



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 1, January 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

Analysis of the Strength of the Losari Wastewater Treatment Installation Tank Structure in Makassar City

Olan Jujun Sanggaria¹, Frans Phengkarsa², Jergy Artaban Parinussa³

Assistant Professor, Department of Civil Engineering, Universitas Kristen Indonesia Paulus, Makassar, Indonesia¹

Associate Professor, Department of Civil Engineering, Universitas Kristen Indonesia Paulus, Makassar, Indonesia²

Student, Department of Civil Engineering, Universitas Kristen Indonesia Paulus, Makassar, Indonesia³

ABSTRACT: Planning the structure of a building must meet the basic principles of the structure, one of which is strength. Which means it aims to produce a structure that is relatively strong, able to withstand loads. A structure is considered strong if it is able to withstand the load for the planned life of the building. For this reason, the purpose of this paper is to determine the strength of the reinforced concrete tank structure of Bio Filter Media at underground elevations and by using the Finite Element Method (FEM) and the help of the SAP2000 application to help design reinforcement in structural elements. The results of the structural strength analysis carried out stated that the planned structural elements had fulfilled the moment control requirements and met the specified safety factor. In terms of strength, the planned structural elements are able to withstand the vertical and horizontal loads that arise.

KEYWORDS: Strength, Tank, Bio Filter Media.

I. INTRODUCTION

Makassar City is one of the Metropolitan Cities in South Sulawesi Province, Indonesia. One of the problems in this city is the processing of liquid waste produced by households and offices and other commercial places. As is known, households, restaurants, markets use a lot of water in their production processes, such as for washing raw materials, for cooking purposes and for washing equipment after use. Most of the water used will be wasted as waste water, so this waste product also has the potential to pollute the environment. To overcome this problem, the government of Makassar City built the Losari Waste Water Treatment Plant (WWTP) located at Metro TanjungBunga before releasing it into the waters so that environmental pollution can be overcome.

Construction of a Wastewater Treatment Plant requires a very strong construction structure. In planning the structure of a building must meet the basic principles of structure, namely strength [1]-[2]. Which means aiming to create a structural element that is relatively strong, as well as fulfilling other goals. The structure will be considered strong if it is able to withstand the load for the planned number of years. So that in order to achieve this goal, the planning of structural elements must comply with the conditions set by the government, namely the Indonesian National Standard (SNI). Such as the infrastructure contained in the waste treatment facility located at one of the WWTP located on Jl. TanjungBunga Lake, Makassar City, South Sulawesi, namely Media Bio Filter, is a sophisticated wastewater purification process using a special biological technology process. It is estimated that the MBBR can process as much as 49.92 m³ of waste per day. With that much volume of waste, the structural strength factor must be taken into account properly.

Strength is the ability of elements and components of a building structure that work vertically or horizontally to withstand the loads that arise. Vertical structural components in the form of columns function to withstand the vertical forces that are flowing and propagated towards the building sub-structure (sloof and foundation). Horizontal structural components in the form of floor and beam structures to support the dead and live loads which are transmitted to the columns. While the elements of the structure are the foundation, floor plates and walls of the structure.

This study focuses on structural analysis based on field data contained in the project. While the analysis carried out is to test the results of the analysis carried out by the planner on the structural elements of the construction

II. RELATED WORK

Prior to conducting this research, there had been many similar studies on structural elements related to this research, such as that conducted by Abdul Rahman with the title "Analysis of Bore Pile Foundation Bearing Capacity Using Sondir and SPT Data in the Loban River Reservoir Development Project". The research results show that the bearing capacity of the bore pile foundation has met the safety factor that has been determined using N-SPT data and the Reese & Wright method. [3]. A research title "Analysis of Bore Pile Foundation Support Strength Based on Field Test Data (Cone and N-Standard Penetration Test)" written by UlfaJusi, concluded that the calculation of the bearing capacity of drilled piles with a small safety factor, will be more efficient in the use of materials and construction costs. [4]. The research according to UlyNurulFadilah and HalimahTunafiah entitled "Analysis of Bored Pile Foundation Bearing Capacity Based on N-SPT Data According to the Reese & Wright Formula and Settlement", states that the ultimate bearing capacity according to conventional methods is smaller than the carrying capacity of the PDA test results. [5]. Research entitled "Redesign of Reservoir Development in Sonowangi Village, Ampelgading District, Malang Regency" made by DafidIrawan, RimanRiman, Abdul Halim, and AnisPurwaningsih, concluded that the dimensions of the reservoir are 10 m x 6 m x 4.15 m with each free threshold a minimum of 30 cm above the highest water level and the bottom of the tub at least 15 cm above the lowest water level. [6]. Research conducted by HerryPuguhPrasetya, KhotibulUmam, and DeckyRochmanto with the title "Structure Planning of Clean Water Reservoirs in PecangaanKulon Village, Pecangaan District, Jepara Regency", with the result that the reservoir is planned to use reinforced concrete material with a base plate thickness of 250 mm and its reinforcement D13-150, concrete wall thickness of 150 mm and reinforcement D13-100, and cover plate with thickness of 100 mm with reinforcement Ø10 – 150. Reservoir planning according to standard, safe and efficient. [7]. Research with the title "Tank Design Analysis Using Response Spectra and Time History Methods", says that the design of the tank structure is a very broad plan because it includes all complex planning and loading, where a lot of uncertainty is obtained due to dynamic loads, hydrodynamic loads, earthquake areas that have been calculated and all of that must be integrated into an adequate structural design. [8]. The research was conducted by Johannes Tarigan, Simon DerthaTarigan, Ernie ShintaYosephineSitanggang, and Philip AmsalApriantoGinting with the title "Study of Planning Criteria and Methods for Implementing Reservoir Structures". From the results of these studies, it is concluded that the condition of the safety factor before the redesign was 0.1798 and there was an increase of up to 1.2 m. To anticipate this, additional soil was added and the thickness of the slab from before the redesign was carried out, which was 25 cm. If the heaving is 6.477 cm, ground anchors will be installed with a total of 2 pieces per piece with each installation distance of 8 m. [9]. Research entitled "Planning of Ground Water Tank Foundations for the Central Jakarta BPJS Building Project" conducted by Erwin Batista, Ridwan Ahmad Fauzi, and AndikanozaPradiptiya. According to the results of this study, there was a total decrease of 15.33976 mm which is still included in the permit requirements, namely below 25.4 mm. [10]. Research conducted by Dina Suryani, FitriIndriyani, and AisyahSalimah with the title "Planning of the Bored Pile Foundation for the Manggarai - Jatinegara Double-Double Track Project", obtained a foundation diameter and pile length of 120 cm and 25 meters for safe dimensions on the foundation piles and The number of foundation piles is 9 pieces. [11]. The research entitled "Analysis of Retaining Wall Stability in the Pump House Development Project on JISidorukunPulo Brayana Darat Medan" conducted by SantuFiedlisMungkur and Nahesson H. Panjaitan, said that from the analysis carried out, the safety factor value for shear was 3.353 more. greater than the minimum safety factor requirements determined for shear, which is 1.5 and for overturning force, a value of 2.01 is greater than the minimum safety factor requirements determined for overturning, which is 2.0. So that it can be said that the planned wall is stable and there will be no overturning or sliding. [12].

III. METHODOLOGY

1. Research Location

The research location is the Package B1 Waste Water Treatment Plant (WWTP) project, the Bio Filter Media processing pond on Jl. Lake Tj. Bunga, MacciniSombala, Kec. Tamalate, Makassar City, South Sulawesi. The Advanced WWTP was built using a budget of IDR 176.18 billion plus USD 3.04 million or the equivalent of IDR 43.44 billion originating from ADB Loans, APBN and APBD Makassar City. The WWTP will later improve domestic wastewater services with a centralized system in urban areas.

The WWTP is expected to establish a Centralized Domestic Wastewater Service System in urban areas whose reference is to meet wastewater quality standards in accordance with Minister of Environment Regulation No.P.68/Menlhk/Setjen/Kum.1/8/2016 concerning Domestic Wastewater Quality Standards . One of the functions of the Losari WWTP development is to improve the quality of groundwater and raw water, and can be an educational tool

to increase public awareness of environmental pollution issues in Makassar City. The fact is that in Makassar City, the percentage of households equipped with domestic wastewater management facilities is 98.7 percent. However, of that number, only 24 percent have met the principles of safe sanitation.

Exemplar based inpainting technique is used for inpainting of text regions, which takes structure synthesis and texturesynthesis together. The inpainting is done in such a manner, that it fills the damagedregion or holes in an image, with surrounding colour and texture. The algorithm isbased on patch based filling procedure. First find target region using mask image and then find boundary of target region. For all the boundary points it defined patch andfind the priority of these patches. It starts filling the target region from the highestpriority patch by finding the best match patch. Thisprocedure is repeated until entire target region is inpainted.



Fig. 1. Research Location

2. Data collection techniques

Data collection techniques were carried out using direct field observation techniques and planning data in the form of soil investigation data and detailed design data from the planner. The data is in the form of Standard Penetration Test (STP) data, Cone Penetration Test (CPT) and data from laboratory testing results [13]-[14].

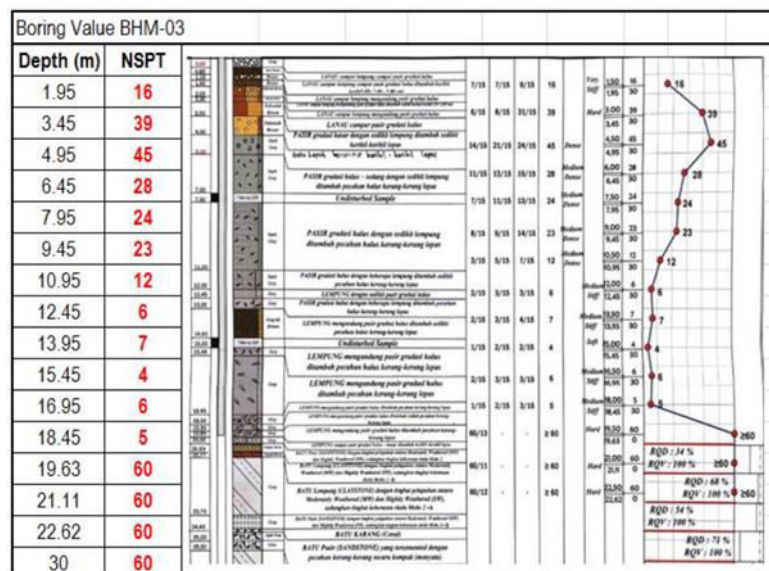


Fig. 2 Standard Penetration Test (SPT) data

From Figure 2, it can be seen that at a depth of 1.95 m to 4.95 m from the ground surface there is silt, then the NSPT value decreases at a depth of 7.95 m to 18.45 m because at that depth there is sand. However, at a depth of 19.63 m to 30 m, the NSPT value increases because there is hard soil at that depth.

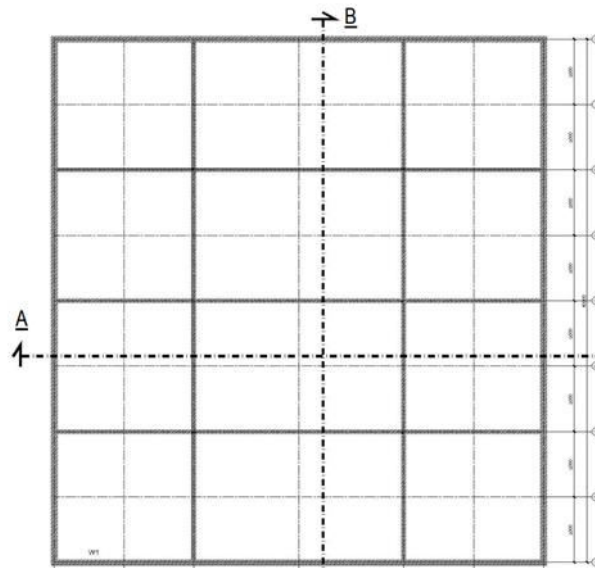


Fig. 3. Plan of processing pond

Table 1. Planning data

No.	Planning data	Value	Unit
a	X-direction building size	35000	mm
b	Y-direction building size	40000	mm
c	Z-direction building size	5000	mm
d	Concrete quality	32	N/mm ²
e	Melting stress of iron	420	N/mm ²
f	Floor plate		
1)	plate thickness	400	mm
2)	Concrete blanket	30	mm
3)	Plan reinforcement	16	mm
4)	Concrete quality	32	N/mm ²
5)	Melting stress of iron	420	N/mm ²
g	Wall		
1)	plate thickness	400	mm
2)	Concrete blanket	30	mm
3)	Plan reinforcement	16	mm
4)	Concrete quality	32	N/mm ²
5)	Melting stress of iron	420	N/mm ²
h	Foundation		
1)	Plan reinforcement	16	mm
2)	Concrete quality	32	N/mm ²
3)	Melting stress of iron	420	N/mm ²
i	Working load		
1)	Dead Load		
a)	Wall	4,8	ton/m
b)	Floor plate	0,96	ton/m ²
c)	Specs	0.11	ton/m ²
2)	live load	4,7	ton/m ²
3)	Lateral earth pressure		
a)	Active earth pressure (Pa1)	6,253	ton/m
b)	Lateral pressure on the groundwater table (Pa2)	0,806	ton/m

4)	Earthquake load		
a)	PGA	0,1115	g
b)	Ss	0,2247	g
c)	S1	0,1087	g
d)	Sds	0,13	g
e)	Sd1	0,06	g

3. Data analysis techniques

1) Structure Modeling.

Structural analysis uses the SAP2000 ver.22 program where the first step is inputting the investigation data and selecting Grid Only to make the modeling easier. Next is to determine the number of grid lines (Number of Grid Lines), the spacing between grids (Grid Spacing) and (First Grid Line Location) in the X, Y and Z directions to make it easier to draw a structural model. Next, input the material data into the program where the quality of the concrete used is $f'_c = 32 \text{ N/mm}^2$, then enter it into the material property data on the Define > Materials tab menu

2) Structural analysis

To analyze the structural plate, walls and foundation of the processing basin, the following equation is used:

a. To fulfill the requirements, equation 1 is used as follows:

$$B1 = 0.85 - 0.008x(fc - 30 \text{ Mpa}) \dots\dots\dots (1)$$

b. To analyze the moment of stiffness using equation 2 as follows:

$$K = \frac{M}{0,8 \times b \times d^2} \dots\dots\dots (2)$$

c. Calculating the maximum moment of stiffness (K_{max}) using equation 3 as follows :

$$K_{maks} = 382 \times B1 \times f'_c \times \frac{600+fy-225 \times 0,8}{600+fy} \dots\dots\dots (3)$$

d. Calculating the required reinforcement using equations 4, 5 da 6 as follows:

$$a = \left(1 - \sqrt{1 - \frac{2 \times K}{0,85 \times f'_c}}\right) \times d \dots\dots\dots (4)$$

$$As, u = \frac{\sqrt{f'_c}}{4 \times fy} \times b \times d \dots\dots\dots (5)$$

$$As = \frac{0,85 \times f'_c \times a \times b}{fy} \dots\dots\dots (6)$$

e. Rebar spacing (using D16 iron) using equations 7 and 8 as follows:

$$s = \frac{0,25 \times 3,14 \times D^2 \times S}{Asu} \dots\dots\dots (7)$$

$$As = \frac{0,25 \times 3,14 \times D^2 \times S}{s} \dots\dots\dots (8)$$

f. To calculate the height of the compressed concrete beam, equation 9 is used as follows:

$$a = \frac{As \times fy}{0,85 \times f'_c \times b} \dots\dots\dots (9)$$

g. To analyze the nominal moment using equation 10 as follows:

$$Mn = As \times fy \times (d - \frac{a}{2}) \dots\dots\dots (10)$$

IV. ANALYSIS AND DISCUSSION

1. Structure Modeling

.Structural components to be created on the Define tab menu > Section Properties, then select the required section. Select Area Sections. Then select the "Shell - Thin" type, enter the thickness of the floor slab in the thickness section of 40 cm, and change the material type to concrete with an f'c of 32 Mpa.

Select Area Sections. Then select the "Shell - Thin" type, enter the wall thickness in the thickness section of 40 cm, and change the material type to concrete with an f'c of 32 Mpa. So that the results of the analysis on the floor slab can be read more accurately, do object meshing, namely dividing the floor slab into smaller elements. The smaller the element size, the more accurate the results will be with side effects is the analysis process is longer and the file size will be larger. The way to divide the divide is by clicking the Edit menu tab > Edit area > Divide Areas, so that the Divide Selected Areas dialog box appears. Then select Divide Area into This Number of Objects in the Divide Options section. For walls and floor slabs measuring 5 m x 5 m, input a value of 5 in the "Along Edge from Point 1 to 2" box, and a value of 5 in the "Along Edge from Point 1 to 3" box. For walls and floor slabs measuring 7 m x 5 m, input a value of 7 in the "Along Edge from Point 1 to 2" box, and a value of 5 in the "Along Edge from Point 1 to 3" box. The results of structural modeling can be seen in Figure 4.

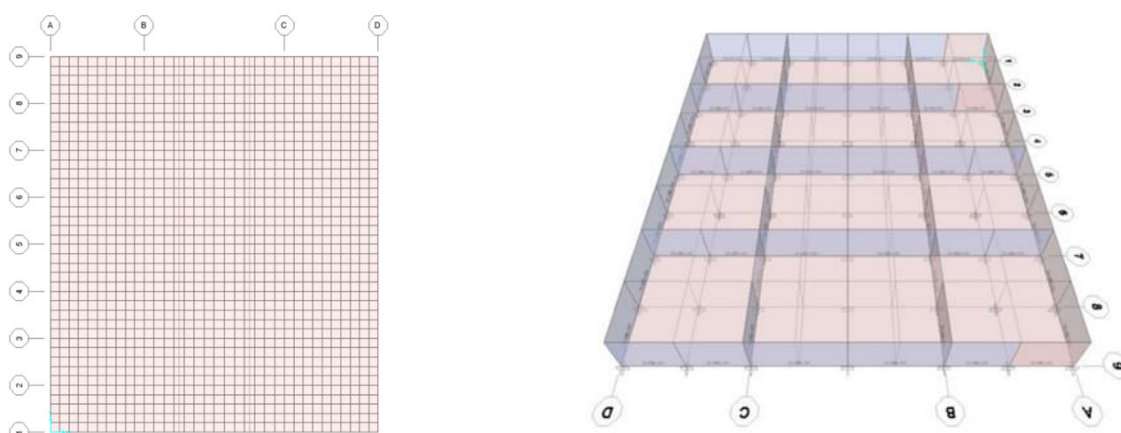


Fig. 4. Structural modeling using the SAP2000 ver.22 application

2. Structural analysis

To analyze whether the structural elements have met the requirements, an analysis of the floor plates is carried out in both the X direction, Y direction and Y direction and the processing tub wall elements, as well as the foundation.

1) Calculation of the base plate in the x direction:

Planning data

Mxx	= 5379362.65	N.mm	Effective height (d)	= 360	mm
Plate thickness (H)	= 400	mm	Concrete quality (f'c)	= 32	Mpa
Plate width (b)	= 1000	mm	Reinforcing iron (fy)	= 420	Mpa

The requirements that must be met are $f'c \ 30 \leq f'c \leq 55 \text{ MPa}$

To fulfill the requirements, equation 1 is used as follows:

From equation 1 it is obtained: $B1 = 0,85 - 0,008 \times (32-30) = 0.834$

Calculating the moment of stiffness (K):

To analyze the moment of stiffness using equation 2 as follows:

From equation 2, the stiffness moment is obtained as follows:

$$K = \frac{537936,65}{0,8 \times 1000 \times 360^2} = 0.052 \text{ N/mm}^2$$

Calculating the maximum moment of stiffness (Kmax) using equation 3 as follows:

From equation 3, the maximum moment of stiffness (Kmax) is obtained as follows:

$$K_{maks} = 382 \times 0,834 \times 32 \times \frac{600+420-225 \times 0,8}{600+420} = 8.231 \text{ N/mm}^2$$

Calculating the required reinforcement using equations 4, 5 da 6 as follows:

From equation 4, the required reinforcement value is obtained as follows:

$$a = \left(1 - \sqrt{1 - \frac{2 \times 0,052}{0,85 \times 32}} \right) \times 360 = 0.687 \text{ mm}^2$$

$$As, u = \frac{\sqrt{32}}{4 \times 420} \times 1000 \times 360 = 1212.183 \text{ mm}^2$$

$$As = \frac{0,85 \times 32 \times 0,687 \times 1000}{420} = 44.515 \text{ mm}^2$$

The largest is chosen, so that the area of reinforcement used is $As, u = 1212,183 \text{ mm}^2$

From equation 7, the reinforcement spacing is obtained as follows:

$$s = \frac{0,25 \times 3,14 \times 16^2 \times 1000}{1212.183} = 165.783 \text{ mm}$$

With the provision of $s < 2H$ ($H = 400 \text{ mm}$)

$s < 2(400)$

$s < 800 \text{ mm}$

worn $s = 160 \text{ mm}$ ($s < 165,783 \text{ mm}$)

From equation 8, the reinforcement spacing is obtained as follows:

$$As = \frac{0,25 \times 3,14 \times 16^2 \times 1000}{160} = 1256 \text{ mm}^2 > As, u$$

So, use reinforcement D16 - 160 = 1256 mm²

Design moment control ($M_u < M_d$)

From the calculation results of SAP2000, $M_u = 5379362.65 \text{ N.mm}$ is obtained

From equation 9, the height of the compressed concrete beam is obtained as follows:

$$a = \frac{1256 \times 420}{0,85 \times 32 \times 1000} = 19.394 \text{ mm}$$

Nominal moment:

From equation 10, the Nominal Moment is obtained as follows:

$$M_n = 1826.909 \times 420 \times \left(360 - \frac{19.394}{2} \right) = 184791807.529 \text{ N.mm}$$

Plate design moment:

Ø value according to SNI 2847:2019

Ø = 0,9

$$\begin{aligned}
 M_d &= \phi M_n \\
 &= 0,9 \times 184791807,529 \\
 &= 166312626,776 \text{ N.mm} \\
 M_u &< M_d \\
 5379362,65 &< 166312626,776 \dots (\text{Ok})
 \end{aligned}$$

For subsequent calculations, use the same equation and use data as in Table 1. The calculation results can be seen in Table 2 and Table 3 as follows:

Table 2. Recapitulation of the calculation of slab and wall structural elements

Structure Elements	Axis Direction	Mu (N.mm)	Mn (N.mm)	Md (N.mm)	Design Moment Control (Mu < Md)
Floor Plate	X	5,379,362.65	184,791,807,529	166,312,626,776	According to requirements
	Y	5,985,875.54	169,240,012,206	152,316,010,985	According to requirements
Wall	X dan Y	491,639,095.00	175,250,093,985	157,725,084,587	According to requirements
	Z	288,570,507.00	165,268,096,912	148,741,287,221	According to requirements

Table 3. The results of the calculation of the foundation structural elements

Structure Elements	Vertical Force (ton)	Obtained Safety Factor	Regulations (FK > 3)
Foundation	128,38	3,244	According to requirements

V. CONCLUSION

Based on the results of the analysis, the planned structural elements, namely floor slabs and walls have met the requirements, where the required moment must be smaller than the design moment ($M_u < M_d$) and for the foundation it also meets the safety factor requirements, where the safety factor of the structural elements must be greater than 3 ($FK > 3$). So it can be concluded that in terms of strength, the planned structural elements are able to withstand the vertical and horizontal loads that arise.

REFERENCES

- [1] V. Ponco, J. Tanijaya, dan O. J. Sanggaria, "Perbandingan Beton Dengan Menggunakan Portland Composite Cement Dan Ordinary Portland Cement," Paulus Civ. Eng. J., vol. 3, no. 3, hlm. 406–411, Okt 2021, doi: 10.52722/pcej.v3i3.292.
- [2] O. J. Sanggariadan I. Apriyani, "Soil Investigation Analysis Bearing Capacity of Caisson Foundation Makassar City Bblk Service Building," IOP Conf. Ser. Earth Environ. Sci., vol. 1097, no. 1, hlm. 012043, Okt 2022, doi: 10.1088/1755-1315/1097/1/012043.
- [3] A. Rahman, "Analisis Daya Dukung Pondasi Bore Pile Menggunakan Data Sondir Dan SPT Pada Proyek Pembangunan Reservoir Sungai Loban," 2021. <http://eprints.uniska-bjm.ac.id/6645/1/ARTIKEL%20oke%20-%20Copy.pdf>
- [4] U. Jusi, "Analisa Kuat Dukung Pondasi Bore Pile Berdasarkan Data Pengujian Lapangan (Cone dan N-Standard Penetration Test)," Jurnal Teknik Sipil Siklus, vol. 1, pp. 50-82, 2015. <https://journal.unilak.ac.id/index.php/SIKLUS/article/view/136>
- [5] U. N. Fadilah dan H. Tunafiah, "Analisa Daya Dukung Pondasi Bored Pile Berdasarkan Data N-SPT Menurut Rumus Reese & Wright Dan Penurunan," Jurnal IKRA-ITH Teknologi, vol. 2, pp. 7-13, 2018. <https://journals.upi-yai.ac.id/index.php/ikraith-teknologi/article/view/326>

- [6] D. Irawan, R. A. Halim and A. Purwaningsih, "Redesain Pembangunan Reservoir Di DesaSonowangiKecamatanAmpelgadingKabupaten Malang," JurnalAplikasi Dan InovasiIpteks SOLIDITAS, vol. 5, pp. 279-289, 2022. <https://publishing-widyagama.ac.id/ejournal-v2/index.php/js/article/view/4078/2166>
- [7] H. P. Prasetya, K. Umam and D. Rachmanto, "PerencanaanStruktur Reservoir Air BersihDesaPecangaanKulon, KecamatanPecangaan, KabupatenJepara," Jurnal Civil Engineering Study, vol. 01, pp. 1-7, 2021. <https://journal.unisnu.ac.id/CES/article/view/217>.
- [8] R. A. Bangun and D. R. Teruna, "Analisis Design TangkiDenganMetode Response Spectra Dan Time History". <https://jurnal.usu.ac.id/index.php/jts/article/view/981/512>
- [9] J. Tarigan, S. D. Tarigan, E. S. Y. Sitanggang and P. A. A. Ginting, "KajianKriteriaPerencanaan Dan MetodePelaksanaanStruktur Reservoir," JURNAL REKAYASA KONSTRUKSI MEKANIKA SIPIL, vol. 1, pp. 63-71, 2018. <https://www.neliti.com/id/publications/282718/kajian-kriteria-perencanaan-dan-metode-pelaksanaan-struktur-reservoir>
- [10] E. Batista, R. A. Fauzi and A. Pradiptiya, "PerencanaanPondasi Ground Water Tank ProyekGedung BPJS Jakarta Pusat," pp. 1-6. <https://prosiding-old.pnj.ac.id/index.php/snts/article/view/2417>
- [11] D. Suryani, F. Indriyani and A. Salimah, "PerencanaanPondasi Bored Pile Proyek Double-Double Track Manggarai – Jatinegara," Seminar Nasional TeknikSipilPoliteknikNegeri Jakarta, 2019. <https://prosiding-old.pnj.ac.id/index.php/snts/article/view/2430>
- [12] N. H. Panjaitan and S. F. Mungkur, "AnalisisStabilitasDindingPenahan Tanah PadaProyek Pembangunan RumahPompa Di JISidorukunPulo Brayan Darat Medan," JURNAL ENGINEERING DEVELOPMENT, vol. 1, pp. 46-51, 2021. <https://jurnal.unimed.ac.id/2012/index.php/edev/article/view/24829>
- [13] I. D. K. Manguki', J. Tanijaya, dan O. J. Sanggaria, "AnalisisKekuatanKolomBetonBertulangBerdasarkan Diagram InteraksiKolom," Paulus Civ. Eng. J., vol. 3, no. 2, hlm. 125–134, Jun 2021, doi: 10.52722/pcej.v3i2.245.
- [14] I. Apriyanidan O. J. Sanggaria, "Soil Investigation Analysis Obstacle Cutting Planning Hill Direction Rh 04 Tana Toraja District," IOP Conf. Ser. Earth Environ. Sci., vol. 1097, no. 1, hlm. 012060, Okt 2022, doi: 10.1088/1755-1315/1097/1/012060



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details