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AUTOMATED PRODUCTION OF SURVEY PLAN AND DATABASE FOR FUTURE DEVELOPMENT (CASE STUDY OF PART OF MAKAMA NEW EXTENSION S13).

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ABSTRACT

This research is about the demarcation and survey of part of S31 layout for the purpose of producing Tittle deeds plan (TDPs), for the preparation of certificate of occupancy (C of O) over all individual plots to be allocated to individuals. The research site is located at Makama New Extension within Bauchi metropolis. The purpose of this research is to compile a survey

INTRODUCTION

Background to the Study

Layout survey is an important aspect of cadastration. A layout survey plan is a vital and pre-requisite document for Land Administrators in effective land evaluation, allocation, reform, utilization and management. In Nigeria, layout design is usually designed for reserved area of interest for future development. A layout design is prepared by the Town Planning Officer or the Local Planning Committee according to an approved scheme, as a result from inspection on ground or from a plan prepared beforehand showing the topographic features and details of the area. On the other hand layout survey is conducted by a Surveyor to correctly transfer the designed layout on paper to the ground without altering the designed specifications. The principle of working from whole to parts plays an important role in the course of laying out

plan for easy retrieval of parcel properties. It aimed at production of automated survey plan and database for future development. This automated survey plan would facilitate the rigorous process of acquiring C of O at affordable cost. It would automatically minimize field observation in all its ramification. The object of this research are; To transfer the designed plan to the ground, to carry out a Survey for the location of position of each property beacons, to demarcate each plot corner with a numbered property beacon accordingly, to carry out a survey for the purpose of determining the final coordinate of each beacon, to compute the area of each plot and produce a layout survey plan, to produce automated survey plan and to generate database of each parcel of land. The hardware and software used are total station, computer, AutoCAD, and ArcGIS. The controls points used for the connection were checked and found to be in-situ. The angular and linear misclosure was less than 30" and 0.30m which confirmed that the controls used for the connection of this project were in their actual position. The survey was carried out using SOKIA set 510 total station and its accessories with 50m steel tape. The layout Survey was carried out using bearing and distance method measured with Total Station and steel tape respectively, beacons were emplaced at the corner of each parcel and the final survey was carried out. The linear accuracy were computed and found to be 1:3000. The total are covered was 26.912 hectare (269120m^2). The survey plan and the automated survey plan was drawn to a scale of 1:2500. The database of each parcel of land were generated.

KEYWORDS: *Automated, production, survey plan and database*

the designed features on ground. Automated survey plan is the process of keeping plans and database (records) in digital format. The purpose of this project is to compile a survey plan for easy retrieval of parcel properties. The project is aimed at production of automated survey plan and database for future development. This automated survey plan would facilitate the rigorous process of acquiring certificate of occupancy (C of O) at affordable cost. It would automatically minimize field observation in all its ramification.

Cadastral layout is a geo-spatial matrix showing pre-survey and post-survey plans of subdivided landmass into contiguous plot sizes for the purpose of development planning and control. This enhances land title, deed ownership and registration. We have what could be referred to as macro and micro cadastral subdivisions. Wuse and Maitama districts in Abuja are examples of macro-cadastral layouts, which are further subdivided by the relevant survey and planning authorities into grid tiles of 15x 30m or 30 x 30m plots. The inherent advantages of a good cadastral layout include easy identification of plots, controlled allocation, litigation-free registration, sustainable land information management system, accessibility to all parcels and it provides basis and framework for urban quality assessment and a development control system.

According to Doebele (1985), urban land is among the most valuable economic and social resources of any nation. It cannot be properly managed without adequate system for measurement and recording of the boundaries of parcels, and registration of legal rights related to each parcel. Establishment of a good cadastral layout system even in the re-design and review of emerging slums and squatter settlements in our cities is imperative to positive response to the demand for quality life and environment in Minna in particular and Nigeria in general. In the new world order, a good cadastral layout is considered as part of the basic infrastructure in much the same way roads, electricity, and pipe borne water, etc. It is an essential element that expedites virtually all other forms of development (Larsson, 1991).

Ahmed B. (2019), This research is about the demarcation and survey of part of GDP/28 layout for the purpose of producing little deeds plan (TDPs), for the preparation of certificate of occupancy (C of C) over all individual plots to be allocated to individuals. The project site is located along Ashaka road within Gombe metropolis. The survey was carried out using SOKIA set 510 total station and its accessories with 50m steel tape. The layout Survey was carried out using bearing and distance method measured with Total Station and steel tape respectively, beacons were emplaced at the corner of each parcel and the final survey was carried out. The plan was drawn to a scale 1:2500.

According to Ojigi M.L, (2020).cadastral layout review and re-design of jikpan area of minna using high resolution imagery and land information system. The existing buildings and road patterns in Jikpan area of Bosso, Minna do not present any definite cadastral layout quadrants or pattern for accessibility and convenience in

social service provisions expected of an urban neighborhood. Jikpan area, lying adjacent to the Bosso Campus of Federal University of Technology (FUT), Minna is a valuable economic and social resource of Bosso Township, which can only be properly managed with a well-structured 'grid-tile' cadastral layout system for the measurement and recording of the boundaries of parcels, and registration of legal rights related to each parcel. The establishment of a functional cadastral layout to replace the current haphazard squatter units in the area is a basic infrastructure necessary for its gradual upgrade into urban layout with good roads, electricity and pipe-borne water grids, which are essential elements in the re-building and restoration of urban ingredients in the environment. This study attempted the use of 2006 Quick-Bird satellite image (0.6m spatial resolution) of the area and land information system to create a grid-tile layout overlay on the existing parcel units. The existing buildings and roads patterns in the area were captured and numbered, and a re-designed cadastral layout overplayed. The re-design, made up of 51 layout tiles (JK1-JK51) cut across many buildings; hence appreciable demolitions in the affected sections would be required to up-grade the area. A total of 861 standard plots (30.48 m x 15.24m) were estimated for the area with full benefit of land revenue from taxation using a Land Information System (LIS). A systematic, gradual and participatory upgrade programme in order to reduce the economic burden of the affected community is recommended for the study area, starting with a well-defined cadastral layout, and gradual re-building of an urban neighborhood, which will help in cementing the urban texture of FUT Campus with Bosso Low-cost Housing Extension.

Statement of Problem

The major problem that prompted this research is inadequacy in automated survey plan in ministries of Lands and Survey, Urban Development Board and other Parastatals in almost all the state of the Federation.

Project Location

The location of the project is at Makama new extension (S31), Bauchi local Government Area of Bauchi State, Nigeria. The project area is Covered by the following longitudes and latitude: 09°50'16.78"E, 10°17'11.23"N,; 09°50'23.10"E, 10°17'2.94"N,; 09°50'13.35"E, 10°17'0.52"N,; 09°50'8.10"E, 10°17'9.43"N. The designed layout covers an approximate area of about 26.91Ha (see appendix I). An

enclosed of 6 blocks containing a total of 96 plots marked and delineated with 154 property beacons at the corners of various respective plots is presented in this project.

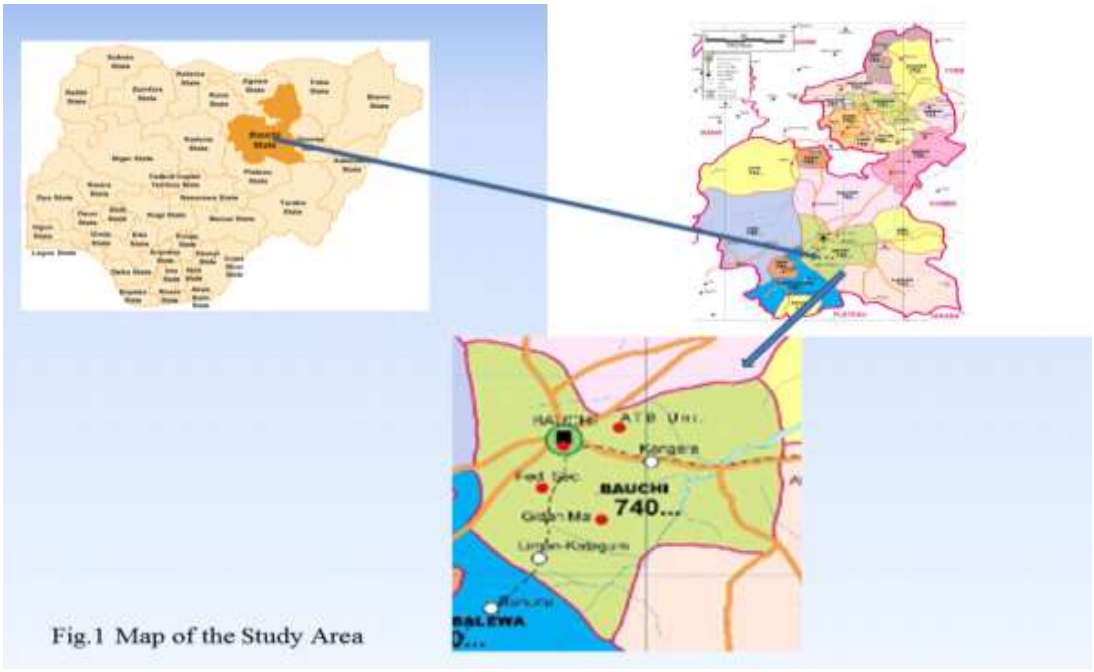

Fig.1 Map of the Study Area

Aim and Objectives

The project is aimed at production of automated survey plan and database for future development. This was achieved through the following objectives:

i. To transfer the design plan to the ground
ii. To demarcate each plot corner with a numbered property beacon accordingly.
iii. To carry out a survey for the purpose of determining the final coordinate of each beacon.
iv. To compute the area of each plot and produce a layout survey plan
v. To produce automated survey plan of the entire area
vi. To generate database of the parcel property.

Scope of work

The scope of this project includes: Connection survey, setting out and parcel Monumentation, final layout Survey, data adjustment and analysis, plotting and map embellishment.

Project Order and Accuracy

The project is classified as (3rd) third order cadastral survey, hence the methodology and instrumentation adopted are appropriate and in conformity with SURCON specification for Large Scale Cadastral and Engineering Surveys. There was a minimal difference between the design and the layout survey plan within an accuracy of 1:3000.

Table 1.1: Computation of Linear Accuracy

	BEACON NUMBER	EASTING (m)	NORTHING (m)	ΔE	ΔN
Starting	BA22564	591952.361	1137385.650		
Closing	BA22564	591952.137	1137385.928	0.224	0.278

The total traverse length was 1071.144 m

Where, ΔN= is coordinate misclosure in Northings = 0.278

ΔE= is coordinate misclosure in Easthings = 0.224

Therefore, the fractional closure (FC) of the traverse is given by:-

$FC = \sqrt{(\Delta E^2 + \Delta N^2)} = \sqrt{(0.224^2 + 0.278^2)}$

$= \sqrt{0.12746}$

Linear accuracy = $\frac{1}{\frac{\sqrt{\Delta E^2+\Delta N^2}}{\sum L}}$ =

$\frac{1}{\frac{\sqrt{0.12746}}{1071.144}} = 1{:}3000.274 \approx 1{:}3{,}000$

A Linear accuracy obtained was 1: 3000 which satisfies the requirements of the accuracy of third order controls.

materials and methods

This research was accomplished with a collective use of survey instruments, computer system hardware and software application. The instruments employed for the execution of this work include Sokkia SET 510 Total Station and accessories, such as reflector, tripod, steel band, ranging poles and handheld GPS. The instruments were properly tested, checked and confirm to be functioning optimally before it was employed to acquire the needed data. The hardware system components used in this project include: A Computer system Acer Aspire Dual Laptop 2.00GHz, An Intel Pentium quad core, 3.1GHz Processor, 4GB RAM 500GB HDD and HP A3 Colour Printer. The following software were employed for

the implementation of this project were: Sokkia link, AutoCAD 2015 Application Software and Microsoft Word and MS Excel Application Software

Field Research Planning

The success or failure of any survey job depends largely on level of the execution of planning. Planning is a pre-requisite and indispensable tool to the success of any survey project. In view of its importance, all items and resources needed for the successful execution of this project, was well planned for and put in place prior to the commencement of the project. The planning involved two major stages, namely office planning and field reconnaissance.

Office Planning

Prior to project site inspection, search for relevant information and data such as the map sheet, co-ordinates of existing controls to be used for the connection was carried out. The instruments used were arranged and booked against the date planned for the job.

Field Reconnaissance

A visit to the site was conducted for thorough inspection of the entire extent covered in this project. The set of controls used for the survey were traced, checked and confirmed to be in-situ. In the course of the preliminary inspection, feasible locations for the required control points established were also considered.

Field Procedure

The field procedure for the execution of this project was designed systematically and followed logically as follows.

Connection Survey

The survey was tied to the following sets of 2nd order controls located at the vicinity of the project site. The coordinates of reference controls are shown in the table below.

Table 1: CONTROL POINTS USED FOR CONNECTION

BEACON NO.	EASTING (m)	NORTHING (m)	HEIGHT (m)
BA24565	591952.361	1137385.701	637.74
BA24568	591936.352	1137468.311	633.766

BA24597	591882.462	1137352.683	635.321

The sets of control points used for the connection of this project was properly checked and confirmed to be in their original spatial location as were originally established, in accordance with survey rules and regulations. This check was conducted on three control points by re-observing them using Total Station. The primary purpose of this check is to ascertain the suitability and reliability of these controls before any survey should be tied to them. The check carried having satisfied the conditions of in-situ as stipulated by the survey profession were used for the connection for this project, as illustrated below.

BEARING AND DISTANCE FROM GIVEN COORDINATES

Distance BA24568 to BA24565

$= \sqrt{(N_{BA24565} - N_{BA24568})^2 + (E_{BA24565} - E_{BA24568})^2}$

$= \sqrt{(952.361 - 936.352)^2 + (385.701 - 468.311)^2}$

$= \sqrt{(-16.009)^2 + (82.61)^2} = 84.15m$

Bearing BA24568 to BA24565 $= \text{Tan}^{-1}\frac{\Delta E}{\Delta N}$

$= \text{Tan}^{-1}\frac{-16.009}{82.61}$

$= 349^{o}\ 01'\ 58''$

Distance BA24568 to BA24597

$= \sqrt{(N_{BA24597} - N_{BA24568})^2 + (E_{BA24597} - E_{BA24568})^2}$

$= \sqrt{(352.683-468.311)^2 + (882.462-936.352)^2}$

$= \sqrt{(-69.90)^2 + (-33.02)^2} = 77.30m$

Bearing BA24568 to BA24597 $= \text{Tan}^{-1}\frac{\Delta E}{\Delta N}$

$= \text{Tan}^{-1}\frac{(69.90)}{(-33.02)}$

$= 244^{o}\ 42'\ 58''$

INCLUDED ANGLE =BACKWARD BEARING – FORWARD BEARING

$= 349^{o}\ 01'\ 58'' - 244^{o}\ 42'\ 58''$

$= 104^{O}\ 19'\ 00''$

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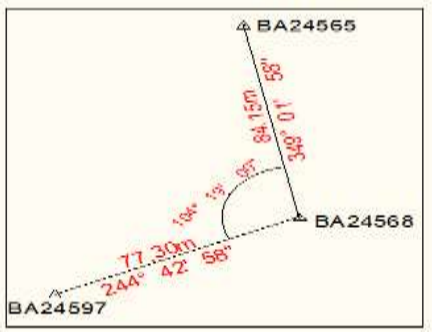


COMPUTED ANGLE AND DISTANCES

Distance BA24568 to BA24565 = 84.15m

Distance BA24568 to BA24597 = 77.30m

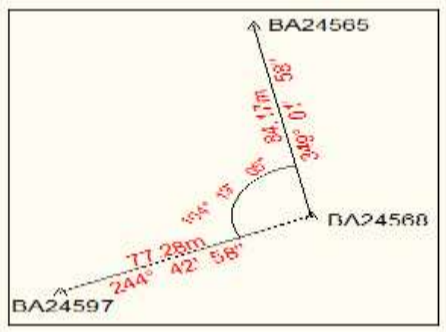
Included Angle = 104° 19'00"

OBSERVED ANGLE AND DISTANCES

Distance BA24568 to BA24565 = 84.17m

Distance BA24568 to BA24597 = 77.28m

Included Angle = 104° 19'05"



Angular Discrepancy = Computed Included Angle - Observed Included Angle

= 104° 19'05"— 104° 19'00"

= 00 °00'05"

Linear Discrepancy = Observed Distance - Computed Distance

BA24568 to BA24565 = 84.15 - 84.17 = 0.02m

BA24568 to BA24597 = 77.30 – 77.28 = 0.02m

The allowable Angular Discrepancy of measurement is 0°0'30" and the allowable linear discrepancy of measurement is 0.30m. Therefore, comparing the Angular

and Linear Discrepancy of the in-situ check with the Allowable Angular and Linear discrepancy proved that the controls are in their actual position.

Table 2: Difference between given and observed co-ordinates of controls used for connection.

Control	Co-ordinates of Existing Controls used			Observed Co-ordinates of Existing			Difference		
	Easting (m)	Northing (m)	Height (m)	Easting (m)	Northing (m)	Height (m)	dE	dN	dH
BA22564	591952.361	1137385.65	601.623	591952.354	1137385.653	601.633	0.007	-0.003	-0.01
BA22575	591936.352	1137468.311	601.35	591936.358	1137468.312	601.345	-0.006	-0.001	0.005
BA22586	591882.462	1137352.683	602.011	591882.468	1137352.685	602.014	-0.006	-0.002	-0.003

The difference between the given and observed co-ordinates is less than 30" and 0.30m which confirmed that the controls used for the connection of this project were in-situ

Survey and Monumentation

The corners of blocks and plots within the blocks were properly determined using the designed dimension in form of bearing and distances and correctly defined and demarcated on ground by property beacons conspicuously planted in line with SURCON Specification. The pillars are casted in the proportion of ratio of 3:2:1 of Cement, Sand and Gravel mixture with the approved dimension of 18cm x18cm top, 12.5cm x 12.5cm bottom, 84cm long, buried 76cm below ground surface, 8cm projected above ground level, inscribed centrally with 12 mm iron rod spike to defined the exact point of the corner.

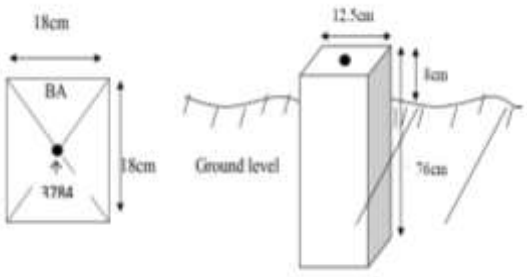


Fig 1: Property beacon

The monumented stations were numbered with a simple naming alphanumerical nomenclature abbreviated as BA followed by the serial number and the order of survey. The lettering were inscribed on top of each pillar cap, showing the beacon identification number and arrow indicating the direction of the next beacon point.

Final Property beacon survey

The emplaced corner beacons were re-observed with Total Station to determine their spatial data for documentation, area computation and the final plotting of the layout survey plan of the area. While carrying out this execise, the following precaution were taken.

- The energy level of the batteries was checked and confirmed to be strong enough to last for the period projected for observation of each day.
- The instrument was properly leveled and all necessary setting done prior the observation.
- The telescope was transited for proper initialization and confirmed that all the reading scales were properly initialized for correct readings.
- In the course of taking readings, the battery is not removed or replaced to avoid loss of memory and data already acquired.
- The power is turned off before the battery was removed after every session of observations.
- The reflector was properly leveled and its verticality ensured before observation is taken
- The instrument was leveled and centered on the instrument station prior to taking observation

Data processing

This process involved data download and adjustment and map embellishment to a suitable scale for presentation.

Data download and adjustment

After the observations, the store data was downloaded to the computer from the total station and processed via Sokkia link software. The X Y Z coordinate was then converted and saved in to Microsoft excel file format to facilitate AutoCAD script writing.

Plotting and Map embellishment

The adjusted data were plotted in AutoCAD 2015 application environment and was exported to ArcGIS for Database creation. The final plan design were prepared in map data frame with the appropriate map items/components e.g. the neat line, Legend, North Arrow, Scale, to produce the final Layout Survey plan and the automated survey plan.

Project Costing and Evaluation

The projected amount of money for this research was based on the personnel, materials, equipment, transportation and other contingences.

Table 3: Project Costing

Cost Implication of Layout Survey			
S/N	**Project Component**	**Direct Cost Parameter**	Cost Estimates(N)
1.	Reconnaissance 1 day	1 - Pupil Surveyor @ N9,814.20/day 1 - Asst. Technical Officer @ N4,673.43/ day 2 - Survey attendants @ N2,039.33 each/ day Vehicle Lease @ N19,826.67/ day Basic Equipment (Folf 685, Steel tape,GPS etc.@ N25,000/day	**19,814.20** **14,673.43** **15,000.00** **19,826.67** **25,000.00**
		Sub-Total (A)	N94,314.30
2.	Pegging/ In-Situ Test 2 days	1 - Pupil Surveyor @ N9,814.20/day 1 - Asst. Technical Officer @ N4,673.43/ day 2 - Survey attendants @ N2,039.33 each/ day Vehicle Lease @ 19,826.67/ day Basic Equipment (Folf 685, Steel tape etc.@ N25,000/day	**19,628.40** **15,346.86** **12,157.32** **39,653.34** **50,000.00**
		Sub-Total (B)	N136,785.92
3.	Monumentation & Numbering 4 days	1 Pupil Surveyor @ N9,814.20/day 1 Technical Officer @ N6,542.80/day 1 Asst. Technical Officer @ N4,673.43/ day 2 Survey attendants @ N2,039.33 each/ day 93 Beacons pre- casting & planting @ N750.50 each Basic Equipment (Hand-held GPS receiver, Steel tape etc @ N15,000.00/ day) Vehicle Lease @ N19,826.67/ day	**39,256.80** **26,171.20** **18,693.72** **16,314.64** **69,796.50** **60,000.00** **79,306.68**
		Sub-Total (C)	N309,539.54
4	Data Acquisition 3 days	1 Pupil Surveyor @ N9,814.20/day 1 Technical Officer @ N6,542.80/day 1 Asst.Technical Officer @ N4,673.43/day 2 Survey attendants @ N2,039.33 each/ day	**29,442.60** **19,628.40** **14,020.29** **12,235.98**
		Sub-Total (D)	N89,955.67
5.	Data processing 2 days	1 Pupil Surveyor @ N9,814.20/day 1 Technical Officer @ N6,542.80/day Basic Equipment (Computer + Accessories) @ N10,000/ day	**19,628.40** **13,085.60** **20,000.00**

		Sub-Total (E)	N52,714.00
6.	Plotting/ Plan Preparation 2 days	1 Pupil Surveyor @ N9,814.20/day 1 Technical Officer (CAD) @ N7,542.80/ day Basic Equipment (computer +Accessories + Plotter) @ N21,814.20/day	**19,628.40** **15,085.60** **43,628.40**
		Sub-Total (F)	N76,342.40
7.	Project Report 2 days	1 No Pupil Surveyor N9,814.20/day 1 No Confidential Secretary @ N6,524.80/ day Basic Equipment (Computer + Accessories) @ N10,000/day Consumables (Lump sum @ N6,000	**19,628.40** **13,049.60** **20,000.00** **6,000.00**
		Sub-Total (G)	N58,678.00
		SUB TOTAL (A+B+C+D+E+F+G)	N818,329.83
8.	Mob/Demob	5% of Total Cost of Project	**38,916.49**
9.	Contingencies	5% of Total Cost of Project	**38,916.49**
		GRAND TOTAL	N896,162.81

The total cost of the Layout Survey was Eight Hundred and Ninety-Six Thousand, One Hundred and Sixty Two Naira, Eighty-One kobo only

Result Presentation

The list of the coordinates of each parcel, beacon number and their respective area is tabulated below in table 4. The coordinates define the boundary of each parcel of land. The beacon number is the nomenclature of each beacon and it was written on top of each beacon accordingly. The total area of each plot was computed. The survey plan was drawn at a scale of 1:2500 as indicated in Figure 1. The plan shows the extent of each parcel of land, parcel number, beacon number and the coordinate of each beacon. The automated survey plan was produced and attribute information was linked to the spatial information as showed on Figure 2. The sample of the database produced is showed in Figure 3. This database consist of the name of the owner of each parcel, beacon number, coordinates of each beacon and the total area of each plot in the survey plan. Due to lack of clarity of result, the survey plan was printed in A3 paper, scanned and inserted in this research in Figure 5.

Table 4: Measured Coordinates

LIST OF COORDINATE OF EACH PARCEL,BEACON NUMBER AND THEIR AREA

		COORDINATES		
PARCEL NUMBER	BEACON NUMBER	EASTING (m)	NORTHING (m)	AREA (m^2)
1	BA 10	591597.404	1137230.336	601.371
	BA 37	591625.102	1137241.969	
	BA 36	591634.035	1137224.018	

	BA 11	591606.343	1137212.371	
2	BA 11	591606.343	1137212.371	600.317
	BA 36	591634.035	1137224.018	
	BA 35	591642.959	1137206.084	
	BA 12	591615.261	1137194.452	
3	BA 12	591615.261	1137194.452	600.538
	BA 35	591642.959	1137206.084	
	BA 34	591651.883	1137188.152	
	BA 13	591624.185	1137176.518	
4	BA 13	591624.185	1137176.518	902.29
	BA 34	591651.883	1137188.152	
	BA 33	591665.263	1137161.264	
	BA 14	591637.565	1137149.631	
5	BA 14	591637.565	1137149.631	902.756
	BA 33	591665.263	1137161.264	
	BA 32	591678.678	1137134.306	
	BA 15	591650.98	1137122.673	
6	BA 15	591650.98	1137122.673	901.678
	BA 32	591678.678	1137134.306	
	BA 31	591692.073	1137107.442	
	BA 16	591664.395	1137095.715	

Figure 2: Survey plan of the study area

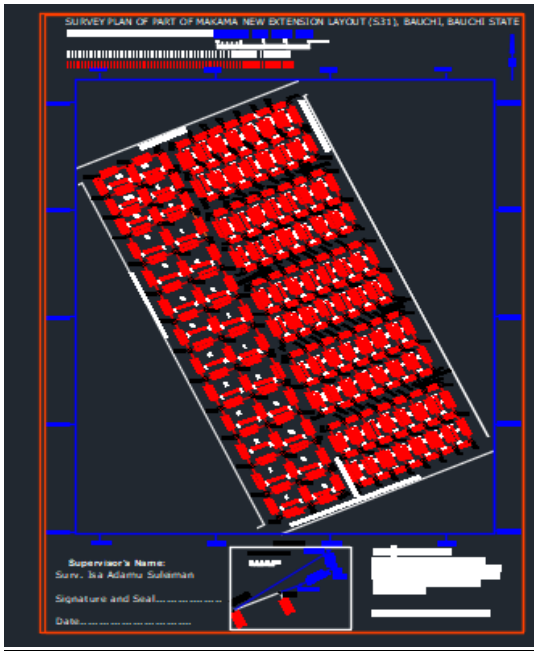


Figure 3: Automated Survey plan of the study area

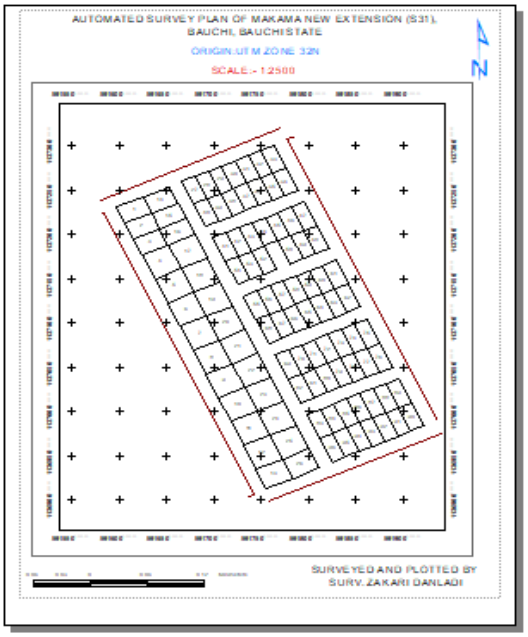


Figure 4: Survey plan of the study area

PARCELS

FID	Shape *	PARCEL_NO	PARCEL_OWN	BEACON_NO	PARCELAREA
0	Polygon	1	MUHMUD MUSA ALI	BA/SC/10, BA/SC/37,BA/SC/36,BA/SC/11	601.408
1	Polygon	2	SHEHU HARUNA	BA/SC/11, BA/SC/36,BA/SC/35,BA/SC/12	600.357
2	Polygon	3	ADAMU ABUBAKAR	BA/SC/12, BA/SC/35,BA/SC/34,BA/SC/13	600.568
3	Polygon	4	MUSTAPHA ISAH ARDO	BA/SC/13, BA/SC/34,BA/SC/33,BA/SC/14	900.434
4	Polygon	5	ENGR. USMAN ABUBAKAR	BA/SC/14, BA/SC/33,BA/SC/32,BA/SC/15	902.817
5	Polygon	6	HAJIYA, MARYAM BELLO	BA/SC/15, BA/SC/32,BA/SC/31,BA/SC/16	901.739
6	Polygon	7	SADIQ MARAFAN SADE	BA/SC/16, BA/SC/31,BA/SC/30,BA/SC/17	899.046
7	Polygon	8	ADAMU MAKAMA PINDIGA	BA/SC/17, BA/SC/30,BA/SC/12,BA/SC/12	904.769
8	Polygon	9	DANLAMI GARBA HARUNA	BA/SC/18, BA/SC/29,BA/SC/28,BA/SC/19	901.014
9	Polygon	10	ZUBEIRU ALIYU FARAU	BA/SC/19, BA/SC/28,BA/SC/27,BA/SC/20	895.165
10	Polygon	11	AISHATU KABIRU	BA/SC/20, BA/SC/27,BA/SC/26,BA/SC/21	912.356
11	Polygon	12	ZAKARIYYA BELLO	BA/SC/21, BA/SC/26,BA/SC/25,BA/SC/22	883.976
12	Polygon	13	ALI BABABA SANI	BA/SC/22, BA/SC/25,BA/SC/24,BA/SC/23	733.891
13	Polygon	14	SAGIR SHUAIBU UMAR	BA/SC/37, BA/SC/38,BA/SC/39,BA/SC/36	601.979
14	Polygon	15	DANLAMI UZAIRU	BA/SC/36, BA/SC/39,BA/SC/40,BA/SC/35	601.379
15	Polygon	16	ARC IDRIS ISA BAWA	BA/SC/34, BA/SC/41,BA/SC/42,BA/SC/33	601.358
16	Polygon	17	NAFIU ADAMU	BA/SC/42,BA/SC/ 33,BA/SC/34,BA/SC/41	901.62
17	Polygon	18	TIJJANI ABUBAKAR MANU	BA/SC/34, BA/SC/41,BA/SC/42,BA/SC/33	904.024
18	Polygon	19	ABDULRAHMAN HASSAN	BA 90, BA 91, BA 92, BA 93	902.227
19	Polygon	20	ALH. TANIMU ADO	BA 82, BA 81, BA 86, BA 85	899.535
20	Polygon	21	NAZURU ZAIDU	BA 65, BA 64, BA 71, BA 70	905.976
21	Polygon	22	HASHIM BARAYA	BA 81, BA 80, BA 87, BA 86	902.216
22	Polygon	23	LADEN GARBA SANI	BA 36, BA 39, BA 40, BA 35	901.161
23	Polygon	24	HUSSAINI UBANDOMA GARKI	BA 63, BA 62, BA 73, BA 72	905.829
24	Polygon	25	dauda rayyanu	BA 35, BA 40, BA 41, BA 34	888.256
25	Polygon	26	MUHAMMAD ISAH AHMED	BA 36, BA 39, BA 40, BA 35	728.774
26	Polygon	27	DURBI BABAYO LAFIYA	BA 37, BA 38, BA 39, BA 36	421.86
27	Polygon	28	MAINA SARDAUNA KIRAM	BA 52, BA 53, BA 66, BA 67	421.377
28	Polygon	29	SHEHU ZAILANI	BA 53, BA 54, BA 65, BA 66	424.949
29	Polygon	30	MUSA GARBA KARMA	BA 54, BA 55, BA 64, BA 65	422.385
30	Polygon	31	YAHAYA BILYA FATIU	BA 55, BA 56, BA 63, BA 64	422.791
31	Polygon	32	IBRAHIM NASIRU	BA 56, BA 57, BA 62, BA 63	422.427
32	Polygon	33	YUSUF ABDULKARIM	BA 57, BA 58, BA 61, BA 62	420.535
33	Polygon	34	ZAKARI MUHD YUSF	BA 58, BA 59, BA 60, BA 61	423.181
34	Polygon	35	MUHMUD MUSA GARBA	BA 61, BA 60, BA 75, BA 74	422.187
35	Polygon	36	USMAN ALIYU	BA 62, BA 61, BA 74, BA 73	422.82
36	Polygon	37	HABIBU NURA ALI	BA 63, BA 62, BA 73, BA 72	422.82
37	Polygon	38	SUNUSI ALIYU UMAR	BA 63, BA 62, BA 73, BA 72	422.82
38	Polygon	39	SANI IBRAHIM	BA 64, BA 63, BA 72, BA 71	422.82

0 (0 out of 337 Selected)

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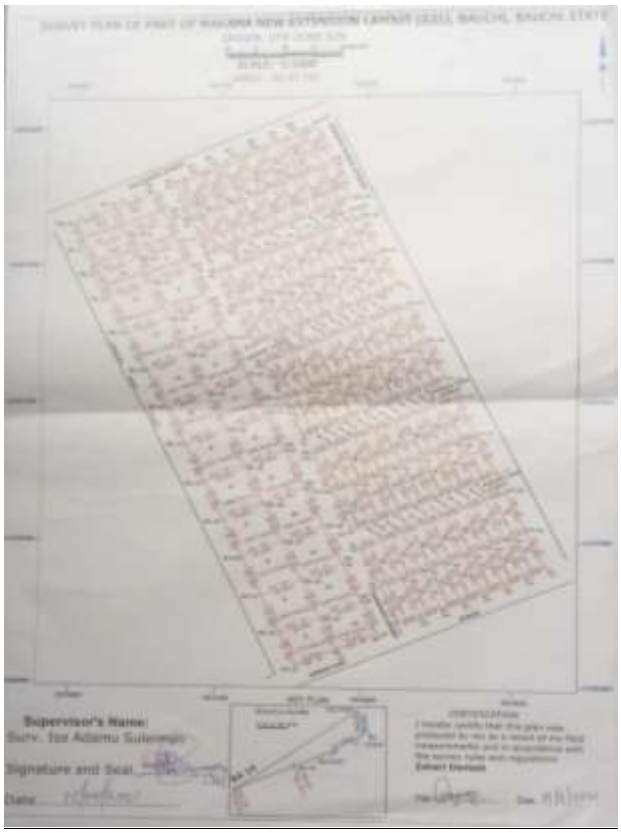
Figure 5: Survey Plan



Conclusion

The approved layout design was set to its ground location and survey layout plan was produced showing the existing plots demarcated with their respective property beacons. The automated survey plan and database were produced. The research has shed lights and further demonstrated the relevance of automation survey means of layout survey for emergency situation where such work are seriously demanded on time without compromising standard.

Recommendations

From the foregoing, it can therefore be recommended that;

Automated means of survey operation is strongly recommended to easily facilitates survey work and reduce time consumption on site.

This research work is recommended for adoption to all ministry of Lands and Housing and Urban Development Board of both State and Federal Government.

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