

SECTION 16706

COMMUNICATIONS SYSTEM SUBMITTALS & SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed Products list.
- D. Product Data.
- E. Shop Drawings.
- F. Contract Record Drawings
- G. Spare Parts
- H. Equipment Manuals
- I. Training
- J. Samples.
- K. Design data.
- L. Test reports.
- M. Certificates.
- N. Manufacturer's instructions.
- O. Manufacturer's field reports.

1.02 RELATED SECTIONS

- A. Division 1
- B. Section 16707 - Communications Systems Quality Assurance & Testing.

1.03 REFERENCES

- A. AGC (Associated General Contractors of America) publication "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry."

1.04 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a

sequential alphabetic suffix.

- C. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite the Project, and deliver to Engineer. Coordinate submission of related items.
- F. For each submittal for review, allow 30 days excluding delivery time to and from the contractor.
- G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- H. Provide space for Contractor and Engineer review stamps.
- I. When revised for resubmission, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

1.05 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedule in duplicate within 20 days after date established in Notice to Proceed.
- B. Revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- D. Submit a computer generated network analysis diagram using the Program Evaluation and Review Technique (PERT) Technique method, as outlined in AGC - The Use of CPM in Construction.
- E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of Work at each submission.
- G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.06 PROPOSED PRODUCTS LIST

- A. Within 30 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

- C. The Contractor shall use the major products described in the Communications Sections when practical, to avoid increasing WMATA's maintenance requirements.
- D. If "equal" products are proposed by the Contractor, he shall insure that the proposed products will interface and operate properly with other Contractor-supplied products, subsystems and systems, and with existing communications products, subsystems, and systems.
- E. Whenever the Contractor proposes a new major product (one where salient characteristics have been described in any Communications Section) that has not been previously used on the Transit System, the Contractor shall include that new product in his training program to be conducted for WMATA operations and maintenance personnel.

1.07 PRODUCT DATA

- A. Product Data For Review:
 - 1. Submitted to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
 - 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article above and for record documents purposes.
- B. Product Data For Information:
 - 1. Submitted for the Engineer's review.
- C. Product Data For Project Close-out:
 - 1. Submitted for the Authority's benefit during and after project completion.
- D. Submit the number of copies that the Contractor requires, plus two copies that will be retained by the Engineer.
- E. Mark each copy to identify applicable products, models, options, and other data. Supplement the manufacturers' standard data to provide information specific to this Project.
- F. Indicate Product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- G. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents.

1.08 SHOP DRAWINGS

The Contractor is not required to prepare new Shop Drawings for the Kiosk Fabrication. The Contract Drawings specify the details for fabrication of the Kiosk. These Kiosk Fabrication Drawings may be submitted by the Contractor as Shop Drawings, with a notation on each drawing stating that the Contractor has elected not to change the drawing, or with the Contractor's changes clearly marked. Alternatively, the Contractor may elect to submit individual sheets of Contractor developed Shop Drawings, which replace specific Kiosk Fabrication Contract Drawing Sheets.

- A. The Contractor shall, unless otherwise directed, submit one reproducible original and four black ink on white paper copies of all communications system shop drawings to the

Engineer for approval using standard transmittal forms in accordance with detailed instructions furnished by the Engineer. Shop drawings shall be 11" x 17" except for drawings designated by the Authority to be full size.

- B. The Contractor shall develop an Engineering Drawing Index which shall be submitted to the Engineer for review and approval. The drawing index shall include descriptive titles, drawing numbers, revision numbers, and the dates of completion of drawings for communications systems and facilities covered in these Specifications and for all Contractor-furnished equipment. The Engineering Drawing Index shall be definitive as to the availability and content of subsequent drawings. It shall be compatible in format and drawing number sequence with Authority Drawing Index for previous Communications Contracts and subject to approval. The Engineer shall assign the drawing number sequence. The drawing number sequence shall be 15XXX. The Contractor shall be responsible for maintaining, revising and updating the Engineering Drawing Index for the duration of the Contract. The Engineering Drawing Index shall be revised and updated quarterly, or as required by the Engineer. A completed Final Drawing Index shall be provided to the Engineer at the conclusion of the Contract.
- C. Shop drawings shall be complete, detailed and dimensioned. All necessary shop drawings shall be provided for use in fabricating, assembling, handling, erecting, installing, connecting, trouble-shooting, testing, and maintaining each complete system/facility, all changes to existing systems, facilities and equipment, and all equipment furnished, as follows:
1. Equipment installation drawings, including sections, elevations, and floor plans showing dimensions necessary for installation, equipment base or mounting details, and location of entrance/exit for cable(s).
 2. Outline drawings indicating overall dimensions, aisle space requirements, locations of all devices mounted on equipment racks/cabinets and panels, locations of all terminal blocks or connectors for connections to external cable, and removable plates for cable entry; sufficient detail shall be provided to show accessibility for maintenance.
 3. Complete detail system/facility block and level diagrams for each system/facility and for all equipment that is provided by the Contractor; each block shall represent one specific function, and each apparatus shall be divided into as many blocks as required. Such system/facility diagrams shall also include existing equipment details.
 4. Complete cable/wire plan and riser diagrams for each system/facility and all equipment that is provided by the Contractor; including designations, destinations, color codes, and termination details for the conductors of each cable and wire.
 5. Separate and complete schematic and logic functional diagrams for circuits of equipment furnished by the Contractor; circuits which are repetitive may be shown as a single schematic and/or logic functional diagram with identical parts indicated. All variations in circuitry must be clearly shown on individual diagrams for each subsystem. Notes which indicate exceptions to typical layout schematics or logics will not be acceptable. Schematic and logic diagrams shall indicate signal flow for all inputs and outputs, bus connections, and all terminal points for external connection. These shall be clearly identified and in agreement with corresponding terminal points on the wiring diagrams. Functional blocks plus their module schematic diagrams on separate drawings will be acceptable for solid-state portions of the logic servicing a specific function. Logic diagrams and schematic diagrams shall conform to the applicable IEEE standards or to alternate approved standards.
 6. Interconnecting wiring drawing(s) for each piece of equipment, indicating all terminal points for external cable connections, including cable designations, wire

- colors or designations; the number of conductors in each cable; and the destination of each cable, by reference to the appropriate unit and Contractor's drawing number or point device and drawing number as provided in the Contract Drawings.
7. Wiring drawings with all terminals, relays, modules, and other devices shown in their relative physical locations shall be provided. Each drawing shall indicate exact point-to-point connections between interconnected devices and between devices and terminals for external connections. Wire lists and cable running lists will be accepted if they include a description and a diagram of the system/facility. The Contractor shall be responsible for the accuracy of the wiring, terminal point identifications, device identifications, and device designations which shall be in exact agreement with schematic functional diagrams accepted by the Engineer.
 8. Schematics and wiring diagrams for all printed circuit boards with all electronic components and test points shown in their relative locations.
 9. Both the schematic functional diagrams and the wiring drawings shall indicate all the points essential for troubleshooting, with their respective operating voltage levels, logic state, current, or other applicable measurable parameters.
 10. Fabrication and assembly drawings for developed equipment, including panel and chassis layouts, circuit designs, components, graphics, component layouts and list of material.
 11. Additional requirements specified in the various Communications Sections.
- D. Groups of associated drawings shall be submitted together, so that Authority reviewers can evaluate the composite design and interface considerations involved for specification compliance. Submissions not in compliance with the foregoing requirement may be returned by the Authority without action.
- E. Separate drawings shall be furnished for each passenger station, building structure, yard, and site along the right-of-way. Notes which indicate exceptions to a typical drawing for a passenger station, building structure, yard, or site along the right-of-way shall not be acceptable.
- F. During construction, (after Shop Drawing approval) the Contractor shall maintain for inspection by the Engineer a record set of Shop Drawings annotated to show all authorized changes incorporated as work progresses. Three set of annotated Shop Drawing shall be submitted not later than three working days after changes are authorized by the Engineer. Information shall include, but not be limited to, the following:
1. Field changes of any type.
 2. Changes accomplished by Change Orders (Change Orders may also specify requirements for the prior submission and approval of Shop Drawings before work commences).
- G. Before Substantial Completion Inspection (SCI), the Contractor shall furnish to the Engineer one set (2 vellum and 1 black on white paper print) of Shop Drawings for the record, all clearly revised and completed and brought up to date, showing the permanent construction as actually accomplished. Not later than 15 calendar days after Substantial Completion, updated shop drawings shall also be submitted on electronic media (optical compact disk or 3.5 inch magnetic disk) using either AutoCad Version 14 (.DWG) or other Authority approved drawing file formats. In addition to these submission requirements for SCI, additional submissions are required subsequently in accordance with the CONTRACT RECORD DRAWINGS article.
- H. Work in the Contract requires modifications, reconfigurations and connections of various existing communications systems and facilities in the passenger stations, transit yards, sites along the rights-of-way and the Jackson Graham Building. Upon request by the Contractor,

and approved by the Engineer, existing Authority Record Drawings may be obtained to incorporate the requirements of this Contract and may be submitted as Contract Shop Drawings. Process for utilizing the Authority Record Drawings shall be in accordance with the requirements of the CONTRACT RECORD DRAWINGS article of this Section.

1.09 CONTRACT RECORD DRAWINGS

- A. General:
 - 1. Before the scheduled date of the Final Acceptance of all Contract work, the Contractor shall submit approved as-built mylar original drawings, electronic media, and microfilmed aperture cards for the completed work.
 - 2. As-built drawings shall be on 22 inch by 34 inch Mylar.

- B. As-built Drawings:
 - 1. As-built CONTRACT RECORD DRAWINGS shall include Installation Drawings, Shop Drawings, Working Drawings, kiosk data file drawings and revisions to all affected existing Authority Record Drawings.
 - 2. Authority Record Drawings are as-built drawings provided to the Authority in previous communications contracts. The Contractor shall coordinate with the Authority to determine which existing Authority Record Drawings require revisions.
 - 3. The Authority will furnish the original mylars of the Authority Record Drawings which require revisions from which the Contractor shall make reproductions for his use in preparing as-built drawings. Such reproductions shall be on three-mil plastic film for black line Diazo printing, both sides matte, similar to mylar and Estar. Images shall be clear, sharp and readily legible. The original Authority Record Drawings shall be returned to the Authority not later than 10 calendar days after their receipt from the Authority.
 - 4. Revisions to Authority Record Drawings shall match the base drawings in line weights, symbols, and lettering style and size. Drafting shall be performed with AutoCad software, and shall match original Contract Drawings in line weights, symbols, and lettering style and size.
 - 5. The Contractor shall submit three sets of prints of as-built drawings in a timely manner for review and approval.
 - 6. Additions and corrections resulting from Authority review comments shall be incorporated by the Contractor. One mylar original and two copies shall be submitted to the Authority not later than the applicable date specified in the Contract Schedule. Final As-Built Drawings shall also be submitted on electronic media (5 sets of CD-ROM's) using either AutoCAD(.DWG) or other Authority approved drawing file formats.
 - 7. Completed as-built Contract Record Drawings shall bear the signature of an officer of the Contractor's organization, certifying compliance with as-built conditions using a rubber stamp, or electronic facsimile, as follows:

<p>As-Built</p> <p>Date _____</p> <p>I certify that this drawing accurately depicts the work as constructed.</p> <p><u>An Officer of the Company</u></p> <p>Signature _____ Title _____</p> <p>CONTRACTOR'S NAME</p>
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1.10 SPARE PARTS

- A. This Contract includes the requirement for Communications spare parts. The Contractor shall assure that all spare parts required by this Contract are provided and delivered in accordance with the requirements of Division 1.

1.11 EQUIPMENT MANUALS

- A. The Contractor shall furnish Operations and Maintenance (O&M) Manuals for communications systems, as specified in Division 1. The Contractor shall also furnish complete sets of O&M Manuals for each type and variation of Contractor furnished equipment - including all communications equipment and other electronic equipment and associated peripheral equipment, of the communications systems (Contractor furnished items only - unless otherwise specified). Sets of manuals shall generally describe the operation, specifications and characteristics, theory of operation, maintenance, and troubleshooting procedures for each type of equipment. Complete parts lists and detailed information concerning specific equipment options installed at WMATA shall be included in equipment manuals. The communications manuals shall be divided into three (3) categories and will meet the additional requirements, as follows:
1. Volume A Manuals shall consist of system-related manual(s) with contents as specified herein.
 2. Volume B Manuals shall consist of equipment-related manual(s) with contents as specified herein.
 3. Manufacturers Service Manuals shall consist of the most complete and most extensive manufacturers' service manual sets available for each item of equipment (applicable to test equipment, or as otherwise specified). (No Contractor furnished supplements or oil resistant covers are required for this category of manuals.)
 4. Accurate, technically correct, easily understandable, concise text, charts, tables, illustrations, photographs, and drawings; all of which are directly applicable to the subject matter and are highly appropriate for their intended purpose; shall be provided by the Contractor subject to review and approval by the Engineer.
 5. Page layouts, formats, spelling and grammar utilized, and reproduction quality, shall be of good commercial quality and shall be subject to review and approval by the Engineer.
 6. Dividers with custom printed tab labels shall be provided for each major subsection (1-1, 1-2, 1-3, etc.), and a distinctive type of divider with custom printed labels shall be provided to separate major parts of each multi-part manual.
 7. Secure screw-down, or other equivalent manual bindings shall be furnished by the Contractor, subject to approval by the Engineer. Standard 3-ring binders will not be acceptable for these manuals. Binders shall have front or back (preferably both) pockets for convenient document storage, if this feature is available as an option to the binders otherwise approved by the Engineer.
 8. Revision Log sheet shall be included in the front of each manual.
 9. The Authority will grant access to all available technical documentation pertaining to prior versions of Communication Systems to aid the Contractor in developing Communication System Manuals.
 10. The Authority will provide one copy of manufacturer's specification sheets for existing equipment installed in prior systems at the start of the Contract. Most of these Specifications will not be of reproducible quality and will require retyping before including them in the manuals. Whenever good reproductions of manufacturers' specification sheets can be made, especially those with photos or illustrations, their use in manuals is preferred.

- B. Adequacy and Completeness
 - 1. Each complete manual set shall contain a significant amount of detail and significant degree of depth of technical content, including all available details for subsystems. Completeness and accuracy to best commercial standards shall be required. Printing, reproduction, drafting, photographs, graphics, illustrations, and organization, shall be to best commercial standards. All manuals shall be written in English. Each individual manual furnished shall be subject to examination by the Authority for Specification compliance. The Engineer will exercise wide latitude in determining Specification compliance, and may reject manual(s) for noncompliance in minor degrees thereof.

- C. Volume A System Related O&M Manuals
 - 1. The Contractor shall furnish complete sets of Volume A Manuals for each of the individual systems.

- D. Volume B Equipment Related O&M Manuals
 - 1. The Volume B Manuals shall be equipment-related manual(s). Complete sets of the most extensive and complete Manufacturers' Manuals available shall be provided, with contractor-developed supplemental parts lists, data covering specific options utilized at WMATA, etc. - when applicable.
 - 2. As an exception to the requirements stated herein, abbreviated requirements shall apply to all "Test Equipment," and "Additional Equipment" (i.e. only standard Manufacturers' Service Manuals shall be required, in the quantity specified for such equipment).

- E. Submittals Required for Each Volume A and Volume B Manual
 - 1. Five copies of sample formats and Table of Contents outlines (with or prior to the Engineering Development Review).
 - 2. Three copies of complete manuals in draft form prior to Installation Completion Testing.
 - 3. See Tables for quantities of final manuals.

Table of Contents Outline with Minimum Content Requirements:
 Carrier Transmission System O&M Manual
 (Volume A - CTS Systems Manual)

<u>SECTION</u>	<u>TITLE/CONTENTS</u>	<u>QTY</u>	<u>MAKEUP</u>
1-1	INTRODUCTION (scope of manual coverage, i.e. all types of carrier transmission systems installed in WMATA passenger stations)	1	page (text)

1-2	SYSTEM DESCRIPTION (detailed description of the latest system, with brief information about major differences in prior systems installed in WMATA passenger stations)	9+ 2+ 1+	pages (text) photographs illustration (sketch)
1-3	SYSTEM SPECIFICATIONS (complete detailed specifications for the latest system, with major differences for prior versions still in use)	1	table
1-4	SYSTEM THEORY OF OPERATION (system theory of operation in detail, covering the latest version of the WMATA Carrier Transmission System)	5+	pages (text)
1-5	INSTALLED SYSTEM CONFIGURATIONS (include written and photographic details covering all types of carrier transmission systems in use)	3+ 15+	pages (text) photographs
1-6	EQUIPMENT LIST (separate lists for each configuration installed in WMATA passenger stations)	1+	page (text)
1-7	EQUIPMENT CHARACTERISTICS (including all models of equipment utilized in various types of WMATA carrier transmission systems)	100+ 60+ 92+	pages (text) photographs tables of equipment specs (derived manufacture's spec sheet info/options, etc.)(WMATA will provide.)
1-8	SYSTEM TROUBLESHOOTING CHARTS (decision tree type flow charts, and horiz. symptom/test/result charts)	1+ 4+	page (text) charts
1-9	SYSTEM/INSTALLATION DRAWINGS (one complete set of system and installation drawings for the current version system, plus block and level diagrams for each prior version)	8+	drawings

OVERRIDING MINIMUM REQUIREMENT TOTALS

Total Page Requirement includes at least 90 full text pages, plus partial text pages; plus pages with photos, charts, tables, illustrations, and title pages	200 (or more)
Total Drawing Requirement, fold-out sizes	10 (or more)
Grand Total of Pages and Drawings Required (minimum acceptable count)	210

Note: The Engineer may allow minor variations to individual section minimum page requirements, when such actions are in the best interest of the Authority, so long as overriding minimum requirements are satisfied.

Table of Contents Outline with Minimum Content Requirements:
 Fiber Optic System O&M Manual
 (Volume A - FOS Systems Manual)

<u>SECTION</u>	<u>TITLE/CONTENTS</u>	<u>QTY</u>	<u>MAKEUP</u>
1-1	INTRODUCTION (scope of manual coverage, i.e. both types of fiber-optic systems installed in WMATA passenger stations)	1	page (text)
1-2	SYSTEM DESCRIPTION (detailed description of the latest system, with brief information about major differences in prior system installed in WMATA passenger stations.)	9+ 2+ 1+	pages (text) photographs illustration (sketch)
1-3	SYSTEM SPECIFICATIONS (complete detailed specifications for the latest system, with major differences for prior versions still in use)	1	table
1-4	SYSTEM THEORY OF OPERATION (system theory of operation in detail, covering the latest version of the WMATA Fiber-Optics System)	5+	pages (text)
1-5	INSTALLED SYSTEM CONFIGURATIONS (include written and photographic details covering all types of fiber optic systems in use)	3+ 15+	pages (text) photographs
1-6	EQUIPMENT LIST (separate lists for each configuration installed in WMATA passenger stations)	1+	page (text)
1-7	EQUIPMENT CHARACTERISTICS (including all models of equipment utilized in various types of WMATA fiber optic systems)	20+ 10+ 10+	pages (text) photographs tables of equipment specs (derived manufacture's spec sheet info/options, etc.)(WMATA will provide.)
1-8	SYSTEM TROUBLESHOOTING CHARTS (decision tree type flow charts, and horiz. symptom/test/result charts)	1+ 4+	page (text) charts
1-9	SYSTEM/INSTALLATION DRAWINGS (one complete set of system and installation drawings for the current version system, plus block and level diagrams for each prior version)	8+	drawings

OVERRIDING MINIMUM REQUIREMENT TOTALS

Total Page Requirement includes at least 60 full text pages, plus partial text pages; plus pages with photos, charts, tables, illustrations, and title pages)	125
Total Drawing Requirement, fold-out sizes	10
Grand Total of Pages and Drawings Required (minimum acceptable count)	135+

Note: The Engineer may allow minor variations to individual section minimum page requirements, when such actions are in the best interest of the Authority, so long as overriding minimum requirements are satisfied.

Table of Contents Outline with Minimum Content Requirements:
Telephone System O&M Manual
(Volume A - TEL Systems Manual)

<u>SECTION</u>	<u>TITLE/CONTENTS</u>	<u>QTY</u>	<u>MAKEUP</u>
1-1	INTRODUCTION (scope of manual coverage, i.e. all types of telephone systems installed in WMATA facilities) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	1	page (text)
1-2	SYSTEM DESCRIPTION (detailed description of the latest system, with brief information about major differences in prior system installed in WMATA facilities) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	9+ 2+ 1+	pages (text) photographs illustration (sketch)
1-3	SYSTEM SPECIFICATIONS (complete detailed specifications for the latest system, with major differences for prior versions still in use) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	1+	table
1-4	SYSTEM THEORY OF OPERATION (system theory of operation in detail, covering the latest version of WMATA telephone systems) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	5+	pages (text)
1-5	INSTALLED SYSTEM CONFIGURATIONS (include written and photographic details covering all types of telephone systems in use) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	3+ 15+	pages (text) photographs
1-6	EQUIPMENT LIST (separate lists for each configuration installed in WMATA passenger stations) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)	1+	page (text)
1-7	EQUIPMENT CHARACTERISTICS (including all models of equipment utilized in various types of WMATA telephone systems)	8+ 8+ 8+	pages (text) photographs tables of equipment specs (derived manufacture's spec sheet info/options, etc.)(WMATA will provide.)
1-8	SYSTEM TROUBLESHOOTING CHARTS (decision tree type flow charts, and horiz. symptom/test/result charts)	1+ 4+	page (text) charts

1-9 **SYSTEM/INSTALLATION DRAWINGS** 8+ drawings
 (one complete set of system and installation drawings for the current version system, plus block and level diagrams for each prior version) (WMATA will provide sections for Telecommunication Network and PABX System for insertion in this section.)

OVERRIDING MINIMUM REQUIREMENT TOTALS

Total Page Requirement includes at least 90 full text pages, plus partial text pages; plus pages with photos, charts, tables, illustrations, and title pages) 260+
 Total Drawing Requirement, fold-out sizes 15+
 Grand Total of Pages and Drawings Required (minimum acceptable count) 275+
 Note: The Engineer may allow minor variations to individual section minimum page requirements when such actions are in the best interest of the Authority, so long as overriding minimum requirements are satisfied.

Table of Contents Outline with Minimum Content Requirements:
 Mobile Radio System O&M Manual
 (Volume A - MRS Systems Manual)

<u>SECTION</u>	<u>TITLE/CONTENTS</u>	<u>QTY</u>	<u>MAKEUP</u>
1-1	INTRODUCTION (scope of manual coverage, i.e. all types of mobile radio systems installed in WMATA facilities) (WMATA will provide brief section on Rail Car radios system.)	1	page (text)
1-2	SYSTEM DESCRIPTION (detailed description of the latest system, with brief information about major differences in prior system installed in WMATA facilities) (WMATA will provide brief section on Rail Car radios system)	9+ 2+ 1+	pages (text) photographs illustration (sketch)
1-3	SYSTEM SPECIFICATIONS (complete detailed specification for the latest system, with major differences for prior versions still in use) (WMATA will provide brief section on Rail Car radios system)	1+	table
1-4	SYSTEM THEORY OF OPERATION (system theory of operation in detail, covering the latest version of WMATA mobile radio systems) (WMATA will provide brief section on Rail Car radios system)	5+	pages (text)
1-5	INSTALLED SYSTEM CONFIGURATIONS (include written and photographic details covering all types of mobile radio systems in use) (WMATA will provide brief section on Rail Car radios system)	3+ 15+	pages (text) photographs
1-6	EQUIPMENT LIST (separate lists for each configuration installed in WMATA passenger stations and yards) (WMATA will provide brief section on Rail Car radios system)	1+	page (text)

1-7	EQUIPMENT CHARACTERISTICS (including all models of equipment utilized in various types of WMATA mobile radio systems)	8+ 8+ 8+	pages (text) photographs tables of equipment specs (derived manufacture's spec sheet info/options, etc.)(WMATA will provide.)
1-8	SYSTEM TROUBLESHOOTING CHARTS (decision tree type flow charts, and horiz. symptom/test/result charts) (WMATA will provide brief section on Rail Car radios system)	1+ 4+	page (text) charts
1-9	SYSTEM/INSTALLATION DRAWINGS (one complete set of system and installation drawings for the current version system, plus block and level diagrams for each prior version) (WMATA will provide brief section on Rail Car radios system)	8+	drawings

OVERRIDING MINIMUM REQUIREMENT TOTALS

Total Page Requirement includes at least 60 full text pages, plus partial text pages; plus pages with photos, charts, tables, illustrations, and title pages)	230+
Total Drawing Requirement, fold-out sizes	15+
Grand Total of Pages and Drawings Required (minimum acceptable count)	245+

Note: The Engineer may allow minor variations to individual section minimum page requirements when such actions are in the best interest of the Authority, so long as overriding minimum requirements are satisfied.

1.12 TRAINING

- A. The objective of the training program shall be to qualify WMATA training instructors, field engineers, and key supervisory personnel to train WMATA maintenance and operating personnel to properly operate, diagnose, troubleshoot and maintain the communications equipment and/or systems provided by, or affected by, work in this Contract.
- B. The Contractor shall provide training for Authority training instructors, engineers, key supervisory technical personnel, and a cadre of maintenance personnel. Training in operating and maintaining equipment shall be provided in accordance with these Specifications. Training shall consist of a combination of formal classroom instruction and hands-on equipment training. Classrooms and on-site training locations will be provided by WMATA. All test equipment and tools for training equipment installation and training course work shall be provided by the Contractor, (for both Contractor personnel and WMATA Trainee use) until training is complete.
- C. Scope of Training Program
 - 1. The training program shall be devoted to overall system functioning and instruction on key items of equipment. The training shall be a combination of formal and hands-on training, including demonstrations. Training shall be conducted at Authority training facilities.
 - 2. The Contractor shall provide the instruction and training sessions specified herein.
 - 3. As part of the Engineering Development Review, the Contractor shall submit a Training Concept Plan to the Authority for approval. It shall include the subject matter to be covered, a tabulation of the hours of instruction to be provided, and the equipment to be included in the training program. It shall include a list of proposed

Contractor training to be conducted at various Authority facilities and locations. The Authority will select training sessions from this list.

- D. Training Course Objectives
1. The Contractor shall develop an individual Training Course designed to cover basic maintenance of the Fiber Optic System using new Training Equipment Mockups supplied by the Contractor.
 2. The maintenance course shall provide each student with instruction designed to meet the following objectives:
 - a. Understanding of the basic overall operation of the Mockup as it relates to an equivalent installed Passenger Station Communications subsystem.
 - b. Understanding of the nature of each of the signal and power inputs and outputs of major Communications equipment items.
 - c. Knowledge of the location of all equipment test points and the best strategy for using the test points.
 - d. Familiarity with the Operation and Maintenance Manuals, and knowledge of how to contact the equipment manufacturers for parts, and information.
 - e. Qualification of the student to begin assuming maintenance (or operations) responsibilities for the system and equipment items.
- E. The Contractor's training program shall be conducted by fully qualified instructors. The instructors shall have thoroughly mastered the specific specialized subject matter involved and shall have the ability to impart technical information to others in easily understood terms. The Contractor shall provide a professional resume for each instructor for review and approval by the Authority. Contractor installation, repair and technical personnel shall also be provided to do installation tasks, with WMATA trainee participation (to the extent agreed to by the Engineer).
- F. Training Aids and Materials
1. The training shall be organized to make optimum use of Volume "B" O&M Manuals, Contract Specifications and Drawings, approved Progress Review material, approved Contractor Shop Drawings, and the test equipment furnished to the Authority, in accordance with other provisions of this Contract. The Contractor shall furnish all other required training aids and materials necessary for the training program.
 2. The Contractor shall provide copies of each Course Outline, copies of each Lesson Plan, copies of Instructor's Guide(s) and copies of Student Work Books. Operations and Maintenance Manuals, Volume "A" System Manuals and Volume "B" Equipment Manuals, furnished by the Contractor, shall be furnished to each student attending the Maintenance Courses, along with additional copies as required.
 3. Training materials, such as lesson plans, study guides, and student handouts, as well as training aids, such as transparencies, slides, photographs, dynamic mockups, models for hands-on demonstration training and hardware cut-aways, utilized in the courses shall become property of the Authority.
- G. WMATA requires the following training course materials to be delivered by the Contractor, according to the following specifications:
1. An instructor's guide, containing all the information and directions necessary for the instructor to make an effective presentation. It shall include adequate guidelines to conduct a comprehensive training program. Individual lessons within the course shall be organized as separate blocks (or modules) which may be taught individually. The Instructor Guide should contain, at a minimum:
 - a. Discussion of student prerequisites (if any);

- b. Program overview;
 - c. Statement of overall program goals;
 - d. Lesson plans (a session by session outline containing the following):
 - 1) Student learning objectives, stated in measurable terms;
 - 2) Overview of each lesson;
 - 3) Suggested instructional methods/ learning activities;
 - 4) Required equipment and/or resources.
2. Student work books, to include all materials for the student to interact in the learning situation. It shall contain, at a minimum:
- a. Program overview/introduction;
 - b. Statement of overall program goals
 - c. Learning objectives, stated in measurable terms, that specifically describe desired behaviors or knowledge to be gained;
 - d. A fully-developed prose treatment (not outline format) of content presentation, developed in the same modular format as the Instructor's Guide;
 - e. Illustrations, charts, or graphics, as needed to enhance text presentation;
 - f. Problems/questions related to lesson content, as appropriate.
3. Audio-visual aids, (handouts, transparencies, slides, films, and mock-ups used to conduct the Training Courses).
4. Supplemental materials, a functional mockup, or a functional representation, is required of any equipment item which requires theoretical discussion. This may be in the form of an animated schematic, a model of the equipment, an actual device, an interactive video training device, or a WMATA approved substitute. All mockups become the property of WMATA.
5. The Contractor shall deliver final copies to WMATA as follows:
- a. Two complete sets of training materials that are completely camera-ready. Camera-ready copy is defined as typewritten or typeset originals or high-quality copies from which further copies can be made with no noticeable decrease in copy quality.
 - b. Five copies of all student and instructor materials, to be used for archival purposes in the WMATA Technical Library.
- H. The Contractor shall meet the following specifications in instructional delivery.
- 1. A description of instructor qualifications, resume, curriculum vitae, or other similar credentials must be submitted to WMATA at least 60 days prior to the presentation of training. The description should document a thorough knowledge of the equipment being taught, an understanding of the adult learning process, and demonstrated experience in vocational instruction.
 - 2. The course shall include at least 4 hours of instruction for each major system, and at least 1 hour of instruction for each significant minor system/subsystem (course layout and time allotment shall be submitted for approval by the Authority at least 30 days prior to scheduled classes).
 - 3. For the purposes of course development and presentation, contractors should assume all WMATA students are high school graduates (or equivalent), and that maintenance personnel possess the ability to use basic hand tools and electronic test equipment, and that most trainees have some experience with the systems to be taught.
 - 4. Instructors shall include written and/or practical tests in the Training Courses. Whenever possible, a practical hands-on test shall be developed to demonstrate the transference of operational/ maintenance skills. Results and student evaluations will be provided to the Engineer on a confidential basis, for WMATA use.

1.13 SAMPLES

- A. Samples For Review:
 - 1. Submitted to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
 - 2. After review, produce duplicates and distribute in accordance with Submittal Procedures article above and for record documents purposes.
- B. Samples For Information:
 - 1. Submitted for the Engineer's knowledge.
- C. Samples For Selection:
 - 1. Submitted to Engineer for aesthetic, color, or finish selection.
 - 2. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Engineer selection.
 - 3. After review, produce duplicates and distribute in accordance with Submittal Procedures article above and for record documents purposes.
- D. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- E. Include identification on each sample, with full Project information.
- F. Submit the number of samples specified in individual specification sections, one of which will be retained by Engineer.
- G. Reviewed samples that may be used in the Work are indicated in individual specification sections.
- H. Samples will not be used for testing purposes unless specifically stated in the specification section.

1.14 DESIGN DATA

- A. Submitted for the Engineer's review.
- B. Submit for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents

1.15 TEST REPORTS

- A. Submitted for the Engineer's review.
- B. Submit test reports for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1.16 CERTIFICATES

- A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit

supporting reference data, affidavits, and certifications as appropriate.

- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.17 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Authority in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- C. Refer to Section 16707 - Quality Control, Manufacturers' Field Services article.

1.18 MANUFACTURER'S FIELD REPORTS

- A. Submitted for the Engineer's review.
- B. Submit report within 30 days of observation to Engineer for information.
- C. Submit for information for the purpose of assessing conformance with information given and the design concept expressed in the contract documents.

PART 2- PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION