

CLAC360 PROFESSIONAL COURSE

QUANTITY TAKEOFF AND COST ESTIMATION FOR BUILDING PROJECTS WITH AI

From Drawings and Specifications to Measurable Quantities,
BOQ and Defensible Cost Estimates

Learn Practical Professional Skills.

Measure What Is Designed. Price What Is Measured. Explain What It Costs.

Course Code:	CLAC-QCEAI-01
Course Type:	Professional Applied Learning
Delivery:	PDF-based learning + practical assignments + quizzes + live guided sessions
Level:	Intermediate / Professional
Primary Disciplines:	Quantity Surveying, Civil Engineering, Construction Estimation, Cost Management
Core Product:	A complete, traceable quantity takeoff and cost-estimation workflow

PART I — COURSE IDENTITY

1. Course Premise

Quantity takeoff is not simply measuring dimensions from drawings and multiplying them by rates.

A professional estimate must establish a defensible chain:

*«Project Information → Drawings → Specifications → Measurement Rules → Quantity Takeoff → BOQ
→ Resource/Rate Build-Up → Cost Estimate → Review → Reconciliation → Report»*

AI can accelerate document reading, classification, spreadsheet development, checking and repetitive calculations.

It must not silently invent dimensions, specifications, rates, productivity assumptions or missing information.

2. Practical Outcome

By the end of the complete course, the learner will develop a building-project quantity takeoff and cost-estimation package containing:

- drawing register;
- measurement basis;
- quantity takeoff workbook;
- measurement assumptions;
- quantity calculations;
- BOQ;
- rate build-ups;
- direct-cost estimate;
- preliminaries/indirect-cost treatment;
- allowances where appropriate;
- summary estimate;
- quantity-check register;
- AI verification log;
- final cost-estimation report.

The learner therefore produces an auditable professional work product rather than merely learning estimating terminology.

3. Learning Outcomes

The learner should be able to:

- C1** — Interpret architectural, structural and MEP drawings for measurement purposes.
- C2** — Identify missing, conflicting and ambiguous information.
- C3** — Establish a measurement strategy before measuring.
- C4** — Perform systematic quantity takeoff.
- C5** — Separate measured quantities from assumptions.
- C6** — Structure a professional BOQ.
- C7** — Develop basic resource/rate build-ups.
- C8** — Understand labour, material, plant and subcontract components.
- C9** — Account appropriately for wastage, productivity, overheads and other estimating components.
- C10** — Use spreadsheets for transparent cost modelling.
- C11** — Use AI for document interrogation, checking, automation and analytical support.
- C12** — Detect hallucinated quantities, rates and assumptions.

C13 — Reconcile quantities between drawings, schedules and BOQ.

C14 — Prepare and defend a professional estimate.

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MODULE 00 — THE ESTIMATOR'S MINDSET

From Drawing to Cost Model

- What quantity takeoff actually accomplishes
- Estimate vs. quotation vs. tender price
- Quantity certainty vs. price uncertainty
- Measurement vs. assumption
- Direct vs. indirect costs
- Why estimates fail
- The importance of traceability

Core principle

«If a quantity cannot be traced back to project information, it should not silently appear in the estimate.»

MODULE 01 — UNDERSTANDING THE BUILDING DOCUMENT SET

- architectural drawings;
- structural drawings;
- civil/site drawings;
- electrical drawings;
- plumbing drawings;
- HVAC drawings;
- fire protection;
- specifications;
- schedules;
- details;
- addenda/revisions;
- notes;
- legends.

Drawing Hierarchy

Establish: Drawing → Revision → Detail → Specification → Measurement

Practical Deliverable

Drawing & Document Register

MODULE 02 — DRAWING READING FOR QUANTITY TAKEOFF

- plans;
- elevations;
- sections;
- details;
- dimensions;
- scales;
- grids;
- levels;
- symbols;
- schedules;
- construction assemblies.

Critical Skill / Issue / Principle

The learner must learn to avoid measuring an isolated drawing without understanding the three-dimensional construction system.

MODULE 03 — MEASUREMENT STRATEGY

Before measuring:

1. Define scope.
2. Define measurement rules.
3. Establish units.
4. Identify work breakdown.
5. Identify exclusions.
6. Identify assumptions.
7. Establish drawing precedence.
8. Establish revision status.

Deliverable

Measurement Basis & Assumption Register

MODULE 04 — EARTHWORK & SITE QUANTITIES

- excavation;
- backfill;
- disposal;
- filling;
- compaction;
- trenches;
- foundations;
- site preparation;
- levels;
- cut/fill logic.

Analytical Skill

Understand the difference between geometric volume and payable/measurable quantity under a specified measurement method.

MODULE 05 — CONCRETE, FORMWORK & REINFORCEMENT

- foundations;
- footings;
- columns;
- beams;
- slabs;
- stairs;
- walls;
- concrete volume;
- formwork area;
- reinforcement measurement;

- bar schedules;
- laps and wastage assumptions.

Integrated / Professional Exercise

Take one structural element from: Drawing → Dimensions → Concrete → Formwork → Reinforcement → BOQ item

MODULE 06 — MASONRY & ARCHITECTURAL WORKS

- blockwork;
- brickwork;
- partitions;
- plaster;
- screed;
- waterproofing;
- finishes;
- painting;
- flooring;
- ceilings.

Critical Skill / Issue / Principle

Learn when openings should be deducted and when measurement rules may treat them differently. The learner must not invent universal deduction rules.

MODULE 07 — DOORS, WINDOWS & BUILT-IN ELEMENTS

- door schedules;
- window schedules;
- hardware;
- frames;
- glazing;
- built-in items;
- dimensions;
- counts;
- unit rates.

Integrated / Professional Exercise

Reconcile: Plan → Elevation → Schedule → Quantity

MODULE 08 — MEP QUANTITY TAKEOFF

- electrical;
- lighting;
- power;
- plumbing;
- drainage;
- sanitary fixtures;
- HVAC;
- fire protection;

- equipment;
- containment;
- piping;
- fittings.

Critical Skill / Issue / Principle

MEP quantities should not be extracted from one drawing alone. Use: Plans + risers + schedules + details + specifications

MODULE 09 — BOQ DEVELOPMENT

From Measurement to Commercial Structure

- item numbering;
- descriptions;
- units;
- quantities;
- rates;
- amounts;
- work sections;
- preliminaries;
- provisional/allowance items where applicable;
- exclusions.

BOQ Architecture

Project → Section → Work item → Unit → Quantity → Rate → Amount

MODULE 10 — RATE BUILD-UP

Understanding Why Something Costs What It Costs

A basic rate build-up may consider:

- material;
- labour;
- plant/equipment;
- subcontract components;
- wastage;
- productivity;
- transportation;
- temporary requirements;
- overheads;
- profit where applicable.

Critical Skill / Issue / Principle

Quantity uncertainty is not the same thing as price uncertainty.

MODULE 11 — PRODUCTIVITY & LABOUR ANALYSIS

- output per labour-hour;
- crew composition;

- productivity assumptions;
- working conditions;
- site constraints;
- access;
- material handling;
- equipment utilization.

AI Application

AI can help structure productivity scenarios but must not invent "industry-standard" productivity without an identified source or stated assumption.

MODULE 12 — COST DATA & RATE INTELLIGENCE

- quotations;
- historical rates;
- supplier prices;
- labour rates;
- plant rates;
- location;
- transportation;
- market date;
- escalation;
- currency;
- taxes/duties where applicable;
- validity periods.

Core principle

«A rate without a date, location and basis is incomplete information.»

MODULE 13 — AI-ASSISTED QUANTITY TAKEOFF

AI may assist with:

- drawing/document classification;
- extracting visible dimensions;
- identifying schedules;
- creating measurement checklists;
- converting structured information into tables;
- generating spreadsheet logic;
- identifying possible omissions.

AI Restriction

AI must never be allowed to silently infer: missing dimensions; concealed quantities; specifications; rates; construction methods.

Required Workflow

AI extraction → human verification → source reference → approved quantity

MODULE 14 — AI FOR DRAWING & SPECIFICATION CROSS-CHECKING

The learner receives conflicting documents. AI is asked to identify:

- inconsistent dimensions;
- mismatched item descriptions;
- missing schedules;
- conflicting specifications;
- drawing-revision differences.

Deliverable

Drawing Coordination Issue Register

The learner then independently verifies each finding.

MODULE 15 — QUANTITY QA/QC

Every estimate should undergo structured checks.

- dimensional check;
- unit check;
- arithmetic check;
- duplication check;
- omission check;
- drawing-to-BOQ check;
- BOQ-to-estimate check;
- revision check;
- reasonableness check.

Traceability Chain

BOQ Quantity → takeoff sheet → drawing reference → dimension → calculation.

MODULE 16 — COST MODEL & SENSITIVITY

- cost composition;
- major cost drivers;
- sensitivity analysis;
- alternative material scenarios;
- quantity variation;
- rate variation;
- escalation;
- uncertainty.

Practical Question

«Which assumptions have the greatest potential influence on total project cost? This moves the learner from "calculator" to cost analyst.»

MODULE 17 — ESTIMATE REVIEW

The learner performs:

Bottom-Up Review

Check individual quantities and rates.

Top-Down Review

Check total cost against: project size; functional scope; cost composition; historical benchmarks where appropriate; major quantity drivers.

A top-down check does not replace detailed measurement.

MODULE 18 — FINAL COST ESTIMATION REPORT

Recommended structure:

1. Executive Summary
2. Project Description
3. Documents Reviewed
4. Measurement Basis
5. Scope
6. Exclusions
7. Assumptions
8. Quantity Takeoff
9. BOQ
10. Rate Basis
11. Cost Estimate
12. Major Cost Drivers
13. Uncertainties
14. QA/QC
15. AI Assistance & Verification
16. Limitations
17. Conclusions
18. Appendices

MODULE 19 — INTEGRATED PROJECT

Building Project Estimation Challenge

Learner receives:

- architectural drawings;
- structural drawings;
- selected MEP drawings;
- specifications;
- schedules;
- revision history;
- deliberately embedded inconsistencies.

Learner must produce:

- A. Document Register
- B. Measurement Plan
- C. Quantity Takeoff
- D. BOQ
- E. Rate Build-Up
- F. Cost Estimate
- G. QA/QC Register

- H. AI Verification Log
- I. Final Estimate Report

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AI GOVERNANCE

CLAC360 Estimating AI Rules

1. AI may assist extraction; it does not approve quantities.
2. AI may propose formulas; the estimator verifies them.
3. AI may identify conflicts; drawings remain the evidence.
4. AI may assist rate analysis; rates require source/basis.
5. AI must not fabricate missing project information.
6. Raw source documents must remain preserved.
7. Material AI assistance should be documented.
8. Confidential project information requires appropriate authorization and safeguards.
9. Every major estimate should retain an audit trail.
10. The estimator remains accountable for the final estimate.

ASSESSMENT

- Assignment 1 — Drawing interpretation.
- Assignment 2 — Concrete/structural takeoff.
- Assignment 3 — Architectural quantity takeoff.
- Assignment 4 — MEP quantity reconciliation.
- Assignment 5 — BOQ development.
- Assignment 6 — Rate build-up.
- Assignment 7 — AI quantity-verification exercise.
- Assignment 8 — Estimate QA/QC.
- Final Project — Complete building-project estimate.

COMPLETE PROFESSIONAL PACKAGE

Includes:

- Complete Course Handbook
- Student Workbook
- Drawing Set
- Specification Package
- Takeoff Excel Workbook
- BOQ Template
- Rate Build-Up Workbook
- Estimating QA/QC Checklist
- Assumption Register
- Drawing Coordination Register
- AI Verification Log
- Assignments
- Quizzes
- Final Project
- Live Sessions

- Assessment
- Certificate of Completion

PROFESSIONAL OUTCOME

The learner should finish capable of moving from:

Drawings → Measurement → Quantities → BOQ → Rates → Cost → Review → Defensible Estimate

CLAC360 Principle

«Measure what is documented. Identify what is missing. State what is assumed. Price what can be justified.»

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