									500,000
SUB-TOTAL			500,000		0		0		0		0	500,000
Fresno Transit												
G Street	122							MAINT. FACILITY	5,000,000			5,000,000
G Street	122	SERVICING FACIL.	825,000									825,000
SUB-TOTAL			825,000		0		0		5,000,000		0	5,825,000
Orange County Transit												
Garden Grove	160					MAINT. FACILITY	950,000					950,000
Garden Grove	160							SHOP/REBUILD FAC.	11,000,000			11,000,000
Garden Grove	160					PARKING AREA	300,000					300,000
Garden Grove	160					SERVICING FACIL.	600,000					600,000
Irvine	140					MAINT. FACILITY	950,000					950,000
Irvine	140					SERVICING FACIL.	600,000					600,000
Anaehiem	140					MAINT. FACILITY	930,000					930,000
Anaehiem	140					SERVICING FACIL.	600,000					600,000
SUB-TOTAL			0		0		4,930,000		11,000,000		0	15,930,000
Gardena Municipal Bus												
Van Ness Av	48			MAINT. FACILITY	2,000,000							2,000,000
Van Ness Av	48							PARKING AREA	4,000,000			4,000,000
SUB-TOTAL			0		2,000,000		0		4,000,000		0	6,000,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
Long Beach Transit												
Gardenia Av	195							MAINT. FACILITY	18,000,000			18,000,000
Gardenia Av	195									ELECTR. YARD FOR T	1,000,000	1,000,000
SUB-TOTAL			0		0		0		18,000,000		1,000,000	19,000,000
Los Angeles Cnty Transit												
Commerce	15	MAINT. FACILITY	7,427,658									7,427,658
Culver City	36							MAINT. FACILITY	20,000,000			20,000,000
SUB-TOTAL			7,427,658		0		0		20,000,000		0	27,427,658
SCRTD												
Division 1	185			MAINT. FACILITY	500,000							500,000
Division 1	185							SERVICING FACIL.	500,000			500,000
Division 1	185									ALT FUEL CONVERSIO	450,000	450,000
Division 2	150							MAINT. FACILITY	2,428,000			2,428,000
Division 2	150							SERVICING FACIL.	500,000			500,000
Division 2	150									UST UPGRADES	180,000	180,000
Division 3	215					PARKING AREA	1,000,000					1,000,000
Division 3	215							SERVICING FACIL.	500,000			500,000
Division 3	215									UST CLEAN UP/REPLA	3,100,000	3,100,000
Division 4	150	MAINT. FACILITY	6,500,000									6,500,000
Division 5	225							PARKING AREA	1,000,000			1,000,000
Division 5	225							SERVICING FACIL.	500,000			500,000
Division 5	225									UST CLEAN UP/REPLA	2,500,000	2,500,000
Division 6	60							MAINT. FACILITY	25,000,000			25,000,000
Division 7	250			MAINT. FACILITY	200,000							200,000
Division 7	250			PARTS STORAGE	100,000							100,000
Division 7	250					PARKING AREA	1,000,000					1,000,000
Division 7	250							SERVICING FACIL.	500,000			500,000
Division 7	250									UST CLEAN UP/REPLA	3,500,000	3,500,000
Division 8	250	MAINT. FACILITY	150,000									150,000
Division 8	250					PARKING AREA	1,000,000					1,000,000
Division 8	250							SERVICING FACIL.	500,000			500,000
Division 8	250									UST UPGRADE	500,000	500,000
Division 9	250			MAINT. FACILITY	1,500,000							1,500,000
Division 9	250							SERVICING FACIL.	500,000			500,000
Division 10	250			PARKING AREA	350,000							350,000
Division 10	250							SERVICING FACIL.	500,000			500,000
Division 10	250									UST CLEAN UP/REPLA	1,200,000	1,200,000
Division 12	125			MAINT. FACILITY	500,000							500,000
Division 12	125					PARKING AREA	750,000					750,000
Division 12	125							SERVICING FACIL.	500,000			500,000
Division 12	125									UST UPGRADE	150,000	150,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS →		← EXPANSION PROJECTS →		← REPLACEMENT PROJECTS →		← NEW PROJECTS →		← OTHER PROJECTS →		TOTAL COST
		PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	
Division 14	0	SHOP/REBUILD FAC.	1,850,000									1,850,000
Division 14	0									UST CLEAN UP/REPLA	1,700,000	1,700,000
Division 15	250					PARKING AREA	1,000,000					1,000,000
Division 15	250							SERVICING FACIL.	500,000			500,000
Division 15	250									UST UPGRADE/CONVER	3,500,000	3,500,000
Division 16	100							MAINT. FACILITY	11,000,000			11,000,000
Division 18	250			MAINT. FACILITY	500,000							500,000
Division 18	250							SERVICING FACIL.	500,000			500,000
Division 18	250									UST CLEAN UP/UPGRA	1,250,000	1,250,000
Vernon Yard	0									UST REPLACEMENT	160,000	160,000
Location 31	0							SERVICING FACIL.	2,500,000			2,500,000
CMF	0									UPGRADES	2,302,000	2,302,000
SUB-TOTAL			8,500,000		3,650,000		4,750,000		47,428,000		20,492,000	84,820,000
Montebello Municipal Bus												
Greenwood Av	55			MAINT. FACILITY	2,500,000							2,500,000
Greenwood Av	55	PARTS STORAGE	200,000									200,000
Greenwood Av	55					PARKING FACILITY	3,000,000					3,000,000
Greenwood Av	55					SERVICING FACIL.	750,000					750,000
SUB-TOTAL			200,000		2,500,000		3,750,000		0		0	6,450,000
Monterey-Salinas Transit												
Monterey	38									INSTALL STORM DRAI	75,000	75,000
Salinas	20	MAINT. FACILITY	75,000									75,000
Salinas	20	PARKING AREA	130,000									130,000
Salinas	20	SERVICING FACIL.	155,000									155,000
SUB-TOTAL			360,000		0		0		0		75,000	435,000
AC Transit												
Hayward	200					MAINT. FACILITY	1,875,000					1,875,000
E. Oakland	200					MAINT. FACILITY	1,875,000					1,875,000
Central Maintenance	0	SHOP/REBUILD FAC.	1,875,000									1,875,000
Emeryville	200	MAINT. FACILITY	1,875,000									1,875,000
Richmond	120			MAINT. FACILITY	1,875,000							1,875,000
SUB-TOTAL			3,750,000		1,875,000		3,750,000		0		0	9,375,000
Riverside Transit Agency												
3rd Street	63			MAINT. FACILITY	6,000,000							6,000,000
SUB-TOTAL			0		6,000,000		0		0		0	6,000,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS →		← EXPANSION PROJECTS →		← REPLACEMENT PROJECTS →		← NEW PROJECTS →		← OTHER PROJECTS →		TOTAL COST
		PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	
Sacramento RTD												
28th. Street	201							MAINT. FACILITY	98,000,000			98,000,000
28th. Street	201	SERVICING FACIL.	2,000,000									2,000,000
SUB-TOTAL			2,000,000		0		0		98,000,000		0	100,000,000
OMNITRANS												
Fifth St	83					MAINT. FACILITY	9,000,000					9,000,000
SUB-TOTAL			0		0		9,000,000		0		0	9,000,000
San Mateo County Transit												
North Access	250			MAINT. FACILITY	2,200,000							2,200,000
501 Pico	210	MAINT. FACILITY	1,500,000									1,500,000
SUB-TOTAL			1,500,000		2,200,000		0		0		0	3,700,000
San Diego Metro												
Imperial Ave	180	SERVICING FACIL.	3,000,000									3,000,000
Kearny Mesa	160	MAINT. FACILITY	500,000									500,000
South Bay	75							MAINT. FACILITY	3,000,000			3,000,000
SUB-TOTAL			3,500,000		0		0		3,000,000		0	6,500,000
San Fran. Muni. Railway												
Islaia Creek	0							MAINT. FACILITY	50,000,000			50,000,000
Kirkland Motor Coach	154					MAINT. FACILITY	17,000,000					17,000,000
Presidio Electric Trolley	169	MAINT. FACILITY	36,850,000									36,850,000
Flynn Motor Coach	124	MAINT. FACILITY	3,500,000									3,500,000
Potrero Electric Trolley	174					SHOP/REBUILD FAC.	3,000,000					3,000,000
SUB-TOTAL			40,350,000		0		20,000,000		50,000,000		0	110,350,000
Santa Clara County Trans.												
Jackson	34									UST,STORM WTR/WTR	3,500,000	3,500,000
North	123									UST,STORM WTR/WTR	6,100,000	6,100,000
Cerone Maintenance	155									UST,STORM WTR/WTR	7,700,000	7,700,000
Chaboya	200									UST,STORM WTR/WTR	7,300,000	7,300,000
SUB-TOTAL			0		0		0		0		24,600,000	24,600,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Golden Gate Transit												
Santa Rosa	75			MAINT. FACILITY	1,000,000							1,000,000
SUB-TOTAL			0		1,000,000		0		0		0	1,000,000
Santa Barbara Transit												
Overpass Rd	60							MAINT. FACILITY	3,000,000			3,000,000
East Cota	15							MAINT. FACILITY	3,000,000			3,000,000
SUB-TOTAL			0		0		0		6,000,000		0	6,000,000
Santa Cruz Transit												
Watsonville	87					MAINT. FACILITY	7,200,000					7,200,000
Watsonville	87					SERVICING FACIL.	1,300,000					1,300,000
SUB-TOTAL			0		0		8,500,000		0		0	8,500,000
Santa Monica Municpal Bus												
Santa Monica	160	MAINT. FACILITY	500,000									500,000
Santa Monica	160			PARKING AREA	700,000							700,000
Santa Monica	160			SERVICING FACIL.	1,800,000							1,800,000
SUB-TOTAL			500,000		2,500,000		0		0		0	3,000,000
Sonoma County Transit												
W. Roles	65			MAINT. FACILITY	2,000,000							2,000,000
W. Roles	65			PARKING AREA	300,000							300,000
W. Roles	65			SERVICING FACIL.	500,000							500,000
SUB-TOTAL			0		2,800,000		0		0		0	2,800,000
Stockton Metro Transit												
Stockton	86			MAINT. FACILITY	642,000							642,000
Stockton	86	PARKING AREA	23,000									23,000
SUB-TOTAL			23,000		642,000		0		0		0	665,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Sunline Transit Agency												
PO Box 398	47	MAINT. FACILITY	15,000									15,000
PO Box 398	47			PARTS STORAGE	15,000							15,000
PO Box 398	47							SERVICING FACIL.	400,000			400,000
PO Box 398	47									CNG FUEL STATION	1,500,000	1,500,000
SUB-TOTAL			15,000		15,000		0		400,000		1,500,000	1,930,000
Vallejo Transit Lines												
Broadway	48	MAINT. FACILITY	50,000									50,000
Broadway	48			PARKING AREA	500,000							500,000
SUB-TOTAL			50,000		500,000		0		0		0	550,000
STATE: CA TOTALS			69,500,658		25,682,000		54,680,000		262,828,000		47,667,000	460,357,658

STATE: CO

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
RTD												
Boulder Division	110	MAINT. FACILITY	412,000									412,000
Boulder Division	110	SERVICING FACIL.	349,000									349,000
East Metro Division	200	MAINT. FACILITY	1,211,000									1,211,000
East Metro Division	200	PARKING FACILITY	206,000									206,000
East Metro Division	200	SERVICING FACIL.	772,000									772,000
Platte Division	300	MAINT. FACILITY	1,380,000									1,380,000
Platte Division	300	PARKING FACILITY	2,678,000									2,678,000
Platte Division	300	PARKING AREA	219,000									219,000
Platte Division	300	SERVICING FACIL.	305,000									305,000
SUB-TOTAL			7,532,000		0		0		0		0	7,532,000
STATE: CO TOTALS			7,532,000		0		0		0		0	7,532,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
STATE: CT												
NE Connecticut Transit												
Brooklyn	12							MAINT. FACILITY	1,400,000			1,400,000
SUB-TOTAL			0		0		0		1,400,000		0	1,400,000
Connecticut Transit 1												
New Haven	125	MAINT. FACILITY	17,000,000									17,000,000
Stamford	36			PARKING FACILITY	1,000,000							1,000,000
SUB-TOTAL			17,000,000		1,000,000		0		0		0	18,000,000
STATE: CT TOTALS			17,000,000		1,000,000		0		1,400,000		0	19,400,000
STATE: DC												
WMATA												
Bladensburg garage	435	MAINT. FACILITY	1,650,000									1,650,000
Bladensburg garage	435					PARKING AREA	3,500,000					3,500,000
Bladensburg garage	435	SERVICING FACIL.	500,000									500,000
Bladensburg garage	435									UST REPLACEMENT	500,000	500,000
Bladensberg overhaul	0	SERVICING FACIL.	1,000,000									1,000,000
Northern	103									UST CLEAN UP	500,000	500,000
Southeastern	160							MAINT. FACILITY	89,000,000			89,000,000
Four Mile Run	177	PARKING AREA	2,750,000									2,750,000
Four Mile Run	177			SERVICING FACIL.	750,000							750,000
Royal	84	SERVICING FACIL.	500,000									500,000
Western	144	MAINT. FACILITY	50,000									50,000
SUB-TOTAL			6,450,000		750,000		3,500,000		89,000,000		1,000,000	100,700,000
STATE: DC TOTALS			6,450,000		750,000		3,500,000		89,000,000		1,000,000	100,700,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
STATE: DE												
Delaware Regional Transit												
Wilmington	124							MAINT. FACILITY	2,500,000			2,500,000
Wilmington	124			PARTS STORAGE	125,000							125,000
Wilmington	124	PARKING AREA	250,000									250,000
Wilmington	124	SERVICING FACIL.	115,000									115,000
SUB-TOTAL			365,000		125,000		0		2,500,000		0	2,990,000
STATE: DE TOTALS			365,000		125,000		0		2,500,000		0	2,990,000
STATE: FL												
Lee County Transit												
Lee County	36									UST EXPANSION	500,000	500,000
SUB-TOTAL			0		0		0		0		500,000	500,000
Metro-Dade Transit Agency												
Northeast	197	MAINT. FACILITY	1,315,000									1,315,000
Northeast	197	PARKING FACILITY	400,000									400,000
Coral Way	141	MAINT. FACILITY	942,000									942,000
Coral Way	141	PARKING FACILITY	200,000									200,000
Central	248	MAINT. FACILITY	2,202,000									2,202,000
Central	248	PARKING FACILITY	1,050,000									1,050,000
SUB-TOTAL			6,109,000		0		0		0		0	6,109,000
Tri County Transit												
new facility	0							MAINT. FACILITY	12,000,000			12,000,000
Orlando	121			MAINT. FACILITY	5,000,000							5,000,000
SUB-TOTAL			0		5,000,000		0		12,000,000		0	17,000,000
East Volusia Transit												
Big Tree Rd	74	MAINT. FACILITY	250,000									250,000
Big Tree Rd	74			PARKING FACILITY	350,000							350,000
Big Tree Rd	74	PARKING AREA	225,000									225,000
SUB-TOTAL			475,000		350,000		0		0		0	825,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
Hillsborough Area Transit												
E 21st Av	182	MAINT. FACILITY	500,000									500,000
E 21st Av	182	PARTS STORAGE	30,000									30,000
E 21st Av	182	PARKING FACILITY	10,000									10,000
E 21st Av	182	PARKING AREA	250,000									250,000
E 21st Av	182	SERVICING FACIL.	200,000									200,000
SUB-TOTAL			990,000		0		0		0		0	990,000
Palm Beach County Trans.												
COTRAN	89					MAINT. FACILITY	5,000,000					5,000,000
SUB-TOTAL			0		0		5,000,000		0		0	5,000,000
STATE: FL TOTALS			7,574,000		5,350,000		5,000,000		12,000,000		500,000	30,424,000
STATE: GA												
Cobb Community Transit												
N Cobb Parkway	36							MAINT. FACILITY	2,500,000			2,500,000
SUB-TOTAL			0		0		0		2,500,000		0	2,500,000
Chatham Area Transit Auth												
Savannah	57									LIMITED REHABILITA	50,000	50,000
SUB-TOTAL			0		0		0		0		50,000	50,000
STATE: GA TOTALS			0		0		0		2,500,000		50,000	2,550,000
STATE: HI												
Honolulu Transit												
Halawa	225							SHOP/REBUILD FAC.	16,000,000			16,000,000
Proposed Campbell	100							MAINT. FACILITY	20,000,000			20,000,000
SUB-TOTAL			0		0		0		36,000,000		0	36,000,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
STATE: HI TOTALS			0		0		0		36,000,000		0	36,000,000
STATE: IA												
Des Moines Metro Transit												
MTA Lane	105	MAINT. FACILITY	66,000									66,000
MTA Lane	105	SHOP/REBUILD FAC.	72,600									72,600
MTA Lane	105	SERVICING FACIL.	110,000									110,000
SUB-TOTAL			248,600		0		0		0		0	248,600
STATE: IA TOTALS			248,600		0		0		0		0	248,600
STATE: IL												
Pace Suburban Bus												
West Div. Melrose Park	116	MAINT. FACILITY	200,000									200,000
Fox Valley Div Aurora	23					MAINT. FACILITY	1,500,000					1,500,000
Heritage Div Joliet	37	MAINT. FACILITY	100,000									100,000
North Div Waukegan	30	MAINT. FACILITY	100,000									100,000
Northwest Div Des Plaines	129					MAINT. FACILITY	4,000,000					4,000,000
South Div Markham	80	MAINT. FACILITY	200,000									200,000
McHenry County	30							MAINT. FACILITY	4,000,000			4,000,000
DuPage County	30							MAINT. FACILITY	4,000,000			4,000,000
North Shore	50			MAINT. FACILITY	7,000,000							7,000,000
SUB-TOTAL			600,000		7,000,000		5,500,000		8,000,000		0	21,100,000
Chicago Transit Authority												
77th Street	288	MAINT. FACILITY	16,700,000									16,700,000
77th Street	288									LIMITED REHABILITA		0
69th Street	262							MAINT. FACILITY	48,300,000			48,300,000
Limits	148	MAINT. FACILITY	12,350,000									12,350,000
Limits	148									LIMITED REHABILITA		0
Forrest Glen	277	MAINT. FACILITY	7,500,000									7,500,000
Forrest Glen	277									LIMITED REHABILITA		0

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
Archer	237	MAINT. FACILITY	13,900,000									13,900,000
Archer	237									LIMITED REHABILITA		0
North Park	336	MAINT. FACILITY	10,500,000									10,500,000
North Park	336									LIMITED REHABILITA		0
South Shops Complex	0	SHOP/REBUILD FAC.	20,000,000									20,000,000
South Shops Complex	0									LIMITED REHABILITA		0
Limits New Garage	250							MAINT. FACILITY	44,000,000			44,000,000
Chicago/Pulaski	250							MAINT. FACILITY	48,200,000			48,200,000
SUB-TOTAL			80,950,000		0		0		140,500,000		0	221,450,000

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECT	COST	EXPANSION PROJECT	COST	REPLACEMENT PROJECT	COST	NEW PROJECT	COST	OTHER PROJECT	COST	TOTAL COST
Rock Island Metro												
Quad City	80	MAINT. FACILITY	50,000									50,000
Quad City	80	SHOP/REBUILD FAC.	70,000									70,000
Quad City	80	PARTS STORAGE	15,000									15,000
Quad City	80	PARKING FACILITY	15,000									15,000
Quad City	80			PARKING AREA	120,000							120,000
Quad City	80	SERVICING FACIL.	10,000									10,000
SUB-TOTAL			160,000		120,000		0		0		0	280,000

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECT	COST	EXPANSION PROJECT	COST	REPLACEMENT PROJECT	COST	NEW PROJECT	COST	OTHER PROJECT	COST	TOTAL COST
Champaign-Urban Transit												
801 E. University	70					MAINT. FACILITY	1,000,000					1,000,000
801 E. University	70					PARTS STORAGE	1,000,000					1,000,000
801 E. University	70			PARKING FACILITY	500,000							500,000
801 E. University	70					SERVICING FACIL.	1,500,000					1,500,000
SUB-TOTAL			0		500,000		3,500,000		0		0	4,000,000

LOCATION		REHABILITATION COST	EXPANSION COST	REPLACEMENT COST	NEW COST	OTHER COST	TOTAL COST
STATE: IL TOTALS		81,710,000	7,620,000	9,000,000	148,500,000	0	246,830,000

STATE: IN

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECT	COST	EXPANSION PROJECT	COST	REPLACEMENT PROJECT	COST	NEW PROJECT	COST	OTHER PROJECT	COST	TOTAL COST
Gary Public Transit												
W 35th	46	MAINT. FACILITY	255,000									255,000
SUB-TOTAL			255,000		0		0		0		0	255,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Greater Lafayette Transit												
Layafette	52	MAINT. FACILITY	375,000									375,000
Layafette	52			PARTS STORAGE	375,000							375,000
Layafette	52			SERVICING FACIL.	750,000							750,000
SUB-TOTAL			375,000		1,125,000		0		0		0	1,500,000
South Bend Public Transit												
Northside Blvd	61	PARKING FACILITY	40,000									40,000
SUB-TOTAL			40,000		0		0		0		0	40,000
STATE: IN TOTALS			670,000		1,125,000		0		0		0	1,795,000
STATE: KS												
Johnson County Transit												
Lenexa	38	MAINT. FACILITY	10,000									10,000
Lenexa	38	PARKING AREA	1,500									1,500
SUB-TOTAL			11,500		0		0		0		0	11,500
Wichita Metro Transit												
McClean Blvd	56							MAINT. FACILITY	5,000,000			5,000,000
SUB-TOTAL			0		0		0		5,000,000		0	5,000,000
STATE: KS TOTALS			11,500		0		0		5,000,000		0	5,011,500
STATE: KY												
TANK												
Madison Pike	104	SHOP/REBUILD FAC.	10,000									10,000
SUB-TOTAL			10,000		0		0		0		0	10,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Lexington Transit												
Lexington	44	SERVICING FACIL.	60,000									60,000
SUB-TOTAL			60,000		0		0		0		0	60,000
STATE: KY TOTALS			70,000		0		0		0		0	70,000
STATE: LA												
Capitol Transportation												
Baton Rouge	55							MAINT. FACILITY	5,466,940			5,466,940
SUB-TOTAL			0		0		0		5,466,940		0	5,466,940
Regional Transit												
Iberville Street	0					MAINT. FACILITY	24,000,000					24,000,000
N. Dupre	0							SHOP/REBUILD FAC.	7,000,000			7,000,000
SUB-TOTAL			0		0		24,000,000		7,000,000		0	31,000,000
Shreveport Transit System												
Shreveport	44			MAINT. FACILITY								0
Shreveport	44									COST OF EXPANS. UN		0
SUB-TOTAL			0		0		0		0		0	0
STATE: LA TOTALS			0		0		24,000,000		12,466,940		0	36,466,940
STATE: MA												
Massachusetts Bay Trans.												
Bartlett Street	160					MAINT. FACILITY	21,000,000					21,000,000
SUB-TOTAL			0		0		21,000,000		0		0	21,000,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Brockton Area Transit												
Main Street	90	PARKING AREA	25,000									25,000
Main Street	90									UST	250,000	250,000
SUB-TOTAL			25,000		0		0		0		250,000	275,000
Merrimack Valley RTA												
Haverhill	45	MAINT. FACILITY	3,500,000									3,500,000
SUB-TOTAL			3,500,000		0		0		0		0	3,500,000
New Bedford SERTA												
New Bedford	50					MAINT. FACILITY	10,000,000					10,000,000
New Bedford	50									COMB. N BEDFORD&FA		0
Fall River	50					MAINT. FACILITY						0
Fall River	50									COMB. N BEDFORD&FA		0
SUB-TOTAL			0		0		10,000,000		0		0	10,000,000
STATE: MA TOTALS			3,525,000		0		31,000,000		0		250,000	34,775,000

STATE: MD

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Mass Transit Admin.												
Northwest	230	MAINT. FACILITY	280,000									280,000
Northwest	230									LNG FUEL STATION&S	800,000	800,000
Eastern	160	MAINT. FACILITY	305,000									305,000
Eastern	160									SECURITY SYSTEM	100,000	100,000
Kirk	200	MAINT. FACILITY	305,000									305,000
Kirk	200									SECURITY SYSTEM	100,000	100,000
Bush	281	MAINT. FACILITY	280,000									280,000
Bush	281									SECURITY SYSTEM	100,000	100,000
Washington Blvd	0	SHOP/REBUILD FAC.	25,000									25,000
Washington Blvd	0	PARTS STORAGE	325,000									325,000
Washington Blvd	0									WATER PIPE REPL./S	2,600,000	2,600,000
SUB-TOTAL			1,520,000		0		0		0		3,700,000	5,220,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
Montgomery County Ride-On												
Gaithersburg	100			PARKING FACILITY								0
Gaithersburg	100									COST UNKNOWN-IN PL		0
SUB-TOTAL			0		0		0		0		0	0
STATE: MD TOTALS			1,520,000		0		0		0		3,700,000	5,220,000
STATE: MI												
Detroit Dept. of Transit												
Shoemaker garage	192	MAINT. FACILITY	10,385,000									10,385,000
Shoemaker garage	192	PARKING AREA	750,000									750,000
Gilbert garage	178			MAINT. FACILITY	4,445,000							4,445,000
Gilbert garage	178	PARKING FACILITY	1,000,000									1,000,000
Coolidge garage	194	MAINT. FACILITY	4,385,000									4,385,000
Coolidge garage	194	PARKING FACILITY	120,000									120,000
Central Shops	0	SHOP/REBUILD FAC.	3,125,000									3,125,000
Central Shops	0	PARKING AREA	2,000,000									2,000,000
SUB-TOTAL			21,765,000		4,445,000		0		0		0	26,210,000
SMART												
Macomb	105					SERVICING FACIL.	800,000					800,000
Oakland	107			MAINT. FACILITY	2,000,000							2,000,000
Oakland	107					SHOP/REBUILD FAC.	1,500,000					1,500,000
Wayne	114			PARKING FACILITY	1,500,000							1,500,000
SUB-TOTAL			0		3,500,000		2,300,000		0		0	5,800,000
MTA												
Flint	125			PARKING FACILITY	2,700,000							2,700,000
Flint	125			SERVICING FACIL.	500,000							500,000
SUB-TOTAL			0		3,200,000		0		0		0	3,200,000
Grand Rapids Area Transit												
333 Wealthy	80									UST OVERHAUL	500,000	500,000
SUB-TOTAL			0		0		0		0		500,000	500,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Kalamazoo Dept. of Trans.												
N. Rose	40			MAINT. FACILITY	641,800							641,800
SUB-TOTAL			0		641,800		0		0		0	641,800
Saginaw Transit System												
Rosa M Parks Facility	45					MAINT. FACILITY	500,000					500,000
SUB-TOTAL			0		0		500,000		0		0	500,000
STATE: MI TOTALS			21,765,000		11,786,800		2,800,000		0		500,000	36,851,800
STATE: MO												
Kansas City Area Transit												
18th St	270	MAINT. FACILITY	1,310,000									1,310,000
18th St	270	PARKING AREA	377,000									377,000
SUB-TOTAL			1,687,000		0		0		0		0	1,687,000
Bi-State Development												
Central Facility	0	MAINT. FACILITY	1,850,000									1,850,000
Debaliviere Station	250	MAINT. FACILITY	1,955,000									1,955,000
Brentwood Station	250	MAINT. FACILITY	225,000									225,000
Illionis Station	120	MAINT. FACILITY	250,000									250,000
SUB-TOTAL			4,280,000		0		0		0		0	4,280,000
STATE: MO TOTALS			5,967,000		0		0		0		0	5,967,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
STATE: MS												
Jackson Transit												
Jackson Transit	50							MAINT. FACILITY	750,000			750,000
SUB-TOTAL			0		0		0		750,000		0	750,000
STATE: MS TOTALS			0		0		0		750,000		0	750,000
STATE: NC												
Chapel Hill Transit												
Chapel Hill	56			MAINT. FACILITY	900,000							900,000
SUB-TOTAL			0		900,000		0		0		0	900,000
Charlotte Transit System												
901 N Davidson ST	175			PARKING AREA	1,500,000							1,500,000
SUB-TOTAL			0		1,500,000		0		0		0	1,500,000
Triangle Transit												
no current facility	30							MAINT. FACILITY	2,000,000			2,000,000
SUB-TOTAL			0		0		0		2,000,000		0	2,000,000
Winston-Salem Transit												
N Trade Street	60	MAINT. FACILITY	300,000									300,000
SUB-TOTAL			300,000		0		0		0		0	300,000
STATE: NC TOTALS			300,000		2,400,000		0		2,000,000		0	4,700,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
STATE: NJ												
New Jersey Transit												
Market Street	170	MAINT. FACILITY	32,000,000									32,000,000
Greenville	82	MAINT. FACILITY	22,000,000									22,000,000
Oradell	210	MAINT. FACILITY	33,000,000									33,000,000
Mercer Metro	65					MAINT. FACILITY	26,000,000					26,000,000
Atlantic City	86					MAINT. FACILITY	21,000,000					21,000,000
SUB-TOTAL			87,000,000		0		47,000,000		0		0	134,000,000
STATE: NJ TOTALS			87,000,000		0		47,000,000		0		0	134,000,000
STATE: NM												
Sun Tran of Albuquerque												
Albuquerque	125							MAINT. FACILITY	6,000,000			6,000,000
Albuquerque	125									CNG FUEL STATION	1,800,000	1,800,000
SUB-TOTAL			0		0		0		6,000,000		1,800,000	7,800,000
STATE: NM TOTALS			0		0		0		6,000,000		1,800,000	7,800,000
STATE: NV												
Las Vegas Transit System												
Las Vegas	0									RECIEVE NO FTA/UMT		0
SUB-TOTAL			0		0		0		0		0	0
STATE: NV TOTALS			0		0		0		0		0	0

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
STATE: NY												
Capital District Transit												
Schenectady	43									UST/FACILITY UPGRA	320,000	320,000
Albany	155	MAINT. FACILITY	1,180,000									1,180,000
Troy	65									UST/FACILITY UPGRA	500,000	500,000
SUB-TOTAL			1,180,000		0		0		0		820,000	2,000,000
New York City Transit												
Walnut Depot	214	MAINT. FACILITY	14,700,000									14,700,000
Walnut Depot	214									PAINT BOOTHS	900,000	900,000
146th Street - Bronx	161									WASTE WATER SEPERA	900,000	900,000
100th Street	164							MAINT. FACILITY	87,000,000			87,000,000
126th Street Depot	150	PARKING AREA	6,000,000									6,000,000
126th Street Depot	150									PAINT BOOTHS/WATER	1,950,000	1,950,000
East New York Depot	219	MAINT. FACILITY	16,200,000									16,200,000
Flatbush Depot	197									WASTE WATER SEPERA	900,000	900,000
Fresh Pond depot	193							MAINT. FACILITY	39,200,000			39,200,000
Jackie Gleason Depot	242									WATER SEPER/STOR M	1,260,000	1,260,000
Ulmer Park Depot	197									PAINT BOOTHS/WATER	1,800,000	1,800,000
Jamaica Depot	137							MAINT. FACILITY	95,000,000			95,000,000
Jamaica Depot	137									WASTE WATER SEPERA	1,050,000	1,050,000
Queens Village Depot	196									WASTE WATER SEPER.	2,350,000	2,350,000
Castleton Depot	155									WASTE WATER SEPERA	900,000	900,000
Yukon Depot	262									PAINT BOOTHS/WATER	1,970,000	1,970,000
East New York Base Shop	0							MAINT. FACILITY	116,300,000			116,300,000
East New York Paint Shop	0									PART OF E. NEW YOR		0
Non-Revenue Shop	0									PART OF E. NEW YOR		0
Crosstown Annex	0									PART OF E. NEW YOR		0
9th Ave Unit Shop	0									PART OF E. NEW YOR		0
SUB-TOTAL			36,900,000		0		0		337,500,000		13,980,000	388,380,000
Niagara Frontier Transit												
Frontier	128	PARKING FACILITY	454,142									454,142
SUB-TOTAL			454,142		0		0		0		0	454,142
County of Rockland Dept.												
Shortline	0									RECEIVE NO SEC 9/1		0
Rockland Coaches	0									RECIEVE NO FTA/UMT		0
SUB-TOTAL			0		0		0		0		0	0

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
Rochester-Genesse Transit												
E. Main	215	MAINT. FACILITY	2,500,000									2,500,000
SUB-TOTAL			2,500,000		0		0		0		0	2,500,000
Central New York Transit												
Syracuse	180	PARKING AREA	68,750									68,750
Syracuse	180									UST, HVAC, & ROOF	330,650	330,650
SUB-TOTAL			68,750		0		0		0		330,650	399,400
Utica Transit Authority												
Utica	49			MAINT. FACILITY	1,123,584							1,123,584
SUB-TOTAL			0		1,123,584		0		0		0	1,123,584
Westchester Co. Transit												
Saw Mill River Rd	250							MAINT. FACILITY	15,700,000			15,700,000
SUB-TOTAL			0		0		0		15,700,000		0	15,700,000
STATE: NY TOTALS			41,102,892		1,123,584		0		353,200,000		15,130,650	410,557,126
STATE: OH												
Canton Regional Transit												
Gateway Blvd	40	MAINT. FACILITY	60,000									60,000
Gateway Blvd	40									UST MODIFICATIONS	200,000	200,000
SUB-TOTAL			60,000		0		0		0		200,000	260,000
SORTA												
Bond Hill	150	MAINT. FACILITY	800,000									800,000
Bond Hill	150									ALT FUEL CONVERSIO	750,000	750,000
Queensgate	230	MAINT. FACILITY	2,000,000									2,000,000
Queensgate	230									ALT FUEL CONVERSIO	2,000,000	2,000,000
SUB-TOTAL			2,800,000		0		0		0		2,750,000	5,550,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS		EXPANSION PROJECTS		REPLACEMENT PROJECTS		NEW PROJECTS		OTHER PROJECTS		TOTAL COST
		PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	PROJECT	COST	
Greater Cleveland Transit												
NOMBL Garage	40							MAINT. FACILITY	5,000,000			5,000,000
planned new garage	200							MAINT. FACILITY	25,000,000			25,000,000
Hayden	185	MAINT. FACILITY	15,350,000									15,350,000
Woodhill	222	MAINT. FACILITY	13,255,000									13,255,000
Triskett	171	MAINT. FACILITY	15,550,000									15,550,000
SUB-TOTAL			44,155,000		0		0		30,000,000		0	74,155,000
Central Ohio Transit												
Columbus	200	MAINT. FACILITY	1,750,000									1,750,000
Columbus	200	SHOP/REBUILD FAC.	1,750,000									1,750,000
SUB-TOTAL			3,500,000		0		0		0		0	3,500,000
Miami Valley Transit												
600 Longworth Street	184							MAINT. FACILITY	3,075,000			3,075,000
SUB-TOTAL			0		0		0		3,075,000		0	3,075,000
Toledo Area Transit												
W Central	220	MAINT. FACILITY	250,000									250,000
W Central	220	SERVICING FACIL.	400,000									400,000
SUB-TOTAL			650,000		0		0		0		0	650,000
Western Reserve Transit												
Youngtown	55	MAINT. FACILITY	1,200,000									1,200,000
SUB-TOTAL			1,200,000		0		0		0		0	1,200,000
STATE: OH TOTALS			52,365,000		0		0		33,075,000		2,950,000	88,390,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
STATE: OK												
Central Oklahoma Transit												
E. California	75					MAINT. FACILITY	8,000,000					8,000,000
SUB-TOTAL			0		0		8,000,000		0		0	8,000,000
STATE: OK TOTALS			0		0		8,000,000		0		0	8,000,000
STATE: OR												
Lane Transit District												
17th Av	112			PARTS STORAGE	150,000							150,000
17th Av	112			PARKING AREA	70,000							70,000
SUB-TOTAL			0		220,000		0		0		0	220,000
Tri-County Metro												
Powell	156					MAINT. FACILITY	446,000					446,000
Merlo	167					MAINT. FACILITY	310,000					310,000
Center	203					MAINT. FACILITY	1,400,000					1,400,000
new facility	0							MAINT. FACILITY	25,000,000			25,000,000
SUB-TOTAL			0		0		2,156,000		25,000,000		0	27,156,000
STATE: OR TOTALS			0		220,000		2,156,000		25,000,000		0	27,376,000
STATE: PA												
Lehigh & Northampton												
Easton Operating Garage	15			MAINT. FACILITY	500,000							500,000
Allentown Garage	45	MAINT. FACILITY	250,000									250,000
SUB-TOTAL			250,000		500,000		0		0		0	750,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
Erie Metro Transit												
14th St	62	MAINT. FACILITY	40,000									40,000
14th St	62	SHOP/REBUILD FAC.	40,000									40,000
14th St	62	PARKING AREA	60,000									60,000
14th St	62	SERVICING FACIL.	160,000									160,000
SUB-TOTAL			300,000		0		0		0		0	300,000
Transit Authority												
Cameron St	71	MAINT. FACILITY	150,000									150,000
Cameron St	71	PARKING FACILITY	300,000									300,000
Cameron St	71	PARKING AREA	300,000									300,000
Cameron St	71					SERVICING FACIL.	100,000					100,000
SUB-TOTAL			750,000		0		100,000		0		0	850,000
Red Rose Transit												
Lancaster	41	PARKING FACILITY	100,000									100,000
SUB-TOTAL			100,000		0		0		0		0	100,000
SEPTA												
Wyoming Ave	999			SHOP/REBUILD FAC.	15,000,000							15,000,000
Callowhill	240					MAINT. FACILITY	25,000,000					25,000,000
Callowhill	240					PARTS STORAGE	1,000,000					1,000,000
Callowhill	240					PARKING FACILITY	10,000,000					10,000,000
Callowhill	240					SERVICING FACIL.	4,000,000					4,000,000
Luzerne	260							MAINT. FACILITY	50,000,000			50,000,000
Frontier	70			MAINT. FACILITY								0
Frontier	70									CAPITAL COSTS UNKN		0
SUB-TOTAL			0		15,000,000		40,000,000		50,000,000		0	105,000,000
Port Authority Transit												
West Mifflin	211	MAINT. FACILITY	13,700,000									13,700,000
Ross Division	158	MAINT. FACILITY	14,100,000									14,100,000
Collier Division	173	MAINT. FACILITY	9,400,000									9,400,000
Harmer Division	150	MAINT. FACILITY	10,700,000									10,700,000
Manchester Shops	921	SHOP/REBUILD FAC.	9,200,000									9,200,000
SUB-TOTAL			57,100,000		0		0		0		0	57,100,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
Berks Area Reading Transp												
11th Street	79	MAINT. FACILITY	100,000									100,000
SUB-TOTAL			100,000		0		0		0		0	100,000
COLTS												
North South Rd	37									UST/FACILITY UPGRA	475,000	475,000
SUB-TOTAL			0		0		0		0		475,000	475,000
STATE: PA TOTALS			58,600,000		15,500,000		40,100,000		50,000,000		475,000	164,675,000
STATE: PR												
Metropolitan Bus Auth.												
Hato Rey	218	MAINT. FACILITY	1,500,000									1,500,000
Hato Rey	218	PARKING AREA	2,000,000									2,000,000
SUB-TOTAL			3,500,000		0		0		0		0	3,500,000
STATE: PR TOTALS			3,500,000		0		0		0		0	3,500,000
STATE: RI												
Rhode Island Public Trans												
Newport garage	40							MAINT. FACILITY	4,500,000			4,500,000
Elmwood Av bus storage	200					PARKING FACILITY	6,000,000					6,000,000
Emlwood Av maintenance	200					MAINT. FACILITY	14,000,000					14,000,000
SUB-TOTAL			0		0		20,000,000		4,500,000		0	24,500,000
STATE: RI TOTALS			0		0		20,000,000		4,500,000		0	24,500,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
STATE: TN												
Chattanooga Area Transit												
Wilcox Blvd	57							PARKING FACILITY	125,000			125,000
Wilcox Blvd	57							SERVICING FACIL.	125,000			125,000
SUB-TOTAL			0		0		0		250,000		0	250,000
Memphis Area Transit												
Watkins St	300	MAINT. FACILITY	2,000,000									2,000,000
SUB-TOTAL			2,000,000		0		0		0		0	2,000,000
STATE: TN TOTALS			2,000,000		0		0		250,000		0	2,250,000
STATE: TX												
Capital Metro												
5th St	300	MAINT. FACILITY	1,200,000									1,200,000
SUB-TOTAL			1,200,000		0		0		0		0	1,200,000
Corpus Christi Transit												
Bear Lane	60	MAINT. FACILITY	250,000									250,000
Bear Lane	60	SHOP/REBUILD FAC.	250,000									250,000
Bear Lane	60	PARKING FACILITY	500,000									500,000
Bear Lane	60	PARKING AREA	200,000									200,000
Bear Lane	60	SERVICING FACIL.	200,000									200,000
Bear Lane	60									ALT FUEL FACILITY	1,000,000	1,000,000
SUB-TOTAL			1,400,000		0		0		0		1,000,000	2,400,000
Dallas Area Rapid Transit												
East Grand	119							MAINT. FACILITY	30,000,000			30,000,000
Oak Cliff	136							MAINT. FACILITY	30,000,000			30,000,000
SUB-TOTAL			0		0		0		60,000,000		0	60,000,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
El Paso Mass Transit Dept												
700 San Francisco	152									CNG/LNG FUEL FACIL	600,000	600,000
SUB-TOTAL			0		0		0		0		600,000	600,000
Fort Worth Transit												
Pine Street	100							MAINT. FACILITY	11,000,000			11,000,000
SUB-TOTAL			0		0		0		11,000,000		0	11,000,000
Metro Transit												
Buffalo Bayou	228							MAINT. FACILITY	3,700,000			3,700,000
Buffalo Bayou	228							PARKING AREA	3,000,000			3,000,000
Buffalo Bayou	228							SERVICING FACIL.	1,300,000			1,300,000
Buffalo Bayou	228									LNG STORAGE & DISP	200,000	200,000
Field Service Center	0			MAINT. FACILITY	100,000							100,000
Field Service Center	0			PARTS STORAGE	50,000							50,000
Field Service Center	0			PARKING AREA	120,000							120,000
Field Service Center	0			SERVICING FACIL.	400,000							400,000
Field Service Center	0									ALT FUEL VEH MAINT	500,000	500,000
Northwest	280			MAINT. FACILITY	800,000							800,000
Northwest	280			PARTS STORAGE	100,000							100,000
Northwest	280			PARKING AREA	200,000							200,000
Northwest	280			SERVICING FACIL.	700,000							700,000
Northwest	280									ALT FUEL VEH MAINT	2,500,000	2,500,000
West	250			MAINT. FACILITY	200,000							200,000
West	250			SERVICING FACIL.	100,000							100,000
West	250									ALT FUEL VEH MAINT	2,500,000	2,500,000
Hiram Clarke	250			MAINT. FACILITY	400,000							400,000
Hiram Clarke	250			SERVICING FACIL.	300,000							300,000
Hiram Clarke	250									ALT FUEL VEH MAINT	2,200,000	2,200,000
Polk Street	250			MAINT. FACILITY	500,000							500,000
Polk Street	250			PARKING AREA	2,000,000							2,000,000
Polk Street	250			SERVICING FACIL.	600,000							600,000
Polk Street	250									ALT FUEL VEH MAINT	1,800,000	1,800,000
Kashmere	180			MAINT. FACILITY	700,000							700,000
Kashmere	180			SHOP/REBUILD FAC.	200,000							200,000
Kashmere	180			PARTS STORAGE	40,000							40,000
Kashmere	180			SERVICING FACIL.	600,000							600,000
Kashmere	180									ALT FUEL VEH MAINT	1,800,000	1,800,000
New Facility	250							MAINT. FACILITY	8,000,000			8,000,000
New Facility	250							PARTS STORAGE	400,000			400,000
New Facility	250							PARKING AREA	8,000,000			8,000,000
New Facility	250							SERVICING FACIL.	3,500,000			3,500,000
New Facility	250									LNG FUEL	200,000	200,000
SUB-TOTAL			0		8,110,000		0		27,900,000		11,700,000	47,710,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	← REHABILITATION PROJECTS → PROJECT	COST	← EXPANSION PROJECTS → PROJECT	COST	← REPLACEMENT PROJECTS → PROJECT	COST	← NEW PROJECTS → PROJECT	COST	← OTHER PROJECTS → PROJECT	COST	TOTAL COST
City Transit Mgt Company												
Texas Ave	44	PARTS STORAGE	100,000									100,000
Texas Ave	44					PARKING AREA	700,000					700,000
Texas Ave	44							SERVICING FACIL.	700,000			700,000
SUB-TOTAL			100,000		0		700,000		700,000		0	1,500,000
VIA Metropolitan Transit												
1720 N Flores	531	MAINT. FACILITY	1,200,000									1,200,000
1720 N Flores	531			PARKING FACILITY	2,100,000							2,100,000
1720 N Flores	531									ALT FUEL	15,500,000	15,500,000
SUB-TOTAL			1,200,000		2,100,000		0		0		15,500,000	18,800,000
STATE: TX TOTALS			3,900,000		10,210,000		700,000		99,600,000		28,800,000	143,210,000
STATE: UT												
Utah Transit Authority												
700 West - new	200							MAINT. FACILITY	8,000,000			8,000,000
SUB-TOTAL			0		0		0		8,000,000		0	8,000,000
STATE: UT TOTALS			0		0		0		8,000,000		0	8,000,000
STATE: VA												
Tidewater Transit												
same	169							PARKING FACILITY	350,000			350,000
SUB-TOTAL			0		0		0		350,000		0	350,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	REHABILITATION PROJECTS: COST	EXPANSION PROJECTS: PROJECT	EXPANSION PROJECTS: COST	REPLACEMENT PROJECTS: PROJECT	REPLACEMENT PROJECTS: COST	NEW PROJECTS: PROJECT	NEW PROJECTS: COST	OTHER PROJECTS: PROJECT	OTHER PROJECTS: COST	TOTAL COST
Greater Richmond Transit												
Richmond	202	MAINT. FACILITY	1,200,000									1,200,000
Richmond	202	PARTS STORAGE	60,000									60,000
Richmond	202	SERVICING FACIL.	100,000									100,000
SUB-TOTAL			1,360,000		0		0		0		0	1,360,000
STATE: VA TOTALS			1,360,000		0		0		350,000		0	1,710,000
STATE: WA												
Kitsap Transit												
S Wycoff	140			MAINT. FACILITY	1,000,000							1,000,000
North & South	0							PARKING AREA	2,000,000			2,000,000
North & South	0							SERVICING FACIL.	2,000,000			2,000,000
SUB-TOTAL			0		1,000,000		0		4,000,000		0	5,000,000
Everett Transit												
Cedar St	33			MAINT. FACILITY	180,000							180,000
Cedar St	33			PARTS STORAGE	25,000							25,000
Cedar St	33			PARKING FACILITY	350,000							350,000
SUB-TOTAL			0		555,000		0		0		0	555,000
Intercity Transit												
Olympia	64			MAINT. FACILITY	5,000,000							5,000,000
SUB-TOTAL			0		5,000,000		0		0		0	5,000,000
Ben Franklin Transit												
Ben Franklin Transit	76			PARKING AREA	82,000							82,000
SUB-TOTAL			0		82,000		0		0		0	82,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
Spokane Transit												
S. Bowdish	18			SERVICING FACIL.	6,250							6,250
1230 W Boone	100			SERVICING FACIL.	89,812							89,812
1229 W. Boone	126	MAINT. FACILITY	267,500									267,500
SUB-TOTAL			267,500		96,062		0		0		0	363,562
Pierce Cty Public Transit												
96th St	180							MAINT. FACILITY	500,000			500,000
96th St	180			SHOP/REBUILD FAC.	250,000							250,000
SUB-TOTAL			0		250,000		0		500,000		0	750,000
Clark Cty Public Transit												
Vancouver	103			MAINT. FACILITY	1,500,000							1,500,000
Vancouver	103			PARKING AREA	1,000,000							1,000,000
SUB-TOTAL			0		2,500,000		0		0		0	2,500,000
STATE: WA TOTALS			267,500		9,483,062		0		4,500,000		0	14,250,562
STATE: WI												
Valley Transit												
Whitman Ave	39	SERVICING FACIL.	100,000									100,000
SUB-TOTAL			100,000		0		0		0		0	100,000
Green Bay Transit												
318 S Washington	34	MAINT. FACILITY	240,000									240,000
318 S Washington	34	SERVICING FACIL.	200,000									200,000
SUB-TOTAL			440,000		0		0		0		0	440,000
Kenosha Transit Comm.												
Kenosha	35	MAINT. FACILITY	200,000									200,000
Kenosha	35	PARKING FACILITY	100,000									100,000
Kenosha	35									ALT FUEL & OFFICE	115,000	115,000
SUB-TOTAL			300,000		0		0		0		115,000	415,000

FTA BUS MAINTENANCE FACILITY DATA ANALYSIS

LOCATION	MAX. BUS CAP.	REHABILITATION PROJECTS: PROJECT	COST	EXPANSION PROJECTS: PROJECT	COST	REPLACEMENT PROJECTS: PROJECT	COST	NEW PROJECTS: PROJECT	COST	OTHER PROJECTS: PROJECT	COST	TOTAL COST
Madison Metro Transit												
E Washington Ave	184	MAINT. FACILITY	273,000									273,000
E Washington Ave	184	PARKING FACILITY	600,000									600,000
SUB-TOTAL			873,000		0		0		0		0	873,000
Belle Urban System												
Washington Av	42									UST REPLACEMENT	80,000	80,000
SUB-TOTAL			0		0		0		0		80,000	80,000
Sheboygan Transit System												
S. Commerce	33	MAINT. FACILITY	201,250									201,250
S. Commerce	33	PARKING AREA	5,000									5,000
S. Commerce	33	SERVICING FACIL.	2,800									2,800
SUB-TOTAL			209,050		0		0		0		0	209,050
STATE: WI TOTALS			1,922,050		0		0		0		195,000	2,117,050
STATE: WV												
Kanawha Valley Transit												
4th Av	64							MAINT. FACILITY	7,000,000			7,000,000
SUB-TOTAL			0		0		0		7,000,000		0	7,000,000
STATE: WV TOTALS			0		0		0		7,000,000		0	7,000,000
GRAND TOTALS			481,276,200		99,375,446		247,936,000		1,170,694,940		103,517,650	2,102,800,236

APPENDIX C
SITE VISIT REPORTS

SITE VISIT REPORT

1. <u>SCRTD's Division 10</u>

SCRTD's (Los Angeles, CA) Division 10 Garage was constructed in 1984 and is one the system's 13 operating garages. The operating garage's site is within a mile of a central overhaul and heavy repair facility. The facility was constructed on property previously owned by the system. This and the fact that the property is bordered by a rail line and several junk yards appears to have created no community acceptance problems. However, in other locations the SCRTD reports that it is difficult to gain community acceptance. This is particularly true of new sites but is also true in regard to previously owned system property. On recent constructions, SCRTD reports that these type problems add minimal cost to the project but they add about a year to the process. In the past the SCRTD has used a process of attempting to select sites that were not heavily developed with residential areas and not to press the issue if it appeared that strong opposition was likely. However, as few non-developed areas are available, future constructions may not be as easy.

The work activities that take place at this location consist of preventive maintenance, normal running repairs, brake relines, transmission replacements, some minimal body work and normal bus servicing. Heavy repairs, such as most body work, engine overhauls, component rebuilds, etc., are sent to the heavy overhaul shop or central maintenance facility. Preventive maintenance schedules are based on a 6,000 mile interval. The fleet is also a very diverse fleet consisting of several major types of buses, different bus lengths (the majority being standard 40 foot buses), and various types of bus engines.

The service island consists of four covered stations and one non-covered bypass lane which could be used to fuel vehicles. Each service lane is equipped with a cyclone cleaner and other fluid dispensing equipment. One drive through washer is used for washing the fleet; this is equipped with a water reclamation system. Fareboxes are emptied at one of two vaults as the buses enter the yard and prior to entering the service island. The buses are parked, uncovered, in rows on the yard between the maintenance and operations building.

A covered area, separate from the garage, has been built for housing the contracted maintenance of the tires for the revenue and non-revenue fleet.

At the time of the site visit, the shop had all the work bays occupied with work. Air conditioning systems on four buses were being repaired outside and approximately six additional buses were awaiting repairs. This amounted to approximately 68 percent of the spare fleet. The facility also allowed for approximately 11 percent of the peak bus fleet to be in maintenance at any one time or 51 percent of the spare fleet. With almost one and one half mechanics per bay during the peak work period, space is at a premium.

This facility was designed to support a mixture of 250 standard sized and articulated buses, but is now supporting more than this number and many of the vehicles are the longer articulated buses. As a result, there is a minor shortage of parking space (particularly for private automobiles) and shop space (air conditioning work had been moved outside). The reason for this expanded bus fleet in a relatively new facility is due to rapidly changing service demands.

In addition to its own bus fleet, Division 10 also receives roadcall repair work from other Divisions operating within Division 10 proximity. Due to the long operating distances of some SCRTD routes, buses from other SCRTD garages are brought to the closest garage when they break down rather than going back to the division where they are housed. This may further complicate the work scheduling and capacity requirements of any one SCRTD garage. However, foreign division buses are replaced with Division 10 buses and exchanged during off-peak periods and after repairs have been made.

In addition to 40 foot buses, the facility also is designed to support 60 foot articulated buses. One hoist and one pit work bay were designed to accommodate these longer buses.

An overview of the site is provided as Exhibit C-1. Noteworthy aspects of the facility and its operation are presented in Exhibit C-2 and as follows:

- Interconnected pits

  The work pits are interconnected by below floor grade work areas. This gives the workers more space to work in, allows for a more readily accessible storage area, and makes it easier to provide the work area with proper ventilation.

- Under chassis bus washer

  Next to the steam cleaner wash area, an area has been equipped for engine compartment and chassis cleaning. This area has one axle lift for raising the rear of the bus, a pressure washer and an automatic mechanism for cleaning the underside of the buses. The automatic mechanism is designed

EXHIBIT C-1
SITE PLAN-SCRTD

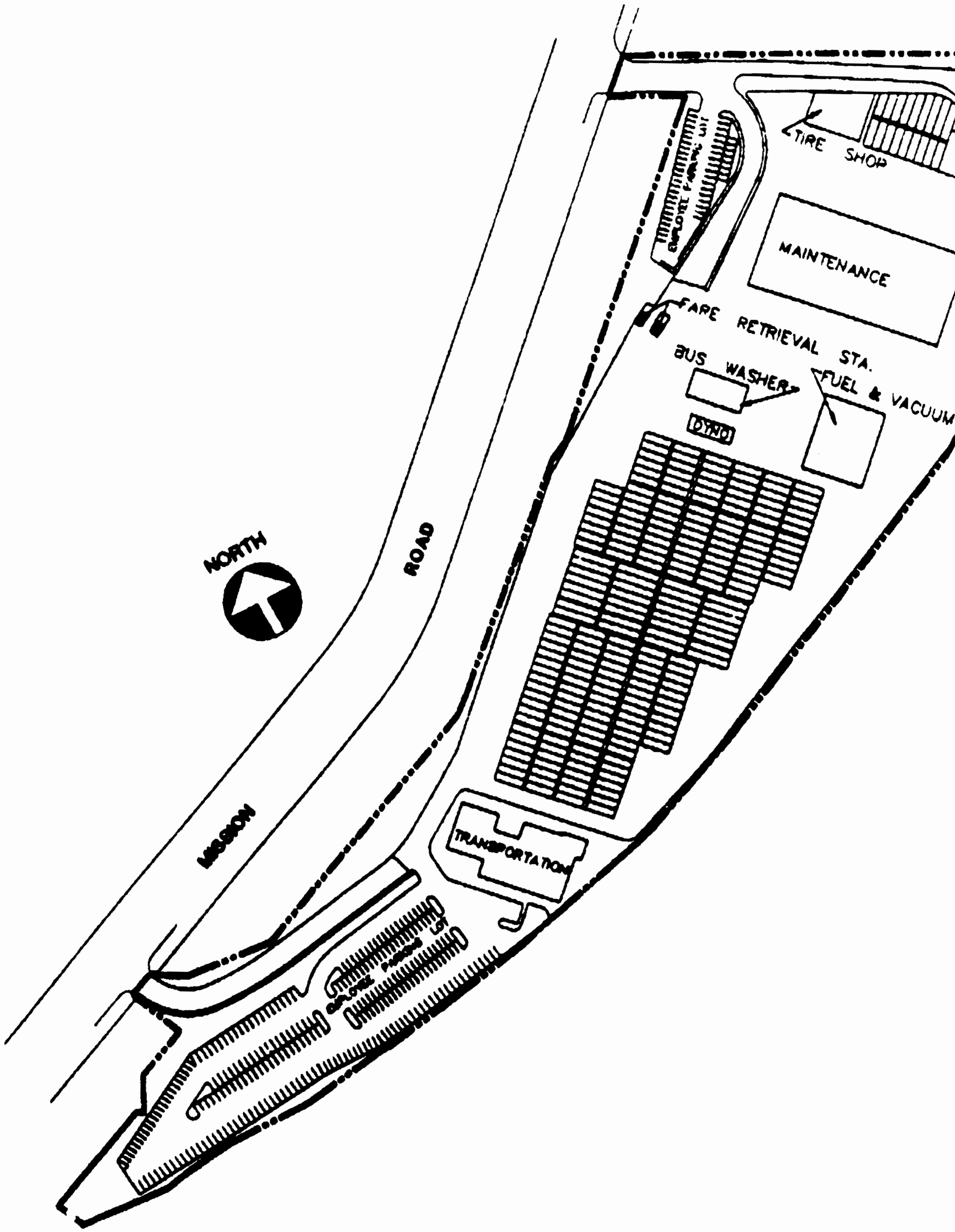


EXHIBIT C-2
MAJOR FACILITY CHARACTERISTICS
SCRTD (LOS ANGELES, CALIFORNIA)
DIVISION 10

Fleet

Assigned Revenue Vehicles:	260 buses
Peak Mass Transit Bus Requirement:	213 buses
Percentage of Spare Buses:	22 percent

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.	5	14		5
Running Repair	1	2		15
Overhaul				2
Other	1		1	2
Total	7	16	1	24

Annual Miles of Operation 10,560,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	38	20	19
Servicer and Cleaning	12	19	13
Total	50	39	32

Miles per Roadcall 6,000±

Maintenance Staff per 1,000 Miles of Operation .015

Buses per Maintenance Staff 2.15

to travel the length of a stationary bus and wash the underside of the bus with high pressure water in order to clean all undercarriage components for inspection purposes. While it is reported that the mechanism cleans particularly well, it is very difficult to keep operational. During the visit it was down for repairs.

- Maximize expansion capacity

  This facility has been designed to support 250 regular sized transit buses, but because of expanded service levels the facility is now supporting more than this number of vehicles. As a result, there is a shortage of parking space, particularly for private automobiles. Requirements for shop space has resulted in some work being done outside the shop. There is also a need for another bus washer for additional capacity and as a backup in case of a failure of the site's one washer.

- Provide more privacy for supervisors

  The shop supervisor's office is a joint office located in a central location at ground level with a reasonably good view of the shop floor. While there are additional offices and a training area on the mezzanine level of the shop, it is reported that a more private area (i.e., less communal) for selected work and counseling would be advantageous.

- Conservation measures

  The SCRTD is actively pursuing various conservation measures, and most of these are in place at the Division 10 facility. Examples include:

- Conservation of energy and water by only washing buses every other night (odd numbered buses are washed one night and the even numbered buses are washed the other night).

- Conservation of water through the use of water reclamation systems on the bus washers.

- Energy conservation by use of solar heating and low energy lighting.

- Use of an on-site oil analysis program, located at the central overhaul facility, which allows the SCRTD to extend engine oil use from 6,000 to 18,000 miles.

- Chassis dynamometers and emission testing at operating garages to assist in keeping engines running at their optimum level.

- Concrete parking lots

  Based on the SCRTD's overall experience with outdoor parking lots, it recommends concrete lots because of improved life cycle cost. The concrete lots cost more initially but last much longer because they do not deteoriate from petroleum products and because they are easier to keep clean.

- Use of masonry or pre-cast concrete

  Based on their experience with rigorous or every day use in transit bus operation and the large number of facilities the SCRTD maintains/operates, masonry or pre-cast concrete construction is viewed as providing better long term value.

- Double walled fuel tanks

  SCRTD recommends the use of double walled fuel tanks. With these types of tanks leaks can be easily detected. Also, since potential leaks are maintained in the area between the inner and outer tank, clean-up becomes much less expensive.

- Fuel piping above ground

  Because most fuel leaks occur in the piping which connects the fuel dispensers to the fuel tanks, SCRTD recommends that this piping be kept above ground and observable to the maximum extent possible. When the piping must be below ground level, SCRTD recommends that it be placed in sealed trenches.

- Accessible hydraulic hoist lines

  Many applications for installation of hydraulic hoist lines are such that the post lifts and the line are buried by concrete. Other, more expensive, approaches minimize this less accessible approach. Based on SCRTD's experience with leaking lines and servicing problems that tend to develop over time, they recommend the more accessible approach.

- Expansion capability or capacity for store rooms

  The complexity and diversity of componentry in individual transit buses continues to grow with each new regulation and technological changes. This and the compounding effect the lack of fleet standardization has on the requirements for inventory stockage, it is very difficult to design a facility that has sufficient storage space over the facility's life. As a result, the SCRTD recommends building bus support facilities with parts space that exceeds current projections or designing the space such that it can be easily expanded.

- Automatic parts storage and retrieval

  While not at the Division 10 garage, the SCRTD reports excellent results from its Automatic Supply Retrieval System located at Divisions 9 and 12. In basic terms, this automated system has two components. One component consists of automated vehicles that transport parts to and from designated work stations based on computer generated requests. This application seems best suited for a central garage function. However, the second component consists of a computerized bin storage system that stores and retrieves parts in high ceiling, multi-leveled bins. At a minimum this system maximizes the floor space and makes the best use of the high ceiling of most garages. As modifications are made to facilities, the SCRTD intends to upgrade other store rooms with the Automatic Supply Retrieval System.

- Low maintenance floors in garage and garage administrative areas

  Because of the normal grime, dirt, etc., associated with bus garages, SCRTD recommends no carpeting and easy clean floor in all garage administrative areas.

- Use of ceramic tile

  Because of low maintenance and cleaning cost, SCRTD recommends ceramic tile in areas such as bath rooms and wash rooms.

- Overhead, color coded utilities

  For ease of trouble shooting and building maintenance, SCRTD recommends that, to the maximum extent possible, all building utilities be installed overhead and be color coded.

- Equip future facilities for natural gas and methanol fleets

  The SCRTD is currently testing several types of "alternatively fueled buses" but no single fuel type appears to be the obvious choice of the future. However, with the mandate toward alternative fueled vehicles in transit bus fleets, SCRTD believes it is prudent to equip facilities for operation of natural gas and methanol type vehicles. This includes detection sensors, explosion proof electrical fixtures, ventilation, etc.

- Use of 2 foot by 4 foot ceiling panels

  SCRTD has found it much less expensive to design ceiling that use 2 foot by 4 foot ceiling panels instead of the 2 foot by 2 foot panels.

- Wall in operating garage lots

  To reduce noise pollution and for security reasons, SCRTD recommends walling in operating garages with 8 foot to 10 foot block walls. In this fashion the operations of the bus facility are less disruptive to the surrounding community.

2. Milwaukee County Transit System's Fond Du Lac Garage

Milwaukee County Transit System (MCTS) in Milwaukee, Wisconsin has three operating bus garages. The Fond du Lac garage is one of these garages and it is 10 years old and its bus storage building is over 30 years old. Exhibit C-3 provides a lot plan for the facility and Exhibit C-4 provides a plan for the garage. It was reported that the local community was supportive of the establishment of the bus garage in this location because it has existed there for many years and because it offers another employer in a poorer neighborhood. The location was also chosen because it is centrally located within the structure of passenger routes served. The central location reduces the number of deadhead miles and is a nominal distance from freeway access. Another factor in the decision making process was the land parcel size. To acquire a parcel large enough to meet its needs would have probably required exercising the "right of eminent domain" (condemning land adjacent to a desired parcel in order to have enough land to meet the needs of the location). MCTS strongly

EXHIBIT C-3
SITE PLAN MCTS

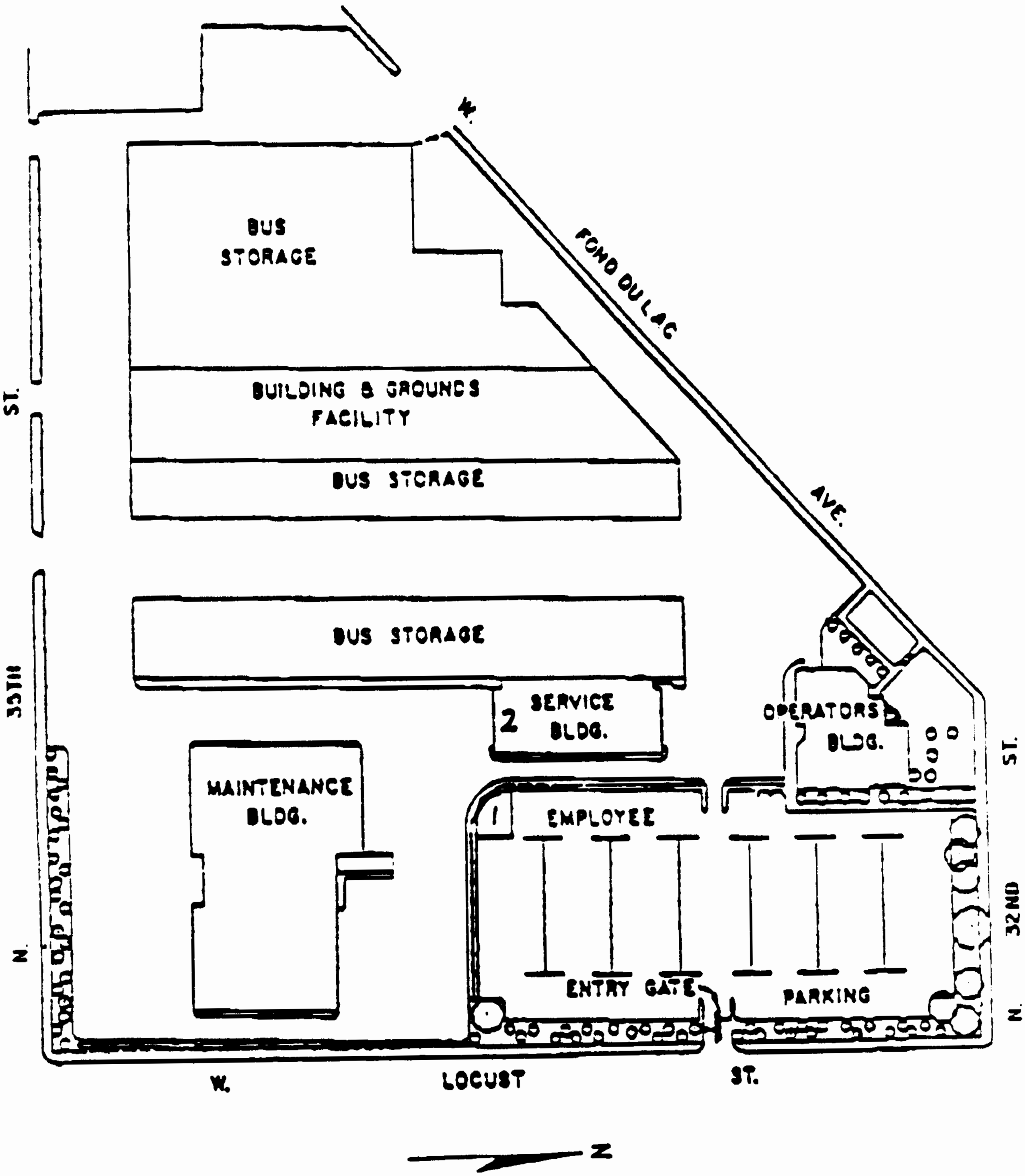
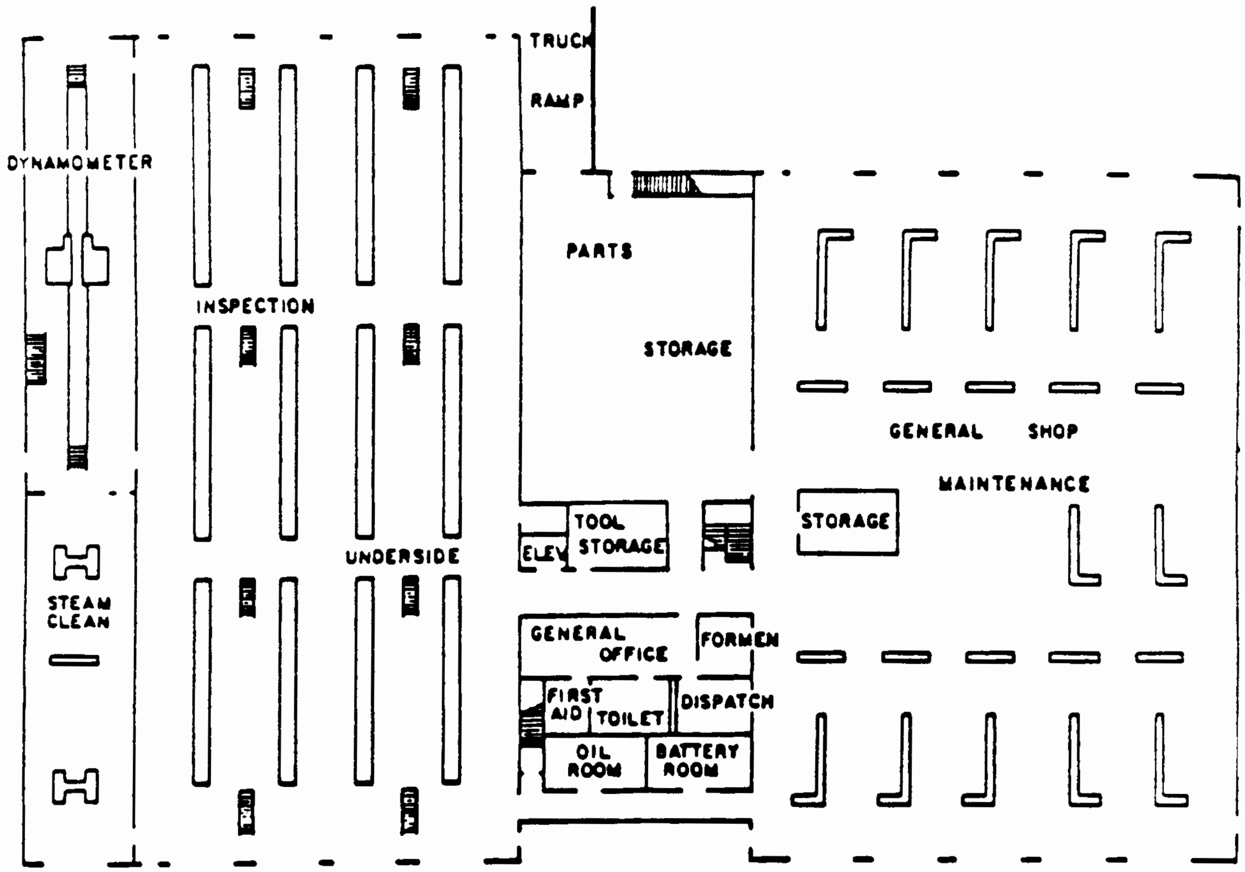


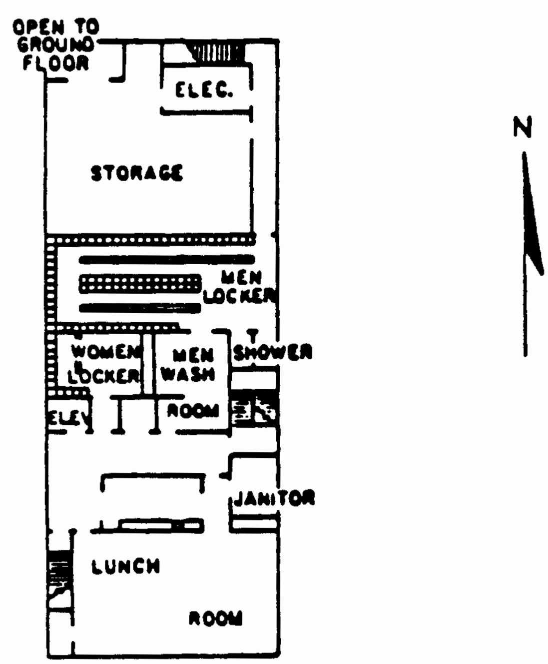
EXHIBIT C-4
GARAGE PLAN

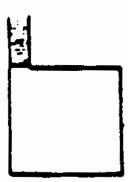
FOND DU LAC
MAINTENANCE BUILDING



FIRST FLOOR

SECOND FLOOR





SECOND FLOOR DYNAMOMETER
ROOM

desired to avoid any such measure in order to maintain good community relations.

The fleet of vehicles supported at this facility consists of 254 buses with a peak commitment of 208. The fleet is quite diverse consisting of nine different fleet types, ten different bus types, seven different engine types, and four different bus lengths. This diversity adds complexity to inventory storage, maintenance programs and facility requirements.

The work activities that take place at this location consist of preventive maintenance, normal running repairs, transmission replacements, minimal body work and normal bus servicing. Heavy repairs such as major body work, engine rebuilds, component rebuilds, break relines, etc. are sent to the heavy overhaul shop.

The service island is a separate structure from the bus maintenance facility. It consists of three service lanes each equipped with fluid dispensing equipment, a cyclone cleaner, and a bus washer with water reclamation system. For accurate tracking of consumables, an automated system is used. The system automatically records the fluids dispensed when the service worker enters the vehicle number of the bus. Buses are then parked indoors in renovated trolley barns on the same site.

The purpose of the water reclamation system is to recycle the bus wash water. It is environmentally sensitive and offers a savings by reducing water usage. However, the system is maintenance intensive. It was also reported that the water in the system quickly became contaminated with road salt during the winter and had to be replaced. The frequent addition of make-up water reduces the water cost savings. A concern was also raised regarding the possibility that the recycled water and its residue might be classed as a hazardous waste. The rationale for this concern was that the concentration of various elements goes up the more the water is recycled and might reach an unacceptable level at some point.

The East end of the garage consists of 12 general repair work bays equipped with lifts. The center of the shop consists of administrative offices, parts storage, and other miscellaneous support functions. Next to this central area there is an interconnected pit area with 12 work bays. Three of these pits are allocated to preventive maintenance inspections which are based on a 5,000 mile interval. The other nine work bays are allocated for running repairs. The west end of the facility houses a dynamometer room and a steam cleaning room.

At the time of the site visit, the majority of the fleet was in peak revenue service and the shop had very little work in progress. Of the 26 available work bays only six were being used and another 16 bad order buses were awaiting various repairs. Both from the size of the fleet supported at the facility and previous records of bus maintenance activities, this appeared to be a unique operational event.

In broader terms there were sufficient work bays to house almost 13 percent of the peak bus commitment or 58 percent of the spare fleet at any one time. There were also a sufficient number of work bays during the peak period to allow a ratio of .7 mechanics to individual work bays.

Noteworthy aspects of the facility and its operation are presented in Exhibit C-5 and as follows:

EXHIBIT C-5
MAJOR FACILITY CHARACTERISTICS
MILWAUKEE COUNTY TRANSIT SYSTEM'S
FOND DU LAC GARAGE

Fleet

Assigned Revenue Vehicles:	254 buses
Peak Mass Transit Bus Requirement:	208 buses
Percentage of Spare Buses:	22 percent

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.	3			3
Running Repair	9			9
General Repair		12		12
Overhaul				0
Body Shop				0
Other		1	1	2
Total	12	13	1	26

Annual Miles of Operation 9,083,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	17	14	10
Servicer and Cleaning		1	17
Total	17	15	27

Miles per Roadcall 2,400 - 3,600

Maintenance Staff per 1,000 Miles of Operation .0065

Buses per Maintenance Staff 4.3

- Pit lighting problems

  The lighting in the pit consists of florescent lights within an enclosed protective box. Because of the amount of water run off that falls from the buses onto these lights, MCTS has experienced problems with the boxes rusting out and with the ballasts failing.

- Chassis Dynamometers

  Many transit properties have dynamometers for testing various components and in some cases a transit property will have an entire work bay devoted to a chassis dynamomoter. The purpose of the chassis dynamometer is to simulate driving loads of a bus under controlled conditions. This allows for better diagnostics of engine, transmission and brake system problems.

  MCTS was not using the dynamometer at the time of the on-site visit, but was using this work bay for air conditioning repairs. The dynamometer had been used, at the garage level, principally for hot engine diagnostic problems. Due to the constant dynamometer training cost (training different mechanics because of frequent job pick) and the cost of maintaining the dynamometer, the benefits were not felt to be worth the cost of keeping the dynamometer in operation. The central garage still maintains a chassis dynamometer for testing troublesome buses, and the employees at this location have less frequent job changes.

- Central core administrative area

  As previously mentioned, the facility has a central core area that houses the parts room, administrative offices, and other support functions. MCTS reports very favorable results from such an arrangement (i.e., reduced travel time from work bays to such areas, better supervision, etc.)

- Isolate pump rooms

  A garage requires several pumps, such as air compressors, grease pumps, coolant pumps, etc. Because these generate a great deal of noise, they should be isolated from other work areas as much as possible.

- Shortage of parts space

  Because of the diversity of bus types and bus equipment that the facility now has to deal with, there is a shortage of parts storage space. Compounding this problem is the fact that many shippers now drop ship bulk orders directly to operating garages as well as to central parts storage. This reduces the handling required at a transit system's central parts room but adds additional parts storage requirements for the operating garages. To make room for this additional storage, the facility has moved the tire storage outside.

- Open parts room

  The parts room at the Fond du Lac garage is open for the mechanics to get the parts they need. There is a day shift disburser who orders and disburses parts but on other shifts the mechanics record the parts they use onto a computer generated card. In such operations, the cost savings from not having to staff the parts windows and the lost production from mechanics waiting for parts is felt to be more than worth any additional parts shrinkage.

With the exception of large components, MCTS expenses parts as they arrive at the operating garage and thus avoid the administrative effort of tracking parts to individual vehicles. However, except for written descriptions of the repair activity, there is no history of which parts were used on which buses.

- Separation of drivers from mechanics

  The Fond du Lac garage is configured so that there is limited opportunity for the operations and maintenance staff to interface during a normal day's work. However, at other MCTS garages the reverse is true. Given a choice between the two approaches, MCTS feels that more integration of the two work forces adds to the overall performance of the operation due to a sharing of information.

- Interior bus circulation

  Bus washing has to be suspended at the Fond du Lac garage during sub-zero weather or the buses and yards become covered with a sheet of ice. It would be possible to avoid this problem if the bus washers, the bus parking, and the circulation area were all under one roof. As it currently exists, the bus parking and washer area are under roof, but the buses must use the normal yard to travel from one building to the other. Interior bus circulation would also greatly reduce energy costs of heating the bus parking area as buses leave and enter as they are serviced. However, the ventilation, capital and maintenance cost and a facility design exceed the current fiscal capabilities of MCTS.

- Optimum bus garage size

  Based on its experience, MCTS feels that a bus support facility of 185 buses is the optimum size. This allows better maintenance attention to individual vehicles, limits deadhead miles (more dispersion into community) and still contains some economy of scale.

- Consolidation of efforts with local agencies

  As a result of the recent changes in fuel tank regulations, MCTS had to devise a plan for upgrading its fuel tanks. Rather than develop its own expertise for the one-time problem or hiring its own consultants, MCTS joined with the county to hire a consulting firm. The results of this one consortium effort were so favorable, MCTS is considering other ways and other agencies where consortium efforts might be practical.

- Increased cost due to ADA

  MCTS reports an estimated increase of over seven cents per mile to maintain a wheelchair lift-equipped transit bus. This figure includes the cost for PM inspection and maintenance but do not include major overhaul or capital cost. These costs do not include paratransit cost because these services are contracted.

- Lack of transit oriented architects

  Because most construction jobs go to local or regional firms and these firms have limited experience with transit, most facility design/construction shows this lack of transit familiarity. As a result, small things such as exhaust, heating and air conditioning, air movement, etc., are often inadequate.

- Possible use of butler type buildings

  Many of the parameters that affect the fleet size and equipment needs for a bus support facility can change over time. Examples include service levels, population density, vehicle types, and fuel types. As a result, facility configuration and size requirements may change. One option that MCTS recommends for consideration is a less expensive building design such as a butler building.

- Equal mix of pits and hoist in shops

  Based on the current fleet mix, MCTS recommends an equal mix of pit and lift-equipped work bays. The pits are better for quick pull-on, pull-off work, while the lifts are better for most other work.

- Re-evaluate pits

  In light of alternative fuel use and other regulation changes, MCTS feels that it is advisable to re-evaluate the use, design, and equipping of pits.

- No guard rail on pits

  Most pits have small guard rails of some type to help guide buses entering or leaving the pits to prevent the bus from driving into the pit. MCTS had no guard rails. One reason for not having such guard rails is that they limit full access to the underside of a bus. MCTS did not feel the guard rails were necessary because the pits could be accessed from the outside in a relatively straight line and the pits were of a pull-on and drive-off design, and the likelihood of an accident appeared remote (i.e., no more than the chance of a bus falling off a post lift).

- Site constraints drive facility design

  MCTS pointed out that site constraints often drive many aspects of a facility design. Specifically, having work bays which are unaccessible except through other work bays creates some inefficiencies. However, due to the site layout, the best way of obtaining the desired number of work bays at the Fond du Lac garage was to place some of the work bays in just such an arrangement.

- Ineffective air exchangers

  The Fond du Lac garage has used an air exchange system for removing particulates from the parking garage. However, the system is expensive to maintain. The fans and filters are the principal expense.

- Higher roofs in bus parking areas

  It is common to reduce the height of the ceiling in bus parking garages to as low a height as possible. This reduces construction cost and heating cost. However, it makes it extremely difficult to move air in sufficient volume to create an acceptable environment during pull outs. Careful consideration should be give to the air movement issue in any bus parking garage design.

- Problems with non-fully recessed front post hoist

  These older style lifts, that were needed when this garage was remodeled, did not allow the lifting plate to recess onto the floor when the lift was fully lowered. Newer style lifts, currently utilized at other MCTS locations, have a front lifting plate that fully recesses into the floor and thus eliminates the possibility of the bus striking the lift.

- Favor double post rear axle lifts

  MCTS reports that it has seen much better results from its dual post rear axle lifts than it has from its single post rear axle lifts. It appears that the double post lifts add more stability and as a result the posts do not have to be replaced as often due to wear. The double post lifts do not allow as much access to the axle area, but this is considered a minor inconvenience.

- Increased tool box storage area

  The size of mechanic tool boxes has increased dramatically over the past few years. This is partially a result of a more specialized tool requirement, more power tools and the availability of larger tool boxes. The end result is that increased shop space is needed to secure these boxes when not in use.

- Non-slip floor surfaces

  At one time many garages were using floor sealers to make shop floors easier to clean. However, this made the floors slippery and resulted in accidents and injuries. MCTS and other operations are now more concerned with non-slip surfaces which are textured, grooved or etched.

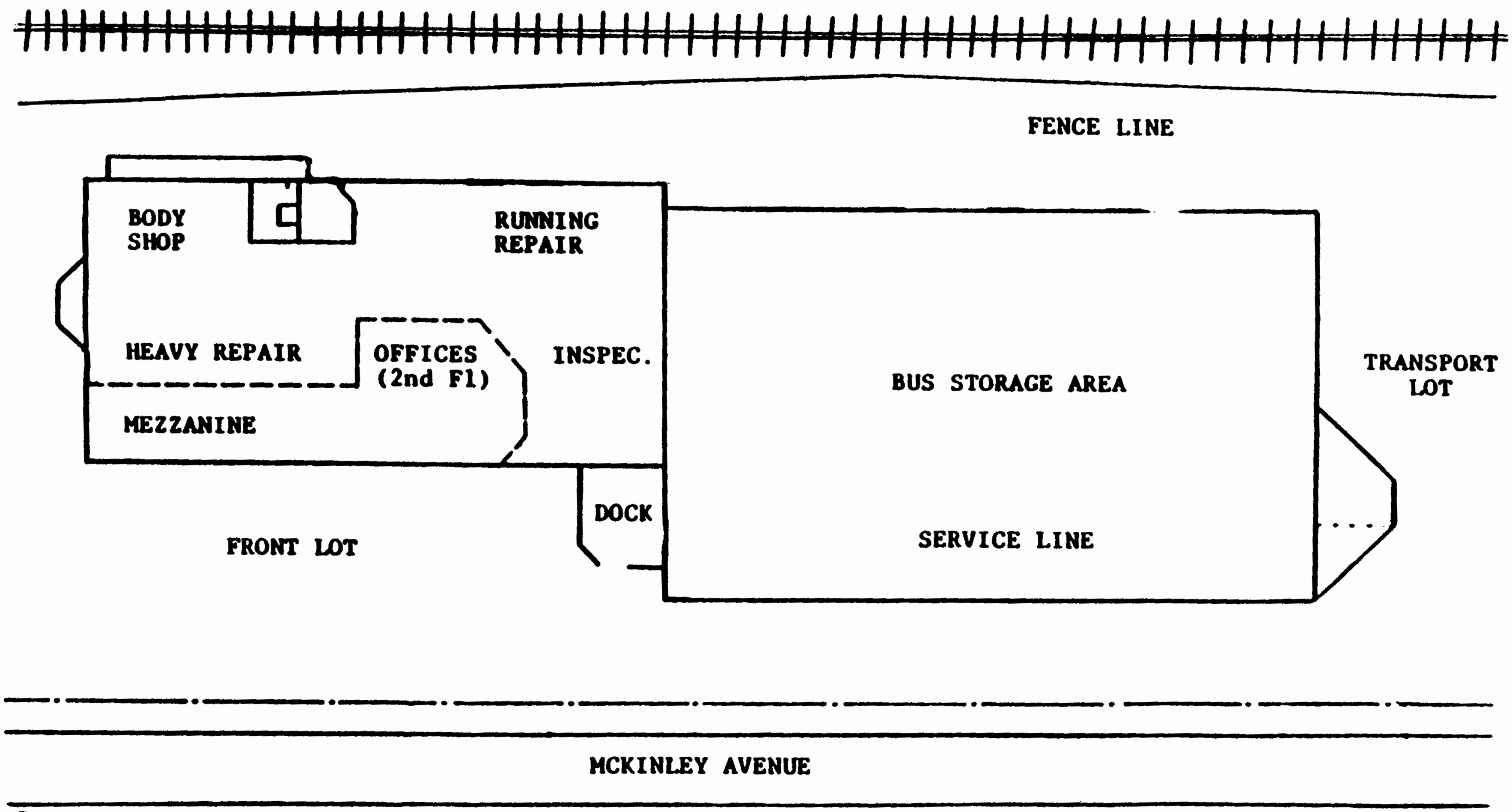
- Exceed minimum building codes

  Most architects design most aspects of a building (i.e, ventilation, battery room exhaust, electrical capacity, etc.) to the minimum requirements. However, in heavy duty applications, such as a transit garage, these are often found to be inadequate. Over time, capacity often has to be increased at considerably more expense.

3. <u>Central Ohio Transit Authority's McKinley Facility</u>

Central Ohio Transit Authority (COTA) is located in Columbus, Ohio. The McKinley facility is a relatively new facility, built in 1980, which supports the operation by providing an operating garage and a central overhaul operation. A site plan is included as Exhibit C-6.

EXHIBIT C-6
SITE PLAN



The fleet of vehicles supported at this facility consists of 342 buses with a peak commitment of 260. COTA also uses another satellite garage which does not have a central garage function. The McKinley garage is designed to support over 240 buses; the other garage is built to support over 160.

The physical configuration of the facility is along the lines of a large rectangle with the bus parking, servicing, maintenance, overhaul, administration and general offices all interconnected and under roof.

The bus servicing and parking area is at one extreme of the rectangle. To conserve heat energy in the winter, this area is enclosed under a low roof and heated to a minimal level. The facility has few doors, thus reducing heat loss and door maintenance. One set of doors leads to the maintenance building, and the other is the entrance/exit for the buses. The service area consists of three service islands equipped with fuel pumps, fluid dispensing equipment and bus washers. The service islands are also equipped with cyclone cleaners (for vacuuming the interior of the bus), but these are no longer in use. It was reported that it was difficult to get the employee to use the equipment properly in order to clean the buses. As a result of that and the fact that the fleet is now equipped with cantilevered seats, the buses are swept out nightly. In case of problems, two fueling bypass lanes have been installed along the wall in the circulation area.

COTA currently has one CNG powered bus in operation. However, the bus is not fueled on site and extra precautions are taken when working on the bus, since the work bays are not properly equipped for CNG maintenance.

Moving into the maintenance area from the bus parking area is by way of the door previously mentioned. This door leads into a spacious central isle running the length of the building to the exit doors at the other end. To the right, is a bus chassis wash area with washer and lift. Next is a bus chassis dynamometer room, but use of the dynamometer has been discontinued. The running repair area is next. This consists of six work bays with exit doors so the buses can be driven on and off quickly, and one area for working on articulated buses. One of these bays and the articulated bus area are equipped with drive-on, ramp type lifts (SEFAC electric ramp lifts). The body shop area comes next. The body shop consists of seven work bays, a paint booth, a paint prep area, and a sheet metal/wood shop.

Crossing the central isle from the body shop is the heavy overhaul and rebuild area. There are 13 heavy overhaul work bays that can be accessed by the central isle. Each of these bays is equipped with post hoists. Based on current work loads, COTA reports that one or more additional work bays are needed in this area. Behind the overhaul bays are work tables and the unit rebuild area.

In the center of the shop across from the paint booth area are the shop offices and the parts room. This provides a relatively central location. Beside the store room is the six bay PM inspection work area. Each of these work bays is equipped with a lift.

Outside the facility and behind the back wall is an asphalt area. This area is used for parking buses which are awaiting repairs. The area is also used for an on-site test track area for testing brake applications, etc.

At the time of the site visit the shop had 35 of the 37 available work bays occupied and another eight bad order buses were awaiting various repairs. This means that about 53 percent of the spare fleet was down for repairs.

The facility provides sufficient work bays to house almost 14 percent of the peak bus commitment or 45 percent of the spare fleet at any one time. Because COTA staffs its operation disproportionally high during the day shift and because many of these mechanics are in overhaul, the ratio of mechanics to work bays seems very high at 1.2. However, there appears to be plenty of work bays for the current fleet and staffing.

Noteworthy aspects of the facility and its operation are presented as Exhibit C-7 and as follows:

- Additional door for back-up purposes

  As previously mentioned, to conserve heat and maintenance cost, COTA has limited the number of doors for buses. In hindsight, it feels more doors are needed in cases where doors fail.

- Combined roof and yard run off waters

  Since COTA has few buses on its yard to leak fluids, it has opted to combine both the roof drains (less likely to have pollutants) and the yard drains. These are then dropped into normal storm drains without going through traps or separators. Combined, these two run offs have been testing within an acceptable run off level.

EXHIBIT C-7
MAJOR FACILITY CHARACTERISTICS
CENTRAL OHIO TRANSIT AUTHORITY
(COLUMBUS, OHIO)
MCKINLEY FACILITY

Fleet

Assigned Revenue Vehicles:	342 buses
Peak Mass Transit Bus Requirement:	260 buses
Percentage of Spare Buses:	32 percent

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.		6		6
Running Repair		2	5	7
Overhaul		13		13
Body Shop			9	9
Other		1	1	2
Total		22	15	37

Annual Miles of Operation 9,000,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	46	4	3
Servicer and Cleaning	7	8	6
Total	53	12	9

Miles per Roadcall 2,800

Maintenance Staff per 1,000 Miles of Operation .008

Buses per Maintenance Staff 4.62

- Discontinued water filtering system

  The company that produced the water reclamation system has gone out of business. As a result of this and the cost of ongoing maintenance, the water in the reclamation process is no longer filtered. As a result, the reclamation process requires more "add water" to keep the concentration of contaminants at an acceptable level.

- Better air conditioning with inside parking

  COTA reports fewer bus air conditioning problems now that it has indoor parking. Part of the previous problem with the air conditioning systems was that the systems did not have sufficient capacity to properly cool down a hot bus before it started picking up passengers. With covered parking, the buses are not as hot when they start and the system is better equipped to meet the lesser demand.

- Maximum visibility of fuel tank lines

  While COTA has had no problems with its fiberglass fuel tanks, it has had numerous problems with its fuel tank lines. They are currently in the process of replacing these lines and reinstalling them to allow maximum visibility. Most fuel leaks occur in the fuel lines instead of the fuel tanks, and that is why COTA is placing as many of the fuel lines as possible above ground level. In this manner the fuel line would be more accessible and, more importantly, more visible for inspection.

- Fuel tanks in vaults

  Because of problems with identifying fuel leaks, COTA recommends that fuel tanks be installed in vaults.

- Fuel suction pumps

  Using suction pumps instead of pressure pumps can limit the amount of fuel loss from leaking fuel lines. The more normal type of pressure pumps places the fuel in the lines under pressure. If a leak occurs, the fuel will be forced out of the line. Under a suction pump application fuel is less likely to leak because the pumping operation slows or stops in cases of fuel line leaks. One caution is that this type of system may pick up other liquids in the pumping process in the case of leaks.

- Fuel tank level monitors

  COTA had automatic fuel level monitoring devices installed when the fuel tanks were initially installed. However, these devices have proven ineffective in properly monitoring the levels in the fuel tanks. As a result, COTA has gone back to physical stick readings.

- Additional electrical capacity

  The requirement for electrically supported tooling continues to grow over time. Most contractors fail to provide for additional capacity and increasing this at a later date is very expensive.

- Water type fire extinguishers over electric junction boxes

  COTA's architect placed a water type fire suppression system over the main electrical junction boxes for the entire facility. During an unusually cold spell, one of the lines broke; fortunately it was not the one over the electrical box. This has been corrected but could have caused a severe problem.

- Higher roofs in bus parking areas

  It is common to reduce the height of the ceiling in bus parking garages to as low a height as possible. This reduces construction cost and heating cost. However, it makes it extremely difficult to move air in sufficient volume to create an acceptable environment during pull outs. Careful consideration should be given to the air movement issue in any bus parking garage design.

- Insufficient ventilation

  The general office area for the transit system is on an upper floor in proximity to the garage. The ventilation system has proven insufficient to keep the engine exhaust out of this area. Additional capacity and a positive exhaust system have both proven inadequate to address the problem. In addition, the make-up air intake is directly over the fuel tank farm, and the odor of fuel enters the administrative area as fuel loads are being received.

- More air replacement

  COTA makes extensive use of air handlers (22 units) which tend to clean pollutants from the air and return the air back into the building. This reduces heating and cooling cost. However, COTA has had problems with its ability to properly clean the air. Because of these costs and the problems associated with alternative fueled buses, it believes it may be more effective to go to an air replacement system.

- Improved access to air changers

  Because of the high maintenance demands of the air changers, COTA feels that they could be better serviced if they were more accessible in a roof mounted configuration.

- Discontinued use of chassis dynamometer

  Use of the chassis dynamometer was discontinued. It was felt that the cost of maintaining the dyno and its frequent down time did not justify keeping it in operation.

- Limit access to antifreeze/coolant in repair shops

  Antifreeze should be recycled. However, if antifreeze/coolant is too accessible in the repair shops, the mechanics are less likely to go to the trouble of properly draining and recovering the coolant.

- Versatility of drive-on ramp lift

  COTA uses two, drive-on ramp type lifts manufactured by SEFAC. To use the lift, a bus is driven onto the lift just as a bus would be driven onto a pit. The entire lift surface is then raised allowing access to a bus in the same manner as provided by a pit. This system takes slightly more time to get under a bus than a pit and less time than a post hoist. However, it is not permanently installed as is a pit or hoist.

- Gantry type paint booth

  COTA's paint booth had originally been equipped with a gantry type paint booth. This is a scaffolding type system with built-in air supply, etc., for supporting bus painting. The scaffolding system can travel back and forth, as well as up or down, to allow a painter to reach the bus conveniently as he or she paints. However, COTA found that the gantry's physical construction limited the painters ability to reach lower portions of the bus. More importantly, the system was very maintenance intensive to support. COTA has gone back to regular scaffolding in its painting operation.

- Body straightening tie downs

  A body shop operation often needs anchor points in which a bus can be pulled in order to straighten frames or bodies. Most times the pull points are anchored into the concrete as the shop floor is constructed. While such points were installed initially, more points are needed, and stouter ones should have been installed.

- Additional lights in body shop

  By the nature of the work, a body shop needs better lighting than most maintenance functions. Since the body shop had been configured with the same lighting system as the other maintenance areas, the lighting had to be upgraded after the facility was constructed.

- Lifts should not be concrete encased

  COTA is currently in the process of replacing the inground lifts and their accompanying piping. In addition to occasional leaking problems with hydraulic pipes, most of the pipes and the post have now rusted out because they appear to have been improperly protected from rust as they were installed. Since the lifts were encased in concrete as they were installed, the removal process is extensive. As the lifts are replaced, the plumbing will be placed in troughs for better access.

- Placement of work room

  Careful attention is needed in considering the placement of the buses in the work bays. Most maintenance functions are performed at the rear of a bus and this is where the most work room and support fixtures (electrical outlets, oil dispensing, etc.) are needed. It is also advantageous to have this work area visible from the foreman station. In COTA's central isle circulation approach, the architect did not properly consider the facts in some work areas.

- Supervision desk closer to shop floor

  The centralized shop offices are difficult to locate in an operation the size of COTA's facility so that they are convenient to their work area. More decentralized offices are needed. In the case of the third shift supervisor, who supervises the service lane and the running repair area, the distance between these two areas makes it impossible to properly supervise both.

- Roof height sufficient for tractor trailers

  The facility was not properly sized for receiving tractor trailer loads. The 10 foot 6 inch ceiling height which is acceptable for a bus is too low for a tractor trailer.

- Lack of transit oriented architects

  Because most construction jobs go to local or regional firms and these firms have limited experience with transit, most facility design/construction shows this lack of transit familiarity. As a result, small things such as exhaust, heating and air conditioning, air movement, lighting, etc., are often inadequate. More involvement by the operations areas is needed in the design reviews.

- More parts room space needed

  When the original design work was performed, the COTA fleet consisted of one basic vehicle type. Since then, the fleet make-up is much more diverse and the parts requirement has increased. While there were areas for expanding the parts room storage (i.e., a mezzanine level), operations has since expanded into this area.

- Ceramic tiles on wall of work areas

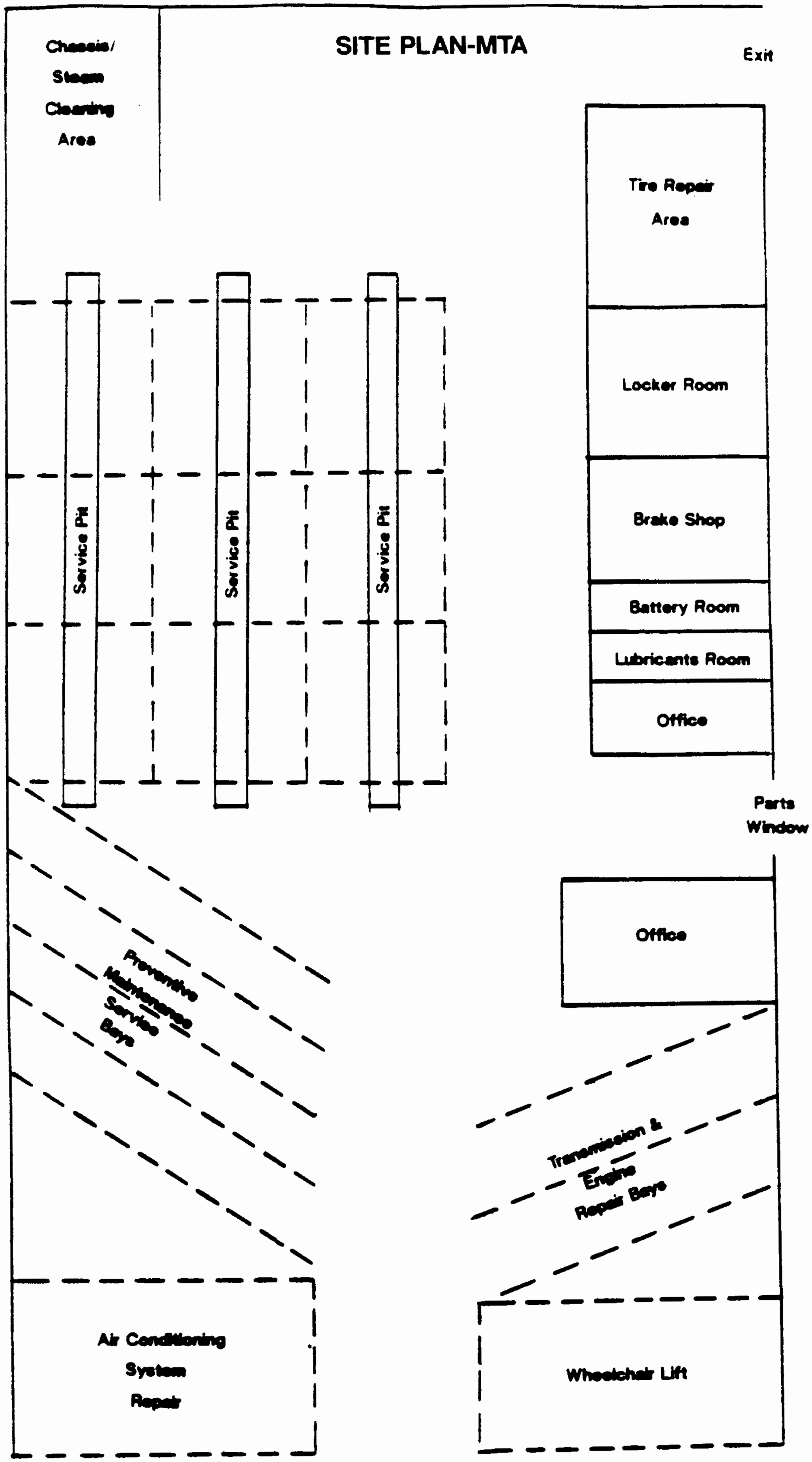
  Low maintenance ceramic type walls in the maintenance area would probably be more cost effective than the continuous process of cleaning and painting standard walls.

4. Maryland Mass Transit Administration's Bush Garage

The Maryland Mass Transit Administration's (MTA) Bush garage is located at 1515 Washington Boulevard in the City of Baltimore. The facility was initially designed and built to house and support trolleys 83 years ago. The site was built upon a swamp area that was filled and raised. Several buildings currently occupy the site: the operating garage (Exhibit C-8), the bus servicing building, a newer storage building, and buildings associated with the heavy repair facility. Contained within the operating garage building are several administrative offices for the MTA and the maintenance administrative offices.

The site is located within an industrial area. All neighbors are businesses with the exception of a park which is directly across the street from the location. As a result of the neighborhood and the length of time it has been on site, MTA reports no appreciable community acceptance problems. However, due to historical building coding, MTA is precluded from changing any of the visible sky line. As the buildings age and need to be modified, this requirement limits the authority's flexibility and adds cost.

EXHIBIT C-8



SITE PLAN-MTA
Chassis/ Steam Cleaning Area
Exit
Tire Repair Area
Locker Room
Brake Shop
Battery Room
Lubricants Room
Office
Service Pit
Service Pit
Service Pit
Parts Window
Office
Preventive Maintenance Service Bays
Transmission & Engine Repair Bays
Air Conditioning System Repair
Wheelchair Lift

The old trolley barns are brick buildings approximately 50 feet tall. Windows are installed along some walls and transom type windows are located in the raised portions of the slanted roof. The original interior walls are brick, while the newer walls and partitions are frame and dry wall. The floors and bus driveways have had concrete poured over the old trolley tracks. In several locations within the garage, the old trolley tracks are still exposed. The old swing open garage doors have been replaced with roll up overhead doors.

The site has limited access being completely surrounded by a 12 foot wire fence. Guard houses are placed at the predominant bus entry and exit points. Surveillance cameras are installed at some points, but entry onto the property is not completely controlled. Lighting on the internal parking lots is limited by the absence of light poles within the yard. The lighting comes from large directional lighting from the sides of the garage bordering the lot. The entire parking lot is laid in concrete and sloped to lead all storm water into lot drains.

The Bush garage bus servicing functions are performed in a building separate from the maintenance and repair garage. The servicing building is centrally located within the parking areas. This is a newer building, approximately 15 years old, consisting of four service lanes. All of the refueling, interior cleaning, washing, and servicing activities are conducted here. A water reclamation system has been installed in the bus wash area. This reduces the daily wash water requirement and facilitates washing during some of the driest summer periods.

All of the Bush garage bus storage is outside. The lot is an open concrete lot with few poles or obstructions. The lot is designed to facilitate lefthand turns. The lot size is limited, forcing the buses to be parked in stacked rows. The lot is broken up into three different areas around the bus servicing building. Circulation and fire lanes are limited to the perimeter of the parking lot in close proximity to the servicing building. The three parking areas provide sufficient space to store the allotted buses while maintaining a degree of maneuverability around the lot. The space does limit the number of fire lanes available within the stacked rows.

The garage consists of 22 work bays situated inside an old trolley barn structure with a bus drive-through lane running through the middle of the structure. Two bays are allocated for air conditioning repairs, one for wheelchair lift repairs, two for major component replacements, four for PM inspection, one for steam cleaning, and 12 for running repairs. Most of the work bays are flat floor bays with portable wheel hoists used for lifting the buses. The 12 running repair bays are the exception. These bays are situated over interconnected pits.

Access to many of the work bays is difficult. The 12 running repair pit work bays are spread over four different pits, creating a cramped stacking of work spaces. The middle of the three work bays in each line is hemmed in. In addition, the two work bays closest to the wall are extremely difficult to access and are seldom used. This results in only eight of the 12 work bays being relatively easy to access. Additionally, there is insufficient work space available between buses to allow for work benches or tables. Some small work benches are located at the rear of the lift equipped work stations, but these are small in size. This work space is further restricted by the portable wheel lifts and the space taken up by them.

The parts room is a limited access room which utilizes a significant amount of vertical storage. Pallet racks and storage shelves utilize the available vertical storage space. The room is separated from the maintenance repair areas by brick walls and steel fencing. Access is limited and only one parts window is accessible from the garage floor. The storage space is not sufficient to house all the parts in inventory. Some larger items are stored on the shop floor.

A separate battery room is utilized in close proximity to the shop floor. The room is approximately 130 square feet and is large enough to house the garage battery needs. The room is not a fully contained room as the walls are half walls. Ventilation is provided to remove fumes, and an eye wash station is in place.

A lubrication pump room is used to house and pump fluids through the overhead reel distribution system. Several drums are used to store fluids as they are pumped out onto the shop floor. Not all fluids are pumped from this room; automatic transmission fluid is pumped into the buses from drums on the shop floor.

A tire storage and repair area is fenced off in the back portion of the garage. The tire repair room houses repair machines, storage cabinets, and tire storage space. Not all of the tires are stored in this room due to space limitations.

Maintenance offices are positioned in the garage so that foremen have a direct view onto the shop floor. The Maintenance Superintendent's office is located above floor level providing a view onto the shop floor. Both offices are located near the middle of the garage and are sufficiently sized.

Employee locker and lunch rooms are located adjacent to the supervisory offices. These are fixed rooms with brick walls and tile flooring.

A steam cleaning area is located in the rear of the garage close to the entry point into the garage. The steaming area has a large drain equipped with an oil/water separator. The area is not completely self-contained as a partial wall bordered one side. This area is primarily brick and cinder block walling with no tile surfaces.

The Bush garage contains no dedicated space for overhaul functions. All of the overhaul functions, body work, paratransit vehicle maintenance and non-revenue maintenance is performed by the heavy repair facility that shares the site with the Bush garage.

A separate employee parking lot for all employees is located outside the fully fenced perimeter of the site. Employee parking is crowded into one corner of the site.

The Bush garage recently raised a portion of the bus storage parking lot to facilitate all storm water run off into drains on the MTA property. All of these drains go into a oil/water separator before the water is discharged into a storm drain. Previously, storm water run off would drained onto a neighbor's property. The storm water run off, oil/water separators are part of a system of separators where all parking lot, garage floor, and service building floor drains flow into oil/water separators. The separator outflow is supposed to be monitored by an environmental consultant retained by the MTA to hedge against discharges.

Underground waste oil tanks are plumbed into the running repair pits to facilitate draining used engine oil. These tanks collect the used oil which is then picked up by a recycler. Recycling of batteries and parts cleaning solvents is also provided through arrangements with the product providers.

At the time of the site visit, the shop had 20 of the 22 available work bays occupied and another 32 buses outside awaiting repair and two awaiting disposal. This means that about 69 percent of the spare fleet was down for repairs. The facility provides sufficient work bays to house almost 12 percent of the peak bus commitment or 29 percent of the spare fleet at any one time.

The garage size and staffing arrangement indicates that the garage space is being fully utilized and that increases in fleet size would tax the abilities of the maintenance department to keep the buses in sound operating condition. There were sufficient work bays during all periods to assign .5 mechanics per work bay. The staffing is sized and scheduled so that the maximum practical number of mechanics are on duty during all three shifts. Any increase in any shift's work force, will result in more mechanics than available work spaces. Consequently, the Bush garage appears to be running at full capacity with little flexibility in the current garage layout for further efficient fleet expansions.

Noteworthy aspects of the facility and its operation are presented in Exhibit C-9 and as follows:

- Site limitation

  The Bush garage is located within a historic area which has hindered plans for modifying or rehabilitating the garage. Consequently, historic districts' land and site usage requirements need to be fully understood before transit properties utilize such sites.

EXHIBIT C-9
MAJOR FACILITY CHARACTERISTICS
MARYLAND MASS TRANSIT ADMINISTRATION (MTA)
BUSH GARAGE

Fleet

Assigned Revenue Vehicles:	261 buses	
Peak Mass Transit Bus Requirement:	186 buses	±40 Seasonal Buses
Percentage of Spare Buses:	16-40 percent	

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.		4		4
Running Repair	12	2	1	15
Overhaul		2		2
Other		2	1	1
Total	12	8	2	37

Annual Miles of Operation 7,768,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	19	19	19
Servicer and Cleaning	10	12	6
Total	29	31	25

Miles per Roadcall 3,300

Maintenance Staff per 1,000 Miles of Operation .011

Buses per Maintenance Staff 3.07

- Older garage offers flexibility of space

  The MTA favors the adaptability of the older Bush facility over the purpose-built Northwest garage. The open unrestricted barn type design of the Bush garage is more easily adapted to ever-changing circumstances.

- High ceiling design

  The high ceiling, open barn type design of the Bush garage suffers from high heating costs. However, the large interior spaces do provide a good degree of ventilation.

- Rehabilitation cost

  While older facilities offer some advantages, it takes significant resources to keep these garages operational. Asbestos abatement projects have been completed in the garage, while further abatement is being studied in other areas of the site. The estimated cost for this one item is approximately one million dollars. Plumbing deterioration has required significant repairs and modifications and a rehabilitation project are just beginning. There have also been extensive upgrades and rewiring of the electrical system.

- Problems with exterior parking

  The outdoor bus parking creates problems because the buses are cold in the winter and hot in the summer, thus increasing the engine run time required to stabilize the interior temperatures.

- Industry UST plan

  The MTA feels that an industry wide underground storage tank (UST) compliance plan would assist it in planning and conducting compliance efforts. MTA surveys have demonstrated that several different interpretations of regulations have resulted in several different approaches of attaining the same end. Consequently, the MTA feels it is reinventing the wheel in developing its plans. An industry standard and guideline would help minimize planning efforts and expedite compliance efforts.

- Fuel storage tanks

  The MTA is currently studying methods of approaching the issues on underground storage tanks. Some above ground tanks are currently in use, but space restrictions will prevent a total shift to above ground tanks. A computerized fuel management system is currently under study.

- Limited access to work bays

  As previously mentioned, the Bush garage is very adaptable to changing situations. However, limitations on access to work bays require more careful work scheduling and result in some wasted efforts.

- Alternative fueled buses

  MTA is currently considering a five bus test of LNG powered buses. If adopted, the buses will have to be fueled outside (not in the current service lane). A work bay will also have to be built which meets the explosion proof codes needed for working on such vehicles.

- Portable wheel lifts

  MTA reports favorable results with portable wheel lifts. The lifts require less extensive construction efforts than other lifts and, as a result, allow more flexibility. The lifts do have some restrictions. They take more time in raising a bus, take up more floor space and are more limiting in accessing the underside of buses.

- Sky lights

  The old trolley barns made extensive use of sky lights for lighting assistance. MTA favors more use of such economical lighting in future facilities.

- Ceramic tile on walls

  Low maintenance ceramic tiles are used on most of the walls in the garage. These are hold-overs from the trolley barn days.

- Limited support features

  Because the garage has been modified to support the current fleet, the facility lacks some of the normal support features designed into purpose-built work bays. Examples include access to electrical outlets, dispensing reels, etc.

- All weather service island

  The service island is a separate building which means that wet buses exiting the building during the winter can lead to dangerous ice formation in the yard. To limit this potential, MTA has installed a water stripper and heated exit pads. The water stripper consists of an air curtain that blows water off the bus as it exits the service washer. Because of the relatively flat designs of most transit bus roofs, this system is only marginally successful. The heated exit pads are activated as temperatures reach freezing. While these do not extend to the entire yard, they have been successful in allowing the washer to operate, except during the most severe weather.

5. <u>Metropolitan Transit (San Antonio, Texas)</u>

At VIA Metropolitan Transit (VIA) of San Antonio, Texas the entire bus support facility operates from one location. The bus support facility centers around a structure which was constructed in 1948. Since the facility has been in operation since that time, there are no appreciable community problems of acceptance. Six additional work bays were added in 1968 when the facility was expanded. Upgrades, such as additional exhaust fans, new underground fuel tanks, wash basin sumps, wash racks, etc. have been added over the years. In addition to the normal maintenance and servicing requirements of an operating garage, this facility also houses administrative offices and heavy overhaul.

The full range of bus support activities (i.e., running repair, overhaul, body work, rebuilds, PM inspections, etc.) is conducted at the location. Preventive maintenance schedules vary according to the type of vehicle, but the schedules are based on a 4,000 to 6,000 mile interval. In this regard, VIA probably has the most standardized transit fleet of its size in the nation. The fleet is made up primarily of 35 foot and 40 foot GMC or RTS type buses, all powered by Detroit 6V-71 and 8V-71engines. There is a small fleet comprised of a 25 foot Chance coaches.

While this has helped VIA's training and parts support needs, it is likely that new bus procurements will begin to degrade this situation.

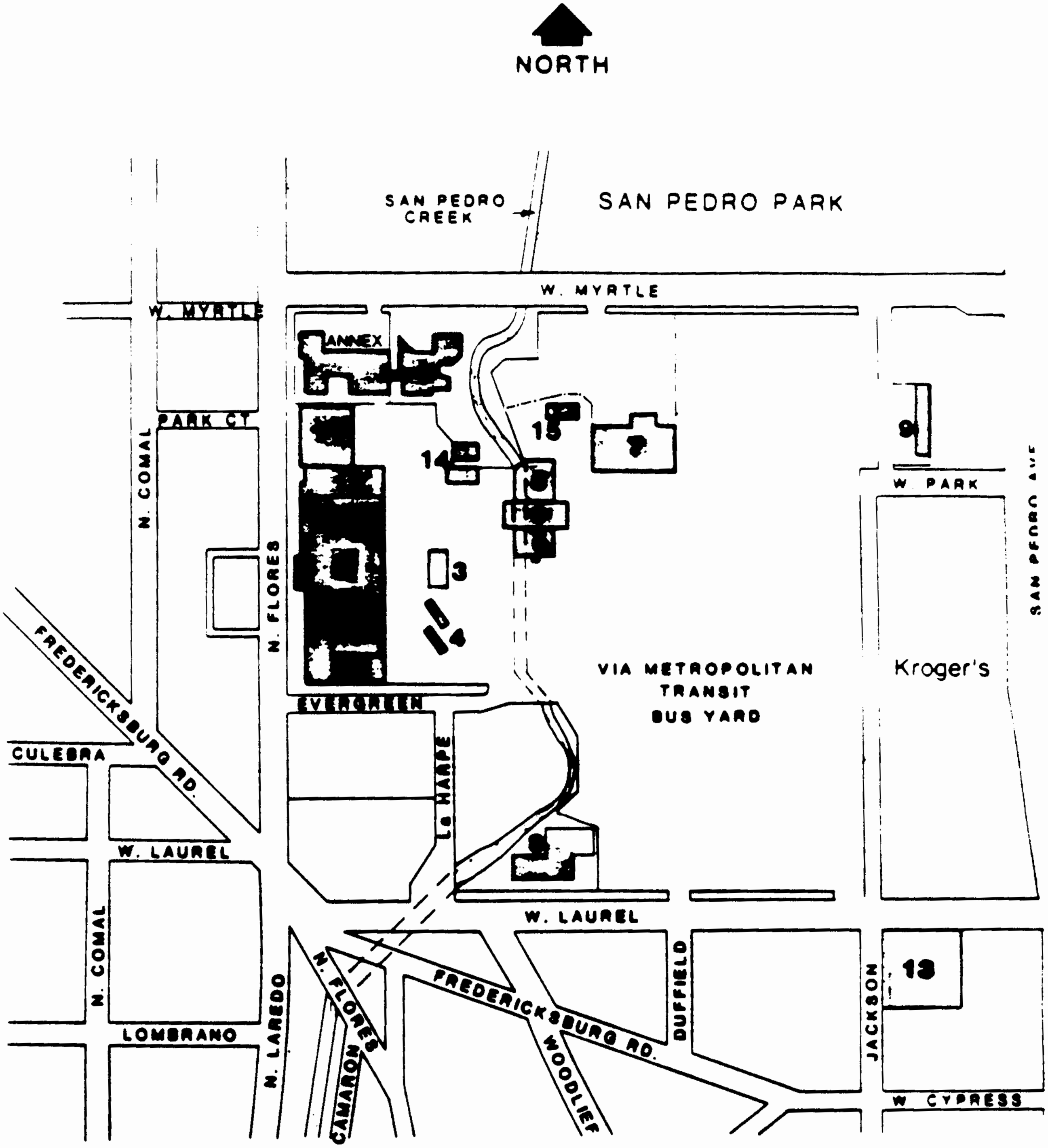
An overview of the site layout is presented as Exhibit C-10. As demonstrated in this exhibit, the service island and bus washers are separated from one another and from the maintenance building. All of the bus storage is outside storage.

Exhibit C-11 provides an overview of the shop layout. The facility provides sufficient work bays to house 11 percent of the peak bus commitment or 50 percent of the spare fleet at any one time. Unlike most of the other transit systems included in this review, VIA also performs the maintenance on the fleet of paratransit vehicles, so these vehicles also take up shop space.

Other noteworthy aspects of the facility and its operation are presented as Exhibit C-12 and as follows:

- Fuel Spill Containment

  Fuel spill containment systems are required for all fueling operations. However, because VIA's fueling operation sits almost directly on top of a major stream, extensive preparation and training has been devoted to its spill containment system.



VIA Headquarters Site

1. Administration Building
2. Maintenance Building
3. Tire Shop
4. Bus Washers
5. Service Station
6. Battery Shop
7. Sta. Foreman/VIA Trans
8. Day-Care Facility
9. Red Mac
10. Body Shop
11. Heavy Unit
12. Inspections
13. SE Parking Lot
14. Steam Cleaning
15. Gasoline Dispensing Station

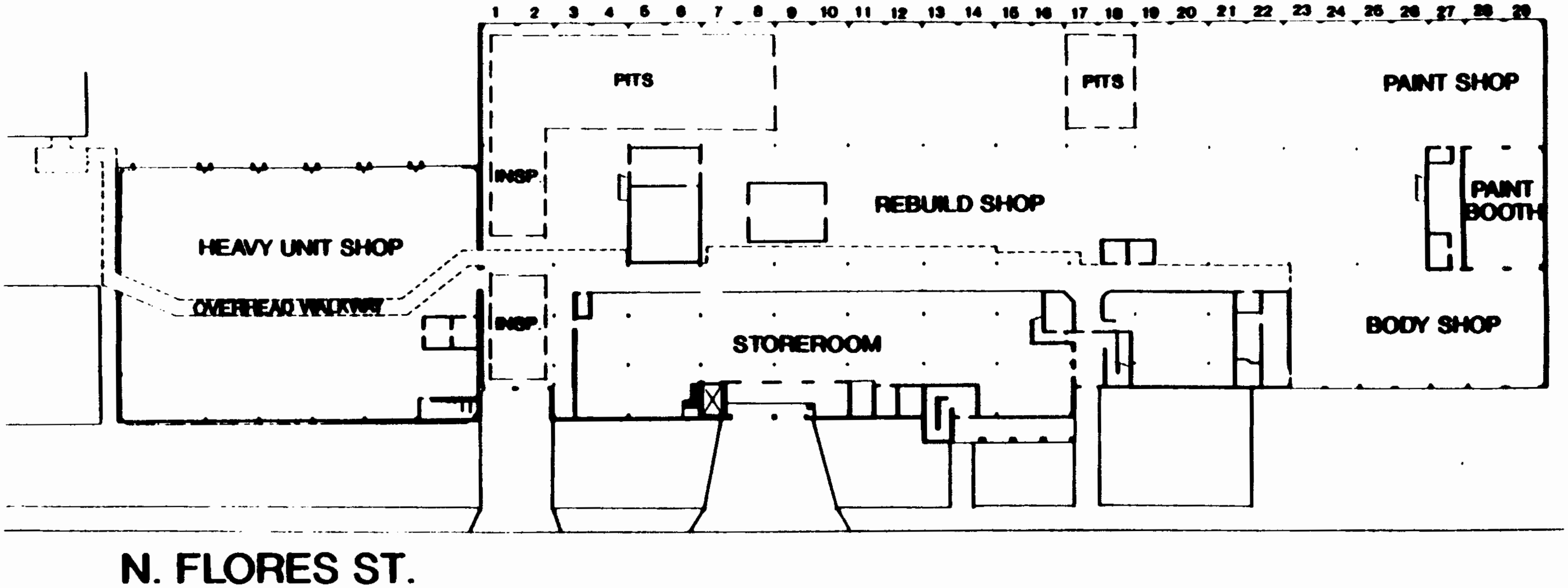
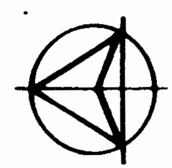


EXHIBIT C-11



SHOP FLOOR PLAN

VIA METROPOLITAN TRANSIT MAINTENANCE FACILITY

EXHIBIT C-12
MAJOR FACILITY CHARACTERISTICS
VIA METROPOLITAN TRANSIT
(SAN ANTONIO, TEXAS)

<u>Fleet</u>

Assigned Revenue Vehicles:	529 buses	
Peak Mass Transit Bus Requirement:	426 buses	106 paratransit
Percentage of Spare Buses:	24 percent	

<u>Bus Work Bays</u>

	Pits	Hoist	Plain	Total
Inspections and P.M.	6	2		8
Running Repair	8	9		17
Overhaul		2	5	7
Body Shop		5	10	15
Other			2	2
Total	14	18	17	49

<u>Annual Miles of Operation</u> 19,200,000

<u>Bus Maintenance Staffing</u>

	1st Shift	2nd Shift	3rd Shift
Mechanics	103	18	18
Servicer and Cleaning	39	59	5
Total	142	77	23

<u>Miles per Roadcall</u> 52,000

<u>Maintenance Staff per 1,000 Miles of Operation</u> .013

<u>Buses per Maintenance Staff</u> 2.19

- Functional Floor Layout

  Despite the fact that the current facility was designed for buses of the 1940s and 1950s, the facility has been adapted remarkably well to current requirements. As seen in Exhibit C-11, most work bays are along one wall with ready access to the parking and servicing area. Selected bench work activities are used to support some bus repairs (i.e., brake block and drum turning for brake relines, component rebuilds for heavy bus overhaul, etc.). These activities have been located in the center area in close proximity to the work bays they are supporting. This reduces wasted motion and helps in sharing of information. Other areas such as the parts cleaning and parts storage areas are also located in more centralized areas.

- Open shop area for improved shop visibility

  All shelving, partitions, work areas, etc., have been designed to allow maximum shop floor visibility. A key element of this program is to limit most vision blocking items to a maximum height of four feet. The end result is that most of the common work areas are visible throughout the shop. This improves supervision, safety, and general shop appearance.

- Individual bus parking spaces

  All storage and parking for the VIA fleet is provided outdoors. Each bus has an assigned parking space, and each bus can be accessed without moving any other bus (they use a herringbone parking arrangement). While this type of parking takes considerably more space, it provides a number of advantages. Each parking space is checked on a regular basis for fluid leaks, and any bus identified in this manner is scheduled for corrective measures. This arrangement also allows for buses to be assigned to particular drivers. This, in turn, reduces a bus's maintenance requirements because the drivers take better care of the buses and problems that do arise are more accurately identified.

- Duel purpose parking area

  Because VIA has considerable land space designated for bus parking it has devised a method for jointly using this same space for employees' privately owned vehicles. The segment of the fleet that is assigned all day is parked in one area of the parking yard. Because this area is vacant during the first shift operation, employees can use this area for parking as long as the cars are moved before the afternoon pull-ins.

- Non-free flow catch basins

  To further limit the chance that environmentally damaging liquid contaminants might leave the property as run off liquid, VIA has designed its catch basins such that the run off must be pumped out into the normal sewage drain system rather than allowing for free flow drainage. Run off can be stopped in cases of large spills or situations where the catch basins are not able to perform their normal function.

- Increased shop ventilation

  The high roof design of the facility provides improved ventilation and a cooler working environment during VIA's long hot season. VIA has also improved on the ventilation capabilities of the facility. In addition to a positive engine exhaust hookup at each work bay, the shop has additional exhaust fans to help remove both heavy and light gases.

- Alternative fuel provision in pits

  VIA is presently out for bids for the installation of explosion proof lighting and ventilation. These upgrades are to be performed in light of the future use of alternative fueled vehicles.

- Additional electrical capacity

  The requirement for electrically supported tooling has grown over the years. When VIA upgraded the amount of electricity supplied to the facility, it also located the power sources in more than one area. In this manner it was hoped that a power failure in one portion of the facility would leave the remaining portion functional and provide for some emergency capability.

- Waste run-off measures

  In addition to the areas previously mentioned, VIA has given considerable attention to environmental concerns. Examples of other areas are:

  - A drying type basket is being installed in the catch basins which allows most of the solids to be lifted from the basin. The total volume of contaminants removed from the site for disposal is reduced (i.e., the water is not pumped out each time the trap is emptied) and the site maintains its rating as a small hazardous waste generator.

- The parking yard is periodically cleaned to limit yard run off and to make it easier to identify leaking buses.

- Water oil separators

  VIA uses water oil separators in its waste water system. To improve its effectiveness, VIA runs water to a substantial holding tank where coalescing plates allow the oil to separate. Many of the solids drop out of suspension in this manner. A diaphragm type pump also is used for the water circulation process. This creates less turbulence and the soap and water is less likely to emulsify the petroleum products.

- Glass etching prevention

  The glass on VIA buses began to look hazy -- a problem encounted by many transit agencies. This was caused by water remaining on the buses after they were washed. The water attracted dust from a newly resurfaced parking yard and the combination created an acid which slowly reacted with the glass. This problem was reduced by improving the sheeting action of the final rinse in the bus washer.

- Double walled storage tanks

  VIA recently upgraded its entire underground fuel storage system to meet current standards. All of the tanks are double walled allowing for monitoring of the space between the walls of the fuel tanks.

- Infra red bus washer activators

  Most bus washers use a mechanical mechanism to activate the washers. VIA reports that it has reduced the failure rate on the bus washer by replacing these mechanical activators with infra red beam activators.

- Interconnected pits

  VIA's work pits are interconnected by below floor grade work areas. This gives the workers more space, provides more readily accessible storage areas, and makes it easier to provide the work area with proper ventilation.

- Glass walled parts cleaning area

  Most parts cleaning areas are walled in to reduce overspray into adjoining areas. Due to VIA's older shop design, its parts cleaning operation is in a central area and enclosed by glass instead of masonry walls. As a result of this added visibility, the area appears to have been kept cleaner than most similar areas.

- Minimum use of shelving in the parts room

  As previously mentioned, to increase visibility most partitions and cabinets were kept below four feet in height. The parts room also utilizes parts drawers instead of the more normal shelving. The parts room had shelving at one time but found that the same amount of inventory held in the eight foot shelves could be stored in cabinets due to the more efficient use of space.

- Minimizing use of parts window

  A common problem in most maintenance operations is time lost by mechanics waiting for parts at parts counters. To limit such unproductive time, VIA has installed an air tube system. The system consists of round air tubes running from the shop foreman's desk to the parts room. As parts requests are made up, they are placed into a plastic container and placed into the air tube. Air pressure transports the plastic container into the parts room where the request is filled. If the parts can fit into the plastic container, they are sent back to the foreman's desk in the same manner. If not, they are hand delivered. In either case, it is a rare occasion for a mechanic to go to the parts room for a part because in most cases the parts are brought to the mechanic within five to ten minutes.

- Low Maintenance Tile Walls

  Most of the walls in the garage are covered with a glazed type tile to a height of several feet. This type material is more resistant to normal shop grime and very easy to clean. As a result, the shop maintains an exemplary appearance and requires much less maintenance than painted surfaces.

- Alternative fueled vehicles consideration

  At present, VIA does not operate any alternatively powered vehicles. As previously stated, VIA has one of the most standardized fleets in the public transit industry. Because of State mandates and impending Clean Air Act requirements, VIA has selected CNG buses for future procurements.

6. MARTA's Hamilton Garage

MARTA's (Atlanta, Georgia) Hamilton Garage is one the systems' three operating garages. The operating garage site is adjacent to but separate from the system's one central overhaul and heavy repair facility. The facility was constructed in 1976. Since the facility was constructed in an industrial area, few problems were reported with gaining community approval.

The work activities that take place at this location consist of preventive maintenance, normal running repairs and normal bus servicing. Heavy repairs such as body work, engine overhauls, component rebuilds, brake relines, etc., are sent to the heavy overhaul shop. Preventive maintenance schedules are based on a 6,000 mile interval.

The fleet of buses supported at the facility is diverse with five major bus types and three bus lengths (35 foot, 40 foot and 60 foot). This adds complexity to the facility design (different work bays and increased storage) as well as to the maintenance task.

At the time of the site visit the shop had 15 of the 18 available work bays occupied and another four bad order buses were awaiting various repairs. This means that about 58 percent of the spare fleet was down for repairs.

The facility provides sufficient work bays to house seven percent of the peak bus commitment or 40 percent of the spare fleet at any one time. The limited number of work bays places 1.7 mechanics, during peak periods, per work bay.

Exhibit C-13 provides an overview of the floor layout of the maintenance facility. Noteworthy aspects of the facility and its operation are included as Exhibit C-14 and as follows:

- Minimal impact from ADA

  From a fleet maintenance perspective, the projections concerning facility requirements associated with recent ADA requirements are minimal. The current fleet is approximately 50 percent equipped with wheelchair lifts and the addition of more overtime is not expected to substantially impact facility requirements. The system's use of paratransit vehicles is expected to grow considerably, but this should not affect the facility requirements as this work will probably be contracted services.

- Concrete parking lots

  Based on the system's experience with concrete lots and asphalt, concrete lots are recommended because of the improved life cycle cost. The concrete lots cost more initially, but last much longer in MARTA's application. Aspects of MARTA's operation and many other transit operations that tend to quickly degrade the asphalt lots are as follows:

  - Petroleum product spills, such as those that occur with normal transit bus operations (e.g., leaking engines, etc.) help dissolve the asphalt.

  - Warm weather and the weight of buses quickly degrade the surface.

EXHIBIT C-13
MARTA'S HAMILTON GARAGE

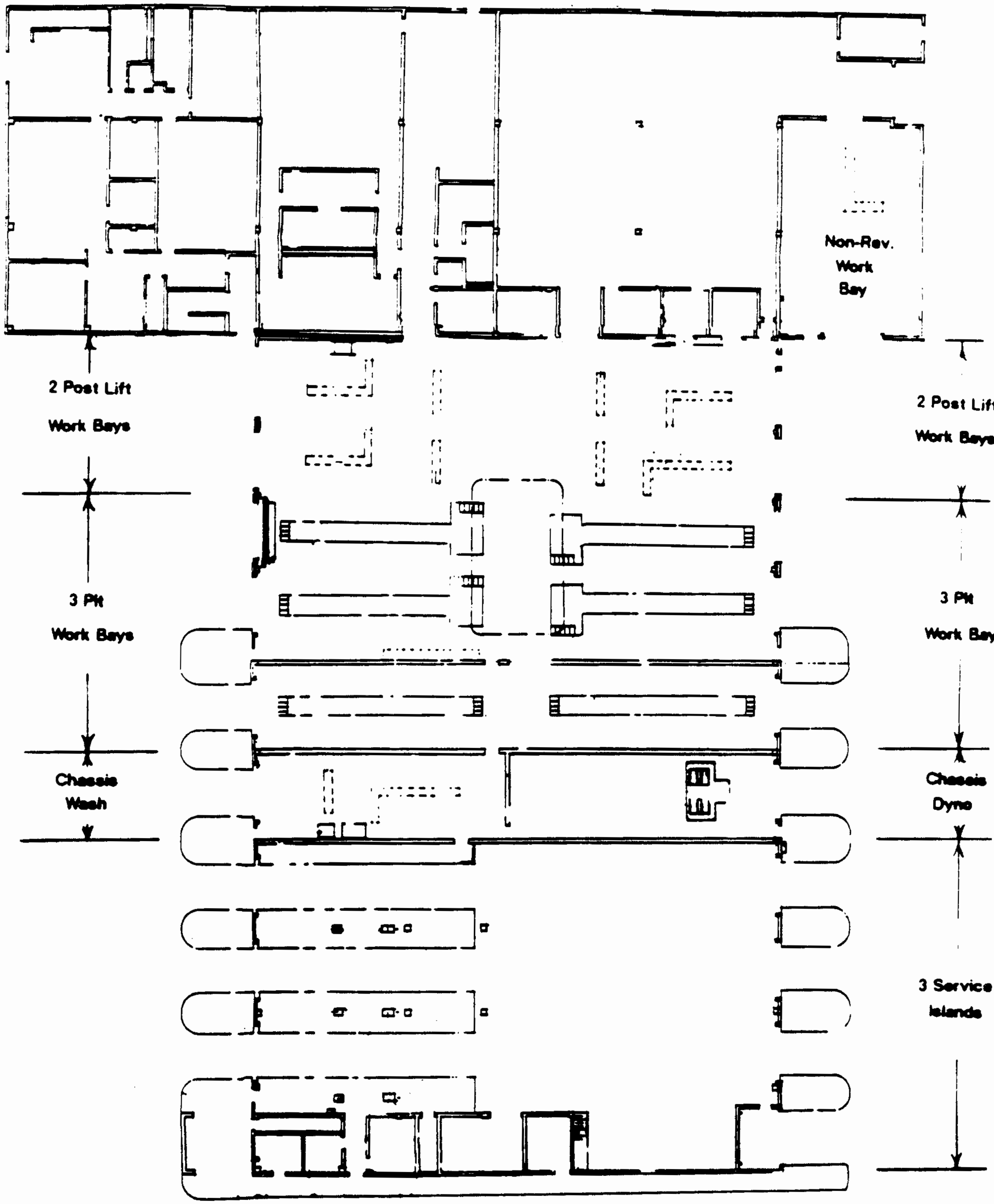


EXHIBIT C-14
MAJOR FACILITY CHARACTERISTICS
MARTA'S (ATLANTA, GEORGIA)
HAMILTON GARAGE

<u>Fleet</u>

Assigned Revenue Vehicles:	209 buses
Peak Mass Transit Bus Requirement:	176 buses
Percentage of Spare Buses:	19 percent

<u>Bus Work Bays</u>

	Pits	Hoist	Plain	Total
Inspections and P.M.	4			4
Running Repair	2	5	2	9
Other				
Total	6	5	2	13

<u>Bus Maintenance Staffing</u>

	1st Shift	2nd Shift	3rd Shift
Mechanics	22	22	10
Servicer and Cleaning	5	7	12
Total	27	29	22

<u>Miles per Roadcall</u> 2,500±

<u>Buses per Maintenance Staff</u> 2.68

- Large amounts of water runoff result after bus washing because of the flat roof design of most buses. This design tends to hold water. The water is especially damaging to asphalt yards during freezing temperatures.

- Additional electrical capacity

  Based on experience, MARTA recommends that facilities be configured with more electrical support. Over time, tooling and fixtures are added which require electrical power. The cost of providing the necessary capacity initially is much less than having to increase capacity at a later date.

- Yard run off

  MARTA performs a periodic enhanced bus cleaning program. These buses are cleaned in a designated area outside. However, due to the runoff concern, a small barn has been constructed around this area to contain any spill that might result. MARTA is also in the process of re-doing the catch basins to provide adequate oil traps and sumps.

- Double walled fuel tanks

  MARTA is is the process of replacing its fuel tanks with double walled fuel tanks. Although the tanks will still be underground tanks, any tank leak can be easily detected and maintained in an area between the inner and outer tank.

- Lack of expansion capability

  The current facility has limited expansion capabilities because the site cannot be enlarged. MARTA suggests that consideration be given to expansion options as new facilities are designed/constructed.

- Alternative fueled vehicles consideration

  MARTA is currently planning to operate a fleet of 20 smaller vehicles, such as cars, which will run on natural gas. Consideration is being given to alternative fueled buses and the impact this will have on the facility but nothing is finalized at this time. Based on its current understanding of the available technology, clean burning diesel engines would be preferable, but CNG is also being considered.

- Chassis dynamometers

  MARTA has a chassis dynamometer at each of its operating garages and at the central garage. The dynamometers are used mostly for engine overheating diagnostic problems and for engine tune-ups. Three of the dynamometers recently received an upgrade (totaling about $100,000 for the three) to eliminate some of the problems they had been experiencing.

7. <u>Metro's North Base Garage</u>

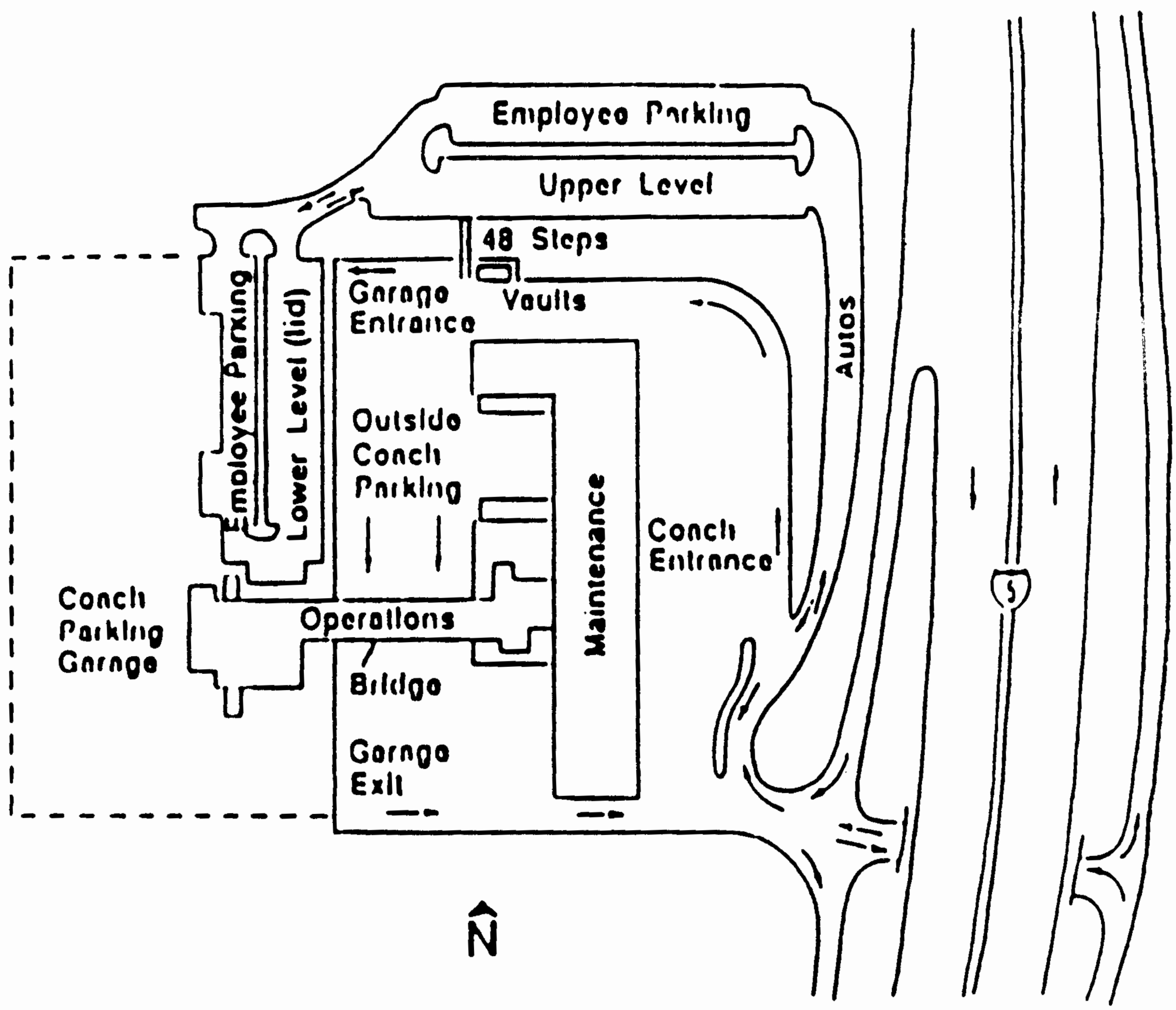
Seattle METRO has six operating garages. The North Base Garage is the newest, having opened one year ago. The opening of the garage ended more than 16 years of planning, compromise, and construction. Unlike any other METRO garage, the North Base was located in a residential neighborhood. This was done to limit cost from deadheading buses to and from other more distant garages to serve the north-end. It was also done to supply more reliable bus service into this area since the buses would be based in the area.

Many compromises and special features had to be adapted in order to incorporate the facility into the neighborhood and be accepted by the neighborhood. The entire facility is below grade level (15-20 feet below the surrounding area) to reduce its visibility in the neighborhood. This includes a 153,000 square-foot covered bus parking area, a two-acre grass playfield on top of the bus parking area, other community amenities (picnic tables, sandbox, etc.), a specially-constructed bus and employee vehicle access off the local interstate highway to alleviate base-generated traffic in the neighborhood, a filtration system in the bus parking structure's ventilation system to reduce air pollutants, and an acoustical wall on the south boundary of the garage to reduce noise. Exhibit C-15 provides an overview of the facility layout. Over the original projections, these types of accommodations almost doubled opening time frame and cost of the facility.

In addition to being a unique facility, the facility also supports a unique bus fleet. Of the 195 buses located at the facility, 52 of the buses are dull powered (electrical and diesel propulsion engines) articulated buses. While the facility was originally designed to support 225 buses, the current capacity is less than 200. This smaller number of total buses housed is a result of the high percentage of articulated buses (60 foot versus 40 foot) and the fact that the buses must be housed in covered parking. The local community was opposed to vehicles being stored outside. In fact, to kept bus circulation down to a minimum, between 35 to 50 buses are keep downtown during the off peak periods in the middle of the day.

EXHIBIT C-15

SITE PLAN-METRO

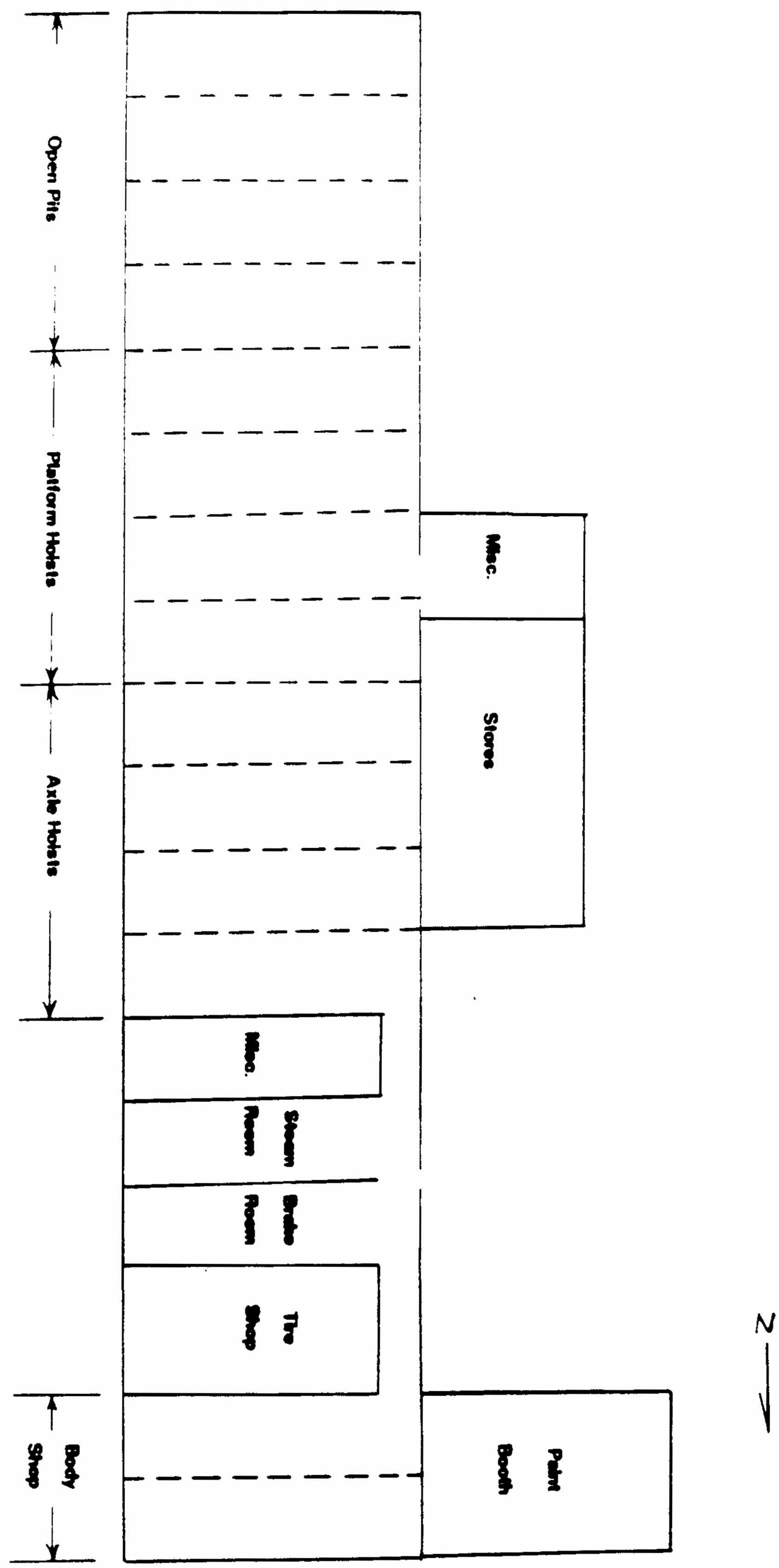


The work activities that take place at this location consist of preventive maintenance, normal running repairs, brake relines, transmission and engine replacements, minimal body work and normal bus servicing. Heavy repairs such as major body work, engine rebuilds, component rebuilds, etc., are sent to a heavy overhaul shop.

The service island consists of two stations housed inside the covered bus parking area. Each service lane is equipped with fluid dispensing equipment, a cyclone cleaner, and a bus washer with water reclamation system. Provisions are in place for fueling buses on the outside wall of the covered parking/servicing area in case of emergency. For accurate tracking of consumables dispensed and which bus they went into, an automated system is used. The system reads the number of the bus as it enters the fueling island by way of a bar code tag on the top of the bus. The system then monitors the amount of fluids dispensed to the bus and automatically records the transaction.

Exhibit C-16 provides an overview of the shop layout. In addition to 40 foot buses and 60 foot articulated buses, the facility also supports electrical and diesel powered buses. To accomodate the electric powered buses, two of the pits were constructed with overhead electrical cables for powering and testing the electrical propulsion engines. The pits are not interconnected. In addition to these four special work bay pits, the garage also has four normal work bay pits and four work bays equipped with hoists. This garage is also equipped with a body shop consisting of one work bay with a hoist, one flat surfaced work bay, and a paint booth. Due to the narrow width of the work bay in the paint booth and the lack of anything like a drop table, the paint booth cannot be used for painting the tops of buses. This work and other major body work is sent to a overhaul garage. Lastly, the garage is equipped with one work bay for a tire

EXHIBIT C-16
METRO'S NORTH BASE GARAGE



shop, one for a brake shop, one for steam cleaning and one for non-revenue automotive repairs.

At the time of the site visit, the shop had 15 of the 17 available work bays occupied and another four bad order buses were awaiting various repairs. This means that about 70 percent of the spare fleet was down for repairs. The facility provided sufficient work bays to house almost ten percent of the peak bus commitment or 53 percent of the spare fleet at any one time. There were also sufficient work bays during the peak period to assign one bay per mechanic.

Noteworthy aspects of the facility and its operation are included in Exhibit C-17 and as follows:

- Difficulty in projections

  With changing regulations (ADA, yard run off, alternative fuels, etc.), changing service demands, and changing vehicle types, it is difficult to make capacity or equipment projections for a facility that is supposed to last 40 years. Therefore, flexibility and the ability to adapt a facility is very important.

- Use of prevailing winds in placement of bay doors

  Many areas of the country have prevailing winds. If the site arrangement is flexible enough, these prevailing winds should be considered. In the warmer climates, the bay doors should be configured in line with the prevailing winds to use the winds as a ventilation assist. In colder climates, the reverse should be used.

EXHIBIT C-17
MAJOR FACILITY CHARACTERISTICS
METRO (SEATTLE, WASHINGTON)
NORTH BASE GARAGE

Fleet

Assigned Revenue Vehicles:	195 buses
Peak Mass Transit Bus Requirement:	168 buses
Percentage of Spare Buses:	16 percent

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.	4	4		8
Running Repair		4	5	9
Overhaul				
Body Shop		1	2	3
Other			1	1
Total	4	9	8	21

Annual Miles of Operation 5,600,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	19	11	10
Servicer and Cleaning	5	11	8
Total	24	22	18

Miles per Roadcall 3,200

Maintenance Staff per 1,000 Miles of Operation .0114

Buses per Maintenance Staff 3.05

- Energy conservation company

  There are companies that will perform an analysis of ways to minimize facility energy cost. These companies will provide the diagnostic efforts and appropriate equipment in exchange for a share of the resulting energy cost savings. METRO is currently in partnership with such a company at the North Base garage. Typical examples of approaches used in such conservation approaches are light timers and zoned heat/air conditioning.

- Use of parts drawers

  The parts room made extensive use of parts drawers instead of the usual shelving.

- On floor stockage of many parts

  Many low cost items and/or often used parts are kept on the shop floor instead of the parts room. This keeps the parts closer to where they are needed and provides more space in the parts room.

- Ten-foot parts room ceiling

  The parts room was designed with a ten foot ceiling. This allows for conversion into an automated parts retrieval system similar in approach to that used by the RTA of Los Angeles.

- Vaults for storage tanks

  Due to the problems with monitoring fuel tank leaks and correcting leaks if they occurs, METRO has placed all tanks at the North Base in vaults or in walled in containment areas.

- Matching tank fill pipe size to siphon pipe size

  Most fuel tanks have a four inch fill pipe for unloading a fuel tanker's load into the tank. Because it is common to connect several tanks together with a siphon pipe, this siphon pipe should allow the same flow of fuel as the fill pipe allows. If it does not, back ups and spills may occur.

- Size of paint booth work bay

  Unless the paint booth is equipped with a drop table or some other means of reaching all levels of a bus when painting it, the work bay should be sufficiently sized to allow for scaffolds.

- Incentive contracts for construction of facilities

  Based on METRO's experience, an incentive contract might make it possible to have a facility constructed according to specifications, and ahead of plan and budget.

- Air exchangers

  To limit odors and particulate exhaust from penetrating the local community, the North Base was equipped with air exchangers for use in the bus parking garage. These have been effective at meeting the local community's requirements. However, they have been and continue to be a very maintenance intensive item for building maintenance. Also, air movement problems have resulted from the low ceiling and the capacity of the system, and the operators have problems with vehicle exhaust in the parking garage during peak periods.

8. Metropolitan Transit Commission's Snelling Garage

The Metropolitan Transit Commission (MTC) of Minneapolis, Minnesota has five operating garages. The Snelling operating garage is an old facility that has undergone several modifications and additions since the first part was initially constructed in 1905. The facility was first built as a trolley car construction and repair site. The original building was capable of lifting and rotating a complete trolley car. The site is located within several miles of the central overhaul base in an industrial/commercial area. When the building was originally built it was out on the fringes of a town that has since expanded and surrounded the location. Consequently, the building looks old in comparison to the neighborhood.

The building has also settled over the years leaving cracks in many of the exterior walls. Brick facings are beginning to separate and pose a potential problem.

The primarily brick building sits on a ten acre site at the corner of Snelling and St. Anthony Avenues. The building contains approximately 265,000 square feet and covers 62 percent of the site. Most of the site not occupied by the building is designated as bus parking. Employee parking and access lanes cover the remainder of the site. Very little landscaping or unused space exists. The site is surrounded by a chain link fence and access is limited to three entrance/exit gates. The building is heated by steam generated from heating oil.

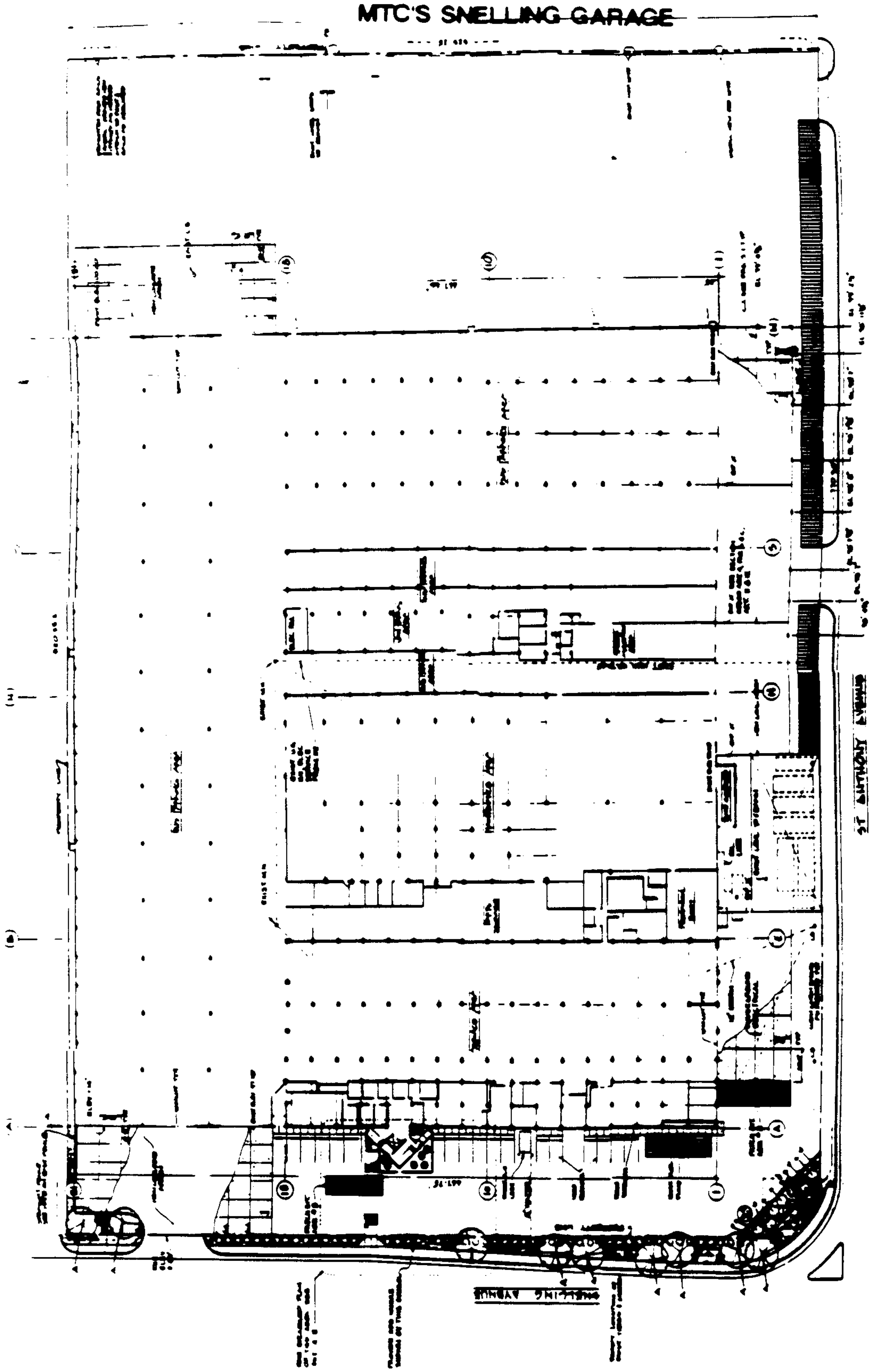
The Snelling garage performs preventive maintenance inspections, running repairs, transmission replacements, minor body work, and tire maintenance. Other activities, such as engine overhaul and brake relines, are performed at the Overhaul Base. The PM schedule is based on 3,000 mile intervals.

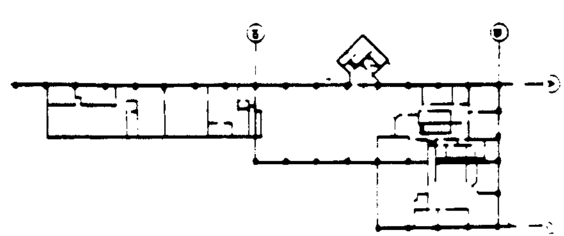
The Snelling garage fleet consists of 239 buses. Most of the buses are standard 40 foot transit buses; there are 12 articulated buses and six 30 foot buses. The mixed fleet is made up of Blue Birds, AMG Artics, Flxibles, MAN's, GMC's, Gilligs, and MAN Artics. The fleet varies in age from 14 years to less than one year with an average fleet age of approximately five years old.

The original building houses the servicing and maintenance areas, while additions to this structure are used to house the parking areas (Exhibit C-18). The building was not originally designed to be a bus maintenance facility. However, modifications have enabled it to perform this function but with some operational difficulties. The building is difficult to manage due to the numerous areas to supervise, difficult traffic flow patterns, and space limitations. Flexibility is also hampered by the numerous interior columns, doors, and combination of interior and exterior traffic flow contained in the building and the exterior parking arrangement.

The facility uses a combination of interior and exterior bus movement areas. The buses pull in by way of the Snelling Avenue entrance to the parking area. After the farebox is pulled, the bus exits the building and is moved to the servicing entrance along St. Anthony Avenue. After the bus is serviced, it enters the bus parking area.

EXHIBIT C-18
MTC'S SNELLING GARAGE





This process creates traffic flow problems with the buses that are still pulling in. This problem is compounded by the numerous poles, narrow interior doors, and the righthand turn traffic pattern. The interior/exterior bus movements have placed a premium on garage door design. The cold winter temperatures have dictated that high speed doors be installed. A lightweight rollup door and a lightweight see-through folding plastic door are currently being used.

The bus servicing area consists of two service lanes with a total of five fueling stations. Each service lane is long enough for three 40 foot buses to be staged. During servicing activities all five fuel pumps on the two service lanes are operated. This results in an inconsistent flow pattern through the service lanes as the fueling time varies. Both service lanes include drive through bus washers. The bus washers are modified with a holding tank to help provide water for the wash cycles. However, the underground water supply does not provide sufficient water and continuous makeup water must be added. No bypass lane is included in the servicing operation.

Recent modifications to the underground fuel storage area has limited the access around the exterior of the building. The tank farm cannot be driven over and this forces the buses to make a "S" type of maneuver to gain entry into the bus servicing area.

The primary preventive maintenance inspection area is placed between the two service lanes. This area consists of a full length drive-through pit, three portable wheel lifts and a flat floor work areas. The PM area is not separated from the wash area by walls or partitions. This hinders inspections and repair work during servicing hours because the water from the bus washers blows a mist through the inspection area. Chassis cleaning, which is also part of the PM process, is also performed in this area which results in additional water spray and dirt being spread into the adjacent PM work areas.

The main maintenance area is separated from the servicing and PM area by the parts room and maintenance support areas. Access into the maintenance area is from the exterior drive area along St. Anthony Avenue and egress is into one of the interior bus parking areas. Two distinct work areas are designed in the main maintenance area. A north-south aligned pit is installed in the eastern part of the work area with five hoists, three pits, and three flat floor work areas located along the western wall in an east-west orientation. This layout creates difficulty in maneuvering buses. The north-south pit is a drive through while the remaining work stations are pull-on back-off designs. Lighting is good with skylights augmenting mercury vapor type lights. Fluids are dispensed through an overhead reel distribution system.

A tire maintenance area is located next to the main maintenance area. A tire repair, storage and change is also included in this space.

Three bus parking areas are used for stacked, row type parking. Two are indoors and one is outdoors. The two indoor parking areas are poorly lit with fluorescent tube lights. The floor is worn concrete that has a rough finish for improved traction. The low ceiling taxes the ability of the ventilation system to keep the garage smoke free during pullout and high traffic times. The ceiling is very dark with carbon build up. The numerous poles are protected by the placement of used tires around the poles to limit damage should a bus sideswipe the pole. The outdoor bus parking area is combined with the employee parking area.

At the time of the site review, 28 buses were down for repair. Nine were at the central overhaul base or the Detroit Diesel distributors, three were awaiting shop and 16 were in the shop. These 16 buses occupied 16 of the 20 designated bus maintenance work bays. Three of the open work bays were in the main maintenance area, while one was in the PM area. The facility provided sufficient work bays to house nine percent of the peak bus commitment or 80 percent of the spare fleet. There were sufficient work bays to assign .9 peak period mechanics per bay.

Exhibit C-19 and the following are some noteworthy observations and MTC staff comments.

- Numerous small work areas

  The additions to the Snelling garage have resulted in several small work areas which are not large enough to be used for many activities (i.e., limited flexibility) and make it difficult for open supervision of the entire work area.

- Accessible fuel line plumbing

  The MTC recommends placing all underground fluid plumbing lines in accessible trenches. Its experience with having to excavate leaking lines from under garage floors was a good example of the problem created when you do not have this type arrangement.

- Designated chassis wash area

  MTC feels that a designated, purpose built, chassis wash, work bay is needed. The over spray from this type of operation is disruptive to other functions. The area should be self contained, tile walled for

EXHIBIT C-19
MAJOR FACILITY CHARACTERISTICS
METROPOLITAN TRANSIT COMMISSION (MTC)
SNELLING GARAGE

Fleet

Assigned Revenue Vehicles:	239 buses
Peak Mass Transit Bus Requirement:	214 buses
Percentage of Spare Buses:	12 percent

Bus Work Bays

	Pits	Hoist	Plain	Total
Inspections and P.M.	3	3	3	9
Running Repair	3	3	5	11
Other				
Total	6	6	8	20

Annual Miles of Operation 7,778,000

Bus Maintenance Staffing

	1st Shift	2nd Shift	3rd Shift
Mechanics	18	13	7
Servicer and Cleaning	11	7	7
Total	29	20	14

Miles per Roadcall	6,200
Maintenance Staff per 1,000 Miles of Operation	.008
Buses per Maintenance Staff	3.79

ease of maintenance, and equipped with a hoist to allow access to the underchassis of buses.

- Improved lighting

  Proper lighting is critical; however, the bus parking areas are often insufficiently lit because it is principally used during limited periods. The MTC recommends the use of maximum indirect lighting, particularly in the bus storage areas, to make maximum use of available light.

- Increased attention to store room capacity planning

  The increased diversity in fleet make-up has resulted in an inventory that now carries over 21,000 line items in stock. Consequently, storeroom space is at a premium. Because of these types of changes, the MTC recommends that more space be included in future facility designs for expansion of parts rooms. Providing separate storage areas for items that are not closely monitored (rebuild components, warranty return items, bulk items, etc.) is one method for maximizing the availability of parts room space.

- Limited landscaping

  For maintenance reasons and for maximum space use, the MTC prefers a minimum amount of landscaping.

- Priority to functionality versus deadhead

  Many site selections are heavily influenced by proximity to existing route designs in order to limit deadhead operation miles and the resulting expense. This often occurs at the expense of selecting a site that can best be configured functionally. Because route structures change, often fairly quickly, but operating facilities have extended lifes, MTC feels more attention is needed in selecting sites that offer efficiencies in the operating functions of the facility.

- Plastic see-through door

MTC uses a four panel, folding, clear plastic door for the fuel island. The clear plastic allows reasonable viewing into and from the service island. More importantly the light weight and folding design of the door allows it to open and close within a couple of seconds. In inclement weather, this saves on heat and also makes the service island area a more comfortable place in which to work. Despite the numerous times the door is cycled each day, MTC has reported only one required repair in the first year of operation.

- Optimal facility size of less than 200 buses

Based on its experience, the MTC feels that the optimum facility size should be designed to house a maximum of 200 buses. Sites with more than 200 buses become difficult to manage and operational scales of economy may actually decline.

- Purpose built undercoating work bay

Because of the extensive use of road salt in the Minneapolis area, MTC has instituted a specialized undercoating work station at the Central Overhaul base. The upkeep of undercoating buses is a primary method of protecting the fleet from the deterioration caused by the corrosives.

- Plastic bead blasting work bay

  The MTC feels that a plastic bead blasting process is faster and more efficient than the normal sanding done in most paint preparation operations. As a result, MTC feels that a plastic bead blasting process should be included as part of any major painting or body shop work area.

- Heavy duty versus portable high pressure washers

  The MTC prefers high volume, heavy duty, purpose-built high pressure washers being plumbed into garages. Based on its experience, the larger washers are more reliable (i.e., cost effective) than more numerous smaller portable high pressure washers.

- High volume ventilation systems in parking areas

  The Snelling garage ventilation system is not sufficient to prevent a significant buildup of soot and carbon in the bus storage area during peak periods. The MTC has since included high volume ventilation systems and higher roof designs in other facilities.

- In-ground lifts versus portable wheel lifts

  The MTC prefers the use of in-ground lifts over portable wheel lifts.

- Pits and lifts

  MTC feels that a combination of pits and lifts offers the best flexibility for an operating garage. As a result, it intends to include both lifts and pits in future constructions.

- Alternative fuel recommendations desired

  The MTC would like to see a set of standards developed for the use and handling of alternative fuel vehicles. The current situation does not provide sufficient input for the MTC to feel comfortable with the decision making process. Consequently, the MTC is testing four different low polluting technologies: particulate traps, ethanol, LNG, and dual fueled buses.

9. <u>NYCTA's Gun Hill Garage</u>

The New York City Transit Authority (NYCTA) has 19 bus support operating garages. The Gun Hill garage is one of the newest of the operating garages having been in operation for three years. The garage is located in the Co-op City area of the Bronx. The garage site is bordered by Interstate 95, some small retail establishments, and a residential community. The site contains additional land that is currently being reviewed as a site for a new central rebuild facility for the NYCTA. This unused land currently acts as a buffer separating the Gun Hill garage from I-95. As part of an agreement with the local community, the NYCTA agreed to build a small park between the garage and the residences. It is doubtful that the garage would have been built without this agreement. This type of community acceptance problem is common and the NYCTA expects future construction and rehabilitation to be hindered.

The Gun Hill garage facility is a shared facility between the Gun Hill operating depot, the non-revenue maintenance department, and the central overhaul facility. The garage was originally built to house only the Gun Hill Depot, but portions have been reassigned to the central overhaul and non-revenue functions. The non-revenue maintenance and central overhaul repair shops were transferred to Gun Hill when the West Farms facility, which housed these shops, was found to be structually unsafe and closed in 1990.

The building is a large purpose-built facility consisting of almost 270,000 square feet. The building is made of concrete, cinder block, and steel framing. It is primarily a single story facility with all maintenance activities conducted at ground level. A small portion of the building contains a second story where the transportation department activities are conducted. This effectively and physically separates the maintenance and transportation departments.

The building incorporates indoor bus storage and indoor bus driveways and maneuvering spaces. This has reduced the amount of open outdoor space associated with the operation of the garage. The building is surrounded by a chain link fence, and NYCTA transit property protection agents are present with offices located on the property. Access is limited onto and off the site.

The large size did force some interior columns to be placed within maneuvering areas of the structure. These were minimized by roof joints spanning approximately 100 feet. Therefore only one set of columns was placed within the bus parking area. The lighting in the storage area is dropped from the roof. The area above the lights is painted with primarily dark colors. This results in a dark looking ceiling as the light is projected down from below the top of the ceiling. The plumbing running through the ceiling rafters identifies its contents. The building is heated by steam generated by an oil fired boiler which is duel fueled.

The bus servicing function is located at the primary entrance point into the facility. Vehicles entering the facility must pass through the service lane to gain access into the remainder of the building. This was done intentionally to facilitate revenue removal from the bus before the bus is parked in the garage and thus to facilitate maintenance operations. Revenues are removed by a vacuum system on the service lane shortly after the bus enters the building. The service lane consists of two fueling stations, fluid dispensing equipment, and two automated bus washers. A water recovery system is included as part of the bus washers. The bus interiors are cleaned and swept by hand.

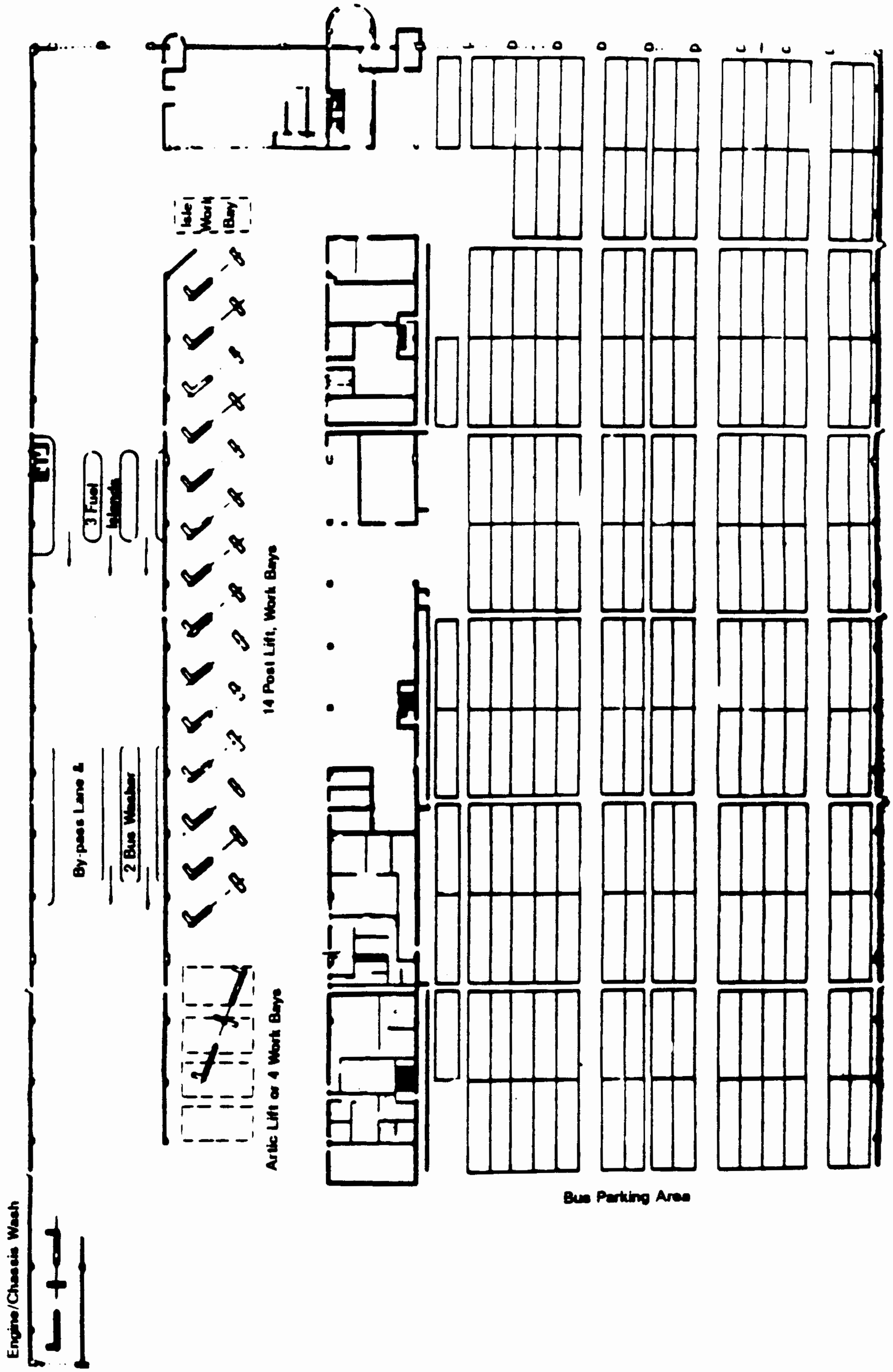
As the buses leave the servicing area, they proceed to the bus storage area. Buses requiring maintenance are driven through the bus storage area and held there until a lift is available in the maintenance area. All these movements are performed inside the building with only lefthand turns.

The original design for bus work bays was for 15 in gound, lift-equipped work bays with one of these sized to handle articulated buses. However, modifications have been implemented to provide more work bays to support the additional bus maintenance activities and the non-revenue vehicles that are presently housed at the facility (see Exhibit C-20). Since articulated buses are not used at Gun Hill at this time, this in-ground lift is not used, but the work bay is now equipped with four above ground lifts for 40 foot buses. There is an additional flat floor work station in the bus storage area which is used for tire changes and a flat floor work area in the circulation aisle next to the maintenance area which is used for bus repairs.

The different preventive maintenance (PM) inspections are based on intervals of 3,000 miles. To accommodate the PM workload, four stations have been designated as PM work stations. These stations are lift equipped and one is flat floor. One of the lifts is designated as a heavy PM lift. Heavy PM's are conducted at 80,000 mile intervals.

EXHIBIT C-20

NYCTA'S GUN HILL GARAGE



The maintenance department performs PM inspections, HVAC repairs, running repairs, brake relines, and a minimal amount of body work. Major repairs such as engine replacements are performed at the central overhaul base. Fifteen work stations are available for this work. Four stations are flat floor with the remaining being lift-equipped. No pits were built into the facility. There is also a flat floor work space located in the bus storage area which is assigned to a contractor for tire maintenance functions.

The building contains a maintenance support area that separates the vehicle maintenance area from the bus storage area. The support area includes offices, parts storage, locker and lunch rooms, tool storage, tire maintenance and other support areas. The parts room is a satellite of the central storeroom. The space available is insufficient to store all parts and supplies kept on site. The bus parking area is being used to store the overflow. Some of this storage is directly attributable to the overhaul and non-revenue functions. Access to the parts room is limited with two parts windows. The parts room is secured with wire mesh fencing.

At the time of the site visit, 17 of the work stations were occupied. One of these stations was in the process of clean up from a recently completed job. The 17 buses in the maintenance area were actually two more than the building was designed to accommodate resulting in 113 percent utilization of the original design. Current designation of work spaces is 133 percent of original design. The current layout of the facility provides sufficient work bays for nine percent of the peak bus commitment or 75 percent of the spare fleet at any time. There was only sufficient work bays during the peak mechanic period to average two mechanics for each work bay.

The Gun Hill fleet is made up of 214 GMC RTS coaches. The oldest coaches are 1981 models and the newest are 1986 models. The buses are all 40 feet long with diesel engines.

The current assigned bus fleet, combined with the additional functions performed at Gun Hill, have resulted in a space sensitive arrangement. Numerous steps have been taken to maximize space utilization such as the use of some original designated fire lanes for bus storage. The crowded condition should decrease when the non-revenue maintenance and body shop functions are moved out.

Exhibit C-21 and the following provide noteworthy observations on the facility and/or operations at Gun Hill.

- Better location and construction of drains

  Floor drainage, especially around the area leading from the bus wash area, need improvement. Because of the standing water in this area, water is tracked throughout the facility during washing periods.

- Ventilation problems

  The relatively low ceiling height in the bus storage area places a premium on ventilation during pullouts.

- UST monitoring problems

  Local fire code regulations limit the size of underground fuel storage tanks to 4,000 gallons. This has led to a very large tank farm consisting of ten tanks. The associated monitoring requirements create a complex UST system.

EXHIBIT C-21
MAJOR FACILITY CHARACTERISTICS
NYCTA (NEW YORK CITY, N.Y.)
GUN HILL GARAGE

<u>Fleet</u>

Assigned Revenue Vehicles:	214 buses
Peak Mass Transit Bus Requirement:	186 buses
Percentage of Spare Buses:	15 percent

<u>Bus Work Bays</u> (original design)

	Pits	Hoist	Plain	Total
Inspections and P.M.		3		3
Running Repair		12		12
Other		1		1
Total		16		16

<u>Bus Work Bays</u> (current Operation)

	Pits	Hoist	Plain	Total
Inspections and P.M.		3	1	4
Running Repair		11	5	16
Other		1		1
Total		15	6	21

Annual Miles of Operation 6,860,000

<u>Bus Maintenance Staffing</u>

	1st Shift	2nd Shift	3rd Shift
Mechanics	43	24	11
Servicer and Cleaning	16	12	7
Total	59	36	18

<u>Miles per Roadcall</u> 3,300

<u>Maintenance Staff per 1,000 Miles of Operation</u> .017

<u>Buses per Maintenance Staff</u> 1.89

- Overhead reel systems

  Significant time savings can be achieved when overhead reel systems are properly allocated for the servicing of buses.

- Single fuel drop point

  A separate station for fuel truck deliveries was designed into the facility. All of the underground tanks have manifolds that radiate out from the single fuel delivery point. This limits the amount of interference a fuel delivery truck presents on site.

- Separation of maintenance and transportation operations

  The physical separation of the maintenance and transportation departments was intentional and done to minimize conflict and confrontation between drivers and mechanics.

- Site constraints drive design

  Land availability is a major concern that has resulted in a compaction of functions and activities. Consequently, no drive-through maintenance work stations exist. All hoists and flat floor work areas are "pull-on, back-off" type work areas. NYCTA would like to have at least one drive-through lift area that would allow a tow truck to deliver a down bus directly to the area where repairs will take place. Current conditions require cumbersome movements for a tow truck with a down bus.

- Construction delays due to community acceptance

  Approximately ten years were spent finding and gaining approval for the operating site which eventually became the Gun Hill site.

- Lack of drive-through inspection pit

  A drive-through inspection pit would facilitate efforts to inspect and repair undercarriage items.

- Locker rooms for changing work force

  The NYCTA would like to see facilities where employee locker rooms are located directly adjacent to each other with a knock out wall separating mens' facilities from womens'. This would facilitate changes to the facilities as the ratio of male to female employees changes.

- Single story garages

  The NYCTA prefers not to utilize garages designed with bus storage and/or movements over more than one level. Multilevel facilities are cumbersome and difficult to manage, frequently experiencing more body damage than single story facilities. However, single story facilities are not always feasible within the confines of facility space needs and site constraints.

- On-site employee parking

  On-site employee parking is important for employee morale and dependable attendance. NYCTA provides such parking where economically feasible.

- Storm water plan being implemented

  Oil water separators are planned for or are currently being installed at all NYCTA facilities for storm water run-off.

- Water reclamation

  Water reclamation systems are planned for or are currently being installed at all NYCTA bus washer facilities.

- Single roof construction

  NYCTA prefers to include all activities under one roof. Multiple buildings on one site become logistically complicated and difficult to manage.

- Hoist maximum height - 6 foot minimum

  To accommodate a mixed work force, hoist lift heights need to be minimum of six feet.

- Dual fuel building heat

  Building heat is accomplished through a dual fuel arrangement. Initially the steam boiler is fired by natural gas until the ambient temperature reaches a point where other users create a higher demand. At that point, the NYCTA switches over to fuel oil. This arrangement entitles the NYCTA to a preferred (cheaper) natural gas rate.

- Fuel spill clean up

  The Gun Hill garage has already experienced a fuel spill and is currently in the process of remediation. Initial clean up has been completed. Monitoring is continuing with additional clean up being conducted as needed. This spill is attributed to a fuel tank overflow.

- Convenient access to highway

  The Gun Hill Depot has direct access onto I-95. An entrance ramp is located directly in front of the garage.

- Skid resistant flooring

  The depot area floor was rough broom finished to facilitate good traction when wet. Some NYCTA storage areas have been smoothly finished initially and later grooved to restore wet traction.

- Indoor parking

  NYCTA believes that indoor bus parking is cost effective. Buses parked indoors do not have to be pre-started and idled during the winter, reducing the need for fire watchers and security. Indoor bus parking also reduces wear from the elements and vandalism, etc.

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