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

METRIC SPECIFICATIONS FOR A CLOSED LOOP SYSTEM ENGINEERING CONSOLE

N. J. Specification No. EBM-EC-1 Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for a Microprocessor Based Closed Loop Traffic Signal System Engineering Console.

The purpose of these specifications is to describe the minimum acceptable design and operating requirements for a microprocessor based closed loop traffic signal system engineering console.

GENERAL - I

1-1 The engineering console shall consist of a digital microprocessor unit, keyboard, monitors, temporary data storage, long term data storage equipment, printers, graphics input unit, modem, operator desk, standby power system, system map display unit portable data input unit, accessories and applications software.

1-2 The complete engineering console shall be fully debugged and all individual units and/or components must be completely compatible.

1-3 The console must be capable of operation in the following environment:

Air temperature, 15 °C to 32 °C
Humidity, 20% to 80%

1-4 All equipment must operate with line voltage variations of 90 to 137 volts AC at 50-60 hertz. All logic level equipment must be powered by a power supply capable of operating the specified equipment.

1-5 All equipment provided as part of this specification shall be color coordinated. The contractor will provide for approval samples of the colors and fabrics to be used.

1-6 The system shall include all cabling, connectors, cards, and other ancillary equipment required for interconnection of the processors and peripheral equipment to perform the functions as required by these specifications.

DIGITAL MICROPROCESSOR UNIT - II

2-1 The digital microprocessor unit shall enclose the microprocessor in a tower case with three disk drives, internal expansion boards, memory, and a 220 watt power supply.

2-2 The digital microprocessor unit shall utilize an Intel 80486 microprocessor with an Intel 80387 math co-processor. The clock speed shall be a minimum of 66 megahertz. The unit shall provide a minimum of 10.7 MIPS. The unit shall be manufactured by IBM, Gateway or Compaq only.

2-3 The digital microprocessor unit shall provide eight (8) expansion slots, one - 32 bit memory and seven - 8-/16-/32 bit EISA for adapter cards that support optional devices.

2-4 The unit shall include 8 megabytes of 70 nanosecond random access memory, expanded to 64 megabytes with memory expansion card.

2-5 The disk operating system with BASIC shall be Microsoft or IBM DOS Latest Version. The unit shall also be provided with the latest revision of IBM OS/2 and Windows operating environments.

2-6 The temporary data storage shall include as a minimum the following:

A. One (1) 1.2 megabyte 130 millimeter "Floppy Disk Drive" (External)

B. Two (2) 1.4 megabyte 90 millimeter "Floppy Disk Drive"

C. One (1) 340 megabyte Minimum Internal Hard Disk Drive

D. One (1) CD ROM Drive MPC compatible

2-7 The unit shall utilize a video display adapter board for the Super Video Graphic Adapter video display with 1 megabyte of video memory. The graphic board shall provide a 1 024 by 786 resolution with 256 colors. The graphics monitor shall be non-interlaced, and support a non-interlaced monitor.

2-8 The unit shall contain one parallel port, two serial ports and a mouse port. The mouse shall be provided.

2-9 The unit shall contain a multi-function expansion board. The board shall provide two (2) RS-232-C serial ports for communications, configured as COM3 and COM4. The board shall also provide a 36-pin Centronics printer port, configured as LPT2.

2-10 The unit shall contain an Ethernet transceiver board and software to support 6 workstations to utilize this unit as a file server when required by the current New Jersey Department of Transportation Specification No. EBM-CL-2 to which this specification applies. The board shall support Thin Ethernet wiring and equipment.

KEYBOARD - III

3-1 The keyboard shall be a qwerty type with 101 keys, with tactile and audio feedback.

3-2 The keyboard shall be detachable, with a three meter coiled cable for connection to digital microprocessor unit.

3-3 The keyboard shall contain a minimum of twelve (12) special function keys, a ten key numeric key pad, and a "print screen" key.

3-4 The keyboard shall be provided with overlays for all provided software and system functions.

3-5 LED indicators shall be provided to confirm when "number lock", "scroll lock", and "caps lock" keys are in use.

MONITORS - IV

4-1 The graphic intersection and system display monitor shall be a high-resolution color 406 millimeter (diagonally measured) monitor. It shall provide 1 024 by 768 pixel resolution with 256 colors. The screen shall be a dark, etched screen with high contrast and reduced glare. The monitor shall have brightness and contrast controls.

4-2 The text monitor shall be provided with a turntable that swivels 360° with a ±15° tilt.

LONG TERM DATA STORAGE - V

5-1 The long term data storage shall be a tape backup unit - 150 megabytes. The tape drive shall be external to the microprocessor unit and have a capacity of 300 megabytes. The tape drive shall be supplied with ten (10) extra tapes and software to provide automatic system backups based on day and time. The tape drive maybe an internal unit of the same manufacture as the microprocessor unit.

PRINTERS - VI

6-1 The engineering console shall include a report printer and a graphics printer.

6-2 The graphics printer shall be an Epson LQ 2550 or approved equal and shall have a friction-feed 381 millimeter platen and be capable of handling paper up to 406 millimeters wide, adjust for up to five carbons, and an automatic single-sheet feeder.

6-3 The graphics printer shall have high-resolution 24 pin "letter quality" printing, at a rate of not less than 106 characters per second. The printer shall support bold face, strike-through, double-underline, superscripts and subscripts.

6-4 The graphics printer shall have eight built-in fonts and a bar code font with a 14 by 14 dots per millimeter maximum resolution. The fonts shall be selectable in software or by a control panel located on the front of the printer.

6-5 The report printer shall be an Hewlett Packard Series 4 or an approved equal and shall be a laser printer with resolution of 24 by 24 dots per millimeter. The printer shall be capable of printing a minimum of eight pages per minute. It shall be capable of handling A4 size paper and shall have a paper tray provided.

6-6 The report printer shall have a minimum of 24 internal "soft" fonts and a postscript cartridge with 35 scaleable Adobe typefaces. An additional cartridge will be provided for premier scaleable fonts and a bar code font.

6-7 The report printer shall be provided with 8 megabytes of RAM.

6-8 The report and graphic printers shall be U.L. listed and have a standard 8 bit data parallel interface with a 36-pin amphenol connector and 25-pin D connector respectively.

6-9 The graphic printer will be supplied with acoustical cabinet. The cabinet shall contain a built in fan with an on-off switch. The cabinet shall be certified to reduce the sound level below 40 decibels. The acoustical chamber shall be of sufficient size to accommodate the specified printer and have a clear acrylic hood. The cabinet shall match the existing office furniture in color and style.

GRAPHICS INPUT UNIT- VII

7-1 The graphics input unit shall be capable of inputting intersection and system maps into the closed loop system. The unit shall be capable of scanning 4 096 colors and 256 levels of gray.

7-2 The graphics input unit shall be a Hewlett-Packard ScanJet IIc or an approved equal and shall provide for full A4-size page scanning with a minimum resolution of 16 dots per millimeter.

7-3 The graphics input unit shall be capable of exporting file into the closed loop system and in addition provide PCX, gray TIFF, color TIFF and IMG file formats. If additional software is required to provide these formats it shall be supplied.

7-4 The graphics input unit shall include software to edit the maps. The software include as a minimum the following editing tools:

A. Zoom function - allows reduction or enlargement of image from 50% to 200% in 1% increments.

B. Rotation - permit image rotation through 180°.

C. Cut, Paste and Move - allows copying of portions of the map from one section of the image to another.

D. Brightness, Contrast, Hue, and Color Control - allows adjusting the image characteristics.

E. Text mode to input or edit text in a graphic map.

7-5 The graphics input unit shall include software to provide optical character recognition. The software shall recognize 8 to 30 point mono-spaced and proportional fonts at up to 200 words per minute. The software shall provide a number of standard fonts for

selection and automatically switches fonts when more than one is selected. The software shall be trainable to learn unrecognized shapes and new fonts and includes real-time viewing of text during normal and training scans. The output shall be an ASCII text file.

MODEM - VIII

8-1 The modem shall be an external internal 9 600 baud modem - Hayes compatible and shall provide full duplex operation using a 2 wire dial up or leased lines. The modem shall comply with part 68, FCC docket 19528.

8-2 The data rates shall be 300, 1 200, 2 400, 4 800 and 9 600 bits per second, and support asynchronous and synchronous communication.

8-3 The modulation shall be frequency shift keying (FSK) for low speed and phase shift keying (PSK) on a dibit basis for high speed.

8-4 Originate, manual, permanent auto answer or controlled auto answer operating modes shall be provided.

8-5 The modem shall have a line impedance of 600 ohms ±10% transformer coupled and transient protected. The transmitter output level shall be 0 to -12 dBm programmable, with an external programming resistor.

8-6 The modem shall provide a RS-232-C and CCITT V.32 and V.22 digital interface via a DB-25S connector.

8-7 The carrier detect sensitivity at low speed shall be -50 dBm +/- 4 dB and at high speed shall be -45 dBm ±4 dB.

8-8 The modem shall provide an auto disconnect function that will disconnect the modem due to a lack of carrier for approximately 18 seconds.

8-9 The front panel of the modem enclosure shall contain 8 diagnostic LEDs. The indicators shall indicate modem ready, terminal ready, make busy, high speed, modem check, receive data, transmit data and test modem.

8-10 A power on-off switch shall be mounted on the modem along with the DB-25S connector, an 8-pin RJ45 data jack, and an RJ-11 telephone jack.

SYSTEM MAP DISPLAY UNIT - IX

9-1 The system map display unit shall utilize the projection of an Liquid Crystal Display (LCD) to display the system maps and other graphics for large groups.

9-2 The unit shall be capable of producing an image from 508 millimeters to 2 540 millimeters measured diagonally. The image will be in color and have a resolution equal to the system graphics monitor.

9-3 The unit shall include all interface boards and cables to provide the SVGA image.

ENGINEERING DESK - X

10-1 The engineering desk shall be located at the Department of Transportation Engineering and Operations Building, seventh floor. The contractor shall furnish and install on the desk the following equipment which will include but is not limited to the text monitor, digital microprocessor unit, keyboard, long term data storage unit, swivel mounted graphics monitor and map display unit

10-2 The approximate size and shape of the desk top surface area is shown on the plans. The desk top shall match the color, style and type of the existing desk at the location

10-3 A keyboard area 610 by 254 millimeters shall be provided. The keyboard area shall be adjustable to extend, retract, raise, lower, or tilt the keyboard. An area shall be provided behind the keyboard area for the monitor.

10-4 The engineering desk shall include a custom made accessory tower. The tower shall be located below the desk and contain standby power system, "T" switches and CPU unit. The accessory tower shall be of sturdy, steel construction and approximately 725 millimeters in height. The CPU unit shall be mounted on a drawer to provide access for maintenance.

10-5 All cables shall pass through slots in the back of the tower. All wiring shall be concealed by a wireway that is covered by a shield that extends approximately 150 millimeters behind the tower. Behind the shield shall be located receptacles to provided for the A.C. power for all the equipment located on the desk. Minor deviations in shape or dimensions shall be permitted subject to the approval of the Engineer. The desk top shall be furnished in a melamine laminate which is resistant to heat and abrasion. All edges of the desk top shall be rounded.

10-6 Two chairs shall be provided with the desk. The chairs shall be 3-way adjustable, with arm rests and have a minimum of 5 breaking casters. The chairs shall match the chairs in the existing office location in color, style, and material.

10-7 The engineering desk shall include two book shelves. The book shelves will match the existing office location in color and style. The book shelves will be a maximum height of 1 524 millimeters, with a minimum 940 millimeters width and a 476 millimeters depth. The book shelves shall have a tambour door and match the media cabinet required below.

10-8 The engineering desk shall include a media cabinet. The media cabinet will match the existing office location in color and style. The cabinet will be a maximum height of 1 524 millimeters, with a minimum 940 millimeters width and a 476 millimeters depth. The cabinet shall have a tambour door and be provided with a roll out drawer for storage of disks, both 130 millimeters and 90 millimeters. the cabinet shall also contain a fixed shelf for storage of operators manuals and roll out drawer for accessories and binders.

STANDBY POWER SYSTEM - XI

11-1 A standby power system shall be provided. The system is to provide power to the engineering console should power be disrupted for 6 milliseconds.

11-2 The system shall provide four (4) outlets (NEMA 5-15R) with an on-off switch.

11-3 Indicator lights shall indicate normal status and backup status.

11-4 The system shall provide a minimum of 1 200 volt-amperes from a dry lead-acid battery, and provide for a minimum of 60 minutes of operation of the system.

11-5 The system shall contain an audible alarm and an output jack for the alarm. An alarm enable/disable switch shall also be provided. The system shall provide three stage protection from voltage spikes and transients.

PORTABLE DATA INPUT UNIT - XII

12-1 The Console shall include a portable data input unit. The portable data input unit shall consist of a digital microprocessor unit with built-in keyboard, monitor, and data storage. The portable data input unit shall also consist of a printer and applications software.

12-2 The complete portable data input unit shall be fully debugged and must be capable of operation in the following environment:

Air temperature, 5 °C to 35 °C.
Humidity, 20% to 80%

12-3 The portable data input unit shall operate on 18 volts D.C. with an A.C. adapter to provide the input voltage that operates on a line voltage with variations of 100 to 140 volts AC at 50-60 hertz. The unit shall also include a Nickel Hydride battery for field operation and a spare battery.

12-4 The portable data input unit shall utilize an Intel 80486 microprocessor with a Intel 80387 math co-processor. The clock speed shall be 25 megahertz. The unit shall be manufactured by IBM, Gateway or Compaq only.

12-5 The portable data input unit shall be provided with an internal 2 400 baud modem - Hayes compatible and a port configured to connect to both local controllers and on-street masters. The unit shall also include a 101 key keyboard adapter and keyboard.

12-6 The unit shall include 4 megabytes of random access memory, expanded to 16 megabytes with a memory module. The unit shall be provided with an operating system with BASIC that shall be Microsoft or IBM DOS Latest Version. The unit shall also be provided with the latest version of IBM OS/2 and Windows operating environments.

12-7 The data storage shall include as a minimum the following:

A. One (1) 1.2 megabyte, 130 millimeter "Floppy Disk Drive (External)"

B. One (1) 1.4 megabyte, 90 millimeter "Floppy Disk Drive"

C. Two (2) 120 megabyte Minimum Internal Removable Hard Disk Drives, one installed and one provided.

12-8 The unit shall utilize a graphic board for the Video Graphic Adapter video display (VGA or equal). The graphic board shall provide a 640 by 480 resolution with 256 colors. The unit shall include a mouse port, a mouse and a built in trackpoint.

12-9 The unit shall include a hard carrying case, AC adapter, external battery charger, 12 volt adapter, extra 3 hour battery, numeric key pad, and docking station with monitor.

12-10 The unit shall include a report printer. The printer shall be an Epson or approved equal and shall have a friction-feed 381 millimeter platen and be capable of handling paper up to 406 millimeters wide, adjust for up to five carbons, and an automatic single-sheet loading. The printer shall have high-resolution 24 pin "letter quality" printing, at a rate of not less than 106 characters per second. The printer shall support bold face, strike-through, double-underline, superscripts and subscripts.

12-11 The unit shall include a bar code reader for the equipment inventory system in accordance with EBM-BCS. The software provided shall provide the unit with the capability of field inventory control that can return the data to the maintenance or engineering console. The software provided shall allow the unit to perform all the functions of the engineering console from a remote location or connected directly to the on-street master. The unit shall also be capable of uploading and downloading traffic data directly to the on-street master or local controllers.

SOFTWARE - XIII

13-1 Closed Loop System

A. The closed loop system software shall provide for all the system capabilities required by the current New Jersey Department of Transportation Specification No. EBM-CL-1 or EBM-CL-2 as required by the contract to which this specifications apply.

B. The software shall provide setting the clocks in the on-street master and local intersection controller from the operator's real time clock.

C. The software shall be fully documented. The documentation shall fully explain the communications protocol used to pass data between all system components.

D. The software shall be configured for the State of New Jersey, in that all graphic and data printouts shall contain the title "New Jersey Department of Transportation, Office of ITS Engineering Closed Loop System".

E. All graphic and data printouts for local intersection controllers will contain the State highway route designation, the intersection name, a 7-digit control number, and the municipality.

F. All software shall be fully operational and "debugged".

13-2 Traffic Analysis

A. The engineering console shall have the necessary software provided for Transit 7F (latest revision).

B. The engineering console shall have the necessary software provided for Passer II-90 and III-90 (latest revisions).

13-3 Off System

The following software shall be provided:

A. Data base management program to create, sort, retrieve, and edit data files, using simple English-like commands. The program shall be R-Base latest version or an approved equal and shall be menu driven and contain an on line context-sensitive help system. The program can have data inputted immediately when a file is created or appended later. The program shall utilize an SQL file format for all data files. The files can be changed, extended and modify the applications without having to re-enter data. Records, or any part of a record, can be displayed, modified and updated. The report function allows quick organization of data. Forms and formats can be created that perform calculations and totals on a field, a record or the entire database. The program shall be fully relational and handle up to one million records per file. The data base software shall allow up to sixteen files to be open at one time. The program shall include a compiler program to create unlimited number of custom application executable programs. The program will also include the development tools and application library.

B. Word processing program with spelling and grammar correction. The program shall be WordPerfect for Windows latest version and shall provide functions to write, edit, rearrange; file merge; boldface, underline, super and subscript; block functions; on-line help; justification; full cursor movement; headers and footers; centering; auto backup; cut and paste; printer support and proofread documents. The program shall be capable of finding mistakes using both letter and phonetic analysis with a 100 000-word dictionary and a personal dictionary of up to 5 000 words. The program shall be capable of producing personalized mailings.

C. Graphics program to prepare intersection graphics from pull-down menus and icons. The program shall be MicroStation Version 4 or latest version. The program shall provide functions to change colors, patterns, line widths, rotate, zoom, tilt, shrink, expand, flip, invert and print to a plotter. The program shall provide for files in a.dgn format and shall use the mouse provided as an input device. The graphics program shall be capable of interfacing with the closed loop system for preparation of intersection displays. The program shall produce plans similar to the contract plans. The program shall include a raster editor IRAS

D. Windows based communications program to provide communication with the Department's mainframe and other Department microcomputers. The program

shall provide functions for transferring files with or without error detection/correction, auto-dial, auto-redial and auto-answer and transfer of files in an unattended mode.

E. Hard disk diagnostic program to reassemble fragmented files to restore file handling speed. The program shall provide a function to sort files and directories by name, extension, date/time, or length. The program shall provide additional functions to detect failing disk sectors and move affected data to new locations on the disk. The program shall automatically backup hard disk file allocation table and place the backup in a known location on the disk. This will enable the program to recover programs and data if the disk is reformatted. The program will provide for recovery of undamaged data in the event of a hard disk crash.

F. Disk file editor program to produce full screen readout of a disk file. The program shall have a function to globally search and change the file. The program shall have the ability to change screen formats and must utilize the commands used in the CMS environment editing program "X-EDIT". The program shall be capable of reading any and all sectors of the disk. The program shall also be capable of editing and the writing or copying the same sector. Two programs may be supplied to comply with this requirement.

G. Memory Manager shall be provided.

H. Editor assembler program shall be capable of macro assemblies of symbolic instruction to machine code.

I. Basic compiler program shall translate the statements of basic language to assembly language.

J. Windows Development System for the development of Windows based software.

TIME SOURCE - XIV

14-1 The engineering console shall include a time source. The time source shall provide for unattended time information synchronized to the international time standard, Coordinated Universal Time (CUT).

14-2 The time source shall be an intelligent radio receiver which employees digital signal processing techniques and process round-the-clock time and date broadcasts from the National Bureau of Standards (NBS).

14-3 The time source shall provide time output over an RS-232 port which the system will utilize to reset the system clocks. The time source shall have a minimum accuracy of 1.5 milliseconds. The time source shall also provide a display of the time for the operator.

ACCESSORIES - XV

15-1 Two four-way RS-232 switches shall be provided. The switches shall be composed of a wave soldered printer circuit board with sealed ceramic switches. Data flow indicators shall be provided. The switch shall provide for a data rate up to 9 600 baud and provide data line surge protection. All connectors shall be pin configured to mate with all peripheral devices utilizing a RS-232-C DB 25-pin connector. The four-way switches shall be mounted in the desk and wired to the equipment or to receptacle boxes behind the desk tower.

15-2 Contrast enhancement filters shall be provided for both monitors. The filters shall have a polarized glare screen that enhances colors on the monitors. The filters shall be attached to the monitors by Velcro fasteners.

15-3 A cleaning kit shall be provided. The cleaning kit shall be composed of as a minimum:

One (1) 90 millimeter disk drive head cleaning disk
One (1) 130 millimeter disk drive head cleaning disk
One (1) 300 megabyte tape drive head cleaning cartridge
Printer typeface cleaner
Five (5) typeface cleaning sheets
Monitor screen cleaning fluid - 237 milliliters.
Anti-static spray - 946 milliliters.
Lint free cleaning wipes - 150 by 150 millimeters - 600 wipes
Platen cleaning solution - 355 milliliters.

15-4 The following startup and observation period supplies shall be provided.

Ten (10) Cartons of #20 white perforated tractor feed paper 406 millimeters wide.
Ten (10) Toner Cartridges for the report printer.
Ten (10) Printer ribbons for the graphics printer.
Ten (10) Boxes of 90 millimeter high density Disks.
Ten (10) Boxes of 130 millimeter high density Disks.
Five (5) Toner Cartridge refill kits. (4 refills each)

INSTRUCTIONS AND GUARANTEES - XVI

16-1 One set of complete schematics of all equipment and maintenance manual of the equipment shall be supplied with each engineering console furnished.

16-2 One reproducible mylar and two prints of the schematic wiring diagram for the engineering console shall be supplied with each console furnished. The schematic wiring diagram shall contain the following information in at least 6 millimeter lettering.

A. Contract and bid date.

B. Model and number of all equipment.

16-3 One complete sets of manuals for all software shall be provided.

16-4 A list of interrupts and address of all COM ports, printer ports, modems and auxiliary peripheral shall be provided.

16-5 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this equipment 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.

16-6 The complete console and all equipment shall carry a two (2) year guarantee from the date of operation and acceptance against any imperfections in workmanship or materials.

16-7 The company shall test all equipment to be supplied in compliance with these specifications and as required by the supplementary specifications to which this specification applies.

16-8 The company shall furnish any and all equipment which they deem necessary for safe and reliable operation of the operator console.

16-9 Equipment furnished under this specification must be current production equipment and of recent manufacture, identical models of which are in use for no less than one year. Untried or prototype units shall not be considered for acceptance.

16-10 Any repairs made by a manufacturer or representative shall be documented when the equipment is repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number. All warranty and maintenance repairs must be made within one day upon receiving notice or replacement equipment must be provided.