

Above or below ground, surveying of Iconic Structures requires numerous Survey technologies and techniques. What considerations would you make if chief surveyor on such a major infrastructure project?

The surveying of iconic structures raises challenges that are not necessarily present in other structures and can emphasize traditional problems faced by surveyors. Firstly the iconic status will likely further problems that arise when surveying in public areas, tourists and onlookers could potentially be numerous. Line of sights may be blocked by crowds, with 3d laser scanning worst affected. Mitigation of this challenge could involve surveying parts of the building during quiet times such as at night or greater reliance on GNSS measurements. The extensive footfall in many of these sites along with public access would mean that survey equipment would have to be supervised in close proximity to prevent interference or even theft.

Iconic structures wish to maintain the appearance and character of the building, often not only to keep in what people expect, but also to obey laws that can protect structures of special nature. To facilitate this any surveying would have to be detailed enough such that if a part of the building became unsafe, or needed to be renovated, builders could reproduce the original to the highest precision. Technologies such 3d laser based scanning could accurately map and create point clouds of detail, perhaps using indexed photographs for colour reproduction. A combination of detailing and 3d laser scanning could be utilised, with the latter more appropriate to elaborate indoor features.

The scale of any surveying plans would also need to be considered. This would depend highly on the type of structure and its extent, large scale maps would be needed to achieve the detail necessary to map the Houses of Parliament as an example. Survey grids require consideration, arbitrary, local or national grids could be chosen depending upon the extent, suitability and requirements for end product. Therefore a specification clarifying the chosen survey grid, scale, detailing procedures for the projects circumstances and timescale must be produced prior to fieldwork.

Surveying can take time, months for extensive surveys. During this time the impact on the users and visitors to the structure would have to be minimised, as not to interfere with the potential attraction or purpose. Locating control points away from busy areas, surveying during quiet hours or temporary closure of specific areas could reduce impacts, subject to liaison with building managers. Time management would require consideration. Expectations on the timescale and resources required to complete tasks need to be evaluated, with priorities assigned to the more critical tasks, such as a primary control network.

Under normal conditions surveyors would place control points into the ground at locations with good geometry and lines of sight. This may be restricted or not possible in locations surrounding or inside iconic structures, to preserve their integrity. This would therefore pose a challenge whereby permanent markers might not be possible. Temporary solutions exist, for example a small round sicker on the floor of a room, these are however subject to potential movement or removal. Otherwise techniques such as free stationing using resection or GNSS SMART total stations outside could provide locational positioning.

Surveying can raise health and safety risks, both to the surveyor and the public. While surveying in quiet times may reduce the risk to the public, many features could present hazards to the surveyor. Older iconic structures were not made with thought for regulations, with potentially narrow access corridors and hazardous drops found in any environment. Special attention must be given to the safety of surveyors especially when performing tasks such as detailing, as areas not traditionally open may have to be accessed. With greater access needed by a surveyor doing a task such as detailing, diligence must be paid to their surroundings as objects can be rare and potentially fragile.

Accessibility can potentially be an issue when surveying all types of structures, including iconic. Modern technologies can be utilised to minimise any problems that may be incurred from not

having direct access. UAVs could create 3d models of areas that are not accessible by land using photogrammetry or Lidar. This could be necessary to use on the roof of the structure such as the Forbidden City, where the speed and flexibility of a UAV could map large swaths of inaccessible areas. Consideration could be given to 3d laser scanning to provide detail to areas which can be seen but not reached.

Many iconic structures are enduring, and have their fame from being masterpieces of their respective eras, The Hagia Sophia, Taj Mahal, Houses of Parliament.... Pressure exists for these structures to be kept in near original form, as would have been in the days they were built. Future generations to come will want to experience these monuments in their original form. After surveying using the wide variety of technologies available today, digital data from 3d laser scans, GNSS and topographic surveys will have to be stored in long lasting formats. Long term support for files are a must, software versions able to access the data must be noted and stored, perhaps even hardcopies of data suitable for printing would be justified. To predict future trends in surveying is difficult, but on the timescale that we wish to see these structures continue into the future it is simply impossible. Allowing future surveyors access to the data care and attention must be given to file formats, data structure, back-ups and data security to allow for the measurements taken today to give reference to a structure for many future years and generations to come.

In conclusion the approach of a chief surveyor tasked with surveying an iconic structure must be to carefully consider the additional impacts that it may have on the survey. While each iconic structure would represent a unique challenge, with different aspects causing the survey to take different forms the overarching principle is that additional workload would be required above and beyond a typical survey. These challenges must be acknowledged and mitigated by preplanning, with appropriate steps available to onsite teams. Furthermore consideration must be given to staying within what is reasonable attainable given financial and time restraints.