Update on Site Management Platform (SMP) and Virtual TOP

Presented by:
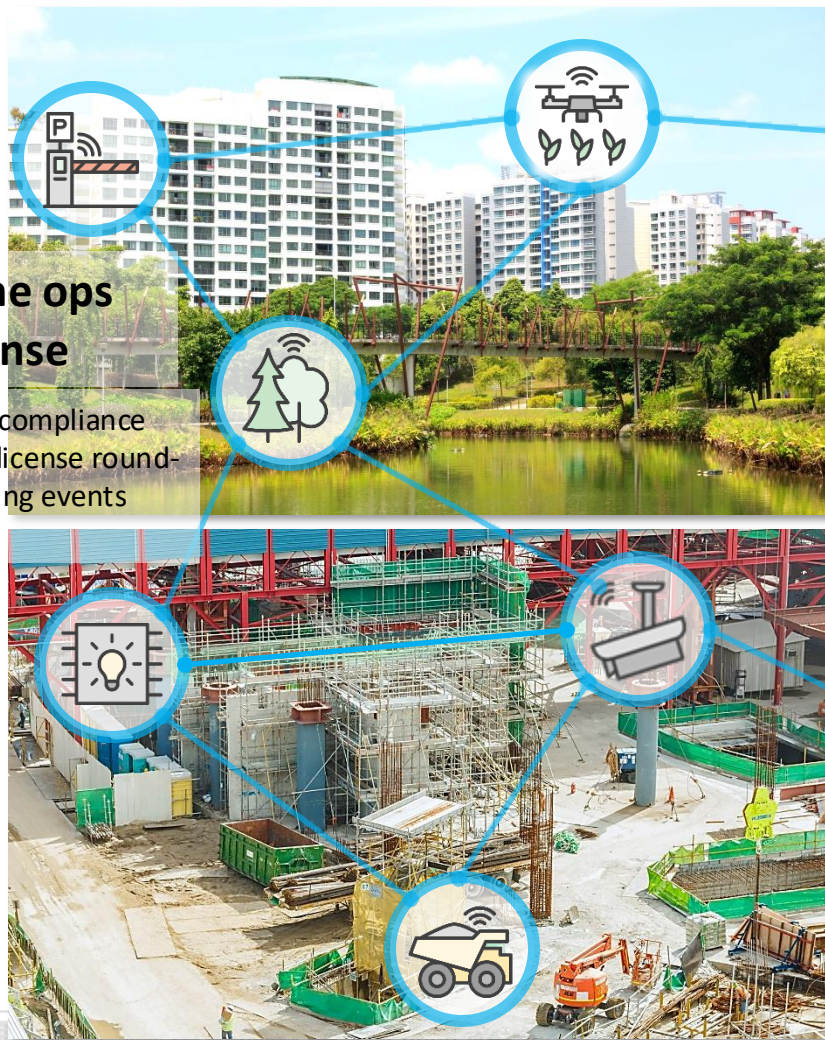*SM/See Toh Chee Fung*
Audit and Inspection Group

Harnessing data for regulatory and compliance inspections ops, enabling officers to identify trends and make informed decisions.

Real time ops response

E.g. ensuring compliance to exhibition license round-the-clock during events (NParks)

Predictive Analysis for efficient resource deployment

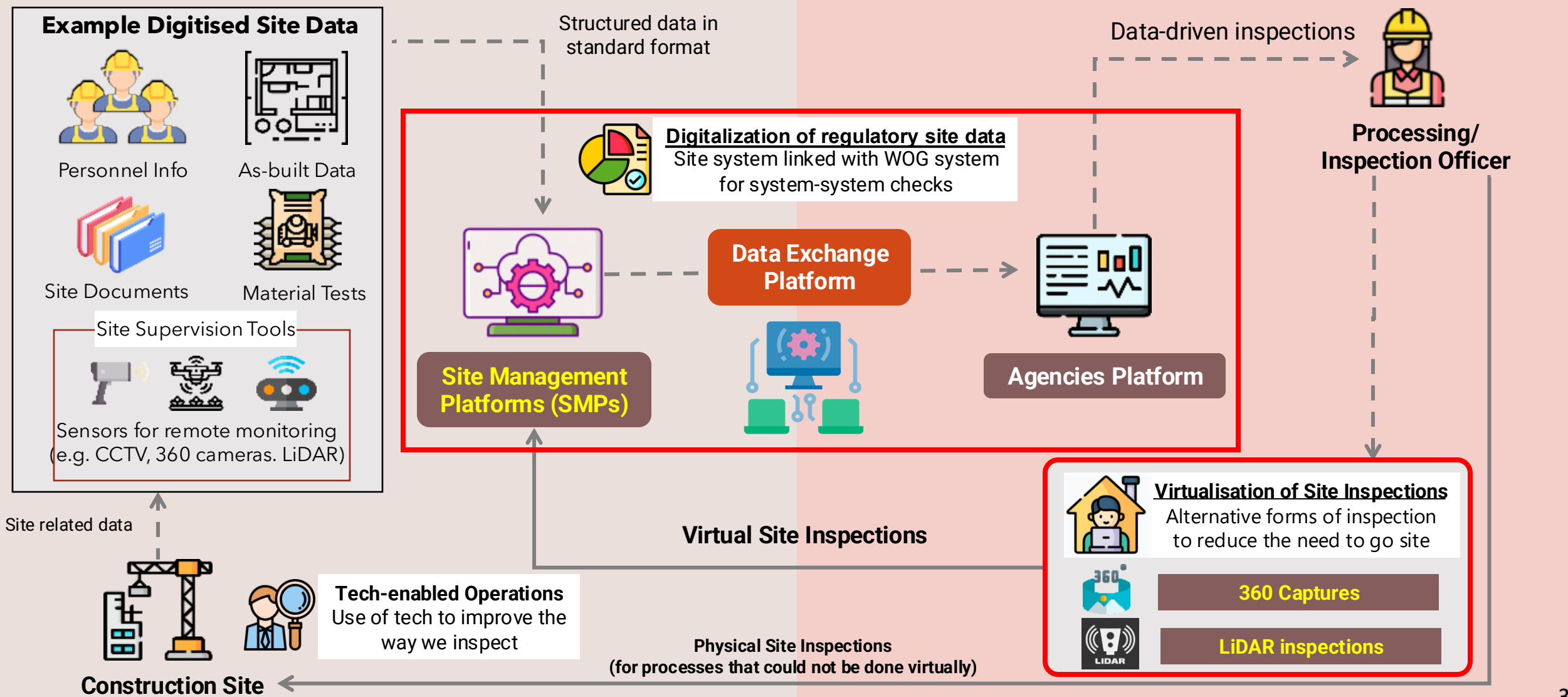E.g. deploying enforcement officers to identified hotspots for carpark offences (URA)

Preventive Intervention

E.g. early detection of site safety non-compliance (HDB, NParks, BCA)

To achieve the envisioned future as a data driven smart regulator, A&I is looking to digitalize and virtualise our inspections so as to make the regulatory checks more efficient and effective.

Example Digitised Site Data

Personnel Info

As-built Data

Site Documents

Material Tests

Site Supervision Tools

Sensors for remote monitoring (e.g. CCTV, 360 cameras. LiDAR)

Structured data in standard format

Digitalization of regulatory site data
Site system linked with WOG system for system-system checks

Data Exchange Platform

Site Management Platforms (SMPs)

Agencies Platform

Data-driven inspections

Processing/ Inspection Officer

Site related data

Virtual Site Inspections

Tech-enabled Operations
Use of tech to improve the way we inspect

Construction Site

Virtualisation of Site Inspections
Alternative forms of inspection to reduce the need to go site

360 Captures

LiDAR inspections

Physical Site Inspections
(for processes that could not be done virtually)

Digitalization of regulatory site data

Site Management Platforms (SMP) are digital tools designed to help construction sites manage data and digitalize processes to achieve Integrated Digital Delivery (IDD).

Legend:

Site Management Platform (SMP) related IDD use cases

1. Digital Carbon Management *(New)*

2. Visualisation & Design Checks
3. BIM-based Documentation
4. Integrated Concurrent Engineering (ICE) Meetings

Site Management Platforms to manage data and digitalise processes

Quality Management
Cost Management
Safety Compliance
Scheduling and Productivity
iOT and Sensors

Different solutions are available to manage these use cases of IDD

6. **Digital Request for information (RFI)**

7. BIM-based Cost Estimation

17. Digital Handover

8. **Digital Construction Management**

11. **Digital Safety Planning & Mgmt.**

12. **Digital Site Management**

13. **Digital Progress Monitoring**
14. **Digital Inspection**
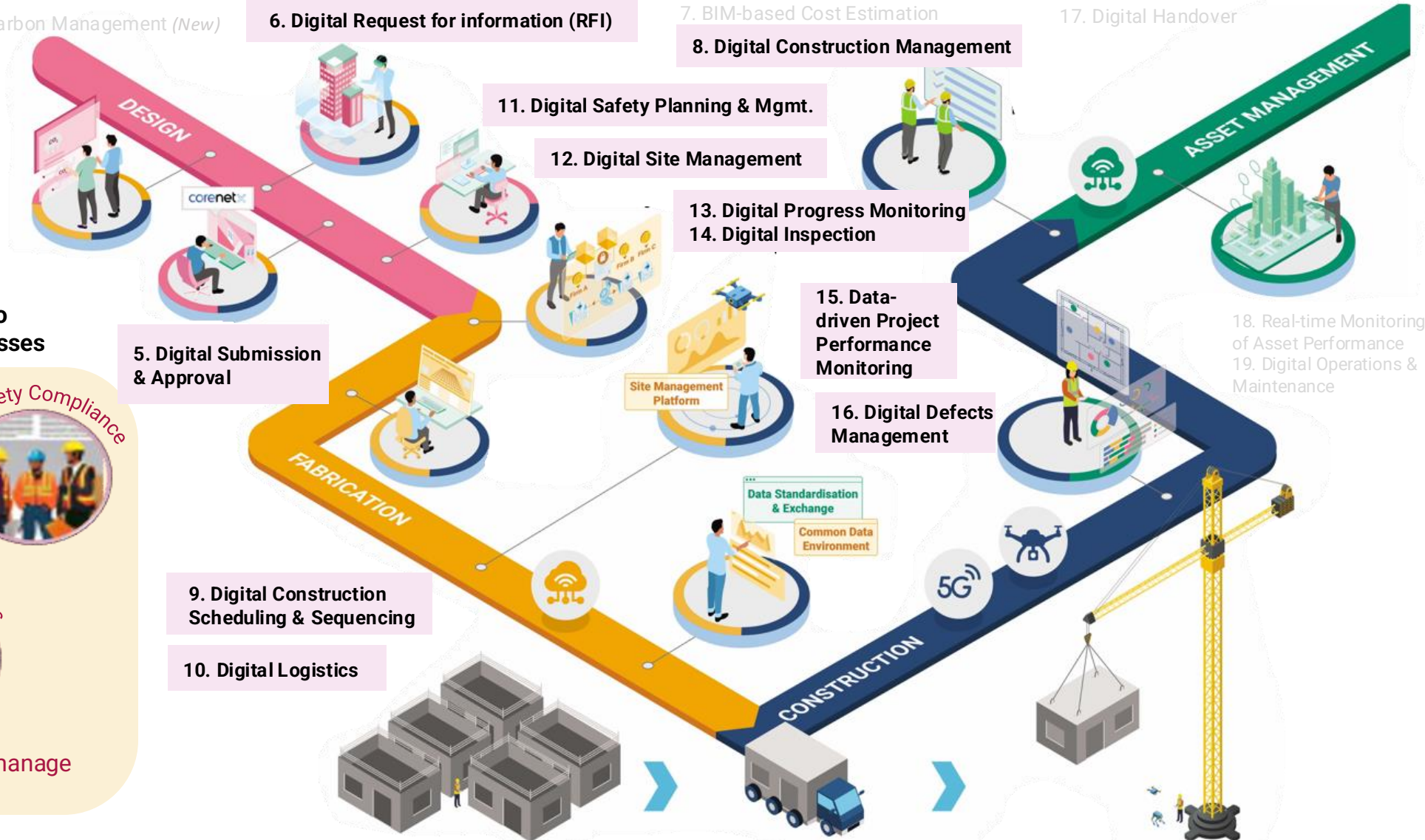
15. **Data-driven Project Performance Monitoring**

16. **Digital Defects Management**

18. Real-time Monitoring of Asset Performance
19. Digital Operations & Maintenance

5. **Digital Submission & Approval**

9. **Digital Construction Scheduling & Sequencing**

10. **Digital Logistics**

DESIGN

FABRICATION

CONSTRUCTION

ASSET MANAGEMENT

Site Management Platform

Data Standardisation & Exchange

Common Data Environment

corenetx

5G

Digitalizing Documents for Audit with Site Management Platforms (SMP)

Current Practice

Structural safety documents and reports are kept as hardcopies with no standardisation.

Pain points

Need physical inspection

No standardisation

Messy and disorganised

Time-consuming

Envisioned Future

Data on these documents and reports can be stored digitally on Site Management Platforms (SMP) to improve collaboration and site supervision.

Example Structural Safety Data

- Site Progress
- Material Test Results
- I&M
- Inspection reports

SMP

Project Parties

- Builder
- Sub-contractor
- QP
- Site Supervisor
- Developer

Intended Outcomes

Improved data accuracy

Improved site supervision

Improved efficiency

Data Analytics

Audit Trail

Understanding SMP's Workflow & Process

SMPs facilitate the digitalization of data from upstreamers and the worksites, allowing firms to analyse trends and make data-driven decisions. The data consolidated could also easily be sent to authorities for more efficient auditing.

Data
- Data from the upstreamers
- Data from the site
- Data for audit/submission

Consultant Office

QP

Official Submissions

Corenet X

BCA

Integration with BCA's system

Data Contributors

e.g. I&M, Material Labs

Using the Data Exchange Platform to connect to Upstreamers

SMP

Systems connected by API

SMP can help to organize submission data

SMP can help to consolidate the required data for BCA's audit

Data Exchange Platform

GPEs & other Regulators

Example Site Data

Safety, Quality, Time, Cost, Productivity (Manpower & Offsite Production) Data

Structural Safety Data

Site Progress   Site Documents   Material Tests   As-built Data   Quality   Personnel Info   Remote Sensors

Industry-Wide Data Standards for Critical Site Datasets
required for Project Performance Monitoring

Cost

Time

Safety

Quality

Productivity

Worksite Safety

Structural Safety

SMP (Regulatory)

Mandatory

For submission

For audit

Good to have

Other Project Data

A&I

BCA has set out the Site Management Data Standards to guide the industry on how to use Site Management Platform and Digitalise their sites.

- **Solution providers are encouraged to comply with BCA's common data standards to ensure a more connected built environment**

Requirements on the data to be kept on SMP
(aligned to regulatory needs)

In **Structured Data** Format
i.e. can be stored in columns and rows

1. Piling Installation Record
2. Working Load Test (WLT)
3. Ultimate Load Test (ULT)
4. Concrete Cube Test
5. Steel Element Test
6. Steel Rebar Test
7. Site Progress
8. QP Attendance
9. Site Inspection & Approval Records (ERSS Annex C-1)
10. Certification & Monitoring Building Settlement (Annex D)
11. Generic Notification Module
12. Instrumentation & Monitoring Records

These data standards covered under
Site Management Data Standards*
(*Live document to be progressively updated)

In **Unstructured Data** Format
e.g. PDFs, photos, videos, reports

1. Pre-con Survey Report
2. Temporary Building Design (COS, PE Design & Layout plans)
3. Steel Mill Cert & FPC
4. MET test results
5. Welding Test Report
6. QP(D) Approval for Proprietary Product
7. 360 Captures
8. Original Reports for structured datasets (if necessary)
9. BCA Permit to carry out structural work
10. BCA Approved drawings/Amendment plans
11. Site Supervision Plan

Please refer to the full data standards:
https://go.gov.sg/datastd

A&I understand that different firms currently have different level of readiness in digitalisation. For more digitalised sites, the documents checks would be audited fully remotely, reducing physical touch points and improving efficiency.

Level of Site Document Digitalisation

Level 0	Level 1A	Level 1B	Level 2A	Level 2B	Level 3

Physical Documents

Digitised Documents

Structured Data
(as to BCA Data Standards)

Connected Data

| All site documents maintained in **hard copy, physical format** | Mixture of site documents in **hard copy and PDF (unstructured)** | All site documents in **PDF (unstructured)** | Mixture of site documents in **PDF (unstructured) + structured data** | All site documents in **structured data** | Site documents are connected via **Exchange Platform** |

Current

Site Management Platforms (SMPs)

No changes to the current BCA document audit

Fully remote digital document checks

For digital document check, BCA officers would be given access to the SMPs to view the required documents, removing the need for physical document on site. The BCA site checks would then be able to be focused to the site works.

Good practice of filing the documents according to the Data Standards headers
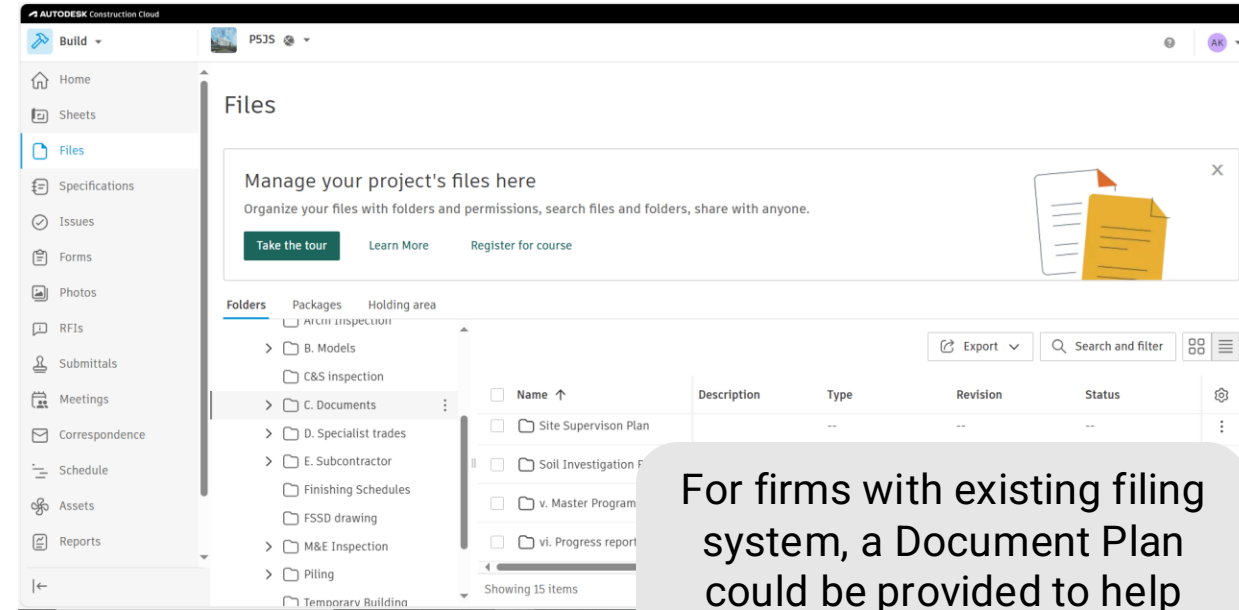
For firms with existing filing system, a Document Plan could be provided to help BCA navigate the platform

## Level 1 or 2 Audits

Firms to consistently file the required document in their SMP

Firms would arrange the document and provide a guide to BCA officer on how to navigate their SMP

BCA officer will conduct the required checks and contact the RE/RTO if any issues were found

As more sites become digitalized, more SMP would need to send data from their site to BCA. Thus, it would make sense for SMPs to be connected to a Data Exchange Platform.
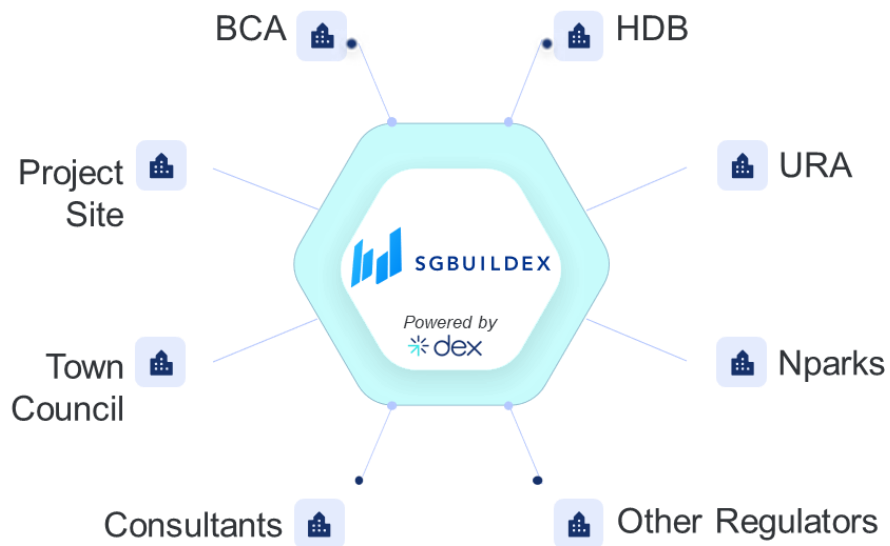
Increasing connectiveness between the various stakeholders through a data exchange platform
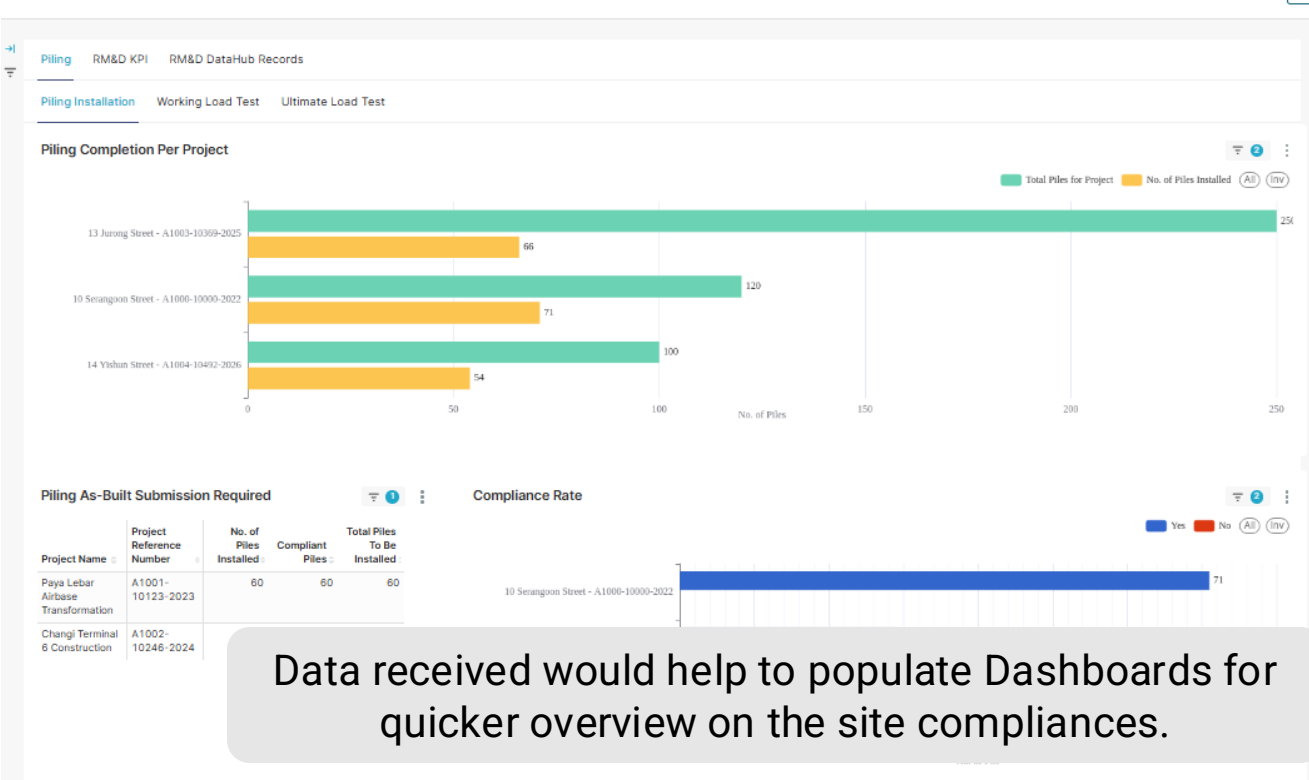
Data received would help to populate Dashboards for quicker overview on the site compliances.

Level 3 Audits

Firms to consistently file the required document in their SMP

SMP would send the required documents through the data exchange platform for BCA audits

BCA officer will conduct the required checks and contact the RE/RTO if any issues were found

Virtualisation of Site Inspections

Virtual Inspection with 360 Capture

Why 360 Capture
- Ready Technology
- Generally, more affordable for industry compared to more advanced tech like LiDAR
- Industry have also been using it

360 Capture could create a digital twin of the physical site and users can move around seamlessly like in Google Street View

360 Capture uses 360 camera to give a 360 view at the point
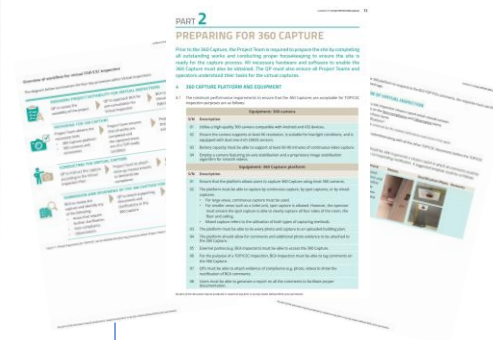
Virtual TOP Journey
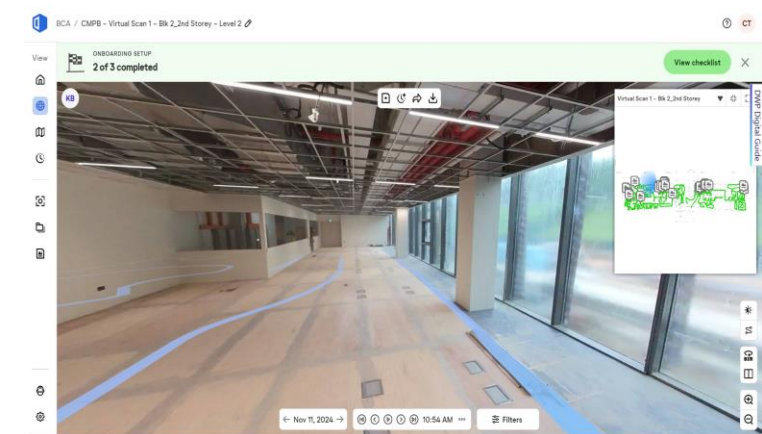
BCA worked with JTC to pioneer virtual inspection at SemiconSpace in 2022.
Thru the experience, shape the virtual TOP process and requirements

Developed the guidebook for VI for industry to adopt the processes.

Mega projects like PDD adopted a hybrid Virtual TOP inspection where the project was divided into areas covered by virtual inspections and key areas covered under physical inspection.

2023

2024

2025

Pilot with Teambuild at Keat Hong Verge to work out Virtual inspection for HDB projects

Inaugural Smart inspection Seminars to share the use of virtual 360 capture as an alternate TOP inspection

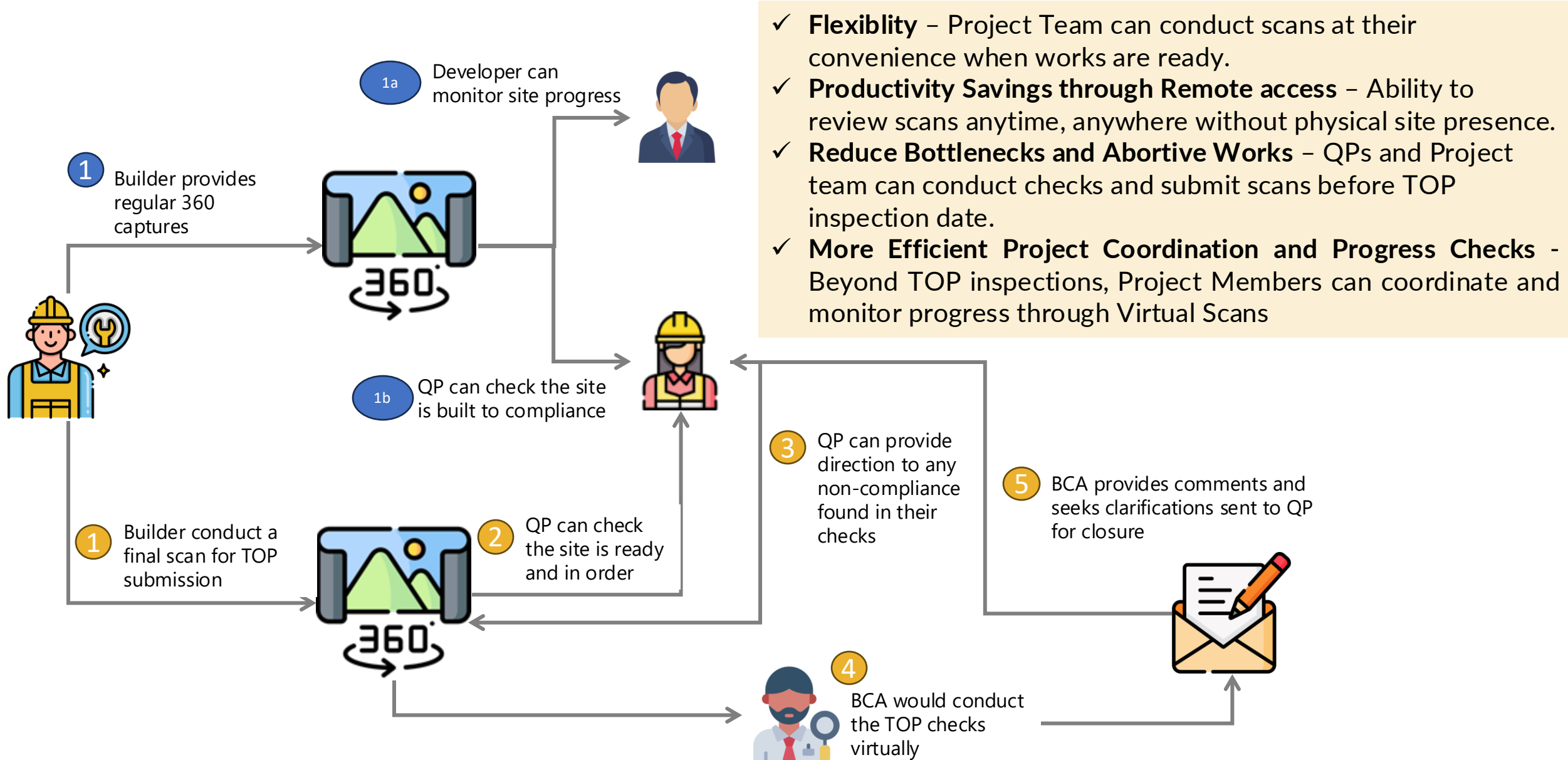Pilot with CDL at City Square Mall A&A to complete inspections with the mall's continuous operation.

BCA-HDB focus group sessions to share with builders on virtual TOP processes

Working closely with Solution Providers on R&D to advance 360-degree capture technologies

Virtual Inspection Process

1a Developer can monitor site progress

1 Builder provides regular 360 captures

1b QP can check the site is built to compliance

✓ **Flexiblity** – Project Team can conduct scans at their convenience when works are ready.
✓ **Productivity Savings through Remote access** – Ability to review scans anytime, anywhere without physical site presence.
✓ **Reduce Bottlenecks and Abortive Works** – QPs and Project team can conduct checks and submit scans before TOP inspection date.
✓ **More Efficient Project Coordination and Progress Checks** - Beyond TOP inspections, Project Members can coordinate and monitor progress through Virtual Scans

1 Builder conduct a final scan for TOP submission

2 QP can check the site is ready and in order

3 QP can provide direction to any non-compliance found in their checks

5 BCA provides comments and seeks clarifications sent to QP for closure

4 BCA would conduct the TOP checks virtually

3 Simple Steps for Virtual Inspection

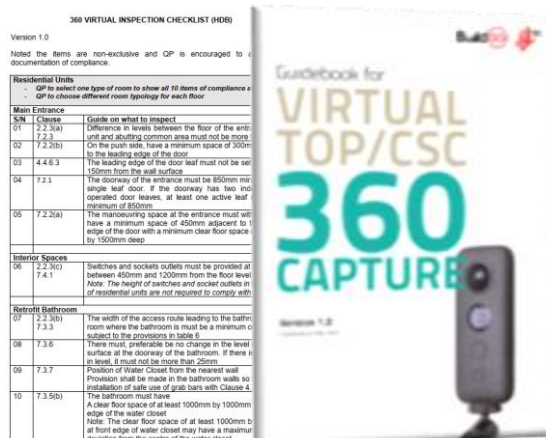| Pre-consultation between project team and BCA officers	Capturing (by project team)	Inspection (by BCA officer)

Industry arranges a pre-consultation with BCA on the virtual inspection for TOP
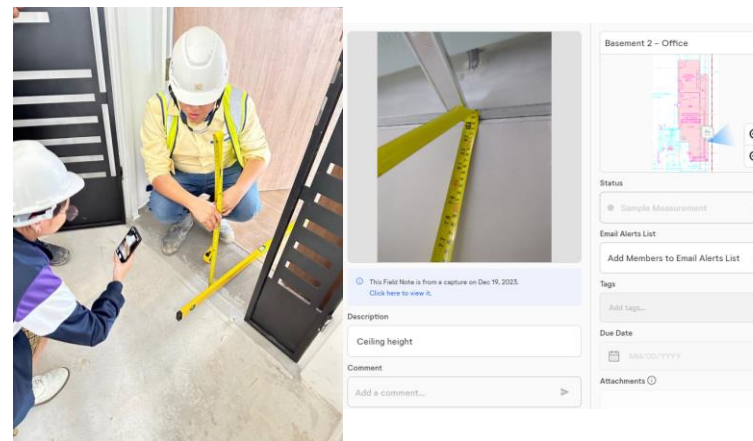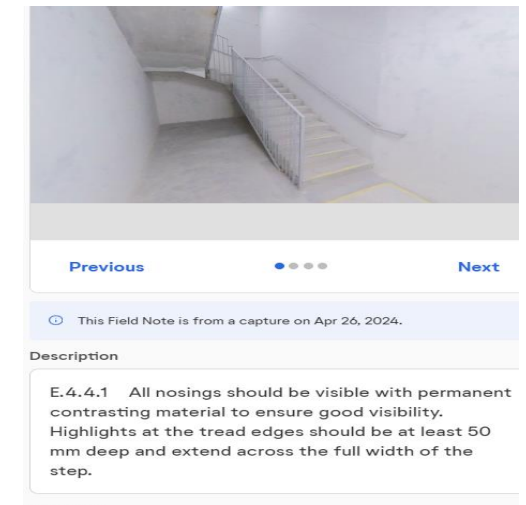

Project team conducts their capture using 360 cameras

BCA officer reviews the captures and check for any non-compliances

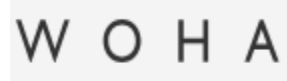Guidelines for industry to prepare for the virtual TOP inspections

Picture evidence is attached to the capture, to show compliance to requirements

More than 50 projects have completed virtual inspections with the support of industry partners

OUR PARTNERS

Grove Spring @ Yishun

Punggol Digital District

NS Hub

"A detailed 360° Visual Recording isn't just documentation — it's our commitment to truth, transparency, and technology. It reminds us that excellence begins with accountability, and that doing the right thing starts with seeing everything clearly and self-regulating at every step."

- Teambuild -

"This digital platform not only streamlines the TOP process but also serves as a comprehensive archival tool. These digital records prove valuable for further post TOP downstream processes, such as for handover or defect records and facilities management (FM) maintenance documentation."

- JTC -

Virtual TOP streamlines the entire TOP process by providing the Qualified Person with remote access to comprehensive visual records for inspection, direct annotation capabilities, and a seamless digital communication channel with the BCA. This integrated technological approach expedites approval timeline and enhance overall project efficiency."

- DP Architects -

Apart form 360 Capture, there are emerging technologies that could be also use for virtual inspections.
A&I would set up the various guidelines for different firms (at their different readiness in virtual technologies) to adopt more productive technologies for inspections.

Alternate Inspection types
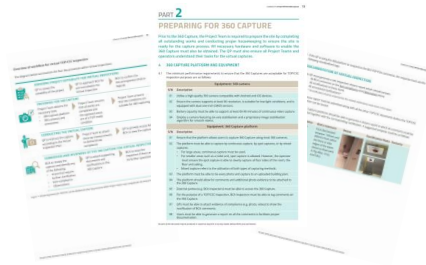
Physical Inspection

Physical Inspection would still require the booking of BCA officers to conduct the checks on-site.

360 Capture Inspection

The use of 360 Capture together with photos to show compliances would replace the physical inspection.
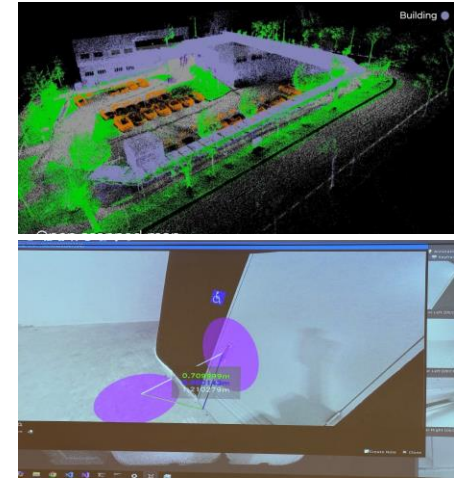

The 360 Capture guidebook set up the processes and what is needed to adopt virtual TOP inspections.

LiDAR Inspection

The use of LiDAR would enable dimensional measurement checks and this would reduce the photos required to be attached to show dimensional compliance.

Coming soon

A&I is working with progressive firms to set up the process for LiDAR Virtual TOP Inspections to cater another alternate process for those ahead of the curve

Find out more about which solution best suits you	**Transform current process to smarter inspection process**	**Co-create the future for Smart Inspections**
1) Visit the different solution providers in our Tradeshow and Tech Talks in the afternoon	1) Work with BCA and other industry partners to adopt SMPs and virtual inspections for TOP	1) Join us in pilot for the different initiatives (e.g. connecting to the Data Exchange Platform and LiDAR)
2) Work with your preferred solution providers to enhance your current processes	2) Contact BCA to kick start the new smart inspection processes like how many of your peers have already done so	2) Join us to build use cases in virtual and digital inspections and share the success story with us to further inspire the industry

Join us to co-create the future of Ops-Tech and data driven inspections for built environment

The End

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