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PROGRESS REPORT  
1989-1992  
DEPARTMENT OF SURVEYS AND LANDS (DSL) BOTSWANA

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## **INTRODUCTION**

1. The main functions of the Department of Surveys and Lands (DSL) are the recording and supply of land, mapping, survey and remote sensing information. In addition the department provides professional services and advice on these subjects, mainly to other government Departments and aid projects. It also does compulsory acquisition work for parastatal organizations and provides an information and sales service on its products to the public.

The Department is concentrated in Gaborone with a Regional Office in Francistown dealing with survey and lands matters for the north of the country and selling some maps.

2. The training policy mentioned at the Seventh Regional Cartographic Conference has been continued. The Department has expanded, professional and technical staff have increased from 104 to 162, only 7 non-citizens remain in the professional grades and these will be replaced within the next two years by trained and experienced citizens.

3. In October 1990 the Department signed an agreement for Institutional Cooperation with Swedsurvey, the overseas arm of the National Land Survey of Sweden. Under this agreement the technical capabilities of the Survey and Mapping Divisions have continued to be enhanced with the purchase of modern equipment and technology, short and medium term training courses and the actual photogrammetric plotting in Sweden of large scale maps.

Major items of equipment acquired during the period include 3 x Ashtech GPS sets, a Topcon total station, 1 x Wild A10 and 2 x Wild A8 photogrammetric plotters, a horizontal axis process camera, and a major extension of the computer network within the department including 1 x GTCO A0 size digitiser, 2 x Hewlett Packard drum plotters and a Wild TA10 flatbed plotter.

## **SURVEY DIVISION**

4. This division is responsible for geodetic, topographic, engineering, ground control and cadastral surveys. During this period there has been no significant expansion of the existing Geodetic Network. Much effort has gone into the survey of township reference marks and the setting out of new urban developments. Engineering and topographical surveys are undertaken on request for government departments, public utilities and town and district councils. In addition destroyed marks have been replaced, and ground control for large scale mapping observed for 21 blocks covering 2318 sq km.

The major function of the division has been cadastral surveying. This includes the subdivision of previously surveyed plots but mainly the setting out of new plots on virgin land.

5. In the past year the division has taken on an additional responsibility. This is the supervision of the surveyors working on the survey and subdivision of tribal land. At present these posts in Local Government service are all filled by expatriate Chinese surveyors but part of their duties is the training of technicians.

6. Major Surveys undertaken during this period

a. Cadastral Lots

1989/90	2408
1990/91	3428
1991/92	5148
1992/93	1280

b. Lots submitted for examination

	Lots	areas
1989/90	9883	30 864 hectares
1990/91	3723	19 354
1991/92	8143	39 860
1992/93	3902	22 413

c. General survey work undertaken

- i. 269 km of the northeastern boundary of the Central Kalahari Game Reserve were cleared.
- ii. 65 km of the Makalamedi fence were set out.
- iii. Photocontrol was completed for 1:5000 mapping of four major villages using conventional methods. Photo control for six more villages and Gaborone was observed using GPS sets under contract. The Dept then acquired its own GPS sets and has since then observed photo control for 10 villages.
- iv. Innumerable minor subdivisions and relocation of lost boundaries were undertaken on a day to day basis.
- v. 253 km of District Boundary line was opened up between the kgalagadi and Ghanzi Districts.

- vi. Permanent Reference Mark systems were established using Ashtec GPS equipment in 17 major rural settlements.

### MAPPING DIVISION

7. The following medium scale photography was obtained during this period.

Year	Locality	Area in sq kms
1990	Western Ngamiland	32 340
1991	Okavango Delta	65 500

At present the oldest cover in use is 7 years old.

There has been extensive photography at 1:20 000 of an area of 2500 sq kms, for large scale mapping of 19 major villages and the capital city.

8. A total of 47728 reprographic products such as airphoto prints, enlargements, landsat imagery etc were produced during the period for various customers.

9. 48868 maps at small, medium and large scale were sold to the public or supplied to other Government departments.

10. Large scale maps were produced during the period of Kanye, Molepolole, Mosopa, Charles Hill, Gabane, Ghanzi, Good Hope, Gumare, Mochudi, Mogoditshane, Nata, Rakops, Sefophe, Shoshong, Thamaga, Tlokweng and Tutume. At present work is continuing on Gaborone, Tonata-Shashe, Tshane, Hukunsi, Lokhwabe, Lehututu and Mahalapye. Eighteen of these were produced by Swedsurvey. The first three villages were done in house using conventional plotting and scribing techniques. The others have been produced by direct digitisation on the photogrammetric plotters using the SOS-Map system with subsequent scribing on a Wild TA10 flatbed plotter.

11. The following medium and small scale maps have been revised since my last report:

1:2 000 000 Road map,  
 1:1 500 000 Country map,  
 1:1 000 000 (2 sheets), new roads and railways were added to these maps.  
 1:50 000 (68 sheets)  
 1:25 000 (1 sheet of Gaborone).

## THE STATUS OF MAPPING IN THE COUNTRY

12. Large scale mapping at various scales exists for the urban areas and most of the major rural centres. This mapping is only available as dyelines or xerox copies. There is an increasing demand for revision and extension of existing large scale mapping. The rate of growth in and around Gaborone is such that December 1989 photography had to be replaced in September 1992.

Orthophotomaps exist at various large scales for some other settlements but these are becoming out of date.

13. The standard 1:50 000 map series has been compiled from air photographs. The conventional line maps are in 5 colours with contours at intervals of 50ft or 20m. This mapping covers the more developed eastern and southern side of Botswana and makes up 27% of the country. Multicoloured photomaps have been produced for other parts of the country in areas of low relief, 17%. The provisional series of photo-mosaics is in monochrome and covers the remaining 56% of the country. These are not being revised. To cover the whole country at 1:50 000 quarter degree sheets would take 8850 sheets. The present divisions have evolved from technical and financial constraints.

14. Photomaps at 1:100 000 scale cover the remote areas in the northwest parts of the country. The series comprises 37 half degree sheets. In conjunction with Swedsurvey 7 more sheets have been produced using SPOT imagery.

15. The largest scale series which covers the whole country is 1:250 000 (41 sheets), other national scales are 1:500 000 (11 sheets), 1:1 000 000 (2 sheets), 1:1 500 000 and 1:2 000 000.

Special thematic maps are produced for other Government Departments from time to time; usually at 1:1 500 000.

There is a regularly revised map catalogue and planning is in hand for a National Atlas.

## COMPUTERISATION

16. The Department has moved on since the early 1980s with the Hewlett Packard machines and the Data General linked to the Wild B8S. The department now has the following equipment linked by Novel Netware 3.22 and Ethernet cabling to a common file server with a 1 gigabyte capacity:-

ICL M55/03	Director		
ICL M55/02	Deputy Director	ICL 1000/01	PR(S)
		ICL M45/02	SSvr/HQ
ICL M45/05	Reception	IBM 30/06	STO Exam
EPSON PCE/02	Typing Pool	IBM 30/02	Exam
ICL M45/01	Computer Room	IBM 60/01	CAD Room
ICL M55/01	Computer Room	IBM 70/01	CAD Room
UNISYS 800/02	Computer Room	UNISYS 800/01	CAD Room
TOSHIBA 2	Computer Room	EPSON PCE/03	CAD Room
Drum Plotter	Computer Room	INTEL 386/01	CAD Room
		EPSON PCE/04	F/TOWN
EPSON PCE/01	PLO		
OLIVE M90	F/TOWN	ICL/M55/04	PR(M)
UNISYS 500/01	SLO(R)		
IBM 30/04	Rating	ICL M55/05	Map D/O 1
IBM 30/01	SLO(Est)	IBM 30/03	Map Sales
IBM 30/05	LRS	Samsung 830/01	Photogram
ICL M45/06	LRS	Samsung 830/02	Photogram
TOSHIBA 1	SLO(L)	Samsung 830/03	Photogram
ICL M40/01	SLAP	Samsung 486/01	Photogram
ICL M40/02	SLAP	Samsung 486/02	Ph/gram 2
ICL M40/03	SLAP		
ICL M40/04	SLAP	Drum Plotter	Photogram
ICL M40/05	SLAP	Flatbed Plotter	Photogram
ICL M40/06	SLAP	Digitiser	Photogram
ICL M40/03	SLAP		
ICL M40/04	SLAP		

The above distribution was the situation in November 1992 it is not immutable and there may have been changes since then.

There are also 14 assorted line and matrix printers and 8 UPSs supporting major groups of PCs or individual ones.

Most of the data held, other than cadastral and mapping, is in dBase format. This includes:

Trig lists by degree square and town reference marks, rating rolls and the supplementary rating rolls, Land board leases, Gaborone Pool housing records, Examination section records.

17. The software in use includes Word Perfect 5.1, Lotus 123 and Dbase III and IV; these are installed on the system disk and accessed from there. In addition there are various survey programs or suites on the system disk.

- a. One purchased from P Ric-Hansen of Durban is used for survey computations on the grid and for conversions to and from UTM, Gauss Conformal projections or geographicals.
- b. There is also one from the University of Cape Town capable of conversions between WGS84, Bessel and Clarke 1880 modified spheroids. This can accept Gauss Conformal (GC), UTM, cartesian or geographicals from either spheroid and outputs GC, UTM, geographicals or cartesian coordinates. This program has the advantage that it can read from a file and write to an output file.
- c. The Global Positioning Systems (GPS) computations are done using the proprietary software GPPS from Ashtech. This is installed on one portable for field use and one other machine.

18. The main programs installed on specialist PCs are:

- a. Intergraph Micro station - 4 sets protected by dongles; these are chiefly used for the design stage of cadastral layouts.
- b. REGIS on one PC. At present this is being used with the scanned and vectorised compilations of the urban areas and the rating rolls.
- c. SOS-Map -5 sets; 4 loaded on PCs linked to photogrammetric plotters and the fifth PC used with the GTCO A0 digitiser or the drum plotter or flatbed plotter. A sixth set is on order to use with the Quasco converted Wild B8.

SOS-Map accepts 'model space' coordinates from the photogrammetric plotters and converts them to ground coordinates. It also accepts table coordinates from the digitiser and converts those. In addition SOS-Map can accept ASCII files or coordinates in almost any format. It can output HPGL plot files, files for Arc-Info or Map-Info and .DXF files for Autocad.

19. Nine machines are in use for State Land allocation Policy(SLAP) work and these are linked through the system to Tangogate which given access via a modem to the mainframe at Government Computer Bureau. These machines are working direct to the mainframe and do not use the system disc for storage.

20. There are two machines at the Regional Office in Francistown and these are used in a stand alone manner or can be connected individually via modems to the system for the transfer of programs or data. They have the programs for lands and survey divisions.

21. All senior staff now have immediate access to a PC and most middle grade staff have received training relevant to their specialism in addition to word processing. Computer literacy has reached the stage where staff expect to be able to switch information around from dBase to Lotus etc and do not expect to have to re-enter data in another format.

Lotus is used for the industrial class paysheets and various land valuation tasks.

22. The computerisation of the examination system records mentioned at Ouagadougou in 1989 is working successfully.

## **FUTURE DEVELOPMENTS**

### **23. Geographical Information Systems**

Various Government departments are beginning to investigate the economy of using these. A Consultant has been appointed by Government to advise on various aspects to ensure that databases and data will be compatible and exchangeable between departments. The total conversion of the mapping division to digital mapping is being investigated.

## **PLACE NAMES COMMISSION**

24. This Commission has continued its work with several villages visited each year. The Fourth Report was published in 1990. the Director, who is Chairman of the PNC attended a UN Conference on Toponymy in 1992 in New York.