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WORKING DOCUMENT

Scan-to-BIM deliverables specification

Agree these ten items in writing before anyone scans or models anything. Fill it in with your modelling team before the capture week is booked.

10	6	3
Sections to agree	Cloud QA acceptance criteria	Parties who sign

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Most Scan-to-BIM disputes trace back to three unwritten assumptions: what level of detail, what tolerance, and what coordinate system. This template forces every assumption into writing. Fill it in with your modelling team (or ours via a partner) before the capture week is booked.

01

Project

WHY IT MATTERS

The basic quantities here (floor area, storeys, occupancy) drive the capture programme, the device choice and the price of the modelling that follows. When they are left vague, every downstream estimate inherits the vagueness: a "roughly 3,000 m²" site that turns out to be 5,000 m² with a basement blows both the capture schedule and the modelling quote. For Singapore projects, note that occupied capture is the norm rather than the exception: handheld SLAM handles it, but the access plan must.

Project name _____

Site address _____

Approx. floor area (m²) _____

Number of storeys / zones _____

Occupied during capture? ☐ Yes ☐ No

02

Purpose of the model

☐ As-built record ☐ Renovation / A&A design base ☐ Facilities management

☐ Clash / coordination reference ☐ Heritage documentation

☐ **Other** _____

02 CONTINUED

Why the purpose drives everything

WHY IT MATTERS

Purpose is the master switch: every later choice (LOD, tolerance, scope, format) should be derivable from it, and when it goes unstated, each party silently assumes a different one. A facilities-management model wants broad, attribute-rich, geometrically-forgiving coverage; a renovation base wants tight geometry in the work zones and little else; a heritage record wants surface fidelity above all. In Singapore, where BCA has pushed BIM adoption through CORENET e-submission requirements for larger projects, it is also worth stating here whether the model must align with any regulatory-submission BIM the project already maintains. An as-built record that contradicts the submission model creates a problem, not an asset.

The purpose drives every choice below. An FM model and a renovation base need different LOD and different tolerances.

03

Level of Development (LOD)

WHY IT MATTERS

LOD is where Scan-to-BIM budgets are won and lost, because modelling effort rises steeply with each step and clouds contain far more detail than anyone can afford to model. When LOD goes unstated, the modeller models to their habit, the client reviews to their imagination, and the gap surfaces at the worst moment: model delivery. Specify LOD **per element group**, not for the whole model: most Singapore renovation projects sensibly run LOD 300 architecture and structure with LOD 200 visible MEP, and skip furniture entirely.

What each level means in practice

- **LOD 200: approximate geometry.** Elements are generic placeholders with approximate size, shape, location and orientation. A wall is a wall of roughly the right thickness on roughly the right line. Right for early design bases, massing, FM location-finding.
- **LOD 300: accurate geometry.** Elements are modelled as specific objects, accurate in size, shape, location and orientation to the stated tolerance. A wall is *that* wall, on its true (as-scanned) line, with true openings. The workhorse level for renovation and as-built work.
- **LOD 350: geometry plus interfaces.** LOD 300 plus how elements connect and interface with each other (supports, connections, penetrations): what coordination-grade modelling needs. Substantially more effort; specify it only for the element groups whose interfaces actually matter to the project.
- **Not modelled.** The honest fourth column. Anything not modelled is still *captured* in the cloud and can be modelled later under change control, which is exactly why the cloud, not the model, is the master record.

ELEMENT GROUP	LOD 200	LOD 300	LOD 350	NOT MODELLED
Structure (columns, slabs, beams)	☐	☐	☐	☐
Architecture (walls, doors, windows)	☐	☐	☐	☐
MEP visible services	☐	☐	☐	☐
Ceilings & finishes	☐	☐	☐	☐
Furniture / loose items	☐	☐	☐	☐

04

Accuracy & tolerance

WHY IT MATTERS

Two different tolerances live in this section and conflating them causes most accuracy disputes. **Capture accuracy** is how close the point cloud is to reality, a property of the scanner and the capture technique. **Modelling tolerance** is how far the model may deviate from the cloud, a property of the modelling contract, and it exists because real buildings are not flat or plumb, so the modeller must simplify. When only one number is stated, each party assumes it means the other thing. For most Singapore renovation and as-built work, centimetre-class capture with ±25 mm modelling tolerance is the pragmatic pairing; ±10 mm modelling against millimetre-grade tripod capture is for tight-tolerance fit-out, heritage and structural verification, and costs accordingly.

Modelling tolerance (deviation from cloud)

☐ ±10 mm ☐ ±25 mm ☐ ±50 mm

Capture accuracy required

☐ Centimetre-class (handheld SLAM: Lixel K2, ≤1 cm relative / ≤3 cm RMSE)

☐ Millimetre-grade (tripod TLS: Leica BLK360 G2, 4 mm @ 10 m)

Check-point verification required?

☐ Yes, _____ points ☐ No

05

Coordinate system & datum

☐ Project-local (relative) ☐ SVY21 (Singapore) ☐ WGS84

☐ **Other** _____

Georeferencing method

☐ RTK ☐ PPK ☐ Control points (surveyor-provided) ☐ None

Level datum source _____

05 CONTINUED

Getting the coordinates right

WHY IT MATTERS

A model that is internally perfect but in the wrong place is a coordination hazard, and coordinate problems are invisible until two datasets meet. If the model must sit alongside survey data, land records or civil works in Singapore, the answer is **SVY21** (the national projected system) and it must be delivered by surveyed control, not assumed. If the model only ever needs to agree with itself (most interior renovations), project-local is simpler and cheaper, but say so explicitly, and state the level datum source either way: "0 m at which floor, per whose survey?" is the question that surfaces at the first setting-out clash.

Capture-side minimums the chosen method commits you to

From the XGRIDS documentation: write them into the capture plan.

- **Control points:** at least 3, spread in a triangle or polygon, never a straight line, spaced under 50 m on the K1/K2 (100 m on the L2 Pro).
- **RTK:** outdoors only; "Fixed" status held with any unfixed stretch under 50 m (K1/K2) or 100 m (L2 Pro); scan spanning at least 10 m with over 100 valid RTK points; antenna within 20° of vertical.
- **Accuracy verification (either method):** route over 100 m and not a straight line.
- **PPK:** base station logging 5 minutes before the scan starts and 5 minutes after it stops, baseline under 5 km.

06

Capture scope & exclusions

WHY IT MATTERS

"Scan the building" is not a scope. Every project has locked rooms, tenanted units, live plant and unsafe zones, and the question is not whether gaps exist but whether they were agreed in writing before capture or discovered by the modeller afterwards. Above-ceiling capture is the most commonly mis-assumed line item in Singapore fit-out work: the cloud captures what the scanner can see, and a closed ceiling hides exactly the services a renovation team most wants. Decide now: no tiles, selected tiles lifted, or full grid, because a return visit costs a second mobilisation.

Included spaces

Excluded spaces
locked, tenanted, unsafe

Above-ceiling capture?

☐ No ☐ Selected tiles lifted ☐ Full

Facade / external envelope?

☐ Yes ☐ No

Roof?

☐ Yes ☐ No

07

Point cloud deliverables

WHY IT MATTERS

The cloud is the primary evidence and usually outlives the model, yet it is often treated as a by-product. Specify its formats and density explicitly: a modelling team in Revit wants **.rcp**; a neutral **.e57** protects you when tools change; **.las/.laz** serves survey and GIS. Density matters twice: full density for measurement, and a decimated copy so reviewers on ordinary laptops can actually open the thing. When this section is unstated, the typical failure is a single multi-gigabyte file in the wrong format that nobody downstream can load, followed by a re-export request weeks after the capture kit went back.

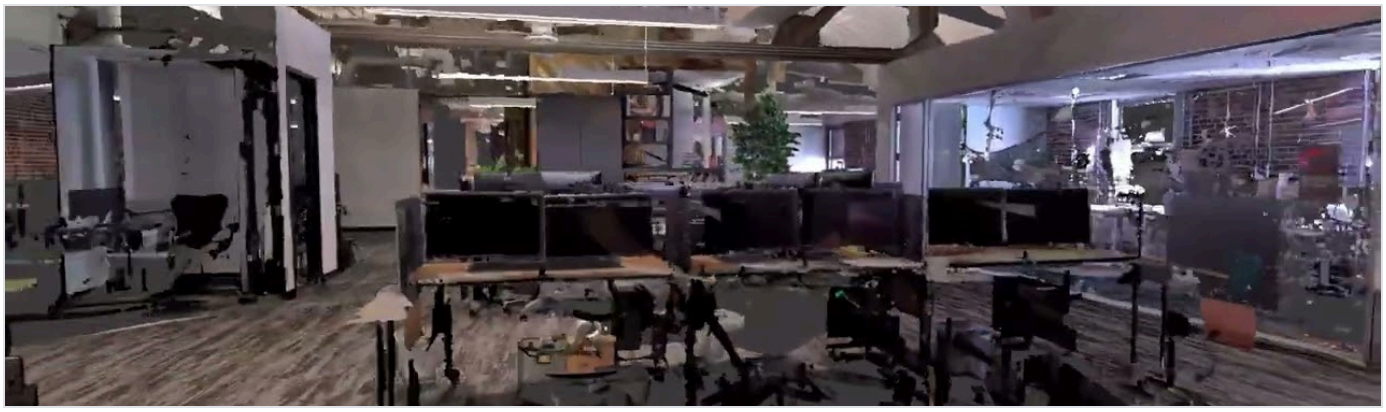
☐ .rcp (ReCap, Revit-ready) ☐ .e57 ☐ .las / .laz ☐ Decimated viewing copy

Cloud density

☐ Full ☐ Thinned to _____ mm spacing

Colourised?

☐ Yes ☐ Not required



The full-density master: the viewing copy is decimated from this, not captured separately

08

Model deliverables

WHY IT MATTERS

Authoring tool *and version* is a real constraint: Revit does not open files saved in newer versions, so a model authored in the wrong year is unusable to the recipient without rework. Who supplies the template and origin file decides whose standards (naming, shared coordinates, view organisation) the model inherits; leaving it open means the modeller invents one and the client's BIM manager rejects it. Keeping the cloud linked into the model, with an audit view showing model against cloud, is cheap to ask for now and is the single most useful thing for verifying the model later.

Authoring tool + version

☐ Revit 20 _____ ☐ Archicad _____ ☐ Other _____

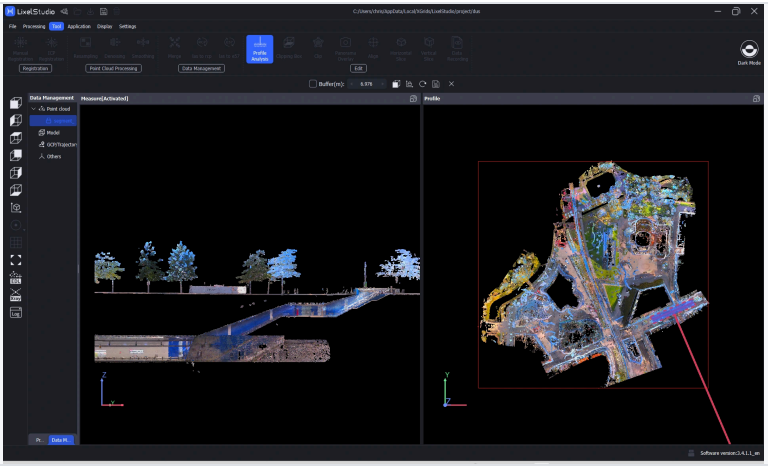
Template / origin file provided by _____

Cloud linked into model?

☐ Yes ☐ No

Modelled-from-cloud audit view included?

☐ Yes ☐ No



Audit view: a section cut through the cloud, where modelled geometry gets checked against as-scanned

09

Programme

WHY IT MATTERS

Scan-to-BIM has a natural quality gate that most programmes skip: accept the **cloud** before modelling starts. Modelling on an unaccepted cloud means every cloud defect becomes a model defect at ten times the correction cost. Put the gate in the programme and give it a named number of days. Note also that capture is usually the shortest activity in the chain (a week), while modelling runs to weeks or months; compressing the capture never rescues a late programme, but a missed capture window (site access, tenant schedules) can sink one.

Capture window _____ → _____

Cloud delivery _____ working days after capture

Model delivery _____ working days after cloud sign-off

Cloud sign-off gate before modelling starts?

☐ Yes (recommended) ☐ No

10

Sign-off

Three parties touch a Scan-to-BIM deliverable (the client, whoever captures, and whoever models), and each hands risk to the next. Sign this before capture week, and re-sign against the change-control log at delivery.

ROLE	NAME	SIGNATURE	DATE
Client			
Capture team			
Modelling team			

ACCEPTANCE

Point cloud QA acceptance criteria

The cloud sign-off gate in section 9 needs pass/fail criteria, or it is just a pause. Adapt these:

1. **Coverage.** Every space listed as included in section 6 is present in the cloud with no unagreed voids larger than an agreed size (typical: 0.5 m² on primary surfaces). Occlusion shadows behind fixed obstructions are noted, not treated as defects. Verify with a floor-by-floor walkthrough of the decimated cloud against the space list.

2. **Density.** Point spacing on primary surfaces (walls, floors, soffits, structure) meets the agreed figure (typical for modelling-grade work: 5–10 mm at the surface). Spot-check with density measurement at several locations per floor, including the worst-lit and furthest-range areas.

3. **Registration / drift.** Where capture passes overlap (scene merges, loop closures, floor-to-stair junctions), coincident surfaces align within the capture accuracy class stated in section 4 (centimetre-class SLAM: no visible doubling beyond ~1–2 cm; TLS: registration report within the scanner's stated class). Cross-sections through junction zones are the honest test: cut a slice, look for onion-skinned walls.

4. **Verification measurements.** The capture team's check dimensions (tape vs cloud, minimum 3–5 per floor including one long run) are delivered as a table and all fall inside the section 4 capture tolerance. If check points against surveyed coordinates were specified, deviations are reported per point.

5. **Georeferencing.** The cloud opens in the agreed coordinate system at true position and correct level datum, verified against at least one known coordinate or benchmark, not by eye.

6. **Format integrity.** Every deliverable format listed in section 7 opens in its target application (e.g. the .rcp actually links into the client's Revit version), with colourisation present where specified. Test-open before sign-off, not after.

Cloud accepted (date / by) _____

CLAUSE

Change control

Changes to scope, LOD, tolerance, formats or programme after signature. Any party may propose a change in writing (email sufficient), identifying the section of this specification affected. The receiving parties respond within _____ working days with impact on cost and programme. No change takes effect until accepted in writing by Client, Capture team and Modelling team. Work already performed to the prior specification remains billable. Additional site capture arising from scope changes after the capture window is a new mobilisation at the then-current rental and access terms. A change log appending each accepted change is attached to this specification and forms part of it at final sign-off.

Two habits make this clause work in practice: log even "free" changes (they establish what was agreed), and treat locked-room discoveries during capture week as changes to section 6, decided that day by phone, confirmed that evening by email, rather than silent gaps.

WORKED EXAMPLE

Mid-size office renovation

How the ten sections read when filled in: a ~2,500 m², two-storey office floor in a Singapore commercial building, being fully renovated by a design-and-build contractor.

1. **Project:** "Levels 7–8, [tower], ~2,500 m² total, 2 storeys, occupied until vacant possession; capture in the vacant week before hoarding up."
2. **Purpose:** Renovation / A&A design base. Model feeds space planning and services coordination; not an FM deliverable.
3. **LOD:** Structure LOD 300; Architecture LOD 300; MEP visible services LOD 200 (routes and sizes, generic families); Ceilings LOD 200; Furniture not modelled.
4. **Accuracy:** Capture centimetre-class (Lixel K2 rental); modelling tolerance ±25 mm; check-point verification: no formal survey points, but tape-verification table required (5 dimensions per floor).
5. **Coordinates:** Project-local; level datum = existing L7 FFL taken as 0 m, stated in the model start file; no georeferencing.

WORKED EXAMPLE · CONTINUED

Sections 6 to 10, filled in

6 **Scope:** All of L7–L8 including toilets, stair lobbies and both stair cores between the levels. Excluded: live tenant server room L7 (scan to door line), facade exterior, roof. Above-ceiling: selected tiles lifted at 12 agreed positions per floor to capture main service runs.

7 **Cloud deliverables:** .rcp for Revit plus .e57 master plus decimated (10 mm) viewing copy; full density retained; colourised.

8 **Model deliverables:** Revit 2026, template and shared-coordinates start file provided by the contractor's BIM lead; cloud linked into the model; audit view included.

9 **Programme:** capture window one week (K2 rental, Mon–Fri); cloud delivery 5 working days after capture; cloud sign-off gate yes, 5 working days; model delivery 20 working days after cloud sign-off.

10 **Sign-off:** contractor's project lead (client role), the in-house team doing the capture on the rented K2 (capture team), outsourced modelling firm (modelling team).

Capture cost in this example: one week of Lixel K2 at `S$2,300` + `S$250` onboarding (GST-excl.): the capture side is a rental, and the contractor keeps the cloud outright for the life of the building.

APPENDIX

Sector notes: how the spec shifts

The ten sections are universal; where the ticks land is not. Four sectors account for most Scan-to-BIM briefs, and each pulls the specification in a recognisable direction. Treat these as starting positions to argue from, not defaults to copy.

Commercial fit-out / renovation

The most common brief and the leanest spec. Purpose: renovation/A&A design base. LOD typically 300 for architecture and structure, 200 for visible MEP, furniture not modelled. Tolerance: ±25 mm modelling against centimetre-class SLAM capture (Lixel K2), the pragmatic pairing for the sector. Coordinates: project-local with a stated level datum; georeferencing is usually wasted money here. The section that earns its keep is **6 (scope)**: above-ceiling capture is the fit-out dispute generator, so specify the tile-lifting arrangement to the count and position. Programme pressure is real but capture is the short activity. Protect the capture window (vacant possession, pre-hoarding) rather than compressing it.

Industrial plant / marine retrofit

The spec tightens around geometry and interfaces. Purpose: clash/coordination reference for brownfield modification. Commonly reported practice is designing the retrofit against the cloud so prefabricated pipework and steel fit first time. LOD: 300–350 on the services and structure in the modification zone (interfaces are the whole point), with surrounding context often left as cloud-only. Tolerance: ±10–25 mm modelling, and millimetre-grade tripod capture (BLK360 G2) in the tie-in zones where new meets old; SLAM coverage for the wider volume. Coordinates: the plant or vessel's own coordinate system, stated explicitly. Scope must name the shutdown or dry-dock window. A missed capture window here is measured in months, not days. Deliverables lean to e57 with imagery preserved, feeding plant-design tools rather than Revit alone.

Heritage / HBIM

The spec inverts the usual priorities: surface fidelity beats abstraction. Purpose: heritage documentation, often both the design base for restoration and the permanent record. Published HBIM practice typically pairs millimetre-grade TLS (with photogrammetry) on significant fabric with broader coverage of the volume, and the *cloud plus imagery*, not the model, is the primary archival deliverable. LOD is awkward for irregular historic fabric. Many briefs specify LOD 300 for regular elements and cloud-or-mesh reference for mouldings, carvings and deformed surfaces rather than forcing them into parametric families. Tolerance: capture at millimetre grade (BLK360 G2) on conserved fabric; modelling tolerance stated per element type. Density and colourisation requirements run higher than any other sector. Archive requirements (formats, storage duration, who holds the master) belong in the spec here, because the record may outlive every party signing it.

Facilities management

The spec broadens and relaxes. Purpose: FM/asset model. Breadth of coverage and searchable structure beat geometric precision, and reported FM practice values remote walkthroughs, space measurement and maintenance planning over tight tolerances. LOD typically 200 across the board (location-finding, not fabrication), with room/space naming and numbering conventions written into section 8: an FM model nobody can query by room code fails at its only job. Tolerance: ±50 mm modelling against centimetre-class SLAM capture is commonly sufficient. Scope: everything, including the plant rooms, risers and roof that other sectors exclude. Those spaces are why FM scans exist. Consider specifying a navigable tour (Matterport Pro3) *alongside* the cloud: FM teams click through tours daily and open point clouds rarely. Programme: FM briefs have no hoarding-up deadline, so use the slack to capture around building operations properly.

APPENDIX

Glossary of key terms

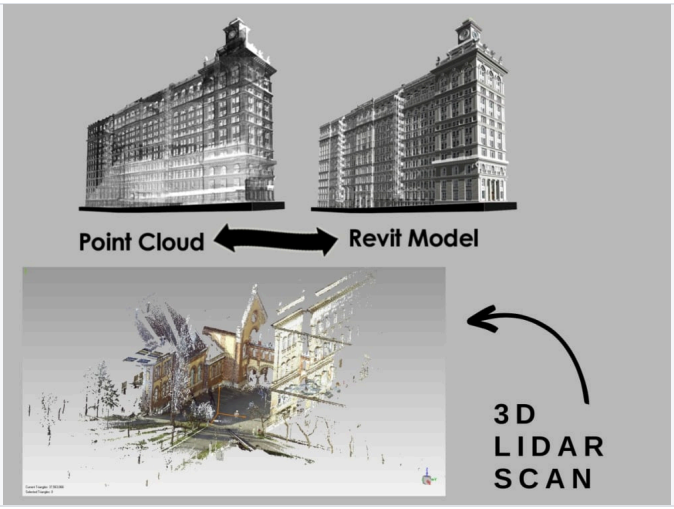
TERM	MEANING
As-built	Documentation of a building as it actually exists, as opposed to as it was designed.
Point cloud	Millions of measured 3D points (with colour/intensity) representing surfaces; the raw evidence Scan-to-BIM models are traced from.
LOD (Level of Development)	The defined reliability and detail of model elements (200 = approximate, 300 = accurate geometry, 350 = plus interfaces).
SLAM	Simultaneous Localisation And Mapping; how a handheld scanner builds a map while tracking its own position within it, no tripod stations required.
TLS (terrestrial laser scanning)	Tripod-based scanning from fixed stations; slower, millimetre-grade (e.g. Leica BLK360 G2).
Registration	Aligning separate scans or scenes into one consistent cloud; registration error is the misfit at the joins.
RTK / PPK	GNSS correction techniques (live / post-processed) that give a cloud absolute coordinates to the ~3 cm class outdoors.
Control point	A marked point with known coordinates used to fix the cloud to a coordinate system.
Check point	A known point deliberately *not* used in fitting, held back to independently verify accuracy.
SVY21	Singapore's national coordinate system for survey work; specify it when the model must align with survey or land data.
Decimation	Thinning a cloud to a stated point spacing to make a fast-loading review copy; the full cloud remains the master.
.rcp (ReCap project)	Autodesk's indexed point cloud format that Revit and AutoCAD link natively; the standard hand-off to BIM modellers.

REFERENCE

Format cheat table

FORMAT	WHAT IT IS	FEED IT TO
`.las / .laz`	Raw/compressed LiDAR cloud	GIS, survey QA
`.e57`	Vendor-neutral exchange	Any modelling pipeline
`.rcp`	Autodesk ReCap project	Revit, AutoCAD (link directly)

Conversion note: LixelStudio exports .las/.laz/.ply/.e57 directly and converts LAS to .rcp in-app (up to 10 files per run, for ReCap and AutoCAD 2020 or newer), so the Revit hand-off needs no third-party tooling.



Scan to model: the captured cloud (left) and the modelled geometry built from it (right)

The capture side of this template is a rental

XGRIDS Lixel K2 from S$2,300/week; Leica BLK360 G2 from S$2,800/week (GST-excl.). You keep every dataset.

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