

Our Ref: WMA20002/AECOM/it220707

**AECOM**

8/F Grand Central Plaza Tower 2  
138 Shatin Rural Committee Road  
Shatin, Hong Kong

**By E-Mail**  
7<sup>th</sup> July 2022

**Attn.: Mr. Chris Ho**

Dear Mr. Ho,

**Service Contract No. NDO 04/2019**

**Environmental Team for Environmental Monitoring and Audit Works in Construction Phase for the First Phase Development of Kwu Tung North and Fanling North New Development Areas**

**- Contract No.: ND/2019/04**

**Fanling North New Development Area, Phase 1: Fanling Bypass Eastern Section (Shek Wu San Tsuen North to Lung Yeuk Tau)**

**Environmental Permit No. EP-473/2013/A:**

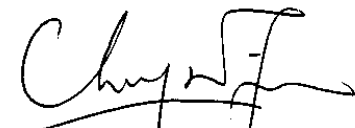
**Baseline Condition Survey and Baseline Vibration Impact Assessment Report (Condition 2.10 and 3.3)**

I refer to the revised baseline condition survey and baseline vibration impact assessment report (EP Condition 2.10) submitted by the Contractor (Daewoo – Chun Wo – Kwan Lee Joint Venture) of the captioned Contract (ND/2019/04) via email dated 7 July 2022.

I am pleased to inform you that I have no further comment and I hereby agree to certify the above document in accordance with the Environmental Permit (No. EP-473/2013/A), Condition 2.10 and 3.3.

If you need any further information, please call our Mr. Marco Ma at 2151 2073 or me at 2151 2089.

Yours faithfully,  
WELLAB Limited



Dr. Priscilla Choy  
Environmental Team Leader

c.c. CEDD (Attn: Mr. FAN Kwok Shing, Felix)  
IEC - Mott MacDonald Hong Kong Ltd  
(Attn.: Mr. Thomas Chan)  
Contractor - DCKJV  
(Attn.: Mr. Donna Tso)

By e-mail: felixksfan@cedd.gov.hk

By e-mail: Thomas.Chan@mottmac.com

By e-mail: donna.tso@chunwo.com

AECOM  
8F, Tower 2, Grand Central Plaza  
138 Shatin Rural Committee Road  
Shatin, N.T. Hong Kong

**Attention: Mr. Chris Ho**

**Your Reference**

**Our Reference**

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348 Kwun Tong Road  
Kowloon  
Hong Kong

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**Agreement No. CE 33/2019 (EP)**

**Independent Environmental Checker for Environmental Monitoring and Audit Works in Construction Phase for the First Phase Development of Kwu Tung North and Fanling North New Development Areas – Investigation**

**Contract No. ND/2019/04 Fanling North New Development Area, Phase 1: Fanling Bypass Eastern Section between Shek Wu San Tsuen North and Lung Yeuk Tau – Environmental Permit No. EP-473/2013/A: Baseline Condition Survey and Baseline Vibration Impact Assessment (Condition 2.10 and 3.3)**

8 July 2022

**BY EMAIL**

Dear Sir,

Reference is made to the Contractor's (Daewoo – Chun Wo – Kwan Lee Joint Venture) submission of the revised baseline condition survey and baseline vibration impact assessment report (EP Condition 2.10) of the captioned Contract (ND/2019/04) in accordance with the Environmental Permit (No. 473/2013/A) certified by the ET Leader on 7 July 2022.

We would like to inform you that we have no adverse comment on the captioned submission. Therefore we write to verify the captioned submission in accordance with the requirement stipulated in Condition 2.10 and 3.3 of EP-473/2013/A.

Should you have any queries, please contact the undersigned at 2828 5967.

Yours faithfully,

For and on behalf of the  
Mott MacDonald Hong Kong Limited



Ir Thomas Chan  
Independent Environmental Checker  
T +852 2828 5967  
Thomas.Chan@mottmac.com

c.c.

CEDD  
Wellab Ltd.

DCKJV

Mr. Felix Fan  
Dr. Priscilla Choy/  
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donna.tso@chunwo.com

## **CURRICULUM VITAE**

**Name** : **Fong Chi Wai, Wilson**  
**Sex** : **Male**  
**Nationality** : **Chinese**  
**Present Position** : **Technical Director**

### **QUALIFICATION**

Juris Doctor – City University of Hong Kong, 2015  
Post-graduate Diploma in Civil Engineering -The Hong Kong Polytechnic University, 2000  
Bachelor of Honours Degree in Civil Engineering -The Hong Kong Polytechnic University, 1994

### **AFFILIATIONS**

Member of Hong Kong Institution of Engineers, 1998  
Associate of Hong Kong Institute of Arbitrators, 1998  
Member of Chartered Institute of Arbitrators, 1999  
Member of The Institution of Engineers, Australia, 1999  
Chartered Professional Engineer, 1999  
Registered Professional Engineer, 2004

### **KEY EXPERIENCE**

Wilson has for 21 years from graduation focused on the design of building structures and civil infrastructure projects, such as site formation, urban drainage and sewerage, utilities diversion, seawall, breakwaters. From 2002, Wilson is the team leader in this company responsible for most of the civil and structural engineering projects including new building, and addition and alteration (A&A) works.

Apart from the experience in design office, he involved in two Shatin new town contracts as an assistant resident engineer, particularly in resolving site queries, liaison with various parties for site meeting and assessment of EOT claims. As an assistant engineer in Central, Western and Wan Chai Sewerage, he was mainly responsible for the detailed design of upgraded sewers and pumping station together with cost estimate for preparation of contract document.

### **WORKING EXPERIENCE**

**Mar 2002 – Present**

**Wong & Cheng Consulting Engineers Limited**  
**Technical Director**

Proactive involvement in the design, management and site supervision of new building, A&A and water proofing projects. Notable examples include :

MTR-Contract No.Q028590 - Structural Integrity of the As-built Pile Caps for Towers 9 and 10 of Nam Cheong Station Property Development

MTR-Nam Cheong Station Property Development –Structural Integrity of the As-built Beams at Station Roof at Level +15.65PD

MTR-West Rail Contract No. CC-204, Public Transport Interchange at Long Ping Station

Olympian City 2, 18 Hoi Ting Road, West Kowloon, Kowloon

Sino Plaza, 256-257 Gloucester Road, Causeway Bay, Hong Kong

Tsim Sha Tsui Centre, Tsim Sha Tsui, Kowloon

18-36 Shing On Street, Sai Wan Ho, Hong Kong

Chuk Yuen Shopping Centre, Wong Tai Sin, Kowloon

23A Repulse Bay Road, Hong Kong  
No. 2-8 Parkes Street, Kowloon  
Lok Fu Shopping Centre Phase 1, Lok Fu, Kowloon  
Cheung Fat Shopping Centre, Tsing Yi, N.T.  
314-324 Hennessy Road, Wan Chai, H.K.  
Cragside Mansion, 23 Barker Road, Hong Kong  
Po Shan Mansion, 10 Po Shan Road, Hong Kong  
Joyful Building, 202 Tsuen King Circuit, Tsuen Wan, N.T.  
Precast Façade and lostform at Residential Development at No. 1 High Street, Hong Kong  
Precast Façade at Residential Development at Lok Kwai Path, Shatin, Quality Assurance for Precast Products in Contract No. : YL53/02 – Yuen Long South Development Roadworks in Area 12 and 14  
Singapore International School, 23 Nam Long Shan Road, Aberdeen, 160 Connaught Road West, Hong Kong  
Boundary Building, Boundary Street, Kowloon

Responsible for the design and management of a variety of civil engineering projects including drainage design and preparation of temporary traffic management scheme, independent checking engineer of both temporary works and permanent works.

**Aug 1999 - Feb 2002**

**Maunsell Consultants Asia Ltd.  
Design Engineer and Coordination Engineer**

**“East Rail Extensions – TDD200 Tai Wai to Shek Mun & TDD300 Shek Mun to Lee On”** – actively involved in the liaison with various Government Departments for the interface between East Rail Extensions and public works projects, responsible for the detailed design of civil works including site formation, drainage and sewerage system; liaison with Water Supplies Department and utility undertakers to work out watermain/cable diversion scheme for the construction of stations, viaducts and miscellaneous structures; coordinate with traffic group for the design of proposed roadworks.

**Sep 1998 - Jul 1999**

**Maunsell Consultants Asia Ltd.  
Design Engineer**

**“West Rail DD210 – Tuen Mun Section”** - responsible for the detailed design of civil works including site formation, drainage and sewerage system; liaison with Water Supplies Department and utility undertakers to work out watermain/cable diversion scheme for the construction of stations, viaducts and miscellaneous structures.

**Oct 1997 - Aug 1998**

**Maunsell Consultants Asia Ltd.  
Assistant Engineer**

**“Feasibility Study for Port Development at Tseung Kwan O Area 131”** – involved in preliminary design of sloping seawall, quay deck, roadworks, drainage and sewerage of the back-up area; cost estimates of various type of seawall and reclamation method; technical review on the feasibility of upgrading the port to typhoon shelter with design of breakwaters.

**Feb 1996 - Sep 1997**

**Maunsell Consultants Asia Ltd.  
Assistant Resident Engineer**

**“TDD Contract No. ST65/92 – Road P8 (Final Section) and Roads and Drains in Area 86 and Area 90 Ma On Shan”** - involved in the site administration include inspection on construction of roads and various structures, vetting contractor’s submissions; attended various liaison meetings together with carrying out EOT claims assessment and final measurement of quantities.

**“TDD Contract No. ST64/92 – Servicing and Minor Formation in Sha Tin Tau Village”** – responsible for the inspection of site formation and minor structures, liaison with government departments for handover of works; monitoring progress of works and explained the objective of works to the villagers.

**Jul 1994 - Jan 1996**

**Maunsell Consultants Asia Ltd  
Assistant Engineer**

**“Central, Western and Wan Chai West Sewerage”** – checking of hydraulic performance of existing sewerage system; detailed design of upgraded trunk sewers and reticulation sewers; liaised with utility undertakers for cable diversion scheme; carried out structural design of pumping station; prepared cost estimate and contract documentation.

**Oct 1992 - Aug 1993**

**Territory Development Department  
Civil Engineering Undergraduate**

**“Contract No. TW74/90 – The Completion and Improvement to Texaco Road Phase II** – involved in the supervision of viaduct and retaining wall construction, prepared site documentation including site instructions and progress reports for the Engineer’s Representative; monitored testing of material and interpreted the test result.

**Baseline Condition Survey**  
**for the**  
**Built Heritages**  
**for**  
**Fanling North New Development Area,**  
**Phase1:**  
**Fanling Bypass Eastern Section**  
**(Shek Wu San Tsuen North**  
**to**  
**Lung Yeuk Tau)**  
**Under Contract No. ND/2019/04**

**Condition Survey Report**

Client : DCK JV  
Prepared by : Wong & Cheng Consulting Engineers Ltd.  
Project Ref. No. : M21030  
Date : August 2021  
Rev. : 1

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## 1.0 INTRODUCTION

1.1 Wong & Cheng Consulting Engineers Ltd. (WCCE) was commissioned by DCK JV to carry out a baseline condition survey for the built heritages which fall within or in the proximity of the Fanling North New Development Area, Phase 1: Fanling Bypass Eastern Section (Shek Wu San Tsuen North to Lung Yeuk Tau) prior to the commencement of relevant construction works. Location Plan of the Fanling Bypass Eastern Section (the section with the built heritages involved) is attached below (**Figure 1.1** refer)

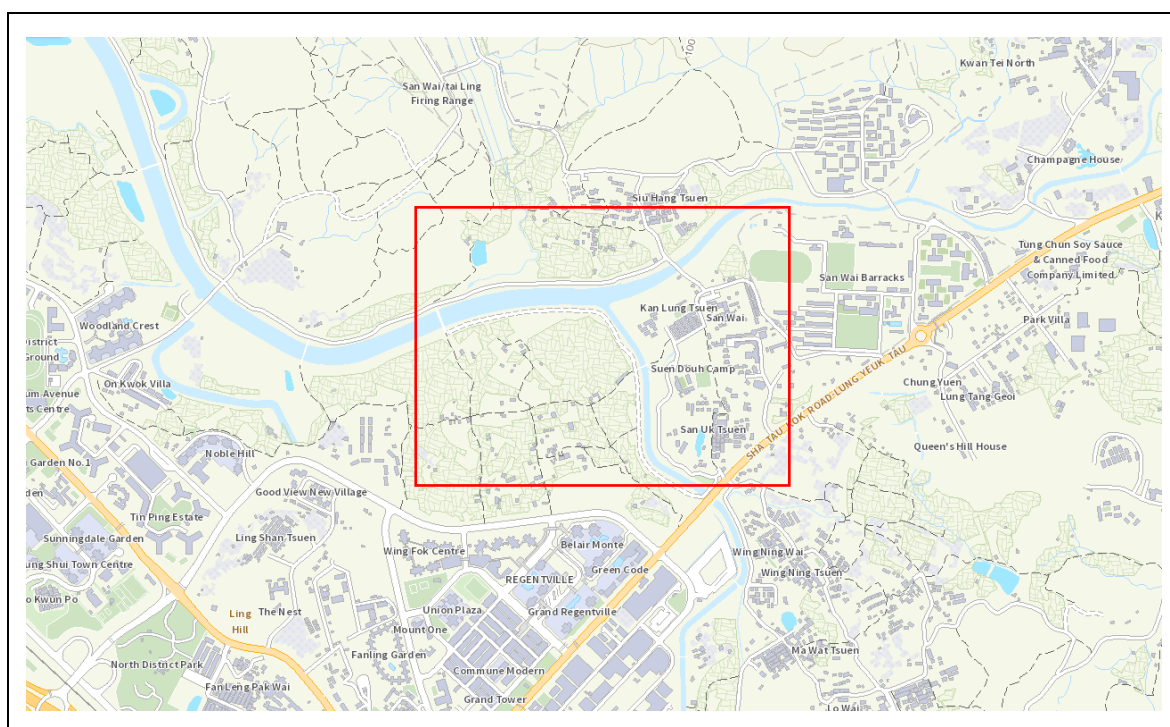


Figure 1.1 Location Plan showing the Fanling Bypass Eastern Section (the section with the built heritages involved).

1.2 Fanling Bypass Eastern Section is a 2-kilometer-long dual two-lane carriageway between Shek Wu San Tsuen North and Lung Yeuk Tau, which comprise viaduct, at-grade road, underpass sections. The scope of construction work includes:

- Construction of Lung Yeuk Tau Interchange connecting Fanling Bypass Eastern Section with existing Sha Tau Kok Road-Lung Yeuk Tau;
- Construction of a footbridge across Ng Tung River and a cycle track cum footbridge over Lung Yeuk Tau Interchange;
- Construction of a sewage pumping station adjacent to Lung Yeuk Tau



Interchange;

- Re-provisioning of the On Lok Mun Street Playground, public toilet and refuse collection point near Lung Yeuk Tau Interchange;
- Road junction improvement works in the North District; and
- Associated ground investigation, geotechnical instrumentation and monitoring, slope and retaining wall works, drainage and sewerage works, waterworks, noise barrier works, traffic control and surveillance system installation, electrical and mechanical works and landscaping works.

1.3 Site survey basing on visual inspection was carried out by the engineers of WCCE on 13 May 2021 for the record of structural defects along the specified ten (10) built heritages, which were decided to be retained subsequent to the completion of construction works.

1.4 It is noted that FL05 and FL31 of built heritages have been covered in the inspection. With reference to the updated Environmental Monitoring and Audit Manual Section 11.2.3 and Environmental Permit 473/2013/A Condition 2.10, baseline condition survey and baseline vibration impact assessment are to be conducted prior to the commencement of construction of the Project, including (1) define the vibration limit of identified built heritage features ; (2) determine whether construction vibration monitoring and/or structural strengthening measures are required during construction phase; and (3) maintain a record of the condition survey of graded historic buildings that may be affected by the Project.

1.5 This report aims to identify and record any structural defects along these ten (10) built heritages basing on the result of inspection for the initial preparation work of site formation and construction as the subject built heritages may be affected by the relevant works (i.e. excavation works).

## 2.0 THE EXTENT OF SURVEY

2.1 Site layout plan (**Figure 2.1** refer) provided by DCK JV showing the exact locations of the specified ten (10) built heritages with the details listed below, which are required to be inspected.

<u>No.</u>	<u>Name of Built Heritages</u>
FL11	Liu Clan Grave
FL10	Kam Tap
FL07	Liu Clan Grave of Sheung Shui
FL08	Wen Grave
FL17	Chick Grave
FL33	7 Kam Taps of Unknown Clan
FL31	6 Kam Taps of Kan's Clan in Sheung Shui
FL05	Earth Shrine of Siu Hang Tsuen
HFL08	Nos. 2 to 4 Siu Hang Tsuen
FL19	Memorial Stone for the Construction of the Jian Bridge

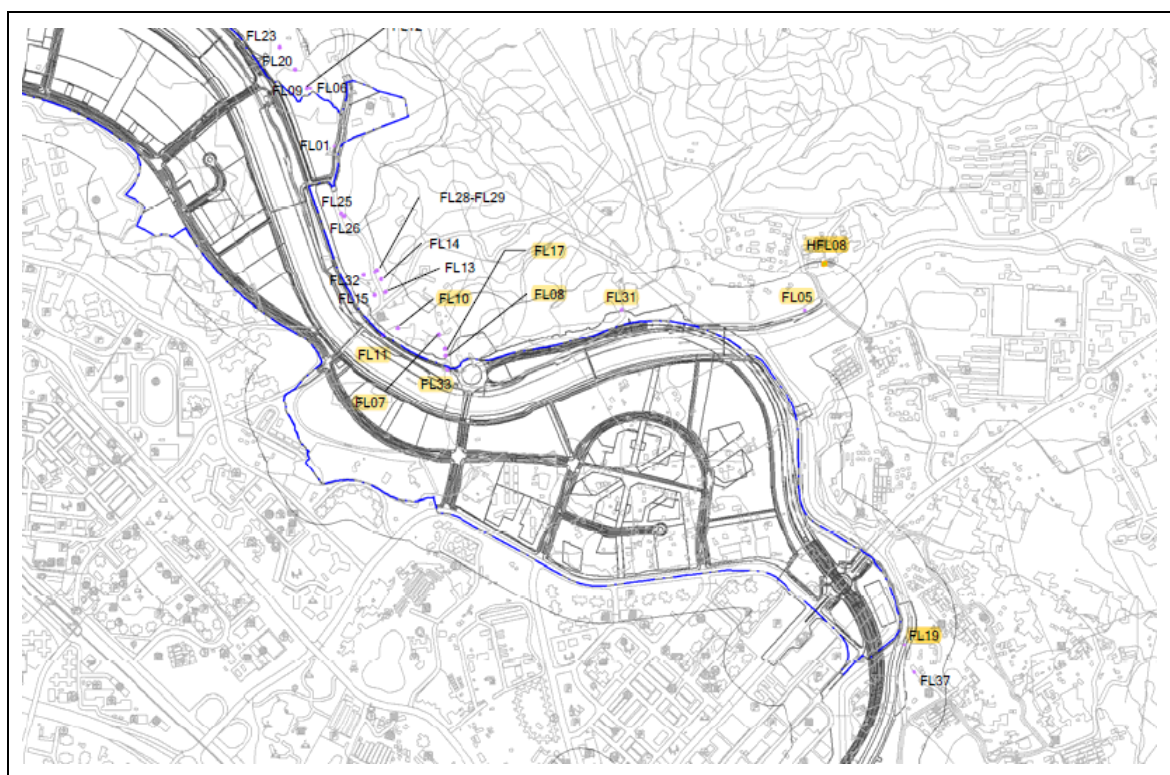


Figure 2.1 Site layout plan showing the exact locations of the specified ten (10) built heritages which are required to be inspected.

### **3.0 RESULT OF VISUAL INSPECTION**

3.1 Visual inspection for the identification of structural defect along the subject ten (10) built heritages was carried out by the engineers of WCCE on 13 May 2021.

3.2 The typical structural elements together with their external envelope were covered during the visual inspection.




3.3 Any observed defects were recorded together with their size and location (where appropriated) during the inspection. Photographs were also been taken.




3.4 The terms used in describing defects shall be defined as follows (but not limited to):




1	Hairline crack	Crack below 1mm wide, and not being structural unless otherwise stated.
2	Minor crack	Crack from 1mm to 2mm wide, and not being structural unless otherwise stated.
3	Severe crack	Crack wider than 2mm, and not being structural unless otherwise stated
4	Minor spalled concrete	Spalling up to 0.1m <sup>2</sup> and sporadic. No reinforcement bar exposed unless otherwise stated.
5	Major spalled concrete	Spalling greater than 0.1m <sup>2</sup> and extensive. No reinforcement bar exposed unless otherwise stated.
6	Water stain	Stain on surface caused by past water penetration. The surface is dry.
7	Damp patch	Moisture saturated surface with no significant trace of water.
8	Water seepage	Water oozing out from surface. The surface is wet.
9	Water leakage	Water oozing out from surface. The surface is wet and/or with running water.
10	Verticality	A visual assessment of verticality of the building.



3.5 Any defective areas with imminent danger to the users or public would be reported immediately.


3.6 The inspection result of the ten (10) built heritages are presented as below:




<p><u>FL11 Liu Clan Grave</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL11-EW-01 Location / Structure: Kerb Defect Category: Crack Size: 300 mm x 1 mm (w) Influenced Area: 0.0003 m<sup>2</sup></p>	
<p>Defect No.: FL11-EW-02 Location / Structure: Kerb Defect Category: Crack Size: 300 mm x 1 mm (w) Influenced Area: 0.0003 m<sup>2</sup></p>	

<p><u>FL10 Kam Tap</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL10-EW-01 Location / Structure: Kerb Defect Category: Cracking Concrete Size: 300 mm x 200 mm Influenced Area: 0.06 m<sup>2</sup></p>	
<p>Defect No.: FL10-EW-02 Location / Structure: External Envelope Defect Category: Crack Size: 1200 mm x 1 mm (w) Influenced Area: 0.0012 m<sup>2</sup></p>	




<p>FL10 Kam Tap (Con't) Defect No.: FL10-EW-03 Location / Structure: External Envelope Defect Category: Crack Size: 1000 mm x 1 mm (w) Influenced Area: 0.001 m<sup>2</sup></p>	 A photograph showing a section of a weathered concrete wall. A thin, vertical crack is visible, highlighted by a red oval. The wall is situated outdoors, with some greenery and a concrete base visible.
<p>Defect No.: FL10-EW-04 Location / Structure: External Envelope Defect Category: Cracking Concrete Size: 1000 mm x 1000 mm Influenced Area: 1.00 m<sup>2</sup></p>	 A photograph of a small, square brick structure, possibly a well or a small shrine, with a dark opening. The roof is made of concrete and shows a significant crack, circled in red. The structure is surrounded by lush green vegetation.
<p>Defect No.: FL10-EW-05 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 2500 mm x 1 mm (w) in total Influenced Area: 0.0025 m<sup>2</sup></p>	 A photograph of a large, ornate concrete structure, possibly a decorative wall or a large well. It features multiple cracks and signs of weathering, with a red oval highlighting a specific area of damage. The structure is set in an outdoor environment with green grass.

<p><u>FL07 Liu Clan Grave of Sheung Shui</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL07-EW-01 Location / Structure: External Envelope Defect Category: Crack Size: 300 mm x 1 mm (w) Influenced Area: 0.0003 m<sup>2</sup></p>	

<p><u>FL08 Wen Grave</u></p>	<p><u>General View</u></p> 
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<p><u>FL08 Wen Grave (Con't)</u> Defect No.: FL08-EW-01 Location / Structure: External Envelope Defect Category: Delamination of Cover Size: 200 mm x 200 mm Influenced Area: 0.04 m<sup>2</sup></p>	
<p>Defect No.: FL08-EW-02 Location / Structure: External Envelope Defect Category: Crack Size: 400 mm x 1 mm (w) Influenced Area: 0.0004 m<sup>2</sup></p>	
<p>Defect No.: FL08-EW-03 Location / Structure: Kerb Defect Category: Multiple Cracks Size: 1800 mm x 1 mm (w) in total Influenced Area: 0.0018 m<sup>2</sup></p>	



<p><u>FL17 Chick Grave</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL17-EW-01 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 1600 mm x 1 mm (w) in total Influenced Area: 0.0016 m<sup>2</sup></p>	
<p>Defect No.: FL17-EW-02 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 800 mm x 1 mm (w) in total Influenced Area: 0.0008 m<sup>2</sup></p>	

FL17 Chick Grave (Con't)

Defect No.: FL17-EW-03

Location / Structure: Kerb

Defect Category: Crack

Size: 300 mm x 1 mm (w)

Influenced Area: 0.0003 m<sup>2</sup>






FL33 7 Kam Taps of Unknown Clan

No structural defect was observed

General View



<p><u>FL31 6 Kam Taps of Kan's Clan in Sheung Shui</u></p>	<p><u>General View</u></p>  
<p>Defect No.: FL31-EW-01 Location / Structure: External Envelope Defect Category: Delamination of Concrete Size: 1000 mm x 200 mm Influenced Area: 0.2 m<sup>2</sup></p>	

<p><u>FL05 Earth Shrine of Siu Hang Tsuan</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL05-EW-01 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 900 mm x 1 mm (w) in total Influenced Area: 0.0009 m<sup>2</sup></p>	
<p>Defect No.: FL05-EW-02 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 2200 mm x 1 mm (w) in total Influenced Area: 0.0022 m<sup>2</sup></p>	

FL05 Earth Shrine of Siu Hang Tsuan (Con't)

Defect No.: FL05-EW-03

Location / Structure: External Envelope

Defect Category: Multiple Cracks

Size: 2200 mm x 1 mm (w) in total

Influenced Area: 0.0022 m<sup>2</sup>



HFL08 Nos. 2 to 4 Siu Hang Tsuen

General View



Defect No.: HFL08-EW-01




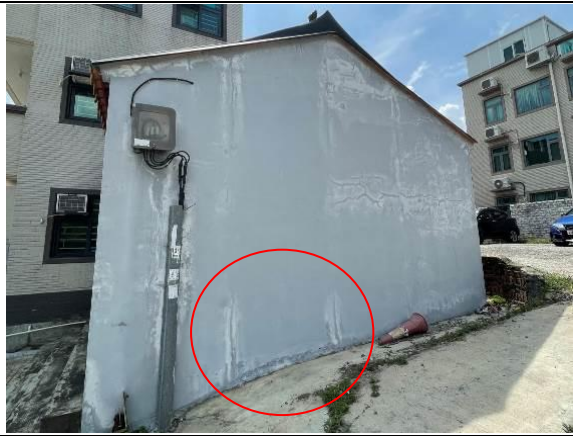
Location / Structure: External Envelope

Defect Category: Multiple Cracks



Size: 1200 mm x 1 mm (w) in total

Influenced Area: 0.0012 m<sup>2</sup>





<p>HFL08 Nos. 2 to 4 Siu Hang Tsuen (Con't) Defect No.: HFL08-EW-02 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 1400 mm x 1 mm (w) in total Influenced Area: 0.0014 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-03 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 1000 mm x 1 mm (w) in total Influenced Area: 0.001 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-04 Location / Structure: External Envelope Defect Category: Crack Size: 1200 mm x 1 mm (w) Influenced Area: 0.0012 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-05 Location / Structure: External Envelope Defect Category: Multiple Cracks Size: 1400 mm x 1 mm (w) in total Influenced Area: 0.0014 m<sup>2</sup></p>	

<p>HFL08 Nos. 2 to 4 Siu Hang Tsuen (Con't)                  Defect No.: HFL08-EW-06                  Location / Structure: External Envelope                  Defect Category: Multiple Cracks                  Size: 3500 mm x 1 mm (w) in total                  Influenced Area: 0.0035 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-07                  Location / Structure: External Envelope                  Defect Category: Crack                  Size: 1300 mm x 1 mm (w)                  Influenced Area: 0.0013 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-08                  Location / Structure: Internal Wall                  Defect Category: Crack                  Size: 1500 mm x 1 mm (w)                  Influenced Area: 0.0015 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-09                  Location / Structure: External Steps                  Defect Category: Crack                  Size: 1800 mm x 1 mm (w)                  Influenced Area: 0.0018 m<sup>2</sup></p>	

<p>HFL08 Nos. 2 to 4 Siu Hang Tsuen (Con't) Defect No.: HFL08-EW-10 Location / Structure: External Steps Defect Category: Crack Size: 1800 mm x 1 mm (w) Influenced Area: 0.0018 m<sup>2</sup></p>	
<p>Defect No.: HFL08-EW-11 Location / Structure: External Wall and Kerb Defect Category: Crack Size: 800 mm x 1 mm (w) Influenced Area: 0.0008 m<sup>2</sup></p>	



<p><u>FL19 Memorial Stone for the Construction of the Jian Bridge</u></p>	<p><u>General View</u></p> 
<p>Defect No.: FL19-EW-01                  Location / Structure: Kerb                  Defect Category: Crack                  Size: 300 mm x 1 mm (w)                  Influenced Area: 0.0003 m<sup>2</sup></p>	

### 3.7 Summary table of the structural defects observed at each of the built heritage.

No.	Name of Built Heritages	Total Nos. of Defect	Total Influenced Area
FL11	Liu Clan Grave	2	0.0006 m <sup>2</sup>
FL10	Kam Tap	5	1.06 m <sup>2</sup>
FL07	Liu Clan Grave of Sheung Shui	1	0.0003 m <sup>2</sup>
FL08	Wen Grave	3	0.042 m <sup>2</sup>
FL17	Chick Grave	3	0.003 m <sup>2</sup>
FL33	7 Kam Taps of Unknown Clan	<i>NIL</i>	<i>NIL</i>
FL31	6 Kam Taps of Kan's Clan in Sheung Shui	1	0.2 m <sup>2</sup>
FL05	Earth Shrine of Siu Hang Tsuen	3	0.005 m <sup>2</sup>
HFL08	Nos. 2 to 4 Siu Hang Tsuen	11	0.017 m <sup>2</sup>
FL19	Memorial Stone for the Construction of the Jian Bridge	1	0.0003 m <sup>2</sup>
		<b>30</b>	<b>1.33 m<sup>2</sup></b>

## **4.0 CONCLUSION**

4.1 As construction works comprises the demolition, site formation and concrete works etc. were implemented to be carried out in Fanling North New Development, Phase 1: Fanling Bypass Eastern Section, a baseline condition survey under visual inspection was carried out by the engineers of WCCE on 13 May 2021 for the identification and record of structural defects along the specified ten (10) built heritages, which were decided to be retained subsequent to the completion of construction works.

4.2 The survey result is summarized as below:

- i) Minor structural defects such as crack and cracking concrete etc. were observed along each of the built heritage (refer to the below summary);
- ii) No imminent danger to the users or public for these observed defects;
- iii) No urgent repair work is required at this moment unless further deterioration is occurred.

- FL11 - Liu Clan Grave (2 defects with a total influenced area of 0.006 m<sup>2</sup>);
- FL10 - Kam Tap (5 defects with a total influenced area of 1.06 m<sup>2</sup>);
- FL07 - Liu Clan Grave of Sheung Shui (1 defect with a total influenced area of 0.0003 m<sup>2</sup>)
- FL08 - Wen Grave (3 defects with a total influenced area of 0.042 m<sup>2</sup>);
- FL17 - Chick Grave (3 defects with a total influenced area of 0.003 m<sup>2</sup>);
- FL33 - 7 Kam Taps of Unknown Clan (No defect was observed);
- FL31 - 6 Kam Taps of Kan's Clan in Sheung Shui (1 defect with a total influenced area of 0.2 m<sup>2</sup>);
- FL05 - Earth Shrine of Siu Hang Tsuen (3 defects with a total influenced area of 0.005 m<sup>2</sup>);
- HFL08 - Nos. 2 to 4 Siu Hang Tsuen (11 defects with a total influenced area of 0.017 m<sup>2</sup>);
- FL19 - Memorial Stone for the Construction of the Jian Bridge (1 defect with a total influenced area of 0.0003 m<sup>2</sup>).

**Baseline Vibration Impact Assessment  
for the  
Built Heritages  
for  
Fanling North New Development Area,  
Phase1:  
Fanling Bypass Eastern Section  
(Shek Wu San Tsuen North  
to  
Lung Yeuk Tau)  
Under Contract No. ND/2019/04**

**Baseline Vibration Impact Assessment**

Client : DCK JV  
Prepared by : Wong & Cheng Consulting Engineers Ltd.  
Project Ref. No. : M21030  
Date : June 2022  
Rev. : 5

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### **APPENDICES**

A - Vibration Monitoring Plan

## **1.0 INTRODUCTION**

- 1.1 On 13 May 2021, a baseline condition survey under visual inspection was carried out by the engineers of WCCE for the identification and record of structural defects along the specified ten (10) built heritages, which were decided to be retained subsequent to the completion of construction works.
- 1.2 Proposed construction works comprises the demolition, site formation and concrete works etc. were implemented to be carried out in Fanling North New Development, Phase 1: Fanling Bypass Eastern Section. Construction activities produce vibration and pose impact on the structural stability of existing buildings or structures at nearby regions.
- 1.3 Hence, baseline vibration impact assessment is necessary to be conducted for the identified built heritages which fall within or in the proximity of the site. Monitoring measures are recommended to be implemented during the construction period to eliminate potential hazards and safeguard the structural behavior of the historical buildings or structures. Proposed monitoring issues are tabulated below.

<u>No.</u>	<u>Method</u>	<u>Instrument</u>	<u>Criterion</u>
1	Vibration	Vibration Monitor (electronic handheld device)	Variation of Vibration

## **2.0 SCOPE OF WORKS**

- 2.1 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.

### 3.0 METHOD STATEMENT

#### 3.1 Vibration Monitoring

- Contractor should assign an experienced technician to use the apparatus to carry out the vibration monitoring;
- The exact location of vibration monitoring shall be determined by the engineer on site;
- The vibration monitoring will be recorded in the following format of table:

<u>Date</u>	<u>Time</u>	<u>Location of Check Point</u>	<u>Result (Max. Point) (mm/s)</u>	<u>Monitoring Duration (Mins)</u>	<u>Location of Demolition Work</u>

- Under requirements of the updated EM&A manual, vibration limit at 7.5 mm/s and 15 mm/s have been adopted for graded historical buildings and historical buildings, respectively;
- Readings will be recorded depending on the distance of each bored pile (refer to Table 1 of Appendix A) throughout the construction period of the piling operation to record the maximum value;
- Vibration monitoring upon piling works is within radius of 100 metres;
- Monitoring records (i.e. Monthly Monitoring Report) will be submitted to engineer throughout the construction period in monthly period;
- All construction works shall cease if the vibration reaches the action level and shall not resume until further mitigation measures are proposed and accepted by engineer.

#### 3.2 Impact Assessment of Cultural Heritages

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

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 monitored based on the Building Department's Practice Note (PNAP APP-137). The table below summarizes the vibration limit from the practice note.

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.

- 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. Otherwise, the vibration would be monitored based on the Buildings Department's Practice Note (PNAP APP-136), the note could be found in Appendix C. The table below provides the provisional AAA trigger values which summarizes the tilting and settlement limit.

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

#### 4.0 MONITORING CHECKPOINTS

THE ALERT / ALARM / ACTION (3AS) LEVELS FOR THE MONITORING CHECKPOINTS TO BE RECOMMENDED AS FOLLOWING:

Type of Monitoring for	Alert	Alarm	Action
Vibration (PPV)	5 mm/s	6mm/s	7.5 mm/s

4.1 The contractor shall act in accordance with the following in the case of trigger levels being reached.

- i) If an Alert level is reached, the contractor shall:
  - a) Notify the project manager immediately.
  - b) Propose a suitable plan of action which may include the installation of addition instruments and/or increasing the monitoring frequency.
  - c) Within 7 days, submit a report to review the instrument responses, including differential deformations. Assess the effects on the monitored elements in the light of the relevant construction activities and predict further responses and their effect, based on the data trend to date.
  - d) Within 7 days, submit a detailed plan of action to the project manager describing the measures to be taken in the event of an alarm trigger level being attained. The plan of action will be subject to the acceptance of the project manager.
- ii) If an Alarm level is reached, the contractor shall:
  - a) Notify the project manager immediately.
  - b) Undertake a joint inspection of the works with the project manager.
  - c) Implement the alarm level trigger actions, phased as appropriate. So that the action level is not reached, in accordance with the detailed plan of action.
  - d) Within 48 hours of exceeding an alarm trigger level, devise and submit an emergency plan describing the measures to be taken in the event of an action trigger level being attained.
  - e) Meet the project manager to discuss the instrument response and review the effectiveness of the trigger level actions.
  - f) As Discussed and agreed with the project manager, undertake additional measures in the affected area to avoid reaching the action level.
  - g) Within 7 days, submit an updated report to review the instrument responses, including differential deformations. Assess the effects on the monitored elements in the light of relevant construction activities and predict further responses and their effect, based on the data trend to date.



- iii) If an Action level is reached, the contractor shall:
- a) Suspend all works within 50m of the instrument.
  - b) Notify the project manager immediately.
  - c) Undertake a joint inspection of the works with the project manager.
  - d) Implement emergency trigger action(s) based on the emergency plan of trigger actions reviewed without objection by the project manager. These emergency trigger actions will include measures to diminish the deformations and ground responses.
  - e) Within 3 days, provide a complete report to examine the construction method and a detailed report to review the deformation and ground response history and the trigger actions adopted related to the construction activities.

## **5.0 RECOMMENDATION**

- 5.1 It is proposed that the built heritages inspected to be monitored in accordance with the PNAP APP-137 from Buildings Department against vibration. A monitoring plan is proposed as following. Each surveyed cultural heritage is adopted to the below vibration monitoring plan.

Distance with Construction Works	Monitoring Plan
Within 50m	Daily assessment is required
Within 75m	Bi-daily assessment
Within 100m	Weekly assessment

- 5.2 Due to the structural feasibility of built heritages as concluded in the baseline structural condition survey, immediate actions for the structural strengthening of built heritages are not necessary. However, visual assessment should be carried out simultaneously with the vibration monitoring assessment. If any significant deficiencies (e.g. tilting, differential settlement) are observed, the contractor should stop construction works immediately and seek engineer's advice for any remedial works.

## Vibration Monitoring Plan

### 1. Introduction

According to the condition survey report from cultural heritage condition survey for Fanling Bypass Eastern Section under EP-473/2013/A, this vibration monitoring plan is proposed for the surveyed cultural heritage based on the Buildings Department's Practice Note (PNAP APP-137).

### 2. Monitoring Location

The locations of vibration monitoring are shown in **Figure 1**. Construction vibration monitoring will be conducted for built heritage features at FL08, FL31 and FL33 when bored piling works was carried out within assessment area of construction works.

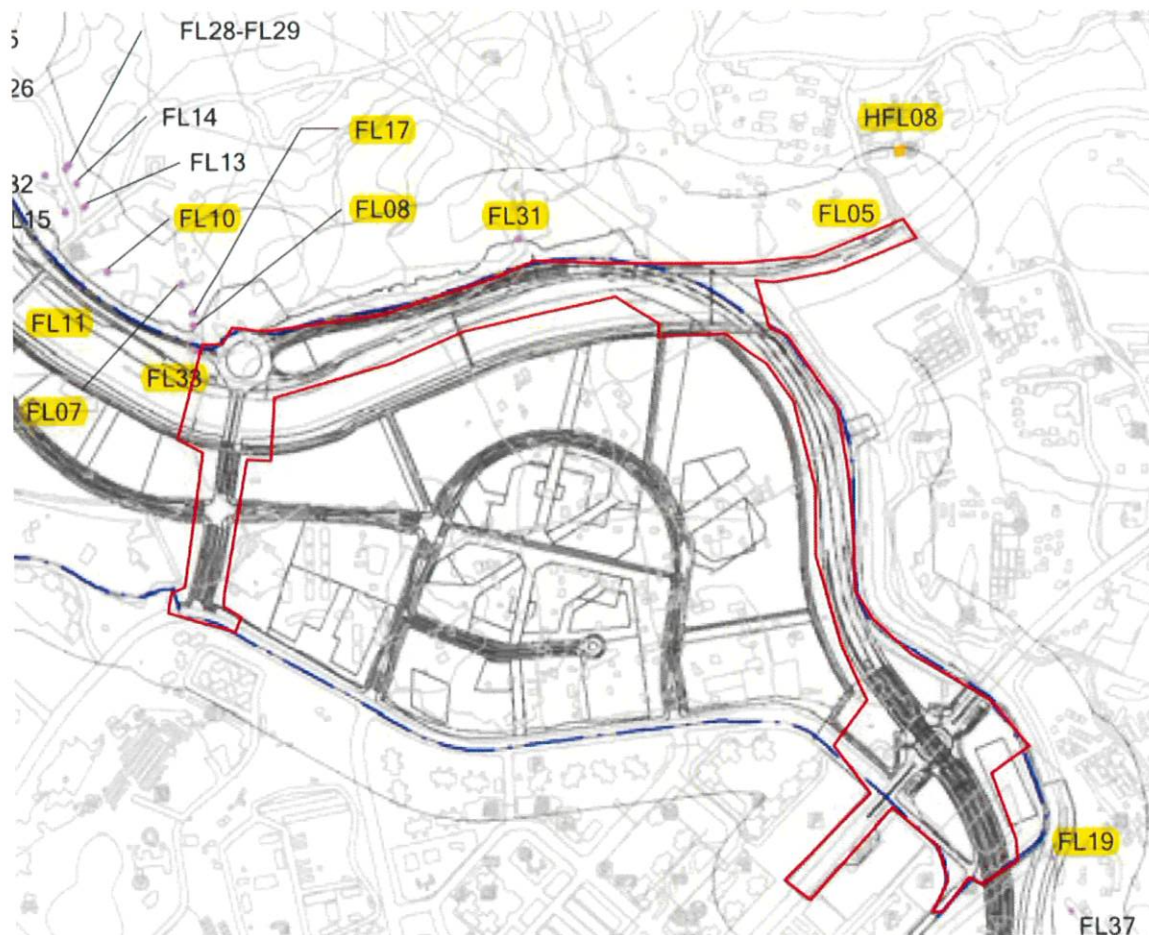


Figure 1. Location of Vibration Monitoring

### Vibration Monitoring Plan

Figure 2 indicates the distance of all built heritage from the bored piling works.

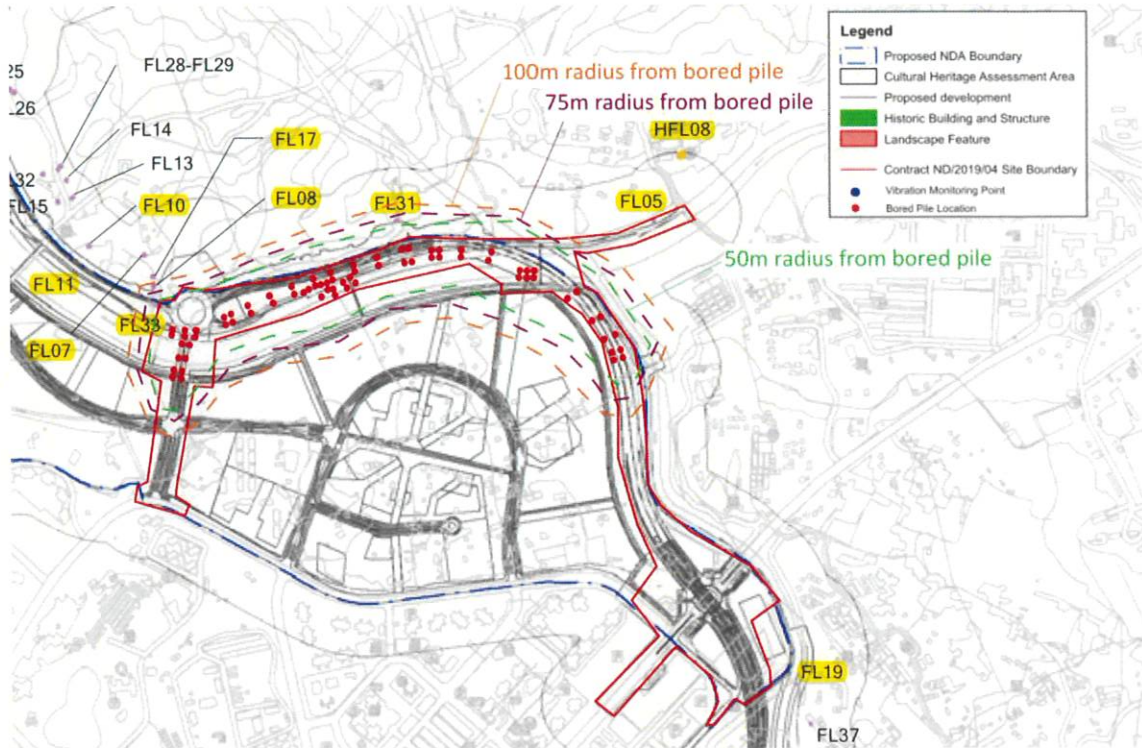


Figure 2. Distance of Built Heritage from Bored Piles

## Vibration Monitoring Plan

### 3. Monitoring Parameters and Frequency

**Table 1** summarises the vibration monitoring plan for surveyed cultural heritage under the Works Contracts when bored piling works is conducted within the assessment area of construction works.

Contract No.	Surveyed Built Heritage	Distance from bored piling works	Monitoring Plan
ND/2019/04	FL08, FL31 and FL33	Within 50m	Daily assessment
		Within 75m	Bi-daily assessment
		Within 100m	Weekly assessment

**Table 1. Summary of Vibration Monitoring Plan**

Remarks:

i. Baseline condition survey was conducted for built heritage features at FL05, FL07, FL08, FL10, FL11, FL17, FL19, FL31, FL33 and HFL08 under ND/2019/04. As FL05, FL07, FL10, FL11, FL17, FL19 and HFL05 were not within the assessment area of construction works, no construction monitoring was conducted for the built heritage mentioned.

The construction vibration monitoring will be conducted throughout each event of the pile driving operation on a basis as such in above table. The effect of ground-borne vibration from piling works on the surveyed built heritage was assessed by the maximum peak particle velocity (ppv), which was obtained from the maximum value of the pile driving operation events.

### 4. Monitoring Equipment

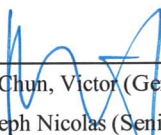
The copy of calibration certificate of the monitoring equipment for construction vibration monitoring is in **Appendix 1**.



## Calibration Report

<b>Calibration No.</b>	: 92008051 - C02C2801	
<b>Laboratory</b>	: FT Laboratories Ltd.	
<b>Address</b>	: Lot No. DD77 Section 1552 S.Ass 1RP, Ng Chow South Road, Ping Che, Fanling, New Territories	
<b>Telephone</b>	: (852) 2758 4861	
<b>Facsimile</b>	: (852) 2758 8962	
<b>Customer</b>	: DCK JV	
<b>Address</b>	: 5C, Hong Kong Spineers Industrial Bulding, Phase 1,601-603 Tai Nan West Street, Cheung Sha Wan, Kowloon, Hong Kong	
<b>Item Calibrated</b>	Name/Description:	Vibration meter
	Manufacturer:	GDS
	Meter's model:	Wave On
	Serial no. of meter:	001342
	Serial no. of sensor:	3304
	Eqt. No.:	-
<b>Reference Standard / Major Measurement Equipment</b>	C/ACC/1 (CNAS Cert No.: 2HB21001704-0001)	Accelerometer
	C/OSC/2 (HKSCS Cert No.: RF210042)	Oscilloscope
	C/F-GEN/3 (CNAS Cert No.: 2HB21000253-0001)	Function Generator
	R/DMM/2 (CNAS Cert No.: 2HB21000253-0002)	Multimeter
	C/ES/1, C/AMP/3	Shaker and amplifier
<b>Calibration Method</b>	: In-house procedure (CAL 091) Calibration of Vibration meters by comparison with reference transducer.	
<b>Date of item received</b>	: 2 Mar., 2022	
<b>Date of Calibration</b>	: 16 Mar., 2022	
<b>Location of Calibration</b>	: Calibration Laboratory of FT Laboratories Ltd.	
<b>Calibration Conditions</b>	Temperature : 20 ± 3 °C Relative Humidity : 30% to 80%	
<b>Test Results</b>	: The test results are detailed in the subsequent page(s).	

HOKLAS Approved Signatory :

  
 LAI Wing Chun, Victor (General Manager)  
 CHAN Joseph Nicolas (Senior Technical Engineer)

Date of Issue: 21 MAR 2022

- Notes:
- (1) The above equipment has been calibrated against standards which are traceable to internationally recognized standards.
  - (2) Hong Kong Accreditation Service (HKAS) has accredited this laboratory under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this report were determined by this laboratory in accordance with its terms of accreditation.
  - (3) Such terms of accreditation stipulate that the results shall be traceable to the International System of Units (S.I.) or recognised measurement standards.
  - (4) This certificate shall not be reproduced, except in full, without the written approval of FT Laboratories Ltd.



## Calibration Report

Calibration No. : 92008051 - C02C2801

### Results

(1) Frequency response at 10.0 mm/s (velocity measurement)

Frequency (Hz)	Measured velocity in the following direction (mm/s)			Error in the following direction (mm/s)		
	Vert.	Tran.	Long.	Vert.	Tran.	Long.
20	9.88	10.66	10.52	-0.12	0.66	0.52
60	10.65	11.45	11.21	0.65	1.45	1.21
100	11.05	12.19	11.70	1.05	2.19	1.70

Error for frequency response = Measured velocity (mm/s) minus 10.0 mm/s

(2) Level linearity at 60Hz (velocity measurement)


Reference level (mm/s)	Measured velocity in the following direction (mm/s)			Error in the following direction (mm/s)		
	Vert.	Tran.	Long.	Vert.	Tran.	Long.
5.0	5.36	5.78	5.75	0.36	0.78	0.75
10.0	10.65	11.45	11.21	0.65	1.45	1.21
20.0	21.31	22.65	22.37	1.31	2.65	2.37


Error for level linearity = Measured velocity (mm/s) minus Reference level (mm/s)

### Remarks:

- (A) The expanded uncertainty of measurement relative to "measured values" with  $k=2$ ,  
10.7 % For frequency range 20 Hz to 100 Hz; 0.1 g to 0.8 g
- (B) Each reported result is the mean of three measurements on UUT (unit-under-test).
- (C) Before calibration, the UUT was allowed to stabilise in the laboratory environment for at least 1 hr.
- (D) The reported uncertainty is the expanded uncertainty  $U$  for a level of confidence of 95%, together with a coverage factor  $k$ . The combined standard uncertainty  $u_c$  can be calculated as  $u_c=U/k$  and its  $k$  value.
- (E) The values given in this Calibration Report only relate to the unit-under-test and the values measured at the time of the test. Any uncertainties quoted will not include allowances for the environmental changes, variation and shock during transportation, or the capability of any other laboratory to repeat the measurement.
- (F) The UUT was mounted in the vibration shaker using mounting jigs and cyanoacrylate adhesive or petro wax.
- (G) Applicable  $g$  value used,  $1g = 9.80665 \text{ m/s}^2$ , as per C/ACC/1 report no. SSD20071651.

<End of Report>

Calibrated by: Yan Wing Man   
Date: 16 Mar., 2022

Checked by: Cheung Chun Hei   
Date: 18 MAR 2022