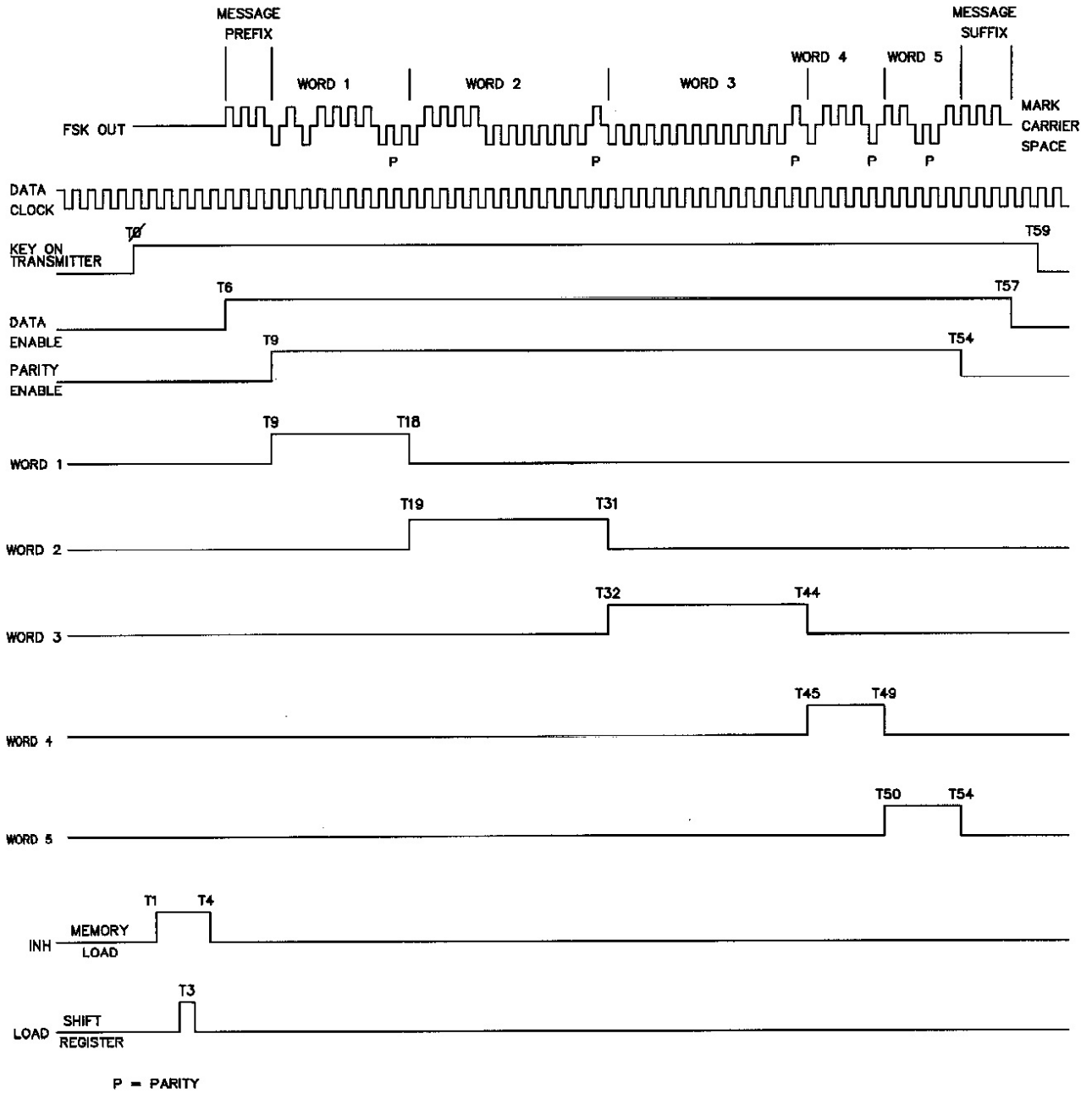


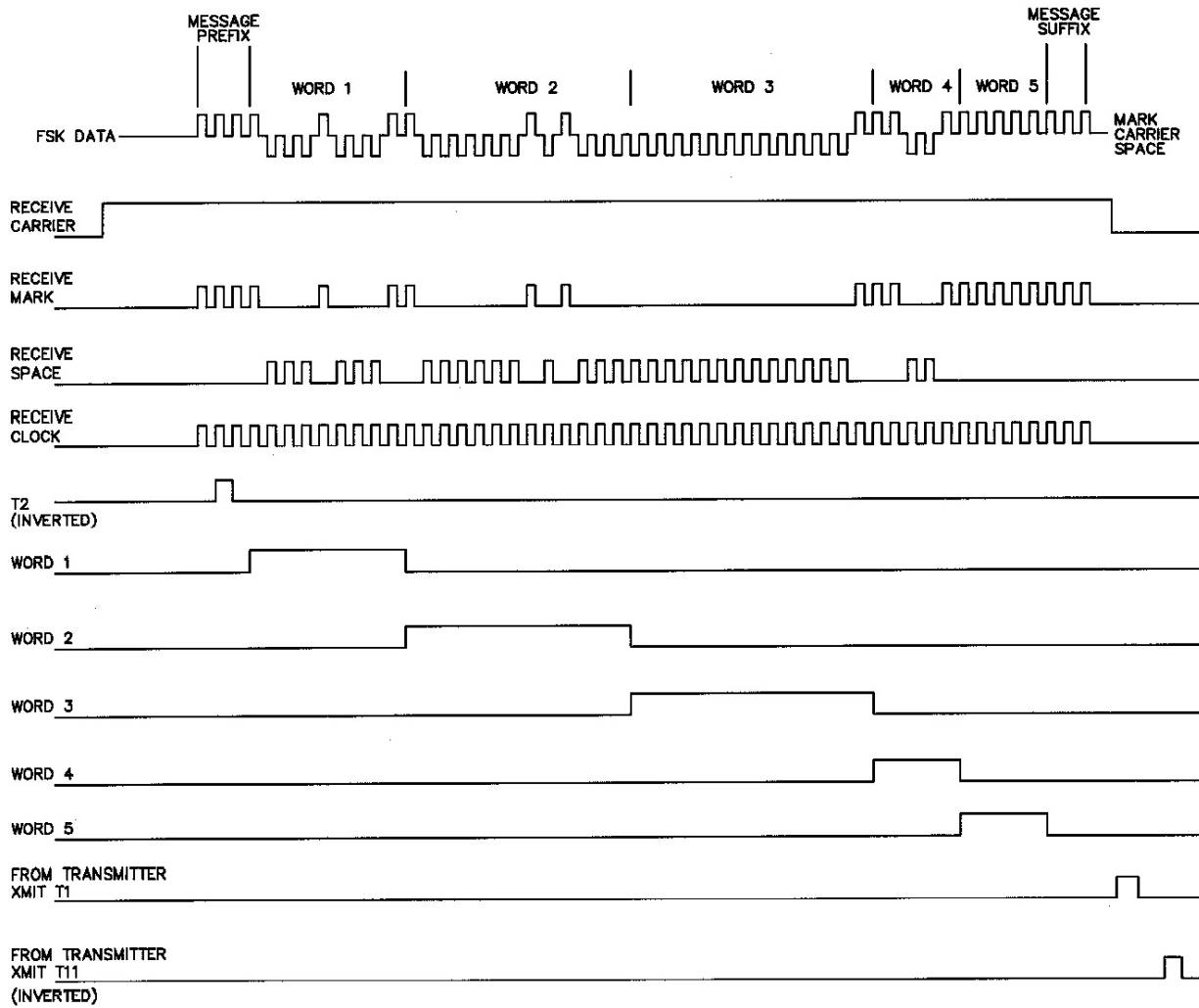
**WMATA MANUAL OF DESIGN CRITERIA
SECTION 25**



TC-25 - TWC STATION TRANSMITTER TIMING DIAGRAM

FIGURE 25 - TC-25

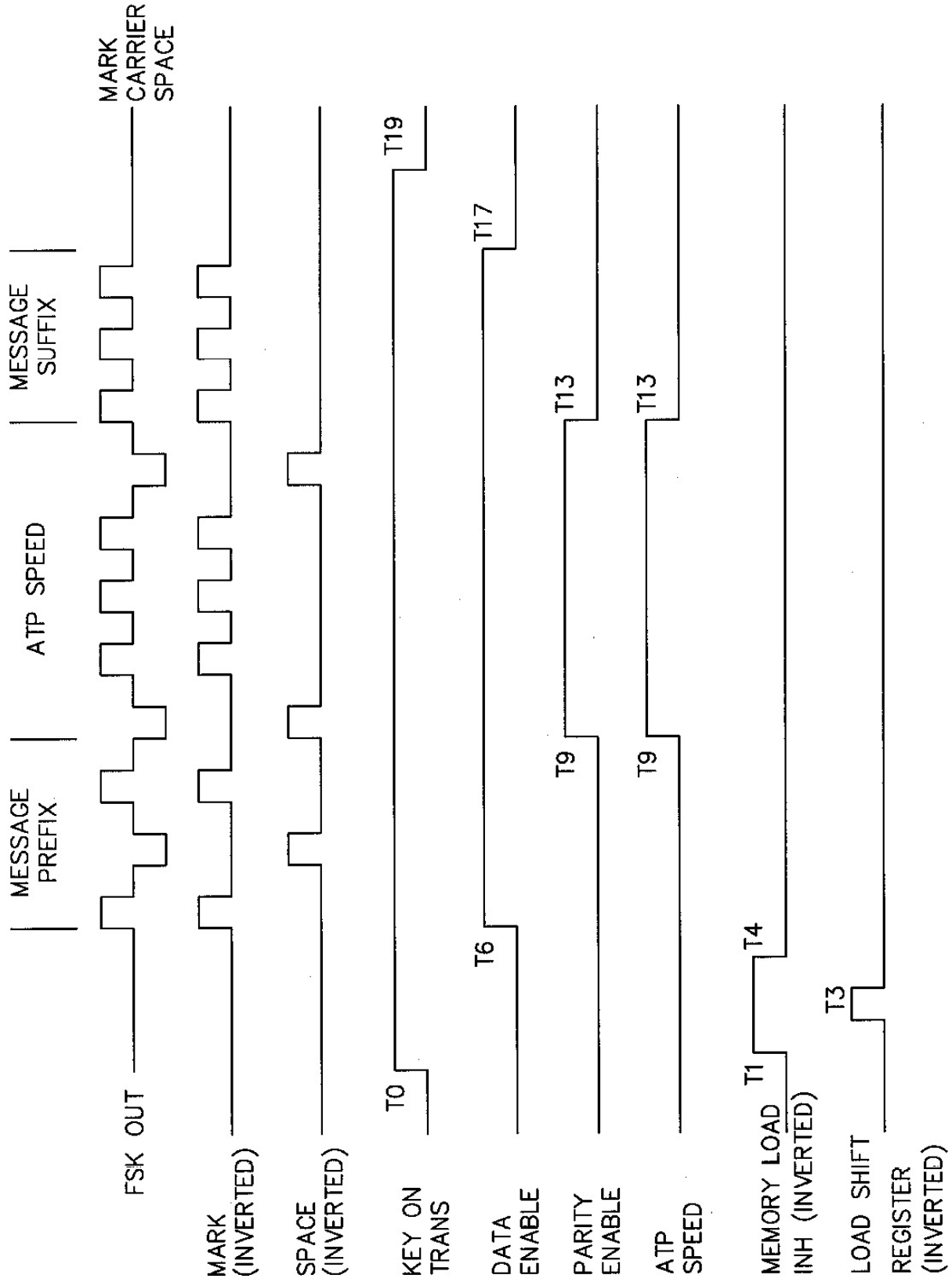
WMATA MANUAL OF DESIGN CRITERIA
SECTION 25



TC-26 - TWC STATION RECEIVER TIMING DIAGRAM

FIGURE 25 - TC-26

WMATA MANUAL OF DESIGN CRITERIA
SECTION 25



TC-27 - TWC FLYBY TRANSMITTER TIMING DIAGRAM

FIGURE 25 - TC-27

WMATA MANUAL OF DESIGN CRITERIA
SECTION 25

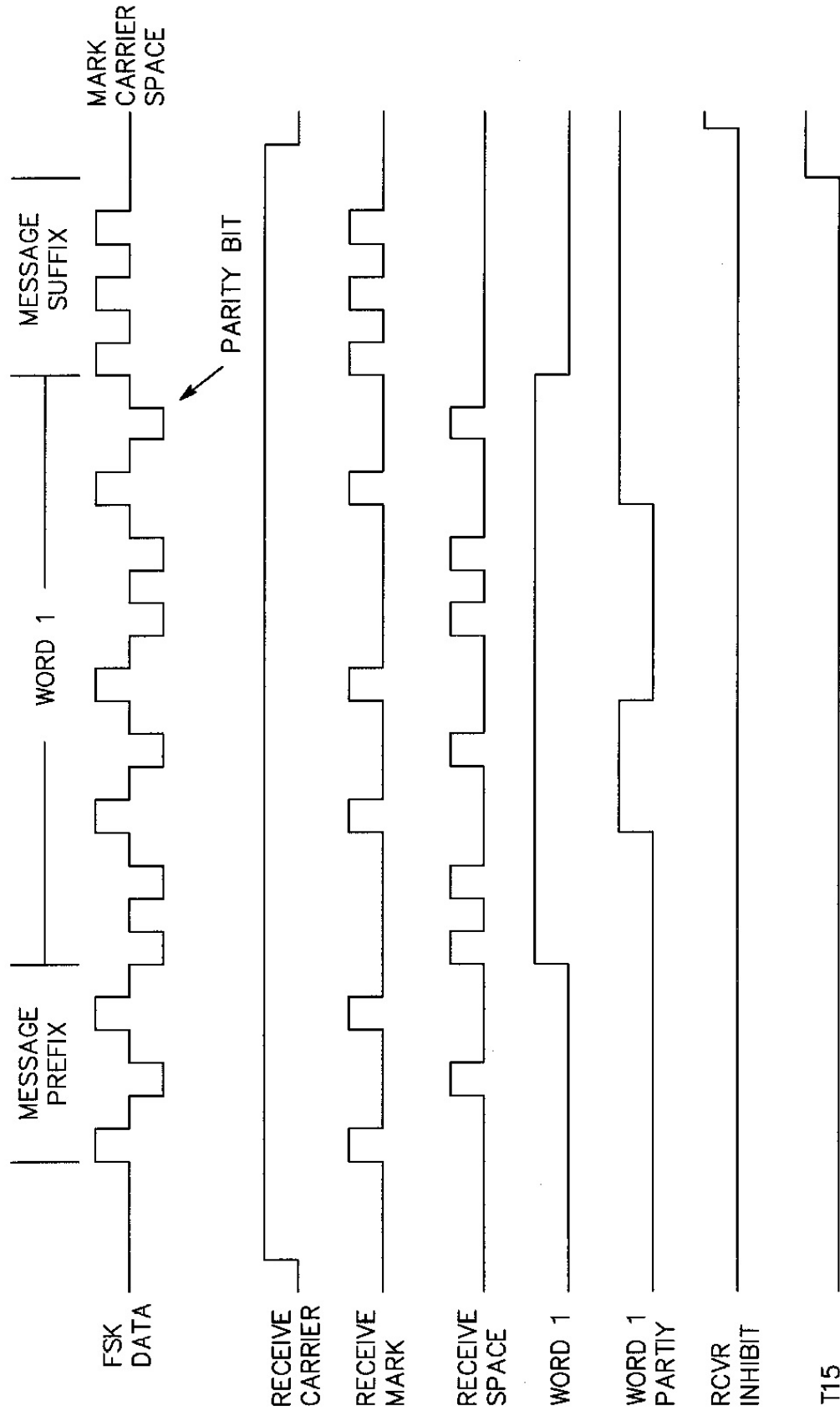
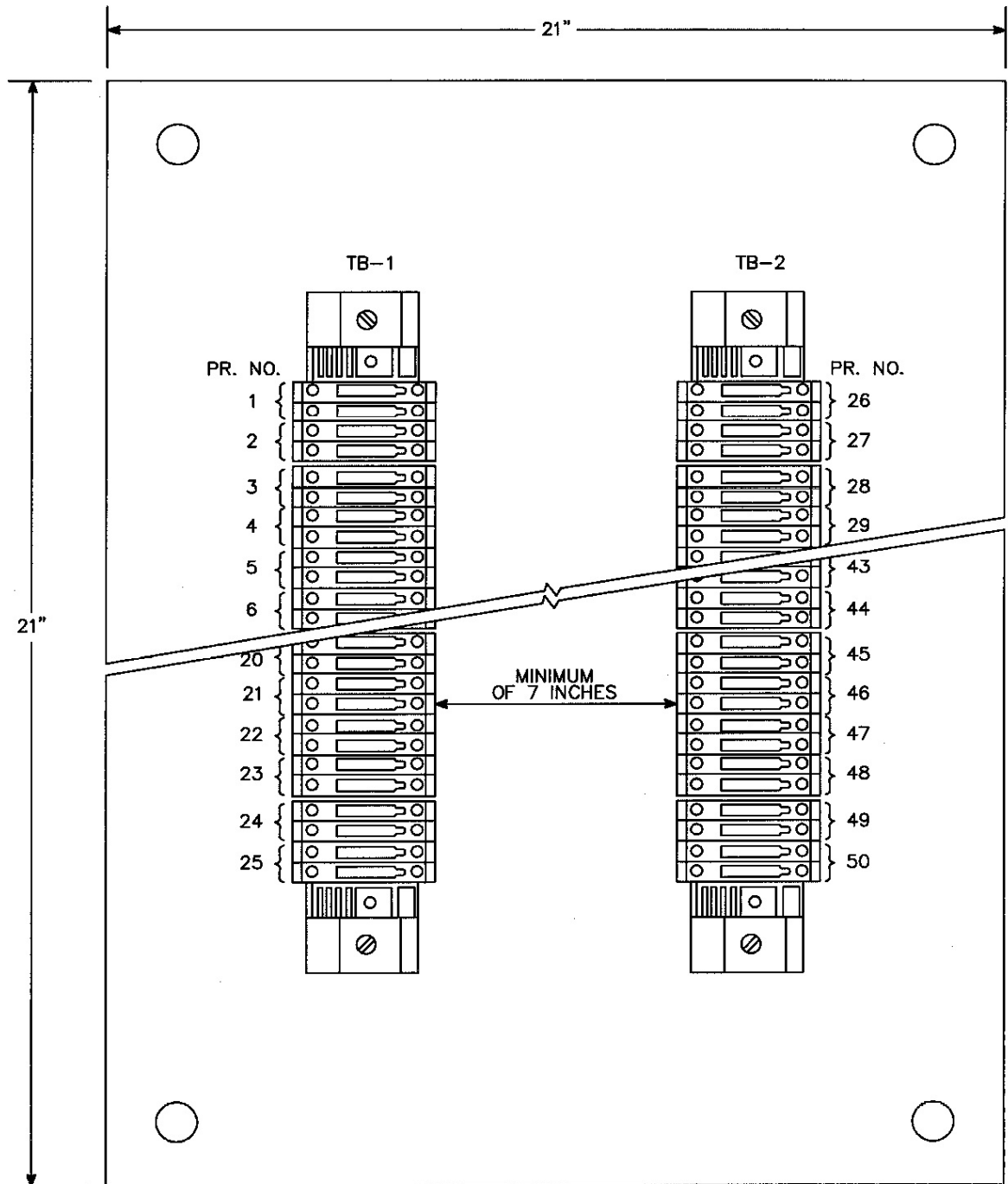


FIGURE 25 - TC-28

TC-28 -- TWC FLYBY RECEIVER TIMING DIAGRAM

WMATA MANUAL OF DESIGN CRITERIA
SECTION 25



TC/COMM INTERFACE CABINET LAYOUT
USUALLY LOCATED IN COMMUNICATIONS EQUIPMENT ROOM
(BY OTHERS)

TC-29

FIGURE 25 - TC-29

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 25**

TC-30: TC/COMM INTERFACE CABINET WIRING & DESCRIPTION

WIRING SCHEDULE				
TERMINAL BLOCK 1			TERMINAL BLOCK 2	
PAIR NO.	USE		PAIR NO.	USE
1	SPARE		26	STATION INTRUSION DTS
2	SPARE		27	STATION FIRE DTS
3	SPARE		28	AFC INTRUSION DTS
4	SPARE		29	SPARE
5	SPARE		30	SPARE INT. DTS
6	SPARE		31	SPARE FIRE DTS
7	SPARE		32	SPARE INT. DTS
8	SPARE		33	SPARE FIRE DTS
9	SPARE		34	SPARE INT. DTS
10	SPARE		35	SPARE FIRE DTS
11	TIME HR/24 HR		36	SPARE INT. DTS
12	TIME MIN		37	SPARE FIRE DTS
13	SPARE		38	SPARE INT. DTS
14	SPARE		39	SPARE FIRE DTS
15	SPARE		40	SPARE INT. DTS
16	SPARE		41	SPARE FIRE DTS
17	ACI-1 WHEN REQUIRED		42	SPARE INT. DTS
18	ACI-2 WHEN REQUIRED		43	SPARE FIRE DTS
19	SPARE		44	SPARE INT. DTS
20	SPARE		45	SPARE FIRE DTS
21	SPARE		46	SPARE INT. DTS
22	SPARE		47	SPARE FIRE DTS
23	SPARE		48	SPARE INT. DTS
24	SPARE		49	SPARE FIRE DTS
25	TCM TELEPHONE		50	SPARE

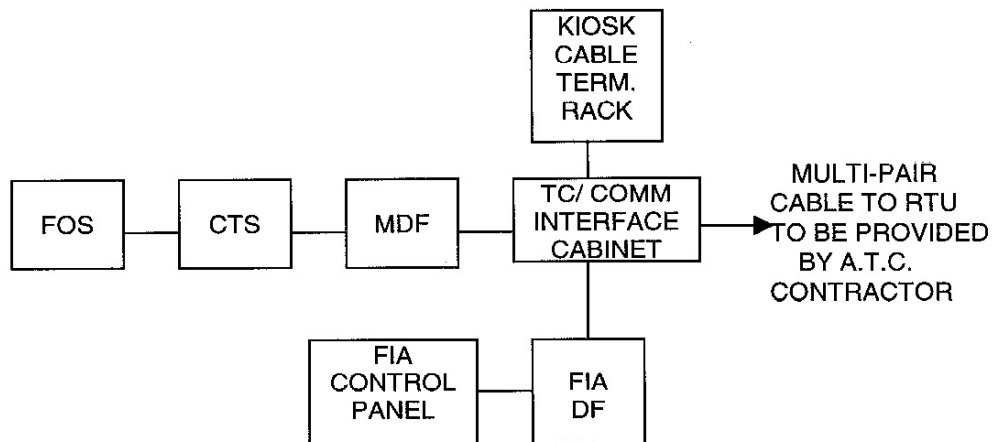


FIGURE 25 - TC-30

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 25**

TRAINING CLASSES --- GENERAL REQUIREMENTS

<u>EQUIPMENT/SYSTEM & CLASS NAME</u>	<u>PRESENTATIONS & DESCRIPTION</u>	<u>CLASS TIME & TRAINEES</u>
Non-Vital Station Processor Maintainer's STAP Training Course	4 Presentations Operation and Maintenance of the STAP System	3 to 5 Days Each 12 Trainees Each
Non-Vital Station Processor Engineer's Station Processor Training Course	1 Presentation Programming, Reprogramming, and Maintenance of the STAP System to the board level	5 to 10 Days 12 Trainees
Data Transmission Sys.(DTS) DTS Field Maintainer's Training Course	4 Presentations Operation and Maintenance of the RTU, CAU, A/D Converter and Multiplexer Equipment and Circuitry	5 Days Min., Each 12 Trainees Each
Data Transmission Sys.(DTS) DTS Shop Maintainer's Training Course	2 Presentations Troubleshooting to the Component Level	5 Days Each 8 Trainees Each
Data Transmission Sys.(DTS) Engineer's DTS Training Course	1 Presentation Program, Reprogram and Maintenance of DTS	5 Days Minimum 12 Trainees
Non-Vital Interlocking Processor (NVIP) Systems Field Maintainer's Training Course for NVIP Systems	1 Presentation Operation, Maintenance and Troubleshooting of Non-Vital portion of Interlocking Control System	5 to 10 Days 12 Trainees
Non-Vital Interlocking Processor (NVIP) Systems Engineer's Training Course for NVIP Systems	1 Presentation Operation, Maintenance and Troubleshooting of Non-Vital portion of Interlocking Control System	5 to 10 Days 12 Trainees
ATC System and IVP Systems Maintainer's ATC/IVP Training Course	4 Presentations Operation, Maintenance and Trouble-shooting of the complete ATC System with Special emphasis on the Interlocking Vital Processor Systems	5 to 10 Days Each 12 Trainees
Interlocking Vital Processor Systems (IVP) Engineer's Training Course for IVP Systems	1 Presentation Programming, Maintenance and Re-Programming of the IVP Systems to the Board Level	5 to 10 Days 12 Trainees
Train Control Room (TCR) Equipment and Systems TCR Maintenance Training Course	4 Presentations Operation, Maintenance and Trouble-shooting of Vital Control Systems, Power Supply Systems, Grounding & Surge Protection Systems, and Non-Vital Systems	10 Days Each 12 Trainees Each
Wayside Equipment & Systems Wayside Maintenance Training Course	4 Presentations Operation, Troubleshooting & Field Maintenance of Switch Machines, Signals, Impedance Bonds, Marker Coil Layouts, Signal & Negative-Return Bonding, Snowmelter Layouts, Vital & Non-Vital Relays, Test Equipment	10 Days Each 12 Trainees Each

FIGURE 25 - TC-31

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 26**

26 .1.1.1.1.1. COMPUTER SYSTEMS

26 .2 GENERAL (Future)

26 .3 HEAVY RAIL

26 .3.1 RAIL OPERATIONS CONTROL CENTER (OCC) OVERVIEW

The overall supervisory control of WMATA METRORAIL operations is conducted by specially trained WMATA personnel at a central control facility known as the Operations Control Center (OCC), located in the Jackson Graham Building (WMATA Headquarters) in downtown Washington, DC. This central control facility, part of the ATC Automatic Train Supervision (ATS) System, contains: a control computer; a hot backup computer, and; a computer for software development, which also serves as the ultimate backup computer.

The control computer receives and transmits messages between the operations control center and station locations via the Data Transmission System (DTS). It communicates with the central control operator by providing displays on a large scale screen and on individual video monitors (CRTs), and by accepting operator input from the computer control consoles. The control computer performs schedule adjustments by changing station dwell times and train performance levels. These changes are sent to the applicable station Remote Terminal Units (RTUs) via the DTS.

The METRORAIL system can operate as a stand alone entity without the computer complex at the OCC. However, without the capabilities provided by the ATS software in the central control computer, the display system, and the DTS, the job of monitoring and supervising the METRO operations, especially to maintain schedules, would be more difficult. This is especially true when an abnormal condition (e.g., a malfunctioning train) is encountered.

The general Train Control and ancillary functions provided to aid the central control operators are:

26 .3.1.1 Display System

26 .3.1.1.1 Train System Displays

26 .3.1.1.2 Train and Interlocking Detail Displays

26 .3.1.1.3 Train Information Displays

26 .3.1.1.4 Electrical System Displays

26 .3.1.1.5 Train and Electrical System Alarm Displays

26 .3.1.1.6 Geographic Displays

26 .3.1.2 Traffic Regulation Monitoring

26 .3.1.2.1 Schedule Control

26 .3.1.2.2 Schedule Adjustment Strategies

26 .3.1.2.3 Schedule linkage of train put-ins

26 .3.1.3 Supervisory Capability

26 .3.1.3.1 Train Control requests to wayside ATP system

26 .3.1.3.2 Interlocking requests to wayside ATP system

26 .3.1.3.3 Commands to wayside ATS equipment

26 .3.1.3.4 Commands to wayside support system devices

WMATA MANUAL OF DESIGN CRITERIA
SECTION 26

26 .3.1.4 Status Monitoring and Alarm Processing

26 .3.2 AUTOMATIC TRAIN SUPERVISION SOFTWARE

The software for the central computer has been designed in a building block approach and provides the primary functions of Traffic Regulation, and Control and Display.

26 .3.2.1 Traffic Regulation

26 .3.2.1.1 All trains in the METRO system under central computer supervision enter revenue service, run, and terminate revenue service according to times provided by predetermined train schedules. These train schedules are the basis for Traffic Regulation Control. A train schedule is defined as a set of arrival and departure times at successive locations which completely dictates a train's intended movement from entry into revenue service until layup. A train schedule defines, among other things, the scheduled arrival time and the scheduled dwell time at every station traversed by a given train. A unique schedule is defined for each train that is in revenue service or is about to enter revenue service. The system schedules are selected by the central control operators at the start of revenue service on a particular day.

26 .3.2.1.2 Traffic Regulation automatically maintains the scheduled headways between all of the trains operating in the territory and regulates train movements for time schedule adherence, proper merging of trains at rail line junction points, and optimum utilization of terminal locations. This is achieved by control of both station dwell time, and train performance (speed) and acceleration levels which govern the interstation running time.

26 .3.2.1.3 The four main components of the Traffic Regulation software are Put-in Processing, the Line Algorithm, the Terminal Algorithm, and Strategy Selection. Also, statistics of the actual performance of trains are gathered for off-line analysis.

26 .3.2.1.3.1 Put-in Processing

The Put-in Processing software initiates train entry into revenue service either from a storage point, such as a yard or a pocket track, or from a terminal station after a train reversal. The primary function of the Put-in Processing software is to construct a schedule for the next terminal-to-terminal run of the train so that the Terminal Algorithm and the Line Algorithm can control it. Another function performed is the lighting of warning lamps at yards prior to the scheduled dispatch of a train so that the yard personnel can prepare a train for revenue service.

26 .3.2.1.3.2 Line Algorithm

26 .3.2.1.3.2.1 The primary function of the Line Algorithm is to attenuate delays due to minor line disturbances as quickly as possible and prior to the arrival of trains in areas where the probability of such delays is high. Line disturbances are events or conditions which cause a train to be early or late with respect to its schedule. Such events cause the Line Algorithm to affect the dwell time of a train at a station and the performance of a train departing from a station. The Line Algorithm minimizes or eliminates the effects of delays by adjusting the dwell and performance level of a train such that the departure schedule error at a station and the arrival schedule error at the next station are both minimized.

26 .3.2.1.3.2.2 There are four performance levels. Performance Level 1 (PL1) requests the train to run at the maximum safe interstation speed, resulting in the minimum safe interstation run time. The normal schedule for a train is based on PL2, which is approximately 10 percent slower than PL1. This gives traffic regulation a catch-up capability by allowing it to request PL1 to reduce a train's lateness. PL3 and PL4 are approximately 10 percent and 20 percent slower than PL2 and are used when trains are ahead of schedule.

WMATA MANUAL OF DESIGN CRITERIA SECTION 26

26 .3.2.1.3.2.3 Each of the four performance levels may be combined with a request for either full or half acceleration, thus providing eight different interstation run times. For each station platform the program can select either a normal dwell time or another value which lies within the range of minimum and maximum dwell times for that platform. Dwell times available for some platforms can be varied with the time of day.

26 .3.2.1.3.3 Terminal Algorithm

26 .3.2.1.3.3.1 A special case handled by a part of Traffic Regulation called the Terminal Algorithm is used to avoid conflicts between trains at terminals having a crossover interlocking located between the terminal station and the penultimate station. Since these interlockings are used to reverse trains, conflicts in the use of the interlockings can be generated by trains arriving at and departing from a terminal station at close headways. A route conflict exists whenever two trains attempt to traverse conflicting routes through an interlocking at the same time.

26 .3.2.1.3.4 Strategy Selection

26 .3.2.1.3.4.1 The central control operators have the capability of providing corrective strategies through the Strategy Selection program whenever required. The control philosophy employed here is that the operator is the best judge of what corrective action is most suitable in any given situation and the computer is most useful as a device to display the options available and to implement the selected option. The Strategy Selection programs include Replace Train, Delete Train, Add Train, Eliminate Gap, Create Gap, Offset Schedule, Tilt Schedule and Skip Stop. All act to either modify or maintain the existing schedule.

26 .3.2.1.4 Control and Display Software

26 .3.2.1.4.1 The Control and Display software drives the displays and alarm printers and responds to central control operator inputs through the console trackballs and keyboards. The Control and Display software responds to field changes or when requested by an operator input to update train displays. It examines the data returned from the field and marked as changed by the Data Base Processor software. It then updates displays and alarm messages for the central operator as required.

26 .3.2.1.4.2 The Control and Display software provides the processing of all operator inputs and coordinates execution of the software required by those inputs. These commands allow the central control operators to manually supervise system operation and to request specific displays.

26 .3.3 OCC SYSTEM HARDWARE

The system hardware is used to perform the required Automatic Train Supervision functions and backup functions. The individual components are integrated to provide the means by which the various software components perform their functions.

26 .3.3.1 General Purpose Computer Subsystem

Three interconnected computers comprise this subsystem. Each computer consists of a central processor with byte addressing, floating point and memory protection instructions, a priority interrupt system, and a power monitoring circuit.

The computer systems are networked to each other and to the peripheral devices through a dual Ethernet network.

26 .3.3.2 Communications Subsystem

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 26**

To handle the specialized data transmission, the central computers are connected to two Front End Processors which are connected to a bank of modems. The modems are connected through the DTS to the various field devices and permit the transfer of data to and from the central control computer. The FEPs receive the raw data from the field and forward change information to the central processors.

26 .3.3.3 Control and Display Subsystem

26 .3.3.3.1 The Control and Display subsystem, used by the central control operators in controlling the system, has as its main functions; the presentation of system status, operational data and alarms to the central operator, and the execution of system commands from the console trackball and keyboard.

26 .3.3.3.2 Video monitors (CRTs) provide the display facility: "Closeup" views of the interlockings; System alarms (Train and E&S Alarm); Performance statistics (Train Information); Electrification system (Traction Power); and the state of mechanical support equipment at a station selected by the operator (Support Station). In the event that a CRT malfunctions, the central control operators have the capability of reconfiguring the displays so that a desired display can be moved to a working CRT.

26 .3.3.3.3 A Large Scale Display System provides an overview display of the METRO System and can also be used to display any of the System's local or special displays.

26 .3.3.3.4 All alarm conditions on the METRO System, whether the result of train control indications, calculations, traction power and support system indications or computer indications, are displayed in tabular form on the appropriate alarm display and can be output to a printer. Alarms are also displayed in the alarm area (bottom three lines) of the CRT screen. Each message is accompanied by an audible alarm. The alarm area contains up to three of the most current unacknowledged alarm messages. There is an indication if there are more than three currently unacknowledged alarms.

26 .4 BUS GARAGE / SHOP FACILITIES (Future)

26 .5 LIGHT RAIL FACILITIES (Future)

26 .6 HEAVY RAIL YARD / SHOP FACILITIES (Future)

26 .7 PARKING GARAGE (Future)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

SECTION 27 General Communication System

27.1 Purpose

- 27.1.1** The purpose of the Rail Communications System is to provide state-of-the-art, efficient and reliable communications between all elements of the Rail System. Verbal, data and visual communications shall be furnished.
- 27.1.2** Communications service shall be provided for train operations, passenger station operation and security, transit police operations, maintenance operations, and monitoring and alarming of all areas for fire, bio-chemical detection, and unauthorized entry.
- 27.1.3** The design of the Communication systems must be coordinated with the design of the Train Control system, the Traction Power system, the Fare Collection system, the IT components, miscellaneous support facilities, revenue and nonrevenue vehicles and equipment, and other components or elements of the transit system.
- 27.1.4** The communications system shall incorporate the most modern proven designs available to provide the highest degree of safety, efficiency, and reliability.
- 27.1.5** All equipment and systems shall be designed for immediate 10% expansion.
- 27.1.6** All equipment and systems shall be designed and constructed with consideration given to physical and electrical environment such as temperature and humidity, range of operation, vibration and shock, dust and weather, electric and magnetic fields, electromagnetic coupling of conductors, pairs and cables, transient peaks of electrical grounding, and voltage and current.
- 27.1.7** Mechanical configuration of equipment shall provide for ease of inspection and replacement.
- 27.1.8** Electrical test points, adjustments, fuses, equipment alarms, and indication shall be provided at front panels wherever possible.
- 27.1.9** All electronic equipment shall be standard, commercially available solid state devices, wherever practicable. Plug-in printed circuit card construction shall provide extender units as standard equipment. Communications and equipment design shall be in accordance with one or more of the following codes and specifications where applicable. The intent of these regulations should also be maintained where new devices or methods are introduced, even through the details of the specifications do not apply.

NOTE:The design criteria for the phone system, network, and Garage communication equipment (such as GETS & Elevator Intercom) can be found in IT Design Criteria.

27.2 Design

- 27.2.1** A Communication Room shall be provided in each rail station, rail yard building, parking garage, bus garage building, or any other facility that WMATA builds. Larger buildings shall be provided with multiple COM rooms. The Communication (COM) room shall be conditioned space and provided with an HVAC sized to provide the designed heat load plus a 40 percent growth margin.
- 27.2.2** A telephone closet or Bell room shall be provided near each kiosk within the station. $\frac{3}{4}$ " x 4' x 8' foot plywood shall line the walls of the telephone closets.
- 27.2.3** Typical Communication conduits shall be as shown on the design drawings. CAT6 and Fiber Optic patch panels shall be provided in the COM rooms and in the Kiosks.
- 27.2.4** The Communication system shall include the following equipment:
 - 27.2.4.1** Public Address System
 - 27.2.4.2** Radio System

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.2.4.3** Video Surveillance System
- 27.2.4.4** Fire Alarm System
- 27.2.4.5** Intrusion Detection System
- 27.2.4.6** Access Control System
- 27.2.4.7** Call for Aid System
- 27.2.4.8** Information Display System
- 27.2.4.9** Kiosks
- 27.2.4.10** Operation Control Centers

NOTE: See IT Design Criteria for Phones, Network, and structured cabling design criteria.

27.3 Power for Communications

- 27.3.1** The Electrical Power System shall provide power distribution from the 3-phase, 4-wire, 120/208 VAC, primary power feed, provided by others, to the communications room.
- 27.3.2** Communication devices with redundant power supplies shall be connected to different power sources. One side shall be connected to the Emergency supply and the other side shall be connected to the Normal supply.
- 27.3.3** The design shall provide for a 120/208 VAC Emergency Power Distribution System for each Passenger Station, and shall include as a minimum:
 - 27.3.3.1** An Emergency power distribution panelboard-3-phase 4-wire, 120/208 VAC w/solid neutral bus and ground bus. Main lugs rated 100 Amp. Minimum 20 single pole breaker capacity.
 - 27.3.3.2** AC Power Disconnect Switch with minimum ampere rating of 100 Amp
 - 27.3.3.3** AC Emergency power distribution panel in the Kiosk
 - 27.3.3.4** AC Normal power distribution panel in the Kiosk
 - 27.3.3.5** AC power receptacles.

27.4 Grounding

- 27.4.1** All conduit shall be electrically insulated from equipment racks and equipment cabinets; power ground shall be separate and isolated from the communications ground.
- 27.4.2** Conduit containing branch circuit conductors shall be insulated from the equipment racks and cabinets by means of short lengths of non-conducting conduit.
- 27.4.3** Short lengths of flexible metallic conduit shall be provided in the equipment cabinets and on the equipment racks between the non-conducting conduit and the ac power receptacle strips.
- 27.4.4** Each branch circuit shall contain a separate neutral conductor to the Communications Equipment Room Power Distribution Panel board.

27.5 Surge Suppression

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.5.1 Surge suppression shall be provided on all incoming lines that are exposed to the external environment.

27.6 Security Provisions

27.6.1 Access control shall be provided on all doors entering or exiting the COM room. A PTZ camera shall be provided to monitor all doors entering or exiting the COM room. Both the Access Control system and the PTZ camera shall integrate with the electronic Safety and Security (ESS) system.

27.7 Public Address System

27.7.1 Purpose

27.7.1.1 The purpose of the Public Address (PA) system is used to provide audio information to the public, employees, and contractors in both the public and non-public areas of passenger stations.

27.7.2 Design

27.7.2.1 A Public Address system shall be installed in each passenger rail station and be designed and maintained to have a Speech Transmission Index (STI) of 0.7.

27.7.2.2 The Public Address system shall allow announcements to be made with the following priority and from the following locations:

27.7.2.2.1 The Station Fire Alarm Panel

27.7.2.2.2 The Rail Operational Control Center at:

27.7.2.2.2.1 Jackson Graham Building

27.7.2.2.2.2 Carmen Turner Facility

27.7.2.2.3 The Kiosk Wireless Microphone

27.7.2.2.4 The Kiosk Wired/Gooseneck Microphone

27.7.2.2.5 The End of Line Station / Dispatcher's Office (Block House)

27.7.2.3 Major System Components

27.7.2.3.1 The PA system shall include the following major components:

27.7.2.3.1.1 JGB OCC Head End

27.7.2.3.1.2 CTF OCC Head End

27.7.2.3.1.3 Station IP to Audio converter

27.7.2.3.1.4 Redundant Station Amplifiers

27.7.2.3.1.5 Station Speakers

27.7.2.3.1.6 Kiosk Control Panel with Microphone

27.7.2.3.1.7 Wireless Microphone System

27.7.2.3.1.8 Intercom

27.7.2.4 The basis of design for the PA system is as follows:

27.7.2.4.1 OCC Head End – Penta

27.7.2.4.2 Station IP to Audio Converter – Barix

27.7.2.4.3 Audio Amplifiers –

27.7.2.4.4 Speakers -

27.7.2.4.5 Intercom - Commend

27.7.2.4.6 OCC Head End

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.7.2.5 The Rail Operations Control Center (OCC) uses the PENTA PA Control Equipment to select and broadcast in the following ways:

27.7.2.5.1 System wide announcements to all Metro Rail Stations

27.7.2.5.2 Announcements to selected Lines (i.e., Red Line, Green Line, or Blue/Orange Lines)

27.7.2.5.3 Individual Passenger Stations

27.8 Passenger Stations Public Address System

27.8.1 Each passenger station in the WMATA Rail System shall be designed to have an independent Public Address (PA) System. The Passenger Station PA System provides for general purpose and emergency evacuation announcements throughout the passenger station.

27.8.2 PA coverage shall be provided to all public and nonpublic areas of the station.

27.8.3 Each station shall be provided with a priority mixer. The line mixer shall be used to control the level of the individual audio inputs. A single output shall be taken from the mixer and input to the power amplification. When an announcement of a higher priority is initiated, the lower priority announcement is removed from the amplifier's input until the high priority announcement is completed.

27.8.4 Below ground stations shall be provided with a noise compensated circuits for the platform and mezzanine areas. This noise compensation circuit shall be used to automatically adjust the PA volume when trains are arriving or departing the station. Above ground stations shall not be provided with noise compensated circuits.

27.8.5 Stations shall be provided with non-noise compensated circuits for service rooms and non-revenue passageways. Service rooms shall be provided with a volume control circuit.

27.8.6 The operation of the Passenger Station PA System from the Kiosk is accomplished by simultaneously depressing the push-to-talk pushbuttons on the hand-held microphone and the Kiosk PA Control Panel, then speaking into the hand-held microphone.

27.8.7 Kiosks shall be provided with a portable wireless microphone. The wireless microphone shall work from any location on the platform or mezzanine(s). The wireless microphone shall by-pass and takes the place of the normal kiosk microphone when the wireless microphone is keyed. This feature is used to allow the kiosk attendant freedom of movement beyond the kiosk for various reasons including crowd control.

27.8.8 When a selection is made by a Passenger Operations Supervisor in the Rail Operations Control Center, the audio path of the console is connected to the station PA via an IP connection.

27.8.9 The PA system design shall have redundant power amplifiers. The Power Amplifiers shall be connected to the Amplifier Supervisory Control Unit. One Power Amplifier shall be connected to the "MAIN CHANNEL" of the Amplifier Supervisory Control Unit, and the second Power Amplifier shall be connected to the "auxiliary channel" of the Amplifier Supervisory Control Unit. Each Amplifier Supervisory Control Unit shall monitor the associated Power Amplifiers and, upon sensing a malfunction of the "main channel" Power Amplifier, shall automatically transfer the audio path to the "auxiliary channel" Power Amplifier.

27.8.10 The Passenger Station PA Speakers shall be designed to be wired in either noise-compensated or non-noise compensated circuits. Noise-compensated circuits shall be used in areas where train noise must be overcome by automatically adjusting the PA volume. The station mezzanine area

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

and Platform areas are of noise compensated circuits which use Automatic Level Control. For areas where noise compensation is required, circuits shall be wired to the Loudspeaker Distribution Panel designated for noise-compensated circuits. Non-noise compensated circuits shall be used in all other areas. In areas where noise-compensated circuits are not required, circuits shall be wired to the Loudspeaker Distribution Panel designated for non-noise compensated circuits. Passenger station service rooms and non-revenue passageways are examples of areas that require non-noise compensated speaker circuits.

27.8.11 The PA amplifiers shall have a constant voltage output of 70.7 volts. Each loudspeaker shall be equipped with an audio transformer to match the 70.7 volt line with the loudspeaker. The transformers shall have various taps to allow for adjustment of the sound level in a particular area. Each transformer shall have a minimum of four taps. The power rating for each of the taps shall be determined during installation.

27.8.12 The design and deployment of public address speakers shall be coordinated with architectural design. The speaker quantities and locations shall be determined by the coverage requirements. A sufficient quantity of speakers shall be placed in passenger stations to give even volume distribution without objectionable loudness from any one speaker location. Speakers shall be feed from two different amplifiers in an alternating feed pattern so that if one amplifier fails, PA audio is provided to all coverage locations.

27.9 End-Of-Line Stations Public Address System

27.9.1 The PA system for End-Of-Line Stations shall be designed to have a Dispatcher PA input at the Station. The Dispatcher PA System input shall provide access to the Passenger Station PA System to make announcements at any time that the station PA system is not already in use.

27.9.2 A Dispatcher's PA Control Panel shall be provided in the dispatcher's office and function in an identical manner as the Kiosk Public Address Control Panel. The Dispatcher's PA Control Panel shall have a Zone Selection capability. The Dispatcher PA system Zone Selection shall provide the Dispatcher with the ability to choose between either (1) All Station Speakers or (2) Platform Speakers Only.

27.10 Intercoms

27.10.1 Each Kiosk in the WMATA Rail System shall be provided with an Attendant/Passenger Interphone System. The Attendant/Passenger Interphone System shall provide for communication between passengers and the Kiosk Attendant at the Kiosk. The Attendant/Passenger Interphone System shall serve both the "PAID" and the "UNPAID" side of each Kiosk.

27.10.2 Additionally, a separate Intercom System shall be provided at the Dispatcher's Room to provide verbal communications between the Train Control Room, the Dispatcher's Room, and the Operations Room.

27.11 Land Mobile Radio Systems

27.11.1 Purpose

27.11.1.1 The purpose of the radio system is to provide public service grade wireless voice communication both above ground and below ground.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.11.2 Design

- 27.11.2.1** The current WMATA Mobile Radio System consists of a 490 MHz Comprehensive Radio Communication System (CRCS) for above ground and below ground communication.
- 27.11.2.2** Additionally, multiple Local Jurisdictional Public Safety Radio Systems (PSRS) operating in the 800 MHz frequency band are installed in underground locations throughout the rail system.
- 27.11.2.3** An old VHF radio system is still deployed by WMATA. It should be removed some time during the 2013 to 2014 time frame.
- 27.11.2.4** The existing CRCS provides voice and data communications among Bus, Rail, Metro Transit Police (MTPD), Para-Transit, Maintenance, and Administrative personnel and vehicles. The existing CRCS is composed of 10 remote above ground sites, 15 voice channels, 4 data AVL (bus) channels, one mobile data channel and one paging channel.
- 27.11.2.5** The WMATA CRCS shall consist of multiple talk groups:
 - 27.11.2.5.1** (OPS-1)
 - 27.11.2.5.2** (OPS-2)
 - 27.11.2.5.3** (OPS-3)
 - 27.11.2.5.4** (OPS-4)
 - 27.11.2.5.5** (MTPD)
 - 27.11.2.5.6** BUS
 - 27.11.2.5.7** Maintenance

27.11.3 Major System Components

- 27.11.3.1** The radio system shall include the following major components:
 - 27.11.3.1.1** Above Ground Radio System
 - 27.11.3.1.2** Below Ground Radio System
 - 27.11.3.1.3** Public Safety Radio System (PSRS)
 - 27.11.3.1.4** Distributed Antenna System
 - 27.11.3.1.5** Consoles
 - 27.11.3.1.6** Subscriber Units
 - 27.11.3.1.7** Future Radio System

27.11.4 Basis of Design

- 27.11.4.1** The basis of design for the radio system shall be Motorola.

27.12 Above-Ground (AG) Radio System

- 27.12.1** The above ground CRCS radio system shall provide DAQ 3.4 quality with 95/95% reliability in street portable radio coverage with the radio mounted on the hip throughout the entire WMATA service area.
- 27.12.2** The WMATA Comprehensive Radio Communication System (CRCS) consists of a frequency modulated, UHF T-Band, (operating in the 470-512 MHz portions of the frequency band) digital, single-cell simulcast trunked Motorola Smart Zone 3.0z radio system, used for communicating with radio users throughout the entire WMATA service area.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.12.3 The radio system is configured to operate with one Master Site Controller located at CTF and geographically redundant Prime Site Controllers located at CTF and JGB. Existing remote radio sites are connected by redundant T-1 lines leased from Verizon.

27.12.4 The WMATA Comprehensive Radio Communication System (CRCS) is a fifteen channel, ten antenna site, 490 MHz ASTRO Simulcast trunked radio system. This system employs the latest trunking technology in a wide area configuration. The Prime Site Controller has control over the call processing activity within the simulcast radio system and is located at the Carmen Turner Facility (CTF). The Zone Controller directs call processing activity for the entire network. The Ambassador Electronics Bank (AEB) serves as the heart of the ASTRO Simulcast system and the central point for all audio routing across the radio sites, the dispatch center, and the telephone interconnect terminal. The Zone Controller processes the inbound signaling word (ISW) from subscribers units requesting a channel and issues the outbound signaling word (OSW) to units in the field

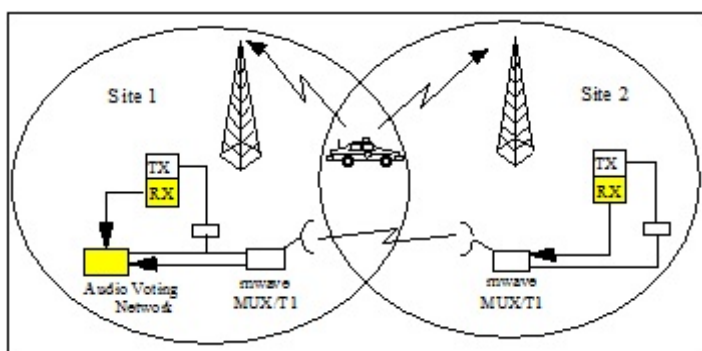


Figure 1- Inbound Transmission Above Ground:

27.12.5 In a simulcast system, audio is often received at more than one site when a user transmits. Voting comparators examine the audio received at each RF site. The system then selects the best audio from each input and creates the optimal output signal. This assures that the signal providing the highest audio quality is used. The simulcast trunking repeaters receive the audio and call requests from the field units and transmit the voted audio to the designated service area. The method of site-to-site transport is leased T1 circuits. Motorola employs the Premisys TeNSr channel bank to interface the network's components (such as the simulcast repeaters, AEB, etc.) with the transport medium. Strongest Signal is Optimized and Retransmitted. The retransmitted audio is always the signal with the highest audio quality. It is optimized and phased to provide consistent, high quality simulcast transmissions.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

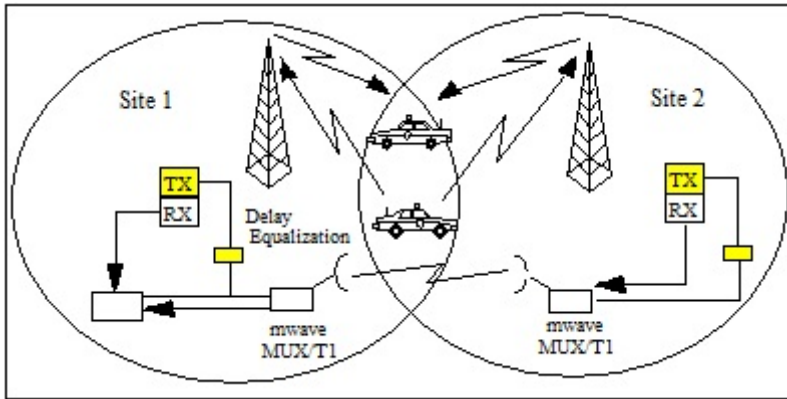


Figure 2 - Outbound Transmission Above Ground:

27.13 Below-Ground (BG) Radio System

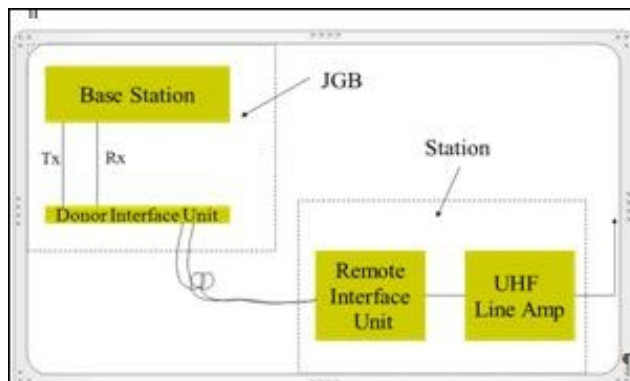
27.13.1 The below ground system shall provide DAQ 3.4 quality with 95/95% reliability in rail vehicles in the tunnels and in station (both public & non-public locations) with the radio mounted on the hip. Radio coverage is provided by a DAS (Distributed Antenna System) installed throughout the underground. The DAS is fed by a redundant radio frequency (RF) donor system, which distributes the above ground RF signal using fiber-optic links to a number of UHF bi-directional amplifiers (BDAs) installed along the right of way.

27.13.2 The below ground systems utilizes fiber-optic transport technology along with wide band Bi-directional Amplifiers (BDA) in a Distributed Antenna System (DAS) configuration to provide two way communications in below ground areas that are not covered by the CRCS 490 MHz above ground system. These areas include station platforms, mezzanines, tunnels bores, and service rooms. Each station has specific antennas on the platform and mezzanine areas to provide radio coverage on these levels. It also includes radio coverage in all station public areas, service rooms and other non-public areas that are part of the station

27.13.3 The underground system has system components in the Jackson Graham Building, throughout 26 select stations and integrated into the neutral host cable system in the tunnels. See figure 3 below.

27.13.4 All CRCS radios in an underground station shall communicate via a slotted leaky coaxial cable antenna system installed in underground stations and tunnels. The 800 MHz PSRS also shares the leaky coax cable throughout the underground by connecting into a Cross-Band Coupler at port #2 with the 490MHz CRCS on Port #1. Port 3 (the output port) is connected to the Underground Radiax Antenna System.

Underground Radiax Antenna System.



**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Figure 3 – Typical underground interface to JGB

27.14 Public Safety Radio System (PSRS)

- 27.14.1** Multiple local jurisdictions have installed 800MHz Public Safety Radio System (PSRS) in the underground. These systems provide two-way voice communications between control center facilities of local Fire Departments, Police Departments, and Emergency Medical Services (EMS) authorities and their corresponding portable radios.
- 27.14.2** Typically, these Public Safety Radio Systems (PSRS) are a frequency modulated voice radio system operating in the 850 MHz portions of the frequency band. Each of the three networks (Fire, Police, and Emergency Medical Services) shall operate, each with its individual radio equipment, control logic frequency(s), and portable radios.
- 27.14.3** The PSRS radio base stations shall be located in the passenger station Communications Equipment Room. The PSRS radios shall provide coverage from portable radios in underground stations and tunnels to their local jurisdictional control consoles, and to other portable and vehicular units above ground. Please refer to drawing CPFI-5583.PSRS.E1 for a system block diagram of the PSRS underground system. Please refer to drawing CPFI-5583.PSRS.E201 for a system block diagram of a typical tunnel system segment (Segment 8).
- 27.14.4** The PSRS radio base stations shall be multiplexed onto the same slotted coaxial cable antenna system used by the WMATA Comprehensive radio communication system (CRCS). Each PSRS network radio base station shall be connected to its Local Jurisdictional Radio Control Facility by leased telephone lines.
- 27.14.5** In general, the PSRS consists of signal splitters, signal taps, impedance transformers and 50-ohm terminating resistors which are wideband enough to pass both the 800 MHz PSRS frequencies as well as the CRCS 490 MHz frequencies simultaneously. Therefore, the combined output of the 800 MHz PSRS fiber optic head end amplifier and output of the CRCS 490 MHz system are fed to a common signal splitter. One or two output ports of the 4-way splitter feed the station antennas and the other 2 output ports feed the tunnel tracks. Returning to the 4-way splitter at the output of the FOHE, one other output port of the splitter feed Track 1 in the tunnel. The backbone cable consists of multiple sections of 50-ohm cable under the neutral host project.
- 27.14.6** The following jurisdictions have underground PSRS within WMATA's tunnels:
 - 27.14.6.1** Washington DC
 - 27.14.6.2** Prince Georges County
 - 27.14.6.3** Fairfax County

WMATA MANUAL OF DESIGN CRITERIA
SECTION 27

27.15 Distributed Antenna System (DAS)

27.15.1 The design of the Distributed Antenna System shall provide for radio coverage in the below ground system. The below ground radio provides radio coverage in tunnels, shafts, ancillary building and underground station areas. Underground coverage shall be provided from slotted coaxial antenna cable installed in tunnels, passenger stations and underground passageways.

27.15.2 A typical underground cable installation is shown in figure 4 below:

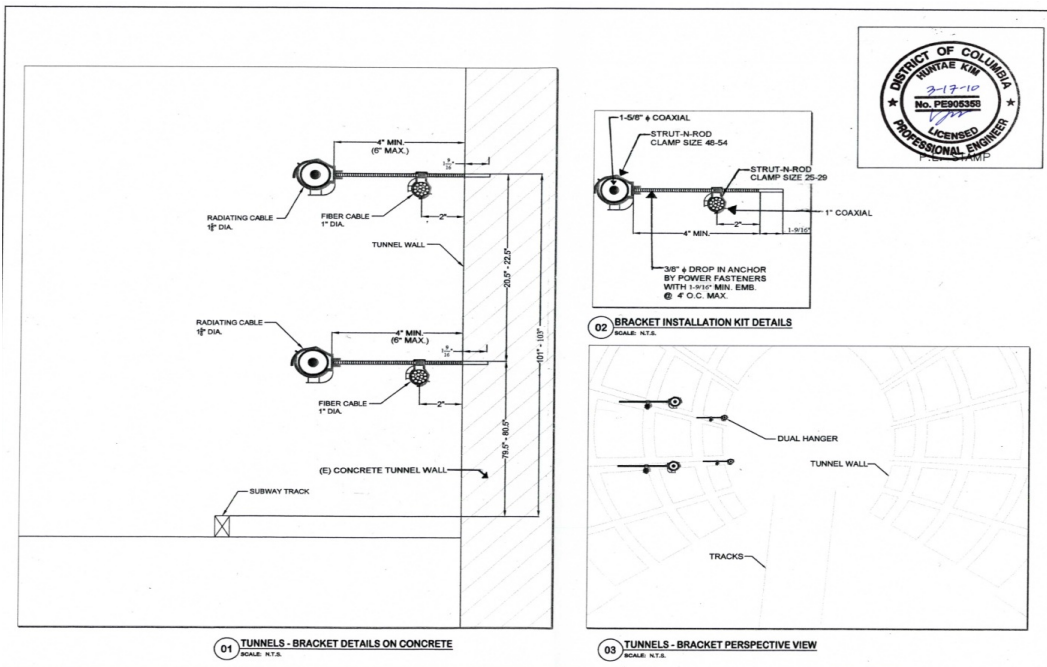


Figure 4 – Typical underground cable installation inside tunnels.

27.15.3 The Slotted Coaxial Cable Antenna System shall act as the medium for receiving and transmitting the radio frequency signals to and from the WMATA Comprehensive Radio Communications system (CRCS) and Public Safety Radio System (PSRS).

27.15.4 The design of the below ground Radio System shall include 490 MHz bi-directional amplifiers (BDA), multi-couplers and associated equipment located in the Communications Equipment

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Rooms. The cascaded BDAs under the CRCS network serve the entire Rail Mobile Radio Subsystem including Rail Operations, Maintenance and Transit Police. Bi-directional amplifiers operating in the 800 MHz frequency band for Public Safety Radio System (PSRS) shall be designed to provide compatible radio service to each particular local jurisdiction.

27.15.5 The design shall include Multi-couplers to simultaneously multiplex with WMATA's comprehensive radio communication systems (CRCS) and the Public Safety Radio System (PSRS) onto the Distributed Antenna System (DAS) which incorporates the Slotted Coaxial Cable. Multi-coupler racks shall contain cavities (filters) which distinguish between RF signals of different frequencies, and which can direct RF signals in specific directions or to specific parts of the cavities.

27.15.6 The above ground CRCS consist fixed transmitters and receivers at the 10 different remote sites and a main prime site housing the system control equipment. This control equipment includes the simulcast voting comparators, simulcast equalization and distribution equipment, the site-to-site links and modems (for connection with all simulcast sites), and a set of test and optimization components

27.16 Consoles

27.16.1 Radio consoles shall be provided in the following locations:

- 27.16.1.1** Rail OCC at CTF
- 27.16.1.2** Rail OCC at JGB
- 27.16.1.3** Bus OCC at CTF
- 27.16.1.4** Bus OCC at JGB
- 27.16.1.5** Police Dispatch at CTF
- 27.16.1.6** Police Dispatch at JGB

27.16.2 Consolettes shall be provided and connected to each console. These Consolettes shall allow the console operator to use the console in the event there is a Master Site failure.

27.17 Subscriber Units

27.17.1 The following subscriber units shall be provided:

- 27.17.1.1** Handheld Radios
- 27.17.1.2** Mobile Radios
- 27.17.1.3** Base Stations

27.17.2 Handheld units shall be distributed to WMATA personnel. Handhelds shall have a MID end unit and a HIGH end unit. LOW end units shall be predominately used by rail and bus personnel. The HIGH end units with encryption shall be predominately used by MTPD.

27.17.3 Handhelds shall be provided with the following accessories:

- 27.17.3.1** Detachable speaker/microphone
- 27.17.3.2** Spare Battery
- 27.17.3.3** Battery Charger
- 27.17.3.4** Automotive Battery Charger
- 27.17.3.5** Holster

27.17.4 Mobile radios shall be installed on busses, revenue rail vehicles, non-revenue rail vehicle (yellow iron), MTPD Scout cars, and miscellaneous non-revenue autos.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.17.5 Mobile radios shall be provided with the following accessories:

27.17.5.1 Permanent power connections External mounted antennas.

27.17.5.2 Concealed antennas on undercover MTPD vehicles

27.17.5.3 Base stations shall be installed in Rail End Of Line offices, Guard Shacks, Yard Tower offices and other locations as required. Base stations shall be provided with the following accessories:

27.17.5.4 120 VAC power supply

27.17.5.5 Desk mounted microphone

27.17.5.6 External mounted antennas.

27.18 Future Radio System - General

27.18.1 The Job Creation Act of 2012 mandated that all radio systems which operate in the 490 MHz spectrum be relocated from the 490 MHz spectrum to another frequency spectrum no later than 2021. WMATA currently operates in the 490 MHz and will need to relocate to a different frequency spectrum. The new radio system shall be a 700 MHz digital simulcast trunked radio system based on Project 25 (P25) Phase 2 standards for public safety radio systems.

27.19 Frequencies

27.19.1 The following frequencies are in use throughout the WMATA rail system.

Assignment	TX Frequency (MHz)	RX Frequency (MHz)	Operating Mode
1	490.8625	493.8625	Mixed Mode (A/D)
2	490.7875	493.7875	Mixed Mode (A/D)
3	496.4375	499.4375	Mixed Mode (A/D)
4	496.5375	499.5375	Mixed Mode (A/D)
5	496.6125	499.6125	Mixed Mode (A/D)
6	496.5625	499.5625	Mixed Mode (A/D)
7	496.4875	499.4875	Mixed Mode (A/D)
8	496.3375	499.3375	Mixed Mode (A/D)
9	490.9625	493.9625	Mixed Mode (A/D)
10	490.9125	493.9125	Mixed Mode (A/D)
11	490.8875	493.8875	ASTRO Only (D)
12	490.8375	493.8375	ASTRO Only (D)
13	489.5375	492.5375	ASTRO Only (D)
14	489.5125	492.5125	ASTRO Only (D)
15	496.5875	499.5875	ASTRO Only (D)
AVL 1	496.4625	499.4625	Orbital Data (A)
AVL 2	489.0875	492.0875	Orbital Data (A)
AVL 3	489.1625	492.1625	Orbital Data (A)
AVL 4	490.7625	493.7625	Orbital Data (A)
MTPD	490.9375	493.9375	Mobile Data
SMNT	496.5125	499.5125	Paging (D)

Table X – WMATA CRCS Frequencies

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Channel No.	Mobile Tx Freq	Base Tx Freq
	Base Rx	Mobile Rx
719	806.2125	851.2125
TBD	806.2750	851.2750
724	806.3375	851.3375
730	806.4875	851.4875
TBD	806.6500	851.6500
784	807.8375	852.8375
786	807.8875	852.8875
787	807.9125	852.9125
795	808.1125	853.1125
797	808.1625	853.1625
TBD	808.2750	853.2750
805	808.3625	853.3625
806	808.3875	853.3875
808	808.4375	853.4375
815	808.6125	853.6125
816	808.6375	853.6375
818	808.6875	853.6875
825	808.8625	853.8625
826	808.8875	853.8875
828	808.9375	853.9375

Table X – Montgomery County Underground Frequencies

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Assignment	TX Frequency (MHz)	RX Frequency (MHz)
1	860.4375	815.4375
2	859.9375	814.9375
3	859.7625	814.7625
4	859.4375	814.4375
5	858.9375	813.9375
6	858.7625	813.7325
7	858.4375	813.4375
8	857.9375	812.9375
9	857.7625	812.7625
10	856.9375	811.9375
11	856.7625	811.7625
12	856.4375	811.4375
13	866.7125	821.7125
14	852.1875	807.1875
15	851.8125	806.8125
16	852.675	807.675
17	860.9375	815.9375
18	860.7625	815.7625

Table X – Arlington County Underground Frequencies

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Channel Number	Pre - Rebanding FIRE 800 MHz		Post - Rebanding FIRE 800 MHz	
	TX	RX	TX	RX
CH 01	852.6125	807.6125	854.8625	809.8625
CH 02	852.6375	807.6375	856.1875	811.1875
CH 03	852.6625	807.6625	856.5875	811.5875
CH 04	852.6875	807.6875	857.1875	812.1875
CH 05	852.7125	807.7125	857.5875	812.5875
CH 06	852.7375	807.7375	858.5875	813.5875
CH 07	852.7625	807.7625	859.0375	814.0375
CH 08	852.7875	807.7875	859.0875	814.0875
CH 09	855.2125	810.2125	855.2125	810.2125
CH 10	855.2375	810.2375	855.2375	810.2375
CH 11	855.4625	810.4625	855.4625	810.4625
CH 12	856.9875	811.9875	856.9875	811.9875
CH 13	857.9875	812.9875	857.9875	812.9875
CH 14	858.9875	813.9875	858.9875	813.9875
CH 15	859.9875	814.9875	859.9875	814.9875
CH 16	860.9875	815.9875	860.9875	815.9875

Table X – DC Fire Underground Frequencies

Fire Dept. Freqs. (MHz)		Fire Dept. Freqs. (MHz)		Emergency Medical Svcs. Freqs (MHz)	
Transmit.	Receive.	Transmit.	Receive.	Transmit.	Receive.
TBD	TBD	TBD	TBD	TBD	TBD

Table X – Prince George’s County Underground Frequencies

TBD = To be Determined by Engineer. These frequencies will be in the bands of 851 MHz to 869 MHz base station Transmit, and 806 MHz to 824 MHz base station receive.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.20 Video Surveillance System

27.20.1 Purpose

27.20.1.1 The purpose of the Video Surveillance system is to provide real time and recorded video for use by all departments at WMATA as well as for viewing by our regional partners.

27.20.2 Design

27.20.2.1 The design shall be based on IP camera technology and Network Video recorders located in the station communication equipment rooms. Where possible, the cabling connecting the cameras to the network switches shall be CAT6 copper connections. Small form factor network switches (packaged in NEMA 4X enclosures) shall be located throughout the station to minimize fiber optic cabling. Both fixed-lens cameras and pan tilt zoom cameras shall be provided in IP-66 enclosures.

27.20.3 Major System Components

27.20.3.1 The Video Surveillance system shall include the following major components:

- 27.20.3.1.1.1** Cameras
- 27.20.3.1.1.2** Video Recording
- 27.20.3.1.1.3** Kiosk Viewing Station
- 27.20.3.1.1.4** Network Connections
- 27.20.3.1.1.5** Video Analytics
- 27.20.3.1.1.6** Remote Viewing

27.20.4 Basis of Design

27.20.4.1 The basis of design for the Video Surveillance system shall be

- 27.20.4.1.1** Fixed View Cameras – Axis
- 27.20.4.1.2** Pant Tilt Zone Cameras – Axis
- 27.20.4.1.3** Thermal Cameras – Axis
- 27.20.4.1.4** Network Video Recorder – Pivot3 hardware with Verint software
- 27.20.4.1.5** Kiosk Viewing Station – Dell hardware with CNL software
- 27.20.4.1.6** Secondary Network Equipment – COMNET switches
- 27.20.4.1.7** Video analytics – BRS & Axis
- 27.20.4.1.8** OCC & SOCC Viewing – Dell hardware and CNL software

- 27.20.4.1.9** The system shall be designed for 30 days of storage and provide viewing at all Kiosks, Operational Control Centers, and other work station locations.

27.20.5 Cameras

27.20.5.1 The design shall use IP cameras. These cameras may be fixed cameras, Pan-Tilt Zoom (PTZ) cameras, or Thermal cameras. The cameras shall provide a minimum of three (3) days local storage.

27.20.5.2 The design shall provide the camera coverage detail in Table No.1 – Station Camera Covergae

27.20.5.3 The design, placement, and installation of the cameras shall be coordinated with the architectural design to provide an appearance that is acceptable to the architects.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.20.5.4 The design, placement, and installation of the cameras shall be coordinated with the station lighting to ensure that adequate illumination is provided for proper camera operation.

27.20.5.5 IP Cameras shall be configured using an enterprise software package from the camera supplier.

27.20.6 Video Recording

27.20.6.1 A Network Video Recorder shall be installed in each COM room. The Network Recording device shall provide 30 days of video storage at a resolution that is acceptable to MTPD and Rail Operations.

27.20.7 Kiosk Viewing Station

27.20.7.1 The design shall provide for camera viewing in the kiosks, in the dispatchers End of Line office, in the various control centers, and on the desktop computers throughout the authority.

27.20.7.2 Each kiosk shall be provided with four (4) monitors mounted up high on the inside of the kiosk and two (2) touch screens mounted on the cabinets inside the kiosk. These four (4) monitors and two (2) touch screens shall be connected to a computer workstation inside the cabinets internal to the kiosk. The workstation shall be running a CNL thick client. This thick client will control cameras and provide alarms inside the kiosk.

27.20.7.3 The design shall provide camera viewing at End of Line dispatch offices. Each dispatch office shall be provided with a workstation, mounting hardware and a minimum of four monitors.

27.20.8 Network Connections

27.20.8.1 The IP cameras shall be connected to IP switches with Power-Over-Ethernet (POE) capability. The Ethernet switches shall be located in the COM room, located in the Kiosk, or in located in NEMA 4X enclosures connected to MetroNET and placed strategically throughout the rail system.

27.20.8.2 See WMATA communication Standard Drawings for a typical NEMA 4X network enclosure.

27.20.9 Video Analytics

27.20.9.1 Video analytics shall be provided at each station.

27.20.9.2 Video analytics software can either reside on the end device or may reside on a dedicated server in the COM room.

27.20.9.3 As a minimum, the video analytics shall detect and alarm:

27.20.9.3.1 Unauthorized access into the Right of Way whether falling or jumping

27.20.9.3.2 Unauthorized passage though end of platform gates

27.20.10 Remote Viewing

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.20.10.1 The cameras shall be viewed from the kiosks, the dispatchers office, the Rail Operational Control Centers (ROCC) at JGB & CTF, the Security Operational Control Center (SOCC), various offices throughout WMATA, and regional partners.

DESIGN CRITERIA

(Video Portion)

BUS GARAGE

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.21 Bus Facility - Communication

27.21.1 Video Surveillance System

27.21.1.1 Purpose

27.21.1.1.1 The purpose of the Video Surveillance system is to provide real time and recorded video for use by all departments at WMATA as well as for viewing by our regional partners.

27.21.1.2 Design

27.21.1.2.1 The design shall be based on IP camera technology and Network Video recorders located in the communication equipment rooms. Where possible, the cabling connecting the cameras to the network switches shall be CAT6 copper connections. Small form factor network switches (packaged in NEMA 4X enclosures) shall be located to minimize fiber optic cabling. Cameras shall be provided in IP-66 enclosures.

27.21.1.2.2 The design of the video surveillance system shall be in accordance with APTA Recommended Practice APTA IT-CCTV-RP-001-11 – Selection of Cameras, Digital Recording systems, Digital High-Speed Networks and Trainlines for Use in Transit-Related CCTV Systems.

27.21.1.3 Major System Components

27.21.1.3.1 The Video Surveillance system shall include the following major components:

- 27.21.1.3.1.1** Cameras
- 27.21.1.3.1.2** Video Recording
- 27.21.1.3.1.3** Viewing Station
- 27.21.1.3.1.4** Network Connections
- 27.21.1.3.1.5** Video Analytics
- 27.21.1.3.1.6** Remote Viewing
- 27.21.1.3.1.7** Structured Cabling

27.21.1.3.2 Basis of Design

27.21.1.3.2.1 The basis of design for the Video Surveillance system shall be

- 27.21.1.3.2.1.1** Fixed View Cameras – Axis
- 27.21.1.3.2.1.2** Pant Tilt Zone Cameras – Axis
- 27.21.1.3.2.1.3** Thermal Cameras – Axis
- 27.21.1.3.2.1.4** Network Video Recorder – Pivot3 hardware with Verint software
- 27.21.1.3.2.1.5** Kiosk Viewing Station – Dell hardware with CNL software
- 27.21.1.3.2.1.6** Secondary Network Equipment – COMNET switches
- 27.21.1.3.2.1.7** Video analytics – BRS & Axis & Other
- 27.21.1.3.2.1.8** OCC & SOCC Viewing – Dell hardware and CNL software
- 27.21.1.3.2.1.9** The system shall be designed for 30 days of storage and provide viewing at viewing stations identified below.

27.21.1.3.3 Cameras

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.21.1.3.3.1 The design shall use IP cameras. These cameras may be fixed cameras, Pan-Tilt Zoom (PTZ) cameras, or Thermal cameras. The cameras shall provide a minimum of three (3) days local storage.

27.21.1.3.3.2 The design, placement, and installation of the cameras shall be coordinated with the architectural design to provide an appearance that is acceptable to the architects.

27.21.1.3.3.3 The design, placement, and installation of the cameras shall be coordinated with the station lighting to ensure that adequate illumination is provided for proper camera operation.

27.21.1.3.3.4 IP Cameras shall be configured using an enterprise software package from the camera supplier.

27.21.1.3.3.5 Cameras mounted on poles shall have conduit routed internal to pole.

27.21.1.3.3.6 External cameras directly attached to COM room switch shall be provided with surge protection.

27.21.1.3.3.7 The cameras shall be mounted to provide for easy maintenance.

27.21.1.3.3.8 Camera shall be ONVIF compliant.

27.21.1.3.4 Camera Coverage

27.21.1.3.4.1 The design shall provide the camera coverage detail in Table No.1 – Bus Garage Camera Coverage

27.21.1.3.5 Video Recording

27.21.1.3.5.1 A Network Video Recorder shall be installed in each COM room. The Network Recording device shall provide 30 days of video storage at a resolution that is acceptable to MTPD and Bus Operations.

27.21.1.3.6 Viewing Stations

27.21.1.3.6.1 The design shall provide for camera viewing in the guard shacks, in the clerk's office and on desktop computers throughout the bus garage.

27.21.1.3.7 Guard Shack Viewing Station

27.21.1.3.7.1 Each guard shack shall be provided with four (4) monitors mounted up high on the inside of the guard shack. These four (4) monitors shall be connected to a computer workstation inside the guard shack. The workstation shall be running a CNL thick client. This thick client will control cameras and provide alarms inside the guard shack.

27.21.1.3.8 Clerk Viewing Station

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.21.1.3.8.1 Each Clerk Office shall be provided with two (2) monitors. These monitors shall be connected to a computer workstation that is running a CNL thick client. This thick client will control cameras and provide alarms.

27.21.1.3.9 Network Connections

27.21.1.3.9.1 The IP cameras shall be connected to IP switches with Power-Over-Ethernet (POE) capability. The Ethernet switches shall be located in the COM room, located in the Guard Shack, or located in NEMA 4X enclosures connected to MetroNET and placed strategically throughout the Bus Garage.

27.21.1.3.9.2 Network connections shall be powered from WMATA's Emergency Power distribution system.

27.21.1.3.9.3 See Video Design Drawings for a typical NEMA 4X network enclosure.

27.21.1.3.10 Video Analytics

27.21.1.3.10.1 Video analytics shall be provided where identified on Table 1 – Bus Garage Camera Coverage.

27.21.1.3.10.2 Video analytics software can either reside on the end device or may reside on a dedicated server in the COM room.

27.21.1.3.10.3 As a minimum, the video analytics shall detect and alarm:

27.21.1.3.10.3.1 Intrusion Detection on the Bus Garage Lot Perimeter

27.21.1.3.10.3.2 Motion Detection in Service Rooms

27.21.1.3.11 Remote Viewing

27.21.1.3.11.1 The cameras shall be viewed from the Bus Operational Control Centers (BOCC) at JGB & CTF, the Security Operational Control Center (SOCC), various offices throughout WMATA, and regional partners.

27.21.1.3.12 Structured Cabling

27.21.1.3.12.1 Structure cabling shall be in accordance with WMATA's IT Design and Wiring standards.

27.21.1.3.12.2 CAT 6 cabling shall be colored yellow.

27.21.1.3.13 Naming Convention

27.21.1.3.13.1 All drawings and other design documents shall identify cameras, displays, network switches and other components using WMATA's standard naming convention.

27.21.1.3.13.2 See Video Design Drawings for a WMATA's naming convention.

27.21.1.3.14 ITS Security

27.21.1.3.14.1 The cameras and all other IP connected equipment shall comply with all WMATA IT security requirements including strong passwords, managed ports, and other related security requirements

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

WMATA DESIGN CRITERIA Bus Garage Camera Coverage				
Coverage Description	Analytics Required?	PTZ Required?	Purpose	Comments
Bus Garage Parking Lot Perimeter	Y		Intrusion Detection	100 % Perimeter Coverage
Bus Garage Parking Lot Interior			Situation Awareness	100 % Bus Movement
Bus Garage Power Service Rooms		Y	Intrusion Detection	Motion Detection
Bus Garage Generator Rooms		Y	Intrusion Detection	Motion Detection
Bus Garage COM Service Rooms		Y	Intrusion Detection	Motion Detection
Bus Garage AC Power Service Rooms		Y	Intrusion Detection	Motion Detection
Bus Garage IT Service Rooms/Closets		Y	Intrusion Detection	Motion Detection
Entry/Exits to Bus Garage Facility			Facial Recognition	60 Pixels per Foot
Entry/Exits to Material Storage Locations			Facial Recognition	60 Pixels per Foot
Entry/Exit to Buildings			Facial Recognition	60 Pixels per Foot
Storage Locations - Toolbox			Situation Awareness	
Storage Locations - Outside			Situation Awareness	
Storage Locations - Interior Parts			Situation Awareness	
Shop Bays			Situation Awareness	75 % Coverage
Office Corridors			Situation Awareness	75 % Coverage
Bus Probing & Fare Collection Area			Situation Awareness	3 Camera Views - See Details
Non-Revenue Vehicle Fueling Area			Situation Awareness	
Time Clock			Situation Awareness	

DESIGN CRITERIA

(Video Portion)

PARKING GARAGE

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.22 Parking Garage - Communication

27.22.1 Video Surveillance System

27.22.1.1 Purpose

27.22.1.1.1 The purpose of the Video Surveillance system is to provide real time and recorded video for use by all departments at WMATA as well as for viewing by our regional partners.

27.22.1.2 Design

27.22.1.2.1 The design shall be based on IP camera technology and Network Video recorders located in the communication equipment rooms. Where possible, the cabling connecting the cameras to the network switches shall be CAT6 copper connections. Small form factor network switches (packaged in NEMA 4X enclosures) shall be located to minimize fiber optic cabling. Cameras shall be provided in IP-66 enclosures.

27.22.1.2.2 The design of the video surveillance system shall be in accordance with APTA Recommended Practice APTA IT-CCTV-RP-001-11 – Selection of Cameras, Digital Recording systems, Digital High-Speed Networks and Trainlines for Use in Transit-Related CCTV Systems.

27.22.1.3 Major System Components

27.22.1.3.1 The Video Surveillance system shall include the following major components:

- 27.22.1.3.2** Cameras
- 27.22.1.3.3** Video Recording
- 27.22.1.3.4** Viewing Station
- 27.22.1.3.5** Network Connections
- 27.22.1.3.6** Video Analytics
- 27.22.1.3.7** Remote Viewing

27.22.1.4 Basis of Design

27.22.1.4.1 The basis of design for the Video Surveillance system shall be

- 27.22.1.4.1.1** Fixed View Cameras – Axis
- 27.22.1.4.1.2** Pant Tilt Zone Cameras – Axis
- 27.22.1.4.1.3** Thermal Cameras – Axis
- 27.22.1.4.1.4** Network Video Recorder – Pivot3 hardware with Verint software
- 27.22.1.4.1.5** Kiosk Viewing Station – Dell hardware with CNL software
- 27.22.1.4.1.6** Secondary Network Equipment – COMNET switches
- 27.22.1.4.1.7** Video analytics – BRS & Axis & Other
- 27.22.1.4.1.8** OCC & SOCC Viewing – Dell hardware and CNL software

27.22.1.4.2 The system shall be designed for 30 days of storage and provide viewing at viewing stations identified below.

27.22.1.5 Cameras

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.22.1.5.1** The design shall use IP cameras. These cameras may be fixed cameras, Pan-Tilt Zoom (PTZ) cameras, or Thermal cameras. The cameras shall provide a minimum of three (3) days local storage.
- 27.22.1.5.2** The design, placement, and installation of the cameras shall be coordinated with the architectural design to provide an appearance that is acceptable to the architects.
- 27.22.1.5.3** The design, placement, and installation of the cameras shall be coordinated with the station lighting to ensure that adequate illumination is provided for proper camera operation.
- 27.22.1.5.4** IP Cameras shall be configured using an enterprise software package from the camera supplier.
- 27.22.1.5.5** Cameras mounted on poles shall have conduit routed internal to pole.
- 27.22.1.5.6** External cameras directly attached to COM room switch shall be provided with surge protection.
- 27.22.1.5.7** The cameras shall be mounted to provide for easy maintenance.

27.22.1.6 Camera Coverage

- 27.22.1.6.1** The design shall provide the camera coverage detail in Table No.1 – Parking Garage Camera Coverage

27.22.2 Video Recording

- 27.22.2.1.1** A Network Video Recorder shall be installed in each COM room. The Network Recording device shall provide 30 days of video storage at a resolution that is acceptable to MTPD and Parking Operations.

27.22.2.2 Viewing Stations

- 27.22.2.2.1** The design shall provide for camera viewing in the Police Room, in the various control centers, and on the desktop computers throughout the authority.

27.22.2.3 Police Room Viewing Station

- 27.22.2.3.1** Each Police Room shall be provided with two (2) monitors connected to a computer workstation inside the Police Room. The workstation shall be running a Verint thick client. This thick client will control cameras and provide alarms inside the kiosk.

27.22.2.4 Network Connections

- 27.22.2.4.1** The IP cameras shall be connected to IP switches with Power-Over-Ethernet (POE) capability. The Ethernet switches shall be located in the COM room, located in the Kiosk, or in located in NEMA 4X enclosures connected to MetroNET and placed strategically throughout the rail system.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.22.2.4.2 See Video Design Drawings for a typical NEMA 4X network enclosure.

27.22.2.5 Video Analytics

27.22.2.5.1 N/A

27.22.2.6 Remote Viewing

27.22.2.6.1 The cameras shall be viewed from the kiosks, the dispatcher's office, the Rail Operational Control Centers (ROCC) at JGB & CTF, the Security Operational Control Center (SOCC), various offices throughout WMATA, and regional partners.

27.22.2.7 IT Security

27.22.2.7.1 The cameras and all other IP connected equipment shall comply with all WMATA IT security requirements including strong passwords, managed ports, and other related security requirements

WMATA DESIGN CRITERIA Parking Garage Camera Coverage				
Coverage Description	Analytics Required?	PTZ Required?	Purpose	Comments
Pedestrian Walkways to/from Stations			Situation Awareness	
Call For Aid Boxes		Y	Situation Awareness	Coverage of Person
Elevators Cabs			Situation Awareness	360 Degree Cameras
Elevators Landings			Situation Awareness	
Entrance Lanes - Car Driver Faces			Facial Recognition	
Entrance Lanes - Car License Plates			License Plates	
Exit Lanes - Car Driver Faces			Facial Recognition	
Exit Lanes - Car License Plates			License Plates	
Pedestrian Entrances		Y	Facial Recognition	100 % Coverage
COM Rooms		Y	Facial Recognition	
Stairway Landings		Y	Situation Awareness	
AC Rooms		Y	Facial Recognition	
Police Rooms			Situation Awareness	
Bike Racks			Situation Awareness	
Parking Deck			Situation Awareness	75 % Parking Deck
WMATA Bus Bays			Situation Awareness	85 % Coverage
High level View		Y	Situation Awareness	100 % Building Corners

DESIGN CRITERIA

(Video Portion)

RAIL SYSTEM

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.23 Rail Facilities - Communication

27.23.1 Video Surveillance System

27.23.1.1 Purpose

- 27.23.1.1.1** The purpose of the Video Surveillance system is to provide real time and recorded video for use by all departments at WMATA as well as for viewing by our regional partners.

27.23.1.2 Design

- 27.23.1.2.1** The design shall be based on IP camera technology and Network Video recorders located in the station communication equipment rooms. Where possible, the cabling connecting the cameras to the network switches shall be CAT6 copper connections. Small form factor network switches (packaged in NEMA 4X enclosures) shall be located throughout the station to minimize fiber optic cabling. Both fixed-lens cameras and pan tilt zoom cameras shall be provided in IP-66 enclosures.
- 27.23.1.2.2** The design of the video surveillance system shall be in accordance with APTA Recommended Practice APTA IT-CCTV-RP-001-11 – Selection of Cameras, Digital Recording systems, Digital High-Speed Networks and Trainlines for Use in Transit-Related CCTV Systems.

27.23.1.3 Major System Components

- 27.23.1.3.1** The Video Surveillance system shall include the following major components:
 - 27.23.1.3.1.1** Cameras
 - 27.23.1.3.1.2** Video Recording
 - 27.23.1.3.1.3** Viewing Station
 - 27.23.1.3.1.4** Network Connections
 - 27.23.1.3.1.5** Video Analytics
 - 27.23.1.3.1.6** Remote Viewing

27.23.1.4 Basis of Design

- 27.23.1.4.1.1** The basis of design for the Video Surveillance system shall be

- 27.23.1.4.1.1.1** Fixed View Cameras – Axis
- 27.23.1.4.1.1.2** Pant Tilt Zone Cameras – Axis
- 27.23.1.4.1.1.3** Thermal Cameras – Axis
- 27.23.1.4.1.1.4** Network Video Recorder – Pivot3 hardware with Verint software
- 27.23.1.4.1.1.5** Kiosk Viewing Station – Dell hardware with CNL software
- 27.23.1.4.1.1.6** Secondary Network Equipment – COMNET switches
- 27.23.1.4.1.1.7** Video analytics – BRS & Axis
- 27.23.1.4.1.1.8** OCC & SOCC Viewing – Dell hardware and CNL software

- 27.23.1.4.1.2** The system shall be designed for 30 days of storage and provide viewing at viewing stations identified below.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.23.1.5 Cameras

- 27.23.1.5.1** The design shall use IP cameras. These cameras may be fixed cameras, Pan-Tilt Zoom (PTZ) cameras, or Thermal cameras. The cameras shall provide a minimum of three (3) days local storage.
- 27.23.1.5.2** The design, placement, and installation of the cameras shall be coordinated with the architectural design to provide an appearance that is acceptable to the architects.
- 27.23.1.5.3** The design, placement, and installation of the cameras shall be coordinated with the station lighting to ensure that adequate illumination is provided for proper camera operation.
- 27.23.1.5.4** IP Cameras shall be configured using an enterprise software package from the camera supplier.
- 27.23.1.5.5** Cameras mounted on poles shall have conduit routed internal to pole.
- 27.23.1.5.6** External cameras directly attached to COM room switch shall be provided with surge protection.
- 27.23.1.5.7** The cameras shall be mounted to provide for easy maintenance.

27.23.1.6 Camera Coverage

- 27.23.1.6.1** The design shall provide the camera coverage detail in Table No.1 – Rail System Camera Coverage

27.23.1.6.2 Video Recording

- 27.23.1.6.2.1** A Network Video Recorder shall be installed in each COM room. The Network Recording device shall provide 30 days of video storage at a resolution that is acceptable to MTPD and Rail Operations.

27.23.1.6.3 Viewing Stations

- 27.23.1.6.3.1** The design shall provide for camera viewing in the kiosks, in the Guard Shacks, in the Yard Masters office, in the dispatchers End of Line office, in the various control centers, and on the desktop computers throughout the authority.

27.23.1.6.4 Kiosk Viewing Station

- 27.23.1.6.4.1** Each kiosk shall be provided with four (4) monitors mounted up high on the inside of the kiosk and two (2) touch screens mounted on the cabinets inside the kiosk. These four (4) monitors and two (2) touch screens shall be connected to a computer workstation inside the cabinets internal to the kiosk. The workstation shall be running a CNL thick client. This thick client will control cameras and provide alarms inside the kiosk.

27.23.1.6.5 Guard Shack Viewing Station

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.23.1.6.5.1 Each guard shack shall be provided with four (4) monitors mounted up high on the inside of the guard shack. These four (4) monitors shall be connected to a computer workstation inside the guard shack. The workstation shall be running a CNL thick client. This thick client will control cameras and provide alarms inside the guard shack.

27.23.1.6.6 Yard Master Viewing Station

27.23.1.6.6.1 Each Yard Master Office shall be provided with four (4) monitors. These four (4) monitors shall be connected to a computer workstation that is running a CNL thick client. This thick client will control cameras and provide alarms.

27.23.1.6.7 End of Line Dispatch Office Viewing Station

27.23.1.6.7.1 The design shall provide camera viewing at End of Line dispatch offices. Each dispatch office shall be provided with a workstation, mounting hardware and a minimum of four monitors.

27.23.1.6.8 Network Connections

27.23.1.6.8.1 The IP cameras shall be connected to IP switches with Power-Over-Ethernet (POE) capability. The Ethernet switches shall be located in the COM room, located in the Kiosk, or in located in NEMA 4X enclosures connected to MetroNET and placed strategically throughout the rail system.

27.23.1.6.8.2 See Video Design Drawings for a typical NEMA 4X network enclosure.

27.23.1.6.9 Video Analytics

27.23.1.6.9.1 Video analytics shall be provided at each station, rail yard, or other locations.

27.23.1.6.9.2 Video analytics software can either reside on the end device or may reside on a dedicated server in the COM room.

- 27.23.1.6.9.2.1** As a minimum, the video analytics shall detect and alarm:
- 27.23.1.6.9.2.2** Unauthorized access into the Right of Way whether falling or jumping
- 27.23.1.6.9.2.3** Unauthorized passage though End of Platform gates
- 27.23.1.6.9.2.4** Intrusion Detection on the Rail Yard Perimeter
- 27.23.1.6.9.2.5** Motion Detection on Vent/Shafts
- 27.23.1.6.9.2.6** Motion Detection in Service Rooms

27.23.1.6.10 Remote Viewing

27.23.1.6.10.1 The cameras shall be viewed from the kiosks, the dispatcher's office, the Rail Operational Control Centers (ROCC) at JGB & CTF, the Security Operational Control Center (SOCC), various offices throughout WMATA, and regional partners.

27.23.1.6.11 ITS Security

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.23.1.6.11.1 The cameras and all other IP connected equipment shall comply with all WMATA IT security requirements including strong passwords, managed ports, and other related security requirements

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

WMATA DESIGN CRITERIA Rail System Camera Coverage					
Coverage Description	Analytics Required?	PTZ Required?	Purpose	Comments	
Stations - Public Area					
Platforms			Situation Awareness	95 % Coverage	
Platforms Edges	Yes		Support Analytics	100 % Platform Edge Coverage	
Track Bed in Station	Yes		Situation Awareness	100 % Coverage	
End of Platforms - Facing Platform			Facial Recognition		
End of Platforms - Facing Track			Situation Awareness	Thermal Camera	
Station Entrance Escalators			Situation Awareness	100 % Landings & 80 % Travel	
Station Escalators			Situation Awareness	100 % Landings & 50 % Travel	
Passageway from Entrance To Kiosk			Situation Awareness	100%	
Fare Vending Machines			Situation Awareness	Theft & Vandalism Protection	
Fare Gate Array			Situation Awareness		
Entrance Elevators Cabs				360 Degree Cameras	
Entrance Elevators Landings					
Kiosks - Facing Entrance			Facial Recognition at Chokepoints	Crown of Kiosks - 60 Pixels / foot	
Kiosks - Facing Exit			Facial Recognition	Crown of Kiosks - 60 Pixels / foot	
Areas of Rescue Assistance (AORA)		Y	Situation Awareness		
Pedestrian Bridges			Situation Awareness	95 % Coverage	
Entrance Canopies		Y	Facial Recognition		
Call For Aid Boxes		Y		Coverage of Person	

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.24 Fire Detection and Alarm System

27.24.1 Purpose

27.24.1.1 The purpose of the Fire Alarm system is to detect a fire and provide audible and visual warnings to assist Washington Metropolitan Area Transit Authority (WMATA) employees in protecting the public, fellow employees, and WMATA property.

27.24.2 Design

27.24.2.1 The design shall be in accordance with NFPA 72 and all local fire codes. In cases of conflict local codes will prevail.

27.24.2.2 The design shall provide an addressable, electrically supervised, closed circuit fire detection and system for the Rail Transit System. The design shall include Fire Detectors located in passenger stations and associated ancillary buildings. Detectors such as fixed temperature fire detectors, combination rate of rise/fixed temperature fire detectors, combination smoke/fixed temperature detectors, products of combustion detectors, duct detectors (in ventilation systems) and water flow switches, shall be included. Ionization detectors with extra contacts to operate the deluge solenoid shall be provided at single-entrance passenger stations.

27.24.2.3 Audible and visual alarms and indications shall be provided in the station Kiosks. An alarm and trouble shall be sent to both JGB-OCC and CTF-OCC via DTS and Network connection. These signals shall be displayed at the Security Operational Control Center (SOCC) when it becomes operational.

27.24.2.4 Manual Pull Stations with local audible/visual alarms (typically a horn/strobe-light) shall be located in hallways connecting passenger station service rooms to the public areas.

27.24.2.5 Manual Pull Stations with local audible/visual alarms (typically a horn/strobe-light) shall be located in the kiosks.

27.24.2.6 Activation of a Manual Pull Station shall cause a Fire Alarm and energize the audible/visual alarm on the Kiosk Annunciator.

27.24.2.7 The design shall include automatic and permanent recording of a fire alarm. This record shall include date, time, and location of each alarm and trouble.

27.24.3 Major System Components

27.24.3.1 The design of the FIA System shall include the following major components:

- 27.24.3.1.1** Common Control Unit
- 27.24.3.1.2** Kiosk Fire Alarm Annunciator Panel
- 27.24.3.1.3** Fire Alarm System Interfaces

27.24.4 Basis of Design

27.24.4.1 The basis of design for the fire alarm system is the Edwards EST3 addressable fire alarm system.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.24.5 Common Control Unit

27.24.5.1 A Common Control Unit shall be located in the Communications Equipment Room and shall contain all the logic, software and circuitry required to supervise and control the Fire and Intrusion Detectors.

27.24.5.2 The Common Control Unit shall be modular in construction and provide for ease of maintenance and expansion. It shall contain trouble circuitry powered from a dedicated power source that electrically supervises all zone circuit wiring for a "Short" or an "Open."

27.24.5.3 The Common Control Unit shall support the following functions:

27.24.5.3.1 Provide audible and visual "Alarm" indications at the Kiosk Annunciator Panel

27.24.5.3.2 Provide audible and visual "Alarm" indications at the Kiosk Annunciator Panel

27.24.5.3.3 Provide contact closures to indicate "Alarm" conditions

27.24.5.3.4 Provide contact closures to indicate "Trouble" conditions

27.24.5.3.5 Provide a network interface for connection to the Fire Alarm head end

27.24.5.3.6 Provide a phone interface for connection to the Fire alarm head end

27.24.5.3.7 Provide common system controls at the Kiosk FIA Annunciator Panel

27.24.5.4 The Common Control Unit shall be provided with twenty-four (24) hours of battery backup for panel, sensors, and alarm indicators.

27.24.5.5 The Common Control Unit shall utilize a fused neutral line design. The neutral line shall be supervised and the indication of a blown fuse shall illuminate the LED integrated in the reset pushbutton located on the Kiosk FIA Annunciator Panel.

27.24.6 Kiosk Fire Alarm (FA) Annunciator Panel

27.24.6.1 A Kiosk FA Annunciator Panel shall be located in each passenger station Kiosk and contain indicators identifying the "Alarm" condition and "Trouble" condition of each detector.

27.24.6.2 The Kiosk FA Annunciator Panel shall contain an audible Annunciator that indicates an alarm condition by using one tone and indicates a trouble condition by using a different tone.

27.24.6.3 The Kiosk FA Annunciator Panel shall also include the following indicators and pushbuttons for common system controls:

27.24.6.3.1 Trouble Silence Momentary Contact Pushbutton

27.24.6.3.2 Alarm Acknowledge Momentary Contact Pushbutton

27.24.6.3.3 Reset Momentary Contact Pushbutton with integral LED

27.24.6.3.4 Lamp (LED) Test Momentary Contact Pushbutton

27.24.6.3.5 Power "On" Indicator

27.24.6.3.6 Manual Fire Alarm Pushbutton

27.24.7 Fire Alarm System Interfaces

27.24.7.1 The design of the Fire Detection System shall provide controls and/or interfaces with the following systems and equipment:

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.24.7.1.1 Ventilation Fans

27.24.7.1.1.1 Selected ventilation fans shall shutdown when a Fire Alarm associated with an area being serviced by a ventilation fan is initiated in a passenger station room or an ancillary building within the passenger station

27.24.7.1.2 Sprinkler System

27.24.7.1.2.1 Tamper switches shall detect any movement of the Fire Main manual shut-off valves and provide a "Trouble" condition for the associated Sprinkler System.

27.24.7.1.3 Fare Gates

27.24.7.1.3.1 The Fare Gates shall open when a Fire Alarm is initiated in a passenger station room or an ancillary building within the passenger station

27.24.7.1.4 Entrance Escalators

27.24.7.1.4.1 The Entrance Escalators shall stop when a Fire Alarm is initiated in a passenger station room or an ancillary building within the passenger station

27.24.7.1.5 Elevator Machine Room

27.24.7.1.5.1 All elevators associated with the Elevator Machine Room that travel more than 25 feet, shall immediately return to a designated level when a Fire Alarm is initiated in a passenger station room or an ancillary building within the passenger station. Additionally elevator cab controls (except for emergency controls) shall be rendered inoperative as long as smoke is detected within the associated Elevator Machine Room.

27.24.7.1.6 Public Address

27.24.7.1.6.1 The Fire Alarm system shall provide a canned message to the station Public Address system when a Fire Alarm is initiated in a passenger station room or an ancillary building within the passenger station. After a predetermined time delay, a "Reset" circuit shall be provided that will silence the Fire Alarm warning being broadcast by the PA system.

27.24.8 Intrusion Detection and Alarm System

27.24.8.1 Purpose

27.24.8.1.1 The purpose of the Intrusion Alarm system is to detect an unauthorized intrusion and provide an intrusion alarm to assist Washington Metropolitan Area Transit Authority (WMATA) employees in protecting the public, fellow employees, and WMATA property.

27.24.8.2 Design

27.24.8.2.1 The design shall be an addressable, electrically supervised, closed circuit intrusion detection system for the Rail Transit System. The design shall include intrusion detection devices such as tape or switches and shall be provided on doors, windows, louvers, and other intrusion points as required in substations, passenger stations, tie-breaker stations, fan and vent shafts, AFC machines, train control and communications buildings which require protection against unauthorized entry.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.24.8.2.2 An Intrusion Detection System shall be installed in the passenger station, equipment areas, ancillary buildings within the passenger station limits and ancillary buildings or outside areas located along the right-of-way that are accessible to the public. Intrusion Detectors shall provide alarms indicating unauthorized entry for each of the following conditions:

27.24.8.2.2.1 A broken or opened window connected to a public or outside area.

27.24.8.2.2.2 A broken or opened air duct cover, louver or grating connected to a public or outside area, if the shortest side is greater than six inches.

27.24.8.2.2.3 A protected door when opened.

27.24.8.2.3 Audible and visual alarms and indications shall be provided in the station Kiosks. An alarm and trouble shall be sent to both JGB-OCC and CTF-OCC via DTS and Network connection. These signals shall be displayed at the Security Operational Control Center (SOCC) when it becomes operational.

27.24.8.2.4 The design shall alarm the following:

27.24.8.2.4.1 Automatic Fare Collection Equipment Intrusion Alarm

27.24.8.2.4.2 Revenue Cart Storage Area Intrusion Alarm

27.24.8.2.4.3 Ancillary Structure Intrusion Alarm

27.24.8.2.4.4 Rail Station Intrusion Alarm

27.24.8.2.4.5 Tie Breaker Station Intrusion Alarm

27.24.8.2.4.6 Traction Power Substation Intrusion Alarm

27.24.8.2.5 The design shall include automatic and permanent recording of an intrusion alarm. This record shall include date, time, and location of each alarm and trouble.

27.24.8.3 Major System Components

27.24.8.3.1 The Intrusion Detection System shall include the following major components:

27.24.8.3.1.1 Intrusion Detection Devices

27.24.8.3.1.2 Alarm Indications

27.24.8.3.1.3 Special Protection Devices

27.24.8.4 Basis of Design

27.24.8.4.1 The basis of design for the intrusion and detection system is the Edwards EST3 platform.

27.24.8.4.2 The current Edwards EST3 system combined both a Fire Alarm system, an Intrusion Detections system, and an Access Control system in the same integrated platform.

27.24.8.5 Specific Location for Intrusion Detection

27.24.8.5.1 The design shall incorporate the latest state-of-the-art intrusion detectors. The following criteria shall be used in the design layout of Intrusion Detection:

27.24.8.5.2 Intrusion Detector shall be provided on each entrance elevator door

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.24.8.5.3** Intrusion Detector shall be provided on each fare collection equipment array
- 27.24.8.5.4** Intrusion Detector shall be provided on protected doors to areas containing multiple rooms or corridors
- 27.24.8.5.5** Intrusion Detector shall be provided on each door of ancillary buildings along the right-of-way
- 27.24.8.5.6** Intrusion Detector shall be provided on each door of the Tie Breaker Station
- 27.24.8.5.7** Intrusion Detector shall be provided on each door of the Traction Power Substation
- 27.24.8.5.8** Trip wire and window tape shall be provided across louver openings and windows
- 27.24.8.5.9** Magnetic Switches shall be used on grates and doors to detect when they are opened
- 27.24.8.5.10** Intrusion Detectors shall be weather tight or installed in a Weather tight enclosure
- 27.24.8.5.11** Tamperproof Intrusion Detectors shall be provided

27.24.8.6 Special Protection Areas

- 27.24.8.6.1** Doors leading from an outside or public area into a protected zone, including roll-up doors, shall be furnished with additional features.
- 27.24.8.6.2** A key-operated access control switch, a non-locking pushbutton switch, and a magnetic switch shall be provided
- 27.24.8.6.3** Roll-up doors shall be equipped with only a key-operated access control switch and a magnetic switch

DESIGN CRITERIA

(Access Control Portion)

BUS GARAGE

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.25 Bus Garage - Access Control System

27.25.1 Purpose

27.25.1.1 The purpose of the Access Control system is to limit access into service rooms and other areas of concern to authorized WMATA employees and/or contractors. Additionally, the Access Control system shall keep a record of who enters each room.

27.25.2 Design

27.25.2.1 The design shall include automatic and permanent recording of each entry and/or exit. This record shall include date, time, and location of each alarm and trouble.

27.25.3 Major System Components

27.25.3.1 The Access Control system shall include the following major components:

- 27.25.3.1.1** Card Reader
- 27.25.3.1.2** Access Controller
- 27.25.3.1.3** Request To Exit Sensor
- 27.25.3.1.4** Door Contact Switch
- 27.25.3.1.5** Door Strike

27.25.4 Basis of Design

27.25.4.1 The basis of design for the Access Control system is a Honeywell Prowatch platform using a HID card reader with a Weigand interface. WMATA plans to change credentials in the future and at some point in the future will go to a MiFare Plus card reader.

27.25.5 Specific Locations for Access Control

27.25.5.1 Access Control shall be provided at the following locations within the station and along the right of way:

- 27.25.5.1.1** Electrical Service Rooms
- 27.25.5.1.2** Communication Service Room
- 27.25.5.1.3** Mechanical Service Room
- 27.25.5.1.4** Parts & Material Storage Locations
- 27.25.5.1.5** Tool Cribs
- 27.25.5.1.6** Clerk's Office
- 27.25.5.1.7** Pedestrian Entrances
- 27.25.5.1.8** Human Resource Office
- 27.25.5.1.9** Police Office
- 27.25.5.1.10** Superintendent Offices
- 27.25.5.1.11** Locations where high value items stored

27.26 Access Control System (RAIL)

27.26.1 Purpose

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.26.1.1 The purpose of the Access Control system is to limit access into service rooms and other areas of concern to authorized WMATA employees and/or contractors. Additionally, the Access Control system shall keep a record of who enters each room.

27.26.2 Design

27.26.2.1 The design shall include automatic and permanent recording of each entry and/or exit. This record shall include date, time, and location of each alarm and trouble.

27.26.3 Major System Components

27.26.3.1 The Access Control system shall include the following major components:

27.26.3.2 Card Reader

27.26.3.3 Access Controller

27.26.3.4 Request To Exit Sensor

27.26.3.5 Door Contact Switch

27.26.3.6 Door Strike

27.26.4 Basis of Design

27.26.4.1 The basis of design for the Access Control system is the Edwards EST3 platform. However, Edwards is not advancing the Access Control portion of this work anymore. There, Prowatch is also being used as the basis of design for limited application. The current Edwards EST3 system combined both a Fire Alarm system, an Intrusion Detections system, and an Access Control system in the same integrated platform.

27.26.5 Specific Locations for Access Control

27.26.5.1 Access Control shall be provided at the following locations within the station and along the right of way:

27.26.5.2 Train Control Room

27.26.5.3 Communication Service Room

27.26.5.4 AC Rooms (typically two per station)

27.26.5.5 Traction Power Substation

27.26.5.6 Tie Breaker Station

27.27 Call-For-Aid System

27.27.1 Purpose

27.27.1.1 The purpose of the Call-For-Aid system is to provide emergency communication between people (employees or patrons) on the platform and the kiosk (or rollover location). Additionally, the Call-For-Aid system provides for emergency communications between the people (employees or patrons) using the station elevators and the kiosk (or rollover location).

27.27.2 Design

27.27.2.1 The Call-For-Aid System shall provide a means of reporting emergency situations from the passenger station platforms to the Station Manager(s). Intercom facilities between Call Station Panels mounted on pylons (approximately 200 feet from the end of each platform)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

and a control panel within the station Kiosk shall permit easy verbal communications between the Station Manager and Rail System passengers.

27.27.2.2 Previously, the Call-for-Aid system was known as the Passenger Emergency Reporting System (PERS) or Raimax system.

27.27.3 Major System Components

27.27.3.1 The Call-for-Aid System shall include the following major equipment:

- 27.27.3.1.1** Kiosk Call-For-Aid Control Panel (located in the Kiosk)
- 27.27.3.1.2** Call-For-Aid Control Unit (located in COM room)
- 27.27.3.1.3** Integrated Power Amplifier (located in COM room)
- 27.27.3.1.4** Call Station Panels
- 27.27.3.1.5** Platform (located at designated positions on the station platform)
- 27.27.3.1.6** Elevator Landing Call Station Panel (located on each station elevator landing)
- 27.27.3.1.7** Elevator Cab Call Station Panel (located in each station elevator cab station)
- 27.27.3.1.8** Kiosk Exterior Speaker Horn/Light (located on the top of the Kiosk)

NOTE: The Call for Aid system on parking garages elevators is a separate system than the Call-For-Aid system within the station.

27.27.4 Basis of Design

27.27.4.1 The basis of design for the Call-For-Aid system is Commend.

27.27.4.2 The Kiosk Call-For-Aid Control Panel design shall provide the interface point between the Station Manager and the Call-for-Aid system. The Call-For-Aid Control Panel shall be mounted in the kiosk and shall provide the controls, indications and input/output devices to the Station Manager.

27.27.4.3 As a minimum the Call-For-Aid Control Panel design shall include:

- 27.27.4.3.1** A Push-To-Call pushbutton switch with an LED indicator for each Call Station. This switch shall control a half duplex audio path to each Call Station.
- 27.27.4.3.2** A monitor speaker.
- 27.27.4.3.3** A timer circuit to inhibit automatic termination of an emergency call.
- 27.27.4.3.4** The capability to transfer an emergency call to the Operation Control Center.
- 27.27.4.3.5** A Call-For-Aid Reset Switch to restore the PERS system to its normal condition ready to receive the next emergency call.
- 27.27.4.3.6** Call-For-Aid Control Unit

27.27.4.4 The Call-For-Aid Control Unit design shall provide the required interfaces between the Kiosk Call-For-Aid Control Panel, the Call Station Panels, and the Integrated Power. The Call-For-Aid Control Unit design shall accommodate four Call Station Panels and shall be able to:

- 27.27.4.4.1** Establish and control the audio paths between the Call Station Panels and the Kiosk Call-For-Aid Control Panel(s).
- 27.27.4.4.2** Detect calls initiated at the Call Station Panels and provide appropriate outputs for indications on the Kiosk Call-For-Aid Control Panel.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.27.4.4.3** Provide signals to a Kiosk Exterior Speaker Horn (to generate a chime) and to a calling Call Station Panel (to generate a call-waiting tone) to indicate that an emergency call has been initiated at that Call Station Panel.
 - 27.27.4.4.4** Provide the appropriate dc power, ground and reset control paths to the Call Station Panels.
 - 27.27.4.4.5** Provide the appropriate outputs for the control of the talk/listen functions of the Call Station Panels.
 - 27.27.4.4.6** Automatically terminate an unanswered call, after the preset time period.
 - 27.27.4.4.7** Provide the appropriate interfaces to the Call Station Panels and the Kiosk Call-For-Aid Control Panel for the activation and termination of the call waiting tone.
 - 27.27.4.4.8** Detect the loss of dc power over a 10 second interval ("FAULT") at each of the Call Station Panels, and then provide the appropriate outputs for the FAULT indication on the Kiosk Call-For-Aid Control Panel.
 - 27.27.4.4.9** Provide the appropriate interfaces for the connections of the Call Station Panels and the Kiosk Call-For-Aid Control Panel to the Call-For-Aid Control Unit.
 - 27.27.4.4.10** Provide signals to a Kiosk Exterior Speaker Horn/Light, to generate a chime/tone, to indicate that the Automatic Public Address Announcement System (APAAS) has been activated.
 - 27.27.4.4.11** The design shall provide a PAS/Call-For-Aid Muting Circuit in the passenger station Kiosk to mute the monitor loudspeaker of the Kiosk Public Address System Control Panel when the "PUSH-TO-TALK" pushbutton on the Kiosk Call-For-Aid Control Panel is depressed. This shall prevent the possibility of creating an acoustical feedback path between the Call-For-Aid and the Public Address System.
 - 27.27.4.4.12** Integrated Power Amplifier
 - 27.27.4.4.13** As a minimum the Integrated Power Amplifier design shall provide the audio amplification necessary to simultaneously drive any combination of the four Call Station Panel speakers and the Kiosk Call-For-Aid Control Panel monitor speaker, the necessary audio pre-amplification adjustments, audio filtering and chime generation.
 - 27.27.4.4.14** Platform Call Station Panels
 - 27.27.4.4.15** The Call Station Panel design shall provide the interface points between the WMATA Rail System patrons and the Call-For-Aid System. The Call Station Panels shall provide the controls, indications, input/output devices, and instructions which are necessary for the patrons to operate the Call-For-Aid System.
 - 27.27.4.4.16** As a minimum the design shall include a loudspeaker and a contact pushbutton switch on the Call Station Panel to initiate an emergency call between that Call Station Panel and the Kiosk Call-For-Aid Control Panel.
 - 27.27.4.4.17** Two Platform Call Station Panels shall be mounted on each center platform for a total of two Platform Call Station Panels in each center platform station.
 - 27.27.4.4.18** Two Platform Call Station Panels shall be mounted on each split platform for a total of four Platform Call Station Panels in each split platform station.
 - 27.27.4.4.19** A Call-For-Aid Call Station panel shall be provided on the each and every landing of all station elevators.
 - 27.27.4.4.20** A Call-For-Aid Call Station panel shall be provided in each and every cab of all station elevators.
 - 27.27.4.4.21** Kiosk Exterior Speaker Horns
- 27.27.4.5** The design shall include Kiosk Exterior Speaker Horns/Lights to provide for the broadcasting of the chime/tone that indicates an emergency call has been initiated at a Call Station Panel. It shall provide for the broadcasting of the chime/tone that indicates activation of the Automatic Public Address Announcement System.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.27.5 Information Display Systems

27.27.5.1 Purpose

- 27.27.5.1.1** The purpose of the Information Display system is to provide real time digital signage information to rail customers.

27.27.5.2 Design

- 27.27.5.2.1** There are two major information display systems in each rail station. The first system is called the Passenger Information Display System (PIDS) and the second system is the Kiosk Information Display System (KIDS).
- 27.27.5.2.2** The PIDS is designed to provide train arrival information and the displays are mounted along the platform.
- 27.27.5.2.3** The KIDS is designed to provide general rail system information or alerts and the displays are mounted on the Kiosk. The specific purpose of this display is to inform the public about service disruption prior to the public entering the paid portion of the station.

27.27.5.3 Major System Components

- 27.27.5.3.1** The Information Display system shall include the following major components:

- 27.27.5.3.1.1** Passenger Information Display System
- 27.27.5.3.1.2** OCC Head End
- 27.27.5.3.1.3** Ethernet Connection from COM room switch to Converter
- 27.27.5.3.1.4** Station COM Room Converter
- 27.27.5.3.1.5** RS-485 Cabling
- 27.27.5.3.1.6** Platform Display
- 27.27.5.3.1.7** Platform Display Mounting Bracket
- 27.27.5.3.1.8** Kiosk Information Display system
- 27.27.5.3.1.9** Software Head End
- 27.27.5.3.1.10** Ethernet Connection to Network Switch
- 27.27.5.3.1.11** Digital Media Player
- 27.27.5.3.1.12** HDMI Cable
- 27.27.5.3.1.13** Kiosk Display
- 27.27.5.3.1.14** Mounting Bracket

27.27.5.4 Basis of Design

- 27.27.5.4.1** The basis of design for the Information Display shall be as follows:

- 27.27.5.4.1.1** PIDS Display -
- 27.27.5.4.1.2** PIDS Head End Software - COMNET
- 27.27.5.4.1.3** KIDS Display - Ciil
- 27.27.5.4.1.4** KID Head End Software -
- 27.27.5.4.1.5** KIDS Media Player - Cisco

27.27.5.4.2 Passenger Information Display System (PIDS)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.27.5.4.2.1 The location of the platform information display shall be in accordance with ADA requirements. New stations shall be provided with a minimum of two displays along each track. Fonts and display images shall be in accordance with ADA requirements.

27.27.5.4.2.2 A platform display shall be provided on the platform at each location where a station entrance elevator is located on the platform.

27.27.5.4.3 Kiosk Information Display System (KIDS)

27.27.5.4.3.1 The location of the kiosk information display shall be in accordance with ADA requirements. New stations shall be provided with a minimum of one display. Fonts and display images shall be in accordance with ADA requirements.

27.27.5.4.3.2 A minimum of one Kiosk Information Display shall be mounted on each kiosk. Some kiosk locations may require two Kiosk Information Displays to be mounted. The display shall be readable when traveling from the Non-Paid to the Paid portion of the station entrance.

27.27.5.5 Kiosk System

27.27.5.5.1 Design

27.27.5.5.1.1 The purpose of the Kiosk System is to provide the Kiosk with the equipment needed to monitor and control passenger station Communications Systems, Fire and Intrusion Alarm Systems, wire and cabling interconnections from parking garage booth's unified fare technology (UFT) and fare collection equipment, elevators and escalators, and to provide an effective communications interface with the public (passengers). At least one Kiosk is located in each passenger station of the Washington Metropolitan Area Transit Authority (WMATA) Rail Rapid Transit System. It is the focal point of activity at each passenger station.

27.27.5.5.1.2 The design shall provide all facilities necessary to monitor and control the passenger station systems. It shall include the Kiosk cabinets, system interface panels, cabling and cable termination facilities and monitoring and control panels for the various systems, facilities and equipment in the passenger stations. It shall include fire and intrusion facilities for protection of the Kiosk and electrical power facilities for the panels, monitors and control.

27.27.5.5.1.3 Cabinet Facilities - As a minimum, the design shall include cabinet facilities for the following items:

- 27.27.5.5.1.3.1** Telephone Instruments
- 27.27.5.5.1.3.2** Public Address System Panel
- 27.27.5.5.1.3.3** Video Surveillance Viewing System
- 27.27.5.5.1.3.4** Fire Alarm Annunciator
- 27.27.5.5.1.3.5** Call-For-Aid Control Panel
- 27.27.5.5.1.3.6** Elevator Monitor and Control Panel
- 27.27.5.5.1.3.7** Escalator Monitor and Control Panel
- 27.27.5.5.1.3.8** Kiosk Attendant/Passenger Intercom System

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.27.5.5.1.4** Interfaces - The design shall include interface between the various panels, monitors and controls and their respective system central control facilities.
- 27.27.5.5.1.5** Performance - The design shall ensure that the system performance of each panel, monitor and control is in compliance with the system performance requirements of the system of which it is a part.
- 27.27.5.5.1.6** Kiosk Construction - It has been the Authority's past practice to include the construction and installation of the station Kiosk in the Communications Contract. The detailed specifications and drawings pertaining to this portion of the work will be supplied by the Authority to the Communications Designer. These drawings and specifications shall be incorporated into the Kiosk & Communications Systems procurement documents.

27.27.5.6 Operations Control Center - Communications

27.27.5.6.1 General

- 27.27.5.6.1.1** The Jackson Graham Building houses the headquarters and associated offices of the management, administration and operations of the Washington Metropolitan Area Transit Authority (WMATA).
- 27.27.5.6.1.2** Located in this building is the Operations Control Center from which is exercised the centralized control of the Rail Rapid Transit System (METRORAIL) and the WMATA Bus System (METROBUS) and the train control and communications systems necessary to support these operations.
- 27.27.5.6.1.3** Located in the Communications Equipment Area of this building is the equipment that provides the hub of the system-wide communications network. Radiating from this centralized equipment the communication service extends throughout the transit property to trains, buses, administrative, transportation, maintenance and security vehicles, passenger stations, yards, ancillary buildings, wayside areas, security and transit police.
- 27.27.5.6.1.4** The central control facility contains a control computer, a hot backup computer, and an additional computer for software development which also serves as another level of backup for the main computer. The control computer receives and transmits messages between the operations control center and station locations via the Carrier Transmission System (CTS) to the Data Transmission System's remote terminal units (RTUs) in the field locations. The central control computer communicates with the central control operator by providing displays on a large scale display and video monitors (CRTs) and accepting operator input from the consoles.
- 27.27.5.6.1.5** The control computer performs schedule adjustments by changing dwell times and inter-station run times, both of which are sent over communications channels to the station RTUs via the DTS. The telephone system provides the means for console operators to contact needed personnel or to report to management.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.27.5.6.1.6 The general communications functions provided to aid the central control operators are:

27.27.5.6.1.6.1 Public Address Display and Control System

27.27.5.6.1.7 The central control facility for the Public Address System is equipped with an electronic switching system, stand-alone central electronics equipment, and touch screen displays. Through the touch screen displays the operator can make an assortment of pre-recorded announcements.

27.27.5.6.2 Description

27.27.5.6.2.1 The Public Address (PA) consoles are installed in the Rail OCC Passenger Operations consoles. The PA consoles are an integral part of the Public Address Control System provided by Penta Corporation, serving as the means for accessing the PA system.

27.27.5.6.2.2 Each PA console is comprised of the following components:

- 27.27.5.6.2.2.1** PA console Central Processor Unit (CPU)
- 27.27.5.6.2.2.2** Touch screen CRT
- 27.27.5.6.2.2.3** mouse
- 27.27.5.6.2.2.4** headset
- 27.27.5.6.2.2.5** foot switch
- 27.27.5.6.2.2.6** microphone
- 27.27.5.6.2.2.7** console speaker panel
- 27.27.5.6.2.2.8** keyboard

27.27.5.6.3 Keying Stations

27.27.5.6.3.1 In order to make announcements to the connected stations, they must be keyed by pressing one of the console PTT switches. There are three PTT switches available. PTT on the microphone panel; PTT on the headset; and the foot switch. Activating any of the PTT switches results in audio being transmitted over the stations in the Connect list.

27.27.5.6.3.2 Intercom Use - Each console has the same ability to connect to another console for communication as it has for any station. The intercom link is established when the connected console answers a call.

27.27.5.7 Public Address Console Equipment

27.27.5.7.1 PA Console CPU - The Central Processor Unit (CPU) is the main portion of the PA console. There are power, reset, and turbo activation switches on the front of the CPU, as well as connectors on the back for the monitor, mouse, and the console speaker panel. Each Passenger Operations Console supports two PA consoles. The CPUs are installed on the back table at either end of the operations console, as they require no hands-on contact during normal daily operations.

27.27.5.7.2 Touch screen CRT/Mouse - The Touch screen CRT is the primary device for operating the PA System. Menu selections are made by touching the CRT display

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

"buttons" with a finger, or by positioning the cursor on the desired selection and clicking the mouse.

- 27.27.5.7.3** Touch screen CRT Controls - The CRT displays provide information which enables the operator to control the PA System by touching the screen in a prescribed manner.
- 27.27.5.7.4** Microphone - At the end of the operations con-sole closest to the PA Touch screen there is a microphone with a push-to-talk switch for making voice transmissions.
- 27.27.5.7.5** Headset - A headset is provided as an alter-native to the microphone mounted to the console. A headset jack is mounted on the side of the console electronics bay for each operating position.
- 27.27.5.7.6** Foot switch - The foot switch provides an alternative to the push-to-talk switch on the microphone mounting as a means for keying connected base station radios. There is one foot switch provided for each console operating position.

27.27.5.8 Directories

- 27.27.5.8.1** Types - To simplify access to the WMATA PA system, the individual stations and operations consoles have been subdivided into access groups called directories. In the descriptions and procedures which follow, the term "station" may refer to either of these two types of directory entries. Passenger Stations are assigned to directories at the PACES.
- 27.27.5.8.2** Directory Assignment - The PA CES is connected with the two Radio Base Station Control System CESs (Systems A and B). The Radio System A and System B CESs, and the PA System CES all have their own directory assignments. Since the Radio Base Station Control System is comprised of two identical CESs, each is assigned an identical directory.
- 27.27.5.8.3** Status Indications/Instant Transmit Selections are as follows:
 - 27.27.5.8.3.1** Connect - A list of all the currently connected stations is provided in the Connect field. As many as eight stations may appear in the Connect list, for multi-station announcements. More than eight stations may be connected at once, but only eight will appear in the list.
 - 27.27.5.8.3.2** Instant Transmit - This list indicates stations which have been programmed for instant transmit, i.e. stations to which transmissions may be made without first connecting. A maximum of four stations may be programmed for instant transmit by calling up the Edit Menu.
 - 27.27.5.8.3.3** Last Select - This field allows the most recently disconnected station to be recalled without first accessing the appropriate directory.
 - 27.27.5.8.3.4** Function Menu Bar - This menu bar displays the available console functions. Selecting one of these screen fields provides access to the corresponding function.

WMATA MANUAL OF DESIGN CRITERIA
SECTION 27

- 27.27.5.8.3.5** Volume - This function provides a means to adjust the volume of the right (Select) and left (Unselect) speakers on the console speaker panel. When VOLUME is selected, a volume adjust window appears.
- 27.27.5.8.3.6** Left Mon - LEFT MON allows the connect speaker to be used as an additional monitor speaker. When LEFT MON is selected, and then a station is selected to monitor, the connect speaker is used to monitor that station; to return the speaker to a connect speaker, LEFT MON must be selected. When a station is being monitored over the connect (left) speaker, its name appears red in the Monitor list. Stations being monitored on the monitor (right) speaker appear blue in the Monitor list. While the connect speaker is being used to monitor, "LEFT MONITOR" appears on the left side of the Message display.
- 27.27.5.8.3.7** Status - The STATUS function provides a quick summary of console communications activity. When STATUS is selected, a Console Status Screen appears. This screen shows which stations are currently active, as well as the type of communications activity occurring. The station names which appear in the Status display appear in the proper colors representing the activity occurring.
- 27.27.5.8.3.8** PA - PA calls the PA Announcement Menu to record, store, and select recorded announcements. When a recorded announcement is selected from this menu, the Call Check Options display allows listening to or broadcasting the recorded message.

27.27.5.9 Section Terminology

- 27.27.5.9.1** Central Electronics System (CES)(PA) - The central computer, switch matrix, and interface cards which route all PA traffic between the operations consoles and the METRORAIL passenger stations. The PA System CES is connected to the two Radio Base Station Control CESs (System A and System B).
- 27.27.5.9.2** Central Electronics System (CES) (Radio) - The central computer, switch matrix, and interface cards which route all radio traffic between the operations consoles and the base stations. The Radio Base Station Control System is comprised of two identical CESs (System A and System B), each of which is capable of handling all radio base station communications.
- 27.27.5.9.3** Connect (PA) - A designation indicating that a communications link has been established between a console and a passenger station or another console. "Connect" is also used to refer to the act of establishing such a communications link. The Connect field on the directory display lists the names of all connected stations and consoles.
- 27.27.5.9.4** Connect (Radio) - A designation indicating that a communications link has been established between a console and a radio base station, Group Expansion Module (GEM) group, or another console. "Connect" is also used to refer to the act of establishing such a communications link. The Connect field on the directory display lists the names of all connected base stations, GEM groups, and consoles.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.27.5.9.5** Connect Audio (PA) - Audio transmissions to connected passenger stations or consoles. Connect audio is broadcast over the connect (left) speaker on the console speaker panel. Connect audio is also referred to as "select" audio.
- 27.27.5.9.6** Connect Audio (Radio) - Audio transmissions from connected radio base stations, GEM groups, or consoles. Connect audio is broadcast over the connect (left) speaker on the console speaker/microphone panel. Connect audio is also referred to as "select" audio.
- 27.27.5.9.7** Disconnect (PA) - To terminate an established communications link between a console and passenger station(s) or another console.
- 27.27.5.9.8** Disconnect (Radio) - To terminate an established communications link between the console and a radio base station, GEM group, or other console.
- 27.27.5.9.9** Group Expansion Module (GEM) - A hardware/software configuration which permits simultaneous operation of a group of radio base stations (maximum of 32 stations per group). The group may consist of voted and non-voted sites, and is normally configured for radios operating on the same frequency.
- 27.27.5.9.10** Key - To activate a PA microphone by depressing a push-to-talk switch.
- 27.27.5.9.11** Monitor - To receive audio transmissions from radio base stations or consoles which are not connected at the console doing the monitoring.
- 27.27.5.9.12** Monitor Audio - Audio transmissions from monitored radio base stations or consoles. Monitor audio is broadcast over the monitor speaker on the console speaker panel.
- 27.27.5.9.13** Phantom Group (PA) - A pre-selected and pre-programmed station indication that connects a number of individual passenger stations.
- 27.27.5.9.14** Phantom Group (Radio) - A pre-selected and pre-programmed station indication that connects a number of individual radio base stations.
- 27.27.5.9.15** Un-monitor (PA) - To terminate the monitoring of a passenger station or operations console.
- 27.27.5.9.16** Un-monitor (Radio) - To terminate the monitoring of a base station, GEM group, or operations console.
- 27.27.5.9.17** Voting (Radio) - A process in which the received signals from a number of base stations are analyzed to determine and choose the highest quality signal.

27.28 ABBREVIATIONS AND GLOSSARY

27.28.1 Abbreviations

- 27.28.1.1** AAR Association of American Railroads, 50 F St., N.W. Washington, DC 20001
- 27.28.1.2** AASHTO American Association of State Highway and Transportation Officials

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.28.1.3	ACD	Automatic Call Distributor
27.28.1.4	AC	Alternating Current
27.28.1.5	ACI	Automatic Car Identification
27.28.1.6	ADRA	Area of Rescue Assistance
27.28.1.7	AEMS	Automated Energy Management System
27.28.1.8	AFC	Automatic Fare Collection
27.28.1.9	AGC	Automatic Gain Control
27.28.1.10	AM	Amplitude Modulation
27.28.1.11	ANSI	American National Standards Institute, Inc., 1430 Broadway New York, NY 10018
27.28.1.12	amp	Ampere
27.28.1.13	APAAS	Automatic Public Address Announcement System
27.28.1.14	APA	American Plywood Association
27.28.1.15	APL	Average Peak Level
27.28.1.16	APD	Avalanche Photodiode
27.28.1.17	AR	As Required
27.28.1.18	AREMA	American Railway Engineering and Maintenance-of-Way Association, 8201 Corporate Dr., Ste. 1125, Landover, MD 20785 (Successor to American Railway Engineering Association (AREA))
27.28.1.19	AORA	Area of Rescue Assistance's
27.28.1.20	ASCII	American Standard Code for Information Interchange
27.28.1.21	ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103
27.28.1.22	ATC	Automatic Train Control
27.28.1.23	AWG	American Wire Gauge

27.28.2 B

27.28.2.1	BBL	Bus Buildings
27.28.2.2	BCD	Binary Coded Decimal
27.28.2.3	BER	Bit Error Rate
27.28.2.4	bps	Bits Per Second
27.28.2.5	BUS	OCC Bus Operation Control Center
27.28.2.6	BW	Bandwidth

27.28.3 C

27.28.3.1	C	Celsius (Centigrade)
27.28.3.2	CBX	Computerized Branch Exchange
27.28.3.3	CCE	Control Center Equipment
27.28.3.4	CCS	Hundred Call - Seconds
27.28.3.5	CCTV	Closed Circuit Television (System)
27.28.3.6	CDF	Combined Distribution Frame
27.28.3.7	CER	Communications Equipment Room
27.28.3.8	CHP	Chilled Water Plant
27.28.3.9	cm	Centimeter
27.28.3.10	CM	Communications
27.28.3.11	CMNT	Car Maintenance
27.28.3.12	CNC	Console Configuration
27.28.3.13	COMM	Communications
27.28.3.14	CPU	Central Processing Unit
27.28.3.15	CRT	Cathode Ray Tube
27.28.3.16	CTS	Carrier Transmission System

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.28.4 D

- 27.28.4.1** DADS Data Acquisition and Display System
- 27.28.4.2** dB Decibel
- 27.28.4.3** dc Direct Current
- 27.28.4.4** DCTB DC Tie Breaker
- 27.28.4.5** DPS Drainage Pumping Station
- 27.28.4.6** DS Digital Signal
- 27.28.4.7** DTMF Dual Tone Multiple Frequency
- 27.28.4.8** DTS Data Transmission System

27.28.5 E

- 27.28.5.1** ECS Emergency Communications System
- 27.28.5.2** ELEV Elevator
- 27.28.5.3** ESCL Escalator
- 27.28.5.4** EDADS Enhanced Data Acquisition and Display System
- 27.28.5.5** EE Emergency Exit
- 27.28.5.6** EIA Electronics Industries Association, 1722 Eye St., N.W., Washington, DC 20006
- 27.28.5.7** EMS Emergency Medical Service
- 27.28.5.8** ETS Emergency Trip Station/Emergency Telephone System (Formally called FRTS)

27.28.6 F

- 27.28.6.1** F Fahrenheit
- 27.28.6.2** FCC Federal Communications Commission
- 27.28.6.3** FD Fire Department
- 27.28.6.4** FDM Frequency Division Multiplexing
- 27.28.6.5** FEP Fluorinated Ethylene Propylene
- 27.28.6.6** FIA Fire and Intrusion Alarm (System)
- 27.28.6.7** Fig Figure
- 27.28.6.8** FM Frequency Modulation
- 27.28.6.9** FMC Facility Maintenance Center
- 27.28.6.10** FMFB Facilities Maintenance Field Base
- 27.28.6.11** FMNT Facilities Maintenance
- 27.28.6.12** FOS Fiber-Optics System
- 27.28.6.13** FRTS Fire and Rescue Telephone System (Now called ETS)
- 27.28.6.14** FS Fan Shaft
- 27.28.6.15** FSK Frequency Shift Keying
- 27.28.6.16** ft Foot, Feet
- 27.28.6.17** FVD Flammable Vapor Detection (System)

27.28.7 G

- 27.28.7.1** GAC General Architectural Consultant
- 27.28.7.2** GCC General Construction Consultant
- 27.28.7.3** GEC General Engineering Consultant
- 27.28.7.4** GETS Garage Emergency Telephone System
- 27.28.7.5** GMFB General Maintenance Field Base (building) now FMFB

27.28.8 H

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.28.8.1 HIB Halon Interface Box
- 27.28.8.2 HVAC Heating, Ventilation, and Air Conditioning
- 27.28.8.3 Hz Hertz (Cycles per Second)

27.28.9 I

- 27.28.9.1 IC Integrated Circuit
- 27.28.9.2 ICEA Insulated Cable Engineers Association, 155 East 44th Street, New York, NY 10017
- 27.28.9.3 ID Identification or Identifier
- 27.28.9.4 IDF Intermediate Distribution Frame
- 27.28.9.5 IDW Intrusion Detection and Warning (System)
- 27.28.9.6 IEEE Institute of Electrical and Electronics Engineers, Inc.
- 27.28.9.7 ILD Injection Laser Diode
- 27.28.9.8 IPS Inches Per Second
- 27.28.9.9 IR Infrared
- 27.28.9.10 ITU International Telegraphic Union

27.28.10 J

- 27.28.10.1 JEDEC Joint Electronic Device Engineering Council
- 27.28.10.2 JGB Jackson Graham Building, 600 Fifth St., N.W., Washington, DC 20001

27.28.11 K

- 27.28.11.1 K Kelvin
- 27.28.11.2 kHz Kilohertz
- 27.28.11.3 km Kilometer
- 27.28.11.4 KSK Kiosk Equipment

27.28.12 L

- 27.28.12.1 LED Light Emitting Diode
- 27.28.12.2 LF Linear Feet

27.28.13 M

- 27.28.13.1 mA Milliampere
- 27.28.13.2 Main-PABX Main Private Automatic Branch Exchange (at the JGB)
- 27.28.13.3 max Maximum
- 27.28.13.4 MDF Main Distribution Frame
- 27.28.13.5 mF Microfarad
- 27.28.13.6 mFd Microfarad
- 27.28.13.7 MHz Megahertz
- 27.28.13.8 min Minimum or Minute
- 27.28.13.9 MISV Management Information Service
- 27.28.13.10 mm Millimeter
- 27.28.13.11 MOCC Matintenance Operations Control Center
- 27.28.13.12 mph Miles Per Hour
- 27.28.13.13 MRS Mobile Radio System
- 27.28.13.14 ms Millisecond

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.28.13.15	MTBF	Mean Time Between Failures
27.28.13.16	MTTR	Mean Time to Repair
27.28.13.17	MUX	Multiplexer
27.28.13.18	mV	Millivolt
27.28.13.19	MW	Microwave Radio
27.28.13.20	mW	Milliwatt
27.28.13.21	µm	Micrometer

27.28.14 N

27.28.14.1	N	Newton, North
27.28.14.2	NA	Numerical Aperture
27.28.14.3	N/A	Not Applicable
27.28.14.4	NEC	National Electrical Code
27.28.14.5	NEMA	National Electrical Manufacturers Association, 2101 L St., N.W., Washington, DC 20037
27.28.14.6	NIC	Not Included in (this) Contract
27.28.14.7	nm	Nanometer
27.28.14.8	NRZ	None Return to Zero

27.28.15 O

27.28.15.1	OCCB	Jackson Graham Building (formerly the Operations Control Center Building or Operations Command Center Building)
27.28.15.2	OCC	Operations Control Center
27.28.15.3	OCCS	Operations Control Center Security (Console)
27.28.15.4	OCUDP	Office Channel Unit Data Port
27.28.15.5	OD	Outside Diameter
27.28.15.6	OFS	Order for Service
27.28.15.7	OPS	Operations
27.28.15.8	OTDR	Optical Time Domain Reflectometer

27.28.16 P

27.28.16.1	PA	Public Address (System)
27.28.16.2	PABX	Private Automatic Branch Exchange
27.28.16.3	PAM	Pulse Amplitude Modulation
27.28.16.4	PAS	Public Address System
27.28.16.5	PC	Printed Circuit
27.28.16.6	PCM	Pulse Code Modulation
27.28.16.7	PCO	Purchase Change Order
27.28.16.8	PD	Police Department
27.28.16.9	PEP	Peak Envelope Power
27.28.16.10	PERS	Passenger Emergency Reporting System
27.28.16.11	PIDS	Passenger Information Display System
27.28.16.12	PIN	Positive-Intrinsic-Negative (refers to solid state structure of device)
27.28.16.13	PLJ	Primary Local Jurisdiction (Radio System)
27.28.16.14	PM	Phase Modulation
27.28.16.15	P/O	Part of
27.28.16.16	Pr	Pair
27.28.16.17	psi	Pounds Per Square Inch
27.28.16.18	p to p	Peak to Peak

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

- 27.28.16.19** PT&Z Pan, Tilt, Zoom
- 27.28.16.20** PVC Polyvinylchloride
- 27.28.16.21** PWR Electrical Power Distribution

27.28.17 R

- 27.28.17.1** RCF Revenue Collection Facility (building)
- 27.28.17.2** RCV Receive
- 27.28.17.3** RCVR Receiver
- 27.28.17.4** RDDS Remote Digital Display System
- 27.28.17.5** RF Radio Frequency
- 27.28.17.6** RI Raytheon Infrastructure Inc, 1627 K St., N.W., 4th Floor, Washington, DC 20006-1702
- 27.28.17.7** RMFB RAIL Maintenance Field Base
- 27.28.17.8** rms Root Mean Square
- 27.28.17.9** RPMC Rail Plant Maintenance Center
- 27.28.17.10** RPT Repeater
- 27.28.17.11** RPTR Repeater
- 27.28.17.12** RTCR Remote Train Control Room
- 27.28.17.13** RTLTP Reference Transmission Level Point
- 27.28.17.14** RTRA Rail Transportation
- 27.28.17.15** RTU Remote Terminal Unit
- 27.28.17.16** RZ Return to Zero

27.28.18 S

- 27.28.18.1** SPABX Satellite Private Automatic Branch Exchange
- 27.28.18.2** S&I Service and Inspection (Yard)
- 27.28.18.3** SEJ Sewage Ejector
- 27.28.18.4** SMADS Station Monitor and Display System
- 27.28.18.5** SMNT System Maintenance
- 27.28.18.6** SP Sump Pump
- 27.28.18.7** SPL Sound Pressure Level
- 27.28.18.8** SPNO Single-Pole, Normally Open Contact
- 27.28.18.9** SPNC Single-Pole, Normally Closed Contact
- 27.28.18.10** SPDT Single-Pole, Double-Throw Contact
- 27.28.18.11** SYPM Systems Project Management

27.28.19 T

- 27.28.19.1** TBS Tie Breaker Station
- 27.28.19.2** TC Train Control
- 27.28.19.3** TC/COMM Train Control/Communications
- 27.28.19.4** TCF Tech. Control Facility
- 27.28.19.5** TCR Train Control Room
- 27.28.19.6** TDM Time Division Multiplex
- 27.28.19.7** THD Total Harmonic Distortion
- 27.28.19.8** TPAS Transit Police and Security
- 27.28.19.9** TPSS Traction Power Substation
- 27.28.19.10** TS,TEL Telephone System
- 27.28.19.11** TV Television
- 27.28.19.12** TX Transmit

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.28.20 U

- 27.28.20.1 UFT** Uniform Fare Technology
- 27.28.20.2 UHF** Ultra High Frequency
- 27.28.20.3 UL** Underwriters Laboratories
- 27.28.20.4 UPS** Uninterruptible Power Supply

27.28.21 V

- 27.28.21.1 V_{ac}** Volts, Alternating Current
- 27.28.21.2 V_{dc}** Volts, Direct Current
- 27.28.21.3 V_{pp}** Volts, Peak to Peak
- 27.28.21.4 VS** Vent Shaft
- 27.28.21.5 VSWR** Voltage Standing Wave Ratio

27.28.22 W

- 27.28.22.1 WDM** Wavelength Division Multiplex
- 27.28.22.2 WMATA** Washington Metropolitan Area Transit Authority (METRO), 600 Fifth St., N.W., Washington, DC 20001 (Also referred to as "The Authority".)

27.28.23 X

- 27.28.23.1 X** Transmit
- 27.28.23.2 XMT** Transmit
- 27.28.23.3 XMIT** Transmit
- 27.28.23.4 XMTR** Transmitter

27.29 Glossary Of Terms

As used in these Criteria, the listed terms shall be defined as follows:

27.29.1 Absorption Losses (Fiber Optics)

Reduction in light amplitude or strength caused by impurities in the optical fiber and by the scattering of light from the optical fiber.

27.29.2 AC Service Room

Room housing equipment and facilities for the distribution of ac power throughout an installation such as a passenger station or shop building.

27.29.3 Alarm

An alerting signal indicating an abnormal condition.

27.29.4 Alphanumeric

Alphabetic and numeric representation, letters, numbers, and symbols.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.5 Ambient

Typical of the environment. Specifically used to designate properties of the surroundings which are measurable and distinguishable from absolute zero energy levels.

27.29.6 American National Standards Institute, Inc. (ANSI)

American National Standards Institute, Inc. (ANSI)
1430 Broadway
New York, NY 10018

27.29.7 American Railway Engineering and Maintenance-of-Way Association

American Railway Engineering and Maintenance-of-Way Association (AREMA)
8201 Corporate Dr., Ste. 1125
Landover, MD 20785-2230

27.29.8 American Society for Testing and Materials (ASTM)

American Society for Testing and Materials (ASTM)
916 Race Street
Philadelphia, PA 19103

27.29.9 American Standard Code for Information Interchange (ASCII)

Consists of 10 or 11 bits per character - one start bit, seven information bits, one parity bit, one or two stop bits.

27.29.10 Amplitude Modulation (AM)

The process of varying the amplitude of a carrier wave in accordance with the instantaneous value of a modulating signal.

27.29.11 Ancillary Building

A room, area or structure which is used primarily to house some WMATA METRORAIL function other than Train Control or Communications.

27.29.12 Angstrom

(Fiber Optics) A unit of optical wavelength historically used in the field of optics, but not an International System unit.

1 Angstrom = 0.1 nanometer

27.29.13 Annunciator

An audible signaling device which usually includes signal lights, each one indicating the conditions that exist or have existed in an associated circuit.

27.29.14 Armored Cable

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

A cable provided with a wrapping of metal primarily for the purpose of mechanical protection. The armor is sometimes used as an electrical shield.

27.29.15 Association of American Railroads (AAR)

Association of American Railroads (AAR)
50 F Street, N.W.
Washington, DC 20001

27.29.16 ATC and Communications General Consultant

ATC and Communications General Consultant
Currently:
Raytheon Infrastructure Inc.
1627 K St., N.W. - Fourth Floor
Washington, DC 20006-1702

27.29.17 At-Grade

That portion of the system which is constructed at the approximate elevation of the adjacent ground surface.

27.29.18 Attenuation

A decrease in the amplitude of a signal as it travels along or through a transmission medium, usually expressed as a ratio or in dB.

(Fiber Optics) A measure of the decrease in energy transmission (loss of light) expressed in dB/km. In optical waveguides it is primarily due to absorption losses and scattering losses.

27.29.19 Attenuation Distortion

Distortion caused by the non-uniform attenuation or gain of a system, with respect to frequency, under specified terminal conditions.

27.29.20 Audio Frequency

Frequency range approximately equal to 15 Hz to 20,000 Hz (i.e. frequencies typically audible by human ears).

27.29.21 Authority (The)

Washington Metropolitan Area Transit Authority (WMATA).

27.29.22 Auto Scan

The automatic scan of the TV cameras in the horizontal (pan) plane.

27.29.23 Automatic Fare Collection (AFC)

Computer controlled system for the collection of fares, control of access, and associated functions.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.24 Automatic Frequency Control (AFC)

Means whereby the frequency of a circuit is automatically maintained, within specified limits, with respect to a reference frequency.

27.29.25 Avalanche Photodiode (APD)

(Fiber Optics) One type of receiver or detector used in the receiving portion of Fiber-Optics terminals or repeaters. It is called a detector or receiver, since it detects and converts the light signal to a copy of the original electrical signal.

27.29.26 Bandwidth

Limiting frequencies between which the performance of a device or system falls within specified limits.

(Fiber Optics) The capacity of an optical fiber to transmit information, expressed in bits of information transmitted per specific time period for a specific length of optical waveguide. Bandwidth is limited by pulse spreading or broadening due to dispersion, so that adjacent pulses overlap and cannot be distinguished.

27.29.27 Ballast

(Trackwork) Crushed rock, slag, or other suitable material placed between, under, and at the ends of railroad ties to support and stabilize the track.

(Electronics) A device utilized to limit current flow.

27.29.28 Battery

An assembly of cells electrically connected for producing electric energy. In telephone systems, it usually refers to centralized dc source, located in the central office, nominally -48 volts.

27.29.29 Baud

Unit of signaling speed equal to the number of discrete signal events per second.

27.29.30 Binary Coded Decimal (BCD)

A notation in which each individual decimal digit is represented by a pattern of "ones" and "zeros."

27.29.31 Bit

A binary digit, 0 or 1 in number representation, with the radix 2.

27.29.32 Bus

A conductor, or group of conductors, that serve as a common connection for two or more circuits.

27.29.33 Cable Binder

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

A wrapping of tapes or cords around several conductors of a multiconductor cable used to hold them together which may be color coded to designate the group of conductors enclosed.

27.29.34 Cable Tray

A tray or rack used for the installation and support of cable.

27.29.35 Cable Trough

A trough used for the installation, support, and protection of cable.

27.29.36 Call

The act of establishing and completing a telephone connection from one telephone instrument to another.

27.29.37 Called Party

The telephone instrument at the "distant end" being called.

27.29.38 Calling Party

The telephone instrument that originates the call.

27.29.39 Cardioid (Pattern)

A heart-shaped pattern obtained as a response or radiation characteristic of certain directional antennas, or as the response characteristic of certain types of microphones.

27.29.40 Cassette

A small reel-to-reel tape magazine on which is recorded analog or digital information.

27.29.41 Cassette Recorder

A tape recorder used to record or playback cassettes.

27.29.42 Central Office

Equipment in a telephone system that provides centralized switching, battery, and supervision for a group of subscribers or terminals (i.e. a Main PABX or Satellite PABX Equipment Room).

27.29.43 Channel

A path for transmitting electrical signals.

27.29.44 Character

A combination of bits denoting a specific alphanumeric symbol.

27.29.45 Chromatic or Material Dispersion

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

(Fiber Optics) This refers to "colors" or wavelengths in a lightwave source. Light rays with different wavelengths travel along a fiber at different speeds. The broader the range of wavelengths emitted, the more light pulse will spread as it traverses the length of the fiber.

27.29.46 Circuit

A conductor or system of conductors through which an electric current is intended to flow. A network providing one or more closed paths.

27.29.47 Cladding

(Fiber Optics) The low refractive index material which surrounds the core of the fiber and protects against surface contaminant scattering. The cladding may be glass or clear plastic. In interoffice telecommunication systems, glass cladding is used.

27.29.48 C-Message Weighting

Noise weighting used in a noise measuring set to simulate use of the Type 500 telephone (which has characteristics that are typical of most modern telephone instruments in commercial use in this Metropolitan area).

27.29.49 Combined Distribution Frame (CDF)

A distribution frame which, in addition to the functions of an MDF, provides for the cross-connection of the PABX subscriber line multiple and the subscriber line circuits.

27.29.50 Command Message

Digital message transmitted from the Mobile Radio System control console to base stations to query status or to direct action.

27.29.51 Command Message Enable

Message used to cause selected base station(s) to be ready for two-way voice operation.

27.29.52 Command Message Station Connect

Message used to restore a base station(s) to service in the system in a quiescent mode with its receiver in a monitoring condition with squelch operating.

27.29.53 Command Message Station Disconnect

Message used to intentionally remove a base station(s) from service in the system.

27.29.54 Commercial Telephone Network

The public telephone system. In the WMATA area, usually Bell Atlantic for local public network and special services cable connections.

27.29.55 Communications Equipment Room

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Room housing centralized communications equipment for an installation such as a Metrorail passenger station or yard.

27.29.56 Communications Ground

An earth ground connection of 5 ohms or less resistance that is provided in the Communications Equipment Room in each passenger station and yard for the sole purpose of grounding communications equipment. The Communications Ground in the Communications Equipment Room at Jackson Graham Building has a resistance of 1 ohm or less to earth.

27.29.57 Compandor

A combination of a compressor at one point in a communications path for reducing the amplitude range of signals followed by an expander at another point for a complementary increase in the amplitude range. The purpose is to improve the ratio of the signal to the interference entering the path between the compressor and the expander.

27.29.58 Compartmental Cable

A multiconductor cable with its core divided into two compartments, a transmit section and a receive section, which are separated by an insulated metallic divider.

27.29.59 Conduit

A tube-like structure for electrical wires or cables. Conduit may be either rigid or flexible, metallic or non-metallic, as specified.

27.29.60 Conduit Stub Out

A short length of conduit that is joined as a branch to a conduit run and, as used in these Specifications, is the termination of a conduit run.

27.29.61 Console

A panel or cabinet on which are mounted switches or lamps for use by a human operator in monitoring and controlling equipment and functions.

27.29.62 Contact Rail

A bus bar alongside a track that carries electric energy for the propulsion of trains.

27.29.63 Contractor (The)

The person, partnership, corporation, or joint venture that is awarded the prime contract to provide the facilities, equipment, and installations described in the Specifications. As used in the Specifications, this term also includes subcontractors, suppliers, vendors, and employees thereof, except as otherwise stated (subject at all times to the Contractor's responsibility therefore).

The person or company who is awarded a contract to provide all the facilities, equipment, and installations described in the Specifications.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.64 Core (Fiber Optics)

The light conducting portion of the optical fiber, defined by the high refractive index region. The core is normally in the center of the optical fiber, bounded by the cladding material.

27.29.65 Coverage

Inclusion within the range of a communications device, equipment unit, system or medium.

27.29.66 Crosstalk

Undesired signal coupling between two different communications channels or signal components.

27.29.67 Data Acquisition and Display System (DADS)

A system for the collection, recording, consolidation, and display of fare collection data at the passenger stations.

Enhanced Data Acquisition and Display System (EDADS)

An upgraded version of the DADS System.

27.29.68 Data Transmission System (DTS)

The bi-directional, non-vital, digital, communications system between Central Control and the Train Control Room. The DTS utilizes a channel of the Carrier Transmission System (CTS) as a transmission medium.

27.29.69 Decibel (dB)

Unit used to express the ratio between two amounts of electrical power, P₁ and P₂, defined as:

$$dB = 10 * \log_{10}(P_1/P_2)$$

Also used to express voltage and current ratios, defined as:

(Voltages and currents must be measured with identical impedances.)

$$dB = 20 * \log_{10}(V_1/V_2) = 20 * \log_{10}(I_1/I_2)$$

Also used to express intensity of sound; defined as equal to 20 times the common logarithm of the ratio of the sound pressure of a wave to a reference pressure of 0.0002 dyne per square centimeter.

27.29.70 dBm

Measure of absolute electrical power in decibels referred to one milliwatt.

27.29.71 dBm0

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

A measure of power, with reference to zero dBm, at the reference transmission level point (RTLTP).

27.29.72 dBrnc0

A measure of noise power in dB above one picowatt measured with a C-message weighting network referred to or measured at an RTLTP.

27.29.73 Delay Distortion

Distortion caused by differences in transit time for different frequencies within a specified system bandwidth.

27.29.74 Desk Telephone

A telephone instrument designed for desk top use.

27.29.75 Detector

A device used to sense a particular condition - smoke, temperature, open circuit, received signal, etc.

27.29.76 Dial

Normally, a face plate which has been graduated into arbitrary units. As a special case, in telephony, the hand operated device used to generate pulses or tones for establishing connections over a telephone switching system.

27.29.77 Dialing

The act of operating a dial - specifically, a telephone dial. As used in this document, includes the act of operating a telephone instrument "touchtone" pad.

27.29.78 Diode Auctioneering

A method of obtaining redundancy in use of power supplies by utilizing diode coupling from each power supply to a common load.

27.29.79 Direct Burial

A method of installing cable underground, not in conduit or duct, in such a manner that it cannot be removed without disturbing the soil.

27.29.80 Dry Contact

An electrical contact through which no direct current normally flows.

27.29.81 Duct Bank

An arrangement of conduit providing more than one duct to accommodate and protect cables between two points.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.82 DTMF

Dual Tone Multifrequency audio signaling scheme utilized as the standard subscriber line tone signaling method in the USA. Also known as Touch-tone dialing, which is a copyrighted Bell Telephone Company term for such signaling. (Utilized for some other remote control devices also.)

27.29.83 Duplex

Type of operation that permits simultaneous communications in both directions.

27.29.84 E&M Signaling

A signaling system characterized by the use of separate paths for the signaling and voice signals. The M lead transmits battery or ground to the distant end of the circuit while incoming signals are received as ground or open on the E lead.

27.29.85 E&M Trunk

An audio trunk circuit utilizing E&M signaling.

27.29.86 Electro-Mechanical

An electrical device with moving parts.

27.29.87 Electronic Industries Association (EIA)

Electronic Industries Association (EIA)
2001 Eye Street, N.W.
Washington, DC 20006

27.29.88 Elevated

That portion of the Metrorail System which is constructed above the adjacent ground surface.

27.29.89 Emergency Power

Electrical power provided to operate essential equipment during periods of failure of primary power source.

27.29.90 Emergency Trip Station (ETS)

An enclosure containing an emergency telephone and an electric switch to deenergize a section of the contact rail.

27.29.91 Engineer (The)

Wherever, on the Contract Drawings or in the Specifications, the term "Engineer" is used, it shall mean the Resident Engineer or other duly authorized representative of the Contracting Officer.

27.29.92 Engineering Services

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Engineering Services to be provided, as required and detailed in the Contract Documents.

27.29.93 Entrance Escalator

Escalator from street level to a passenger station.

27.29.94 Environment

The universe within which the system must operate, the elements over which the designer has no control.

27.29.95 Error Rate

The ratio of the number of characters of a message(s) received incorrectly to the total number of characters of the message(s) received.

27.29.96 ETS Telephone

An emergency telephone generally located along Metrorail R.O.W. and co-located with or enclosed in Emergency Trip Station boxes in most instances.

27.29.97 Factory Test

Test of equipment at the manufacturer's plant.

27.29.98 Failure

An inability to perform an intended function.

27.29.99 Fare Gates

Gate in stations through which passengers pass separating FREE (UNPAID) and PAID areas.

27.29.100 Federal Communications Commission (FCC)

Federal Communications Commission (FCC)
Washington, DC 20554

27.29.101 Fiber Buffer

(Fiber Optics) A material that may be used to protect an optical fiber from physical damage, thus providing mechanical isolation and/or protection.

27.29.102 Fiber Bundle (Fiber Optics)

In a fiber optics cable, a group of parallel optical fibers over which a loose-fitting jacket (fiber buffer) has been extruded. (As used in "loose tube" type fiber optic cables, for example).

27.29.103 Fiber Optics

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, or plastic.

27.29.104 Fiber Optics Cable

A cable made up of several optical fibers incorporated into an assembly of organic materials arranged for providing the necessary tensile strength, external protection, and handling properties. (Communications cables usually utilize "loose tube" or "open channel" type internal construction.)

27.29.105 Fire Zone

A portion of a building, installation or area designated for fire detection by a specific circuit.

27.29.106 Flutter

Cyclic deviation of signaling power (with a period in the neighborhood of 10 Hz for audio, for example).

27.29.107 Foot Lambert (fl)

The amount of light energy reflected from an object or scene equal to the product of illumination in foot-candles and the luminous reflectance of the object or scene.

27.29.108 4-Wire Terminating Set

A hybrid set for interconnecting a four-wire and a two-wire circuit (usually refers to audio frequency devices).

27.29.109 FREE (Unpaid) Area

Area of passenger station to which public has access (from the street) prior to passing through entrance fare gates.

27.29.110 Frequency Modulation (FM)

The process of varying the instantaneous frequency of a sine wave carrier by an amount proportional to the instantaneous value of a modulating signal.

27.29.111 Frequency Response

The measure of effectiveness with which a circuit or device receives or transmits a range of frequencies.

Frequency Shift Keying (FSK)

The form of frequency modulation in which the modulating wave shifts the output frequency between pre-determined values, and the output wave has no phase discontinuity (usually accomplished at audio frequencies).

27.29.112 Fuse

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

An overcurrent protective device with a circuit-opening part that is heated and severed by the passage of overcurrent through it.

27.29.113 Fuse Alarm

A circuit which produces a visual or audible signal to indicate a blown fuse.

27.29.114 Fusion Splice (Fiber Optics)

A splice accomplished by the application of localized heat sufficient to fuse or melt the ends of two lengths of optical fiber, forming a continuous, single fiber.

27.29.115 Gallery Place

A Metrorail passenger station located at the junction of Route B with Routes J, E, & F, which is a secondary hub of the WMATA Rail Rapid Transit System.

27.29.116 Gatehouse

A building at the entrance to a Metrorail train yard, from which control of pedestrian and vehicular (other than trains) access to the yard is exercised.

27.29.117 General Architectural Consultant (GAC):

Currently:Formerly:

Harry Weese & Associates
600 Fifth Street, N.W.
Washington, DC 20001
(Subject to change without prior notice to the Contractor)

27.29.118 General Construction Consultant (GCC):

Formerly:

Bechtel Associates
600 Fifth Street, N.W.
Washington, DC 20001
(No GCC is currently employed by WMATA)

DeLeuw Cather & Company Inc.
1133 15th Street, N.W.
Washington, DC 20005
(Subject to change by WMATA without prior notice to the Contractor)

27.29.119 On-Call General Architectural and Engineering Services Consultant (GEC²D):

Currently:
Parsons Transportation Group Inc., PB Americas, Inc., Delon Hampton & Associated,
Chartered
DeLeuw Cather & Company Inc.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

1133 15th Street, N.W.
Washington, DC 20005
(Subject to change by WMATA without prior notice to the Contractor)

27.29.120 Graded-Index (Fiber Optics)

An optical fiber type wherein the core refractive index decreases almost parabolically radially outward toward the cladding. This type of fiber combines high-bandwidth capacity with moderately high coupling efficiency.

27.29.121 Ground

A conducting connection, whether intentional or accidental, by which an electric circuit or equipment is connected to the earth, or to some conducting body of relatively large extent that serves in place of the earth. A common return to a point of zero potential. (Intentional grounding for WMATA projects providing low resistance current return paths to the earth.)

27.29.122 Half Duplex

A method of operation in which two-way communication is possible, but only one way at a time.

27.29.123 Handset/Speaker Station

A self-contained terminal station of the paging-intercom subsystem of the Yard Public Address System.

27.29.124 Hardware

Physical entities such as computers, equipment, and instruments. Also parts made of metal such as fasteners, straps, clamps, and anchors.

27.29.125 Harmonic Distortion

Non-linear distortion of a system or transducer characterized by the appearance in the output of harmonics, other than the fundamental component, when the input wave is sinusoidal.

27.29.126 Hertz (Hz)

Unit of frequency equal to one cycle per second.

27.29.127 Hundred-Call-Seconds (CCS)

A measure of communications traffic equal to one hundred seconds of communicating. In practice, "CCS" is used for hundred call seconds per hour.

27.29.128 Identifying Digits

Alphanumeric digits that identify each passenger station and yard.

27.29.129 Idle

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

In communications systems, indicates a circuit, device or system is not in active use (i.e. in the quiescent state).

27.29.130 Idle Noise

That noise which is inherent in a circuit or device and is not contingent upon modulation.

27.29.131 Impedance

The opposition in an electrical circuit to the flow of alternating current.

27.29.132 Impulse Noise

Noise characterized by transient disturbances separated in time by quiescent intervals.

27.29.133 Inbound Track

Track that is normally used by trains travelling toward Metro Center passenger station on the A, B, C, D, G, and K routes; and towards the Gallery Place passenger station on the E, F, J, and L routes.

27.29.134 Incident Scene Illumination

The amount of light expressed in footcandles which is actually falling on an object.

27.29.135 Index of Refraction (Fiber Optics)

The relative index of refraction is a fraction or ratio of the velocity of light in one medium, compared to the velocity of light in another medium.

27.29.136 Infrared (Fiber Optics)

The region of the electromagnetic spectrum between the long-wavelength of the visible spectrum (about 750nm) and the shortest microwaves (about 1300nm). Infrared is used extensively in the transmission of light through optical waveguides.

27.29.137 Injection Laser Diode (Fiber Optics)

A laser employing a forward-biased semiconductor junction as the active medium. Light is emitted from the diode edge.

27.29.138 Insertion Loss

The loss resulting from the insertion of a transducer or other device in a transmission system.

27.29.139 Install

When used in these Specifications, the verb install shall signify that the Contractor shall furnish, install, and test the equipment and materials specified, unless specifically indicated differently in the text.

27.29.140 Institute of Electrical and Electronics Engineers, Inc. (IEEE)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Institute of Electrical and Electronics Engineers, Inc. (IEEE)
345 East 74th Street
New York, NY 10017

27.29.141 Insulated Cable Engineers Association (ICEA)

Insulated Cable Engineers Association (ICEA)
155 East 44th Street
New York, NY 10017

27.29.142 Interface

A shared boundary. The interconnection between two pieces of equipment or systems/facilities.

27.29.143 Interlocking

An arrangement of signals and signal appliances interconnected so that their operations must succeed each other in proper sequence, thereby permitting train movements over controlled routes, only if safe conditions exist.

27.29.144 Intermodulation Noise

That noise which is contingent upon modulation and results from any non-linear characteristic in the path or device.

27.29.145 Interphone

Equipment used to provide telephone communications between personnel at various locations within a defined space. As used in these Specifications, provides communications between the Station Manager in the Kiosk and the public.

27.29.146 Intrusion Zone

A portion of a building, installation or an area designated for detection of intrusion by a specific circuit.

27.29.147 Jacket

A thermoplastic or thermosetting covering, sometimes fabric reinforced, applied over the insulation, core, metallic sheath or armor of a cable.

27.29.148 Jackfield

An arrangement of telephone jacks, usually grouped on a mounting strip, to provide convenient access to lines and equipment for testing.

27.29.149 Joint Electron Device Engineering Council (JEDEC)

Cooperative effort of Electronic Industries Association (EIA) and National Electrical Manufacturers Association (NEMA).

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.150 Key Telephone System (KTS)

Assemblage of telephone relay or electronic equipment which provides switching and control of telephone service within a localized area. KTS equipment is differentiated from PABX equipment primarily by more limited switching functions. Insofar as external telephone trunks are concerned, KTS equipment is generally limited to applications requiring less than 100 subscriber lines and the provision of service that is generally limited to a single building or area of a building.

27.29.151 Kiosk

A booth-like structure within Metrorail passenger stations which contains station monitoring and control facilities and from which an attendant may provide information and assistance to passengers.

27.29.152 Laser (Fiber Optics)

A device that produces optical radiation using population inversion to provide Light Amplification by Stimulated Emission of Radiation and (generally) an optical resonant cavity to provide positive feedback.

27.29.153 Light Emitting Diode (LED)

A pn junction semiconductor device that emits incoherent optical radiation when biased in the forward direction.

27.29.154 Main Distribution Frame (MDF)

Provides for the termination and cross connection of outside lines entering a building, including electrical protection devices, internal subscriber lines, and terminal equipment.

27.29.155 Major Items

Major Items are defined as items listed in Estimated Quantities Tables.

27.29.156 Manhole

A subsurface chamber or opening in the route of a conduit or duct run that provides facilities for splicing, testing, and maintaining cables and conductors.

27.29.157 Manual Pull Box

Specifically refers to FIRE alarm switch which, when operated manually, initiates a FIRE alarm.

27.29.158 MDF/Protector Cabinet

Specifically refers to a cabinet located in passenger stations and yard buildings containing MDF and cable protection facilities.

27.29.159 Mechanical Splice (Fiber Optics)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

An optical fiber splice accomplished by fixtures or materials, rather than by thermal fusion. Index matching material may be applied between the two fiber ends.

27.29.160 Metro Center

A Metrorail passenger station located at the junction of Routes A and B with Routes C and D, which is the major hub of the WMATA Rail Rapid Transit System.

27.29.161 Microbar

Unit of pressure equal to one dyne per square centimeter.

27.29.162 Millisecond (ms)

A unit of time equal to one one-thousandth of a second.

27.29.163 Mobile Radio Unit

A radio transmitter/receiver designed for installation in a vehicle or train.

27.29.164 Modal Dispersion (Fiber Optics)

The component of pulse spreading caused by differential optical path lengths in a multimode fiber.

27.29.165 Modem

A modulator and demodulator housed in a common assembly.

27.29.166 Multi-Mode Fiber (Fiber Optics)

An optical fiber that will allow more than one mode to propagate. May be either a graded index or step index configuration.

27.29.167 Multiline Telephone

A telephone instrument with the capability of being connected to more than one line.

27.29.168 Multiplexer (MUX)

A device which combines several inputs into a single output.

27.29.169 Muting

The action of reducing a sound level.

27.29.170 National Electrical Manufacturers Association (NEMA)

National Electrical Manufacturers Association (NEMA)
155 East 44th Street
New York, NY 10017

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.171 Noise

Any undesired, interfering signal contained in a communications channel or circuit.

27.29.172 Noise Weighting

An amplitude-frequency characteristic of a noise measuring set. C-Message weighting is so designed as to give numerical readings which approximate the amount of transmission impairment, due to noise, that an average listener experiences using a specific commonly utilized modern class of telephone subset. "Flat" weighting and other wideband weighting may be utilized to measure noise on data channels. Meters designed to measure ambient noise (environmental) utilize other weighting networks (to obtain readings in dba, for example).

27.29.173 Numerical Aperture (Fiber Optics)

Measure of light acceptance of an optical fiber.

27.29.174 Off-Hook

A telephone line condition or the signal indicating that the circuit is in use (i.e., the handset is off its switch-hook).

27.29.175 Omni-Directional

(Antenna) An antenna having essentially non-directional pattern in azimuth but that may have a directional pattern in elevation in many instances.

(Microphone) A microphone, the response of which is essentially independent of the direction of sound input.

27.29.176 On-Hook

A telephone line condition or the signal indicating that the circuit is idle - not in use.

27.29.177 On-Site Test

Test of equipment or system after installation in its operational location.

27.29.178 Open

A break or discontinuity in a circuit which normally passes a current.

27.29.179 Operations Control Center (OCC)

(Located in the Jackson Graham Building which was previously designated as the OCC Building - OCCB on some WMATA documentation).

The operational center for the WMATA Metrorail and Metrobus systems (includes centralized operations and communications functions). Also known as "Central Control" and "Command Center."

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.180 Operations Control Center - Security (OCCS)

Usually refers to the consoles in the Security Center for the WMATA System.

27.29.181 Optical Fiber (Fiber Optics)

Any filament or fiber, made of dielectric material, that guides light.

27.29.182 Outbound Track

Track normally used by trains traveling away from Metro Center passenger station on the A, B, C, D, G, and K routes, and away from Gallery Place passenger station on the E, F, J, and L routes.

27.29.183 Override

A communications trunk feature whereby one call has a greater priority of using a common facility over another call.

27.29.184 PABX

A designation used in the national telephone system to denote a privately owned telephone switching center which operates by the use of dialing (i.e. Private Automatic Branch Exchange). PABXs can be differentiated from KTS systems by their generally more extensive trunk and remote line switching capability, and by the fact that they generally handle 60 or more subscriber lines.

27.29.185 PABX Extension

A telephone instrument connected to a PABX.

27.29.186 Paging-Intercom

A system which provides for public address type paging and telephone type intercom service.

27.29.187 PAID Area

Area of passenger station accessed by the passengers after passing through entrance fare gates.

27.29.188 Parity

Used in digital code formats for self-checking in which the total number of 1s or 0s in an acceptable code is always odd or always even, depending on whether an odd or even parity check is used.

27.29.189 Passenger Station

A location which provides the public access to the WMATA Rail Rapid Transit System (Metrorail System), i.e., provides facilities for payment of fares, train information, entrance and exit of passengers.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.190 Phase Modulation (PM)

The process of varying the angle of a carrier from its reference value by an amount proportional to the instantaneous value of a modulating signal.

27.29.191 Pin Photodiode (Fiber Optics)

A diode with a large intrinsic region sandwiched between p-doped and n-doped semiconducting regions. A commonly used detector or receiver in fiber systems.

27.29.192 Plug-In Unit

A communications device so designed that connections to the device may be completed through pins, plugs, jacks, sockets, receptacles or other forms of ready connectors.

27.29.193 Portable Radio

A radio transmitter/receiver designed to be carried by or on a person.

27.29.194 Power Distribution Panel

A facility which provides for the distribution of power circuits and overload protection for those circuits.

27.29.195 Power Supply

A unit for converting power from an ac or dc source into ac or dc power at voltages suitable for supplying power to equipment.

27.29.196 Pre-empt

A communications trunk feature whereby one call takes a common trunk facility away from another call.

27.29.197 Primary Cable

Specifically refers to the normally on-line cable of the dual redundant communications cable facility of the Fiber Optics/Carrier Transmission Systems.

27.29.198 Protection Tube

An expulsion arrester or glow-discharge cold cathode tube that employs a low-voltage breakdown between two or more electrodes to protect circuits against overvoltage.

27.29.199 Pulse Dispersion

(Fiber Optics) The separation or spreading of the input characteristics of the optical signal that appears along the length of the optical fiber and limits the useful transmission bandwidth of the fiber. Expressed in time and distance as nanoseconds per kilometer. Three basic mechanisms for dispersion are the material effect, the waveguide effect, and the multimode effect.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.200 PT&Z Camera(Pan, Tilt, Zoom)

A television camera with facility for remote control of azimuth, elevation, and zoom.

27.29.201 Public Address System

A system which provides transmission, amplification, and reproduction of speech with high communications band fidelity and sufficient power to make sound simultaneously available, and fully intelligible, to large numbers of people.

27.29.202 Pulse Code Modulation (PCM)

A modulation process involving the conversion of a wave form from analog to digital by means of coding. Usually a form of pulse modulation in which a code is used to represent quantized values of instantaneous samples of the signal waves.

27.29.203 Push-To-Talk (Operation)

Voice communications on a circuit in one direction at a time requiring activation of a switch prior to and during transmission.

27.29.204 Quench

An action whereby an active circuit is stifled or inhibited.

27.29.205 Radio Base Station

A complete assemblage of equipment for radio transmission and reception including antenna(s) and control devices or interfacing equipment accommodating remote control devices.

27.29.206 Rail Rapid Transit System

The portion of the WMATA transportation system that is a third rail electrified system as distinguished from the motor bus operations.

27.29.207 Rapid Battery Charger

Electrical device used for rapidly charging storage batteries.

27.29.208 Redundancy

The existence in a system of more than one means of accomplishing a given function, for the purpose of increasing security or reliability.

27.29.209 Redundant Cable

Specifically refers to the secondary cable of the dual cable facility of the Fiber Optic/Carrier Transmission Systems.

27.29.210 Reference Transmission Level Point (RTLTP)

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

In a communications system it is an arbitrarily chosen point to which the levels at all other points in the system are referenced. It is frequently the input to the 2-wire side of the 2-wire/4-wire terminating set at the transmitting end of a telephone channel.

27.29.211 Relay Contact Types

FORM-A: SPNO(Single-Pole, Normally Open) Contact

FORM-B: SPNC (Single-Pole, Normally Closed) Contact

FORM-C: SPDT (Single-Pole, Double-Throw) Contact

27.29.212 Reliability

The probability of performing a specified function, without failure and within design parameters, for the period of time intended under actual operating conditions.

27.29.213 Remote Building

An area or structure (frequently containing support equipment, such as: Fan shafts, chiller plants, substations, and tie breaker stations) generally within or along the WMATA right-of-way, but not part of a passenger station or yard. Remote buildings may also include MRS Two-Way Line Drivers, Fire and/or Intrusions alarm detectors, wayside telephones, etc.

27.29.214 Remote Terminal Unit(RTU)

A modem installed at each ATC field control location (usually at passenger station TCRs) to act as the interface unit between the Data Transmission System (DTS) and the local ATC and support system functions.

27.29.215 Response Message

Digital message transmitted from base station(s) of the Mobile Radio System to the control console with information in reply to a command message initiated at the control console.

27.29.216 Revenue Service

The transportation of passengers who have paid a fare.

27.29.217 Revenue System

The portion of the METRO System on which revenue service is conducted.

27.29.218 Right-of-Way (R.O.W.)

The land or structure surface occupied by the Metrorail Transit System, especially for its mainline. Also, the land or structure surface used by another transportation facility such as a railroad or highway.

The right of traffic on a given route to take precedence.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.219 Ringdown

A method of signaling in which ringing current is transmitted over a circuit to operate a device or circuit to produce a steady signal.

27.29.220 Ringing

The audible or visual signal produced by an alternating or pulsating current to signal a telephone station, central office or other terminating equipment.

27.29.221 Root Mean Square (rms)

The square root of the mean of the squares of the sum of instantaneous voltages or currents during a complete cycle.

27.29.222 Rotary Hunting Group (RHG)

A group of telephone lines which are accessible under a common calling number and are used sequentially as calls are received.

27.29.223 Scene Highlight Brightness

The amount of illumination which is reflected off an object of interest expressed in foot lamberts.

27.29.224 Seize

In communications signaling terminology, to take control of a connecting circuit.

27.29.225 Sensitivity

The degree to which a component, circuit or system is affected by some condition.

27.29.226 Sensor

A device for detection of a condition or change in condition - such as smoke, temperature, humidity, light level, open circuit, closed circuit.

27.29.227 Service and Inspection (S&I) Yard

Yard which provides for the make-up, cleaning, maintenance, inspection, and repair of trains.

27.29.228 Shield

A housing, screen or other object, usually conductive, that substantially reduces the effect of electric or magnetic fields on one side and upon devices or circuits on the other side.

27.29.229 Shop Building

Building within a Metrorail yard or elsewhere which houses repair facilities.

27.29.230 Short Circuit

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

An abnormal connection of relatively low resistance between two points of different potential in a circuit.

27.29.231 Simplex

A method of operation in which communications takes place in one direction only.

27.29.232 Singing Point

The point at which the gain is just sufficient to make the circuit break into oscillation.

27.29.233 Single Mode Fiber (Fiber Optics)

An optical fiber in which only the lowest order mode can propagate at the wavelength of interest.

27.29.234 Slotted Coaxial Cable

A coaxial cable with slots cut into the outer conductor, thereby permitting radio frequency radiation into and from the cable.

27.29.235 Software

Computer programs and routines; a collection of related utility, assembly, and other programs that are desirable for proper utilization of a device or equipment; detailed procedures, documents, manuals, drawings, and diagrams relating to a device, equipment or system.

27.29.236 Solid State

A device or system whose operation is dependent upon a combination of optical, electrical or magnetic phenomena occurring within a solid. Functions are performed by semiconductors and wholly static components, i.e., resistors, capacitors, etc.

27.29.237 Sound Pressure Level (SPL)

A measure, in dB, of acoustic loudness, usually designated to be the effective rms sound pressure referenced to 0.0002 dyne per square centimeter.

27.29.238 Span Section

A span section is defined in these Specifications as a transmission segment of the Fiber Optic System or Carrier Transmission System that extends from the Control Center to and including the passenger station, yard or other intermediate repeater or terminal of the span.

27.29.239 Spare

Equipment, assemblies or components, complete or in parts, on hand for repair or replacement.

27.29.240 Speech-Plus

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

Method of operation that permits the simultaneous transmission of speech and telegraph signals over a single voice channel.

27.29.241 Squelch

An action whereby a signal is completely cut off, unless a predetermined threshold level is attained.

27.29.242 Stationing

A system for establishing reference points along the Rail System. Civil stationing is used in initial design and development of the Rail Right-Of-Way. Train Control Stationing is later established as a permanent reference for operation of the Rail System.

27.29.243 Storage and Inspection Yard

A Metrorail yard which provides for the make up of trains and for the cleaning and minor maintenance of cars. No major repair facilities are provided.

27.29.244 Sub-Ballast

Crushed rock or stone that is placed between the ballast and the sub-grade.

27.29.245 Subscriber Loop

A circuit that is formed by the subscriber's telephone, the cable pairs and other conductors, and the telephone central office, PABX or other terminating equipment.

27.29.246 Substation, Traction Power

Building housing equipment and facilities for providing electrical energy to the trains via the contact rail.

27.29.247 Subway

That portion of the system which is constructed beneath the ground surface (i.e., underground Metrorail facilities).

27.29.248 Supervision

The process of monitoring the condition of a circuit to determine its status.

27.29.249 Supervisory Alarm Subsystem (SAS)

A subsystem of the Technical Control Facility which provides for the transmission of alarm information from a remote terminal in passenger stations and yards to the Control Center.

27.29.250 Talkback System

A system of the yard which provides two-way voice communications between the Yard Communications Console and the track areas.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

27.29.251 Talk Path

In a telephone or radio system, the circuit or channel which provides for the transmission of voice signals.

27.29.252 Terminal Strip (Board)

An insulating base equipped with terminals for connecting wires.

27.29.253 Third Rail

See contact rail.

27.29.254 Tie Breaker Station

Building housing power switching equipment for the purpose of sectionalizing contact rail power.

27.29.255 Tone Call

A system of exchanging calling or alerting signals and acknowledgment signals between mobile radio units and base stations that utilize modulated tones in the voice band.

27.29.256 Tone Dialing

The transfer of digital information from a telephone instrument to a central office or other terminal device utilizing multi-frequency tones. (Typically by standard DTMF tone signaling).

27.29.257 Tone Generator

A device for providing audio frequency currents suitable for signaling purposes.

27.29.258 Total Harmonic Distortion (THD)

A measure of the total effect of the various higher order harmonics of a sinusoidal signal.

27.29.259 Trackbed

The area and material directly under the track which provides support to the track. It includes ties and ballast, or other supporting material.

27.29.260 Train Control Contractor

The contractor who has been awarded a contract to provide a mainline Automatic Train Control System or a Yard Signal Control and Interlocking System.

27.29.261 Train Control Room (TCR)

(Mainline) A room located in a passenger station or at some other strategic point to house wayside ATC equipment including a Remote Terminal Unit. A major wayside control point for the ATC system.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**

(Yard) A room located at a strategic point in a Yard to house wayside Train Control equipment.

27.29.262 Trunk

A one or two-way channel connecting two telephone central offices, or a central office and an individual terminal.

27.29.263 Vehicular Radio

Radio transmitter/receiver and associated equipment designed to be installed in and operated from vehicles.

27.29.264 Voltage Standing Wave Ratio (VSWR)

The ratio of the highest to the lowest voltage of a standing wave at a feed through point.

27.29.265 Washington Metropolitan Area Transit Authority (WMATA)

Headquarters Located at:

Jackson Graham Building
600 Fifth Street, N.W.
Washington, DC 20001

27.29.266 Wayside Telephone System

A subsystem of the WMATA Telephone System.

27.29.267 Wet Contact

An electrical contact through which direct current flows.

27.29.268 WMATA Configuration

The arrangement of hardware or software, wiring, etc. within the equipment, equipment racks, rooms, or systems utilized by WMATA.

27.29.269 WOW

The slow cyclic deviation of audio signaling power with an approximate period of 0.5 Hz.

27.29.270 Yard

A system of Metrorail tracks and buildings within defined limits provided for the make-up of trains, storage of cars, and for cleaning, maintenance, inspection, and repair of trains.

27.29.271 Yard Control Room

The room in a Metrorail Yard which contains the Yard Train Control Console.

**WMATA MANUAL OF DESIGN CRITERIA
SECTION 27**