

# CHAPTER 2

## Equipment

### Chapter Contents

<b>Sec. 2.01</b>	<b><u><a href="#">Responsibility</a></u></b>
<b>Sec. 2.02</b>	<b><u><a href="#">Care And Adjustment Of Instruments</a></u></b>
<b>Sec. 2.03</b>	<b><u><a href="#">Calculators And Computers</a></u></b>
<b>Sec. 2.04</b>	<b><u><a href="#">Electronic Distance Meter (EDM) Reflector Constants</a></u></b>
<b>Sec. 2.05</b>	<b><u><a href="#">Survey And Miscellaneous Supplies</a></u></b>
<b>Sec. 2.06</b>	<b><u><a href="#">Periodic Checks Of Electronic Total Stations And Accessories</a></u></b>
<b>Sec. 2.07</b>	<b><u><a href="#">GPS</a></u></b>

### *Sec. 2.01 Responsibility and Inventory*

It is the responsibility of the State Location and Design Engineer or his representative to secure, assign and keep in good working order all major surveying instruments and equipment.

An Equipment List shall be kept on each survey party of all equipment with a purchase cost of \$2,000 or more. In addition all equipment that is furnished by the central office is to be kept on the Equipment List. The list is to be kept up to date and readily available upon request.

All major equipment with a purchase cost of \$ 2,000 or more shall be added to the Major Inventory data base via the procurement section and a VDOT property tag is to be attached to the equipment upon receiving said equipment. The Major Equipment database is to be kept up to date with the transfer and disposal of major equipment. Central Office is responsible for the major equipment database.

The assignment of instruments within a district is the responsibility of the Survey Manager. This should be reported **bi-annually\*** to the **Geospatial Program Manager**.

In the event a survey party is disbanded, all instruments and equipment should be returned to District Stock.

### *Sec. 2.02 Care and Adjustment of Instruments*

#### **Electronic Total Station and Data Collector**

The electronic total station and the data collector are the most important instruments used by the survey party, each representing a considerable monetary investment. These are carefully adjusted scientific instruments constructed to a very fine degree of accuracy and precision. They are necessarily delicate, very sensitive to vibration and subject to being seriously damaged by careless handling. The realization of just what a survey instrument is and how it should be handled is an essential requirement of a competent instrument (survey) technician. Each Total Station and Data Collector has an operator's manual containing instructions on operating procedures. Every operator should read and become familiar with the procedures before attempting to operate these instruments.

The Land Surveyor Supervisor is responsible for all equipment and at no time shall a senior technician assign these instruments to the care of a junior technician unless authorized to do so.

When not in use, all instruments should be placed in its carrying case, or protective cover, even when it is necessary to suspend work. Before climbing a fence or similar obstacle, the instrument should be put in the carrying case and, along with the tripod, placed on the other side. **Under no circumstances should an instrument be carried on the tripod**, and under no circumstances should the equipment be positioned in a vehicle so that it could bounce around.

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\* Rev. 3/19

### **Levels**

Many levels are assigned to other VDOT Divisions and Departments. These instruments also are delicate, very sensitive to vibration and subject to serious damage by careless handling. The Survey Manager should facilitate minor adjustments and cleaning when necessary. They should never be disassembled except as authorized by the Survey Manager. If these instruments have been exposed to inclement weather, they must be wiped dry as soon as possible, in any event, as soon as brought indoors.

### **Storage and Shipping**

Under ordinary circumstances, instruments should not be shipped, but carried by box. Should circumstances require that an instrument be shipped, it should be clamped on its spindle and paper packed carefully and snugly into the box around it.

Careful consideration should be given to the location where instruments are stored when not in use, and every possible precaution should be taken to insure that they are not damaged, vandalized or stolen.

If it is sent in for repairs, **only** the instrument should be sent with a detailed report of why repairs are needed.

### **Sec. 2.03 Calculators and Computers**

Since programmable calculators and computers have become available, various programs have been developed which will solve most routine surveying calculations. This applies mainly to the alphanumeric programmable type calculators with continuous memory. Available programs can be obtained by contacting the **Geospatial\*** Program Manager or by contacting the VITA representative.

### **Sec. 2.04 Electronic Distance Meter (EDM) Reflector Constants**

The constant for each reflector unit **must** be known before its use. If the refractive index of glass were the same index as air (1.00), there would be no corrective constant. Since the refractive index of glass is about 1.57, the thickness of the prism from the front of the apex to the back can be multiplied by 0.57, to get the reflector constant that is always negative. Actually, it is not necessary to do this because the constant, which varies with the different types of reflectors, is usually noted in the reflector specifications or corrected within the E.D.M. system. In any case, it must be taken into account, because failure to do so can result in serious errors.

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\* Rev. 3/19

### **Sec. 2.05 Survey and Miscellaneous Supplies**

Surveying and miscellaneous supplies shall be obtained through the District Office, either from the District supply or by requisition.

### **Sec. 2.06 Periodic Checks of Electronic Total Stations and Accessories**

A suitable range shall be established in each District to check the Electronic Distance Meters and accessories at three (3) month intervals. This shall include both horizontal and vertical checks and also shall include all tribrachs and range poles. Survey instruments should be serviced and calibrated by a qualified service technician licensed by the equipment manufacturer at least once a year. All servicing will be coordinated with Geodetic Survey Supervisor.\* The NOAA Technical Memorandum NOS NGS 8, "Establishment of Calibration Base Lines" should be used as a guideline when establishing your baselines.

A record shall be prepared and retained by the District showing the date, instrument number, operator and the results of this testing, with a copy to the Geospatial Program Manager. An example is shown in [Figure 2-A](#). Any major deficiencies should be reported immediately in order that corrective steps may be taken. Before adjusting the instrument, a check of the tribrachs must be made.

### **Sec. 2.07 GPS**

The GPS equipment must be maintained with the utmost care possible. All components of the receiver must be inventoried and returned to the case after each use. Damage to any of the components must be reported immediately to the supervisor and arrangements made to have the damaged parts repaired or replaced.

Repair work shall only be performed by a qualified service technician licensed by the equipment manufacturer. Under no circumstance shall the instrument case be opened or field adjustments made. Updates to the onboard firmware shall be coordinated with the manufacturer and installed according to their guidelines.

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\* Rev. 3/19

**Figure 2-A**

SURVEYING EQUIPMENT – EDM and SURVEY INSTRUMENT EVALUATION												
YEAR 2004												
				1 <sup>st</sup> Quarter		2 <sup>nd</sup> Quarter		3 <sup>rd</sup> Quarter		4 <sup>th</sup> Quarter		
Party	Type Instr.	Model	Serial No.	Date	Chkd .By	Date	Chkd .By	Date	Chkd. By	Date	Chkd By	Remarks
99	TOPCON	601AF	F 30988	3-2		6-8		8-24		10-17		No Adj.
		Accessories	3 Tribrach	3-2		6-8		8-24		10-17		Needed
			2 RangePole	3-2		6-8		8-24		10-17		
99	TOPCON	501	P 70236	3-2		6-8		8-24		10-17		Dist. OK
		Accessories	1 Tribrach	3-2		6-8		8-24		10-17		Adj. Vert.
			0 RangePole									Cross Hair
99	TOPCON	GTS 2	B 40525	3-2		6-8		8-24		10-17		
		Accessories	1 Tribrach	3-2		6-8		8-24		10-17		
			RangePole									
		Accessories										
		Accessories										