A Comparison of As-built Position Computation

(Perbandingan Kedudukan *As-built* dalam Kerja Hitungan)

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ARTICLE INFO

Abstract

The as-built position is a monitoring work carried out once after the construction work of piling was completed. Is it to ensure that the position and dimensions of piles are exactly as specified in a plan? A comprehensive plan will be prepared to demonstrate all the amendments that have been made during construction. As-built drawings are the final set of drawings produced for the completion of a construction project. The information included all the changes that have been made to the original construction drawings such as notes, modifications, and other relevant information. The as-built position of the pile needs to be surveyed after the piling work to ensure the construction work is finished and compare the alignment of the actual position with the as-built position. The amendment drawing is carried out by a consultant based on the information of the as-built position. An informative plan provided by the consultant later will be useful while facing any possibilities during construction or future modification. Autolisp software is used to calculate and produce alignment of the as-built position. Autolisp is AutoCAD's inbuilt programming language which is also used to create programs that will automatically generate drawings.

Keywords: as-built, construction, alignment, Autolisp

INTRODUCTION

As-built surveying is carried out to make sure the position of the as-built point is the same as the actual point in the construction drawing. This process will be conducted by a surveyor after the completion of construction works. This study aims to discuss the use of Autolisp in calculating the alignment of the as-built position for the setting out bore pile. This process is very essential, hence, setting out records, monitoring progress, accuracy, and any changes from the original design, are kept by both the engineer and the contractor as the scheme proceeds. The need for accuracy and efficiency in setting out is paramount if civil engineering projects are to be completed on time and within the allocated budget. When the initial site survey is being carried out, the survey team must use equipment and techniques to ensure that the plan produced shows the required detail and is within the agreed upon with the clients.

LITERATURE REVIEW

If at any time during the progress of the works any error shall appear or rise in the position levels dimensions or alignment of any part of the works the contractor on being required so to do by the engineers shall at his own cost rectify such error to the satisfaction of the engineer or the engineer's representative in which case the cost of rectifying the same shall be borne by the employer (Uren & Price, 2010).
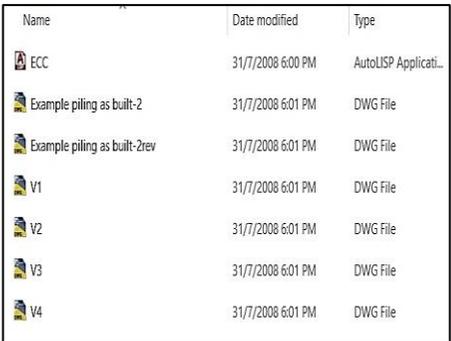
The as-built project information represents how construction is performed (Zubair, 2006). Construction managers need to keep track of design and construction changes and as-built information to control and monitor construction progress. As-built surveys are required by many agencies to prove the location of a structure at a point in time. This process is required to record variations of points from original engineering plans to what is built, and the final set of drawings produced after a construction project (Kaamin, Sarif, Husin, Supar, Razali, Sahat, & Mokhtar, 2019).

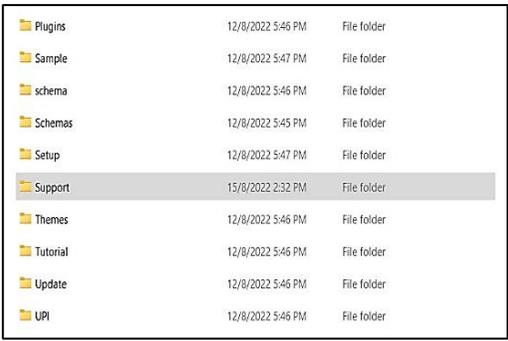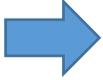# METHODS

DATA AND SOFTWARE

Autolisp software installation is needed as the system support in the AutoCAD software before proceeding with the calculation of the alignment for the as-built position bore piles. Figure 1(a) shows the AutoCAD Software. Figure 1(b) shows the installation of Autolisp software in the system program AutoCAD. After installation of the software of Autolisp from the support of the programs for the AutoCAD software. Then, proceed to go to open the AutoCAD software to load the Autolisp software. Figure 1(c) shows the starting to load the Autolisp software in AutoCAD software. Figure 1(d) shows to find the Autolisp software in the system of the support that is already installed in the program AutoCAD software.

The Autolisp software needs to load to calculate the alignment for the as-built bore piles by using the AutoCAD software. Figure 1(e) shows the autolisp software load into the AutoCAD Software. Figure 1(f) shows the start of the calculation of the alignment of the as-built bore pile by using Autolisp software. The data of the alignment will auto-generate after creating the point of the actual bore piles with the as-built bore piles.
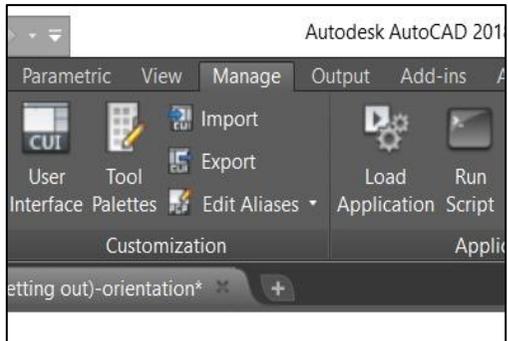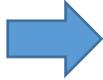
(a) Autolisp software

(b) Installation of autolisp software

(c) Starting with AutoCAD
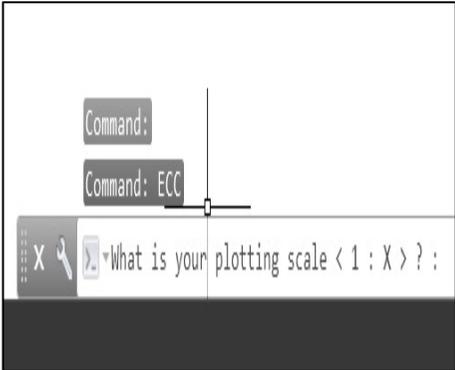
(f) Start the Autolisp software
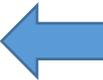
(e) Load the Autolisp
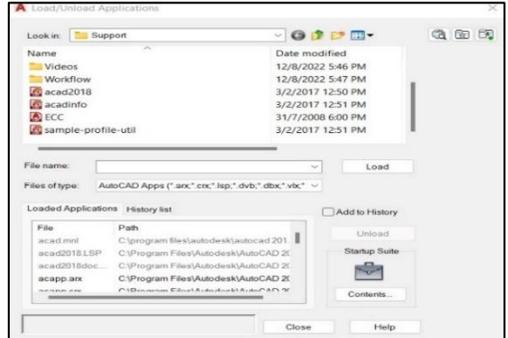
(d) Find the Autolisp software

Figure 1. Software installation

Construction drawing consists of the position of the actual point and as-built point used in calculating the alignment of the bore piles. Figure 2 shows the construction drawing with the alignment of the grid line. There are 16 bore pile points used in the calculation of the alignment as-build position of the bore pile. There are 10/C-A, 10/C-B, 10/C-C, 10/C-D, 10/G-A, 10/G-B, 10/G-C, 10/G-D, 9/D-A, 9/D-B, 9/D-C, 9/D-D, 9/F-A, 9/F-B, 9/F-C and 9/F-D.
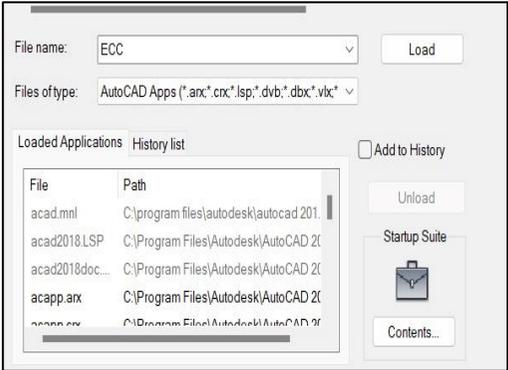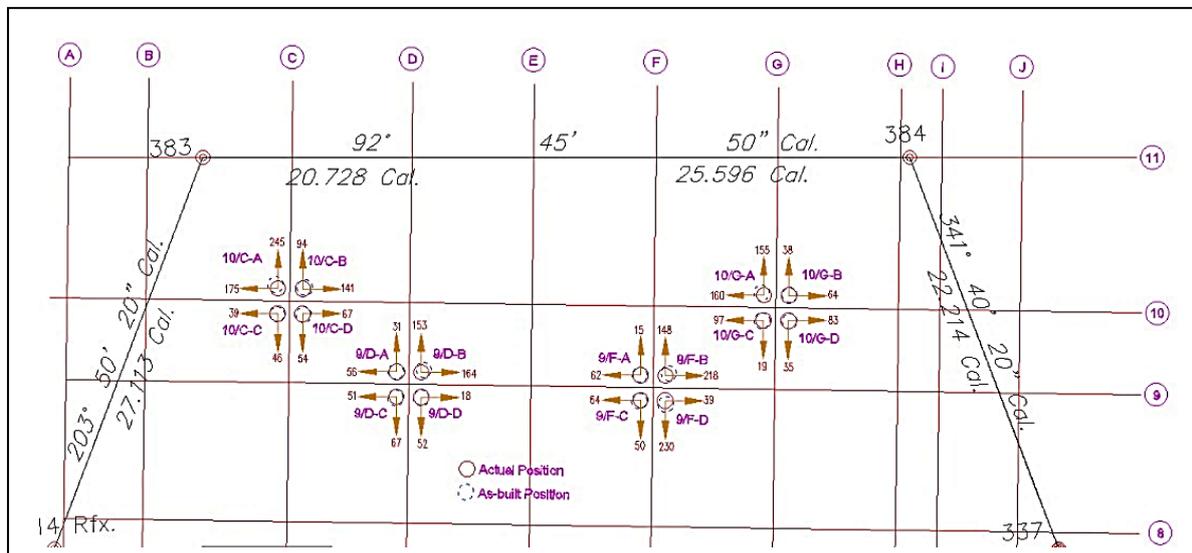

Figure 2. Construction drawing

Figure 3 shows the plotting of the as-built position with the actual position of the bore piles by using AutoCAD. Autolisp software will be used in the calculation of the alignment for the as-built position with the actual position.
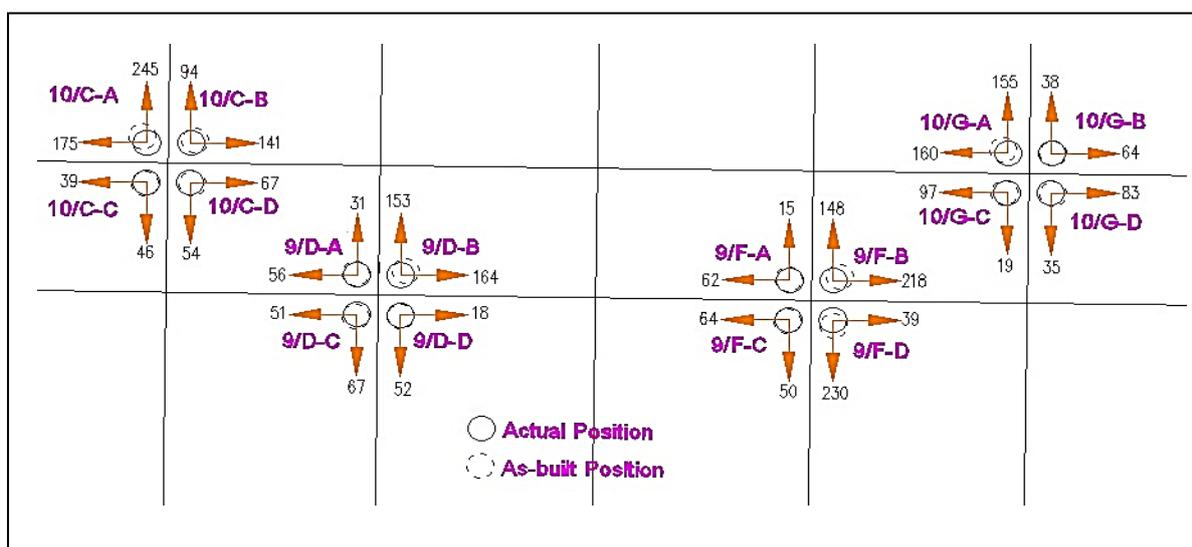
Figure 3. Plotting of the as-built position with the actual position

Figures 4a, 4b, 4c and 4d show the alignment for the actual position with the as-built position for the bore piles of the grid llines9/D, 9/F, 10/C and 10/G by using the Autolisp software.

Figure 4(a). Alignment bore piles for the grid line 9/D

Figure 4(b). Alignment bore piles for the grid line 9/F

Figure 4(c). Alignment bore piles for the grid line 10/C

Figure 4(d). Alignment bore piles for the grid line 10/G
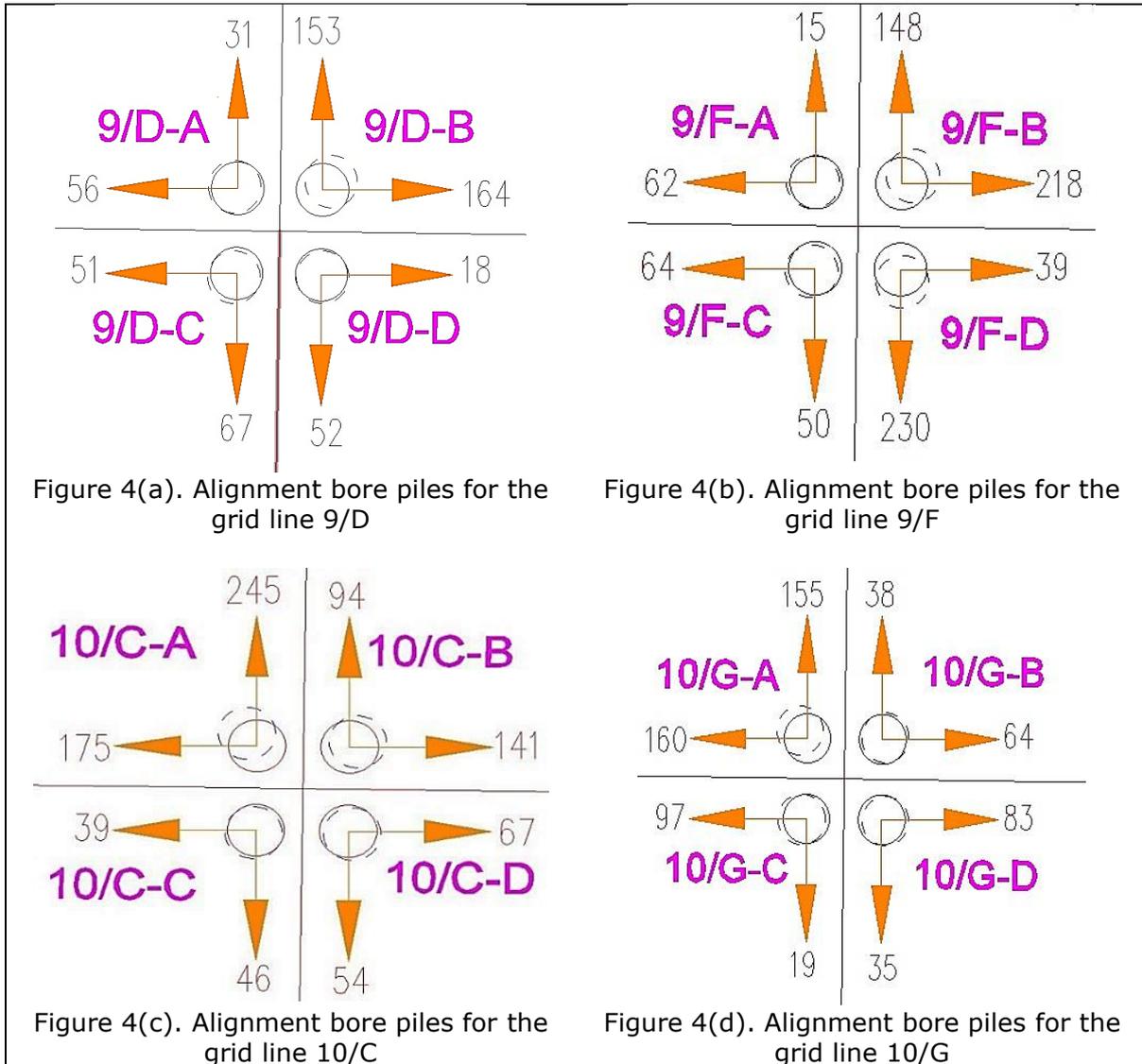
Figure 4. Alignment bore piles

RESULTS AND DISCUSSION

The finding of this study is the comparison between the coordinate method and with Autolisp software method to calculate the alignment of the position for the actual and as-built bore piles.

Table 1 shows the coordinate of the actual position and as-built position for the bore pile. There is a comparison of the coordinate for easting and nothing between the actual position and as-built position of the bore pile points 9/D-A, 9/D-B, 9/D-C, 9D-D, 9/F-A, 9/F-B, 9/F-C, 9F-D, 10/C-A. 10/C-B. 10/C-C, 10/C-D, 10/G-A, 10/G-B, 10/G-C and 10/G-D. The coordinate of the actual position for the bore points is from the construction drawing provided by the consultant while the coordinate of the as-built position is from the as-built surveying after completing the pilling work.

Table 1. Coordinate the actual and as-built position

BORE PILE POINT	ACTUAL POSITION		AS-BUILT POSITION	
	EASTING	NORTHING	EASTING	NORTHING
9/D-A	2071994.396	5167145.152	2071994.341	5167145.183
9/D-B	2071996.016	5167145.130	2071996.180	5167145.283
9/D-C	2071994.374	5167143.532	2071994.323	5167143.465
9/D-D	2071995.994	5167143.510	2071996.012	5167143.458
9/F-A	2072010.395	5167144.932	2072010.333	5167144.946
9/F-B	2072012.015	5167144.909	2072012.232	5167145.057
9/F-C	2072010.373	5167143.312	2072010.309	5167143.261
9/F-D	2072011.992	5167143.289	2072012.031	5167143.059
10/C-A	2071986.620	5167150.539	2071986.445	5167150.784
10/C-B	2071988.240	5167150.517	2071988.381	5167150.611
10/C-C	2071986.597	5167148.920	2071986.558	5167148.873
10/C-D	2071988.217	5167148.897	2071988.284	5167148.843
10/G-A	2072018.467	5167150.101	2072018.307	5167150.256
10/G-B	2072020.087	5167150.079	2072020.151	5167150.117
10/G-C	2072018.444	5167148.481	2072018.347	5167148.462
10/G-D	2072020.064	5167148.459	2072020.148	5167148.424

Table 2 shows the difference between the alignment of the actual and as-built bore pile position by using the coordinate method. The bore piles points of 9/D-B, 9/F-B, 9/F-D, 10/C-A, 10/C-B and 10/G-A may not meet the required tolerances from the consultant. It exceeded +/- 75mm if compared with the actual position.

Table 2. Comparison coordinates of the alignment for the actual position and as-built position of the bore piles by using the coordinate method

BORE PILE POINT	ACTUAL POSITION		AS-BUILT POSITION		DIFFERENT	
	EASTING (mm)	NORTHING (mm)	EASTING (mm)	NORTHING (mm)	EASTING (mm)	NORTHING (mm)
9/D-A	2071994396	5167145152	2071994341	5167145183	15	31
9/D-B	2071996016	5167145130	2071996180	5167145283	164	153
9/D-C	2071994374	5167143532	2071994323	5167143465	51	67
9/D-D	2071995994	5167143510	2071996012	5167143458	18	52
9/F-A	2072010395	5167144932	2072010333	5167144946	62	14
9/F-B	2072012015	5167144909	2072012232	5167145057	217	148
9/F-C	2072010373	5167143312	2072010309	5167143261	64	51
9/F-D	2072011992	5167143289	2072012031	5167143059	39	230
10/C-A	2071986620	5167150539	2071986445	5167150784	175	245
10/C-B	2071988240	5167150517	2071988381	5167150611	141	94
10/C-C	2071986597	5167148920	2071986558	5167148873	39	47
10/C-D	2071988217	5167148897	2071988284	5167148843	67	54
10/G-A	2072018467	5167150101	2072018307	5167150256	160	155
10/G-B	2072020087	5167150079	2072020151	5167150117	64	38
10/G-C	2072018444	5167148481	2072018347	5167148462	97	19
10/G-D	2072020064	5167148459	2072020148	5167148424	84	35

Table 3 shows the difference in the alignment for the coordinate of the actual and as-built bore pile point's position by using Autolisp software. This data is auto-generated in AutoCAD by using Autolisp software as shown in Figure 4.

Table 3. Difference between the actual and as-built position

Bore Pile Point	DIFFERENT	
	EASTING (mm)	NORTHING (mm)
9/D-A	56	31
9/D-B	164	153
9/D-C	51	67
9/D-D	18	52
9/F-A	62	15
9/F-B	218	148
9/F-C	64	50
9/F-D	39	230
10/C-A	175	245
10/C-B	141	94
10/C-C	39	46
10/C-D	67	54
10/G-A	160	155
10/G-B	64	38
10/G-C	97	19
10/G-D	83	35

Table 4 shows the difference in the alignment of the actual position and as-built position by calculation using the coordinate method and Autolisp method. From the comparison of Table 4, there are no differences in the coordinates between the coordinate method and the Autolisp method.

Table 4. Difference between the coordinate method and the Autolisp method

BORE PILE POINT	COORDINATE METHOD		AUTOLISP METHOD		DIFFERENT	
	EASTING (mm)	NORTHING (mm)	EASTING (mm)	NORTHING (mm)	EASTING (mm)	NORTHING (mm)
9/D-A	56	31	56	31	0	0
9/D-B	164	153	164	153	0	0
9/D-C	51	67	51	67	0	0
9/D-D	18	52	18	52	0	0
9/F-A	62	14	62	15	0	1
9/F-B	217	148	218	148	1	0
9/F-C	64	51	64	50	0	1
9/F-D	39	230	39	230	0	0
10/C-A	175	245	175	245	0	0
10/C-B	141	94	141	94	0	0
10/C-C	39	47	39	46	0	1
10/C-D	67	54	67	54	0	0
10/G-A	160	155	160	155	0	0
10/G-B	64	38	64	38	0	0
10/G-C	97	19	97	19	0	0
10/G-D	84	35	83	35	1	0

CONCLUSION

The outcome of the comparison for the different alignments for the actual position and as-built position by calculation of using the coordinate method and Autolisp method can prove that the calculation alignment on position for actual and as-built bore point is same by

using coordinate method and Autolisp. But the Autolisp method can be shown more easily, fast, and more accurately. In conclusion, the Autolisp method is more widely used for calculating the alignment of position for actual and as-built bore piles. The as-built information plays an important role in project planning and control. Nowadays, based on the requirement of the consultant, the tolerances between the actual position and the as-built position were not exceeded +/- 75mm. The consultant can do the amendment drawing based on the information on the as-built position. At the design stage, the designer must specify suitable tolerances which ensure not only that the construction will function properly but also that it can be built.

ACKNOWLEDGEMENT

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