ahp

by Mega Waty

Journal of Physics: Conference Series

Sensitivity Analysis with AHP Method: Selection of Foundation Design on Bridge Sei Muara Bulan Anak 2

To cite this article: Hendrik Sulistio *et al* 2018 *J. Phys.: Conf. Ser.* **1028** 012069

IOP Conf. Series: Journal of Physics: Conf. Series **1028** (2018) 012069 doi:10.1088/1742-6596/1028/1/012069

Sensitivity Analysis with AHP Method: Selection of Foundation Design on Bridge Sei Muara Bulan Anak 2

Hendrik Sulistio[1*], Mega Waty[1], Muhammad Ikhsan Setiawan[2], Nuning Kurniasih[3], and Ansari Saleh Ahmar[4]

[1]Department of Civil Engineering, Doctoral Program, Tarumanagara University, Jakarta 11440, Indonesia
[2]Department of Civil Engineering, Narotama University, Surabaya, Jawa Timur 60117, Indonesia
[3]Faculty of Communication Science Library & Information Science, Universitas Padjadjaran, Bandung, Jawa Barat 45363, Indonesia
[4]Department of Statistics, Universitas Negeri Makassar, Indonesia

**hendriksulistio.tarumanagara@gmail.com*

Abstract. The selection of the bridge is fundamental thing to Sei Anak Muara Bulan 2 Bridge Planning. After knowing the results of capacity analysis of land and pile support capacity, ease of implementation, determine the selection of foundation planning decisions. The results of AHP implementation indicate that the aspects of land and pile carrying capacity are the main priority criteria with the amount 61.7% as the reason to determine the choice of bridge foundation and the result of alternative is the foundation of equal to 42,2%

1. Introduction

Sei Muara Bulan Child 2 bridge is located in East Kutai Regency with initial condition only Bailey bridge that has been finished but is not proper used anymore. There is a bridge made of log wood beside Sei Muara Bulan Child 2 which although somewhat damaged but still can be used as a means of transportation where for long distance planning required new permanent bridge, so it is necessary to do a bridge planning called Sei Muara Bulan Child 2. The planning referred to in this research is the basic selection to choose the elect bridge. Based on the survey results, there are four alternative selection of the type of foundation that is wells foundation, bore pile foundation, concrete pile foundation. The foundation of the bridge is the basic part of the bridge building structure that exists under the bridge structure, including abutment and foundation. The foundations are heavily dependent on land carrying capacity, and local topography is also influenced by hydrological factors. There are some factors that influence in determining the type of foundation that is the state of the building and the load transferred to the foundation, it determines the general underground conditions, it is need to consider the general form of the foundation immediately, make a more detailed study and early design of the form of the foundation, more detailed and early design of the most appropriate form of foundation, estimating the cost of each foundation form, and choosing the most acceptable form in accordance with the conditions of implementation and cost. This research aims to analyze the Hierarchy (the level of selected criteria), the criteria for selecting the priorities used in the foundation selection based on recommendations by experts and the selection of the tendency of the type of foundation based on priority criteria. This research focuses on determining the parameters used parameters used based on four criteria: Cost Estimation (CE), ease of implementation (EI), Material Availability and Tool (AM) and soil and pillar carrying capacity (CSP). to achieve the purpose in this research used Analytical Hierarchy Process (AHP) method. The Analytical Hierarchy Process (AHP) process is a decision-making tool that describes complex problems in hierarchical structures with varying degrees comprising AHP objectives, criteria and alternatives. The basic approaches to decision-making with hierarchy, complex and unstructured problems broken up into groups, then organized into the hierarchy [1]-[7]

2. Research Design

This research is a quantitative research using Analytical Hierarchy Process (AHP). The primary data were obtained through direct survey to study sites in East Kutai district to directly observe the site and conduct good survey of hydrology survey, topography and dull soil to know the exact location of the location so as to determine the selection of expected type of foundation. The secondary data were obtained from the Central Bureau of Statistics literature on rainfall data and population data and the latest data on roads and bridges. data processing following the AHP steps developed by Saaty (1993), the way to process the data is by defining the problem and determining the desired solution, creating a hierarchical structure, creating a pair wise matrix of comparison, making the pair comparisons to get a rating of nx [(n-1) / 2, where n is the number of elements that are compared, calculates the Eigen values and consistency of tests, if inconsistent data collection must repeat the steps of form all levels of hierarchy. The criteria and level of AHP in choosing the type of bridge foundation is done by three stages, the first step is the determination of bridge foundation planning, the second stage is the carrying capacity of the soil and pole, cost estimation, then the implementation, and the availability of materials and tools, the third step is the choice of alternative foundation. Stage decision-making process using the AHP outline is to look at the problem structure into a hierarchy [8]-[10]

Table 1. Assessment Scale AHP (Cabala 2010)

N	**1,2**	**3**	**4**	**5**	**6**	**7**	**8**
RI	0,00	0,58	0,90	1,12	1,24	1,32	1,41
N	9	10	11	12	13	14	15
RI	1,45	1,49	1,51	1,48	1,56	1,57	1,59

Table 2. Random Value Index Sukarto, 2006

Intensity of	**Verbal Definition**
1	Both are equally important
3	A little More important
5	More important
7	Very important
9	Absolute important
2,4,6,8	The values of the middle of the above of assessment above assessment
The opposite of above	j elements having a value above the value of element i

If participation includes perception for every comparison between elements that are in comparable level or refer to determine which elements are the most important from the most liked or the most important, compiled matrix comparison. After pairwise is formed then the next step is measuring the weight priority of each element. The final result of calculating the weight priority is decimal number less than one. All elements are grouped logically and consistently championed based on logical criteria. Weighting that is obtained from paired comparisons should be related to the cardinal and ordinal. The following steps do logical consistency calculation as follows [11]-[13]

[a] The number of each line times by each priority and the result is divided by weight [illegible]ck and then in total

[b] The result is divided with the number of element, will be obtained λmaks.

[c] Index consistency (CI) = (λmaks-n) / (n-1)

[d] Ratio consistency = CI / RI, where RI is random index consistency. If ratio ≤0,1 consistency, the result can be justified the list of RI values is Table 1.

3. Result and Discussion

3.1. AHP Hierarchy Structure

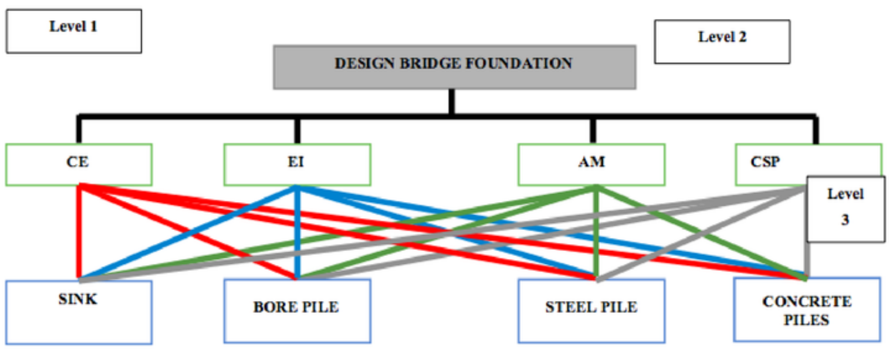

Fig.1. Hierarchy of criteria alternatives that influence the selection of bridge (Source: Research Analysis Results, 2016)

In calculation by AHP, factors that influence the selection of foundations based on four criteria (according to the expert) which is considered that the most influential is Cost Estimated (CE), Ease of Implementation (EI), Availability of Materials and tools (AM), and the Capacity of Soil and Pole (CSP). The selection of foundation type based on the technical calculation of wells foundation bore pile foundation, steel pile foundation and concrete pile. The importance of hierarchy setting is shown in figure 1.

3.2 Pairwise Comparison Matrix, Matrix and Computation Normalization Weights Priorities and Eigen Value and maximum Lamda

The next step is creating pairwise comparison matrix. From the assessment that is given by all members of group, then we get new comparison of matrix. The assessment of respondents who normalization matrix and weight value of priority criteria can be seen in Table 3 and Table 4.

Table 3. The result of matrix calculation criteria

Criteria	CE	EI	AM	CSP
CE	1,00	0,50	0,33	0,20
EI	2,00	1,00	0,50	0,20
AM	3,00	2,00	1,00	0,20
CSP	5,00	5,00	5,00	1,00
Total	**11,00**	**8,50**	**6,83**	**1,60**

Table 4. The value of priority criteria

Criteria	Priority
CE	0,508333333
EI	0,925
AM	1,55
CSP	4,00

Adding the value of each cell in one column does the normalization matrix, and then each value divided by the number of each column will be obtained by the relative value of each cell. While the weight priority is obtained by finding the average value of each cells in each row.

Table 5. The scale of weighting determination alternative bridge foundation

Cost Estimation (CE)				
Alternative	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile
Sink Foundation	1	1/5	1/3	¼
Bore Pile	5	1	1/2	1/3
Steel Pile	2	2	1	½
Concrete Pile	3	3	2	1
Ease of Implementation (EI)				
Alternative	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile
Sink Foundation	1	1/4	½	1/3
Bore Pile	4	1	1/2	1/3
Steel Pile	2	2	1	½
Concrete Pile	3	3	2	1
Availability of Materials and Tools (AM)				
Alternative	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile
Sink Foundation	1	1/7	1/3	¼
Bore Pile	7	1	3	4
Steel Pile	3	1/3	1	2
Concrete Pile	4	1/4	½	1
Capacity of Soil and Pole				
Alternative	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile
Sink Foundation	1	1/4	1/2	1/3
Bore Pile	4	1	2	2
Steel Pile	2	1/2	1	1
Concrete Pile	3	1/3	1	1

Table 6. The Normalization of bridge foundation alternative matrix

Cost Estimation (CE)				
Criteria	CE	EI	AM	CSP
CE	0,0909	0,0323	0,0870	0,1200
EI	0,4545	0,1613	0,1304	0,1600
AM	0,1818	0,3226	0,2609	0,2400
CSP	0,2727	0,4839	0,5217	0,4800
Total	1,0000	1,0000	1,0000	1,0000
Ease of Implementation (EI)				
Criteria	CE	EI	AM	CSP
CE	0,1000	0,0500	0,1300	0,1500
EI	0,4000	0,1900	0,1250	0,1530
AM	0,2000	0,3810	0,2500	0,2310
CSP	0,3000	0,3810	0,5000	0,4620
Total	1,0000	1,0000	1,0000	1,00
Availability of Materials and Tools (AM)				
Criteria	CE	EI	AM	CSP
CE	0,0670	0,0800	0,0700	0,0300
EI	0,4670	0,5790	0,6210	0,5520
AM	0,2000	0,1930	0,2070	0,2760
CSP	0,2670	0,1450	0,1030	0,1380
Total	1,0000	1,0000	1,0000	1,00
Capacity of Soil and Pole (CSP)				
Criteria	CE	EI	AM	CSP
CE	0,1000	0,1200	0,0910	0,1250
EI	0,4000	0,4800	0,3640	0,5000
AM	0,2000	0,2400	0,1840	0,1250
CSP	0,3000	0,1600	0,3640	0,2500
Total	1,0000	1,0000	1,0000	1,00

Eigen Value (EV) rated evenly the row value for each element criteria for each matrix of the normalization result seen on the Table 6.

Table 7 Eigen Value on each criteria

Criteria	CE	EI	AM	CSP	EV
CE	0,091	0,059	0,049	0,125	0,081
EI	0,182	0,118	0,073	0,125	0,124
AM	O,273	0,235	0,146	0,125	0,195
CSP	0,455	0,588	0,732	0,625	0,600
Total	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**

Eigen Value (EV) rated evenly the row value on each element determining the foundation on Table 7 and recapitulation on Table 8.

Table 8. Eigen value for each determination of the foundation

Criteria	EV			
Alternative	CE	EI	AM	CSP
Sink Foundation	0,079	0,104	0,063	0,109
Bore Pile	0,209	0,232	0,555	0,436
Steel Pile	0,264	0,261	0,219	0,187
Concrete Pile	0,448	0,402	0,163	0,268
Total	**1,000**	**1,000**	**1,000**	**1,000**

The largest eigenvalues (Lamda Maximum) are obtained by multiplying the total of matrix before the normalization with the main eigenvector values.

Table 9. Lamda Maximum Criteria

Criteria	EV	Total	λ maks
CE	0,081	11,00	0,890
EI	0,124	8,50	1,057
AM	0,195	6,83	1,331
CSP	0,600	1,60	0,960
Total	**1,00**	**27,93**	**4,238**

Table 10. Lamda Maximum of selection foundation

Cost Estimation			
Alternative	EV CE	Total	λ maks
Sink Foundation	0,083	11	0,907840112
Bore pile	0,227	6,2	1,404,719,368
Steel Pile	0,251	3,83	0,963382209
Concrete Pile	0,44	2,08	0,915800714
Total	1,00	23,11	4,191742,403
Ease of Implementation			
Alternative	EV EI	Total	λ maks
Sink Foundation	0,107	10	1,066,756,631
Bore pile	0,217	5,25	1,139,274,364
Steel Pile	0,286	4	1,062,077,188
Concrete Pile	0,411	2,16	0,888698413
Total	1,0	21,41	4,156,805,597
Availability of Materials and Tools			
Alternative	EV AM	Total	λ maks
Sink Foundation	0,063	15	0,948275862
Bore pile	0,555	1,73	0,957734127
Steel Pile	0,219	4,83	1,058,333,333
Concrete Pile	0,163	7,25	1,183,333,333
Total	1,0	28,81	4,147,283,799
Capacity of Soil and Pole			
Alternative	EV CSP	Total	λ maks
Sink Foundation	0,109	10	1,089,772,727
Bore pile	0,436	2,08	0,908143939
Steel Pile	0,187	5,5	1,026,875
Concrete Pile	0,268	4	1,073,636,364
Total	1,0	21,58	409,842,803

IOP Conf. Series: Journal of Physics: Conf. Series **1028** (2018) 012069 doi:10.1088/1742-6596/1028/1/012069

3.3. Index Consistency

Table 11. Index Consistency

Metric	CI		Hirarki/Level
1	0,07944809	Criteria	hirarki 2
2	41,917,424	Sink Foundation	hirarki 3
3	41,568,056	Bore Pile	hirarki 3
4	41,472,838	Steel Pile	hirarki 3
5	409,842,803	Concrete Pile	hirarki 3

Saaty has proven that the index consistency from matrix of the berth n can get with the formula

$$\text{C.I.} = \frac{\lambda\ maksimum\ - n}{n-1} \qquad (1)$$

where:

C.I. = index consistency

λ maximum = the eigenvalues has spread from matrix that have ordo n

scattered eigenvalues gained by summing up of multiplication result the number of columns with the main Eigen vector, the example for CI calculation for criteria, index consistency calculation:

λ max = 11 x 0,081 + 8,5*0,124+ 6,83* 0,195+1,6*0,6 = 4,24

Because matrix have an ordo 4 (that is consist of 4 factors) , the value of consistency index which is obtained:

$$CI = \frac{4{,}24 - 4}{4\text{-}1} = 0{,}0794$$

If CI worth zero, means a consistent matrix. The limit of inconsistency Saaty, measured by use Consistency Ratio (CR), that is the comparison of consistency index with random generator value (RI) which are labeled on the table 1. This value is depend on ordo matrix n. Therefore, consistency ratio can be formulated:

$$CR = CI/RI \qquad (2)$$

For example, continuing the values of the respondents which is listed,

CR=0,0794/0,9=0,088

If the matrix of CR value is less than 10%, the inconsistency of opinion is still acceptable. The calculation above is continued for level 3, to obtain the main eigenvector and C.R. on every level can be obtained. Composite weights are used to settle weight and overall consistency.

Table 12. Consistency Ratio criteria and selection of bridge foundations

Matrix	CR
1	0,088
2	0,071
3	0,058
4	0,055
5	0,036

Table 13. Synthesis of the iteration Matrix

Criteria	CE	EI	AM	CSP	Fourth Interaction	Normalization
CE	1.8O8.629.776,32	1.072.548.343,64	761.212.825,28	234.708.969,27	**3.877.099.914,52**	**0,078**
EI	2.814.432.417,63	1.669.012.691,68	1.282.060.602,14	365.233.692,30	**6.130.739.403,74**	**0,124**
AM	4.154.671.133,64	2.462.976.166,00	1.748.617.113,49	539.159.016,59	**8.905.423.429,72**	**0,180**
CSP	14.240.496.251,62	8.444.857.642,81	5.993.514.275,01	1.848.013.474,52	**30.526.881.643,96**	**0,617**

On the table above show that the priority criteria are the main on:

[a] Carrying capacity of soil and pole = 0,617
[b] Availability of Materials = 0,180
[c] Ease of Implementation = 0,124
[d] Estimated costs = 0,078

Table 13 show that the selection based on carrying capacity of soil and pole is the factor that the most influence with the scale 61,7 %. While the result of the smallest ranking is the cost estimates by scale 7,8 %.

3.4. Alternative Priority Weights

For the alternative iteration process of bridge foundation on each criteria conducted by matrix multiplication until iteration to 5 in each calculation, hence got result :

Table 14. Alternative Choice of Bridge Foundation Based on Cost Estimation

	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile	Fifth Interaction	Norm
SF	9.635.003.150.250.020.000,00	27.573.086.213.394.800.000,00	30.561.909.280.626.500.000,00	55.739.328.648.984.900.000,00	123.509.327.293.256.000.000,00	0,540
BP	3.766.115.079.923.920.000,00	10.777.722.413.044.100.000,00	11.825.757.649.822.300.000,00	21.787.302.286.897.000.000,00	48.156.897.429.687.300.000,00	0,210
SP	2.827.890.830.582.650.000,00	8.089.725.162.370.140.000,00	8.969.973.023.591.840.000,00	16.359.593.581.065.000.000,00	36.247.182.597.609.600.000,00	0,158
CP	1.629.825.157.525.110.000,00	4.664.171.729.396.260.000,00	5.169.751.149.094.850.000,00	9.428.679.853.967.400.000,00	20.892.427.889.983.600.000,00	0,091

Table 15. Alternative Choice of Bridge Foundation Based on ease of implementation

	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile	Fifth Interaction	Norm
SF	12.901.447.066.989.000.000,00	27.530.425.283.719.600.000,00	31.769.005.264.591.500.000,00	50.989.145.529.348.000.000,00	123.190.023.144.648.000.000,00	0,500
BP	5.437.013.907.901.960.000,00	11.602.050.999.482.700.000,00	13.008.227.882.949.100.000,00	21.488.185.934.138.600.000,00	51.535.478.724.472.300.000,00	0,209
SP	4.767.524.996.694.010.000,00	10.172.878.167.713.600.000,00	11.739.727.136.975.400.000,00	18.842.229.432.766.700.000,00	45.522.359.734.149.800.000,00	0,185
CP	2.717.414.868.020.960.000,00	5.798.697.344.505.570.000,00	6.691.463.895.472.950.000,00	10.739.776.821.133.900.000,00	25.947.352.929.133.400.000,00	0,105

Table 16. Alternative Choice of Bridge Foundation Based on availability of ingredients and materials

	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile	Fifth Interaction	Norm
SF	16.592.810.555.021.600.000,00	140.726.929.445.811.000.000,00	69.260.808.179.841.600.000,00	42.719.820.346.754.100.000,00	269.300.368.527.429.000.000,00	0,562
BP	2.064.113.679.879.950.000,00	17.507.770.031.772.700.000,00	10.554.770.210.728.100.000,00	5.314.263.389.541.510.00,00	35.440.917.311.922.200.000,00	0,074
SP	4.259.591.320.074.820.000,00	36.093.633.367.785.200.000,00	17.781.772.540.534.600.000,00	10.966.735.353.155.200.000,00	69.101.732.581.549.700.000,00	0,144
CP	6.482.288.332.255.710.000,00	54.977.583.802.616.100.000,00	27.058.015.678.493.000.000,00	16.689.287.934.184.800.000,00	105.207.175.747.550.000.000,00	0,220

Table 17. Alternative Choice of Bridge Foundation Based on carrying capacity of soil and pole

	Sink Foundation	Bore Pile	Steel Pile	Concrete Pile	Fifth Interaction	Norm
SF	8.518.383.186.413.480.000,00	32.325.271.399.564.600.000,00	18.780.596.300.992.200.000,00	17.739.490.656.782.900.000,00	77.363.741.543.753.200.000,00	0,475
BP	1.932.892.662.068.140.000,00	7.335.108.780.817.650.000,00	4.894.928.099.656.710.000,00	4.025.239.363.963.270.000,00	18.188.168.906.505.800.000,00	0,112
SP	3.610.547.889.752.320.000,00	13.692.137.797.342.400.000,00	7.960.463.883.144.620.000.00	7.518.948.041.306.360.000,00	32.782.097.611.545.700.000,00	0,201
CP	3.790.184.360.629.120.000,00	14.382.862.960.752.500.000,00	8.356.271.469.108.430.000,00	7.893.040.097.104.800.000,00	34.422.358.887.594.800.000,00	0,211

Table 18. Score for each alternative to the criteria

Foundation	CE	CI	AM	CSP
Sink Foundation	0,540	0,500	0,562	0,475
Bore Pile	0,210	0,209	0,074	0,112
Steel Pile	0,158	0,185	0,144	0,201
Concrete Pile	0,091	0,105	0,220	0,211

3.5. The best alternative determination

Determine the best alternative by combining the weighting result between the weighting result on the criteria and the weighting of alternatives based on the criteria.

Table 19. Multiplication of foundation aligned with the criteria

Foundation	CE	CI	AM	CSP	Bobot
Sink Foundation	0,540	0,500	0,562	0,475	0,078
Bore Pile	0,210	0,209	0,074	0,112	0,124
Steel Pile	0,158	0,185	0,144	0,201	0,180
Concrete Pile	0,091	0,105	0,220	0,211	0,617

Obtained: Table 20 Global Priority

Table 20 Global Priority Value

Foundation	Weight
Sink Foundation	0,423
Bore Pile	0,147
Steel Pile	0,257
Concrete Pile	0,165

Table 21 Ranking Priority of bridge foundation selection

Level	Foundation	Weight (%)
1	Sink Foundation	42,3
2	Steel Pile	25,7
3	Concrete Pile	16,5
4	Bore Pile	14,7

In table 21 we can see the ranking criteria of the most influence foundation alternatives. The obtained result of the main alternative priorities is the same age foundation =42,3%, the second alternative is steel pile foundation =25,7%, concrete pile foundation =16,5%, and the last is bore pile foundation =14,7%.

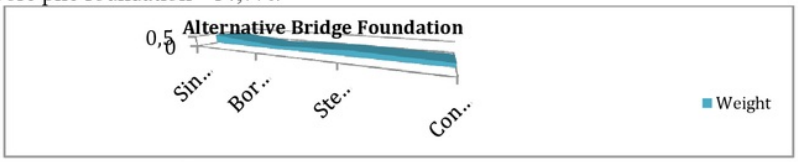

Figure 2. Alternative of foundation selection

3.6 Sensitivity Analysis

To apply the policy which appropriate with the purpose, then conducted AHP sensitivity analysis on each factor of each foundation researched. The design below is an AHP analysis design that can be used to determine the tendency of each selection type of foundation to several influential factors. The design below is obtained from the weight value selection of each foundation based on each criterion in table 18.

Y Sink = 0.540 Cost Estimate + 0.500 Ease of Implementation +0.562 Availability of Materials and Tools + 0.475 Capacity of Soil and Pole (3)

Y Steel = 0.158 Cost Estimate + 0.185 Ease of Implementation + 0.144 Availability of Materials and Tools + 0,201 Capacity of Soil and Pole (4)

Y Concrete = 0.091 Cost Estimate + 0.105 Ease Of Implementation + 0.220 Availability of Materials and Tools + 0.211 Capacity of Soil and Pole (5)

Y Bore = 0.210 Estimate Cost + 0.209 Ease of Implementation + 0.074 Availability of Materials and Tools + 0.112 Capacity of Soil and Pole (7)

where:

Y sink = sink foundation

Y Steel = Steel Pile

Y = Concrete Pile

Y Bore = Bore Pile

Cost estimation, ease of implementation, availability of materials and tools and capacity of soil and pole is a percentage of the priority criteria. Based on the formula obtained, then implemented sensitivity analysis that is to change each factors so that it can change the quality of each mode. Figures 3 to 6 show a graph of the selection of each foundation of the factors that influence it.

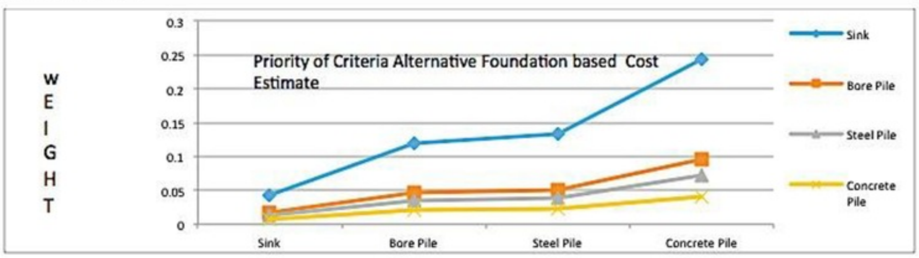

Figure 3. Graphic priority of foundation selection based on cost estimation

Figure 3 shows the change in the priority estimate that connected with the increasing of cost estimation in the selection of foundation, especially the foundation of the same age. The

IOP Conf. Series: Journal of Physics: Conf. Series **1028** (2018) 012069 doi:10.1088/1742-6596/1028/1/012069

second influential foundation is bore pile foundation and the third is steel pile foundation and the last is concrete pile foundation. The same age foundation can reach 25% then followed by bore pile, steel pile and the last is concrete pile foundation.

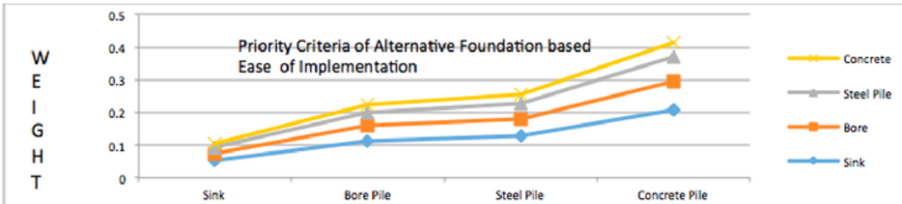

Figure 4. Graphic priority of foundation selection based on ease of implementation

Figure 4 shows the changes based on the selection of the foundation factor priorities that are influenced by the ease of implementation. The biggest influence based on the ease of implementation occurs on the concrete pile foundation that can reach more than 40%, but the smallest influence is on the same age foundation that is about 20%.

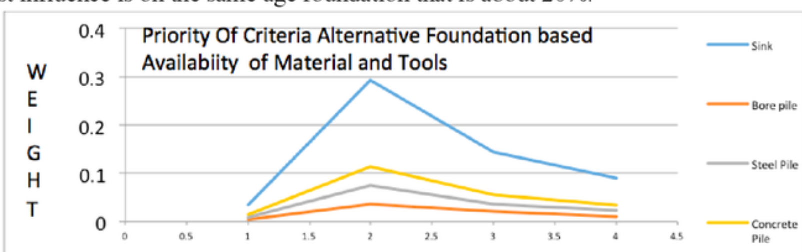

Figure 5. Graphic priority of foundation selection based on materials and tools availability

Figure 5 shows that the changing priorities which is caused by the changing of materials and tools availability occurs on the same age foundation that is about 35% as the biggest then concrete pile foundation as the smallest influence that is below 5%.

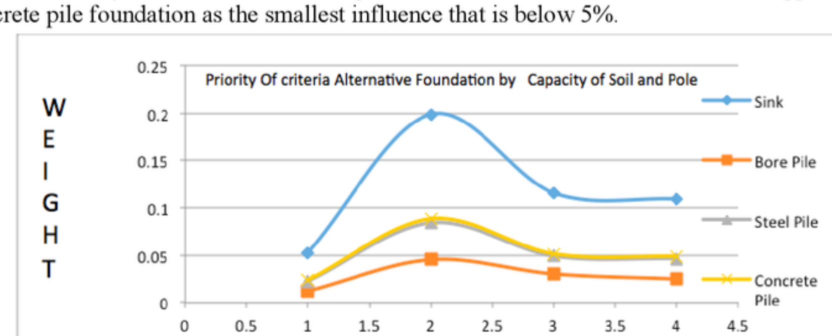

Figure 6. Graphic priority of foundation selection based on the capacity of soil and pole

Figure 6 shows that the changing priority which is caused by the capacity of soil and pole occurs on the same age foundation that is about 20% as the biggest and the smallest is occurs on the concrete pile foundation that is below 5%.

4. Conclusion

The most influential factor in foundation selection of the Sei Anak Muara bulan 2 bridge is the capacity of soil and pile. Based on the calculation technics, the highest founded in the calculation of the same age foundation. The changes of weight priority selection that caused by cost estimation, capacity of soil and pole, and the materials and tools availability make the increasing foundation where the more higher weight of the same age foundation will make bigger the selection of the same age foundation on the bore pile foundation, steel pile foundation and the last is concrete pile foundation based on the ease of implementation in the selection factor of weight increase that lies on the concrete pile foundation which is can reach 40% but the smallest changes occurs on the same age that is about 20%.

5. Acknowledgement

This research was supported by Civil Engineering Department, Doctoral Program, Tarumanagara University, Jakarta, Indonesia.

References

[1] Bowles, J.E, 1993, Analisis dan Desain Pondasi, Edisi Keempat, Jilid 1, 1997, Penerbit Erlangga
[2] Brojonegoro, B. 1992. Teori dan Aplikasi Model AHP. Pusat Antar Universitas, Studi Ekonomi, UI. Jakarta
[3] Cabala, Powel 2010. Using The Analytical Hierarchy Process in Evaluating Decisiion Alternatives. Deparment of Management Process Cracow Universiy of Economic, Rakowicka
[4] Christiadi H, 2011, Analisa dan Desain Pondasi I, Penerbit Gajah Mada Universitiy Press, Teknik Pondasi I, Jilid 2 ,
[5] H, S Sarjono, Pondasi Tiang Pancang I, 1988, Pernerbit Sinar Wijaya.
[6] H, S Sarjono, Pondasi Tiang Pancang II, 1991 Publisher Sinar Wijaya.
[7] Kadarsyah, Suryadi and Ramdhani, M Ali, 1998, Decision Support System: A Discourse Structural idealization and Decision Making Concept implementation, PT. Teens Rosdakarya, Bandung.
[8] Peck , R.B., Hanson, W.E., Thornburn,T.H., Teknik Pondasi , Edisi Kedua Gadjah Mada University Press, 1996.
[9] Saaty, TL, 1994, Fundamentals Of Decision Making, Pittsburgh: RWS Publications, England.
[10] Wells, G.R. Comprehensive Transport Planning. High Wycombe. London. 1975
[11] Saaty, T.L The Analitic Hierarchy Process What it is dan How it used, *Journal of Matehematical Moderlling* ***9*** *3-5, 1987 0. 161-176*.
[12] Wicaksana, Dali Kesuma, Sensitivity Analysis and Community Characteristics in the city of Palembang in choosing the means of transportation and the method of Analytical Hierarchy Process (AHP) Department of Civil Engineering, University of Sriwijaya, *Journal of Civil and Environmental Engineering* ***3*** *March 1 2015*
[13] Suyono, Joko, Agus Sukoco, M.Ikhsan Setiawan, Suhermin, and Robbi Rahim. 2017. Impact of GDP Information Technology in Developing of Regional Central Business (Case 50 Airports IT City Development in Indonesia) *IOP Conf. Series: Journal of Physics: Conf. Series* ***930****:11002*

ahp

ORIGINALITY REPORT

19%	13%	13%	13%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Hasanuddin Student Paper	7%
2	china.iopscience.iop.org Internet Source	4%
3	Submitted to Beykent Universitesi Student Paper	2%
4	Siti Nor Fatimah Zuraidi, Mohammad Ashraf Abdul Rahman, Zainal Abidin Akasah. "A Study of using AHP Method to Evaluate the Criteria and Attribute of Defects in Heritage Building", E3S Web of Conferences, 2018 Publication	1%
5	www.tandfonline.com Internet Source	1%
6	digilib.uinsby.ac.id Internet Source	1%
7	M Djelosevic. "Designing a flexible facade lift and development of optimal shape of the column", IOP Conference Series: Materials	1%

	Science and Engineering, 2018 Publication	
8	Submitted to Universiti Teknikal Malaysia Melaka Student Paper	1%
9	Submitted to University of Birmingham Student Paper	<1%
10	Soleman -. "Decision Support System for Employee Candidate Selection using AHP and PM Methods", International Journal of Advanced Computer Science and Applications, 2019 Publication	<1%
11	Wiwien Hadikurniawati, Edy Winarno, Taufiq Dwi Cahyono, Dahlan Abdullah. "Comparison of AHP-TOPSIS Hybrid Methods, WP and SAW for Multi-Attribute Decision-Making to Select The Best Electrical Expert", Journal of Physics: Conference Series, 2018 Publication	<1%
12	Submitted to School of Business and Management ITB Student Paper	<1%
13	Submitted to UIN Syarif Hidayatullah Jakarta Student Paper	<1%
14	www.science.gov Internet Source	<1%

15	MI Setiawan, S Surjokusumo, DM Ma’soem, J Johan et al. "Business Centre Development Model of Airport Area in Supporting Airport Sustainability in Indonesia", Journal of Physics: Conference Series, 2018 Publication	<1%
16	link.springer.com Internet Source	<1%
17	www.researchgate.net Internet Source	<1%
18	www.people.revoledu.com Internet Source	<1%
19	Haoli Xu, Daqing Wang, Zhengdong Deng, Zhixin Liu, Longsheng Hu. "Research on Assessment of Risk of Gas Disaster in Mine Based on Monte Carlo - AHP Method", IOP Conference Series: Earth and Environmental Science, 2018 Publication	<1%

Exclude quotes	Off	Exclude matches	< 5 words
Exclude bibliography	On		