TSA Surveying Course

with ProQual Level 3 in Engineering Surveying

A Block-by-Block Outline

Introduction

The TSA Surveying Course consists of six study blocks, each lasting two weeks, delivered over two years at The Survey School in Worcester. Completing all six blocks satisfies **100% of the academic requirement** for upgrading from Student to Technical membership of the Chartered ICES (additional experience and documentation also required). It also meets the eligibility requirements for **AssocRICS** when combined with two years of relevant experience.

The course runs alongside the **ProQual Level 3 Diploma in Engineering Surveying**, a CSCS-recognised qualification requiring minimal additional effort for students completing all blocks.

The programme introduces the core principles and practices of modern surveying. Students should expect to undertake further study and practical experience to achieve full professional competence.

Each block includes:

- Assessed classwork
- Practical fieldwork
- A written exam
- A written assignment (Blocks 1–5)

Employers receive a written performance report after each block. Successful students receive their certificates at the TSA Conference each November.

Block 1 — Level and Total Station

Block 1 develops the foundational skills required for engineering surveying, focusing on levelling, angle measurement, distance measurement, and basic computations.

Core Skills and Technical Competencies

- Set up and use a level and total station accurately.
- Locate benchmarks and transfer levels onto site.
- Perform and interpret a two-peg test; adjust levelling observations.
- Measure distances with a tape and apply slope and temperature corrections.
- Solve right-angled triangles and compute bearings and distances from coordinates.
- Observe and record rounds of horizontal angles, vertical angles, and slope distances.
- Compute a basic traverse from field observations.
- Understand the history of surveying, units of measurement, and instrument operation.
- Apply good practice in equipment care and health & safety.

Technology Awareness

- Demonstration of current total station technology.

Assignment (Between Blocks 1 & 2)

Complete a short control traverse and produce a full technical report including:

- Site description and risk assessment
- Traverse diagrams and station descriptions
- Observations and calculations (plan and height)
- A separate level loop tied to a benchmark or TBM
- A two-peg test
- Comparison of levelling results against trig heighting
- Survey presented on a local grid

Block 2 — Topographic Surveying and Monitoring

Block 2 builds capability in topographic data capture, traverse adjustment, and monitoring techniques.

Core Skills and Technical Competencies

- Apply atmospheric and prism corrections; determine correct prism offsets.
- Conduct chain and offset surveys and produce hand-drawn plans.
- Solve non-right-angled triangles using sine and cosine rules.
- Observe and compute a trilateration network.
- Use a digital level for precise monitoring and present results in a spreadsheet.
- Use calculator polar/rectangular functions for coordinate computations.
- Adjust traverses using Bowditch, transit, and equal-shifts methods.
- Observe and plot radial (stadia) detail using a level and staff.
- Understand height representation on maps; interpolate contours and long sections.
- Capture radial detail with a total station and plot manually before computer processing.

Technology Awareness

- Demonstration of robotic total stations.

Assignment (Between Blocks 2 & 3)

Produce a small topographic survey based on a trilateration, cross-braced triangle, including:

- Detail captured by total station, chain survey, and stadia methods
- Contours and a long section
- Combined plot drawn by hand or in CAD

Block 3 — Advanced Fixation, GNSS, National Grid & Photogrammetry

Block 3 advances students' analytical and computational skills, introducing GNSS, geodesy, and photogrammetric principles.

Core Skills and Technical Competencies

- Understand curvature and refraction effects on observations.
- Observe and compute 3D intersections using angles only.
- Perform angle-only resections and compare with total station free-station solutions.
- Strengthen understanding of Greek letters and mathematical notation.
- Understand GNSS theory and good practice for static and RTK observations.
- Use GNSS receivers to determine positions in static and RTK modes.
- Occupy EA passive stations and access OS Passive/Active station data.
- Process GNSS results and understand Network GNSS workflows.
- Understand map projections, survey grids, and scale factors for OSGB36.
- Convert between latitude/longitude and OSGB36 using software.
- Calculate approximate meridian and parallel distances using a circular Earth model.
- Understand the relationship between longitude and time, early navigation, and time zones.
- Learn the development of stereo photogrammetry and orthophoto production.
- Gain awareness of Lidar, satellite imagery, and SUAV photogrammetry.
- Plan ground control for aerial photography.

Assignment (Between Blocks 3 & 4)

Establish two new stations—one inside and one outside a known control rectangle—using:

- Intersection
- Resection
- Direct radial or GNSS positioning (for comparison)

Submit a report comparing results from different station combinations.

Block 4 — Specialist Surveys - Measured Building Surveys, Laser Scanning, Surveying Underground & Hydrography

Block 4 develops building measurement, scanning awareness, and hydrographic survey techniques.

Core Skills and Technical Competencies

- Survey and draw a room plan using tape and Disto.
- Survey building footprints and internal rooms using a total station and process digitally.
- Calculate net internal area for surveyed spaces.
- Perform hand-calculated coordinate transformations between topographic and building grids.
- Survey building elevations using multiple methods and produce drawings.
- Draw cross sections from previously surveyed points.
- Understand scanning workflows and applications, including mobile scanning.
- Understand underground surveying methods, including risks and procedures.
- Survey river cross sections and long sections to Environment Agency standards.
- Perform simple tidal predictions and tidal offset calculations.
- Understand health, safety, and environmental risks in building, underground, and hydrographic surveys.

Assignment (Between Blocks 4 & 5)

Produce a measured building survey including:

- Two floor plans with area calculations
- One cross section
- One elevation
- Any suitable survey and drawing method may be used

Block 5 — Setting Out and Engineering Surveys

Block 5 focuses on practical engineering surveying, construction workflows, and geometric design.

Core Skills and Technical Competencies

- Set out drainage runs using tape, level, and staff.
- Calculate gradients, batters, and cross-falls.
- Set out house foundations using angles and distances; verify using tape and total station tie-distance checks.
- Set out profiles for levelling using a total station.
- Upload coordinates to a total station, set out points, and verify by downloading as-built data.
- Use reference line programs for structural setting out.
- Compute points for circular curves.
- Set out curves using chords, coordinates, and reference arc programs.
- Use free-station and height-transfer programs to support setting out.
- Calculate and set out vertical road curves.
- Determine cross-section points for road centreline, channels, and batter rails including horizontal/vertical curves and superelevation.
- Understand the use of lasers and total stations for grade, level, and alignment.
- Transfer levels on high-rise structures and understand building control plumbing.
- Apply good record-keeping and document control.
- Determine whether a point lies within tolerance.
- Understand machine control systems and the evolving role of surveyors.
- Recognise construction-site health and safety risks.

Assignment (Between Blocks 5 & 6)

Prepare a theoretical report describing the setting out of a small housing estate from initial topographic survey to completion, including:

- Houses
- Road
- Drainage run
- Sample calculations and illustrative plans

Block 6. Survey Management, Areas and Volumes, Legal Surveys GIS, Surveying Underground Utilities & PAS128:2022 Specification

Block 6 develops the practical, analytical, and professional skills needed to plan, manage, and deliver modern surveying projects. You'll work across technical computation, fieldwork, legal frameworks, and digital technologies, building a comprehensive understanding of how surveyors operate in commercial and collaborative environments.

Survey Planning & Professional Practice

- Create a full survey plan including scope, methodology, and resources.
- Understand business essentials: costing, insurance, risk, and profitability.
- Produce quotations, specifications, method statements, and risk assessments.
- Apply the RICS Specification to ensure accuracy and compliance.
- Recognise the importance of ongoing CPD.

Accuracy, Quality & Data Assessment

- Distinguish between accuracy and precision.
- Apply QA/QC processes to survey data.
- Calculate and interpret RMSE to validate observations.
- Perform and compare spot-height surveys using multiple methods.

Areas, Volumes & Computational Skills

- Compute areas using geometry and the cross-coordinate method.
- Subdivide surveyed land into plots and verify results using total station functions.
- Calculate volumes from cross sections.
- Build digital ground models and compute volumes using survey software.
- Use alignment and cross-section tools in processing software.
- Write spreadsheet routines for bearings, distances, and traverse adjustment.

Legal & Boundary Surveying

- Understand requirements for Land Registry determined boundary surveys.
- Learn the responsibilities of an expert witness in boundary disputes.

GIS, BIM & Advanced Technologies

- Explore how GIS systems store, manage, and visualise asset data.
- Understand how BIM reshapes collaborative project workflows.
- Gain awareness of industrial metrology and high-precision scanning technologies.

Underground Utilities & Detection

- Learn how utility surveys are undertaken to PAS128:2022.
- Interpret statutory undertakers' records and existing utility plans.
- Use EML and GPR equipment for underground detection.

After completion of all 6 Blocks

An Awards Day, where successful students receive their certificates, is held as part of the TSA Conference each November.

The ProQual Level 3 Diploma in Engineering Surveying is also assessed as the student progress through our course and a separate qualification certificate will be issued digitally.

Assessment

This course recognises the importance of continued professional development.

During each block, the students undertake a number of class and practical exercises. Some of these involve a formal assessment.

In addition, at the end of each block students sit a written exam that covers both theoretical and mathematical aspects of the subjects taught and which will accurately chart their achievement against the block aims.

These assessments, including the tutors' observations and comments, will highlight the student's strengths and limitations and are provided to the employer as a written report at the end of each block.

In blocks 1-5, the student is set a "work experience" assignment. This is marked and reported on. Students complete these assignments prior to commencing the next block. The assignments are an integral part of the course that reinforce what has been learnt and lead to further development. It is important that students are encouraged and assisted, where necessary, to complete their assignments.

Course Material

The material produced is intended for course use and as an aide memoir to the subjects covered. It is also a reference for general surveying; it is not meant to be a substitute textbook or an exhaustive coverage of the subject.

Use is also made of Client Guides and publications issued by the TSA, RICS, CICES and others. Students are issued with relevant copies either in their manual or digitally and are referred to relevant web sites for further information.