



Hong Kong Institute of Utility Specialists
Non – profit Making Organization

Method Statement

For

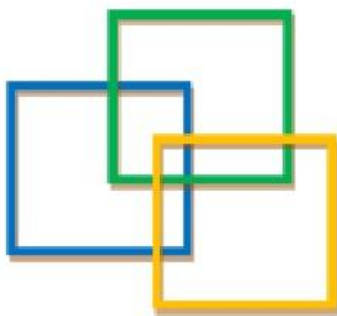
Advanced Leakage Detection

Of Buried Water

Carrying Services Affecting

Slopes

(BWCS)



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UTILITY TRAINING INSTITUTE (UTI)
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Community & Construction Professionals'
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社區、建造及工程專業發展中心

Foreword

It's been more than ten years now since the disastrous landslip that occurred in Kwun Lung Lau on Hong Kong Island on 23 July, 1994. Since 1995, the Government of HKSAR has awarded tens of millions of dollars in contracts related to detection of leakage from buried water carrying services (BWCS) both on slopes and on the roads throughout the territory. As expected, this sequence of events generated an increasingly large pool of "Utility Specialists (US)", with most working almost independently, devoid of any standardized surveying methods, quality requirements (on survey results) and the "registration" of operation personnel in the market before the establishment of HKIUS in 2002.

In view of the availability of the multitude of method statements, specifications, training manuals, and the contracts documents produced for the vast number of underground utility survey contracts (by government and private projects), the following sections try to provide a comprehensive set of method statement, by addressing the following topics in general and where the abbreviation can be found in the Appendix:

- (1) Method Statement of Conduit Condition Evaluation (CCTV Survey for Drain)
- (2) Method Statement for Manhole Internal Condition Survey (MHICS)
- (3) Method Statement for Utility Mapping By Non-Destructive Methods
- (4) Method Statement for Water Leakage Detection Survey

You are welcome to take reference to this method statement for your contract and in case you need further information, please send an e-mail to info@hkius.org.hk or call Ir Dr. King Wong.



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Advanced Leakage Detection of Buried Water Carrying Services Affecting Slopes

1. Scope of the Works

To inspect and testing of Buried Water Carrying Services in Slope and Hillside - Checking Typical Slope Condition. To inspect the potential risk on the slope which affect the stability and the structure of the slope and therefore prevent landslip.

The scope will contain the following services:

- (1) To requisite and review any relevant and necessary information provided by other Government Department and utilities companies related within the survey area;
- (2) To investigate on the alignment of underground utilities by Pipe/ Cable Locator within the survey boundary
- (3) To investigate the internal condition of manholes by Manhole Internal Condition Survey (MHICS) and to prepare IDMS Manhole Record Cards;
- (4) To investigate all the accessible buried drain services connected with the manholes by CCTV camera within the extent of survey. The CCTV surveys were coded on site in accordance with Hong Kong Conduit Condition Evaluation Codes, 2009 of UTI which is compatible to MSCC 2004 of WRc and HKIUS adopted specification for CCTV survey;
- (5) To conduct the LNC survey within the survey extent for pressurized water mains in accordance with HKIUS adopted specification for Water Leakage Detection;
- (6) To give an integral evaluation in accordance with the “Code of Practice on Monitoring and Maintenance of Water Carrying Services Affecting Slopes, ETWB, 2006” on the investigated buried water carrying utilities;
- (7) To give recommendations for further maintenance works.

2. Field Procedures

2.1 Calibration and preparation

- (1) Checking past record
- (2) For private services, collect all information available regarding the assets from the client (asset owner).
- (3) For public services, information can be obtained from various relevant Government Departments.
- (4) Reconnaissance survey
- (5) The full extent of assets (manholes, pipes, catchpits and other ancillaries) located within the survey extents.
- (6) Any other manholes and additional features not shown on the base mapping or layout plans, and/or revisions to match existing conditions on site
- (7) Safety precautions include Permit-to-work (PTW), Temporary Traffic Arrangement (TTA), Personal Protective Equipment (PPE), etc

2.2 Operation

- (1) Locating buried water-carrying services
- (2) Observe surface installations.
- (3) Carry out utility survey.
- (4) Electromagnetic method (PCL) for metallic pipes
- (5) GPR for non-metallic pipes
- (6) Visual inspection to find out clues of leakage like water spots and seepage
- (7) Inspection of drains
- (8) High pressure water jetting if found suitable.
- (9) CCTV survey / Man-entry survey if necessary.
- (10) Manhole internal condition survey
- (11) Inspection for water mains.
- (12) Leak Noise Correlation Survey.
- (13) Mechanical Leak Detection/ Electronic Leak Detection.

2.3 Checking

- (1) Checking field data on site
- (2) Final report checked by RPUS

3. Survey Requirements

Both employers and employees shall comply with relevant occupational health and safety legislations and obligations to ensure a safe working environment and minimize disturbance to the public caused by the work.

The Occupational Safety and Health Ordinance (Cap. 509) and the Factories and Industrial Undertakings Ordinance (Cap. 59) specify several requirements for personnel involved in works, some of the requirements are stated in relevant ordinances or regulations such as working in confined space, road traffic control, excavation safety, dangerous substance, noise at work, etc. It is important to follow relevant ordinances stated on the Occupational Safety and Health Council (<http://www.oshc.org.hk>) before commencement of work.

Also, operators shall use Personal Protective Equipment (PPE) and shall have sufficient knowledge in both usage and maintenance of the equipment. PPE shall include:

- (1) Steel toe cap, rubber safety boots
- (2) Safety helmet
- (3) Safety vest (reflective at night)
- (4) Safety goggles/Anti-glare glasses
- (5) Breathing apparatus/Disposable respirator
- (6) Harness and Fall arrester
- (7) Gloves
- (8) Ear muffs / ear plugs
- (9) Handy gas detector
- (10) Audio-visual alarm
- (11) Resuscitator

In works for the Water Supplies, the Drainage Services or other government departments, appropriate steps shall be taken to minimize or even eliminate any potential risks of injuring the public. In case where excavations are required, the access around the work area has to be properly supervised by a Competent Person (CP)(合資格人士), under Cap. 406H, the Electricity Supply Lines (Protection) Regulation, at all times. The access for "essential services", e.g., police, fire services and ambulance, has to be retained. Access to other public services, such as bus stops, footpaths, etc, shall also be maintained and supervised. Such regulations can be referred to Cap. 28, the Land (Miscellaneous Provisions) Ordinance.

If excavations are required, no dirt, excess spoil or other material shall be left in the water channel to avoid polluting the drainage system. Sediment control procedures can be referred to the Environmental Protection Department (<http://www.epd.gov.hk>).

4. Quality assurance and quality control

4.1 Training and experience requirements for personal

Special equipment and demands judgment based on information available are required for BWCS monitoring. Personnel taking part in the monitoring should be suitably experienced and trained. Requirements for Personnel Carrying Out Inspection of Appendix gives Indicative guidelines.

The ability of the proposed teams and the suitability of the equipment and methods should be demonstrated in a trial test before commencement of the inspection and leak detection in order to ensure the quality of work and service provided.

4.2 Quality control of Manhole and CCTV survey

Quality checks are performed on the results of the inspection so that process of making recommendations for the subsequent repair works will then be facilitated. According to COP on Monitoring and Maintenance of BWCS (2006), the following quality check practices are recommended for surveys involving a large number of manholes and drains:

- (1) Validate data collected at surveys; and/or
- (2) Re-survey a number of randomly selected manholes and sections of drains that have been inspected.

Data validation and inconsistency checks for manhole surveys should include items such as missing data, inconsistent pipe sizes, inconsistent invert levels, connectivity, etc.

4.3 Quality control of Leak Detection for water mains

The quality control of leak detection can be monitored by exposing a section of water main at the suspected leak location for verification. Two quality check methods are suggested (COP on Monitoring and Maintenance of BWCS, 2006). They can be adopted for leak detection works carried out, depending on the scale of works:

- (1) Install identification tags randomly inside the valve chambers along the sections of water mains to be surveyed and request the contractor to report immediately on the findings of the tags during the course of the leak detection works; and/or
- (2) re-survey a number of randomly selected sections of the water mains that have been surveyed either by an independent qualified leak detection specialist or by using alternative instrument such as noise loggers if appropriate

References

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- (22) WRC (2004). Manual of Sewer Condition Classification. Water Research Council, Swindon.
- (23) WRC “Model contract document for sewer condition inspection”
- (24) WRC “Model Contract Document for Manhole Location Surveys and the Production of Record Maps”
- (25) 黃敬博士工程師, 郭啟業先生-如何利用非破損方法(管內閉路電視(CCTV)檢測)以改善城市管道狀況

Appendix

A1 Abbreviations

Company/ Organization	
Code	Description
BD	Buildings Department, HKSARG
CEDD	Civil Engineering and Development, HKSARG
DSD	Drainage Services Department, HKSARG
EMSD	Electrical and Mechanical Services Department, HKSARG
EPD	Environmental Protection Department, HKSARG
HA	Hong Kong Housing Authority, HKSARG
HKIUS	Hong Kong Institute of Utility Specialists, HKSARG
HKURC	Hong Kong Utility Research Centre
HyD	Highways Department, HKSARG
LandsD	Lands Department, HKSARG
LD	Labour Department, HKSARG
PolyU	The Hong Kong Polytechnic University
UTI	Utility Training Institute
WRc	Water Research Centre
WSAA	Water Services Association Australia
WSD	Water Supplies Department, HKSARG
WTI	Water Training Institute
Others	
Code	Description
%	Percentage
BMP	Bitmap (Picture Format)
BWCS	Buried Water Carrying Service
CCE	Conduit Condition Evaluation

Company/ Organization	
CCE(CCTV & ME)	Conduit Condition Evaluation(Closed Circuit Television & Man- Entry)
CCES	Conduit Condition Evaluation Specialists
CCTV	Closed Circuit Television
CD	Compact Disc
CL	Cover Level
COP	Code of practice
CP	Competent Person
DN	Nominal Diameter
DP	Design Pressure
DVD	Digital Versatile Disc
e.g.	Exempli Gratia
GIS	Geo-Information System
EPR	Environmental Protection Requirements
etc.	et cetera
GL	Ground Level
H	Height
HKCCEC	Hong Kong Conduit Condition Evaluation Codes
HPWJ	High Pressure Water Jetting
hr	Hour
Hz	Hertz
ICG	Internal Condition Grade
ID	Internal Diameter
IDMS	Integrated Data Management System
IL	Invert Level
ISO	International Standards Organization
JPEG	Joint Photographic Experts Group (Picture Format)

Company/ Organization	
kHz	Kilo- Hertz
kPa	Kilopascal
m	Meter(s)
ME	Man Entry
MHICS	Manhole Internal Condition Survey
mm	Millimetre(s)
Mpa	Megapascal
MPEG	Motion Picture Experts Group (Video Format)
MS	Method Statement
MSCC	Manual of Sewer Condition Classification, UK
OHSAS	Occupational Health and Safety Assessment Series
PPE	Personal Protective Equipment
ppm	Parts per million
PS	Particular Specification
PSI	Pound Per Square Inch
QA/ QC	Quality Assurance/ Quality Control
Ref.	Reference
RMSE	Root Mean Square Error
RPUS	Recognized Professional Utility Specialist
RTO	Recognized Training Organization
SCG	Service Condition Grades
SOPs	Safe Operator Procedures
SPF	Sun Protection Factor
SPG	Structural Performance Grade
SRM	Sewer Rehabilitation Manual
STP	System Test Pressure
TTA	Temporary Traffic Arrangement

Company/ Organization	
US	Utility Specialist
VHS	Video High Speed
W	Width
WLD	Water Leakage Detection
WO	Works Order
WP	Work Procedure

A2 Requirements for Personnel Carrying Out Inspection

Training and Experience Requirements for Personnel Carrying Out Inspection (HKIUS standard, 2011)			
Title	Role	Minimum Training Requirement	Qualification
Project Leader	Responsible for contract administration and preparation, checking and certifying of reports for compliance with the technical specification.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	Either: M/FHKIUS, RPUS plus CP, CW or MHKIE/ R.P.E. plus CP, CW and relevant training in RTO (e.g. PolyU, UTI) for surveys and data management
Deputy Project Leader	Responsible for assisting project leader and acting the post of project leader when project leader temporary not with the team	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	Either: M/FHKIUS, RPUS plus CP, CW or MHKIE/ R.P.E. plus CP, CW and relevant training in RTO (e.g. PolyU, UTI) for surveys and data management
Team Leader	Responsible for works arrangement and data processing including checking of raw data for quality and consistency.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	M/FHKIUS, RPUS, CP, CW
Crew Leader	Responsible for supervising the field works and site safety.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	O/MHKIUS, CP, CW
Operators	Responsible for operating equipment and carrying out inspection and survey.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	AMHKIUS, CP, CW