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PROCURING REALITY CAPTURE SERVICES

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Procuring Reality Capture Services 2025

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Overview

Reality Capture (RC) is the process of documenting existing conditions at a site, building under construction, or completed building in a manner that supports specific processes in the design, construction, and/or operation of buildings and infrastructure. This guide is intended to help consumers of RC efforts get the results they need to support the use cases for which they are undertaking the effort.

Section 1 is an overview of reality capture definitions, standards, procedures, etc. it is intended to provide someone unfamiliar with reality capture with enough information to effectively communicate their needs to reality capture professionals.

Section 2 is a step-by-step guide to generating a specification that will enable an RC professional to efficiently produce the results that will be effective in supporting the consumer's needs.

Section 3 provides a list of useful resources.

Contents

1 Reality Capture Basics

This section provides foundational knowledge about reality capture, explaining key concepts, measurement techniques, and documentation methods. Understanding these basics will help practitioners specify their RC needs more effectively.

1.1 Definitions

Key definitions to establish a common understanding of reality capture principles.

1.1.1 Accuracy vs. Precision

- **Accuracy** refers to how close a measurement is to the true or accepted value. In RC, higher accuracy ensures that captured data more correctly represents real-world conditions.
- **Precision** refers to the repeatability of measurements—how consistently a measurement method produces the same results.

More Accurate Less Precise | Less Accurate More Precise

- Example: A laser scanner may be precise (consistently measuring the same distance every time) but not accurate (if it systematically over- or under-estimates distances due to calibration issues).

1.1.2 Tolerances vs Standard Deviation

Tolerances define acceptable limits for variations in measurements. Tolerance values do not "allow" statistically varying parameters. If a window must be assembled into a window's opening, it doesn't help to know that it will fit in 95% of all cases, since a 100% rate is required. Tolerances do allow a variation of values, e.g. by defining a tolerance as 2 m ± 5 mm, but in theory this deviation must not be exceeded in any case, which means it requires a confidence level of 100%. Tolerance represents the maximum permissible error in the part's dimensions. A tolerance may be plus or minus about a defined measurement, but it may not exceed the stated tolerance in either direction.

Standard Deviation is a statistical measure of measurement variation. In RC, a lower standard deviation indicates higher confidence in data consistency. Standard deviation is a way to measure how much a set of measurements varies from the average. Every time you measure a distance or capture a 3D coordinate, there can be slight differences due to factors like equipment precision or environmental conditions. Think of it like this: If you measure the same point five times using a laser scanner, the numbers might not be exactly the same each time. Standard deviation helps express how much those measurements differ from one another. A smaller standard deviation means the measurements are more consistent, while a larger standard deviation means they vary more.

1.1.3 Confidence Levels and Standard Deviation (Sigma Values)

Standard deviation is often linked to confidence levels, which show how certain you can be about a measurement.

- **1 Sigma (67%)**: About **67% of measurements** will fall within the given margin of error.
- **2 Sigma (95%)**: About **95% of measurements** will be within the margin of error.
- **3 Sigma (99.7%)**: About **99.7% of measurements** will be within the margin of error.

For example, if a laser scanner has a standard deviation of 5 mm at a 2-sigma confidence level, it means that 95% of all measurements will be within 5 mm of accuracy.

When comparing different measurement tools such as laser scanners, total stations, or handheld laser range finders you should also consider their confidence levels to fully understand the reliability of their measurements.

1.2 Standards

1.2.1 USIBD LOA Specification (LOA Spec)

The Level of Accuracy (LOA) Specification from the U.S. Institute of Building Documentation (USIBD) establishes standardized accuracy expectations in RC. The LOA Specification is comprised of a Guide and a spreadsheet referred to as "the Framework."

1.2.1.1 Level of Accuracy (LOA)

LOA defines required measurement accuracy for different elements within a project (e.g., walls, MEP systems, structure).

LOA ranges from LOA 10 (low accuracy) to LOA 50 (high accuracy), with the exception being a UDLOA (User Defined LOA).

1.2.1.2 Measured Accuracy vs. Represented Accuracy

Measured Accuracy refers to the accuracy of collected data. In laser scanning the measured accuracy is the registered point cloud.

Represented Accuracy describes how accurately the measured data is translated into a final deliverable, such as 2D line work or a 3D model.

1.2.2 BIM Forum LOD Specification (LOD Spec)

Level of Development is a methodology for specifying the accuracy and reliability of elements in a design BIM. The LOD Spec is a reference standard that defines requirements for specific building elements, assemblies, and systems at each LOD.

1.3 Understanding LOA and LOD in Reality Capture

In RC both LOA and LOD play unique, yet complimentary roles. It is important to understand the relationship between them. In a nutshell, measurements of existing objects and dimensions of model elements representing them are *always* specified by LOA. Elements in an existing conditions model that are taken from design drawings or models are specified by LOD.

1.3.1 Level of Accuracy (LOA) and Its Role in Reality Capture

LOA is primarily associated with reality capture and the documentation of existing conditions. It defines how accurately real-world measurements are captured and represented in deliverables such as point clouds, 2D drawings, or 3D models. Since all measurement methods contain some level of error, LOA ensures that expectations for accuracy are clearly defined and that the final deliverables meet project needs.

In existing conditions documentation, LOA plays a critical role because the data originates from measurements of the real world, where structures may be out of plumb, warped, or settled over time. The LOA specification guides the modeling process, helping to determine:

- How accurately elements should be captured and represented.
- Whether deviations from true geometry (e.g., a sagging pipe) should be included or simplified.

For example, in a point cloud, a sagging pipe might appear with visible deflections. The represented LOA specification helps define whether the pipe should be modeled with its actual sag or simplified into a perfectly straight and orthogonal representation.

1.3.2 Level of Development and Its Role in Reality Capture

The **Level of Development (LOD)** applies to both **design modeling** and **existing conditions modeling**. However, these are two very different applications of BIM:

1.3.2.1 Design BIM

- Created from scratch by designers, engineers, and architects.
- Accuracy is assumed to be perfect since objects are placed according to design intent, using exact dimensions.
- There is no need to specify a level of accuracy because the designer models are based on intended dimensions rather than real-world conditions.

1.3.2.2 Existing Conditions (EC) BIM

- Created from reality capture data, such as laser scans or survey measurements.
- Accuracy must be explicitly defined since all measurements have inherent errors.
- LOA must be specified to set expectations for accuracy and tolerance of model elements generated from measurements of real objects. For these elements, LOA serves as a critical quality benchmark, informing us how close to reality the model needs to be and how much simplification is allowed
- Existing conditions BIMs may include elements that represent objects that have not been measured (e.g. studs in a wall, underground foundations) but rather are taken from design information. These elements are specified through LOD.

1.4 Measurement

1.4.1 Direct measurement

Direct measurement refers to the process of determining distances, dimensions, or locations manually and physically using measurement tools, without the aid of automated or remote sensing technologies like laser scanners or photogrammetry.

1.4.1.1 Common Examples of Direct Measurement:

- Using a **tape measure** to measure the width of a doorway
- Using a **measuring wheel** to determine a floor's length
- Using a **caliper** or **ruler** for small objects
- Using a **total station** to capture control points (though more advanced, this is still often classified as a direct method compared to scan-based data)

1.4.1.2 Key Characteristics:

- Physical contact or direct line-of-sight with the object is required
- Typically slower and more labor-intensive than scanning

- Often used for spot-checking, verifying scan data, or measuring specific critical elements when high accuracy is needed and scanning isn't feasible
- Results in individual measurements rather than comprehensive spatial datasets

1.4.2 Scanning

In the context of reality capture, scanning refers to methods that use active or passive sensors to rapidly capture the shape and position of physical objects or spaces. These methods create dense datasets (like point clouds or meshes) representing 3D geometry. Below are the primary scanning-based reality capture methods:

1.4.2.1 Terrestrial Laser Scanning (TLS)

Terrestrial laser scanning is one of the most common and accurate methods used in reality capture. It involves placing a stationary laser scanner on a tripod or mount at ground level to capture millions of data points in a full 360° sweep. The scanner emits laser pulses that measure the distance to surfaces, creating a dense "point cloud" of 3D data. This method is ideal for documenting buildings, infrastructure, and complex architectural elements, both indoors and outdoors. It provides high-resolution data and is often used when a high Level of Accuracy (LOA) is required, particularly for creating precise as-built documentation.

- **What it is:** Ground-based laser scanning using tripod-mounted devices.
- **Output:** Dense 3D point clouds.
- **Best for:** Buildings, infrastructure, interiors, façades, historic documentation.

1.4.2.2 Mobile Laser Scanning (MLS)

Mobile laser scanning builds on the same principles as terrestrial scanning but adds mobility. In this method, the laser scanner is mounted to a moving platform—such as a backpack, cart, or vehicle—allowing for continuous data collection while in motion. This is especially useful for documenting large areas efficiently, such as corridors, campuses, roadways, or large indoor environments. While slightly less accurate than static scanning, mobile scanning provides rapid coverage with sufficient accuracy for many applications, especially when supported by good control and calibration.

- **What it is:** Scanners mounted on moving platforms (backpacks, carts, vehicles).
- **Output:** Continuous 3D point clouds captured during motion.
- **Best for:** Large corridors, roadways, campuses, indoor navigation.

1.4.2.3 Structured Light Scanning

Structured light scanners project a known light pattern (such as stripes or grids) onto an object and calculate its 3D shape based on how the pattern deforms over the surface. This technique is widely used in industrial design, manufacturing, and heritage preservation, where small to medium-sized objects need to be captured with very high resolution. Structured light scanners are typically handheld or placed on a stand and used in controlled environments. They offer high detail and accuracy over small areas, making them ideal for parts, artifacts, or precise object reconstruction.

- **What it is:** Projects a known light pattern onto a surface and uses distortion to compute 3D shape.
- **Output:** Highly accurate 3D models of small to medium objects.
- **Best for:** Industrial parts, objects for manufacturing, cultural heritage artifacts.

1.4.2.4 Aerial LiDAR (Drone or Aircraft-based)

Aerial LiDAR (Light Detection and Ranging) scanning involves mounting a LiDAR sensor to a drone, helicopter, or fixed-wing aircraft to capture topographic and structural data from the air. This method is particularly effective for surveying large, open areas such as landscapes, rooftops, infrastructure corridors, or hard-to-reach facades. Aerial LiDAR penetrates vegetation and captures ground surfaces, making it a preferred method for terrain modeling and utility planning. While not as detailed as terrestrial scans, it provides an essential bird's-eye perspective and complements ground-based data.

- **What it is:** LiDAR sensors mounted to UAVs (Unmanned Aerial Vehicles, aka: drones), helicopters, or planes.
- **Output:** 3D point clouds of terrain and structures from above.
- **Best for:** Topography, vegetation mapping, large outdoor sites, hard-to-reach areas.

1.4.2.5 Ground Penetrating Radar (GPR)

Ground-penetrating radar scanning uses electromagnetic pulses to detect objects or changes in material beneath the surface. It is a non-destructive method commonly used to locate utilities, voids, rebar, and subsurface structures. GPR is classified as a scanning method because it collects data systematically across a grid or path and can produce 2D slices or 3D volumes. It is often used in construction, archaeology, and forensic investigations to "see" below concrete slabs or soil without excavation.

- **What it is:** Uses radar pulses to detect subsurface structures.
- **Output:** 2D/3D representations of buried utilities, voids, or features.

1.4.2.6 Best for: Concrete scanning, utility mapping, archaeological surveys.

1.5 Documentation: Representing Measured Data

Once reality capture measurements are collected—whether via laser scanning, photogrammetry, direct measurement, or other methods—they must be translated into deliverables that are usable for the intended project needs. This section outlines the primary formats and representations of measured data; each suited to different use cases ranging from design and construction to facilities management and historical preservation.

1.5.1.1 2D CAD Drawings

Computer-Aided Design (CAD) remains one of the most common ways to represent as-built conditions in 2D. These can include:

- Floor plans
- Reflected ceiling plans
- Elevations
- Sections
- Site plans

Key Characteristics:

- Easy to integrate with most design and construction workflows.
- Useful when the project scope does not require full 3D modeling.
- Can be extracted directly from point clouds or generated from 3D models.

Common File Types: .dwg, .dxf, .pdf

1.5.1.2 3D Models

Building Information Modeling (BIM) represents measurements as intelligent 3D geometry, often enriched with data (e.g., material, asset ID, system type).

Key Characteristics:

- Best suited for renovation design, construction coordination, and digital twins.
- Supports a wide range of **Levels of Development (LOD)** and **Levels of Accuracy (LOA)**.
- Enables clash detection, quantity takeoffs, and simulation workflows.

Common File Types: .rvt (Revit), .ifc (Industry Foundation Classes)

1.5.1.3 Mesh Models and Textured Meshes

Meshes are 3D representations of surfaces created from laser scan data or photogrammetry. They can be colorized or textured with photographic imagery.

Key Characteristics:

- Often used in heritage documentation, visual inspections, or visualization-heavy applications.
- Less structured than BIM; not ideal for parametric editing or system design.
- Can be used for 3D printing or game engine visualization.

Common File Types: .obj, .fbx, .stl, .ply

1.5.1.4 Photogrammetric Models

Photogrammetry uses 2D photos from multiple angles to create 3D representations of geometry and textures. Deliverables may include:

- Dense point clouds
- Orthophotos
- 3D textured meshes

Key Characteristics:

- Excellent for **visual fidelity**, making it ideal for marketing, forensic analysis, and asset documentation.
- Accuracy depends on camera quality, overlap, and image control.
- Often used when scanning equipment is unavailable or cost prohibitive.

Common File Types: .rcp, .las, .obj, .tif (orthophoto)

1.5.1.5 Point Clouds

Point clouds are collections of millions of 3D points captured during scanning. They are the **raw geometric data** from which most other deliverables are derived.

Key Characteristics:

- Can be viewed directly or used as a reference for modeling.

- May include intensity, RGB color, or classification data.
- Useful for analysis, clash detection, deformation monitoring, and surface fitting.

Common File Types: .e57, .rcs, .rcp, .pts, .las, .laz

1.5.1.6 Panoramic and 360° Photography

Panoramic photos provide visual context and immersive navigation of the space.

Key Characteristics:

- Often used for facilities documentation, construction tracking, and virtual tours.
- May be linked to floor plans or integrated into documentation platforms.
- Not suitable for precise measurement unless paired with scan data.

Common File Types: .jpg, .tif, hosted web viewers (e.g., Matterport, Cupix)

1.5.1.7 Hybrid Deliverables

In many projects, multiple representation formats are combined for greater utility. For example:

- A BIM model (for design coordination)
- Linked panoramic tour (for visualization)
- Accompanying 2D drawings (for permitting)

When specifying documentation, the consumer should align the **deliverable type** with the **intended use case** and **required level of precision**.

1.5.1.8 Selecting the Right Format

When choosing documentation formats, consider:

- **Use case:** Design, renovation, FM, historic record, visualization
- **Audience:** Architects, engineers, contractors, owners, regulators
- **Accuracy requirements:** As defined by LOA and LOD
- **Interoperability:** With existing platforms (e.g., Revit, AutoCAD, CMMS)

2 Specifying a Reality Capture Effort

Reality Capture efforts usually result in one or more EC models that will be used for specific functions or use cases. The success of the effort is measured by how well the EC model(s) support the specified use(s), so a pull-planning process is used:

1. **Identify the use case(s)**
2. **Specify the model(s) that will effectively support the use case(s).**
3. **Specify the measurement effort that will enable the generation of the specified model(s)**

While it is important to make sure that all relevant information is captured, it is also important to note that accuracy costs time and money, so over-specifying the accuracy and scope of the measurement and modeling efforts should be avoided. It is usually best to include an RC professional and the end users of the EC model(s) in the planning effort in order to distill the effort down to “just enough” accuracy and scope.

2.1 Identify the Use Case(s)

Note that often a reality capture effort will be undertaken to support several use cases – e.g., remodeling, facilities maintenance. It is usually most economical to identify all the anticipated use cases and plan the RC effort to support all of them.

Use cases for RC efforts usually fall under 5 categories:

2.1.1 New Building Design

In this use case it is usually the building site as it exists, and sometimes the surroundings that are important. Items to consider:

- Site topography
- Adjacent hardscape
- Underground and overhead utilities
- Nearby buildings
- View corridors

2.1.2 Renovation Design

Here the existing building is usually the most important. Consider:

- Structural elements
- Nearby building services (HVAC, electrical, etc.)
- Building exterior in the renovation area
- Areas or elements designated for historic preservation

Note that if the renovation is to include exterior addition the items under “New Building Design” above should also be considered.

See also “**Record Model**” below.

2.1.3 Facilities Operation

Facilities operation includes a number of specific use cases with widely varying requirements for EC information. Some of the more common use cases are listed below along with important elements to consider:

- Space and asset management (including charge-back for space use, asset tracking, moves/adds/changes)
  - Visible building geometry including elements such as doors and windows (if used for charge-back be sure to include enough detail to support any space-measurement protocol in use such as BOMA or IFMA)
- Maintenance
  - Building elements requiring maintenance – doors, windows, etc.
  - Building services equipment – air handlers, pumps, etc.
  - Building services distribution elements – ducts, pipes, etc.
- Security
  - Possible entry and egress points
  - Visible building geometry in enough detail to support planning for security issues such as access control and security camera locations
- Emergency response
  - Visible building geometry
  - Safety equipment such as fire extinguishers, standpipes, fire alarm controls, etc.

See also “**Record Model**” below.

2.1.4 Construction QC

Construction QC is usually a process of comparing an EC model with the design model to ensure that construction is complying with design intent. The effort will focus on those elements that are difficult or costly to change and/or will cause significant problems later:

- Structural elements
- Elements embedded in concrete such as rebar and pipe/conduit stub-ups
- Openings in concrete slabs and walls

Construction QC usually requires multiple measurement sessions in order to identify issues before they become difficult or impossible to change. Thus the RC effort must be tightly coordinated with the construction schedule and must be adjusted as the schedule changes. It should also be noted that the EC models must be available quickly in order to be of any use in correcting issues, so usually point clouds are compared directly with the design model.

Typical points at which scans are made include:

- Excavation and grading (to determine cut and fill volumes)
- Concrete elements such as foundations, columns, decks, and walls – after installation of embedded elements and forming of edges and openings, and before concrete placement.
- After completion of floors and walls to determine flatness.

2.1.5 Record Models

A record of structural and building service elements that are hidden when construction is completed can be extremely useful in renovation projects and maintenance. To get the most complete record scans should be made as late as possible before elements are hidden by insulation or cover. This will require many scanning sessions, but panoramic photography will usually suffice and can be done relatively quickly and economically.

2.2 Specify the Documentation

Once the use cases and the areas and building elements needed in the supporting EC model(s) have been identified, the model(s) is/are defined by developing Represented LOA/LOD profile(s) and documenting them in the Reality Capture Specification spreadsheet.

- Model elements that are generated from measurements of real objects are always specified by an LOA. See Section 1.3.1.
- Model elements that are generated from design information such as drawings or models are specified by an LOD. See Section 1.3.2

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Row	Breakdown Level	UNIFORMAT		Space Utilization				Moves/Adds/Changes				MEP Maintenance			
				xxx	xxx	xxx		xxx	xxx	xxx			xxx	xxx	
				Measured	Represented	Represented		Measured	Represented	Represented		Measured	Represented		
				LOA	LOA	LOD	Notes	LOA	LOA	LOD	Notes	LOA	LOA	LOD	Notes
154	1	C	**INTERIORS**												
155	2	C10	**Interior Construction**												
156	3	C1010	**Partitions**	30	30	300		30	30	300		20	20	300	
157	4	C1010.10	Interior Fixed Partitions												
158	5	C1010.10.10	Masonry												
159	5	C1010.10.20	Cold-Form Metal Framing												
160	5	C1010.10.30	Wood												
161	4	C1010.20	Interior Glazed Partitions												
162	4	C1010.40	Interior Demountable Partitions												
163	4	C1010.50	Interior Operable Partitions												
164	4	C1010.70	Interior Screens												
165	4	C1010.90	Interior Partitions Supplementary Components												
166	3	C1020	**Interior Windows**	30	30	300		30	30	300		20	20	300	
167	4	C1020.10	Interior Operating Windows												
168	4	C1020.20	Interior Fixed Windows												
169	4	C1020.50	Interior Special Function Windows												
170	4	C1020.90	Interior Window Supplementary Components												
171	3	C1030	**Interior Doors**	30	30	300		30	30	300		20	20	300	
172	4	C1030.10	Interior Swinging Doors												
173	4	C1030.20	Interior Entrance Doors												
174	4	C1030.25	Interior Sliding Doors												
175	4	C1030.30	Interior Folding Doors												
176	4	C1030.40	Interior Coiling Doors												
177	4	C1030.50	Interior Panel Doors												
178	4	C1030.70	Interior Special Function Doors												
179	4	C1030.80	Interior Access Doors and Panels												
180	4	C1030.90	Interior Door Supplementary Components												
181	3	C1040	**Interior Grilles and Gates**									20	20	300	
182	4	C1040.10	Interior Grilles												
183	4	C1040.50	Interior Gates												
184	3	C1060	**Raised Floor Construction**									20	20	300	
185	4	C1060.10	Access Flooring												
186	4	C1060.30	Platform/Stage Floors												
187	3	C1070	**Suspended Ceiling Construction**									20	20	300	
188	4	C1070.10	Acoustical Suspended Ceilings												
189	4	C1070.20	Suspended Plaster and Gypsum Board Ceilings												
190	4	C1070.50	Specialty Suspended Ceilings												
191	4	C1070.70	Special Function Suspended Ceilings												
192	4	C1070.90	Ceiling Suspension Components												

2.2.1 Steps in Specifying Documentation

As mentioned before this is a pull-planning process – beginning with the specification for the EC model and then specifying the accuracy

2.2.1.1 Identify priority elements/systems

Section 3.1 outlines usual priority elements/systems by Use Case. These are selected in column G of the RC spreadsheet, then LOA/LOD profiles are developed for only the selected elements/systems.

2.2.1.2 Identify Areas of interest

Clearly defining the Area of Interest (AOI) is one of the most critical steps in specifying a successful reality capture effort. The AOI identifies the physical locations, spaces, systems, or components that must be documented. Without a clearly defined AOI, the reality capture provider may collect too much or too little data, leading to inefficient fieldwork, gaps in the deliverable, budget misalignments, or wasted resources.

Note that an EC effort may cover multiple AOIs requiring different LOA/LOD profiles. E.g., an area slated for historic preservation may have higher LOA/LOD requirements than an area slated only for space and asset management.

2.2.1.2.1 Why Defining the Area of Interest Matters

Efficiency and Cost Control: Field capture and processing time are directly tied to the size and complexity of the area being documented. By limiting the AOI to only what is required, the effort remains focused and budget efficient.

Fit for Purpose: Different use cases—such as renovation, facility maintenance, or historic documentation—require different spatial scopes. Some may require entire buildings, while others need only MEP rooms, vertical shafts, or a single wing.

Scope Clarity for Deliverables: Deliverables such as 3D models or drawings are only useful if they correspond to the consumer's specific needs. Specifying the AOI ensures that modeled geometry aligns with the required documentation both horizontally and vertically.

Legal and Logistical Considerations: Access limitations, security requirements, or property boundaries may restrict where scanning can occur. These constraints should be anticipated and incorporated into the AOI.

2.2.1.2.2 How to Define the Area of Interest

Reference Existing Floor Plans or Site Maps: Annotate PDFs or markups that visually indicate which areas are to be included or excluded, preferably with a solid translucent fill or a boundary line. Additionally, it is beneficial to highlight priority zones, access paths, or staging areas. Identify any areas that may be specifically excluded, especially within the defined boundary of the AOI. Color coding is often helpful with an accompanying legend.

Use Control Boundaries: For outdoor areas, clearly identify control limits using GPS coordinates, survey markers, or site-specific landmarks. This is especially important for UAV surveys.

Break Down by Zone or System: Sometimes it is difficult to document a distinct boundary for a survey. When documenting specific systems (e.g., HVAC, fire protection), define the AOI by zone, floor, or building system to focus measurement and modeling efforts where needed.

Communicate Intent with Use Case Alignment:
Tie the AOI to the intended application:

- For **design planning**, include structural and contextual adjacencies.
- For **construction verification**, define areas by construction phases or trade-specific scope.
- For **facility management**, target operationally critical areas like mechanical rooms or vertical chases.

2.2.1.3 Determine Represented LOA/LOD

The next step is to determine the accuracy required in the EC model. These requirements vary by use case – e.g., a model for renovation design may have higher accuracy requirements than one that will only be used for space and asset management. Note also that the requirements may vary by location – areas slated for historic preservation will often have higher accuracy requirements than other areas.

2.2.1.4 AOI and the Level of Accuracy (LOA)

The AOI should also correspond with required LOA. For example, high-accuracy scanning (e.g., LOA 40) may be needed for mechanical rooms, while adjacent corridors may only require LOA 30. Including this detail helps the RC provider plan fieldwork accordingly.

2.3 Specify the Measurement Accuracy

Once the Represented LOA/LOD profile – i.e. the definition of the EC model – is determined, a Measured LOA profile that will support these requirements is developed. Note that the Measured LOA must be at least as high as the Represented LOA. The Measured LOA profile is then used to guide the measurement effort.

Often an RC effort is intended to support multiple use cases – e.g. the results of a renovation design effort may also be used as a model for MEP maintenance after the project is finished. In this case, LOA/LOD profiles for each use case are developed, and the LOA/LOD profile for the overall effort is determined by the maximum LOA/LOD for each line item.

2.4 Specify the validation

It is important to determine at the outset what form of validation, if any, will be required. The USIBD LOA Specification offers 3 levels of validation for measurement and representation. Remember that as with accuracy, higher levels of validation cost time and money, so it is best to require "just enough" validation for the use case(s). Below is a brief outline of validation methods – more detail can be found in the *LOA Specification*.

2.4.1 Measurement Validation

2.4.1.1 Method A, No Data Check

2.4.1.2 Method B – Check by Overlapping Data Sets

The easiest way to accomplish this is to make sure the scan plan provides for significant overlap between setups. The overlapping areas can then be checked to see if the results match.

2.4.1.3 Method C – Independent Measurements or Methods

Examples of this method:

- Comparison of the distance between the same two points as measured by a laser range finder and the primary laser scan
- Comparison of the actual dimension of a known object with that shown by the laser scan

2.4.2 Representation Validation

2.4.2.1 Method A – No check

2.4.2.2 Method B – Single check

Examples:

- Check of the deliverables by an independent person
- Check of the deliverables against record drawings or models
- Overlay the represented data with the scan results (point cloud)

2.4.2.3 Method C – Double check

Use two of the above methods

3 Resources

3.1 USIBD

- USIBD LOA Specification (https://usibd.org/level-of-accuracy/)
- RFQ
- RFP

3.2 BIMForum

- BIMForum LOD Specification (https://BIMForum.org/LOD)