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Condition Survey Report

ND/2019/05 - Condtion Survey for Fanling North New Development Area, Phase 1 Fanling Bypass Eastern Section (Shung Him Tong to Kau Lung Hang)

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Prepared for CRCC – Paul Y. Joint Venture
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1 BACKGROUND INFORMATION

1.1 Introduction

1.1.1 Starting from year 1998, the Hong Kong Government began the Planning and Development Study on The North East New Territories (NENT), to establish a planning and development framework for the Kwu Tung North (KTN), Fanling North (FLN) and Ping Che/Ta Kwu Ling (PC/TKL) as New Developemnt Areas (NDAs). According to the Policy Address in 2013, the potential development in New Territories North (NT North) is to be explored in order to provide land to meet the demand for housing and economic development.

1.1.2 As part of the development of KTN and FLN NDA, one of the major infrastructure project planned is the Fanling Bypass (Eastern Sesction), which is about 4km in total length. A dual two-lane carriageway connecting the FLN NDA and Fanling Highway, to enhance the transportation network in the future.

1.1.3 CRCC – Paul Y. Joint Venture was awarded with the Phase 1 of the FLN NDA project under contract ND/2019/05, to construct the phase 1 Fanling Bypass Eastern Section from Shung Him Tong to Kau Lung Hang, which is approximately 2km in length. The bypass is mainly on viaduct which at the middle, there would be two long span overbridges across the existing East Rail Line. Below **Figure 1.1** shows the layout plan of the Eastern Section of Fanling Bypass (Shung Him Tong to Kau Lung Hang).

1.2 Scope of Works

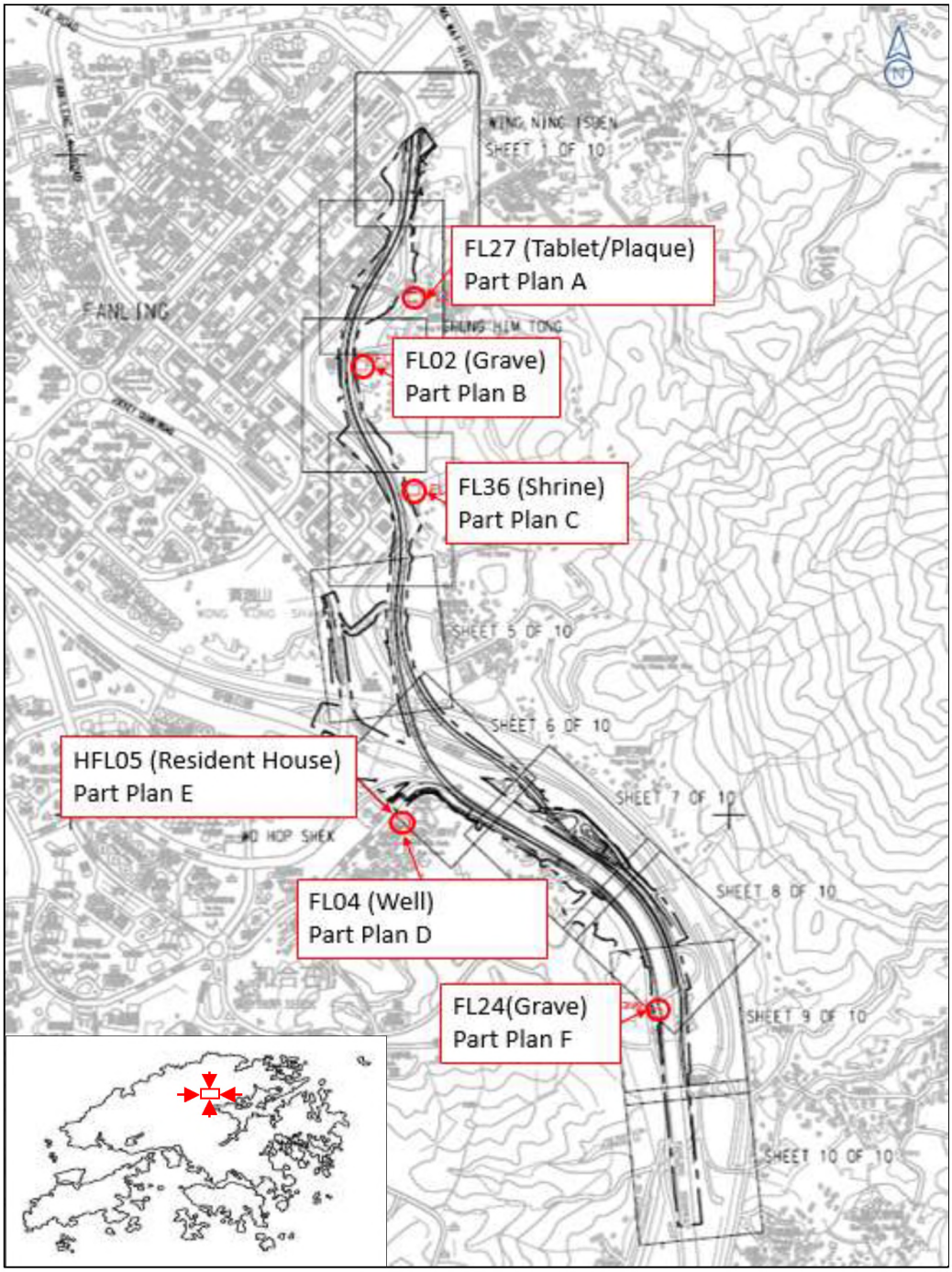
1.2.1 In reference to the Environmental Permit (ref. EP-473/2013/A) condition 2.10 and Environmental Monitoring and Audit Manual (ref. 137-05)(Appendix D) section 13.2.2, a condition survey and vibration impact assessment should be carried out for Cultural Heritage HFL 05, FL 02, FL 04, FL 24, FL 27 and FL 36. Their corresponding location is shown in below **Figure 1.1** and **Appendix A**.

1.2.2 Refer to attached Appendix D showing distance between ND/2019/04 is less than 50m whereas ND/2019/05 is about 900m, therefore, the closest site to FL31 is not ND/2019/05 and baseline condition survey and vibration impact assessment is not representative to be conducted by ND/2019/05.

1.2.3 This report aims to provide a baseline condition survey and baseline vibration impact assessment to the abovementioned cultural heritage. Other than that, the following information should be included:

a. Determine a vibration limit;
b. Determine tilting limits;
c. Determine settlement limits;
d. Determine if any construction vibration, tilting, settlement monitoring and structural strengthening measures are required during the construction phase.

Figure 1.1: Layout Plan of Eastern Section of Fanling Bypass (Shung Him Tong to Kau Lung Hang)


FL27 (Tablet/Plaque)
Part Plan A
FL02 (Grave)
Part Plan B
FL36 (Shrine)
Part Plan C
HFL05 (Resident House)
Part Plan E
FL04 (Well)
Part Plan D
FL24(Grave)
Part Plan F
FANLING
SHUNG HIM TONG
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2 CONDITION SURVEY METHODOLOGY

2.1 General Approach

2.1.1 The visual inspection would be conducted for condition survey and vibration impact assessment. It shall be carried out to present a true and accurate record of the state of cultural heritages at the time of the inspection. This comprises a comprehensive inspection of the cultural heritages to establish their general condition. Particular emphasis was given to the presence of existing defects such as cracks, water leakage, corrosion, spalled concrete, surface spalling, signs of settlement and defective finishes.

2.1.2 The location and details of these defects were recorded on sketches and a schedule of defects accompanied by a comprehensive set of record photographs is presented in this report. The visual inspection also comprised a detailed crack mapping; with crack widths measured utilising a crack visual gauge.

2.1.3 The terminology used in the description of general structural element defects, excluding road pavement surfaces shall be interpreted as follows:

Table 2.1: General Defect Terms and Corresponding Descriptions

DEFECT TERMINOLOGY	DESCRIPTIONS
Fine Crack	Crack below 1mm wide, and not being structural unless otherwise stated
Moderate crack	Crack not wider than 2mm, and not being structural unless otherwise stated.
Wide crack	Crack wider than 2mm, and not being structural unless otherwise stated.
Minor spalled concrete	Spalling up to 0.1m² and sporadic. No reinforcement bar exposed unless otherwise stated.
Major spalled concrete	Spalling greater than 0.1m² and extensive. No reinforcement bar exposed unless otherwise stated.
Crazing	A network of fine cracks on the surface of a material.
Water stain	Stain on surface caused by past water penetration. The surface is dry.
Damp patch	Moisture saturated surface with no significant trace of water.
Water seepage	Water oozing out from surface. The surface is wet.
Water leakage	Water oozing out from surface. The surface is wet and/or with running water.
Verticality	A visual assessment of verticality of the building.
Rust and pits	Discoloration and uneven steel surfaces caused by corrosion, and not being structural unless otherwise stated
Serious corrosion	Corrosion of structural steel member that has resulted in a loss of section

2.2 Condition Grading of Cultural Heritages

2.2.1 The condition grading of the cultural heritages shall be defined as follow:

Table 2.2: Condition Grading of the Cultural Heritages

GRADE	GENERAL CONDITION	DESCRIPTIONS
1	Good	No significant visible deterioration, new or evidence of recent maintenance and / or repair / modification
2	Fair	Dilapidated with significant visible deterioration
3	Poor	Seriously dilapidated, significant visible deterioration, damage to major component
4	Very Poor	Spalling up to 0.1m² and sporadic. No reinforcement bar exposed unless otherwise stated.

2.3 Impact Assessment of Cultural Heritages

2.3.1 To assess the impact of the vibration from future construction works to the existing heritage, there are multiple factors that should be taken into concern:

a. Distance to the future construction site
b. Surrounding environment of the heritage
c. Current condition of the heritage

2.3.2 The determination of vibration limit should be based on the abovementioned factors. If the cultural heritage is expected to suffer from potential hazards (e.g. collapse) due to future construction works, this report would propose a vibration, tilting and settlement monitoring scheme and structural strengthening measures to that particular heritage as required. Otherwise, the vibration would be mintoring based on the Buildings Department's Practice Note (PNAP APP-137), the note could be found in **Appendix C**. Below **table 2.3** summarizes the vibration limited from the practice note.

Table 2.3: Vibration Limit from PNAP APP-137 & PS 34.01(2)

TYPE OF BUILDING	GUIDE VALUES OF MAXIMUM PPV* (MM/SEC)	
	TRANSIENT VIBRATION	CONTINUOUS VIBRATION
Vibration-sensitive / dilapidated buildings#	7.5	3.0
Declared monuments/ Historical structures	3.0	

* peak particle velocity.

as cultural heritages are sensitive receivers, vibration monitoring should be classified as vibration-sensitive.

2.3.3 As each existing heritage will have different tolerance in accommodating movements of their foundations, acceptance of estimated ground settlements should be considered on a case-by-case basis with respect to the integrity, stability and functionality of the supported structures. the vibration would be mintoring based on the Buildings Department's Practice Note (PNAP APP- Otherwise, the vibration would be mintoring based on the Buildings Department's Practice Note (PNAP APP-137), the note could be found in **Appendix C.** Below **table 2.4** is the provisional AAA trigger values which summarizes the tilting and settlement limit

Table 2.4: Tolerable ground settlement limits and tilting limits

INSTRUMENT	CRITERION	ALERT	ALARM	ACTION
Ground settlement marker	Total settlement	12mm	18mm	25mm
Services settlement marker	Total settlement & Angular distortion	12mm or 1:600	18mm or 1:450	25mm or 1:300
Building tilting marker	Angular distortion	1:1000	1:750	1:500

Remarks:

The "Action Level" response actions should be taken if any of the following criteria occurs:

1. Any monitoring station has a reading reaching the specific trigger value based onserviceability limit[1], or in the absence of such engineering assessment, the provisionaltrigger value, whichever is applicable.
2. Undue settlement as indicated in any check points (e.g. an increase of 5mm between twoconsecutive daily readings).
3. Sign of distress or damages observed in any adjacent structures and/or services.

[1] Serviceability limit is defined as the maximum calculated movements estimated in the design or the maximum allowable movement or response of the adjacent ground, groundwater regime, structures and services. (10/2018)

3 RECORD OF INSPECTION

3.1 Basic Information to Cultural Heritages

3.1.1 The cultural hertiages are located along the two sides of the future Fanling Bypass, those heritages are in different nature. **Table 2.1** below summarizes the nature of those cultural heritages and distances to future Fanling Bypass. **Appendix B** would provide a detailed description to the cultural heritages.

Table 3.1: Basic Information of the Cultural Heritages

Cultural Heritage Label	Nature of Cultural Heritage
HFL 05	Resident House
FL 02	Grave
FL 04	Well
FL 24	Grave
FL 27	Monument
FL 36	Shrines

3.2 Inspection Record

3.2.1 The owner of House 4B2 from HFL05 was not able to contact at the first visit in 13th July 2020, an appointment was made in advance with the house owner for a re-visit on 17th July 2020, with no response from the owner. Due to escalating COVID-19 outbreak in Hong Kong, the government has tightened the social distancing rule to 2-person limit on group gatherings, hence the third visit to House 4B2 is cancelled.

Table 3.2: Table of Inspected Items

LABEL		DATE OF INSPECTION	DISTANCE TO FUTURE FANLING BYPASS	LOCATION
HFL 05	4A, 4B	13 July 2020 (2nd Floor access rejected)	~50m	Near the entrance of Wo Hop Shek Village
	4C	16 July 2020		
	4B2	13 July 2020 (Unable to Contact Owner) 17 July 2020 (Contacted with no-show)		
	5	13 July 2020 (2nd Floor access rejected)		

LABEL		DATE OF INSPECTION	DISTANCE TO FUTURE FANLING BYPASS	LOCATION
	6	13 July 2020		
	Unknown	13 July 2020		
FL 02		13 July 2020	<10m	Northwest side of Shung Him Tong Tsuen, at the hillside behind On Lok Garden
FL 04		13 July 2020	~50m	Adjoining the cultural heritage HFL 05
FL 24		13 July 2020	>100m	In between the Tai Wo Service Road West and Fanling Highway, near the junction of Tai Wo Service Road West and Kiu Tau Road
FL 27		13 July 2020	>75m	At the opposite of Shung Him Tong Public Toilet, at the bottom of slope feature
FL 36		13 July 2020	~25m	Opposite to Lincoln Centre, adjoin the Ma Wat River, slightly on the uphill side

3.3 Summary of Defects

3.3.1 The defects identified during the visual inspection and their corresponding photo ID are summarised in the table below. The elevation and plans showing the location of the defects and their corresponding photo ID can be referred to **Appendix B**.

Table 3.3: Summary of Defects

LOCATION	DESCRIPTION OF DEFECTS	LENGTH (MM)	WIDTH (MM)	PHOTO ID
FL27 Tablet/Plaque (Part Plan A)	Moderate Crack on Tablet	300	2	1A-D1
FL02 Grave (Part Plan B)	Moderate Crack on Surface	1000	2.5	2A-D1
	Peeling Paint from Surface	-	-	2A-D2
	Fine Crack on Surface	200	0.65	2A-D3
	Fine Crack on Floor Surface	200	0.80	2A-D4
	Moderate Crack on Surface	250	1.20	2A-D5
	Moderate Crack on Surface	1200	1.50	2A-D6
	Fine Crack on Surface	250	0.60	2A-D7
	Wide Crack on Surface	1200	3.00	2A-D8
	Wide Crack on Surface	1000	3.00	2A-D9
FL36 Grave (Part Plan C)	Wide Crack on Surface	1000	2.00	3A-D1
	Moderate Crack on Floor	3000	1.10	3A-D2
	Shoving on Floor Surface	-	-	3A-D3
	Ravelling on Surface	-	-	3A-D4
	Ravelling on Surface	-	-	3A-D5
	Wide Crack on Surface	300	5.00	3A-D6
	Surface Spalling	-	-	3A-D7
	Wide Crack on Floor	1500	4.00	3A-D8
	Fine Crack on Surface	100	0.20	3A-D9
	Wide Crack on Surface	800	3.40	3A-D10
	Block Work Defects on Surface	-	-	3A-D11
	Wide Crack on Surface	600	8.00	3A-D12
	Revalling on Floor Surface	-	-	3A-D13
	Wide Crack on Slope	-	8.00	3A-D14
	Wide Crack on Slope	600	5.00	3A-D15
FL04 Well (Part Plan D)	Wide Crack on Floor	150	5.00	4A-D1
	Wide Crack on Floor	200	2.50	4A-D2
	Spalling on Floor Surface	-	-	4A-D3
HFL05 House 4A & 4B	Wide Crack on Surface	-	-	5A1-D1
	Moderate Crack on Wooden Floor	-	-	5A1-D2

LOCATION	DESCRIPTION OF DEFECTS	LENGTH (MM)	WIDTH (MM)	PHOTO ID
(Part Plan E1)	Broken Floor Tile	-	-	5A1-D3
	Wide Crack on Wall Tile	100	4.00	5A1-D4
HFL05 House 4C (Part Plan E2)	Crack on Surface	-	-	5A2-D1
	Spalling between Wall & Ceiling	-	-	5A2-D2
HFL05 House 5 (Part Plan E3)	Water Stain on Surface	-	-	5A3-D1
	Moderate Crack on Wall Surface	700	2.50	5A3-D2
	Wide Crack on Wall	600	3.00	5A3-D3
HFL05 House 6 (Part Plan E4)	Dislodged False Ceiling	-	-	5A4-D1
HFL05 Unknown House (Part Plan E5)	Fine Crack on Wall Surface	1500	0.75	5A5-D1
	Fine Crack on Wall Surface	-	-	5A5-D2
	Fine Crack on Wall Tiles	200	0.08	5A5-D3
	Cracked Wall Tiles	1500	2.20	5A5-D4
	Crack and Broken Tiles	-	-	5A5-D5
	Water Stain and Crazing	-	-	5A5-D6
	Moderate Crack on Wall Surface	2000	1.75	5A5-D7
	Moderate Crack on Wall Surface	400	1.8	5A5-D8
	Moderate Crack on Wall Surface	300	1.80	5A5-D9
FL24 Grave (Part Plan F)	Wide Crack on Grave	500	45.00	6A-D1
	Fine Crack on Grave	900	0.50	6A-D2
	Broken Surface	-	-	6A-D3
	Wide Crack on Grave	200	20.00	6A-D4

4 CONCLUSION AND RECOMMENDATION

4.1.1 From the Survey of the EBSS, the summary of the conclusions and condition grading for the following items are presented in the table below:

Table 4.1: Summary of Condition Grading

ITEM	PHOTO RECORD SERIES	CONCLUSION	CONDITION GRADING
FL27 Tablet/Plaque (Part Plan A)	G1-G8, D1	The grave (FL27) is in fair condition, with a majority of defects being surface cracks.	2 - Fair
FL02 Grave (Part Plan B)	G1-G8, D1-D9	The grave (FL02) is in poor condition, with a volume of cracks on the on the structure	3 – Poor
FL36 Shrine (Part Plan C)	G1-G9, D1-D15	The grave (FL36) is in poor condition, with a volume of cracks on the on the structure	3 – poor
FL04 Well (Part Plan D)	G1, D1-D3	The well is demolished and covered with concrete. A majority of defects being surface cracks on the concrete surface.	2 - Fair
HFL05 Resident House House 4A & 4B (Part Plan E1)	G1-G18, D1-D4	The House 4D is in Fair condition, with a majority of defects being surface cracks on the walls and ceilings. Access to 2nd floor is rejected by the owner, the conclusion is based on observation on the first floor.	2 - Fair
HFL05 Resident House House 4C (Part Plan E2)	G1-G25, D1-D2	The House 4C is in Fair condition, with a majority of defects being surface cracks on the walls and ceilings.	2 - Fair
HFL05 Resident House House 4B2 (Part Plan E2)	-	The House 4B2 is not accessible, hence, no condition grading will be provided.	-
HFL05 Resident House House 5 (Part Plan E3)	G1-G12, D1-D3	The House 5 is in Fair condition, with a majority of defects being surface cracks on the walls and ceilings. Access to 2nd floor is rejected by the owner, the conclusion is based on observation on the first floor.	2 - Fair
HFL05 Resident House House 6 (Part Plan E4)	G1-G16, D1	The House 5 is in Fair condition, with a majority of defects being surface cracks on the walls and ceilings. Most of the walls are obstructed by furnitures.	2 - Fair
HFL05 Resident House Unknown House	G1-G25, D1-D9	The unknown house is in fair condition, with a volume of cracks on the walls and ceilings.	2 - Fair

ITEM	PHOTO RECORD SERIES	CONCLUSION	CONDITION GRADING
(Part Plan E5)			
FL24 Grave (Part Plan E)	G1-G6, D1-D4	The grave (FL24) is in poor condition, with a volume of cracks on the structure	3 – poor

4.2 Conclusion

4.2.1 Though defects (e.g. cracks) were observed on some of the cultural heritages, they are assessed to be structurally feasible, with no potentially hazards to their structural performance from the future construction works associated with the Fanling Bypass.

4.3 Recommendation

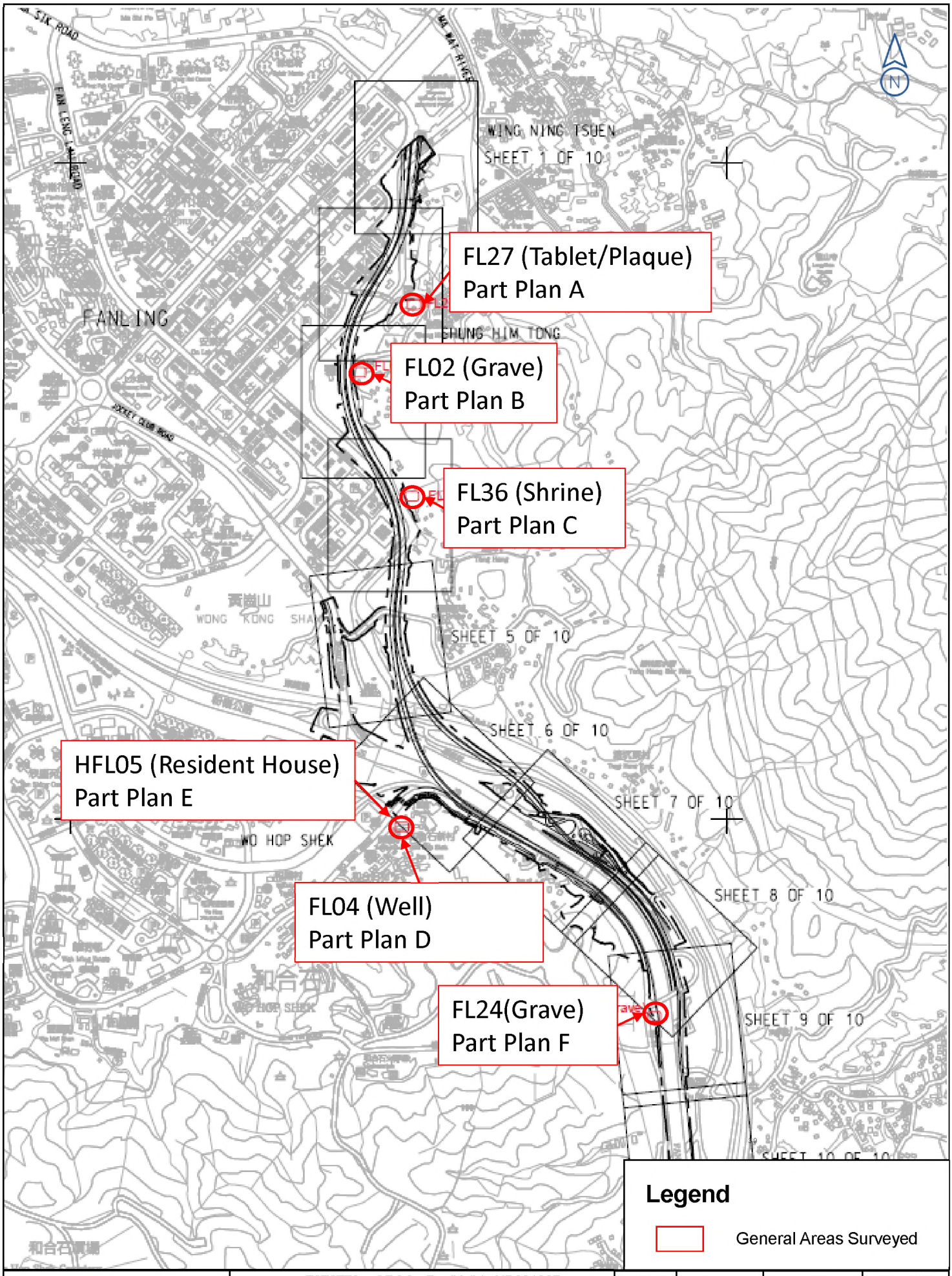
4.3.1 It is proposed that all the cultural heritage abovementioned to be monitored in accordance with the PNAP APP-137 from Buildings Department against vibration. A monitoring plan is proposed according to below table 4.1. Each surveyed cultural heritage is adopted to vibration monitoring plan. Except HFL05, the residential houses at Kau Lung Hang village, due to some of the inaccessible areas, the condition of HFL05 should be closely monitored, three monitoring points are proposed to this particular cultural heritage, other cultural heritages are proposed to have one monitoring point for each. The location of the monitoring points should submit to RSS for approval prior to the construction works.

Table 4.2: Proposed Monitoring Plan

DISTANCE WITH CONSTRUCTION WORKS	MONITORING PLAN
Within 50m	Daily assessment is required
Within 75m	Bi-daily assessment is required
Within 100m	Weekly assessment is required

4.3.2 Immediate action for structural strengthening of the cultural heritages are not required. However, visual assessment should be carried out concurrently with the vibration monitoring assessment, once significant deficiencies (e.g. tilting, differential settlement) were observed, the construction works should stop immediately and seek structural engineer's advise for any remedial works.

Appendix A LAYOUT PLAN OF CULTURAL HERITAGE



SMEC Member of the Surbana Jurong Group	7076779 – CRCC - PaulY JV - ND201905 Fanling Bypass – CS Condition Survey Location Plan of General Area in Fanling North New Development Areas, Phase 1	SCALE	DATE: JUL 2020
		CHECK: JY	DRAWN: Various
		JOB NO.: 7076758	DRAWING NO.: Figure 1 / REV.: -

Appendix B DETAILED DESCRIPTION OF CULTURAL HERITAGE

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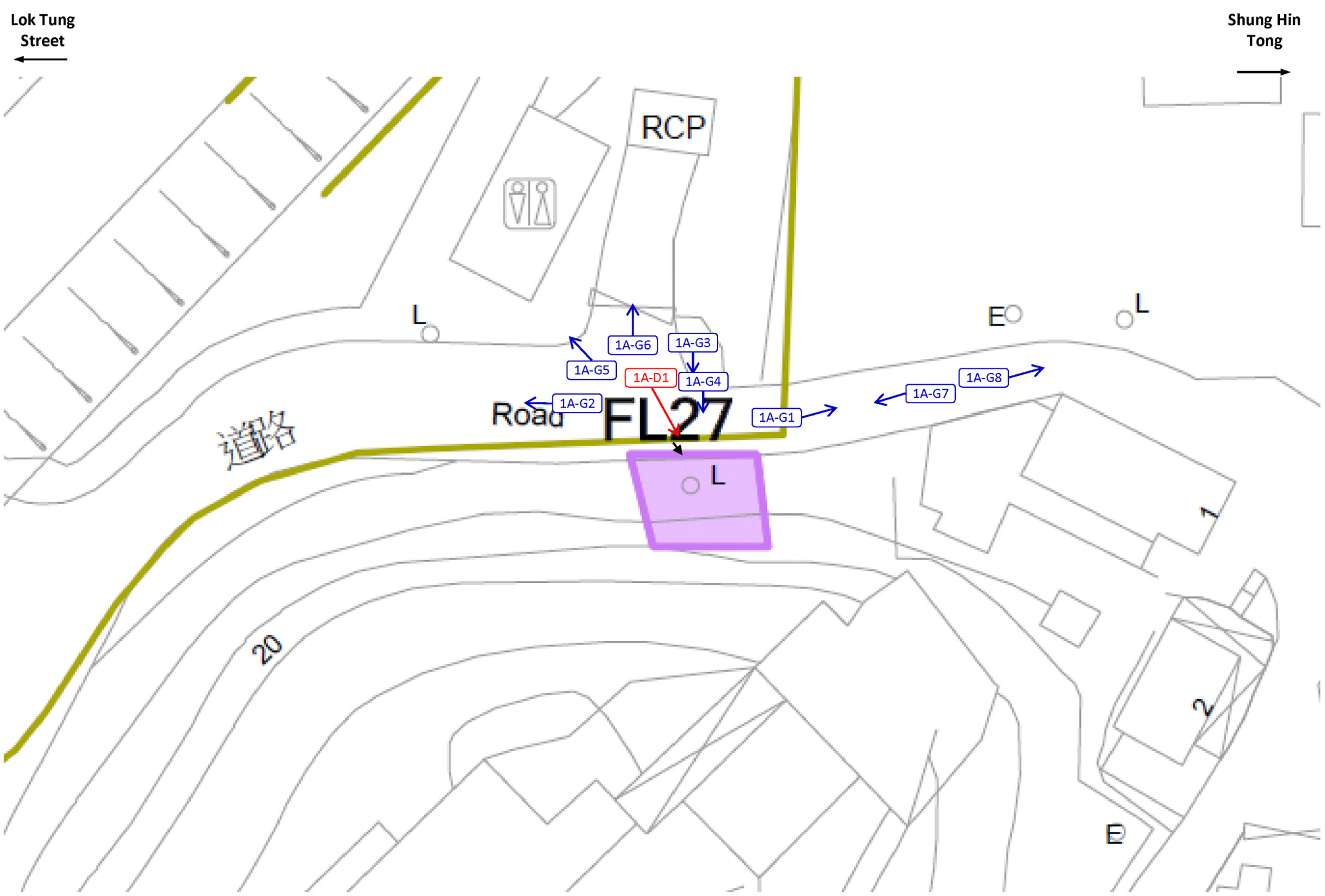


Part Plan A - Layout Plan of FL27 with Location of General Photos

1A-G1 → Photo Mark (General)
1A-D1 → Photo Mark (Defect)

Appendix B – Detailed Inspection Report of General Areas
Part Plan A – FL27 (Tablet/Plaque)
Date of Photo Taken: 13rd July 2020

General View

1A-G1

1A-G2

1A-G3

1A-G4

Appendix B – Detailed Inspection Report of General Areas
Part Plan A – FL27 (Tablet/Plaque)
Date of Photo Taken: 13rd July 2020

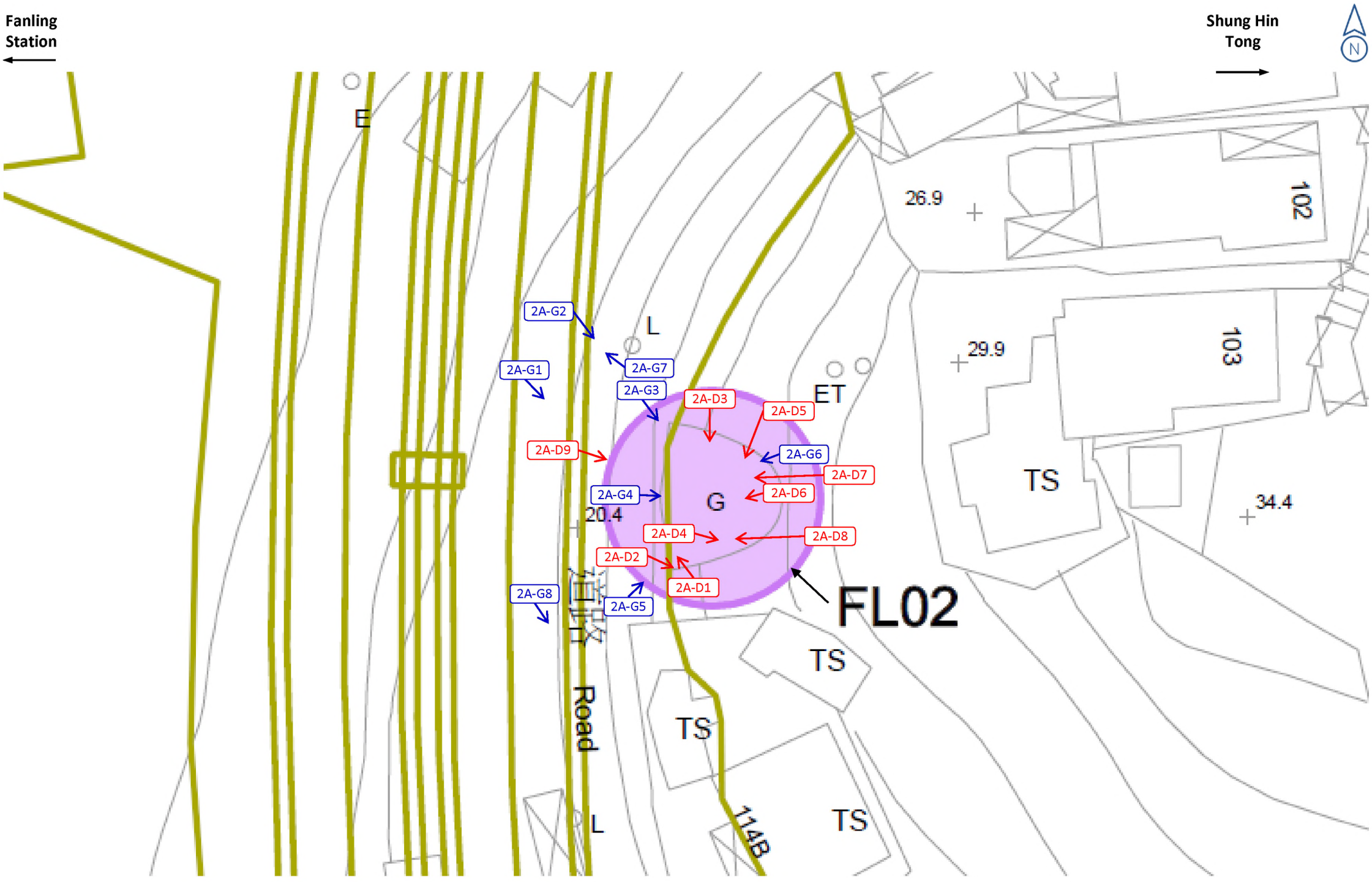
General View

	
1A-G5	1A-G6
	
1A-G7	1A-G8

Appendix B – Detailed Inspection Report of General Areas
Part Plan A – FL27 (Tablet/Plaque)
Date of Photo Taken: 13rd July 2020

Defects

	
1A-D1(1) - Moderate Crack on Tablet (General View)	1A-D1(2) - Moderate Crack on Tablet (Length:300mm/Width:2mm)



Part Plan B - Layout Plan of FL02 with Location of General Photos

2A-G1 → Photo Mark (General)
2A-D1 → Photo Mark (Defect)

Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

General View

	
2A-G1	2A-G2
	
2A-G3	2A-G4

Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

General View

	
2A-G5	2A-G6
	
2A-G7	2A-G8

Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

	
2A-D1(1) - Moderate Crack on Surface (General View)	2A-D1(2) - Wide Crack on Surface (Length:1000mm/Width:2.5mm)
	
2A-D2(1) - Peeling Paint from Surface (General View)	2A-D2(2) – Peeling Paint from Surface

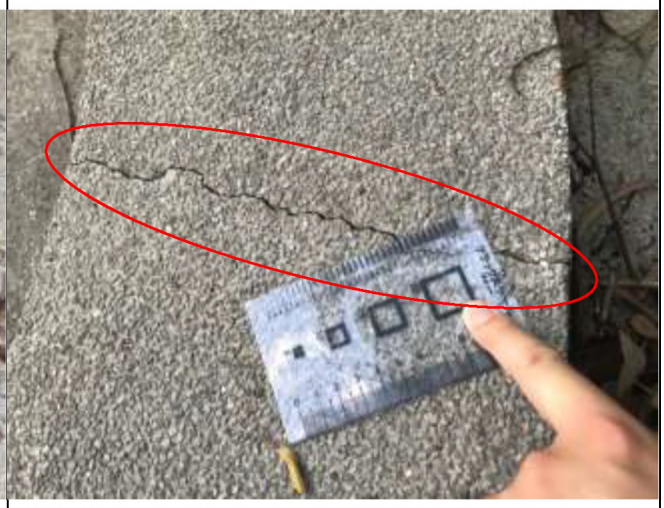
Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

	
2A-D3(1) - Fine Crack on Surface (General View)	2A-D3(2) - Fine Crack on Surface (Length:200mm/Width:0.65mm)
	
2A-D4(1) - Fine Crack on Surface (General View)	2A-D4(2) - Fine Crack on Surface (Length:200mm/Width:0.80mm)

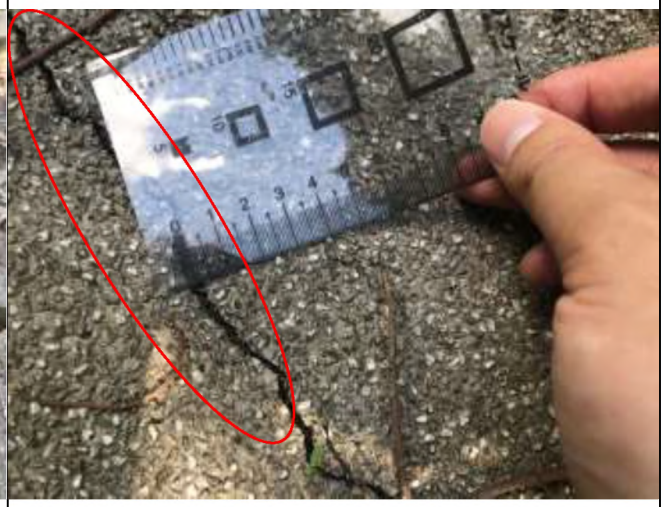
Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

	
2A-D5(1) - Moderate Crack on Surface (General View)	2A-D5(2) - Moderate Crack on Surface (Length:250mm/Width:1.20mm)
	
2A-D6(1) - Moderate Crack on Surface (General View)	2A-D6(2) - Moderate Crack on Surface (Length:1200mm/Width:1.50mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

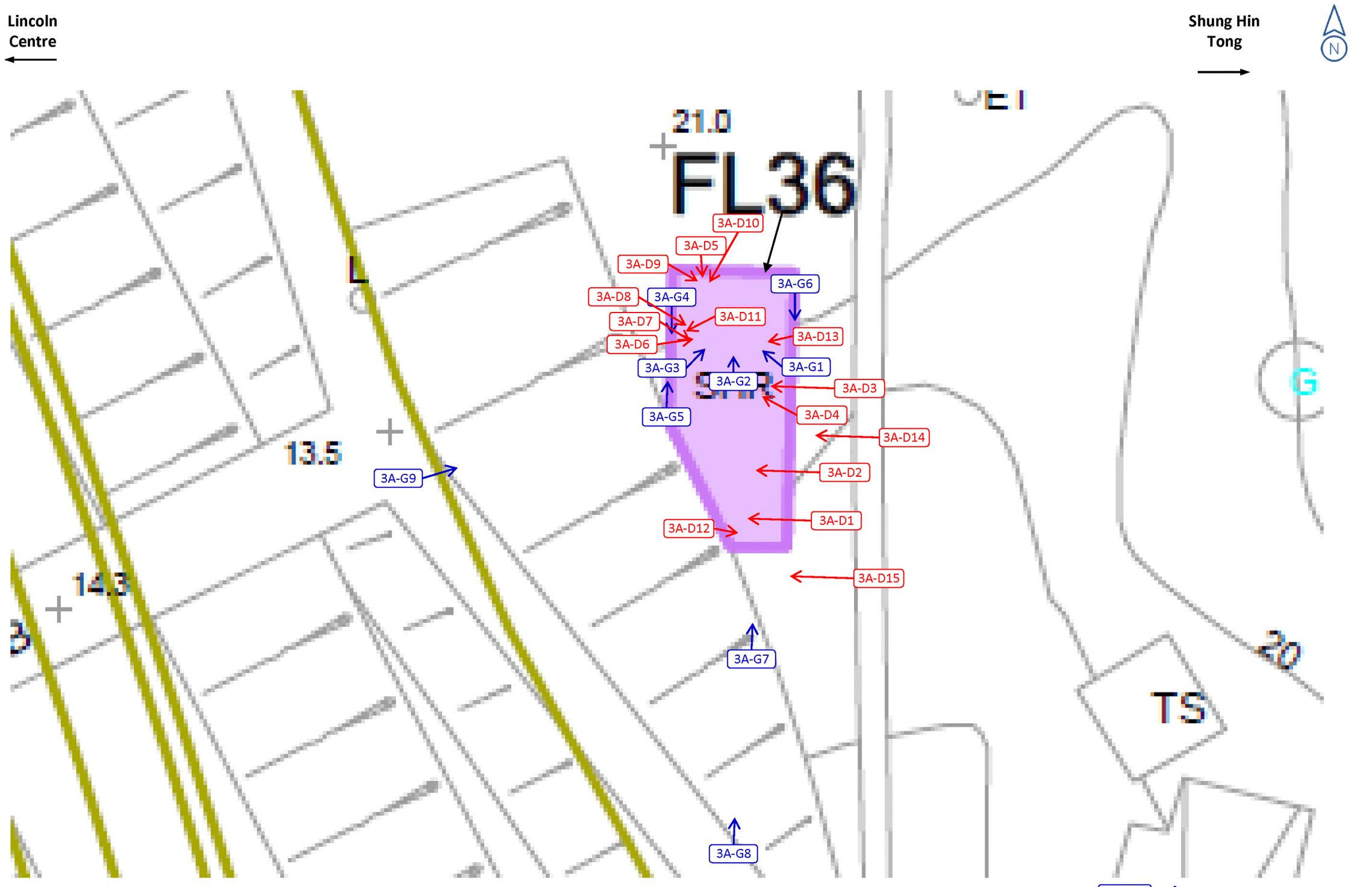
Defects

	
2A-D7(1) - Fine Crack on Surface (General View)	2A-D7(2) - Fine Crack on Surface (Length:250mm/Width:0.60mm)
	
2A-D8(1) - Wide Crack on Surface (General View)	2A-D8(2) - Wide Crack on Surface (Length:1200mm/Width:3.00mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan B – FL02 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

	
2A-D9(1) - Wide Crack on Surface (General View)	2A-D9(2) - Wide Crack on Surface (Length:1000mm/Width:3.00mm)



Part Plan C - Layout Plan of FL36 with Location of General Photos

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

General View

3A-G1

3A-G2

3A-G3

3A-G4

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

General View

	
3A-G5	3A-G6
	
3A-G7	3A-G8

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

General View

3A-G9

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

	
3A-D1(1) - Moderate Crack on Surface (General View)	3A-D1(2) - Wide Crack on Surface (Length:1000mm/Width:2.00mm)
	
3A-D2(1) - Moderate Crack on Floor (General View)	3A-D2(2) – Moderate Crack on Floor (Length:3000mm/Width:1.10mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

	
3A-D3(1) - Shoving on Floor Surface (General View)	3A-D3(2) - Shoving on Floor Surface
	
3A-D4(1) - Fine Crack on Surface (General View)	3A-D4(2) - Ravelling on Surface

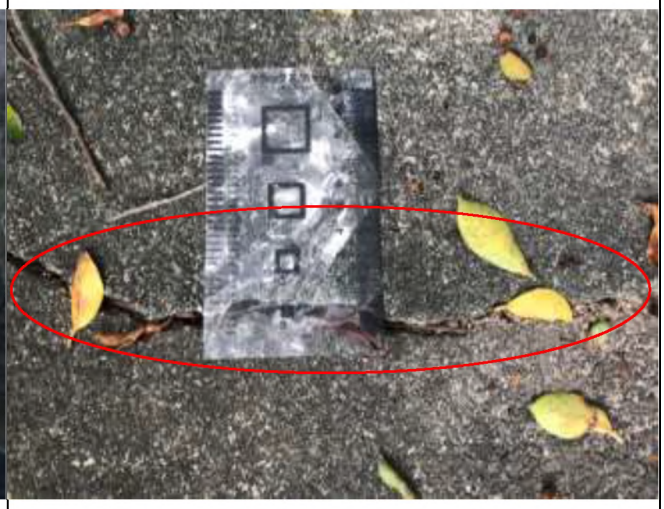
Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>3A-D5(1) - Ravelling on Surface
(General View)</td><td>3A-D5(2) - Ravelling on Surface</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>3A-D6(1) - Fine Crack on Surface
(General View)</td><td>3A-D6(2) - Wide Crack on Surface
(Length:300mm/Width:5.00mm)</td></tr>
</table>

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

	
3A-D7(1) - Surface Spalling (General View)	3A-D7(2) – Surface Spalling
	
3A-D8(1) - Fine Crack on Floor (General View)	3A-D8(2) - Wide Crack on Floor (Length:1500mm/Width:4.00mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>3A-D9(1) - Fine Crack on Surface
(General View)</td><td>3A-D9(2) - Fine Crack on Surface
(Length:100mm/Width:0.20mm)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3A-D10(1) - Wide Crack on Surface
(General View)</td><td>3A-D10(2) - Wide Crack on Surface
(Length:800mm/Width:3.40mm)</td></tr>
</table>

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

	
3A-D11(1) – Block Work Defects on Surface	3A-D12(1) - Wide Crack on Surface (General View)
	
3A-D12(2) - Wide Crack on Surface (General View)	3A-D12(3) - Wide Crack on Surface (Length:600mm/Width:8.00mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

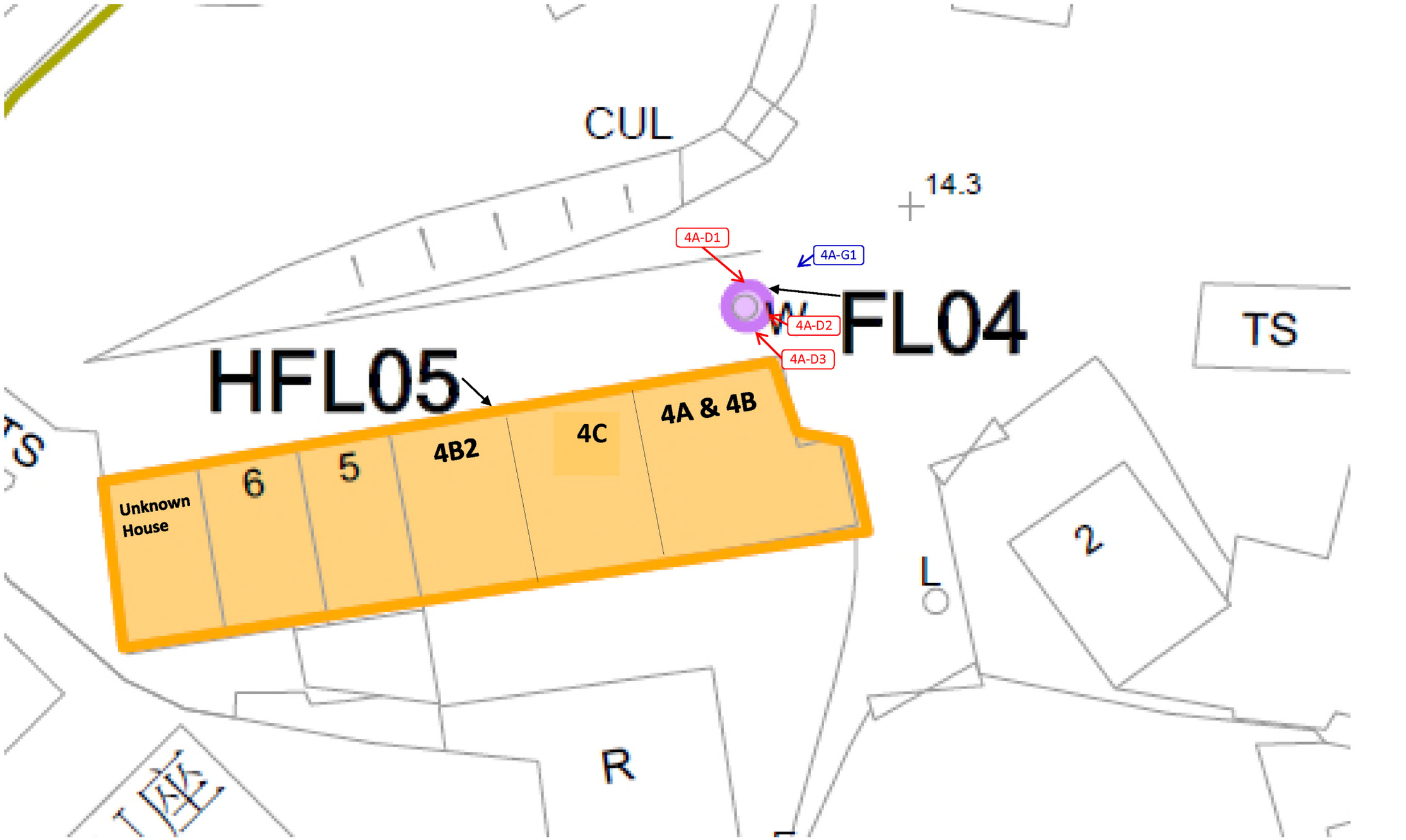
Defects

	
3A-D13(1) - Ravelling on Floor Surface (General View)	3A-D13(1) - Ravelling on Floor Surface
	
3A-D14(1) - Wide Crack on Slope (General View)	3A-D14(2) - Wide Crack on Slope (Width:8.00mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan C – FL36 (Shrine)
Date of Photo Taken: 13rd July 2020

Defects

	
3A-D15(1) - Wide Crack on Slope (General View)	3A-D15(1) – Wide Crack on Slope (Length:600mm/Width:5.00mm)



Part Plan D - Layout Plan of FL04 with Location of General Photos

4A-G1 → Photo Mark (General)
4A-D1 → Photo Mark (Defect)

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL04 (Well)
Date of Photo Taken: 13rd July 2020

General View

4A-G1(1)

4A-G1(2)

4A-G1(3)

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL04 (Well)
Date of Photo Taken: 13rd July 2020

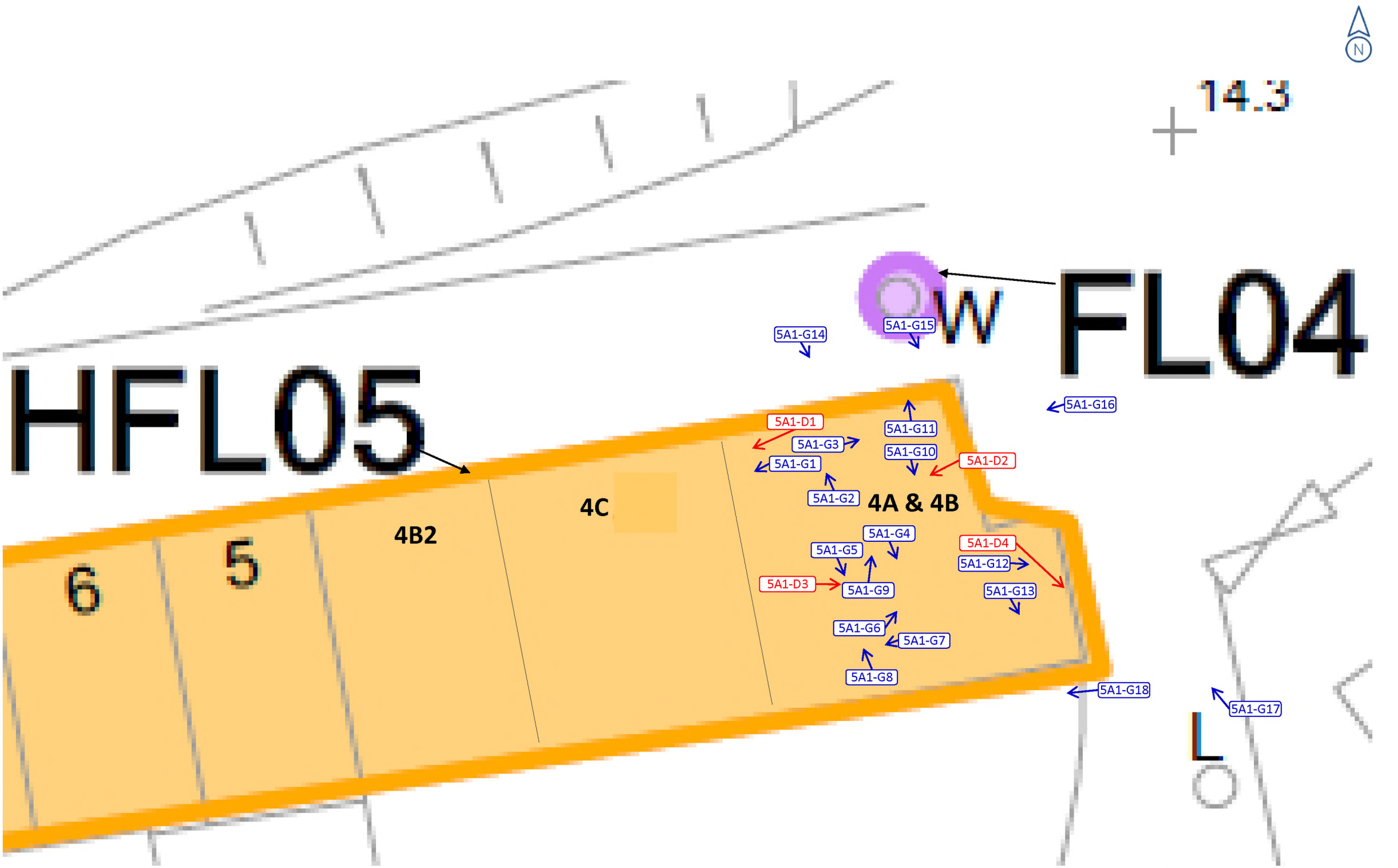
Defects

	
4A-D1(1) - Wide Crack on Floor (General View)	4A-D1(2) - Wide Crack on Floor (Length:150mm/Width:5.00mm)
	
4A-D2- Moderate Crack on Floor (Length:200mm/Width:2.50mm)	4A-D3(1) – Spalling on Floor Surface

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL04 (Well)
Date of Photo Taken: 13rd July 2020

Defects

4A-D3(2) – Spalling on Floor Surface

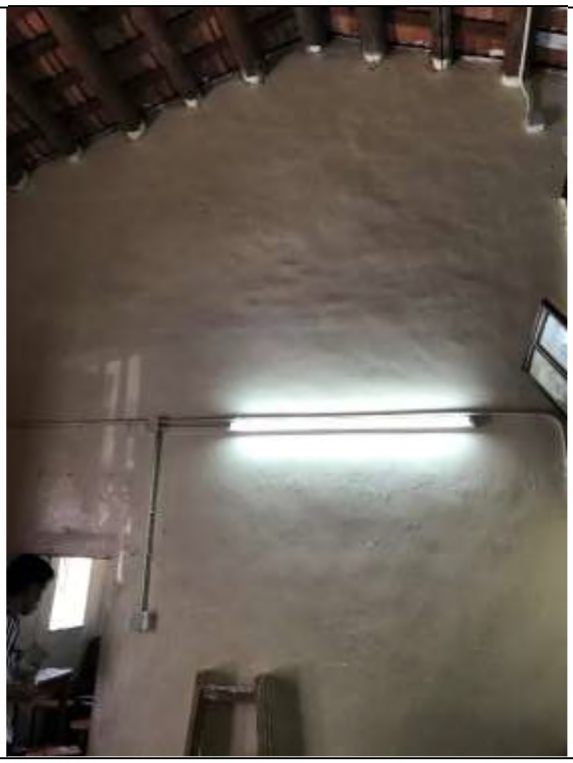
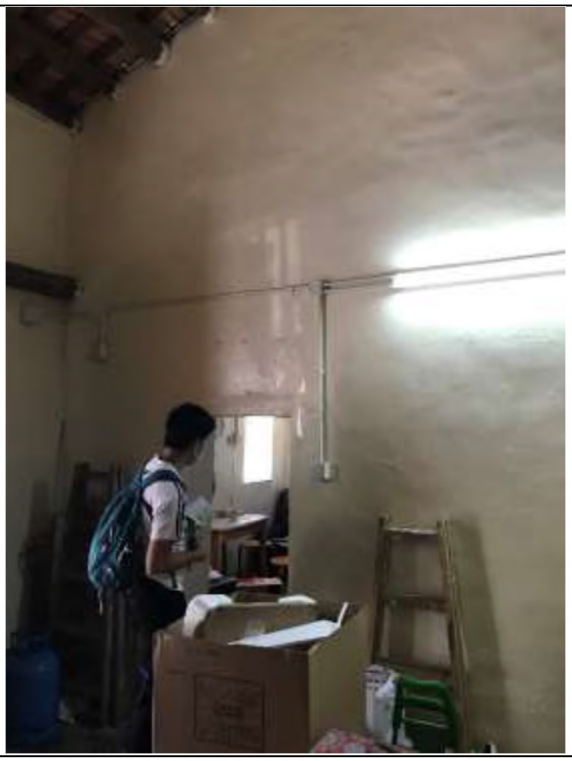


5A1-G1 → Photo Mark (General)
5A1-D1 → Photo Mark (Defect)

Part Plan E(1) - Layout Plan of HFL05 (House 4A & 4B) with Location of General Photos

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

General View

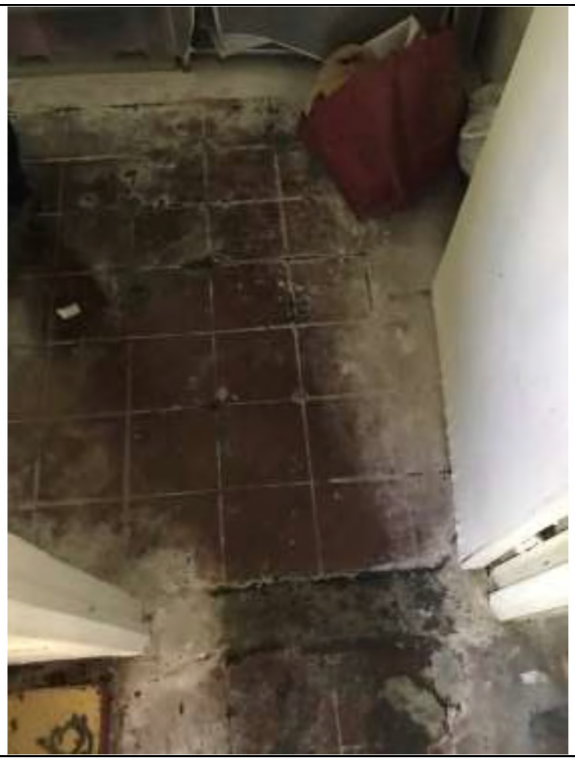
	
5A1-G1	5A1-G2
	
5A1-G3(1)	5A1-G3(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

General View

5A1-G4

5A1-G5(1)

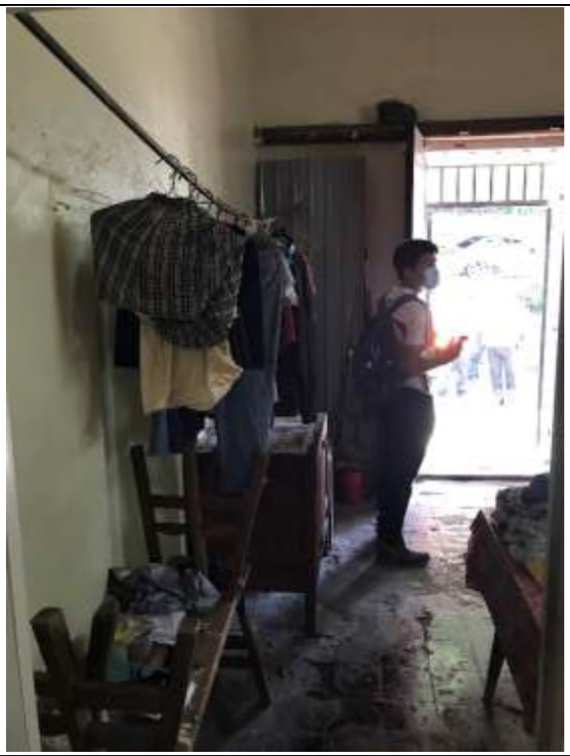


5A1-G5(2)

5A1-G6(1)

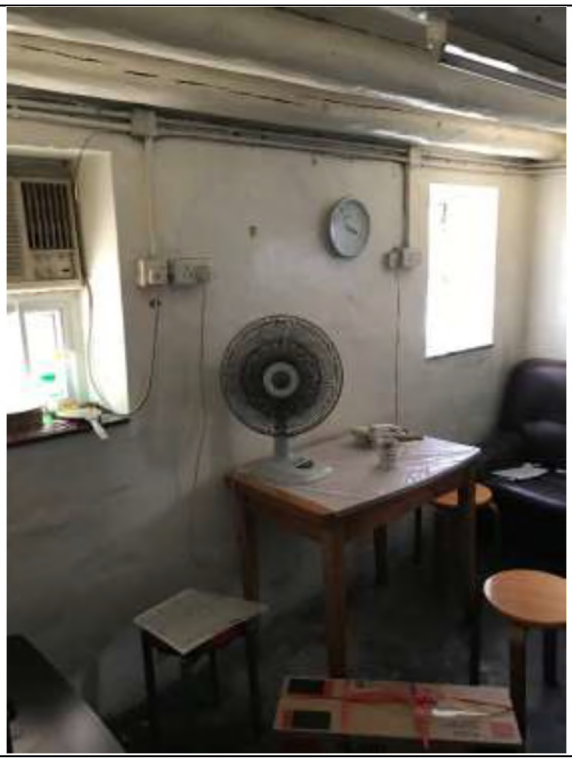
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

General View

	
5A1-G6(2)	5A1-G7
	
5A1-G8(1)	5A1-G8(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

General View

	
5A1-G9	5A1-G10
	
5A1-G11(1)	5A1-G11(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

General View

	
5A1-G12(2)	5A1-G13
	
5A1-G14(1)	5A1-G14(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

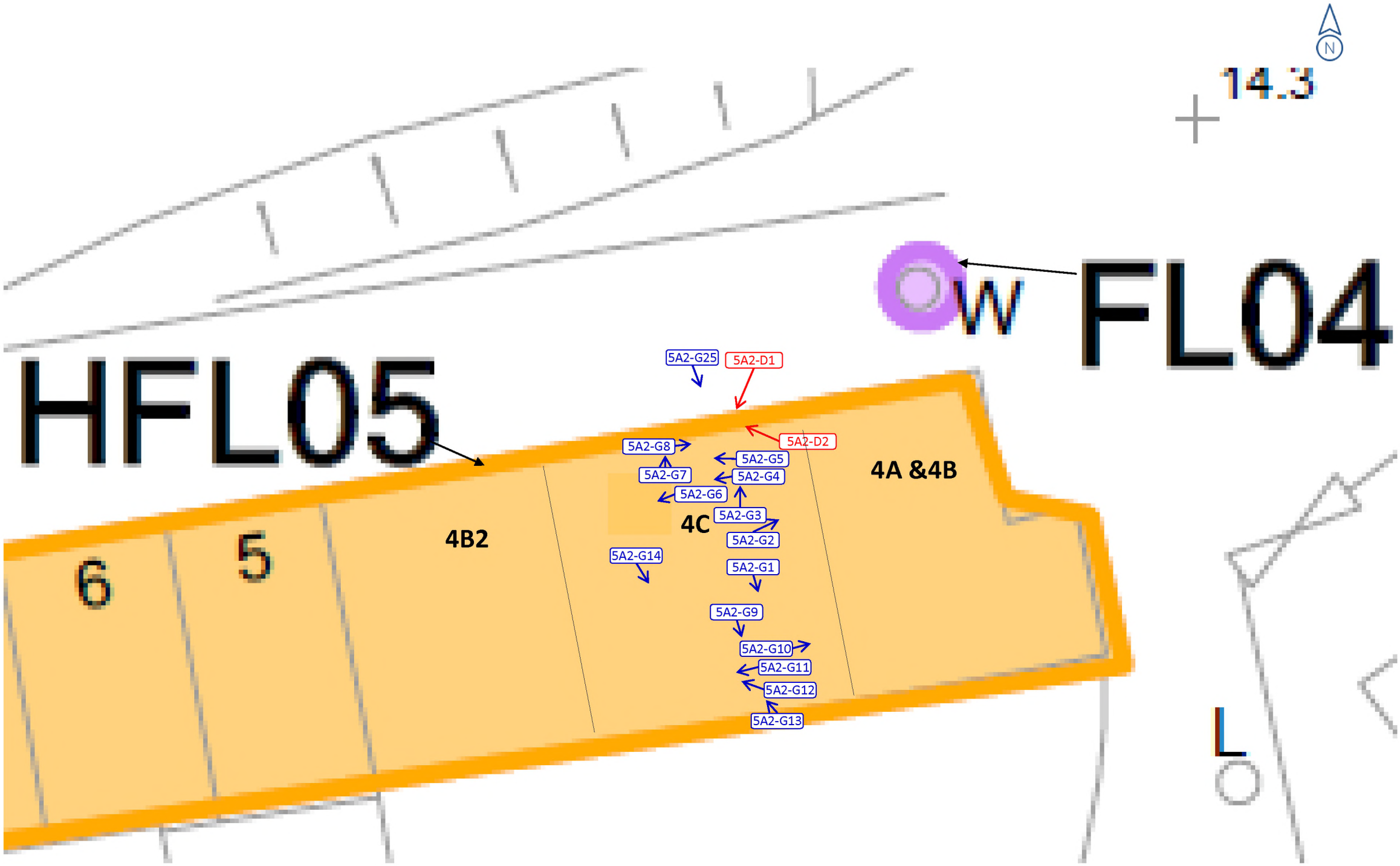
General View

	
5A1-G15	5A1-G16
	
5A1-G17	5A1-G18

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(1) – HFL05 (House 4A & 4B)
Date of Photo Taken: 13rd July 2020

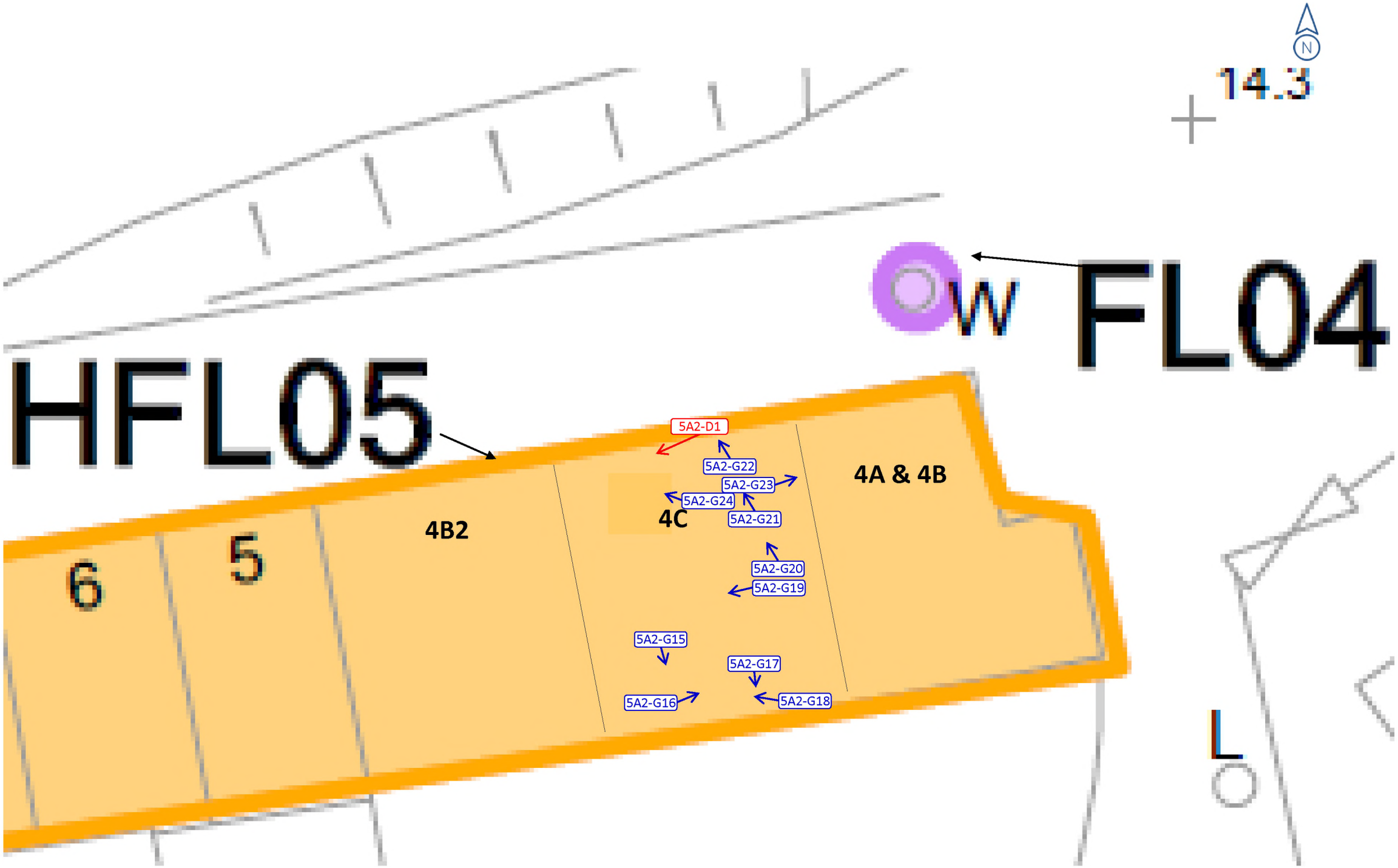
Defects

	
5A1-D1 - Wide Crack on Surface	5A1-D2 - Moderate Crack on Wooden Floor
	
5A1-D3 – Broken Floor Tile	5A1-D4 – Wide Crack on Wall Tile (Length:100mm/Width:4.00mm)



Part Plan E(2) - Layout Plan of HFL05 (House 4C – 1st Floor) with Location of General Photos

5A2-G1 → Photo Mark (General)
5A2-D1 → Photo Mark (Defect)



Part Plan E(2) - Layout Plan of HFL05 (House 4C – 2nd Floor) with Location of General Photos

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

5A2-G1

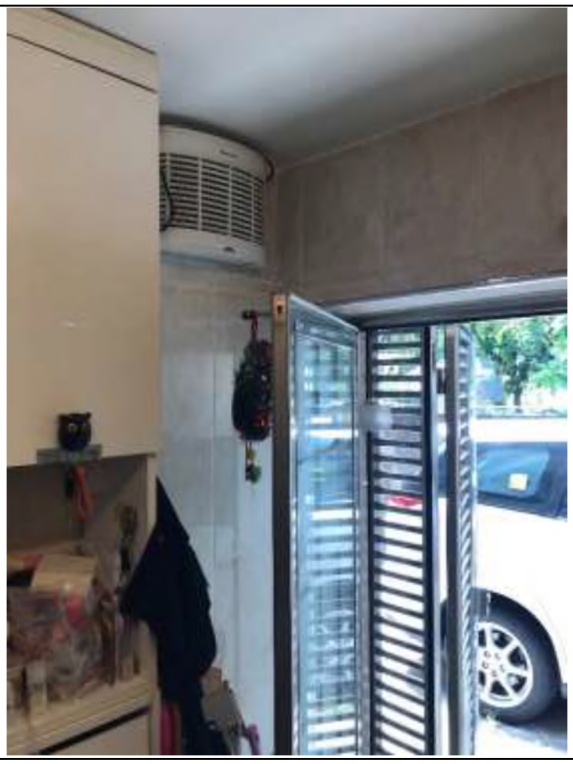
5A2-G2

5A2-G3

5A2-G4

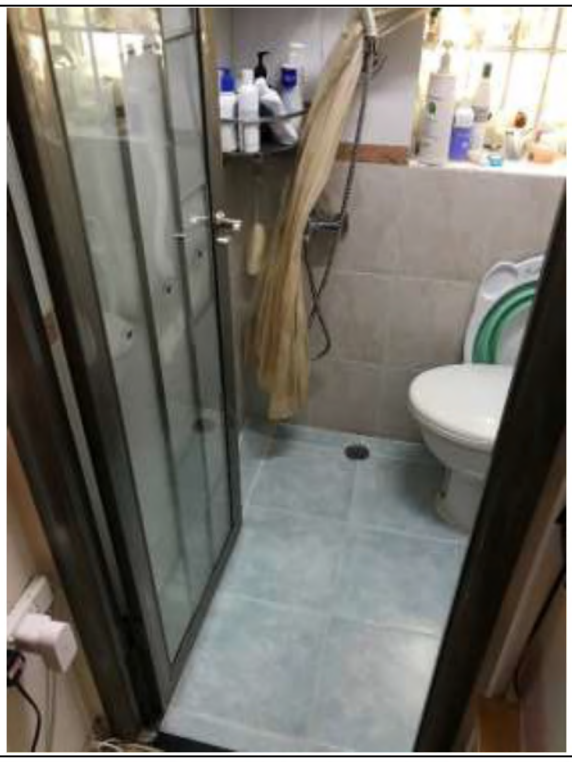
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G5(1)	5A2-G5(2)
	
5A2-G6(1)	5A2-G6(2)

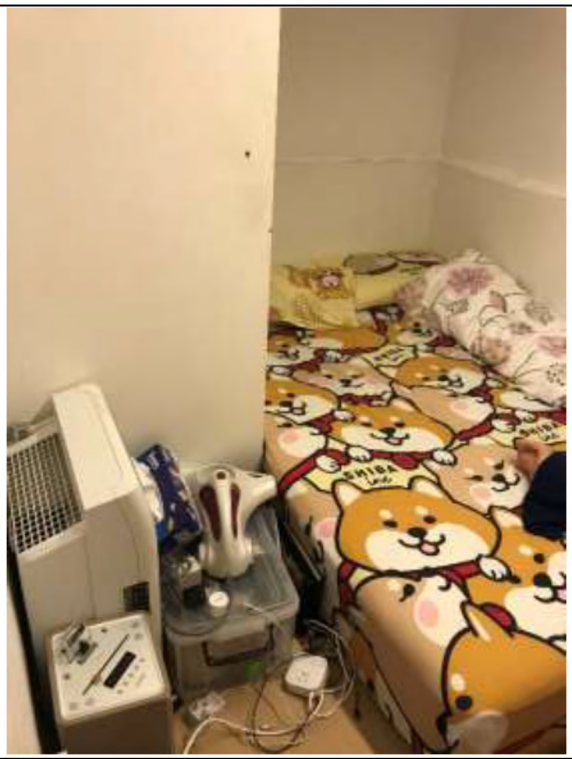
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G7(1)	5A2-G7(2)
	
5A2-G8(1)	5A2-G8(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G9	5A2-G10(1)
	
5A2-G10(2)	5A2-G11(1)

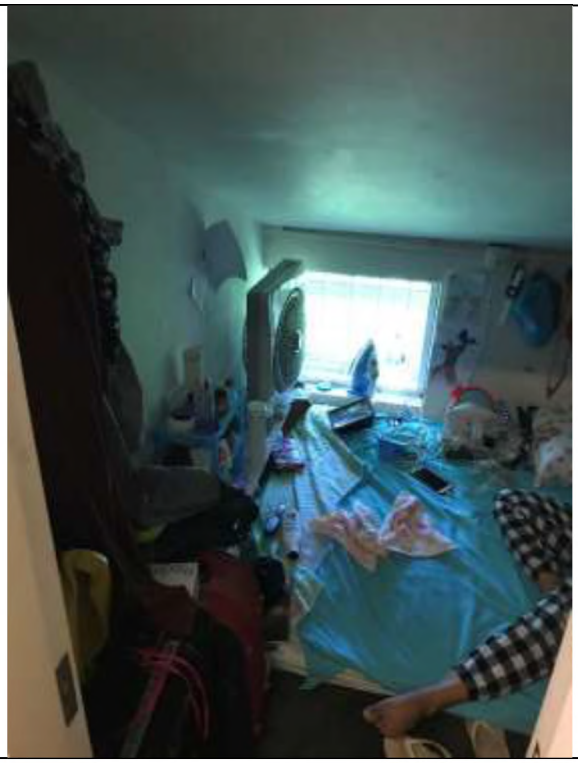
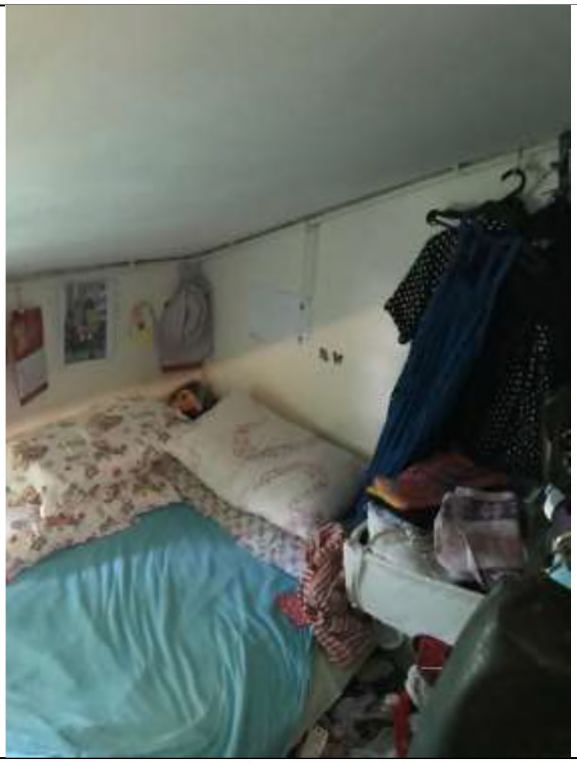
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G12(2)	5A2-G13
	
5A2-G14	5A2-G15

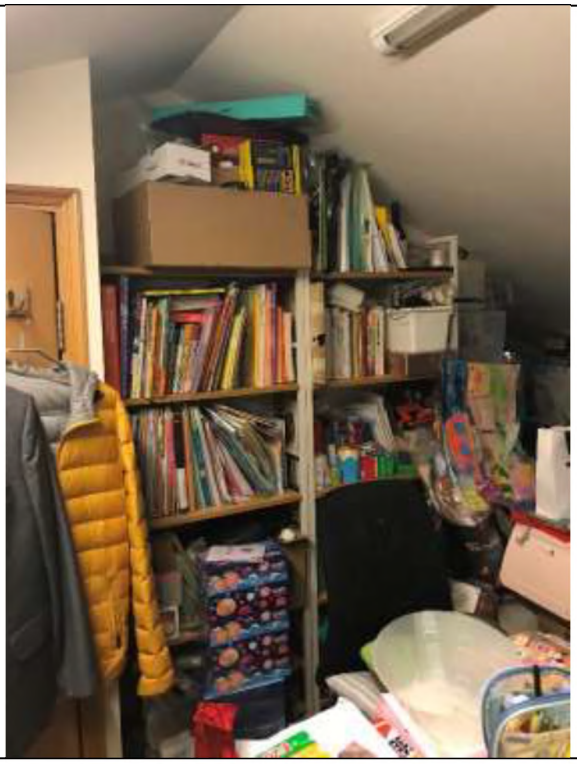
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G16(1)	5A2-G16(2)
	
5A2-G17	5A2-G18

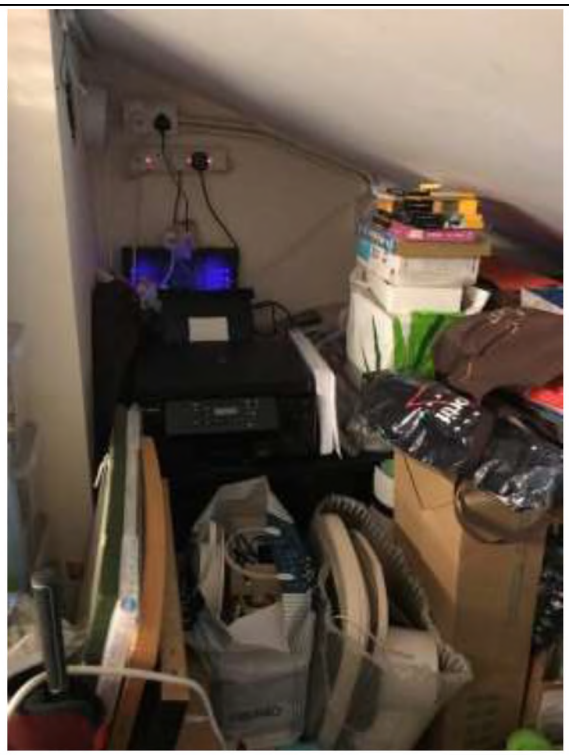
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

	
5A2-G19(1)	5A2-G19(2)
	
5A2-G20	5A2-G21

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

General View

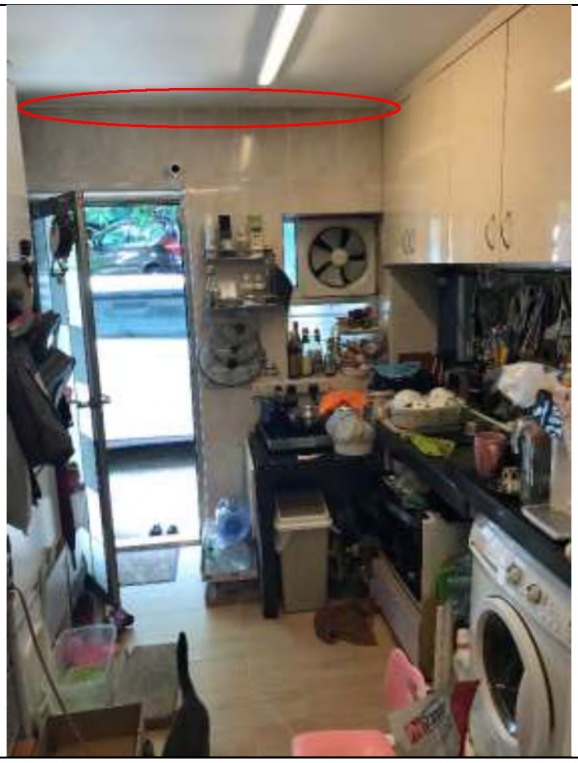
	
5A2-G22	5A2-G23
	
5A2-G24	5A2-G25

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(2) – HFL05 (House 4C)
Date of Photo Taken: 13rd July 2020

Defects

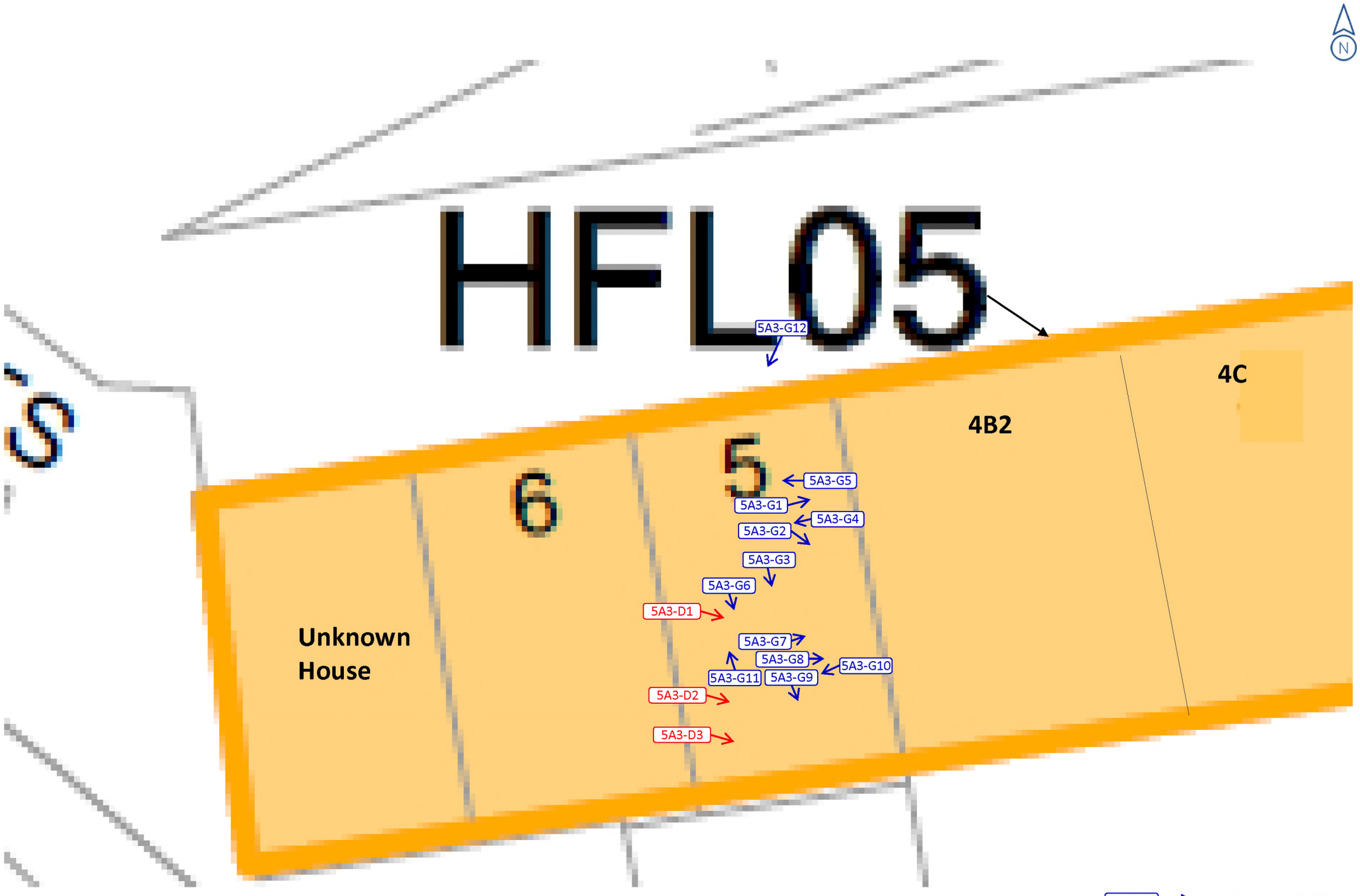
5A2-D1(1) - Crack on Surface

5A2-D1(2) - Crack on Surface



5A2-D2(1) – Spalling between Wall & Ceiling

5A2-D2(2) – Spalling between Wall & Ceiling

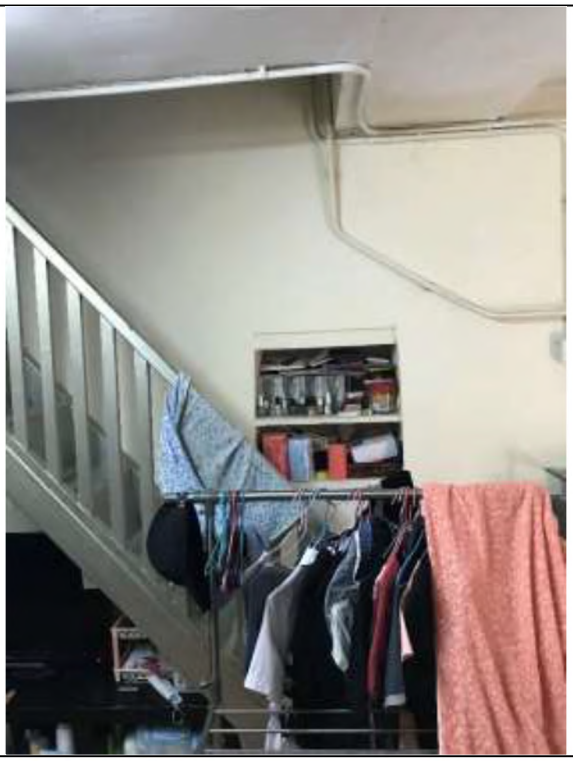


Part Plan E(3) - Layout Plan of HFL05 (House 5) with Location of General Photos

5A4-G1 → Photo Mark (General)
5A4-D1 → Photo Mark (Defect)

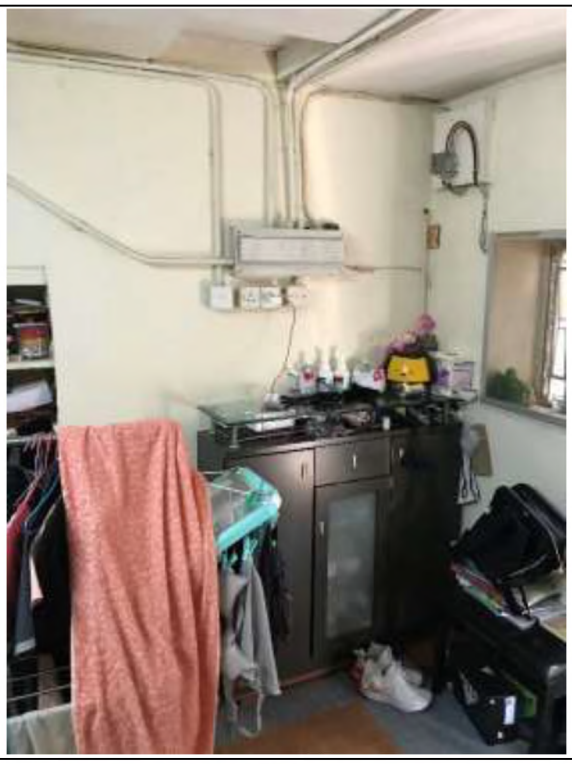
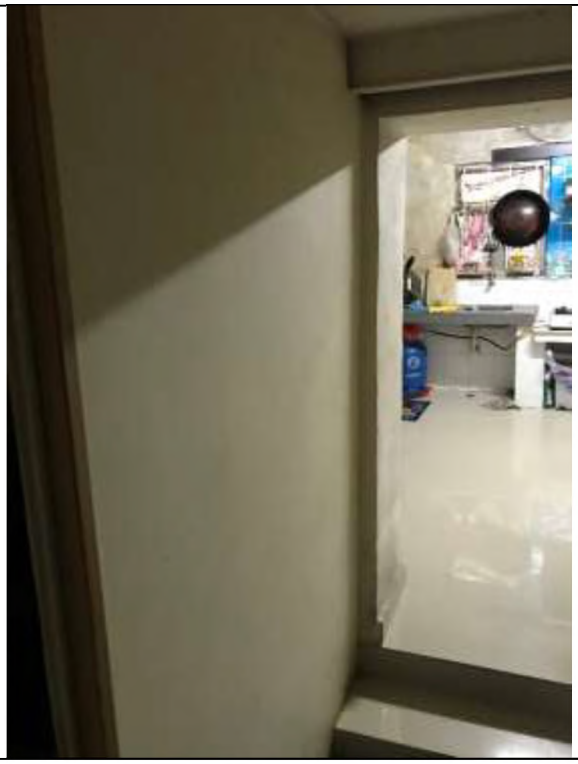
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

General View

	
5A3-G1	5A3-G2
	
5A3-G3	5A3-G4

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

General View

	
5A3-G5(1)	5A3-G6(1)
	
5A3-G6(2)	5A3-G7

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

General View

	
5A3-G8	5A3-G9(1)
	
5A3-G9(2)	5A3-G10

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

General View

	
5A3-G11	5A3-G12

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

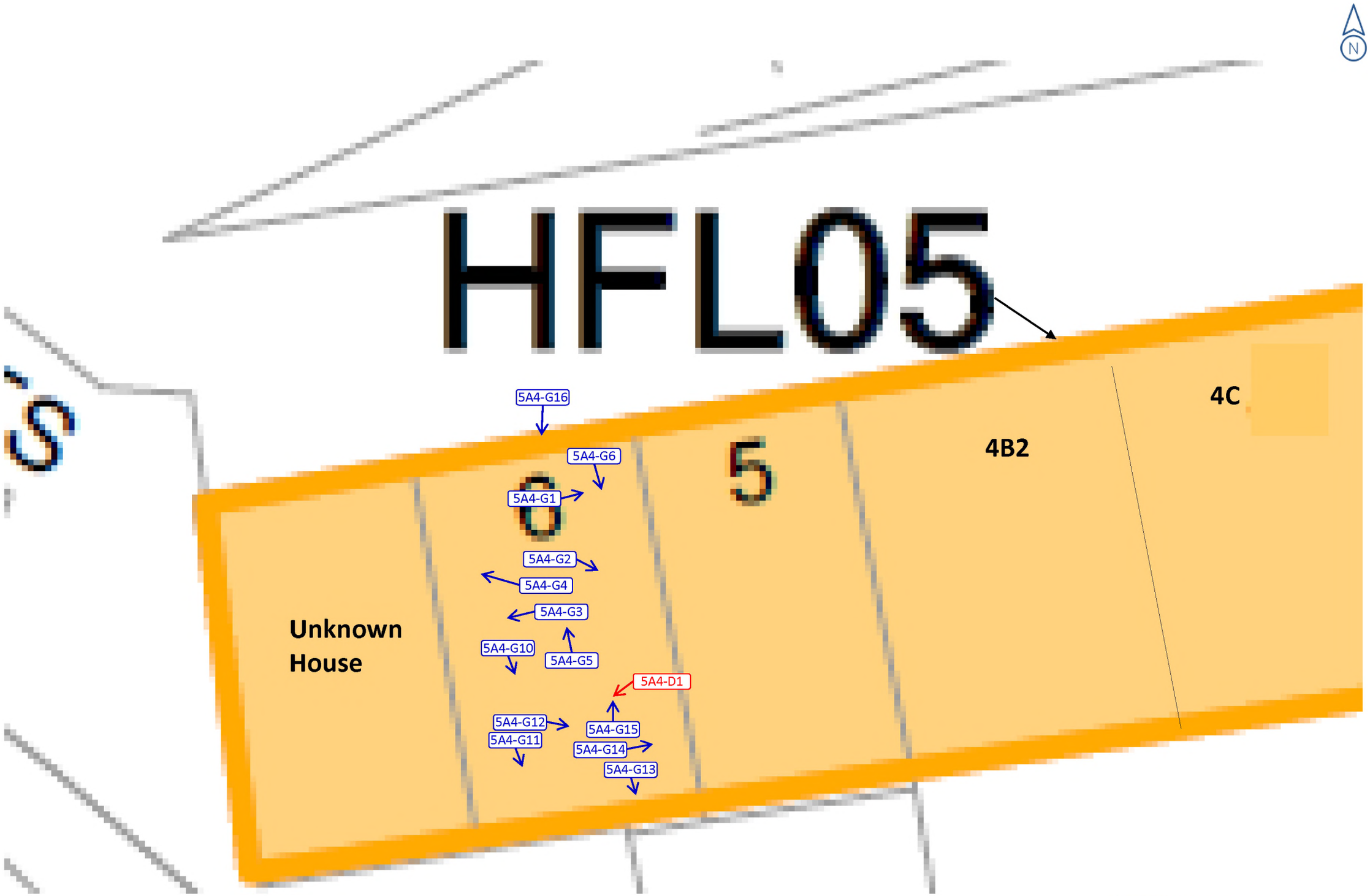
Defects

	
5A3-D1(1) - Water Stain on Surface (General View)	5A3-D1(2) – Water Stain on Surface
	
5A3-D2(1) – Moderate Crack on Wall Surface (General View)	5A3-D2(2) – Moderate Crack on Wall Surface (Length:700mm/Width:2.5mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(3) – HFL05 (House 5)
Date of Photo Taken: 13rd July 2020

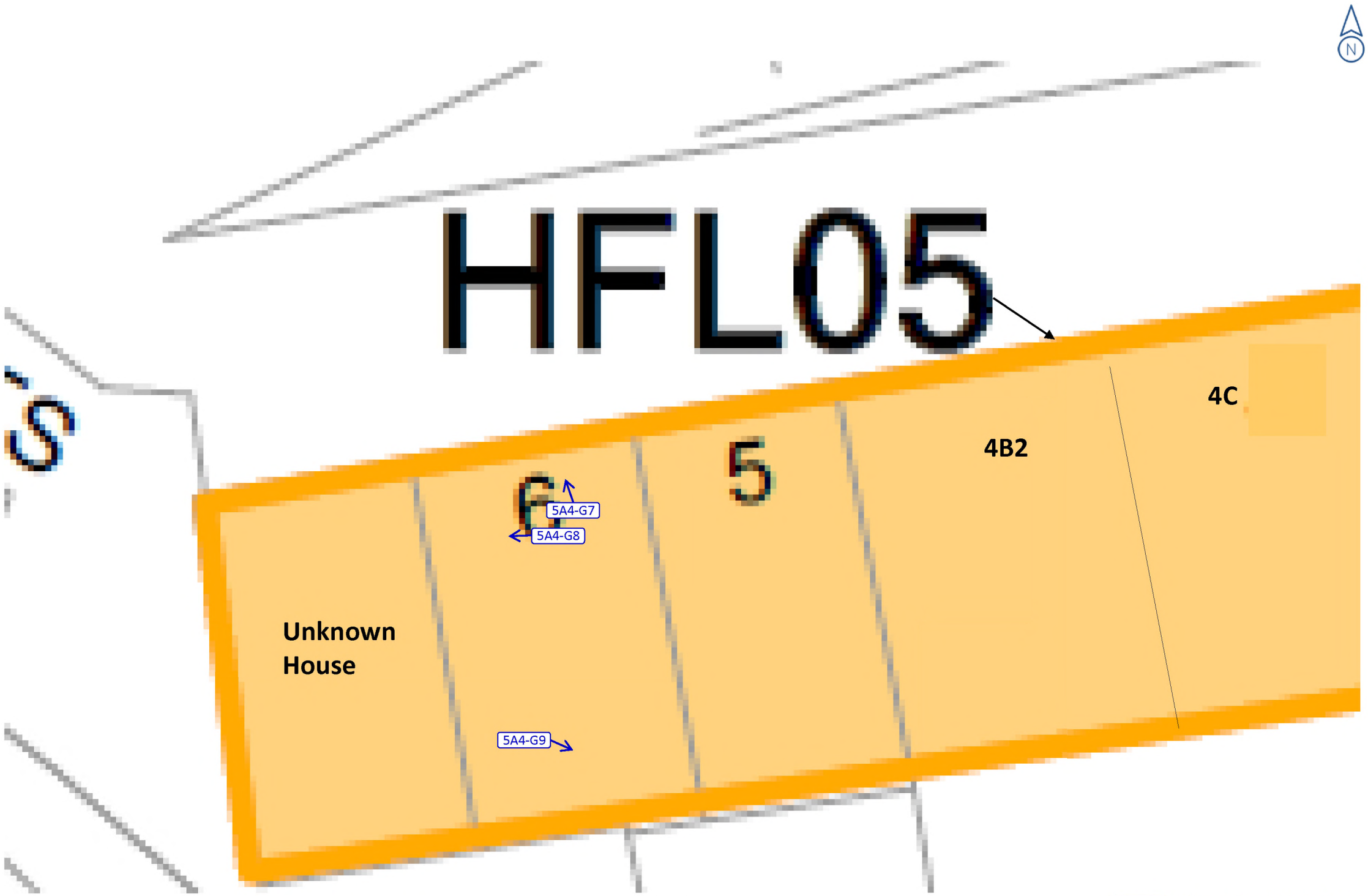
Defects

	
5A3-D3(2) – Wide Crack on Wall (General View)	5A3-D3(2) – Wide Crack on Wall (Length:600mm/Width:3.00mm)



Part Plan E(4) - Layout Plan of HFL05 (House 6 – 1st Floor) with Location of General Photos

5A4-G1 → Photo Mark (General)
5A4-D1 → Photo Mark (Defect)

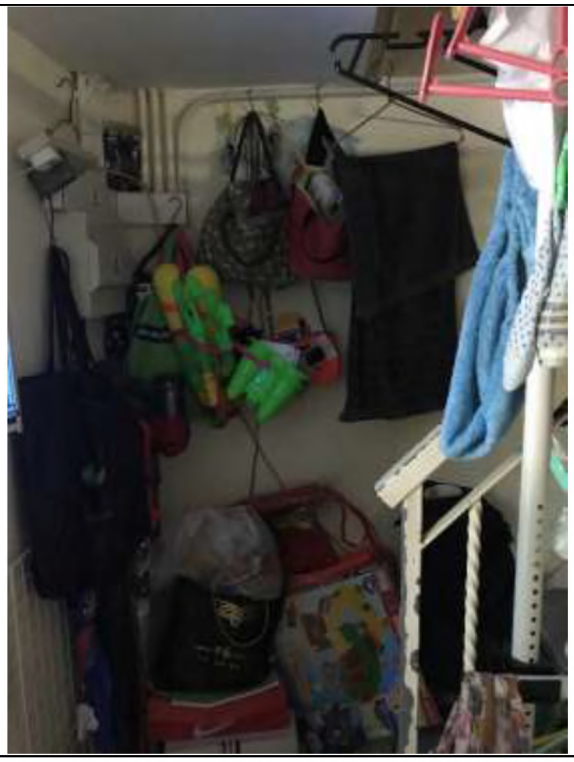
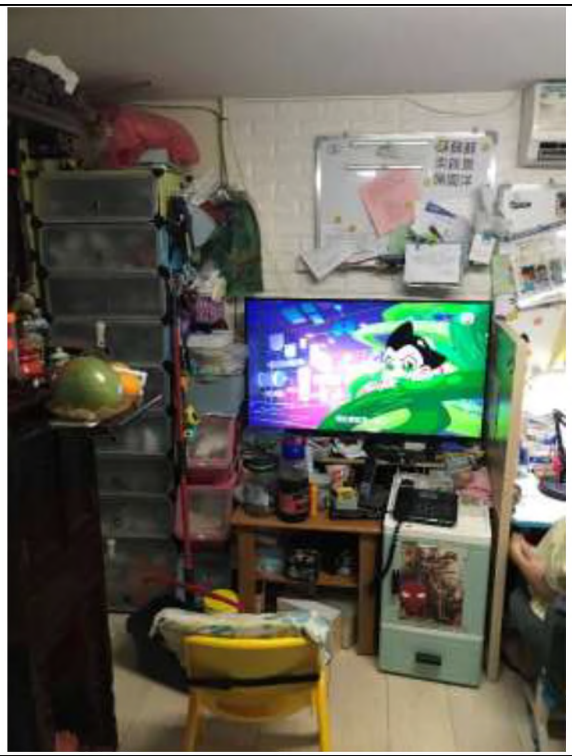
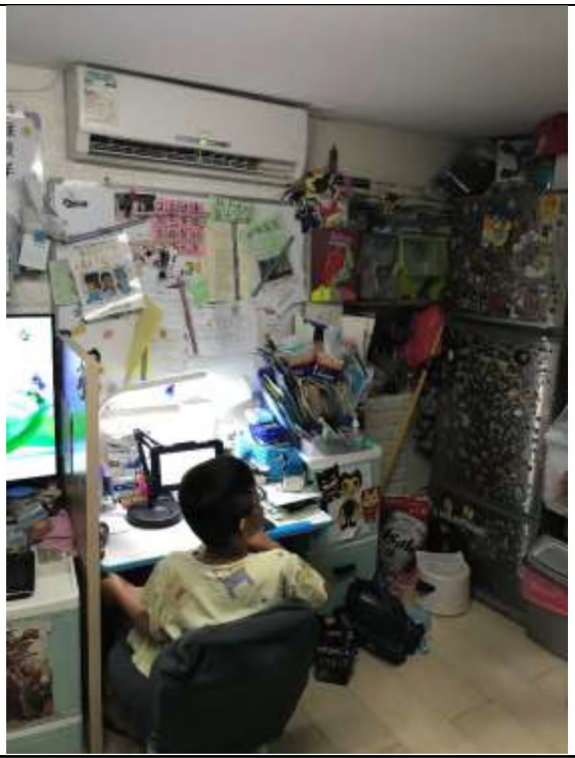


Part Plan E(4) - Layout Plan of HFL05 (House 6 – 2nd Floor) with Location of General Photos

5A4-G1 → Photo Mark (General)
5A4-D1 → Photo Mark (Defect)

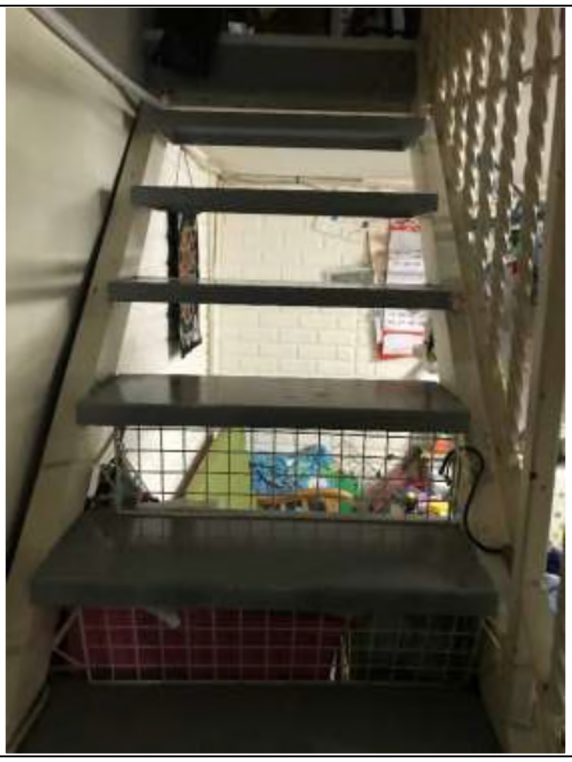
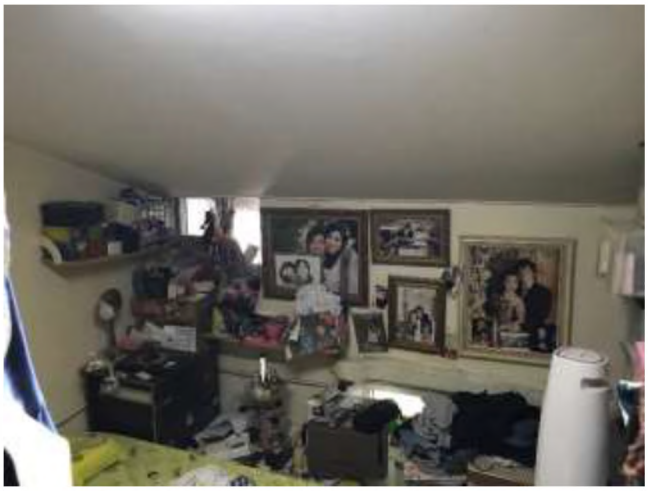
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

General View

	
5A4-G1	5A4-G2
	
5A4-G3	5A4-G4

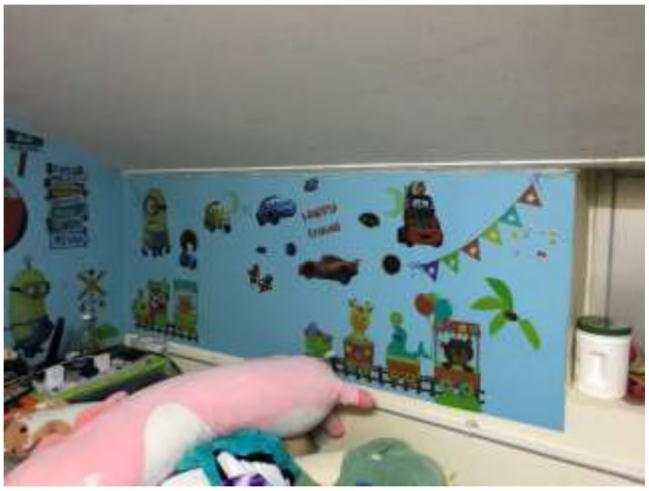
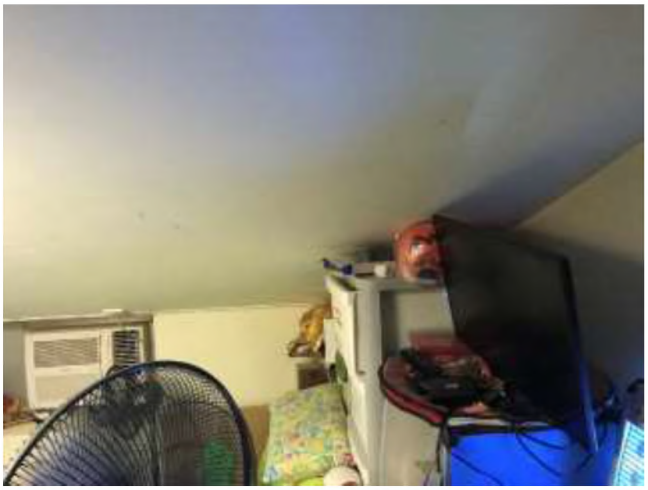
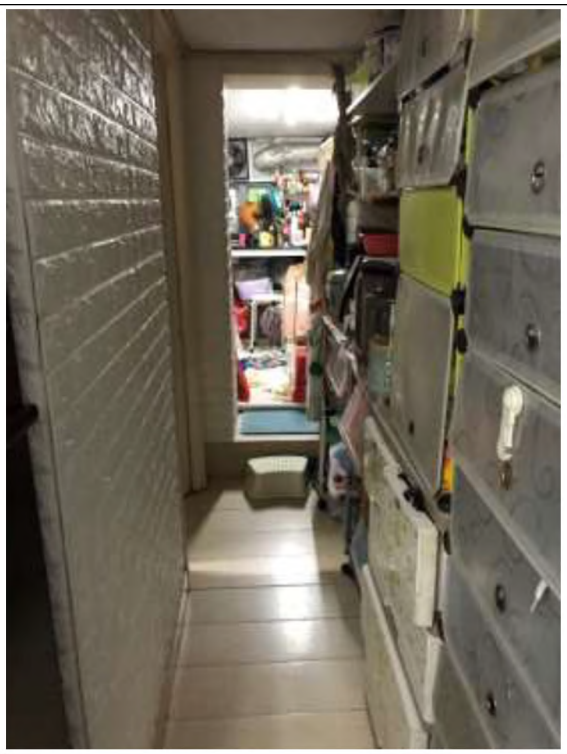
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

General View

	
5A4-G5	5A4-G6
	
5A4-G7	5A4-G8

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

General View

	
5A4-G9	5A4-G9(1)
	
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Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

General View

	
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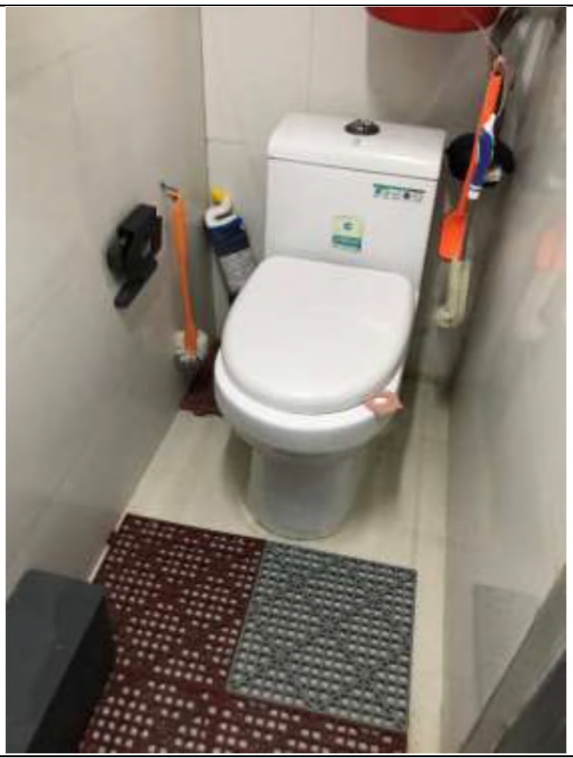
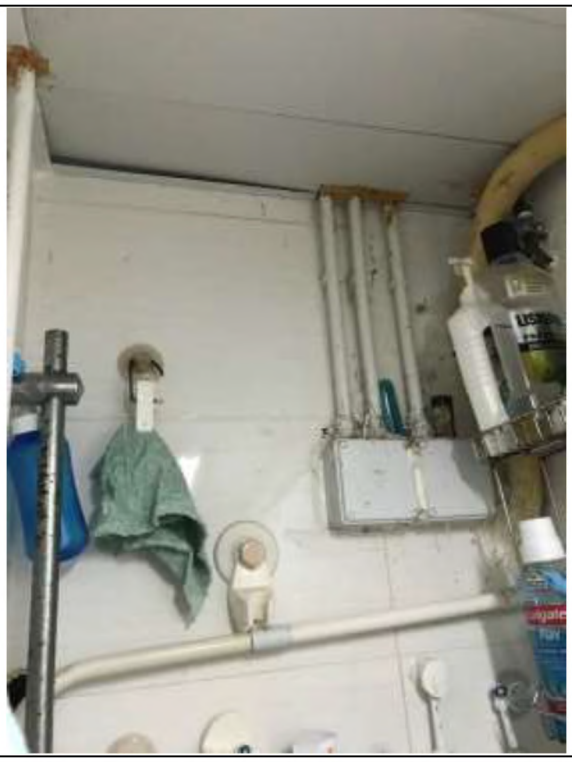
	
5A4-G13(1)	5A4-G13(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

General View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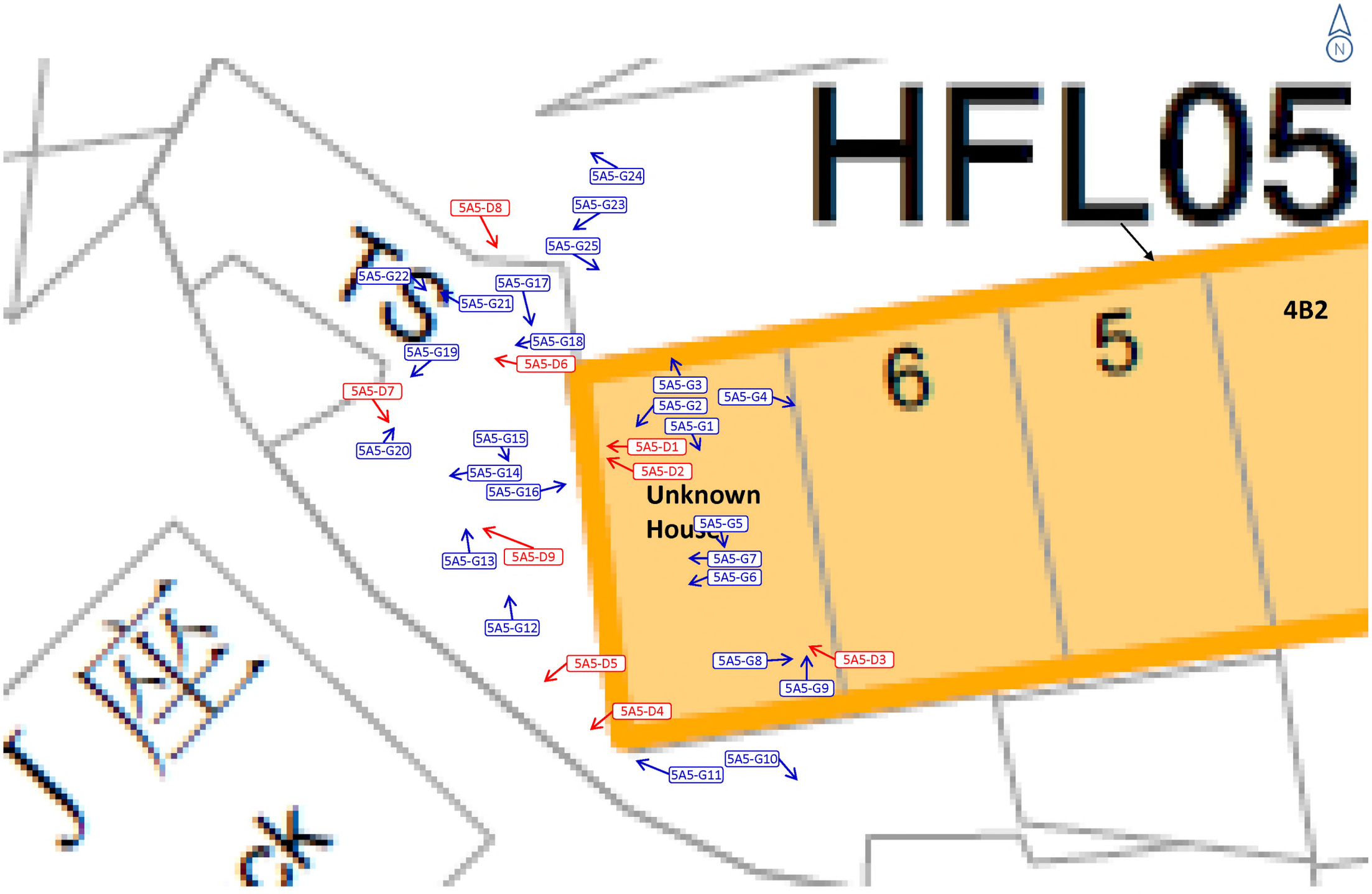
5A4-G15(2)	5A4-G16

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(4) – HFL05 (House 6)
Date of Photo Taken: 13rd July 2020

Defects

	
5A4-D1(1) – Dislodged false ceiling (General View)	5A4-D1(2) – Dislodged false ceiling



Part Plan E(5) - Layout Plan of HFL05 (Unknown House) with Location of General Photos

5A5-G1 → Photo Mark (General)
5A5-D1 → Photo Mark (Defect)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

5A5-G1

5A5-G2

5A5-G3

5A5-G4

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

	
5A5-G5(1)	5A5-G5(2)
	
5A5-G6	5A5-G7(1)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View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	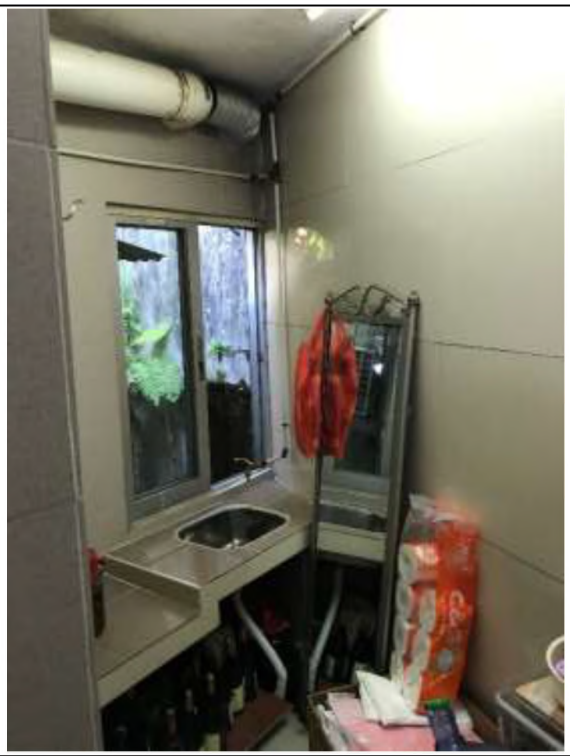
5A5-G9	5A5-G10

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

	
5A5-G11	5A5-G12
	
5A5-G13(1)	5A5-G13(2)

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

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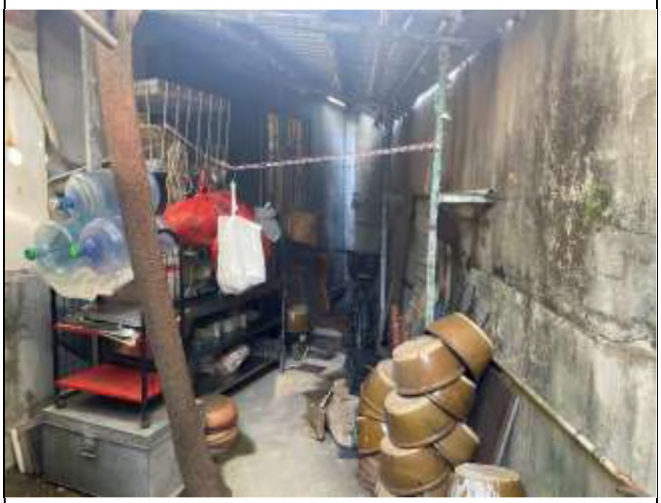
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

	
5A5-G17	5A5-G18(1)
	
5A5-G18(2)	5A5-G19

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

	
5A5-G20	5A5-G21(1)
	
5A5-G21(2)	5A5-G22

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

General View

	
5A5-G23(1)	5A5-G23(2)
	
5A5-G24	5A5-G25

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

Defects

	
5A5-D1(1) – Fine Crack on Wall Surface (General View)	5A5-D1(2) – Fine Crack on Wall Surface (Length:1500mm/Width:0.75mm)
	
5A5-D2(1) – Fine Cracks on Wall Surface (General View)	5A5-D2(2) – Fine Cracks on Wall Surface

Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

Defects

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(General View)</td><td>5A5-D3(2) – Fine Crack on Wall Tiles
(Length:200mm/Width:0.08mm)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>5A5-D4 –Cracked Wall Tiles
(Length:1500mm/Width:2.20mm)</td><td>5A5-D5 –Crack and Broken Tiles</td></tr>
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Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

Defects

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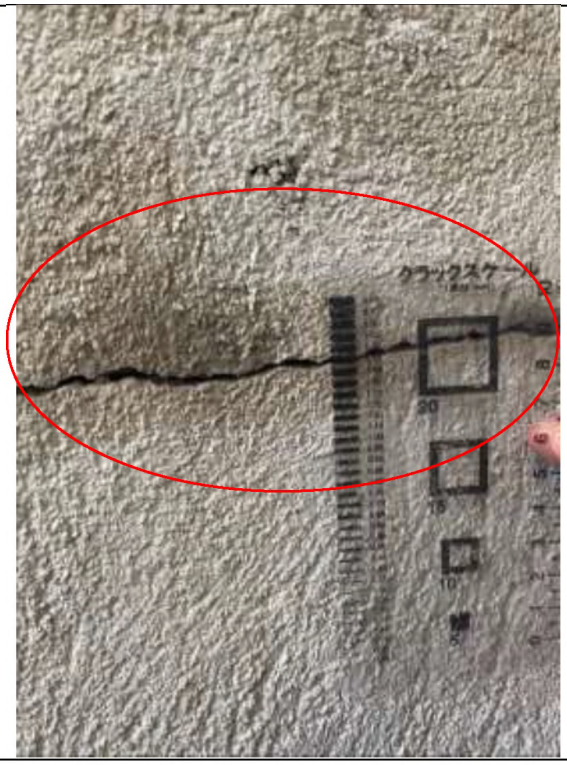
(General View)</td></tr>
<tr><td>  </td><td>  </td></tr>
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(General View)</td></tr>
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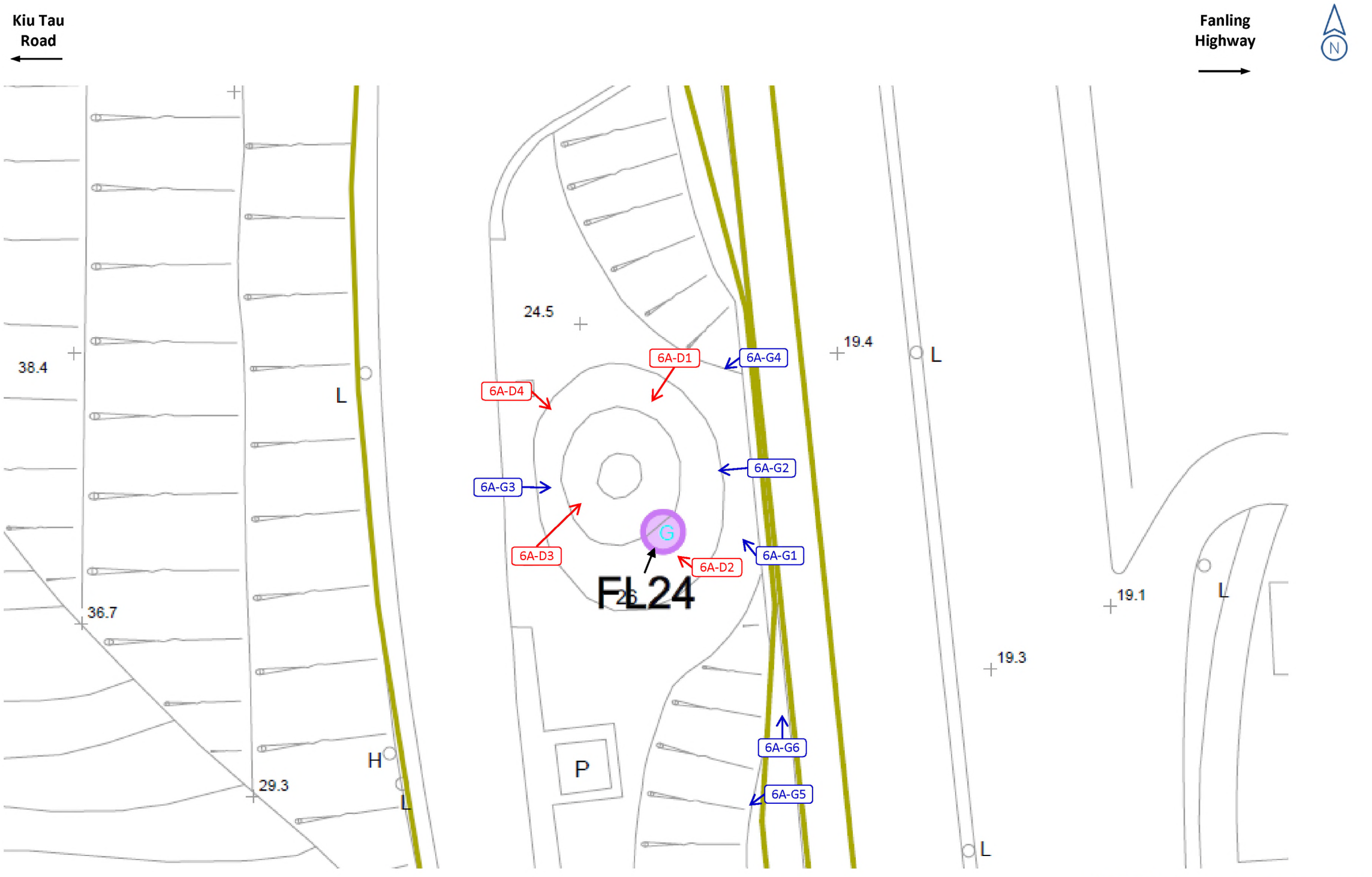
Appendix B – Detailed Inspection Report of General Areas
Part Plan E(5) – HFL05 (Unknown House)
Date of Photo Taken: 13rd July 2020

Defects

5A5-D8(2) – Moderate Crack on Wall Surface (Length:400mm/Width:1.80mm)

5A5-D9(1) – Moderate Crack on Wall Surface (General View)

5A5-D9(2) – Moderate Crack on Wall Surface (Length:300mm/Width:1.80mm)



Part Plan F - Layout Plan of FL24 with Location of General Photos

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL24 (Grave)
Date of Photo Taken: 13rd July 2020

General View

	
6A-G1(1)	6A-G1(2)
	
6A-G2	6A-G3

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL24 (Grave)
Date of Photo Taken: 13rd July 2020

General View

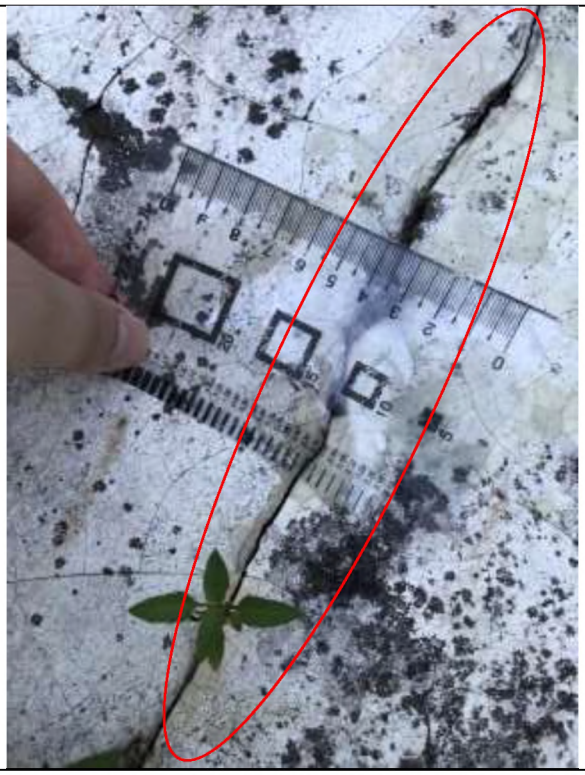
6A-G4

6A-G5

6A-G6

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL24 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

	
6A-D1(1) - Wide Crack on Grave (General View)	6A-D1(2) - Wide Crack on Grave (Length:500mm/Width:45.00mm)
	
6A-D2(1) - Fine Crack on Grave (General View)	6A-D2(2) – Fine Crack on Grave (Length:900mm/Width:0.50mm)

Appendix B – Detailed Inspection Report of General Areas
Part Plan F – FL24 (Grave)
Date of Photo Taken: 13rd July 2020

Defects

6A-D3(1) - Broken Surface

6A-D3(2) - Broken Surface

6A-D4(1) - Wide Crack on Grave
(General View)

6A-D4(2) - Wide Crack on Grave
(Length:200mm/Width:20.00mm)

Appendix C BD PNAP APP-137

Ground-borne Vibrations and Ground Settlements Arising from Pile Driving and Similar Operations

Pile driving (including pile withdrawal) operations and the like generate vibrations and settlements which, if not properly controlled, may have adverse effects on, or cause damage to, adjacent buildings/structures/services, in particular, non-structural elements therein. For the purpose of this practice note, such operations are termed as "pile driving operations".

2. This practice note aims to provide guidelines on the control of ground-borne vibrations and ground settlements generated from pile driving or similar operations with a view to minimizing possible damage to adjacent properties and streets. Authorized Persons (AP)/Registered Structural Engineers (RSE) are reminded that under the Buildings Ordinance, it is their responsibility to ensure that the building works carried out will not impair the stability of, or cause damage to any building, structure, land, street or services. They should also exercise their professional judgment in choosing suitable and safe construction methods and provide vigilant supervision over the works throughout the construction period.

Piling Plan Submission

3. Piling plans submitted for approval should, in general, follow the requirements laid down in PNAP APP-18. AP/RSE's particular attention should be paid to the monitoring requirements and the required appraisal report at items 4(k) and 4(o) therein respectively for adjacent buildings/structures/services. Depending on the structural condition of the adjacent buildings/structures/services, the Building Authority (BA) may require the following details to be included in the appraisal report :

(a) Pre-construction condition survey with a full set of photographic record of the external and common areas of the buildings/structures/services that are vulnerable to vibration and settlement damage. If access to some internal areas can be gained, the condition therein should also be recorded.

(b) Recommended vibration and settlement control limits (with due consideration of the recommendations given in Appendix A and Appendix B of this practice note) and monitoring proposal. Critical locations for monitoring should be identified by the RSE and included in the monitoring proposal.

(c) Preliminary appraisal including a vibration and settlement assessment of the stability of the structural and non-structural elements of adjacent buildings/structures/services under the expected ground-borne vibrations and ground settlements.

/(d) ...

(d) If vibration control limits greater than those given in Appendix A are to be adopted, a detailed assessment of the magnitude of the ground-borne vibrations generated by the piling operations should be made. Under such circumstances, reference could be made to Technical Note 142 published by CIRIA of the UK for such assessment or to any other relevant references acceptable to the BA. Consideration should also be given to the cumulative effects from the driving of all piles at the site. The structural stability of all adjacent buildings/structures/services due to the effects of ground-borne vibrations in item (c) above should also be appraised by detailed engineering analyses.

(e) A monitoring proposal to monitor the movements of adjacent grounds and buildings/structures/services.

(f) If the site is situated close to buildings/structures/services that are vulnerable to damage caused by the piling operations, a trial pile proposal to confirm the accuracy of the vibration and settlement assessments and the effects of the pile driving operations on adjacent buildings/structures/services (see paragraphs 7 to 8 below).

Required actions from the RSE prior to consent application for piling works

4. Prior to consent application, the RSE is required to confirm with the Registered Specialist Contractor (RSC) the method of construction including the maximum number of piles to be driven concurrently and the relevant details of the construction plants. In case there are changes from the approved details, the RSE should submit an amendment plan together with a re-assessment of the ground-borne vibrations and ground settlements and, if necessary, revise the appraisal report for item 3(c) above. Final reports for items 3(b) & (c) above shall be submitted together with the amendment submission.

5. It should be noted that certain types of piles installed by percussive/vibratory equipment may cause significant damage to vibration sensitive buildings/structures/services such as those mentioned in Appendix A of this practice note. Such method will not normally be accepted by the BA unless it can be satisfactorily demonstrated to the BA by means of trial piling as described below. Prior to the installation of the trial piles, precautionary measures such as the provision of shoring for temporary support to cracked structural members of adjacent buildings may need to be provided.

Trial /Test Pile(s) for Vibration and Settlement Control

6. If the adjacent buildings/structures/services are not vulnerable to the effects of vibration from the pile driving operations, the magnitude of ground-borne vibrations and ground settlements as assessed at item 3(b) or the re-assessed values at paragraph 4 above, as appropriate, can be verified during the driving test of piles. Ground-borne vibrations should be measured during the driving of the test pile(s) as

/detailed ...

detailed in paragraph 8 below and the associated settlements recorded upon the completion of the test. The RSE will be required, under BO section 17 and in accordance with the Code of Practice for Site Supervision to provide quality supervision of the pile driving works to ensure that the allowable limits of the ground-borne vibrations and ground settlements will not be exceeded. The effects of the pile driving operations on the adjacent buildings/structures/services should also be assessed by the RSE during the driving of the test pile(s).

7. In cases where buildings or structures that are particularly vulnerable to the effects of vibration, such as declared monuments or masonry buildings, are in the proximity of the piling site, the AP/RSE should submit for approval a trial pile proposal to confirm the magnitude of ground-borne vibrations assessed at item 3(b) or the re-assessed values at paragraph 4 above, as appropriate, at each critical ground condition where generation of maximum ground-borne vibrations will be expected (usually at the highest founding level/obstruction at shallow depth/interbedded strata of rock and soil). The number of such trial pile(s) would depend on the actual site condition in particular for very large construction site. The RSE will be required, under BO section 17 and in accordance with the Code of Practice for Site Supervision to provide quality supervision of the pile driving works to ensure the allowable limits of the ground-borne vibrations will not be exceeded.

8. For the vibration monitoring of trial/test pile(s), the maximum ground-borne vibrations, measured in terms of peak particle velocity (ppv), should be recorded at every meter length of penetration of pile, at final set and at levels where obstructions are encountered. The monitoring readings should be taken by a properly calibrated device under the direction of the RSE with the agreement of the BA. If the measured ground-borne vibrations have been found to exceed the allowable values or if damage to either the structural or non-structural elements of the adjacent buildings/structures/services has been observed, all pile driving operations should be stopped and the agreed precautionary measures referred to at item 4(o) of PNAP APP-18 should be reviewed and revised as necessary, and submitted by the RSE to the BA for agreement. The suspended pile driving operations should not be resumed without the prior agreement of the BA.

9. A condition survey of all adjacent buildings/structures/services should be carried out after the completion of the trial piles for confirmation of the effects of the pile driving operations. Two sets of trial piling report on ground-borne vibrations and ground settlements and their effects on adjacent buildings/structures/services should be submitted to the BA for consideration prior to the application for consent to the commencement of the driving of the working piles.

10. To address the concerns of the occupants of adjacent buildings affected by the vibrations of pile driving operations, the AP/RSE/RSC are advised to formulate a Public Relations Plan (PR Plan), setting out the actions to be carried out before and after the commencement of the pile driving operations. Guidelines on the PR Plan are given in Appendix C of this practice note. The purpose of the PR Plan is to put in place a system to notify in advance the nearby occupants of the forthcoming pile driving

/operations ...

operations, to facilitate communication between the affected occupants and the contractor, to minimize possible complaints, and to enable the AP/RSE/RSC to handle complaints in a timely and effective manner. The RSE is advised to submit the PR Plan to the BA for agreement prior to the commencement of pile driving operations.

Required actions from the RSE during the pile driving operations

11. The RSE is required to submit the related works programme of the pile driving operations setting out clearly the types and duration of the major vibration-generating construction activities to the BA prior to the commencement of pile driving operations. The supervision of the monitoring works should be provided in accordance with the Code of Practice for Site Supervision. The RSE should review the site situation from time to time and if found necessary, suspend the pile driving operations, revise the precautionary measures and/or vibration monitoring proposal and submit them to the BA for agreement prior to the resumption of the pile driving operations. Reference shall be made to item 4(k) of PNAP APP-18.

Requirements for controlling vibrations and settlements arising from site formation and excavation and lateral support works

12. The installation of temporary pile walls such as steel sheet piles, pipe piles or steel channel plankings are often included in the site formation and excavation and lateral support works. Such temporary pile walls, if installed by percussive or vibratory methods, are likely to generate vibrations and settlements that may cause damage to adjacent buildings/structures/services, particularly those that are vulnerable to vibrations. Excessive vibrations are also likely to be experienced during the removal of underground obstructions. Guide values on limits of vibration and ground settlements are given in Appendices A and B respectively to this practice note. A detailed vibration and settlement monitoring proposal on all adjacent buildings, structures, land, streets or services should be included in the site formation or excavation and lateral supports plans to be submitted to the BA for approval/acceptance. If there are vibration sensitive buildings in the proximity of the site, a test pile proposal to confirm the accuracy of the vibration assessments and effects of the piling works on adjacent buildings/structures/services shall be included in the plans for the approval/acceptance of the BA. The AP/RSE/RGE will be required, under BO Section 17 and in accordance with the Code of Practice for Site Supervision to provide quality supervision of the piling works.

(CHEUNG Tin-cheung)
Building Authority

Ref. : BD/GP/BREG/C/36

This PNAP is previously known as PNAP 289
First issue May 2004
Last revision February 2012
This revision October 2018 (AD/NB2) (Appendices B & C amended)

Appendix A
(PNAP APP-137)

Vibration Measurement and Recommended Ground-borne Vibration Limits Resulting from Piling and Similar Operations

Vibration measurement

The effect of ground-borne vibration from piling works on adjacent structures should be assessed by the maximum peak particle velocity (ppv). The maximum ppv should be evaluated from the peak particle velocities at three orthogonal axes measured at ground levels of the structures in question. All such measurements should be made by properly calibrated device and under the supervision of the RSE or his representatives.

Recommended Ground-borne vibration limits

2. For the detailed assessment of the effects of ground-borne vibrations on adjacent buildings/structures/services, an engineering analysis should be carried out. Reference could be made to BS 7385 Part 1 : 1990 or similar references.

3. In the absence of an engineering analysis, the following empirical guidelines may be used for reference :

Type of building	Guide values of maximum ppv (mm/sec)	
	Transient Vibration (eg. Drop hammer)	Continuous Vibration (eg. Vibratory hammer)
Robust and stable buildings in general	15	7.5
Vibration-sensitive/ dilapidated buildings	7.5	3.0

4. The above guide values of maximum ppv are suggested to give minimal risks of vibration-induced damage. Due attention should also be paid to sensitive buildings close to the piling site such as hospitals, academic institutes, declared monuments, old buildings with shallow foundations, old tunnels/caverns, buildings installed with sensitive equipment, masonry retaining walls or sites with history of instability, monuments or buildings with historical significance etc. A more stringent control on the allowable limit of ppv for these buildings may have to be specified based on site and building conditions together with the duration and frequency of the exciting source.

5. The AP/RSE/RGE is also required to fulfill the requirements imposed by other government departments.

6. For vibration impacts on existing railway and related structures, technical requirements given in PNAP APP-24 may be useful.

(2/2012)

Appendix B
(PNAP APP-137)

Recommended Ground Settlement Limits Resulting from Piling and Similar Operations

Ground movements

. The ground movements arising from pile driving and similar operations depend on several factors including installation method, construction sequence, sub-soil geology, groundwater conditions, layout of the piling works and workmanship. Excessive ground movements in the vicinity of the pile driving and similar operations may be detrimental to adjacent buildings or structures, especially those supported by shallow foundations, piles with inadequate lateral resistance or foundations with inherently low factors of safety.

Tolerable ground settlement limits

2. As different structures will have different tolerance in accommodating movements of their foundations, acceptance of estimated ground settlements should be considered on a case-by-case basis with respect to the integrity, stability and functionality of the supported structures.

3. Provided that there are no particularly sensitive adjacent buildings, structures and services, the following empirical limits may be taken as the provisional AAA trigger values for the purposes of item 4(k) of PNAP APP- 18:

Instrument	Criterion	Alert	Alarm	Action
Ground settlement marker	Total settlement	12mm	18mm	25mm
Services settlement marker	Total settlement & Angular distortion	12mm or 1:600	18mm or 1:450	25mm or 1:300
Building tilting marker	Angular distortion	1:1000	1:750	1:500

Remarks :

The "Action Level" response actions should be taken if any of the following criteria occurs:

- Any monitoring station has a reading reaching the specific trigger value based on serviceability limit[1], or in the absence of such engineering assessment, the provisional trigger value, whichever is applicable.
- Undue settlement as indicated in any check points (e.g. an increase of 5mm between two consecutive daily readings).
- Sign of distress or damages observed in any adjacent structures and/or services.

[1] Serviceability limit is defined as the maximum calculated movements estimated in the design or the maximum allowable movement or response of the adjacent ground, groundwater regime, structures and services.

Appendix C
(PNAP APP-137)

Guidelines on Public Relations Plan (PR Plan)

A PR Plan should include the following information :

i) Background of the project, including list of vibration-generating construction activities and its tentative construction programme;

ii) Details of AP, RSE, RGE and RSC of the project;

iii) Organization chart including the appointment of a PR Officer;

iv) Objectives of the PR Plan;

v) List of concerned groups (eg Owners'Corporation, Mutual Aid Committee, District Council etc.);

vi) List of vibration and/or settlement sensitive buildings/structures/services;

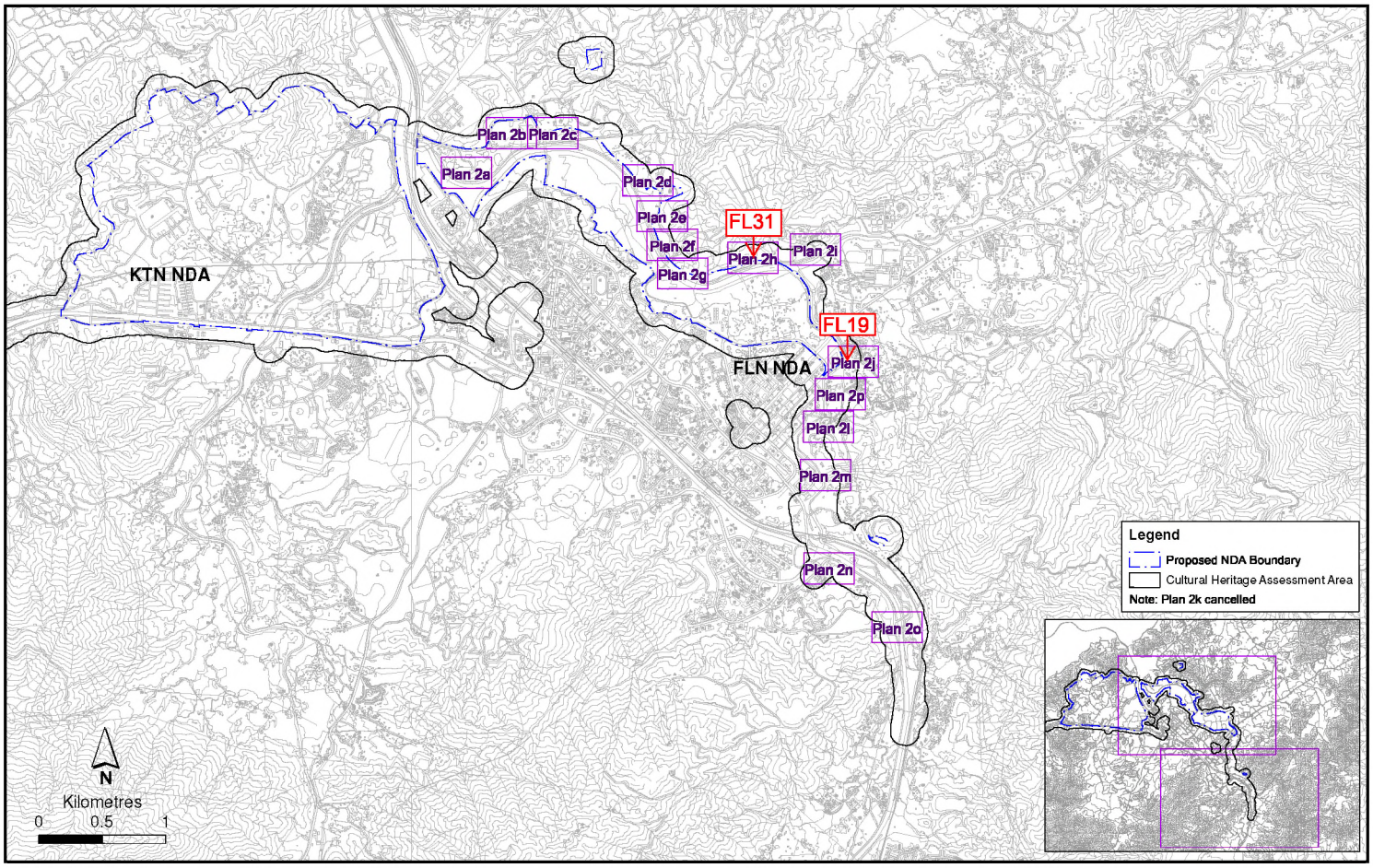
vii) List of public relation activities (e.g. briefing session; posting notices; issuing notifications on works programme etc.);

viii) List of telephone hotlines and contact persons for public enquiries;

ix) Arrangement for issuing notification letters to the relevant stakeholders of nearby building/structure/services informing that they would be notified immediately upon any monitoring reading(s) in relation to their building/structure/services reaching the "Action Level" trigger value during the construction period, and the relevant monitoring readings could be made available upon request; and

x) Complaint handling system to resolve complaints or incidents in timely and effective manner.

Appendix D FL31 LOCATION PLAN



CEDD 土木工程拓展署 CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT / 規劃署 PLANNING DEPARTMENT	ARUP	Job Title: Agreement No. CE 61/2007 (CE) North East New Territories New Development Areas Planning and Engineering Study - Investigation	Drawing Title: Key Plan of Identified Built Heritage Items in FLN NDA and Associated Infrastructure Works CHAA

Rev	Description	Date	Drawn	Date
4th ISSUE		04/13	FT	04/13
3rd ISSUE		01/13	Checked	Approved
2nd ISSUE		12/11	PW	LQ
1st ISSUE		10/10	Scale 1:27,000	

Drawing No. Plan 2

Rev.

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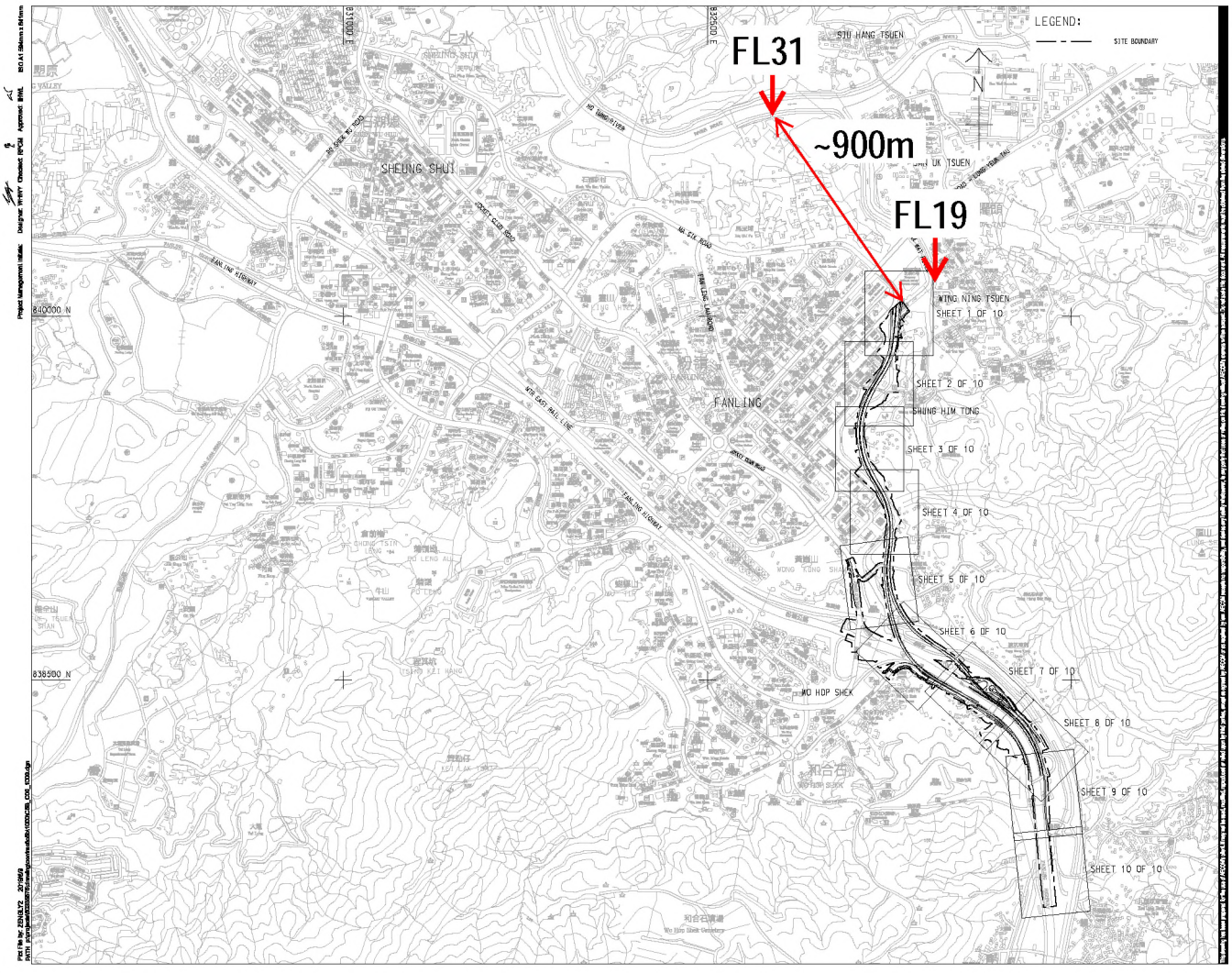

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PROJECT
DEVELOPMENT OF KWU TUNG NORTH AND FANLING NORTH NEW DEVELOPMENT AREAS, PHASE 1

CONTRACT TITLE:
FANLING NORTH NEW DEVELOPMENT AREA, PHASE 1: FANLING BYPASS EASTERN SECTION (SHUNG HIM TONG TO KAU LUNG HANG)

CLIENT
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Checked:

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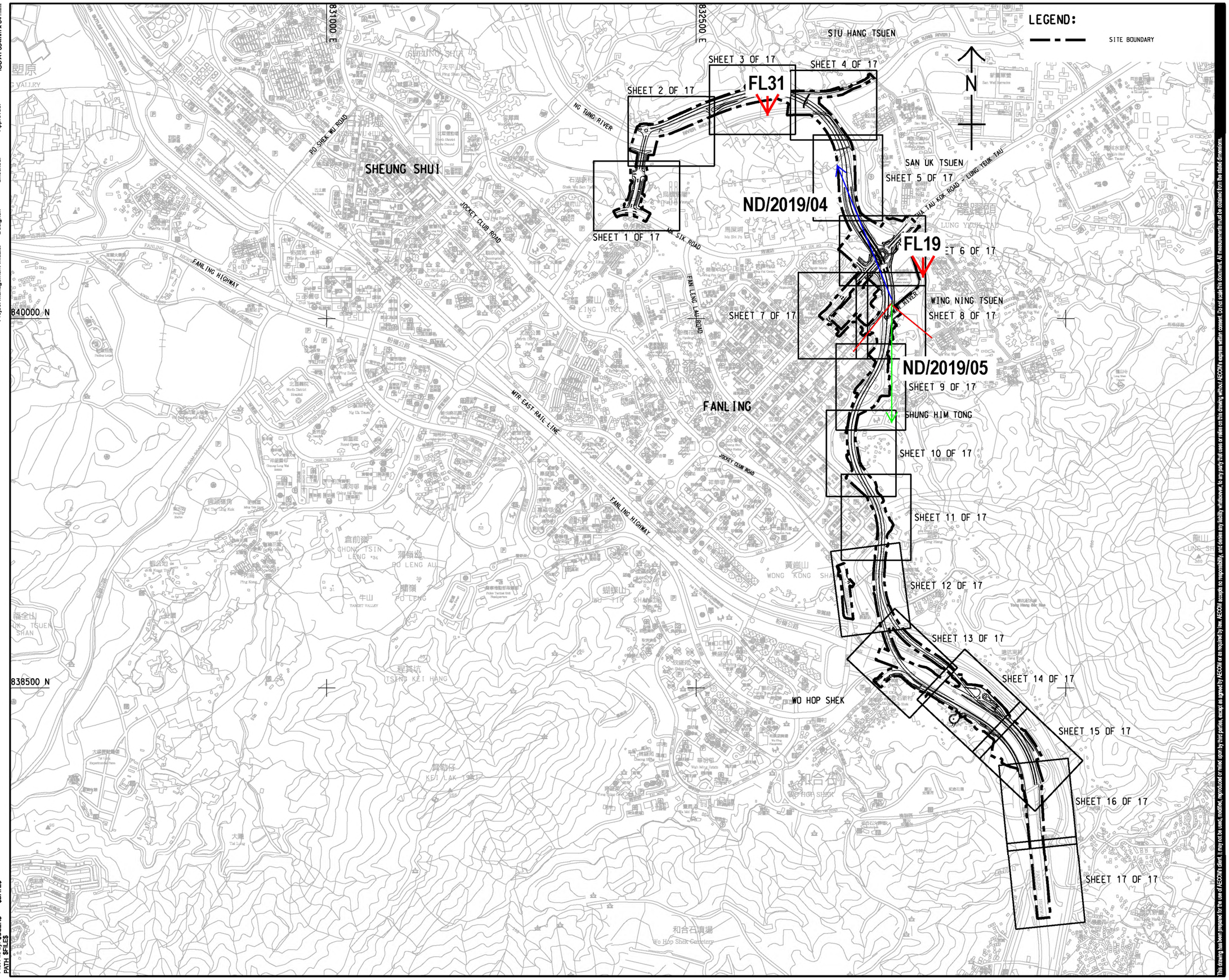

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PROJECT
項目

DEVELOPMENT OF KWU TUNG NORTH AND FANLING NORTH NEW DEVELOPMENT AREAS, PHASE 1 - DESIGN AND CONSTRUCTION

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業主

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Civil Engineering and Development Department

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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核

STATUS
狀況

SCALE 比例
A1 1 : 7000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60335576

CONTRACT NO. 合約編號
CE 13/2014 (CE)

SHEET TITLE
圖紙名稱

KEY PLAN AND LOCATION PLAN

SHEET NUMBER
圖紙編號

60335576/TR/400

Appendix E CV OF QUALIFIED BUILDING SURVEYOR

SMEC
Member of the Surbana Jurong Group

Jacky YAU
Technical Director

YEARS OF INDUSTRY EXPERIENCE

- 22 Years

QUALIFICATIONS AND MEMBERSHIPS

- BEng (Hons) in Civil & Structural Engineering, HKUST
- MSc in Civil Engineering, The University of Hong Kong
- Cert. in Urban Design & Development in China, HKU
- Member of the Institution of Civil Engineers
- Member of the Institution of Structural Engineers
- Member of Hong Kong Institution of Engineers
- Chartered Engineer (UK)
- Registered Professional Engineer of Hong Kong – Civil & Structural
- Associate of the Hong Kong Institute of Arbitrators
- Registered Structural Engineer, HK

KEY SKILLS AND COMPETENCIES

- Project Management
- Structural Design
- Design & Build

PROFESSIONAL HISTORY

Jacky has 20 years' experience as a professional Structural and Civil Engineer in Hong Kong. He has hands-on experience in design and construction supervision of multi-disciplinary civil, building and structural engineering projects.

His extensive experience encompassed a wide spectrum of projects from feasibility studies, preliminary design, detailed design, **condition survey, structural assessment** of existing buildings, BD approval, site supervision and contract administration of multi-disciplinary infrastructures comprising railway tunnels, stations and ancillary buildings, site formation, slopeworks, roadworks, storm water drainage works, sewerage systems, pumping stations, water supply systems, utilities installations, landscape softworks and irrigation systems.

Jacky has hands-on experience in preparation of structural plans and liaison with BD officers for approval of the plans under both the BD full approval and consultation processes in tight schedule. He has also experienced in construction supervision under TCP T5 RGE and RSE streams and coordination with RGE and AP and liaison with BD for the approval and consent applications for commencement of works.

RELEVANT PROJECT EXPERIENCE

Sha Tin Central Link Contract No. SCL1112 Construction of Hung Hom Station and Stabling Siding (for Leighton Contractors (Asia) Limited, March 2014 – Present)
Contract 1112 is a critical component of the Shatin Central Link (SCL) development, a 17km railway link serving the New Territories, Kowloon and Hong Kong Island. Works under Contract 1112 comprise the permanent and temporary works for Hung Hom Station, Hung Hom Stabling Sidings, the South and North Approach Tunnels to the new platforms, and reprovisioning, remedial and improvement works. The existing Hung Hom Station will require integration with the new platforms, with extensive underpinning and modification of the existing podium structure of the station required. A number of existing buildings shall be demolished including the International Mail Centre, MTR Freight Operations Building and a number of railway ancillary facilities to make way for the construction. A notable challenge on this project is that the major civil works are to be constructed beneath the existing podium slab; with reduced headroom within a range of 5 - 7 m. Construction must also take place under and within an operating railway station, with no disruption to services.

SMEC was appointed by Leighton to carry out condition survey of the existing podium structure and structural assessment for the design of the proposed A&A works, as the detailed designer for the detailed design of structural design for the ABWF, temporary support and protection of the existing CLP 3.5m diameter TBM cable tunnel, ELS for protection of the CLP cable tunnel and construction of manholes adjacent to the live West Rail Line, alternative design of NAT Noise Enclosure Foundation and the Stabling Track Slab. All the design packages are submitted to BD for full approval or consultation and approval in principle.

As the Project Manager of the project, the responsibilities included: overseeing the condition survey teams in carrying out the structural assessment of the EBS, ensuring the work was delivered on time and level of quality of work was defined and maintained; providing technical advices on design issues; ensuring compliance with brief and programme requirement; ensuring allocation of adequate and suitable resources for the smooth, satisfactory and timely completion of the project; and providing high-level communication / liaison with the management of the client on project progress and financial performance and management.

MTRCL Kwun Tong Line Extension Contract 1002 Whampoa Station and Overrun Tunnel (for Chun Wo – Hip Hing Joint Venture, 2014 – 2016)
The Kwun Tong Line Extension (KTE) is a 2.6km underground extension of the existing MTR Kwun Tong Line. It extends from the overrun tunnels at Yau Ma Tei Station (YMT) to a new terminal station at Whampoa (WHA) via a station at Ho Man Tin. Ho Man Tin Station (HOM) will become an interchange station with the proposed Shatin to Central Link beneath a future property development at the ex-Valley Road Estate site. SMEC was appointed by Chun Wo – Hip Hing Joint Venture (CHJV) as the detailed designer as the Contractor's designer to prepare the temporary works design of temporary staircase & extension of existing pedestrian bridge, temporary openings at concourse slab and alternative design of permanent works of permanent tunnel lining, precast staircase in station structure, and condition surveys for existing Integrated Entrances and concrete air duct in Whampoa Station for the Works Contract No. C1002. As the Project Manager, responsible for providing technical input on design issues, ensuring compliance with brief and programme requirement, and management of the Condition Survey team in conducting the condition survey of the residential buildings where the integrated entrances were proposed to be constructed.

Contract No. HY/2016/06 Lift and Pedestrian Walkway System at Cheung Hang Estate, Tsing Yi – Precondition Survey for Existing EBS (for Concentric Construction Limited, June 2017 – August 2017)
Project Manager responsible for leading and overseeing a team of Engineers in conducting the pre-construction condition survey of adjacent roads, structures and other properties likely to be affected by the construction of the lift and pedestrian walkways system. . The purpose of this survey was to record in general terms the overall condition of the identified survey items in close proximity to the proposed works before the commencement of the construction Works. The major components of the works consist of construction of two lift towers each with two lifts in a single lift shaft with staircase. A covered elevated walkway is included to connect the aforementioned two light systems from Cheung Hang Estate to Tsing Yu Street, including a section across Tsing Yi Road West.

Contract No. NE/2015/02 Tseung Kwan O – Lam Tin Tunnel – Road P2 and Associated Works (for CRBC-Build King Joint Venture, October 2016 – June 2017)
Project Manager responsible for leading and overseeing a team of Engineers the pre-construction condition survey for the Tseung Kwan O – Lam Tin Tunnel – Road P2 and associated works. The works for the project included reclamation of approx. 3 hectares at Junk Bay, construction of the dual two-lane Road P2 of approx. 800m long with approx. 200m of depressed carriageway covered by landscape deck, and other associated facilities. The condition survey was performed for the EBS within an influence zone of the proposed blasting zone at Tseung Kwan O. The survey works were separated into two individual packages 1A and 1B and the surveyed items included existing buildings, box culverts, seawalls and roads.

MTRCL Consultancy Agreement A 073-09C – Consultancy for Flood Gates and Associated Station Modification Works at East Tsim Sha Tsui Station (December 2009 – August 2010)
Project Manager responsible for the detailed design of additional flood gates to be installed in the existing East Tsim Sha Tsui (ETS) Station. The works comprise the construction and retrofit works for three flood gates within the existing ETS Station, at the boundaries of the connecting subways, including civil and structural works, ABWF works, BS works, modification of existing station operation facilities. Responsible for leading and co-ordinating the condition survey and structural assessment of the existing structures adjacent to the proposed new flood gates installation location. Submissions were updated and submitted for endorsements by the Station & Transport Integration Committee (STIC) and Safety & Security Coordination Committee (SSCC). Flood risk assessments including the hydraulic modelling of the existing stormwater drainage network at the East Tsim Sha area were carried to assess the flood level.

MTRCL Contract No. 705 Kennedy Town Station (KET) and Overrun Tunnel (ICE Services, January 2010 – August 2010) Design Checking Engineer responsible for the review and independence checking of all the contractor's detailed design of temporary works and alternative design of permanent works. Major works comprise:

- Excavation and Lateral Support (ELS) and Decking in KET
- ELS and Noise Enclosure in Ventilation Shaft
- Mixed Ground Tunnel Support & Grouting
- Rock Tunnel Support
- ELS for Tunnel Portals
- Diversion and Reinstatement Scheme for Box Culvert in Smithfield Road
- Loading ramp and Noise Enclosure for Crusher at Barging Point

In addition to the role for ICE, the scope of works included **carrying out condition survey** of the newly constructed overhead ventilation ducts. Jacky lead and co-ordinated the site inspection teams in conducting the condition survey.

DSD – Contract No. DC/2012/02 Upgrading of Mui Wo Sewage Treatment Works and Village Sewerage at Wang Tong and Yue Kwong Chuen Hong Kong (March 2013 – Present) The project comprises of upgrading the existing Mui Wo STW to a capacity of 3,700m^3 per day; construction of Preliminary Treatment Facility Building (PTF), Membrane Bioreactor Building (MBR), Sludge Treatment Facilities Building (STF), Deodourization Facilities Building (DOF) and Administration Building (AB), upgrading of about 2km of existing gravity trunk sewers with larger pipes ranging from 300mm to 750 mm in diameter in Mui Wo town centre; construction of about 2.9 km of sewers ranging from 150mm to 250mm in diameter for two unsewered areas in Mui Wo, namely Wang Tong and Yue Kwong Chuen; and all the associated ancillary works. SMEC Asia Ltd was commissioned by the Contractor, Sum Kee – CEC Joint Venture to provide Contractor's design of the MBR and Cost Saving designs for all the buildings and engineering support for the construction stages including Detailed Design of all the Temporary Works. As the Project Manager of the project responsible for providing day to day project and technical advices on design issues, ensuring compliance with brief and construction programme requirement, adding value to the JV, ensuring allocation of adequate and suitable resources for the smooth, satisfactory and timely completion of the project, and providing high-level communication / liaison with the management of the client on project progress and financial performance and management.

MTR Contract No. C3840-13C – Tsim Sha Tsui Station Carnarvon Road Subway (2013 – Present) The project involves reconstruction of the existing Carnarvon Road MTR entrances and subway and connect to a shopping mall (K11) nearby. This is a challenging project entailing horizontal pipe-pile mined tunnel construction 10m below the highly congested downtown area in Tsim Sha Tsui. One of the key constraints is to maintain the high pedestrian flow in the existing subway and exits while demolishing, modifying and re-constructing the new subway and exits in the original space. Complex utility diversions for the existing gas and watermains and well-coordinated construction sequence will be required.

SMEC was appointed by Maeda Corporation as the detailed designer for the Project. SMEC is to provide detailed design of excavation and lateral support for subway construction, temporary traffic management, ground movement assessment and instrumentation & monitoring, existing building impact assessment, underpinning of existing underground structures, temporary traffic deck and working platform, utilities protection and diversion, temporary support and ground treatment for tunnel excavation, flood protection measures for the operating station. All the design packages are submitted to **BD for full approval** or **consultation and approval in principle**.

As the Project Manager of the project responsible for providing technical advices on design issues, ensuring compliance with brief and programme requirement, and ensuring allocation of adequate and suitable resources for the smooth, satisfactory and timely completion of the project, and providing high-level communication / liaison with the management of the client on project progress and financial performance and management. Also responsible for overseeing a team of Engineers in conducting the pre-construction condition survey of the EBS and other areas that could be affected by the Works. The survey was conducted to record the existing condition of the EBS and to determine the preventive or mitigation measures that may be required, in order to avoid damage or injury as result of the construction process.

Makkah Public Transport Program Phase 1 Section 1 Civil Construction Works CW1 - Tender Design for
As the structural leader responsible for tender design of all the underground and at grade stations (10 nos.), cut-and-cover tunnels, access and egress shafts, stairwells, temporary excavation and lateral support works design, ground water control works designs, instrumentation and monitoring works design and the preparation of the design and build tender submission documents under a very tight time schedule.

Hanoi Pilot Light Metro Line, Hanoi, Vietnam - Tender Design for Obrascon Huart Lain, 2014
As the structural leader responsible for tender design for the 4 km length underground section of the Hanoi Pilot Light Metro Line. The underground section comprises four underground stations of 200 m in length and 20 m in depth, a shaft of 32 m in depth, twin bored tunnels of 6.2 m in diameter and drainage sumps. Regional ground subsidence caused by groundwater extraction has been one of the challenges for design of the underground works. The tender design included for all the station design, cut-and-cover tunnel design, access and egress shafts, stairwells, temporary excavation and lateral support works design, ground water control works designs, instrumentation and monitoring works design and the preparation of the tender submission documents under a very tight time schedule.

MTR Shatin Central Link C1114 Pedestrian Links at Tze Wan Shan (March 2013 – Present) The work comprises the construction of Pedestrian Links at Tze Wan Shan. SMEC was appointed by Paul Y Construction Co. Ltd. as the Independent Checking Engineer for the contractor's design of the alternative foundation for the Pedestrian Links and the provision of RGE and RSE Services. As the Designated ICE Signatory responsible for ensuring the contractor's alternative designs of permanent works satisfied the design brief and are up to required technical/quality/safety requirements. SMEC was also appointed as the Designer for the major temporary works including ELS, falsework for footbridges construction. Design packages are submitted to MTR, HyD and **ICU of HA**. As the Project Manager ensuring no adverse impacts on adjacent permanent works, existing building, structures, utilities services and facilities imposed by the Temporary works. And delivery of design submissions in a timely manner.

Secondment to SIL 903 as Temporary Works Design Coordinator for Leighton on site
MTRC South Island Line (East) Contract No.SIL 903 (August 2011 – March 2013). Temporary Works Coordination for the major elements of works under Contract 903 comprising the following: Ocean Park Station, Wong Chuk Hang Station, Viaducts and Aberdeen Channel Bridge. Design Leader for the site based temporary works design team for C903. Provide Engineering support to the Construction process including Design of Temporary Works schemes (e.g. Pedestrian Footbridge, Formwork, Falsework, Access scaffolds, Steel Structures / Platforms, Retaining Walls, Foundations, Lifting schemes). ELS design packages are submitted to for **consultation and approval in principle** and temporary pedestrian footbridge design package is submitted to **BD for full approval**. Production of Method Statements & Construction Sequences. Check and Critique Temporary Works Designs provided by Subcontractors. Critique Permanent Works design and propose innovative alternative solutions. Design & Preparation of Safe and Economical Construction Methods and Temporary Works Schemes.

Chuang's Consortium International Limited – Consultancy for Detailed Design of Chuangs Tower and Edelweiss Residence (March 2011 – August 2011)
Project Manager responsible for management of detailed design of high rise buildings in Ulaanbaatar, Mongolia including an office tower (Chuangs Tower) and a property development of two residential towers (Edelweiss Residence). Each tower is to be 25 storey with 2 basement levels. The scope includes detailed design of foundation, superstructure and all the associated building services for the landmark buildings to Mongolian standard. The buildings are designed to meet the stringent requirements of the severe environment and intense earthquakes.

Leighton-LNS Joint Venture – DSD Contract DC/2007/24: Harbour Area Treatment Scheme Stage 2A – Construction of Sewage Conveyance System from Aberdeen to Sai Ying Pun (August 2010 – March 2011)
Temporary Works Coordinator responsible for on-site engineering management of temporary works design by the Designer (Atkins China Limited) and coordination of temporary works requirements and construction on site. Temporary works include excavation and Lateral Support (ELS) for various building structures including shafts, noise enclosures, primary tunnel support and miscellaneous working platforms and lifting appliance. All these temporary works are developed, designed and implemented to meet the construction requirements on site.

MTRCL Contract No. 703 Sheung Wan Station (SHW) to Sai Ying Pun (SYP) Tunnels (ICE Services, September 2009 – August 2010) Design Checking Engineer responsible for the review and independence checking of all the contractor's detailed design of temporary works and alternative design of permanent works. Major works comprise:

- Sai Woo Lane (SWL) Shaft ELS including diaphragm walls, prop and struts, rock support and connection interface with tunnel
- King George V Shaft ELS including pipe pile walls and rock support
- Primary Support and Secondary Tunnel Linings
- TBM Tunnel Precast SegmentsSWL Shaft Gantry Crane Structure and Noise Enclosure

MTRCL Contract No. 705 Kennedy Town Station (KET) Station and Overrun Tunnel - Tender Design (2009) Design Manager responsible for the review and value engineering for Penta Ocean – Hsin Chong Joint Venture. Led the design of the temporary works for the construction of KET Station, the associated overrun tunnel and ventilation shaft. Construction of the KET Station involves 10-20m deep excavation in soft ground across Smithfield and 20m deep excavation in rock at the eastern end of the proposed station. Heavy excavation and lateral support (ELS) system was proposed to suit the stringent site constraints, in particular the existing Kwun Lung Lau caisson wall, which was constructed after a major retaining wall failure in 1997, and the old and valuable wall trees at Forbes Street. The ELS comprises large diameter bored piles (2.5m diameter at 3m spacing) and steel pipe piles with four to five preloaded strut layers.

The overrun tunnel spans 6m for single track section, 12m for double track section and 8m for the section connecting with ventilation adit. The tunnel is approximately 700m long and starts from the west end of the station and ends with a ventilation shaft at the former Police Quarters Compound. Near the station, the tunnel is in soft/ mixed ground and is designed to be excavated by NATM method. Excavation is divided into headings and benching to minimise the ground settlement. The primary support will be in the form of canopy tubes with steel ribs embedded in sprayed concrete and annulus grouting. For the tunnel in rock (tuff), drill and blast method is adopted for the excavation.

Contract NEX/2101, Express Rail Link Preliminary Design for West Kowloon Terminus, MTRC (May 2008 – Feb 2009) Lead Structural Engineer for the topside development. The Guangzhou-Shenzen-Hong Kong Express Rail Link (XRL) is a committed cross boundary transport infrastructure project which will provide high speed rail services between HK and Guangzhou, and a connection to the national high speed rail network serving the major mainland cities outside of Guangdong province. The development of the West Kowloon Terminus comprise topside commercial properties which include four high rise office towers up-to 250m tall and three retail podium levels. These topside developments are directly above the terminus and require transfer structures. Being the Lead Structural Engineer for the topside development, Jacky coordinated with the architect, the M&E team, the terminus designers and foundation engineers to optimize the structural systems. The enabling works in terminus are designed for earthquake loadings with reference to the New York City Seismic Code modified to suit local conditions.

Contract C704, MTRC West Island Line (May 2008) West Island Line is an extension of the existing Island Line from Sheung Wan to Kennedy Town. As design engineer for the consultancy contract C704 includes detailed design for the construction of Kennedy Town Station and the associated overrun tunnel formed by drill and blast method. The Kennedy Town Station is a 20 meters deep box structure made up of typical 1 meter thick perimeter walls with Track Slab floor founded on socketted H-Piles. Extensive stabilisation works are required for at the area adjacent to the existing Kwun Lung Lau caisson wall, which is 5 meters away from the bulk excavation. In order to minimise the impact on the caisson wall that retains soil behind and provides lateral support Kwun Lung Lau, large diameter bored piles (2.5m diameter) with preloaded struts were proposed to form the ELS system.

Contract CS01, Ocean Park Master Redevelopment Project (MRP) (May 2007 - May 2008)
The master redevelopment project was divided into phases by different contract packages comprising Site Formation, Back of House for Marine Mammals - Veterinary Hospital, Panda Paradise, Funicular Tunnel, Entry Plaza, Aqua City, Thrill Mountain, Polar Adventure, Marine World and Complementary Public Works on Sewage Upgrading. Major civil works include site formation for all these complex structures and construction of a funicular (railway) tunnel connecting the Summit to the Waterfront.

As the Resident Engineer on site, he was responsible for supervision of the earthwork, site formation and the construction of the Veterinary Hospital. He carried out the site supervision under **TCP TS RSE and RGE streams** in accordance with BD requirements. He resolved all the technical queries on construction issues and ensured the safety, progress and quality of works. He coordinated with the RSE and the AP for the statutory submissions. He liaised with BD for the timely approval of consent applications for commencement and smooth progress of the works.

KCRC Kowloon Southern Link, KDB200 West Kowloon Station and Tunnels, Jordan Road to East Tsim Sha Tsui Station (Aug 2005 - May 2007) Lead Structural Engineer for a multi-disciplinary team on a design and build commission comprising 1.3 km of 7m ID twin bore stacked tunnels through the densely populated commercial district of down town Tsim Sha Tsui in close proximity to adjacent structures and MTRC tunnels. The project also included cut and cover tunnels, the West Kowloon underground station, an ancillary building and emergency exit structures.

Led the structural design team and prepared the best technical proposal leading to the award of the KDB200 Design and Build Contract to Leighton, Balfour Beaty, Kumagai, John Holland Joint Venture.

Led the detailed structural and civil design for the cut and cover (C&C) tunnels and ancillary buildings. The C&C tunnels are side-by-side underneath Salisbury Road, East Tsim Sha Tsui and are immediately (less than 2 m) above the Mass Transit Railway Tsuen Wan Line which remains in operation during the construction of the tunnels. The ancillary buildings have 5 basement levels of 17 m ID and 3 above ground levels for all the E&M equipment. Being located aside Canton Road and close to the prominent basement shopping malls, the buildings are spatial constrained resulting in asymmetric structures and rigorous 3-D finite element analyses were conducted for the design optimization. Condition survey of the EBS was conducted owing to the

close proximity of these buildings and structures to the proposed works. Involved in the co-ordination and carrying out of the site inspections of the EBS to record their existing condition and propose mitigation measures if deemed necessary.

KCRC East Rail Extensions, LCC300 Lok Ma Chau Terminus and Associated Works (Aug 2005 – Apr 2006) Engineer for the Supervision in Chief (SiC) for the construction of Lok Ma Chau Terminus and the associated works. The Terminus provides a new cross-border facility at the end of the Sheung Shui to Lok Ma Chau Spur Line. The three-level terminus building covers a footprint area of approximately 24,000m2. In addition to accommodate the railway operations, the terminus also provides comprehensive facilities for sewerage water treatment, Customs and Excise, Immigration and other government departments involved in processing cross-border traffic. The Terminus connects across the Shenzhen River to the new Huanggang Station on the Shenzhen Mass Transit. The Contract Sum for construction is above HK$1.2 billion.

Shatin to Central Link, SDC300 Consultancy for the Scheme Design of the Kai Tak to Hung Hom Section, KCRC (Apr 2003 – Aug 2005) Engineer for the structural design of deep box excavated stations at Ma Tau Wai and To Kwa Wan on the East Kowloon section of the project. The stations are to be constructed by top-down method using diaphragm walls in made ground and CDG. The locations of the main station box structures and entrances are in busy main roads with restricted working space and are immediately adjacent to 30 to 40 years old multi-storey buildings. Responsibilities include:

- Coordination with all disciplines including utilities, M&E, traffic management, value engineering, programming, fire engineering, landscaping and architect;
- Design of all the railway system structures which comprise the approximate 300m long, 21m wide and 25m deep main station box, tunnel ventilation buildings, link bridges and entrances;
- Design of construction methods and construction sequences. The main station box was designed to be constructed partly by 1m thick diaphragm wall panels with the internal elements constructed by top-down construction method and partly by in-situ reinforced walls stage with pipe pile walls as temporary the support.

North Lantau Development, Territory Development Department (now CEDD) (Apr 2000 – Mar 2003) Assistant Resident Engineer for supervision of construction and maintenance works under various contracts (NL6, NL7, NL9, NL10, NL11 and KL33) at various stages from pre-tender to final account with a total value in the region of HK$900 million. Deal with all aspects of civil, structural, geotechnical and M&E engineering issues related to new town development. Responsibilities cover the whole spectrum of project delivery from project acquisition to project completion. These included:

- On-site co-ordination, design and detailing of reinforced concrete elements of pumping stations and noise barriers
- On-site co-ordination and design of waterfront amenity areas for construction
- Co-ordination and design checking of storm water drainage systems
- Drafting and preparation of contract documents and specifications for new construction contracts
- Supervision of construction of site formation, slope formation, roadworks, storm water drainage works, sewerage systems, pumping stations, water supply systems, utilities installations, landscape softworks and irrigation systems
- Carrying out **condition survey and crack mapping of constructed foot/cycle bridges** and supervision of maintenance of highway bridges and long span steel truss foot/cycle bridges
- Review and checking of contractors' method statements and material submissions in accordance with contract requirements, responding to contractors' technical queries, drafting variation orders and associated site sketches, carrying out assessment of contractors' claims, attending various site meetings and drafting minutes, carrying out weekly safety walks and day-to-day inspection of the works, and preparing the monthly Environmental and Audit reports
- Co-ordination and liaison with all the relevant government departments for handover of the works

Route 10 – North Lantau to Yuen Long Highway (NLYLH), Highways Department (Aug 1998 – Mar 2000) Graduate Engineer for the design of superstructures and substructures for all the viaducts on Route 10 (NLYLH) between Fa Peng on Lantau Island and Siu Lam in the New Territories. The superstructures comprised pre-stressed concrete box girder and were designed to be constructed using the balanced cantilever construction method. Different types of substructures including pad footings and piled foundations were designed to suit the site conditions. The piers in coastal area were protected from ship impact by sacrificial piles which were analysed using a dynamic response approach. Also responsible for the assessment of initial cable sizes of Tsing Lung Bridge, a suspension bridge with a main span of 1418m and carries the dual 3 lane Route 10 over the Ma Wan Channel, and assessment of dynamic effect on the bridge tower during vessel collision on the man-made island surrounding the bridge tower.

Tsing Ma Bridge Graduate Engineer for the preparation of the Operation and Maintenance Manual for the HK$7 billion Tsing Ma Bridge. The suspension bridge has a main span of 1377m and as the world's longest span road-and-rail bridge.

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global experience

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