

Certification Exam Handbook Civil Engineering Technology

Offered by:



CTTAM

*Certified Technicians & Technologists
Association of Manitoba*



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Introduction

The Civil Technologist Certification Exam Handbook has been prepared for civil engineering technologists who are required to pass a certification exam to achieve registration as a Certified Engineering Technologist or Applied Science Technologist. The handbook is designed to provide candidates with essential information regarding the certification examination.

Examination Information

Purpose of Examination

The purpose of the Civil Technologist Certification Examination is to identify competent civil engineering technologists who possess technical competencies in their discipline, as outlined in a discipline-specific competency profile (**see Appendix A**). The ultimate goal is to protect the public by granting designations only to those professionals who have the skill and knowledge necessary to perform their job in a safe and competent manner.

Examination Development Process

The Civil Technologist Certification Examination consists of 100 multiple-choice questions, including questions with graphs, diagrams, and schematics and questions that require calculations. Each multiple-choice question has four answer options, only one of which is correct. Exam questions vary in the level of cognitive difficulty.

A rigorous exam development process was implemented to ensure that the resultant exam meets professional testing standards as specified in the Standards for Educational and Psychological Testing. Exam development involved numerous consultations with experienced civil engineering technologists, as well as education providers and industry representatives. These individuals contributed their expertise to seven stages of exam development, including: 1) competency development; 2) exam blueprinting; 3) item writing; 4) group item review; 5) pilot testing; 6) standard setting; and 7) exam form assembly.

Examination Content

The Civil Technologist Certification Examination tests candidates' competencies in four areas (**see Table 1 and Appendix A for detailed information on examination content**).

Technical Analysis: In this competency area, candidates are expected to be able to apply civil engineering knowledge, equipment, and tools to gather information, analyze it, and contribute to solutions that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.

Technical Design: This competency area deals with candidates' ability to design civil projects in accordance with technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.

Technical Evaluation: In this competency area candidates are expected to be able to evaluate civil projects to determine their compliance with technical specifications.

Project Management: This competency area deals with candidates' ability to assist project managers in the implementation of projects.

Table 1. Description of Examination by Competency Area

Competency Area	Percentage of Questions	Number of Questions
1. Technical Analysis	31%	31
2. Technical Design	19%	19
3. Technical Evaluation	27%	27
4. Project Management	23%	23
Total	100%	100

Table 2 provides the breakdown of exam questions by cognitive level. “Knowledge” questions require that candidates recall information and provide its interpretation. “Application” questions require that candidates apply their knowledge to practical situations, while “Critical thinking” questions require that candidates analyze complex situations and provide solutions.

Table 2. Description of Examination by Cognitive Level of Questions

Cognitive Level	Percentage of Questions	Number of Questions
Knowledge	48%	48
Application	37%	37
Critical Thinking	15%	15
Total	100%	100

As can be seen in Table 3, 15% of exam questions have an image (e.g., a graphic, figure, table, or a schematic).

Table 3. Description of Examination by Images

Images	Percentage of Questions	Number of Questions
Questions with Images	15%	15
Questions without Images	85%	85
Total	100%	100

Examination Registration

Applicants who are required to complete the Civil Technologist Certification Examination will register for the examination at the time of application. Please see the ASET, CTTAM, or ASTTBC websites for current information on examination dates, fees, and policies.

Study Resources for Examination

The following resources may be of use to candidates interested in refreshing their knowledge prior to writing the examination. **Candidates are not expected to study each of these resources.** Rather, candidates may wish to review particular content areas in which they feel they would like to update their current knowledge. For detailed information on the content areas covered on the exam, candidates should refer to **Appendix A**.

- Atkins, H. N. (2003). Highway materials, soils, and concrete (4th ed.). Upper Saddle River, NJ: Pearson Education.
- Canadian Institute of Steel Construction. (2012). Handbook of Steel Construction. (10th ed.)
- Canadian Wood Council. (2010). Wood Design Manual.
- Cement Association of Canada. (2006). Concrete Design Handbook. (3rd ed.). Cement Association of Canada.
- Cheng, Fa-Hwa. (1997). Statics and Strengths of Materials. (2nd ed.). Glencoe/McGraw-Hill.
- Cheng Liu, Jack B. Evett. (2014). Soils and Foundations. (8th ed.). Pearson Education Canada, Prentice Hall.
- Gupta, Ram S. (1995). Hydrology and Hydraulic Systems. Prospect Heights, Ill.: Waveland Press.
- Kavanagh, B., & Mastin, T. (2014). Surveying principles and applications. (9th ed., p. 19). Upper Saddle River, NJ: Pearson/Prentice Hall.
- Kosmatka, Steven H. (Ed.) et al. (2011). Design and Control of Concrete Mixtures. (8th Cdn ed.). Canadian Portland Cement Association, c1995.
- McCarthy, D. F. (2007). Essentials of soil mechanics and foundations: Basic geotechnics. Upper Saddle River, NJ: Pearson/Prentice Hall.
- Mott, Robert L. and Joseph A. Untener. (2014). Applied Fluid Mechanics. (7th ed.). Upper Saddle River, NJ : Pearson Education Inc.
- Pratt, D. J. (2011). Fundamentals of construction estimating (3rd ed., p. 19, Chapter 2) Australia; Boston, MA: Wadsworth Cengage Learning.
- Project Management Institute. (2013). A Guide to the Project Management Body of Knowledge. (5th ed.)

Exam Accommodations for Candidate with Disabilities

According to Canadian human rights legislation and test industry standards, exam developers are responsible for providing candidates with disabilities with exam accommodations where appropriate and feasible. Exam accommodations are designed to remove barriers related to individual characteristics of candidates that may prevent them from demonstrating their technical competencies on the exam. “An appropriate accommodation is one that that responds to specific individual characteristics but does so in a way that does not change the construct the test is measuring or the meaning of scores.”¹

Candidates with disabilities should request accommodations to write the certification exam at the time of application. To protect the integrity of the examination, documented evidence of the candidate’s disability must be submitted to ASET, CTTAM, or ASTTBC along with the application form. Such evidence includes a formal detailed diagnosis of the specific disability

¹ American Educational Research Association (2014). *Standards for Educational and Psychological Testing*. Washington, DC (p. 67)

from an appropriate professional (e.g., physician, psychologist, rehabilitation counsellor) and supporting documentation citing the need for exam accommodations and what accommodations the candidate received in the past.

ASET, CTTAM, or ASTTBC will review the candidate's written request for accommodation and determine if it can be supported. Depending on the candidate's individual needs, ASET, CTTAM, or ASTTBC may modify exam administration conditions, including exam setting, exam presentation, or the addition of individuals to the exam (e.g., readers, scribes). Each request will be reviewed on a case-by-case basis.

Below is a list of reasonable exam accommodations for candidates with a disability.

1. *Separate Room*

A separate room is provided to candidates who due to the nature of their disability require an exam environment that minimizes distractions resulting from noise or movement or process information by talking aloud.

2. *Additional Time*

Extending additional time to candidates is a frequently used exam accommodation that is used with a variety of disability-related conditions. Often candidates are offered time-and-one-half to complete the exam (e.g., a 3-hour exam is extended to 4.5 hours).

3. *Interpreter*

Candidates with hearing impairment may request an interpreter who has proficiency in sign language.

4. *Reader*

A reader is an individual who reads exam instructions and/or exam questions to a candidate. Candidates with visual impairment or those with a learning disability may benefit from services of a reader during the examination.

5. *Recorder*

A recorder is an individual who fills in the answers for a candidate who has difficulty writing independently.

Costs related to exam accommodations will be the responsibility of the candidate.

Examination Administration

The Civil Technologist Certification Examination will be administered on a computer in one of Yardstick's exam centers in Alberta, Manitoba, or British Columbia. Generally, exam centers are located in colleges and universities. An experienced proctor will oversee the examination. Limited space is also available for virtual proctoring of examinations. Please contact ASET, CTTAM, or ASTTBC for more information.

Admissions to the Exam Centre

ASET, CTTAM, and ASTTBC provide Yardstick with a list of examination candidates for each exam sitting. When an exam appointment is made, candidates will receive a booking

confirmation email from Yardstick. **It is important that candidates bring this email with them to an examination center on the day of the examination.**

Upon entering the examination center, candidates will be asked to register with the proctor. The following information will need to be provided to the proctor.

- Candidate's first and last name
- Valid government-issued photo ID
- Candidate's booking email as provided by Yardstick

After the initial verification of identity, candidates will be asked to sign a roster.

Candidates' personal belongings, such as bags and jackets, will be stored in a designated area. Electronic devices, including but not limited to cell phones, tablets, and reference books, may not under any circumstances be brought into the exam center. The only exception to this rule is personal calculators. The proctor is responsible for inspecting candidate's calculators prior to the exam.

Candidates may bring with them into the exam center water, juice, coffee or another drink in a spill proof container with no label and, only if approved by the proctor, a sweater without pockets, and disposable ear plugs.

The use of scratch paper is permitted. The proctor will provide scratch paper to the candidates before the exam and collect it after the exam.

Taking the Exam

At the beginning of the examination, candidates will hear verbal examination instructions from the proctor and read the Candidate's Statement of Understanding and/or Non-disclosure Agreement in the software. Failure to comply with the regulations outlined in these documents will result in the candidate's results being invalidated. Candidates will not be able to begin the examination without agreeing to the conditions outlined in the document.

Next, exam candidates will be given written exam instructions in the software. These exam instructions will emphasize the fact that some exam questions contain images and/or require calculations. If the images appear too small on the screen, candidates will be advised to hover their mouse over them to get an expanded view.

Following exam instructions, there will be a tutorial available to candidates before they proceed to the exam.

After the Examination

Upon submitting their exam responses, candidates will be offered an opportunity to provide feedback on exam material and exam administration conditions by completing a short online survey. Then, candidates will submit their scrap paper to the proctor, sign out from the candidate roster, and leave the examination center.

Examination Scoring and Reporting

Multiple-choice examination questions are scored dichotomously, using a score of “0” for an incorrect response and a score of “1” for a correct response. The Technologist Certification Examinations are criterion-referenced exams, which means that a candidate should obtain a score that is equal or higher than an exam pass mark to pass the examination.

Each Certification Examination has its own pass mark. The pass mark for the Civil Technologist Certification Examination was determined by the Exam Committee, which took into account the difficulty of exam questions and the expected level of performance for a minimally competent engineering technologist. A psychometrically acceptable standard-setting methodology was used to set examination pass marks.

The examinations are electronically scored. Candidates can expect to obtain their exam score and the associated pass/fail decision within four to six weeks after the date of exam administration. Unsuccessful candidates will also receive a performance report indicating a failure to pass, their score, and areas of strength and weakness in the four tested competency areas. The unsuccessful candidates will be able to retake the exam.

Review and Appeal Process

A candidate who fails the Certification Examination may request that their exam score be verified. Due to the automated scoring and extensive quality control procedures, errors in scoring are extremely unlikely. However, candidates may request that ASET, CTTAM, or ASTTBC manually rescore their exam to verify the original score. The candidate will be responsible for any expenses incurred during the review and appeals process.

Appendix A: Civil Technologist Professional Competencies

Role Description

Entry-level civil engineering technologists collect technical data, compile data for decision-making purposes, and perform field inspections for civil projects. Working under supervision of authorized professionals, they perform technical design and assist in the implementation and evaluation of civil projects.

Competency Name:	
Technical Analysis (Civil Engineering Technologists)	
Competency Definition:	
Apply civil engineering knowledge, equipment, and tools to gather information, analyze it, and contribute to solutions that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.	
#	Competency Indicators
1.1	Collect quantitative and qualitative information to assist in the design and development of technical solutions.
1.2	Assess site safety before collecting data.
1.3	Calculate linear dimensions, areas, volumes, and quantity.
1.4	Obtain test results from technical reports.
1.5	Perform tests.
1.6	Compile test results for future analysis.
1.7	Perform basic topographic and construction surveys.
1.8	Inspect project sites and facilities to report on general site conditions.
1.9	Document data from site inspections (e.g., sketches, notes, and photos).
1.10	Assess data to identify potential opportunities and constraints.
1.11	Analyze data in relation to regulatory requirements, industry standards and local codes.
1.12	Evaluate municipal requirements for civil infrastructure.
1.13	Analyze record drawings.
1.14	Integrate data using appropriate software management techniques.
1.15	Identify basic structure types and components.
1.16	Apply drafting techniques to draw plans and details.
1.17	Assist in the development of technical solutions.

Competency Name:	
Technical Design (Civil Engineering Technologists)	
Competency Definition:	
Design civil projects in accordance with technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.	
#	Competency Indicators
2.1	Identify and analyze alternative approaches to meeting technical specifications.

2.2	Take into consideration cost, quality, safety and environmental impact.
2.3	Use resources effectively to complete tasks.
2.4	Collaborate with a multi-disciplinary team to solve technical problems.
2.5	Assist in the production of technical drawings, specifications, and other design documents for municipal infrastructure projects, such as: 1) Sanitary sewer systems; 2) Storm water management systems; 3) Water systems; 4) Transportation infrastructure.
2.6	Assist in the production of technical drawings, specifications, and other design documents for concrete, wood, and steel structures, including: 1) Elements in steel, wood, and reinforced concrete buildings (e.g., slabs, beams, columns, walls, foundations and stairs); 2) Building envelopes
2.7	Assist in the production of technical drawings, specifications, and other design documents based on geotechnical design, including: 1) Shallow and deep foundations for support structures; 2) Flexible and rigid pavement structures; 3) Retaining walls.
2.8	Assist in the production of technical drawings, specifications, and other design documents for transportation projects, such as: 1) Highways; 2) Airports; 3) Railways; 4) Water terminals
2.9	Assist in design review for civil projects.

Competency Name:	
Technical Evaluation (Civil Engineering Technologists)	
Competency Definition:	
Evaluate civil projects to determine their compliance with technical specifications.	
#	Competency Indicators
3.1	Perform inspections of components of civil projects.
3.2	Coordinate the tests required to ensure compliance with technical specifications.
3.3	Conduct tests to ensure compliance with technical specifications.
3.4	Take appropriate action to address design and construction issues as they arise.
3.5	Maintain complete and regular records of inspections, logs, and tests.
3.6	Monitor the equipment to ensure that it operates in accordance with technical specifications.
3.7	Assist in resolving quality issues internally and externally.
3.8	Monitor the quality of sub-contractors' work.
3.9	Assist in identifying the non-conforming components of civil projects.
3.10	Monitoring the non-conforming components of civil projects until corrective solutions are effectively implemented.
3.11	Conduct measurement checks or visual inspections for earthworks, civil foundation, structures, buildings and buildings systems.
3.12	Review vendor documentation to ensure compliance with technical specifications.
3.13	Carry out quality control and quality assurance testing on soils, concrete, asphalt, and other materials.
3.14	Conduct construction layout using basic surveying techniques.
3.15	Assist in the development of operations and maintenance procedures (e.g., compilation of inspection data)
3.16	Assist with the preparation of project reporting documentation.

Competency Name:	
Project Management (Civil Engineering Technologists)	
Competency Definition:	
Assist in the implementation of projects to ensure the quality of deliverables, customer satisfaction, and adherence to schedules and budgets.	
#	Competency Indicators
4.1	Calculate costs, materials, quantities, and resources required for projects.
4.2	Assist in the preparation of budgets and schedules for deliverables.
4.3	Assist in tracking actual spending, trends, and project budget forecasts.
4.4	Monitor progress on projects.
4.5	Update schedules.
4.6	Recognize critical paths and bring them to the attention of the project manager.
4.7	Quantify work that is completed to-date.
4.8	Provide input into preparation of tender documentation.
4.9	Assist in managing contracts, including progress payments.
4.10	Assist in managing change orders.
4.11	Establish and maintain effective working relationships with internal and external clients.
4.12	Assist in managing customers' expectations.
4.13	Provide mentorship to peers.
4.14	Prioritize own work activities to ensure that project objectives are met on time and on budget.
4.15	Explain the value of workplace safety legislation.
4.16	Comply with workplace safety legislation.