REPORT OF THE BUS TECHNOLOGY LIAISON BOARD

MEETING OF
APRIL 28, 1982
AT THE
TRANSPORTATION SYSTEMS CENTER
CAMBRIDGE, MASSACHUSETTS

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Prepared by
AMERICAN PUBLIC TRANSIT ASSOCIATION
Department of Technical and Research Services
1225 Connecticut Avenue, N.W.
Washington, D.C. 20036

Prepared for
U.S. DEPARTMENT OF TRANSPORTATION
Urban Mass Transportation Administration
Office of Bus and Paratransit Technology
Washington, D.C. 20590

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American Public Transit Association

Report of the Bus Technology Liaison Board Meeting
at the Transportation Systems Center
Cambridge, Massachusetts
April 28, 1982

Those present: Attachment #1

1. INTRODUCTION

Mr. Graebner, Chairman, called the meeting to order at 10 a.m. and asked for self-introductions. The final report from the last BTLB meeting in Indianapolis, February 25 and 26, 1982, was distributed. Mr. Cihak stated that APTA will distribute this report to all transit systems. The Agenda for the April 28, 1982 meeting is Attachment #2.

2. GUIDELINES FOR BUS MAINTENANCE

Mr. Cihak requested BTLB approval of the APTA Draft Guidelines for Bus Maintenance. At the request of APTA Executive Vice President, Jack Gilstrap, the APTA staff prepared the guidelines with contributions from the BTLB and the APTA Bus Mechanical Committee. Mr. Cihak added that the Bus Mechanical Committee has approved the guidelines.

Mr. Graebner remarked that these guidelines will be especially helpful to small transit systems that may not have well established bus maintenance procedures.

Mr. Stokel asked how these guidelines will be used.

Mr. Cihak responded that the guidelines will be published as an association document for voluntary use by APTA members.

Mr. Graebner emphasized that these guidelines do not represent an effort to establish a "White Book" on bus maintenance. The use of these guidelines would be strictly voluntary. Without objection, the Guidelines for Bus Maintenance were approved by the Liaison Board (Attachment #3).

3. NCTRP BUS RELATED PROJECTS

Mr. Jones reported on the progress of bus related projects under the National Cooperative Transit Research and Development Program (NCTRP) (FY '80 and FY '81 bus related project statements are included as Attachment #4).

Mr. Kravitz made several remarks on project 54-1 entitled, "Improve Transit Bus Energy Efficiency and Productivity." He noted that as a project panel member he had cast his first "no" ballot on the work plan submitted by the contractor, Booz, Allen & Hamilton, Inc. Mr. Kravitz asked, who will pay the contractor to continue to evaluate the energy impacts of various bus components after the original handbook is produced?

Mr. Cihak noted that the Booz, Allen & Hamilton report is in draft form and that it might be worthwhile for the BTLB to review this draft. He then proceeded to describe the NCTRP process as follows.

In January and February of each year, APTA solicits problem statements from local transit agencies, state departments of transportation, municipal planning organizations, and other agencies concerned with public transportation (approximately 1600 solicitations). Problem statements received at APTA are circulated among the four NCTRP support organizations: APTA, UMTA, the Transportation Research Board (TRB), and Public Technology, Inc. (PTI, Secretariat to the Urban Consortium). The support organizations review each problem statement to identify work that is underway or completed that relates to the problem submitter's statement. When this search is completed, the comments of all reviewers are assembled and returned to the original problem submitter.

If the problem submitter finds that the information uncovered in the search satisfies his needs, then the NCTRP has achieved its information dissemination objective, and no further work is required. If, however, the search does not satisfy the problem submitter's needs, he may resubmit his problem statement as a second stage problem statement for consideration by the Technical Steering Group.

The Technical Steering Group (TSG), provided by APTA, is composed of representatives from local governments, local transit systems, and state departments of transportation. The TSG meets in October of each year to review the second stage problem statements and select from among them the annual program for the NCTRP. The annual program is submitted to UMTA for funding approval, then on to TRB. TRB assembles project panels to draft a statement of work for each problem statement in March and select contractors to perform the research in August. TRB negotiates contracts with agencies selected to do research in the fall of the year following the initial problem solicitation. Thus, almost two years elapse from the time problem statements are first solicited until the time they are placed under contract.

Mr. Marino remarked that there is an inordinate amount of time between problem solicitation and the actual start of research. He added, a good subject for research today may not be good eighteen months from now.

Mr. Cihak said the NCTRP process is designed to reflect user needs and national problems.

Mr. Graebner asked APTA staff to arrange for the Liaison Board to hear presentations by the contractors performing research on the following NCTRP projects:

Project Number	Project Title
47-1:	Improved Service Life of Urban Transit Coach Brakes;
54-1:	Improve Transit Bus Energy Efficiency and Productivity; and
60-1, TS-1:	Cleaning Equipment and Procedures for Transit Buses.

4. TWENTY-YEAR TRANSIT INDUSTRY NEEDS

Mr. Jones stated that APTA is under contract to UMTA to produce a report containing projections of transit industry capital, operating, and manpower requirements through the year 2000. Conclusions of the report will emphasize the need for energy efficiency, manpower training, and maintenance facilities.

5. WHOLE BUS TESTING PROCEDURES

Mr. Francis reported that UMTA had just recently assigned Battelle Columbus Laboratories (BCL) the task of designing procedures for first article whole bus testing. The goal of this task is to develop a method to determine the capabilities and reliability of buses that are new entrants in the transit bus industry. Under these procedures, manufacturers will perform nonrevenue service tests; and the transit systems purchasing buses will perform revenue service tests. This testing would involve first article production buses, not prototypes.

Mr. Norman stated that these procedures will be designed for forty foot buses, but that they should be applicable to thirty-five foot and articulated buses as well.

Mr. Marino said that development of these procedures is an attempt to promulgate good practice within the transit bus manufacturing industry. It will enable transit systems to identify what kind of performance is expected from buses made by particular manufacturers. However, there will be no federal testing requirement nor sanction of any test criteria or procedure.

Mr. Graebner recommended the retention of this subject as a continuing agenda item.

6. MARTA/NEOPLAN TEST PLAN

Mr. Francis reported on the testing of the Neoplan buses at the Metropolitan Atlanta Rapid Transit Authority (MARTA). MARTA requested technical assistance from UMTA to perform the testing and now has an UMTA grant to do so. Battelle Columbus Laboratories (BCL), under its task order contract to support the Office of Bus & Paratransit Technology, has a task to

assist MARTA in the development and execution of its test plan and procedures.

Mr. Stokel remarked that the UMTA task should be expanded to include specification compliance testing of the Neoplan bus just as General Motors and Flxible had to submit to this testing by Booz, Allen & Hamilton, Inc. He added that the Neoplan bus is not an Advanced Design Bus (ADB).

Mr. Marino responded that UMTA cannot do what Mr. Stokel suggests without violating current administration policies to relax the regulatory nature of UMTA activities. UMTA will not initiate a specification compliance test nor will it place a seal of approval on any manufacturer's bus. UMTA can, however, provide funding to transit systems that wish to perform this testing on their own. Mr. Marino emphasized that UMTA is responsible to provide technical assistance to transit systems for testing, etc., only when transit systems request such assistance.

Mr. Norman stated that the purpose of the MARTA grant and the Battelle task order is to enable MARTA to collect data and identify problems that MARTA could not do otherwise.

Mr. Stokel said he believes the Neoplan testing should be expanded to include such cities as Lynchburg and Philadelphia that will soon receive Neoplan buses.

Mr. King remarked that Battelle is now receiving MARTA data on the revenue service testing of the Neoplan buses.

7. CRITERIA FOR BUS SUBSYSTEM TESTING

Mr. Venezia presented a paper he prepared entitled, "Criteria for Bus Subsystem Testing" (Attachment #5). After a brief explanation of the paper and some discussion, Mr. Graebner asked the BTLB members to carefully read this paper and prepare comments and textual revisions. These comments should then be sent as soon as possible to Mr. Ernie Miller for review since Mr. Venezia will be leaving the Liaison Board.

Mr. Cihak stated that he would like Battelle to help Mr. Miller incorporate these comments in the final text of the proposed criteria.

Mr. Graebner suggested that the Liaison Board plan to approve these criteria at the next BTLB meeting.

8. LIFE CYCLE COST (LCC) PROCUREMENT

A. Activities of APTA Life Cycle Cost Procurement Task Force

Mr. Cihak reviewed the report of the March 22, 1982 Task Force meeting (Attachment #6). The goals of this meeting were to: (1) develop an APTA position in response

to the UMTA guidelines on rolling stock procurement and (2) determine how to make these guidelines work, i.e., how to help grantees comply with them. From the discussions at this meeting, Mr. Cihak prepared "Draft Guidelines for Grantee Evaluation of Performance, Standardization, and Life Cycle Cost Factors for the Procurement of Transit Buses." Mr. Cihak requested that comments on these guidelines be sent to him at APTA as soon as possible.

Another meeting of the Task Force was scheduled for May 10, 1982 at the APTA Eastern Conference in Nashville, Tennessee for the purpose of reviewing comments on the draft "Guidelines."

B. Survey of Transit Systems Planning to Purchase Buses Using UMTA FY '82 Funds

Mr. Jones reported that APTA had conducted a survey of transit system members to determine which transit systems plan to purchase buses in 1982 using UMTA FY '82 funds (Attachment #7). Forty-four (44) transit systems reported that they plan to purchase buses using UMTA FY '82 funds. The characteristics of the buses to be purchased are illustrated in the following matrix*:

TYPE	MINIMUM # REQUIRED	MAXIMUM # REQUIRED
40' ADB	443	499
35' ADB	144	146
40' "New Look"	166	166
35' "New Look"	36	41
40' Unspecified	1123	1153
35' Unspecified	4	4
60' Articulated	313	313
19' - 31' Small	130	160
TOTAL	2359	2482

*Preliminary Figures as of 5/24/82.

C. Activities of the LCC Working Group (J. Reading, Chairman)

Mr. Cihak noted that APTA conducted the transit bus procurement survey to help the working group in its task to ascertain which transit systems plan to purchase buses using UMTA FY '82 funds. He also noted that the Urban Transportation Development Corporation, a contractor to the Santa Clara County Transportation Agency, will be

contracted to assist the working group to consolidate life cycle cost evaluation procedures into one guideline document.

Mr. Okasinski pointed out that the Southeastern Michigan Transportation Authority is now performing a technical study of various life cycle cost procurement procedures. Mr. Okasinski will report on this technical study at the next BTLB meeting.

D. UMTA Simplified LCC Evaluation Procedure

Mr. Symes introduced the UMTA simplified LCC evaluation procedure by stating that the AMS procedure used in Providence, RI, and Phoenix, AZ, was found to be too complex. The UMTA simplified procedure, on the other hand, is a worksheet method of evaluating LCC impacts using simple mathematical computations (Attachment #8). Mr. Symes cautioned that UMTA is not in the position to say that one LCC evaluation procedure is better than another. He noted that transit systems have the responsibility to assess the reasonableness of manufacturer supplied data.

One of the advantages of the UMTA simplified LCC procedure over the AMS procedure is that the transit system is not required to have baseline data on its own buses covering a two-year period. Instead of comparing the LCC of the manufacturer's buses to the LCC of its own buses, the transit system simply compares the LCC of manufacturer A to that of manufacturer B, and manufacturer C, etc.

E. LCC for Bus Procurement--General Discussion

Mr. Stokel remarked that we seem to be ignoring the subjects of performance and standardization. He said performance involves such factors as the manufacturer's financial ability, service availability, training facilities, parts service and distribution points, publications and maintenance manuals. Standardization pertains to the costs associated with retooling facilities and retraining for mechanics and drivers.

Mr. Kravitz stated that Grumman Flxible has a problem with the term standardization. If standardization means the ability to supply a bus like the buses that are already in the grantee's fleet, then Grumman Flxible could never have sold buses to Columbus, OH, because Columbus possessed a 100 percent General Motors fleet until 1976. Also, he asked, what recourse does the manufacturer have if the grantee changes the LCC figures furnished by the manufacturer in response to the solicitation document?

Mr. Norman responded that if the grantee rejects certain data supplied by a manufacturer, the grantee must have the ability to replace the rejected data with some other data in order to complete its LCC calculations.

Mr. Hale remarked that he does not like any of the LCC evaluation procedures that are now being used.

Mr. Stokel emphasized that the guidelines for rolling stock procurement require the evaluation of four separate factors: initial capital cost, life cycle cost, performance, and standardization. The grantee must determine the costs associated with each factor to determine the final evaluated cost for each manufacturer.

Mr. Marino warned that quantifying or putting a price tag on all of the elements associated with performance and standardization is extremely difficult if not impossible. He added that bus manufacturers should be given an incentive for developing product improvements.

Mr. Venezia said he fears the evolution of a mandatory "White Book" on LCC procedures. Mr. Graebner said he does not think that will happen.

Mr. Graebner suggested that the Liaison Board devote half a day at the next meeting to consider the Providence, Rhode Island, life cycle cost exercise.

9. APTA/UMTA BUS MONITORING AND REPORTING SYSTEM

Mr. Jones reported on the progress of APTA's Bus Monitoring and Reporting System (Attachment #9). APTA will collect data on significant operational and maintenance problems that occur on a sample of advanced design, "new look," and articulated buses manufactured since January 1980.

Under the first level reporting system, participating transit systems are asked to report each month the total number of unscheduled maintenance actions that occur under each of ten major bus systems. The second level reporting system involves a more detailed functional breakdown of each bus system into subsystem, assembly, subassembly, etc., so that the precise cause or causes of unscheduled maintenance actions within a major bus system can be determined.

Mr. Hale stated that VIA Metropolitan Transit would be happy to participate in this program but lacks the resources to supply the data required by the second level reporting system. He also questioned whether APTA could assimilate all of the data generated by the second level reporting system.

Mr. Norman remarked that the second level reporting system requests information that either may not exist or is impossible

to produce. It was agreed that Messrs. Symes, Cihak, and Jones would meet to decide the merits of the second level reporting system.

10. BUS REHABILITATION GUIDELINES

Mr. King reported that Battelle Columbus Laboratories is under contract to UMTA to develop a manual of guidelines to assist transit systems in evaluating, selecting, and managing bus rehabilitation programs. The guidelines will address the definition of rehabilitation, the life cycle costs and benefits of rehabilitation, "in-house" versus contractor work, quality control, and performance of rehabilitated buses.

The guidelines will be based on recent transit system experience with bus rehabilitation. Battelle and its sub-contractor, ATE Management and Service Co., will conduct field surveys of six to eight transit systems with rehabilitation experience. Industry input regarding the contents and use of the guidelines will be obtained through the Bus Rehabilitation working group of the Bus Technology Liaison Board. (See Attachment #10 for a complete description of the Battelle task and composition of the working group.)

11. ROTARY SCREW AIR CONDITIONING COMPRESSOR UPDATE

Mr. Ow made a vu-graph slide presentation on the rotary screw air conditioning compressor (Attachment #11). Mr. Hale, whose transit system (VIA, San Antonio, Texas) is testing this compressor, said it is a viable piece of machinery. The Dunham-Bush compressor is small, compact, and operates on freon 12 instead of freon 22. Mr. Hale added that the absence of vibration is impressive. He said VIA has offered to continue testing this compressor as long as necessary.

12. AUTOMATED PASSENGER COUNTING SYSTEMS (APCS) PROJECT

Ms. Hobbs reported on the APCS Project using vu-graph slides (Attachment #12). The object of this program is to improve automated passenger counter accuracy which is now equivalent to the accuracy of manual data collection. Ms. Hobbs stated that automated passenger counting systems have suffered from bad press associated with automatic vehicle monitoring systems. She noted that the accuracy of both APCS and manual data collection decreased as the number of people boarding the bus at one time increased.

13. SCANIA BUS DEMONSTRATION AT NORWALK, CT

Mr. Gundersen reported on the Scania bus demonstration at Norwalk, CT (Attachment #13). Norwalk Transit District decided to test the Scania 112 transit coach because it was reported to have improved operating characteristics such as:

•Fuel efficiency	-5-6 miles per gallon (without air conditioning);
•Low noise level	-substantially lower noise levels;
•Improved brake service life	-oversized brake area and brake retarder; claimed to increase brake service life to 50,000 miles or more;
•Improved vehicle maneuverability	-increased turing angles of front wheels result in turning radius of less than 40 feet (to body corner); and
•Improved passenger accessibility	-low floor design, wide rear door, and lift-equipped rear door.

14. TECHNOLOGY OF ARTICULATED TRANSIT BUSES

Mr. Gundersen reported on a study he prepared entitled, "Technology of Articulated Transit Buses" (Attachment #14). The purpose of this study is to provide technical information to transit managers to assist in their decision making related to the deployment of articulated buses. This study embraces a description of the design and technology of foreign and domestically produced articulated buses, and provides a general review of the current U.S. operating and maintenance experience of articulated buses.

15. TRANSIT BUS TECHNOLOGY WORKSHOP

Mr. Dumke reviewed the program of the Transit Bus Technology Workshop to be held at the Transportation Systems Center over the next two days. He said the purpose of the workshop is to expose to a larger audience the subjects discussed at BTLB meetings and to provide UMTA additional information with which to develop its R&D program.

16. NEXT MEETING

The next meeting of the BTLB will be held in July or early August, 1982. Liaison Board members will be advised as to the precise date and location.

17. ADJOURNMENT

The Bus Technology Liaison Board meeting was adjourned at 4:30 p.m. The Liaison Board thanked the Transportation Systems Center staff for their hospitality in providing use of the TSC facilities for this meeting.

18. ACTION ITEMS

(1) Guidelines for Bus Maintenance were approved by the BTLB.

(2) Messrs. Cihak and Gimmler will meet to discuss improvements to the National Cooperative Transit Research and Development Program (NCTRP) process.

(3) APTA staff will arrange reports at the next meeting from contractors performing research on the following NCTRP projects:

Project Number	Project Title
47-1:	Improved Service Life of Urban Transit Coach Brakes;
54-1:	Improve Transit Bus Energy Efficiency and Productivity; and
60-1, TS-1:	Cleaning Equipment and Procedures for Transit Buses.

(4) Whole bus testing will remain a continuing agenda item.

(5) Comments on Mr. Venezia's proposed "Criteria for Bus Subsystem Testing" should be sent to Mr. Miller. Battelle will help Mr. Miller to incorporate these comments in the final text. Liaison Board members should be prepared to approve these criteria at the next meeting.

(6) Comments on "Draft Guidelines for Grantee Evaluation of Performance, Standardization, and Life Cycle Cost Factors for the Procurement of Transit Buses" should be sent to Mr. Cihak at APTA. Mr. Cihak will report on the results of the May 10, 1982 Task Force meeting.

(7) Messrs. Symes, Cihak, and Jones will meet to determine the usefulness of the second level reporting system under APTA's Bus Monitoring and Reporting System.

(8) Mr. Okasinski will report on the SEMTA technical study of LCC procurement procedures at the next meeting.

Report prepared by:

Patrick D. Jones
Research Associate

7/13/82

LIST OF ATTACHMENTS

Bus Technology Liaison Board Meeting
at the Transportation Systems Center
Cambridge, Massachusetts
April 28, 1982

1. Participants List
2. Meeting Agenda
3. APTA Guidelines for Bus Maintenance
4. NCTRP Project Statements for fiscal years 1980 and 1981
5. Criteria for Bus Subsystem Testing
6. Report of the March 22, 1982 Life Cycle Cost Procurement Task Force Meeting
7. 1982 Transit Bus Procurement Survey (4/13/82)
8. UMTA Simplified Life Cycle Cost Evaluation Procedure
9. Letter from Patrick D. Jones to Denis J. Symes on APTA Bus Monitoring and Reporting System
10. Letter from Frank J. Cihak to Bus Rehabilitation Working Group
11. Rotary Screw Air Conditioning Compressor (Vu-graph slides)
12. Automated Passenger Counting System Project (Vu-graph slides)
13. Evaluation of Scania 112 Transit Bus at Norwalk Transit District (Vu-graph slides)
14. Technology of Articulated Transit Buses (Vu-graph slides)
15. June 4, 1982 Passenger Transport Article on Bus Technology Liaison Board Meeting

Attachment #1

List of Participants at the Bus Technology Liaison Board Meeting April 28, 1982

BTLB MEMBERS OR ALTERNATES:

James H. Graebner, BTLB Chairman
Director
Santa Clara County Transportation Agency, San Jose, CA

Barton G. Betz
Program Manager, Capital Programs
Transport of New Jersey, Maplewood, NJ

Phil Dyer
Sales Manager, West
Pacific Bus Rebuilders, Inc., San Ramon, CA

Wayne Hale
Manager of Maintenance
Via Metropolitan Transit, San Antonio, TX

Ed Kravitz
Vice President, Engineering
Grumman Flxible Corporation, Delaware, OH

Ernie Miller
General Manager
Metro Regional Transit Authority, Akron, OH

T. Thomas Okasinski
Manager of Capital Development
Southeastern Michigan Transportation Authority, Detroit, MI

Norman C. Silverman
Manager, Planning & Engineering
Metropolitan Suburban Bus Authority, East Meadow, NY

Edward R. Stokel
Director of Public Transportation
GMC Truck & Coach Division, Pontiac, MI

Edward Tanski, BTLB Vice Chairman
Vice President of Equipment & Maintenance
Niagara Frontier Transit Metro, Inc., Buffalo, NY

Frank W. Venezia
Director, Rail Maintenance
Chicago Transit Authority, Chicago, IL

UMTA STAFF, WASHINGTON, DC:

Franz Gimmler

Douglas A. Kerr

John J. Marino

Al Neumann

Thomas A. Norman

Denis J. Symes

TSC STAFF, CAMBRIDGE, MA:

Thomas Comparato

Richard Gundersen

Neil Harrington

Bernd Kliem

Robert S. Ow

David Perez

Fred Seekell

Frank Tung

APTA STAFF, WASHINGTON, DC:

Frank J. Cihak

Patrick D. Jones

OTHER PARTICIPANTS:

Battelle Columbus Laboratories
Jerry Francis
Manager, Automotive Program Office

Rolland King
Associate Manager, Transportation Systems Section

Cummins Engine Company, Inc.
John E. Baker
Manager, Transportation Marketing

Detroit Diesel Allison Division of General Motors
Tony Bonacci
Zone Sales Manager, DDA Great Lakes Region

Detroit Diesel Allison Division of General Motors (continued)
Jim Swaim
Product Service Manager, Off-Highway Series Transmissions

Jerry Trotter
Senior Project Engineer, Applications Engineering Department

Jay W. White
Manager, On-Highway Sales

Transport of New Jersey
Martin D. Judd
Administrative Assistant to Director of Engineering and Maintenance

Scania Division/Saab-Scania of America, Inc.
John Schiavone
Service & Parts Administrator

UTDC (USA) Inc.
Robert E. Furniss
Director, Transit Systems Services

Reed Winslow
Project Engineer
Consultant to UTDC (USA) Inc.

Attachment #2

American Public Transit Association
Bus Technology Liaison Board
Meeting Agenda
Cambridge, Massachusetts
April 28, 1982

		Subject	Action	Person Responsible
10:00 a.m.	1.	Opening Remarks	Introductions and Review of Agenda	James Graebner, Chairman
	2.	Guidelines for Bus Maintenance	Approval by Liaison Board	Frank Cihak, APTA
	3.	NCTRP Bus Related Projects	Progress Report	Patrick Jones, APTA
	4.	Twenty-Year Transit Industry Needs	APTA Report	Patrick Jones, APTA
	5.	Industry Panel to Develop Criteria for Whole Bus Testing	Review of Giuliani Proposal	Clarence Giuliani, Neoplan
	6.	MARTA/Neoplan Test Plan and First Article Test Procedures	Progress Report	Rolland King and Jerry Francis, Battelle Columbus Laboratories
	7.	Bus Subsystem Testing	Liaison Board Working Group Report	Frank Venezia, CTA
12:00 Noon	LUNCH			
1:00 p.m.	8.	Life Cycle Cost Procurement		
		a. Activities of APTA Bus Procurement Task Force	Report	Frank Cihak, APTA
		b. Survey of Transit Systems Planning to Purchase Buses in FY '82	Report	Patrick Jones, APTA
		c. Activities of Reading Subcommittee	Report	James Reading, COTA
		d. UMTA Simplified LCC Evaluation Procedure	Report	Denis Symes, UMTA

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	Subject	Action	Person Responsible
9.	APTA/UMTA Bus Monitoring and Reporting System	Progress Report	Patrick Jones, APTA
10.	A/C Compressor Update	Report	Thomas Comparato, TSC
11.	Bus Rehabilitation Guidelines	Report	Rolland King and Jerry Francis, Battelle Columbus Laboratories
12.	Scania Bus Demonstration at Norwalk, CT	Status Report	Richard Gunderson, TSC
13.	Passenger Counting Workshop	Report	Vivian Hobbs, TSC
14.	Summary/Action Items		James Graebner, Chairman

5:00 p.m. ADJOURN

Attachment #3

APTA

Guidelines for Bus Maintenance

I. Introduction

II. Daily Maintenance

III. Intermediate Maintenance

IV. Long-Term Maintenance

V. Periodic Unit Removal and Replacement

VI. Rehabilitation

VII. Maintenance Quality Assurance

VIII. Maintenance Information Systems

I. Introduction

A. Background and Purpose

The ability to provide buses for revenue service depends on proper selection of equipment and the maintenance support for that equipment. This second point, the appropriate maintenance support, is the subject of this guideline.

The goal of the Guidelines for Bus Maintenance is to provide safe, clean reliable buses for revenue service in a cost-effective, efficient manner. The purpose of this document is to capture the proven effective maintenance practices of the urban bus transit industry. The document is intended as a guideline which can be modified as necessary to suit local conditions. Each transit system should develop a written bus maintenance plan which sets forth in detail the activities determined to be necessary. This bus maintenance plan is the individual transit system interpretation of the Guidelines for Bus Maintenance.

Local conditions are important determiners of the frequency and extent of maintenance actions. Climate influences air conditioning and heating practices, terrain influences transmission and brake practices, dust and dirt influence lubrication intervals. It is important that these influences be accounted for in the individual transit system bus maintenance plan and incorporated with the manufacturer's recommended maintenance schedule.

These guidelines have been prepared by the APTA in conjunction with the Bus Mechanical Committee and the Bus Technology Liaison Board. The concepts presented in the guidelines are not intended to be static and dogmatic. This document will be revised as needed to reflect improved maintenance practices and procedures. Readers are encouraged to suggest improvements by contacting the Director - Technical and Research Services Department of APTA.

B. Use of Manufacturer Maintenance Manuals and Recommendations

Bus and component manufacturers prepare manuals which recommend maintenance practices and provide specific guidance and instructions for trouble-shooting, removal, overhaul and repair and replacement of components. The ability of the transit system to provide this information at the point of needed use, i.e., when the maintenance worker is doing the work, is critical to reliable maintenance. A complete training program, initial and refresher, and internal information system to provide and update technical information is a must.

Manufacturer maintenance manuals are an important part of the bus maintenance plan. The manual recommendations*

*Typical recommendations are included in Appendix A.

should be carefully evaluated against local experience to develop the specific maintenance intervals and practices in the bus maintenance plan. If in doubt or no local experience indicates otherwise, follow manufacturer's recommendations.

II. Daily Maintenance

A. Fueling, Cleaning and Repair

This work is generally conducted during evening and night hours. Primary emphasis is on preparing the maximum number of buses for morning service. Examples of these activities are:

1. cash vaults are changed/emptied
2. bus is taken to fuel island
3. engine coolant level checked
4. fuel added
5. engine oil level checked
6. transmission fluid level checked (this may be done at weekly intervals)
7. rear tires are checked for low-pressure condition by "hammer bump" test
8. interior cleaned and inspected for graffiti, cut seats, glazing, lights, fire extinguisher, mirrors and body for damage or defects
9. during servicing, observations are made of functions, such as air pressure, transmission, brake operation and lights
10. all additions of fluids are recorded
11. hubodmeter/odometer readings are recorded
12. all defects observed are reported for correction
13. exterior cleaned daily or as directed
14. buses scheduled for safety/brake checks are inspected
15. buses reported by service personnel for defects are repaired and tested to confirm repair
16. buses reported by operators during the day for minor defects are routed for repair and tested to confirm repair
17. buses that failed in service, i.e., road calls, are repaired and tested to confirm repair

18. buses are parked in appropriate locations: buses without defects are placed ready for service; buses with defects are placed for repair operations

19. all repairs are recorded in Maintenance Information Systems (MIS)

20. repaired buses are parked ready for service

21. buses that cannot be repaired prior to morning pullout are held out of service for continued repair

The above are typical of the evening/night activities performed by maintenance personnel. In addition to the routine activities described above, provision must be made for the repair of road calls and pull in buses during daytime hours. Care must be taken to ensure work not started or completed is communicated to next shift for completion.

1. buses which fail in service must be returned to the garage, diagnosed and repaired or are repaired in the field by mobile mechanics

2. operator comments on buses which are returned to the garage during the day as a result of scheduled pull-ins should be checked for defects before the afternoon pull-out time

III. Intermediate Maintenance

The 5,000 miles* inspection is aimed at performing lubrication and inspections to ensure that the bus is in condition to operate to the next inspection mileage without failure or wear out of components. Examples of actions are as follows:

1. Buses are cleaned prior to inspection. This includes interior washing, exterior washing, engine and chassis washing. Engine and/or transmission oil samples for analysis are taken prior to inspection so that results can be used to determine need to change fluids during inspection.

2. Previous defect reports are reviewed to determine areas for special attention.

3. Inspection should include all major systems, such as engine, A/C, windows, transmission, doors, chassis, seating and wheelchair lifts. Typical inspection checklists are included in Appendix B.

4. Lubrication and change of various fluids may be performed at this time.

5. Change out of components for "wear out" may be performed at this time.

*Approximate - Based on manufacturer's recommendations and local conditions, needs and experience.

IV. Long-Term Maintenance

The 50,000 miles* inspection is generally performed to evaluate and repair major bus components. The following are typical activities:

1. Perform 5,000 miles inspection.

2. Dynamometer Test or Timed Acceleration Test - The entire engine, transmission, rear axle assembly (propulsion system) can be evaluated for performance in quantitative terms. Engine can be evaluated as to need for tune-up, repair or replacement.

3. Engine Tune-Up - Heavy duty diesel engines require infrequent but careful tune-up. During tune-up, compression readings can be taken to evaluate need to further engine work.

4. Long-Term Lubricant and Fluid Changes, such as rear axle lubricant or wheel bearings repacking may be performed at this time.

5. Change Out of Components for "wear out" may be performed at this time.

6. Body Components should be inspected and evaluated for possible replacement. This inspection is important in relation to the determination of need for body overhaul (Section VI).

V. Periodic Unit Removal and Replacement

The need to smooth out and predict work load for maintenance personnel and facilities has evolved the concept of periodic unit removal and replacement. Several purposes are served:

1. work load can be planned

2. material procurement requirements can be planned. This will enable manufacturers to supply material and reduce costs

3. component overhaul costs can be minimized

4. inspection and testing of "wear out" components can be reduced

Some examples can illustrate these purposes:

1. Rear Axle Angle Drive Gears and Differential (axle assembly)

   The axle assembly is a very long-life component with frequent operation of 300,000 miles before failure. Since the normal failure is due to wear out of bearings and gears,

*Approximate - Based on manufacturer's recommendations and local conditions, needs and experience.

it is possible to establish a mileage point where it is most economical to remove, overhaul and replace the axle assembly than to continue to operate to destruction. Operation to failure may result in the destruction of costly main components, i.e., the axle housing, the third member casting or the drive gears. The removal of the axle assembly prior to failure may only require an overhaul consisting of bearing and seal replacement and adjustment of gear clearances. The determination of the optimum and economic mileage is discussed later.

2. Shock Absorbers

These components are excellent examples of "wear out" since they are true throw away items with no overhaul possibilities. The only maintenance required is inspection for leaks and mounting bushing failure. The primary purpose of the shock absorber cannot be evaluated by visual inspection on the bus. Various methods have been tried to evaluate the condition of shock absorbers after they have been removed from the bus. It is apparent that the cost of removal, testing and reapplication of a used shock absorber has to be justified by the remaining service life of that shock absorber. High labor costs generally overshadow the cost of the replacement component. It is therefore necessary to determine the wear out point (mileage) and replace with new units.

3. Determination of Optimum Unit Life

Example: Rear axle assembly - 1) determine mileage and costs of overhaul of assemblies that run to failure, 2) determine costs of overhaul of units removed at a reduced mileage (suggested mileage is 90 percent of average miles to failure), 3) compare average cost per mile of the two methods.

Example: Shock absorber - Determine useful life by removing sample units at predetermined intervals to determine remaining useful life. Testing of the condition and remaining life may require cooperation with the shock absorber manufacturer. Shock absorbers should then be replaced at a mileage point when only a few percent exceed the wear out point (suggested 5 to 10 percent).

In order to obtain maximum life from these components, it is necessary to have an ongoing test program using control groups of buses that are not in the change out cycle. This is necessary to reach the wear out or failure point of a component or the point at which the required number fail.

Mileage has been used as a basis of wear in these examples. This use may not be correct for specific examples of revenue service. Careful monitoring must be made to ensure correlation of unit "wear" to bus miles.

Various methods of easily identifying dates of equipment installation, such as color code or date marking, have been applied to bus maintenance. These methods usually reduce record keeping and errors due to record keeping.

VI. Rehabilitation

Even with a closely controlled maintenance program, the condition of a bus can deteriorate to a point where replacement of a few components is not sufficient to restore reliable service or appearance. Paint, interior and exterior, and floor covering cannot be "touched up" indefinitely. Eventually the bus should be repainted.

The usual major condition requiring correction involves the structure of the body. Other systems to be considered are propulsion, electrical and air conditioning. A careful analysis of all major systems may lead to the conclusion that a bus or series of buses be given an extensive rehabilitation treatment.

Many levels of rehabilitation are offered ranging from cosmetic, such as repainting the exterior and interior to complete cosmetic and mechanical rebuilding or replacement. This may include replacement of bulkheads, suspension components, rubber floor covering and wood subflooring, rebuilding of the engine and transmission and rewiring of the electrical system.

Transit systems contemplating doing this work "in house" should make careful note of the requirements needed, such as working space, specialized skills, parts and supervision. Quality control is also a requirement.

In addition to doing this work in their own facilities, many transit systems find it to their advantage to contract rehabilitation to private sector contractors.

VII. Maintenance Quality Assurance

Transit systems have not made extensive use of established industrial Quality Assurance (QA) methods. In general, the present method has been to rely on the skill and dedication of the individual worker. In order that management be fully informed, an independent QA organization is essential. In smaller transit systems, a separate QA organization may not be practical; however, the responsibility should be assigned to a specific person. A sample QA report performed by a maintenance foreman is shown in Appendix C. Like safety, QA must be independent and report to the chief executive officer. Quality Assurance does not establish standards of performance but only evaluates the degree to which they are attained. Criteria and standards for evaluation must be established and made a part of each job procedure. It is therefore evident that established job procedures are necessary for maintenance functions.

Management should be advised of the quality level of services and equipment purchased by the transit system and also services and equipment furnished to the passenger. Several levels of assessment are proposed for maintenance related equipment.

A. Condition of Equipment Available for Revenue Service

The physical condition of the bus after all service and repair operations are completed is an accurate indicator of the service provided to the passenger. Conditions that can be evaluated are:

1. interior and exterior cleanliness
2. propulsion system fluid levels, such as engine and transmission fluid and cooling system fluid levels
3. tire pressure and tread depth
4. interior and exterior lights
5. mirrors and windshield wiper
6. door operation
7. compressed air system leaks and leak down time, brake push rod travel and lining thickness
8. interior and exterior body conditions including windows, floors, seats and body panels

B. Condition of Equipment After Specific Maintenance Actions

An evaluation of significant parameters can be performed after maintenance actions are complete. For example, after a diesel engine is tuned-up, checks can be made for:

1. governed RPM
2. idle RPM
3. valve clearance
4. injector timing
5. fuel pressure
6. oil leaks
7. oil pressure

It is important that the results of the QA evaluations be presented to management in simple, clear quantitative

terms. This information can then be analyzed to determine trends, compliance with minimum quality levels and need to revise or institute maintenance procedures or job procedures.

VIII. Maintenance Information Systems

A Maintenance Information System (MIS) is essential for scheduling of maintenance activities and for controlling labor and material costs. Another major benefit of MIS is the ability to evaluate the effects of changes in maintenance procedures and policies.

The MIS should be able to identify labor and material costs to specific job procedures or maintenance functions. Examples of the level of identification desired are:

1. oil change
2. tune-up
3. tire maintenance
4. daily cleaning and servicing
5. vandalism damage
6. collision damage
7. inspection program

Typical Bus Manufacturer Maintenance Recommendations

1) Grumman Flxible Corporation

2) GMC Truck and Coach

Note: Only first pages are included -- final version will contain complete copies.

P.M. MAINTENANCE SCHEDULE

The following Preventive Maintenance Schedule is a collection of suggested maintenance operations contained in the current Maintenance Manual.

Also included in the schedule is Emission Control System Maintenance in compliance with the Federal Clean Air Act, with references made to the Engine Manufacturers Service Manual. This maintenance is denoted by the key note (F) in the column headed Maint. Man. Ref. Page (Maintenance Manual Reference Page). See Federal Clean Air Act below.

Service intervals may be given as: regular intervals (Reg. Int.), Months, and/or miles. Regular intervals are to be determined by shop personel based on operating conditions, previous experience, and component failure history. In cases where both time (in months) and miles (in thousands) are given for a particular operation, maintenance should be performed at whichever interval occurs first.

This Maintenance Schedule shall serve only as a guideline to maintenance personel in developing a maintenance schedule applicable to local operation conditions.

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act requires the engine manufacturer to furnish, with each new diesel engine to be installed in a motor vehicle, written instructions for proper maintenance and use of the vehicle or engine by the ultimate purchaser. The Instructions shall correspond to regulations which the Administrator of the Environmental Protection Agency (EPA) shall promulgate. This Section provides these instructions to owners in compliance with the law.

NORMAL ENGINE USE

The owner's maintenance instructions contained in this Section are based on the assumption that the engine will be used to power a motor vehicle which will be used as designated:

- To carry passengers and/or cargo within the wEight limitations indicated on GVW plate affixed to the vehicle.
- To operate within legal limits.
- To operate on a daily basis, as a general rule, for at least several miles, and
- To operate on specified fuel and lubricating oils as covered in the Maintenance Manual.

Unusual operation conditions will require more frequent engine maintenance where an engine is operated under other than normal conditions (e.g., heavy dust, excessive idle.)

C-8123-A

GMC

COACH MAINTENANCE MANUAL

RTS MODEL T80204

SERIAL NUMBERS 811803 THRU 812867

GMC TRUCK & COACH

Typical Transit System Maintenance Checklists

1) VIA Metropolitan Transit - San Antonio, TX
   a) Pre-Inspection Bus Cleaning
   b) Bus Interior Cleaning
   c) Bus Interior Glass Cleaner
   d) Engine Tune-Up
   e) Inspection Guide City Buses RTS-II

2) Southern California Rapid Transit District - Los Angeles, CA
   6,000 Miles Minor Inspection Report

3) Central Ohio Transit Authority - Columbus, OH
   ABCD Inspection Checklist

PRE-INSPECTION BUS CLEANING

Scheduled _____ 19___ BUS _____
Due for 24,000_____ 4800_____

__1. Position bus on hoist.

__2. Open doors to engine, transmission and air conditioning compressor compartments.

__3. Disconnect battery cables.

__4. Spray Engine, transmission, and accessories with Actusol Spray Solution.

PAY SPECIAL ATTENTION TO ALL HOSE CLAMPS AND END FITTINGS. STARTER SIDE OF ENGINE MUST ALSO BE CLEAN.

Using long wand. reach in from transmission side and spray ENTIRE starter area of engine.

__5. Raise bus, steam steering gear boxes, tierod ends and front spindles.

__6. Steam brake relay valve, leveling valves, and rear slack adjusters.

__7. Steam under side of engine, transmission, filters, starter area, and frame work in engine compartment.

__8. Lower bus to floor.

__9. Using water hose. flush engine, accessories, transmission and air conditioning compressor.

__10. Connect Battery cables.

__11. On completion of cleaning make sure all compartment doors are closed securely.

DATE COMPLETED _____ 19_____

SIGNED _____

CHECKED AND
APPROVED BY _____
Foreman

Form 23
JUB pc
4/75 - 400

Form 1633

BUS NO _____

Scheduled _____ 19___

BUS INTERIOR CLEANING

___Park bus, left rear wheel raised on wood block.
___Remove chewing gum from seats, walls, floor & stepwells.
___Remove farebox card, signs, and bus schedules. Start at driver's seat; work to rear of bus, and on opposite side to front of bus.
___Cover A/C intakes, power-pak, instrument panel, farebox and horn.
___Spray eintre bus interior with plain water (set dial on rinse position, nozzle #65).
___Spray; set dial on mix, nozzle #65.
___Soak for 5 minutes.
___Wash-set dial on mix, nozzle #15. (Give particular attention to extremely dirty areas.)
___Rinse—set dial on rinse, nozzle #15 (start with ceiling and move forward from rear spraying suds and dirt out the doors).
___Dry with cyclone cleaner.
___Replace bus schedules, signs and farebox card by reversing No. 3 above.
___Apply insecticide.
___Wipe all hand rails.
___Remove all covers.
___Inspect bus and make necessary corrections before returning to service.

If work other than the above was done report it on the reverse side, showing how much time it required.

SIGNED _____

DATE COMPLETED _____

APPROVED _____
(Foreman)

5/78-300 INSPECTION
DIV.FOREMAN

Form 1601
Monday-#1

BUS INTERIOR GLASS CLEANER

Wash all interior glass, including windshield, mirrors, gauges, and doors. Dust dash, farebox, destination signs, doors, and back of rear seat. Dust ledges under transom glass throughout bus. Clean front and center door step wells. Clean front and center door glass.

CHECK EACH BUS NBR. AS COMPLETED

BUS NUMBER (Past Due)	BUS NUMBER	BUS NUMBER
	200	848
	201	849
	202	850
	203	851
	204	852
	205	853
	206	854
	207	
	208	
	209	
	210	
	846	
	847	

DATE: _____

SIGNED: _____

APPROVED: _____
Foreman

Bus No. _____

Date _____ 19 ____

ENGINE TUNE-UP

1. Adjust valve bridge
2. Adjust valve lash
3. Time fuel injectors
4. Loosen buffer screw
5. Loosen throttle delay cyl.
6. Install tachometer
   Adjust idle speed-Preliminary
7. Adjust low speed gap
8. Inspect rack brackets for cracks, checks, etc.
   Adjust injector control racks
9. Adjust maximum No-load speed
10. Adjust power equalizer if equipped
11. Adjust idle speed --Final
12. Adjust buffer screw
13. Adjust throttle delay

By _____

Date _____ 19 ____

Signed _____
Foreman

Form 4070
KMK/hc - 7/63 - 200

BUS #_____ INSPECTION GUIDE DUE ON_____19_____.
TIME STAMP: CITY BUSES RTS-II

4____8____16____24____48____

SYMBOLS: A-Adjust; C-Clean; Ch-Change; I-Inspect; L-Lubricate; O-Operating Test; S-Service; T-Tighten. Check off each item as completed. Record on 1580 defects likely to cause problems before next inspection.

48	24	16	8	4	
					OPERATIONS PERFORMED IN YARD AND ON WAY TO PIT:
					INSTRUMENTS, DASH: O&I-air pressure(building up & drop), indicator lights, warning buzzer, 12 & 24 volt meters; I-speedometer.
					LIGHT, HOURMETER: I-burning/not burning (circle which).
					PARK BRAKE: O-effectiveness; O-release.
					BRAKES, INTERLOCK & FOOT: O&I-door brake, foot brake application, release; I-stopping distance.
					CLEANING; (AIR & WATER GUN): Radiator, A/C condenser.
					OPERATIONS PERFORMED OVER PIT INSIDE OF BUS:
					LIGHTS & SWITCHES: O&I-all interior & exterior lights; T-control knobs; Ch-defective bulbs; I-hourmeter reading, record hourmeter reading_____reset hourmeter to "0".
					W/S WIPERS: O&A-speed; sweep; I&A-blades; S-water reservior.
				X	FIRE EXTINGUISHER: I-hose, seal; I-gauge readings(must be in green area.)
					BODY,INTERIOR: I-accident hazards-floor plates, all glass,mirrors,hand rails,seats,& backs,stanchions,steps,signal switches; O-exit door lock; T-screws, bolts,nuts; O&A-door operation; I-push bars; I&A-sensitive door edges; I-operation of all blower motors.
					HEATING: C-filter panels, A/C return,operators heater; C-evaporator fins.
					KNEEL FEATURE: O-performance, warning device, indicator lights.
					OPERATIONS PERFORMED IN PIT, UNDER BUS:
					AIR BRAKES: I-clearance (.010" - .060") I-Lining wear.
				X	STEERING: O&I-free play; I-joints,stops,toe-in; I-bracket, knuckles, power steering hoses and front lines.
					TRANSMISSION: I&A-gear shifter cable for full engagement; T-clamps.
					ENGINE CRANKCASE: Ch-oil; (take sample & deliver to Foreman.)
					OIL FILTER: Ch-bypass and full flow elements.
X	X				REAR AXLE: I-leaks; S-oil level; C-breather.
		X	X	X	REAR AXLE: I-leaks;Ch-oil;I-wheel bearing adj;C-breather;A-Park brake.
					DIFFERENTIAL CARRIER: T-mounting nuts; I-park brake mounting.
					LUBRICATION: L-chassis(see chart); I-front wheel bearing adjustment.
					DRIVE SHAFTS: L-bearings; I-lock wires; T-flange bolts.
					A/C EVAPORATOR DRAIN: C-drain tube and nipple.
					SUSPENSION: I-bellows, stablizer bars, radius rods, shock absorbers, links,, bushings, mounts, control arms; I-mud flaps.
	X	X	X	X	UNITS: Ch-air strainer, compressor check valve, air tank pressure, protection valve, air pressure safety valves, fire extinguisher.
					OPERATIONS PERFORMED OUT OF PIT, OUTSIDE OF BUS:
					EMERGENCY ENGINE STOP CONTROL:I-switch,solenoid,choke-valve latch.
					TRANSMISSION:Power steering: I&S-fluid level; I-hoses, rear.
					A/C COMPRESSOR:T-mountings;I-belt guard;A-belt (see lube chart).
					ACCELERATOR:I-linkage full opening (pedal depressed).
					AIR CLEANER:O-air cleaner gauge I-hose,connections,drain tubes & hose.
					DOORS,CLOSURE: I&O-all closure doors, locks and latches.
			X	X	TRANSMISSION:Ch-fluid; C-governor screen Ch-filter element.
					AIR SYSTEM:I-drain air bottle & reservoirs;I&O-automatic reservor drain.
	X	X	X	X	POWER STEERING: Ch-element and fluid.
					COOLING SYSTEM: I-hydraulic fan drive,water hoses; T-clamps; I&S-anti freeze per instructions; O-pressure test cooling system.
			X	X	COOLING SYSTEM: Ch-filter element.
				X	FUEL FILTERS:: Ch-secondary and primary.
					AIR COND. UNIT: I-condenser; leaks; O&I-refrigerant level, compressor oil level, safety switch 25 PSI.
					BATTERIES: I-corrosion,Delco Eye,battery cases for leaks & distortion.
				X	BODY,EXTERIOR: I-accident hazards,lamp mountings,mirrors,loose panels; Ch-defective bulbs, lenses, closure doors.
					TIRES:I-damage,matched duals,wear,valve stem accessibility.
					WHEELS:I-grease leaks; T-axle flange nuts, wheel nuts.
					LEAKS: O&I-engine;I-oil lines and air,cooling,exhaust & fuel systems.
					YARD TEST: I-performance; O-transmission shift points.
					FRONT HUB CAPS: I-plastic lens,leaks; S-fluid level (SAE 140).
					HUBOMETER: Inspect hubdometer and record reading:_____.

COMPLETED BY_____ APPROVED_____
Inspector Foreman

WMH:PC - 500
Form 1522-B 11/78

RTD 33-63
FRONT SIDE
REV 4/79

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
MINOR INSPECTION REPORT

6,000 MILES

Div. No. _____

Coach No. _____ Accumulated Miles _____ Date _____

Type of Operations to be performed: "√" if O.K. "X" if Adjusted "O" if Repairs Needed

(Mechanic Making Inspection — Show Badge Number in Ink)

ENGINE: All Coaches

_____ CK Engine Idle Speed _____ RPM
_____ CK Engine RPM Maximum from Operator's Seat _____ RPM
_____ CK Engine Stall Speed _____ RPM
_____ CK Throttle Linkage, Springs & Operation
_____ CK Engine for Oil Leaks
_____ CK All Fuel Lines & Connections for Leaks
_____ CK Hose Condition, Connections & Water Leaks
_____ CK All Belts for Wear & Adjustment
_____ CK Fan Blades, Hubs and Drive
_____ Service Air Cleaners
_____ Change Engine Oil – Spectrographic analysis determine
_____ Change Oil Filters
_____ Service Engine Oil Strainer

DRIVE: All Coaches

_____ CK Clutch Clearance and Arm Travel _____"
_____ CK Trans. & Diff. for Oil Level & Leaks
_____ CK Differential Backlash 1½" Max. _____"
_____ CK Drive Line & Universal Joints and Tighten Bolts
_____ CK Trans. Pressures

Idle		Drive-Idle	
CC	_____	CC	_____
DD	_____	DD	_____
Main	_____	Main	_____
Turbine	_____	Turbine	_____

CHASSIS: All Coaches

_____ CK Steering Gear (Boxes) & Add Oil
_____ Torque Front Wheel Lugs
_____ Tighten Rear Wheel Lugs
_____ CK Radius Rod Bushings, Tighten All Suspension Bolts

CHASSIS: All Coaches (Continued)

_____ CK Air Suspension for Leaks & Proper Height _____"
_____ CK Axle Flanges, Gaskets & Tighten Nuts
_____ Grease Coach, Jack Up Front End
_____ CK Fuel Tank & Filler Cap
_____ CK Steering Travel _____"
_____ CK Tire Skid Readings

_____	LF	_____	RF
_____	LRI	_____	RRI
_____	LRO	_____	RRO
_____	LTr	_____	RTr

BRAKES: All Coaches

_____ CK Air Compressor & Main Discharge Line
_____ CK Air Compressor for Build Up Time _____ Min. _____ Sec.
_____ CK Air System for Air Leaks
_____ Drain Air Tanks
_____ CK Main Check Valve Operation
_____ CK Low Air Pressure Switch for Proper Operation Cut Out Between 57 & 63 lbs.
_____ CK Brake Valve Pressure & Operation _____ lbs.
_____ CK All Brakes for Adjustment, Lining & Cam Heights
_____ CK Emergency Brake, Lining, Linkage & Adjustment
_____ CK DD Brake Operation
_____ CK Anti-Skid Brake Operation
_____ CK Brake Lining Thickness

_____	LF	_____	RF
_____	LR	_____	RR

_____ CK Brake Rod Travel

_____"	LF	_____"	RF
_____"	LR	_____"	RR

RTD 33-63
REVERSE SIDE
REV 4/79

ELECTRICAL: All Coaches

_____ CK Hydrometer Reading of Battery
Battery No. 1 Min._____ Max._____
Battery No. 2 Min._____ Max._____

_____ CK Battery Cell Voltage (With lights on)
Battery No. 1 Min._____ Max._____
Battery No. 2 Min._____ Max._____

_____ CK Main Cable Resistance

_____ CK Battery Water Level

_____ CK Batt. Cables & Connects; add Corrosion Free

_____ CK Generator & Starter Brushes, Springs, Holders & Commutators

_____ CK All Instruments & Safety Devices for Proper Operation

_____ CK Buzzer and Buzzer Cords

_____ CK Horn

_____ CK Power Packs and All Lights

_____ CK Directional Signals

_____ CK Voltage Drop – Starter_____
Battery_____

_____ CK Voltage Regulator Output

BODY: All Coaches

_____ CK Windshield Wiper & Blades

_____ CK All Mirrors

_____ CK Fire Extinguisher & No._____

_____ CK Head & Run Signs for Operation

_____ CK For Loose Grab Rails & Stanchions

_____ CK All Seats & Frames for Wear & Damage

_____ CK & Clean Interior Heating & Ventilating Screens

_____ Brush all Lint from Heater Radiator Core

DOORS: All Coaches

_____ CK & Lube All Door Mechanisms

_____ CK Door Rollers and Track

_____ CK Front Door Operation:
Timing_____ Sec.

_____ CK Rear Door Operation
Throttle Interlock_____lbs.
Rear Brake Pressure_____lbs.
Push Type 1½ Sec.
Others 2½ to 3½ Sec.
Sensitive Edge Deflection to Energize Switches_____"
Pressure to Open Push Type_____ lbs.

LIFTS: Handicapped – Where Applicable

_____ CK Operation, Incl. Brake & Throttle Interlocks

_____ CK Cycle Time:
Deploy_____ Sec.
Raise_____ Sec.
Lower_____ Sec.

_____ CK Bus Kneeling Time
Raise_____ Sec.
Lower_____ Sec.

_____ CK Lift Hydraulic Level

ROAD Test: All Coaches

_____ Road Test Vehicle after Inspection and Repairs are Completed

_____
Supervisor's Signature

INSPECTION TYPE
A B C D

AIR FILTER
YES NO

CAMPAIGN
SPECIAL SERVICE

BUS #_____
MILES_____
DATE _____
INSP#_____

A

1. AIR CONDITIONER, on while driving to Inspection Area.
   - A. Did blowers come on? YES NO
   - B. Did A/C compressor come on?
   - C. Did condenser fan come on?
   - D. Any unusual noises?
   - E. Any cold air?
2. HAND BRAKE, check
3. SAFETY ITEMS, inside, check
   - A. Mirrors
   - B. Sun visor
   - C. Windshield wipers
   - D. Door controls
   - E. Flooring & Stepwells
   - F. Passenger signals & Door alarms
   - G. Grab rails, Seat handles, Stanchions
   - H. Drivers seat adjustment
4. ENGINE COMPARTMENT, check for condition, noises, leaks
5. A/C RECEIVER, check for refrigerant level
6. A/C COMPRESSOR, check for oil level

   NOTE: Engine must be operating to properly check items #5 and #6. However, items #7,8,9, and #10 must be accomplished immediately after engine is shut down. Samples must be taken even if the lubricants are to be changed.

7. TRANSMISSION, Shut down engine, Check torque fluid level
8. TORQUE FLUID, sample, reading |_____|
9. ENGINE OIL, sample, reading |_____|
10. ENGINE OIL, check quantity
11. EXTERIOR LIGHTS, all, check
12. CONDENSER FAN FLUID RESERVOIR, check (if applicable)
13. AXLE STUD NUTS, check
14. WHEEL STUD NUTS, check
15. BATTERIES, check, record readings
16. The following items must be cleaned, lubricated and checked for proper operation.
    - A. BRAKE PEDAL, spray lube
    - B. ACCELERATOR PEDAL, spray lube or grease
    - C. AIR INTAKE SYSTEM, service air filter as required
    - D. DESTINATION SIGNS, spray lube gears & shaft ends
    - E. DRIVER SEAT, spray lube post and latch wipe off excess lube
    - F. ENTRANCE DOOR, front and rear post bearings
17. ENGINE COMPARTMENT
    - A. SPEEDOMETER ADAPTER, lubricate
    - B. AIR INTAKE SYSTEM, inspect for air leaks
    - C. AIR INTAKE SYSTEM, service air filter A/R
    - D. LINES, HOSES, FITTINGS, inspect for chafing and leaks
18. AIR TANKS, Bleed momentarily and check for excessive oil before installing shop air line.
19. PARKING BRAKE, clean and adjust (if necessary)
20. SERVICE BRAKES, all, inspect and adjust
21. RADIUS RODS, check for excessive wear
22. SWAY BAR and links, inspect
23. SHOCK ABSORBERS, check
24. NYCAL BUMPERS, inspect
25. AIR BAGS, inspect
26. LEVELING VALVES, inspect
27. FUEL TANK, inspect
28. DIFFERENTIAL, inspect for oil leaks
29. ENGINE, check for leaks
30. TIRES, inspect
31. OIL LEVEL, check, inspect for leaks and general condition
    - A. STEERING GEAR BOX
    - B. BEVEL GEAR BOX
    - C. DIFFERNTIAL
32. LUBRICATION, At propeller shaft splines, U-joints, and and all steering components; each item should be checked for wear and evidence of rust before grease is applied. All lube fittings should be wiped clean of dirt before being greased.
    - A. STEERING SHAFT, U-Joints and spline (3)
    - B. TIE ROD ENDS (4)
    - C. KING PINS (4)
    - D. BRAKE CAMSHAFTS, front & rear (4)
    - E. ANCHOR PINS, front & rear (4)
    - F. SLACK ADJUSTER, front & rear (4)
    - G. ENTRANCE DOOR, Rear post (1)
    - H. BATTERY CARRIER
    - I. EXIT DOOR, both posts (2)
    - J. PARKING BRAKE, linkage (4)
    - K. PROPELLER SHAFT, main (3)
    - L. A/C COMPARTMENT, check general condition, lubricate U-Joints and spline (3)

      NOTE: Item L may be accomplished while bus is in the intermediate raised position
33. SPRAY LUBRICATE
    - A. PARKING BRAKE, ratchet and linkage
    - B. ACCELERATOR, pedal linkage
    - C. SLACK ADJUSTER, clevis pins
    - D. FILTER BAY, latches, inspect filters
34. TIRES, check and record pressure

    NOTE: Tire pressure check may be accomplished with bus in the intermediate raised position. The tire pressure prior to servicing is the pressure that

BUS #_____ TORQUE READING_____
ENGINE OIL READING_____

INSP#_____

B

1. ENGINE OIL, change
2. ENGINE OIL filter, change
3. PRIMARY FUEL FILTER, change

NOTE: When the engine is first started after an oil change it must not be operated at more than idle sped for 30 seconds after start up.

B

C

1. TRANSMISSION FLUID, change
2. TRANSMISSION FILTER, change
3. SECONDARY FUEL FILTER, change

C

D

1. DIFFERENTIAL, gear oil, change,

D

DISCREPENCIES THAT CANNOT BE CLEARED IMMEDIATELY WILL BE ENTERED HERE AND ON A COACH DEFECT REPORT.

8-4 / Rev. 5/01

NAME NUMBER

1. _____
2. _____
3. _____

TIRE PRESSURES

RF_____, RRI_____, RRO_____,

LRI_____, LRO_____, LF_____,

BATTERY CONDITION

(LW) Indicates water too low for reading

(H) High

(M) Medium

(L) Low

____	____	____	____
____	____	____	____
____	____	____	____

SPECIAL INSTRUCTIONS

Quality Assurance Checklist

Used by VIA Metropolitan Transit - San Antonio, TX

Form 27

Foreman's Report of Job "Shake-down" Inspection

(Each foreman to turn in minimum of five per week)

Date _____ 19____

Job inspected _____

Just completed by _____

What, if anything, was wrong with job? _____

_____

_____

_____

_____

Time required to complete job was:

Very Good	Good	Satisfactory	Unsatisfactory	Poor
( )	( )	( )	( )	( )

Quality of Workmanship:

Very Good	Good	Satisfactory	Unsatisfactory	Poor
( )	( )	( )	( )	( )

Comments: _____

_____

_____

_____

Was the employee present during shake-down? _____

If not, has he been informed of results? _____

How many minutes did you spend making this shake-down inspection? _____

Signed _____
Foreman

NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 30-1

Research Project Title: Small Transit Buses: A Manual for Improved Purchasing, Use, and Maintenance

Specific Problem Area: Procurement

Research Problem Statement:

One of the important decisions facing both rural and urban transit decision-makers is whether to invest scarce funds in more expensive or less expensive small transit buses. Available small buses (i.e., ranging from van conversions to 31-ft heavy-duty small buses) are highly diverse in both capital costs and technology. Their uses are also highly diverse, spanning the range from large transit fleets in major urban areas to small rural operators, and including fixed-route, demand-responsive, shuttle and other services. The complexity of both needs and possible solutions has led to many poor choices of buses for specific duties. In addition, uncertainties with respect to the small bus market have led to a lack of continuity in design and development; perceived problems in bus operation, maintenance, and reliability; a lack of clear definition of bus demand; and little standardization within realistic price ranges. Consequently, no guidelines exist with which transit providers, seeking to purchase or replace small buses, can make objective decisions concerning the best bus type to be procured.

Objectives:

The general objective of this research is to develop a workbook-style manual for local transit operators and to identify key recommendations that might feasibly be taken by transit operators, local governments, states, and UMTA to substantially improve the procurement, appropriate use, and maintenance processes for small transit buses. The manual is intended for use by individuals experienced and inexperienced in the procurement and operation of small transit buses. Furthermore, the manual is intended to assist individuals in the cost-effective procurement, maintenance, and operation of buses in a wide range of local, institutional, service, and operating environments. (Included in the definition of service and operating environments are maximum and average loads; type of service; range requirements (i.e., distance between refueling); wheelchair-lift or ramp needs, and actual usage; types, conditions, and grades of roads/streets; dwell-time constraints; weather extremes; frequency and degree of acceleration/braking; communication equipment requirements; and fare collection equipment requirements.) The manual will be based on research requiring the collection, tabulation, and analyses of primary information and data. While performing the research, investigators must be particularly cognizant of bus maintainability and fuel efficiency. (Included in the definition of maintainability are life expectancy of the bus's power train, body, and major components; minimum mean time before failure (MTBF) rates of components; availability and cost of

parts; maintenance and servicing facilities required; skill levels and representative times and costs required for servicing and repair; complexity of subsystems (i.e., lifts and air conditioning).) Fuel efficiency studies should consider duty cycle, propulsion technology, maintenance, bus size and weight, gearing, etc. Transit operators will be the principal users of the research results, although they should also be of interest to manufacturers and funding agencies. To accomplish this objective the following tasks are considered essential but not limiting:

Task 1 - Determine the present capital and operating costs, and performance of small transit buses in U.S. operations as affected by (1) service and operating environments, (2) institutional environments, and (3) maintenance availability and sophistication.

A. Develop a classification system for small buses by type (life expectancy, maintainability, operating cost) and size.

B. Develop a classification system for operational environments and maintenance programs.

C. Develop a detailed data collection plan for use in determining capital and operating costs for various classes of buses, maintenance programs, and operating environments. Approval of an interim report submitted for Task 1 through Item C will be obtained from NCTRP before proceeding with Item D. One month for this approval should be reflected in the schedule of tasks.

D. Collect data and summarize results for various bus and component classes to provide transit operators with relevant design characteristics and operating experience. Analyze MTBF data (as developed in this study or available elsewhere), design characteristics, and general operating experience for key components, subsystems, chassis types, etc. that are critical to the development of minimum specifications for various service and operating environments, appropriate maintenance actions, and realistic replacement intervals. Develop from these data an engineering analysis of each bus class describing its suitability for various types of service and likely operating results. Assess the practicality of using life-cycle costs to assist in the description of operating results.

E. Identify problems for transit operators and manufacturers in using or producing small transit buses that are supported by the data.

Task 2 - Develop practical recommendations for resolution of key problems, identified in the research, for improving the purchase, maintainability, and cost-effective use of small transit buses. These recommendations should be oriented towards actions that can be taken by transit operating agencies to improve delivery of service. (NOTICE: At the conclusion of Task 2, a second interim report will be submitted to the NCTRP for approval. The approval process should not delay the initiation of Task 3).

Task 3 - Based on the results of Task 1, develop a workbook (flow-chart type) manual that can be used by transit operators to make appropriate small bus choices. The manual should be designed to take as input such planning factors as service type, anticipated passenger loads, typical speeds, maintenance and institutional factors. Its output should include the classes of small transit buses that are best suited to the projected operating environment, special specification items or options that should be required, the range of maintenance and fuel costs likely to be experienced, and special maintenance provisions that should be undertaken.

Funds Available: $300,000

Contract Time: 21 months (includes 3 months for final report review and revision)

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K.W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 9, 1982

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

In the event that proposals are hand carried on their due date, be aware that our offices are located on the 5th floor (Room 528) of the George Washington University Joseph Henry Building at 2100 Pennsylvania Avenue, N.W., Washington, DC.

Note 1. The National Academy of Sciences requires compliance with Title 49, Code of Federal Regulations, Part 21, and hereby notifies all parties that it will affirmatively insure that the contract entered into pursuant to this announcement will be awarded without discrimination on the grounds of race, color, religion, sex, or national origin.

Note 2. In compliance with Department of Transportation prime contract DTUM60-81-C-72012 and Section 211 of P.L. 95-507, the National Academy of Sciences asks that submitters of proposals identify themselves according to the following: (1) Large Business, (2) Small Business, (3) Women-Owned Business, (4) Minority Business, (5) Small Disadvantaged Business, (6) Labor Surplus Area Concern, and (7) Non-Profit. The National Academy of Sciences is committed to fulfillment of its goals under Section 211 of P.L. 95-507 and encourages proposals from small and small disadvantaged firms.

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Administrative Engineer, NCTRP
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 334-3224

In the interest of saving paper, reduced mailing costs, and ease of handling, it is desired that proposal pages be printed on both sides using the lightest bond weight permitting such practice, and maintaining margins of less than 1 inch.

Note 4. Proposals are evaluated by the NCTRP staff and a project panel approved by the National Academy of Sciences as outstanding individuals collectively very knowledgeable in the problem area. Selection of an agency is made only by the project panel and in consideration of: (1) the proposer's demonstrated

understanding of the problem; (2) the merit of the proposed research approach and experiment design; (3) the probability of success in meeting the project's objectives; (4) the successes ("track record") in the same or closely related problem area; and (5) the adequacy of the facilities. The total funds available are made known in the Project Statement and line items of the budget are examined to determine the reasonableness of the allocation of funds to the various tasks. If the proposed total cost exceeds the funds available, the proposal is rejected.

Note 5. Mr. R. Ian Kingham is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 334-3224 to answer inquiries.

Note 6. All proposals become the property of the National Cooperative Transit Research and Development Program. Final disposition will be made according to the policies thereof, including the right to reject all proposals.

Note 7. It is not necessary for recipients of this project statement to notify the NCTRP that they do not intend to submit a proposal but that they wish to remain on our mailing list. Until we are otherwise notified, the addressee will remain on our mailing list and automatically receive all future project statements.

NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 31-1

Research Project Title: The Impacts of Federal Grant Requirements on Transit Agencies

Specific Problem Area: Finance

Research Problem Statement:

As the federal transit program has grown, this growth has been accompanied by a proliferation of federally imposed requirements. The costs and effects of grant requirements are causing increasing concern to transit agencies. A Section 3 grant application for a new bus purchase requires approximately 21 exhibits to comply with UMTA requirements. Additionally, several annual submissions are required if the grant approval process takes more than one year.

Such requirements have forced many transit operators to allocate scarce resources to federally required procedural work. The costs of compliance may include (1) inflationary cost escalations, (2) allocation of funds to administrative detail, (3) project delays, (4) revisions of project scope, (5) reductions in management flexibility, and (6) increased capital costs.

There is a need to quantify the impacts of federal requirements on the capacity of a transit system to (1) comply and (2) serve effectively the intent of the legislation. Furthermore, there is a need to develop recommendations to improve the grant application process.

Presently available funds are sufficient to address but a portion of the entire problem; therefore, research needed beyond that described below will depend on provision of additional resources from future years.

Objective:

The general objective of this study is to determine the costs and effects of federal legislation, regulations, UMTA circulars, administrative letters and formal administrative guidelines for the Section 3 capital grant application process and to make recommendations for its improvement. The study results are anticipated to be useful to (1) transit agencies in their decision to apply for federal grants, (2) legislators drafting legislation, and (3) the Urban Mass Transportation Administration in amending requirements. In recommending improvements consideration will be given to the intent of legislation, regulations, circulars, letters and guidelines.

Because of the limitation on available funds, proposals are being solicited at this time only for Phase I, which specifically excludes consideration of Section 13(c) and 504 requirements. Additionally, the research is not to consider

Section 5 capital and operating grants; applicability to fixed guideway systems; project management requirements for approved grants; and applicability to specialized transit services.

Toward this general objective, the following tasks are considered essential but not limiting.

Task 1 - Develop scenario(s) that will describe medium-sized transit agencies qualifying for and applying for an increase in size of their bus fleet by 25 percent. Such scenario(s) should identify the requirements that the agency would have to meet in order to be eligible for funding under UMTA Section 3. Scenario elements should include but not necessarily be limited to (1) project justification and planning (SRTP - TIP), (2) grant application and documentation, (3) bus maintenance requirements (4) human resource regulations, and (5) public hearing requirements.

Task 2 - Determine, on the basis of real experience, the costs and effects to the transit agency of the requirements in the scenario(s) outlined in Task 1.

Task 3 - Determine how the results of Tasks 1 and 2 can be applied to larger and smaller agencies.

Task 4 - Compare the actual results of the various requirements with the procedural intent of those requirements.

Task 5 - Develop recommendations: (a) procedural reform to expedite UMTA's obligation of funds, and (b) strategies to reduce costs to transit agencies. These are to be a part of the final report summary.

Subsequent phases, for which funds are not presently available, are expected to broaden the Phase I study to address the following problems: (1) applicability of Phase I results to fixed guidway systems, (2) Section 13(c) and 504 requirements, (3) Section 5 capital and operating assistance grants, (4) specialized transit services, (5) project management requirements for approved grants, and (6) transferability of Phase I results to small and large transit agencies.

Funds Available: $50,000, Phase I only

Contract Time: 9 months (includes 3 months for final report review and revision)

Authorization to Begin Work: September - October 1981

Submit Twenty-Five (25) Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., May 29, 1981.

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

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Administrative Engineer, NCTRP
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 389-6734

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various tasks. If the proposed total cost exceeds the funds available, the proposal is rejected.

Note 5. Mr. R. Ian Kingham is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 389-6741 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 33-1

Research Project Title: Transit Bus Operator Selection and Training for Dealing with Stress

Specific Problem Area: Personnel Management

Research Problem Statement:

Some bus operators possessing the basic skills to operate the vehicle may still experience difficulties in performing their job satisfactorily because of inability to cope effectively with the public. Use of all possible training and disciplinary action does not help when the individual hired does not have the psychological strengths necessary to deal effectively with continuous public contact, and the resultant stress may lead to more workers' compensation claims for nonvisible physical injury (i.e., heart and psychological problems) as well as to more accidents, absenteeism, and personnel turnover.

Various selection and training methods are currently being used by individual transit agencies. Some of these methods have been developed specifically for application in the transit industry, some have evolved from practice within individual agencies, and others represent modifications to methods originally developed for agencies outside of the transit industry. At present, however, no single method of selecting or training bus operators from the viewpoint of their ability to deal with stress is considered to be generally acceptable for wide application by transit agencies. To ensure that methods have general applicability, the range of needs and capabilities of different size transit agencies, regional differences, and the makeup of the bus operator population (i.e., male/female and minorities) must be fully considered.

Objective:

The objective of this research is to provide an evaluative device or questionnaire for use as part of the bus-driver-selection process that will validly indicate the applicant's susceptibility to stress which is likely to affect job performance. The research will also provide two training modules: one designed to help newly hired operators anticipate and deal with typical stressful situations, and one designed to help supervisors recognize stress symptoms displayed by operators and provide guidance on appropriate courses of action.

This research is directed to the needs of bus operators and their immediate supervisors, to public rather than private transit agencies, to intracity rather than intercity operations, and to all sizes of fixed-route bus transit systems in the United States. School bus operations are excluded.

To accomplish this objective, the following tasks are to be conducted:

Task 1 - Review and cite applicable literature, actual training programs, and studies currently being undertaken in the transit industry that deal with how to treat stress or its causes, how to understand the problem, and how to cope with it. Work sponsored by the Urban Mass Transportation Administration and individual transit properties, as well as stress-related studies outside of the transit industry, shall be reviewed for input to this research. At a minimum, this review shall identify the various environmental, physiological, and psychological factors commonly used in stress analysis.

Task 2 - Identify representative fixed-route bus transit agencies to participate in Tasks 3 and 5. The sample to be selected shall include a minimum of one large agency (more than 500 buses), two medium agencies (100 to 500 buses), and three small agencies (less than 100 buses) that will provide an objective test of the operator-selection device to be prepared in Task 4. Actual contacts with transit agencies to solicit their participation in this research shall be accomplished as part of this task; however, proposers shall indicate in their proposal the types of agencies to be contacted to ensure representativeness and include a preliminary list of candidate agencies (pending later confirmation). The sample need not include all regions of the country, but the means of ensuring wide applicability of the resulting selection and training devices shall be presented in the proposal.

Task 3 - Verify a set of stress factors and job characteristics to use in the preparation of the selection device (Task 4) and training modules (Task 6). Using the results from Task 1, a preliminary set of factors and characteristics relevant to the bus operators' job shall be prepared. This preliminary set shall be reviewed and evaluated by managers, operators (primary emphasis), and labor representatives from the selected transit agencies for suggested additions and deletions. The operators selected shall be representative of the total operator population (including males/females and minorities).

Task 4 - Evaluate existing operator-selection-test mechanisms for general applicability in measuring an individual's tolerance for stress and then either modify an existing device or develop a new test device or questionnaire. The resulting device shall bring together current efforts dealing with the effects of stress, shall have wide applicability in the transit industry, and shall be primarily aimed at screening new applicants. The device shall treat stress factors individually and in major groups such as passenger contact, environment, management/union/employee relations, personal problems, and equipment. The test shall be designed so that its statistical properties will provide a suitable basis for future validation.

NOTE: An interim report describing the work accomplished in the first four tasks shall be submitted to, and approved by, the National Cooperative Transit Research and Development Program (NCTRP) prior to the initiation of Task 5.

Task 5 - Field test the device or questionnaire using existing operators from the agencies selected in Task 2 to establish its usefulness (e.g., readable and understandable). The field test results shall be analyzed to confirm that the statistical properties of the device are adequate for future validation. Feedback from the operators tested shall be used to modify the device as necessary.

Task 6 - Prepare two sample training modules: one for newly hired operator training (and perhaps for voluntary retraining) and one for supervisor training. The primary focus of the new operator training will be to alert the driver to typical stress-causing situations and to provide specific guidance on how to cope with each situation. These situations shall include (1) passenger contacts, e.g., fights on the bus; (2) environmental factors, e.g., bad weather; (3) management/union/employee relations; (4) personal problems, and (5) equipment. The supervisor's training module shall focus on the recognition of stress symptoms and tendencies (resulting from personal or job-related causes) and on the identification of appropriate courses of action. Both modules shall be adaptable by an individual transit agency so that through property-specific modifications they can be made part of existing training programs.

Task 7 - Provide a listing of appropriate pertinent data and resources (films, videotapes, surveys, models, books, papers, etc.) identifying concomitant costs, sources, and transit agencies that are using such methods for selection and stress management training of bus operators and supervisors.

Task 8 - Prepare a final report describing the research and its results. The test device or questionnaire with application guidelines and each sample training module shall be detailed in stand-alone documents but shall be included as appendixes to the report.

Funds Available: $150,000

Contract Time: 24 months (including 3 months for final report review and revision)

Authorization to Begin Work: September - October 1981

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., May 29, 1981.

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

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Washington, DC 20418
(202) 389-6734

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Note 5. Mr. Robert E. Spicher is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 389-6741 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 33-2

Research Project Title: Assessment of Job Enrichment Programs for the Transit Industry

Specific Problem Area: Personnel Management

Research Problem Statement:

The political and fiscal environment of transit agencies is in a period of significant change. Scarcity of funds will mean a renewed emphasis on productivity and redoubled efforts to retain and motivate quality employees in the absence of financial incentives. New federal policies stressing local initiative will encourage management to be more sensitive to innovative ideas, and a changing work force will make different demands.

Although the transit industry is highly labor-intensive, a great deal of emphasis has been placed in the past on capital development, financial controls,and transportation planning. Potentially, one of the most important areas for improving transit agency effectiveness is the development and management of human resources through job enrichment programs. There is a need for a systematic investigation of the feasibility of job enrichment programs, such as job restructuring, quality circles, and other techniques that utilize the full talents and abilities of transit employees. It is anticipated that the greatest benefits of job enrichment efforts could be derived from first-line supervisors and those they supervise.

For purposes of this study, job enrichment will be defined as making the elements of the job both physically and psychologically more stimulating, resulting in more productive behavior. The organization could thus provide an environment that allows and influences self-esteem and promotes a positive attitude about one's employment through an individual's own initiatives. Job enrichment offers several possible benefits to the transit industry. For the organization, it provides the prospect of improving the operating environment by enhancing the effective management of human resources. For the individual employee, the concept fosters greater job satisfaction, improved self-esteem, and higher productivity.

Objective:

The general objective of this research is to assess the feasibility of job enrichment programs for the transit industry for first-line supervisors and those they supervise. The assessment would include a survey and analysis of current techniques used to improve job satisfaction and productivity in transit as well as other fields with similar characteristics. The assessment would identify common barriers to the implementation of job enrichment programs in transit agencies including, but not limited to, cost, labor-management relationships, political climate, and resistance to change. The assessment would also include

specific methods for measuring, monitoring, and evaluating the effectiveness and cost benefit of job enrichment programs. It is anticipated that these objectives will involve the following tasks:

Task 1. Review of job enrichment literature.

Task 2. Inventory and assessment of current status of job enrichment in transit.

Task 3. Select and evaluate, for application, at least 5 job enrichment techniques from Tasks 1 and 2. The evaluation should include an assessment of the feasibility of these techniques when applied to different size properties (small, 50 buses or less; medium, 51 to 200 buses; and large, over 200 buses).

Task 4. Develop sample detailed job enrichment programs for bus and rail operators, mechanics, first line supervisors, and one other support position.

Task 5. Develop strategy for dissemination to the industry of job enrichment programs.

Task 6. Prepare final report that also contains an appendix that catalogs specific job enrichment techniques applicable to the transit industry.

Funds Available: $100,000

Contract Time: 12 months (including 3 months for final report review and revision)

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K.W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 2, 1982

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

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(202) 334-3224

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Note 5. Mr. Crawford F. Jencks is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 334-3224 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 36-1

Research Project Title: Improving Decision-Making for Major Urban Transit Investments

Specific Problem Area: Alternative Analysis

Research Problem Statement:

The environment for transportation planning and investment decisions is in a period of dramatic change. Fiscal constraints, a possible reorientation of federal transportation policies, and an increasing reliance on local commitment and decision-making are all likely to influence significantly the future of transportation in urban areas. Even with these pressures, however, urban areas will still be facing decisions on major investments in transit systems. Thus, there will be a need in future years for a planning and analysis process which examines major transportation options and which informs decision-makers so that most cost-effective investment decisions can be effected.

Since 1975, the Urban Mass Transportation Administration has required, as a condition for federal funding support, a structured process termed alternatives analysis for proposed major investments in urban mass transit facilities. This process is used to identify priority corridors for possible major investments and to assess the cost-effectiveness of these investments in comparison to less costly transit improvements. Information generated in the process is used both by federal officials in administering a discretionary capital grant program and by state and local officials in determining priorities and identifying needed improvements in mass transportation services. Three important decision points occur within the UMTA major transit investment planning process. First, appropriate local officials identify the corridor(s) where major investments appear to be most needed. Second, local and federal officials agree on a small set of investment alternatives that encompass a reasonably broad range of options. Finally, local, state, and federal officials agree on one (or more) of these alternatives for advancement into preliminary engineering.

Since the advent of the alternatives analysis requirement, a significant number of urban areas have been involved in some aspect of the process. Concerns have been expressed with the process. For example, there is uncertainty regarding both the effect on the timing of transit investment decisions and the use of information in the federal review process and in local decision-making. Although adjustments to the process have been made to enhance its usefulness in local, state, and federal decision-making, no comprehensive assessment has been made of the degree to which the analytical requirements have provided appropriate information at key decision points.

There is a need to evaluate past experience with alternatives analysis and to recommend improvements in the process that will result in more effective local, state, and federal decision-making. Such an assessment would be useful, for example, in identifying points where decision-makers have not had complete information, where the process has constrained appropriate decisions, or where significant efforts are invested in the development of information that is not used in decision-making. Although it is unclear what direction federal policy will take in regard to alternatives analysis, the need for some form of alternatives analysis for such investments will continue.

Objective:

The general objective of this research is to assess the federal, state, and local decision-making process for major urban mass transportation investments by evaluating recent alternatives analysis experiences. The purpose of the assessment is to identify potential improvements in policy, procedures, and use of technical information; and to formulate planning procedures recommendations for use by federal, state, and local agencies. Such improvements would be in terms of time, cost, scale, presentation of information, role of participants, and the like. (The assessment is not intended to prescribe specific analytical techniques or to judge the appropriateness of previous major urban transit decisions.) It is anticipated that research tasks to satisfy the general objective will consider, but will not be limited to, the following tasks:

Task 1. Inventory all applicable regulations and requirements concerning the evaluation of proposed major urban mass transportation investments.

Task 2. Review relevant literature on alternatives analysis and transit investment decision-making.

Task 3. Prepare methodologies for (a) the analysis and assessment of recent alternatives analysis decision-making experiences and (b) the selection of case studies.

NOTE: The proposal should include key evaluation criteria, data requirements, and data collection methods.

Task 4. Select and conduct case studies, including those undertaken pursuant to the 1976 guidelines as well as other cases.

Task 5. Evaluate the usefulness of information developed in alternatives analysis for decision-making at each level of government.

Task 6. Formulate recommendations to Federal DOT and to state and local agencies.

NOTES: References considered important to the historical development of UMTA's alternative analysis procedures are as follows:

1. U.S. Congress, Office of Technology Assessment, Assessment of Community Planning for Mass Transit. Washington, DC: Government Printing Office, 1976, 12 volumes. (Volumes 1 through 10 are available from the GPO and NTIS; Vols. 11 and 12 are available only from NTIS. Volume 1 is the summary, Vols. 2 through 10 are case studies, Vol. 11 is the technical report, and Vol. 12 is the bibliography. NTIS accession numbers begin with PB-253-679 for Vol. 1 and end with PB-253-688 for Vol. 10; Vol. 11 is PB-253-641 and Vol. 12 is PB-253-642. Microfiche copies are

available from NTIS @ $3.50 each. In paper form, Vol. 1 is priced at $1.80 from the GPO and $9.50 from NTIS.)

2. Transportation Research Board, "Urban Transportation Alternatives: Evolution of Federal Policy." Proceedings of a conference held February 23 - 26, 1975, Warrenton, VA, and another held March 29 - April 1, 1976, Hunt Valley, MD, under the sponsorship of the U.S. Urban Mass Transportation Administration. TRB Special Report 177, Washington, DC, 1977. Available from TRB Publications Office @ $2.00 per copy.

3. Transportation Research Board, "Technical Aspects of Urban Transportation Alternative Analysis." Proceedings of a conference held November 8 - 10, 1977, Warrenton, VA, under the sponsorship of the U.S. Urban Mass Transportation Administration. Report No. UR 5. Washington, DC, 1978. Available from TRB Publications Office @ $3.00 per copy.

4. Comptroller General of the U.S., "Communication and Management Problems Hinder the Planning Process for Major Mass Transit Projects." Report No. CED-79-82, Washington, DC, June 5, 1979. Up to five copies are available at no charge from the U.S. General Accounting Office, Distribution Section, Room 1518, 441 G Street, NW, Washington, DC 20548. Phone (302) 275-6241.

5. Frank C. Colcord, Jr., "Urban Transportation Decision Making: Summary." Office of the Secretary, U.S. Department of Transportation, Report No. OST-TPI-76-02, I. September, 1974. NTIS No. PB-257995, $15.50 per copy.

Funds Available: $150,000

Contract Time: 15 months (includes 3 months for final report review and revision)

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 5, 1981.

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

In the event that proposals are hand carried on their due date, be aware that our offices are located on the 5th floor (Room 528) of the George Washington University Joseph Henry Building at 2100 Pennsylvania Avenue, N.W., Washington, DC.

Note 1. The National Academy of Sciences requires compliance with Title 49, Code of Federal Regulations, Part 21, and hereby notifies all parties that it will affirmatively insure that the contract entered into pursuant to this announce-

ment will be awarded without discrimination on the grounds of race, color, religion, sex, or national origin.

Note 2. In compliance with Department of Transportation prime contract DTUM60-81-C-72012 and Section 211 of P.L. 95-507, the National Academy of Sciences asks that submitters of proposals identify themselves according to the following: (1) Large Business, (2) Small Business, (3) Women-Owned Business, (4) Minority Business, (5) Small Disadvantaged Business, (6) Labor Surplus Area Concern, and (7) Non-Profit. The National Academy of Sciences is committed to fulfillment of its goals under Section 211 of P.L. 95-507 and encourages proposals from small and small disadvantaged firms.

Note 3. The essential features required in a proposal for research are detailed in a 1980 issue National Cooperative Transit Research and Development Program brochure entitled "Information and Instructions for Preparing Proposals." Proposals must be prepared according to this document, and attention is directed specifically to pages 20 through 29 for mandatory requirements. Proposals that do not conform with these requirements will be rejected. Requests for the brochure should be addressed to:

Administrative Engineer, NCTRP
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 389-6734

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Note 5. Mr. R. Ian Kingham is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 389-6741 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 38-1

Research Project Title: National Transit Computer Software Directory

Specific Problem Area: System Planning

Research Problem Statement:

Over the past decade, computer (software) systems have gained widespread acceptance as important management and operating tools in public transit agencies. Representative software applications include planning (UTPS), scheduling (RUCUS), operations control, maintenance (SIMS), finance, and personnel. It is estimated that the public transit industry spends several million dollars each year on the design of software. Because there are great similarities in the structure and operation of transit agencies, software developed by one agency can often be adapted for use by other agencies with much less cost and effort than custom-designing completely new software. The lack of knowledge of existing software and its applications results in the spending of significant amounts of money by many transit agencies to develop new software that may not be as effective as it could be or may be "reinventing the wheel." Therefore, there is a need for the design and implementation of a detailed and complete national transit computer software directory that can be continuously updated to function as a central clearinghouse, making information available to individual public transit agencies that are planning software development. The anticipated benefit from the design and implementation of the directory is lower costs for software users. Use of the directory should lead directly to commonality of systems, faster software implementation, and public domain software that can be obtained at minimal cost. The benefit of identifying and using transportable software can only be realized if there are provisions for maintenance of the directory on a continuing basis.

Objective:

The objective of this research is to develop and pilot test a methodology for the establishment and continuous updating of an automated directory of computer software useful to the public transit industry. The directory shall have the capability of including (1) software suitable for use by transit agencies of all sizes, and (2) existing and future software for use on computers of all types and sizes.

To accomplish the objective, the following tasks are to be conducted:

Task 1 -- Directory Content

Review and cite the applicable literature describing the availability of computer software programs for use by public transit agencies. Examples of such references include, but are not limited to, the American Public Transit Association (APTA) "Catalog of Management Information System Applications within the Transit Industry," the American Association of State Highway and Transportation Officials (AASHTO)

"Computer System Index," and work of the Institution of Transportation Engineers (ITE). Using these references, and in consultation with the transit industry as appropriate, the researchers shall propose content, structure, and format for a directory of computer software. The content of the directory shall focus on the principal categories of transit operation, such as finance, operations, maintenance, administration, planning, as well as others deemed appropriate.

The researchers shall provide a detailed format, specifying the description for each principal category and software application. In order to assist users in identifying software that is potentially useful to them, sufficient detail should be provided, for example, hardware environment, operating system, programming language, and the like.

Task 2 -- Methodology

The researchers shall investigate existing information systems, such as the Transportation Research Information System (TRIS), the International Road Research Documentation, and others, to evaluate their capabilities regarding the recommended directory as part of those existing systems. The researchers shall review and evaluate other methods of designing and maintaining the automated transit directory. This evaluation should include:

- Description of methods reviewed.
- Review criteria used.
- Pros/cons of each method.
- Recommended method.

Documentation of the recommended method should include an overview, description of major functions, copies of forms/screens/reports used for input/inquiry/output, and necessary procedures.

Task 3 -- Management Procedures

The ultimate success of this project requires the existence of an organization (not yet identified) that will be responsible for the provision and maintenance of an up-to-date directory. The researchers shall define the management function required of this organization. This function shall be based on a thorough examination of existing software directories and their deficiencies. The management function should assure that the system will serve the need of both large and small transit agencies. It should include methods for attracting and holding participation by the transit agencies. Particular attention should be paid to providing incentives to the participants for supplying and updating the entries in the directory. Methods should be described for making all transit agencies, and others who can benefit from the services offered, aware of the existence of the directory. The description of the management function should also include the methods by which information can be collected from and disseminated to interested parties or transit agencies.

Task 4 -- Case Study

As a means of demonstrating the capabilities of the proposed methodology, the researchers shall provide an updated "1980 APTA Catalog of Management Information Systems Applications within the Transit Industry." This catalog is to be provided in both hardcopy and machine-readable format. It should contain all of the data elements as defined in Task 1.

Contact should be made in person with all APTA members to solicit updates to the existing data. The purpose of this contact is to demonstrate the procedures, forms, and incentives of the proposed methodology.

Additionally, agencies should be asked to request items from the directory as a method of testing the validity and flexibility of the recommended search criteria.

Researchers shall provide sample output reports that illustrate the output types as defined in Task 3.

Task 5 -- Directory Maintenance

Evaluate and recommend potential organizations that can provide the management functions as described in Task 3.

Consideration must be given to the following issues:

- How and by whom should the directory be maintained?
- How should directory information be disseminated?
- What will be the estimated cost of this function?
- What permanent funding sources are recommended?

Because the ultimate selection of the organization to maintain the directory will depend on these issues, a complete discussion should be provided, particularly with respect to recommending funding sources; including consideration of applicable laws, regulations, policies, and institutional inter-relationships.

Funds Available: $100,000

Contract Time: 12 months (including 3 months for final report review and revision)

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 4, 1982.

This is a firm deadline, and extensions simply are not granted. Twenty-five (25) copies of the agency's proposal must be in the offices of the NCTRP not later than the deadline shown. Proposals arriving after the deadline will be rejected; therefore, submitters are cautioned to plan for transmittals well ahead of the deadline. Because all mail is received at the address shown above and then forwarded to our offices, allowance should be made in such planning for one extra day of transit time.

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(4) Minority Business, (5) Small Disadvantaged Business, (6) Labor Surplus Area Concern, and (7) Non-Profit. The National Academy of Sciences is committed to fulfillment of its goals under Section 211 of P.L. 95-507 and encourages proposals from small and small disadvantaged firms.

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Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 334-3224

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 39-1

Research Project Title: A Modular Approach to On-Board, Automatic Data Collection Systems

Specific Problem Area: Route Planning

Research Problem Statement:

Current economic conditions require that a transit system improve productivity while making the best use of limited resources. Increasing emphasis is being placed on improving route productivity through such means as better schedules, on-time performance, and service allocation. These requirements place an increasing importance on good ridership and schedule adherence data so that responsible decisions on routing and scheduling can be made. In addition, fare-box revenue is becoming increasingly important to the stability of transit systems. Accurate fare payment information by fare category is needed to calculate effects of alternative fare adjustment proposals, including an analysis of the equity of fare structures. The need for ridership, schedule adherence, and fare information is expected to continue for the foreseeable future.

Currently the most predominant form of gathering ridership data in the transit industry is collecting data manually by ride checks or load (point) checks. Information gathered in this manner is expensive to collect and process, limited in scope, and usually infrequent because of the number of "checkers" required. For example, some systems have reported that a point check may provide accurate load data at one location, but may understate true route ridership by as much as 50 percent. Fare/revenue data are generally available only on a systemwide basis. Special efforts that usually rely on driver participation or cumbersome fare-box handling are required to collect route-level fare-payment information.

In recent years, a few transit systems have turned to automated methods to collect ridership, schedule adherence, and fare data. The levels of sophistication of these systems have varied from real-time data collection and analysis systems to more basic systems that provide information in summary form on an historical basis. Although, in general, transit properties that have used these automated systems have been satisfied, widespread use has not occurred.

There are several reasons why the majority of transit systems have not implemented automated technology: (1) a general lack of understanding of the options available in terms of hardware to provide the information; (2) an uncertainty as to how much of what type of hardware and software is needed; (3) the lack of commitment by transit management to implement the technology; (4) the difficulty in quantifying benefits,

together with costs, and in determining the net benefit to the transit system; (5) the general unavailability of funding for much of this equipment at the federal level; and (6) the lack of standardization of functional requirements of the technologies, which, in turn, dampens the availability of hardware and discourages manufacturer participation.

Objective:

The general objective of this research is to develop requirements and implementation guidelines for the use of automated on-board passenger/fare information collection systems. The system hardware should be constructed on a modular basis. Depending on the complexity of information desired, the modules should include, but not be limited to: (1) basic passenger counters (e.g., treadle, infrared), (2) location detection devices (e.g., odometer, signposts), (3) fare category counter (e.g., electronic fare-box), and (4) data storage/retrieval equipment (e.g., radio, cassette, solid state). Functional specifications for each of these systems are to be developed so that one module or component is compatible with another regardless of manufacturer. Requirements for modules or components will depend on the decisions a transit property must make, which, in turn, determines the level of detail the data collection system must provide. The levels of detail range from systemwide information to detailed stop-by-stop information. The system should be designed so that a transit property can choose, in modular fashion, the level and type of hardware needed for the data desired. It is anticipated that research to satisfy the general objective will require at least the following tasks:

Task 1 - Review existing literature and acquire other information as needed to determine the state of the art of automated data collection systems and information needs requiring passenger counts, schedule adherence, and fare data. (Substantial work has been, and is being, conducted in this area by the U.S. DOT's Transportation Systems Center and UMTA.)

Task 2 - Determine modular hardware requirements to provide the information desired for various levels of decision-making. Standardize the functional requirements and develop uniform specifications for the hardware by module type. Upon completion of this task, a technical paper containing the specifications will be submitted to NCTRP for review.

Task 3 - Develop methods to permit transit properties to select the modules and supporting hardware in sufficient quantity, on the basis of a sampling plan, to meet their data needs.

Task 4 - Develop a format for quantifying all benefits and all costs so that a transit property can determine the overall net benefit compared with alternative means of collecting the data.

Task 5 - Investigate other considerations that affect implementation, such as labor restrictions, organizational commitment, and maintenance support capability.

Task 6 - Define data processing requirements (hardware/software) and develop flow charts that describe how various outputs can be produced using the data collected together with such external information as schedule data or mileage data.

Task 7 - Prepare a manual that describes the methods a transit property would follow to design, select, and implement an automated ridership and fare data collection system. Recommend two (2) transit properties of different sizes to test the application of the manual.

Twenty (20) copies of the manual shall be submitted within 10 months after the beginning date of the contract period. NCTRP approval of the manual and the two transit properties recommended will be required before initiation of Task 8. It is anticipated that the necessary review and approval will be completed within 2 months after receipt of the manual.

Task 8 - Demonstrate the validity of the procedures in the manual by applying the techniques to the two (2) transit properties and revise the manual accordingly. (The cost for this task should include costs that may be incurred by the transit properties in carrying out the study.)

Task 9 - Prepare a technical specification for procurement that describes the electronic/mechanical requirements of the module interfaces.

Task 10 - Prepare a final report that includes the revised manual as a stand-alone appendix.

Funds Available: $150,000

Contract Time: 18 months (includes 2 months for manual review and revision, and 3 months for final report review and revision).

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 7, 1982

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 40-1

Research Project Title: Simplified Guidelines for Evaluating Transit Options in Small Urban Areas

Specific Problem Area: Impact Analysis

Problem Statement:

Small transit systems, as well as larger systems, are caught in a continuing struggle of determining the impacts of transit system investment decisions on users as well as on the community at large. The actual impacts of a transit system are difficult to determine. In addition to the obvious potential impacts, such as changes in vehicle-miles of travel, fuel consumption, pollution, etc., there is also a group of not-so-obvious impacts that relate to the costs and benefits of a transit investment (e.g., vehicle accidents, peak-hour congestion, traffic volume changes, commercial parking space requirements, and changes in future capital costs for street construction). Nonquantifiable impacts must also be considered, such as changes in mobility for the economically disadvantaged and for those who cannot drive (i.e., handicapped, elderly, and young people).

To ensure that city managers and councils have information on which to make intelligent and consistent appraisals pertaining to such investments, many types of factors must be fully considered. Typical factors are (1) socioeconomic (e.g., percentage of elderly population, minority population, cronic unemployment problems, diversity of existing industries, existence of large institutions), (2) political (e.g., attitude of the "affected parties," social-economic advocate groups), (3) current local concerns (e.g., ecology, air quality, traffic congestion), (4) business decisions, and (5) geographic (e.g., climate, topography, proximity to major urban areas).

Transit planning methods for cost-benefit analysis and for alternatives analysis have been well documented in studies sponsored by AASHTO, FHWA, UMTA, and the Office of the Secretary, U.S. DOT. Typically, however, these studies have been too complex and, in many cases, too data intensive for understandable public presentation and use in small cities. Therefore, research is needed to prepare a technically based, yet simple, analytical tool for use in the public decision process relating to the potential impacts of transit alternatives.

Objective:

The objective of this research is to develop procedural guidelines for use by transit and municipal agencies in guiding their analysis of proposed transit and paratransit alternatives and in presenting their proposals to the decision-making

bodies. Use of these guidelines will result in the public's better understanding of proposed investments for a new transit system or improving an existing system. Also, increased use of sound cost-benefit techniques to safeguard against inadequate analyses should result from the availability and use of these guidelines. The guidelines shall be designed for application by nontechnical persons and shall be directed to the types of decisions faced in urban areas up to 200,000 population. Consideration such as total costs, avoided costs, transportation alternatives, ridership, urban development factors, conservation of energy and other resources, and typical transit evaluation criteria shall be included.

To accomplish this objective, the following tasks shall be conducted:

Task 1 - Identify the priceable and nonpriceable factors that need to be included in the guidelines to address the specific concerns of small urban areas (i.e., the factors that are important to the community, city council, etc.). These factors shall cover the anticipated impacts on the transit system itself, on transportation in general, and on the community at large (nonuser impacts).

Task 2 - Assemble relevant resource materials that have applicability to the evaluation of alternatives for public transit. Existing literature and related studies shall be reviewed, and a synthesis shall be prepared of information relevant to decision-making for transit service options in small urban areas. Information requirements, availability, and sources used in existing analysis techniques shall be assessed in relation to the actual needs of small areas.

Task 3 - Develop a set of procedural guidelines utilizing the best available techniques to describe how to handle both priceable and nonpriceable factors. For agencies that are generally familiar with cost-benefit analysis techniques, the guidelines shall serve to focus the transit service evaluation to ensure that the pertinent information is available for presentation to decision-makers. For agencies with limited experience in conducting cost-benefit studies, the guidelines shall include simple analysis techniques (based on accepted, technically sound procedures) for direct application. Data intensive techniques and extensive software/hardware systems are to be avoided. Equity and distribution questions of who pays and who benefits shall be considered.

Task 4 - Develop an educational and portable package for use in demonstrating the analysis procedures and the factors considered in evaluating transit improvements and alternatives. A package suitable for presentations to city councils and transportation planning boards is desired and, although based on a prototype application, should be adaptable to local situations. Video-tape or slide presentations, including a script and/or audio, are examples of candidate approaches.

Task 5 - Prepare a research report, including the guidelines.

Funds Available: $150,000

Contract Time: 15 months (includes 3 months for final report review and revision)

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., on June 4, 1982.

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Note 3. The essential features required in a proposal for research are detailed in a .1982-1983 National Cooperative Transit Research and Development Program brochure entitled "Information and Instructions for Preparing Proposals." Proposals must be prepared according to this document, and attention is directed specifically to pages 22 through 31 for mandatory requirements. Proposals that do not conform with these requirements will be rejected. Requests for the brochure should be addressed to:

Administrative Engineer, NCTRP
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 334-3224

In the interest of saving paper, reduced mailing costs, and ease of handling, it is desired that proposal pages be printed on both sides using the lightest bond weight permitting such practice, and maintaining margins of less than 1 inch.

Note 4. Proposals are evaluated by the NCTRP staff and a project panel approved by the National Academy of Sciences as outstanding individuals collectively very knowledgeable in the problem area. Selection of an agency is made only by the project panel and in consideration of: (1) the proposer's demonstrated understanding of the problem; (2) the merit of the proposed research approach and experiment design; (3) the probability of success in meeting the project's objectives; (4) the successes ("track record") in the same or closely related problem area; and (5) the adequacy of the facilities. The total funds available are made known in the Project Statement and line items of the budget are examined to determine the reasonableness of the allocation of funds to the various tasks. If the proposed total cost exceeds the funds available, the proposal is rejected.

Note 5. Mr. Robert E. Spicher is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 334-3224 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '81

Project Statement

Project Number: 43-1

Research Project Title: Detection of Low-Level Fault Currents on Rail Transit Systems

Specific Problem Area: Track and Ancillary Systems

Research Problem Statement:

Devices presently in use by the rail transit industry can adequately detect and respond to overload fault currents. Detection of less than overload fault currents is particularly difficult because the fault current characteristics tend to resemble characteristics normally associated with train or power switching operations. Rapid and reliable detection of low-current electrical faults on direct-current rail transit systems would provide a significant improvement to safety and operation of these systems.

Objective:

The objective of this research is to identify and evaluate detection methods and equipment to enhance transit system safety through reliable detection of electrical faults that are not detected by circuit breaker overload protection. Cooperation by transit systems and associated industries is essential to the success of the project, inasmuch as this research seeks a solution that can easily be adapted to various transit systems.

To accomplish this objective, the following tasks shall be conducted:

Task 1 - Perform an in-depth survey of rail transit systems worldwide, under the auspices of an international institution, such as the International Union of Public Transport, to determine how the problem being researched is handled on each system. Concurrently, survey the electrical industry organizations and suppliers worldwide for methods and equipment that are potential solutions to the detection problem. Review the work of other industries that may also be relevant to the problem and its solution.

Task 2 - Using information obtained in Task 1, identify the electrical system characteristics that will define the parameters of the required detection systems for various types of vehicle propulsion systems and network configurations.

Task 3 - Using the parameters developed in Task 2, determine the extent to which available methods and equipment meet the research objectives.

Task 4 - Prepare a final report describing the research and its results, including a detailed evaluation of the performance and economics of available methods and equipment.

Funds available: $100,000

Contract Time: 15 months (including 3 months for final report review and revision)

Authorization to Begin Work: October - November 1982

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 4, 1982.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 47-1

Research Project Title: Improved Service Life of Urban Transit Coach Brakes

Specific Problem Area: General Materials

Research Problem Statement:

The operation and maintenance history of advanced design urban transit coaches shows a dramatic decline in brake life compared with early "new look" coaches. Major factors associated with this decline in brake life appear to be, but are not limited to:

- Increased gross vehicle weight
- Increased operating speed
- Body configuration
- Changed regulations

The resultant increased brake temperatures are believed to be the cause of reduced brake life that has increased operational costs to unacceptable levels. Therefore, the need exists to identify and develop methods to increase brake life to previous levels.

Objectives

The overall project objective will be to develop methodologies for improving existing and future urban transit coach brake life. This will include quantification of in-service brake operating temperatures plus identification of methods of reducing brake operating temperatures and/or alternate friction materials.

The project objective will be accomplished in two phases, as follows:

Phase I

Task 1. Confirmation of the premise that temperature is the cause of reduced brake life by the collection and evaluation of brake operating temperatures. This is to be accomplished in cooperation with a major metropolitan transit operator that has experienced the problem. As a minimum, temperature levels will be established for advanced design and early "new look" transit coaches.

Task 2. Development of practical methods for reduction of operating temperatures and/or identification of friction materials for compatibility with the service temperatures determined in Task 1. The following factors must be considered: (a) adaptability to coaches in service, (b) initial and operating costs, (c) regulations, (d) serviceability, (e) reliability, (f) public acceptability, and (g) feasibility.

Task 3. Cost-benefit prioritization of methods for increasing brake life based on Tasks 1 and 2.

Task 4. Preparation of an interim report with recommendations for implementation of Phase II demonstration.

Phase II

Task 5. Demonstration of one or more suggested corrective methods based on selection by the panel from those recommended in Phase I. This will be accomplished in cooperation with a major metropolitan transit operator.

Task 6. Preparation and submittal of the final report.

> NOTE: Proposals shall be submitted in response to both Phase I and Phase II. Conduct of Phase II shall be subject to NCTRP approval of the demonstration program developed under Task 4.

Funds Available: $300,000 of which no more than $200,000 shall be expended on Phase I.

Contract Time: Phase I, 18 months (including 3 months for final report review and revision). Phase II, to be determined after review and approval of Phase I report.

Authorization to Begin Work: September - October 1981

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, D. C. 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 2, 1981.

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Note 5. Mr. Harry A. Smith is the Projects Engineer having responsibility for surveillance of this project. He can be reached at (202) 389-6741 to answer inquiries.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 54-1

Research Project Title: Improve Transit Bus Energy Efficiency and Productivity

Specific Problem Area: Energy Efficiency

Problem Statement:

Because of rapidly rising fuel prices and uncertain fuel availability, there is a critical need in the transit industry to improve energy efficiency. However, as a result of governmental regulation and other factors, the recent trend in bus technology has actually been toward poorer efficiency. For example, the Advanced Design Buses introduced in recent years require more energy than the buses replaced and, compounding the problem, also have fewer seats. Energy efficiency losses are due to many causes including requirements to satisfy environmental considerations, safety, styling, accessibility, and the like.

Higher energy prices and increased consumption have made fuel costs an increasingly larger portion of transit operating costs. Further, because these costs have increased at a faster rate than general inflation, the ability of the transit properties to increase fares to cover the added costs has been limited.

Transit operators need to become more aware of the inherent relationships between energy efficiencies and other objectives, such as low initial bus cost and passenger comfort. To promote this awareness, the specific tradeoffs involved in the decision to purchase a particular bus need to be identified and documented in guidelines directed to transit property managers.

Objective:

The objective of this research is to develop guidelines for transit property managers to follow in specifying a new bus. The guidelines shall focus on the energy efficiency and productivity of different bus types, equipment, and options; and be applicable to properties of all sizes and geographic locations. This research is limited to intracity bus operations, equipment and options that will be available in the near term, and bus sizes in common use (35 ft, 40 ft, and articulated). Characteristics of a property's physical plant or maintenance practice will not be addressed in this research.

To accomplish this objective, the following tasks shall be conducted:

Task 1 - Determine the basic types of equipment and options available in 35-ft, 40-ft, and articulated transit buses. The equipment and options of interest include, but are not limited to, power train features (e.g., transmission shift schedule and converters, axle gear ratios, engine size and power rating); special equipment (e.g., wheelchair lifts, kneeling capability); standard component op-

tions (e.g., type of heating/air conditioning system, tire size and type, lighting and other hotel loads); basic design and safety features (e.g., overall weight, seating plan, safety bumpers); and environmental controls (e.g., air pollution and noise). This information shall be obtained from available literature and current studies, as well as from contacts with manufacturers and property operators.

Task 2 - Determine the relative energy consumption levels of the various items of equipment and options using existing information. Precise definitions of all consumption levels may not be possible within the available funds; therefore, estimates or approximations will suffice recognizing that later refinements may be desirable. For each bus type and size, specify a baseline equipment configuration and relate the energy-consumption characteristics of the available options to this baseline.

Task 3 - Develop an approach for estimating energy-efficiency characteristics of buses over the full range of operating environments (e.g., terrain, altitude, climate, maximum operating speed, number of stops per mile). At a minimum, this approach shall specifically address (1) the interrelationship of components and combination of components (e.g., axle ratio vs. engine rating vs. transmission shift points); and (2) the tradeoffs between energy efficiency and speed, acceleration, passenger comfort, etc.

Task 4 - Prepare a concise set of guidelines for use by managers of individual transit properties in selecting and specifying buses for purchase. The approach developed in Task 3 shall serve as the basis for the guidelines. The guidelines shall be primarily directed to, and usable by, operating property management, but they may also provide useful information to manufacturers and to governmental agencies responsible for setting regulatory policy and conducting research and development programs. The guidelines shall be designed for immediate use and be capable of being updated as additional information is developed by individual properties and manufacturers and/or through further research.

Task 5 - Recommend methods for updating and improving the guidelines considering data needs, procedural steps, dissemination, and training.

Funds Available: $40,000

Contract Time: 12 months (including 3 months for final report review and revision)

Authorization to Begin Work: October - November 1981

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 2, 1981.

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NATIONAL COOPERATIVE TRANSIT RESEARCH AND DEVELOPMENT PROGRAM

Transportation Research Board
National Research Council

FY '80

Project Statement

Project Number: 54-2

Research Project Title: Energy Management of Electric Rail Transit Systems

Specific Problem Area: Energy Efficiency

Research Problem Statement:

Rapidly increasing electric energy costs have resulted in a dramatic increase in operating expenses of transit authorities operating electric rail systems. This problem is further augmented by additional increases in rates being sought by electric utilities. The peak demand component of these rates is directly associated with the electric energy generation, transmission, and distribution facilities cost. As major electric energy consumers, transit authorities are subject to allocated costs associated with these facilities. If transit authorities can improve the management of peak demand on their systems, energy costs can be significantly reduced. Several transit authorities have developed strategies for: reducing peak energy consumption (such as load management), improving vehicle energy efficiency, and more energy efficient operating practices.

Objective

The objective of this research is to provide guidelines for transit authorities to lower peak electric demand and, thereby, lower costs. It is anticipated that the proposed study will include but not be limited to:

1. Identification of the contributing factors that cause peak demand and the timing and significance of each.

2. Identification of monitoring strategies and conservation opportunities in order to be able to control peak demand.

3. Identification and evaluation of various load management techniques and their cost/benefits and effectiveness on reducing peak demand.

4. Development of strategies so that the benefits of peak demand management are reflected in rates.

It is intended that the research will result in the development of methodologies for: (1) forecasting the peak electric energy demand, (2) monitoring the actual demand, and (3) controlling the demand. It is also intended that a preliminary plan will be prepared for validating and demonstrating the developed methodologies.

Funds Available: $150,000

Contract Time: 15 months (including 3 months for final report review and revision)

Authorization to Begin Work: September - October, 1981

Submit Twenty-Five Single Bound Copies of Proposal to:

K. W. Henderson, Jr.
Director, Cooperative Research Programs
Transportation Research Board
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

Proposal Deadline: Proposals are due not later than 4:00 p.m., June 5, 1981

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Attachment #5

D R A F T

PROPOSAL

CRITERIA FOR

BUS SUB-SYSTEM

TESTING

by ... Frank W. Venezia
4-18-82

CRITERIA FOR BUS SUB-SYSTEM TESTING

GENERAL: There was a request for bus component and system testing by various Transit properties and UMTA as a result of increased problems in some components. With the introduction of new buses in the market place, the transit properties have been plagued with failures of sub-systems. Some of these failures are due to inadequate testing of the component before it is released to transit service. This is not to say that a manufacturer is not testing his product but that his testing does not always duplicate transit operation.

If adequate testing had been performed, there would have been a reduction in costs for both the bus builder/component manufacturer and the transit property.

OBJECTIVE: To outline criteria for sub-system testing that can be used by bus builders, component manufacturers, and transit properties. This criteria should result in a proper and complete testing of a component before it is released for service for the whole transit industry.

TESTING OUTLINE:

1. The manufacturer should satisfactorily complete his own in-house testing.
2. There should be a review of the manufacturer's in-house testing. Two questions must be answered.
   (a) Is the manufacturer confident in putting these products out for a field test?
   (b) Is the BTLB confident that the manufacturer's testing reflects in-service conditions as much as possible?

3. A fair amount of units should be field tested throughout the country at properties that can monitor the test along with the manufacturer.

   The propexties selected for the test should be from:

   (a) varing geographic locations

   (b) temperature extremes (hot, cold, etc.)

   (c) road conditions (flat, hilly, pot-holed streets, etc.)

   (d) type of operation (urban, suburban, combination of both)

   (e) atmospheric conditions (dust, rain, snow, salt, etc.)

   (f) maintenance capabilities (good, fair, bad)

4. The properties selected should have the capabilities to keep accurate records indicating:

   (a) number of failures

   (b) type of failures

   (c) repairs made due to failure

   (d) maintenance performed on the unit

5. The testing of a new component should be run simultaneously with control units so that a direct comparison can be made. Both the test units and control units should be operated in the same type of operation.

6. There should be a plan developed to show proposed time schedules and goals. Periodic meetings should be held with the manufacturer/bus builders and the transit property to inspect the unit and discuss problems, if any. The unit should not receive any special care, and it should be subject to normal operation of the transit property.

7. After any failure analysis is performed, any necessary modifications to the unit must be properly documented, and the testing should be restarted at zero until the set time or mileage goal is attained.

FWV: kf

Attachment #6

To: Life Cycle Cost Procurement Task Force

From: Henry M. Mayer, Chairman Hank

Date: April 12, 1982

Subject: Report of the Task Force Meeting of March 22, 1982 and Meeting Announcement

Enclosed for your review and comment is the report of the March 22, 1982 meeting. Your attention is directed to the draft "Guidelines for Grantee Evaluation of Performance, Standardization and Life Cycle Cost Factors for the Procurement of Transit Buses". (Attachment #6)

Please send your comments to Frank J. Cihak by April 30, 1982.

The Task Force will meet at the Opryland Hotel, Nashville, Tennessee, on Monday, May 10, 1982 beginning at 2:00 p.m. The meeting will adjourn by 5:00 p.m. The primary purpose of the meeting is to review comments on the draft "Guidelines".

The secondary purpose of the meeting is to develop a response to the Federal Register notices of February 22 and March 4, 1982.

Please return the enclosed form to indicate your intention to attend.

cc: R. C. Buchanan
R. M. Coultas
F. J. Cihak
P. D. Jones

Enclosures

AD-2144

1225 Connecticut Avenue, N.W., Washington, D.C. 20036 Phone (202) 828-2800

American Public Transit Association
Report of the Life Cycle Cost Procurement Task Force Meeting
at the Chicago O'Hare Hilton
March 22, 1982

Those Present: Attachment #1

1. INTRODUCTION

Mr. Mayer, Chairman, called the meeting to order at 10:10 a.m. and asked for self-introductions. He reviewed the agenda (Attachment #2) and offered the following remarks. Mr. Mayer criticized the procurement process as a major factor contributing to the increasing cost of transit buses. He noted that the 1982 DOT Appropriations Act represents a departure from previous Acts in that both the FY 1980 and 1981 DOT Appropriation Acts required that grants related to contracts for the acquisition of rolling stock be awarded based on consideration of performance, standardization and life cycle costs (LCC). The FY 1982 Act, however, requires that UMTA be assured that the factors mentioned in the Act be evaluated by a grantee prior to awarding a procurement contract for any type of rolling stock using FY 1982 Section 3,5 or 16(b) (2) funds.

Mr. Mayer referred to APTA's "Compendium of Information Related to Life Cycle Cost Procurement of Transit Buses" and to the LCC procurements conducted by Rhode Island Public Transit Authority (RIPTA) and Phoenix Transit System. He added that LCC procurement is easier to say than it is to execute, especially with respect to new products. The purpose of this meeting, then, is to formulate an industry response or reaction to the new UMTA guidelines on procurement of rolling stock (Federal Register notice dated February 18, 1982 with corrections dated March 4, 1982).

2. BUS TECHNOLOGY LIAISON BOARD (BTLB) AND OTHER ACTIVITIES

Mr. Cihak reported on BTLB activities with respect to LCC bus procurement (Attachment #3). At the December 4, 1981 BTLB meeting, the Board agreed that one of the disadvantages of LCC procurement is that no one seems to have good operating cost data to predict the influence on LCC of various cost drivers.

At the February 26, 1982 BTLB meeting, Ms. Colleen Weule, a legal representative from UMTA, stated that the Federal Register notice does not specify how transit systems are to evaluate performance, standardization and life cycle costs. The notice encourages transit systems to develop alternative procurement procedures.

At this meeting, the Board established a subcommittee to ascertain which transit systems plan to purchase buses in 1982 and develop an information exchange on existing and proposed methods of LCC procurement. The Board determined that White Book Sections I, III, and IV should be applicable to all future bus procurements.

Mr. Cihak requested that members of this Task Force submit to APTA other pertinent information for inclusion in the LCC Compendium.

Mr. Cihak mentioned the participants and actions of the 1979 Bus Procurement Task Force and the resulting APTA Policy Statement on Bus Procurement adopted by the APTA Executive Committee on December 12, 1979 (Attachment #4).

3. DISCUSSION

Mr. Mayer requested comments from the bus manufacturers on the UMTA guidelines for bus procurement.

Mr. Aaron, Grumman Flxible Corporation, emphasized three terms that he considers essential to this discussion: definition, guidelines and interpretation. First, he asked, how do we define standardization, performance and life cycle costs? We tend to lump them together, yet these three factors are not mutually compatible. He challenged the Task Force to define these three factors.

Second, what are the guidelines for evaluating standardization, performance and life cycle costs? Mr. Aaron stated that the Federal Register notice does not actually present any guidelines for evaluating these factors. He pointed to the White Book as an example of a guideline that establishes standards for performance and standardization. He added that the flood of seemingly inconsistent regulations emanating from DOT has increased the use of specifications that could be considered exclusionary or discriminatory.

Third, how do we interpret the Federal Register notice of February 18, 1982? More specifically, what is the basis for awarding procurement contracts? Mr. Aaron believes that the basis for awarding bus procurement contracts is becoming more and more subjective.

Mr. Mayer suggested that transit systems ought to be able to purchase buses in the same manner that an individual purchases a personal automobile: they should be able to to compare the products of the various manufacturers and choose the bus that the transit system likes best.

Mr. Aaron argued that when public funds are involved in a procurement, transit system representatives are bound by a separate mandate which does not permit them to make a subjective assessment and an arbitrary contract award. Congress will not remove the requirement for accountability in the use of public funds.

Mr. Pullin, GMC Truck & Coach, remarked that under the Federal Register notice grantees are encouraged to develop and use their own procurement methods. GM believes that life cycle costing is a legitimate means to assess the value of a bus. Performance can also be defined according to factors that apply to the bus manufacturer such as the road call history of a bus, financial ability, service availability, training facilities, parts service, distribution points, publications and maintenance manuals. Mr. Pullin stated that standardization pertains to the ownership costs associated with re-tooling facilities and training for mechanics and drivers. He concluded that bus manufacturers can be evaluated according to these three criteria -- life cycle costs, performance and standardization -- using a simple, workable approach that encourages innovations by assigning a value to them.

Mr. Mayer asked, how do you put a price tag on all the factors mentioned by Mr. Pullin and the Federal Register notice?

Mr. Coryell, Crown Coach, repeated Mr. Mayer's question and added that it would be difficult to assess Crown Coach buses' road call history because each of its customers has a different bus.

Mr. Bean, Neoplan, expressed his agreement with Mr. Aaron's remarks and added that this Task Force should address two key issues: (1) a definition of factors according to which buses will be evaluated and (2) the development of standard methods for performing this evaluation. Neoplan favors any system that allows it to compete in the bidding process against other manufacturers. Mr. Bean emphasized that the Federal Register notice refers to buses and not bus manufacturers.

Mr. Mayer asked, what is life cycle costing? Does it involve all of the factors mentioned in the Federal Register notice including fareboxes, air conditioners, brake linings and other components that the bus manufacturers do not make?

Mr. Mallhi asked if grantees are past the stage of being able to substitute a detailed specification for the requirement of a life cycle cost evaluation.

Mr. Coryell observed that it is easier to develop a detailed non-discriminatory specification than it is to defend a cost driver.

Mr. Mayer asked, why should transit systems not be permitted to buy the products they believe will best meet their needs? He believes Congress is attempting to return to this basic notion.

Mr. Bean re-emphasized the notion that Mr. Aaron raised earlier of accountability for public funds.

Mr. Mayer remarked that before UMTA existed there were transit systems supported by public funds that made contract awards on a basis other than low bid.

Mr. Mallhi said life cycle costing is a good way to go if some solution can be found to all the difficulties involved. Why, for instance, did the Phoenix procurement take so long?

In regard to the Phoenix procurement, Messrs. Pullin and Aaron agreed that both GM and Grumman Flxible experienced difficulty substantiating their data with respect to certain cost drivers but that much progress has been made in the understanding of life cycle cost procurement of transit buses.

Mr. Walters asked how, five years after contract award, does the purchaser hold the manufacturer accountable to the claims he made at the time of bid regarding future operating costs?

Mr. Pullin suggested that the manufacturer would be out of business in five years if the claims he made at the time of bid were invalid.

Mr. Aaron stated that since neither the Congress nor UMTA has defined the factors and methods necessary to evaluate life cycle costs, the charge of the transit industry in the area of bus procurement is to conduct competitive bidding based on non-exclusionary and non-discriminatory specifications ensuring that the basis of contract award is made known to all manufacturers from the beginning.

Mr. Pullin urged the Task Force to promote "best buy" decisions on the part of transit systems. The courts, he said, have always upheld "best buy" decisions except in cases of fraud.

Mr. Walters said that contracts involving public funds in the state of California must be awarded to the lowest bidder that meets the specification.

4. MAJOR COST DRIVERS

Mr. Mayer suggested that the Task Force attempt to narrow down to a manageable number the laundry list of LCC cost factors identified in the Federal Register notice. Eight major cost factors were identified: 1) fuel, 2) tires, 3) oil, 4) brakes, 5) transmission, 6) engine, 7) preventive maintenance and 8) air conditioning. These drivers account for more than 75% of the life cycle cost of a bus.

5. STANDARDIZATION

Mr. Mayer then recommended that the Task Force attempt to define standardization. Three definitions of this concept were identified. The first approach relates to the development of a national bus. It seemed to be the consensus that this concept was inappropriate because of the vast differences in operating and climatic conditions among transit systems throughout the country.

The second approach to standardization relates to the needs of smaller transit systems. The Task Force members agreed that small transit systems should be permitted to negotiate for the procurement of additional buses of the same make as buses already in their fleet. This practice would eliminate the need of small transit systems to dramatically increase their parts inventory to accommodate the service needs of buses produced by several different manufacturers.

Under the third approach to standardization, transit systems would be encouraged to award multi-year procurement contracts with the option to purchase additional buses from the same manufacturer over several years. This procedure would help transit systems avoid having to increase parts inventories.

Mr. Aaron referred to a paper prepared by Mr. James H. Graebner entitled, "Locally Determined Procurement - (LDP) - A Modest Proposal." The key to this proposal for bus procurement is that a fixed dollar amount of UMTA funding would be made available to every approved grantee (transit system) for a given class of bus. The local transit system would be responsible to make up the difference between the funding level fixed by UMTA and the actual price of the bus. Thus, "bells and whistles" or extra features would be paid for in local dollars.

6. PERFORMANCE

Standardization having been considered, Mr. Mayer suggested performance as the final discussion topic.

Mr. Aaron remarked that the White Book defines the requirements of buses in performance terms. He said the White Book does not stipulate how the manufacturer is to achieve these requirements. If the manufacturer is permitted to determine his own approach to meet the requirements of the performance specification, then standardization is sacrificed. Performance and standardization are therefore not compatible.

Much discussion ensued over the issue of what happens when a manufacturer cannot provide a particular item called for in the specification, (e.g., a 48-inch door). Is this manufacturer automatically eliminated from the bid process or can he offer an alternate for approval, or accept some penalty to stay in the procurement process?

Mr. Pullin read a proposed specification deviation provision which he suggested be included in any standard specification document (Attachment #5). The Task Force members approved of this provision. Mr. Pullin also announced his support for price offests. Mr. Aaron added his support to the price offset concept.

Mr. Aaron asked if the Task Force could agree that the basis of award in any bus procurement be specified in the bid documents. The Task Force agreed that it is essential. Indeed, the Federal Register notice states "the method of evaluation should be clearly set out in the solicitation document so that all bidders can understand the basis upon which contract award will be made."

7. ACTION ITEMS

Mr. Mayer asked the APTA staff to draft a set of guidelines on bus procurement based on the discussions of this meeting. These draft guidelines (Attachment #6) are to be circulated to members of the Task Force for comment and are to be returned to Frank J. Cihak at APTA. The Task Force will meet again in late April or May, 1982 to solidify these actions.

8. ADJOURNMENT

The Bus Procurement Task Force meeting was adjourned at 3:45 p.m.

Report prepared by:

Patrick D. Jones
Research Associate

BUS PROCUREMENT TASK FORCE MEETING - 3/22/82

LIST OF ATTACHMENTS

1. Meeting Participants

2. Meeting Agenda

3. Discussion on Life Cycle Cost Procurement of Transit Buses from Recent Bus Technology Liaison Board meeting reports

4. APTA Policy Statement on Bus Procurement Adopted by the Executive Committee - December 12, 1979

5. Specification Deviation Provision Proposed by General Motors

6. APTA Draft Guidelines for Grantee Evaluation of Performance, Standardization and Life Cycle Cost Factors for the Procurement of Transit Buses.

List of Participants
At The
Bus Procurement Task Force Meeting
March 22, 1982

Henry M. Mayer, Chairman
Managing Director
Milwaukee County Transit System, Milwaukee, WI

Raymond W. Gareau, Vice Chairman
President, Union Street Bus Company, Inc.
Southeastern Regional Transit Authority, New Bedford, MA

Wayne Aaron
Vice President, Sales and Marketing
Grumman Flxible Corporation, Delaware, OH

Manley L. Bean
President
Neoplan, U.S.A Corporation, Lamar, CO

Bart Betz
Program Manager, Capital Programs
Transport of New Jersey, Maplewood, NJ

Jean Braheney
Engineer
Neoplan U.S.A. Corporation, Lamar, CO

Robert C. Buchanan
Executive Director - Administration
American Public Transit Association, Washington, DC

Arnold F. Burkhart
Executive Vice President - Operations
American Transit Corporation, St. Louis, MO

Frank J. Cihak
Director - Technical & Research Services
American Public Transit Association, Washington, DC

William H. Coryell
Transit Program Director
Corwn Coach Corporation, Los Angeles, CA

Harold H. Geissenheimer
General Operations Manager
Chicago Transit Authority, Chicago, IL

Patrick D. Jones
Research Associate - Technical & Research Services
American Public Transit Association, Washington,DC

Frank J. Kirshner
Director, Equipment Engineering
Southern California Rapid Transit District, Los Angeles, CA

Bhupindar S. Mallhi
Engineer
Chicago Transit Authority, Chicago, IL

William E. McNeely
Vice President, Maintenance & Purchasing
City Coach Lines, Inc., Jacksonville, FL

George Millonas
Manager, Engineering
Chicago Transit Authority, Chicago, IL

George Prytula
Vice President, Government Affairs
Grumman Flxible Corporation, Arlington, VA

Mel Pullin
Sales Manager, Coaches
GMC Truck & Coach Division, Pontiac, MI

Robert Ulmer
Engineer
Greater Cleveland Regional Transit Authority, Cleveland, OH

Frank W. Venezia
Superintendent - Bus Shops
Chicago Transit Authority, Chicago, IL

Maynard Z. Walters
Director, Purchasing & Stores
Southern California Rapid Transit District, Los Angeles, CA

J. David White
Director of Materials
Massachusetts Bay Transportation Authority, Boston, MA

Attachment #2

American Public Transit Association

Bus Procurement Task Force
Meeting Agenda

Chicago O'Hare Hilton
March 22, 1982

		SUBJECT	PERSON RESPONSIBLE
10:00 A.M.	1)	Introduction	Henry Mayer, Milwaukee County Transit System
	2)	Statement of charge	Henry Mayer
	3)	Purpose of meeting and expected actions	Henry Mayer
	4)	Summary of Bus Technology Liaison Board activities	Frank Cihak, American Public Transit Association
	5)	Discussion	All
Noon		Lunch	
12:30 P.M.	6)	Continue discussion	All
2:30 P.M.	7)	Identification of action items	Henry Mayer
3:30 P.M.	8)	Summary--closing remarks	Henry Mayer
4:00 P.M.	9)	Adjourn	

3/19/82

Discussion on Life Cycle Cost Procurement of Transit Buses: Excerpts from Recent Bus Technology Liaison Board Meeting Reports

FROM THE DECEMBER 4, 1981 BUS TECHNOLOGY LIAISON BOARD MEETING REPORT:

Life Cycle Costing as a Procurement Method for Buses

Mr. Cihak distributed an informal, two-page APTA document entitled "Life Cycle Costing as a Procurement Method: for Discussion Only" (Attachment #19). Much of the discussion on this subject centered around members' frustrations with existing procurement procedures and ways in which "low bid" could be avoided as an undesirable means of awarding contracts. One of the disadvantages of life cycle costing (LCC) is that no one seems to have good operating cost data to predict the influence on LCC of various cost drivers. This lack of hard data tends to invalidate the entire life cycle cost process.

One suggested alternative to the low bid process and LCC as procurement methods was a two-stage process. First, manufacturers would be required to "qualify" to present bids to a particular transit system. Then, from among the qualified bidders, the contract would be awarded to the lowest bidder.

Mr. Graebner requested that UMTA transit assistance and legal representatives attend the next BTLB meeting to discuss the possibility of alternatives to low bid as procurement methods for buses. It was also agreed that the subject of LCC and bus procurement methods should remain on the agenda for future discussion.

FROM THE FEBRUARY 26, 1982 BUS TECHNOLOGY LIAISON BOARD MEETING REPORT:

Life Cycle Costing for Procurement of Transit Buses -- UMTA Guidelines

Ms. Weule began this discussion by reviewing the new Rolling Stock Procurement Guidelines which appeared in the Federal Register on February 18, 1982 (Attachment #). She noted that both the fiscal years 1980 and 1981 DOT Appropriation Acts required that rolling stock be awarded based on consideration of performance, standardization, life cycle costs and other factors the Secretary may deem relevant, in addition to the consideration of initial capital costs. However, the FY 1982 Appropriation Act requires that UMTA be assured that the factors mentioned in the Act are evaluated by a grantee prior to awarding a procurement contract for any type of rolling stock using FY 1982 Section 3, 16(b)(2) or 5 funds. This requirement applies to the

procurement of all rolling stock, including advanced design buses.

The Federal Register notice states, "It is UMTA's intent to encourage grantees to utilize procurement methods that will allow grantees maximum flexibility to make the most cost-effective purchases." In other words, transit systems are free to develop their own methods of compliance with the requirements of the Act. Ms. Weule emphasized, however, that procurement mechanisms cannot be designed in a manner which unduly restricts competition. The Federal Register notice states, " UMTA is prohibited by Section 3 of the Urban Mass Transportation Act of 1964, as amended, from funding procurements which use exclusionary or discriminatory specifications." Nonetheless, Ms. Weule added, if a transit system can demonstrate that it needs a particular product that only one manufacturer can supply, then the transit system is permitted to specify that product.

On the subject of disputes the notice states, "Any protest involving the application of life-cycle cost procurement methods is considered a local issue and should be resolved by the parties to the procurement. UMTA will not entertain protests involving life-cycle cost issues but will defer to the decisions of the grantees. However, UMTA will offer technical assistance when requested in connection with the development of the procedure."

Mr. Marino observed that UMTA's interpretation of the life cycle cost requirement is very broad. The Federal Register notice does not answer the question of how to evaluate performance, standardization and life cycle costs; it states only that an evaluation of these factors must be made by the grantee. Emphasizing that the AMS procedure is only one method of evaluating life cycle costs, Mr. Marino encouraged members of the BTLB and transit systems in general to consider other LCC evaluation procedures as well as other procurement methods. He added that the Federal Register notice requests that comments on the new guidelines be submitted to UMTA by May 19, 1982.

Phoenix Transit System Experience with LCC Bus Procurement

Mr. Colby and Ms. Heffernan, Phoenix Transit System, discussed their experience with LCC bus procurement. Mr. Colby stated that life cycle costing is not a "license to steal"; it is a method of comparing the relative costs of different buses by evaluating the principal operating and maintenance costs of these buses over their useful life instead of by comparing only their initial capital costs. Phoenix determined that seven cost factors (drivers) accounted for 70 to 75 percent of their operating and maintenance costs and calculated the actual costs over a two-year period for each of these factors: 1) fuel, 2) oil, 3) tires, 4) transmission, 5) air conditioning, 6) brakes, 7)preventive maintenance.

Bidders were required to compute corresponding costs for their advanced design buses based on Phoenix's operating circumstances.

They were also requested to submit supporting data to aid in the bid analysis. The technical proposal, which contained the technical data needed to evaluate LCC impacts, was opened on June 19, 1981. Phoenix evaluated the LCC impacts of the two manufacturers before opening the original bid price proposal on July 10, 1981. Mr. Colby stated that Phoenix's attorneys are confident that their LCC procurement method will survive challenges in court.

Ms. Heffernan offered some suggestions to the BTLB on the mechanics of managing a life cycle cost procurement process. First and foremost, to avoid the biases of a single individual, the transit agency should set up a Technical Evaluation Committee consisting of several individuals who possess considerable technical expertise and mathematical ability. The committee will be responsible to (1) decide whether to accept or reject manufacturer data based on its reasonableness and completeness and (2) perform the actual LCC impact calculations. For these reasons, at least one member of the committee should have a thorough knowledge of maintenance practices and costs so that obvious errors in a manufacturer's maintenance cost estimates will be detected. Another member of the committee should be a competent engineer who will not be overwhelmed by complicated and detailed technical data. Once it has been determined that the manufacturer supplied data is reasonable, the Technical Evaluation Committee must determine whether the data of the several manufacturers is comparable. In other words, are we comparing apples to apples or apples to oranges? In response to a question, Ms. Heffernan said that the Phoenix bid documents stated that data supplied by the manufacturer shall not be construed as representing an implied warranty.

Both Mr. Colby and Ms. Heffernan remarked at the relative complexity of the AMS method for calculating LCC impacts versus the method developed by Phoenix Transit System. It took three days to perform the calculations required of the AMS method but only three hours to do the calculations for their own method. Mr. Colby stated that Phoenix will use LCC for future bus procurements because he believes it encourages technological innovations which result in a better bus. Ms. Heffernan then distributed two charts (Attachment #___) to illustrate the difference between the AMS and Phoenix methods for calculating the LCC impact of one cost driver. Please see Attachment #___ for a summary of Phoenix's suggested life cycle cost procurement procedures.

LCC for Bus Procurement -- General Discussion

Following the UMTA and Phoenix Transit System presentations, several questions arose as points of departure for further discussion on life cycle costing. Mr. Graebner asked, where do we wish to go as a group in making recommendations to UMTA regarding LCC? He added, is the precision with which we can calculate LCC impact data significant in terms of the differences between actual bid proposals, and how will the variance in transit system judgment decisions about manufacturers' cost data be reflected in the evaluated bids?

Mr. Kravitz asked, how can the manufacturer or transit system evaluate the LCC impact of a cost driver for which complete data is unavailable, for instance the 6V-92TA engine?

Another question concerned the implications of the LCC requirement for small transit systems. Without bountiful staff resources, how do small transit systems intend to perform the judgments and time consuming calculations necessary to evaluate LCC impacts in future bus porcurements?

Mr. Graebner appointed a Life Cycle Cost Committee composed of Messrs. Reading (Chairman), Kirshner, Okasinski and Venezia. Messrs. Colby, Droske and Mead will be committee correspondents. The charge of the committee is twofold: (1) ascertain which transit systems plan to purchase buses in 1982 and (2) develop an information exchange on existing and proposed methods of LCC procurement to assist those transit systems that plan to purchase buses.

Pursuant to the charge of the LCC Committee, Mr. Cihak reported that APTA has assembled a "Compendium of Information Related to Life Cycle Cost Procurement of Transit Buses." This compendium (Table of Contents included as Attachment #___) will be distributed to the BTLB with the request that any additional pertinent documents be submitted to APTA for inclusion in the compendium. APTA will make this document available to members on request.

PDJ
3/19/82

Attachment #4

APTA POLICY STATEMENT ON BUS PROCUREMENT

ADOPTED BY THE EXECUTIVE COMMITTEE - DECEMBER 12, 1979

The American Public Transit Association welcomes the initiative being taken by the Secretary of Transportation and the UMTA Administrator-designate to increase the availability of new transit buses as rapidly as possible in light of increasing ridership demand and the urgent need to reduce oil consumption.

APTA convened a Task Force on Bus Procurement to review current bus procurement policies and to recommend changes. Although the Task Force recognized the need for increased local, state, and federal operating assistance to provide additional driver, mechanics, and training to support an increase in the bus transit fleet, this statement deals only with the bus and bus facility procurement process.

The Task Force made one principal assumption:

> Federal funds for buses and bus facilities must be dramatically increased.

The windfall profits tax and immediate corresponding authorizing and appropriating legislation is the most expeditious means of generating these added funds.

The Task Force deliberations included discussions with bus manufacturers who have assured APTA that they are prepared to respond to additional orders resulting from simplified procurement procedures.

The Task Force recommends the following:

1. Federal grant delivery procedures must be simplified and expedited.

   a. The level of available Section 5 formula capital funds should be increased so apportionments are sufficient to meet national bus and bus facility replacement needs. Since urbanized areas are entitled to apportioned formula capital funds, grant requests for buses and bus facilities should be routinely processed without elaborate justification.

   b. Section 3 capital assistance requests for replacement buses and bus facilities should be granted on a routine basis. Grantees should be subject only to a minimum justification and specification review.

   c. Where feasible, multiyear contracts which include conditional approval of funds subject to future appropriations, should be used for Section 3 and Section 5 bus and bus facility grants. Grantees would prepare one grant request instead of several annual requests and, in some cases, would complete procurement in advance of federal funding. UMTA should consider multiyear replacement and expansion commitments to large transit systems to annualize replacement needs.

d. Capital assistance for maintenance facilities should be processed as one grant with two phases, rather than as two separate grants, one for engineering and one for construction.

2. Productivity and performance of current production buses must be improved significantly.

Immediate design changes are mandatory to improve fuel economy, increase passenger capacity, reduce operating and maintenance expenses, and to lower capital costs.

To achieve these objectives the following actions are recommended:

a. APTA, UMTA, and bus manufacturers should review specifications and agree to modifications which will accomplish the objectives. Operating test results should be used to confirm that the modifications are effective.

b. Modifications should be phased into production as soon as possible.

c. Elimination of amenities no longer consistent with national needs should be considered.

3. The federal government should guarantee incremental increases in bus production for a period of at least 5 years.

The federal government should seek legislation authorizing the Secretary of Transportation to guarantee sale of up to 150% of qualified manufacturers' 1979 production. The guarantee would provide the necessary incentive for manufacturers and suppliers to increase inventories and manufacturing capacity. The guarantee should be reviewed and adjusted annually, as appropriate.

Key elements of this plan include the following:

a. The guarantee would take the form of a federal procurement of such quantity of buses which exceed those ordered by transit operators and are necessary to achieve the guaranteed production.

b. APTA will recommend specifications to achieve a simplified standard national bus for federal procurement. As an alternative, buses produced under the federally guaranteed procurement would be consistent with then current bus production.

c. Allocation of federally-procured buses would be on the basis of need, in a manner jointly determined by APTA and UMTA. In order to benefit from rapid delivery, these buses would be available to transit operators which elect to substitute such buses as an alternative to the local bid process providing local matching funds are available. In addition, such buses could be allocated by a federal grant of equipment or by temporary leasing to operators with short-term needs.

d. Any additional manufacturer who can meet all applicable U. S. laws and regulations should be invited to contract for the production of buses for testing and qualification purposes.

4. Grantees should be permitted to issue non-exclusionary bus specifications without prior federal approval.

   Such specifications would conform to federal regulations.

   UMTA should develop procedures for negotiated and life-cycle cost procurement techniques.

   APTA will obtain agreement between manufacturers and operators on simplified standard designs and specifications of major components and features.

5. Bus rehabilitation should be encouraged.

   UMTA should encourage and fund bus rehabilitation capital projects where operating agencies deem such projects feasible.

   UMTA should not require rehabilitation to include lift retrofit since such installation will make rehabilitation structurally and financially infeasible.

6. Grantees should be able to create reserve fleets in accordance with local needs.

   The creation of stand-by bus fleets through the replacement process or other means should be left to the discretion of local policy makers determining their own needs. Federal procedures impeding these actions should be eliminated.

7. The federal government should initiate a bus demonstration program.

   Current federal regulations adversely affect bus productivity. Accordingly, manufacturers currently participating in the U. S. bus market should be invited to produce practical and economical bus prototypes to demonstrate performance and productivity improvements.

   In addition, the federal government should procure a variety of unmodified foreign buses for deployment in U. S. cities to demonstrate their operating and maintenance costs, reliability, and rider acceptance.

   Cost/benefit analyses of both such demonstrations could lead to changes in current federal regulations affecting bus productivity and performance levels.

APTA believes these recommendations will increase the number of buses manufactured for deployment in the United States and significantly improve bus performance and productivity. APTA is prepared to support these actions through industry committees and the Transit Development Corporation. Public transit agencies will play an active role in carrying out each action, in conjunction with UMTA and the manufacturing and supply industry.

SECTION 1.1.11.1 SPECIFICATION DEVIATIONS

The specifications released herewith represent the coach which the (Procuring Agency) feels is ideally suited for its operations; however, the (Procuring Agency) will consider requests for deviations to the specifications. The bidder must submit such requests prior to bid opening and in accordance with the specified timing in Section 1.1.11, Bidder Review Procedures.

All requested deviations from these specifications will be responded to in one of the three following categories:

1. Approved as an equal.
2. Approved as a substitute which will be evaluated in accordance with the contract award procedures specified in Section 1.1.10 regarding life cycle cost,performance, standardization and other factors.
3. Rejected.

DRAFT GUIDELINES FOR GRANTEE EVALUATION OF PERFORMANCE, STANDARDIZATION AND LIFE CYCLE COST FACTORS FOR THE PROCUREMENT OF TRANSIT BUSES

I. PURPOSE

These guidelines are intended to assist grantees to evaluate procurement factors required under the 1982 DOT Appropriations Act as defined in the Federal Register notices of February 18 and March 4, 1982.

The guidelines were prepared by APTA staff at the direction of the APTA Bus Procurement Task Force chaired by Mr. Henry M. Mayer, Managing Director, Milwaukee County Transit System. Suggestions for improving those guidelines should be directed to Frank J. Cihak, Director - Technical & Research Services, of the APTA staff.

II. REFERENCES

APTA has prepared a "Compendium of Information Related to Life Cycle Cost Procurement of Transit Buses." The Compendium is available through the APTA library. The table of contents is attached as Appendix I.

III. DEFINITIONS

PERFORMANCE

Features or advantages to a grantee that a specific bus builder can provide. Examples are:

- Financial resources to insure completion of a procurement.
- Availability of trained service personnel and manuals to provide adequate, timely technical support for the maintenance and operation of the buses including modification and upgrading programs.
- Availability of training facilities, training materials and personnel to provide training to grantee personnel for the maintenance and operations of the buses.
- Availability of service and repair parts through dealer or support organizations.
- Production facilities adequate to insure rapid manufacture and delivery of buses.

- o Alternate features with better performance capabilities than those specified. Deviations from a specification requirement are provided for under the following suggested provision of the procurement specification:

Baseline Advanced Design Transit Coach Specifications

Part I

1.1.11 Bidder Review Procedures
1.1.11.1 Specification Deviations

The specifications released herewith represent the coach which the (Procuring Agency) feels is ideally suited for its operations: however, the (Procuring Agency) will consider requests for deviations to the specifications. The bidder must submit such requests prior to bid opening and in accordance with the specified timing in Section 1.1.11, Bidder Review Procedures.

All requested deviations from these specifications will be responded to in one of the three following categories:

1. Approved as an equal.
2. Approved as a substitute which will be evaluated in accordance with the contract award procedures specified in section 1.1.10 regarding life cycle costs, performance, standardization and other factors.
3. Rejected.

STANDARDIZATION

The degree of similarity or interchangeability that reduces or eliminates extra cost to the grantee to own and operate a specific bus. Examples are:

- o Bus is exactly the same or all parts are interchangeable with the grantee's present bus. Extra costs to the grantee would be very small.
- o Some parts are different but major mechanical components such as engine or transmission are interchangeable with grantee's present bus. Extra cost to the grantee would be moderate.
- o All parts and major components are different from grantee's present bus. Extra cost to the grantee would be high.
- o Multi-year procurements will increase standardization of a transit system's fleet.

Costs of non-standardization are incurred due to additional stocking of parts (inventory costs), additional training of personnel, both maintenance and operating, and additional tools, equipment and facilities.

LIFE CYCLE COSTS

Total cost of ownership of a bus comprised of:

- o Initial cost.
- o Operating costs including routine maintenance, expendables such as fuel and tires, major component rebuilding and replacement (does not include operator).
- o Salvage or resale costs. (This is negligible for transit buses at the end of 12 to 15 years).

IV. MAJOR COST DRIVERS

The following eight major cost drivers comprise more than 75% of the operating cost of the bus:

1. fuel
2. tires
3. engine oil
4. brakes
5. transmission
6. engine
7. air conditioning
8. preventive maintenance

LCC should include evaluation of these factors. In addition site specific factors such as body corrosion, seating/standing capacity, road call frequency, availability, etc. may be used based on grantee's decision.

V. PROCEDURES

1. The basis for contract award must be specified in bid documents.
2. Transit systems with small fleet of a few models of buses should be permitted to negotiate for procurement of additional buses of the same model with minimal justification. A fleet size of 100 buses or less and a procurement of up to 10% additional buses was recommended for this minimal justification.
3. Objective factors such as lab tests, operational test results, cost or performance factors should be used to the maximum extent possible in an evaluation.
4. Subjective factors such as peer group opinion can be used when applicable objective factors are not available. Subjective opinion is especially applicable when evaluating a new product, component or design that does not have field experience or results.
5. The procedure used by the Phoenix Public Transit Administration should be examined as a possible model for subsequent procurement.

COMPENDIUM OF INFORMATION RELATED TO LIFE CYCLE COST

PROCUREMENT OF TRANSIT BUSES

TABLE OF CONTENTS

1) Advanced Management Systems, Inc. Life Cycle Costing for Current Rohr and AM General Buses and General Motors RTS-II Bus. (Final Report). Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1976. (UMTA-VA-06-0039-76-1)

2) Advanced Management Systems, Inc. Life Cycle Cost Procurement Procedures for Advanced Design Buses (Development and Test Application). (Final Report). Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1980. (UMTA-VA-06-0045-80-1)

3) Gill Associates, Inc. Use of Life Cycle Costing for Transit Equipment Procurement. (Final Report). Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1980. (DOT-UT-RI-06-0007-2)

4) Gill Associates, Inc. Life Cycle Costing for Procurement of Small Buses. Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1980. (UMTA-RI-06-0007-80-1)

5) Advanced Management Systems, Inc. Life-Cycle Cost Procurement of Advanced Design Buses at Providence, Rhode Island, and Phoenix, Arizona. (Final Report). Washington, D.C.: U.S. Department of Transportation, Urban Mass Transportation Administration, 1981. (UMTA-VA-06-0045-81-1)

6) Simon, Michael E. "Acquisition Costs Versus Life Cycle Costs." Presentation at the APTA Mid-Year Meeting, May 22, 1975.

7) Chaput, Hector. "The Fallacy of the Low Bid." Paper presented at the APTA Annual Meeting, September 24-28, 1978.

8) Graebner, James. "Santa Clara County's Life Cycle Costing Project." Paper presented at the APTA Western Conference, April 4, 1979.

9) Cioe, Eileen. "Rhode Island Public Transit Authority Evaluation Procedures." June 1980.

10) Chaput, Hector. "Life Cycle Cost Program at OTC/OC Transpo."

11) Colby, Chester E. "City of Phoenix Modifications to Baseline Advanced Design Transit Coach Specifications for Life-Cycle Costing." February 1981.

12) Advanced Management Systems. "Life-Cycle Cost Procurement Procedures and Guidelines." March 1, 1981.

13) Graebner, James H. "Locally Determined Procurement - (LDP) - A Modest Proposal." Paper presented at the APTA Western Conference, April 15, 1981.

14) Public Technology, Inc. Transit Technology Briefs - Life Cycle Cost Bus Procurement. Vol. 1, No. 5, September 1981.

PDJ
2/24/82

Attachment #7

american public transit association

David F. Girard-diCarlo, *Chairman*
Leonard Ronis, *President*
Harvel Williams, *Secretary-Treasurer*
John L. McDonnell, *Immediate Past Chairman*
Houston P. Ishmael, *Immediate Past President*

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E. V. Miller
Neil Peterson
Daniel T. Scannell
Frank Snowden
Forest D. Swift

Jack R. Gilstrap
Executive Vice President

MEMORANDUM

TO: U.S. Transit System Members

FROM: Executive Vice President

DATE: April 13, 1982

SUBJECT: Rolling Stock Procurement Procedures

In light of recent UMTA guidelines on the procurement of rolling stock (Federal Register notice dated February 18, 1982 with corrections dated March 4, 1982), APTA needs to determine which transit systems plan to purchase buses in 1982 using UMTA FY '82 funds so that we can help to develop procedures to comply with the new guidelines. Your cooperation in this effort is greatly appreciated.

Please complete the enclosed questionnaire and return it to APTA by April 23, 1982. APTA staff will use the results to develop a mailing list so that relevant information can be sent to the involved transit systems.

Jack R. Gilstrap

Enclosure

BP-11-447

1225 Connecticut Avenue, N.W., Washington, D.C. 20036 Phone (202) 828-2800

American Public Transit Association
1225 Connecticut Avenue, NW
Washington, DC 20036
(202) 828-2888

1982 TRANSIT BUS PROCUREMENT SURVEY

TRANSIT SYSTEM _____

MAILING ADDRESS _____

CITY _____ STATE _____ ZIP _____

SUBMITTED BY _____ _____
(typed name) (written signature)

TELEPHONE _____ EXT. _____

1. Does your transit system plan to purchase buses in 1982 using UMTA FY 82 funds?
   YES _____ NO _____

   If "yes" to number 1, please supply the following information about the buses you plan to purchase.

2. Type of bus (e.g. ADB, "new look," articulated, small):

   _____

3. Length: _____ Width: _____

4. Number of buses: _____

5. Planned bid opening date: _____

6. What method of life cycle cost evaluation are you planning to use? (Please attach copies of procurement documents.)

   _____

Please return by April 23, 1982 to: Frank J. Cihak
Director, Technical & Research
Services Department
American Public Transit Association
1225 Connecticut Avenue, NW
Washington, DC 20036

FJC
4/13/82

BP-11-447

SIMPLIFIED LIFE CYCLE COSTING PROCEDURE

Life Cycle Costing (LCC) permits a transit operator to procure rolling stock by considering important costs other than the lowest acquisition cost. While the acquisition cost, or purchase price, is relevant, the operating and maintenance costs for the life of the rolling stock are also extremely important. This document presents a simplified LCC procedure for buses that considers several important operating costs, referred to as cost drivers, that heavily influence the total costs to own and operate the bus throughout its useful life. A worksheet to calculate the life cycle cost of a bus is included. (Attachment 1)

There are many acceptable LCC procedures that can be used to conduct a LCC procurement. This document lists but one possible, and very simplified, method. Purchasers with substantial technical skills and extensive data bases may wish to use more complex procedures. A basic guideline to LCC procedures may be found in an UMTA report entitled, Life Cycle Cost Procurement of Advanced Design Buses at Providence, Rhode Island, and Phoenix, Arizona (Advanced Management Systems, Inc., dated October 31, 1981).

The Cost Drivers

This simplified LCC procedure uses seven cost drivers which many operators report as significant. Attachment 2 lists a more extensive set of cost drivers which could be used in an LCC procedure. The cost drivers used in this procedure are:

(a) Bus LCC lifetime adjustment factor
(b) Acquisition cost per bus
(c) Fuel costs for the lifetime of that bus
(d) Transmission repair costs for the lifetime of that bus
(e) Brake repair costs for the lifetime of that bus
(f) Air conditioning and ventilation repair costs for the life of the bus
(g) Preventive maintenance costs for the life of the bus

By calculating the costs which would be incurred for each cost driver over the entire life of the bus and adding up the results, the life cycle costs can be determined. This is done for each competing bus in the procurement. From this, the bus with the lowest overall life cycle cost can be determined. Data is required for calculating the cost drivers. The data can be obtained from the bus manufacturers and transit operator records, as shown on page 3. The purchaser is responsible for determining the correctness or reasonableness of all data. For the procedure to work correctly, the data for all buses must be comparable and in the same terms.

Cost Driver Elements

The above listed cost drivers are comprised of various elements. All of the elements are not considered in this simplified LCC procedure, only those which transit operators have reported to be significant. If the purchaser believes that other elements are significant, it is encouraged to use them.

The bus LCC lifetime adjustment factor adjusts the LCC calculation so the number of miles the manufacturer states his product will last is considered. The cost driver element for the acquisition cost is the purchase price of the vehicle itself. The cost driver elements for the fuel costs are the estimated miles per gallon of fuel that the bus is expected to average and the cost per gallon of fuel which the operator will pay. The cost driver elements used in this simplified LCC procedure for transmission repair costs, brake repair costs, and air conditioning and ventilation repair costs include the number of miles between repair actions, the number of hours required for each repair action (including removal and re-installation, performing the work, and testing), the hourly labor rate for the skill level required, and the material (parts) costs. The cost elements for the preventive maintenance (PM) costs requires information on the number of PM actions recommended by the manufacturer for the life of the bus, the labor hours for each PM action, the hourly labor rate for the work involved, and the cost of the materials (parts) required for each PM.

LCC Calculation

The formula for calculating the LCC for a procurement using this procedure is:

(1) Unadjusted Life Cycle Cost = Acquisition cost (b) + Lifetime operating costs of (c) + Lifetime operating costs of (d) + Lifetime operating costs of (e) + Lifetime operating costs of (f) + Lifetime operating costs of (g).

(2) Adjusted bus lifecycle costs = Unadjusted LCC x Bus LCC lifetime adjustment factor.

Data Sources

The data required for the calculation can be obtained from the manufacturer or from transit operator's records.

The following data are requested from the manufacturer:

- o the bus acquisition cost
- o the estimated life of the bus in miles for the purchaser's location
- o the estimated miles per gallon of fuel the bus can be expected to average
- o the estimated number of miles between transmission overhauls
- o the number of labor hours required to remove and re-install the transmission
- o the number of labor hours required to dismantle, overhaul and test the transmission
- o the cost of the materials (parts) required to overhaul the transmission
- o the estimated number of miles between brake repairs using old drums
- o the estimated number of miles between brake repairs installing new drums
- o the cost of materials (parts) required to repair brakes using old drums
- o the cost of materials (parts) required to repair brakes installing new drums
- o the estimated number of hours between A/C compressor overhaul
- o the estimated number of hours required to rebuild the A/C compressor
- o the cost of materials (parts) required to rebuild the A/C compressor
- o the estimated number of miles between A/C blower motor overhaul
- o the number of labor hours required to remove and re-install the A/C blower motor
- o the number of labor hours required to rebuild the A/C blower motor
- o the estimated number of miles between A/C condenser motor overhaul
- o the number of labor hours required to remove and re-install the A/C condenser motor
- o the number of labor hours required to rebuild the A/C condenser motor
- o the schedule of preventive maintenance actions in miles
- o the number of preventive maintenance actions for the life of the bus
- o the number of labor hours required to perform each preventive maintenance action
- o the cost of materials (parts) required for each preventive maintenance action.

The following data are drawn from transit operator's records:

- o the cost of fuel per gallon
- o the hourly labor rate for the personnel needed to perform the various repairs and preventive maintenance actions
- o the number of years the operator plans to keep the bus
- o the number of miles the bus will be operated per year (average utilization rate)

Attachment 1

LCC CALCULATION WORKSHEET

a. Bus LCC lifetime adjustment factor calculation:

(1) _____ (# years intending to keep bus) x _____ (# mi./yr. average utilization of buses in fleet) = _____ (# miles for bus LCC lifetime)

(2) _____ (# miles for bus LCC lifetime) ÷ _____ (Mfg. est. of bus life in miles) = [ ] (Bus LCC lifetime factor)

b. Acquisition cost per bus: . . . . . [ ]

c. Fuel Cost:

(1) _____ (estimated bus life in miles) ÷ _____ (estimated MPG) = _____ (# of gallons for bus lifetime)

(2) _____ (# of gallons for bus lifetime) X _____ (fuel cost per gallon) = ... [ ] (Fuel LCC)

d. Transmission repair cost:

(1) _____ (estimated bus life in miles) ÷ _____ (estimated miles between overhauls) = _____ (# of overhauls per bus life)

(2) Overhaul cost:

Maintenance event	estimated hours labor		labor rate		material cost		cost per event
Remove and re-install transmission	_____	x	_____	+	_____	=	_____ (event A)
Dismantle, overhaul and test	_____	x	_____	+	_____	=	_____ (event B)

(3) _____ (event A) + _____ (event B) = _____ (cost per overhaul)

(4) _____ (cost per overhaul) X _____ (# of overhauls per bus life) = ... [ ] (transmission overhaul LCC)

e. Brake repair cost:

(1) _____ (estimated bus life in miles) ÷ _____ (estimated miles between relines/ turning old drums) = _____ (# of relines per bus life using old drums)

(2) _____ (estimated bus life in miles) ÷ _____ (estimated miles between relines/ installing new drums) = _____ (# of relines per bus life using new drums)

(3) Reline Costs:

Maintenance event	est. hours of labor		labor rate		material costs		# of relines for bus life		Reline costs
Reline/turn drums	_____	x	_____	+	_____	x	_____	=	_____ (event A)
Reline/install new drums	_____	x	_____	+	_____	x	_____	=	_____ (event B)

(4) _____ (event A) + _____ (event B) = ... [ ]

Brake Reline LCC

f. Air Conditioning and ventilation repair cost

(1) A/C Compressor

(A) _____ (estimated bus life in miles) ÷ _____ (estimated miles between A/C compressor overhaul) = _____ # of A/C compressor overhauls for life of bus

(B) A/C Compressor Overhaul Cost:

Maintenance event	est. hours		labor rate		labor cost		materials cost		cost per event	
Remove and Re-install A/C Compressor	_____	x	_____	=	_____	+	_____	=	_____	(event A)
Rebuild Compressor	_____	x	_____	=	_____	+	_____	=	_____	(event B)

(C) _____ (event A) + _____ (event B) = _____ (cost per event)

(D) _____ (# of A/C compressor overhauls for life of bus) X _____ (cost per event) = _____ A/C compressor LCC

(2) A/C blower

(A) _____ (estimated bus life in miles) ÷ _____ (estimated miles between A/C blower motor overhaul) = _____ # of A/C blower overhauls for life of bus

(B) A/C Blower overhaul cost:

Maintenance Event	est hours	labor rate	labor cost	materials cost	cost per event
Remove and replace A/C blower	_____ x	_____ =	_____ +	_____ =	_____ (event A)
Rebuild blower motor	_____ x	_____ =	_____ +	_____ =	_____ (event B)

(C) _____ (event A) + _____ (event B) = _____ (cost per event)

(D) _____ (# of A/C blower overhauls for life of bus) x _____ (cost per event) = _____ A/C blower LCC

(3) A/C Condenser Motor

(A) _____ (estimated bus life in miles) ÷ _____ (estimated miles between A/C condenser motor overhauls) = _____ (# of A/C condenser motor overhauls per life of bus)

(B) A/C Condenser motor overhaul cost:

Maintenance event	est. hours	labor rate	labor cost	materials cost	cost per event
Remove and replace condenser motor	_____ x	_____ =	_____ +	_____ =	_____ (event A)
Rebuild condenser motor	_____ x	_____ =	_____ +	_____ =	_____ (event B)

(C) _____ (event A) + _____ (event B) = _____ (cost per event)

(D) _____ (# of A/C condenser motor overhauls per life of bus) x _____ (cost per event) = _____ A/C Condenser motor motor overhaul LCC

(4) Air Conditioning and Ventilation cost computation:

(A/C Compressor LCC)	+	(A/C Blower Motor LCC)	+	(A/C Condenser Motor LCC)	=	[ ] (A/C and ventilation LCC)

g. Preventive Maintenance Cost

(1) Preventive maintenance (PM) schedules are specified by the manufacturer. They are generally stated as a list of actions to be performed at periodic intervals (e.g., 6,000 mile PM, 12,000 mile PM, 18,000 mile PM, etc.). For each PM interval, the purchaser calculates the cost of performing that type of PM.

(A) Manufacturer's First Specified PM: _____

(# labor hours for this PM)	x	(hourly labor rate)	=	(labor cost per PM)	+	(materials cost)	=	(cost per PM)	x	(# of PM's of this interval for bus life)	=	(PM total cost for bus life for this interval)

(B) Manufacturer's Second Specified PM: _____

(# labor hours for this PM)	x	(hourly labor rate)	=	(labor cost per PM)	+	(materials cost)	=	(cost per PM)	x	(# of PM's of this interval for bus life)	=	(PM total cost for bus life for this interval)

(C) Manufacturer's Third Specified PM: _____

(# labor hours for this PM)	x	(hourly labor rate)	=	(labor cost per PM)	+	(materials cost)	=	(cost per PM)	x	(# of PM's of this interval for bus life)	=	(PM total cost for bus life for this interval)

(D) Etc. for Each Other Manufacturer Specified PM:

(2) To determine the PM cost for the life of the bus, each of the "PM total costs for bus life for this interval" must be added together, as shown below:

_____	+	_____	+	_____	+
Cost of Manufacturer's First Specified PM		Cost of Manufacturer's Second Specified PM		Cost of Manufacturer's Third Specified PM	

_____	. . . . . =	[ ]
Cost of Each Other PM Specified by Manufacturer		Preventive Maintenance LCC

Calculation of Bus LCC:

(1) Unadjusted LCC computation:

	+		+		+
Acquisition cost (from item b)		Fuel cost (from item c)		Transmission cost (from item d)	

	+		+		=	
(Brake cost from item e)		(Air conditioning and ventilation cost from item f)		(Preventative maintenance cost from item g)		Unadjusted bus LCC

(2) Adjusted LCC calculation:

	x		=	
Unadjusted bus lifetime LCC		Bus LCC lifetime factor from item (a)		Adjusted Bus Life Cycle Cost

Attachment 2

LCC Cost Factors

- BODY
  - Shell
    - Ext. & Applied Panels
    - Finish
    - Skirt Aprons
    - Floors
    - Steps & Stepwells
    - Wheel Housing
    - Passenger Doors
    - Service Compart. Serv. Doors
  - Operating Components
    - Door Actuators
    - Windshield Wiper/Washer
    - Light Control & Instruments
    - Fare Box
    - Loading System
    - Signals
  - Interior
    - Mirror
    - Passenger Seats
    - Driver Seats
    - Floor Covering
    - Panels & Bulkheads
    - Access Doors
    - Stanchions & Handrails
  - Windows
    - Driver's Windows
    - Side Windows
- CHASSIS
  - Propulsion System
    - Engine
    - Cooling System
    - Transmission
    - Engine Accessories
    - Hydraulic Drive
  - Final Drive
    - Rear Axle
    - Drive Shaft
  - Suspension
    - Springs & Shocks
    - Front Axle
    - Kneeling
  - Steering
  - Brakes
    - Hubs & Drums
    - Air System
    - Friction Material
  - General Chassis
    - Wheels
    - Fuel System
    - Bumper System
    - Frame
    - Electrical System
    - Electrical Components
  - Climate Control
    - Heating
    - Air Conditioning
    - Ventilation
  - Radio & Public Address System
    - Mobile Radio System
    - Public Address System
- ROAD CALLS
- PREVENTIVE MAINTENANCE
  - Oil Change
  - Tuneup
  - Inspections
  - Lubrications
  - Cleaning & Washing
- OPERATING FACTORS
  - Fuel
  - Tires
  - Oil

merican public transit association

Attachment #9

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Frank Snowden
Forest D. Swift

ack R. Gilstrap
xecutive Vice President

April 23, 1982

Mr. Denis J. Symes
URT-22
Urban Mass Transportation Administration
400 Seventh Street, SW
Washington, DC 20590

SUBJECT: Bus Monitoring and Reporting System Progress Report
Contract DTUM60-82-C-72130

Dear Denis:

The following is a report on APTA's progress in the above referenced project since the date of contract award, December 15, 1981:

1. APTA developed a program implementation plan for the Bus Monitoring and Reporting System and received verbal approval from the UMTA Contracting Officer's Technical Representative (COTR) on February 4, 1982.

2. On February 19, 1982, APTA sent a memorandum to fifteen (15) U.S. transit systems soliciting their participation in the system.

3. As of this date, APTA has received responses from twelve of the fifteen potential transit system participants. Seven transit systems have agreed to participate and five have declined. APTA is now following up on the remaining three transit systems.

4. When responses have been received from all of the solicited transit systems, the APTA Project Supervisor will confer with the UMTA COTR to determine whether to solicit the participation of additional transit systems to compensate for the transit systems that have declined.

MR-12

5. APTA is now collecting data from transit systems beginning with the month of January 1982.

Sincerely,

Pat

Patrick D. Jones
Research Associate

PDJ/ssh

cc: T. Norman
J. Marino
F. J. Cihak

MR-12

Attachment #10

american public transit association

David F. Girard-diCarlo, *Chairman*
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E. V. Miller
Neil Peterson
Daniel T. Scannell
Frank Snowden
Forest D. Swift

Jack R. Gilstrap
Executive Vice President

April 19, 1982

TO:
J. Bass Dyer - Pacific Bus Rebuilders, Inc.
Don Edmondson - Grand Rapids Area Transit Authority
John Jontig - Santa Clara County Transportation Agency
Richard G. Long - Capital District Transportation Authority
Thomas Okasinski - Southeastern Michigan Transportation Authority
James E. Reading - Central Ohio Transit Authority
Leon J. Rung - New Orleans Public Service, Inc.
P. K. Varma - Blitz Bus & Truck

SUBJECT: Development of a Bus Rehabilitation Guidelines Manual
Contract DOT-UT-80006

Gentlemen:

APTA, under contract to the Urban Mass Transportation Administration, has been assigned a task to support the development of a Bus Rehabilitation Guidelines Manual. The purpose of the manual is to provide to transit system general managers the full range of methods to:

1) decide the cost/benefits of rehabilitation;

2) select the extent of work to be done;

3) develop specifications;

4) select "in house" or contractor rehabilitation;

5) establish quality control of the work;

6) select contract instruments, options and warranties; and

7) manage the entire process of a rehabilitation program.

1225 Connecticut Avenue, N.W., Washington, D.C. 20036 Phone (202) 828-2800

UMTA has contracted with Battelle Columbus Laboratories (BCL) for the development of the manual. APTA is to provide, under the Bus Technology Liaison Board (BTLB), a working group to guide, support and critique the work of BCL.

The purpose of this letter is to confirm your participation as a member of the Bus Rehabilitation Working Group. Two or three meetings of the Working Group over the next nine to ten months are expected. Travel and per diem expenses of Working Group members are reimbursed under the APTA contract according to established APTA policy. Enclosed is a copy of the APTA policy and an expense report form.

The first meeting of the Working Group will be on May 6 and 7, 1982. The meeting will start at 10 a.m. on May 6th at the APTA offices and will adjourn by 3 p.m. on May 7th. The preliminary agenda and the Statement of Work of BCL are enclosed.

Your participation in this timely and important project is solicited. Please return the enclosed form indicating your intention to participate on the Working Group and plans to attend the May 6 and 7, 1982 meeting. Please secure any internal approvals you need to participate.

Please contact me at (202) 828-2888 or Mr. Patrick D. Jones at (202) 828-2880 for any further information you may require.

Sincerely,

Frank J. Cihak

Frank J. Cihak
Director
Technical & Research Services
Department

FJC/ssh

Enclosures (5)

cc: J. R. Gilstrap
R. M. Coultas
R. C. Buchanan
J. B. Schnell
P. D. Jones
J. Marino
T. Norman
D. Symes
J. Graebner

Work Plan For Task 2 - Bus Rehabilitation Guidelines

Purpose

The purpose of this task is to develop a manual of guidelines to assist transit systems in evaluating, selecting and managing bus rehabilitation programs. The handbook should consider life-cycle costs, benefits, management philosophies, and recent industry experience.

Approach

Activity 1. Establish Transit Liaison Board

APTA, with the assistance of UMTA and BCL, will establish a Bus Rehabilitation Subcommittee (BRS) of the BTLB. The BRS will serve as a medium for incorporating industry concerns and recommendations into the task effort. The BRS will consist of six to eight members from transit systems and rehabilitation contractors.

Activity 2. Review Prior Work on Bus Rehabilitation

BCL and ATE will gather and review literature on bus rehabilitation, rehabilitation of other vehicles which may be relevant, and life-cycle cost/benefit (LCC/B) analysis methodology. Anticipated outputs of the literature review are limited rehabilitation data, transit systems and contractors who have performed bus rehabilitation, and useful analysis concepts.

Activity 3. Develop Analysis Framework

BCL, with assistance from ATE, will develop the framework for LCC/B analysis of bus rehabilitation. The framework will define the cost and benefit factors to be investigated (i.e., a data list) and the procedures to be used in analyzing the factors (i.e., the model). In addition, the data requirements will be defined. All costs and benefits will be defined from the viewpoint of a transit system manager.

The number of alternatives associated with bus rehabilitation can be quite large. The basic options are for a transit system to acquire replacement

buses or to rehabilitate existing buses. Acquired buses could be new or could require rehabilitation. Rehabilitation can involve different amounts of structural, mechanical, electrical, or cosmetic work. This work could be contracted out, performed in-house, or some mix thereof. The LCC/B analysis framework should be broad enough to consider all of these options.

The framework must consider the economic and technical factors which are associated with bus rehabilitation. In addition, it should accommodate possible resource limitations, such as limitations of Federal or local funds, and opportunity costs.

The LCC/B analysis framework may be structured with two (or more) levels of detail. The levels would have different orientations. The first, or top, level would address the question of how many, if any, buses should be rehabilitated. It would require inputs of current fleet status, future fleet needs, UMTA funding policy, discount factor, and bus costs. Bus costs would be for acquisition, operations, and maintenance of new and rehabilitated buses, but they would be estimated at a gross level. The first level of the framework should identify the factors which are the "drivers" (i.e., the factors which have the largest impacts on bus rehabilitation decisions).

The second level of detail would be oriented towards determining which buses should be rehabilitated and to what extent. Bus costs should then be expressed in more detail to provide an understanding of the impacts of possible decisions.

Activity 4. Conduct Initial Workshop

BCL and ATE will meet the BRS to obtain industry inputs. Specific topics to be addressed include the following:

- Definition of bus rehabilitation
- Guideline outline and chapters
- Candidate properties for the survey
- Rehabilitation contractors
- Life-cycle cost/benefit analysis issues
- Information to be collected during surveys
- Contracting practices

In preparation for the workshop, BCL and ATE will develop initial products for each topic area. An outline of potential guideline chapters will be presented. Candidate criteria for selecting transit systems to survey will be developed. In addition to experience with bus rehabilitation, the following factors will be included:

- Age and/or condition of buses prior to rehabilitation
- Climate (and terrain) variations
- Contractor versus in-house rehabilitation
- Data availability
- Size of property.

Since the guidelines are to have broad applicability, the criteria should be developed to reflect the variety of situations which could be faced by transit systems. A list of transit systems to be considered for the survey will be formulated. The LCC/B analysis framework from Activity 3 will be presented.

During the workshop, the initial products will be used to motivate and guide discussion of each topic area. The BRS members will be encouraged to respond to each topic and to identify any additional topics which they consider pertinent to bus rehabilitation.

The expected outputs of the meeting are a transit industry consensus of a definition of rehabilitation, handbook chapters, and a LCC/B analysis framework. In addition, lists of transit systems to survey and information to collect will be generated. A meeting report which documents the results of the effort will be produced and distributed to all participants.

Activity 5. Plan Field Surveys

The results of the Activity 4 meeting will be used to plan the field surveys. Final selection of transit systems to be surveyed will be made by the BCL team. Six to eight transit systems will be selected. Property concurrence will be obtained prior to inclusion in the final list of survey sites. In addition, two or three bus rehabilitation manufacturers will be selected for visits.

BCL and ATE will develop data requirements and interview guides to be used in the field surveys. The information collected during the site visits is

expected to be a mix of recorded data, engineering judgment, and opinion. The latter two types can be useful if the meaning of the information is clear. Structured interview tools assist in maintaining clarity. The data requirements will be developed from the LCC/B analysis framework and the anticipated guideline chapters. Some data requests may be mailed to the sites for pre-visit data collection.

The final survey plan will be reviewed with UMTA.

Activity 6. Conduct Field Surveys

Trips to the selected properties and manufacturers will be scheduled. This will include selection of appropriate BCL and ATE personnel and identification of the appropriate personnel to interview at each site.

The selected sites will be visited for two or three days each by two to three personnel from the BCL team. During each site survey, the survey team will collect data and information to support the guidelines. Specific topics will include:

- Bus rehabilitation activities
- Rehabilitation decision process
- Rehabilitation costs by subsystems and major components
- Rehabilitation schedules (planned and actual, key issues)
- Operations and maintenance costs for new buses, old buses, and rehabilitated buses
- Bus usage patterns.

Activity 7. Analyze and Document Information

The information collected from the field surveys will be documented and collectively analyzed to develop material for the guidelines. Most of the available information is expected to be qualitative or quantitative approximations. Detailed and accurate quantitative data on bus rehabilitation experiences are not expected to be available. (Note: If sources of such data are identified, then a task modification to incorporate that data into the handbook should be considered). Rehabilitation experiences of transit properties will be assessed to extract key issues and "lessons learned".

The decision process and management issues will be addressed. Quantitative approximations will be used with the life-cycle cost/benefits analysis framework to identify primary costs and benefits of possible bus rehabilitation programs.

Activity 8. Conduct Survey Review Workshop

The BCL team will prepare for and conduct a meeting for the BRS to review the results of the surveys and analysis. This meeting will provide the industry members an opportunity to consider the total set of collected information, the study team's conclusions, and potential guidelines. Topics for the guidelines and the outline will be finalized. A meeting report will be produced and distributed.

Activity 9. Prepare, Review, and Issue Guidelines

BCL and ATE will produce draft guidelines for bus rehabilitation. The guidelines will be designed to aid transit systems in the evaluation and management of bus rehabilitation programs. It will be based primarily on the case studies and BRS inputs. Results of the literature review will also be used. The guidelines will be structured for ease of use and for orderly updating.

The guidelines are currently envisioned to be relatively small to facilitate its use. The language will be clear, concise, and direct. Assumptions and impacts of changes in assumptions will be clearly identified. Charts, tables, and graphs will be used to present data and parameter relationships. Supporting data and LCC/B model development may be presented in a separate appendix.

The guidelines are expected to contain information on contractors and suppliers of bus rehabilitation services, a glossary, procedures, and guidelines for deciding how many buses to rehabilitate and which buses to rehabilitate, and methods of structuring and managing a bus rehabilitation program. Additional chapters may be defined during performance of this task.

The guidelines will be reviewed with UMTA and the BRS and modified as required.

Deliverables

The following reports will be submitted:

(1) Meeting 1 Reports, 5 copies
within 4 weeks of workshop

(2) Meeting 2 Reports, 5 copies
within 4 weeks of workshop

(3) Draft Bus Rehabilitation Guidelines
5 copies, 8-1/2 months from start of task

(4) Final Bus Rehabilitation Guidelines, 1 reproducible
copy and 5 copies, 10 months from start of task.

The number of copies of the reports was predicated on the assumption that APTA would publish the reports for distribution to the industry.

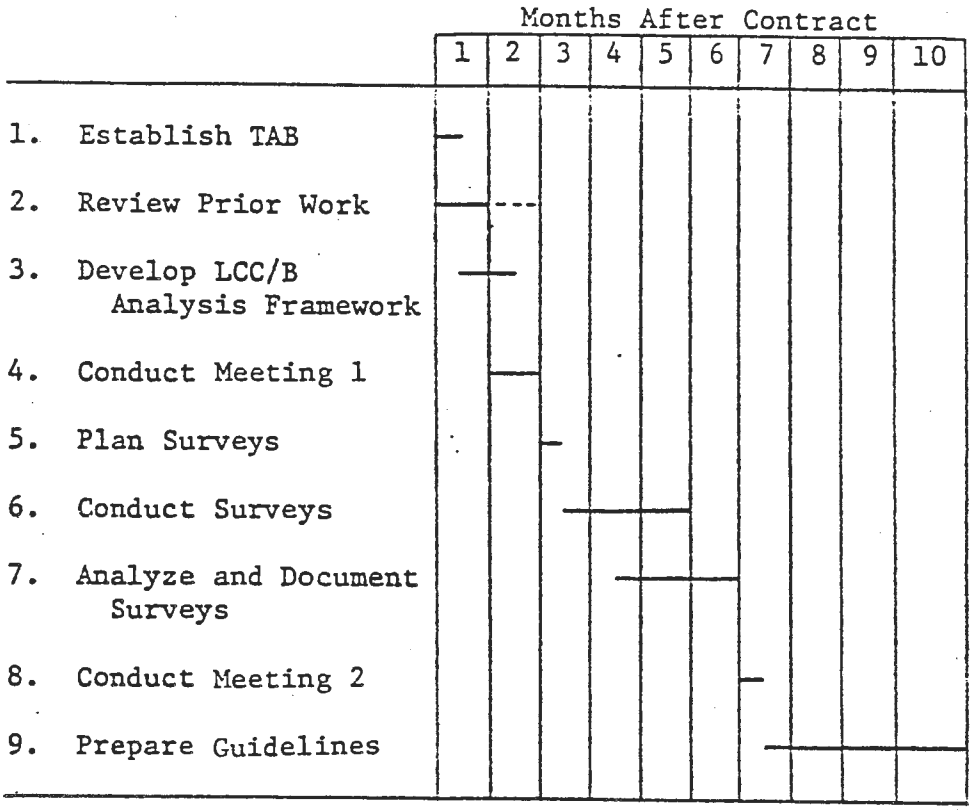


FIGURE 1. PLANNED TASK ACTIVITIES SCHEDULE

PROPOSED AGENDA

BUS REHABILITATION SUBCOMMITTEE MEETING

MAY 6-7, 1982

Thursday, May 6	10:00	Objectives and Overview
	10:30	Definition of Rehabilitation
	11:30	Lunch
	1:00	Guideline Outline and Chapters
	1:30	Rehabilitation Decision Process
	2:30	Break
	2:45	Life Cycle Cost/Benefit Analysis
	4:30	Close
Friday, May 7	8:30	Life Cycle Cost/Benefit Analysis
	9:30	Contractors and Suppliers
	10:00	Break
	10:15	Properties to Survey
	11:15	Lunch
	1:00	Management of Bus Rehabilitation
	1:30	Information to Collect in Survey
	2:30	Summary
	3:00	Adjourn

ROTARY SCREW AIR CONDITIONING COMPRESSOR

... WHAT'S HAPPENING NOW ...

Attachment #11

TSC

ROTARY SCREW AIR CONDITIONING COMPRESSOR

LABORATORY TEST

- BUILD COMPRESSOR WITH PRODUCTION TOOLING
- TEST COMPRESSOR AND CONTROL SYSTEM IN BUS CONFIGURATION AND OPERATIONAL MODES
- ANALYZE DATA
- DEVELOP INTEGRATION PACKAGE FOR "NEW LOOK" AND ADVANCED DESIGN BUSES

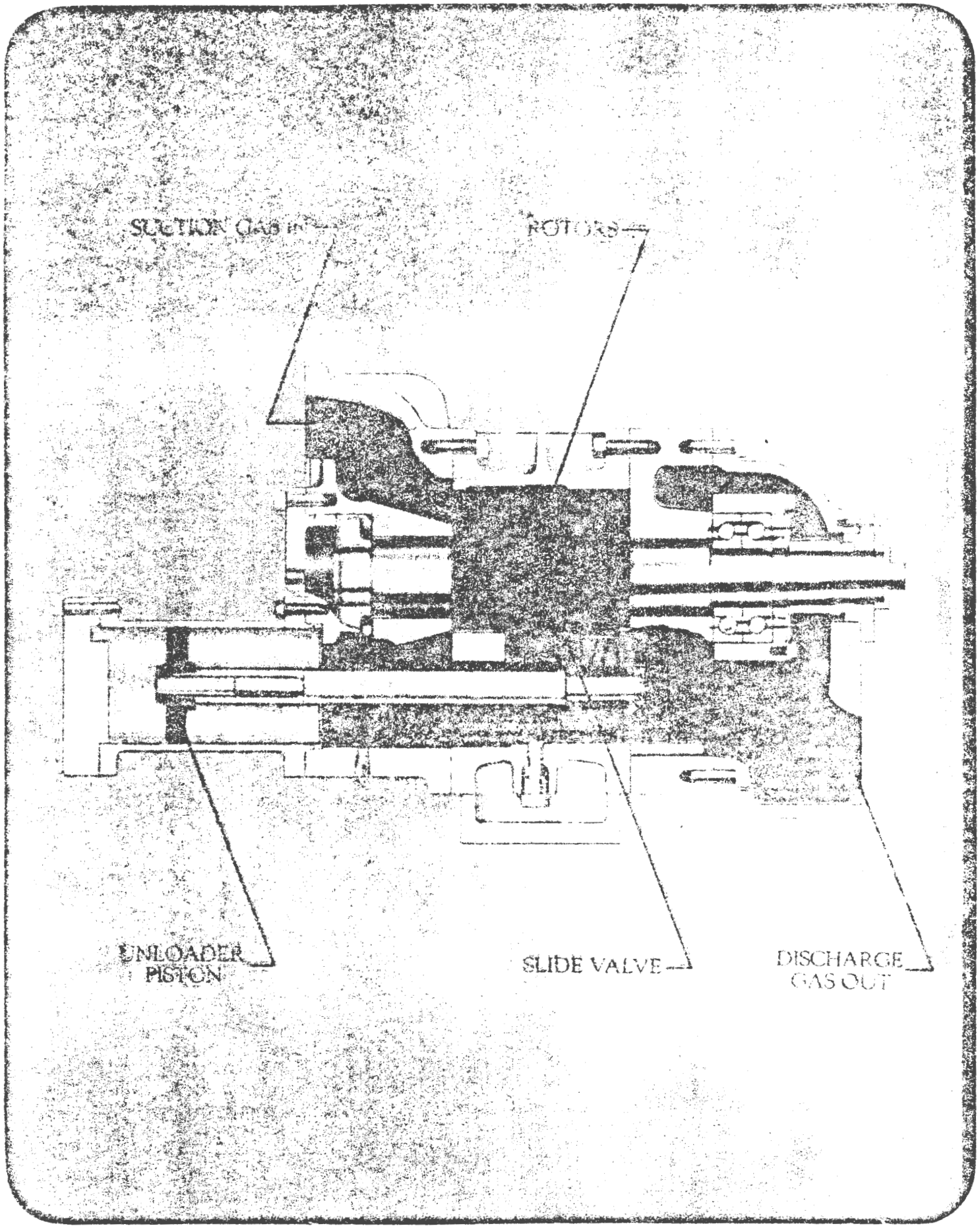
ROTARY SCREW AIR CONDITIONING COMPRESSOR

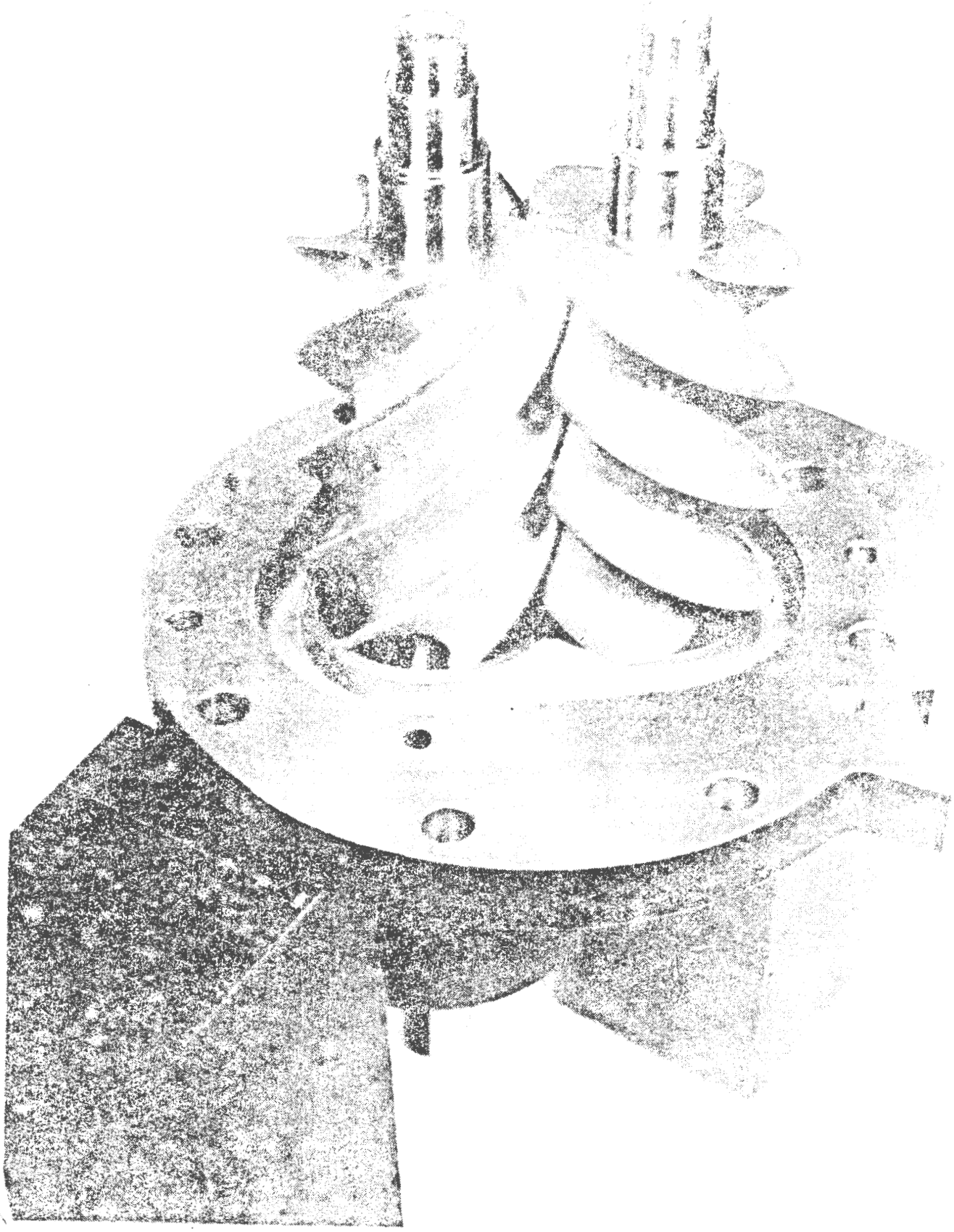
FIELD TEST

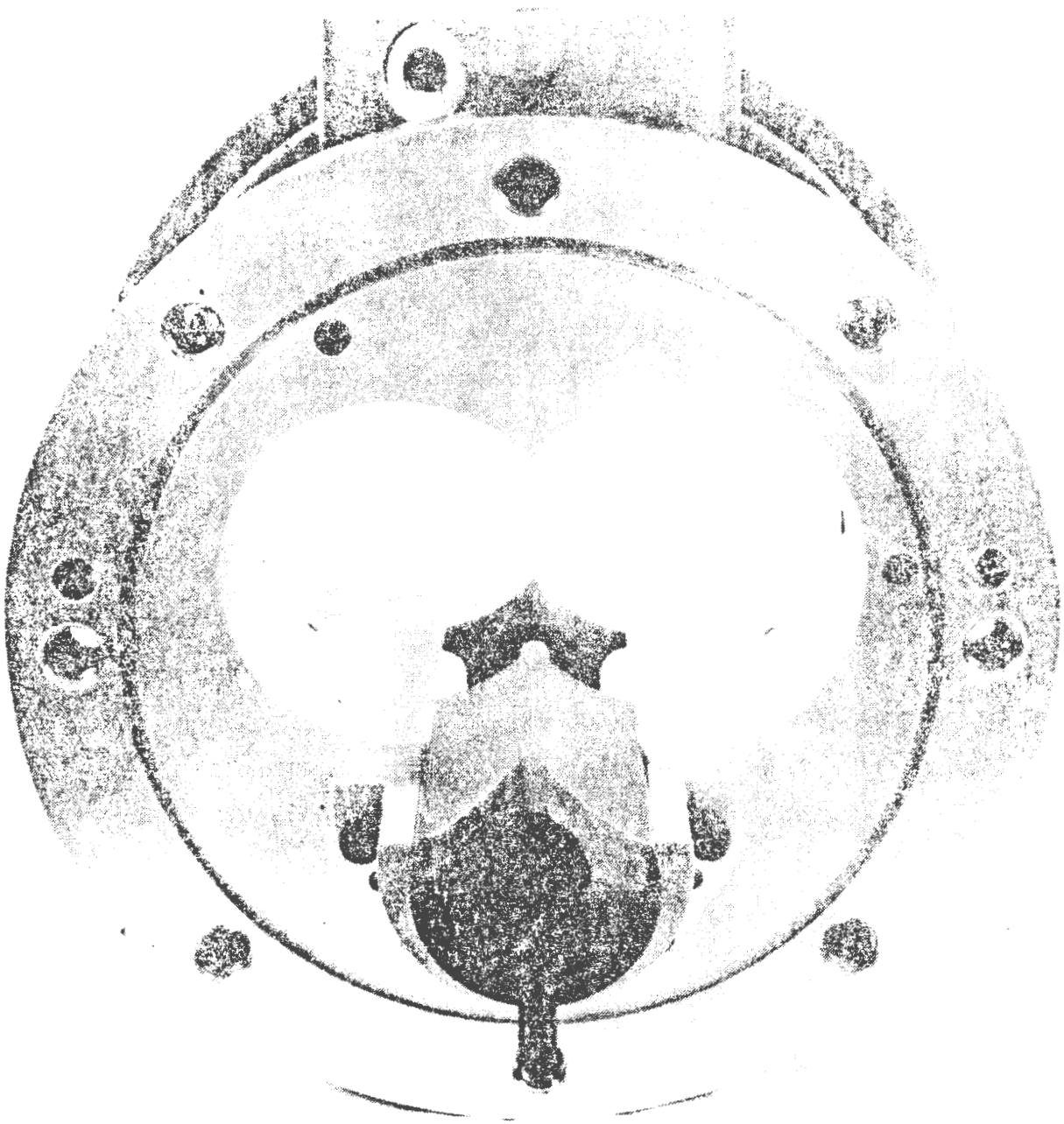
- INTEGRATE COMPRESSOR AND CONTROL SYSTEM INTO RTS-II BUS
- COLLECT DATA FROM REVENUE SERVICE
- ANALYZE DATA AND PREPARE REPORT
- FINALIZE SPECIFICATION

PROJECT PARTICIPANTS

- UMTA - OFFICE OF BUS AND PARATRANSIT SYSTEMS
- TSC - URBAN SYSTEMS DIVISION
- GARRETT CORP. - AiRESEARCH MFG. CO. OF CALIFORNIA AND DUNHAM-BUSH, INC.
- SAN ANTONIO - VIA METROPOLITAN TRANSIT


SUCTION GAS IN
ROTORS
UNLOADER PISTON
SLIDE VALVE
DISCHARGE GAS OUT





LABORATORY TESTS

TESTS	DURATION	HOURS RUN	EXPECTED COMPLETION
DURABILITY TESTS • LOAD CYCLING • ELEVATED TEMPERATURES • SHOCK LOADING	2000 HRS	1100 HRS	FIRST WEEK IN JUNE
SYSTEM TESTS • COMPRESSOR IN BUS A/C PACKAGE • URBAN RUN PROFILE	500 HRS	100^{+} HRS	FIRST WEEK IN JUNE

REVENUE SERVICE TESTS

- EQUIPMENT INSTALLATION - END OF MAY, 1982
- TESTS AT SAN ANTONIO - JUNE

AUTOMATED PASSENGER COUNTER SYSTEMS (APCS) PROJECT

GOAL: TO ENCOURAGE AND FACILITATE USE OF APCS FOR ENHANCEMENT OF TRANSIT SYSTEM EFFICIENCY, EFFECTIVENESS, AND PRODUCTIVITY

1/19/82

Attachment #12

APCS PROJECT

INITIAL OBJECTIVE:

IMPROVE SENSOR SYSTEM ACCURACY

INITIAL PLAN:

PHASE I

- o SURVEY STATE-OF-THE-ART
- o LABORATORY EVALUATION OF EXISTING SENSORS
- o DEVELOP MEANS FOR IMPROVING SENSOR SYSTEM ACCURACY
- o CONDUCT APCS WORKSHOP

PHASE II

- o SYSTEM IMPROVEMENTS/DEVELOPMENT
- o TESTING & EVALUATION
- o DEMONSTRATION
- o WORKSHOP

PHASE III

- o DEPLOYMENT

SURVEY RESULTS

APCS SYSTEMS

UNITED STATES

COLUMBUS	GM	6 DUAL BEAM (LEASED)
KALAMAZOO (MICHIGAN DOT)	GM	20 DUAL BEAM
LOS ANGELES (AVM)	DYNAMIC CONTROL	200 TREADLE MATS + 100 TREADLE MATS (PLANNED)
	DYNIMAN	65 MULTIPLE BEAM (REMOVED)
MINNEAPOLIS/ST. PAUL	PRODATA	44 DUAL BEAM
PORTLAND	P. ISAACS	50 DUAL BEAM (ON ORDER)
SACREMENTO, MONTEREY & 4 OTHERS (CALTRAN)	DYNIMAN	35 MULTIPLE BEAM
SEATTLE	DYNAMIC CONTROL	56 TREADLE MATS

CANADA

CALGARY	GROUP FIVE/ISAACS	5 DUAL BEAM (INITIAL DEMO)
LONDON	LONDON MAT (VAPOUR CANADA)	1 TREADLE MAT + 30 TREADLE MATS (PLANNED)
OTTAWA	GROUP FIVE/PRODATA/ISAACS	50 DUAL BEAM + 30 DUAL BEAM (PLANNED)
QUEBEC	GROUP FIVE/ISAACS	3 DUAL BEAM + 10 DUAL BEAM (PLANNED)
TORONTO (AVM)	IN-HOUSE DEVELOPMENT (CONTRACTOR ASSISTED)	- TREADLE MATS 100 DUAL BEAM 150 ADD'L EQUIP PLANNED
WINDSOR	GM	27 DUAL BEAM

SURVEY CONCLUSIONS:

- ACCURACY IS NOT SEEN AS PRIMARY PROBLEM
- OPERATIONAL IMPROVEMENTS ARE DESIRABLE
- SUPPLY (SUPPORT) INDUSTRY IS NOT STABLE
- DATA UTILIZATION IS AN ISSUE

APCS PROJECT

REVISED PROJECT DIRECTIONS

GENERAL OBJECTIVES:

- o DEVELOP PERSPECTIVE ON ACCURACY OF PASSENGER COUNTING METHODS
- o FACILITATE FULL AND EFFECTIVE USE OF APCS CURRENTLY INSTALLED ON BUS TRANSIT SYSTEMS
- o FOSTER STABILITY IN APCS SUPPLY INDUSTRY

APCS PROJECT
REVISED APPROACH

PHASE I - FUNDED (10/81 - 4/82)

- o S-O-A SURVEY (COMPLETED)
- o MEASURE ACCURACY OF PASSENGER COUNTER METHODS IN FIELD
- o DEVELOP WORKING GROUP OF APCS TRANSIT PROPERTIES & SUPPLIERS TO:
  - PRESENT & EXPLORE ACCURACY ISSUES
  - IDENTIFY ENGINEERING MODS FOR EXISTING APCS TO ENHANCE SYSTEM UTILITY AND/OR OPERATIONS
  - EXPLORE FEASIBILITY OF SPECIFYING UNIFORM APCS REQUIREMENTS & MODULAR LEVELS OF CAPABILITY
  - IDENTIFY R&D NEEDS FOR MAKING EFFECTIVE USE OF APCS DATA IN TRANSIT MANAGEMENT
- o REPORT RESULTS OF WORKING GROUP AT BUS SUBSYSTEM TECHNOLOGY WORKSHOP

WORKING GROUP RESULTS/CONCLUSIONS

ACCURACY

- APCS ACCURACY IS REASONABLE AND GENERALLY ACCEPTABLE TO USING TRANSIT PROPERTIES
- APCS ACCURACY IS SUBSTANTIALLY EQUIVALENT TO ACCURACY OF BEST EFFORTS IN MANUAL DATA COLLECTION
- THE PERCEPTION OF ACCURACY IS INFLUENCED BY SENSOR INSTALLATION, PROCESSING LOGIC AND/OR POLLING PROCEDURES
- REASONABLENESS CHECKS AND DATA FILTERING TAILORED TO SPECIFIC OPERATIONAL PECULIARITIES SHOULD BE APPLIED VIA SOFTWARE TO IMPROVE OVERALL DATA ACCURACY AND UTILITY

FEASIBILITY OF UNIFORM REQUIREMENTS

- UNIFORM REQUIREMENTS AT SOME LEVEL ARE NECESSARY TO ENCOURAGE A STABLE SUPPLY INDUSTRY - TO ASSURE AVAILABILITY OF APCSs AS A COMMERCIAL PRODUCT WITH NECESSARY SUPPORT (PARTS, REPAIRS, REPLACEMENTS, ADDITIONS)
- SUFFICIENT EXPERIENCE EXISTS TO ESTABLISH UNIFORM MINIMUM FUNCTIONAL REQUIREMENTS AND A MODULAR APPROACH TO APCS DESIGN
- TRANSIT PROPERTIES SHOULD AVOID 'UNIQUE' REQUIREMENTS AND SPECIFICATIONS UNLESS THEY ARE WILLING TO ASSUME THE COSTS AND RISKS OF AN R & D EFFORT.

WORKING GROUP RESULTS/CONCLUSIONS

DATA UTILIZATION

- ACCURATE LOCATION INFORMATION IS ESSENTIAL TO MAKING FULL AND EFFECTIVE USE OF APCS DATA
- THE FULL POTENTIAL OF APCS DATA FOR TRANSIT IMPROVEMENTS HAS BARELY BEEN TAPPED
- SCHEDULING STAFF RELUCTANCE IS SEEN AS A STUMBLING BLOCK
- FRONT-END PLANNING ON HOW DATA IS TO BE USED IS CRITICAL, SINCE SOFTWARE DEVELOPMENT IS A MAJOR SYSTEM COST.
- APCS SUPPLIERS GENERALLY DO NOT PROVIDE SOFTWARE

WORKING GROUP RESULTS/CONCLUSIONS

GENERAL

- APCS SHOULD BE DISTINGUISHED FROM AVM SYSTEMS
- PROCEDURES FOR QUANTIFYING COSTS AND BENEFITS OF USING APCS VERSUS MANUAL METHODS OF DATA COLLECTION NEED TO BE DEVELOPED AND DISSEMINATED
- GUIDELINES ARE NEEDED ON SAMPLING PLANS AND NUMBER OF APCS UNITS TO SATISFY DATA NEEDS
- POSITIVE APCS EXPERIENCE SHOULD BE DEMONSTRATED AND PUBLICIZED
- UMTA SHOULD CONTINUE TO FOSTER AND SUPPORT USE OF APC SYSTEMS

OPTIONS FOR AUTOMATING DATA COLLECTION AND ANALYSIS

- AUTOMATED AIDS FOR MANUAL RIDE CHECKS — E.G. E-Z DATA
- CONSULTING SERVICE (LEASE OF APCS EQUIPMENT AND DATA ANALYSIS) — E.G. URBAN TRANSP. ASSOCIATES
- BUY AVAILABLE APCS EQUIPMENT & SEPARATE SOFTWARE DEVELOPMENT SERVICES — E.G. GROUP FIVE/P. ISAACS
- UTILIZE AVAILABLE APCS EQUIPMENT AND DEVELOP SOFTWARE IN-HOUSE — E.G. SEATTLE
- DEVELOP CUSTOM APCS EQUIPMENT AND SOFTWARE IN-HOUSE AND/OR VIA DIRECTED CONTRACT — E.G. TORONTO

EVALUATION OF SCANIA 112 TRANSIT BUS AT NORWALK TRANSIT DISTRICT

PURPOSE

TO PROVIDE TECHNICAL INFORMATION TO THE TRANSIT COMMUNITY ON NEW BUS DESIGNS AND ASSOCIATED TECHNOLOGY THAT APPEAR TO OFFER POTENTIAL OPERATING AND MAINTENANCE COST SAVINGS.

SCOPE OF PROJECT

THREE CATEGORIES OF TESTING AND DATA COLLECTION ARE PLANNED FOR THE SCANIA VEHICLES:

1) VISUAL AND MATERIALS INSPECTION TESTS;
2) NONREVENUE PERFORMANCE TESTS; AND
3) OPERATING AND MAINTENANCE DATA

EVALUATION OF SCANIA 112 TRANSIT BUS AT NORWALK TRANSIT DISTRICT

FEATURES OF INTEREST

- o FUEL EFFICIENCY
- o NOISE LEVEL
- o BRAKE SERVICE LIFE
- o VEHICLE MANEUVERABILITY
- o PASSENGER ACCESSIBILITY

STATUS OF THE PROJECT

- o COMPLETED ALL VISUAL AND MATERIAL INSPECTION
- o COMPLETED VEHICLE INTERIOR/EXTERIOR NOISE MEASUREMENTS

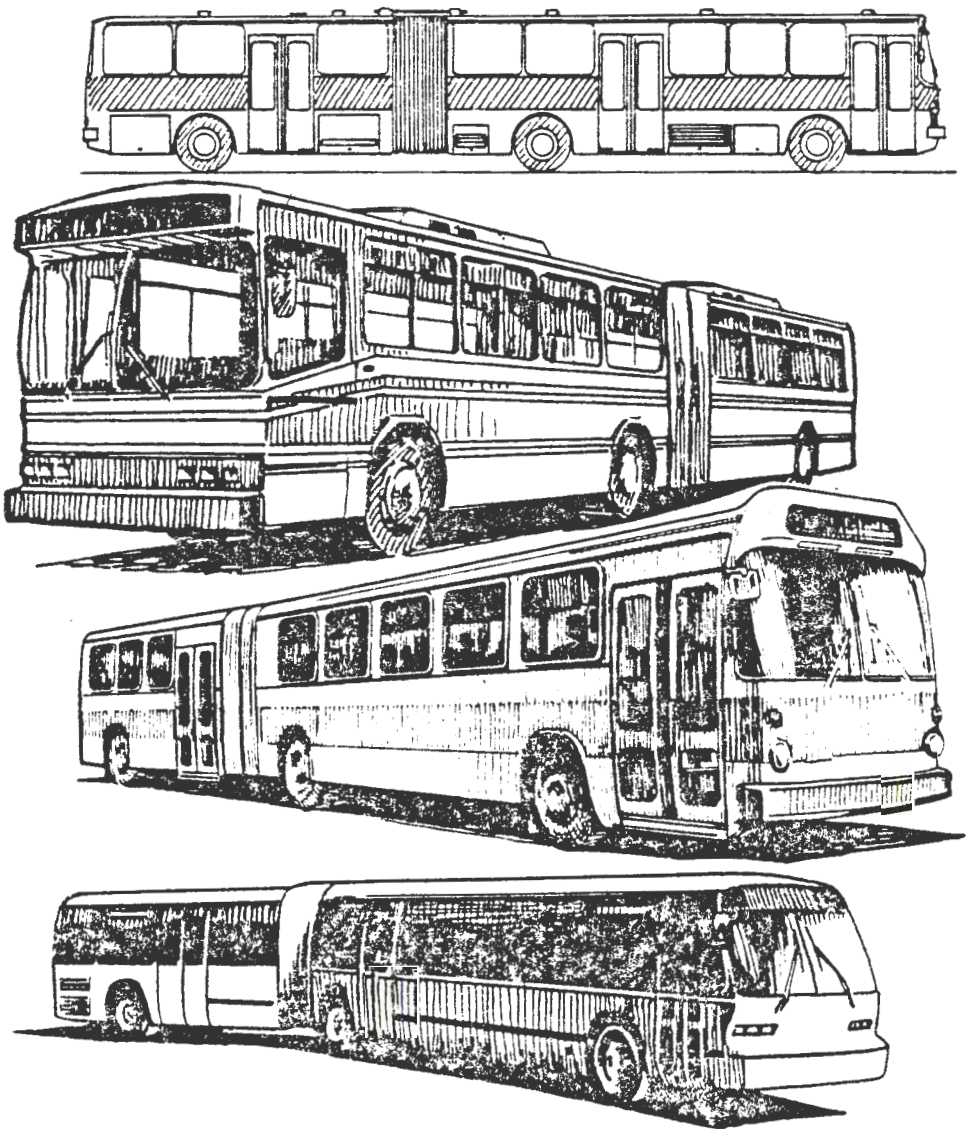
Attachment #14

U.S. Department
of Transportation

**Urban Mass
Transportation
Administration**

Technology of Articulated Transit Buses

March 1982



TECHNOLOGY OF ARTICULATED TRANSIT BUSES

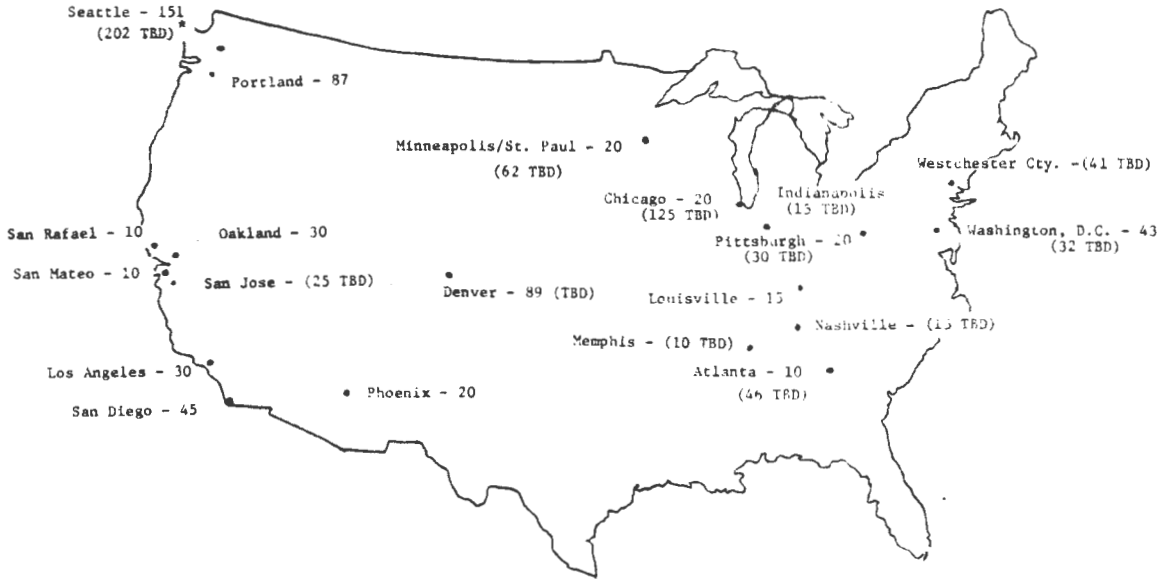
PURPOSE

TO PROVIDE TECHNICAL INFORMATION TO TRANSIT MANAGERS TO ASSIST IN THEIR DECISION-MAKING RELATED TO THE DEPLOYMENT OF ARTICULATED TRANSIT BUSES.

SCOPE OF THE STUDY

- o DESIGN AND TECHNOLOGY OF CURRENT ARTICULATED BUSES, BOTH FOREIGN AND DOMESTIC.
- o GENERAL REVIEW OF DOMESTIC OPERATING AND MAINTENANCE EXPERIENCES.

DISTRIBUTION OF DOMESTIC FLEET
OF
ARTICULATED TRANSIT BUSES



*Delivery commenced in March, 1982.

(TBD) = To Be Delivered.

Bus Technology Liaison Board Approves Use of Voluntary Maintenance Guidelines

CAMBRIDGE, MASS.—A meeting of the Bus Technology Liaison Board was held at the Transportation Systems Center in Cambridge recently. In attendance were representatives from eight transit systems, three bus manufacturers and one bus rebuilder. UMTA, TSC, APTA, Battelle Columbus Laboratories, Cummins Engine Company, Detroit Diesel Allison, and the Urban Transportation Development Corporation.

The Liaison Board acted to approve guidelines for bus maintenance which had been approved by APTA's Bus Mechanical Committee. These guidelines are scheduled to be published for voluntary use by APTA members.

A major discussion topic was life cycle costing for the procurement of transit buses. In relation to this subject, the APTA Task Force under Chairman Henry Mayer has prepared *Draft Guidelines for Grantee Evaluation of Performance, Standardization, and Life Cycle Cost Factors for the Procurement of Transit Buses.*

Other topics of interest included bus-related projects under the National Cooperative Transit Research and Development Program, whole bus and subsystem testing, APTA's monitoring and reporting system for new buses, and bus rehabilitation guidelines.

The Liaison Board also heard TSC presentations on the Dunham-Bush rotary screw air conditioning compressor; automated passenger counting systems; the Scania bus demonstration at Norwalk, Conn.; and the technology of articulated buses.

The Bus Technology Liaison Board is provided by APTA under contract to UMTA.