PROCEEDING

47TH ANNUAL SCIENTIFIC MEETING

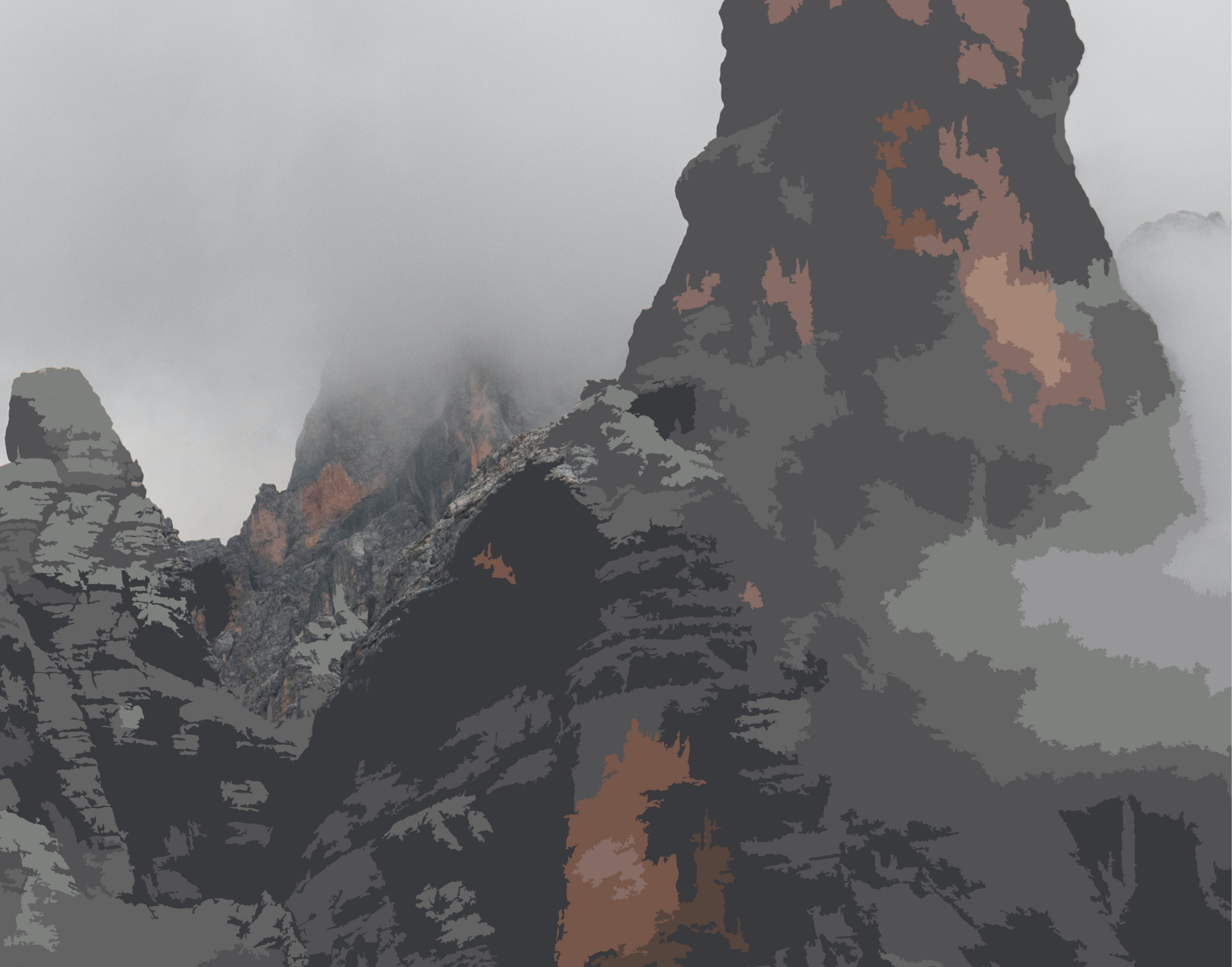
INDONESIAN ASSOCIATION OF GEOPHYSICISTS

HIMPUNAN AHLI GEOFISIKA INDONESIA HAGI

47TH ANNUAL SCIENTIFIC MEETING HAGI

10th-13th OCTOBER 2022

HARRIS HOTEL & CONVENTION MALANG



FOREWARD

Welcome,

The 47th HAGI 2022 Annual Scientific Meeting, a meeting where the Indonesia Association of Geophysicists (HAGI) brings you various audiences from industry and educational fields, in a prestigious forum which annualy holds.

Malang is one of the best places to present and share innovations and collaborate, in order to answer the challenges of oil and gas exploration, mining, hazard mitigation, geo-tourism, and relevants field of geophysical sciences and engineering. Collaboration in research or development, between an industry and educational body, is one of the most important ways for accelerating innovation, and downstreaming research products. Malang is an area surrounded by varied topography, the mountainous nature of Malang, with its natural beauties and fresh air, also a perfect place for travel and refresh.

A theme of "the Impact of Sustainable Energy Transition on The Climate, Economies, and Societies", for which we believe, that in the 47 year journey HAGI, an excellent momentum to reflect what we have done.

The 47th HAGI 2022 Annual Scientific Meeting is one of the best ways for employers, employees, executives, lectures, and students to share their knowledge, ideas, experiences, and success stories, in handling the challenges they have been facing. This also serve as agreat opportunity to expose your company profiles, which you may have invented. We look forward your participation in Malang.

Prof. Dr. Sunaryo, S.Si., M.Si.
PIT HAGI Chairman

Organizing Committee

Board of Advisor	
President of HAGI	: Muharram Jaya Panguriseng
President HAGI Elected	: Randy Condronegoro
Steering Committee	
HAGI General Secretary	: Helmi Indrajaya
	: Riky Hendrawan Bayu P
	: Aryo Radityo
	: Abdullah Nurhasan
Organizing Committee	
Chairman	: Prof. Dr. Sunaryo
Co - Chairman	: Oddy Anggadi Pranidhana
Treasury	: Tenny Octaviani
	: Mawar Indah Nursina
Secretariat	: Nurtifriani Gati Rixy
	: Joko Andi Wibowo
Technical Committee	
Chairperson Technical Program	: Muhajir
Paper Reviewer	: Argya Hastubrata Basundara
	: Cholisina Anik Perwita, S.Si., M.Si
	: Mayang Bunga Puspita, S.Si, M.Eng Oral
Presentation Session	: Haryono, M.Si.
	: Shabrina Aqiilah N
	: Nadaa Daneshara
Poster Presentation Session	: Davis Reza
	: Muhammad Ezra Alhazmi
	: Adib Banuboro
	: Lisna Sekar Arum
Session Chair & Judge	: Fahriansyah
	: Aprilia Himatina
Fieldtrip and Shortcourse	: Yarris Ibdian Cakra
	: Dinar Arubi
Geophysical Career Path	: Diky Aulia
Signage/Memento	: Khalif Alfaiz
Non-Technical Committee	
Chairperson	: Fikrizan Hilmy Andradit
Coordinator of Event	: Dimas Rahfaditya Pradana
Ceremony	: Sevi Maulinadya
	: Annisa Aprilliani
	: Nadya Noorvita
Panel Discussion	: Jihan Hardiyanti Arief

	: Khusnul Fitroh
	: Ilona Jocelynn Untung
Special Event	: Dimas Rahfaditya Pradana
Geophoto	: Dwandari Ranalko
	: Emmanuelta Naibaho
	: Aji Darma Maulana
Golf	: Yuliawati
Run & Bike	: Fakhriar Naufaldi
E-Sport Competition	: Dana Helmi
Dive	: Dimas Rahfaditya Pradana
Student Competition	: Aulia Rahman Pangab
	: Ishaidir
	: Al Salang Ressy Bhaktituta A
Courtesy Relation	: Bina Yuanita
	: Andri Syafriya
Sponsorhip and Venue	: Nada Revita
	: Yuliawati
	: Novitri Lilaksari
	: Saraswati
	: Maria Juliana Gultom
Coordinator of Multimedia	: Rahmat Hidayat
IT	: Irfan Tsany Rahmawan
	: Eka Fitriani
	: Anisa Nur Oktavia
Publication	: Muhammad Kautsar Rahmareza
	: Alifia Marshanda
	: Mar'i Muhammad
	: Stevany Abigail Haman
	: Shabrina Tasha Zahra
	: Syawal Ridha,. S.Si., M.Si
	: Anggi Arwin Pratama
Media and Design	: Faiz Fathoni
	: Rizky Dwi Renaldy
	: Sofia Salsabila
	: Sekar Indah Tri Kusuma
Registration	: Annisa Mutiara Badri
	: Bryna Mustika
	: Maulana Ibnu U.S.A
	: Shelly Habsari, S.Si., M.Si
Exhibition	: Sheila Kusuma Putri
	: Isnianto Saputra
	: Ahmad Syauqi
	: Dr. Ir. Wiyono., M.Si

Student Volunteer	: M. Kurnia Oktavianto
	: Danastri Kusuma W
	: Viraldi Diyesa
	: Vanissa Sahra, S.Si., M.Si
	: Intang Pingki Virginia
Logistic and Transport	: Tristantyo Yoga
	: M. Arief Wicaksono
	: Faizal Aliffiansyah R.
	: Bramasta Adya Dewanta
HSSE	: Fuad Aulia Bahri
	: Fakhriar Naufaldi

Reviewer:
Dr. Siti Zulaikah., M.Si
Ratri Andinisari, S.Si., M.Si., Ph.D
Prof. Drs. Adi Susilo, M.Si., Ph.D
Prof. Sukir Maryanto, S.Si., M.Si., Ph.D
Drs. Alamsyah Mohammad Juwono, M.Sc., Ph.D
Drs. Didik Yudianto, M.Si
Dr. Cahyo Aji Hapsoro., M.Si

SPUN PILE IDENTIFICATION OF BUILDINGS USING THE GROUND PENETRATING RADAR METHOD (GPR)

Geofhary Raditya Syamsurijal[1], Syamsurijal Rasimeng[1*], Fikri Alami[2], Aria Alhadi[3], Ida Bagus Suananda Yogi[1]

[1]Department of Geophysical Engineering, University of Lampung, Indonesia
[2]Department of Civil Engineering, University of Lampung, Indonesia
[3]A Square Engineering Services Consultant and Construction, Batam, Indonesia

**Corresponding author's email: syamsurijal.rasimeng@eng.unila.ac.id*

Abstract. Ground Penetrating Radar (GPR) is a nondestructive geophysical exploration method that records the response of the subsurface based on reflected electromagnetic waves. In this study, the GPR method was used for geotechnical studies, especially in identifying the depth of the spun pile in the gas engine power plant (PLTMG) Project, Baloi, Batam Island. This research is useful as basic information in evaluating the subsurface condition as the PLTMG is planned to be built on a former diesel power plant location. The location of the GPR measurement point is carried out on the floor surface just above the spun pile based on information on the former building structure plan, using the GPR AKULA 9000C with a frequency of 100 MHz made by Geoscanner AB. The results of the analysis of GPR measurements provide information about the depth of the spun piles. The depth of the spun pile ranges from 2 meters to 20 meters.
Keywords: Ground penetrating radar, spun pile, electromagnetic, Geotechnical

1. Introduction

Ground Penetrating Radar (GPR) is a nondestructive geophysical exploration method that records the response of the subsurface based on reflected electromagnetic waves. In this study, the GPR method was used for geotechnical studies, especially in identifying the depth of the spun pile in the gas engine power plant (PLTMG) 30 MW building. This research is useful as basic information in evaluating the bearing capacity of the spun pile on the loading of a building, as basic information in evaluating the bearing capacity of the spun pile on the loading of the PLTMG 30 MW building.

The GPR method is a geophysical method that uses an electromagnetic wave (EM) source that uses radio waves with a frequency between 1-1000 MHz. The application of GPR can be used for surveying buried objects in shallow places, in deep places, and checking concrete. The advantage of this method is that it is relatively easy to perform and non-destructive [1]. The first use of electromagnetic signals to determine the presence of a remote terrestrial object is usually attributed to Hülsmeyer in 1904. Hülsenbeck's work in 1926 is seen as the first use of the pulse technique to determine hidden structures. After the 1930s, pulse techniques were developed to investigate as far as possible the depths of various mediums and detect objects buried in the ground.

It is the safest and most complete scanning method, so it covers all industries. Archeology and rock mapping are two fields that require geophysical surveys. But not only those two fields, here are some applications of GPR in geophysics such as mapping tree; river and lake profiling; and forensic geophysics.

2. Data and Methodology

One example of GPR applications is position detection or radar imaging. GPR which has the same working principle as radar, is a tool used for the detection process of objects buried underground or behind walls with a certain depth level by using radio waves. To get good depth resolution the pulse size should be as short as possible, which is why monocycles are used.

GPR has the ability to detect differences in permittivity values of the layers below the surface, as in the example of **Figure 1**. The existence of a distinct boundary between one layer and another will produce a large amplitude on the radargram. At the boundary of layers with low to high permittivity values, polarity reversal will occur, and vice versa [2].

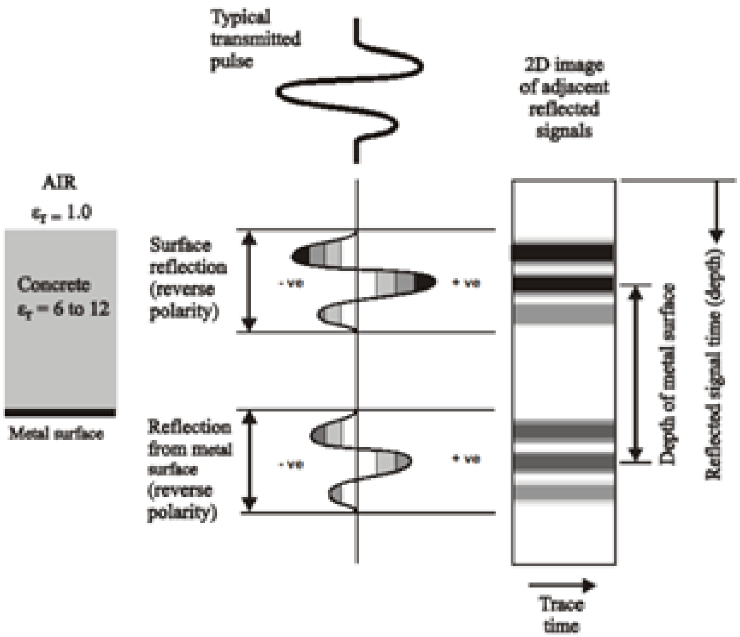


Figure 1. Schematic of radar signal reflection [3]

The measurement method commonly used in GPR is the continuous identification method. This continuous identification is a method of collecting data by moving the GPR instrument along the line that has been marked. Instead of using the continuous identification method, in this study, measurements were made by a point identification method. The point identification is a method of collecting GPR data by allocating GPR at certain point without continuous movement. The point identification method results can be shown in **Figure 2**. Since no movement occurs, a similar radargram along the measurement time is recorded. The radargram recorded during a certain time is shown by the colored data in **Figure 2**.The recordings within the time interval then stacked so that a wavelet is obtained that represents the 1D state of the subsurface. The stacked wavelet is displayed as wave images over the colored recordings in **Figure 2**. The research was conducted by using AKULA900C GPR instrument with a 100 MHz frequency antenna by Geoscanner AB Instrument.

This measurement was carried out at the former diesel power plant as shown in the following plan (**Figure 3**). Point PIP 1 is a point in the center of the former building structure and is expected to find features of the former building. Point PIP 2 is the perimeter of the former building so it is possible to find features of the former building. The PIP 2's building features was expected to be less intensive than the PIP 1's. Point PIP 3 is outside the building area. This point was surveyed to give a good comparison between a point with building features and without buildings features.

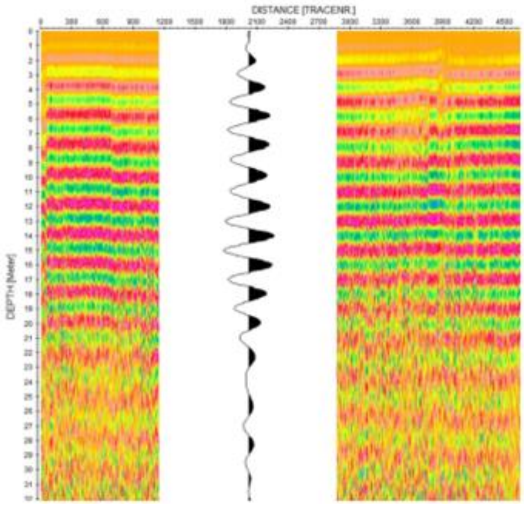


Figure 2. Example of measurement results on PIP 1. The wavelets in the image are the stacking results of radargrams recorded at the same point in time.

The GPR data processing includes correction, filter, migration, and stacking. The correction carried out is in the form of static correction which aims to find the ground 0 m point so that the depth displayed on the radargram represents the actual situation. The filter process is done by involving the following filters: bandpass filter, dewow filter, background removal F-K filter. The filter process is used to remove existing noise, one of the filters used is a bandpass filter with a range of 60 - 220 MHz. The next activity is time to depth migration to convert the time value into depth according to the speed. The last process is stacking so that a wavelet can be produced that has a strong information signal and weak noise.

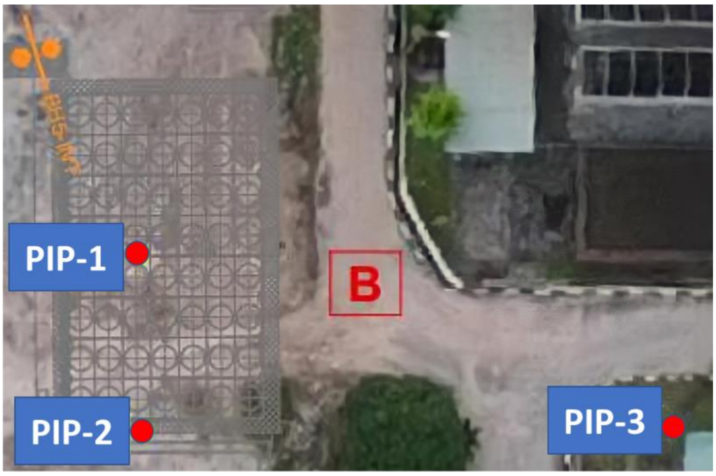


Figure 3. Location plan of GPR, PIP 1, 2, and 3 measurement points. The gray schematic at the PIP 1 and the PIP 2 is the former building site plan that contains spun pile features beneath the surface.

3. Results and Discussion

PIP 1 is a point that used to have many building features, at this point the GPR measurement results are obtained in **Figure 4**. In the figure it appears that at certain times the recording results are similar, there is a slight change. This is thought to be due to interference or noise from the environment. This difference can be suppressed by the stacking so that the reflection signal will be amplified, and the noise will be suppressed. This is clearly shown in the 0-0.5 m layer is the cover layer, 0.5-2 m layer is the concrete/strong compacted layer, 2.0-20 m depth is the spun pile. Meanwhile, at a depth of more than 20 m, a sediment layer can be found. In this layer it can be clearly seen that the existing noise is suppressed, and the reflection layer becomes clear in the wavelet.

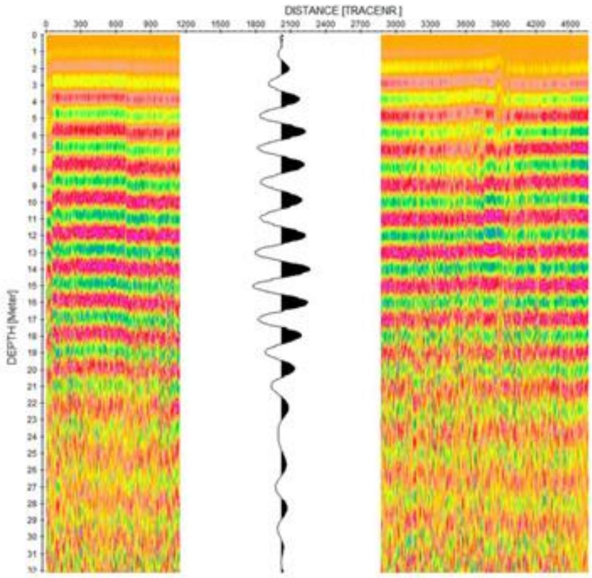
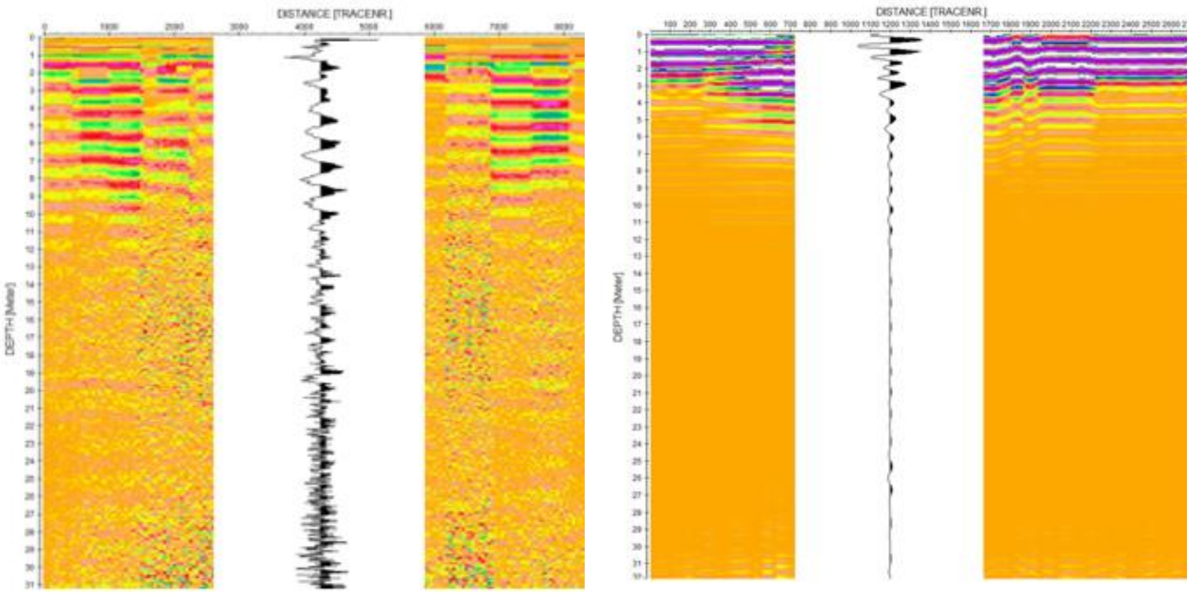


Figure 4. Stacked Wavelet from the radargram of PIP 1.

At point PIP 2, it was found that the solid layer in the form of a former collapse was only found to a depth of 1.5m (**Figure 5a**). The collapse response at point PIP 2 has a thinner thickness than PIP 1 because PIP 2 is on the edge of the former building. Furthermore, rock layers were found up to a depth of 10.5 m. At a deeper depth is a layer that contains a lot of water. This water content is shown from the stacking results which have no layer reflections, and only random noise. This pattern is due to the presence of water with high conductivity which can attenuate the strength of the electromagnetic wave signal from the GPR instrument.

PIP 3 is a point outside the former building, so the results show that the layers found are solid soil up to 1 m and rock layers up to 3 m deep (**Figure 5b**). After these layers, a relatively uniform wavelet response is obtained compared to the upper part due to the absence of a distinct layers difference or high water content so that the strength of reflection waves are weak.



(a) (b)

Figure 5. Stacked Wavelet from the radargram of (a) PIP 2 and (b) PIP 3.

4. Conclusions

By using the GPR method, especially the point identification method, we can get a 1D subsurface that has strong signal quality and low noise. If the depth has water content, the stacking results will give a unique response as in the recording at PIP 2.

At the PIP 1 and PIP 2, there were fewer traces of the former building at a depth of 0.5 to 2 m indicated as concrete/strong compacted layers. Especially, at the PIP 1 it was found that there were former building spun piles at a depth of 2 to 20 m. Meanwhile, the PIP 3 consistently did not show any building features because it was outside the former building area. It can be concluded that the point identification method of the GPR can be used to detect subsurface spun pile features of an old building with a high signal quality and low noise.

References

[1] Knight R 2001 Ground Penetrating Radar for Environment Application *Annu. Rev. Earth Planet. Sci* **29** 229-55.

[2] Conyers L B 2016 *Ground-penetrating Radar for Geoarchaeology (Analytical Methods in Earth and Environmental Science)* Wiley-Blackwell

[3] Bungey J H and Millard S G 1993 Radar Inspection of Structures, *Proc. Int. Civ. Engnrs. Structures & Buildings* **99** 173-178.

CERTIFICATE

Geofhary Raditya Syamsurijal

As **PRESENTER**

ANNUAL SCIENTIFIC MEETING

INDONESIA ASSOCIATION OF GEOPHYSICISTS

THE IMPACT OF SUSTAINABLE ENERGY TRANSITION ON THE CLIMATE, ECONOMIES, AND SOCIETIES

October 10th-13th, 2022
Malang, East Java, Indonesia

Muharram Jaya Panguriseng, S. T., M. Si.
President of HAGI 2020-2022

Prof. Drs. Adi Susilo, M.Si., Ph.D.
Chairman of PIT HAGI 2022