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# Updates on Smart Inspection Initiatives

29th May 2026

Presented by:

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Audit and Inspection Group

# Shaping a Safe and Liveable Built Environment

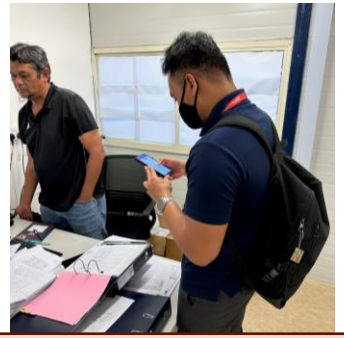
Audits, Assessments, and Inspections conducted throughout the construction phases for user safety, accessibility, and construction quality

## Engineering Inspections
(Structural, CD Shelter, Buildability Inspections)

Checks that shelters are built as designed

Checks on the deployment of productive technologies

Inspection for any non-authorized works



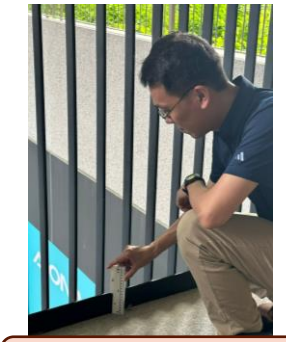
Ensuring proper site documentations

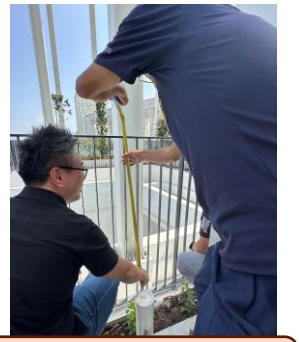
## Quality Assessments

Assessments on Construction Processes

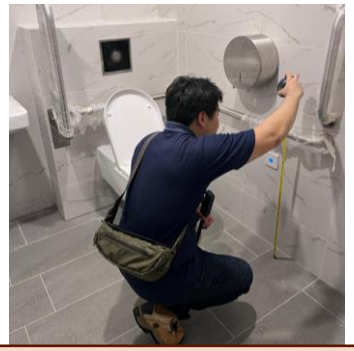
Assessments on Construction workmanship

## TOP/CSC





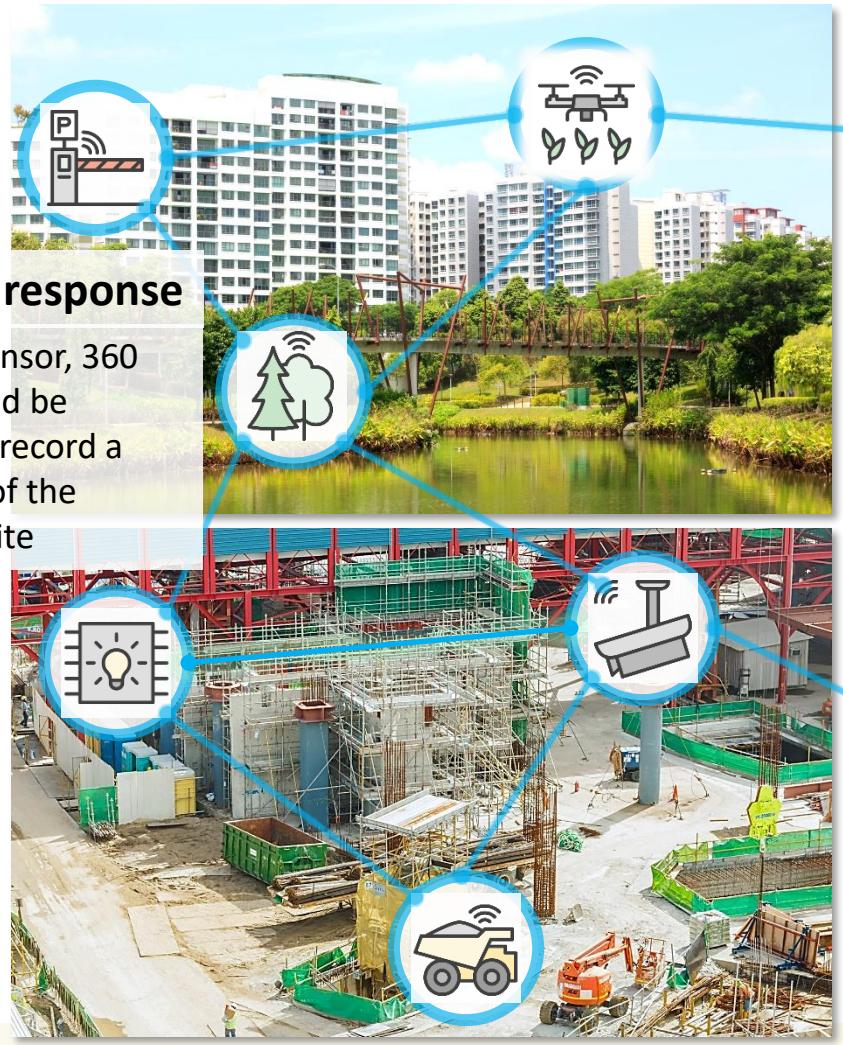
Checks on building safety



Checks on Accessibility Provisions

# Future of the Built Environment

The envisioned future of the built-environment is digitalised and data driven, enabling both the industry and public agencies to tap on digital platforms to enhance safety and improve productivity.



## Real time response

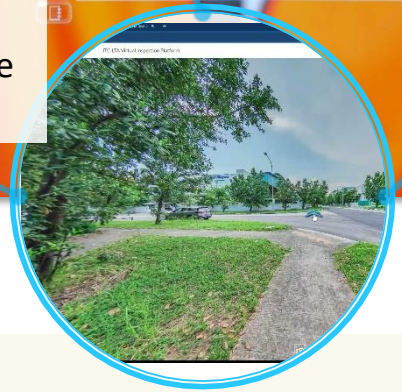
E.g. CCTV, sensor, 360 Capture could be deployed to record a digital twin of the building or site

## Predictive Analysis for efficient resource deployment

E.g.. Focusing resources on areas that are of highest risk

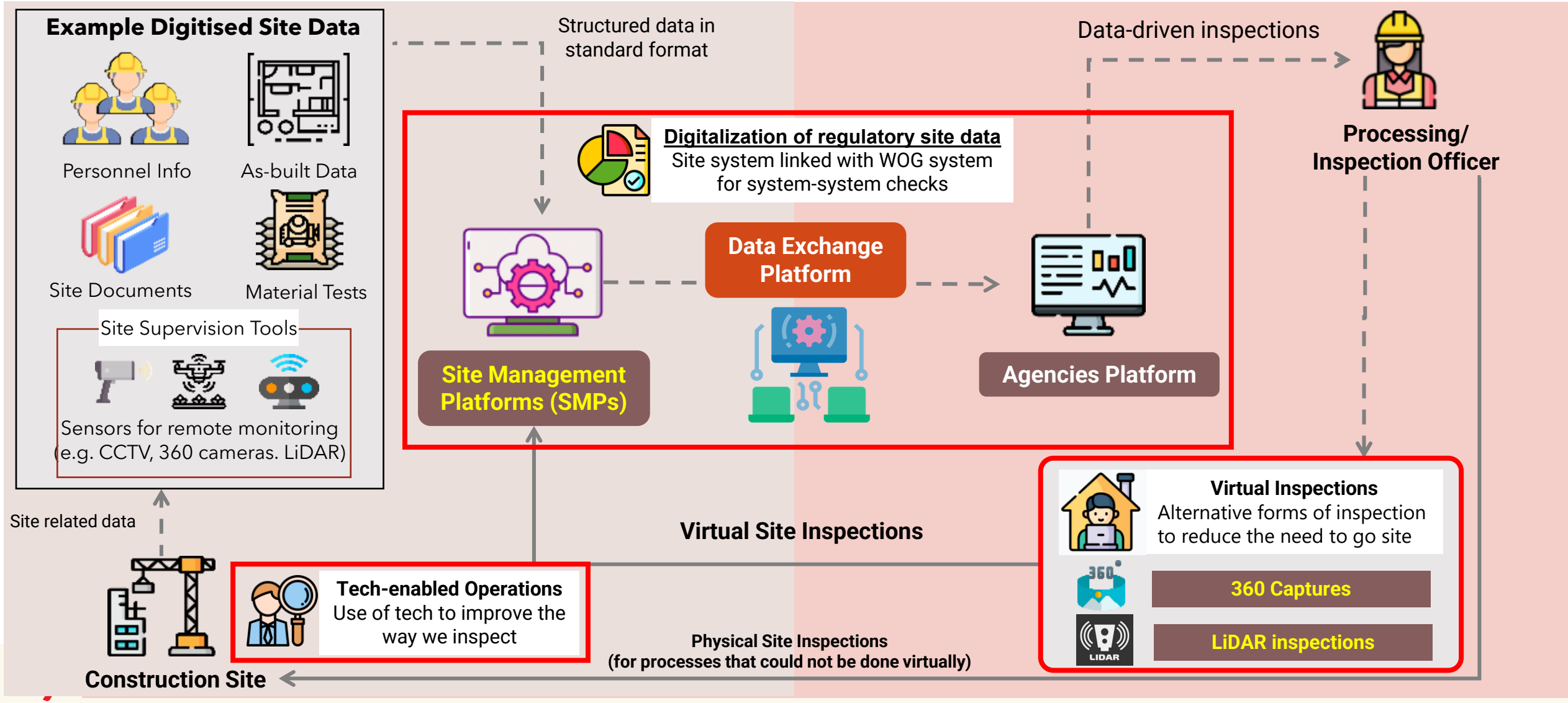
## Preventive Intervention

E.g. data can be used to analyse and identify potential areas to make data-driven decisions



# Overview on the Smart Inspection Initiative

To move towards the envisioned future of a data driven smart regulator, BCA is looking at 3 key areas to digitalise inspections and virtualising regulatory checks to become more efficient and effective.



# Digitalization of regulatory site data

# SMP as part of the strategy to achieve IDD

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

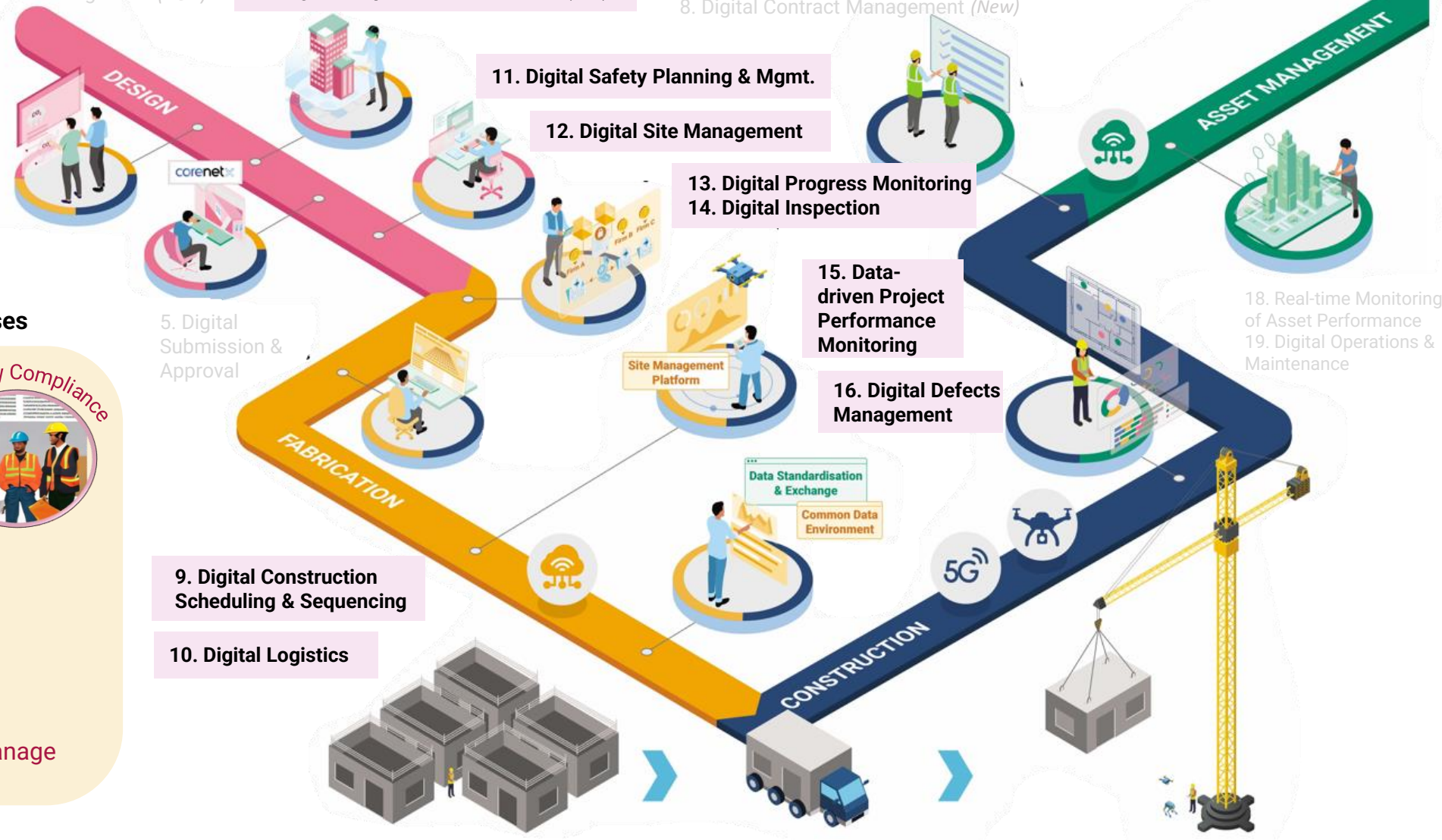
**Legend:**

**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
5. Digital Submission & Approval
6. Digital Request for information (RFI)
7. BIM-based Cost Estimation
8. Digital Contract Management *(New)*
9. Digital Construction Scheduling & Sequencing
10. Digital Logistics
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
17. Digital Handover
18. Real-time Monitoring of Asset Performance
19. Digital Operations & Maintenance

**Site Management Platforms to manage data and digitalise processes**


Different solutions are available to manage these use cases of IDD



# Publication of SMP Guidebook

BCA has worked closely with the progressive partners to consolidate industry knowledge into publications that could help provide adequate guidance for firms to kick start their journey in digitalisation.

**A**


**SMP Guidebook Part A: For Solution Provider**
To share the overview of the SMP initiative and to bring digital specialists to onboard the vision.

**Site Management Data Standards Guidebook**
The industry joint effort to standardise the data standards to bring about a common language in the digital built environment

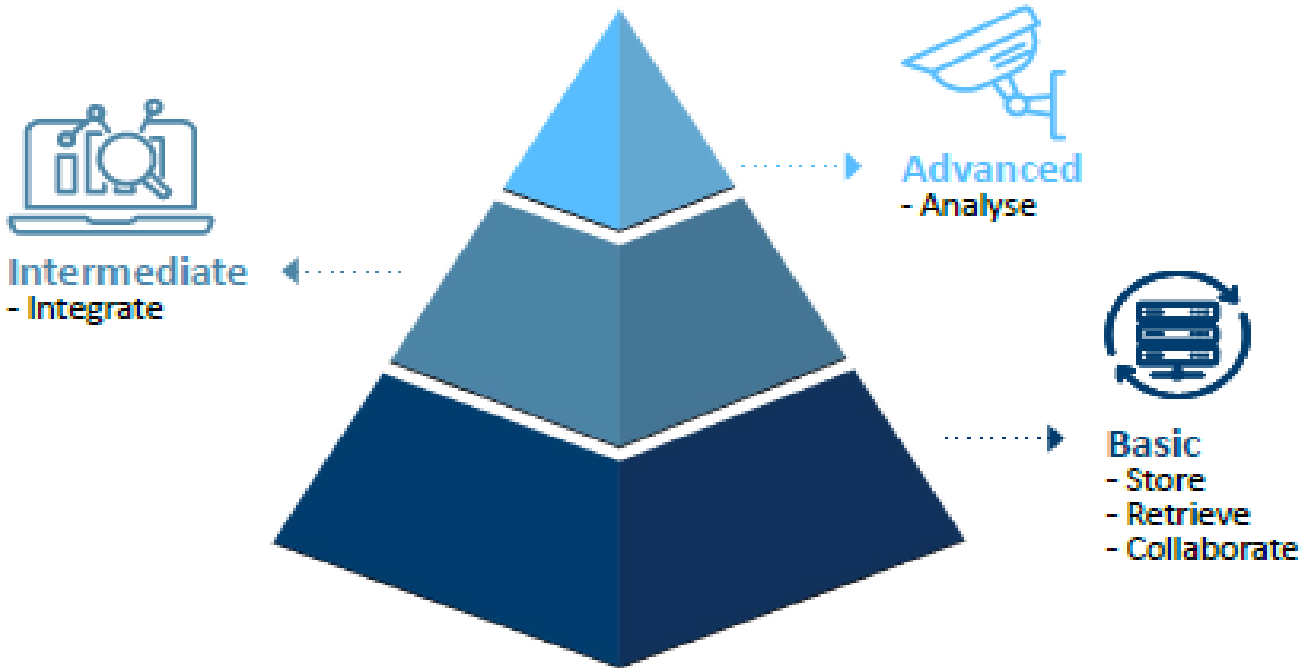
**B**


**SMP Guidebook**
**Part B: For Industry Stakeholders**

- What are SMPs and Data Exchange Platforms
- Different levels of digitalisation to facilitate regulatory document audits
- Progressive Industry Partners Digital Use cases that industry can learn from
- How to kick start the journey

# Digitalizing Documents with Site Management Platforms (SMP)

Site Management Platforms (SMPs) are centralised digital systems that capture and manage construction site data, turning it into a strategic decision-making tool for project stakeholders to enhance efficiency, productivity, progress, safety, and quality performance at the construction stages




**Advance SMP**
Unlocking the potential of data to draw insights for more data-driven decisions

**Intermediate SMP**
Breaking down silos and linking different systems, platforms and sensors together to connect the dots between different datasets

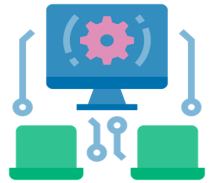
**Basic SMP**
Digitalising data to move from hardcopy to softcopy, which enables better transparency and traceability when managing the data.
Digital processes also enhances seamless collaboration between project parties

We encourage the industry to digitalise with more advanced SMPs to draw out the potential of site data from previous siloed system or hardcopies records

# SMP Digital Readiness and Regulatory Audits

BCA 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**

**No changes to the current BCA document audit**

**Site Management Platforms (SMPs)**

**Fully remote digital document checks**

# Use case beyond Regulatory use cases

However, the key benefits of SMPs goes beyond regulatory compliance. Using data for more insights and in the different IDD use cases

**Key SMP-related IDD use cases include:**

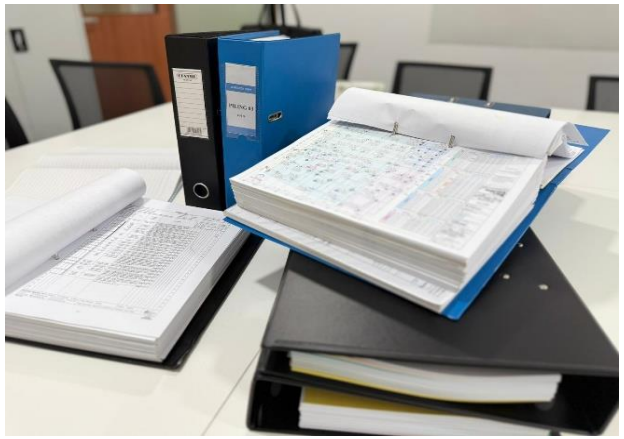
- Digital Request for Information (RFI)
- Digital Progress Monitoring
- Digital Construction Scheduling and Sequencing
- Digital Inspection
- Digital Logistics
- Digital Defects Management
- Digital Safety Planning and Management
- Data-driven Project Performance Monitoring
- Digital Site Management

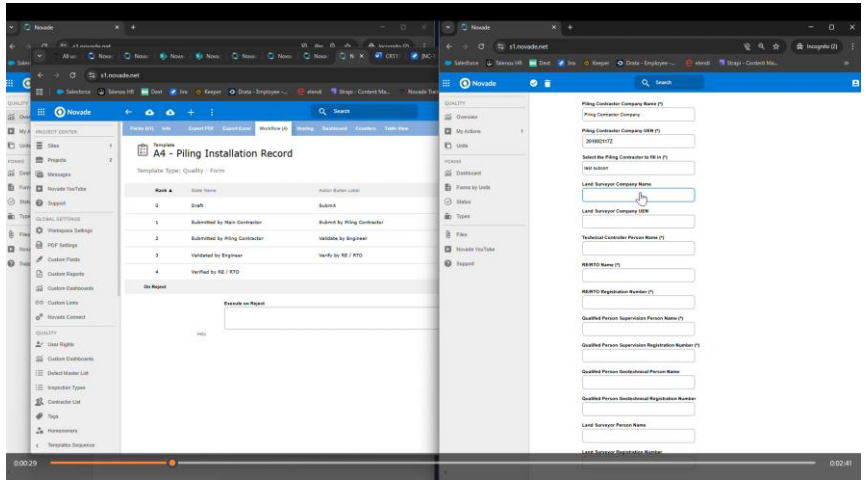
Through our industry Focus Group Discussions, participants have shared the benefits of digitalisation using digital platforms, such as:

1) Savings on administrative processes
2) Information readily available at their fingertips
3) Reduced wastage, promoting greater sustainability (e.g. less paper on site)

**BCA would continue to organise industry consultations. Reach out to tell us more on how you use your digital data!**

# Sharing from progressive partners use cases






**"… By adopting digital platforms for site management, we not only enhance compliance and minimise paperwork but also gain valuable real-time insights that benefit the whole project team…"**

- Wee Hur Construction Pte Ltd

**"… our company has streamlined compliance workflows, reduced duplication of effort, and built a foundation for datadriven project delivery. It has transformed how we manage regulatory data – from a manual process to an integrated digital ecosystem…"**

- Rich Construction Company Pte Ltd

**"… Importantly, this digital transformation was achieved with minimal disruption to existing workflows, demonstrating that regulatory data management can be significantly improved without compromising operational continuity…"**

- Takenaka Singapore Pte Ltd "

# Digitalizing of the construction Site

Beyond just digitalising records , BCA also envisions the industry further connecting to other systems, sensors and supervision platforms to layer additional useful data that helps projects better manage their sites.


Integrated with the approved BIM, Plan for drawing design data and general project fields

IoT integration such as sensors on piling rigs

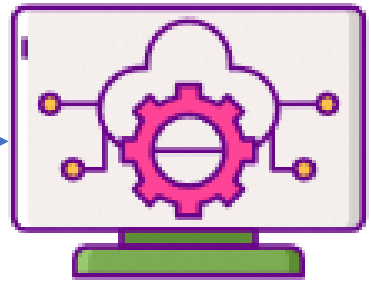
Site Supervision Tools

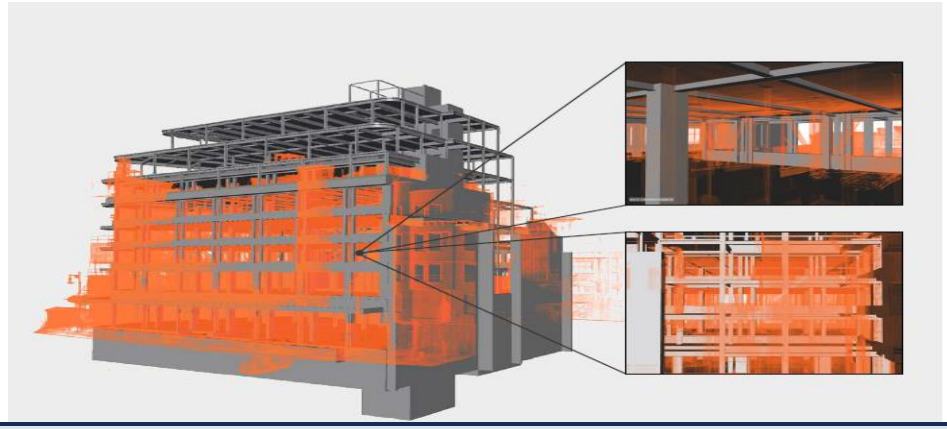
Sensors for remote monitoring (e.g. CCTV, 360 cameras. LiDAR)

Integrations with site supervision platforms to obtained the virtualised site digital twin data

Integrate to Data converters (e.g. OCR, AI converters)

## SMP

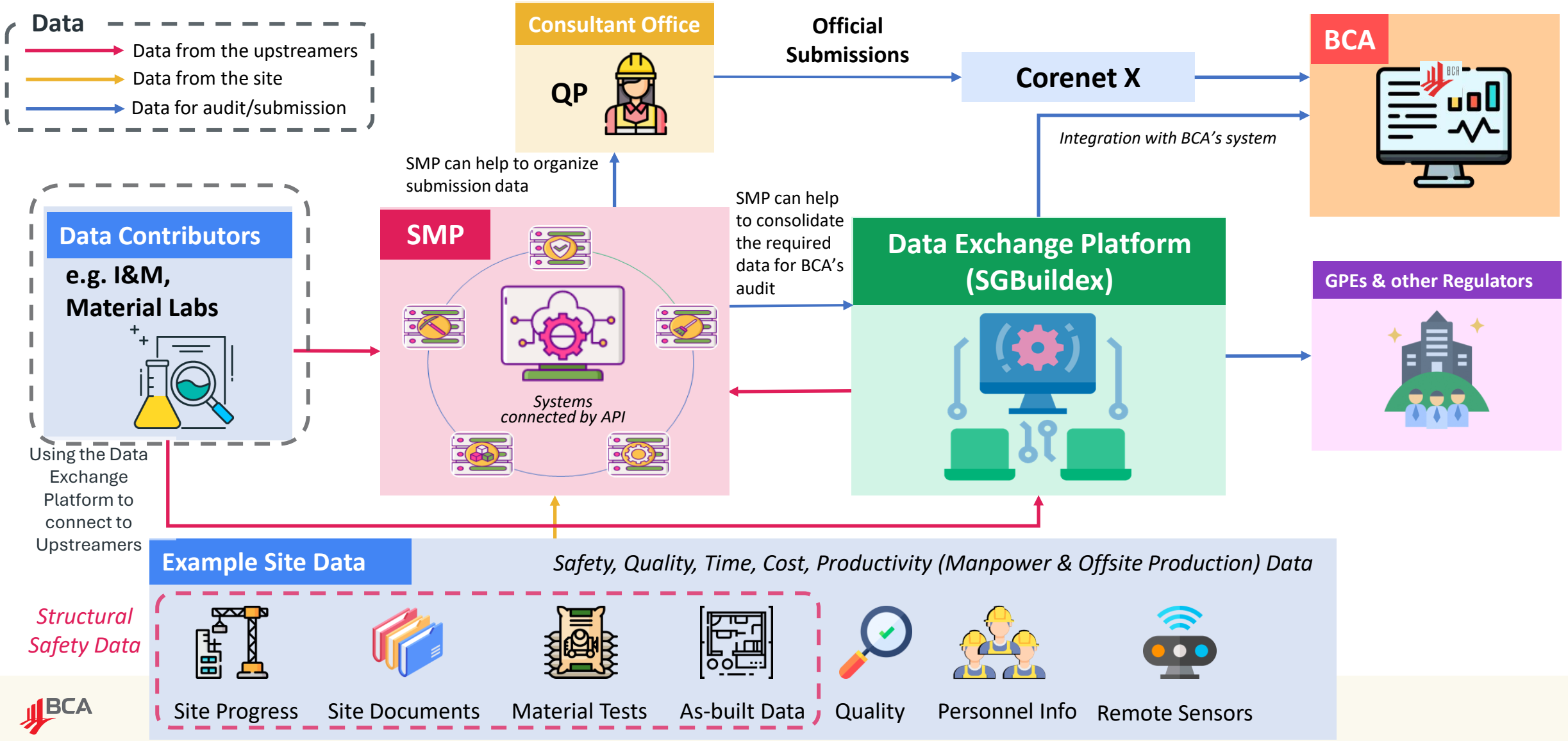




A data rich site management platform for project team to better manage their projects

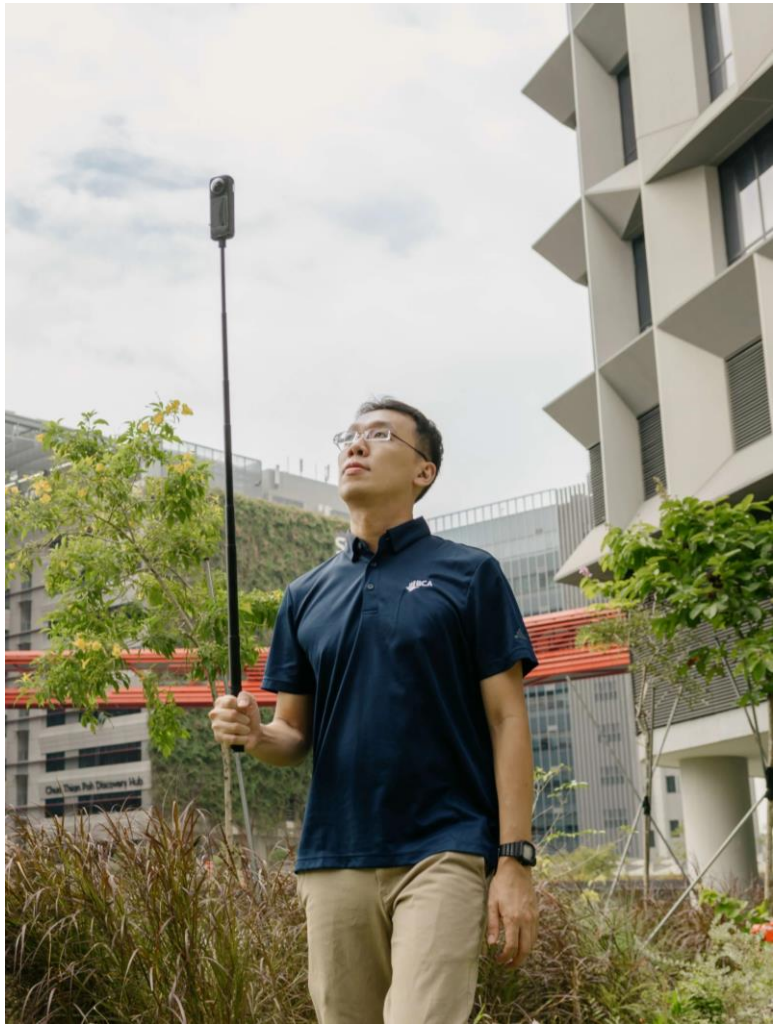
# Envisioned SMP's Workflow & Process

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 via data exchange platform for more efficient auditing.

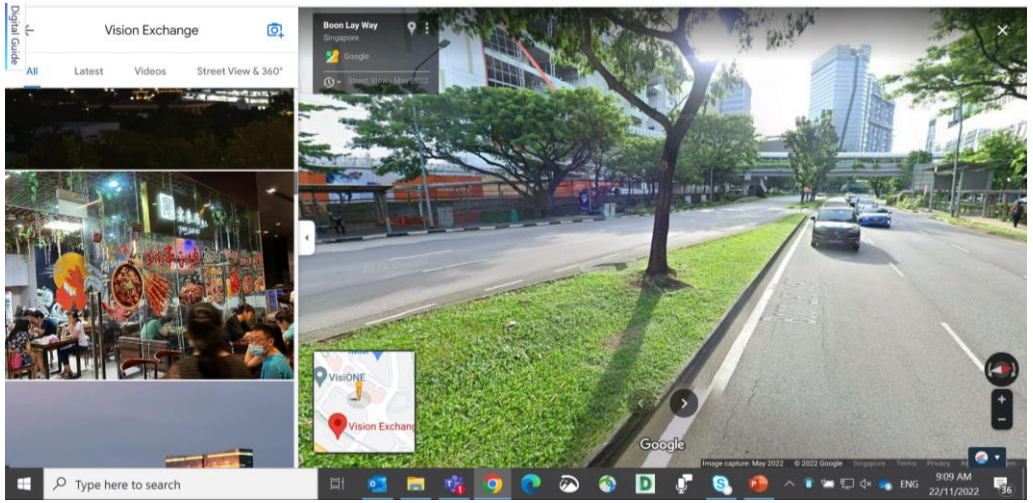


# Virtual Inspections

# Virtual Inspection with 360 Capture



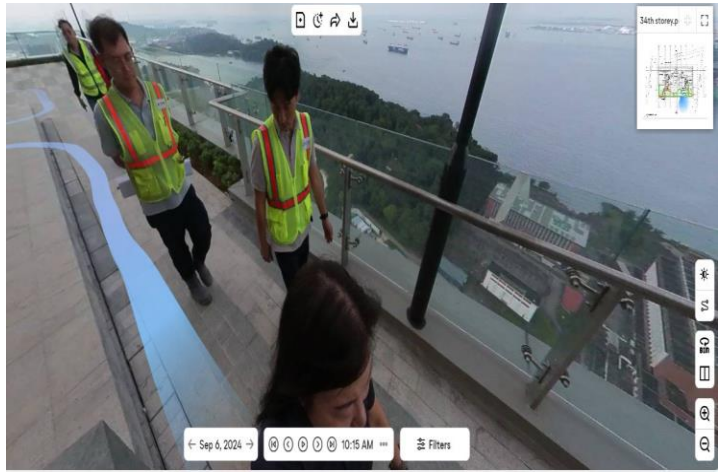
360 Capture uses 360 camera to give a 360 view at the point

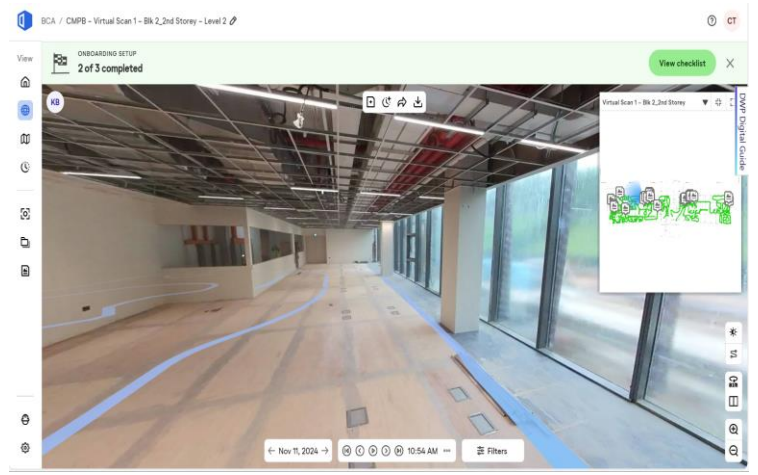



Why 360 Capture

- 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





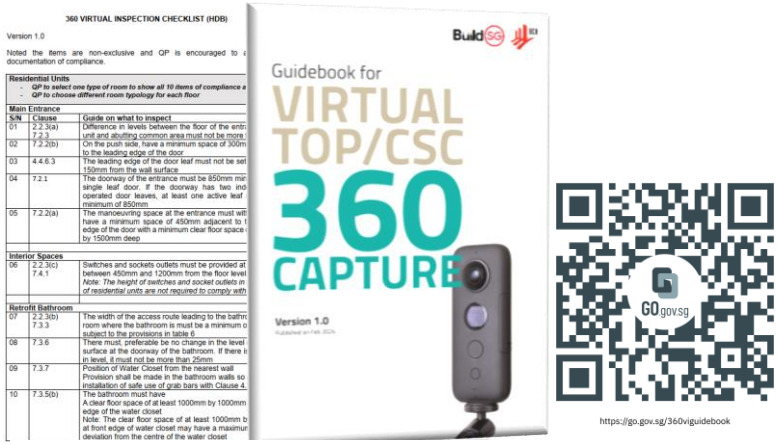
# The Virtual Inspection Process

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

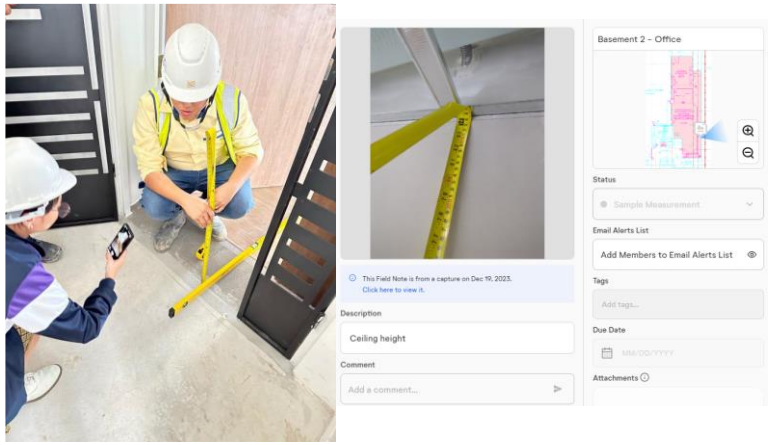
Industry arranges a pre-consultation with BCA on the virtual inspection for TOP

Project team conducts their capture using 360 cameras

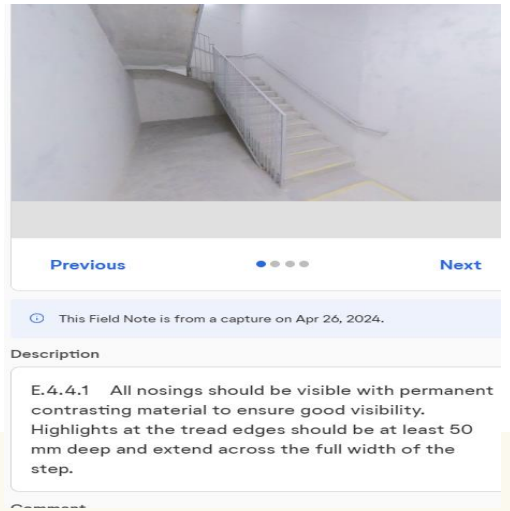
BCA officer reviews the captures and check for any non-compliances




Guidelines for industry to prepare for the virtual TOP inspections

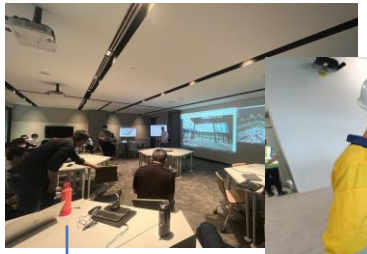



Picture evidence is attached to the capture, to show compliance to requirements



# Virtual TOP Journey

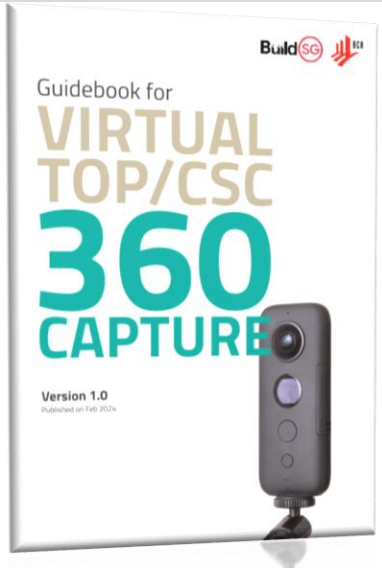
BCA worked with JTC to pioneer virtual inspection at SemiconSpace in 2022.
Thru the experience, shape the virtual TOP process and requirements



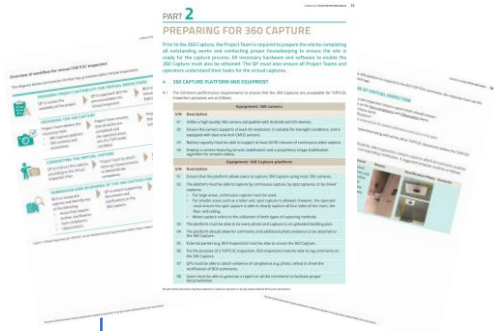
## 2023

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




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




## 2024

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

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.

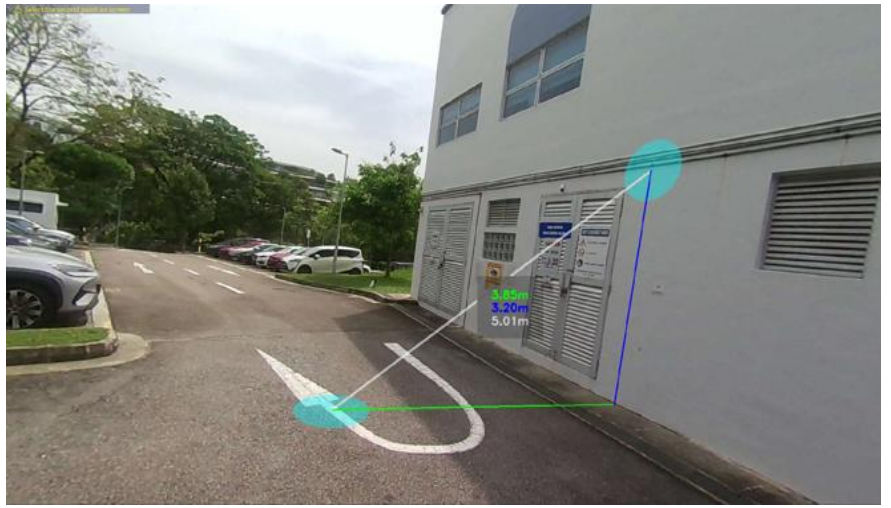
## 2025

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

# Publication of Guidebook for Virtual Inspection LiDAR

Recognising limitations in 360 capture in terms of dimensional measurements and with feedback from the industry to explore LiDAR BCA has worked with industry champions to develop a guidebook on the use of LiDAR for TOP inspections.


With many different ways to capture LiDAR scans, LiDAR scans is now much easier, faster with the right hardware.



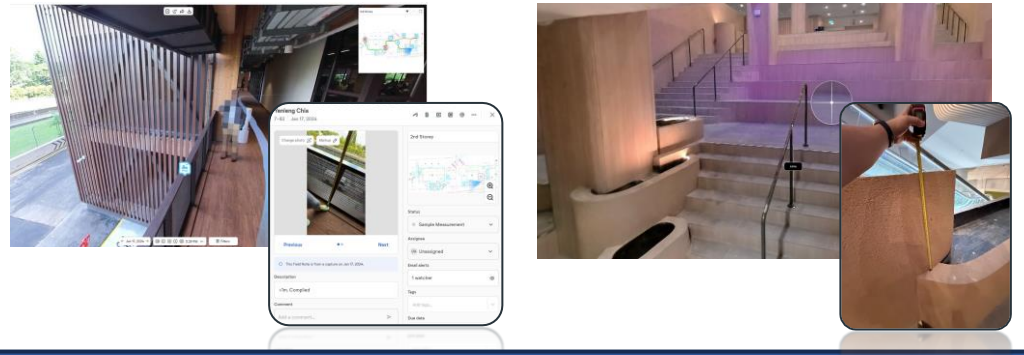

Current LiDAR and photogrammetry technologies have enabled the recreation of immersive digital scans with measurements

## What is in the guidebook?

- What is LiDAR
- Limitation of LiDAR tech for Virtual Inspections
- Technical Requirements for Virtual Inspections
- Updated process for Virtual Inspection

# BCA Toolkit for Virtual Inspection

Virtual inspection does not need to be limited to just 360-degree captures, and BCA will progressively provide different pathways and guidelines for the industry to adopt the technology best suited to their business needs

| | Physical Inspection for TOP (baseline) | 360 Capture or LiDAR Inspection for TOP | LiDAR Inspection for TOP |
|---|---|---|---|
| |  |  |  |
| **Classification (for BCA VI)** | Physical Inspection | Digital Visualisation | Digital Dimensional Measurement |
| **What features the platform needs to have to qualify for BCA VI ready** | | 1 Able to provide a Virtual Digital Twin environment for user to "walk" around<br>2 Able to pin comments on the platform for users to view and collaborate<br>3 Able to attached sample measurement pictures<br>4 Able to generate inspection/closure reports | 1 Able to provide the system Accuracy Range<br>2 Have features to assist digital measurement to reduce human errors |

**Virtual Inspection platforms would be classified according to the features that it can meet**

VI product vendors are encouraged to reach out for product evaluation to shorten the review process for project submissions

# BCA Toolkit for Virtual Inspection

Virtual inspection does not need to be limited to just 360-degree captures, and BCA will progressively provide different pathways and guidelines for the industry to adopt the technology best suited to their business needs

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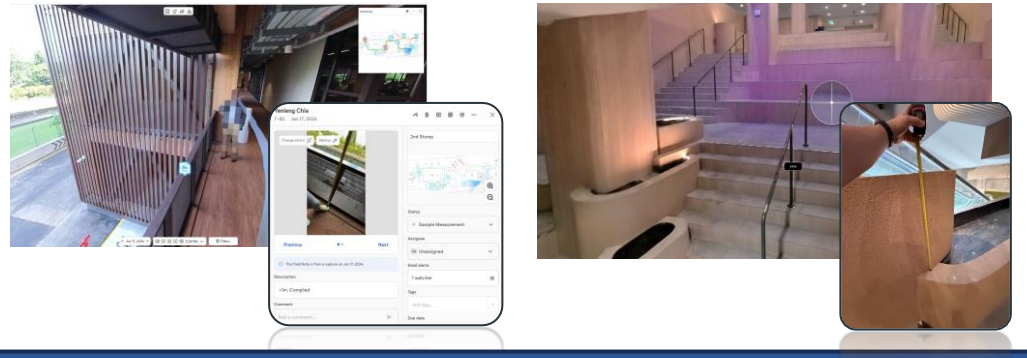
| |  |  |  |
| **Classification** (for BCA VI) | Physical Inspection | Digital Visualisation | Digital Dimensional Measurement |
| **BCA VI Process Requirements** | | **VI requirements**<br>• Submit sample floor scans (Typical and non-typical)<br>• Attach all photo measurement base on checklist | **Reduced VI requirements**<br>• Submit sample floor scans (Typical and non-typical)<br>• Save Digital measurements on platform base on checklist<br>• Photo measurements attachment is only needed for smaller items (<100mm) |

Moving into digital dimensional measurement capability will significantly reduce the preparation time that comes with Virtual Inspection submissions

# Virtualisation of the Construction Site

## Site Data Capture Technologies

### Level 1
Readily available tools & evidences to replace physical inspections

Photo report

Evidence-based submission
Video recordings

Video call

### Level 2
Advanced imaging evidence used for pre-screening or remote assessment

360 Capture

With photo measurements

With mobile LiDAR

With LiDAR camera

LiDAR Capture

With sample measurements

With LiDAR camera

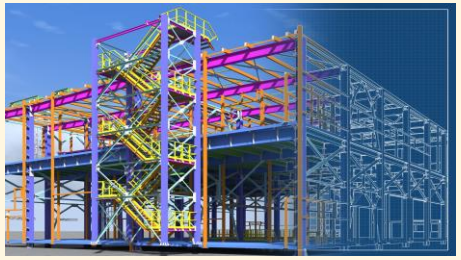
With focused physical inspections (if necessary)

## Site Data Analysis

### Level 3
AI tools to identify non-compliances

AI to auto detect non compliances would achieve significant savings
- Auto detection of objects
- Auto dimensional measurements
- Rule based analysis

### Level 4
Accurate as-built scans-to-BIM submission to BCA



Model checkers to understand as-built models and conduct checks automatically

With sample physical audits

# Envisioned future of the Virtualisation in construction Sites

Future of virtual inspection could be as simple as  submission of as-built scans to BCA without the need to tag or include photos.

Automated interpretation of scans and compliance checks would result in a more efficient process

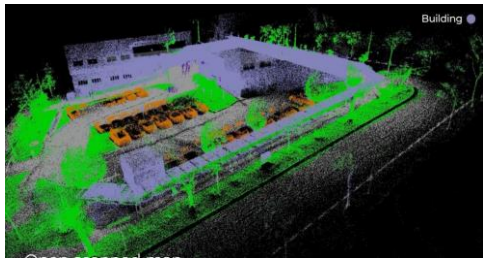
**Industry Virtual Capture devices**

360 Cameras

LiDAR Cameras

**VI Input Data source**

Photogrammetry



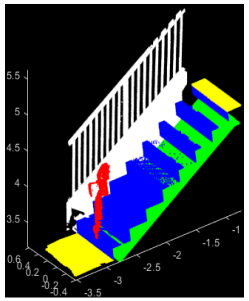

Point-clouds

BCA would accept any form of VI inputs for our inspections

**AI System**


Computer Vision to recognize objects

Re-create the digital model for officer to digitally move around the site



Analytic to segmentize objects in the scan

3 List of Out of Tolerance Items – Architectural

| Item | Element Name | Element Description | Image of Element | Issues |
|---|---|---|---|---|
| 1 | Basic Wall:NC_Partition_JLL_P1_100mm:508790 3 | Partition wall element.<br><br>Length:1850mm<br>Area: 1.852m²<br>Volume: 0.185 m³ | | Offset of ~222 mm (horizontal) to as-designed element |
| 2 | Basic Wall:NC_Partition_JLL_P1_100mm:510119 2 | Partition wall element.<br><br>Length:4650mm<br>Area: 3.991m²<br>Volume: 0.399 m³ | | Offset of ~317 mm (horizontal) to as-designed element |

As-built model rule checks

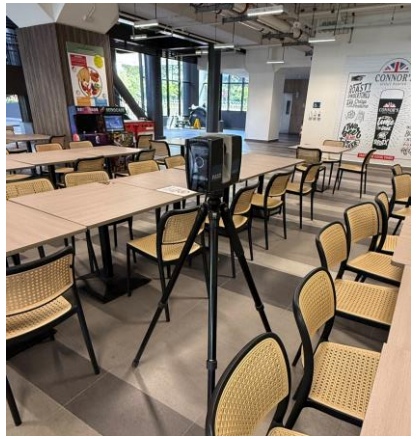
Auto Design to As-built comparison

Backend AI system will auto check and provide a report on compliance. As-built model would also be created for officer to randomly audit beyond the programmed checks

# Further Development of Technology and Processes to support VI

## 1. Simplifying Scanning

To introduce more accessible means of capturing site point clouds while balancing accuracy and cost

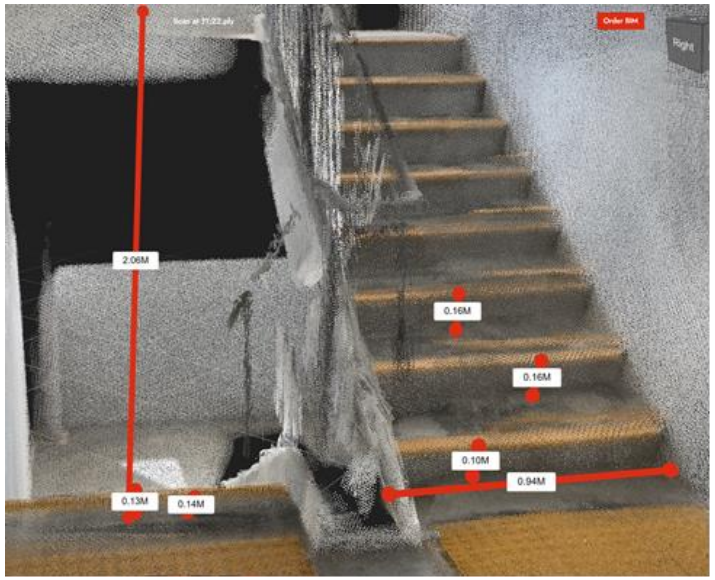


## 2. Automate VI Capture

Partner with solution providers to further automate the Virtual Inspection capture process with enablers such as robotics and drones

## 3. Developing VI Analytic tools

Partner with technology providers to introduce AI analytics capabilities for automated non-compliance detection, reducing inspection time and improving efficiency.



# What's next

Looking forward to further partnerships with industry champions on this digital journey
We can build the envision future of a smarter and more efficient built environment together



GO.gov.sg

https://go.gov.sg/smart-inspections

Building and Construction Authority

# Thank you