



# Virginia Surveyor Apprenticeship Program

Revised January 3, 2003

Originally approved by the APELSLA (*now APELSCIDLA*) Board on September 19, 1996

# Table of Contents

- I. Forward
- II. Overview
- III. Special Inclusions Specific to the Virginia Surveyor Apprenticeship Program
- IV. Apprenticeship Related Instruction (Course Outline)
- V. Course Correlation
- VI. Work Processes (On the Job Training)
- VII. Apprentice Textbooks Relative to Related Instruction
- VIII. Reference Materials List
- IX. Signature Page

## Addendums:

- X. Minimum Standards for Apprenticeship  
(Virginia Apprenticeship Council)

# I.

## PURPOSE

The purpose of these Standards is to establish minimum requirements for the training of the Land Surveyor Apprentice in accordance with the guidelines of the Virginia State Board of Land Surveyors.

## FORWARD

To insure the development of highly skilled Land Surveyors throughout the Commonwealth, these Standards were developed in conjunction with the APELSCIDLA Board and the Virginia Apprenticeship Council.

To assure that the intent of these Standards is implemented, each Apprentice should be encouraged to develop their skills to the highest level of their ability. The training should be thorough, well planned and designed to enhance the dignity of the profession.

## II.

### ABOUT THE VIRGINIA SURVEYOR APPRENTICESHIP PROGRAM-

This program was developed in conjunction with the Board for Architects, Professional Engineers, Land Surveyors & Landscape Architects-APELSLA (now APELSCIDLA), the Virginia Department of Transportation (VDOT), the Woodson Related Instruction Team, and the Apprenticeship Training Division, as approved July 25, 1996.

Minor modifications to the original program were adopted in 1998 to include the acceptance of related instruction from Old Dominion University (ODU), and the use of ODU's TeleTechnet Program.

### THE LAND SURVEYOR (PROFESSIONAL)-

Surveyors measure and map the earth's surface. Surveyors establish official boundaries, write descriptions of property lots, measure site, and supervise survey technicians. The measurements of land areas determined by surveyors may be used for mapmaking, construction, and engineering projects. Surveyors may work for engineering, architectural, or surveying firms. State and local governments employ surveyors and survey technicians, mostly in highway and urban planning departments. Additionally, surveyors work for public utilities, construction firms, or are self-employed. Thus, all surveyor apprentices will receive diverse instruction as well as health and safety training comparable to the industry.

### WHAT IS APPRENTICESHIP?

Apprenticeship is a training program in those industrial and craft occupations that require a wide and diverse range of skills and knowledge. As practiced by modern industry, apprenticeship is a business oriented system in which the employee entering a certain industry is given intensive instruction and applied work experience in all of the theoretical and practical aspects of the given skilled occupation, craft or trade.

### WHO IS AN APPRENTICE?

An Apprentice is a person at least 16 years of age who, as a principal occupation, is engaged in learning and working in a trade as stated in the Standards, and who is covered by a written agreement with a Sponsor providing for the employment and training in accordance with the Standards of Apprenticeship and who is registered with the Virginia Apprenticeship Council.

## ON-THE-JOB TRAINING:

Apprenticeship is a training program that allows individuals to prepare for a skilled occupation through supervised training on-the-job combined with classroom instruction.

## CLASSROOM RELATED INSTRUCTION:

An Apprentice is required by the Voluntary Apprenticeship Act (Code 40.1-117 - 40.1-126) to attend apprenticeship related instruction classes during the course of their apprenticeship.

## APELSCIDLA BOARD

Board for Architects, Professional Engineers, Land Surveyors, Certified Interior Designers and Landscape Architects (APELSCIDLA). Formerly referred to as "APELSLA" in the original document.

The 13-member Board which examines, licenses and regulates the approximately 26,000 Architects, Professional Engineers, Land Surveyors, Certified Landscape Architects and Certified Interior Designers and related business entities in Virginia. The Board was established in 1920 for Architects, Engineers and Surveyors. Landscape Architects were added in 1980 and Interior Designers joined in 1990.

## FROM THE APELSCIDLA REGULATIONS (MARCH 1, 2002)- 18 VAC 10-20-300.

### REQUIREMENTS FOR LAND SURVEYOR-IN-TRAINING (LSIT) DESIGNATION.

The education or experience, or both, and examination requirements for the LSIT designation are as follows:

*Item #5 States-*

*"An applicant who has successfully completed a survey apprenticeship program approved by the board with at least 480 hours of surveying related classroom instruction with a specific record of six years of approved land surveying experience that is progressive in complexity shall be admitted to an examination in the Fundamentals of Land Surveying. Upon passing such examination, the applicant shall receive the LSIT designation."*

*Important Note: The Surveyor Apprenticeship Program was developed to assist those professionals performing surveying or surveying-related services to acquire the education necessary to improve their eligibility for the Fundamentals of Surveying (LSIT) Examination. Completion of this program does not guarantee that the apprentice will be approved by the APELSCIDLA Board to sit for the examination. The APELSCIDLA Board also evaluates each applicant's work experience to make the determination to allow individuals to sit for the*

*examination. In order to receive credit for completing the surveyor apprenticeship program, all applicants must provide the APELSCIDLA Board with proper documentation indicating that the program (including classroom instruction and on the job training), has been successfully completed.*

Everyone submitting an application to the APELSCIDLA Board is strongly encouraged to be thorough, complete, and accurate when filling out the education and experience sections of the application.

### III.

Special Inclusions to the "Minimum Standards for Apprenticeship" as specifically related to the Virginia Surveyor Apprenticeship Program:

#### TERM OF APPRENTICESHIP

The minimum term of the Land Surveyor (Professional) apprenticeship shall be 10,000 hours (five years) of work experience as stipulated in the Training Program Outline and shall consist of reasonably continuous employment, supplemented by required approved related instruction. When the Apprentice is required to work overtime, these hours will not be credited to the term of apprenticeship.

#### SCHEDULE OF WORK PROCESSES

A condensed schedule of the major divisions of the trade based on approximate hours is recorded in the Training Program Outline as adopted by the APELSCIDLA Board.

#### SAFETY AND HEALTH TRAINING

Before starting training at any site or in any facility, the Sponsor shall instruct the Apprentice in safe and healthful work practices and shall insure that the Apprentice is trained in facilities and other environments that meet the Virginia Occupational Safety and Health Standards for General Industry and the Construction Industry developed pursuant to the Federal Occupational Safety and Health Act.

#### IV.

### APPRENTICESHIP RELATED INSTRUCTION

Approved by the APELSLA (now APELSCIDLA) Board, July 25, 1996,  
and revised December 19, 2002

#### Please Note:

All Math instruction as set forth by the APELSCIDLA Board,  
must be provided by a qualified High School or above teacher.  
All Surveying instruction as set forth by the APELSCIDLA Board,  
must be provided by a licensed Land Surveyor.

### FIRST YEAR

1. **Mathematics I** - registration and background examination, whole numbers, common and decimal fractions, percentages, ratios and proportions, powers and roots, and examination. 30 Hours
2. **Mathematics II** - Algebra introduction, algebra, quadratic equations, and examination. 30 Hours
3. **Health and Safety - CPR** 6 Hours
4. **Mathematics III** - Trigonometry introduction, right angles, oblique triangles, and examination. Statistics introduction, statistics, and examination. 30 Hours

### SECOND YEAR

1. **Mathematics IV** - Geometry introduction, geometry, calculus introduction, calculus, and examination. 30 Hours
2. **Health and Safety - OSHA** 6 Hours
3. **Surveying I** - Introduction, leveling, route surveying, measurement of horizontal distances, and examination. Compute coordinate values, adjust coordinates and appropriate data, and analyze sources of error, adjust field measurements, and examination. 30 Hours
4. **Surveying II** - Introduction, measurement of vertical angles and distances, systematic & random errors & adjustments, boundary traverse - monumentation, sources of error adjusting field notes, topographic survey, and examination. 30 Hours

### THIRD YEAR

1. **Surveying III** - Introduction, photogrammetry, GPS HARN, horizontal control networks, related computations, and examination. 36 Hours
2. **Health and Safety** - First aid. 6 Hours
3. **Surveying IV** - Introduction, state plane coordinate system, practical astronomy -azimuth by altitude of the sun, practical astronomy -azimuth by Polaris, practical astronomy -related computations, horizontal & vertical curves, and examination. 30 Hours
4. **Surveying V** - Introduction, earthwork -volume, cross sections, area computations -DMD, coordinate method arc segments, irregular areas, and examination. 24 Hours

### FOURTH YEAR

1. **Surveying VI** - Introduction, site & grading plans, street profiles, as-built plans. construction staking - roadbeds, slope-stakes, grades, R/W, drainage, easements, and examination. 36 Hours
2. **Plat & Plan Development** - Survey base plan development, incorporating current technologies and methods such as CADD, and examination. 30 Hours
3. **Surveying VII** - Introduction, subdivision & zoning ordinances, preliminary planning & feasibility studies, subdivision computations, plats & legal descriptions, monumentation, and examination. 30 Hours

## FIFTH YEAR

1. **Surveying VIII** - Introduction, drainage - Anderson method, pipes & culverts, inlets, structures, ditches, sanitary sewer, water & other utilities, and examination. 36 Hours
  
2. **Surveying IX** - Introduction, research - prior surveys, road plans, assessor records, court records, maps, railroad & utility plans, titles, etc., examination. Legal principles - field evidence of possession, boundary discrepancies, priority of calls, right of way, riparian and littoral boundaries, project management - consultation with owner, attorney's fee negotiation, liability, etc., and examination. 30 Hours
  
3. **Surveying X** - Introduction, Architects, Professional Engineers, Land Surveyors, Certified Interior Designers, and Landscape Architects (APELSCIDLA) Board rules and regulations, ethics & professionalism. Land Surveyor examination qualifications, and final examination. 30 Hours

**TOTAL = 480 HOURS**

V.

Virginia Surveyor Apprenticeship Program Course Correlation

Virginia Surveyor Apprentice Program / Old Dominion University Surveying Program / Community College System  
 Updated: April, 2002

Virginia Surveyor Apprenticeship Program Module	H O U R S	Old Dominion University Surveying Program	U N I T S	Community College System Course	U N I T S	NOTES
Health and Safety – CPR	6	N/A		HLT 105	1	
Health and Safety – OSHA	6	N/A		N/A		
Health and Safety – First Aid	6	N/A		HLT 106	2	
Math I – Background examination, whole numbers, common and decimal fractions, percentages, ratios and proportions, powers and roots, and exam.	30	MATH 162M- Precalculus 1  (Covers Math I and II of apprenticeship program)	3	MTH 163	3	ODU Transfer Credits=3 Prerequisite: Qualifying score on Math placement test
Math II – Algebra, quadratic equations, and exam.	30					
Math III - Trigonometry, right angles, oblique triangles, and exam. Statistics and exam.	30	MATH 163 – Precalculus 2	3	MTH 164 or MTH 168	3	ODU Transfer Credits = 3 Prerequisite: Math 162M
Math IV – Geometry, calculus, and exam.	30	MATH 205 – Introduction to Calculus I	3	MTH 175	3	ODU Transfer Credits = 3
Surveying I – Introduction, leveling, route surveying, measurement of horizontal distances, and exam. Compute coordinate values, adjust coordinates and appropriate data and analyze sources of error, adjust field measurements, and exam.	30	CET 305 – Principles of Surveying (partial) CET 313 – Advanced Surveying (partial)	3 3	CIV 171 and CIV 172	3 3	Preferred for apprentice: Take the two semester Community College course sequence. Prerequisites CET 305: MATH 162M, MATH 163, MET 100, Engineering Graphics
Surveying II – Introduction, measurement of vertical angles and distances, systematic & random errors & adjustments, boundary traverse-monumentation, sources of error, adjusting field notes, topographic survey, and exam.	30	CET 305 – Principles of Surveying (partial) CET 313 – Advanced Surveying (partial)	3 3			Prerequisites CET 313: MATH 162M, MATH 163, MET 100, MET 230, CET 305, ENGL 131C(Technical Writing)
Surveying III – Introduction, Photogrammetry, GPS, HARN, horizontal control networks, related computations, and exam.	36	CET 318 – Control/GPS Surveying (partial) CET 412 – Route & Construction Surveys (partial for photogrammetry)	3 3	N/A		Prerequisites CET 318: MATH 162M, MATH 163, MET 100, MET 230, CET 305, CET 313, ENGL 131C Prerequisites CET 412: MATH 162M, MATH 163, MATH 205, MET 100, MET 230, CET 305, CET 313, ENGL 131C (Photogrammetry for the Apprenticeship Program is an introductory overview only and is covered as a part of CET 412)

Surveying IV – Introduction, state plane coordinate system, practical astronomy-azimuths by altitude of the sun, Polaris, and related computations. Horizontal and vertical curves, and exam.	30	CET 305 – Principles of Surveying (partial) CET 313 – Advanced Surveying (partial)	3 3	N/A		
Surveying V – Introduction, earthwork-volume, cross-sections, area computations, coordinate methods, arc segments, irregular areas, and exam	24	CET 412 – Route & Construction Surveying (partial) CET 425 – Land Design and Site Development (partial)	3 3	N/A		Prerequisite CET 425: CET 349, CET 420, Senior standing Technical Writing required
Surveying VI – Introduction, site & grading plans, street profiles, as-built plans, construction staking, roadbeds, slope-stakes, grades, R/W, drainage, easements, and exam.	36	CET 412 – Route & Construction Surveying (partial) CET 425 – Land Design and Site Development (partial)	3 3	N/A		
Plat & Plan Development – Survey base plan development, incorporating current technologies and methods such as CADD, and exam.	30	MET 230 – Computer Aided Drafting and Design (or work-related exp.) (partial)	3	DRF 201 <OR> DRF 231 and DRF 232	3-4 2-3 2-3	It is preferred that the Apprentice take the CADD course(s) at a Community College.
Surveying VII – Introduction, subdivision and zoning ordinances, preliminary planning and feasibility studies, subdivision computations, plats & legal descriptions, monumentation, and exam.	30	CET 425 – Land Design and Site Development (partial)	3			
Surveying VIII – Introduction, drainage, Anderson method, pipes & culverts, inlets, structures, ditches, sanitary sewers, water & other utilities, and exam.	36	CET 420 – Hydrology and Drainage CET 425 – Land Design and Site Development (partial)  <OR> VDOT Hydraulics Course	3 3	N/A		Prerequisite CET 420: Senior standing. <b>PROBLEM:</b> This class is designed to support the 3B Surveying License and requires Soils and Fluid Mechanics, which would add another 6 units unless a different class is developed unsuitable for the 3B license.
Surveying IX – Introduction, research-prior surveys, road plans, assessor records, court records, maps, railroad & utility plans, titles, etc., and exam. Legal principles-field evidence of possession, boundary discrepancies, priority of calls, right-of-way, riparian and littoral boundaries, project management-consultation with owner, attorney's fee negotiation, liability, etc., and exam.	30	CET 314 – Boundary Law and Mock Trial	3	N/A		Prerequisite CET 314: MATH 162M, MATH 163, MET 100, MET 230, CET 305, ENGL 131C
Surveying X – Introduction, APELSCIDLA Board rules and regulations, ethics and professionalism. Qualifications for exams (LSIT and LS), and final exam.	30	N/A		N/A		

**Work Processes (On-The-Job Training)**

**Surveyor (Land, Professional)**

**018.167-018**

Approved by the APELSLA (*now APELSCIDLA*) Board, July 25, 1996, and revised  
December 19, 2003

The apprentice shall obtain practical supervised training in the following areas of surveying procedures. The apprentice should progress through the different levels of responsibility and training related to the procedures in both the field and office environments until a thorough knowledge of the procedures is attained. The hours indicated shall be the minimum hours required for advanced operations of the listed procedures. It is expected that the apprentice will have additional hours achieving competency in the advanced operations and procedures.

Please Note:

This program is five years in duration. Credit for previous experience towards these years must be given based on the procedures as set forth in the Standards.

- |   |                    |
|---|--------------------|
| 1. Application, care and practices of proper steel and cloth tape measurement procedures with the understanding of obtainable precision and accuracy in determining horizontal distances. | <b>200 Hours</b>   |
| 2. Application, care, and adjustment of surveying equipment.  | <b>200 Hours</b>   |
| 3. Recording of hand and electronic field notes, including the use of reference sketches, describing control points and other pertinent field data.                                       | <b>800 Hours</b>   |
| 4. Application, care, use, operation, and adjustment procedures for vertical and horizontal angles when performing topographic contouring and open or closed traversing.                  | <b>700 Hours</b>   |
| 5. Application, care, and use of equipment for selecting turning points, identifying topographical features on site surveys.  | <b>800 Hours</b>   |
| 6. Establishing observation points, performing interior angle and deflection angles, controls for R/W and boundary identification, determine error of closure and accuracy.               | <b>1,000 Hours</b> |
| 7. Astronomical observation for azimuth determination, establishing GPS control sites, HARN stations, identifying picture points for aerial photography.                                  | <b>500 Hours</b>   |

8. Application and use of field and office equipment including software programming for the development of plans or plats from field surveys.	1,000 Hours
9. Interpret plans for establishment of: boundaries and R/W, drainage and utility layout, horizontal and vertical curves, slope and grade stakes.	1,000 Hours
10. Field and office procedures for area and volume determinations.	500 Hours
11. Application, care, and adjustment procedures for establishing elevation profiles and cross sections using differential, trigonometric, and GPS leveling procedures.	800 Hours
12. Application, care, and procedures for conducting research of land records, deeds, wills, and plats. Understanding, applying, and relating local or state codes, statutes, and regulations that influence or control surveying procedures	400 Hours
13. Application, computation, and field procedures for establishing state plane coordinates.	400 Hours
14. Other general or advanced surveying operations that lead to the complete development of the surveying apprentice but does not clearly fit into the previous thirteen items.	1,200 Hours
14. Health and Safety Procedures.	500 Hours
<b>TOTAL =</b>	<b>10,000 Hours</b>

## VII.

### APPRENTICE TEXTBOOKS RELATIVE TO RELATED INSTRUCTION

Basic Text: "Land Surveyor Reference Manual", second edition, Andrew L. Harbin  
ISBN: 0-912045-09-4, Professional Publications, Inc.

References: "Solutions Manual for the Land Surveyor Manual", second edition,  
Andrew L. Harbin  
ISBN: 0-912045-42-6, Professional Publications, Inc.

"Surveying", ninth edition, Moffet & Bouchard  
ISBN: 0-06-500059-5, Harper Collins Publishers, Inc.

"Elementary Surveying", current edition, Paul R. Wolf and Russell Brinker  
ISBN: 0-06-500399-3, Harper Collins Publishers, Inc.

"Basic Occupational Mathematics", David Newton  
ISBN: 0-8251-1676-7, J. Weston Walch Publisher

All Other Texts as the Instructors Deem Necessary

## VIII.

### VIRGINIA SURVEYOR APPRENTICESHIP PROGRAM REFERENCE MATERIALS LIST

PLEASE NOTE:

THE FOLLOWING PUBLICATIONS ARE SUGGESTED BY THE APELSCIDLA BOARD AS REFERENCES FOR LAND SURVEYOR STUDENTS IN PREPARATION FOR THE L.S.I.T. EXAMINATION

1. ACSM Definitions of Land Surveying and Associated Terms
2. Basic Geodesy, by J.R. Smith
3. Black's Law Dictionary
4. Boundaries and Adjacent Properties, Skeleton
5. Boundary Control and Legal Principles, Brown
6. Chesapeake Bay Preservation Act
7. Code of Virginia:
  - Title 2.1, Chapter 32
  - Title 3.1, Chapter 17.2
  - Title 6.1, Chapter 7.3
  - Title 7.1, Chapter 2
  - Title 8.01, Chapters 3, 4, 14, and 26
  - Title 11, Chapter 1
  - Title 13.1, Chapter 7
  - Title 15.1, Chapters 10, 11, and 24
  - Title 17, Chapter 2
  - Title 18.2, Chapter 5
  - Title 21, Chapter 6
  - Title 28.1, Chapter 5
  - Title 33.1, Chapter 1
  - Title 38.2, Chapter 46
  - Title 41.1
  - Title 43, Chapter 1
  - Title 45.1, Chapters 10 and 22.1
  - Title 49, Chapter 1
  - Title 54.1, Chapters 1, 2, 3, and 4
  - Title 55, Chapters 1, 4, 4.1, 4.2, 5, 6, 8, 10, 17, 18, 19, 20, and 24
  - Title 56, Chapter 2
  - Title 62.1, Chapters 1, 2, and 8

8. Evidence Procedures for Boundary Locations, Brown and Eldridge
9. Federal Register, Volume 40, No. 23, February 3, 1975
10. GPS Satellite Surveying, Alfred Leick
11. GPS Theory and Practice, B. Hoffman-Wellenhof, H. Lichtenegger, and J. Collins
12. Guide to GPS Positioning, by David Wells & Canadian GPS Associates
13. Minimum Standard Detail, Requirements for ALTA/ASCM Land Title Surveys
14. Route Surveying, Hickerson
15. Rules and Regulations for the Board for Architects, Professional Engineers, Land Surveyors, Certified Interior Designers and Landscape Architects
16. Surveying, Moffit/Bouchard
17. Surveying and Boundaries, Clark
18. Surveying Handbook, Hickerson
19. The Navstar Global Positioning System, by Tom Logsdon
20. Federal Clean Water Act
21. Virginia Chesapeake Bay Local Assistance Department, Local Assistance Manual, Current Edition
22. Virginia Chesapeake Bay Preservation Area Designation and Management Regulations (VR 173-02-01)
23. Virginia Department of Transportation Drainage Manual
24. Virginia Department of Transportation Road and Bridge Standards
25. Virginia Department of Transportation Survey Manual
26. Virginia Erosion and Sediment Control Handbook, Current Edition
27. Virginia State Library Board, Standards for Plats
28. Writing Legal Descriptions, Wattles

IX.

These Standards are hereby approved:

BOARD FOR ARCHITECTS, PROFESSIONAL ENGINEERS, LAND SURVEYORS,  
CERTIFIED INTERIOR DESIGNERS & LANDSCAPE ARCHITECTS

  
\_\_\_\_\_  
Chairperson Executive Director  
3/18/03  
\_\_\_\_\_  
Date

Registered with the Virginia Apprenticeship Council:

  
\_\_\_\_\_  
Secretary  
D. PECH 19, 2003  
\_\_\_\_\_  
Date

Adopted by:

\_\_\_\_\_  
Sponsor Representative  
\_\_\_\_\_  
Date

X.

ADDENDUM – Minimum Standards for Apprenticeship

(Attached – Next Page)