



Specification for Manhole Internal Condition Survey (MHICS)

References:

1. 16/WSD/97, Leakage Detection of Buried Watermains Affecting Slopes - Stage I, Water Supplies Department
2. Course Note, Advanced Manhole Condition Survey for Operators, Engineers/Surveyors and Managers, UTI, 2007.
3. DC96/19, Investigation of Sewers and Drains Behind and Adjacent Fill Slopes and Retaining Walls, Drainage Services Department.
4. HKHA161/95, Detection of Leakage from buried water carrying services in the vicinity of slopes and retaining walls within the lands maintained by Housing Authority.
5. HKCECC2007, Hong Kong Conduit Condition Evaluation Codes, UTI, 2007
6. Constitution, Hong Kong Institute of Utility Specialists (2007).
7. Works Branch, Code of Practice on Monitoring and Maintenance of Water Carrying Services Affecting Slope, 2006.

HKIUS Guidelines for Requirements for Manhole Internal Condition Survey

Foreword

It's been more than ten years now since the disastrous landslide 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 throughout the territory. As expected, this sequence of events generated an increasingly large pool of "underground Utility Specialists", 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.

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 guidelines, by addressing the following topics in general:

- Utility Services Information to be investigated
- Level of Accuracies
- Types of Deliverables and Schedules
- Requirements for Personnel and Deliverables

You are welcome to take reference to this Particular Specification 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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President, HKIUS (2007/09 & 09/10)

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RECONNAISSANCE AND MANHOLE SURVEYS
RECONNAISSANCE SURVEYS

*Scope of
Reconnaissance
survey*

- 26.01 (1) The Utility Specialist shall conduct a reconnaissance survey at each slope/site before commencement of works. The survey shall cover the full survey extent as confirmed on the Layout Plans. The reconnaissance survey shall identify:
- i. The full extent of the assets (manholes, pipes, catchpits and other ancillaries) located within the survey extents
 - ii. Any other manholes, pipes, catchpits and other ancillaries.
 - iii. For pipelines extending beyond the survey extent the closest upstream and downstream manholes outside the survey extent.
 - iv. Any salient features which may impede the execution of the surveys
 - v. Any additional features not shown on the base mapping or the Layout Plans, and/or revisions required to match existing conditions on-site.
- (2) The Utility Specialists shall establish the ownership of all manholes, pipes, catchpits and other ancillaries identified within the survey extent..
- (3) It is the Utility Specialists' responsibility to ascertain the ownership of manholes and pipes based on site survey information together with the latest available information from various sources.
- (4) The Utility Specialists shall ensure that all reconnaissance surveys, manhole surveys, pipeline investigations and all other surveys are carried-out under the supervision of an operative/professional member of HKIUS (O/M/FHKIUS) or otherwise agreed with the client. Any surveys carried-out without the supervision, or any data from such surveys, shall not be accepted and any such surveys will be required to be repeated under the supervision at no extra cost to the Contract.
- (5) The Utility Specialists shall make arrangements for the client's staff to access survey sites not accessible by contract vehicles, including, but not limited to, survey sites in outlying islands, at no extra cost to the Contract for all reconnaissance surveys, manhole surveys,

pipeline investigations and other surveys instructed by the Client or his representative.

*Method statement
required for
Reconnaissance
surveys*

- (6) The Utility Specialists shall provide all necessary justification as to the positions of all drainage and sewerage assets located within or adjacent to the survey extents, to the satisfaction of the Client or his representative.
- 26.02 (1) The Utility Specialists shall submit a detailed method statement for undertaking the Reconnaissance surveys in advance of undertaking any Reconnaissance surveys. A method statement is not required for each slope or survey extent, however where there is significant difference in the scope of the Reconnaissance Survey the Utility Specialists may be required to produce a series of tailor-made method statements.

MANHOLE SURVEYS

<i>Scope of Manhole Survey</i>	26.03	(1)	The Utility Specialists shall carry out a survey of manholes and sewerage pipes within the Survey Extent for each of the slope/site specified in the Contract. The survey shall include manholes on both storm drains and foul sewers as identified in the agreed Reconnaissance Survey Report. The objective of the manhole surveys is to record all salient features, obtain evidence of the structural and surface condition of the manholes, evidence of leakage or infiltration, record and verify the position of the manhole structure against the supplied Layout Plans and survey manhole cover levels and invert levels and determine the location.
<i>Location</i>	26.04	(1)	The manholes to be surveyed shall be designated on the Reconnaissance Survey Drawings agreed with the Client or his representative.
<i>Method statement required for Manhole surveys</i>	26.05	(1)	The Utility Specialists is required to provide a detailed method statement of the procedures to be adopted for manhole surveys. Approval of the method statement by the Client or his representative's shall be required in advance of any surveys.
<i>Special considerations for confined spaces requirements</i>	26.06	(1)	The Utility Specialists shall submit separately detailed method statement of the procedures to be adopted whenever men are required to work in confined spaces, in accordance with the latest Factories and Industrial Undertakings (Confined Spaces) Ordinance 1989 (amended year 2000). The Utility Specialists shall take special note of the recent amendments which require a risk assessment to be carried out under this ordinance as part of the safety procedures. Evidence shall be required in order to confirm that all personnel have attended the appropriate courses for this type of work. The approval by the Client or his representative's of this method statement shall not relieve the Utility Specialists of his responsibility for ensuring the safety of his personnel.
<i>Equipment</i>	26.07	(1)	The Utility Specialists shall equip the team undertaking the manhole survey work with the following: <ul style="list-style-type: none"> (i) equipment for easing and lifting manhole covers; (ii) Sewer safety equipment; (iii) Road safety equipment.

(iv) Personnel Protective Equipment, PPE.

ACCURACY OF SURVEY DATA

<i>Accuracy of survey data</i>	26.08	(1)	The standard of accuracy required in the Survey and completion of manhole record cards shall be as follows: <ul style="list-style-type: none"> (i) All textual information shall be correct; (ii) All measurements shall be accurate within the following tolerances; <ul style="list-style-type: none"> - Grid References ± 1m - Location Measurement ± 300 mm - Levels ± 25 mm - Relative levels of pipe inverts within the chamber ± 20 mm - Pipe sizes : ± 20 mm - box-culverts ± 20 mm - All other dimensions ± 50 mm <p>Levels shall be referenced to Survey Bench Marks, the location and values of which are obtainable from the Lands Department of the Hong Kong Government.</p> <p>Grid references shall be supplied in Hong Kong 1980 Grid format.</p>
<i>Method Statement to be provided for Data validation</i>	26.09	(1)	The Utility Specialists shall provide a method statement to the Client or his representative outlining his proposed data validation procedures. Data validation shall be undertaken in accordance with the established sewerage network data validation inconsistency checks such as those incorporated into the STC25 or IDMS software. These include but are not limited to checks for: <ul style="list-style-type: none"> • Missing data (invert levels, cover levels, diameters) • Inconsistent pipe sizes (eg downstream pipe smaller than upstream pipe) • Inconsistent invert levels/reverse gradients (eg downstream invert level above upstream invert level) • Inconsistent pipe materials • Connectivity

Submission of Survey Information 26.10 (1) The Utility Specialists shall check the information to be submitted by M/FHKIUS(MHICS) and submit his validated Survey Information within 5 working days of the survey (or surveys). The submission shall take the form as shown in Appendix 26A and shall comply with all requirements detailed in the Quality Assurance and Quality Control procedures:

- Location plan including all assets with connectivity delineated
- Completed Manhole cards Validation check sheet
- Corresponding STC25 or IDMS electronic data

If errors are found to exceed the tolerances indicated in Clause 26.08, the Client or his Representative shall instruct the Utility Specialists to return and re-survey the manhole at his own expense.

A fully completed Manhole Record (MH) Card showing the total data to be captured is shown in Appendix 26A. The Utility Specialists shall obtain all relevant data to complete the record cards. In particular, the Utility Specialists shall complete the final MH record card by drawing the MH location Plan and the MH general arrangement plan with slope/road reference and manhole number on each page.

Accuracy and Annotation for Location Sketches 26.11 (1) Location sketches should be drawn with the manhole or spot level check location referenced to at least two fixed structures shown on the 1:1000 (Lands Information Centre) base mapping survey sheets. The sketch shall show the manhole layout, including the distance and direction of offset from the manhole cover to the centre line of flow in the main pipe. Lamp posts, traffic lights or similar shall not be acceptable as Fixed Structures. If existing buildings are taken as the fixed structures, the building names and numbers should be highlighted in the sketches. If village houses are taken as the fixed structures, the house number should be identified and indicated in the sketches.

Manhole photographs 26.12 (1) The Utility Specialists shall provide a minimum of two photographs for each manhole as shown in Appendix 26A. One photograph should show the general location of the manhole with respect to the road, slopes or buildings in the vicinity. The second photograph shall be a general view of the inside of the manhole. The manhole reference number shall be required to be

shown on each photograph. The Utility Specialists may use a blackboard placed in the manhole or paint on the road surface to indicate the manhole reference number.

Where photographs are submitted in digital “*.jpeg” format a minimum resolution of 2 million pixels shall be provided. Samples shall be submitted to the Client or his representative’s in advance.

- (2) It shall be subject to the opinion of the utility surveyor that whether additional photographs are required to highlight a defect or special feature. The Utility Specialists shall report to the Client or his representative’s in a summary report on slope/site by slope/site basis for such occurrence on a weekly basis. The Client or his representative’s shall spot-check and confirm the acceptance of such additional photographs prior to payment being made at the appropriate rate in the Bill of Quantities. The Utility Specialists shall include these accepted additional photographs in producing the relevant slope/site reports.

REFERENCE SYSTEM

- Reference system* 26.13 (1) All assets (manholes, lamp holes and ancillaries) shall be referenced as below by the Utility Specialists. The referencing system is divided into three parts:
- 1) 1:1000 Topographic Map Number
1/500 base map
e.g. 38135(e) and 21236(n)=HK3821
 - 2) 100 Metre Grid Co-ordinate
Referred to easting and northing of 100 metre grid.
e.g. 38135 (e) and 21236(n) = 12
 - 3) Manhole Reference Point Number
Each Manhole would be numbered as 01, 02 .12, 13 etc – 49 for foul & 51, 52, etc-99 for storm.
I.e. The first Foul Manhole on the left top corner shall be referenced as 3821 12 01 &;
The first Storm Manhole on the left top corner shall be referenced as 3821 12 51
- (2) The Utility Specialists shall ensure that each new manhole has a unique reference and is not duplicated in the original datasets provided at the start of the project. The Utility Specialists shall also maintain

consistent references for each asset (ie an asset shall not be given two different numbers). Where appropriate pipeline assets shall be referred to by the upstream node number plus an appropriate suffix (eg HK 3821 135 236).

BASE TOPOGRAPHICAL MAPPING

- Base topographical mapping* 26.14 (1) Base maps shall be the latest published version of the 1:1000 B1000 series Digital Topographic Maps published by Lands Department. The base maps will be supplied to the Utility Specialists in a suitable digital format to enable him to carry out his work.
- (2) The Utility Specialists shall bring any deficiencies in the original base maps to the attention of the Client or his representative

CONNECTING POINTS WITHOUT MANHOLES

- Connecting points without manholes* 26.15 (1) Where sewers and drains connect without a manhole the connection point shall be numbered as though a manhole were present and the actual point of connection physically located. This shall apply to the first manhole outside the survey extents which is required to be located but not fully surveyed.
- (2) Locating of connecting points without manholes shall only be carried out once a written instruction has been given by the Client or his representative upon the request of the Utility Specialists.

LOCATION OF BURIED MANHOLES

- Location of buried manholes* 26.16 (1) The Utility Specialists shall only carry out survey works to locate buried manholes when a written instruction has been given by the Client or his representative upon the request of the Utility Specialists.
- (2) The Utility Specialists shall report the findings of the buried manholes to the Client or his representative upon completion of the investigation in an approved format accepted by the Client or his representative's.

LOCATING OF INTRUDING UTILITIES

- Locating of intruding utilities* 26.17 (1) Intruding utilities located in manholes identified during the course of the surveys are to be commented in the remarks section of the manhole record card. In addition

the Utility Specialists must indicate on the layout or other sketch the position and size of the utility.

CONNECTIVITY TESTING

- Connectivity testing* 26.18 (1) The Utility Specialists may use smoke, dye testing or electronic methods to determine connectivity of manholes.

QUALITY CONTROL

- Quality Control* 26.19 (1) On completion of the survey of each 100 manholes or other similar structures the Utility Specialists shall supply completed computer generated manhole record cards (CDR STC25 or UTI IDMS) and a copy of the relevant portion of the map in respect of those manholes or other structures and notify in writing to the Client or his representative's that in the opinion of the Utility Specialists the records are ready for a site check to be carried out. The Client or his representative shall either reject the batch of data or arrange for a site check as specified below within 2 weeks of the written notification.

- (2) Prior to the supply of data to the Client or his representative, the Utility Specialists shall carry out his own validation test on all data according to the requirements as outlined in his method statement on data validation, which shall be approved by the Client or his representative's in advance of any surveys.

A site check comprising a resurvey of 5% of each batch of 100 manholes submitted by the Utility Specialists shall be required. The manholes to be resurveyed shall be randomly selected by the Client or his representative's and checked against the results obtained by the Utility Specialists in the initial survey. The resurvey shall include the reproving of all associated pipework lengths. The Utility Specialists shall supply a survey team to carry out the resurvey under the supervision of the Client or his representative's, and a person appointed by the Utility Specialists as his representative.

- (3) The resurvey shall be deemed to have failed if any item of manhole measurement falls outside the tolerances stated in this PS. Notwithstanding any of the foregoing if in the opinion of the Client or his representative's the other data on the manhole record

- sheets are sufficiently defective then the survey shall be deemed to have failed the quality control check and the Client or his representative is entitled to reject the data.
- (4) If the results of the resurvey are accepted by the Client or his representative, the Utility Specialists shall be entitled to payment for the resurvey at the rates included in the Bill of Quantities.
- (5) If the results of the resurvey are considered to be unacceptable to the Client or his representative, the Utility Specialists shall resurvey that portion of the work which failed to meet the tolerances stated in PS at his own expense and he shall not be paid for the work involved in that check. When he is satisfied that the previously failed work has been corrected he shall inform the Client or his representative and a further resurvey shall be carried out in accordance with the above procedure on five of the remaining 95 manholes. Quality control checks shall be repeated at the Utility Specialists' expense until the Client or his representative's is satisfied that this portion of the work has met the requirements of the check as stated in PS. The Utility Specialists shall then be paid for the resurvey of which results were accepted by the Client or his representative.

Utility Specialists data management system

- 26.20 (1) The Utility Specialists shall provide a method statement to the Client or his representative's outlining his proposed data management system to be implemented as part of the project.

The method statement for the Utility Specialists data management system shall include but not limited to the following :

- Method for managing the sewerage data in different formats (STC25 or IDMS included)
- Method for performing connectivity and inconsistency validation checks on the imported data (ie. Checks for missing or inconsistent data as detailed in the specification)
- Method for managing Examiner or IDMS (*.dat) format CCTV data and validating the data
- Method of managing any GIS base data if used
- Method of managing / updating drawings (including slope polygons and survey extents)

- management of data associated with any drawings reporting of results and data to the Client or his representative's and client.
- The Utility Specialists shall host and maintain all checked data on a secured database to be accessed by Client or his representative, this shall include but not limited to the following information:

Daily Reports

- Reconnaissance survey information
- Manhole survey information
- Pipeline survey information
- Other on site surveys/activities (eg. Cleaning)
- Number of survey crews/staff deployed
- No of CCTV camera sets deployed
- Name of qualified crew leader on site (O/M/FHKIUS(MHICS))

Planning/ programme activities

- Contract programme showing updated progress on each survey
- Planning of Temporary Traffic Arrangements
- Rescheduling of surveys due to site access conflicts.

The costs associated with the implementation of such a database system shall be deemed to have been included in the rates included in the Contract.

- (2) The Client or his representative may also operate a data management system. The Utility Specialists shall be responsible for interfacing with this system by ensuring
- (i) only validated data is issued to the Client or his representative's in the required format (CDR STC25 or UTI IDMS or Examiner)
 - (ii) validation reports shall accompany each data submission.

The Utility Specialists shall be responsible for ensuring that all datasets submitted shall be in the correct format for input into the Client or his representative's data management system.

ABANDONMENT AND RESCHEDULING OF MANHOLE SURVEYS

- Abandonment and rescheduling of manhole surveys*
- 26.21 (1) Abandonment of the survey of a manhole may be considered by the Utility Specialists subject to the agreement of the Client or his representative in any or a combination of the following circumstances:
- risk to Utility Specialists' equipment,
 - inability to locate the manhole,
 - inability to gain access to the manhole once located,
 - risk to Utility Specialists' operations due to unsafe condition of manhole,
 - inability to survey from the manhole due to blockage, silt or high water level
 - inability to gain access to the manhole due to possession of the site by a third party.
- (2) In case (e) the Utility Specialists shall carry out cleaning works ventilation, flow control or other measures as necessary to complete the survey. The Utility Specialists shall report the matter to the Client or his representative's as soon as possible and report the same in the survey report. Cleansing works shall be paid under a separate item.
- (3) In case (a, b, c & d) the Utility Specialists shall, if possible, take photographs of the situation causing abandonment, mostly due to physical obstructions, abandon the survey of the manhole. The Utility Specialists shall report the matter to the Client or his representative's and report the same in the survey report.
- (4) In case (f) the Utility Specialists shall first reschedule his works to minimise the effects of the possession of a site by a third party. Arrangements shall be made to revisit the site in order to complete the survey. The Utility Specialists shall report the matter to the Client or his representative's as soon as possible and report the same in the survey report. The Utility Specialists shall re-visit the site, as well liaise with any third parties, as required to ensure that the survey works are carried out where permitted.
- (5) In all cases (a-f), the Utility Specialists shall only be paid for the effort for manhole locating on site.

26.3. Deliverables

The Utility Survey Specialist shall supply the following for each site:

26.3.1 Preliminary Stage

- One set of preliminary digital data.
- One set of paper copy of drawings
- Control results, including simple description of permanent ground markers.
- One Copy of brief technical report.
- One set of photographs.

26.3.2 Interim Stage

- one set of interim digital data.
- one set of paper drawings in 1:100 scale
- one copy of interim technical report.

26.3.3 Final Stage

- 2 copies of Final Report which is a compilation of all deliverables required under interim stage to incorporate all comments provided by the Engineer.

26.4. Delivery Schedule

- 26.4.1** The Utility Specialist shall supply for the Site preliminary digital data and paper check plots including a draft technical report with control results within one (1) week after the programmed completion of the works for the Site. The Engineer may direct the Contractor to submit preliminary reports of the Site during the execution of investigation, the Contractor shall submit the reports within 1 week after the Engineer has given such written instruction at no additional costs.
- 26.4.2** The Client Representative shall return a copy of preliminary data with comments and correction progressively within one week of receipt of preliminary data. The Utility Specialist shall incorporate the Client Representative's comments on the preliminary data within the preparation of his Final Survey report.
- 26.4.3** The Utility Specialist shall submit a Final Report for the investigation within 4 weeks after the completion date of the Works.

26.5. Electronic Data Files for Utility Services

- 26.5.1** The results of the investigation (layout plan only) shall be supplied in AutoCad R14 or above or DGN/GIS/IDMS format. All surface and underground features shall be located as described in Clauses 1 and 2. Non graphic information shall be included in the AutoCad or DGN/GIS/IDMS file database as block attributes or similar. All data shall be separated by type into a logical system of AutoCad or DGN/GIS/IDMS layers as approved by the Engineer.
- 26.5.2** The Utility Surveyor shall submit a schedule of AutoCad or DGN/GIS/IDMS standards to the Engineer for approval, which shall contain proposed division of investigation data into separate AutoCad or DGN/GIS/IDMS files and layers; naming conventions; symbol definitions and annotation.
- 26.5.4** Data files shall be labelled with the filename, number, extent, size, date of investigation, or revision, to be agreed with the Engineer.

26.5.5. Presentation of Drawings

1. The investigation results (layout plan only) shall be plotted in 1:100 scale or other scale to be confirmed in A1 drawings on the specified grid and datum approved by the Engineer. The layout, border and title block shall be approved by the Engineer.
2. The drawings shall show building lines, roads with road names and traffic lane road markings, pavement and kerbs, and other significant physical features within the investigated area.

26.6. Preliminary and Final Report

The Utility Survey Specialist shall examine, analyse, process and interpret the investigation results and incorporate findings in a report. The report shall include the following essential information:

- (a) Introduction
 - Project name and Location
 - Site appreciation
- (b) Details of Investigation
 - Date of Investigation
 - Detailed description of the investigation procedure adopted
 - All equipment used for the investigation
 - Identification of supervisor(O/M/FHKIUS(MHICS) and equipment operators carrying out the investigation
- (c) Investigation results
 - Summary of results
 - Report on examination, analysis and interpretation of the investigation results;
 - Identification of utilities, chambers (including all manholes) and sub-surface anomalies (if possible by GPR survey);
 - Records of on-site verification of data handled by the qualified person (M/FHKIUS(MHICS)) responsible for the Report;
 - Report on difficulties encountered
- (d) Appendix
 - floppy diskettes or CDR for the digital data files of qualitative and numeric data about the underground assets found;
 - Engineering Drawings (updated) showing the types and location of various underground assets;
 - Survey Photographs - 3R coloured photographs (prints and negatives/digital copy in JPEG format)

The drawings and textual report will be certified and stamped by the approved qualified person responsible for the preparation of the Report.

The Utility Surveyor shall supply the Survey Report as described fully as in the above. This report shall include all results with a detailed discussion and accompanying plans. It shall be prepared and signed by an qualified person who shall hold one of the following qualifications: -

- i) MHKIUS (MHICS) plus 2 years local experiences or RPUS (MHICS);
or
- ii) MICE, or MHKIE or MHKIS with 10 years relevant training and experiences,

26.7. Non-compliance: utility investigation result

- (1) The utility investigation survey result for a site shall be considered as not complying with the specified requirements if the position or level of any underground services reported in the preliminary stage deliverables does not comply with the requirements of Clause 26.08.
- (2) If the utility investigation result for a particular site does not comply with the specified requirements, the Contractor shall re-execute utility investigation in the area within a week from receiving notification by the Engineer. The Utility Surveyor shall submit the investigation result as deliverables defined in Clause 26.3. within 2 weeks from receiving notification.
- (3) If the utility investigation result again fails to comply with the specified requirements, the Utility Survey Specialist shall repeat the work specified until the result complies with the specified requirements. The costs for re-execution of utility investigation shall be borne by the Contractor.

Appendix 26A

1. IDMS Manhole Record Card
2. IDMS Manhole Record Photos

(Updated samples may be found in www.hkius.org.hk)