



Board/Authority Authorised Course Civil Engineering – Construction Management and Estimating

School District/Independent School Authority Name	Kamloops/Thompson
School District/Independent School Authority Number	#73
Developed by	Briar Beers
Date Developed	December 2013
School Name	NorKam Secondary
Principal's Name (District)	Sheryl Lindquist
Superintendent Approval Date (for School Districts only)	
Superintendent Signature (for School Districts only)	
Board/Authority Approval Date	
Board/Authority Chair Signature	
Course Name	Civil Engineering - Construction Management and Estimating
Grade Level of Course	11 and 12
Number of Course Credits	4
Number of Hours of Instruction	120
Prerequisite(s)	Completion of Grade 10 as well as successful application process.



Synopsis

This course has been developed so students can work through a basic project from beginning to end, starting with estimating and pricing the job, scheduling, through document control, and cost tracking.

Students will be able to see the progression of a project from beginning to end and the importance of each part of project estimating and management. This course will allow students to have a firsthand look at the many possible job opportunities in the construction field as a Civil Engineer/Civil Engineer Technologist.

Rationale

This course will:

1. Provide students with the basic knowledge of the construction process from estimating to completion.
2. Provide students with basic construction take-off skills.
3. Provide students with practical document control skills and the understanding of why it is a crucial part of all construction jobs.
4. Introduce students to the basics of scheduling so they can understand how they work, how to use them, and why they are important.

Unit/Topic	Title	Time
Unit 1	INTRODUCTION TO ESTIMATING	5 hours
Unit 2	DRAWING TAKE-OFFS	25 hours
Unit 3	SCHEDULING	25 hours
Unit 4	PRICING AND SUBMITTING AN ESTIMATE	15 hours
Unit 5	DOCUMENT CONTROL	25 hours
Unit 6	COST TRACKING AND ANALYSIS	25 hours
	Total Hours	120 hours

Unit 1 - Introduction to Estimating

Objective: In this unit, students will get a general overview of how you start a job from the first day you get the tender documents until you put in a quote or price for the work. They will learn about different types of estimates and how you begin to approach estimating any job.



Prescribed Learning Outcomes

It is expected that students will:

1. Define and understand what a Work Breakdown Structure is.
2. Define the following terms:
 - Tender
 - Tender documents
 - Specifications
 - Construction drawings
 - Schedules (i.e., door schedules, pipe schedules, finishing schedules)
3. Read and review tender documents and drawings.
4. Understand and define different types of estimates such as:
 - Fixed price
 - Cost plus
5. Determine what type of estimate is required for a specific job.
6. Determine what work will be completed by the company and what work will require subcontractors.
7. Send out a Request for Quotation (RFQ) to potential subcontractors.

Unit 2 – Drawing Take-Offs

Objective: In this unit, students will learn how to use construction drawings to complete quantity take-offs and track their quantities for the purpose of estimating a job. They will learn to use different methods to calculate their take-off quantities including, scaling, digitizer, electric scales, estimating take off software. They will also use excel to track their quantities. Students will start an ongoing project that will test all of their skills throughout this course, beginning with quantity take-offs.

Prescribed Learning Outcomes

It is expected that students will:

1. Know and identify the 16 construction divisions:
 - Division 01 — General Requirements
 - Division 02 — Site Construction
 - Division 03 — Concrete
 - Division 04 — Masonry
 - Division 05 — Metals
 - Division 06 — Wood and Plastics
 - Division 07 — Thermal and Moisture Protection
 - Division 08 — Doors and Windows
 - Division 09 — Finishes
 - Division 10 — Specialties
 - Division 11 — Equipment
 - Division 12 — Furnishings



- Division 13 — Special Construction
 - Division 14 — Conveying Systems
 - Division 15 — Mechanical
 - Division 16 — Electrical
2. Understand the use of a site visit prior to completing an estimate.
 3. Set up spreadsheets to track their quantities for take-offs organized by division and area
 4. Read drawings and use scales to complete take-offs
 5. Use electric scale to get quantities
 6. Use electric digitizer to get quantity take-offs
 7. Use an estimating program to input different dimensions to calculate take-offs and estimate
 8. Learn to use specifications to determine what products are necessary and what the requirements are for different items in order to track them correctly
 9. Read contract documents and specifications to know exactly what is required for quantity take-offs

Unit 3 - Scheduling

Objective: In this unit, students will learn how to use a scheduling program to map out the construction activities in sequence of performance. This will help them to understand how long a job will take, which will help them to complete their estimate. They will also know how many people they will need to have at a time to complete the work. They will also learn how to track progress in a schedule during construction and they will learn how to adjust the schedule to accommodate changes.

Prescribed Learning Outcomes

At the completion of this course, students will be able to:

1. Define the following:
 - Early start (ES)
 - Early Finish (EF)
 - Late Start (LS)
 - Late Finish (LF)
 - Total Float
 - Free Float
 - Work Breakdown Structure (WBS)
2. Learn the process of building a network model, including:
 - Defining activities
 - Ordering activities
 - Establish relationships between activities and learn to draw network diagrams
 - Determine quantities and establish durations for activities
 - Calculate early and late start/finish times
 - Calculate total float values and identify critical path activities
 - Schedule all activity start and finish times



3. Use Microsoft Project to set up a project schedule.
4. Input data and manipulate it to make sure the schedule works for the project.
5. Input actual dates during the construction process and make adjustments to the schedule.
6. Identify activity relationships and how that is relative to the estimating process.
7. Gain some understanding of resource loading and resource allocation.

Unit 4 – Pricing and Submitting an Estimate

Objective: In this unit, students will understand what is required to put prices to the quantities that they have taken off. They will look at production rates, material costs, accessibility, and labour rates. They will also look at how to set up a quote for pricing a job and what is included in that. They will send out Request for Quotes to potential subcontractors and learn the process of a job closing and putting the estimate together.

Prescribed Learning Outcomes

At the completion of this unit, students will be able to:

1. Put production rates, labour rates, and material rates to each item that has been taken off.
2. Use an estimating program to price all items.
3. Review tender documents and specifications to ensure all items are covered in the bid.
4. Put together a quote that indicates all inclusions and exclusions as well as a price breakdown.
5. Include for Overhead and Profit in estimate.

Unit 5 – Document Control

Objective: This unit will provide students with a basic understanding of common documents that are used in construction and how to send, track, and use the documents. They will also learn the importance of tracking changes.

Prescribed Learning Outcomes

At the completion of this unit, students will be able to:

1. Explain and understand why document control is so crucial to any construction project
2. Explain and use the following:
 - Request for Quotation (RFQ)
 - Request for Information (RFI)
 - Change Order (CO)
 - Subcontract
 - Red line drawings – As-Builts
 - Site Instruction (SI)



3. Learn how to create submittal logs.
4. Understand the basics of materials tracking and its importance.
5. Learn how to track all documentation.
6. Use SI's and other documents to mark As-Built drawings.

Unit 6 – Cost Tracking and Analysis

Objective: This unit will expose the students to the basic principles of cost tracking and analysis. This will demonstrate the importance of cost tracking and the benefits of affective cost tracking.

Prescribed Learning Outcomes

At the completion of this unit, students will be able to:

1. Read and understand a cost report.
2. Update cost reports with progress and incurred costs.
3. Project final cost of project.
4. Track extra items or time and material items and be able to submit them to the owner for a project.
5. Calculate earned value.
6. State benefits to affective cost tracking.

Instructional Components

- Direct instruction
- Indirect instruction
- Interactive (peer) instruction
- Independent instruction
- Modeling
- Practical creativity
- Brainstorming
- Group work
- Analysis of own and classmates' project work
- Project-based learning

Assessment Component

- Daily quizzes
- Unit quizzes
- Demonstration of skills related to practical activities



Twenty per cent (20%) of the grade will be based on safety tests, unit quizzes, skill-set evaluation through Units 1-3

Eighty per cent (80%) of the grade will be based on demonstration of proper employability skills (proper industrial work habits ranging from the safe use of equipment to good “housekeeping” techniques, project management), demonstration of skills related to practical activities.

Learning Resources

- Teacher handouts
- Guest speakers from the community in related fields
- Visit/interview local trades people in related fields
- ILM’s

Instructor Resources

- Teacher handouts
- Guest speakers from the community in related fields
- Visit/interview local trades people in related fields
- ILM Modules:

Additional Information

FACILITY REQUIREMENTS

Classroom Area

- Minimum 30 square feet per student
- Comfortable seating and tables suitable for learning
- Compliance with the Local and National Fire Code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Overhead and multimedia projectors with a projection screen and associated computer equipment
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/air conditioning for comfort all year round
- Acoustics in the room must allow audibility of the instructor

Shop Area

- Minimum 2400 square feet of shop area including a tool crib and work stations
- Minimum 15’6” foot ceiling height in shop areas
- Adequate heating, lighting, and ventilation



- Acoustics in the room must allow audibility of the instructor
- Refuse and recycling bins for used shop materials
- First-aid facilities

Lab Requirements

- Minimum 2400 square feet in lab
- Minimum 15' 6" ceiling in lab areas
- Adequate heating, lighting and ventilation
- Acoustics in the room must allow audibility of the instructor
- Refuse and recycling bins for used lab materials

Student Facilities

- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.85 OHS Regulation and Guidelines)
- Minimum 10 cu. Ft. personal storage lockers

Instructor's Office Space

- Adequate office space for student consultation
- Desk and filing space
- Computer
- Internet access
- Printer access
- Adequate storage facilities for material and training aids
- Access to photocopier/scanner
- Telephone

Tools and Equipment

- Equipment List is based on the standard class size of 16 students.
- The facilities must be suitable for instructional use.
- 8 Power supply stations (with fixed and variable AC and DC outputs and metering)
- 8 Sets of resistors for circuit analysis labs
- * Miscellaneous magnetic devices such as relays, solenoids, bells, buzzers, chimes, etc.,
- 8 Motor Control Stations (with manual and magnetic starters, reversing starters, assorted switches, TD relays and pilot devices as necessary)
- 8 Small 3-phase motors
- 4 Single-phase, split-phase, dual-voltage motors
- 8 Analogue multimeters
- 8 Digital multimeters
- 8 Wattmeters
- 8 Clamp-on ammeters
- 4 Solenoid-plunger (wiggy) testers
- 4 Meggers



- 2 Wheatstone bridge
- 4 Outlet Analyzers
- 2 Watt-hour meters
- 8 Wire gauges, micrometers, calipers
- * Miscellaneous conductors, cables and raceways for demo purposes
- * Miscellaneous dimmer and snap switches
- * Variety of circuit protective devices
- 8 Electronic trainers
- 16 Computer stations with CD Rom, modem, software, etc.
- 1 Printer

Required Student Tools (supplied by student)

Contact Training Facility for recommended tools and equipment that students need to supply.

Reference Materials

Required Reference Materials

- Contact Training Facility for Required Reference Material

Recommended Resources

- Industry Training Authority (ITA) www.itabc.ca
- BC Construction Industry Training Organization www.bccito.com
- Workplace Hazardous Materials Information System (WHMIS) and First Aid <http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php>
- WorkSafeBC (WCB) www.worksafebc.com

Codes

- National Fire Code of Canada <http://www.nrc-cnrc.gc.ca/eng/ibp/irc/codes/2010-national-fire-code.html>
- BC Ministry of Housing www.housing.gov.bc.ca/building Queen's Printer for BC Code books <http://www.bccodes.ca/default.htm>
- BC Building Code
- BC Fire Code
- BC Electrical Code
- National Fire Protection Association www.nfpa.org
- NFPA 80 – Standards for Fire Doors and Fire Windows
- NFPA 101 – Life Safety Code
- Canadian National Building Code <http://www.nrc-cnrc.gc.ca/eng/ibp/irc/codes/2010-national-building-code.html>