
Appendix A

SURVEY TECHNICIAN

WORK PROCESS SCHEDULE

AND

RELATED INSTRUCTION OUTLINE

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WORK PROCESS SCHEDULE

SURVEY TECHNICIAN

O*NET-SOC CODE: 17-3031.00 RAPIDS CODE: 0551 (Surveyor Assistant)

This schedule is attached to and a part of these Standards for the above identified occupation.

1. APPRENTICESHIP APPROACH

Time-based Competency-based Hybrid

2. TERM OF APPRENTICESHIP

The term of the apprenticeship is approximately 2-3 years with an on-the-job learning (OJL) attainment of 4,000 hours, supplemented by the minimum required 608 hours of related instruction.

3. RATIO OF APPRENTICES TO JOURNEYWORKERS

Consistent with proper supervision, training, safety, and continuity of employment throughout the apprenticeship, the ratio of apprentices to journeyworkers employed in each shop, and/or job site shall be as follows: one (1) apprentice(s) to one (1) Teamster Journeyworker(s).

4. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on either a percentage or a dollar amount of the current hourly journeyworker wage rate.

Before an apprentice is advanced to the next segment of training or to journeyworker completion status, the program sponsor will evaluate all progress to determine whether advancement has been earned by satisfactory performance in their on-the-job learning (OJL) and in related instruction courses.

Non-TAPS Agreement(s)

Period	Wage Percentage	On-the-Job Hours
1 st	60%	0 – 1000 Hours
2 nd	70%	1001 – 2000 Hours
3 rd	80%	2001 – 3000 Hours
4 th	90%	3001 – 4000 Hours
End	100%	Complete

The current Non-TAPS Survey Technician journeyworker wage rate is \$41.55 per hour.

TAPS Agreement

Period	Wage Percentage	On-the-Job Hours
1 st	80%	0 – 4000 Hours
End	100%	Complete

The current TAPS Survey Technician journeyworker wage rate is \$40.80 * per hour.

* The current journeyworker wage rates may vary and depend upon the rates contained in the collective bargaining agreement for the particular segment of the construction industry they are working in. The current journeyworker wage rate shall be modified on any prevailing wage project to comply with the applicable wage rate when the prevailing wage is higher than the journeyworker rate specified in the standards.

5. PROBATIONARY PERIOD

Every applicant selected for apprenticeship will serve a probationary period of 1,000 hours.

6. SELECTION PROCEDURES

APPLICATION PROCEDURES

- A. Applicants will be accepted at specified intervals in the geographic jurisdictions specified in the applicable collective bargaining agreement. An announcement of specific apprenticeship openings must be disseminated thirty (30) days in advance of the earliest date for application at each interval to the agencies/organizations outlined in the approved Affirmative Action Plan. All persons requesting an application will have one made available upon being recorded in the applicant tracking system that corresponds to the geographic jurisdiction recruitment area. Applications will be accepted throughout the recruitment cycle.
- B. All applications will be identical in form and requirements. The application form will be numbered in sequence corresponding with the number appearing on the applicant tracking system so that all applications can be accounted for. Columns will be provided on the applicant tracking system to show race/ethnic and sex identification and the progress by dates and final disposition of each application.
- C. Before completing the application, each applicant will be required to review the Apprenticeship Standards and will be provided information about the program. If the applicant has any additional questions on the qualifications or needs additional information to complete the application, it will be provided by the JATC.
- D. Receipt of the properly completed application form, along with required supporting documents (proof of age, driver's license, birth certificate or other acceptable documentation; copy of high school diploma, GED Certificate, drug & alcohol screening results, or other acceptable documentation) will constitute the completed application.
- E. Completed applications will be checked for minimum qualifications. Applicants deficient in one or more qualifications or requirements or making false statements on their application will be notified in writing of their disqualification. The applicant will also be notified of the appeal rights available to them. No further processing of the application will be taken.
- F. Applicants meeting the minimum qualifications and submitting the required documents will be notified where and when to appear for an interview.

SELECTION PROCEDURES

- A. The JATC will schedule the interview and evaluation session. All applicants who have met the minimum qualifications and have submitted the required documents must be notified of the date, time, and place to appear.
- B. The interviewers will rate each applicant during the interview on each of the factors on the applicant rating form taking into account the information on the application and required

documents, if applicable. The interviewer will record the questions asked and the general nature of the applicant's answers. The interviewer will then prepare a written summary of his/her judgment of the applicant derived from the interview.

- C. After completing the interview and evaluation of the applicants, the individual rating scores of the interviewer(s) will be added together and averaged to determine the applicant's final rating.
- D. Applicants will be placed on a "Ranking List" according to their scores at the evaluation session, with the applicant having the highest score being at the top of the list, and all applicants then listed in descending order based on score. A separate ranking list will be maintained for each geographic jurisdiction recruitment area. As openings for the registration of new apprentices occur, the highest ranked applicant will be notified of selection by telephone. It will be the responsibility of the applicant to keep the JATC informed of their current mailing address and telephone number.
- F. Selected applicants must respond to the notice of selection within 48 hours of notice. If applicants cannot be reached by telephone, their names will be passed and notice sent to their address by "Certified Mail-Return Receipt Requested, or an equivalent electronic delivery tracking method, to determine if the applicants are still interested. If no response is received in fifteen (15) working days from the written notice, the applicant's name will be removed from the list. Only one certified notice will be mailed.
- G. Qualified applicants remaining on a preceding ranking list will automatically be carried forward on the new ranking list and slotted in wherever their rating score placed them for a period of two (2) years, unless the applicant has been removed from the list by their own written request or following failure to respond to an apprentice opening. Applicants who were not placed during the two (2) - year period that were on the ranking list, will be required to reapply.
- H. During the two (2)-year period, applicants who feel that their qualifications have improved since their original rating may submit documented evidence of such additional experience or training and request reevaluation and rating at the next regular processing cycle.

DIRECT ENTRY PROCEDURES

Sponsors that wish to invoke the direct entry provision may do so without regard to the existing selection procedure used for entry into the apprenticeship program. Individuals selected into the apprenticeship program via direct entry shall include only those individuals described below who have received training or employment in an occupation directly or indirectly related to the occupation(s) registered in these Standards. The JATC will award credit for previous experience in accordance with Section I.E. of these standards and will pay each apprentice at the wage rate commensurate with his or her skill attainment. The direct entry of candidates and the credit for previous experience shall be awarded without regard to race, color, religion, national origin, sex (including pregnancy and gender identity), sexual orientation, genetic information, or because they are an individual with a disability or a person 40-years old or older. The available methods for direct entry are as follows:

- A. A Military Veteran who is registered with the Helmets to Hardhats program or has completed military technical training school and/or participated in a registered apprenticeship program or related occupation while in the military in the occupations registered in these Standards, may be given direct entry into the apprenticeship program. The JATC shall evaluate the military training received for granting appropriate credit on the term of apprenticeship and the appropriate wage rate. The sponsor will determine what training requirements the

veteran needs to meet to ensure he or she receives all necessary training for completion of the apprenticeship program. Applicants must submit a DD-214 to verify military training and/or experience if they are a veteran and wish to receive consideration for such training/experience.

- B. Technical School Graduate: Individuals who graduate from a Technical Training School that has been reviewed and approved by the Program Sponsor, in recognition of the relevant training they have already received for occupations registered in these Standards, may be given direct entry into the apprenticeship program. With the approval of the sponsor, such a new apprentice may start at the recommended apprentice wage rate for graduates of that particular program. The JATC will determine what additional training requirements are needed to ensure that the new apprentice(s) receive all the necessary training for completion of the apprenticeship program.
- C. An employee of a non-signatory employer not qualifying as a journeyworker when the employer becomes signatory will be evaluated by the JATC in accordance with the procedures for the granting of credit for previous experience, and registered at the appropriate period of apprenticeship based on previous work experience and related training. Any employee not eligible for receipt of credit must make application in accordance with the normal application procedures.
- D. An individual who signs an authorization card during an organizing effort wherein 51% or more of the employees have signed authorization cards, whether or not the employer becomes signatory, and is an employee of the non-signatory employer and does not qualify as a journeyworker, will be evaluated in accordance with the procedures for the granting of credit for previous experience and registered by the sponsor at the appropriate period of apprenticeship based on previous work experience and related training. Any employee not eligible for receipt of credit must make application in accordance with the normal application procedures.

For such an applicant to be considered, he or she must meet the following requirements:

1. Be employed in the sponsor's jurisdiction when the authorization card is signed;
 2. Have been employed by the employer before the organizational effort commenced;
 3. Have been offered the opportunity to sign an authorization card and be evaluated along with all other employees of the employer; and
 4. Provide reliable documentation to the sponsor to show he or she was an employee performing Transportation or Logistics work prior to signing the authorization card.
- E. An individual who has completed a structured pre-apprenticeship training program that meets the requirements outlined in Training and Employment Notice 13-12, Defining a Quality Pre-Apprenticeship Program and Related Tools and Resources, in any occupational area covered in these standards of apprenticeship and who meets the minimum qualifications of the apprenticeship program may be admitted directly into the program. The candidate shall provide official documentation confirming that he or she fulfilled the specific requirements of the pre-apprenticeship program, such as completion/graduation certificates, transcripts, notarized letters of confirmation, and sworn statements. The JATC will evaluate the training received to grant appropriate credit on the term of apprenticeship.
 - F. Union Members: General Teamsters Local 959, State of Alaska journeyworker members may request a change or revision to their classification and/or a change from their current apprenticeable occupation to another occupation and receive direct entry into the

apprenticeship program sponsored by their local union. For entry into the program, the applicant must:

1. Complete an application form and provide the required documentation.
2. Additionally, to determine placement, the applicant should:
3. Take the same skills and aptitude test used for evaluation and placement of apprentices into the program, if applicable.

WORK PROCESS SCHEDULE

SURVEY TECHNICIAN

O*NET-SOC CODE: 17-3031.00 RAPIDS CODE: 0551 (Surveyor Assistant)

During the term of apprenticeship, the Apprentice shall receive such instruction and experience, in all branches of the occupation, as is necessary to develop a practical and versatile worker. Major processes in which Apprentices will be trained (although not necessarily in the order listed) and approximate hours (not necessarily continuous) to be spent in each are as follows:

Survey Technician On-the-Job Learning Outline	Approximate OJL Hours
A. Survey land, properties, or bodies of water to measure or determine features.	1200
1. Position and hold the vertical rods, or targets, that theodolite operators use for sighting to measure angles, grades, distances, and elevations.	
2. Conduct surveys to ascertain the locations of natural features and man-made structures on the Earth's surface, underground, and underwater, using electronic distance-measuring equipment, such as GPS, and other surveying instruments.	
3. Record survey measurements or descriptive data, using notes, drawings, sketches, or inked tracings.	
4. Set out and recover stakes, marks, or other monumentation. May include line clearing, establishing points, taping, leveling and compass reading.	
5. Adjust and operate surveying instruments such as prisms, theodolites, electronic distance measuring equipment, or electronic data collectors. May include field care and cleaning of survey instruments and equipment.	
B. Evaluate designs or specifications to ensure quality.	100
1. Check all layers of maps and plans to ensure accuracy, identifying and marking errors and making corrections.	
C. Gather physical survey data.	500
1. Compile information necessary to stake projects for construction, using engineering plans.	
2. Identify and compile database information to create requested maps.	
3. Analyze aerial photographs to detect and interpret significant military, industrial, resource, or topographical data.	
4. Research and combine existing property information to describe property boundaries in relation to adjacent properties, taking into account parcel splits, combinations, or land boundary adjustments.	
5. Collect information needed to carry out new surveys, using source maps, previous survey data, photographs, computer records, plans and drawings, or other relevant information.	

D. Operate computer systems.	400
1. Operate and manage land-information computer systems, performing tasks such as storing data, making inquiries, and producing plots and reports.	
2. Enter Global Positioning System (GPS) data, legal deeds, field notes, or land survey reports into geographic information system (GIS) workstations so that information can be transformed into graphic land descriptions, such as maps and drawings.	
E. Verify mathematical calculations.	400
1. Compare survey computations with applicable standards to determine adequacy of data.	
F. Calculate geographic positions from survey data.	600
1. Calculate latitudes, longitudes, angles, areas, units of measurement, or other information for mapmaking, using survey field notes or reference tables.	
2. Compare topographical features or contour lines with images from aerial photographs, old maps, or other reference materials to verify the accuracy of their identification.	
3. Perform calculations to determine earth curvature corrections, atmospheric impacts on measurements, traverse closures or adjustments, azimuths, slope & grade, level runs, curves, or placement of markers.	
G. Prepare maps and field drawings.	400
1. Trim, align, and join prints to form photographic mosaics, maintaining scaled distances between reference points.	
2. Produce or update overlay maps to show information boundaries, water locations, or topographic features on various base maps or at different scales.	
3. Determine scales, line sizes, or colors to be used for hard copies of computerized maps, using plotters.	
4. Trace contours or topographic details to generate maps that denote specific land or property locations or geographic attributes.	
5. Prepare or update topographic or contour maps of land surveyed, including site features and other relevant information, such as charts, as-built surveys, graphical land descriptions, drafting/CAD, and survey notes.	
H. Document technical design details.	200
1. Complete detailed source and method notes describing the location of routine or complex land parcels.	
I. Determine geographic coordinates.	200
1. Search for section corners, property irons, or survey points.	
Total Hours	4000

RELATED INSTRUCTION OUTLINE

SURVEY TECHNICIAN

O*NET-SOC CODE: 17-3031.00 RAPIDS CODE: 0551 (Surveyor Assistant)

Source: Penn Foster Workforce Development; Program Sponsor

Method: Classroom and Self-paced Study; Online Media

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Trust
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<https://www.workforcedevelopment.com/engineering/surveyor.html>

The related instruction outlines the courses that provide the technical ability that supplements the on-the-job training. It is through the combination of both the on-the-job training and the related technical instruction that the apprentice can reach the skilled level of the occupation. Under a registered apprenticeship, 144 hours of related instruction each year of the apprenticeship is recommended. The following is the suggested course curriculum during the term of apprenticeship.

Related Instruction Outline	
Year-1	Hours
Teamster In-Person Related Instruction	46
Basic Industrial Math	30
Introduction to Algebra, Geometry, and Trigonometry	72
Basic Surveying and Measurement	20
Logarithms	10
Practical Geometry	20
Plane Trigonometry	60
Linear Surveying	10
Leveling	10
Transit Surveying	30
Year 1 Sub-total	308
Year-2	Hours
Geometrical Drawing	110
Drafting with AutoCAD	60
Topographic Surveying	20
Mapping	80
Highway Curves	20
Hydrographic Surveying	10
Year 2 Sub-total	300
Total Hours	608

Teamster In-Person Related Instruction

Program Orientation	8 Hours
NSTC (North Slope Training Cooperative)	8 Hours
First Aid/CPR & AED	8 Hours
Defensive Driving	8 Hours
OSHA 10 – General Construction	10 Hours
Flagger/Pilot Car	4 Hours

Penn Foster Land Surveyor Course List

Mathematics and Technical Foundation Skills

Basic Industrial Math

Course #: Block X21

Duration: 30 hours

What Students Learn: This module of six study units offers the trainee arithmetic and basic mathematics, metric measurement, and calculator fundamentals. The Metric System is an introductory unit which includes metric conversions. Problem exercises and examples in this module are presented in on-the-job scenarios with applications drawn from the industrial context. Components: Addition and Subtraction (186008); Multiplication and Division (186009); Fractions, Percents, Proportions, and Angles (186010); Metric System (186011); Formulas (186012); Introduction to Algebra (186013)

Special Notes: This updated course replaces lessons contained within Practical Math and Measurements, Block X01. Each study unit contains a progress examination.

Introduction to Algebra, Geometry, and Trigonometry

Course #: Block X02

Duration: 72 hours

Course Prerequisites: Basic Industrial Math (Block X21)

What Students Learn: This twelve-lesson block is for those trainees requiring more advanced math subjects. The subject of algebra is covered in detail and the subjects of geometry and trigonometry are introduced in a practical manner.

Because math skills vary widely, a placement test is available to determine the trainee's specific knowledge of the various areas. Test X0250: Introduction to Algebra, Geometry, and Trigonometry is divided into four sections: lessons X0201 through X0204; lessons X0205 through X0208; lessons X0209 through X0210; and lessons X0211 and X0212.

Components: Algebra: Monomials and Polynomials (X0201); Algebra: Factoring (X0202); Algebra: Addition and Subtraction of Fractions (X0203); Algebra: Multiplication and Division of Fractions (X0204); Algebra: Linear Equations (X0205); Algebra: Simultaneous Linear Equations (X0206); Algebra: Determinants (X0207); Algebra: Quadratic Equations (X0208); Algebra: Exponents (X0209); Algebra: Radicals and Imaginary Numbers (X0210); Applied Geometry (X0211); Practical Trigonometry (X0212); Progress Examination Booklet (X0220); Progress Examination (X0221); Progress Examination (X0222); Progress Examination (X0223); Progress Examination (X0224); Placement Test: Introduction to Algebra, Geometry, and Trigonometry (X0250)

Basic Surveying and Measurement

Course #: 686E04

Duration: 20 hours

Course Prerequisites: Formulas (186307)

What Students Learn:

Lesson 1—Introduction to Surveying and Measurement

Lesson 2—Leveling, Angles, and Calculating Land Area

Lesson 3—GPS, GIS, and Construction Surveying

Lesson 4—Land Surveying, Curves, and Professional Practices

Logarithms

Course #: 5254

Duration: 10 hours

Course Prerequisites: Basic Industrial Math (Block X21)

What Students Learn:

Table of Common Logarithms; Table of Useful Numbers; Exponents; Logarithms of Numbers; Determination of Characteristics of a Logarithm; Determination of Mantissa of a Logarithm; Proportional Parts; Determination of Antilogarithms; Multiplication by Use of Logarithms; Division by Use of Logarithms; Finding Powers and Roots by Logarithms; Cologarithms; Hyperbolic Logarithms.

Practical Geometry

Course #: 5983A-B

Duration: 20 hours

Course Prerequisites: Introduction to Algebra, Geometry, and Trigonometry (Block X02)

What Students Learn:

PART 1 (5983A). Points, Lines, Surfaces, and Angles; Perpendicular and Parallel Lines; Triangles; Quadrilaterals; Other Polygons.

PART 2 (5983B). The Circle; Arcs and Areas of Figures Bounded by Them; Solids; Areas and Volumes of Unusual Figures.

Special Notes: Covers subject at an advanced, in-depth level.

Plane Trigonometry

Course #: 2309A-B

Duration: 60 hours

Course Prerequisites: Practical Geometry (5983A-B); Introduction to Algebra, Geometry, and Trigonometry (Block X02)

What Students Learn:

PART 1 (2309A). Solving a Triangle; Deriving Trigonometric Functions; Trigonometric and Geometric Identities; Values for the Trigonometric Functions; Using the Table of Natural Trigonometric Functions; Interpolation; Solving the Right Triangle; Solving the Right Triangle by Using Logarithms.

PART 2 (2309B). Angles and Their Measurement; Degrees and Radians; Rectangular Coordinates; The Trigonometric Formulas; Finding the Values of the Functions of Angles; Reduction Formulas; Solving the Oblique Triangle; Law of Tangents; Using Half-Angle Formulas; Area of a Triangle; Radius of an Inscribed Circle; Radius of a Circumscribed Circle.

Special Notes: Covers subject at an advanced, in-depth level.

Introduction to Surveying and Mapping Principles

Linear Surveying

Course #: 6670

Duration: 10 hours

Course Prerequisites: Plane Trigonometry (2309A-B); Logarithms (5254);

What Students Learn:

Methods of Measurement; Tapes and Accessories; Description of Geodimeter and Tellurometer; Use of Tape; Adjustment of Taped Distances; Use of Geodimeter; Use of Tellurometer; Simple Field Problems; Survey of Tract with Tape.

Leveling

Course #: 6671

Duration: 10 hours

Course Prerequisites: Plane Trigonometry (2309A-B); Logarithms (5254); Introduction to Algebra, Geometry, and Trigonometry (Block X02)

What Students Learn:

The Engineer's Level; Definitions; Construction of Levels; Setting Up Level; Leveling Rods; Reading the Rod; Operations of Direct Leveling; Forms for Level Notes; Precision in Leveling; Adjustments of Levels; Profiles; Barometric Leveling.

Transit Surveying

Course #: 5460A-C

Duration: 30 hours

Course Prerequisites: Linear Surveying (6670); Leveling (6671)

What Students Learn:

PART 1 (5460A). Meridians; Magnetic Declination; Azimuth of Lines; Bearings of Lines; Angles Between Lines; The Engineer's Transit; Reading Vernier; Reading Compass; Optical-Reading Theodolites; Adjustments of a Transit.

PART 2 (5460B). Operations with Transit; Measurement of Direct Angles; Measurement of Deflection Angles; Details of Transit Surveys; Field Problems; Surveying by Triangulation; Trigonometric Leveling.

PART 3 (5460C). Computations involving Latitudes and Departures; Balancing Closed Traverses; Errors of Closure; Computation of Omitted Measurements; Plotting Traverse by Lengths and Directions of Courses; Plotting Traverse by Latitudes and Departures; Computation of Area; Problems on Partitioning Tracts of Land.

Drafting Kit

Course #: 1200M

Duration: 0 hours

What Students Learn:

This drawing board includes a straight-edge rather than a separate T-square, a setup preferred by professionals. The drawing instruments are tools trainees will use on the job. The drafting outfit includes: one set of drawing instruments, one 18" x 24" drawing board/straight-edge combination, one 6" protractor, one 10" 300/600 triangle, one 8" 450 triangle, one 12" architect's scale, one 12" engineer's scale, one 300 mm metric scale, one irregular curve, one lettering guide, one erasing shield, one roll of drafting tape, two mechanical pencils, two tubes of lead, one lead pointer, one pink eraser, and one pad 25 sheets of 15" x 20" transparent paper.

Special Notes: The Drafting Kit must be used for the study of all texts that teach drafting techniques, in which the trainee is required to prepare drawings or architectural plates. Refer to the special notes of the individual print course when this kit is required.

Geometrical Drawing

Course #: 5544A-B

Duration: 110 hours

What Students Learn:

Geometrical Terms; Lines, Angles, Triangles, Quadrilaterals, Circles, Ellipse, and Parabola, Solids; Drawing Equipment: Paper, Drawing Board, T-Square, Triangles, Scales, Compasses, Dividers, Protractor, Irregular Curve and Drafting Machine; Ruling; Straight Lines; Care of Drawing Instruments; Protecting Drawings; Erasing; Styles of Lettering; Relative Widths and Spacing of Letters; Vertical Single-Stroke Lettering; Inclined Single-Stroke Lettering; Five Drawing Plates Consisting of 26 Problems.

Special Notes: Covers subject at an advanced, in-depth level. Includes 5 plates, and requires drafting kit.

Drafting with AutoCAD

Course #: 686E06

Duration: 60 Hours

What Students Learn:

Lesson 1—Lines, Essential Tools, and Drawing Circles

Lesson 2—Drawing Aids, Layers, Colors, and Line types

Lesson 3—Templates, Copies, Arrays, Arcs, and Polar Arrays

Lesson 4—Mirror Images, Page Setups, and Object Snap

Lesson 5—Text and Dimension Fundamentals

Lesson 6— Dimensioning and Polylines

Lesson 7—Blocks, Attributes, and External References

Lesson 8—Isometric Drawing, Customized Panels, the CUI Dialog Box, and Macros

Lesson 9— 3D-Modeling

Lesson 10— More Modeling Techniques and Commands

Special Notes:

This course consists of one textbook and five supplemental study guides. This course requires submittal of a project for grading in addition to taking ten exams.

Topographic Surveying

Course #: 5461A-B

Duration: 20 hours

Course Prerequisites: Transit Surveying (5460A-C)

What Students Learn:

PART 1 (5461A). Determination of Distances by Stadia; Instrument Constants; Formulas for Stadia Distances; Stadia Reduction Table; Beaman Stadia Arc; Field Operations in Stadia Work-Transit-Stadia Surveys for Locating Topography; Indirect Leveling by Stadia; Accuracy of Stadia Work.

PART 2 (5461B). Plane-Table Surveying; Locating Points from Plane Table; Plotting Position of Plane Table; Field Methods for Locating Topography; Accuracy of Plane-Table Work; Topographic Maps; Methods of Control; Locating Topography by Side-Shot Method; Locating Topography by Cross-Section Method.

Mapping

Course #: 5462A-B

Duration: 80 hours

Course Prerequisites: Geometrical Drawing (5544A-B)

What Students Learn:

PART 1 (5462A). Two Drawing Plates; Scale of Map; Azimuths and Bearings of Lines; Plotting Angles; Planning Maps' Locating Points on Traverses; Plotting Open Traverses; Plate 1801, Plotting Closed Traverses; Routes involving Circular Curves; Plate 1802, Plotting Route Centerlines.

PART 2 (5462B). Two Drawing Plates; Preparation of Topographic Maps; Conventional Symbols; Location of Contours; Plotting Topographic Details; Plate 1803, Topographic Symbols and Contours; Plotting Cross Sections and Profiles; City and Village Maps; Plate 1804, Map of a Portion of Southport; Laying of Tints.

Special Notes: Includes 4 plates and requires drafting kit.

Highway Curves

Course #: 6812A-B

Duration: 20 hours

Course Prerequisites: Transit Surveying (5460A-C)

What Students Learn:

PART 1 (6812A). Elements of Highway Routes; Tangents and Horizontal Curves; Grades and Vertical Curves; Radius and Degree of Simple Curves; Procedure for Locating Points on Simple Curves; Measurement of Distances on Curves; Field Layout for Simple Curves; Special Problems Relating to Simple Curves; Problems on Relocation of Route.

PART 2 (6812B). Compound and Reverse Curves; Transition Curves; Superelevation on Curve; Spiral Curve; Deflection Angles for Spiral; Coordinates for Spiral; Minimum Length of Spiral; Field Layout of Spiral; Spiral Joining Two Curves; Vertical Parabolic Curves; Elevations on Vertical Curves.

Hydrographic Surveying

Course #: 5751

Duration: 10 hours

Course Prerequisites: Topographic Surveying (5461A-B)

What Students Learn: Preparatory Surveys; Control Surveys; Triangulation and Topography; Shore Stations; Control Buoys; Taking Soundings; Equipment for Measuring Depth; Locating and Observing Soundings; Plotting Soundings; Boat Sheet; Smooth Sheet; Volume of Body of Water; Adjustments of the Sextant.