STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625

METRIC SPECIFICATIONS FOR TOC CENTRAL COMPUTER (TRAFFIC OPERATIONS CENTER COMPUTER EQUIPMENT)

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New Jersey Department of Transportation Specifications for Traffic Operations Center Computer Equipment.

The purpose of these specifications is to describe the minimum acceptable design and operating requirements for Traffic Operations Center Computer Equipment and interconnection via an Ethernet 10BaseT local area network. This equipment includes personal computer systems for operator interface, network and database, video server, remote operator interface, communications, and backup.

GENERAL - I

The complete Traffic Operations Center control system is comprised of a network of personal computers. All computer equipment shall be premium quality incorporating the latest personal computer technology that is available from the manufacturer's standard product line.

Several computer systems are to be supplied in accordance with the following specifications. Each computer system is identified by its function in the traffic operation system. There are variances between the system configurations.

1-1 Minimum Requirements

The following are minimum general requirements for all computer equipment to be supplied in accordance with these specifications:

A. OS/2 Certification

All computers shall be certified to run OS/2 Version 2.X, latest available version.

B. Computer Service Centers

All computers shall be manufactured by either IBM, Gateway or Compaq with service centers located in New Jersey who can provide on-site service and support 24 hours a day, 7 days a week, with an average response time of 4 hours or less.

C. ECC Memory

All computers shall provide ECC (Error Checking and Correction) Memory.

D. Channel Checking and Parity

All computers shall provide Synchronous Channel Check with Bus and Channel Parity.

E. Error Logging

All computers shall provide System Error Logging for OS/2 V2.X.

1-2 Documentation/Manuals

Documentation/manuals shall be provided for all hardware and software items specified herein. The documentation for the computer systems shall contain all standard manufacturer's hardware and software manuals for the assembly. Standard manuals are those manuals that are typically supplied by the manufacturer with the hardware or software product and all manuals that are required to fully use and operate the hardware or software.

A. Equipment List

The documentation shall include an equipment list which contains the quantity of each component supplied, model numbers, serial numbers, manufacturers' name/address, cost, options, and special features of all hardware provided.

B. As-built Plans

The documentation shall include as-built plans for the layout of the central computer equipment hardware, which show the exact way that installation of the computer hardware was completed, including locations of the equipment (computers, keyboards, monitors, printers, modems, power strips, cabinets, and external devices), and routing of all cabling (power cords, networking cable, printer cables, video cables, and phone lines). Five sets of the as-built plans shall be provided to the Engineer, including one set of reproducible. All cables shall be neatly labeled and tagged on each end and shall contain information on were it is terminated. All terminations on the equipment shall be identified with permanent labels.

C. Standard Manuals

The documentation shall include standard manuals for all manufacturer supplied software. Standard manuals are those manuals that are typically supplied by the manufacturer with the hardware or software product and all manuals that are required to fully use and operate the hardware or software.

1-3 Quality Control

Quality control procedures shall be used to assure that components have not been damaged during shipping and storage. A quality assurance program shall be developed

and followed for the construction and installation of all software/hardware. The program shall assure that each component, as installed in the system, meets the full requirements of these specifications.

1-4 Reliability and Operational Stability

The Supplier shall furnish and install all necessary equipment for a completely operational system, which is of high quality, high reliability, and has operational stability. Compliance with the operational and technical requirements of these specifications pertaining to individual elements of the system does not in itself constitute compliance with the reliability and operational stability of the complete integrated system.

1-5 Latest Design

All equipment and components parts shall be new, of the latest design and manufacture, meet all requirements of these specifications, and be in operable condition at the time of delivery. All parts shall be of high quality workmanship, shall be in production at the time of bid, and no part or attachment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices.

1-6 Component Quality

The components, including all parts, accessories, and connections, shall be constructed in a thoroughly workmanlike manner and in accordance with best commercial practice. Particular attention shall be given to the neatness and thoroughness of soldering, wiring, connections, and connectors.

1-7 Safety

Provisions for personnel safety shall be designed into each device and component. The design and installation shall be as such to prevent reversed assembly or installations of connectors, fasteners, etc., where possible malfunction or personnel hazards might occur.

1-8 Process and Software Upgrade

All 80486DX processors specified shall be replaced with upgraded units, if faster and/or more powerful processors are commonly available at the time of the contract bid. In addition, all software shall automatically be upgraded to the latest versions available at the time of the contract bid.

OPERATOR INTERFACE COMPUTER SYSTEM - II

2-1 Configuration

One (1) personal computer system based on the Intel Pentium microprocessor to run the operator interface software. The Operator Interface computer shall include the following components:

A. Minimum 400 megabytes SCSI hard disk drive with an average access time less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter floppy disk drive.

C. CPU speed of 60 megahertz or greater.

D. Minimum 6 full length 32 bit adapter slots.

E. Computer and all adapter boards shall be MCA compatible.

F. 32 megabytes of ECC RAM, 70 nanosecond, expandable to 128 megabytes on the system board.

G. 256K Write-back L2 Cache, 16K internal Cache.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of PC DOS software.

L. 483 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad.

O. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

P. DVI (Digital Video Interactive) video playback board with OS/2 2.X drivers version 1.2 or later.

Q. DVI video capture board that is compatible with the DVI video playback board.

R. 130 millimeter internal high density floppy drive.

S. Battery backed up real-time clock/calendar.

T. Built in serial/parallel ports.

NETWORK AND DATABASE COMPUTER SYSTEM - III

3-1 Configuration

One (1) personal computer system based on the Intel Pentium microprocessor to run the network and database software. The Network and Database Computer System shall include the following components:

A. Two (2) 1 gigabyte SCSI hard disk drives with an average access times less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter floppy disk drive.

C CPU speed of 60 megahertz or greater.

D. Minimum 6 full length 32 bit adapter slots.

E. Computer and all adapter boards shall be MCA compatible.

F. 64 megabytes of ECC RAM, 70 nanosecond, expandable to 128 megabytes on the system board.

G. 256K Write-back L2 Cache, 16K internal Cache.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of PC DOS software.

L. 356 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad.

O. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

P. LAN Server (Advanced) software V3.0 for OS/2 2.X.

Q. UPS Software with LAN Server support.

R. Thin Ethernet cabling and connectors for entire network, including five (5) 15 meter cables and five (5) 1.5 meter cables.

S. E-Mail software (Lotus CC:Mail or similar) with 25 user licenses and OS/2 2.X support.

T. Sybase SQL database software for OS/2 2.X with 10 user, 32 bit client support and 1 year maintenance.

U. Sybase DB-Lib 32 bit, 'C' Language API software.

V. Sybase Net-Lib network access software.

W. 130 millimeter internal high density floppy drive.

X. Battery backed up real-time clock/calendar.

Y. Built in serial/parallel ports.

Z. Laserjet printer (HP Laserjet 4 or equivalent) with 24 dots per millimeter.

AA. Parallel Printer cable, minimum length of 4.5 meters.

AB. Lotus 123 spreadsheet software for OS/2 2.X.

AC. External 8 millimeter 2.3G SCSI Tape backup device.

AD. Tape backup SCSI cable.

AE. Sytos Plus Tape backup software for OS/2 2.X.

AF. Lotus Datalens Software for OS/2 2.X Database Server.

AG. Lotus Datalens Software for OS/2 2.X Sybase SQL Server.

VIDEO SERVER COMPUTER SYSTEM - IV

4-1 Configuration

One (1) personal computer system based on the Intel Pentium microprocessor to run the video server software. The Video Server Computer System shall include the following components:

A. Minimum 400 megabyte SCSI hard disk drive with an average access time less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter internal floppy disk drive.

C. CPU speed of 60 megahertz or greater.

D. Minimum 6 full length 32 bit adapter slots.

E. Computer and all adapter boards shall be MCA compatible.

F. 64 megabytes of ECC RAM, 70 nanoseconds, expandable to 128 megabytes on the system board.

G. 256K Write-back L2 Cache, 16K internal Cache.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of PC DOS software.

L. 432 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad.

O. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

P. DVI (Digital Video Interactive) video playback board with OS/2 2.X drivers version 1.2 or later.

Q. DVI video capture board that is compatible with the DVI video playback board.

R. DVI C Language Toolkit that is compatible with both DVI boards listed above.

S. 130 millimeter internal high density floppy drive.

T. Battery backed up real-time clock/calendar.

U. Built in serial/parallel ports.

REMOTE COMPUTER SYSTEM - V

5-1 Configuration

The remote computer system shall consist of three (3) personal computer systems based on the Intel Pentium microprocessor to run the remote operator interface software. The three (3) Remote Computer Systems shall each include the following components:

A. One (1) 400 megabyte (or greater) SCSI hard disk drive with an average access times less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter floppy disk drive.

C. CPU speed of 60 megahertz or greater.

D. Minimum 6 full length 32 bit adapter slots.

E. Computer and all adapter boards shall be MCA compatible.

F. 32 megabytes of ECC RAM, 70 nanosecond, expandable to 128 megabytes on the system board.

G. 256K Write-back L2 Cache, 16K internal Cache.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of PC DOS software.

L. 356 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad.

O. External, synchronous, V.25bis, 9 600 bits per second dial-up/lease line modem.

P. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

Q. Ethernet Network Bridge with one (1) synchronous port, TCP/IP protocol compatible, Thinnet, and up to 4 megabits per second line speed.

R. 130 millimeter internal high density floppy drive.

S. Battery backed up real-time clock/calendar.

T. Built in serial/parallel ports.

COMMUNICATIONS COMPUTER SYSTEM - VI

6-1 Configuration

One (1) personal computer system based on the Intel Pentium microprocessor to run the communication software. The Communications Computer System shall include the following components:

A. One (1) 400 megabyte (or greater) SCSI hard disk drive with an average access times less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter floppy disk drive.

C. CPU speed of 60 megahertz or greater.

D. Computer and all adapter boards shall be MCA compatible.

E. 32 megabytes of ECC RAM, 70 nanoseconds, expandable to 128 megabytes on the system board.

F. 256K Write-back L2 Cache, 16K internal Cache.

G. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

H. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

I. OS/2 Version 2.1 (or latest) software.

J. Latest commercially available version of PC DOS software.

K. 356 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

L. Mouse Port.

M. Mouse compatible with other hardware and software specified and mouse pad.

N. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

O. Multiport Hardware to support 200 or more RS-232C DTE ports with continuous data rates of up to 9 600 bits per second per port (Digiboard MCA C/16 with C/16 concentrators or equivalent), DB25 connectors, and OS/2 2.X drivers.

P. Minimum of six (6) expansion slots.

Q. External, synchronous, V.25bis, 9 600 bits per second dial-up/lease line modem.

R. 130 millimeter internal high density floppy drive.

S. Battery backed up real-time clock/calendar.

T. Built in serial/parallel ports.

U. Ethernet Network Bridge with one (1) synchronous port, TCP/IP protocol compatible, Thinnet, and up to 4 megabits per second line speed.

BACKUP COMPUTER SYSTEM - VII

7-1 Configuration

One (1) personal computer system based on the Intel Pentium microprocessor to provide a backup computer system in the event that one of the others fail. The Backup Computer System shall include the following components:

A. Two (2) 1 gigabyte SCSI hard disk drives with an average access times less than 20 milliseconds.

B. 2.8 megabyte, 90 millimeter floppy disk drive.

C. CPU speed of 60 megahertz or greater.

D. Minimum 6 full length 32 bit adapter slots.

E. Computer and all adapter boards shall be MCA compatible.

F. 64 megabytes of ECC RAM, 70 nanoseconds, expandable to 128 megabytes on the system board.

G. 256K Write-back L2 Cache, 16K internal Cache.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of PC DOS software.

L. 356 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad.

O. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

P. DVI (Digital Video Interactive) video playback board with OS/2 2.X drivers version 1.2 or later.

Q. DVI video capture board that is compatible with the DVI video playback board.

R. 130 millimeter internal high density floppy drive.

S. Battery backed up real-time clock/calendar.

T. Built in serial/parallel ports

UTILITY COMPUTER - VIII

8-1 Configuration

One (1) personal computer system based on the Intel Pentium computer (manufactured by either Gateway or Compaq) with an AT ISA bus to provide a utility computer system. The Utility Computer System shall include the following components:

A. The computer shall have a minimum of 6 full length 32 bit spare adapter slots.

B. The computer shall provide four RS 232 communications ports.
C. 400 megabyte hard disk drives with an average access times less than 20 milliseconds.

D. Video and disk controllers shall be installed on a local bus or equivalent to provide enhanced performance. The local bus shall be compatible with all other hardware/software components.

E. 2.8 megabyte, 90 millimeter floppy disk drive.

F. CPU speed of 60 megahertz or greater.

G. 32 megabytes of RAM, 70 nanoseconds, expandable to 128 megabytes on the system board.

H. Alphanumeric keyboard with 101 key emulation and status indications for key lock functions.

I. XGA-2 Video display card with a resolution of 1 024 by 768 (or greater) by 256 colors, and 1 megabyte of on-board memory. Must have OS/2 2.X drivers.

J. OS/2 Version 2.1 (or latest) software.

K. Latest commercially available version of MSDOS 6.0 or latest and Microsoft Windows 3.1 or latest software.

L. 356 millimeter (or greater) non-interlaced color monitor with a dot pitch of 0.31 millimeter or less, and supporting resolutions of 1 024 by 768 (or greater).

M. Mouse Port.

N. Mouse compatible with other hardware and software specified and mouse pad. The mouse shall have a PS/2 type interface and shall require neither a slot nor a communications port to operate.

O. 10 megabits per second Ethernet network adapter board with 10BaseT, Thinnet and Thicknet cable ports and LAN Server 3.X drivers.

P. 130 millimeter internal high density floppy drive.

Q. Battery backed up real-time clock/calendar.

R. Two (2) parallel ports.

S. Laserjet printer (HP Laserjet 4 or equivalent) with 24 dots per millimeter.

T. Parallel Printer cable, minimum length of 4.5 meters.

REMOTE COMMUNICATIONS EQUIPMENT - IX

9-1 Configuration

One (1) modem rack with five (5) dual channel modems and the associated communications cables and connectors to provide system communications with remote users. The Remote Communications Equipment shall consist of the following components:

A. Modem rack with dual power supply.

B. Five (5) dual channel 19.2K rack modems which support both dedicated (leased) and dial up lines.

C. Ten (10) rack face plates.

D. Twenty (20) 6 meter Male to Female 25 pin RS-232 cables.

E. Ten (10) 1.5 meter RJ-11 cables.

F. Five (5) 6 meter RJ-11 cables.

G. Five (5) 1.5 meter RJ-45 cables.

H. Five (5) 25 pin Male to 9 pin Female adapters.

OTHER EQUIPMENT - X

10-1 Configuration

Additional computer related supplies and hardware including floppy disks, telephone, toolkit, and power strips. All hardware and supplies shall be premium quality fully tested, certified and guaranteed. Hardware and supplies shall consist of the following components:

A. Fifty (50) 90 millimeter, 1.4 megabyte floppy disks.

B. Fifty (50) 90 millimeter, 2.8 megabyte floppy disks.

C. Fifty (50) 130 millimeter high density floppy disks.

D. Fifty (50) 8 millimeter backup tapes certified compatible with the specified backup tape drive at the highest available capacity.

E. Telephone with hands free headset.

F. Personal computer system toolkit with assorted items, including screwdrivers, chip remover, and voltage meter.

G. Ten (10) AC power strips with surge protection, current capacity of 15 amps, maximum joule rating of 120, resetable circuit breaker, and minimum EMI/RFI filtration of 60 decibels.

LAN EQUIPMENT - XI

11-1 Configuration

The Traffic Operations Center Computer Equipment shall be interconnected via an Ethernet 10BaseT (twisted pair) local area network. The Supplier shall provide all equipment and cabling necessary to install connect and operate a fully functional local area network (LAN). Note that the computer network interface cards (NICs) are specified with each individual computer system. All computer network interface cards provided in response to these Specifications shall be identical unless otherwise specified.

The LAN components shall be compliant with IEEE 802.3 10BaseT standards. The LAN components shall include network interface cards (specified with the computer systems), connectors and cabling between the network interfaces cards and an associated local outlet box, cabling from the outlet boxes to a patch panel, a fan-out cable assembly between the punch-down block and the 10BaseT hub and a 10BaseT hub.

The cable connecting the NIC to the local outlet shall be 10BaseT compatible 24 AWG stranded copper cable containing two cable pairs terminated at each end with RJ-45 type gold plated connectors. Cable length shall be a minimum of 3.6 meters or the length required to complete the connection with 1.5 meters of slack.

The local outlet shall include two RJ-45 sockets on the face. The sockets shall terminate in a mini 110 style punch-down panel. The local outlet shall be enclosed in a non-metallic case suitable for installation under a raised floor. One local outlet containing a minimum of two sockets shall be provided for each computer (two outlets per computer minimum).

The cable connecting each local outlet to the patch panel shall be plenum rated Teflon jacketed cable. Each cable shall contain 4 unshielded twisted pair 24 AWG solid copper with color coated individual jackets. Cabling shall be Level 4 grade having the following minimum specifications:

A. Maximum attenuation at 10 megahertz 20 decibels or less per 300 meters.

B. Near end cross-talk attenuation minimum 30.5 decibels at all frequencies to 10 megahertz.

C. Characteristic impedance minimum 85 maximum 115 ohms.

D. Mutual capacitance any pair of 67 picofarads per meter maximum.

E. Color coded pairs

Cable lengths shall be sufficient to provide a minimum 4.5 meters slack at each end. Maximum cable lengths shall be less than 90 meters. If longer lengths are required due to facility design limitations, compatible repeaters shall be supplied. All cables shall be individually labeled with a unique sequential alphanumeric identifier within 450 millimeters of each end and every 3 meters.

The patch panel shall be a 32 position 483 millimeter rack mountable panel with 32 RJ-45 sockets on the face and a 110-type punch down block on the rear. All eight connectors of all 32 RJ-45 sockets shall be terminated on the integrated 110 block.

The LAN circuits from the patch panel shall be connected to the 10BaseT hub via a fan-out cable that has 12, 2-pair 10BaseT compatible stranded cables terminated in individual RJ-45 connectors at one end and a 25 pair telco connector for the hub end. All connecting cable and connectors shall be of a quality that is compatible with IEEE 10BaseT specifications. All connector connections shall be made using the same color code scheme, for example if the scheme is Wht/Blu-pin 1, Blu-pin 2, Wht/Org-pin 3 and Org-pin 6 (a typical 10BaseT wiring scheme), the same scheme shall be used throughout the system. All patch panel positions shall be clearly labeled and documentation provided so that the entire computer to hub circuit can be easily identified.

The 10BaseT Ethernet hub shall be configured to be compatible with the NICs and all wiring and connectors specified above. The 10BaseT Ethernet hub shall have the following features and functions:

F. Compliant with IEEE 802.3 10BaseT specifications for Ethernet on unshielded twisted pair wiring.

G. Link integrity test

H. Intelligent squelch

I. 5 volt peak to peak signaling with pre-equalization

J. Jabber function

K. Full IEEE 802.3 repeater function

L. Auto Partition

M. Twisted pair to twisted pair hub connection for additional hubs
N. Individual port control

O. Built-in microprocessor based diagnostics

P. Remote diagnostics and management

Q. Expandable architecture

R. Hub electronics may be removed from stand-alone case and installed in a larger concentrator chassis for expansion.

S. RS-232C port for network management

T. Power supply

U. Compliant with FCC Part 15 subpart J, Class A standards

V. UL listed (power supply)

W. 10 megabits per second data rate

11-2 Tools and Equipment

The following installation tools and spare equipment shall be provided:

A. 150 meter 4-pair cable of the same type used for the local outlet to punch-down block link.

B. 15 meter 2-pair stranded cable of the same type used for the local outlet to NIC connection.

C. 10 of each type of RJ-45 connector used with the above cable (10 stranded type, 10 solid type)

D. punch-down tool with attachments for 66 and 110 type blocks with cutting blades

E. RJ-45 connector attachment tool (premium quality with lifetime warranty).

TESTING - XII

All equipment defined in this specification shall be subject to factory testing as subsequently described. The factory test shall demonstrate or provide confirmation that all of the equipment meets the overall specifications.

The supplier shall be responsible for submitting a test plan which has been designed to exercise and monitor the equipment for the purpose of determining compliance with the specifications.
All equipment and software furnished shall be subject to monitoring and testing to determine conformance with all applicable requirements and to ensure an orderly implementation of the system. Documentation to demonstrate component performance and operation in conformance with these Specifications shall be furnished as part of the project. Each hardware/software component shall be examined and tested to verify that the materials, design, construction, operation, performance, and workmanship comply with these specifications.

Each component shall be examined carefully to verify that the materials, design, and construction, markings, and workmanship comply with the requirements of these specifications. Visual inspections shall be performed on all components and subassemblies to determine any physical defects, such as cracking, scaling, poor fastening, incorrect component values, etc. Complete electrical testing shall be performed on each component and subassembly to determine compliance to the designed function. Housing, chassis, and connection terminals shall be inspected and mechanical sturdiness, and harnessing to sockets, shall be electrically tested for proper wiring sequence. Any missing mounting hardware, screws, bolts, or loose connections shall be noted. All such conditions shall be corrected prior to the conclusion of the test.

As part of the factory acceptance test, the complete configuration shall be integrated and activated, including the LAN system.

The test shall demonstrate that all of the components are operational and can communicate over the LAN system. Each port on every computer and all internal boards shall be tested to insure that all of the equipment is operational. Diagnostics shall be run on each machine to verify that the correct internal and disk memory is available. All floppy disks and tape drives shall be exercised to verify that they are operational. All printers shall be exercised to verify that they are operational to manufacturer's standards.

INSTRUCTIONS AND GUARANTEES - XIII

13-1 One set of complete schematics and operations/maintenance manuals of each component shall be supplied with every field and central assembly furnished. Maintenance manuals shall include complete sub-component parts listing. Operations manuals shall include a complete description of the software protocol.

13-2 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of ITS Engineering, New Jersey Department of Transportation, P.O. Box 613, 1035 Parkway Avenue, Trenton, New Jersey 08625.

13-3 All components shall carry a two-year guarantee from the date of acceptance against any imperfections in workmanship or materials.

13-4 The manufacturer agrees to, upon the request of the Manager, Office of ITS Engineering to deliver to the Office, a sample of each assembly to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.

13-5 The supplier shall furnish any and all equipment which they deem necessary for safe and reliable field and operation of the central computer equipment as part of the quoted price for the specified equipment.

13-6 All components furnished under this specification shall be current production equipment and of recent manufacturer, identical models of which are in field operation in not less than one hundred sites. Untried or prototype units shall not be considered for acceptance.

13-7 All major components shall be identified with a metal plate containing the serial number with a bar code identification.

13-8 Any repairs made by a manufacturer or representative shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs shall be completed within thirty days of delivery of the equipment to the designated repair depot.