Acquisition and Processing of Topographic Data in Order to Develop a Topographic Map Delimiting the University Cities (Case of the University of Lubumbashi, DRC)

Kabasele Kazadi Chr[1], Mbuya Mukombo Jr[2], Mwamba Kanunga JP[3]

[1, 2]Polytechnic FacultyDepartment of Mines, University of Lubumbashi, PO. Box 1825 Lubumbashi, DR Congo

Abstract: ***This study consists of developing a topographical map delimiting the University Cités de Lubumbashi, Democratic Republic of Congo. For this, we examined the location of the extent of the land in question, we took into account the invasion of the private within the concession as well as see what type of Topographic material used, adapted to the state of this terrain, to achieve a good acquisition of Topographic data, which are the essential elements for drawing up the map. A comparison of the current area to the initial area of this land, allowed us to see the impact caused by the invasions of the private within this concession which led to a considerable loss of hectares known to the University. . To achieve our objectives, we relied on certain data (the coordinates of different points), obtained by topographic ground surveys carried out in the field, with the Total Station (TopconDs: 103 A) and DGPS (Topcon) as equipment, as well as the parametric analysis of these data and the use of Google Earth and Arc GIS 10.4 as topographic data processing software, which the rest of the work will be responsible for clarifying, revealed that following the results obtained, the University of Lubumbashi, its current area of its concession has a perimeter of 6.84 km with an area of 1.49 km2 equivalent to 149 hectares. However, it has been three decades since the Cités Universitaires concession occupied an area of 557.90 hectares. Finally, we have made some suggestions for a rational management and conservation of this concession of University Cities.***

Keywords: Acquisition, Processing, Topographic map, GIS, Geomatics

1. Introduction

Topometry is an important division of geomatics. Geomatics, also called geodetic sciences, is the discipline that encompasses all methods of acquiring and processing the physical dimensions of the Earth [1]. This geomatics is used to: Map the Earth, above the ground as well as at the bottom of the sea; Draw up air, land and sea navigation maps; Establish the limits of both public and private property (case of our study) ; Create databases relating to natural resources and land use; Determine the shape and dimensions of the Earth as well as to study gravity and the magnetic field; Draw maps of our natural satellite and, possibly, of other planets. For this study, it will help us in the acquisition of data and their processing in order to draw up the map of the University Cities. The data acquisition will go through a Topographic survey, which will aim to collect existing data in the field for their transcription, to scale, on plan or on map. Two joint operations are necessary to be able to locate each point along three X axes; Y (plane) and Z (altitude): the planimetric survey and the altimetric survey. There are different ways of acquiring this data. Either the operations are carried out jointly with two different measuring devices (x; y + z), or the lifting operations are carried out using a single measuring device (x; y; z): it consists of putting a measuring device on a chosen station point. [2]. Regardless of the type of data to be processed and the way in which the processing is carried out, it is essential to always proceed in the same way, in order not to prejudice the quality of these data. [3] The field of Kassapa granted to the University of Lubumbashi in the years 1958 [4], is currently undergoing a massive invasion of the private sector. A risk looms in the coming years of losing this concession through this gravity as well as the acceleration of this invasion observed in its land. For this, it is a question for us of working on the project for the acquisition and processing of Topographic data in order to develop a Topographic map delimiting the University Cities of the University of Lubumbashi. The main goal of this project is the implementation of a topographical map of the university housing estates to facilitate the good management and conservation of the boundaries of this concession, in order to remedy the problems of invasion of the private sector in the concession of the University of Lubumbashi. The realization of this project will start by, the acquisition of data collected in the field using the DS Total Station: 103 A and differential GPS (Topcon) as equipment. These collected data, which are Topographic data, will be defined in our project as all the coordinates of the points located on the ground. These data will be processed in Google Earth, by the technique of the system of localization of all the points surveyed on the Terrestrial Globe, otherwise called (WGS 84: Word general system 1984) for question of compatibility of its metric units UTM (Universal Transverse Mercator) data with software (Google Earth). The processing on Google Earth will aim to obtain the polygonal of all the points surveyed on the ground. Another step will consist in using this polygonal which will be recorded in the KML file, an extension of Google Earth, presenting this polygonal in the form of digital terrain models (DTM), to facilitate further processing in the Arc geographic information system. GIS 10.4 to obtins the card.

2. Methodology and Material

2.1 Topographical data of the site

1) Geographical location

The University of Lubumbashi is located on the Kassapa road, in the Gambela district, in the municipality of Lubumbashi; in the province of Haut-Katanga, in the city of Lubumbashi, a city located in the south-east of the Democratic Republic of Congo (DRC). It has latitude 11 ° 39'57 "South and longitude 27 ° 28'36" East. It is the second city of the DRC and capital of the province of Haut-Katanga, is located in the southern growth of the country about 30 km from its southern border with Zambia. The Cité Universitaires have as geographical coordinates: Zone: 35L; Abscissa: 552999.69 East; Ordinate: 8715911.54 South; Altitude: 1291 m.

Figure 1: University Cities

2) Recognition of the terrain and identification of characteristic points

Long before proceeding with the actual survey, we must first of all make the reconnaissance of the ground in order to determine its nature. It is a question, to know if the ground is in plateure that is to say the ground is on the ground. " angle <20-25 °, less rugged or uneven; to know the obstacles on the ground; to know the atmosphere of the terrain (the temperature); the topology of the terrain (morphology of the terrain); the quality of visibility As soon as we have made the reconnaissance on the basis of the nature of the ground as well as the obstacles therein, we choose, among the different lifting procedures, a procedure which will allow us to carry out the work while avoiding complex and complicated operations. In the case of the Cités Universitaires of the University of Lubumbashi, the land is practically tilted with a very low steep slope in the north-east direction. It has a temperature of 26 ° C, concerning the morphology, the land is plateau. Then it also presents some anarchic constructions of the private houses which invade this concession, and the presence of some trees, these elements constitute an obstacle for the progress of the operations of topographic survey on the ground. Taking into account the characteristics of the terrain, the polygonation method was retained as the main method for this survey. We say main because for the survey of certain details we also resort to other survey methods. The characteristic points are in our case the corners of the concession located at the intersection of the two avenues. So it is these points that are mainly staked, apart from some particular stakes carried out in places where there is a curvature, change of direction or change of dimension of an avenue.

3) Lifting operations

a) Data acquisition

The data being specific to the site of use of the software, can be in different forms. In our case, they were fully found in the field, particularly in the concession of the University Cités Universitaires of Lubumbashi. More pragmatically, the data in our case are the set of coordinates of each point surveyed on the ground, and in which the most important will appear on the screen of the Total Station (DS: 103A) and DGPS Topcon during topographic survey. Data acquisition was facilitated by topographic ground surveys.

b) Topographic Survey with Total Station and Differential GPS

Stationing: The stationing is an operation which consists in making the main axis of the Total Station in the vertical position. For this operation the following steps are respected: The choice of the station, which must be done in such a way that we can collect as many details as possible in a single station without having to be able to do it in two or more stations; Placement of the tripod above the station point so that its plate is more or less horizontal. This is done either by lengthening or shortening the legs of the tripod; Centering above the station point and leveling the instrument platform horizontal, which causes the main axis to be vertical, i.e. above the station point. The centering operation is carried out using first: The plumb line, which will be placed over the station point by lengthening or shortening the legs of the tripod; The scaling screws, to adjust the spherical level and the level of the alidade in order to achieve the verticality of the main axis. The stationing is achieved when the bubble of the level occupies the central position when the alidade is rotated around the main axis.

Figure 2: Differential GPS (Polytechnic Topography lab / UNILU)

- Switching on the device: To switch on the Topcon Total Station Topographic device, we proceed as follows: Press the switch-on key, display the program and execute the program launch (MAGFIELD); Appear the menu, choose the tab station; Selection of the direction line point; Obligation to enter the known station point and another known point to target; Press validate, display of a menu asking the mobile operator to go to the known point to target ; After reading this known point, ask to choose an alignment point (that is to say a random point); And reading the coordinates of this point, validate and save.
- Device settings: After switching on the machine, the following elements must be defined: Definition of the datum system (WGS84); Definition of the choice on the coordinate system; in our case we have opted for the Cartesian coordinate system with the adopted units of Mercator or metric (UTM); Definition of the working area, for our case we worked in the 35L area, because the greater Katanga as a whole is in this area. Another procedure, we press on the station icon, by there we choose another icon written direction of a line, click, exit a menu, forcing us to define the station point then the first direction point, click following, forcing us to take the reflector to put on this point of direction and bubble the reflector and pressed to measure. Then move the cane to another point, by there we will read the coordinates of this point then record the direction; The registration of the coordinates of the landmark.
- Aiming at characteristic points: Aiming at a point amounts to directing the telescope of the device in the direction of the latter. The telescope essentially comprises: the eyepiece, the objective, and the reticle. First, we direct the telescope horizontally and then turn the eyepiece until the reticle appears in focus. Second, we direct the telescope towards the prism using the automatic optical sight, then we slightly block the screw of the telescope and that of the alidade, finally we place the center of the reticle on the prism using the screws reminder of the alidade and the telescope, then focus the image to get the sharpness.
- Reading angles: To be able to read on the screen of the device, Total Station or DGPS, angle readings, data is presented on the screen in digital form depending on the brand of the device.

c) Field book keeping

When a Topographer does the survey, the data collected in the field is directly entered in a notebook called a field notebook. In our case, the field notebook was electronic, as we work in planimetry, the notebook will essentially contain the values of the angles and distances measured; each time next to it, a sketch is placed showing the positions of the points surveyed in relation to each other. Then we introduce the field notebook model used as well as the various data collected in this concession, into the software. Topographic data acquisition, using ground topographic survey, was carried out over four days with a duration of 5 hours of time per day.

d) Analysis and processing of Topographic data

Data analysis

This part of the work is important because of all the data collected, we only retained the most relevant to achieve the objective, which is the production of the Topographic map delimiting the University Cities. We therefore had to imagine how how to structure the different data, while keeping in mind that to design the global Topographic map delimiting this concession of the University of Lubumbashi. It is in particular to highlight the important information in storage, by imagining a better structure for the latter, that is to say an organization which will subsequently offer a good result. Topographic data analysis is generally based on on well-established principles of Topography. The main difficulty is to apply these principles to a heterogeneous and poorly observed natural environment (insufficient density and poor distribution of observation points). [5] The related events are generally unforeseen and uncontrolled.

Type of analyzes performed

Analyzes are performed to obtain spatial and temporal information about certain variables as well as regional generalizations to establish relationships between these variables. Often relevant items are not measured directly. There are different approaches to Analysis: For example the methods: deterministic, parametric, probabilistic and stochastic. Analysis based on a deterministic approach closely follows the laws describing the physical and chemical processes; In the parametric approach, we compare Topographic data obtained in different places and at different times; The probabilistic approach proceeds to the frequency analysis of topographic variables (frequency according to their order of magnitude); In the stochastic approach, we take into account both the frequency distribution and the chronological order of events.For the framework of our study, we proceeded to a parametric analysis approach which consisted in comparing all the data collected in the field according to the different places as well as at the time of survey, given that the different lifting operations were respected in this case that of the setting up as well as that of precision parameterization of Topographic devices in order to avoid any kind of harmful influence on the internal and external quality of the data. And especially since our terrain did not present enough dangers or obstacles.

e) Data processing

Recall that initially the data received were stored in the memory of the Total Station as well as in the USB key, recorded during the Topographic ground surveys in the field. These data consisted of the coordinates of the various points surveyed in the field and they were essentially composed the various points targeted, the abscissa, the ordinate, the altitude as well as the points of the stations. Considering the distribution of the data, we must use an appropriate software offering an easy, fast and efficient possibility of entering in columns and rows. Our choice was therefore made on Excel. Topographic data processing requires two main steps: An internal check of the quality of the raw data; And external quality control. For quality control, three main points should be ensured: the data density (to ensure the production of a suitable DEM) as well as the horizontal and vertical precision of the data. Data density may not be respected when routes or overflights of the site are not performed correctly, resulting in holes between adjacent swaths or on water bodies (since water theoretically absorbs infrared radiation).

f) Data processing by GIS

The geographic information system (GIS), which is a set of geographic or topographic data management programs providing documentary, thematic or managerial restitution on a map. This system is considered to be a family containing within it several software for drawing up maps and plans, such as: Google Earth, Arc GIS, etc. Arc GIS software; which is a GIS or GIS software in its English version, widely used for the treatment of Topographic, hydrological, geological and geotechnical data, it is also used for certain mathematical operations including statistics. This software uses two programming languages namely: basic visual and piton. The interface of the Arc GIS software, it must be said here that this software consists of three components in its package each with a very specific function. These are: Arc catalog: this entity takes care of the data connection, project management and the creation of chape-files (shapefile); Arc Map: it is a component of the software that takes care of the display and management of attribute tables, it should be noted that this is the component that allows us to view the operations performed by the software; Arc Toolbox: this is the most important extension because it is the one that takes care of the processing of "data", that is to say it is the one that performs all the operations of modifications, arrangements , projections and others on the data. This extension like the first is incorporated into the interface of the previous Arc Map extension.

g) Realization of the contour map of the University Cities

Contour lines are intended to give an overview of actual relief on a map. A contour line is the intersection of the real relief with the horizontal plane of elevation given as a round dimension (usually a whole number). Their horizontal spacing depends on the slope of the terrain to be represented and the scale of the plan or map. It is after collecting the field data, they are stored in Excel, then undergo an import, from Excel to Google Earth, to obtain a polygonal, this polygonal will be saved in KML format (a digital processing model) an extension of Google.

h) Creation of the map delimiting the University Cities

This map of University Cities obtained using Topographic data collected on the ground, only gives us information on its current geolocation in relation to the city of Lubumbashi, its current area in terms of hectares which will be compared to the old area in order to have an idea of the space lost by the University of Lubumbashi As we mentioned previously during the realization of the contour map of the University Cités, after having collected the data in the field and Analyze, they were entered in Excel then imported into Google Earth, in order to stake out all the surveyed points. After that all these points are connected to obtain a polygonal which will give the shape of the figure delimiting the raised area. Then this polygonal will be saved on a ¨KML ¨ file an extension of Google Earth, this file will transform this polygonal by presenting it in the form of digital terrain mode (DTM) for compatibility of its processing in the Arc GIS software. The next step will be to run the Arc GIS software.

3. Results

3.1 Topographic data

In all four days of survey operations, for all the contour of the Cités Universitaires concession, we have parked more or less 30 times, and we have surveyed more than 825 points, for an area of 1.49 km ^ 2 which had a perimeter of 6.84 km, distributed as follows: The first day, i.e. May 30, 2019; we traveled a distance of 1533 meters, the station points were 6, with 167 points surveyed; The second day, May 02, 2019; distance covered is 1304 meters, with 7 station points, and 142 points surveyed; The third day, May 07, 2019; distance covered is 1904 meters, 11 points from stations and 210 points surveyed; The fourth day, May 10, 2019; we travelled a distance of 2040 meters, we parked 6 times and surveyed 306 points.

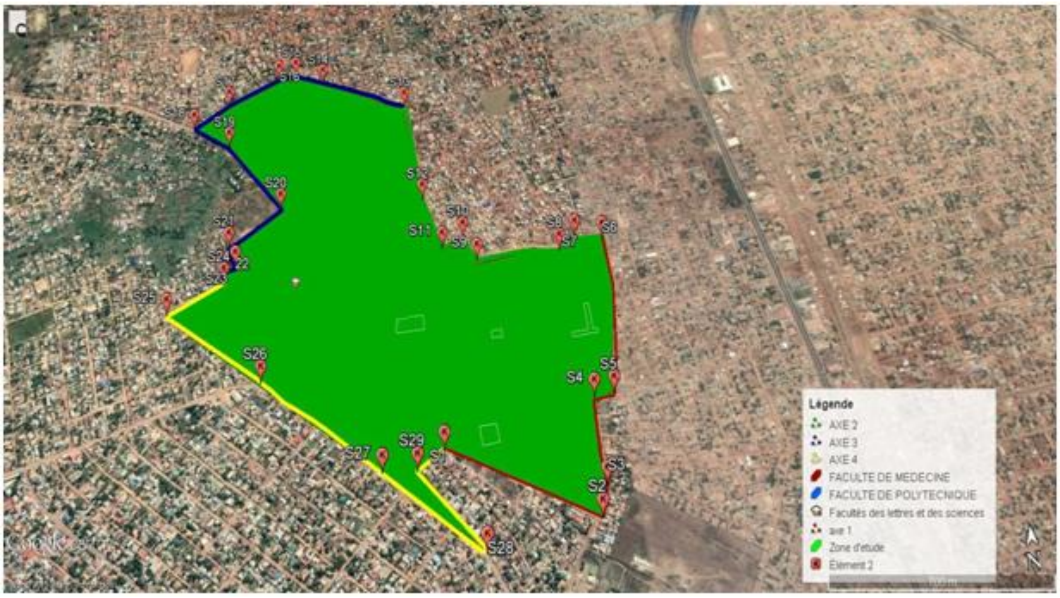


Figure 3: Raised area

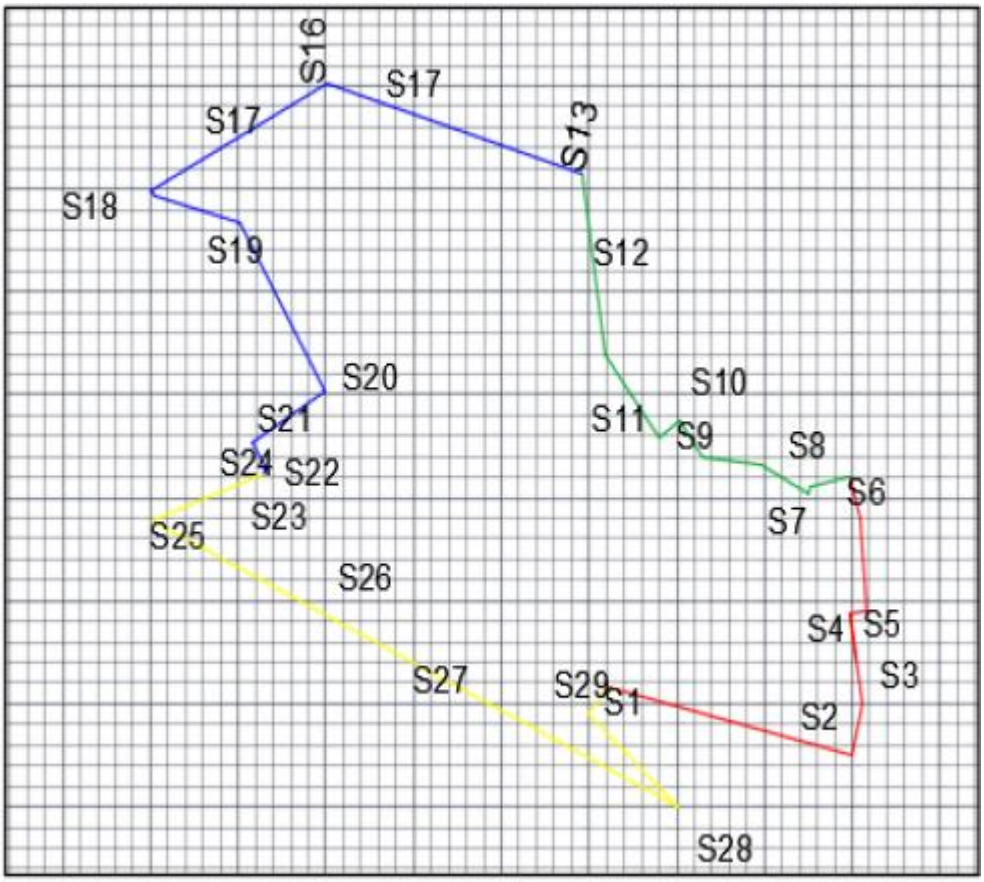


Figure 4: Sketch of the surveyed plane

Table 1: Different points of stations and distances covered first day

Location: University Cities Operator: TshangaBelangani and Ir AmedSeku					
Station	Zoned	Longitude (m) E	Latitude (m) S	Distance (m)	Sketch + observation

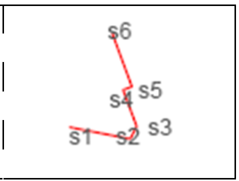
S1	35L	552455,29	8715600,96		
S2	35L	552931,20	8715326,14	546	
S3	35L	552963,68	8715416,91	90	
S4	35L	552969,23	8715682,98	260	
S5	35L	553040,93	8715693,26	70	
S6	35L	553108,01	8716259,38	567	

Table 2: Different points of stations and distances covered second day

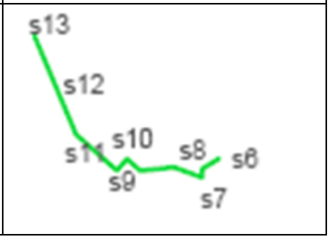
Location: University Cities Operator: TshangaBelangani and Ir AmedSeku					
Station	Zoned	Longitude (m) E	Latitude (m) S	Distance (m)	Sketch + observation
S6	35L	553108,01	8716259,38		
S7	35L	553006,00	8716273,00	101	
S8	35L	552941,46	8716228,57	80	
S9	35L	552635,00	8716236,00	302	
S10	35L	552592,58	8716330,66	96,9	
S11	35L	552512,13	8716302,37	81	
S12	35L	552455,00	8716512,01	214	
S13	35L	552415,63	8716940,66	429	

Table 3: Different points of stations and distances covered third day

Location: University Cities Operator: TshangaBelangani and Ir AmedSeku					
Station	Zoned	Longitude (m) E	Latitude (m) S	Distance (m)	Sketch + observation
S13	35L	552415,63	8716940,66		
S14	35L	552086,40	8717105,81	36	
S15	35L	551975,51	8717160,89	121	
S16	35L	551906,72	8717152,22	69,9	
S17	35L	551704,18	8717056,42	214	
S18	35L	551566,20	8716968,58	167	
S19	35L	551709,13	8716863,19	181	
S20	35L	551916,00	8716555,56	375	
S21	35L	551724,53	8716528,22	232	
S22	35L	551751,68	8716346,83	89,9	
S23	35L	551702,93	8716333,94	49	
S24	35L	551711,99	8716289,18	45	

Table 4: Different stations and distances covered fourth day

Location: University Cities Operator: TshangaBelangani and Ir AmedSeku					
Station	Zoned	Longitude (m) E	Latitude (m) S	Distance (m)	Sketch + observation
S24	35L	551711,99	8716289,18		
S25	35L	551512,10	8716201,02	218	
S26	35L	551852,31	8715909,83	449	
S27	35L	552249,27	8715560,37	530	
S28	35L	552559,66	8715284,98	412	
S29	35L	552363,76	8715548,55	325	
S30	35L	552456,77	8715601,66	106	

International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Table 5: Topographic data collected

N°	Point de Stationnement	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude (m)	N°	Point de Stationnement	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude (m)
1	P 01	0,00	552914	8715327	1292.00	31		128	553381.39	8715127.88	1287.68
2		1	552921	8715322	1292.00	32		129	553399.88	8715119.53	1287.33
3		100	552914,85	8715322,11	1293.62	33		130	553400.04	8715120.29	1287.34
4		101	552920,28	8715318,24	1293.74	34		131	552936.81	8715366.62	1294.08
5		102	552953,46	8715310,54	1293.60	35		132	552949.05	8715382.41	1293.96
6		103	552972,77	8715301,86	1293.43	36		133	552949.05	8715382.38	1293.96
7		104	552992,12	8715294,03	1293.32	37		134	552964.96	8715408.38	1294.17
8		105	553010,79	8715285,41	1293.20	38		135	552977.04	8715425.82	1294.17
9		106	55302406	8715280,16	1292.99	39		136	552974.96	8715426.81	1294.29
10		107	553035,69	8715274,62	1292.98	40		137	552937.75	8715329.30	1293.82
11		108	553047,85	8715269,46	1292.84	41		138	552937.73	8715329.27	1291.82
12		109	553061,12	8715264,39	1292.67	42		139	552962.12	8715332.58	1291.58
13		110	553074,18	8715258,51	1292.54	43		140	552981.23	8715337.67	1291.60
14		111	553092,31	8715251,34	1292.26	44		141	553004.46	8715340.86	1291.36
15		112	553107,56	8715243,98	1292.03	45	P 02	142	552963.25	8715404.06	1291.36
16	P 02	113	553107,54	8715244,01	1292.03	46		143	552979.86	8715437.56	1291.19
17		114	553131,74	8715234,04	1291.53	47		144	552993.71	8715464.14	1290.80
18		115	553156,07	8715223.22	1291.23	48		145	553005.32	8715484.27	1290.73
19		116	553156,08	8715223.21	1291.24	49		146	553016.34	8715503.11	1290.50
20		117	553168,86	8715217.79	1291.06	50		147	553029.85	8715526.70	1290.37
21		118	553187.62	8715210.02	1290.79	51		148	553046.51	8715554.10	1290.11
22		119	553206.65	8715203.03	1290.48	52		149	553060.13	8715580.86	1289.72
23		120	553230.27	8715193.62	1290.11	53		150	553031.98	8715551.25	1290.16
24		121	553257.28	8715181.04	1289.68	54		151	553041.73	8715544.23	1290.09
25		122	553279.72	8715170.54	1289.32	55		152	552921.68	8715340.34	1292.02
26		123	553301.95	8715161.39	1288.94	56		153	552921.61	8715340.32	1292.02
27		124	553301.97	8715161.42	1288.94	57		154	552936.41	8715373.05	1292.03
28		125	553325.92	8715151.16	1288.42	58		155	552948.99	8715399.62	1291.94
29		126	553346.86	8715142.55	1288.29	59		156	552949.00	8715400.05	1291.93
30		127	553364.90	8715136.08	1287.84	60		157	552925.21	8715348.26	1291.25

Table 6: Topographic data collected

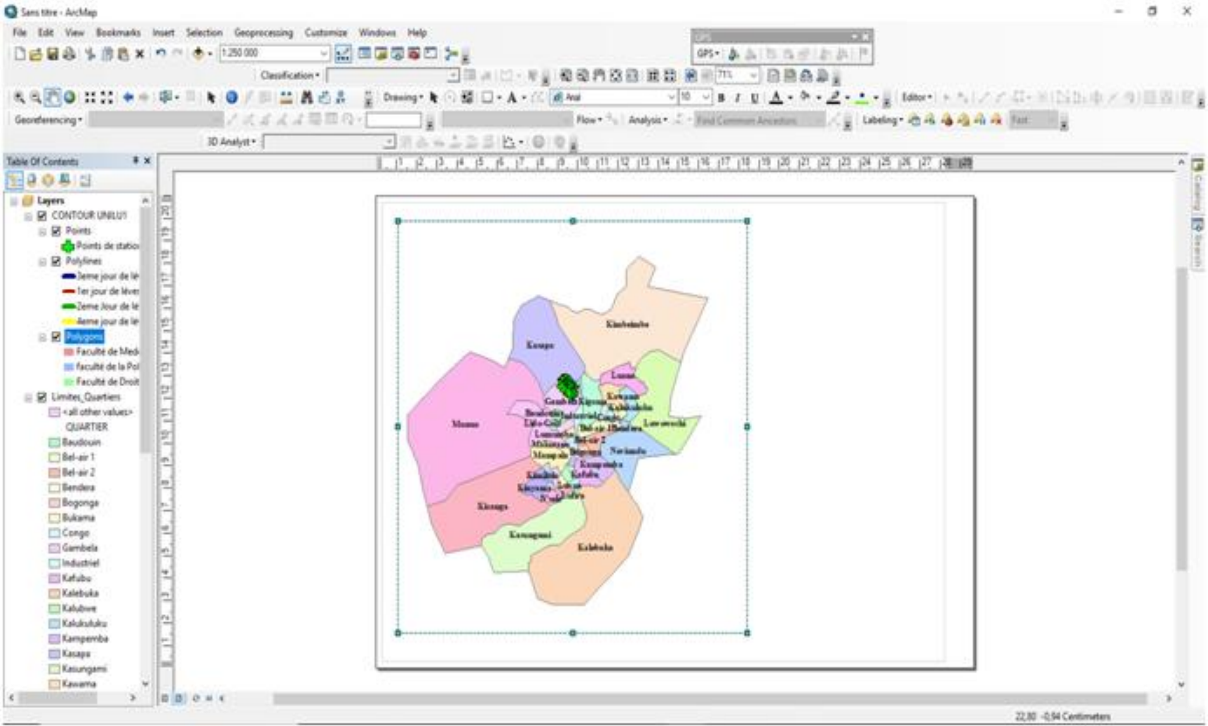
N°	Point de Stationnement	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude (m)	N°	Point de Stationnement	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude(m)
61		158	552937.72	8715366.39	1290.83	91		184	552920.52	8715381.74	1292.50,Bor
62		159	552949.32	8715389.74	1291.24	92		185	552918.74	8715408.73	1292.32,Bor
63		160	552958.29	8715409.38	1291.13	93		186	552920.83	8715442.40	1292.03,Bor
64		161	552974.58	8715441.39	1291.03	94	P 06	187	552920.99	8715482.52	1291.40,Bor
65		162	552987.63	8715468.68	1290.82,Bor	95		188	552919.81	8715526.29	1291.70,Bor
66	P 02	163	552987.68	8715468.71	1290.82,Bor	96		189	552921.20	8715555.57	1290.71,Bor
67		164	552998.81	8715493.72	1290.71,Bor	97		190	552920.03	8715572.24	1290.83,Bor
68		165	553012.96	8715522.45	1290.60,Bor	98		0,00	552889.30	8715479.79	1288.81,Bor
69		166	553022.80	8715543.99	1290.18,Bor	99		191	552841.35	8715487.10	1289.66,Bor
70		167	553030.23	8715561.59	1290.10,Bor	100		192	552889.29	8715479.79	1288.81,Bor
71		168	553036.87	8715571.52	1289.90,Bor	101	P 07	193	552935.54	8715471.71	1288.27,Bor
72		0,00	553030.26	8715561.59	1290.10,Bor	102		194	552988.51	8715461.42	1287.59,Bor
73		169	553061.74	8715580.99	1290.59,Bor	103		195	553027.62	8715452.05	1287.49,Bor
74		170	553005.47	8715545.59	1290.00,Bor	104		196	553073.61	8715442.64	1286.46,Bor
75		171	552983.75	8715534.30	1289.59,Bor	105		0,00	552921.24	8715555.57	1290.71,Bor
76	P03	172	552954.85	8715517.81	1289.30,Bor	106	P 08	197	552926.34	8715564.40	1290.76,Bor
77		173	552925.48	8715503.63	1288.96,Bor	107		198	552877.43	8715480.33	1289.51,Bor
78		174	552889.29	8715479.79	1288.81,Bor	108		0,00	552877.47	8715480.33	1289.51,Bor
79		175	552863.69	8715465.78	1288.43,Bor	109	P 09	199	552877.45	8715464.18	1289.49,Bor
80		176	552821.98	8715444.03	1288.30,Bor	110		200	552877.33	8715562.31	1288.90,Bor
81		0,00	552920.86	8715322.11	1293.62,Bor	111		0,00	552877.34	8715562.31	8715562.31
82	P 04	177	552920.97	8715339.71	1293.10,Bor	112		201	552877.32	8715530.78	1289.36,Bor
83		178	552920.76	8715307.19	1293.68,Bor	113		202	552877.58	8715611.26	1288.37,Bor
84		0,00	552920.87	8715322.11	1293.62,Bor	114	P 10	203	552877.84	8715655.00	1287.83,Bor
85	P 05	179	552903.25	8715317.79	1293.92,Bor	115		204	552879.51	8715761.13	1286.61,Bor
86		180	552942.85	8715327.48	1293.67,Bor	116		205	552879.38	8715894.55	1285.60,Bor
87		0,00	552920.86	8715322.11	1293.62,Bor	117		206	552877.05	8716001.96	1284.82,Bor
88		181	552920.85	8715281.36	1294.05,Bor	118		0,00	552878.39	8716123.40	1284.17,Bor
89	P06	182	552920.85	8715322.09	1293.61,Bor	119	P 11	208	553034.56	8716085.07	1285.26,Bor
90		183	552920.67	8715352.52	1293.05,Bor	120		209	552878.36	8716123.40	1284.16,Bor

Table 7: Topographic data collected

N°	Point de Stationn e-ment	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude (m)	N°	Point de Stationn ement	Point visé	Abscisse (m) Est	Ordonnée (m) Sud	Altitude (m)
210		0,00	556029.46	8716256.34	1298.35,Bor	241		surface unilu_6_0	554919.30	8716371.03	1282.00
211		307	556006.70	8716250.00	1297.93,Bor	242		surface unilu_6_0	554930.56	8716358.28	1282.00
212		308	556029.46	8716256.32	1298.35,Bor	243		surface unilu_6_0	554946.43	8716337.63	1282.00
213		surface unilu_1_0	554404.21	8716319.47	1272.00	244		surface unilu_6_0	554916.36	8716309.86	1282.00
214		surface unilu_1_0	554410.27	8716322.63	1272.00,	245		surface unilu_6_0	554895.99	8716293.75	1282.00
215		surface unilu_1_0	554461.85	8716347.72	1272.00	246		surface unilu_7_0	555052.28	8716385.52	1284.00
216		surface unilu_1_0	554488.79	8716349.37	1272.00	247		surface unilu_7_0	555037.08	8716369.70	1284.00
217		surface unilu_1_0	554484.59	8716331.01	1272.00	248		surface unilu_7_0	555027.46	8716356.18	1284.00
218		surface unilu_2_0	553619.98	8715964.35	1274.00	249		surface unilu_7_0	555045.69	8716335.56	1284.00
219		surface unilu_2_0	553617.92	8715967.97	1274.00	250		surface unilu_7_0	555046.70	8716334.93	1284.00
220		surface unilu_2_0	553601.55	8716007.47	1274.00	251		surface unilu_8_0	555172.66	8716385.12	1286.00
221		surface unilu_2_0	553539.20	8716038.19	1274.00	252		surface unilu_8_0	555149.97	8716361.50	1286.00
222		surface unilu_2_0	553516.46	8716047.36	1274.00	253		surface unilu_8_0	555135.63	8716341.34	1286.00
223		surface unilu_2_1	554354.43	8716287.57	1274.00	254		surface unilu_8_0	555137.00	8716339.79	1286.00
224		surface unilu_2_1	554495.24	8716306.91	1274.00	255		surface unilu_8_0	555144.36	8716335.21	1286.00
225	P 30	surface unilu_3_0	553587.01	8715837.79	1276.00	256	P 30	surface unilu_9_0	553352.07	8715135.68	1288.00
226		surface unilu_3_0	553581.35	8715847.73	1276.00	257		surface unilu_9_0	553354.48	8715138.95	1288.00
227		surface unilu_3_0	553536.46	8715956.05	1276.00	258		surface unilu_9_0	553362.67	8715135.68	1288.00
228		surface unilu_3_1	554577.70	8716292.41	1276.00	259		surface unilu_9_1	553580.41	8715196.80	1288.00
229		surface unilu_3_1	554576.47	8716292.32	1276.00	260		surface unilu_9_1	555291.58	8716204.46	1288.00
230		surface unilu_4_0	554519.15	8716364.43	1278.00	261		surface unilu_9_2	553073.75	8715396.06	1288.00
231		surface unilu_4_0	554729.87	8716377.34	1278.00	262		surface unilu_9_2	553078.57	8715391.87	1288.00
232		surface unilu_4_0	554651.32	8716336.81	1278.00	263		surface unilu_9_3	552989.18	8715461.77	1288.00
233		surface unilu_4_0	554656.12	8716335.73	1278.00	264		surface unilu_10_0	553209.60	8715183.81	1290.00
234		surface unilu_4_0	554650.19	8716329.19	1278.00	265		surface unilu_10_0	553212.42	8715187.64	1290.00
235		surface unilu_5_0	554811.53	8716386.34	1280.00	266		surface unilu_10_1	554118.34	8715427.02	1290.00
236		surface unilu_5_0	554811.29	8716386.09	1280.00	267		surface unilu_10_2	552992.41	8715463.46	1290.00
237		surface unilu_5_0	554811.13	8716385.87	1280.00	268		surface unilu_11_0	554694.63	8715666.95	1292.00
238		surface unilu_5_0	554811.49	8716385.47	1280.00	269		surface unilu_11_0	554656.27	8715657.25	1292.00
239		surface unilu_5_0	554814.97	8716380.94	1280.00	270		surface unilu_11_1	552885.58	8715339.40	1292.00
240		surface unilu_5_0	554814.96	8716380.94	1280.00	271		surface unilu_14_0	556011.79	8716244.23	1298.00

4. Analysis and processing of Topographic data

1) Map of the Cités Universitaires contour lines



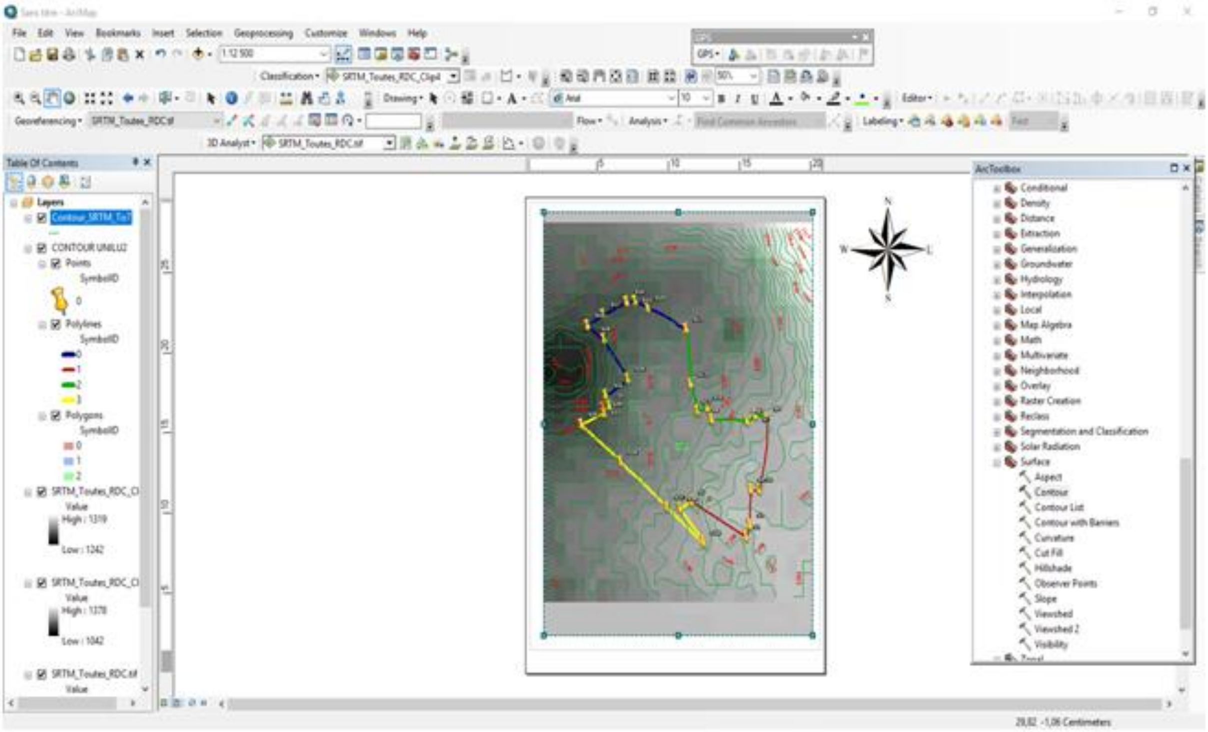


Figure 5: Map of contour lines in digital terrain mode

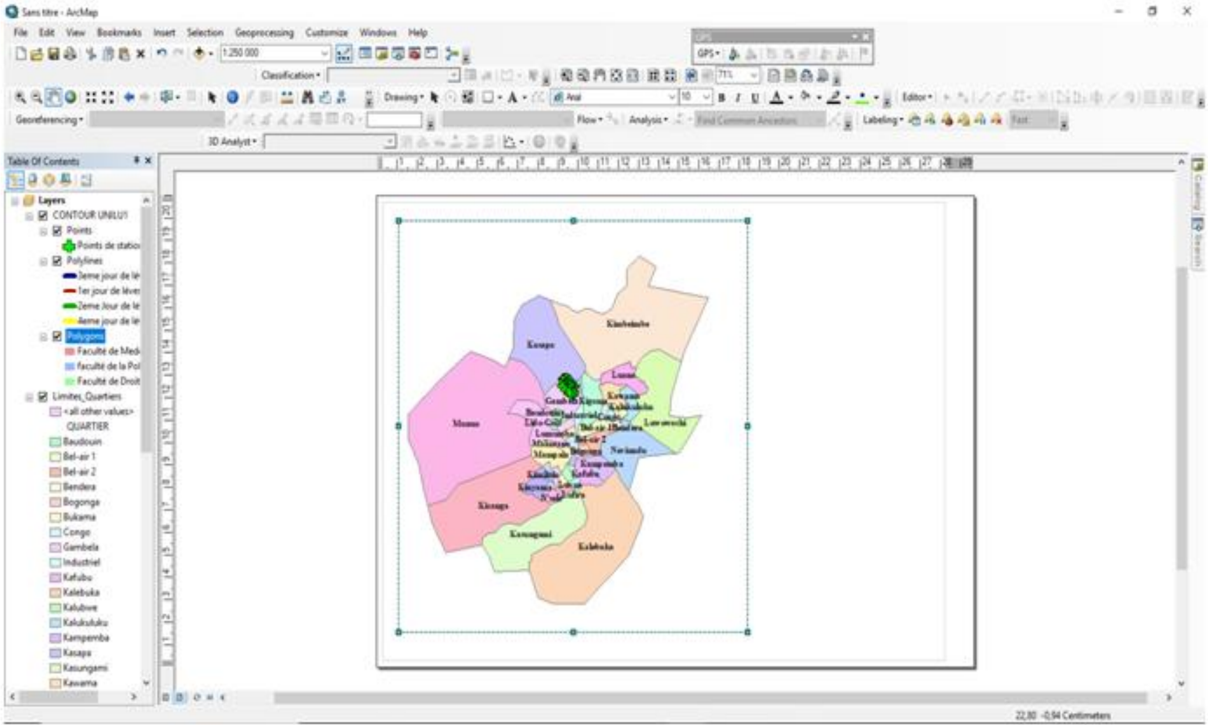


Figure 6: Polygonal of points imported to Google

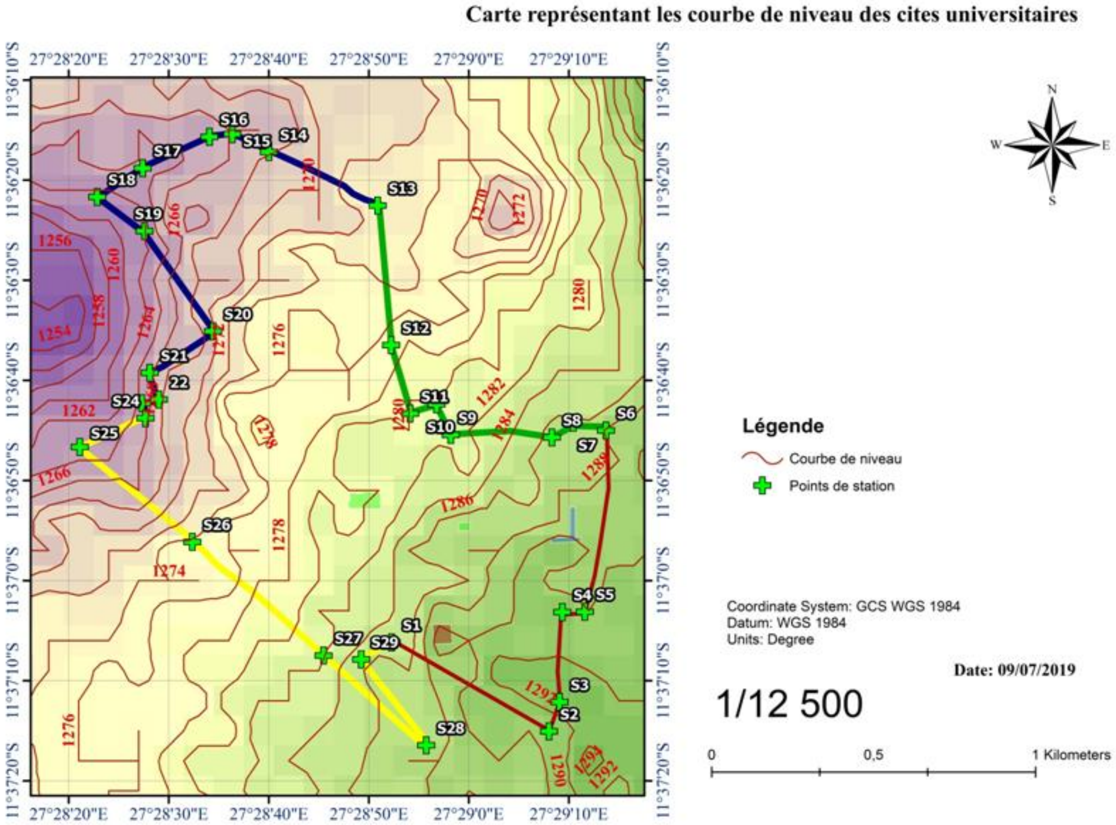


Figure 7: Map of the Cités Universitaires contour lines

2) Map delimiting the University Cities

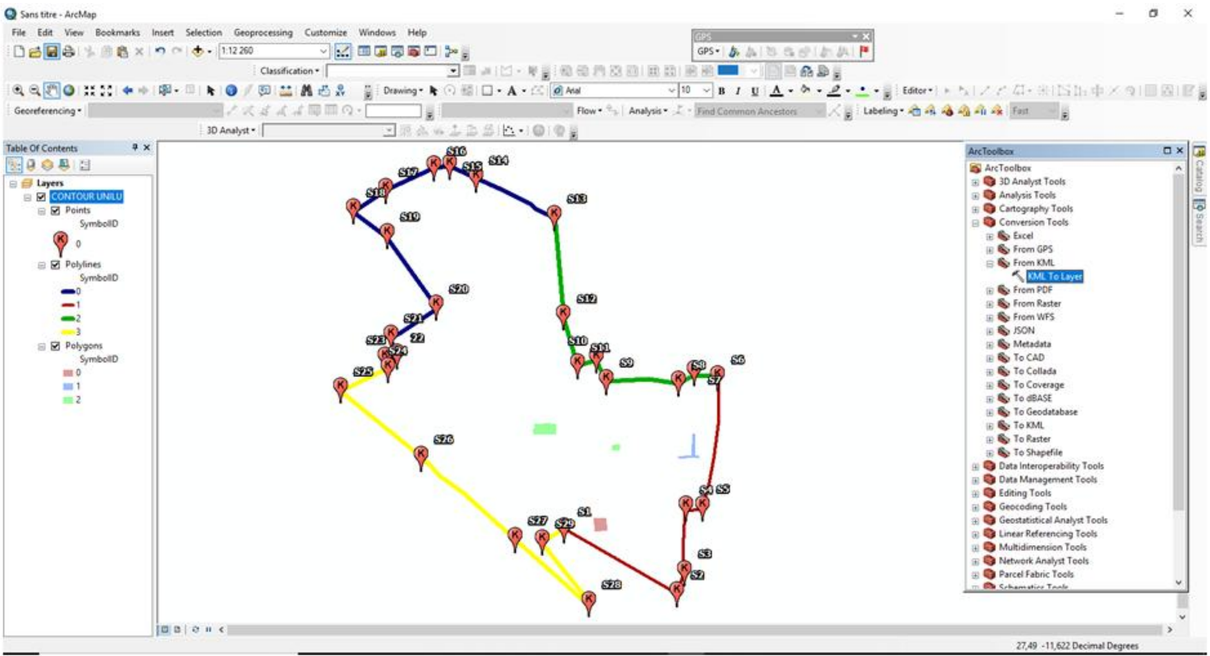


Figure 8: The polygonal of the points established on Google

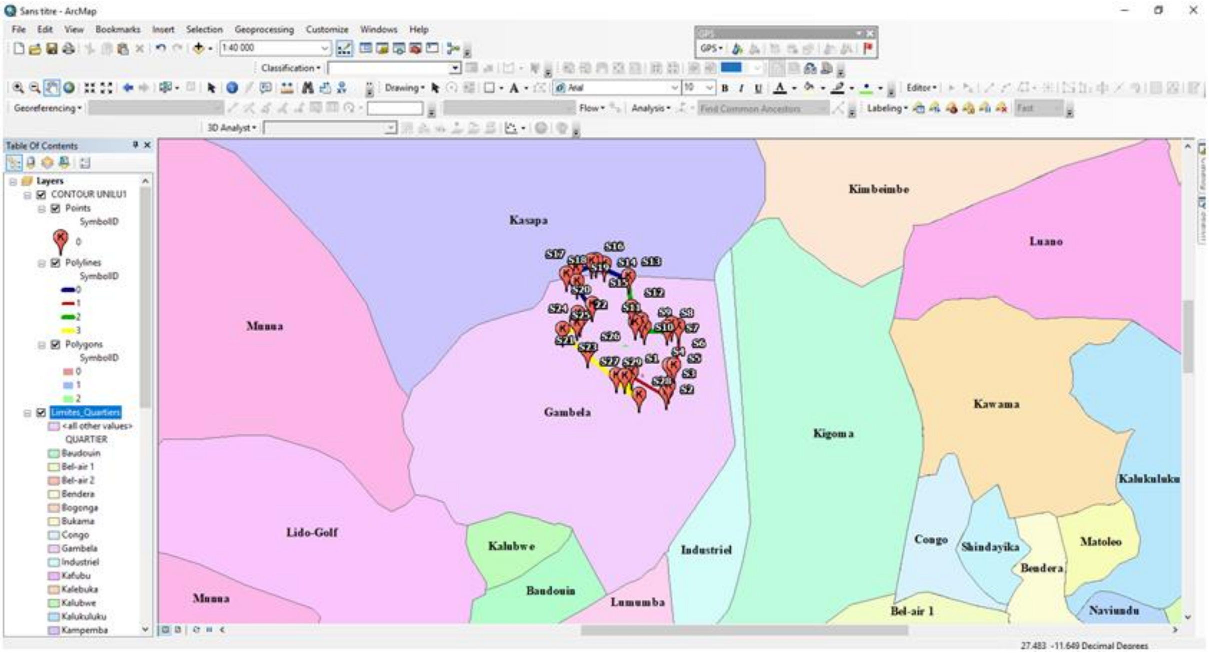


Figure 9: Geolocation of the site

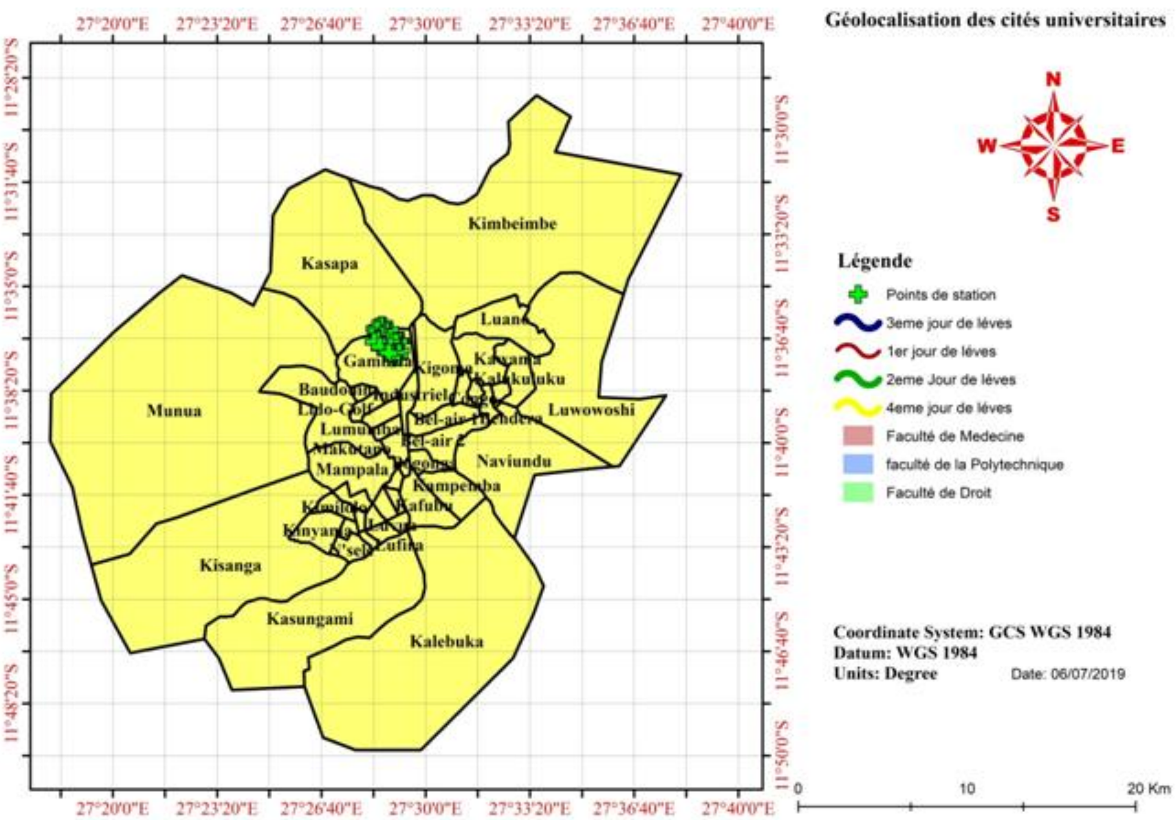


Figure 10: Geo-reference map of the University Cities

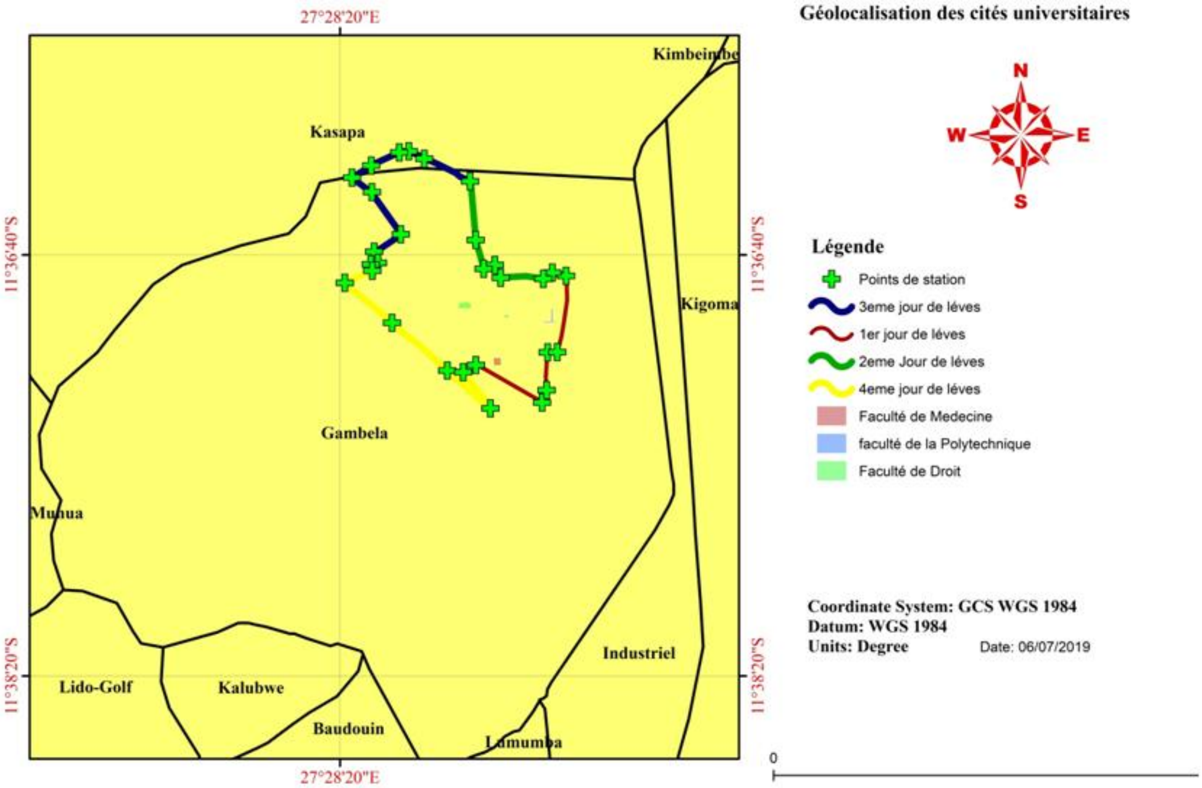


Figure 11: Map delimiting the University Cités

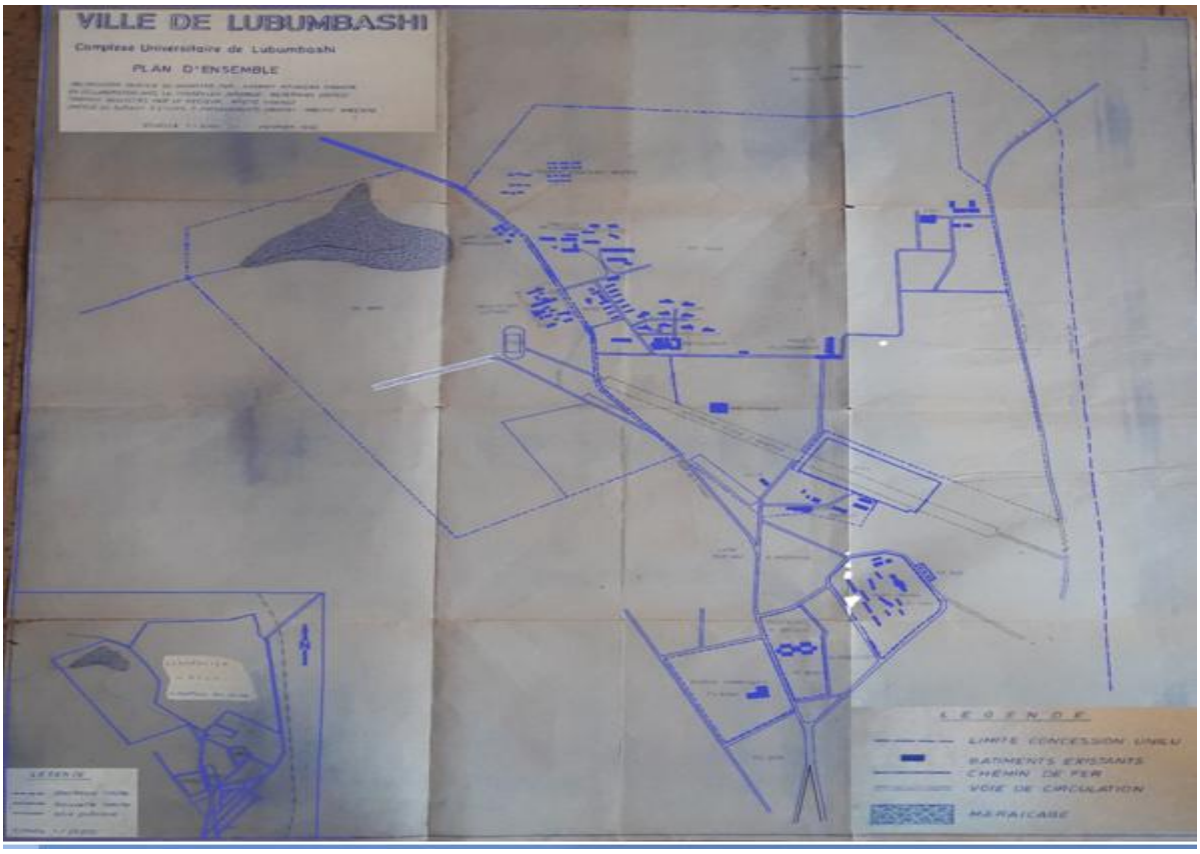


Figure 12: Old plan of the University Cités

5. Conclusion

The present work concerns the realization of a Topographic map, obtained using Topographic data, collected by Topographic surveys on the ground. The main objective was to design and produce a Topographic map delimiting the University Cities and containing in its within the information essential to the heritage division of the University of Lubumbashi, for the execution of a good management and conservation of the limits of the concession of the University Cities This device created is supposed to ensure certain utilities, but its purpose is to ensure improved management of this scope. After a tolerable period of data analysis, these were collected using a USB key in which all the Topographic data records were contained during the Topographic survey in the field. This step was one of the most crucial , given the volume of information obtained. The other step was that in Google Earth, which after importing the data, will obtain a polygonal facilitating the subsequent processing to obtain the map. Implementing such a project requires a crucial and consequent phase requiring a lot of time, this are the most voluminous stages. Faced with the realities of feasibility and technical and technological compatibility, an Analysis was carried out and our choice fell on the tools used in order to better exploit this device and thus benefit from its advantages. Offers the possibility of knowing the current remaining extent of the Cités Universitaires concession, as well as a good geolocation in relation to the city of Lubumbashi. In addition to the technical aspect, the reflection that preceded the creation of the map made it possible to ensure its relevance to the needs expressed to facilitate subsequent operations. However, around 825 points were surveyed with 30 points from the stations on a land with an area of 6.89 km of perimeter over an area of 1.49Km², equivalent to 149 Hectares. Thus, we can say that our objective has been successfully achieved, because the map we have designed concretely allows to gather in a single overview all the information on the limits of the concession. This manual explains our modus operandi for carrying out such a project. We hope that those who undertake a similar project in turn will take into account all possible details.

References

[1] AUTIN et VAN ROSSIN, Fond de Carte (Carte géologique) Février 1981, éd. G.Z. 1963.
[2] www.allislam.net, Topographie et topométrie modernes : Techniques de mesure et de représentation.
[3] MILLES S. et LAGOFUN J., 2007- Topographie et Topométrie moderne. Tome 2 EYROLLES, Paris.
[4] René DEKKERS, 1968 ; Rapport annuel, U.O.C, Lubumbashi.
[5] BERNARD D., 1979- Elément de Topographie, Eryelle.
[6] JOSEPH et REVAULT E., 1991, Topographie Pratique, éd J.B BAILLERIE.
[7] Paul DEBOUNY et Pierre DELCOURT, 2008, Notions de Topographie, février.