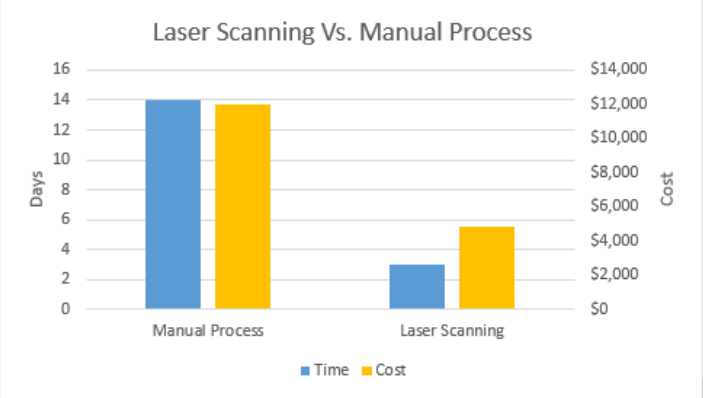
3D Laser Scanning: Practical Applications in Adaptive Reuse

Adaptive reuse, sometimes referred to as retrofitting, is the process of adapting existing structures for new purposes. Renovating buildings to give them a second (or third) chapter can provide substantial financial and environmental benefits as well as the societal advantages of breathing new life into historic structures. The very nature of adaptive reuse, reworking existing structures which are often over 100 years old, makes obtaining as-built data difficult or impossible. Even if the original plans can be located, there have likely been alterations made through the years which are not reflected in the documentation, as well as the inevitable settling of the structure which occurs over time. As British architect Simon Barnes noted in 2009, outdated blueprints are not useful for historic preservation ventures, "When they do exist, they are most often hard copy blueprints that may have limited value for preservation, rehabilitation, restoration or reconstruction efforts tied to today's efforts."



Sample Time and Cost Savings of Laser Scanning over Manual Process

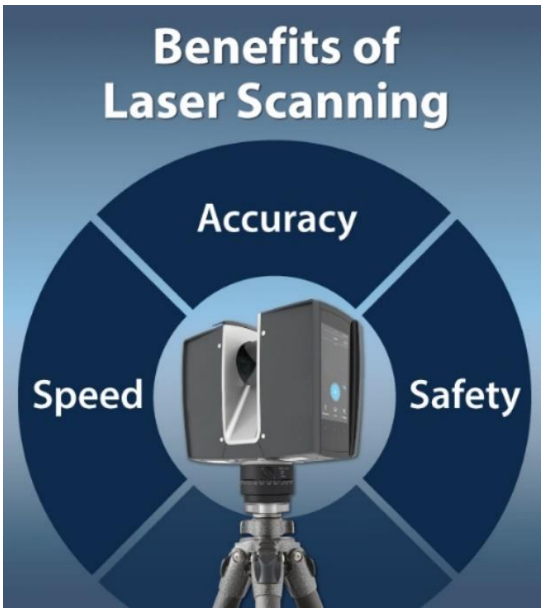
Conventional measuring techniques require a person (or team of people for a large project) to enter the space and take manual measurements. This method is both time consuming and prone to error and, depending on the integrity of the structure being measured, may be fraught with potential physical and airborne hazards. A missed measurement requires an additional trip to the jobsite, while an inaccurate measurement can lead to schedule-breaking and budget busting change orders. The use of a 3D laser scanner may be higher in cost per day, however, it completes the job much faster and with greater accuracy than hand measurements, making it a cost-effective method of documenting buildings.

Laser scanning captures rich, 3D as-built data that can be used directly in Building Information Modeling (BIM) software as well as downstream applications. Not only does 3D laser scanning capture true-scale measurements of the geometry of historic spaces, it combines photographic image capture to produce a rich photorealistic data set that conveys the textural qualities of the space. Additionally, laser scanning provides a safe way to remotely measure industrial piping and structures while also allowing for the data to be used for clash detection and off-site fabrication of new components.

Laser Scanning Process and Deliverables

Laser scanning uses laser beams to capture in minute detail the scanned area to produce accurate, complete and photorealistic 3D images. Applications for laser scanning include both indoor and outdoor

spaces. Prior to the scanning, the team will determine positioning of spherical targets which will allow the data to be registered together to create an “as built” point cloud model. The 360-degree scan captures over 44 million points which will be used in Revit to create a model which will be an accurate representation of the space.



Benefits of Laser Scanning over Conventional Measurement Methods

Production of as builts with greater detail and accuracy at a significant cost savings over conventional measurement methods is the most obvious and tangible benefit of laser scanning. In fact, laser scanning produces accurate as builts in There are additional compelling reasons to utilize this technology in both new builds and adaptive reuse, including:

- Delivery of an easy-to navigate virtual building for the developers/owners that can be used to better communicate direction to design and construction members. The model is also an effective sales tool for potential tenants to explore the building space and explore opportunities for personalization.
- Engineers and designers are provided with the ability to show floorplans or section views of any part of the building in seconds.
- Decreased time and personnel requirements combined with increased safety.
- Ability to scan otherwise inaccessible or difficult to access areas (such as high ceilings), can be combined with a drone to capture roof areas.
- Enables teams to understand the building as a whole better and to design at a building level, not a floor level.
- Facilitates visualization, analysis and modeling of continuous load-bearing structures.

“Mapping” the Historic Fox Theatre in Billions of Data Points

Imagine how much easier their task would have been if Atlanta Landmarks’ “Save The Fox” organization had the advantage of 3D laser scanning data which would have given them precise, as-built renderings of the theater exactly as it was when it first opened in 1929. Unfortunately, that project took place before the technology that documents space to within ±2mm existed. Forty-one years after that restoration project, the Fox Theatre’s personnel engaged Repro Products, Inc. (RPI) to utilize decidedly 21st century 3D scanning technology to document every part of the historic space from the basement to the rafters. The project was undertaken to accurately capture the facility with point cloud data which will be used for historical documentation and renovations, as well as maintenance and operations.

RPI, one of the pioneers in providing 3D laser scanning services to property owners, architects, General Contractors and property managers across the U.S., scanned the facility creating billions of data points. Point cloud data from 3D laser scans is used to create 3D models which are useful for the past, present and future. Like many other historic landmarks around the world such as Mount Rushmore and the Tower of London, it was imperative to scan Atlanta's beloved landmark, The Fox Theatre, to create documentation as a historic preservation tool.

This data also enabled the Fox managers to understand the entire space and represent with precision how each space interacts with the others, providing measurements which are useful for the day-to-day operations of the building. When the need arises to make any repairs, workers are afforded accurate floorplans which facilitates timely and cost-efficient decisions and the ability to restore the property to the condition it was in on the day it was scanned. The 3D model was also crucial for any enhancements to the space, such as the incorporation of the former Churchill Grounds into the Fox facility. The captured data has enabled the historic space to honor its past while it stretches to meet the needs of today and tomorrow.