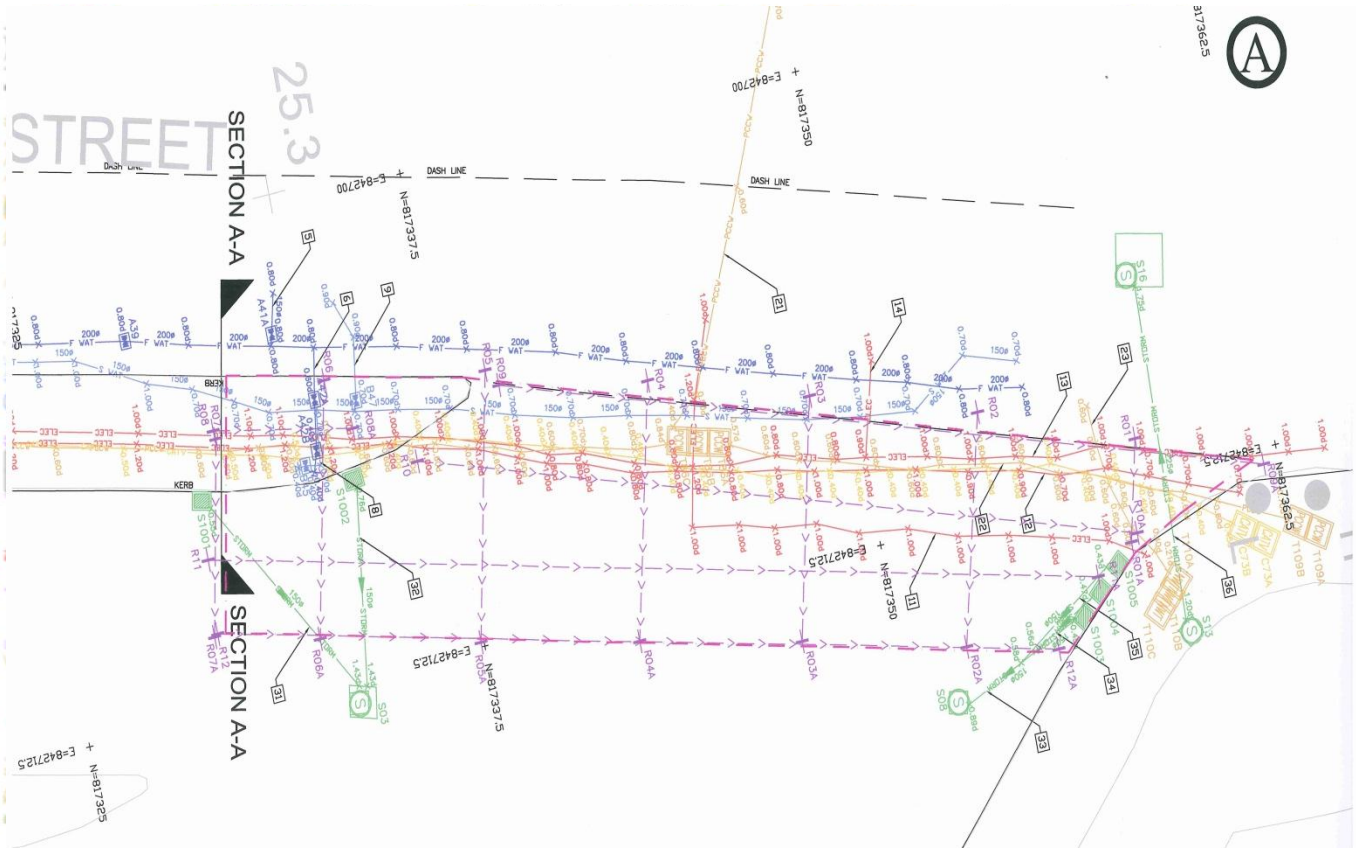
Guide to Utility Data Management



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FOREWORD

After the disastrous landslip of 1994 occurred in Kwun Lung Lau on Hong Kong Island, the Government has paid more attention on utility maintenance with particular emphasis on leakage detection of buried water carrying services on both slopes and roads. The Government has increased resources and imposed additional legislation on the detection of underground utilities. As a direct result, the utility profession has been developing rapidly, and over the last decade, the number of "Utility Specialists" (管綫專業監理師) has grown as the Government's requirements for Competent Persons to carry out the investigations has been implemented, in addition, Recognized Professional Utility Specialist (RPUS) (管綫專業監察師) has been recognized in recent years. However, lack of standard surveying methods, centralized monitoring systems and organized management, have lead to unsatisfactory investigation results.

In order to address these issues, Hong Kong Institute of Utility Specialists (HKIUS) (香港管綫專業學會), targeting the promotion of knowledge and good practice in the utility profession, collaborated with Hong Kong Utility Research Centre (HKURC) and supported by the funding from the Professional Services Development Assistance Scheme (PSDAS) of HKSAR, published a series of guide books and pamphlets in 12 disciplines of the utility profession in order to set standards for the practitioners to follow. As part of HKIUS continual effort to enhance the professionalism of the utility profession, it is the intention of the series that the quality of the survey can be raised and that utility related incidents can be avoided by performing high quality utility practices. Hopefully, the resulting benefits can extend to the general public.

This issue provides good practice of Utility Data Management (DM) (管綫資料管理). It states the ways to manage the data of underground utilities so that the system can be properly maintained. This document is intended to be used by all personnel involved in the works.

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April, 2011

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1. INTRODUCTION

The underground utility systems in Hong Kong are rather complex but extremely important in supporting the growth of our society. Construction, maintenance and repair can be extremely difficult. As every utility system is laid according to their own requirement and there is no general system governs all the individual system and how they shall be laid under a systematical manner, the system is unorganized. It is uneasy to predict the alignment of the services. Therefore, the records of the utilities become an important indication regarding the alignment of the utilities. An organized database of the utility system gives convenience to future maintenance, upgrade, and installation of new utilities within the system.

Utility system came from various utility undertakers, public or private. Each of them has their own database and system. General type of underground utility systems in Hong Kong include drainage service, fresh and salt water supply, electricity power, gas, communication, street lighting and government signaling system. The utility undertakers keep their records separately. This hinders the efficiency of utility works.

As the city develops, the demand for utility services is also growing. The number of utility services buried underground is enormous. Without comprehensive and accurate record of the location of the utilities, there is a higher possibility of damage to utility or accidents caused by excavation works. Therefore, utility data management is necessary and shall be part of the responsibilities of all utility practitioners. A well-managed utility system can reduce the cost of maintenance and risk of utility related accidents. HKIUS with support from Utility Training Institute (UTI) and Hong Kong Utility Research Centre (HKURC), aiming at maintaining a healthy underground drainage system and safe working environment, prepared guidelines to provide a standardized process of utility data management in order to promote a good practice for the practitioners.

2. OBJECTIVE AND SCOPE

Utility data refers to the structural details of the services such as function of the services, location, diameter, material, length, etc. of the services. The purpose of this guide is to provide recommendations on good practice of the methods of utility data management to enhance the efficiency of the utility data system. A well-managed database provides comprehensive information regarding the services including their locations, features and conditions.

Since a large amount of data in different kinds is being processed, powerful tools and system shall be employed or established to process the data. This document provides standardized processes and recommends the use of systematized information recording systems to minimize errors. It aims at providing guidelines for the practitioners to follow and to improve the organization of the data.
This guide provides information on the data that shall be processed and tools for processing. It must be stressed that the guidelines given in this guide are in no way exhaustive, and professional judgment must be employed in all cases.

This guide is intended to be used by all personnel who are involved in the planning, commencement and supervision of manhole internal condition survey, including contractors, utility companies, consultants, government departments and other parties concerned.

3. TYPES OF UTILITY DATA

There are different kinds of utility services serving the community. Before the information can be well-managed, knowing what information shall be collected and stored is important. Information that shall be stored is listed below.

Surface water drainage

- All drains and drain connections with invert levels
- All manholes which are within survey area and immediate upstream and downstream manholes outside the survey area
- Type and diameter of pipe work
- Connections to storm/foul and combined water sewers
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Internal dimensions of manholes and invert levels of manholes and their connection pipes

Foul sewerage

- All sewers and sewer connections with invert levels
- All manholes within the survey area and also immediate upstream or downstream manholes outside the survey area
- Type and diameter of pipe work
- Connections to foul/storm and combined water sewers
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Internal dimensions of manholes and invert levels of manholes and their connection pipes

Water mains (including cooling water mains)

- Pipe routes including fire mains with levels
- Valves and meter pits
- Diameters and material specifications (from record)
- Classifications (i.e. salt water, fresh water, cooling water, etc)
- Owner/operator
- Connections to building
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Dimensions and levels of the thrust blocks & concrete surrounds (if available from record or by extensive GPR survey by instruction after PCL survey)
- Internal dimensions of the inspecting valve and meter pits

Telecommunications

- Cable routes with levels, numbers and sizes of ducts
- Cable draw pits and manholes
- Owner/operator
- Connections to buildings
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Number and configuration of cables/ducts
- Dimensions and levels of concrete surrounds (if available)
- Internal dimensions of the inspecting cable draw pits and manholes

Ventilation ducts

- Grilles and underground ventilation ducts including duct routes, levels and sizes
- Depth below ground shall be annotated at each surface feature and at significant change of depth

Electricity

- Cable routes and levels
- Cable draw pits and manholes including those associated with traffic control and street lighting
- Voltages classified as: Low (0-11kv), High (below 11kv-66kv) and Transmission (132kv or over)
- Connections to buildings
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Dimensions and levels of concrete surrounds (if available)
- Internal dimensions of the inspecting cable draw pits and manholes

Cable TV

- Cable routes with levels and junction boxes
- Connections to buildings
- Depth below ground shall be annotated at each surface feature and at significant changes of depth
- Dimensions and levels of the inspecting concrete surrounds (if available)
- Internal dimensions of cable draw pits and junction boxes

Combined services ducts

- Internal box dimensions of ducts and access points
- All pipes and cables identified and surveyed as for individual services
- Dimensions and levels of the inspecting concrete surrounds (if available)

Gas main

- Pipe routes with levels
- Valve and meter pits
- Diameters, material specifications and working pressures
- Depth below ground shall be annotated at each surfaced feature and at significant changes of depth
- Dimensions and levels of concrete surrounds (if available)
- Internal dimensions of the inspecting valve and meter pits

Other services

- Other services including abandoned services which are located during the survey shall be recorded with any available information regarding the identity or type of materials or services

4. STAGES OF DATA MANAGEMENT

4.1 Keeping of data after new installment

When new utilities were laid underground, records shall be kept by the utility owners. The utility owners shall be able to provide the record plan of the new utilities. Detailed structural information of the service shall be recorded. Besides structural information of the utilities, other information such as when the pipe was laid, any special circumstances of the surroundings, is useful reference for future maintenance works.

4.2 Update of data after survey

Investigation and maintenance works may carry out periodically to ensure the services are functioning properly. Records of such works shall be kept by the owner as well as the agent who carries out the works. Any change to the pipe shall be recorded and correspondent update shall be made to the original record. If it is found that the information of the record plan does not match the actual situation during investigation, the service perhaps had been moved without notice to the utility owner. The actual situation shall be recorded and informed to the respective Utility Undertakers (UU). The respective UU shall survey the utility cable/duct/pipe on site, update the record drawings in question and remove abandoned utility services on site if necessary.

The purpose of different survey is different and so it provides different information. The result of the survey conducted shall be firstly reported and then entered to a database for records. To ensure the accuracy, the data shall be checked and verified to avoid conflicts or inconsistency among the data before the release of final result.

Manhole internal condition survey
The purpose of manhole survey is to investigate the condition of manhole. Details and defects (if any) of manhole will be recorded on a manhole card on site. Information recorded shall include the location, structural features, connections and sketch of the manhole.

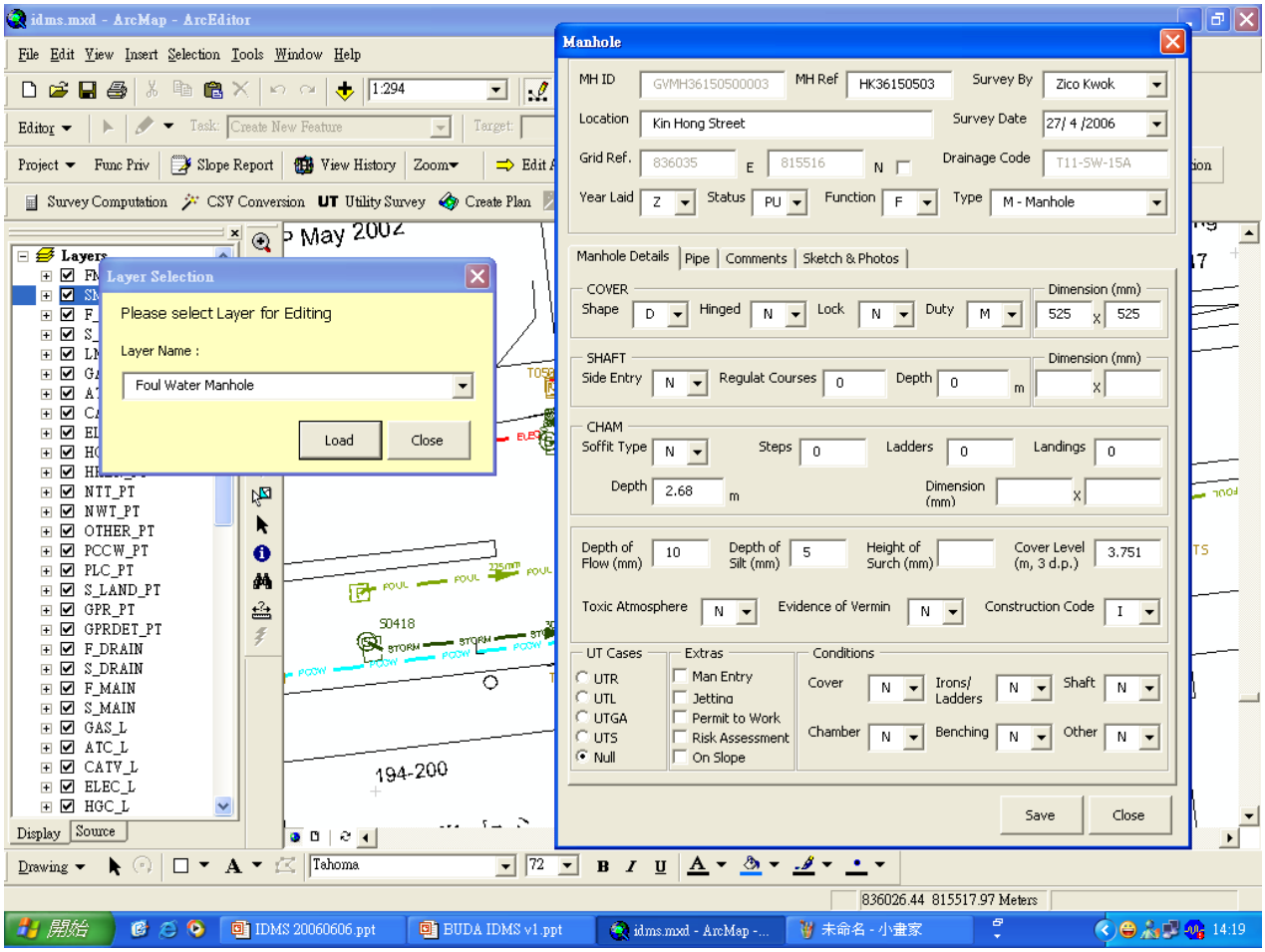


Fig. 4.2.1. Window for entering information collected by Manhole Internal Condition Survey.

Computer programmes create overlay drawings. They can plot manholes and their connecting pipes on the map according to the information entered. Details like manhole reference, pipe diameter and function of the pipe are also shown in the plan for easy reference.

For data storage, each batch of manhole records submitted shall be assigned a unique survey filename. Each computer programme may store the data in different format. The data stored shall be able to be retrieved and searched later on despite the format.

For quality control, computer software can check the consistency and accuracy of the data. This option is used to check the consistency of node data and to produce relevant inconsistency reports. Any duplication or intersection can also be checked.

Reporting - Result of the manhole internal condition survey shall include all necessary information including:

1) Location plan with all the manholes plotted within the survey extent.

2) IDMS manhole record card.

3) At least 2 photographs (location photo and internal photo).

4) Condition photos for any other circumstances.

5) Corresponding electronic data by computer programme validated by RPUS.

CCTV survey
The purpose of CCTV survey is to investigate any structural or operational defect in the conduit. The CCTV video and coding of defects are essential for analysis. Coding of defects shall be done on-site and to be processed by computer programme either on site or in office.

Mandatory information shall be entered. Each defect code shall be accompanied a photograph captured from the video. In order to evaluate the condition of the conduit, grading and scoring system are applied. Computer programme shall be employed to calculate the scores and final grade of the conduit. The whole video record shall also be kept.

The programme can also check for any contradicting information. For example, the consistency of the starting and fininshing manholes.

Reporting - Result of CCTV Survey shall include all necessary information including:

1) Operator's report – background information, summary of pipes, summary of defects, recommendations by OMHKIUS

2) Layout plan

3) Video record – video record of the entire inspection

4) Survey result by MHKIUS

5) Photographs – general photographs at 5m interval (if no defect is found) defect photographs capturing defects and defects shall be clearly seen

6) Final grading of internal condition by RPUS.

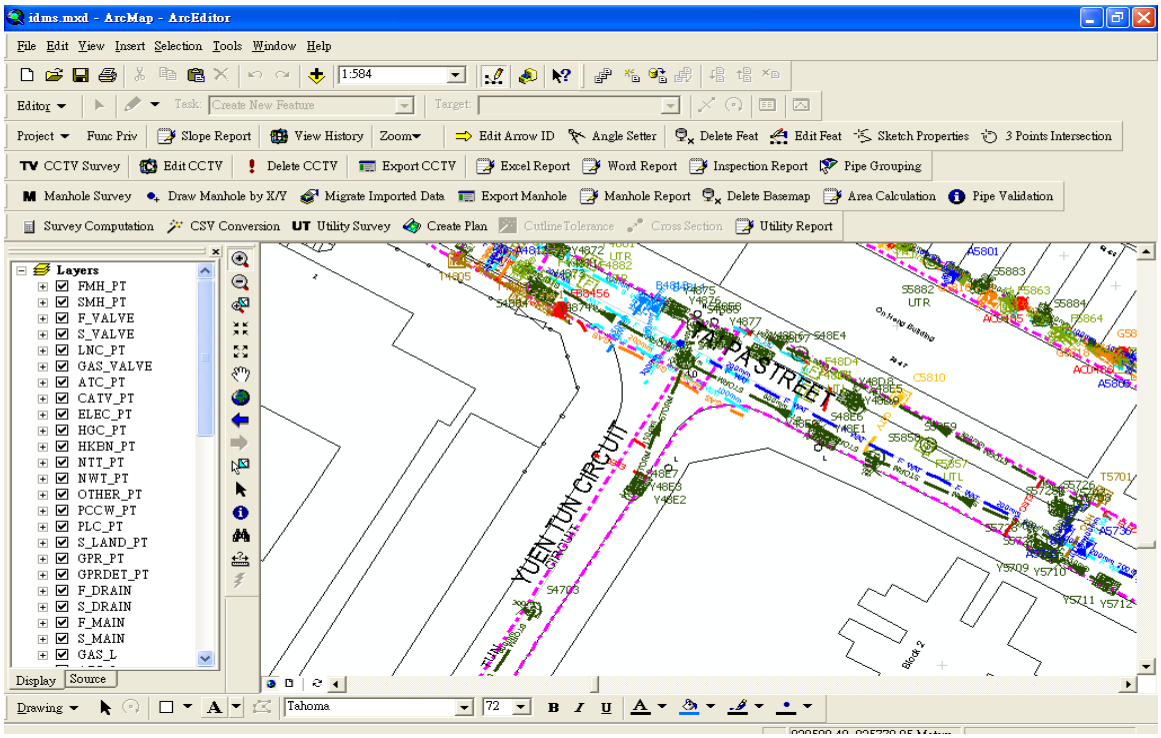


Fig. 4.2.2 Window for entering CCTV Survey result.

Utility Survey

The purpose of utility survey is to investigate the location, alignment and depth of the utility services. The exact location of the underground services (such as cables, pipes, mains) as well as surface installations (such as manholes, fire hydrants) shall be recorded.

Information of each facility shall be entered. Computer programme can be employed to create the utility plan. Computer programmes are capable of creating the plan automatically using the information entered.

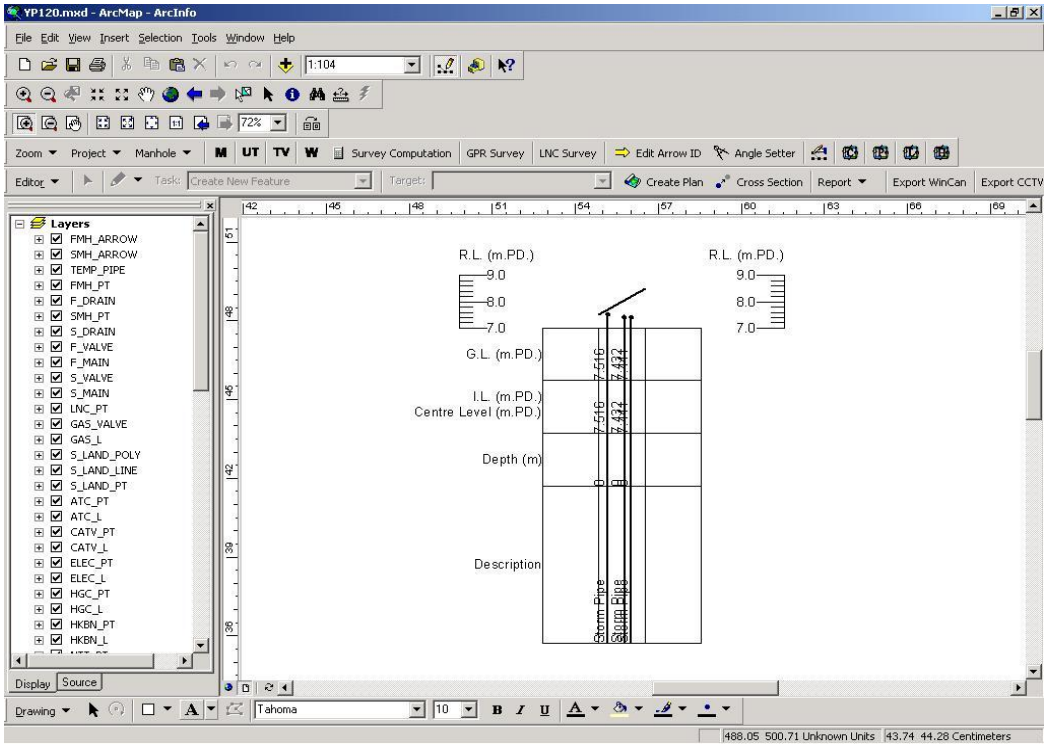


Fig. 4.2.3 Drawing shall be created after survey.

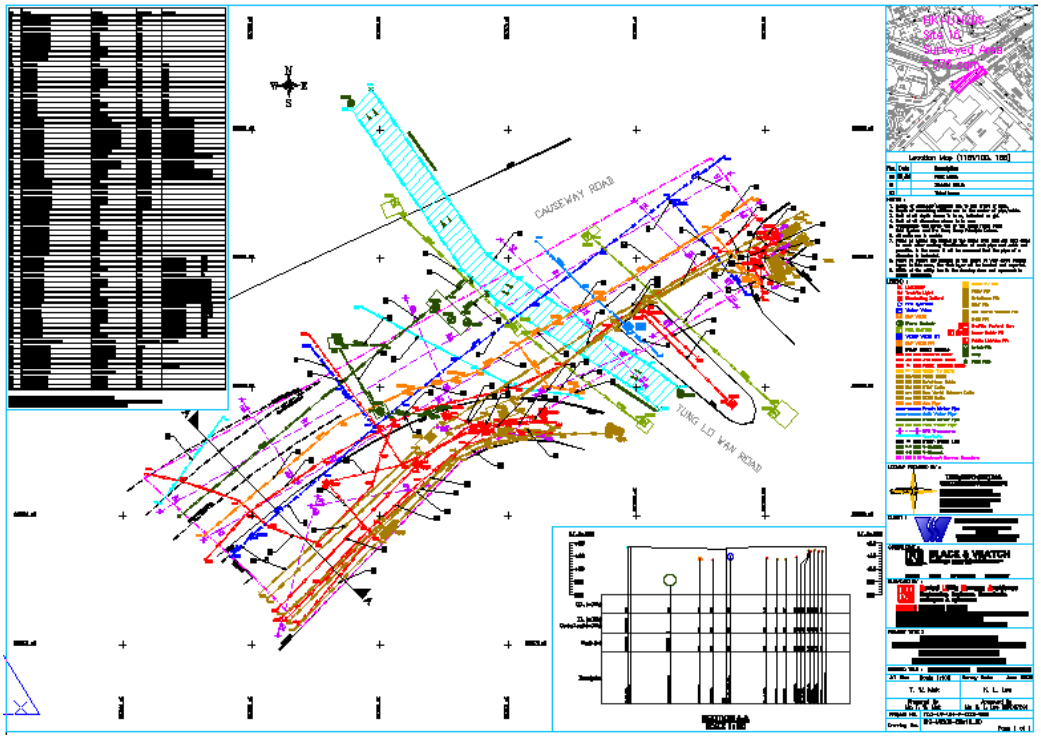


Fig. 4.2.4 Plans shall be created after survey.

Reporting - Result of utility survey using pipe/cable locator shall include all necessary information including:

- Survey report – name and certificate number of competent person, mandatory information, survey result, recommendation by OMHKIUS.
- Site photographs.
- Information of equipments used.
- Utility survey drawing - alignment, depth, diameter, direction (drainage services), type of the services, location of manholes and other related surface installations by MHKIUS.
- Report to be confirmed by RPUS.

Water leakage detection survey
The purpose of water leakage detection is to investigate the structural integrity of the water mains. Any leakage of the pipe shall be pinpointed by using different machines and tools. Usual methods for water leakage detection are leak noise correlation and mechanical detection.

Results of the leak noise correlation shall be recorded. The graph showing the signs of leakage shall be recorded. Experienced operator would determine whether there is any leakage and where is the exact leak location.

Basic information shall be entered. Graph showing the suspected leak location and the final result determined by the operator shall be clearly presented. Trial pit may be excavated to verify the result. The verified result and any follow-up actions shall also be recorded.

Reporting - Result of leak detection of water mains shall include all necessary information including:

- Layout plan shows the alignment of the pipes and location of manholes.
- A report consists of mandatory information (date and time, location, total length, number of setups of survey) and results, analysis of results and suspected or confirmed leak location by MHKIUS.
- Photographs of each leak detection setup points.
- Report to the client by RPUS.

Ground Penetrating Radar Survey

The purpose of utility GPR survey is to find out the alignment and depth of the underground services. The result of GPR survey is presented in the form of synthetic graph. The interpretation of the result depends on the operator (OMHKIUS) and checker (MHKIUS).

Reporting - The result shall be presented in a plan, indicating the alignment and the depth of the cable/ conduits. The synthetic graph generated by the GPR shall be kept for record.

- Result of GPR Survey shall include all necessary information including:
- Survey report – mandatory information, result of investigation (OMHKIUS).
- Site location plan.
- Survey result drawing by MHKIUS.
- GPR radargram.
- Site photographs.
- Information of equipment used.
- Report by RPUS

4.3 Centralized data for future use

A centralized database facilitates the exchange of information between the utility undertakers and companies. The database can provide a more comprehensive and updated utility information to who would carry out utility related works or excavation works. This prevents damage to utilities by reckless excavation. The utility data can be retrieved easily which facilitate the maintenance works.

An effective exchange of data relies on the cooperation of all the stakeholders. The utility undertakers (both private undertakers and government departments) and utility companies shall provide their information so that every entity involved in utility-related works can obtain comprehensive and updated information.

In 2000, 8 utility undertakers and Government Departments committed to develop the Electronic Mark Plant Circulation (EMPC) System, a system to request / provide utility records electronically. The system can automatically compile and transmit electronic utility record drawings by email to the requesting organizations. This saves time and effort of both the requesting organizations and the replying organizations (i.e. utility undertakers). Joint Utilities Policy Group (JUPG) targets to provide underground utility records to the concerned parties within 2 hours for emergency incidents.

EMPC has the following functions:

- Authenticate the identity of requesting organization by electronic certificate.
- Automatically compile and transmit electronic utility record drawings.
- Exchange information by email.
- Electronic document management.

The EMPC acts as a platform for exchange of information between different parties. Organizations requesting utility information by enter location, details and period of proposed works into the EMPC system. The system sends out e-mails automatically to request utility records. The organization reply to the request retrieves utility records within the extent of works to compile an electronic drawing using the EMPC system and replies requesting organization automatically by e-mail.

5. DATA MANAGEMENT TOOL

The Integrated Data Management System (IDMS) is a system to provide a centralized database for the management of survey records as well as semi-automatic data input and reporting functions. The purpose of IDMS is to maintain and manage the vast amounts of treasured data and to provide seamless and verified underground utility information to reduce road opening, to make safer excavations, and to provide better slope maintenance.

Different surveys obtain different kinds of information. The presentation and storage format also varies. There are some general steps that shall be taken for every batch of data.

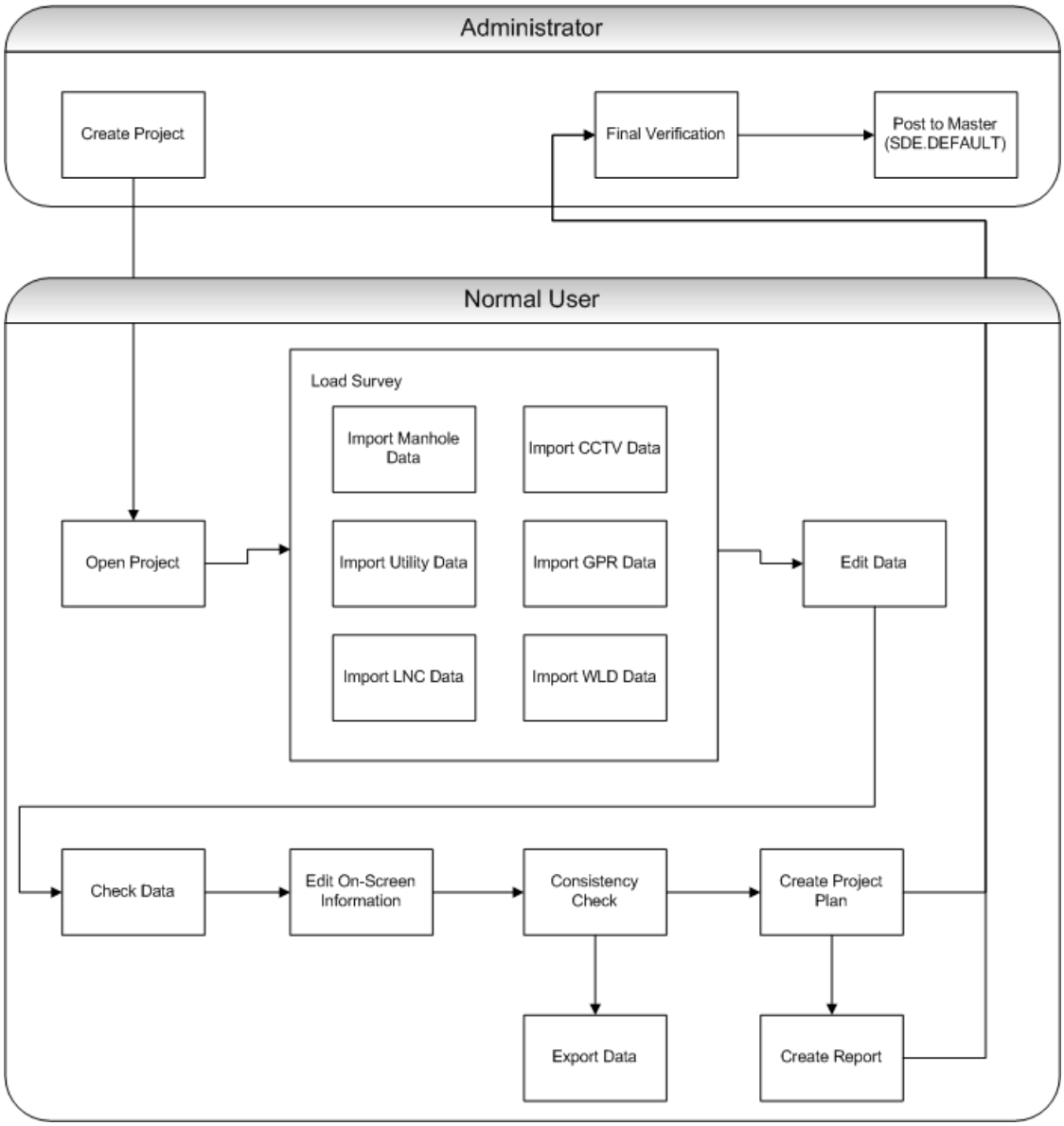


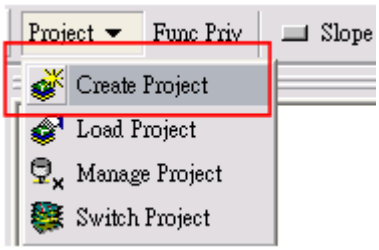
Fig. 5.1 IDMS Overall Procedural Flowchart

5.1 Data processing

Data processing involves project creation, project textual information and site boundary update, project deletion, final verification and master copy update.

Create Project
To start working, a project must first be created so that all work done can be designated under one particular project.

To create a project, from the IDMS toolbar, from the Project pull-down menu, select Create Project:



The following window will appear. Fill in the appropriate fields with the relevant information, including:

1) Project number
2) Project title
3) Contract number
4) Contract title
5) Commencement date (click on the drop down arrow to select the date from a calendar)
6) End date (click on the drop down arrow to select the date from a calendar)
7) Status

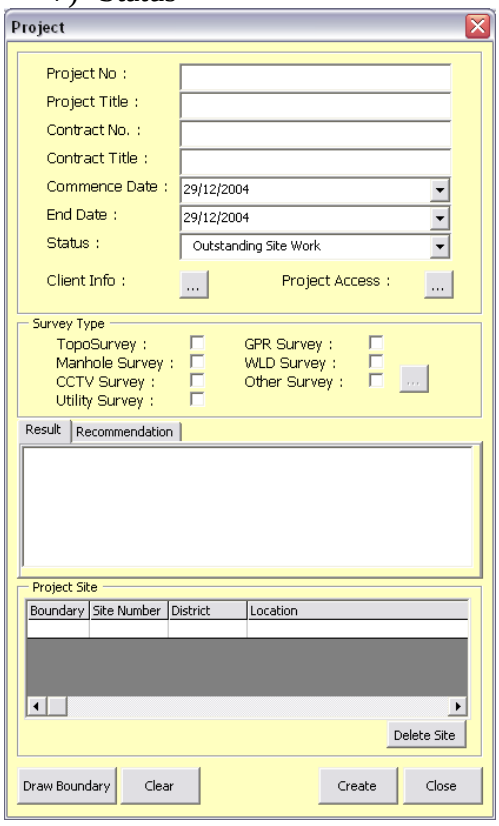


Fig. 5.1.1 Window for project creation.

One final step remains before the project can be created. A boundary for the project site must be defined. To do so, click on “Draw Boundary”. Then on the main ArcMap window, use the drawing tool on the Drawing toolbar to draw a boundary on the map:

Click on the “Create” button to create the project and store its relevant information. Note that each project must have a unique project number. If the project number already exists then the project will not be created.

Data Entry
Data entry is the first step. The software provides a standard page to enter the collected data. The page is similar to or the same as the site data collecting sheets. As many of the records are shown in abbreviation, it shall be check carefully whether the correct abbreviation is used. If the information collected from the site is not clear, they shall be clarified. Reinvestigation maybe needed if the data are found wrong or unreasonable.

Verification
IDMS geodatabase allows multiple users to edit the same version at the same time. Each edit session in ArcMap is its own representation of the version until user saves. Saving the edit session applies user’s modifications to the version, making these changes immediately accessible in the database.

When multiple users simultaneously edit a version or administrator reconciles two versions, conflicts can occur. Reconciling is the process of merging two versions. Conflicts occur when the same feature or topologically related features are edited by two or more users and the database is unclear about which representation is valid. Conflicts are rare but can occur when overlapping geographic areas in the database are edited. To ensure database integrity, the geodatabase detects when a feature has been edited in two versions and reports it as a conflict. ArcMap provides the necessary tools for conflict resolution, though user shall make the final decision as to the feature's correct representation.

Reconcile
The ‘Reconcile’ function merges all modifications between the current edit session and the master version. The reconcile process detects these differences and discovers any conflicts. If conflicts exist, a message is displayed, followed by the conflict resolution dialog box. Reconciling happens before posting a version to a master version.

In addition, the reconcile process requires that you are the only user currently editing the version and that you are the only user able to edit the version throughout the reconcile process until you save or post. If another user is simultaneously editing the version or attempts to start editing since you have reconciled, an error message will inform you the version is currently in use.

Conflicts
Conflicts occur when the same feature, topologically related feature, or relationship class is modified in two versions: the current version being edited and a master version. Conflict detection only occurs during the reconciliation process. If conflicts are detected, a message will appear, followed by the conflict resolution dialog box.

There are two categories of conflicts: when the same feature has been updated in each version and when the same feature has been updated in one version and deleted in the other.

When conflicts are detected, the parent version's feature representation takes precedence over the edit session's representation. Therefore, all conflicting features in the current edit session are replaced by their representation in the parent version. If multiple users are editing the same version and conflicts are detected, the feature that was first saved, the current version's representation, is preserved by replacing the edit session's feature representation. ArcMap ensures database integrity by forcing you to interactively inspect each conflict and resolve the conflict by replacing the feature in the current version with user's edit session's representation.

Prepare sketch and plan

Sketch and plan, indicating the services investigated in the area, is essential for every survey. The software can create the plan or sketch automatically by importing the relevant information. The plan can be edited by changing the corresponding information.

The investigation results (layout plan only) shall be plotted in 1:100 scales or other scales 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. 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.

Export of data and creation of report

If the survey results are to be presented in a report, the data can be exported to create a file in word or excel format for reporting.

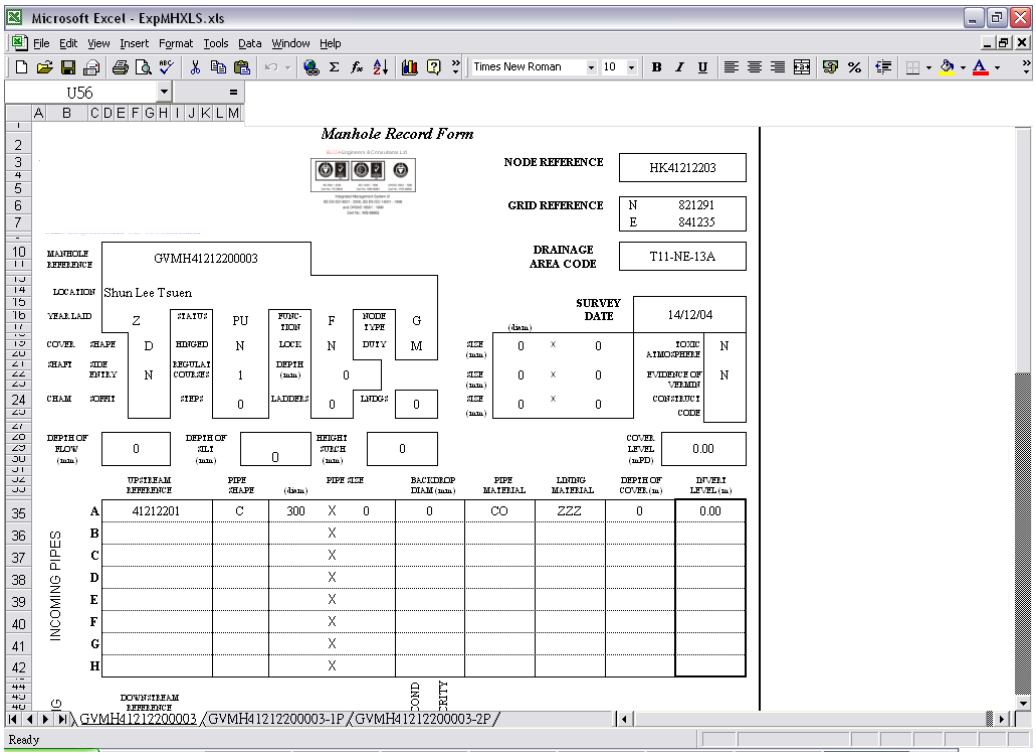


Fig. 5.1.5 Export of manhole card in excel format for reporting.

Creation of database

The result of various surveys gives information on part of the utility system. Existing information and newly surveyed data can form an archive or database for future use. This database contains different layers of utilities including the Topographic map, Electric cables, CCTV network, utility layer, gas pipes, manhole survey and CAD layer. Data can be searched and retrieved when needed.

The data can be searched and retrieved by various ways. For retrieval of the data of a specific project, the project ID can be used for searching. Information of different layers can be retrieved by selecting an area on the map. This gives convenience on the utility related works.

The software is able to perform the following functions which enable an easier management of the data collected.

View	
Basic Map Navigators	This function enables users to move around the map by pan, zoom-in, zoom-out, zoom to full extent, zoom to selected feature and switching layer on or off to display essential feature class layer
Map Search and Georeferencing Tools	This function enables users to address map area of interest by project reference, x-y map coordinates, B1000 grid index, slope registration number, building address and street name

Edit	
Spatial and Textual Data Editing Tools	This function enables users to add new features, update and delete existing features, as well as building topology for data integrity maintenance
Multimedia Linkage Tools	This function enables users to manage, update and retrieve photos, videos and documents with reference links being stored in the centralized database.
Manhole Data Editing Tools	This function enables users to create new manhole features, update and delete existing manhole features spatially. It also allows users to retrieve and update textual data by manhole selection
CCTV Data Editing Tools	This function enables users to create new CCTV records, update and delete existing CCTV records by pipe selection
Utility Data Editing Tools	This function enables users to create new utility features, update and delete existing utility features spatially. It also allows users to retrieve and update textual data by utility feature selection
GPR Data Editing Tools	This function enables users to create new GPR features, update and delete existing GPR features spatially. It also allows users to retrieve and update textual data by GPR feature selection
WLD Data Editing Tools	This function enables users to create new WLD records, update and delete existing WLD records by pipe selection
Project Information Editing Tools	This function enables users to create new project features, update and retrieve existing project features. It also allows users to retrieve and update textual data by project sites selection.
Historical Data Editing Tools	This function enables users to archive and retrieve out-of-date survey records spatially and informatively

Query	
Basic Attribute Query Tools	This function enables users to query attribute data based on data grouping, data counting and basic data calculation, like average, sum, maximum and minimum
SQL Query Tools	This function enables users to query tables and fields data by user-customized query string in SQL where-clause form
Cross-Table Query Tools	This function enables users to query attribute data from more than one tables and fields by join and relate functions
Basic Spatial Query Tools	This function enables users to query multi-layer spatial data, query spatial data based on selected features and also based on spatial data relationships, like intersection, containment and overlapping
Feature Query Tools	This function enables users to query spatial and attribute data by feature identification on manhole, pipe, utility features and so fourth

Report and Map Generation	
Map Generation Tools	This function enables users to generate map drawings in crystal report format instead of cad drawing format. Map templates are based on user defined scale and map components selection.
Report Generation Tools	This function enables users to print interim and final report based on user default templates and survey type selection
Appendix Generation Tools	This function enables users to print appendix information in crystal report format and PDF format based on user selection
Appendix Generation Tools - Manhole Card	This function enables users to print manhole cards in crystal report format and PDF format based on user default templates
Appendix Generation Tools - CCTV Summary Report	This function enables users to print CCTV summary reports in crystal report format and PDF format
Appendix Generation Tools - CCTV Inspection Report	This function enables users to print CCTV inspection reports in crystal report format and PDF format

Data Capture	
Traverse Calculation Tools	This function enables users to perform traverse calculation on the total station log files
Features Generation Tools	This function generates point, linear and polygon features automatically based on users' look-up tables and total station log files with standard feature codes
Manhole Data Capture Tools	This function enables users to capture existing manhole data in XLS, TXT and STC25 data formats
CCTV Data Capture Tools	This function enables users to capture existing CCTV data in WinCAD (MDB) and Examiner (DAT) data formats
CCTV Photo Capture Tools	This function enables users to capture defect images from the CCTV video, and then maintain it into database (MDB)
CAD Data Capture Tools	This function enables users to capture existing CAD data in DWG and DGN data formats
Upload B5000 Tools	This function facilitates users to upload B5000 data stored in Arc/Info coverage format into ArcSDE

Data Export	
Manhole Data Export Tools	This function enables users to export manhole data in XLS, TXT and STC25 data format
CCTV Data Export Tools	This function enables users to export CCTV data in WinCAD (MDB) and Examiner (DAT) data format
CAD Data Export Tools	This function enables users to export spatial data to CAD data in DWG and DGN format
GIS Data Export Tools	This function enables users to export data into GIS compatible format, like shapefile, arc/info coverage, personal geodatabase

Validation	
Manhole Data Validation Tools	This function enables users to validate manhole data which align with STC25 validation rules and issue a manhole validation report result
CCTV Data Validation Tools	This function enables users to validate CCTV data which align with Examiner validation rules and issue a CCTV validation report result
Utility Data Validation Tools	This function enables users to validate Utility survey data which align with user pre-defined rules and issue a Utility validation report result

6. UPDATED TECHNOLOGIES ON UTILITY DATA MANAGEMENT

6.1 Geographical Information System (GIS)

Today's utilities industry is realizing the benefits of geographic information system (GIS) technology for engineering, construction, and operations purposes. The typical requirements of these utilities reflect business needs to:

- Update GIS databases with as-built data
- Produce standard and custom map products
- Integrate computer-aided design (CAD) drawings into the GIS environment
- Integrate with other enterprise systems, such as work management systems (WMSs), document management systems (DMSs), infrastructure management systems (IMSs), materials management systems (MMSs), and customer information systems (CISs)
- Analyze installed network for capacity planning and capital improvement projects
- Manage operations activities, such as leaks, repairs, and inspections

GIS relates different information in a spatial context and to reach a conclusion about this relationship. GIS helps us to combine information with location reference on the map. Different kinds of data in map can be entered into GIS.

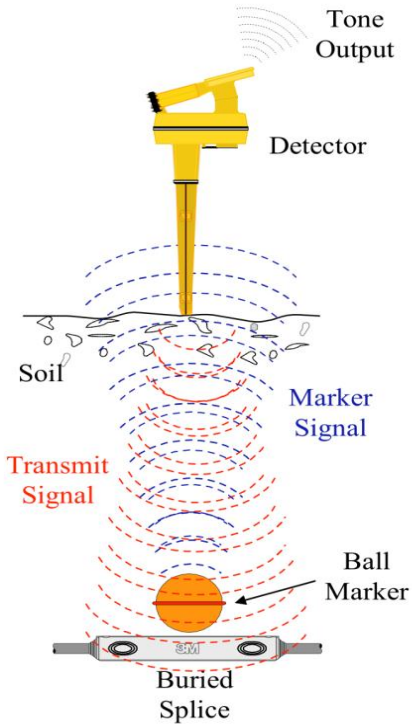
6.2 Electronic Marker System (EMS)

Principle of Marker Locating
The detector transmits a marker type specific signal to the marker and the marker absorbs, stores and discharges the signal energy. The detector then detects the signal from the marker.

There are different types of iD Markers for different usages. They are Near-surface Marker, Ball Marker, Mini Marker, Full-range Marker and Disk Marker.

How it works:

1. The detector transmits the signal to the marker
2. The marker in return, absorbs and stores the signal energy.
3. After the transmit phase, the detector switches to receive mode and then the stored energy in the marker starts to discharge.
4. As the signal energy discharges, the marker acts as a transmitter and starts transmitting the signal back to the detector.
5. Once the detector detects the incoming signal from the marker, it emits a continuous audible tone. The tone is strongest when the detector is exactly over the marker. Also, the bargraph will move towards the center of the display and indicate a maximum closed position.
6. The cycle is then repeated over and over again until the detector is turned off.



2200M Cable Locators 3M Telecommunications

Fig. 6.2.1 Illustration of the detection process of iD Ball Marker. (Source: 3M)

Path Locating

1) For metallic services or non-metallic services with accessory.

2) To locate the path of the service.

3) Receiver detects the signal carried by the service from the transmitter.

4) Require access point for signal injection.

Marker Locating

1) For both metallic and non-metallic services.

2) To locate a specific point.

3) Provide more information of services (such as type, layers, rating).

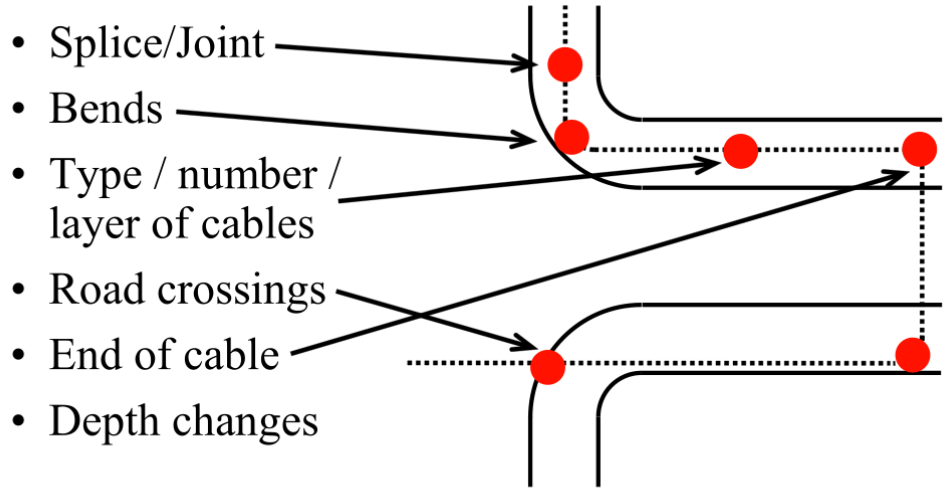
4) Marker absorbs signal transmitted by the detector and reflects back to detector.

5) Marker has to be buried next to the service at installation.

Features of iD Ball Marker

- 7 families of markers are available for different utilities.
-
- Each marker has a unique 10-digit serial number.
- Information can be programmed into the marker on site to denote the function represented by the marker. Field names and contents can be chosen from given list or user defined.
- Marker location is a built-in function of the locator, no adapter is required.
- Maximum of 6 fields of information can be recorded, field names and contents can be chosen from given list or user defined.

Direct buried cable



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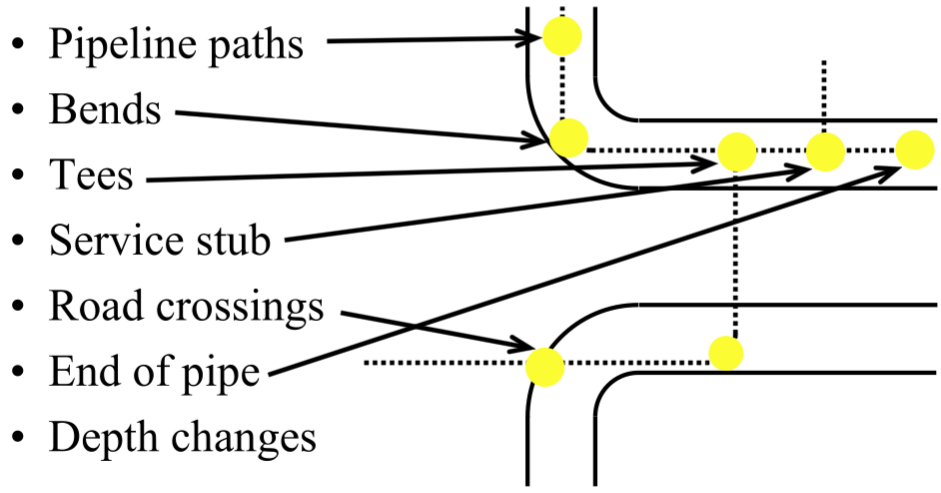
Non metallic pipes



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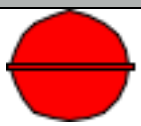
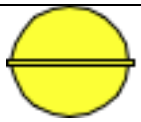
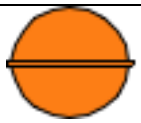
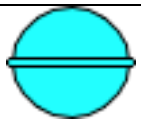
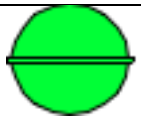
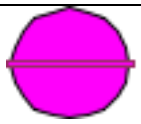
Colour code of iD Ball Markers

iD Marker Color Code	Utility
Red 	Power
Yellow 	Gas
Orange 	Telecom
Blue 	Water
Green 	Storm/Sewer
Black & Orange 	CATV
Purple 	General Purpose

Benefits of EMS-iD Marking System

1) Protects Facility.

2) Improves Safety.

3) Improves Productivity.

4) Quick and positive correlation to facility records (Asset Management).

5) Quick and positive identification of facilities in the absence of records.

6) Insures field personnel are aware of facility owner information.

7) Extremely accurate, effective in severe conditions.

8) Reduces accidents, damage, rework.

9) Prevention based solution.

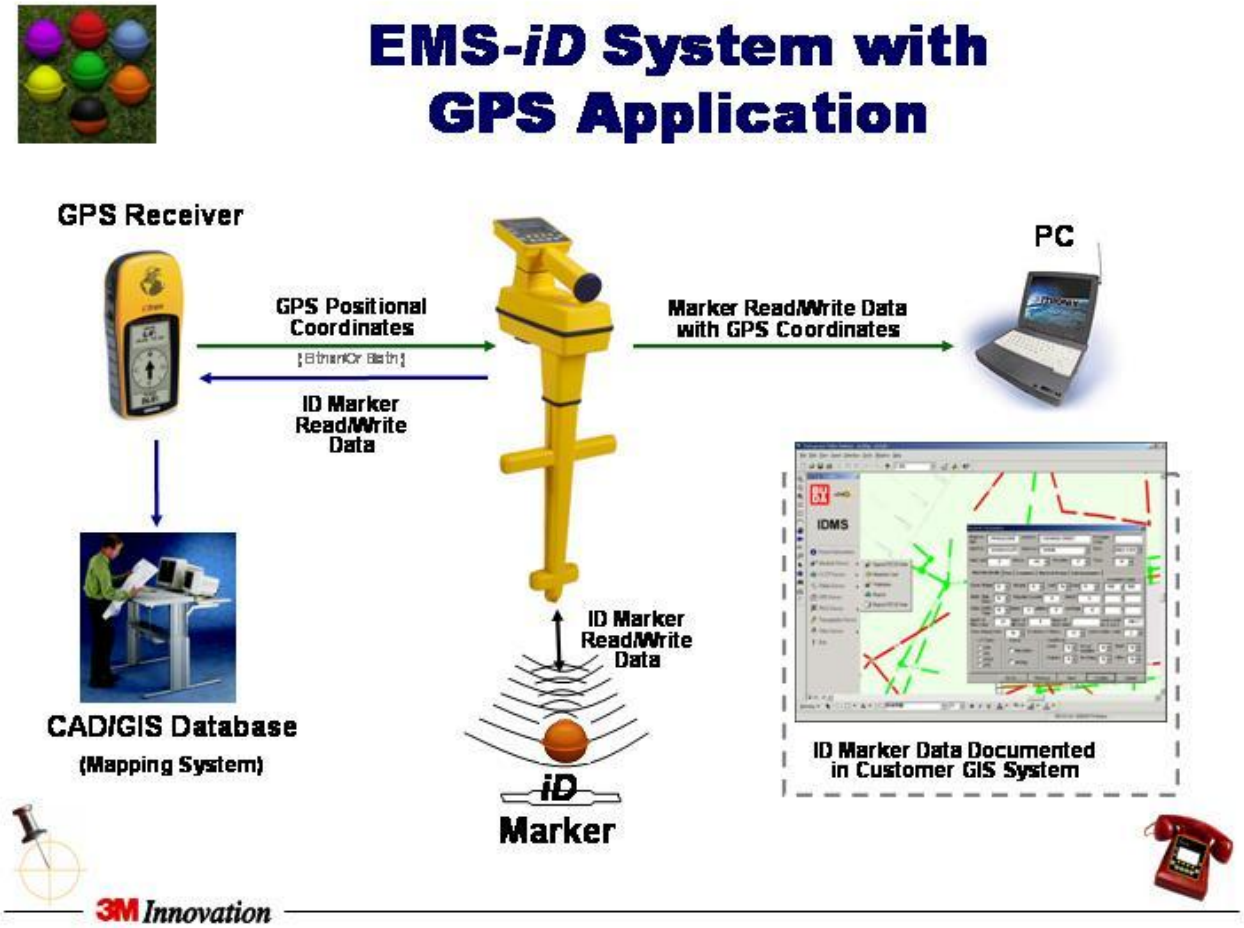
EMS-iD Marking System with GPS Application

The GPS communications capability that is being added to the functionality of some Locators is a software upgrade for new units and is also available to existing units in the field from an internet downloadable program from the manufacturer's website. This enables the EMS-iD locator to communicate using standard device interfaces to hand held field GPS receivers to share information. Specific functionality is detailed as:

The EMS-iD locator is connected to the GPS receiver via a serial cable that has a null modem in it.

When a field technician fills facility data into iD Markers or reads information from the iD Marker, the locator communicates with the GPS receiver to exchange Marker and GPS data.

The GPS receiver can then export this map file to synchronize with the existing plant facility maps to update the facility maps with the newly recorded iD Marker position and GIS attribute data.



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3) Grise, S., Idolyantes, E., Brinton, E., Booth, B. and Zeiler, M., (2001), ArcGIS Water Utilities Data Models. ESRI, California.

4) Environment, Transport and Works Bureau (2006), Code of Practice on Monitoring and Maintenance of Water-carrying Services Affecting Slopes. ETWB, Government of HKSAR.

5) User manual of IDMS, UtilityINFO Limited.

Appendix A: 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
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
CCE(CCTV & ME)	Conduit Condition Evaluation(Closed Circuit Television & Man- Entry)

Company/ Organization	
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)
kHz	Kilo- Hertz
kPa	Kilopascal

Company/ Organization	
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
US	Utility Specialist
VHS	Video High Speed

Company/ Organization	
W	Width
WLD	Water Leakage Detection
WO	Works Order
WP	Work Procedure

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Guideline Amendment Form

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Discipline*	Page No.	Description of Existing Content	Suggested Amendment

* A. Conduit Condition Evaluation (CCTV and ME Survey)
B. Manhole Internal Condition Survey
C. Utility Survey (Pipe Cable Locator Survey, PCL)
D. Water Leakage Detection and Control
E. Advanced Leakage Detection of Buried Water Carrying Services Affecting Slopes
F. Pipe Rehabilitation by Trenchless Technology
G. GPR(Ground Penetrating Radar) Survey
H. Flow Study in Drainage Conduit (流量監控)
I. Pipe Condition Surveys by other non-destructive methods
J. Data Management for Utility Records
K. Utility Management
L. Safety

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Professional Guide Notes and Pamphlet for utility professionals in Hong Kong
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