



**Report on Survey & Mapping Development
in
Hong Kong, China**

Prepared by
**The Hong Kong Institute of Surveyors
Hong Kong Special Administrative Region
The People's Republic of China**

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Skyline of Hong Kong Island at Dusk



**A Bird's Eye View of
Hong Kong International Airport
(Courtesy : SMO, HKSAR
Government)**



**Tsing Ma Bridge from a
Vantage Point, Looking West
Towards Ma Wan**

This report is prepared for the information of all member associations and other members of the International Federation of Surveyors (FIG) at its XXII International Congress in Washington, DC, USA, April 19-26, 2002.

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I Introduction

1. Hong Kong is a metropolitan city with a rapid pace in both land and infrastructure developments. At present, many construction and surveying projects worth hundreds of millions of US dollars, like the West Rail and the Hong Kong Disneyland projects, are in progress. The Government of the Hong Kong Special Administrative Region (HKSAR) is also planning various infrastructure projects, including the roads and bridges connecting to neighbouring Shenzhen, a rapidly developing Special Economic Zone of China. Ample opportunities exist for professional surveyors to get involved, to participate and leave their marks in the continual development of Hong Kong.

2. The Hong Kong Institute of Surveyors (HKIS) is a professional surveying organization incorporated under the Hong Kong Institute of Surveyors Ordinance. HKIS officially represents the whole surveying industry at professional level in Hong Kong. It comprises the General Practice Division, Quantity Surveying Division, Building Surveying Division, Land Surveying Division and Planning & Development Division. The Land Surveying Division (LSD) embraces the disciplines of geodetic surveying and global positioning system (GPS) application, photogrammetry and remote sensing, engineering surveying, hydrographic surveying, cadastral surveying, geographic information system (GIS) application and topographic mapping.

3. Members of HKIS are officially recognized by HKSAR Government under the Surveyors Registration Ordinance. Under this Ordinance, a professional surveyor who is a member of HKIS or of other professional qualification equivalent to HKIS, with one year of survey practice in Hong Kong, may apply for registration as a Registered Professional Surveyor (RPS). Member surveyors continually upgrade themselves by attending seminars and taking courses to improve on their survey services to the public.

4. The majority of LSD members of HKIS work for the Survey and Mapping Office (SMO) in the Lands Department of HKSAR Government. For those in the private sector, many practise as Authorized Land Surveyors (ALS) for land boundary survey work under the Land Survey Ordinance. Others are working in engineering consultancy firms, construction companies, GIS vendors and application consultants, and educational institutions. This report gives an account of the survey and mapping development in Hong Kong in which LSD members of HKIS have been actively engaged.

II Geodetic Survey

5. The geodetic network of Hong Kong is established and maintained by SMO. The geodetic control system is the spatial reference framework to integrate geo-reference information so that users can share and exchange information from different sources. SMO is the key agency dealing with the establishment of the Hong Kong geodetic network and the global geodetic network. While Hong Kong is relatively small with a combined land and sea area of 2,754 km² (40% of which is land), it boasts an elaborate geodetic control coverage.

Horizontal Network

6. The main horizontal network was resurveyed in 1978-79. The Hong Kong 1980 Geodetic Datum and the Hong Kong 1980 Grid System were defined in this survey. At present, there are 37 main triangulation stations, 183 minor triangulation stations and 4,300 traverse stations throughout. The 1980 Grid System is the standard reference system used for land surveying, construction and mapping. This 1980 Grid System is also the basis for developing regional GIS and remote sensing applications in Hong Kong.

Vertical Network

7. All heights on land are referred to the Hong Kong Principal Datum (HKPD). The relationship between mean sea level and HKPD was defined by 19 years of tidal observation at the tide gauge at Victoria Harbour, with the zero point of HKPD being 1.23m below mean sea level. There are about 4,000 benchmarks in Hong Kong.

Gravity Network

8. A gravity survey was conducted in 1991 for geophysical studies. 640 points were surveyed, with point spacing of 2 km on land and point spacing of 2 to 4 km at sea. Four new gravity base and standard stations were constructed in 2001. These points were linked to the adjacent regions by relative gravity measurement. Absolute gravity measurements were also taken at the gravity standard stations in 2001.

GPS Network

9. The first GPS network in Hong Kong was surveyed in 1991. In recent years, SMO has densified the network and improved its accuracy. The new 2000 GPS Network has 46 points and is connected to the IGS (International GPS Service for Geodynamics) stations in the Asia and Pacific regions. The reference frame of the 2000 GPS Network is ITRF96 (International Terrestrial Reference Frame 1996).

Satellite Positioning Reference Station Network

10. A Satellite Positioning Reference Station Network is being established by SMO and is the satellite positioning spatial reference infrastructure for Hong Kong. It collects GPS data continuously from multiple reference stations and delivers quality-checked data to the users. This network of reference stations enables

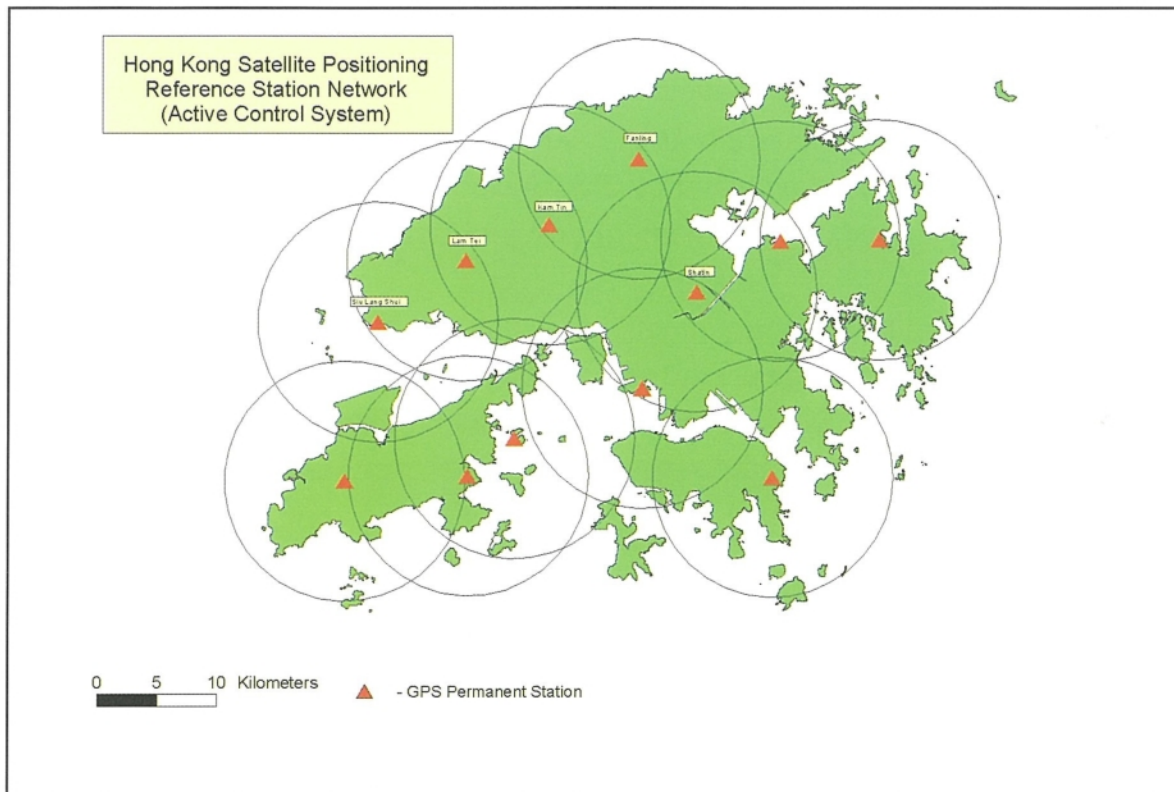


Figure 1: Hong Kong Satellite Positioning Reference Station Network
(Copyright © SMO, HKSAR Government)

the users to achieve centimetre-level positioning accuracy within a short period of time using only one GPS receiver. It supports metre-level positioning accuracy for navigation and transportation management applications using differential GPS (DGPS). This array of GPS stations, with station spacing of 10 to 15 km, can also be used for scientific research such as deformation monitoring and weather forecast. Six stations have been built and six more will be built in 2002.

III Photogrammetry and Remote Sensing

Photogrammetric Services Provided by SMO

11. Aerial photography has been frequently used for land use mapping, town planning, engineering development, topographic mapping and record keeping purposes in Hong Kong. Every year, a large array of aerial photographs of the whole territory in 1:8000, 1:16000 and 1:40000 photo scales are taken by SMO, which is the key player in photogrammetry and its applications. The oldest set of metric aerial photographs being kept by SMO dates back to the early 1960s. For the first time in Hong Kong, a set of infrared aerial photographs covering the whole territory has just been taken early this year.

12. The two-year map revision cycle for the 1:1000 basic maps maintained by SMO, while generally acceptable, can barely keep pace with the rapid land development and re-development occurring in most of the areas in Hong Kong. Because of its expediency and effectiveness, photogrammetry has therefore been employed by SMO to sustain the 1:1000 basic map revisions. Other photogrammetric services provided by SMO include aerial mapping, digital terrain modelling, building height measurement and production of orthophotos.

Applications of Digital Photogrammetry

13. In recent years, digital photogrammetry has been used for a variety of applications in Hong Kong. In 2001, the production of a territory-wide digital



Figure 2 : 3-D Visualization of City Model Produced by Digital Photogrammetry
(Courtesy : SMO, HKSAR Government)

orthophoto series with one-metre ground resolution was completed by SMO. This high-resolution digital orthophoto product has been widely used by various professions as the base or backdrop map to depict the ground conditions. To cater for the overwhelming response and the demand for higher

quality products, SMO will pursue the production of digital orthophotos of half-a-metre resolution.

14. Digital Photogrammetric System (DPS) is the latest technology utilized by the surveying, mapping and GIS industries in Hong Kong. It has outgrown the conventional analogous and analytical photogrammetric systems and its applications seem to know no bounds. Professional land surveyors have successfully applied DPS in various applications such as visualization of civil engineering projects, virtual site inspection, monitoring, change detection, 3-D city visualization, photo-interpretation and virtual reality. There is an obvious trend in Hong Kong for government departments and private firms to use DPS and photogrammetric products to enhance the values of their own products or services to their clients.

Applications of Remote Sensing Data

15. Landsat and SPOT satellite images are the most common sources of remote sensing data in Hong Kong. With an overall extent of about 60km by 50km, the entire territory can be covered by a single Landsat scene or a pair of SPOT scenes. Since 1987, these satellite images have been used for geological, hydrological and environmental studies. With an adequate supply of high quality aerial photographs from SMO, land use mapping over the years has been mainly based on aerial photographs. However, from mid-1990 onward, with sustainable development plans extending geographically to cover the Pearl River Delta Region of Guangdong Province, China (Hong Kong being positioned at the mouth of Pearl River Delta), Landsat and SPOT satellite images have emerged as an important supplementary source of information in land use mapping of the Region. The SPOT images have also been employed for habitat and wetland mapping within Hong Kong.

16. As the land in Hong Kong is densely utilized, the requirement on the remote sensing data is for imagery to have high ground resolution and definition. The commercial imaging satellite IKONOS, which captures ground details with resolution up to one metre by one metre, is particularly suitable for Hong Kong. The IKONOS images, with their fine geographic definition, link perfectly with the densely distributed data used in many of the GIS. It is foreseeable that the integration of high resolution remote sensing data and GIS will play an important role in the urban planning and development monitoring of the Pearl River Delta Region including Hong Kong.

IV Engineering Survey

17. All major infrastructure development in Hong Kong as in elsewhere requires land surveying support to collect and analyse the topographic data for design, construction and maintenance purposes. The scope of engineering survey work includes, but not limited to, site survey, monitoring survey, earthwork quantity survey, etc. With the advancement of technologies, surveying life has been made easier and survey projects can be accomplished in more effective and efficient ways. New technologies have changed the way our fellow land surveyors offer their services in engineering projects in Hong Kong.

Monitoring Survey by GPS

18. Real-time kinematic (RTK) GPS technology has been widely applied in many engineering projects to determine real-time positions to centimetre accuracy.



Figure 3: Tsing Ma Bridge Monitoring by GPS

In the Highways Department, the first application of GPS for monitoring road structures was made in the Vehicular Load Trial Project carried out for the three cable-stayed bridges, namely Tsing Ma Bridge, Kap Shui Mun Bridge and Ting Kau Bridge, in the Northeast Lantau and Tsing Yi areas. The aim of the project was to establish the load-deformation relationship for each of the bridges. GPS receivers fixed on the bridges were used to monitor the bridge movement caused

by a moving heavy transporter with 300 tons of concrete load. The project has determined the baseline reference data for the future monitoring of the bridge movement. It has also given the engineers the confidence to integrate GPS technology into the Wind And Structural Health Monitoring System (WASHMS). The current WASHMS on the three bridges comprises 29 sets of GPS receivers and associated accessories to capture the real-time motion of these cable-stayed bridges due to wind, seismic activities, temperature fluctuations and traffic loads.

19. Promising results have also been achieved using RTK GPS technology to monitor the horizontal movement of problematic building blocks in a housing estate. The system comprises a remote GPS base station with 4 rover receivers mounted on the rooftop of the building. This automatic round-the-clock system has been designed to collect the instantaneous X-Y positioning information to monitor the building's restoration progress.

Use of Photogrammetry in Engineering Works

20. Photogrammetry has been successfully applied in the surveying of different engineering works, such as in quarry surveying and in structural deformation monitoring. At present, excavation progress of large quarry sites in the territory

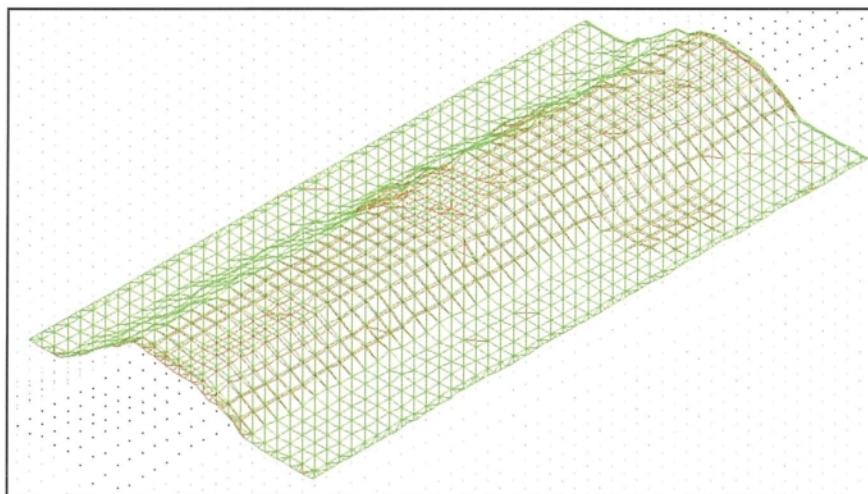


Figure 4: Digital Terrain Model Applied in Structural Deformation Monitoring

is regularly monitored at half-yearly intervals by photogrammetric method using DPS, sparing the tremendous effort that conventional ground survey and computation will otherwise require.

The structural health of some of the breakwaters in Hong Kong is also regularly monitored at half-yearly intervals by means of low altitude or terrestrial photogrammetry. Any armour settlement of the breakwaters can be detected by analysing the overlays of the digital terrain models or the orthophotos created at different epochs. This photogrammetric monitoring method of the breakwaters has proven to be safe and systematic, and more precise as compared with the conventional walkover visual inspection method.

3-D Topographic Laser Scanning

21. Land surveyors working in the vicinity of unstable slopes have to face the danger of landslips and associated hazards.



Figure 5: Application of 3-D Laser Scanning in Slope Survey

3-D laser scanning technology offers a speedy, safe and labour-saving means to capture the features and the topography in the hazardous and inaccessible areas. A field test on the application of 3-D laser scanning in slope survey has been carried out to map the topography of an existing slope. A number of individual scans were registered together to form one uninterrupted cloud of points covering the entire slope surface.

With the aid of modelling software, 3-D models were generated for the visualization of the slope and the creation of contour maps and cut profiles. The test result shows that 3-D laser scanning technology offers many advantages over conventional survey method in measuring, visualizing and modelling the hazardous and inaccessible areas. This new technology may soon find more applications in the monitoring of slopes and landslips in Hong Kong in the future.

V Hydrographic Survey

Charting of Hong Kong Waters

22. Hong Kong, with its harbour and surrounding waters frequented by ocean liners, cruise ships and ferries, and traversed by other ships and boats of various sizes and for different purposes, including the construction barges, is considered one of the busiest but safest international ports. The Marine Department has been playing a key role in producing the nautical charts of the Hong Kong waters for navigation purposes. Its main responsibilities are to acquire, collate and maintain the hydrographic data. It regularly updates and publishes the nautical charts and other relevant port information.

23. Near shore construction activities rely on knowledge of its bathymetry. Surveys to determine the up-to-date seabed terrain, for reclamations, and for the

construction and maintenance of marine facilities such as fairways, piers, container terminals and mooring buoys, are continuously undertaken by both the public and the private sectors. Thanks to the advances made in both instrumentation and data processing technologies, the efficiency, effectiveness and precision of hydrographic surveying are continuously improving. Single-beam / multi-beam echo sounding system with DGPS has become the standard method for bathymetric survey in Hong Kong.

Hydrographic Survey for Port Works and Studies

24. With the increase in public concern over the environment and for its protection, particularly during marine works, the demand for hydrographic survey measurements for monitoring and analysing purposes is increasing. Such



Figure 6 : A Catamaran Used in Hydrographic Survey

hydrographic survey activities include the measurement of water current, bottom sampling, search of wreck and underwater obstruction, determination of sub-aqueous filling and dredging quantities, and collection of any other relevant information. The resultant survey records also provide valuable information for geodesists and marine engineers to carry out their relevant

studies. Amid all these on-going activities, there is a need for hydrographic surveying practitioners to continually explore expanding the scope of their services to serve the community in port management and in environmental protection.

VI Cadastral Survey

25. Land in Hong Kong is leased or otherwise held from HKSAR Government. Historically, deeds registration under English common law has been adopted as the land registration system. This, together with land valuation and land boundary survey, constitute the cadastral system of Hong Kong. HKSAR Government employs LSD members of HKIS to perform cadastral survey services for land administration purposes. Other LSD members in the private sector practise as

RPS or ALS in offering cadastral survey services to the community. Only ALS registered under the Land Survey Ordinance are permitted to conduct land subdivision surveys.

Government Cadastral Surveying Services

26. Upon the alienation of government land to private owners and non-



Fig 7 : Re-establishment of Old Lot Boundary for Re-development in Urban Area

government bodies or the requests for boundary re-establishment for re-development purposes, SMO will conduct the corresponding land boundary surveys, which include measuring, recording and marking the lot boundaries on the ground. SMO is also responsible to conduct boundary surveys for other land administration purposes such as to facilitate the allocation of land to various government departments, the acquisition of land for public roads and lanes, and the designation of special areas such as Country Parks. The District Survey Offices of SMO maintain a comprehensive cadastral record system containing the information on land boundaries and

previous surveys. These records are available for inspection by the land surveyors in private practice for their reference in conducting surveys.

Private Cadastral Surveying Services

27. There was no law to regulate the land surveyors in private practice until the enactment of the Land Survey Ordinance, which became effective in January 1996. The Ordinance provides for the registration and discipline of ALS engaged in land boundary surveys, the control of the standards of land boundary surveys, the establishment of land boundary records and related matters. By law, only ALS registered under the Ordinance shall be engaged to conduct land boundary surveys for the subdivision of private lands in Hong Kong. For every subdivision of land, a land boundary plan prepared and certified by an ALS in accordance with the Code of Practice is required for land registration. The ALS is also required to deposit a duplicate of the land boundary plan and the corresponding survey record plan with the Land Survey Authority for the establishment of a comprehensive record system for land boundary surveys.

VII Geographic Information Systems (GIS)

Computerized Land Information System

28. SMO is the central authority for all basic mapping and land parcel boundary surveys in Hong Kong. In order to be more cost-effective and expeditious in providing the map and land boundary information, the Computerized Land Information System (CLIS) was launched by SMO in 1990. It took SMO six years to convert the paper maps and land boundary records into digital form. The digital map and land boundary data are being continuously updated by SMO. To meet the diversified needs of GIS users, they are provided in various commonly used data formats including the Arc/Info, DGN, DXF, DWG and ASCII formats.

29. The CLIS contains two main types of land information, namely topographic maps of some 3,000 sheets at the scale of 1:1000 and land boundary records of over 300,000 land parcels, covering the whole territory of Hong Kong. This versatile and intelligent CLIS records all land related graphic and textual information on a seamless map base. The map features and land parcels are uniquely coded and attributes are attached to the graphic entities. Data are topologically organized



Figure 8 : 1:1000 Digital Land Boundary Record
(Copyright © SMO, HKSAR Government)

into sets of layers for easy retrieval and data analysis. The graphic and textual information of an area can be searched by means of a number of identifiers such as the house address, building name, lot number, street intersection and grid coordinates.

Applications of Digital Map

30. The digital map and land boundary data serve as a common and standardized fundamental dataset on which GIS users can build their applications. Since the completion of the data conversion for the CLIS in 1996, SMO has continued to develop further applications to meet its internal needs and market demands. Various digital map databases have been produced to facilitate its day-to-day survey and mapping operations and other applications in the private sector. The Lands Department has, since 2000, launched on the Internet the GIS based Slope Maintenance Responsibility Information System for the public to retrieve the maintenance responsibility information on individual slopes. The Fire Services Department is implementing the Third Generation Mobilizing System of which GIS is an important component. The Transport Department will bring about a comprehensive transport information system using GIS. The digital maps are also extensively used by utility companies, engineering consultants, property developers, transportation companies and educational institutes for a wide range of GIS applications.

Map Information Services on the Internet

31. To widen the scope of applications using digital maps, SMO has continually promoted its use to serve the community. In 1996, SMO together with the then Hong Kong Tourist Association launched a Map Enquiry System on the Internet. Tourists can obtain information on accommodation, restaurants, shops, scenic spots as well as travelling routes between prominent places, prior to their trips to Hong Kong. In 1998, SMO teamed up with two business partners in the private sector to implement the project of "Community Map on the Internet" by using SMO's bilingual maps as a user-friendly platform for delivery of everyday-life information to the community on the Internet. The two web sites are well received by the community and attained the goal of promoting SMO's digital maps and disseminating community information to the general public. Favourable feedback has been received from those who have visited these two web sites. There are more than 2 million map pages generated and served to the Internet users every month. The high hit rates are attractive to companies wishing to advertise their products and services at these two web sites.

Commercial Use of Digital Maps

32. Licenses are issued by SMO to permit commercial firms to use its digital map data. With these licenses, any private enterprises can develop and deliver maps or location related applications at their web sites. This type of web-based map information dissemination includes the selection of stores convenient for the collection of goods ordered through the Internet, finding of route between two destinations by walking or by public transport, viewing of popular scenic spots, and searching of locations and information about commercial firms, restaurants, public facilities and entertainment. Many companies have used SMO's digital maps as the reference base along with different add-on information to develop their own tailor-made commercial map products. These commercial map-based products are available in different forms such as CD-ROM and other storage media for use on the personal computers and mobile devices. More advanced applications such as in-car navigation and fleet management are being developed for commercial use by other enterprises.

Hong Kong Spatial Data Infrastructure

33. There has been a growing number of GIS installed in government departments and companies in the private sector. The Planning and Lands Bureau has completed a consultancy study on the alignment of those commonly used spatial data being created or maintained by the planning, lands and works departments. There are other policies being formulated to facilitate data exchange among government departments. To promote the use and sharing of spatial data among different organizations, the Land Information Centre of SMO has set up the Hong Kong Geo-spatial Data Clearinghouse containing the catalogue and metadata documents of those GIS developed by the government departments under the Planning and Lands Bureau, and the Works Bureau. The Hong Kong Geo-spatial Data Clearinghouse server is also connected to the Geo-spatial Data Clearinghouse at the website of the US Federal Geographic Data Committee (FGDC). Users can at any time explore the data content, data quality and contact point information about the spatial data available in Hong Kong, either through a number of clearinghouse gateways to the FGDC website or directly from the SMO website.

Global Mapping

34. The International Steering Committee for Global Mapping is a strategic initiative of the United Nations Conference on Environment and Development. It collaborates with the national mapping organizations to produce the Global Map

for global change monitoring and environmental analysis. SMO is one of the participating members among some 90 countries and regions in the Global Mapping Project. A digital geographic dataset of Hong Kong in one-kilometre resolution and at 1:1000000 has been compiled in accordance with the Global Map specifications. The Global Map data comprises eight layers of geographical data, viz. transportation, boundaries, drainage, population centres, elevation, vegetation, land cover and land use.

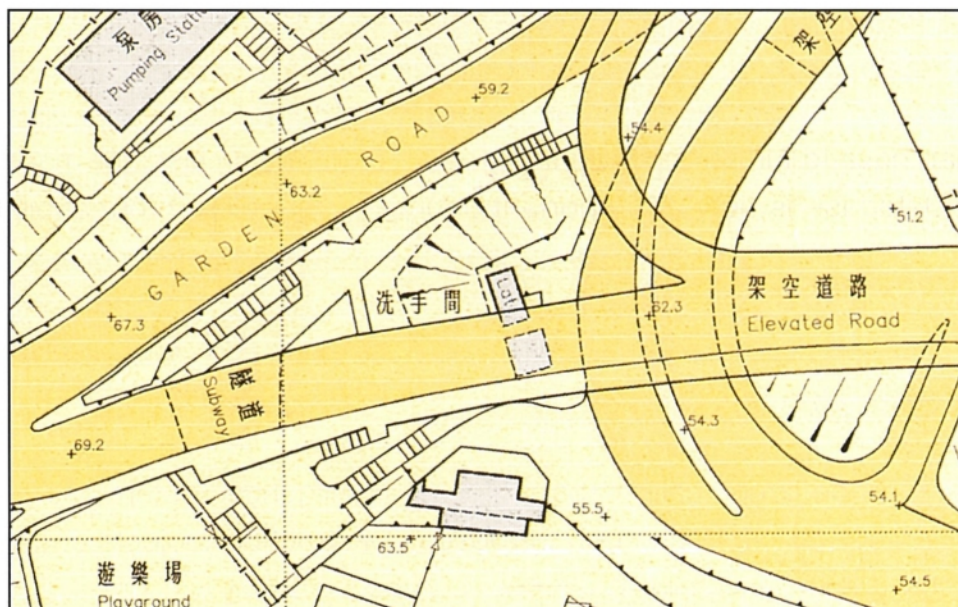
VIII Topographic Mapping

History of Topographic Mapping

35. The mapping of the whole territory using aerial survey and photogrammetry was launched in early 1960s. The project was completed in 1971. Maps of Hong Kong Island, Kowloon and New Kowloon were plotted at 1:600 with contours at 5-foot intervals and maps of the rural New Territories, excluding the highest hill areas and outlying islands, were plotted at 1:1200 with contours at 10-foot intervals. Following the policy of metrication in the early 1970s, SMO converted all its imperial maps into metric maps.

Types of Topographic Maps

36. The 1:1000 metric topographic maps, produced by SMO, are the basic maps of Hong Kong. While the 1:1000 topographic maps are essential for land



**Figure 9 : 1:1000 Digital Topographic Map
(Copyright © SMO, HKSAR Government)**

administration and planning purposes, topographic maps at smaller scales are also required by many government departments and the public for other purposes. These maps at smaller scales are mainly derived from the basic mapping series by means of map compilation via generalization of details and the establishment of various mapping and cartographic databases. One of these derived maps is the 1:5000 bilingual topographic map series covering the whole of Hong Kong. The same computer hardware and software systems set up for CLIS have also been used for the direct derivation of the 1:5000 colour maps in digital form from the 1:1000 digital map base. Other derived standard series of bilingual topographic maps covering the whole of Hong Kong are continuously updated and published using the computerized Small Scale Mapping System at the scales of 1:10000, 1:20000, 1:50000, 1:100000 and 1:200000. These maps are produced with different selected contents and grid information for different purposes.

37. The grids on all topographic maps depicting geographical coordinates are based on the Hong Kong 1980 Grid System. Starting from the late 1993, the latitudes, longitudes and UTM (Universal Transverse Mercator) grids on the new edition of 1:20000 and smaller scale maps are based on the World Geodetic System 84 Datum. Today, most colour topographic maps have adopted this datum.

Small Scale Mapping

38. Before 1996, manual cartography was the main method used by SMO to make the printing plates for publishing colour maps. Beginning from 1996, the procedures for making maps at various small scales have been fully computerized with the setting up of a Small Scale Mapping System. Since 1999, a 1:10000 Mapping Database has been derived and developed from the data of the 1:1000 digital map base to further facilitate the production of the small scale maps. This 1:10000 Database is now an important source of mapping information for the derivation of maps at smaller scales.

Map Revision

39. SMO is responsible for updating maps continuously, giving priority to those areas with rapid land development or having a lot of construction activities. For revision of the large scale maps, a Survey Intelligence System has been set up to collect survey information on proposed construction projects and building works, and to record the anticipated project completion dates. With this information, a revision programme can be planned to update the major changes on the ground within a short time after the completion of projects. As both the

large and small scale maps are in digital form, this facilitates not only the revision work but also the derivation work for updating the small scale maps. As a result, up-to-date maps at various scales are more readily available.

IX Education and Professional Development

Hong Kong Polytechnic University

40. Hong Kong Polytechnic University is the most significant academic institution in Hong Kong for surveying. It offers a variety of programmes for training surveying and mapping personnel from sub-degree to doctoral degree levels. Its Department of Land Surveying and Geo-Informatics offers two full-time programmes, the Bachelor of Science (Honours) in Surveying and Geo-Informatics and the Higher Diploma in Geomatics. Graduates of these two programmes can pursue careers in government departments, statutory authorities and private companies. With regard to professional recognition, graduates of the Bachelor of Science programme are fully exempted from the entrance examination of the Hong Kong Institute of Surveyors, the UK Royal Institution of Chartered Surveyors and the UK Institution of Civil Engineering Surveyors. The Department also offers part-time programmes, namely the Higher Certificate in Land and Engineering Surveying, Bachelor of Science (Honours) in Surveying and Geo-Informatics, and Master of Science in Geomatics. These part-time programmes not only provide opportunities for different levels of geomatic practitioners to upgrade their qualification but also allow other disciplines to broaden their knowledge. Other than the taught programmes, the Department also offers research type of studies leading to the award of Master of Philosophy and Doctor of Philosophy degrees in the area of geomatics.

Other Educational/Training Institutions

41. Besides the Hong Kong Polytechnic University, the Hong Kong Institute of Vocational Education also provides one-year part-time course on Certificate of Engineering Surveying. The University of Hong Kong, the Chinese University of Hong Kong and the Baptist University offer GIS and remote sensing courses for undergraduates in their departments of geography. These universities together with the Hong Kong Polytechnic University also offer postgraduate courses in GIS. Basic land surveying courses are being taught in all the engineering departments of the universities.

42. The Survey and Mapping Office Training School of the Lands Department was established in 1965. In the past, the School provided basic land surveying and cartography courses to newly recruited government officers. At present, it still provides refresher courses and basic land surveying, cartography, GIS and GPS courses to staff working in more than 10 government departments.

Assessment of Professional Competence

43. HKIS has set up the mechanism for university graduates or candidates with appropriate qualification to become its members. To be a member in LSD of HKIS, a graduate candidate will have to undergo two-year practical training with his or her employer and pass the Assessment of Professional Competence conducted by HKIS. At present, both the government and the private firms operate the two-year structured professional training scheme for their graduate employees. SMO recruits about nine graduates every year while the recruitment in the private sector is very much dependant on the economic situation.

Continuing Professional Development

44. Continuing Professional Development (CPD) is the hallmark of every professional. According to the bye-law of HKIS, each of its members has to complete at least 20 hours of CPD training annually. HKIS has the tradition and the commitment to organize its own CPD events, including the hosting of international survey conferences. HKIS also encourages its members to attend other professional courses, seminars and meetings so as to broaden their professional horizon and increase their participation in the community.

X Conclusion

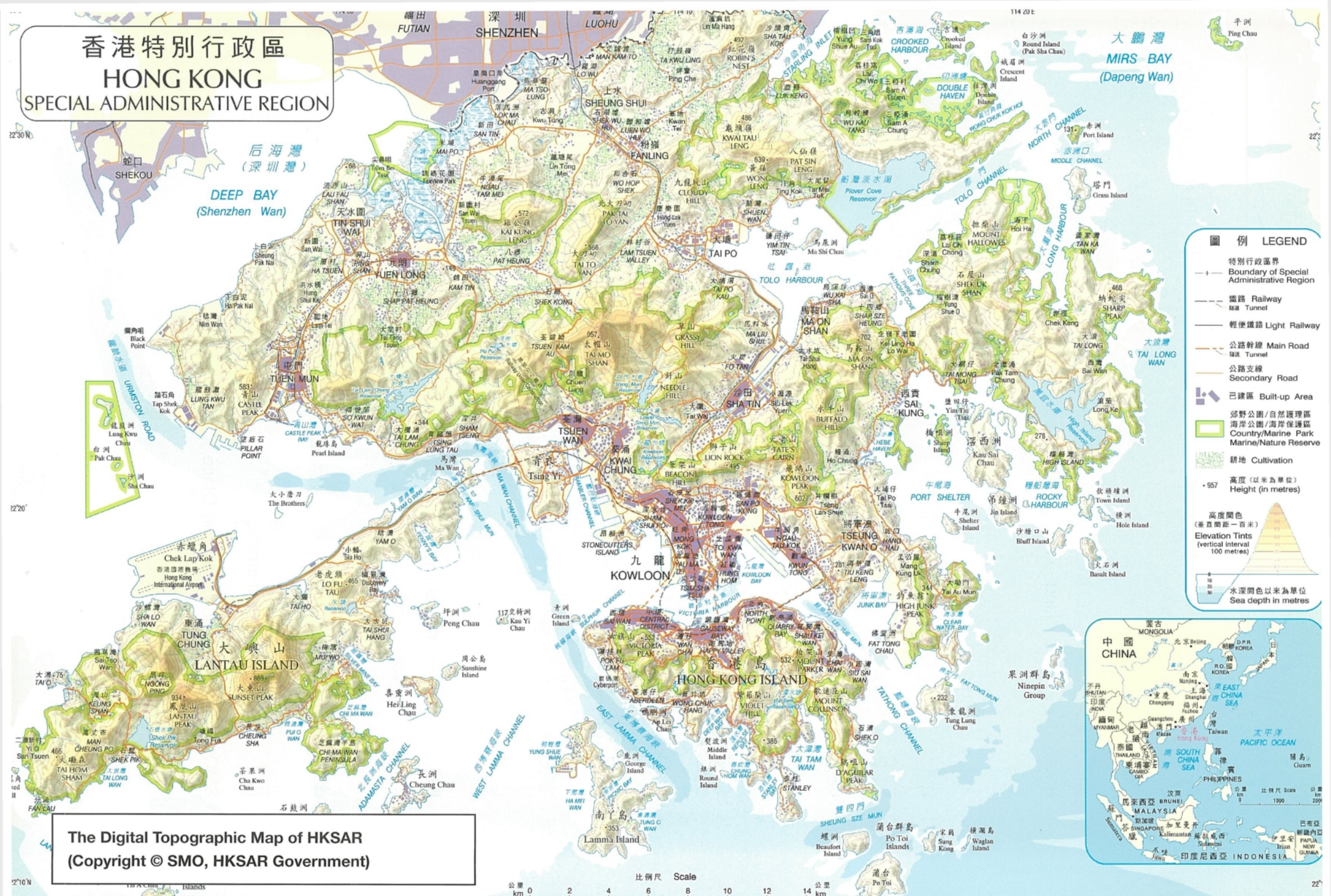
45. Hong Kong is a developed society. The survey and mapping development has been in step with the land and engineering infrastructure development of the territory, and will continue to do so as it enters the information age. The latest satellite survey technology and digital survey data manipulation have been applied across the spectrum of survey and mapping product and services. Hong Kong has almost completed a Satellite Positioning Reference Station Network to augment an already extensive and elaborate traditional survey control network. Production of maps has been fully computerized with the digital base maps in 1:1000 and other derived digital maps in smaller scales that cover the whole territory. Professional land surveying HKIS members have been the driving force behind such survey and mapping achievements in Hong Kong.

46. Great strides have been made. Still there is room for improvement, especially in the government policy on establishing a comprehensive spatial data infrastructure and improving the legal system for land boundary survey. The implementation of more effective policies and plans will result in a more systematic survey and mapping development for Hong Kong, and a more sustained growth environment for the land surveying profession as well.

Acronyms used in this Report

ALS	Authorized Land Surveyor
CLIS	Computerized Land Information System
CPD	Continuing Professional Development
DGPS	Differential Global Positioning System
DPS	Digital Photogrammetric System
FGDC	US Federal Geographic Data Committee
GIS	Geographic Information System
GPS	Global Positioning System
HKIS	The Hong Kong Institute of Surveyors
HKPD	Hong Kong Principal Datum
HKSAR	Hong Kong Special Administrative Region
IGS	International GPS Service for Geodynamics
ITRF96	International Terrestrial Reference Frame 1996
LSD	Land Surveying Division
RPS	Registered Professional Surveyor
RTK	Real-time Kinematic
SMO	Survey and Mapping Office
UTM	Universal Transverse Mercator
WASHMS	Wind And Structural Health Monitoring System

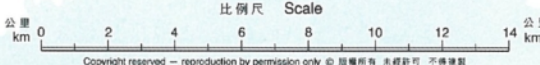
香港特別行政區 HONG KONG SPECIAL ADMINISTRATIVE REGION



圖例 LEGEND

- 特別行政區界 Boundary of Special Administrative Region
- 鐵路 Railway
- 輕便鐵路 Light Railway
- 公路幹線 Main Road
- 公路幹線 Tunnel
- 公路幹線 Light Railway
- 公路幹線 Main Road
- 公路幹線 Tunnel
- 公路副線 Secondary Road
- 已建區 Built-up Area
- 郊野公園/自然護理區 Country Park/Nature Reserve
- 海岸公園/海岸保護區 Marine/Nature Reserve
- 耕地 Cultivation
- 高度 (以米為單位) Height (in metres)
- 高度間色 (垂直間距一百米) Elevation Tints (vertical interval 100 metres)
- 水深間色以米為單位 Sea depth in metres

The Digital Topographic Map of HKSAR
(Copyright © SMO, HKSAR Government)



香港特別行政區
航空照片鑲嵌圖

HONG KONG
SPECIAL ADMINISTRATIVE REGION
AIR PHOTO MOSAIC

此香港航空照片由七十多幅攝於一九九九年
的空中攝影照片鑲嵌而成，但未經航攝像片
糾正處理。

This Air Photo of Hong Kong, consisted of more than 70
aerial photographs taken in 1999, was combined into a
mosaic without rectification.

The Air Photo Mosaic of HKSAR
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