

Smart Inspection Industry Sharing 2024

17 April 2024

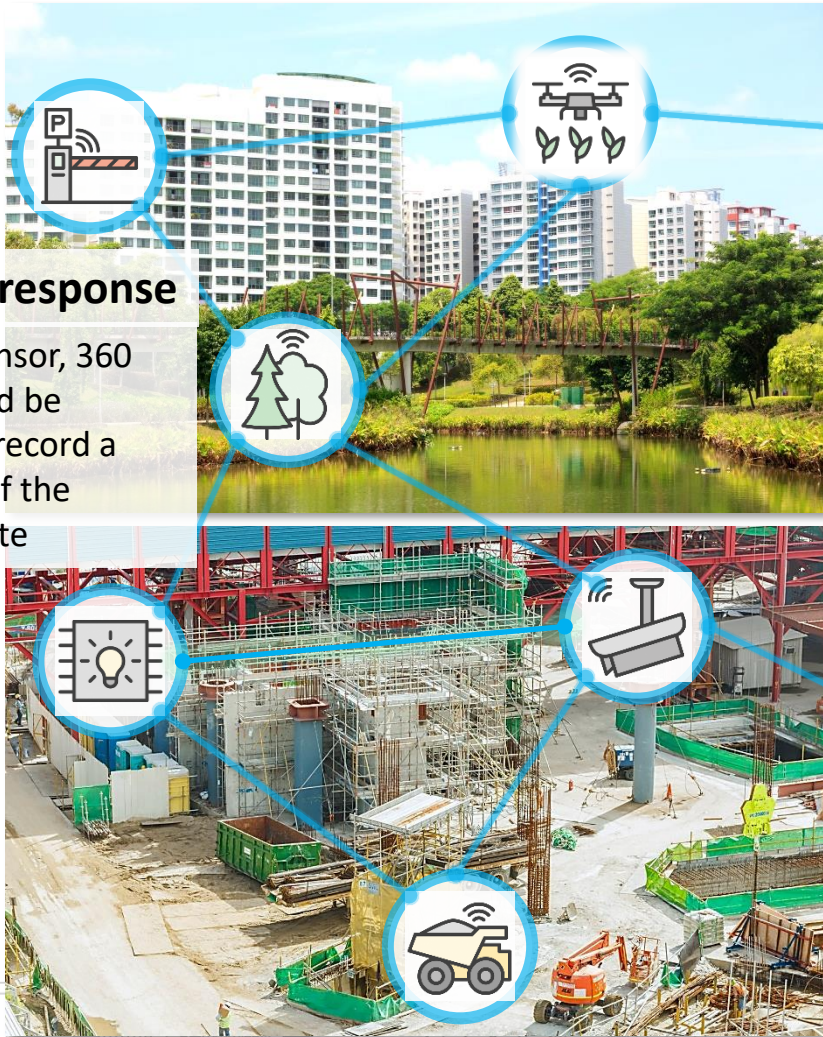
*Presented by:
SM/See Toh Chee Fung
Audit and Inspection Group*



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

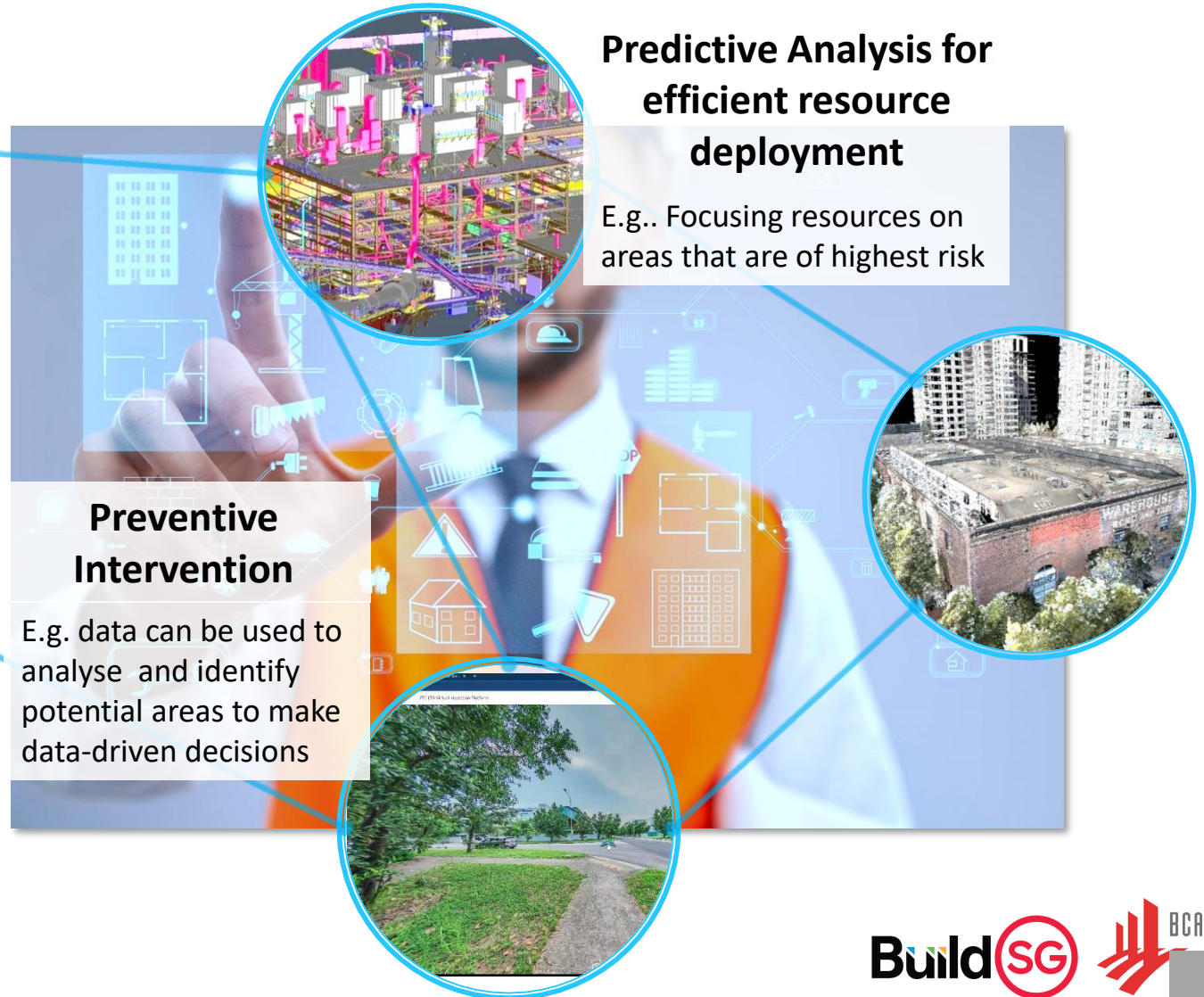


Predictive Analysis for efficient resource deployment

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





Industry Processes

Example Digitised Site Data

- Personnel Info
- As-built Data
- Site Documents
- Material Tests
- Sensors for remote monitoring (e.g. CCTV, 360 cameras)

Structured data in standard format

Site Management Platform

Site related data

Construction Site

BCA Document Audits
Send documents for submission and audit via API

Data-driven inspections

BCA system

BCA Processes



BCA Processing/ Inspection Officer

Virtual & Remote Inspections

- 360 Capture for virtual inspections

Tech-Enabled Inspections

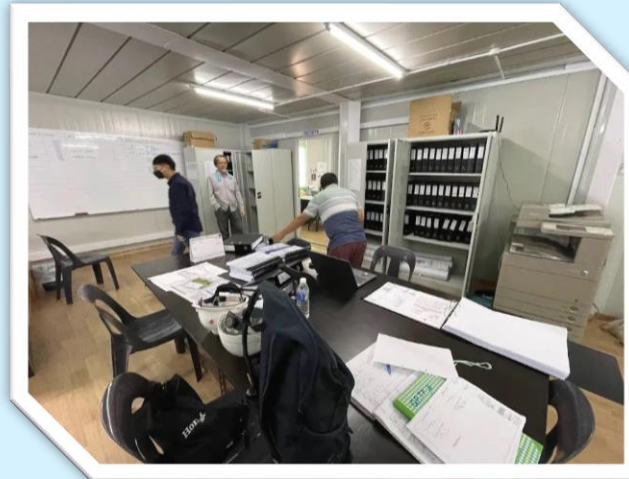
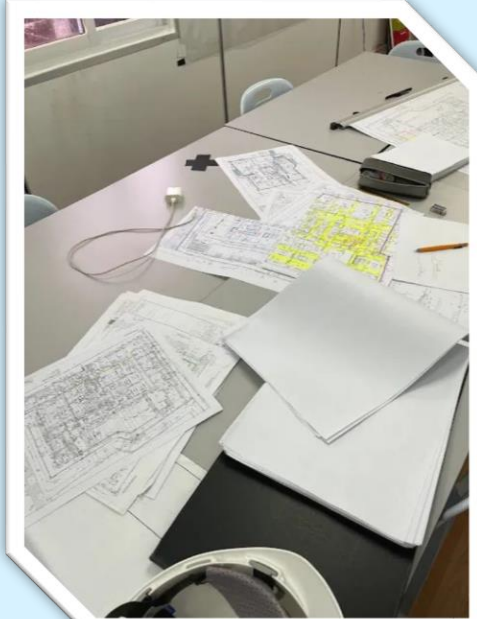
- OpTech Tools to aid officers in their Physical inspections

Site Management Platforms

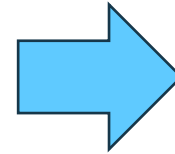




What if we can move away from this ...



To this

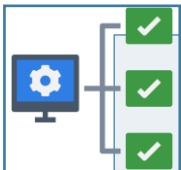




Site Management Platforms can consolidate data from the site to



Improve collaboration and communication between stakeholders



Improve integrity of data recorded on site



Streamline administration and documentation processes



Provide an overview of the site and improve supervision





- 1** Systems used by data upstreamers like I&M companies and material testing labs can also be integrated with SMPs to streamline data flow.

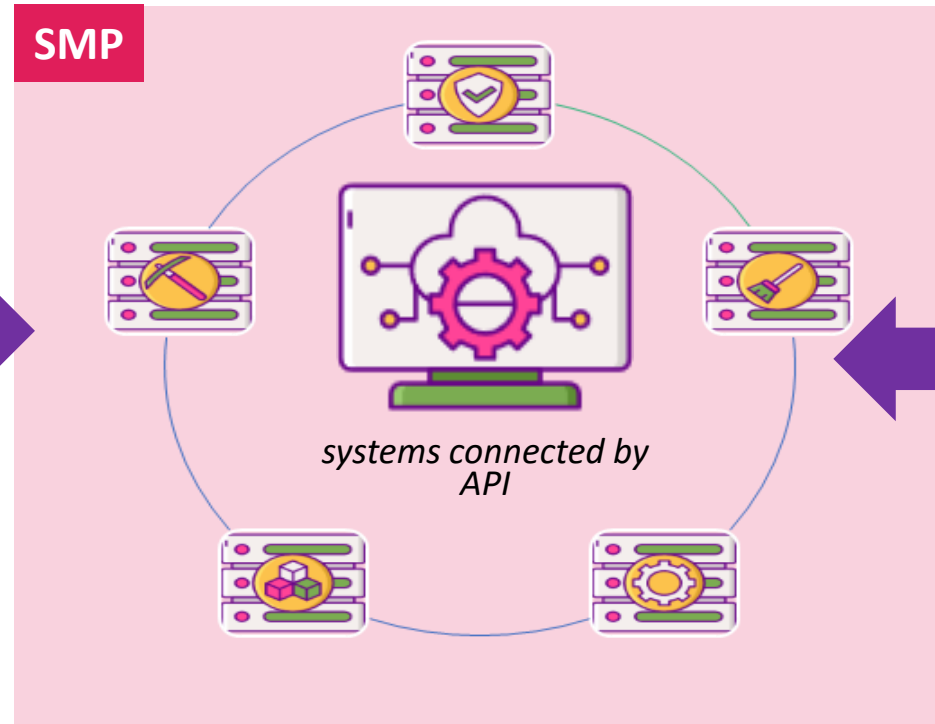
Data Upstreamers

e.g. I&M,
Material Labs



Structured
Data

- 2** SMPs need not be a single system used by the site and its stakeholders, but can be multiple systems integrated with each other.



- 3** SMP environment should be accessible to project stakeholders to encourage collaboration and data integrity.

Project Parties

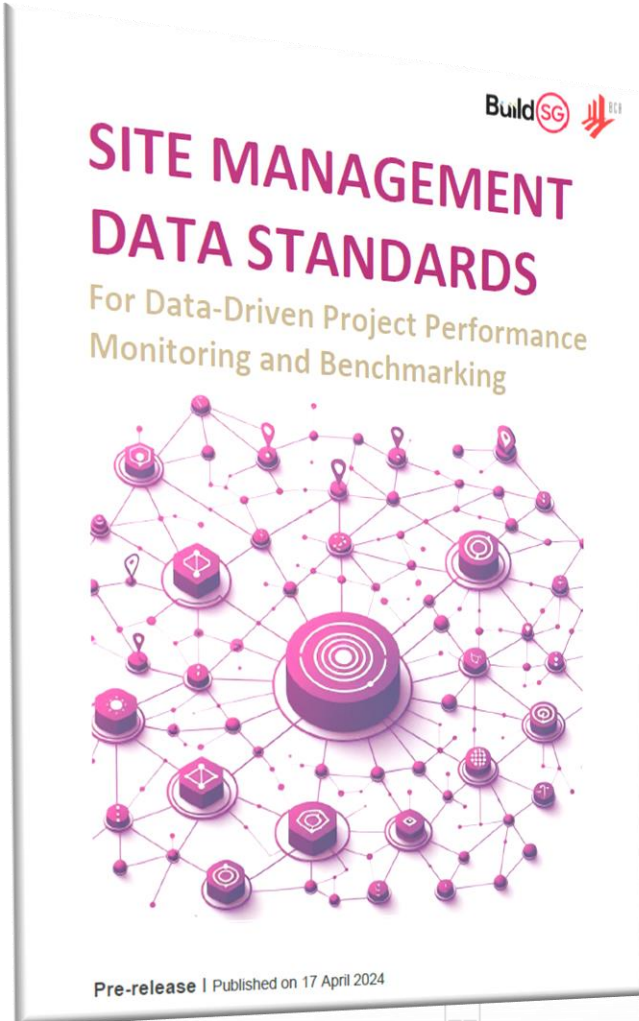
- Builder's HQ
- Developers
- QP
- Sub-contractors

Public Agencies

- BCA
- Other technical agencies

- 4** Eventually, SMPs can also integrate with the systems used by public agencies to reduce touchpoints with authorities and the need for site inspections.





Site Management Data Standards (Pre-release)

- Datasets serving both **regulatory and project management needs**
- Grouped into **safety, productivity, quality, time and cost** categories
- Site management platforms should take reference from the Standards

Site Management Data Standards					
	Safety (Pre-release)	Productivity (Pre-release)	Quality (Next Release)	Time (Next Release)	Cost (Next Release)
Regulatory Data Requirements	Workplace Safety and Health	Construction Productivity	CONQUAS	<i>Not required by regulators</i>	
	Structural Safety				
Project Delivery Data Requirements	Public/Private-sector Clients & Contractors				

Available for industry feedback at go.gov.sg/datastd-feedback

Download Data Standards from
go.gov.sg/datastd



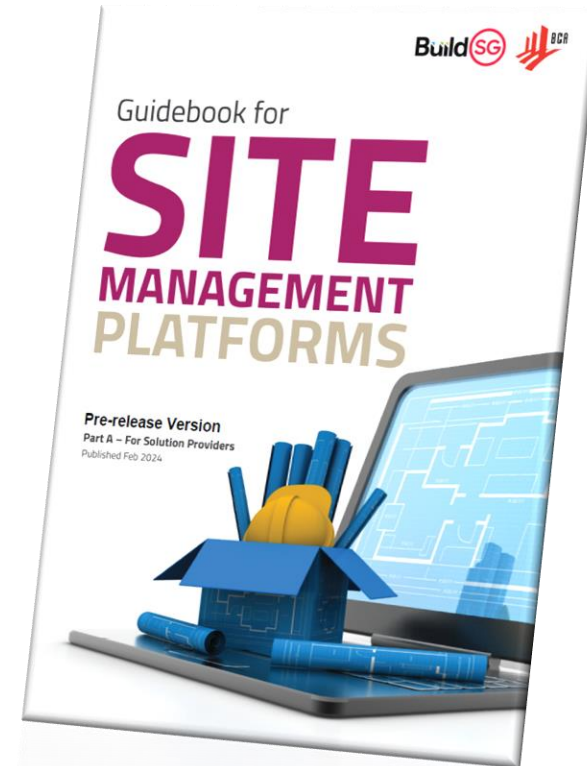
The first **Guidebook for Site Management Platforms** **Part A – For Solution Providers**

- Focus on **Structural Safety data** as per BCA's requirements
- For solution providers, the guidebooks helps to layout the requirements and data standards to prepare the necessary modules
- For industry practitioner can embrace the guidelines and transform their internal processes to become more efficient

Other Guidebook for Site Management Platforms in the pipeline

Part B – Case Studies and Best Practices for Industry adoption of SMP

Part C – Change Management Best Practices SMP Adoption





Solution providers can refer to the SMP Guidebook to set up the **necessary modules to facilitate the collection, validation and storage** of the required structural safety data on SMPs



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*

Examples:

- QP & Site Supervisor Attendance Records
- Piling Installation Records
- Concrete Cube Test Results
- Instrumentation and Monitoring Records
- ERSS Annex C-1

These data requirements will be covered under **Site Management Data Standards**

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

Examples:

- BCA Approved Plans
- Temporary Building Design (with COS & PE Calculation report)
- Pro-con Survey Report
- 360 Captures



SMP Guidebook Part A focuses on structural safety data for regulatory needs. Solution providers should work with clients for their preferred workflow or additional data requirements and meet their needs.

For example:

Project Progress Data Standards

Asks specifically for:

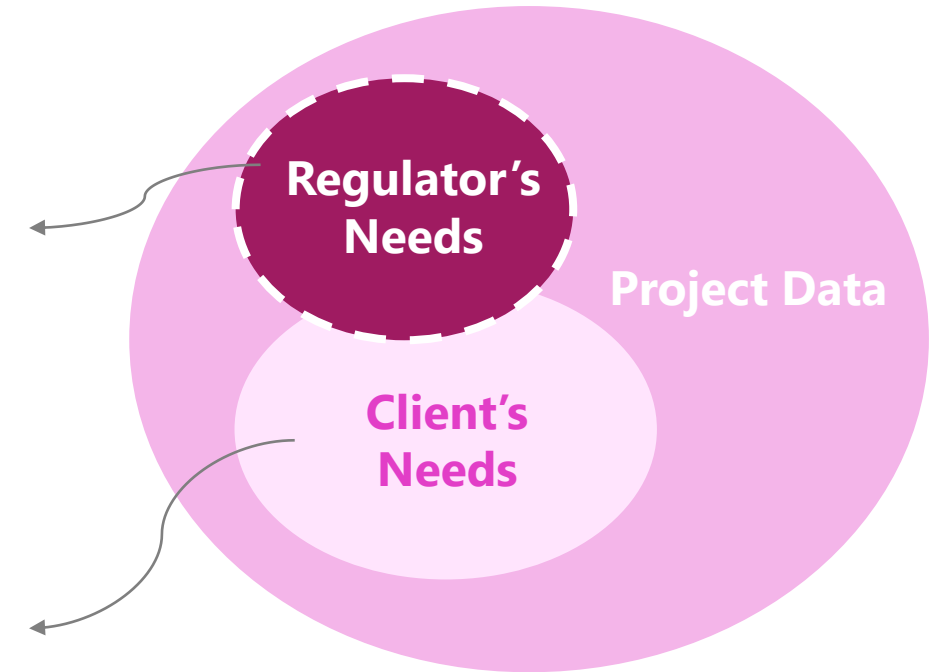
1. ERSS Progress
2. Piling Progress
3. Basement/Sub-structure Progress
4. Superstructure Progress

These are data that BCA requires to facilitate our audits frequency

Additional data that may benefit the project team (not required for BCA submission)

1. Precast yard Progress
2. Superstructure Progress by zones/blocks/work type etc.

Can be available for the project team to use, but not necessary to provide to BCA



Solution providers are also encourage to customise the forms to the clients' needs, as long as it is able to generate the data that BCA requires in the standards we have specified

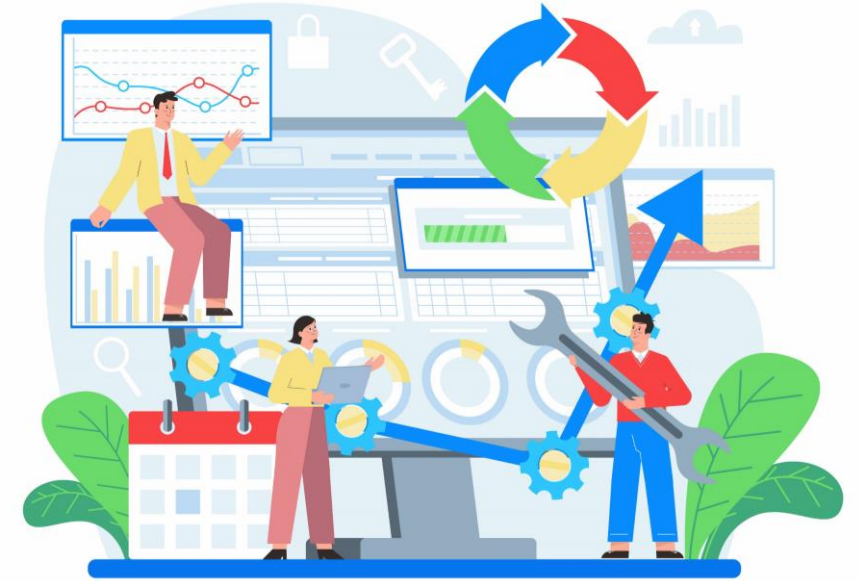


Adopting SMPs and the modules/data standards required will

- Improve site supervision
- Improve efficiency
- Reduce touch points with BCA during structural audits

Reach out to us!

To opt into having your structural audits carried out digitally or provide feedback to our guidebook



Example of solution providers:



INTERCORP

AUTODESK

ORACLE

arth

Build SG



Virtual Inspections

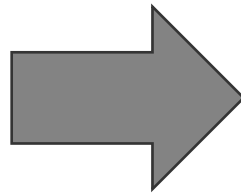




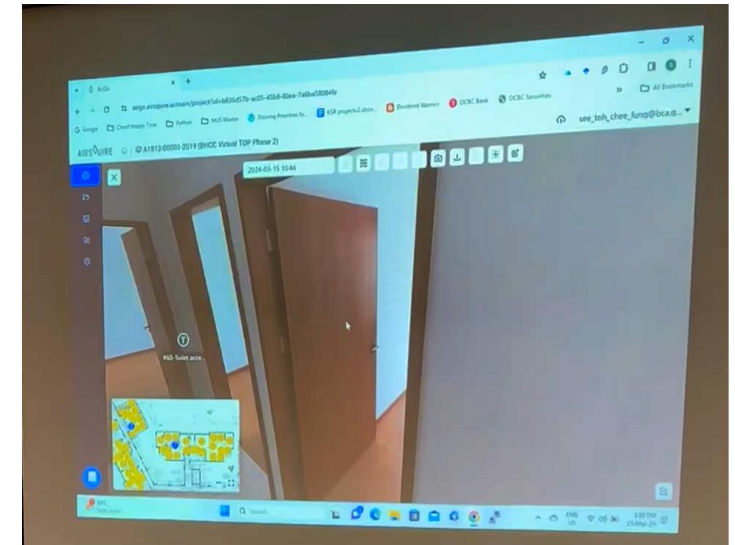
What if we can move away from this ...



Inspections are usually manpower intensive involving many parties



To this



- Project Team can capture 360 scan and compliance photos
- The Capture can be reviewed anytime, anywhere without the need to go down to the site

Note

- The areas sampled and items checks are what already being done in physical inspections .
- There is no difference for a virtual or a physical inspection.



Recording inspectors' comments on loose paper and sending different instructions through whatsapp and emails



Better coordination and documentation

Gathering all subcontractors and following the inspector.



Increased productivity and manpower savings

Queueing to find a booking slot and waiting for the written comments after inspections

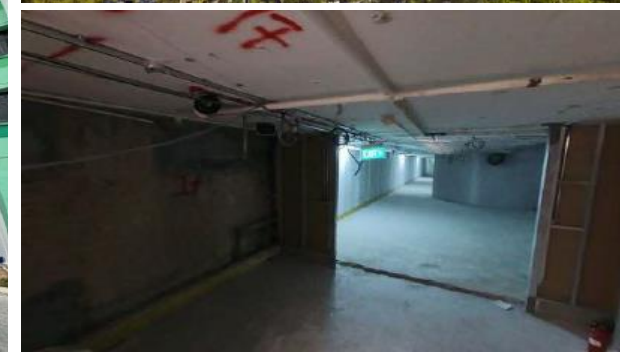


Faster overall Process with reduced waiting time

Other beneficial use case

Industry have been using 360 capture for

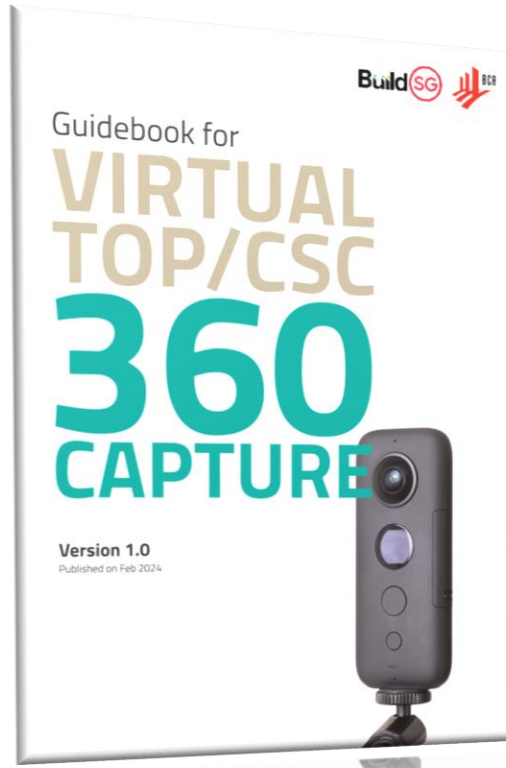
- Checking of project progress
- QA/QC checks
- As a collaborative platform to discuss and update



Different projects have successfully completed the virtual inspection



The first **Guidebook for Virtual TOP/CSC**



- Listing the requirements industry need to adopt a virtual TOP inspection
- Sharing on the **best practices in using 360 Captures** for BCA TOP inspections

The Guidebook is divided in 4 sections to help guide on the different processes in a virtual inspection for TOP/CSC to help answer the key questions that the industry have.



Part A :
ASSESSING PROJECT SUITABILITY FOR VIRTUAL INSPECTION



Part B :
PREPARING FOR 360 CAPTURE



Part C :
CONDUCTING THE VIRTUAL CAPTURE



Part D :
SUBMISSION AND REVIEWING OF THE 360 CAPTURE FOR VIRTUAL INSPECTION



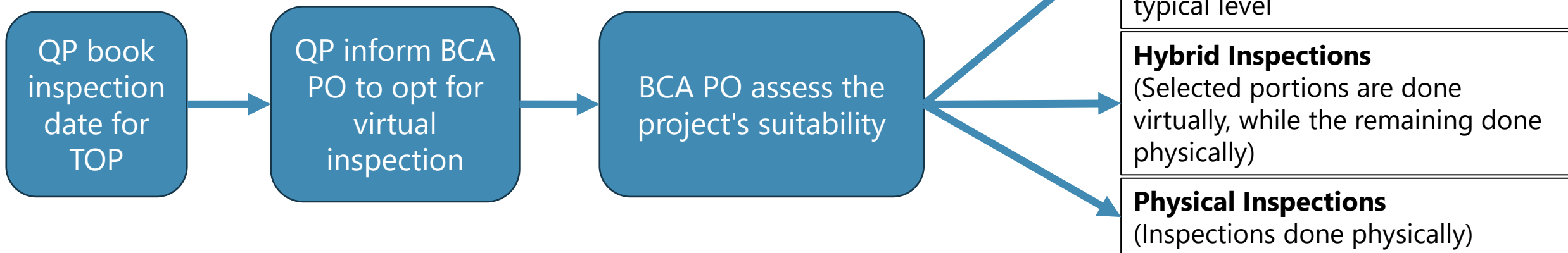
ASSESSING PROJECT SUITABILITY FOR VIRTUAL INSPECTION

Suitable features	Remarks
Typical layouts	This enables one scan to represent more floors, reducing efforts needed to scans
Simple layouts	Projects which are designed with large open areas that enable less steps to capture the whole project as the
Project already using 360 Capture for monitoring	Enable more value as the same scan could be used for multiple purposes (e.g. project progress and TOP checks)

Things to consider

- 1) Size of the area required to be scanned
- 2) Conditions of the site for virtual scans

The Process



Typical levels

- A minimum of 3 typical floors (~1 for every 10 floors) are to be selected in each building for the virtual inspection.

Non-typical levels

- Roof with maintenance access in the building,

Non-typical levels

- To include all other non-typical floors whenever applicable

Non-typical levels

- External surrounding around the building





PREPARING FOR 360 CAPTURE

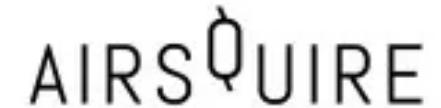
360 Capture Hardware



360 cameras are widely available off-the-shelf and compatible with most 360 Capture platforms

At the initial phase, BCA will help to facilitate projects that do not have a platform but keen to conduct a virtual inspection.

360 Capture Solution Providers



Note

- There are many more 360 capture platforms available in the market.
- Please consult your platform provider for their product offerings, services and best practices.



CONDUCTING THE VIRTUAL CAPTURE

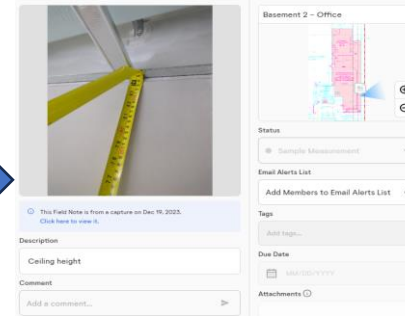
Project Team



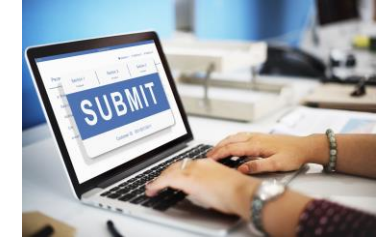
Identify the areas to be scanned in the project



Assigned personnel equip with 360 camera and walk throughout the project to do the scan



Photos with sample measurements would need to be attached in the platform



QP check through and inform BCA to review the capture when ready

Note

Proper Lighting



Please ensure the areas scanned are sufficiently bright or lighting provision would need to be made

Completed Site



Virtual would be like conventional inspection and the site must be captured in a TOP- ready condition

QP to check compliance



QP would be responsible to ensure compliance and demonstrate to BCA through the sample measurements photos.

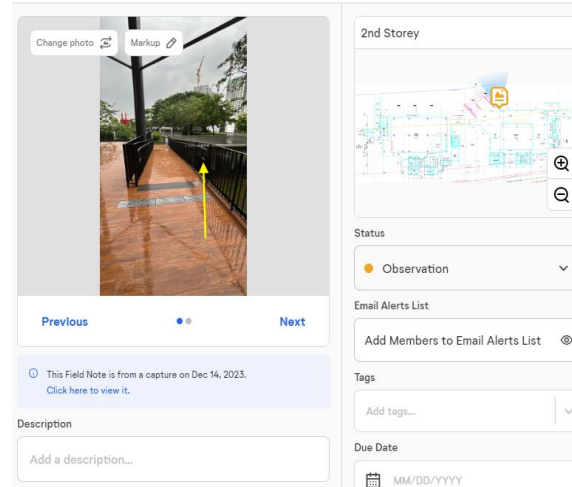


REVIEWING OF THE 360 CAPTURE

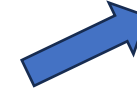
**TOP
Processing
Officer**



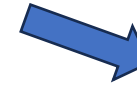
Review the submitted scans



Comments would be given and tagged directly to the location



Written Direction would be issued within 3 working days



Concurrently, Project Team can start rectification works

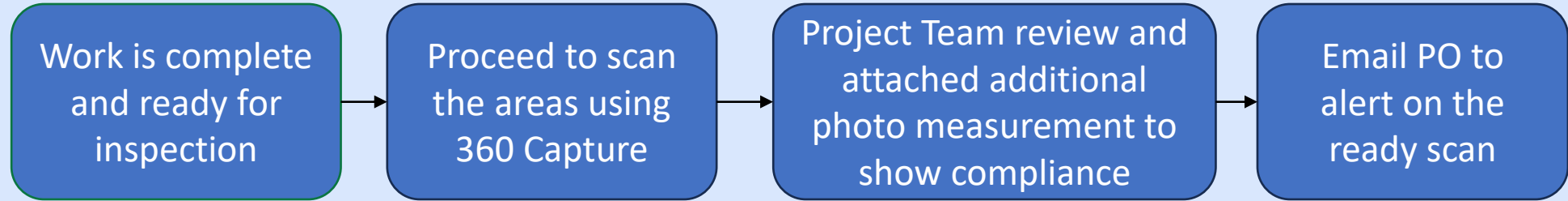
Type of BCA comment	Details	QP/Project Team's reply
Non-Compliance	Items that are not in compliance to the Approved Document and the Accessibility Code	Rectified
Observation	Any other issues that are identified from the virtual site inspection	Rectified
Clarification required	When the area in the capture is blurry, underexposed or not easy for any user to see, and thus, the provision of a photo measurement to clarify will be required	Clarification attached.

Standardised template and fields for ease of

- Tracking of status
- Finding the location of the non-compliances
- Generating closure reports

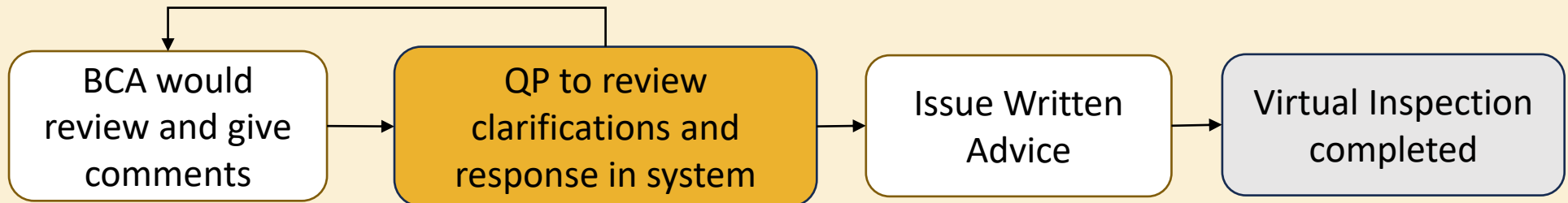
1

Project Team's Preparation



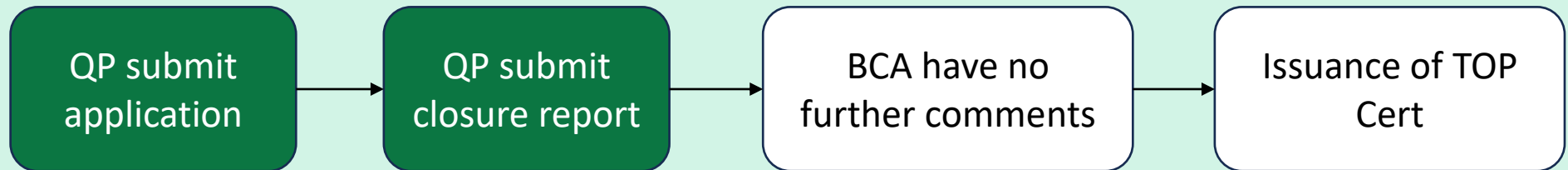
2

Virtual Review by BCA (within 3 working days)



3

TOP Application & Document Clearance



Include all the rectifications done in response to the WA from virtual inspection

Current Technologies

Readily available tool to replace going down to site



Using 360 Capture which are easy to see the exact condition on site

Limitation

The inspector would still need to scroll through the site to view the digital site

Using 360 Capture to digitalise site for the various different type of inspections

Together with the industry, build up our data to train our AI/ML models

On-going Tech Development

AI tools to identify non-compliances in the collected videos/photos



Development of AI to

1. Recognize and measure elements in the 360 capture
2. Auto detect non-compliance

This would enable all parties to achieve significant savings



The Journey is only possible with the support from many of our industry partners.
We would continue to seek the industry support to work with us to refine the processes.

Public Agencies



BUILDING INDUSTRIES

Industry



Solution Providers



Download the
Guidebooks here



Site Management
Data Standards



Alternatively, type in
go.gov.sg/datastd-feedback

SMP Guidebook



Alternatively, type in
go.gov.sg/smpguidefeedback

360 Capture
Guidebook



Alternatively, type in
go.gov.sg/vifeedback

Your feedback is important. We seek your comments on the guidebooks and what else you want to know. Please click the link and input your

- Comments and reactions to the guidebook
- Recommendation on what else the industry would want to know and be included in this or future Guidebooks

These current drafts are for industry consultation and feedback.

End

