

# Guide Book for Remote Supervision (Structural Works)

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## History of Amendments

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1	Version 1.0 – first issue	Oct 2021

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## PART I. INTRODUCTION

### 1. OBJECTIVES AND APPLICATION

- 1.1 This Guide guides supervising qualified persons (as defined in the Building Control Regulations 2003) (“**Supervising QP**”) and site supervisors (as defined in the Building Control Act) (“**SS**”) when using technology such as video conferencing tools to perform real-time supervision of the carrying out of structural works from a remote location, whether such remote location is at the site or outside the site (“**remote supervision**”). Such structural works include geotechnical building works.
- 1.2 As remote supervision is a method through which supervision of structural works may be conducted, this Guide must be read in conjunction with the Building Control Act (“**BC Act**”), Building Control Regulations 2003 (“**BC Regulations**”), and Guide Book for Site Supervision Plan (“**SSP Guide**”).
- 1.3 The provisions in this Guide are not exhaustive as to the steps that Supervising QPs and SSs are required to take when using remote supervision, in order to discharge their respective duties under the BC Act, BC Regulations and SSP Guide. Supervising QPs and SSs should consider carefully all steps that they need to take in order to discharge such duties, prior to adopting remote supervision. For examples:
  - 1.3.1 Supervising QPs and SSs must take all reasonable steps and exercise due diligence in supervising the structural works pursuant to the BC Act, BC Regulations and SSP Guide.
  - 1.3.2 The minimum number of SSs required under the BC Regulations must continue to be present at site even if remote supervision is adopted. For example, if a minimum of 3 SSs are required to be appointed to supervise structural works under the BC Regulations, all 3 SSs must be present at site. When at site, the SSs may supervise building works carried out at one part of the site using remote supervision while being at another part of the site. None of the 3 SSs may supervise the structural works from a location outside the site.
  - 1.3.3 Where critical structural works that require continuous supervision pursuant to the SSP Guide are involved, the SS must only conduct continuous supervision of one type of critical structural works performed at one location at any one time even if remote supervision is adopted.
  - 1.3.4 The SS must have the relevant approved plans and inspection checklists on hand before conducting remote supervision, and must ensure that all structural elements are checked against the relevant inspection checklists.

- 1.3.5 For structural elements that have been entirely supervised through remote supervision for overseas fabrication yards, Supervising QP should conduct further onsite tests in Singapore, to verify that the structural components meet the design specifications.
- 1.4 Remote supervision should only be adopted for large building works (as defined in the BC Act) carried out at construction sites and/or fabrication yards. Remote supervision must not be adopted for small-scale building works (as defined in the BC Act).

## **PART II. PREPARING FOR REMOTE SUPERVISION**

### **2. ASSESSING THE SUITABILITY OF REMOTE SUPERVISION**

- 2.1 The Supervising QP should assess whether they can meet the requirements set out in the BC Act, BC Regulations and SSP Guide for the supervision of structural works if remote supervision is adopted.
- 2.2 The Supervising QP should conduct the necessary trials in order to understand and be familiar with the remote supervision process, before adopting remote supervision for the project.
- 2.3 The Supervising QP should understand and be familiar with the contents of this Guide, before adopting remote supervision for the project.
- 2.4 The Supervising QP should ensure that the following actions can be performed *via* the use of appropriate equipment (see paragraph 4.3 below), before adopting remote supervision for the project:
- 2.4.1 Real-time video conferencing between the SS at the remote location and the person holding the equipment at the part of the site where the structural works to be supervised are being carried out (“**operator**”), such that the live video feed and live audio feed can be transmitted instantaneously or almost instantaneously; and
- 2.4.2 Two-way video conferencing between the SS and the operator can be transmitted smoothly without disruptions, such that the audio feed can be transmitted back and forth between the SS and the operator and the video feed can be transmitted from the operator to the SS.

### **3. SUBMITTING DOCUMENTS TO THE COMMISSIONER OF BUILDING CONTROL**

#### **A. Documents to be submitted**

- 3.1 A Supervising QP who intends to adopt remote supervision should submit the following documents to the Commissioner of Building Control (“**CBC**”):
- 3.1.1 The completed and signed notification form set out at **Annex A**; and
- 3.1.2 The completed and signed Remote Supervision Plan (“**RS Plan**”) set out at **Annex B**.
- 3.2 Where a permit to carry out structural works has not been issued for the structural works, the notification form and RS Plan should be submitted together with the application for a permit to carry out structural works.
- 3.3 Where a permit to carry out structural works has been issued for the project, the notification form and RS Plan should be submitted *via* email to BCA’s processing officer for the project and *via* correspondence through Corenet, at least 2 weeks before the commencement of remote supervision.

#### **B. Remote supervision plan**

- 3.4 When preparing the RS Plan:
- 3.4.1 The Supervising QP should adopt a risk-based approach to identify and assess if remote supervision is suitable. For examples, remote supervision should not be used for the supervision of structural works:
- which, in the event of failure, will result in or be likely to result in severe consequences;
  - when there is high probability that remote supervision cannot be carried out effectively; or
  - which require the SS’s touch and feel of the structural works.
- 3.4.2 The Supervising QP should not adopt remote supervision for more than 50% of the total structural works in a project.
- 3.4.3 The Supervising QP should implement the use of remote supervision in progressive stages to enable the SS to gradually adapt to the remote supervision process without compromising the standards of supervision. Please see the examples set out in the implementation plan in the RS Plan set out at **Annex B**.
- 3.4.4 The Supervising QP should prepare a checklist setting out the preparations to be made before adopting remote supervision by the SS.

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A good checklist should minimally address the matters set out in Section 4 below.

## **4. PREPARING FOR REMOTE SUPERVISION**

- 4.1 The Supervising QP and SS should ensure that preparations are made in accordance with the RS Plan before conducting remote supervision. This will enable the SS to conduct remote supervision with minimal disruptions.
- 4.2 The recommended preparations which should be made before conducting remote supervision are set out below.

### **A. Equipment preparation**

- 4.3 The operator may use a hands-free camera (such as wearable camera which is mounted on helmet, body etc) to enable him to take measurements of structural works (such as rebar size or rebar spacing) when instructed by the SS to do so. The hands-free camera must comply with the requirements set out in paragraph 2.4 above.
- 4.4 It is recommended for the operator using a handheld camera to also use equipment to stabilise the handheld camera.
- 4.5 There should be a strong and reliable internet connection to enable high-quality video and audio streaming with minimal disruptions.
- 4.6 The SS should use a laptop or monitor screen to conduct the remote supervision in order to better observe the details of the structural works being carried out.
- 4.7 An all-in-one video conferencing platform which provides two-way streaming, recording, and uploading functions should be used. Some examples include Zoom Meetings, Google Meet and Microsoft Teams.
- 4.8 There should be enough space in the relevant equipment or cloud for the SS to store the records of remote supervision.
- 4.9 A secondary device and/or platform should be prepared to be deployed in the event the primary device and/or platform fails.

### **B. Site preparation**

- 4.10 Labels and/or signs should be provided to enable the SS to identify the location where the structural works to be supervised are being carried out and the type of structural works being supervised. Some examples include providing grid lines, numbering storeys, and labelling the type of structural works being supervised.

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- 4.11 The location where the structural works to be supervised are being carried out should be well-lit.
- 4.12 Good housekeeping should be practised at the location where structural works is being performed, especially if the operator is using a handheld device for streaming, as the operator may be less aware of his surroundings while he navigates the site. At all times, safety of all workers including the operator must be maintained.

**C. Operator preparation**

- 4.13 The operator should be conversant in the same language as the SS.
- 4.14 The operator should be equipped with the relevant tools required for assisting the SS in supervising the structural works. Some examples include a torch light, measuring tape and digital Vernier calliper.

## **PART III. CONDUCTING REMOTE SUPERVISION**

### **5. BRIEFING BY QUALIFIED PERSON**

- 5.1 The Supervising QP must brief each SS on the RS Plan and the matters set out in Sections 6 and 7 below before remote supervision is conducted for the first time by each SS.
- 5.2 The Supervising QP must attend a minimum of two remote supervision sessions conducted by each SS to ensure that each SS is conducting the remote supervision properly and in accordance with the BC Act, BC Regulations, SSP Guide, RS Plan and this Guide.
- 5.3 Failure by the Supervising QP to carry out the above may constitute a failure by the Supervising QP to take all reasonable steps and exercise due diligence in supervising the structural works under the BC Act.

### **6. CONDUCTING REMOTE SUPERVISION**

**A. Start of remote supervision session**

- 6.1 All involved parties (especially the SS) should turn on their video cameras continuously throughout each remote supervision session.
- 6.2 At the start of each remote supervision session:
  - 6.2.1 The SS should start recording the session.
  - 6.2.2 The SS should state the date and time.

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6.2.3 All involved parties should introduce themselves (name, company and designation) and such introductions should be captured on the SS's video and audio feeds.

6.2.4 The SS should establish the location where the structural works to be supervised are being carried out. Any labels and/or signs which assist in establishing such location should be captured on the SS's video feed.

## **B. Remote supervision of structural works**

6.3 Notwithstanding the use of remote supervision, the Supervising QP and SS must continue to take all reasonable steps and exercise due diligence in supervising the structural works pursuant to the BC Act, BC Regulations and SSP Guide.

6.4 The SS must ensure that the remote supervision session is being conducted in real-time, that he is able to observe the structural works being carried out clearly, and that he is able to communicate his instructions to the operator clearly.

6.5 Where the SS encounters any of the issues set out in paragraph 7.1 below, the SS must take the appropriate remedial action set out in paragraph 7.2 below.

6.6 The SS should comply with the specifications and methodology set out in the RS Plan.

6.7 The SS should where necessary, intervene in the carrying out of structural works and give instructions to the builder's personnel in the same manner as though the SS was physically present to supervise the carrying out of the structural works.

6.8 Where critical structural works that require continuous supervision pursuant to the SSP Guide are involved (such as concreting, pre-stressing, and tightening of high friction-grip bolts), the SS must only conduct continuous supervision for one type of critical structural work carried out at one location at any one time. For example, when the SS is conducting remote supervision for concreting works at one location, the SS must not concurrently conduct supervision (whether physically or remotely) of other structural works at another location.

6.9 A failure to do any of the steps described in paragraphs 6.3 to 6.8 above may constitute a failure to take all reasonable steps and exercise due diligence in supervising the structural works under the BC Act.

## **C. End of remote supervision session**

6.10 At the end of each remote supervision session:

6.10.1 The SS should state the time; and

6.10.2 The SS should stop recording the session.

6.11 After the remote supervision session:

6.11.1 The SS should ensure that the relevant inspection forms and/or the supervision checklists have been completed.

6.11.2 The SS should prepare, keep and maintain the records in accordance with Section 8 below.

## **7. TROUBLESHOOTING AND FEEDBACK**

7.1 Problems may occur during the conduct of remote supervision which may result in any one of the following issues:

7.1.1 The remote supervision session cannot be conducted in real-time. This may occur where, for examples, there is unresolvable network disruption or lag.

7.1.2 The SS is unable to communicate his instructions to the operator effectively, due to technical issues, language issues or otherwise.

7.1.3 The operator is unable or unwilling to follow the SS's instructions.

7.1.4 The SS is unable to observe the structural works being carried out or the measuring tools used to verify the dimensions of structural items clearly.

7.2 Where the SS encounters any of the issues set out in paragraph 7.1 above, the SS must immediately stop the carrying out of the structural works unless it is structurally unsafe to do so, following which the SS must either:

7.2.1 Cease remote supervision and be physically present at the location where such structural works are being carried out, before resuming supervision of the carrying out of such structural works; or

7.2.2 Resolve such issue(s) before resuming remote supervision of the carrying out of such structural works.

7.3 The SS should provide regular feedback to the Supervising QP throughout the project on the use of remote supervision.

## **PART IV. DOCUMENTING REMOTE SUPERVISION**

### **8. RECORD-KEEPING**

- 8.1 After each remote supervision session, the SS should prepare the Remote Supervision Report (“**RS Report**”) using the template set out at **Annex C**.
- 8.2 Hard copies of the completed and signed RS Report should be kept and maintained at site at which the structural works are carried out.
- 8.3 The SS should ensure that the number of photos and duration of video recordings for each remote supervision session be taken, kept and maintained in accordance with the RS Plan.

## **ANNEX A**

### **Notification to the Commissioner of Building Control**

#### **Adoption of Remote Supervision**

*(This form should be submitted at least 2 weeks before commencement of remote supervision.)*

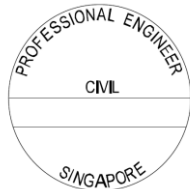
*Where a permit to carry out structural works has not been issued, this form should be submitted together with the application for a permit to carry out structural works.*

*Where a permit to carry out structural works has been issued, this form should be submitted via email to BCA's processing officer for the project and via correspondence through Corenet.)*

<b>Commissioner of Building Control Building and Construction Authority</b> 52 Jurong Gateway Road, #12-01 Singapore 608550 Fax: 63342561	<b>Project ref no. &amp; title ("Project"):</b>
<b>Address of construction site OR fabrication yard where remote supervision will be adopted:</b>	<b>Address (Fabrication yard/ Construction site):</b>

This is to notify the Commissioner of Building Control (CBC) that remote supervision will be adopted for the Project for some of the building works as described in the remote supervision plan. Enclosed is the remote supervision plan prepared by me for implementation.

Yours faithfully



**Qualified Person (Supervision) for Structural Works**

**Name:**

**Date:**

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**ANNEX B**

# **Remote Supervision Plan**

Project Reference No.:
Project Description:
Fabrication yard or Construction site:  Address:

Prepared by:

Name of Qualified Person (Supervision) & PE Registration No.	
Company	
Date	

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## PROJECT BACKGROUND

Brief description of project

- site location
- structural and foundation system
- challenges to carry out remote supervision, if any.

Overall site plan or location of construction site or fabrication yard.

Figure 1: Overall Site Plan or Location of Fabrication Yard

## IMPLEMENTATION PLAN FOR REMOTE SUPERVISION

**(Ensuring Only Up To 50% of Structural Works in Project are Supervised Using Remote Supervision)**

To include implementation plan for remote supervision which adopts progressive phased implementation of remote supervision in a project.

Examples:

### A) Construction Site

#### Example 1

**Location of building works** – Superstructure, Tower “A” (10-storey)

**Type of building works** – reinforced concrete beam (included the associated slab (cast together), applicable for beam-slab structural system)

Phase of Building Works	Permitted Extent of Building Works for Remote Supervision
First 30% (up to 3 <sup>rd</sup> storey)	up to a max. of 15% of beams
Subsequent 30% to 75% (4 <sup>th</sup> to 7 <sup>th</sup> storey)	up to a max. of 30% of beams
Subsequent 75% to 100% (8 <sup>th</sup> to roof)	up to a max. of 50% of beams

(measurement of beams: by volume of concrete or length of beams)

### Example 2

**Location of building works** – Superstructure, Tower “A” (10-storey)

**Type of building works** – reinforced concrete slab (applicable for flat slab system)

<b>Phase of Building Works</b>	<b>Permitted Extent of Building Works for Remote Supervision</b>
First 30% (up to 3 <sup>rd</sup> storey)	up to a max. of 15% of slabs
Subsequent 30% to 75% (4 <sup>th</sup> to 7 <sup>th</sup> storey)	up to a max. of 30% of slabs
Subsequent 75% to 100% (8 <sup>th</sup> to roof)	up to a max. of 50% of slabs

(measurement of slabs: by surface area on plan)

### **B) Fabrication Yard**

### Example 3

**Location of building works** – Precast yard, for structural works of Tower “A” (10-storey)

**Type of building works** – precast beam

<b>Phase of Building Works</b>	<b>Permitted Extent of Building Works for Remote Supervision</b>
First 30% (up to 3 <sup>rd</sup> storey)	up to a max. of 15% of beams
Subsequent 30% to 75% (4 <sup>th</sup> to 7 <sup>th</sup> storey)	up to a max. of 30% of beams
Subsequent 75% to 100% (8 <sup>th</sup> to roof)	up to a max. of 50% of beams

(measurement of beams: by volume of concrete or length of beams)

### Example 4

**Location of building works** – PPVC precast yard, for structural works of Tower “A” (10-storey)

**Type of building works** – PPVC module

<b>Phase of Building Works</b>	<b>Permitted Extent of Building Works for Remote Supervision</b>
First 30% (up to 3 <sup>rd</sup> storey)	up to a max. of 15% of PPVC modules
Subsequent 30% to 75%	up to a max. of 30% of PPVC modules



(4 <sup>th</sup> to 7 <sup>th</sup> storey)	
Subsequent 75% to 100% (8 <sup>th</sup> to roof)	up to a max. of 50% of PPVC modules

(measurement of PPVC modules: by volume of concrete for PPVC modules)

Note:

1. The permitted extent (%) of building works can be measured by the volume of concrete (e.g RC beams), length of structural members (e.g RC beams or structural steel beams) or surface area on plan (e.g slab).
2. First 30% of building works (first phase) should be considered as learning stage, the supervision of structural works is encouraged to be carried out in both methods, physical presence at site and remotely. This serves as a learning curve for the site supervisors to familiarise with the use of digital tools for carrying out remote supervision.

## TYPES OF STRUCTURAL WORKS, SUPERVISION AND RECORDING REQUIREMENTS FOR REMOTE SUPERVISION

Please indicate the type of structural works, supervision (continuous or periodic) and recording requirements.				
Notes:				
<b>Continuous Supervision</b> is the full-time observation of works by SS who is continuously present in the area where the structural works are being carried out (e.g. concreting, pre-stressing of PT works). For remote supervision, the SS must be able to observe the structural works clearly, intervene and instruct the contractor at site instantaneously.				
<b>Periodic Supervision</b> is the full-time intermittent observation of structural works by SS who is present in the area where the structural works have been or are being performed and at the completion of the structural works (e.g. laying rebar). For remote supervision, the SS must be able to observe the structural works clearly using digital tools, and instruct the contractor at site instantaneously.				
S/N	List of Structural/ Geotechnical works (e.g. Concreting works, reinforcement)	Periodic/ Continuous	Minimum duration of video recordings to be saved for each remote supervision session (e.g xx% of total duration of RSS)	Minimum number of photos to be taken for each remote supervision session
1	Reinforcement inspection	Periodic	30%	3
2	Concreting of beam/slab	Continuous	50%	5 (1 photo for every

			(3min of video recording for every 15mins interval)	15 mins interval)
3	Pull out test (post installed anchor, reinforcement)	Continuous	100%	5
4	Pre-stressing works	Continuous	100%	5

## DEVICES FOR REMOTE SUPERVISION

Examples of the items to be specified in this section (not exhaustive):

- Name the devices used for image capturing, video recording, live streaming
- Number of device(s) to be used
- Indicate whether a back-up device will be provided (this is recommended in case of device malfunction during continuous supervision e.g concreting)
- Indicate all the relevant devices to be used for remote supervision such as digital Vernier calliper for rebar size measurement
- Indicate whether torch light is required
- Indicate whether back-up battery is required

## INFRASTRUCTURE REQUIREMENTS

Examples of the items to be specified in this section (not exhaustive):

- To specify the internet connection, requirement, specifications which will be used to ensure effective remote supervision
- To state the method or infrastructures used for storage of photos/videos – cloud base/server space
- To provide the details of remote supervision platform/software
- To specify the requirement or specification of video during live streaming and recording - resolution

## **METHOD STATEMENT FOR EXECUTION OF REMOTE SUPERVISION**

### **Before Remote Supervision (Preparation Works)**

- To provide checklist on the works to be done before the carrying out of the remote supervision such as labelling of site

### **During Remote Supervision**

- To provide detailed method statements for carrying out remote supervision.
- To include the good practices such as self-introduction before the commencement of remote supervision.
- To refer to the Guide on Remote Supervision.


### **After Remote Supervision**


- To provide follow up action by SS after the carrying out of remote supervision such as preparing of remote supervision report (Annex C)

# ANNEX C

## Remote Supervision Report

*(This form shall be prepared by Site Supervisor who conducted the remote supervision)*

Project Ref No. (“Project”)	
Location of Remote Supervision (Fabrication yard or construction site)	Insert address
ST No.	
Type of structural works	Beam 2HB2 at level 2 (block A)
Scope of supervision	Reinforcement inspection
Type of supervision	Periodic or continuous supervision
Date of remote supervision	
Duration of remote supervision	30 mins (from 1400H to 1430H)
Outcome of remote supervision (approved, rejected, approved with minor comments)	approved
Parties involved in the remote supervision  Screenshot of parties involved (with name, company and designation) in remote supervision  Note: The operator must turn on his video camera throughout each remote supervision session. All other involved parties (especially the site supervisor) should turn on their video cameras throughout each remote supervision session.	<p>Example</p> 

<p>Photos of structural works (to capture/screenshot from site supervisor's device)</p>	<p>Example</p> 
<p>File name and duration of video recording</p>	
<p>Storage of video (cloud/server):</p>	
<p>Attachment of Inspection Checklist (yes/no)</p>	
<p>Builder's Signature</p> <p>Name: Designation: Date:</p>	

I confirm that I have conducted remote supervision for the structural works recorded in this report in accordance with the remote supervision plan prepared in respect of the Project. I am satisfied with the process of remote supervision and confirm that the structural works were carried out in accordance with the plans approved by the Commissioner of Building Control under Section 5 of the Building Control Act, the Building Control Act and the Building Control Regulations 2003.

Yours faithfully

---

**Site Supervisor**

**Name:**

**Designation (RE/RTO):**

**Date:**