



## Topographical Drafting

PEIMS Code: N1300421

Abbreviation: TOPDR

Grade Level(s): 11-12

Award of Credit: 1.0

### Approved Innovative Course

- Districts must have local board approval to implement innovative courses.
- In accordance with Texas Administrative Code (TAC) §74.27, school districts must provide instruction in all essential knowledge and skills identified in this innovative course.
- Innovative courses may only satisfy elective credit toward graduation requirements.
- Please refer to [TAC §74.13](#) for guidance on endorsements.

### Course Description:

Topographical Drafting focuses on knowledge and skills essential to map drafting. Emphasis is given to plotting of surveyors' field notes, plotting elevations, contour drawings, plan and profiles, and laying out traverses.

### Essential Knowledge and Skills:

(a) General requirements. This course is recommended for students in Grades 11-12. Recommended prerequisites: Architectural Design, Algebra I, and Geometry. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Architecture and Construction Career Cluster focuses on designing, planning, managing, building, and maintaining the built environment.

(3) In Topographical Drafting, students will gain knowledge and skills in map drafting. Emphasis is given to plotting of surveyors' field notes, plotting elevations, contour drawings, plan and profiles, and laying out traverses.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

- (A) identify employment opportunities, including entrepreneurship and preparation requirements in the construction industry;
- (B) describe how teams work related to citizenship and career preparation;
- (C) identify employers' expectations and appropriate work habits;
- (D) apply the competencies related to resources, information, systems, and technology in appropriate settings and situations; and
- (E) demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate governmental regulations.

(2) The student applies key cognitive skills and academic behaviors to the requirements of the construction industry. The student is expected to:

- (A) assess learning needs and seek assistance when needed;
- (B) practice study habits necessary to manage academic pursuits and requirements;
- (C) prepare drafting documents with accuracy and precision;
- (D) demonstrate effective verbal and written communication skills with individuals from varied cultures, including fellow workers, managers, and customers.

(3) The student interprets technical drawings and civil documents. The student is expected to:

- (A) interpret and explain technical drawing symbols;
- (B) interpret and explain topographical drawings;
- (C) interpret and explain aerial photographs and maps;
- (D) interpret and explain building and neighborhood site drawings;
- (E) interpret and explain architectural drawings;
- (F) interpret and explain engineering specifications;
- (G) interpret and explain building plan addendums;
- (H) interpret and explain machine shop and technical drawings;
- (I) interpret and explain master and development plans and documents.

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(4) The student interprets and applies principles of architectural and engineering design.

The student is expected to:

- (A) interpret soil analysis reports;
- (B) interpret soil compaction test reports;
- (C) interpret and apply fundamentals of site space utilization requirements; and
- (D) determine and apply site space relationships.

(5) The student demonstrates an understanding of terminology, tools and symbols pertinent to the civil drafting field. The student is expected to:

- (A) apply legal descriptions to drafting;
- (B) investigate civil engineering and civil drafting standard practices;
- (C) demonstrate the use of various drafting equipment including the care of the equipment;
- (D) demonstrate the use and care of survey equipment;
- (E) demonstrate the use of typographical symbols;
- (F) define terminology and criteria related to land development codes;
- (G) identify the types and purposes of surveys such as boundary, topographic, and as-built;
- (H) describe sections or townships, ranges, metes and bounds, and plats;
- (I) apply the civil engineering scale to perform measurements;
- (J) apply the Civil Engineering Standard Method of Measurement;
- (K) investigate surveying and mapping practices in the United States;
- (L) set up, process, and manage survey point data; and
- (M) differentiate between various infrastructure drawing types and determine their appropriate uses in civil engineering projects.

(6) The student applies survey field notes to drafting projects. The student is expected to:

- (A) prepare survey field notes utilized in preparing drafting documents;
- (B) demonstrate the use of survey field notes in developing land maps (plats);
- (C) apply information from survey field notes to draw and detail a contour map; and
- (D) employ survey field notes for fee ownership and lease holder maps.

- (7) The student conducts survey measurements. The student is expected to:
- (A) measure horizontal distances;
  - (B) measure angles;
  - (C) measure vertical distances (leveling procedure);
  - (D) identify types of equipment used for horizontal measurement;
  - (E) identify types of equipment for vertical measurement; and
  - (F) calculate survey bearings using horizontal and vertical measuring equipment.
- (8) The student produces civil engineering drawings. The student is expected to:
- (A) demonstrate lettering styles and fonts used in civil engineering to ensure legibility and uniformity;
  - (B) plot elevations and contours;
  - (C) construct alignment sheets for construction design;
  - (D) adapt plan profile sheets for construction design;
  - (E) plot a survey traverse;
  - (F) create, edit, analyze, and display Triangular Irregular Network (TIN) Surfaces;
  - (G) construct a topographic map using horizontal and vertical values; and
  - (H) demonstrate skills in layer management, dimensioning, and drawing setup.
- (9) The student applies drafting skills to create street plans and profiles. The student is expected to:
- (A) draw and detail a level road plan with profile views;
  - (B) draw a curved level road plan with profile views; and
  - (C) draw and detail a graded road plan with profile views.
- (10) The student designs and drafts map drawings. The student is expected to:
- (A) interpret and explain the components of map drawings;
  - (B) create traverse drawings;
  - (C) create plat drawings;
  - (D) create street layout drawings; and
  - (E) create map drawings.
- (11) The student uses computer aided design software to design and draft map details. The student is expected to:
- (A) identify and explain computer-aided map details;

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- (B) draft range, section, and township maps;
  - (C) create a map using bearings;
  - (D) create a map using coordinates;
  - (E) convert maps into metric dimensions;
  - (F) create a map using a Triangulated Irregular Network (TIN) and;
  - (G) create a map using contour lines.
- (12) The student prepares final survey and map drawings for civil engineering projects. The student is expected to:
- (A) interprets and explains surveying and mapping drawings;
  - (B) apply appropriate line work in a drawing using the standard Alphabet of Lines;
  - (C) create drawings that include lot lines, easements, setbacks, and building lines;
  - (D) create a platted residential lot survey;
  - (E) create multi-lot plat drawings with roadway networks;
  - (F) create topographic survey with ground elevations; and
  - (G) create computer aided drawing with Triangulated Irregular Network (TIN).

### Recommended Resources and Materials:

Madsen, D.A., Shumaker, T.M. & Madsen, D.P. (2010) *Civil Drafting Technology*.

Columbus, OH: Prentice Hall

Autodesk Design Suite

Solidworks

Survey equipment

### Recommended Course Activities:

Create civil engineering drawings.

Make use of Civil Engineer measurements.

Apply skills using Civil Scales.

Produce drawings that include layer management, dimension and drawing setup.

Mapping project including topographic survey and plotting of a survey traverse.

**Suggested methods for evaluating student outcomes:**

Performance on assigned projects and teacher developed assessments will be used to determine the student's success. Students will be evaluated on skill competency, tests, daily grades and group/individual projects using rubrics.

**Teacher qualifications:**

Secondary Industrial Arts: Grades 6-12

Secondary Industrial Technology: Grades 6-12

Technology Education: Grades 6-12

Trade and Industrial Education:

Grades 6-12 with appropriate work approval as identified on the certificate

Grades 8-12 with appropriate work approval as identified on the certificate

Vocational Trades and Industry with appropriate work approval as identified on the certificate

**Additional information:**

References

Hogan, S and Roberts, B. (2015) Occupational employment projections to 2024. Monthly Labor Review, US Bureau of Labor Statistics (December 2015). Retrieved from <https://www.bls.gov/opub/mlr/2015/article/occupational-employment-projections-to-2024.htm>

The Labor Market & Career Information Department (LMCI) of the Texas Workforce Commission (2017). Retrieved from <http://www.tracer2.com/>