# Guidance Note
# Survey Control Reports

## Purpose

This guidance note details the minimum expectations for survey control reports to enable members of CICES to produce a standard deliverable. The aim is to produce a base level which can apply across all industries rather than be a sector specific guide. The report should be understandable and clear to all stakeholders.

The note is split into the following sections:

- Relevance of survey control
- Main report requirements
- Appendices and attachments
- Relevant standards

## Relevance of survey control

Survey control is a system of ground markers used to provide a positional framework for the dimensional control of construction projects. Such points may be used for activities such as capturing topographic data, construction setting-out, as-built verification, infrastructure maintenance and deformation monitoring.

The survey control report is a vital deliverable which documents the control installed over the lifespan of the project. A survey control report enables the client to check and verify the accuracy of the survey and should be submitted, and updated, in a timely manner. A well-produced report can reduce the need to validate the survey control network by clearly demonstrating the quality achieved is fit for purpose. Furthermore, it makes maintenance and densification of a control network more manageable, in particular ensuring the spatial validity of survey and design information for the full project duration.

The survey grid and vertical datum used for the control needs definition and agreement with the client and these should be clearly stated in the survey control report. It is important to understand the different types and hierarchy of reference frameworks versus national and project grids.

- Global or regional geodetic frameworks such as WGS84 or ETRF89
- Low distortion engineering grids, such as London Survey Grid or SnakeGrids
- National or regional mapping grids such as UTM, British National Grid (OSGB36), France National Grid (Lambert-93), HK1980, US State Plane Coordinate Systems
- Quasi grids which are national grids with localised scale factor applied (note this needs to be rigorously managed to reduce potential errors and should be clearly documented in the report)
- Local project grids. These may be fixed on a single point at arbitrary coordinates such as E 1000.00, N 2000.00, with a known bearing to a second permanent control point, or a factory grid aligned to a building axis for specific industry environments

A clearly defined approach to project grids is relevant to all projects but essential for large long running projects where multiple design organisations, lead contractors and phases of construction, can result in a disjointed delivery. The longevity of survey control is critical to successful project delivery.

The positional accuracy of the survey control is fundamental to the success of the works. This includes both absolute accuracy (i.e. the position in space relative to the project grid), and relative accuracy (i.e. accuracy between adjacent points). The accuracy of the survey control should therefore be appropriate to the intended use, which should be evidenced by a computation scheme that includes observational redundancy and robust error-checking.

A defined naming convention for the survey control is essential. It should be agreed with the client at the outset and consistently applied through the project. Consideration should be made to using unique identifiers such as location, mileage, meterage and date. This should be clearly stated in the survey control report.

### Main report body

The survey control report should include as a minimum:

- Front sheet including:
    - Company details
    - Document number and report date
    - Prepared by/Checked by/Approved by
- Introduction, including purposes of the works
- Applicable standards/specifications
- List of departures/dispensations from the applicable requirements
- Survey location
- Key personnel involved in the surveys, including roles and responsibilities
- List of software used for adjustment, including version numbers
- List of all equipment used and link to calibration certificates in appendix
- Survey grid and vertical datums, including all relevant transformations used
- Control methodology statement. This should stipulate how the control was established, observed and computed; including challenges encountered
- Survey control monumentation (i.e. types of marker)
- Validation of all adopted/existing control points
- Date & times of observations including periods of site works
- Recording of environmental data relevant to the observations
- Adjustment parameters, including but not limited to:
    - Relevant processing settings
    - Instrument settings based on manufacturers specification
    - Centring errors
    - Weighting used in adjustment
    - Fixed and floating control points
- Data edits and adjustments made to raw observations made during processing
- Adjustment results explanation, including but not limited to:
    - Chi-squared test pass/fail levels
    - Standard deviations
    - Post-fit residuals
    - Misclosures (level/traverse)
    - Legible network diagrams with error ellipses
- Derived and validated transformations to interfacing/other grids. This may include:
    - Coordinates of the site centre point and the scale factor used to convert between OS grid and a Quasi OS local grid. This should be annotated on survey drawings and stated in survey reports enabling the transformation of data to other grids, and include a worked example with test points
    - Transformation definitions to/from alternate survey grids (such as Helmert including rotation, shift and scale)
- Conclusions. These should include accuracy achieved and ongoing recommendations.

### Appendices and attachments

Appendices should include the following as a minimum:

- Final coordinate listing in a PDF and a machine-readable format (such as Excel / CSV). Coordinate precision should be proportionate to the intended use
- Full results listings of control computations such as least squares adjustments, traverse computations, levelling runs and any angular reductions
- Calibration certificates for all equipment, service reports from recognised instrument supplier and check and adjust records for all equipment used
- PDF export of full adjustment with all input data shown

- Witness diagrams to enable ground marker identification. To avoid issues related to coordinate revisions, full precision coordinates should not be included instead round to the nearest metre, but do include what three words or similar such as grid reference finder.  This is to eliminate revision of witness diagrams as the project progresses and coordinates are revised, allows witness diagrams to remain relevant for project duration

Appendices can also include the following:

- Zip file containing all raw data including GNSS (e.g. RINEX), total station observations and levelling digital data with an explanation for any manual edited data including windowing of GNSS
- Zip file of full adjustment in native format to enable running of adjustment
- Photos of instrument set-ups (e.g. antenna height measurements)
- Scanned copies of all hand booked detail such as optical levelling
- Control positions in a digital spatial format, such as KML

### Relevant Standards

- UK Ordnance Survey – A Guide to Coordinate Systems in Great Britain
- UK Highways – GG951
- UK HS2 – Railway Survey Standard HS2-HS2-GL-STD-000-000001
- UK Network Rail - NR/L2/TRK/3100
- UK London Underground – S1026
- UK RICS – Measured surveys of land, buildings and utilities
- Ireland SCSI – Measured Surveys of Buildings Guidance Note
- Australia & New Zealand – ANZLIC Guideline for Control Surveys by GNSS v2.2
- Australia & New Zealand – ANZLIC Standard for Australian Survey Control Network v2.2
- National Standards for the survey of Canada Lands v1.2
- South Africa Geomatic Institute: SAGI Survey Specifications

This guide has been produced by the Geospatial Engineering Practices Committee of the Chartered Institution of Civil Engineering Surveyors

Endorsed by

RICS THE SURVEY ASSOCIATION

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