

PROCUREMENT AND UTILIZATION OF RADIO EQUIPMENT  
UNDER UMTA'S SECTION 16(b)(2) PROGRAM IN VIRGINIA

by

E. D. Arnold, Jr.  
Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway & Transportation Research Council  
(A Cooperative Organization Sponsored Jointly by the Virginia  
Department of Highways & Transportation and  
the University of Virginia)

In Cooperation with the U. S. Department of Transportation  
Federal Highway Administration

Charlottesville, Virginia

July 1982  
VHTRC 83-R4

## PLANNING RESEARCH ADVISORY COMMITTEE

- MR. R. C. LOCKWOOD, Chairman, Transportation Planning Engineer, VDH&T
- MR. E. D. ARNOLD, JR., Research Scientist, VH&TRC
- MR. D. W. BERG, Assistant Public Transportation Engineer, VDH&T
- MR. G. W. BROWN, Assistant City Manager, City of Martinsville,  
City Hall
- MR. G. R. CONNER, Assistant Rail Div. Admin., VDH&T
- MR. JAMES C. ECHOLS, Executive Director, Tidewater Transp. Commission
- MR. TOM FAULKNER, JR., Civil Engineering Department, V.M.I.
- MR. D. R. GEHR, Northern Virginia Division Administrator, VDH&T
- MR. J. N. HUMMEL, Chief, Planning & Engineering Division,  
Arlington Department of Public Works
- MR. D. E. KEITH, Northern Virginia Division Administrator, VDH&T
- MR. J. D. PAULUS, Planner I, Transportation Peninsula Planning  
District Comm.
- MR. J. K. SKEENS, Assistant Urban Engineer, VDH&T
- MR. F. L. TODD, Assistant Planning & Research Engineer, FHWA

ABSTRACT

The Virginia Department of Highways and Transportation has been designated the administering agency for UMTA's Section 16(b)(2) program of capital grants to private, nonprofit organizations for the provision of transportation to the elderly and handicapped. The Department's procedures for purchasing communication equipment and the utilization of that equipment by recipients were reviewed and evaluated. Additionally, a questionnaire survey of the procurement practices in other states was undertaken. Based on the results of these activities, findings and conclusions regarding the procurement of communication equipment and its utilization were developed, and recommendations regarding these matters were made.



ACKNOWLEDGEMENTS

A number of individuals were helpful during the course of this study. Thanks go to Judi Brehony and Bill Shipman of NVARC; Don Thorne of RADAR; Fred Fluckiger of SPECTRAN; Camilla Sutherland of GCNP; Francis Christie of CVCA; Madeline Dunstan of SEVAMP; Jim Toye of Yellow Cab; Susan Parry of AOA; Chris Crabtree of the state's Department of Telecommunications; the 16(b)(2) coordinators in other states who responded to the questionnaire; Jayne Crowder, Scott McClellan, and Bill LaBaugh of the Public Transportation Division; Jan Kennedy and Susan Kane for typing; and to Harry Craft and his staff.



PROCUREMENT AND UTILIZATION OF RADIO EQUIPMENT  
UNDER UMTA'S SECTION 16(b)(2) PROGRAM IN VIRGINIA

by

E. D. Arnold, Jr.  
Research Scientist

INTRODUCTION

Section 16(b)(2) of the Urban Mass Transportation Act of 1964, as amended, authorizes a program of capital grants to private, non-profit corporations and associations to assist them in providing transportation services to elderly and handicapped persons. Money for the program has been appropriated by Congress annually since FY 1975. Based on a distribution formula that considers the population of elderly and handicapped persons, the Urban Mass Transportation Administration (UMTA) of the U. S. Department of Transportation sets aside a certain amount of money for each state each year. Virginia's grant has generally been between \$0.4 and \$0.5 million per year, and can be used to provide 80% of the cost of transportation equipment. The amount of money requested by the private, non-profit organizations has increased each year, and the FY 1981 allocation will cover only about one-third of the requested funds.

The Virginia Department of Highways and Transportation (VDH&T), the designated administering agency for the state of Virginia, is responsible for soliciting applications from private, nonprofit organizations, evaluating and selecting appropriate projects, and forwarding an "umbrella" application containing the projects to the UMTA for final approval. Typical equipment requested in the projects includes station wagons; vans, with or without wheelchair accommodations; small buses, with or without wheelchair accommodations; wheelchair lifts for existing vehicles; and radio equipment. Upon approval of the umbrella application by the UMTA, the Department proceeds with procurement, utilizing competitive bidding. When the equipment is delivered, the 20% matching funds from the private, nonprofit organization is combined with the UMTA grant for final settlement with the vendor, and the organization then implements the project. Finally, the Department is responsible for monitoring the utilization of the equipment and evaluating the projects during the useful life of the equipment by obtaining operating information from the organizations.

As indicated previously, radio equipment, particularly that associated with two-way radio systems, is an allowable item for procurement under the Section 16(b)(2) program. In the eight years of the program to date, the Department has approved projects involving radio equipment which total approximately \$220,000, or approximately \$176,000 of UMTA funding. While this amount represented only about 6% of the total eight-year expenditure, it was still a significant amount that may have been more effectively utilized. For example, the estimated cost of \$68,500 for the radio equipment in the seventh year of the program could have been used to procure five or six 15-passenger vans. The question of effective utilization of the grant funds is especially important since current requests exceed the available funds.

For the first six years of the program, the procurement of radio equipment caused serious problems for the Department. In fact, the procurement procedures have been revised recently in an attempt to correct the difficulties; however, the procedures for the procurement of radios still vary considerably from those for the procurement of vehicles. The primary reason for this difference is that detailed, technical specifications must be developed for each radio system, and the Department does not employ a person who has the necessary expertise in radio engineering. Since the procurement of radio equipment does involve additional administrative costs, the question of effective utilization of grant monies is again raised.

In order to address the question of whether the purchase of radio equipment is an effective utilization of available funds, information on current radio procurement procedures and on the utilization of the radio equipment obtained by the private, non-profit agencies was needed. This study describes the investigation undertaken to obtain that information.

#### PURPOSE AND SCOPE

The primary purposes of the study were (1) to review and evaluate the new procedures followed by the Department in procuring radio equipment for private, nonprofit agencies under UMTA's Section 16(b)(2) program, and (2) to determine the utilization of the radio equipment obtained by these agencies.

The scope of the research was limited to a review of pertinent literature, a survey of the practices of other states, discussions with personnel involved in procurement, and an evaluation of the utilization of radio systems by nine agencies that had obtained equipment under the program.

## CURRENT RADIO PROCUREMENT PRACTICES

As the designated administrator of the Section 16(b)(2) program, the Department is required to ensure that equipment is procured through competitive bidding, and specific procurement procedures have been established to satisfy that requirement. Procedures for procuring communication equipment differ from those for procuring vehicles; however, in both cases the Department, rather than the private, nonprofit agency, assumes major responsibility for procurement.

Upon approval by the UMTA of the state's "umbrella" application for funding, the Public Transportation Division (PTD) of the Department, which manages the Section 16(b)(2) program, initiates contact with the state's Department of Telecommunication (DOT) regarding those individual private, nonprofit agencies that will receive radio equipment. The DOT is responsible for overseeing the procurement of any communication-related equipment or services by state agencies. The DOT has no mandated responsibility in the case of the Section 16(b)(2) equipment, as the ultimate user is not a state agency; however, DOT personnel have agreed to assist the PTD as their work load allows. To date, this limitation has not been a problem.

Based on information contained in the private, nonprofit agency's application and personal contacts, DOT personnel develop competitive specifications and a cost estimate for the radio equipment needed for each project. This information is then forwarded to the PTD for final approval. Since DOT and PTD personnel have maintained close contact during the developmental period, any problems with equipment selection or project budgets have been resolved, and final approval is essentially a formality. The 20% matching funds are requested, and a requisition form, which includes the specifications, is prepared for each private, nonprofit agency and forwarded to the Division of Purchases and Supply (DP&S) of the state's Department of General Services. Each requisition lists the VDH&T as purchaser with delivery to the private, nonprofit agency.

Upon receipt of the requisition, the DP&S proceeds with procurement along one of two paths. If the radio equipment requested matches that which is already under state contract for the current year, which had been previously competitively bid, the DP&S simply orders the equipment from the appropriate vendor for delivery to the private, nonprofit agency. If the needed equipment is not under state contract, the DP&S mails out requests for bids on the specified equipment, receives and selects the proper bid, and, upon concurrence from the PTD staff, orders the equipment for

delivery to the private, nonprofit agency. From that point the private, nonprofit agency and vendor work together for delivery and installation. When installation has been successfully completed, final invoices are provided to the PTD for processing of payment directly to the vendor.

To date, this procedure has proven to be extremely advantageous to both the Department and to the individual private, nonprofit agency. Prior to the current DOT involvement, the Department required that each private, nonprofit agency, in conjunction with a local radio vendor, develop the specifications for the needed equipment. Then PTD staff and staff from the Department's Purchasing Division, none of whom had radio engineering expertise, attempted to review the specifications for competitiveness and sufficiency. This process was time-consuming and beset with seemingly endless problems. From the Department's standpoint, the new procedures have resulted in a significant reduction in staff time while not compromising the program. In fact, by availing itself of the expertise of the independent, non-biased DOT, the Department has enhanced the program. From the private, nonprofit agency's standpoint, it no longer has to concern itself with the development of specifications and is ensured of obtaining the most economical system needed at the lowest price.

It would be remiss not to mention the obvious fact that the DOT has incurred a significant increase in staff time devoted to the Section 16(b)(2) program, albeit a more efficient expenditure of time than that previously expended by the Department in reviewing specifications. The DOT does not charge for consultative services; therefore, the 16(b)(2) program per se is not charged for their assistance. Although formal documentation of DOT staff time is unavailable, it has been estimated that approximately 70 staff hours at a cost of approximately \$840 were expended by DOT personnel in the first five months of assistance. While this is not a major expenditure, it does represent assistance to private, nonprofit agencies which already had equipment specifications developed under the earlier procurement procedures. As the DOT becomes more fully involved in the program, it is obvious that its costs will be significant. Thus this expenditure cannot be simply dismissed from consideration because it does not directly affect the Section 16(b)(2) program budget.

Finally, it should be noted that the DOT anticipates having under state contract an even greater variety of communication equipment than is currently under contract. This implies that radio procurement for the Section 16(b)(2) program will be further facilitated.

## SURVEY OF OTHER STATES

A questionnaire concerning the UMTA's Section 16(b)(2) program was mailed to the designated administering agency in all 50 states plus Puerto Rico and the District of Columbia. It is interesting to note that only 6 of the 52 states have designated agencies other than the highway agency to administer the program. Forty-four states, Puerto Rico, and the District of Columbia responded to the questionnaire, which, along with the number of responses for each question, is given in Appendix A. Following is a discussion of the results of the survey, with specific comparisons with the responses from Virginia.

### Allowable Expenditures

Forty of the 46 respondents allow the purchase of communication equipment under the Section 16(b)(2) program; however, 4 have never processed applications for that type of equipment and did not provide information on procurement procedures. Two basic reasons for not funding communication equipment were cited. First, the administrative tasks involved in procuring and monitoring the equipment are not considered justifiable. Second, since requests for funding often exceed the available funding, priority has been placed on the purchase of vehicles.

Regarding types of communication equipment, all 36 respondents allow the purchase of 2-way radio systems, and all but 1 have procured these systems. The next most common type is CB radios, with almost 1/2 of the respondents allowing that purchase and a little over 1/3 having actually bought CB's. Close to 1/3 of the respondents allow paging devices and mobile telephones; however, very little of this equipment has been purchased. Very few respondents allow the purchase of or have purchased digital systems, automatic vehicle monitoring systems, or teletypewriters.

Paging devices, 2-way radio systems, and teletypewriters are eligible for funding under Virginia's administration of the program; however, only radio system equipment has been procured. Interestingly, PTD personnel have been advised by the UMTA that CB radios are ineligible for funding, a policy which is obviously contradicted by the experiences in other states.

### Evaluation and Selection Procedures

Questions 4 through 6 were intended to solicit information on how other states evaluate and select applications for funding

communication equipment. All but one of the respondents utilize the same evaluation and selection procedures for all applications, regardless of the type of equipment. The different procedure used by 1 respondent is that consideration is given to an application for communication equipment alone only if funds remain after all other projects have been selected. Administrators in only 2 states are dissatisfied with the established procedures. The main reason for their dissatisfaction is that specific guidelines for evaluating communication equipment are needed. Although apparently not formally used in the evaluation procedure, specific factors are considered by 14 respondents in evaluating applications for communication equipment. A listing of some of these factors by respondents is as follows:

1. Applicants that have existing communication systems receive priority.
2. The communication system must tie into an area-wide network and serve to further the coordination of services.
3. The communication system must have access to public communications, is needed due to the nature of the riders, and is needed for schedule changes after the vehicle leaves the base.
4. The communication equipment must be used in conjunction with vehicles acquired under the Section 16(b)(2) program.
5. The communication equipment must be capable of fulfilling the applicant's expectations.
6. CB radios are not allowed in an urbanized area unless used solely to monitor the emergency channel.
7. The fleet size, degree of scheduled versus dynamic operations, and urban versus rural location must be considered. (The respondent did not quantify these criteria.)

In Virginia the basic evaluation and selection procedures are the same for all equipment; however, it is recognized that specific guidelines are needed to evaluate the need for communication equipment. Applicants must provide an explanation of how the communication equipment will prove useful to the operation and utilization of other project equipment.

## Procurement Procedures

Questions 7 through 21 were intended to solicit information on the states' procurement procedures and experiences. A large majority, 26, of the respondents follow the same procedures for all equipment. The differences noted were minor, most involving only a change in the agency responsible for a certain step in the procedure. This is the case in Virginia. Only 5 states, not including Virginia, expressed dissatisfaction with the procurement procedures. It was noted that competitive bidding is a very inflexible purchasing procedure for the relatively small amount of money involved and the many types of communication systems available. Also, it is difficult, if not impossible, to reject bids from questionable manufacturers. Finally, 1 state agency obtains a single brand of equipment from a state contract, and compatibility problems have arisen when trying to tie-in with existing equipment of a different brand.

All but 1 of the respondents reported the use of competitive bidding, the exception being the District of Columbia, which utilizes the schedule of eligible contractors developed by the General Services Administration. Only 3 states, not including Virginia, utilize performance specifications rather than the traditional, technical specifications, and this is discussed in depth in a later section of the report. Thirty-three respondents indicated the use of direct mailing to reach prospective bidders, 14 of these also advertise publicly, 2 use only public advertising, and 3 also employ other distribution techniques, which can generally be described as personal contact with vendors. Virginia uses direct mailings only.

Over 1/2 of the respondents reported that more than six months typically elapse between UMTA approval and delivery, with 10 reporting more than a year of elapsed time. The average time in Virginia was reported as more than a year; however, this related to the earlier procurement procedures. Under the new procedures the delivery time can be as short as 2 to 3 months, if the equipment is already under state contract. It is interesting to compare the procurement procedures used by the 14 respondents who reported an elapsed time of less than 7 months with the composite procedures developed in the next few paragraphs. The responsible party in the procurement steps basically agrees with the composite; however, generally these 14 respondents have more state level participation in drafting the specifications and less in reviewing the specifications for competitiveness.

Questions 9 through 17 were intended to set forth, in a series of steps, a generalized procurement procedure beginning with drafting the specifications and ending with obtaining the necessary licenses. Only 3 states indicated that the questions did not encompass

their procedures; however, they still answered the questions, and the differences noted were minor. It is noted that agency refers to the designated administering agency for the 16(b)(2) program, applicant refers to the private, nonprofit organization, and vendor refers to the supplier of the communication equipment. Upon reviewing the survey results, it was noted that another party was frequently cited as being a participant in procurement. Sixteen of the respondents, including Virginia, reported that other state agencies assisted in purchasing equipment. These agencies were typically general service or purchasing agencies.

Table 1 presents a summary of the survey results that shows the organization or combination of organizations responsible for the steps in the procurement procedure. Based on this tabulation, a composite representation of the states' procurement procedures was developed and is shown in Table 2. With the exception of sending out the bid requests, which is most typically performed by other state agencies, the administering agencies most typically perform all the steps in procurement. Checking the equipment after receipt and obtaining licenses are typically undertaken by the applicants.

A closer review of the procurement steps, responses to questions 9 through 14, indicated that in 8 instances the agency itself is responsible for all the steps. An additional 11 respondents reported that the designated agency plus another state agency perform the procurement. Thus, in slightly over half of the instances procurement is conducted totally at the state level with no assistance from the applicant. If the concept of total state level responsibility is also considered for each of the procurement steps, then the percentage of respondents increases significantly as shown in Table 2. There is 1 state in which the applicant has total responsibility for the total procurement procedure.

The responsible parties for the steps in procurement in Virginia are compared with the composite responsible parties in Table 2. In every case where there is a difference it is due to the participation of another state agency. Therefore, if state level responsibility is considered, then Virginia's procedure is consistent with that of the majority of the respondents.

Finally, it is noted that only 5 states, including Virginia, reported the use of previously obtained state contracts for the procurement of communication equipment. This procedure appears to be very advantageous, and it is surprising that more states do not use it.

TABLE 1

## Assignment of Responsibility for Steps in Procurement Procedure by Number of Respondents

Responsible Party	Step	Draft Specs	Review Specs - Sufficiency	Review Specs - Competitiveness	Send Bid Requests	Select Bid	Check for Compliance	Check for Performance	Obtain License
Agency	11	17	18	9	16	12	5	1	
Agency/ Other State Agency	2	3	3	0	1	0	0	0	
Agency/Applicant	1	2	2	0	2	5	6	0	
Agency/Applicant/ Other State Agency	1	2	0	0	0	0	0	0	
Agency/Vendor	0	3	3	0	0	0	0	1	
Agency/Applicant/ Vendor	1	0	0	0	0	0	0	0	
Other State Agency	7	3	8	14	10	2	1	0	
Other State Agency/ Applicant	0	0	0	0	0	0	0	1	
Applicant	6	2	1	12	6	15	21	22	
Applicant/Vendor	6	1	0	0	0	0	0	4	
Vendor	0	2	0	0	0	0	2	6	
No One	0	0	0	0	0	1	0	0	

TABLE 2  
 Composite State Procurement Procedure  
 vs.  
 Virginia Procedure

<u>Step</u>	<u>Responsible Party - Composite</u>	<u>Percent Respondents*</u>	<u>Responsible Party - Virginia</u>
Draft Specifications	Agency	31% (57%)	Agency/Other State Agency
Review Specifications for Sufficiency	Agency	49% (66%)	Agency/Other State Agency
Review Specifications for Competitiveness	Agency	51% (83%)	Agency/Other State Agency
Send Bid Requests	Other State Agency	40% (66%)	Other State Agency
Select Bids	Agency	46% (77%)	Agency/Other State Agency
Check Compliance	Applicant	43%	Applicant
Check Performance	Applicant	60%	Applicant
Obtain License	Applicant	63%	Applicant/Other State Agenc

\*Numbers in parentheses are percent of respondents, if the responsible party or parties are at the state level.

#### Monitoring Procedures

Twenty respondents do not monitor the utilization of communication equipment. Of those reporting that monitoring is undertaken, none actually collect data on utilization. Several states undertake periodic visits to see if the equipment is there and in operation. Otherwise, most of the monitoring is simply an inventory of the equipment or an annual certification by the nonprofit organization that the equipment is being utilized as intended. Monitoring in Virginia falls under this latter category.

## PERFORMANCE SPECIFICATIONS

In the majority of cases involving radio procurement, detailed, technical specifications are developed for competitive bidding. These specifications identify each piece of equipment needed in the radio system and give a technical description of its operating characteristic. Radio systems vary according to each agency's needs, location, and other factors; thus someone with radio engineering expertise is needed to develop specifications that will result in successful procurement. Otherwise, an agency may find itself with an inadequate system. Unfortunately, most agencies applying for Section 16(b)(2) funds, and, in fact, many of the designated administering agencies lack the expertise needed to design the required radio system. A typical option in this case is to allow a local radio vendor to develop the specification, and this raises questions regarding competitiveness. As noted previously, earlier procurement procedures by the VDH&T utilized this option.

Another method of circumventing the problems associated with the development of technical specifications is to utilize a performance specification. In this case, a general description of required system performance is specified, and it is left to the bidders to visit each agency, determine the needs, design and appropriate system, and submit a bid on that system. Payment is dependent upon satisfactory system performance.

As mentioned previously, 3 states use performance specifications to some degree. In the most general case Wisconsin simply lists the desired basic equipment, i.e., mobile units and base station, indicates a range, and advises each bidder to contact the identified agency to determine specific equipment needs.

California, on the other hand, has a 30-page bid form in which very detailed instructions and contract provisions regarding the procurement are provided. Bidders must contact the individual agencies and plan, design, install, and test the desired communication system; however, performance and coverage requirements are defined. The state provides a coverage map and specifies that "signal input levels from 90% of the area to be covered exceeds the level required to produce a 267dB signal-to-noise ratio at the input of both the base station and mobile receivers." Several other items such as solid-state design, equivalency in quality to a specified list of manufacturers' equipment, and installation details are also specified. The bid must include a detailed description of the system components, including the technical operating specifications, so that the state can review the proposed system to ensure compliance with the contract.

Finally, Massachusetts requires that the individual agencies undertake procurement, and, in that regard, has developed a sample bid specification to guide them. The format allows each agency to fill in blanks describing its specific situation. The bid package includes sections on general intent, rules and regulations, required clauses, appeal procedures, general and specific equipment specifications, acceptance testing procedure, and warranty. General specifications include a requirement of "95% coverage 95% of the time" over a specified service area. The section on specific specifications lists typical technical operating measures and indicates that the agency has the option of completing the section or requiring the bidder to provide the information. In either case, the state recommends the involvement of local radio professionals.

Both California and Massachusetts expressed satisfaction with their procurement procedures in the previously described questionnaire; however, Wisconsin indicated that vendors did not like the procedure as it is too nebulous. Although Wisconsin has generally experienced success with its procedure, there have been instances when it was questioned whether proper and cost-effective equipment had been purchased.

Virginia is quite fortunate in that radio engineering expertise is available to administrators of the Section 16(b)(2) program through the state's Department of Telecommunications. The lack of this expertise did, in fact, cause innumerable problems in procurement undertaken prior to the DOT's involvement. Thus the utilization of performance specifications for radio purchases in Virginia is not an issue at this point; however, personnel at the DOT were questioned as to their opinion of performance specifications. C. L. Crabtree, radio communications engineer, expressed the general opinion that performance specifications are not satisfactory. Technically trained persons should assist in implementing the radio projects, a practice that in the long run will probably save considerable money. He cited the following negative aspects of procurement through the use of performance specifications.

1. Bidders may have problems interpreting the performance specification, i.e. it may be very nebulous. For example, performance based on the miles of radial coverage can cause a problem, as the range of a radio system varies, depending on a multiplicity of factors such as terrain, interference from other stations, and man-made obstructions.

2. Agencies may acquire a system that is more sophisticated and expensive than is really needed.
3. A marginal system may be purchased based on lowest cost; however, it might not be the optimum system in terms of total capabilities and costs.
4. The bid might be obtained by a small company in which reliability, service, and parts might be a problem.

Finally, Crabtree noted that state law required the development of detailed, technical specifications for the procurement of radio equipment for state agencies.

#### UTILIZATION OF RADIO SYSTEMS

Through the first seven years of the Section 16(b)(2) program, the Department approved requests for radio equipment to 11 private, nonprofit agencies. One agency leased its equipment to another agency, which later applied for and received more radio equipment itself. Further, 1 agency has never received its equipment because the requested equipment does not have the intended capabilities. Accordingly, 9 private, nonprofit agencies in the state are currently operating radio systems for which all or part of the equipment was obtained under the Section 16(b)(2) program. These 9 agencies are as follows.

1. RADAR — Roanoke Area Dial-A-Ride, operating under United Human Services Transportation System, Inc., some of radios operated for program grantee League of Older Americans (LOA).
2. SPECTRAN — Capital Area Specialized Transportation for the Elderly and Handicapped, Inc.
3. NVARC — Northern Virginia Association for Retarded Citizens.
4. STS — Special Transportation Services, operates equipment for program grantee Southeastern Virginia Areawide Model Program, Inc. (SEVAMP)
5. Assist, Inc.
6. GCNP — Gillfield-Crater Nutrition Project, Inc.

7. CVCA — Central Virginia Commission on Aging, Inc.
8. AOA — Alexandria Office on Aging, operates equipment for program grantee Senior Citizen Employment and Services, Inc.
9. Saunders B. Moon Community Action Association, Inc.

Information from 8 of these agencies was obtained through a questionnaire and log sheet, copies of which are contained in Appendices B and C, respectively. (The S. B. Moon CAA failed to respond to numerous requests for the information.) The questionnaire was intended to solicit the latest information on each agency's programs, operation, transportation system, and radio system if applicable. The log sheet was intended to collect current data on the utilization of the radio system for at least a month. The remainder of this section discusses the findings of these two data collection activities.

#### Questionnaire Findings

Tables 3 and 4 summarize background and operating information for the agencies investigated. Most agencies provide reservation service and scheduled service under contract; however, service area characteristics, equipment operated, and operating statistics vary widely. This information is intended for comparative purposes, and thus does not provide a comprehensive review of each agency. Very little quantitative information was obtained on the operating characteristics of the radio systems other than that collected from the log sheets, which is discussed later.

#### Maintenance of Radio System

For those agencies that have had their radio system longer than the initial warranty period, maintenance is provided on an as-needed basis or under a maintenance contract with a local service company. The limited data collected suggest that maintenance on an as-needed basis may be more cost-effective, at least in the early years. A recent study by the Transportation Center at the University of Tennessee reached the same conclusion.<sup>(1)</sup> Data from RADAR indicated a maintenance expenditure of \$412 in FY 81, which reduces to approximately \$3/month/mobile unit. The NVARC reported an average maintenance cost of \$8/month/mobile unit, whereas the corresponding cost of a maintenance contract would be \$10. On the other hand, STS is paying approximately \$10/month/mobile unit under a service contract for normal repairs, and this cost does not include needed parts. The STS system, however, is several years older than the above systems. Further, maintenance had been neglected, and just recently repairs costing approximately \$3,400 were needed.

TABLE 3

## Background Information on Recipients of Radio Equipment

Agency	Jurisdictions Receiving Service	Service Schedule	Service Type	Number Vehicles In System	Number Radios In System	Date of Section 16(b)(2) Radio Delivery
RAVAR (Roanoke)	Roanoke Salem Winton Roanoke Co.	6:30 a.m.-5:00 p.m. M-F Special Trips on Demand	Scheduled via Contract Reservation (24-hr. notice)	11 vans 9 buses 2 autos	22	12/77 (LOA) 2/82
SPECTRAN (Richmond)	Richmond Charles City Co. Chesterfield Co. Goochland Co. Hanover Co. Henrico Co. New Kent Co.	6:00 a.m.-10:00 p.m. M-F 12:00 m.-10:00 p.m. Sat. 8:00 a.m.-2:00 p.m. Sun.	Scheduled via Contract Reservation (24-hr. notice)	22 vans	16	3/82
NVARC (Falls Church)	Fairfax Alexandria Falls Church Fairfax Co. Arlington Co. Loudoun Co.	6:30 a.m.-11:00 a.m. 3:00 p.m.-7:00 p.m. M-F Special Trips on Demand	Scheduled via Contract Reservation (24-hr. notice)	33 vans 1 bus	25	12/79 3/82
STS (Norfolk)	Norfolk Portsmouth Chesapeake Virginia Beach Suffolk	6:30 a.m.-6:30 p.m. M-F Special Trips on Demand	Scheduled via Contract Reservation (24-hr. notice)	47 vans	24	8/77
Assist, Inc. (Arlington)	Fairfax Co.	9:00 a.m.-5:00 p.m. M-F	Scheduled via Contract Reservation (24-hr. notice)	6 vans 1 bus	7	4/80
GCNP (Petersburg)	Petersburg Colonial Heights Emporia Sussex Co. Dinwiddie Co. Greensville Co. Prince George Co.	8:00 a.m.-4:30 p.m. M-F	Scheduled via Contract Reservation (24-hr. notice)	18 vans	5	3/82
CVCA (Lynchburg)	Lynchburg Campbell Co. Amherst Co. Appomattox Co. Bedford Co.	8:30 a.m.-4:00 p.m. M-F	Scheduled via Contract Reservation (18-hr. notice)	12 vans	5	5/79 9/81
AOA (Alexandria)	Alexandria	8:30 a.m.-3:30 p.m. M-F Special Trips on Demand	Scheduled via Contract	3 buses	2	10/81

TABLE 4

## Operating Statistics for Recipients of Radio Equipment

<u>Agency</u>	<u>Vehicle Miles Per Month</u>	<u>Passenger Trips Per Month</u>	<u>Passenger Classification</u>	<u>Costs Per Mile</u>
RADAR	16,600	11,600	35% elderly and/or handicapped 65% other	\$1.36
SPECTRAN	40,600	8,400	60% elderly 40% handicapped	\$0.95
NVARC	55,000	12,000 - 15,000	90% handicapped 6% elderly 4% other	\$0.85 - \$1.25
STS	75,300	13,900	57% elderly 43% handicapped	\$0.85
Assist, Inc.	12,600	2,000	100% elderly, of which 10% handicapped	Unknown
GCNP*	3,804	2,388	74% elderly 26% handicapped	\$0.71
CVCA	16,900	3,700	98% elderly 2% other, of which 25% handicapped	\$0.26
AOA	2,100	2,400	95% elderly 5% other	\$2.44

\*Statistics for 5 Petersburg area vans only.

Use of CB Radios

Seven of the 8 responding agencies rejected the potential use of CB radios for their operations. Since these agencies have 2-way radio systems, this response is to be expected, and is probably subject to some bias; however, the reasons cited for the negative response agree with those found in the literature.<sup>(2)</sup> The range of CB's is generally too limited for the needs of the agencies, and with the agencies being located in populous areas, there is simply too much traffic on the radio waves to allow for an efficient dispatching operation. A CB radio system may be justified in a rural area when only limited range is needed; otherwise, besides the low cost of CB radios, the only real advantage is for communication in case of an emergency.

Problems with Radio System

Generally, the radio systems are reliable, easy to operate, provide the needed range and clarity, do not require excessive maintenance, and perform as expected. Neither theft nor the interchange and matching of the different manufacturers' components has been a problem for the 8 agencies in Virginia. Only 1 agency, GCNP, had problems obtaining an FCC license, and both Assist, Inc. and the CVCA reported some interference from other stations or overloading of channels.

Benefits of Radio System

A radio system is essential for the operation of a true demand-responsive transportation system; i.e., a system that provides service immediately or within a short period. Continual schedule changes based on the demand necessitates constant communication with the vehicles. None of the 8 agencies provide demand-responsive service as described above on a routine basis; therefore, their radio systems are generally not essential to the operation of their transportation systems. The radios are still very beneficial; however, and the benefits cited by the agencies can be summarized qualitatively as follows:

1. The efficiency of the transportation system is increased. Scheduled routes derived from contract or advance reservation can be modified immediately to accommodate cancellations or other last-minute schedule changes, thus reducing deadhead mileage and gasoline consumption. Drivers can be given directions if they experience trouble locating an address.

2. The productivity of the transportation system is increased. For example, ridership may be increased because of the capability of providing demand-responsive service in special cases even if the system operates basically through advance reservations or on fixed schedules. Further, the radio system provides a valuable management tool as the vehicles can be more closely monitored to prevent or reduce unwarranted use. Knowledge of the vehicles' locations also increases the potential for the special demand-responsive service mentioned above.
3. Immediate communication is available in an emergency. This capability is especially important in light of the clientele of the agencies receiving grants under the Section 16(b)(2) program. Communication is also beneficial in the case of a vehicle breakdown or accident.
4. Clients benefit from the radio system through better service and a feeling of security. Benefits are also derived from the agency's capability to advise a client of a change in pick-up plans or a parent or guardian of a change in delivery plans.
5. Drivers benefit from the capability of exchanging information with other drivers on such items as roadway conditions, weather conditions, accidents, and traffic conditions.

If the above qualitative benefits are significant, then ideally they should be reflected in the operating statistics of the agency's transportation systems or of individual vehicles. The most readily available statistic that is indicative of efficiency and productivity is the number of passengers or passenger trips per vehicle mile of travel, which should increase upon the introduction of a radio system. Information was lacking as only 4 agencies were able to provide data, 2 providing system data and 2 providing vehicle data on a total of 16 vehicles. The results of the analysis of data before and after the introduction of the radio system were inconclusive. The range of the passengers per mile statistic over time was significantly large due to a multitude of factors influencing day-to-day operations, and thus it was not possible to isolate the effects of adding radios. Further, most of the data were from agencies just receiving their radios, and sufficient time had not elapsed to establish any trends.

#### Log Sheet Findings

Table 5 contains basic data collected from each agency from the log sheet; that is, the dates and number of days the log was maintained and the number of calls by various categories. The intent

was to keep the log during the month of February; however, due to delays in obtaining equipment, only 4 of the agencies followed the intended schedule. Two agencies kept the log for approximately a month's period spanning February and March, while the final 2 agencies maintained the log during April. Both STS and the NVARC reported only 3 weeks of data, the former because of a base station breakdown and the latter because of delays in equipment delivery.

In reviewing the log sheets it became obvious that a major category of radio calls had been omitted; that is, those calls which allow the monitoring of the operation of the vehicle. Examples would include checking in and out of service, reporting that vehicle is enroute to some destination, reporting that vehicle is waiting for passenger, and reporting location. These calls have been labeled "routine" calls for purposes of this study, and have been separated as accurately as possible for inclusion in Table 5. Nonroutine calls, therefore, include calls relating to schedule changes, route and traffic information, client information, instructions, and emergencies.

TABLE 5

Summary of Information from Log Sheets

Agency	Date of Log	No. Days Logged	Total No. Calls	No. Routine Calls	No. Vehicle Emergency Calls	No. Passenger Emergency Calls
RADAR	2/15-3/15/82	21	274	53 (19%)	8	0
SPECTRAN	3/22-4/20/82	25	1,635	722 (44%)	14	2
NVARC	4/12-4/30/82	15	1,946	1,845 (95%)	2	2
STS	2/1-2/26/82	15	242	147 (61%)	1	0
Assist, Inc.	2/1-2/26/82	19	287	0 (0%)	Unk.	Unk.
GCNP	4/1-4/30/82	22	32	0 (0%)	0	0
CVCA	2/1-2/26/82	19	616	527 (86%)	5	0
AOA	2/1-2/26/82	19	13	0 (0%)	0	0

Based on the large number of calls and the large percentage of routine calls, it is apparent that the NVARC and CVCA place a high priority on using the radio system to monitor the operation of the transportation system. As indicated earlier, the use of a radio system as a management tool is a valuable benefit. On the other hand, Assist, the GCNP, and the AOA apparently do not monitor their operations by using the radio system, as no routine calls were reported. The final 3 agencies, RADAR, STS, and SPECTRAN, do monitor the vehicles; however, a conclusion regarding the emphasis placed on the radio system as a management tool is not possible.

Emergency calls constitute a very small percentage of the radio usage; however, the capability of a quick response to an emergency is an extremely valuable asset of a radio system.

It should be noted that other information of value to the individual agency has not been compiled in Table 5. Examples include peak days and times of radio usage and origin of calls. Another item of information not requested on the log sheet but often included by the agencies was the call number of the vehicle from or to which the call was made.

#### Comparison of Radio Utilization

Because of the many differences in the agencies, e.g., size of fleet, days of log, and operating characteristics, the total number of calls is not a valid statistic on which to base a comparison of radio utilization. The average number of calls per radio-equipped vehicle per day is easily calculated and is certainly a logical first step in developing a comparison. Unfortunately, this statistic is really not indicative of operating characteristics, particularly the amount of service offered and the amount of service provided. Statistics reflecting these two operating characteristics are the number of calls per 100 vehicle miles of travel and per 100 passenger trips. It is recognized that even these statistics are not ideal. For example, if an agency provides service for a large geographical area, then the number of calls per vehicle mile of travel for that agency would naturally be lower than for an agency which provides service in a small area. Also, the number of calls per passenger trip would vary according to the type of service provided; that is, demand-responsive and reservation service would tend to require more calls per passenger than fixed-route contract service.

Mileage for the radio-equipped vans for the period the log was maintained was obtained from the agencies. The number of passenger trips per day of log per radio-equipped vehicle was not available in all cases and was estimated based typically on ridership averages provided by the agencies. It was also considered important to compare

the usage as reflected by nonroutine calls in order to discount the large number of routine calls made by several agencies using the radio system to monitor operations. The results of all these calculations are contained in Table 6. A comparison of the usage parameters, the number of calls, and other known data yielded no discernible patterns or trends which might be used to predict radio usage.

In order to review any general patterns that might exist, the agencies were ranked by radio usage parameter. This ranking is shown in Table 7. When comparison is made on the basis of total calls, the CVCA, the NVARC, SPECTRAN, and Assist consistently rank in the top four spots. When only nonroutine calls are considered, the only exception to these rankings is that the NVARC, which places a high priority on monitoring, drops out of the top four. It is replaced by RADAR in two of the three categories. As expected, those agencies which monitor their operations rate high in the rankings; otherwise, no factors identified in this study are characteristic of only the higher ranking agencies.

As in the case of the highly ranked agencies, there are basically no factors characteristic of the lower ranked agencies. It is noted that the ADA, which is consistently ranked last, does not operate its own base station. Rather, the two mobiles operate through the base station for the city of Alexandria, and the AOA is very reluctant to use that base except for real problems. This reluctance, and the fact that the AOA provides only contract service, probably explain the very low usage.

TABLE 6

Comparison of Radio Utilization by Agencies

Agency	No. Vehicles in Service	No. Vehicle Miles of Service	No. Passenger Trips (Est.)	Calls/Day/ Vehicle	Calls/100 Vehicle Miles	Calls/100 Passenger Trips	Nonroutine Calls/Day/ Vehicle	Nonroutine Calls/100 Vehicle Miles	Nonroutine Calls/100 Passenger Trips
RADAR	17	23,826	15,519	0.8	1.2	1.8	0.6	0.9	1.4
SPECTRAN	15	92,291	10,438	4.4	1.8	15.7	2.4	1.0	8.7
NVARC	22	33,431	9,205	5.9	5.8	21.1	0.3	0.3	1.1
STS	18	31,454	3,994	0.9	0.8	6.1	0.4	0.3	2.4
Assist, Inc.	6	11,407	1,840	2.5	2.5	15.6	2.5	2.5	15.6
GCNP	5	3,804	2,388	0.3	0.8	1.3	0.3	0.8	1.3
CVCA	3	3,061	436	10.8	20.1	141.3	1.6	2.9	20.4
AOA	2	1,993	2,373	0.3	0.7	0.5	0.3	0.7	0.5

TABLE 7  
Agency Ranking by Radio Usage Parameter

Day/Vehicle	Total Calls Per		Nonroutine Calls Per	
	100 Vehicle Miles	100 Passenger Trips	Day/Vehicle	100 Vehicle Miles
CVCA (10.8)	CVCA (20.1)	CVCA (141.3)	Assist (2.5)	CVCA (2.9)
NVARC (5.9)	NVARC (5.8)	NVARC (21.1)	SPECTRAN (2.4)	Assist (2.5)
SPECTRAN (4.4)	Assist (2.5)	SPECTRAN (15.7)	CVCA (1.6)	SPECTRAN (1.0)
Assist (2.5)	SPECTRAN (1.8)	Assist (15.6)	RADAR (0.6)	RADAR (0.9)
STS (0.9)	RADAR (1.2)	STS (6.1)	STS (0.4)	GCNP (0.8)
RADAR (0.8)	STS (0.8)	RADAR (1.8)	NVARC (0.3)	AOA (0.7)
GCNP (0.3)	GCNP (0.8)	GCNP (1.3)	GCNP (0.3)	NVARC (0.3)
AOA (0.3)	AOA (0.7)	AOA (0.5)	AOA (0.3)	STS (0.3)
				CVCA (20.4)
				Assist (15.6)
				SPECTRAN (8.7)
				STS (2.4)
				RADAR (1.4)
				GCNP (1.3)
				NVARC (1.1)
				AOA (0.5)

716

## FINDINGS AND CONCLUSIONS

### Current Radio Procurement Practices

1. Once an application for radio equipment is approved, personnel in the Department's Public Transportation Division (PTD) notify staff of the state's Department of Telecommunications (DOT) of the agency's selection. Based upon the application and personal contact, DOT personnel design the needed radio system and specify its components. If the components are already included in the state's previously bid upon contract for radio equipment, the Division of Purchases and Supply (DP&S) orders the components and has them delivered to the agency. If not in the state's contract, the DP&S sends out a request for bids for radio equipment having specifications developed by the DOT. Upon review and concurrence by the PTD staff, the DP&S orders the equipment from the low bidder for delivery to the agency.
2. This procedure is extremely advantageous to both the PTD and the agencies obtaining the radio equipment. Non-biased radio engineering expertise is being provided at no charge by DOT personnel. Also, very little time is expended by the PTD staff in the procurement process. Finally, the best equipment prices result from the competitive bidding, especially if the equipment is already in the state contract, which affords the additional price break of volume buying. It is doubtful that any reasonable improvements could be made to the existing procedures, and there is certainly an effective utilization of administrative funds.

### Survey of Other States

1. The questionnaire survey was very successful, as a response rate of 88% was achieved.
2. Eighty-seven percent of the respondents allow the purchase of communication equipment under the program, with 2-way radio systems and CB radios being the most common types procured.
3. CB radios are eligible for funding in almost half of the states responding, and have been purchased in over a third of the states. This finding appears to contradict the UMTA's statement to PTD personnel that CB radios are ineligible.
4. Ninety-seven percent of the respondents, including Virginia, have no special evaluation and selection procedures for communication equipment. Only 2 states reported dissatisfaction with their procedures.

5. Most states follow the same basic procurement procedures for all equipment, with reported differences being typically that other agencies become involved in the purchase of communication equipment, as is the case in Virginia. Very few states are dissatisfied with the procedures.
6. Almost all the states, including Virginia, use competitive bidding, develop technical specifications, and request bids through direct mailings.
7. At least 6 months typically elapse in over half of the states between the UMTA approval of the project and the delivery of the communication equipment. In Virginia this time can be as short as 2 or 3 months, if the equipment is already under state contract.
8. A composite state procurement procedure shows that the designated administering agency drafts and reviews the specifications for sufficiency and competitiveness; another state agency sends out the bid requests; the administering agency selects the proper bid; and the applicant, or private, nonprofit agency, checks the equipment for compliance with bid and performance and obtains the necessary licenses. Many of the administering agencies also obtain assistance from other state agencies in steps other than sending out the bid requests. Thus it can be stated that in the majority of the states, an agency at the state level performs all steps in the procurement process described above, except for checking the equipment and obtaining licenses, which are generally performed by the applicant. Virginia requests assistance from the state's DOT, and thus its basic procedures are consistent with those of the majority of the states. It is noted that the DOT will assist the applicants in obtaining licenses if so requested. Also, only 4 other states reported the utilization of a state level communication equipment contract, the use of which appears to be very advantageous to Virginia.
9. Only 44% of the states monitor the utilization of radio equipment; however, no actual data are obtained. Most of the monitoring is an inventory of the equipment or, as is the case in Virginia, an annual certification from the operating agency that the equipment is being utilized as intended.

#### Performance Specifications

1. Performance specifications are occasionally used in the procurement of radio equipment; e.g., 3 states use them. One of the advantages is that the need to have radio engineering expertise

for the design of the radio system is eliminated, because that expertise must be provided by the bidder as a part of the proposal. There seem to be however, several disadvantages. Bidders sometimes have problems interpreting the specification. Also, agencies may not obtain the optimum system in that it may be more sophisticated than is required or it may be marginal in performance capabilities. Finally, agencies may experience reliability and service problems from little or unknown companies whose bids had to be accepted because they were the lowest and met the general performance specifications.

2. Since the Department enjoys the advantages of non-biased radio engineering expertise through its association with the state's DOT, there is no need to consider the use of performance specifications at this point.

#### Utilization of Existing Radio Systems

1. Currently, 9 agencies in the state are operating radio systems for which all or part of the equipment was obtained under the Section 16(b)(2) program. All but 1 provided information on its programs, operation, and radio utilization. The agencies differ greatly in type and amount of service area, size of transportation and radio systems, and operating characteristics. With one exception, all the agencies provide a combination of advance reservation service and fixed-route contract service.
2. The agencies have experienced very few problems in the operation of their radio systems.
3. A limited amount of data plus findings from the literature suggest that maintenance on an as-needed basis is more cost-effective than maintenance under a contract with a local dealer, at least in the early years.
4. CB radios would not substitute for the 2-way systems because the limited range and the overcrowded radio waves in the populous urban areas would not allow the efficient dispatching required by all the agencies. A CB radio may be satisfactory in a rural area where only a limited range is needed or when the radio is to be used only for emergency reporting.
5. As none of the agencies operate a true demand-responsive system, the radio system is not absolutely essential. The agencies reported, however, that the radio system increased the efficiency and productivity of their transportation systems, allowed for

immediate communication in the case of a vehicle or passenger emergency, allowed the drivers to exchange information on driving conditions, and improved the passenger's security and service. An attempt was made to quantify these benefits in terms of an improvement in passenger trips per vehicle mile of travel; however, because the data were limited and several of the systems had just begun operation, the results were inconclusive.

6. Since the benefits of installing a radio system could not be quantified, it is impossible to quantitatively address the key question of whether the purchase of radio equipment is a cost-effective utilization of the grant money. That is, it is impossible to calculate the increase in passenger-carrying capability resulting from a radio system costing a certain amount of money and then compare it to the increase in passenger-carrying capability resulting from a vehicle purchase involving the same amount of money. In fact, it may not be reasonable to compare the two purchases on the basis of passenger-carrying capability. It is the opinion of this writer that the purchase of a vehicle, which provides an immediate and direct increase in passenger-carrying capacity, will always be more effective than a radio system, which provides a less immediate and less direct increase in passenger-carrying capacity through an improvement in efficiency and productivity. However, the previously mentioned qualitative benefits of a radio system must be considered. Therefore, it is felt that the procurement of radio equipment, which, strictly speaking, may not be a cost-effective use of Section 16(b)(2) funds, is certainly a valid and justifiable item.
7. Radio utilization was measured by having the agencies maintain a log sheet. Calls were separated into three categories — total, routine, and emergency. Routine calls generally concerned monitoring of the operation, and the percentage of these calls was indicative of the agency's policy on the use of monitoring as a management tool. Monitoring appears to be a valuable asset of a radio system. Non-routine calls generally concerned schedule changes; very few concerned emergencies.
8. The level of utilization, as measured by the average number of calls per 100 vehicle miles of travel and the average number of calls per 100 passenger trips, varied widely among the agencies. No discernible patterns or trends relating the calls to some specific characteristic of the agencies could be found. Although the same agencies generally utilized the radio the most as measured by the above parameters, there appeared to be no factor which characterized those agencies. As expected,

700

the radio systems of those agencies monitoring operations were generally well utilized. Likewise, there were no factors which consistently characterized those agencies which had relatively low levels of usage. The agency which consistently had the least usage as measured by the above parameters does not operate its own base station.

9. Because of the aforementioned lack of patterns and trends, it is impossible to draw conclusions regarding an expected or required level of usage. It can be noted that the following range of values was observed for the agencies studied. (Statistics for the agency not operating its own base station are not included.)

Total calls per:

day/vehicle — 0.3 to 10.8  
100 vehicle miles — 0.8 to 20.1  
100 passenger trips — 1.3 to 141.3

Non-routine calls per:

day/vehicle — 0.3 to 2.5  
100 vehicle miles — 0.3 to 2.9  
100 passenger trips — 1.1 to 20.4

#### RECOMMENDATIONS

Based on the results of this study, the following recommendations are made.

1. The Department should continue to allow the purchase of 2-way radio systems under the UMTA's Section 16(b)(2) program. While the results of this study do not allow quantifiable support of this recommendation, radio systems are beneficial and are being utilized by the agencies that have received radios through Virginia's program.
2. The Department should contact the UMTA's Region III Field Office to determine the feasibility of that office changing its policy of not allowing the procurement of CB radios. Many states throughout the country have purchased CB units, and they are of benefit under certain conditions.

3. The Department should retain its current procurement procedures for communication equipment. Utilization of the resources of the state's Department of Telecommunications is extremely advantageous.
4. In evaluating future applications for 2-way radio systems, consideration should be given to the following items. A suggested method of incorporating these items into the Department's evaluation and selection procedure is described in Appendix E.
  - a. The applicant should benefit from the capability of making dynamic schedule changes in the operation of its transportation system. This benefit is typically found in true demand-responsive service and advance reservation service. Approval based solely on other benefits, e.g. anticipated emergency utilization, should occur only in extraordinary circumstances.
  - b. The applicant must operate, or control the operation of, the total radio system.
  - c. The radio systems requested must be capable of fulfilling the applicants' expectations.
  - d. Once the above conditions are satisfied, applicants having the following should normally be given priority.
    - . Have the highest percentage of operations benefitting from the radio system.
    - . Have riders with the most tendency to require radio communication.
    - . Have the largest radio system.
    - . Have a proven existing system with a demonstrated need for the requested equipment.
    - . Have plans to utilize the radio system as a management tool through the monitoring of operations.
5. Should the UMTA's current policy of not allowing the purchase of CB units be changed, then consideration should be given to the following factors when evaluating applications for CB's. A suggested method of incorporating these factors into the Department's evaluation and selection procedure is described in Appendix E.
  - a. Only agencies located in rural, sparsely populated areas and providing service to a small area should use CB's for dispatching.

- v 732
- b. For other agencies, the only reasonable justification is for emergency uses.
  - c. The equipment requested must be capable of fulfilling the applicant's expectations.
  - d. Once the above conditions are satisfied, the guidelines described in 4d may be applied.
6. It is recommended that the evaluation process be revised to indicate "preliminary approval" of a radio project until such time that the Department of Telecommunications can review the application to ensure that the proposed system is feasible and optimum and fulfills the agency's expectations.
  7. The Department should encourage new recipients of radio systems to thoroughly investigate the pros and cons of a radio maintenance contract. There is evidence that maintenance on an as-needed basis is more cost-effective than a contract in the early years of the system.
  8. If applicable, the Department should encourage new recipients of radio systems to initiate monitoring of their transportation system as a management tool. This is a valuable benefit of a radio system that is sometimes overlooked. A copy of the monitoring form contained in Appendix D should be made available to the recipients for their consideration.
  9. The Department should initiate the practice of annually monitoring the utilization of radio equipment received by the private, nonprofit agencies. It is suggested that to accomplish this the agencies be requested to maintain the log sheet contained in Appendix D for a period of one month each year. It is noted that the log used in this study has been revised to reflect the experiences gained from this study. The monitoring should continue for the useful life of the equipment or until the Department is confident that the system is being satisfactorily utilized. The levels of utilization determined for this study should serve as guides for determining satisfactory utilization. Personnel at the state's Department of Telecommunications have indicated that, assuming proper maintenance and reasonable care, the useful life of a new, solid state, 2-way radio system is from 15 to 20 years. The life of a mobile unit falls in the low end of the range due to the relatively rough treatment it receives. The expected life of a CB unit is 7 to 10 years, again assuming proper maintenance and reasonable care.

## REFERENCES

1. Baksa, E. J., Jr., Wegmann, F. J., and Chatterjee, A., The Use of Radio Communications in Rural Transportation, prepared for the Bureau of Mass Transit, Tennessee Department of Transportation, by the Transportation Center, University of Tennessee, March 1980, p. 53.
2. Hayes, Jack, Rural Public Transportation Vehicles: A Section 147 Demonstration Program Technical Manual, Number 4, Bureau of Urban and Public Transportation, Michigan Department of Transportation, supported by the U. S. Department of Transportation, Final Report, August 1979, p. 60.



APPENDIX A

Questionnaire on UMTA's Section 16(b)(2) Program

QUESTIONNAIRE ON UMTA'S SECTION 16(b)(2) PROGRAM

(Please check the correct response or complete the question as appropriate)

- 1. Is the purchase of communication equipment an allowable expenditure under your administration of UMTA's Section 16(b)(2) program? 36 Yes 6 No 4 Allowable but no applications ever received.

IF YES, PROCEED TO QUESTION 2.  
 IF NO, COMPLETE a AND b BELOW.

a) Explain your reasons for not accepting communication equipment.

---



---



---

b) Briefly describe your procedures for procuring other equipment under the 16(b)(2) program or attach available documentation.

---



---



---



---

PROCEED TO QUESTION 23.

- 2. Which of the following are eligible items?

<u>11</u> Paging devices	<u>5</u> Digital systems
<u>10</u> Mobile telephones	<u>4</u> Automatic vehicle monitoring systems
<u>17</u> CB radios	<u>5</u> Teletypewriter
<u>36</u> Two-way radio systems	<u>4</u> Other (please specify) _____

- 3. Which of the following have been purchased?

<u>4</u> Paging devices	<u>1</u> Digital systems
<u>3</u> Mobile telephones	<u>0</u> Automatic vehicle monitoring systems
<u>13</u> CB radios	<u>2</u> Teletypewriter
<u>35</u> Two-way radio systems	<u>1</u> Other (please specify) _____

- 4. What specific guidelines, criteria, or standards are applied in the evaluation of projects and the selection of projects involving communication equipment? 22 Check here if there are none.

---



---



---



---

- 5. In your opinion, is the evaluation and selection process for communication equipment satisfactory? 34 Yes 2 No

If not, why? \_\_\_\_\_

---

- 6. How do the procedures for evaluating and selecting projects for funding communication equipment differ from the procedures involving other equipment; e.g. vehicles? 35 Check here if they do not differ.  


---



---
  
- 7. How is equipment purchased?  
35 Competitive bidding  
1 Other (please describe) \_\_\_\_\_  


---
  
- 8. What kind of specifications do you use?  
3 Performance specification (please attach a sample if possible)  
33 Traditional, technical specification  
0 Other (please describe) \_\_\_\_\_  


---
  
- 9. Who drafts the specifications?  
18 Your agency                      7 Applicant in conjunction with local vendor  
11 Applicant                         10 Other (please specify) \_\_\_\_\_  


---
  
- 10. Who reviews the specifications to ensure that they are sufficient for the anticipated utilization?  
27 Your agency                      8 Communication equipment vendor  
8 Applicant                         10 Other (please specify) \_\_\_\_\_  
0 No one  


---
  
- 11. Who reviews the specifications to ensure that they are competitive?  
26 Your agency                      3 Communication equipment vendor  
4 Applicant                         12 Other (please specify) \_\_\_\_\_  
0 No one  


---
  
- 12. Who sends out the bid requests?  
10 Your agency                      14 Other (please specify) \_\_\_\_\_  
14 Applicant  


---
  
- 13. How are bid requests distributed to vendors?  
33 Direct mailing  
19 Public advertising in newspapers, magazines, etc.  
3 Other (please describe) \_\_\_\_\_  


---
  
- 14. Who receives the submitted bids and selects the proper bid?  
15 Your agency                      22 Other (please specify) \_\_\_\_\_  
15 Applicant  


---
  
- 15. Who checks the communication equipment upon delivery to ensure compliance with the bid?  
18 Your agency                      1 No one  
21 Applicant                         2 Other (please specify) \_\_\_\_\_  


---
  
- 16. Who checks the communication equipment upon installation to ensure anticipated performance?  
12 Your agency                      0 No one  
28 Applicant                         3 Other (please specify) \_\_\_\_\_  


---
  
- 17. Who is responsible for obtaining required licenses or permits?  
3 Your agency                      10 Vendor  
28 Applicant                         2 Other (please specify) \_\_\_\_\_  


---

18. Do the steps in the procurement process described in the preceding questions generally encompass your procedure? 33 Yes 3 No

If no, briefly describe or attach documentation showing your procurement procedure.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

19. In a typical case, how much time elapses between UMTA approval of the state's application and delivery of the communication equipment?

2 1-2 months                      7 7-8 months                      10 more than 12 months  
6 3-4 months                      2 9-10 months                      2 do not know  
6 5-6 months                      1 11-12 months

20. In your opinion, is the procurement process for communication equipment satisfactory?

31 Yes 5 No

If not, why? \_\_\_\_\_

\_\_\_\_\_

21. How do the procedures for procuring communication equipment differ from the procedures involving other equipment, e.g. vehicles? 26 Check here if they do not differ.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

22. Since UMTA does not provide a required form, how do you monitor the utilization of communication equipment? (Be sure to describe any data collected and by whom if not your agency.)

20 Check here if it is not monitored.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

23. Please do not hesitate to include or attach any additional information or comments which you feel may benefit the study.

24. Would you like a copy of the final report? 42 Yes 4 No

25. Who can be contacted if further information is needed?

Name: \_\_\_\_\_ Telephone: \_\_\_\_\_

Please return the questionnaire to:

Mr. E. D. Arnold, Jr.  
Va. Highway & Transportation Research Council  
Box 3817 University Station  
Charlottesville, Virginia 22903-0817

THANK YOU FOR YOUR ASSISTANCE

APPENDIX B  
Questionnaire  
for  
Recipients of Radio Equipment  
Under UMTA's Section 16(b)(2) Program

## QUESTIONNAIRE

for

Recipients of Radio Equipment  
Under UMTA's Section 16(b)(2) Program

- I. General description of transportation system.
  - A. Define specific goals and objectives of the service.
  - B. Define the service area.
  - C. List the days and hours of service.
  - D. Describe the types of services provided.
  - E. Define the clientele served.
  - F. Define the revenues used to support the services.
  - G. Describe any coordination of services.
  - H. Describe how the radio system is utilized.

II. Inventory of equipment.

<u>Type of Vehicle*</u> <u>(bus, van, etc.)</u>	<u>Passenger</u> <u>Capacity</u>	<u>Number Vehicles</u> <u>of this Type</u>
--	-------------------------------------	---

\*Separate vehicles with and without hydraulic lifts.

Radio System Components

Number of Base Stations \_\_\_\_\_

Number of Repeaters \_\_\_\_\_

Number of on-line Mobile Units \_\_\_\_\_

Other \_\_\_\_\_

III. Operating characteristics of transportation system. (Please provide any statistics you routinely develop for your transportation system. Be sure to specify the time unit, e.g. trips per day).

A. Vehicle miles of travel:

B. Number of 1-way trips:

C. Breakdown of trips by purpose:

D. Average trip length:

E. Deadhead mileage:

F. Number of passengers:

G. Passenger classification (no. elderly, handicapped, etc.):

H. Operating cost data:

I. Other data you collect:

IV. Operating characteristics of radio system. (Please provide any statistics you routinely develop for your radio system. Be sure to specify the time unit, e.g. calls per day).

A. Number calls:

B. Breakdown of calls by purpose (emergency, dispatching, etc.):

C. Peak times of usage:

D. Average duration of calls:

E. Operating cost data:

F. Other data you collect:

V. How is your radio system maintained? Is this arrangement satisfactory? Please provide maintenance history for the radio equipment.

VI. What are the benefits to your transportation system of having a radio system? Quantify cost savings, time savings, etc., if possible.

VII. Could CB radios or other communication systems be substituted for your radio system? Yes \_\_\_\_\_ No \_\_\_\_\_ Please explain why or why not.

VIII. What problems have you experienced with the radio system?

1. Is the system performing as you expected? Yes \_\_\_\_\_  
No \_\_\_\_\_, please explain.

2. Does the system provide the needed range and clarity? Yes \_\_\_\_\_  
No \_\_\_\_\_, please explain.

## VIII. (Cont'd)

3. Is the system easy enough to operate? Yes \_\_\_\_\_  
No \_\_\_\_\_, please explain.
  
4. Is the system reliable? Yes \_\_\_\_\_  
No \_\_\_\_\_, please explain.
  
5. Do you experience interference from other stations? No \_\_\_\_\_  
Yes \_\_\_\_\_, please describe.
  
6. Have you experienced problems with theft of equipment? No \_\_\_\_\_  
Yes \_\_\_\_\_, please describe.
  
7. Have you experienced problems with matching or interchanging the  
radio components of different manufacturers? No \_\_\_\_\_  
Yes \_\_\_\_\_, please describe.
  
8. Would you have been financially able to procure the radio equipment  
without the Section 16(b)(2) grant? Yes \_\_\_\_\_ No \_\_\_\_\_

VIII. (Con'td)

- 9. Do you feel maintenance has been excessive? Yes \_\_\_\_\_ No \_\_\_\_\_
- 10. Are your existing channels overloaded? Yes \_\_\_\_\_ No \_\_\_\_\_
- 11. Did you have problems obtaining an FCC license? Yes \_\_\_\_\_ No \_\_\_\_\_
- 12. Please describe other deficiencies or problems.



APPENDIX C

Log Sheet  
UMTA's Section 16(b)(2) Radio System Utilization

LOG SHEET

UMTA's Section 16(b)(2) Radio System Utilization

Agency \_\_\_\_\_ Sheet Number \_\_\_\_\_

INSTRUCTIONS: Record or check the requested information each time the radio system is used. When times does not permit providing all of the information, record the date for each call.

Call No.	Date	Time a.m./p.m.	Origin of Call		Purpose of Call				Passenger Emergency	Miscellaneous (Briefly Describe)
			Base	Mobile	Pick-up	Dispatching		Vehicle Emergency		
						Schedule Change	Delivery			
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

APPENDIX D  
Radio Log Sheet

RADIO LOG SHEET

Agency \_\_\_\_\_ Sheet No. \_\_\_\_\_

(1) Call No.	(2) Date	(3) Time a.m./p.m.	(4) (5) Call Between:		(6) Schedule Change	(7) (8) (9) Purpose of Call			(10) Other
			Base & Mobile	Mobile & Mobile		Vehicle Emergency	Passenger Emergency	Routine Call	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									

INSTRUCTIONS: Record or check the requested information every time the radio system is used. Show total conversation as one call.

Columns 4 & 5: Record the unit/van number(s) as appropriate.

Columns 6 through 10: If you use a radio code (e.g., 10-code), record code number and attach a copy of the code; otherwise check proper column.

Column 9: Calls such as check-in, check-out, location, etc., routinely used in your operation.

APPENDIX E

Guidelines for Evaluating Requests for Radio Projects

## Guidelines for Evaluating Requests for Radio Projects

The Department currently has a formal procedure for evaluating and selecting projects for funding under UMTA's Section 16(b)(2) program. As part of that procedure, each application is reviewed and rated based on evaluation criteria and a scoring scheme. A copy of that scheme is included in this appendix.

An evaluation of a project involving radio equipment should also be reviewed in light of these criteria. Accordingly, the best approach is to incorporate the factors for evaluating radio projects recommended in this report into the existing evaluation process. This can be accomplished in criteria V, which calls for a rating on the reasonableness and justification of the requested capital improvements. It is suggested, therefore, that the guidelines for evaluating radio projects be attached as an instructional supplement to the current criteria and scoring scheme. Such a supplement is also included in this appendix.

APPLICANT'S NAME: \_\_\_\_\_

EVALUATION AND SELECTION OF PROJECTS  
UMTA'S SECTION 16(b)(2) PROGRAM

Note: If rating column contains any "0's," the project is rejected

Criteria	Evaluation	Score
Rate each agency considering the range of points for each criteria.		
I. The proposed project should exhibit a high probability of success. This should be reflected in the proposal by the degree of local support (technical and financial), the commitment of the 20% local match, a sound managerial and financial operating strategy, and assurance of adequate operating funds.		
Rating: Project has high probability of success	= 40	
Project will likely succeed	= 20	
Project has no chance of success	= 0	
II. The private, non-profit organization should have the capability to plan, implement, and manage the project. This is reflected by the current organizational structure, the length of time the organization has been in existence, the experience the corporation has in providing similar services.		
Rating: Applicant has high degree of capability	= 30	
Applicant has limited but adequate degree of capability	= 15	
Applicant has no apparent capability	= 0	
III. The proposal should reflect cooperative planning and coordination among the local organizations involved with providing services to the elderly and handicapped, with other local planning activities, and with existing transit and paratransit operators. This must include evidence of willingness by the applicant to structure its services to achieve coordination, where possible, such as a plan in place for joint use of vehicles, written agreements for cooperative use of vehicles, etc.		
Rating: Proposal reflects a high degree of cooperative planning and coordination	= 60	
Proposal reflects limited but adequate degree of cooperative planning and coordination	= 30	
Proposal reflects no cooperative planning and coordination	= 0	
IV. The proposal should document the need for the proposed project in order that a relative degree of need can be measured. Such information as the number of clients to be served, the estimated ridership, the lack of other transportation, amount of existing similar service, etc., would be pertinent.		
Rating: Area exhibits a high degree of need	= 30	
Area exhibits an average degree of need	= 15	
Area exhibits no need	= 0	
V. The proposed capital improvements are reasonable and justified based on the documented need and on the proposed utilization of the equipment. Equipment purchased under other federal transportation assistance programs is being fully utilized, and the applicant proposes to provide services to the elderly and handicapped beyond those already accommodated.		
Rating: Capital improvements are reasonable and highly justified	= 40	
Capital improvements are reasonable and adequately justified	= 20	
Capital improvements are neither reasonable nor justified	= 0	
RATER'S NAME: _____	TOTAL SCORE	

746

Guidelines for Determining Reasonableness and  
Justification of Requests for Radio Equipment  
(Criteria V)

If the proposed capital improvements involve either a 2-way radio system or CB radios, the following guidelines for determining a rating for Criteria V should be followed. (It is noted that extraordinary circumstances may negate any or all of these guidelines.)

I. Two-way radio system:

- A. The essential benefit of a 2-way radio system to an agency is that it provides the capability of making dynamic or immediate schedule changes in the operation of the transportation system. The operation of the applicant's transportation system must benefit from this capability; otherwise, the radio system, or a part thereof, is not justified, and a rating of "0" is applicable.
- B. The applicant must operate, or control the operation of, the total radio system; otherwise, it is questionable whether an efficient operation can be maintained, and a rating of "0" is applicable.

II. CB radios:

- A. If the applicant agency intends to use the CB's for dispatching, it should be located in a rural, sparsely populated area and provide transportation service to a small area; otherwise, CB's do not have the needed capabilities, and a rating of "0" is applicable.
- B. If dispatching is not proposed, then the only reasonable justification for CB's is the need for emergency contact; otherwise, a rating of "0" is applicable.

III. Two-way radio systems and CB radios:

- A. The requested radio equipment must be capable of fulfilling the applicant's expectations; otherwise, a rating of "0" is applicable. (It is noted that experts at the state's Department of Telecommunications will make the final determination of the adequacy of the proposed equipment.)

- B. If the request for radio equipment has not been eliminated by the above guidelines, i.e., a rating of "0" has not been assigned, then the following questions should be considered in determining whether a rating of "1" or "2" is applicable. Normally a positive response to at least three of the questions should justify a rating of "2".
1. Will the radio equipment be incorporated into an existing radio system?
  2. Will the radio equipment be used as a management tool to monitor the operations of the applicant's transportation system?
  3. Will at least 75% of the anticipated riders have a tendency to require communication capability, either for schedule changes in the case of certain types of programs or for emergency contact in the case of certain kinds of clients?
  4. Will at least 75% of the applicant's transportation service benefit from the radio equipment?
  5. Will the applicant operate at least three radio-equipped vehicles?

