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

METRIC SPECIFICATIONS FOR ACCIDENT INVESTIGATION UNIT

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

New Jersey Department of Transportation Specifications for equipment to be used by the Accident Investigation Unit, which will be responsible for the investigation of incidents on roadways.

The purpose of these specifications is to describe minimum acceptable design and operating requirements for this equipment.

GENERAL - I

1-1 The Accident Investigation Unit equipment shall consist of a portable electronic survey instrument, known as a "Total Station", a portable data collector with additional memory, a field locator unit, surveying software, data transfer software, CAD software, and an office computer with plotter.

1-2 The manufacturer shall train operating personnel.

1-3 The construction and testing of the electronic equipment shall comply with all applicable Electronic Industry Standards (EIA/TIA), International Telegraph and Telephone Consultative Committee (CCITT), ANSI, ASTM standards, National and State Electrical codes, Underwriters Laboratory (UL) and FDDI specifications.

PORTABLE ELECTRONIC SURVEY INSTRUMENT (TOTAL STATION) - II

2-1 The unit shall be a portable instrument with hard plastic carrying case, and include battery, spare battery, and battery charger.

2-2 The instrument and case shall have the following physical characteristics:

A. Weight of instrument with battery - 4.0 kilograms

B. Weight of carrying case - 3.6 kilograms

C. Size of instrument - 190 millimeters W x 345 millimeters H x 150 millimeters D

D. Keypad shall have the ability to do the following:

1. Hold horizontal angle
2. Operate the angle measurement
3. Set the horizontal angle to zero
4. Operate the distance measurement
5. Set the atmospheric correction value and the prism constant
6. Start the measurement

7. Switch between horizontal angle clockwise and counter clockwise
8. Illuminate display and reticle
9. Set audio mode
10. Turn tacking mode on and off
11. 88Function key for alternate key assignments to reduce size of keypad
12. Power on and off

E. Display shall be liquid crystal

2-3 The instrument shall have the following Telescope characteristics:

A. Length - 490 millimeters

B. Objective lens diameter - 35 millimeters (EDM: 35 mm)

C. Magnification - 26x

D. Field of view at 1 000 meters - 1° 30'

E. Image - erect

F. Resolving power - 89 millimeters

G. Minimum focusing distance - 0.9 meter

H. Reticle illumination - provided

2-4 The instrument shall have the following Distance Measurement characteristics:

A. Measuring range in slight haze, visibility of about 20 kilometers, moderate sunlight with heat shimmer:
1. 1 prism - 600 meters
2. 3 prisms - 900 meters

B. Measuring range in no haze, visibility of about 40 kilometers, overcast, with no heat shimmer:
1. 1 prism - 700 meters
2. 3 prisms - 1 000 meters

C. Measurement accuracy -±(3 millimeters + 5 parts per million) m.s.e. (0 °C to 40 °C)
±(5 millimeters + 5 parts per million) m.s.e. (-20 °C to 0 °C & 40 °C to 50 °C)

D. Least count in measurements -
1. Single / Repeat mode - 1 millimeter
2. Tracking / Coarse mode - 10 millimeters / 1 millimeter

E. Measurement display - 8 digits (max display 99 999.999 meters)

F. Measuring time:
   1. Repeat measurement mode - 2.5 seconds
   2. Tracking mode - 0.5 seconds

G. Atmospheric correction range - -99 to +99 parts per million (by 1 part per million)

H. Prism constant correction - -99 to +99 millimeters (by 1 millimeter)

I. Ambient temperature range - -20 °C to +50 °C

2-5 The instrument shall have the following Electronic Angle Measurement characteristics:

A. Method - Incremental Reading

B. Detecting - Horizontal: 1 side, Vertical: 1 side

C. Minimum reading - 10 seconds/20 seconds (2 milligons/5 milligons)

D. Accuracy - (standard deviation based on DIN 18723) ±10 seconds (±2 milligons)

E. Measuring time - less than 0.3 seconds

F. Circle diameter - 71 millimeters

G. Tilt sensor - included with compensating range of ±900 millimeters

H. Angle display shall be selectable to degree, Grad., Mil., or Percentage.

I. Minimum display shall be selectable between 10 seconds (2 milligons) and 20 seconds (5 milligons).

J. During horizontal angle measurement, the unit shall have an audio alarm (buzzer) that sounds as the unit is turned through a 90 degree point.

K. Horizontal angle value shall be able to be retained for future measurements.

L. Horizontal angle measurement shall be selectable between clockwise and counter clockwise by keyboard entry.

2-6 The instrument shall have the following Optical Plummet Telescope characteristics:
A.Image - erect
B. Magnification - 2.2x

C. Focusing range - 1.3 meters to infinity

D. Field of View - 5° at 1.3 meters

2-7 The instrument shall have the following on-board Battery characteristics:

A. Output voltage - 7.2 volts DC

B. Capacity - 4 320 coulombs

C. Maximum operating time when fully charged at +20 °C:
1. Including distance measurement - 3.0 hours
2. Angle measurement only - 12.5 hours
3. Normal use - 6.5 hours
4. Weight - 0.3 kilograms

2-8 The instrument shall have the following Battery Charger characteristics:

A. Input voltage - 120 volts AC

B. Frequency - 50/60 hertz

C. Recharge time - 1.5 hours at +20 °C

D. Operating temperature - +10 °C to +40 °C

E. Charging Signal - red lamp illumination

F. Weight - 0.3 kilograms

DATA COLLECTION EQUIPMENT AND SOFTWARE - III

3-1 Data collection software and TFR software shall be specifically designed for the supplied Electronic Survey Instrument, and the data collection equipment.

3-2 The data collection equipment shall include a hand held Data Collector such as the HP68SX that is totally compatible with the supplied Electronic Survey Instrument. The Data Collector shall have the following characteristics:

A. Size (approximate) - 89 millimeters W x 178 millimeters H x 29 millimeters D

B. Operating temperature range - 0 °C to +45 °C

C. Weight (approximate) - 0.25 kilograms
D. Unit's processor - HP-48SX or equivalent
E. Display -
1. Liquid crystal
2. 8 lines of text
3. 22 characters per line

F. Accepts and is provided with custom alpha-numeric overlays for the keyboard.

G. Power source - 3 Alkaline batteries, size AA

H. Display defaults - degrees and feet

I. Interfaces:
1. RS232C
2. HP connections
3. Infrared printers
4. Memory cards

J. RAM included - 512K

K. Keyboard shall be soft keys, fully alpha-numeric.

L. COGO routines as follows:
1. Areas
2. Changes in elevation
3. Inverses
4. Angle and distance conversions
5. Intersections
6. Predetermined areas
7. Manual traversing
8. 3-point resections

M. Operating manual

3-3 256K RAM card for data storage.

3-4 Instrument and PC cables for connection of the Data Collector to the Electronic Survey Instrument and to a Computer.

FIELD LOCATOR - IV

4-1 The Field Locator shall be a magellan unit used for finding the exact location (on the earth) of the equipment in the field. This device is used in surveying.

4-2 The receiver shall be a NAV 5000 PRO unit or equivalent with the following attachments:

A. Exterior antenna
B. Regulated 12 volt DC adapter

C. Car outlet (cigarette lighter) adapter

D. Carrying case

E. Spare battery

F. Users manual

CAD MAPPING SOFTWARE AND HARDWARE - V

5-1 CAD software shall be compatible with the Data Collector information and HP desktop plotter type HP 7475, and shall be from the same distributor as the Electronic Survey Instrument and the Data Collector. The software shall provide for the following functions:

A. Down load both raw data and coordinate data from the Data Collector detailed in Section III.

B. Accept operator data input by use of a full screen editor.

C. Run multiple traverses within a single (raw) data file.

D. Create a complete drawing with automatically generated lines, symbols and annotations.

E. User defined descriptions that will work with predefined symbols and line types in generating a CAD drawing.

F. Mouse driven editor for complete editing of CAD drawing.

G. COGO functions for all standard surveying procedures including:

1. inverses
2. resections
3. traverses
4. elevation adjustments
5. stakeouts

5-2 CAD output shall include DXF files to permit data transfer to other CAD systems.

5-3 The software shall support user defined ASCII text files for import and export of coordinate data.

5-4 CAD output shall be compatible with HP-GL type plotters, specifically with the unit stated in Subsection 4-1, dot-matrix printers, and HP Laser Jet series III printers. All special programs shall be included for connection and operation of these output devices.

OFFICE COMPUTER - VI

6-1 The office computer shall be a computer as detailed in NJDOT Specification EBM-TOCCE-1, with the following additional software and connections:

A. CAD software as detailed in Section V.

B. Cables, software, and special boards as required for connection to the Data Collector detailed in Section III.

C. Cables, software, and special boards as required for connection to the Desk Top Plotter detailed in Section VII.

D. Cables, software, and special boards as required for connection to a Hewlett Packard Laser Jet III printer.

PLOTTER - VII

7-1 The plotter shall be a desk top plotter model HP7475 or equivalent. The plotter shall be fully compatible with the CAD software.

7-2 The plotter shall include all cables and connectors required for connection to the Office Computer stated in Section VI.

7-3 The plotter shall be RS232 compatible.

7-4 The plotter shall be capable of plotting on regular paper, up to 279 millimeters by 356 millimeters.

SHIPPING - VIII

8-1 All components shall be shipped in strongly constructed shipping containers. These containers shall be opened with care and given to the State after use, for use by the State in repacking the components for moving to a different location.

8-2 All components shall be shipped to and assembled at a location designated by the State. The Supplier shall be responsible for shipping and assembly to one location for each complete unit in the contract. Each complete unit may be shipped to a different location. These locations shall include the Traffic Operations Center, NJDOT headquarters in Trenton, local/district NJDOT offices, NJ State Police headquarters in Trenton, and local NJ State Police offices.

TESTING - IX

9-1 Testing shall include all standard industry tests on components, both field and office of each complete unit, at the factory and after shipping and assembly. The tests shall also include the demonstration of all software including: survey, data transfer, and CAD.

9-2 The Supplier shall provide all personnel, equipment, instrumentation and materials necessary to perform all testing.

9-3 Documentation of all test results shall be provided to the Engineer two working days before the material is scheduled to arrive on site for factory tests and two working days after the tests following assembly at the designated locations.

9-4 The equipment shall not be accepted until all of the tests have been completed and with written approval by the Engineer.

9-5 The unsatisfactory components shall be replaced with new components at the Supplier's expense. The new components shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

TRAINING - X

10-1 Prior to the acceptance of the equipment, training shall be provided for the Department's engineering, maintenance and operations staff, at a facility provided by the Department. The training shall include all material and manuals required for each participant. The training shall be as follows:

10-2 Maintenance training of field and office components shall be provided for a minimum of 16 hours for at least 5 personnel with an electronics background. The training shall include operation instructions, theory of operation, circuit description, field adjustments, preventive maintenance procedures, troubleshooting, interpretation of results, and repair of all components.

10-3 Engineering training shall be provided for a minimum of 24 hours for at least 20 engineering and operations personnel. The training shall include a complete demonstration of the operation, capabilities of the equipment, and interpretation of results, a complete demonstration of suggested field procedures in the use of the electronic survey instrument, field locator, and data collector, and a demonstration of the use of the office computer with CAD operation.

INSTRUCTIONS AND GUARANTEES - XI

11-1 A set of use, maintenance and repair manuals for all components included in this specification shall be included with the furnished equipment.

11-2 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.

11-3 All major components shall be identified with a metal plate containing the serial number and a bar code identification.

11-4 All supplied equipment shall carry a two-year warranty, from the date of project acceptance by the State, to be free of defects. The installer shall fully test the equipment prior to installation and within the warranty period. The installer shall be fully responsible for the installation of defect equipment and for the replacement of any equipment found to be defective due to improper construction or improper installation for two years after the State's acceptance of the project.