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The Implementation of Point Number Code For Complex Survey Layout

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Abstract— *Using the advanced innovations of survey software to administer land surveying is a powerful tool that the engineering industry uses to gather data, especially regarding land development, planning, and designing any establishments or structures. These survey software providers like Autocad or Autodesk, especially Civil 3D and Land Desktop software, have survey solutions for all modes of land survey production. The Autodesk Civil 3D paves the way to enhance surveying to boost the usefulness of these innovations. Determining only some factors, i.e., Point Number, Northing, Easting, Elevation, and Description (PNEZD), will help the surveyors conduct any survey easier. However, there are many instances wherein land surveying can be much more complex. And many times, land surveyors or researchers find ways to address these conventional challenges by maneuvering to the latest technology of advanced software and incorporating them into more advanced survey instruments, i.e., Real-Time Kinematic (RTK) controller. And upon these complex layouts, the rise of the need to survey less erroneous manners and more time-efficient ways can relatively be the answer. This concept and advancement of Autodesk Civil 3D made Point Identity possible. By configuring the factors of PNEZD into it and downloading it in an RTK device controller to have a fast steady-state of the survey, which can be a remedy to fasten land surveying, especially in complex layouts.*

Keywords— *Advanced Innovation, Autodesk Civil 3D, GPS, PNEZD, RTK.*

I. INTRODUCTION

Land subdivision is one of the urbanization processes. It is the demonstration of isolating area into pieces that prepare to sell or, in any case, grow as a rule utilizing a plat. Subdivision is essentially dividing a parcel of land or a building into one or more further parcels or changing an existing boundary location. [1][2][3].

One must recognize that the result of laying off a tract of land and subdividing it into lots and blocks is to obtain a product or products—something to sell or market. Whether the subdivision is to be offered for sale as vacant lots for individual buyer development or to provide wholly developed with housing or business places ready for occupancy, the ultimate goal is a sale for profit [4][20][21][32]. Subdivisions may likewise be with the end goal of the business or mechanical improvement, and the outcomes shift from retail shopping centers with autonomously claimed bundles to modern parks[5][6][28].

Planning a subdivision is not easy, but subdivision development works its way to the current booming trend. Simulation of the land subdivision process is helpful in many applied and research areas. For example, planners use such tools to understand the potential impacts of planning regulations before their implementation. In contrast, the urban growth would enhance the credibility of both land-use growth models by integrating capabilities to simulate land subdivisions [3][22].

Best professionals should be involved, and land surveyors should be among the experts to hire. Professional land surveyors will take place in subdividing the land as they are the primary source of design development, which will produce the most efficient, attractive, and marketable layout[7][23][24].

Land surveyors measure even situations in geography or plane to facilitate framework comparison with recently overviewed positions called control focuses[8]. Surveyors regularly measure positions in the arrangement. Beginning at control focuses, they measure points and separations to new areas and use trigonometry to figure places in a plane arrange framework. They estimated a progression of positions right now known as running across[8][17].

A Point Identity is a built-in function or command in Autodesk software, especially in the CIVIL3D service for a Land Desktop application that can use for determining the Point Number, Northing, Easting, Elevation, and Description or PNEZD of a particular point in the polygon[9][10][18]. And ready to export into different file extensions suitable for the total station and RTK controller data that can use for the fieldwork lay-out. Real-time kinematic (RTK) GPS can replicate the archaeological surface to a level of accuracy that creates a three-dimensional virtual cast of the topography [11][12][19][26].

They were using the lisp for determining coordinates of a certain point where the surveyor input the data to the total station or RTK controller requires more time and is subject to typo error[13][14][29][30]. Such a method will be bound only to minimal inaccuracy on plans with a small number of lot corners. However, in dealing with complex subdivision layouts, this approach will closely result in a slight flaw in relocating/laying out. Thus the researchers will innovate a new surveying technique that involves an algorithm using software to deal with such a time-consuming proposition. Using a unique coding system that will set rules to follow in a problem-solving operation such as a computer would avoid a possible collision of numbers.

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Measurement errors in a conventional way are reoccurring and thus will be costly[14][15]. Errors in surveying measurement will increase as the gross area of subdivision also increases based on statistical results[16][17][26][27][33]. For these reasons, the researchers will apply a surveying technique that enables surveyors to calculate and account for measurement in the most efficient way by creating a script or code to the Autodesk so that it would be easy to determine the point number lot in the subdivision. Fig 1 shows the study's conceptual framework, wherein it serves as the guide for solving the complex process of determining labels.

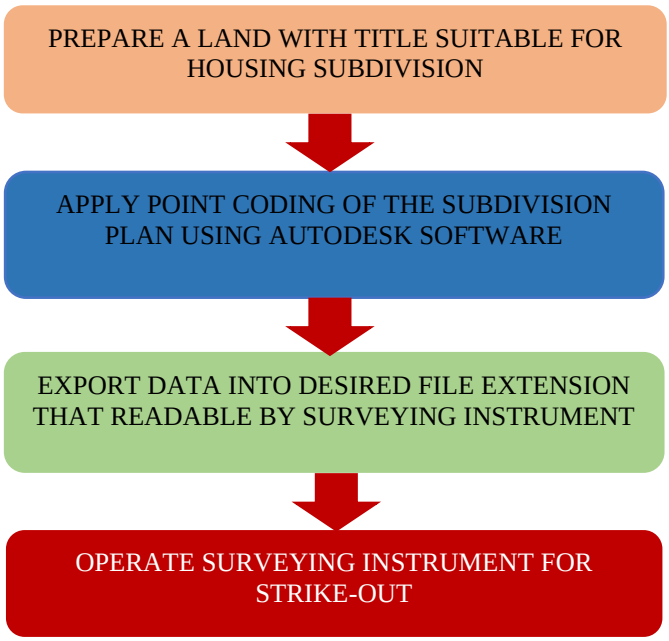

Fig. 1. Conceptual Framework of the study

A. Objectives of the Study

The ultimate objective of the study is the application of point number coding in a complex subdivision layout.

Specifically, involve the following questions:

1. To specify the setting point to the ground survey of a complex subdivision layout.
2. To determine the point number code in every corner to avoid point number collisions.
3. To check the accuracy of the point number code uploaded to the RTK controller.

II. Methodology

The researchers choose to conduct this study to expound on a new method of simplifying and using the latest technology using software that can help Surveyors, Geodetic Engineers, and Geodetic Engineering students. The researchers also adopted a deductive approach to research wherein the Plan-Do-Check-Act scheme guided solving complex solutions acquired in the problem, as stated earlier in this paper. Figure 2 shows the schema of the study.

A. Plan

Design

The researcher designed a sketch plan of the subdivision using Autodesk software based on the lot area of the title[4]. The subdivision of the lot is presented in Fig 3 to elaborate the subdivision plan as the researcher's basis for the study.

Before creating points, specify the settings that control how the spots are numbered and how to handle point number collisions.

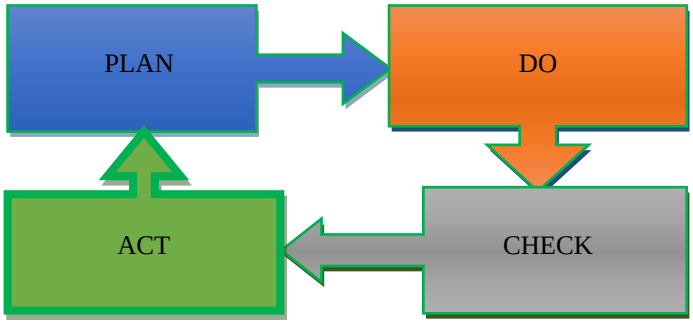

Fig. 2. Schema of the Study

Use the Point Identity settings to control the numbered and labeled points as they are exported. Example:

A point in the drawing with the following properties:

- Point Number: 200703
- Northing: 1137288.7621
- Easting: 570427.0089
- Elevation: 0
- Description: LAY

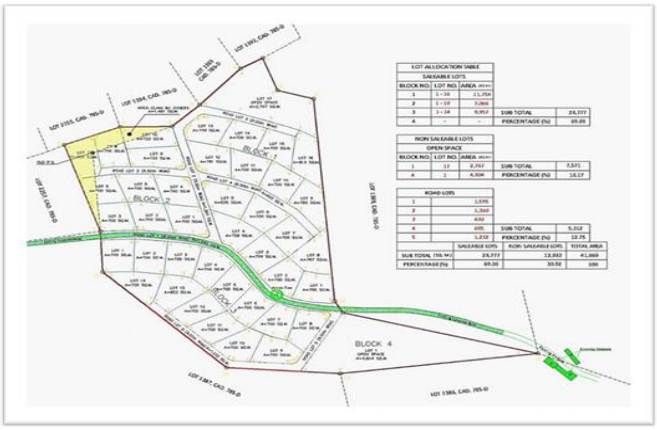

Fig. 3. Complex Subdivision

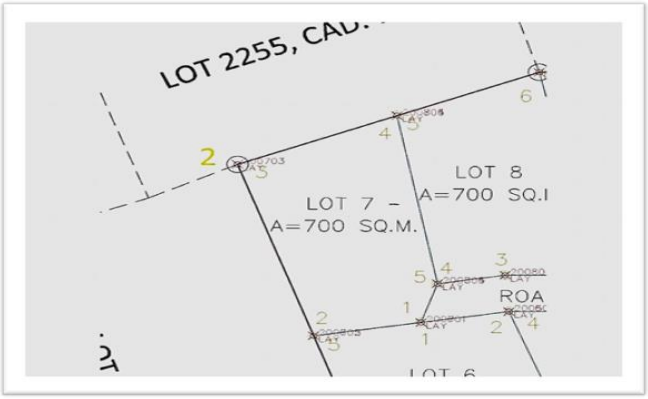

Fig. 4. Lot 7 of Block 2 from Fig 1

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For example, the Point Number is determined as Corner 3 of Lot 7 in Block number 2 of the subdivision plan arranged as 200703 see figure 4 and 5. The first digit refers to the Block number 200703 or may have a double-digit once the subdivision Blocks reach ten (10) and above (i.e., 1000703). The Lot number of the subdivision plan indicates 007 of the example 200703, wherein the lot number has three (3) digits. The lot corner has two (2) digits identified as 03 of 200703.

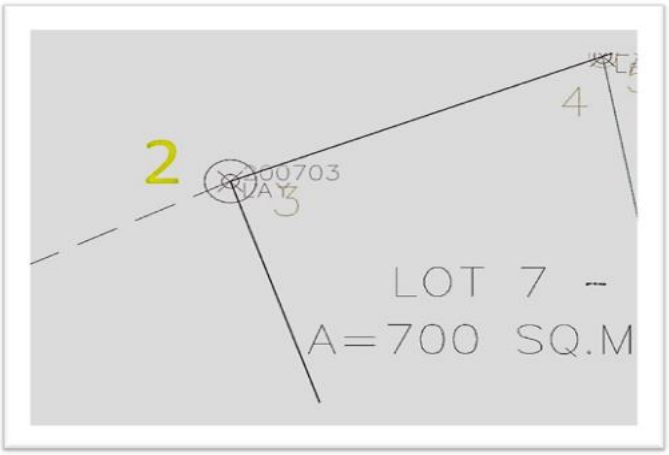

Fig. 5. Indicator of the corner 3 of Lot 7, Block 2 with Point Number Code of 200703.

B. Do

Creating Lisp Script

After creating the script/code from lisp, the researchers run the script/code in the Autodesk environment. The script creates a coordinate with a text file ready to upload to RTK for actual surveying during runtime. Fig 6 shows the created file during runtime and a text file prepared to upload a .csv file to the RTK instrument.

200401	1136675.186	570546.6531	0	LAY
200402	1136702.328	570538.5303	0	LAY
200403	1136699.364	570563.5942	0	LAY
200404	1136699.001	570564.7105	0	LAY
200405	1136698.237	570565.602	0	LAY
200406	1136697.19	570566.132	0	LAY
200407	1136672.056	570573.1305	0	LAY
200501	1136675.186	570546.6531	0	LAY
200502	1136677.144	570530.091	0	LAY
200503	1136676.774	570520.063	0	LAY
200504	1136702.44	570510.5534	0	LAY
200505	1136702.328	570538.5303	0	LAY
200601	1136700.493	570498.7125	0	LAY
200602	1136702.44	570510.5534	0	LAY
200603	1136676.774	570520.063	0	LAY
200604	1136674.343	570492.1484	0	LAY
200605	1136698.107	570484.2098	0	LAY
200701	1136700.493	570498.7125	0	LAY
200702	1136698.107	570484.2098	0	LAY
200703	1136728.812	570473.953	0	LAY
200704	1136737.534	570495.4708	0	LAY
200705	1136707.446	570500.9366	0	LAY
200801	1136725.092	570519.0521	0	LAY
200802	1136708.892	570522.5736	0	LAY

Fig. 6. The coordinates of 200703 in csv file extension format.

The equivalent plotted sketch with coordinates, including the labels of the corners, is deflected in Fig 7 below, based on the output of the lisp code with the script running in the Autodesk Environment..

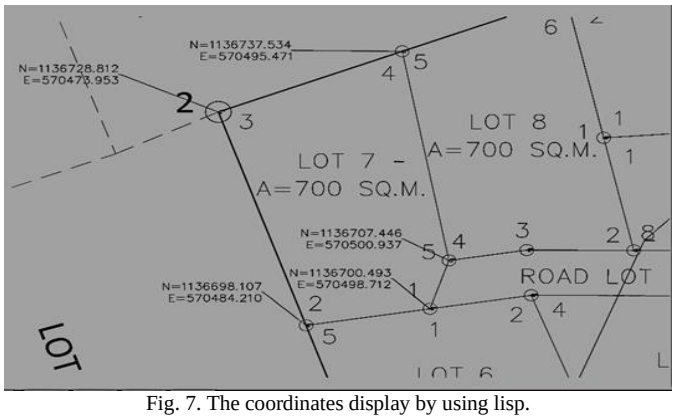

Fig. 7. The coordinates display by using lisp.

C. Check

Creating Point Number Code

After the list script was created, Autodesk is now ready to accept the instruction of creating the point number code. The following shows the step-by-step process of creating the point number code:

1. Open the project with an extension of the .dwg format from the Autodesk file, as shown in Fig 8 below.

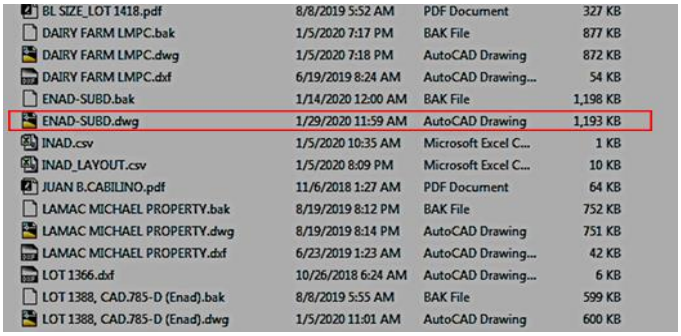

Fig. 8. Selecting Drawing File

2. The selected drawing file is shown in Fig 9 with a finished complex subdivision scheme ready for lay-out.

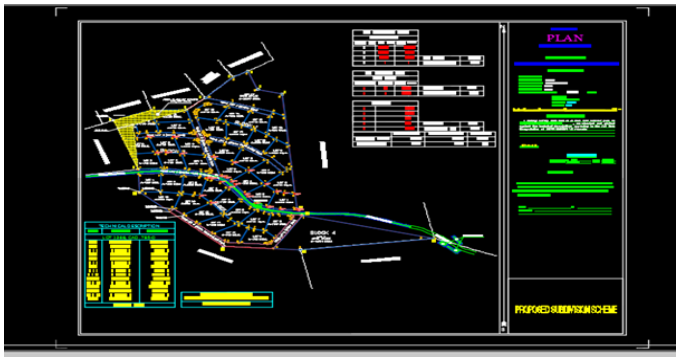

Fig. 9. Selected Drawing File

3. There were different software available to create a drawing file with an extension of the .dwg file like; Civil 3D, Land Desktop, Nmax, and other software. The researchers use Civil 3D to apply the point code identity in this topic. These are the steps on how to create points.

3.1 On the menu bar, click MODIFY. See Fig 10 below for a clear representation.

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Fig. 10. Modify Screen

3.2. Click POINTS tab. See Fig 11 Below

Fig. 11. Points Tab

3.3. Click CREATE POINTS tab. See Fig 12

Fig. 12. Points Tab

3.4. CREATE POINTS a dialog box will appear as shown below. See Fig 13

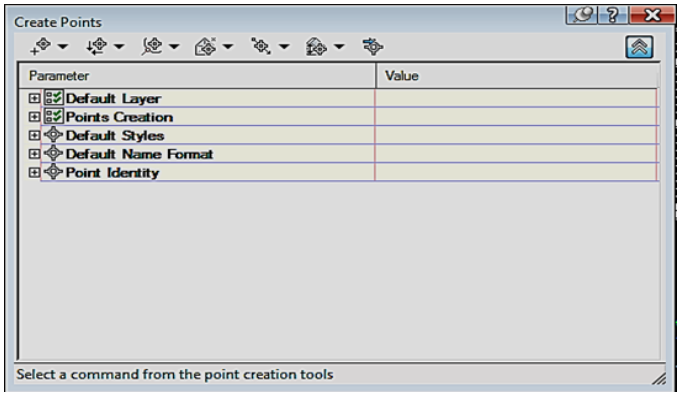

Fig. 13. Dialog Box to Create Points

3.5. The left tab on POINTS CREATION for drop down list and set to Automatic. See example Fig 14

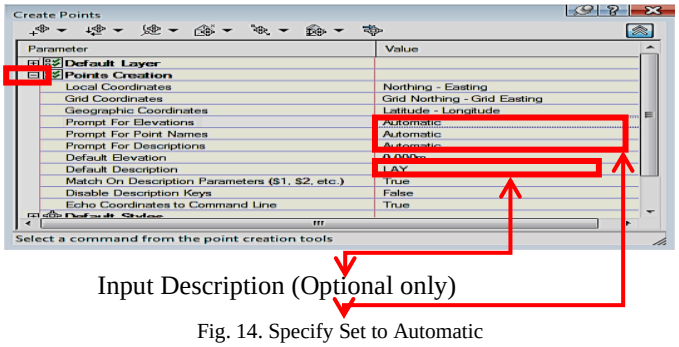

Fig. 14. Specify Set to Automatic

3.6. The left tab on POINTS IDENTITY for the drop-down list and start inputting the desired point code of a specific corner of the lot. See Fig 15 below.

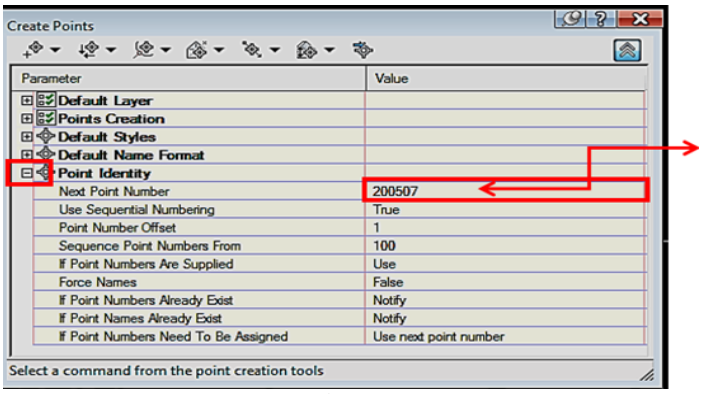

Fig. 15. Specifies Point Identity

3.7 Select a lot to be numbered and input the desired point code.

Example: Lot 5 of Block 2 to be numbered. On the dialogue box Next Point Number input 200501 for the first point and click on corner number 1of Lot 5, Block 2. See Fig 16 below. Then click the miscellaneous tab and select manual.

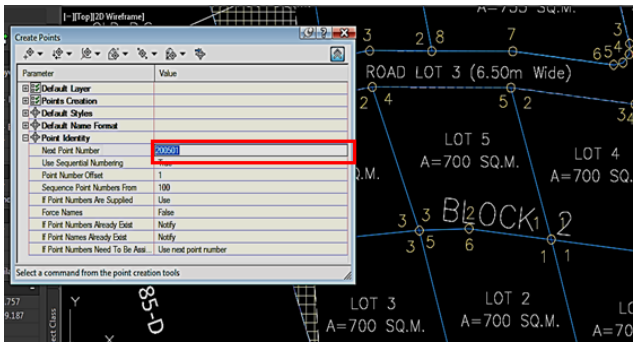

Fig. 16. Point Number Code Entry

3.8 Click the Miscellaneous Tab and select Manual. See Fig 17 below.

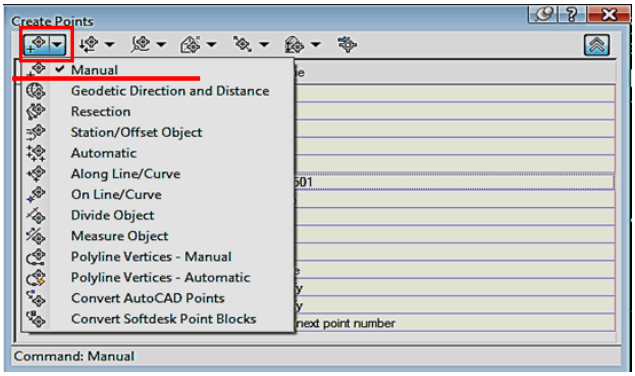

Fig. 17. Miscellaneous Tab

3.9 After clicking manual from the miscellaneous tab, point the crosshair on the corner of the lot with the corresponding code. See Fig 17 below.

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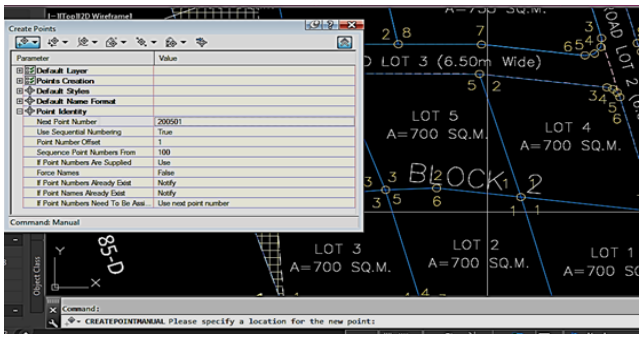

Fig. 17. Create Point Dialog

3.10 After clicking on the corner, the point code will automatically appear and continue to click for the next corner. See Fig 18 below

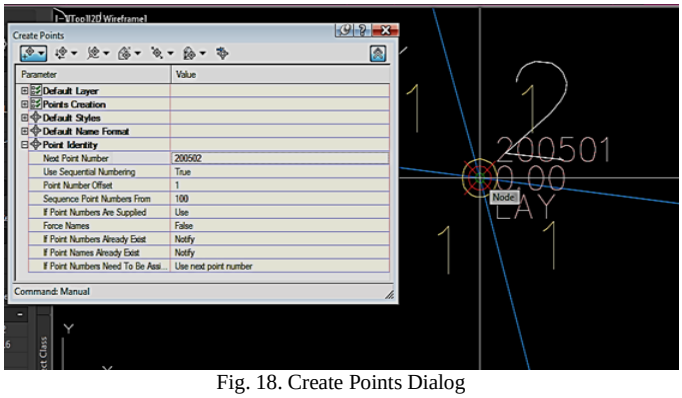

Fig. 18. Create Points Dialog

D. Act

Exporting Points

After coding corners, the next step is to Export points to .csv and convert them to a .dat file. See Fig 19 below. Click Modify, Points, and Export points. See Fig 20 below.

Fig. 19. Export Points

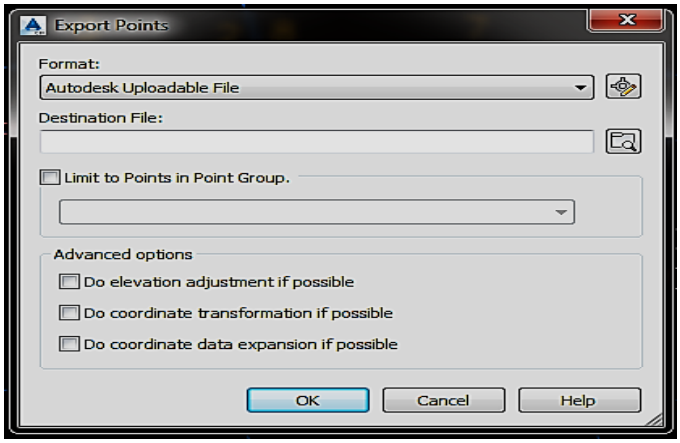

Fig. 20. Export Points Dialog Box

1. In the Export Points dialog box, go to Format drop-down box and select PENZD or PNEZD (comma delimited). See Fig 21 below.

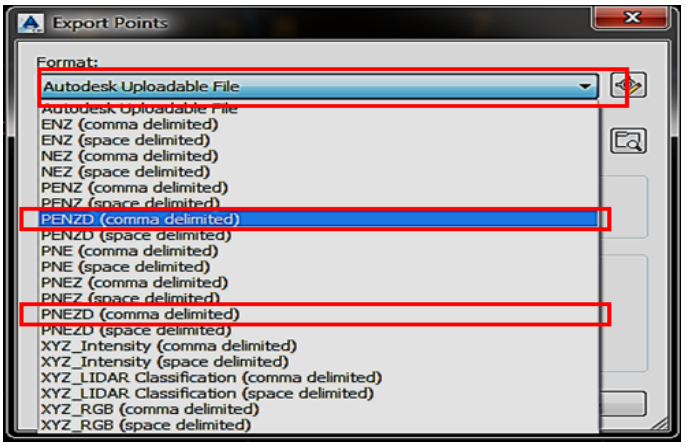

Fig. 21. Export Points

2. Click the correct side box of the Destination file. Write a filename, make sure the file type is .csv or .txt, then click Open and OK. See Fig 22 below.

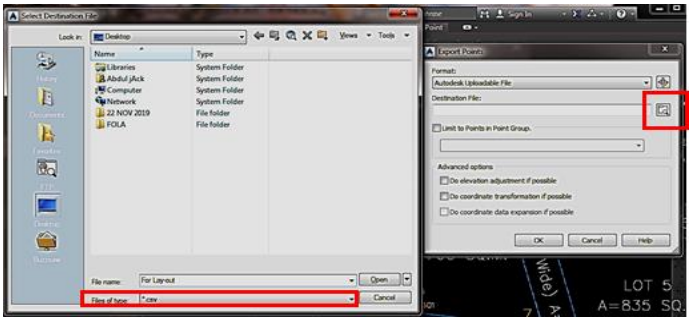

Fig. 22. Saving File

3. After saving the .csv file format. See Fig 22 below for the desktop view.

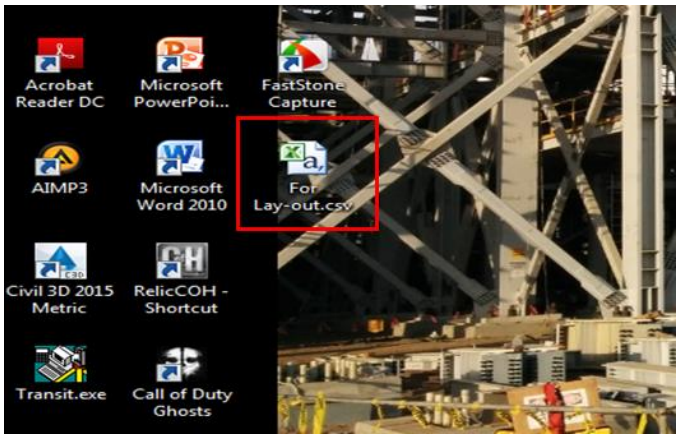

Fig. 22. Desktop View of File

4. Identifying the Properties of Points. See Fig 23 below.

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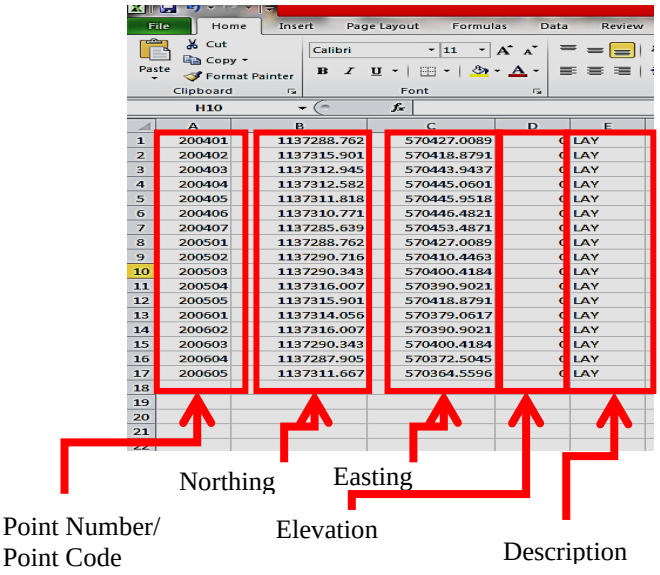

Fig. 23. Detailed Description

III. Results and Discussions

The researcher finally came up with the output of assigning codes to a subdivision Fig. 22 shows how to specify the setting point identity and apply it to the ground survey layout to determine how fast, and accurate the work is.

Geodetic Engineers or surveyors will use Real-Time kinematics (RTK) in surveying. It is a relative positioning technique that measures positions using two GNSS antennas in real-time. One is set up on a fixed point with fixed coordinates and is known as the base station. (See Figures 23 and 24)

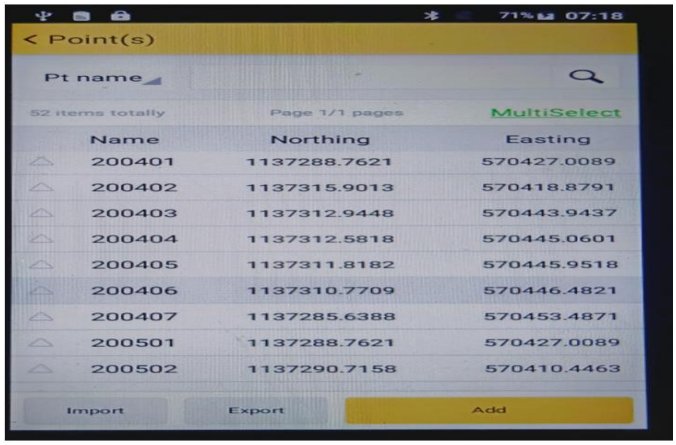

Fig. 24. Coordinates uploaded in RTK controller

This study will contribute to land surveying companies and surveyors' fast track and input accurate coordinates from computer software to total station or RTK (Real Time Kinematics) survey equipment applied for fieldwork layout. Especially in complex subdivisions with multiple corners being staked out. Using the unique number system, the collision of numbers may avoid and guide the surveyor directly to the corner being staked out even if it did not use the conventional method of determining the coordinates and input manually to surveying equipment. Manual input of coordinates using the Philippine Transverse Mercator (PTM) coordinate system may cause an error due to multiple digits to encode. Therefore, the surveyor may only bring the subdivision plan during the field survey lay-out of monuments as long as the data were uploaded on the equipment.

Finally, the researchers uploaded the sample data to the RTK controller (see Fig. 24, 25, 26). The verification survey and testing on the ground layout using Real-Time Kinematic (RTK) Global Positioning System (GPS) THE IMPLEMENTATION OF A POINT NUMBER CODE FOR COMPLEX SURVEY LAYOUT.

Fig. 25. Setting of points by using RTK rover

Fig. 26. Setting of Base

IV. Summary, Conclusions, Recommendations

Based on the result of the design and process of Implementing a point number code for complex survey lay-out, the practical way, precise and accurate coordinate input, time-efficient and less human error. It also found that the Civil 3D software and other software, such as Land Desktop, Nmax, and GE survey, can be used to make the point code.

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Conclusion

The researchers conclude that the unique number system can be applied for complex subdivision layouts and construction survey layouts. Contributed human errors in the survey layout were minimized with point plotting accuracy.

Recommendation

For the future development and betterment of this study, the researcher recommends the following:

1. Conduct training on using AutoDesk software to implement a point number code for complex survey lay-out to help others who are still using the conventional method.
2. Provide training on how to implement a ground survey by using the new surveying equipment techniques without using the conventional land surveying methods.

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