

Part 1 – Planning the Survey

Purpose of the Survey

The purpose of this survey was to manually measure and record the internal layout of an educational building using traditional surveying methods. The aim was to produce an accurate floor plan showing the dimensions and arrangement of the building's circulation spaces. This information can be used for refurbishment projects, space planning, maintenance, or to create accurate CAD drawings of the existing building.

Unlike a laser scanning survey, this survey relied on direct measurements taken by hand using measuring equipment. Recording dimensions manually also allowed observations to be made about the building's layout, access routes and key features that may influence future work.

Survey Area and Level of Detail

The survey focused on the main internal circulation areas of the building. The route began along a long corridor containing classroom entrances on both sides. Partway along the corridor, a set of fire doors provided access into a breakout space. From the breakout area, the survey continued across a link bridge before returning through another corridor, creating a continuous loop back to the starting point.

The following features were included in the survey:

- * Overall corridor lengths and widths.
- * Positions and widths of classroom doors.
- * Fire door locations and openings.
- * Breakout space dimensions.
- * Link bridge dimensions.
- * Wall lengths and junctions.
- * Internal corners and changes in direction.

The required level of detail was sufficient to accurately represent the internal layout and circulation routes. Measurements needed to be accurate enough to produce a scaled floor plan showing wall positions, door locations and room connections. Small architectural features such as skirting boards, electrical sockets, light switches and decorative finishes were not recorded because they were not required for the intended purpose of the survey.

Site Assessment

Access Points

Access to the building was gained through the main entrance after permission had been obtained. The survey route followed publicly accessible internal corridors and communal spaces. All areas surveyed were accessible on foot without requiring specialist access equipment.

Before measurements began, a walkthrough of the building was completed to familiarise the survey team with the layout and identify any obstacles that could affect the survey process. Emergency exits and fire escape routes were also identified to ensure they remained unobstructed throughout the work.

Measuring Positions

Measurements were taken systematically along the survey route to minimise the risk of missing important dimensions. Reference points were established at corridor junctions, corners and door openings. Measurements were taken between wall faces, door frames and other permanent building features to ensure consistency.

Additional measurements were taken where the building changed direction, around the breakout space and across the link bridge to ensure that all sections could be accurately connected when producing the final drawing. Cross-check measurements were also recorded between key points to verify accuracy and reduce the likelihood of cumulative measurement errors.

Lighting Conditions

The survey was carried out under normal internal lighting conditions. Artificial ceiling lighting provided sufficient visibility throughout the corridors, while natural daylight entered through windows located in the breakout area and link bridge.

Lighting conditions were adequate for reading measuring equipment, recording dimensions and identifying building features. No additional lighting equipment was required during the survey.

Safety Considerations

As the building remained occupied during the survey, particular care was taken to minimise disruption to staff and students. Measuring equipment was kept close to the survey team when not in use to prevent trip hazards, and work was paused whenever pedestrian traffic became heavy.

Fire exits, escape routes and classroom entrances remained clear throughout the survey. Good communication was maintained between team members when measuring longer distances to ensure equipment was handled safely and efficiently.

Manual handling techniques were used when transporting equipment between survey locations, and suitable footwear was worn to reduce the risk of slips on polished corridor floors.

Conclusion

Careful planning ensured the survey could be completed safely, efficiently and accurately. By defining the survey area, identifying suitable measuring positions and considering access, lighting and safety, the survey team was able to collect reliable dimensional information that could be used to produce an accurate representation of the building's internal layout.

The purpose of this survey was to undertake a professional 3D laser scan of an educational building corridor using terrestrial laser scanning technology. The survey aimed to capture an accurate digital representation of the internal layout, including corridors, classrooms, fire doors, breakout spaces, and the connecting link bridge. The resulting point cloud data would provide accurate measurements for future design work, building management, refurbishment planning, and asset documentation.

Laser scanning was selected because it offers rapid, highly accurate data capture while minimising disruption to the normal operation of the building. Unlike traditional measured surveys, terrestrial laser scanning records millions of individual points, producing a detailed three-dimensional model of the environment.

Part 2 – Practical Survey Execution Summary

The laser scanning survey was carried out following the planned survey route through the internal circulation spaces of the building. The survey began at one end of the long classroom corridor and progressed towards the breakout area through the fire doors. From there, scans continued across the link bridge before following the return corridor back to the original starting point, creating a complete loop.

The majority of the survey plan was successfully followed. Scan positions were generally placed where originally intended, with sufficient overlap between each scan to allow accurate registration during processing. The looped route proved particularly beneficial as it provided multiple reference points that improved the overall alignment of the point cloud.

The long corridor was relatively straightforward to survey because of the clear lines of sight. However, additional scans were required near classroom entrances to reduce shadowing around recessed doorways. Similarly, extra scans were completed around the fire doors because these created areas that could not be fully captured from a single position.

The breakout space required fewer scan positions because it was more open than the corridor. The link bridge also allowed excellent visibility due to its relatively unobstructed layout.

Some adjustments were required during the survey because the building remained occupied. Staff and students occasionally walked through the scanning area, resulting in temporary interruptions. Rather than continuing immediately, scanning was paused until pedestrian traffic had cleared to minimise unwanted movement within the point cloud.

Furniture positioned within parts of the corridor also reduced visibility of wall surfaces, requiring slight repositioning of the scanner to capture hidden areas. These additional scans ensured complete coverage while maintaining sufficient overlap for registration.

No significant equipment failures occurred during the survey. Batteries lasted throughout the scanning session, and all scans were successfully saved and reviewed before leaving the site.

The greatest practical challenge was balancing efficient data collection with maintaining safe access for building users. The tripod was positioned carefully to avoid obstructing walkways or emergency exits. Each scan location was checked before scanning commenced to ensure that equipment did not create unnecessary hazards.

Overall, the survey achieved its objectives by successfully capturing the full internal circulation route, including the classroom corridor, fire doors, breakout area and connecting link bridge. The completed point cloud provided comprehensive coverage with minimal missing data and will allow accurate extraction of measurements during the processing stage.

Part 3 - Measurements and analysis

Comparing Digital Surveying and Manual Surveying: Time, Accuracy and Completeness

Surveying has always played a vital role in construction, engineering and land management by providing accurate measurements of the natural and built environment. Traditionally, surveyors relied on manual methods using tapes, optical levels, compasses and theodolites to determine distances, angles and elevations. While these techniques remain valuable for some tasks, advances in technology have transformed the profession. Modern digital surveying now uses equipment such as Global Navigation Satellite System (GNSS) receivers, robotic total stations, laser scanners, drones and specialised software to collect, process and present spatial data. Although both approaches aim to produce reliable measurements, digital surveying offers significant advantages over manual surveying in terms of time efficiency, accuracy and the completeness of the information collected.

One of the most noticeable differences between digital and manual surveying is the amount of time required to complete a project. Manual surveying is labour-intensive because measurements are often taken one point at a time and recorded by hand. The process requires frequent calculations, repeated checks and sometimes multiple team members to operate equipment and record observations. As a result, large sites or complex projects can take several days to survey accurately.

Digital surveying dramatically reduces the time needed for both fieldwork and data processing. Modern robotic total stations automatically track prisms and record measurements electronically, while GNSS technology enables surveyors to determine precise positions within seconds. Information is transferred directly into digital software, reducing the need for manual calculations and minimising delays between fieldwork and office analysis. According to Leica Geosystems, automated surveying systems allow surveyors to work more efficiently, improve productivity and meet demanding project deadlines by reducing repetitive manual tasks (Leica Geosystems, 2025). Consequently, organisations benefit from faster project delivery and lower labour costs.

Accuracy is another area where digital surveying has a clear advantage. Manual surveying methods depend heavily on the skill and experience of the surveyor. Human error can occur when reading instruments, recording measurements or performing calculations. Small mistakes may appear insignificant initially but can lead to costly errors during construction or engineering projects. Weather conditions, visibility and physical obstacles can also reduce the reliability of manual measurements.

Digital surveying equipment is designed to minimise these sources of error. GNSS receivers, robotic total stations and laser scanners automatically record measurements with high precision while reducing the possibility of transcription mistakes. Modern systems also include built-in error checking, data validation and automated calculations that improve the overall quality of the survey. The Royal Institution of Chartered Surveyors (RICS) explains that GNSS technology provides highly

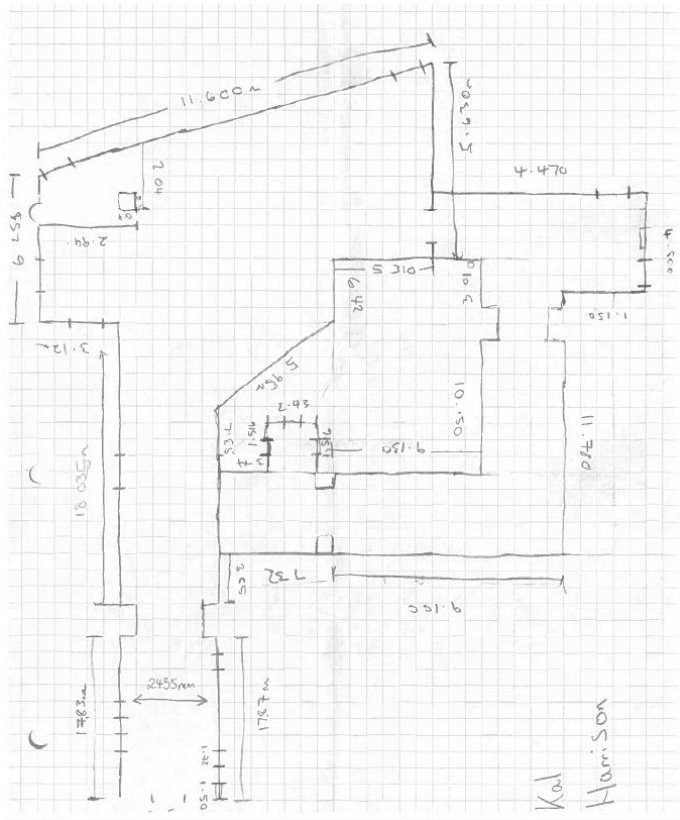
accurate positioning when used correctly and has become an established standard for land surveying and mapping because of its reliability and efficiency (RICS, 2025). Similarly, research carried out at Newcastle University demonstrated that Network Real-Time Kinematic (RTK) GNSS systems are capable of producing highly accurate positional data suitable for professional surveying applications (Edwards et al., 2010).

Completeness is another important factor when comparing digital and manual surveying. Manual methods usually collect only the measurements considered necessary for the immediate task. Because recording each point requires additional time and effort, surveyors often limit the number of observations they collect. If additional information is required later, another site visit may be necessary, increasing project costs and delaying progress.

Digital surveying captures far more comprehensive information during a single visit. Technologies such as terrestrial laser scanning and drone-based photogrammetry can record millions of individual points, creating highly detailed three-dimensional models of the site. These digital records allow surveyors, engineers and designers to revisit the collected data long after fieldwork has finished, measuring features that may not have been identified during the original survey. This provides greater flexibility and reduces the likelihood of expensive return visits. In addition, digital datasets integrate easily with Building Information Modelling (BIM), Computer-Aided Design (CAD) software and Geographic Information Systems (GIS), making collaboration between different project teams much easier.

Despite these advantages, manual surveying has not become completely obsolete. It remains useful in situations where digital equipment cannot function effectively, such as dense forests, underground environments or areas with poor satellite reception. Manual equipment is generally less expensive, requires less specialised software and can continue operating without batteries or electronic components. For smaller projects or educational purposes, manual surveying also helps develop a strong understanding of measurement principles and field techniques. Therefore, many surveyors continue to use manual methods alongside digital technologies depending on the project's requirements.

Overall, digital surveying represents a major improvement over traditional manual surveying. It enables surveyors to collect accurate information more quickly while significantly reducing the risk of human error. Furthermore, the ability to capture large amounts of detailed spatial data ensures that surveys are more complete and useful throughout the entire lifecycle of a project. Although manual surveying still has practical applications in certain environments, modern construction and engineering projects increasingly depend on digital technologies because they improve efficiency, enhance precision and provide richer datasets for decision-making. As surveying technology continues to evolve, digital methods are expected to become even more integrated into everyday professional practice while manual techniques remain an important foundation of surveying knowledge.



Royal Institution of Chartered Surveyors (RICS) (2025) Use of GNSS in land surveying and mapping (3rd edition). Available at: https://www.rics.org/content/dam/ricsglobal/documents/standards/Use%20of%20GNSS%20in%20land%20surveying%20and%20mapping_3rd_edition.pdf (Accessed: 23 July 2026).