DOKUZ EYLÜL UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

DEVELOPMENT OF A KNOWLEDGE BASED GEOTECHNICAL LEARNING AND DATABASE PLATFORM

by

Onur ATLI

October, 2023

İZMİR

DEVELOPMENT OF A KNOWLEDGE BASED GEOTECHNICAL LEARNING AND DATABASE PLATFORM

A Thesis Submitted to the

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İZMİR

M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"DEVELOPMENT OF A KNOWLEDGE BASED GEOTECHNICAL LEARNING AND DATABASE PLATFORM"** completed by **ONUR ATLI** under supervision of **PROF. DR. GÜRKAN ÖZDEN** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

Prof. Dr. Gürkan ÖZDEN

Supervisor

Prof. Dr. Okan Önal

Jury Member

Dr. Öğr. Gör. Esra Güneri

Jury Member

Prof. Dr. Okan FISTIKOĞLU

Director

Graduate School of Natural and Applied Sciences

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Onur ATLI

DEVELOPMENT OF A KNOWLEDGE BASED GEOTECHNICAL LEARNING AND DATABASE PLATFORM

ABSTRACT

Geotechnical engineering is still an emerging branch of civil engineering within modern soil mechanics, which has seen tremendous technological advancements across various domains in recent times. The global effects of COVID-19 pandemic have led to significant changes in education, industry, and research, including the geotechnical field of civil engineering. Geotechnical databases have gained eminence in literature, driven by the rapid growth of online resources. However, problems related to availability, accessibility, and collaboration continues. This study aims to support the geotechnical knowledge in undergraduate and graduate education by introducing "*Geo-Minds*", a knowledge-based geotechnical learning platform. The platform covers topics such as pile foundations and soil mechanics, using a user-friendly interface built on the WordPress content management system. Its efficiency is demonstrated through an online survey, manifesting positive responses from engineers, educators, and those interested in the field. *Geo-Minds* aspires to improve geotechnical education and practice, being powered by the evolving technology in online education.

Keywords: Geotechnical engineering, online education, knowledge-based platform

BİLGİ TABANLI BİR GEOTEKNİK ÖĞRENME VE VERİTABANI PLATFORMUNUN GELİŞTİRİLMESİ

ÖZ

Geoteknik mühendisliği, son zamanlarda çeşitli alanlarda büyük teknolojik ilerlemelere tanık olunan, modern zemin mekaniği içinde gelişmekte olan bir inşaat mühendisliği dalıdır. COVID-19 pandemisinin küresel etkileri, inşaat mühendisliğinin geoteknik alanı da dahil olmak üzere eğitim, endüstri ve araştırma alanlarında birçok önemli değişikliklere yol açmıştır. Geoteknik veri tabanları, çevrimiçi kaynakların hızlı büyümesiyle literatürde önem kazanmıştır. Ancak, kullanılabilirlik, erişilebilirlik ve iş birliği ile ilgili sorunlar hala devam etmektedir. Bu çalışma, bilgi tabanlı bir geoteknik öğrenme platformu olan "*Geo-Minds* "ı tanıtarak Türkiye'deki geoteknik bilgi eğitimini desteklemektedir. Platform, WordPress içerik yönetim sistemi üzerine inşa edilmiş kullanıcı dostu bir arayüz kullanarak kazıklı temeller ve zemin mekaniği gibi konuları kapsamaktadır. Platformun etkinliği, mühendisler, eğitimciler ve bu alana ilgi duyanlardan gelen olumlu tepkileri ortaya koyan çevrimiçi bir anket aracılığıyla gösterilmiştir. *Geo-Minds*, çevrimiçi eğitim alanında gelişten teknolojiden güç alarak geoteknik eğitimini ve uygulamasını geliştirmeyi amaçlamaktadır.

Anahtar Kelimeler: Geoteknik mühendisliği, çevrimiçi eğitim, bilgi tabanlı platform

LIST OF FIGURES

Page

ABBREVIATIONS

COVID	: Coronavirus Disease
CALS	: Computer-Aided Learning Systems
CAE	: Computer-Aided Education
SIGMA	: System for Interpreting Geotechnical Information
CAD	: Computer-Aided Design
SAP2000	: Structural Analysis Program 2000
PLAXIS	: Plane Strain and Axial Symmetry
CATIGE	: Computer-Aided Teaching in Geotechnical Engineering
CAL	: Computer-Aided Learning
3D	: Three-Dimensional.
DEU	: Dokuz Eylül University
GIS	: Geographic Information Systems
ANFIS	: Adaptive Network-Based Fuzzy Inference System
CD	: Compact Disc
DVD	: Digital Versatile Disc
UI	: User Interface
PHP	: Hypertext Preprocessor
SQL	: Structured Query Language
GPL	: General Public License
PNG	: Portable Network Graphic
GIF	: Graphics Interchange Format
CMS	: Content Management System
AFAD	: The Disaster and Emergency Management Presidency
MTA	: General Directorate of Mineral Research and Exploration
TURDEMAP	: Determining Earthquake Master Plan Standards for Turkiye
TS	: Turkish Standards
GPA	: Grade Point Average

CONTENTS

Page

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Geotechnical engineering is a relatively recently developed area of civil engineering that falls under the umbrella of modern soil mechanics. The credit for transforming it into a scientific discipline goes to Karl Von Terzaghi, often hailed as the pioneer and founding figure of this field who contributed to the geotechnic literature by exploring related topics such as soil's exploration, identification, definition, compressibility and consolidation, and many more (Venkatramaiah, 2006).

However, unfortunately, geotechnics was not a branch of science that has found the value it deserves in Turkiye especially at the practice, ground studies are not given adequate attention due to budgetary reasons in construction, even though the costs that are avoided at the beginning of construction are usually amply repaid later.

Fortunately, in recent years, the importance of geotechnics has been realized due to several incidents and reasons. To exemplify, the COVID-19 pandemic has been affecting all the ways of our lives, and previous studies show that the youth population is the one that has been affected most (Grasso, Briggs-Gowan, Carter, Goldstein & Ford, 2020). During the pandemic, education was one of the sectors that have been harshly affected. At the beginning of the Coronavirus outbreak, almost all the learning activities had been interrupted. As the time passed; online learning activities started to spread, and the digitalization process started to gain momentum. Technological developments are observed in many fields, from social sciences to the medical, from tourism to engineering, every department without exception has changed, especially after the pandemic (Murdock, Ehrie, Bennett & Kogan, 2023; Arafin & Jiang, 2017, pp.1-32; Wang, 2023). Geotechnical science has also benefited from this situation and in recent years, studies on geotechnical databases have started to take place in the literature (Axmedova & Kenjayeva, 2021, pp. 48-50; Kenett & Redman, 2019, pp.1-12). The number of websites in general, the databases in particular has risen rapidly in recent years, and even there are loads of research papers that discuss the ways of

developing geotechnical websites such as gathering years of geotechnical data to form online interactive geological maps with soil parameters that can support the geotechnical engineers (Cheriet, Zerguine & Cheriet, 2023, pp. 10239-10242; Todo, Yamamoto, Mimura & Yasuda, 2013, pp. 941-963). For scientific research, data needs to be organized, easily accessible, and presented in a common language to be understood by most of the population (Pool & Esnayra, 2000). Furthermore, the researchers emphasised that the creation of various databases can provide multifaceted benefits, and in this respect, it will both increase the level of efficiency and allow for lower costs in the long run. There are crucial points to consider for future databases; such as better data integration, improved data quality, and the development of new tools for data analysis. For example, in civil engineering, there is a need for a publicly accessible, quality-controlled, and human-annotated extensive dataset to drive and advance deep learning research and applications (Qurishee, Wu, Atolagbe, Owino, Fomunung & Onyago, 2020, pp. 151-165). However, according to Qurishee and his collaborators, the availability of datasets is currently insufficient and collecting this type of data, requires collaboration between researchers, industry partners, and government agencies. On the other hand, another point that needs to be highlighted is that many databases are not accessible online or free, which makes it hard for other researchers to access them (Pool & Esnayra, 2000).

Although there is considerable amount of research studies in this field abroad, the number of ongoing studies within Turkiye is quite low. For example, computer-aided learning systems (CALS) and computer-aided education (CAE) have been used since the 1950s to facilitate students' education and learning, some of the studies can be listed as follows (Cingi, 2013, pp. 220-229). In 1997, Huckvale et al. published a book named "The Landscape of Future Education in Speech Communication Sciences: 1 Analyses" which discusses how the Internet can benefit education in terms of distance, and they called this concept as "Telematic Computer Aided Learning" (Huckvale, Benoit, 1997, pp. 94-99). In 1995, D.G. Toll's study named *SIGMA* (System for Interpreting Geotechnical Information) also supports this. In some cases, the user may use the results from the correlation as well as from the direct measurements for reaching a final decision. The user will also be alarmed by the inconsistencies if they

exist. In this study, Toll argues that knowledge-based systems should not take away the work of engineers, but instead, help the engineers (Toll, 1995). *Prokappa,* another study of Toll, (as the Sigma) is also an additional tool for the engineers. In addition, Jaksa and Toll stated that computer-aided learning systems should primarily be seen as supportive ways for education (Jaksa, Davison & Toll, 2000). In the 2000s, many engineering faculties have been using computer-aided learning systems in their university education, and there are various programs used in the business field today. Some of the best-known programs for *Civil Engineer*s are *Autocad*, *SAP2000*, *Bentley PLAXIS*, *DEEPSOIL*, *GEO5* and *ALLPILE.* The last 4 programs are generally used only used by geotechnical engineers. CATIGE for Windows, worked on by Jaksa et al. in 1996, or GeotechniCAL, which gained popularity in the 2000s, are examples of computer-aided knowledge-based systems in the field of geotechnics. (Jaksa et al., 2000). In 2006, Hong Kong's piling database was established for parallel reasons; to collect data chronologically, to test the reliability of the data, and to learn from previous failures (Zhang, Shek, Pang & Pang, 2006), or the 3D geographic information system software that contains the topographic data of the Karşıyaka region was created by using Arcview (Yeniceli & Ozcelik, 2016, pp. 129-134).

Started in 2020, a study by a group of researchers in Dokuz Eylül University (DU) focuses on the development of GeoDU, a geotechnical database for regional mapping. It emphasizes the importance of consistent documentation of geotechnical data and highlights the need for a structured data format. The main objective of GeoDU is to enable the quantification of geotechnical properties of geological units at the surface level, particularly for the assessment of geological hazards. A major challenge discussed in the paper is the variability in both the quantity and quality of geotechnical drilling data commonly used for mapping liquefaction hazards. Furthermore, the presentation of geotechnical drilling logs as images within reports creates difficulties in organizing and interrogating the information, especially at large scales. In contrast, geological mapping at the surface level is more accessible in GIS format. To overcome these challenges, the GeoDU database has been developed to compile geotechnical data in a structured and easily queryable format. This facilitates better organization

and analysis of the data, supporting regional mapping studies and geohazard assessments. The database provides valuable information for assessing geological hazards such as liquefaction by quantifying the geotechnical properties of geological units at the surface level (Sharifi-Mood, Gillin, Olsen, Franke & Bartlett, 2020).

Another study presents a research investigation into predicting rock bursts using fuzzy inference systems and field measurements collected from published works. The study developed and validated five models, which included a knowledge-based model and fuzzy inference systems based on fuzzy C-mean clustering (Mamdani type) and fuzzy C-mean and subtractive clustering (Takagi-Sugeno type), as well as ANFIS models. The models utilized input variables such as maximum tangential stress of surrounding rock, uniaxial compressive stress of surrounding rock, uniaxial tensile strength of rock, elastic strain energy index, stress coefficient, and rock brittleness. The output was represented by the rockburst intensity index. Model performance was evaluated using various indices, including variance account for, root mean square error, mean absolute percentage error, and percentage of successful prediction. The ANFIS model demonstrated the best performance, while the knowledge-based Mamdani fuzzy inference system exhibited the lowest performance. The study also found that data clustering approaches yielded better results compared to the knowledge-based model. In conclusion, the proposed models in this study offer reliable predictive capabilities for rockburst intensity (Adoko, Gokceoglu, Wu, & Zuo, 2013).

A fairly recent study discusses the seismic microzonation of Lisbon, which involves the integration of geological, geophysical, and geotechnical data to determine the local ground conditions and potential seismic hazards in the city. The authors collected and analyzed a multidisciplinary dataset, including geological maps, borehole logs, geophysical surveys, and seismic records, to develop a 3D geological model of the study area. They also conducted seismic site response analyses to estimate the ground motion amplification and soil liquefaction potential in different parts of the city. The results of this study can be used to improve the seismic safety of Lisbon by informing

land-use planning, building design, and emergency response strategies (Oliveira, Gomes & Teves-Costa, 2023).

In addition to these, there are even more advantages of using an integrated database. The study of Hartsell and Yuen mainly focuses on the benefits, such as the ability to effectively teach complex concepts and practical skills by streaming online video instructions has both its advantages and disadvantages. It also provides valuable tips for creating high-quality streaming video content in the online educational environment, such as using bright colors and solid backgrounds (Hartsell & Yuen, 2006, pp. 31-43). Without a doubt, online education's benefits also comes with specific challenges and obstacles. These are often discussed in the literature by many scholars and researchers (Axmedova & Kenjayeva, 2021, pp. 48-50; Al-Rawashdeh et. al, 2021, pp. 107-117; Mayadas, Bourne & Bacsich, 2009, pp. 85-89). According to Zapalska and Brozik (2006), offering students virtual trips may enhance their general comprehension and application skills. There are numerous techniques to achieve success in online learning, such as combining individual assignments with group tasks, providing step-by-step instructions and directions, and utilizing short-term and long-term individually written assignments, among others. In addition, presenting content in multiple formats may benefit various learning styles (Zapalska & Brozik, 2006, pp. 325-335). Mayadas et al. (2009) explore the opportunities and challenges of online education, particularly in developing countries, like Turkiye. They highlight the need of a comprehensive approach to education policies while integrating technology into education. Especially for developing countries, implementing large-scale technology installations may be fairly costly, and gradual implementation of technological developments may help with this issue on most cases. Lastly, they mention that technology is a crucial part of educational reform and needs to be carefully integrated with policies that may be impactful on various aspects and branches of education (Mayadas et. al, 2009, pp. 85-89).

There is more than one way to create an open database for those who are not a software developer, and this can be listed as follows; ClickUp, Figma, Canva, Adobe, Wix, Marvel, Trello, etc. and *Geo-Minds* (the name of the database) is an open

database created using WordPress. While long research books provide readers and researchers with a wealth of information, gathering precise knowledge from them is time-consuming. At this point, geotechnical databases aim to provide pinpoint information to researchers, students, and engineers. The aim of this thesis is to provide practical, precise, and accurate information to students, engineers, and everyone interested in the field of geotechnics. *Geo-Minds* is established to provide information mainly on pile foundations and soil mechanics, which are two of the main subtopics of geotechnics. *Geo-Minds* aims to be an alternative to conservative learning techniques. It also aspires to be a guide even for actively working engineers thanks to the real engineering projects included in the database. A very big portion of Turkiye's territory is located on active fault lines. However, despite this, geotechnics has not received the attention it deserves until recent years. Especially, after witnessing the devastating consequences of the 1999 Gölcük Earthquake, and the 6th of February Earthquake (also known as The Great Turkiye-Syria Earthquake) the importance of knowledge in the field of geotechnics has been understood and has gained more importance in Turkiye. It is important to fully comprehend the actual reasons behind the inflicted damage on structures such as insufficient(or wrongly applied) soil improvement methods, regional weak bands existing within the soil layers or parameters that could not be measured accurately, etc., to prevent unnecessary and harmful outcomes.

In conclusion, *Geo-Minds* aims to contribute filling the gap in the literature in Turkiye and draw a road map for geotechnical students and engineers while including most of the advantages of online education and databases discussed above.

CHAPTER TWO
GEO-MINDS

2.1 Introduction

As mentioned in the Chapter One, *Geo-Minds* is a non-profit information portal established to fill the gap in the Turkish geotechnical literature by forming a database, focusing especially on the concepts of soil mechanics and pile foundations.

Following a brainstorming session on the method of creating the database, website style was determined to be the most advantageous one. Website style design has various advantages over other options; such as creating a downloadable smartphone or computer application, or being installed on personal computers by using tools like outdated Compact Disc (CD), Digital Versatile Disc (DVD), etc. The main ones are:

- It is not affected by the operating system of the device used,
- There is no need for any physical ports on devices like a CD player etc.
- The device is independent of the version of the operating system; hence, it is not affected by version updates taking place over the years.
- Low maintenance costs, especially in the long run.
- Easy access from anywhere in the world (only internet connection and a compatible device is required).

The *Geo-Minds* Database can be accessed via phone, tablet, or a personal computer, *Geo-Minds* automatically detects the type of the used device and adjusts the user interface (UI) corresponding to the users device for optimal browsing quality (as shown in Figure 2.1).

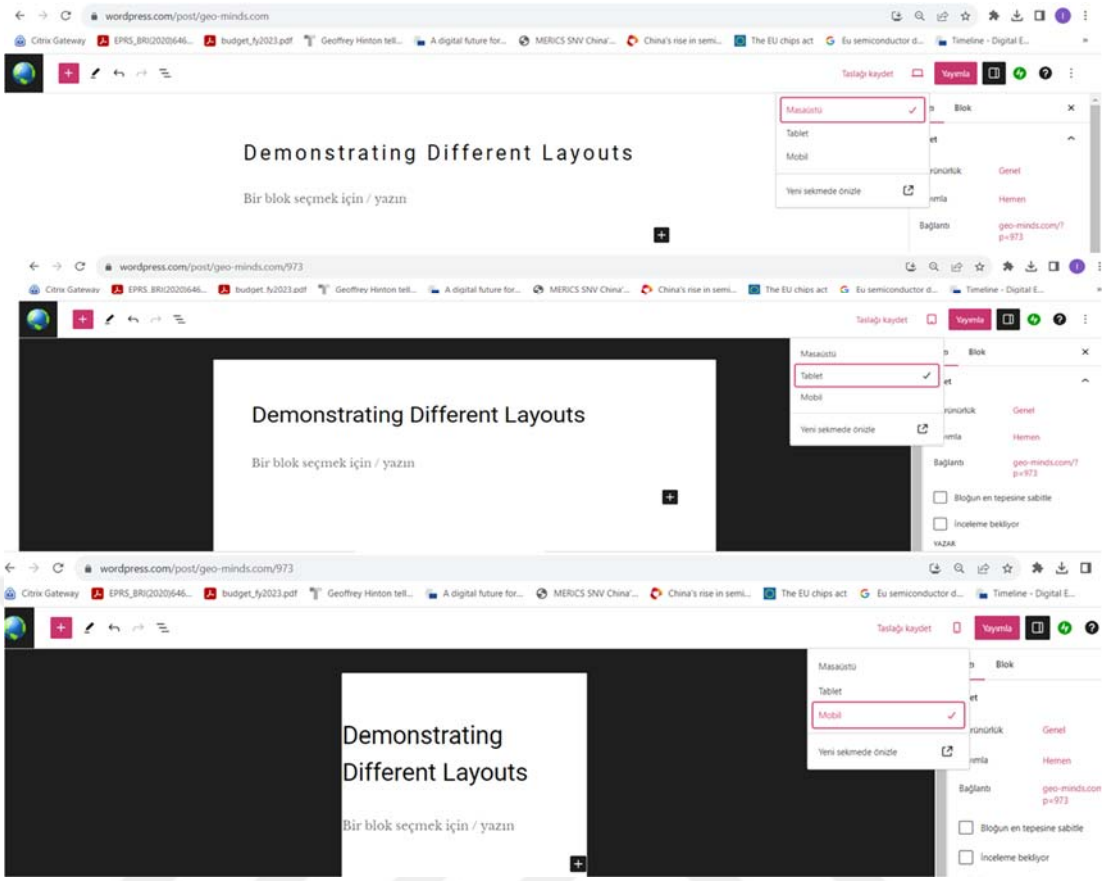


Figure 2.1 Demonstrating different layouts of *Geo-Minds* (Geo-Minds, 2023)

After deciding on the style of the website as a database layout, the next stage is determining the creation of the website. At the beginning of the research, PHP (Linux supported, server-side software language) was used as a conventional web site design tool, but as the project progressed, it was understood that this method was not ideal for editing, security and aesthetic reasons. As a result, Wordpress was chosen among the remaining alternative website design methods such as ClickUp, Figma, Canva, Adobe, Wix, Marvel, Trello, etc. According to current data, WordPress is the most preferred database creation tool. "Today, WordPress is built on PHP and MySQL[1], and licensed under GPL2[2]. It is also the platform of choice for over 43% of all sites across the web."

[1] MySQL is an open-source relational database management system
[2] Initially released in 1991, the GPL 2 is a copyleft license, meaning users must abide by some strict rules and requirements.

2.2 Database Design In Wordpress

2.2.1 Creating A Website In Wordpress

Firstly, an account is created in wordpress, and then all subsequent processes continue through this account. Access to the account is provided via the admin panel (as shown in Figure 2.2) with the username and password initially set.

Figure 2.2 WordPress administrator interface (Poorna et al., 2013)

After logging into the account, the ones that correspond to the need among the template types that appear on the admin home page (as shown in Figure 2.3) screen can be extracted using the filter.

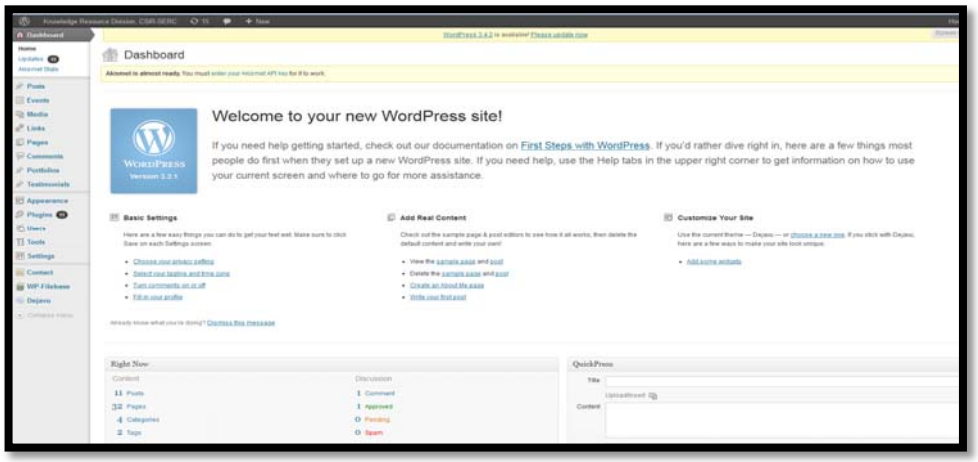


Figure 2.3 WordPress administrator homepage (Poorna et al., 2013)

The filter includes options such as popularity, site type (commercial, advertisement, education, public, etc.), site features (as shown in Figure 2.4). For example, templates containing the hierarchical list feature, which was a necessity in the design of *Geo-Minds*, can be checked directly using the filter.

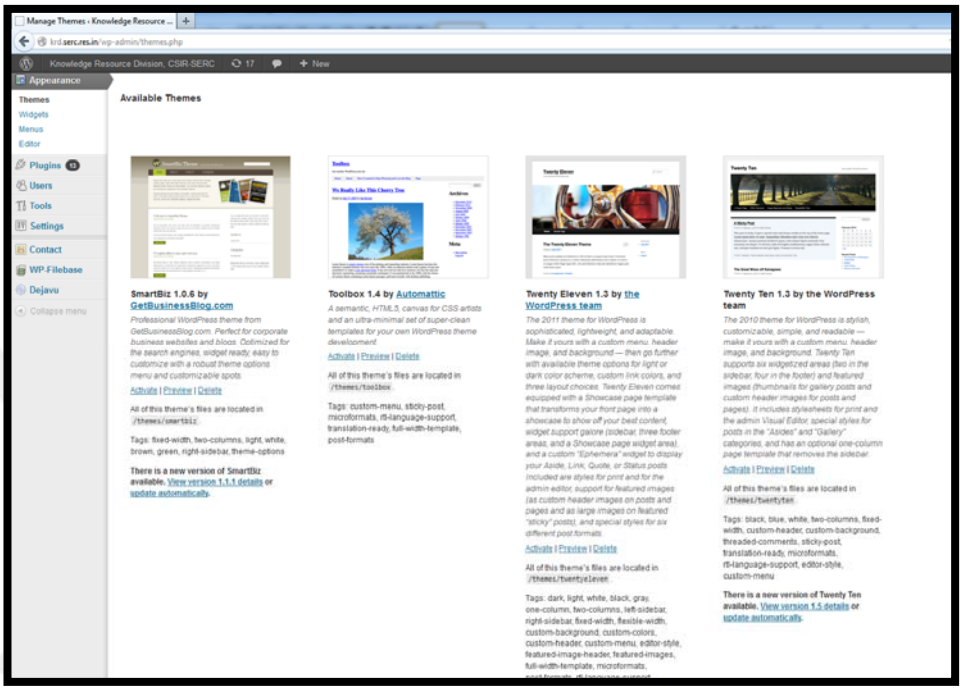


Figure 2.4 Various WordPress themes (Poorna et al., 2013)

After the template selection, in addition to the hundreds of design options included in the theme, extra features such as interactive advertising, adjustable sidebar, and additional search button can be added to the site by using paid or free widgets offered by Wordpress (as shown in Figure 2.5). Apart from the ready-made applications mentioned above, different features can be added to the template by using the command prompt.

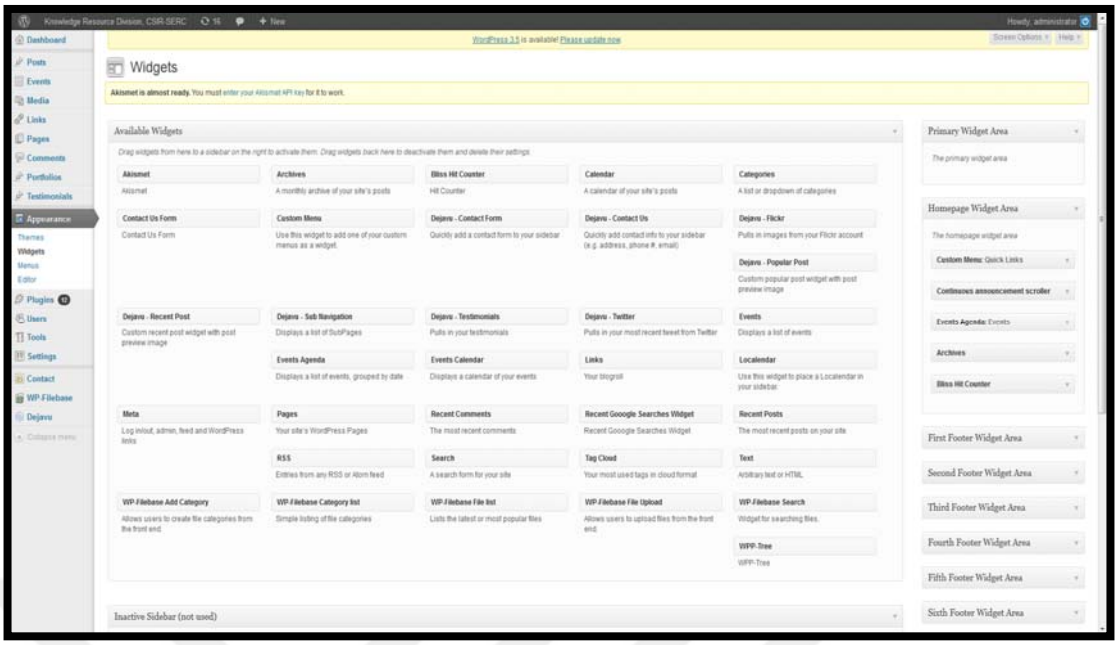


Figure 2.5 WordPress widgets (Poorna et al., 2013)

After the preliminary design of the site is completed and the name is determined, a selection is made among the appropriate domains, such as website.com, website.org, website.engi, etc., and a plan with features that meet the needs of the site to be established is chosen, (individual, premium, commercial, etc.) and the site is put into use.

2.2.2 Editing A Wordpress Website

When adding contents to the website after choosing its template and widgets, content adding order is preferably from general to specific. Each main headline should directly be related to all of its subheadings. A logo in png (300x300) format (as shown in Figure 2.6) or a tag line can be set using the general settings tab.

Figure 2.6 *Geo-Minds* logo (Clipart, 2023)

Additionally the main languages (as shown in the Figure 2.7) of the contents or the error codes (404 or the missing page being the most common) can be chosen separately. In addition, the number of content to be displayed on the page at one time can be set in the settings (as shown in Figure 2.8), and if the said site has a paid membership or subscription system, there is an option of presenting the specified contents only for the paying subscribers.

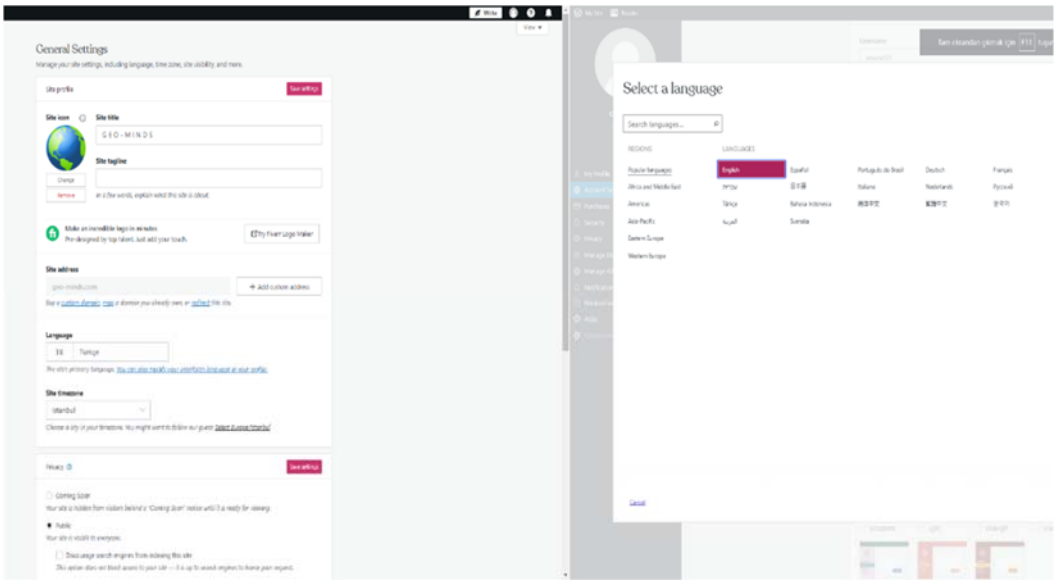


Figure 2.7 Main languages (Geo-Minds, 2023)

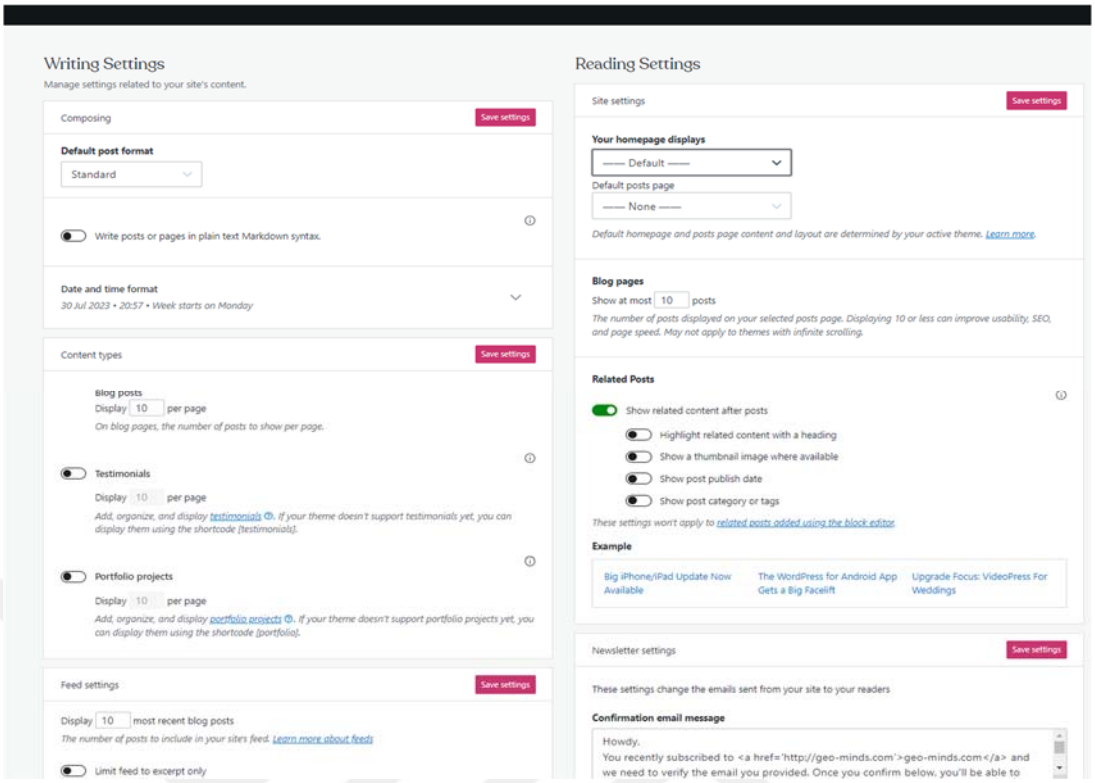


Figure 2.8 Reading and writing settings (Geo-Minds, 2023)

To diversify and enrich the content and information (Figure 2.9), visual learning can be provided by uploading files such as videos, images, GIFs, animations, etc.

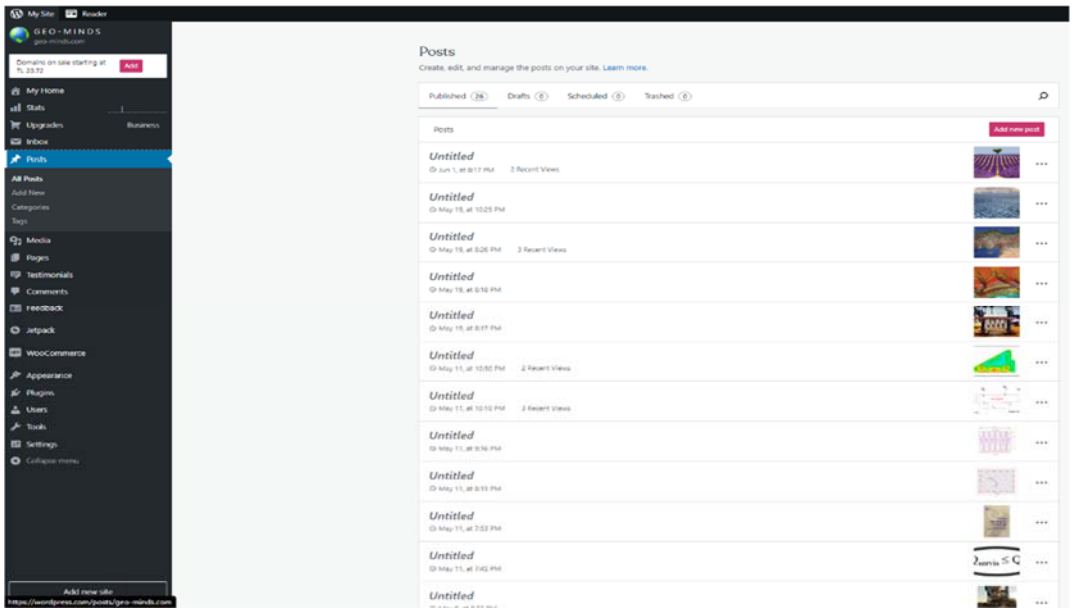


Figure 2.9 Posts screen (Geo-Minds, 2023)

Also it should be taken into consideration that to benefit from the desired features, it may be necessary to upgrade to Premium Plan or Business Plan (as shown in Figure 2.10).

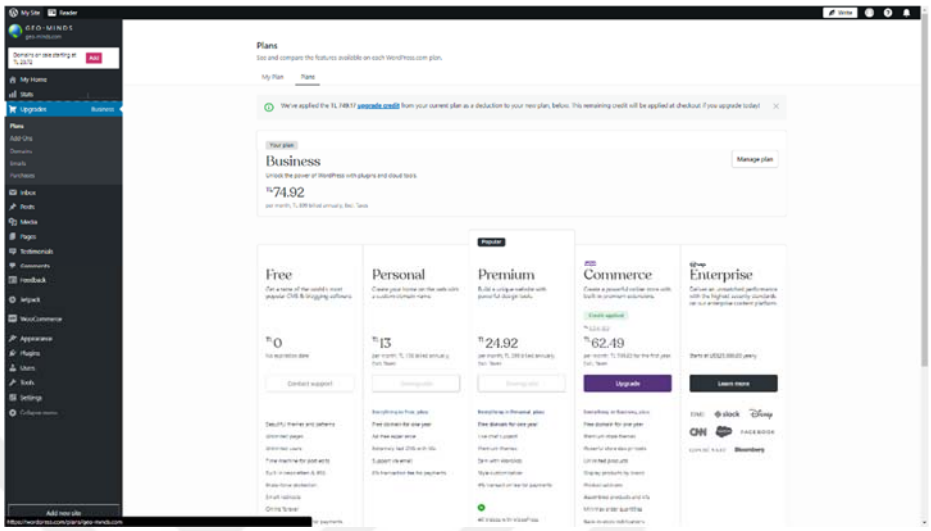


Figure 2.10 Plans (Geo-Minds, 2023)

2.2.3 Statistics

Wordpress offers a statistics page in the admin panel (as shown in Figure 2.11). This page contains general numerical information about the people who entered the site in the last week, month or year. This information includes various data that the Admin can access, including the most viewed content, how many people from which country have viewed the site, the number of people accessing the site through search engines such as Google, etc.

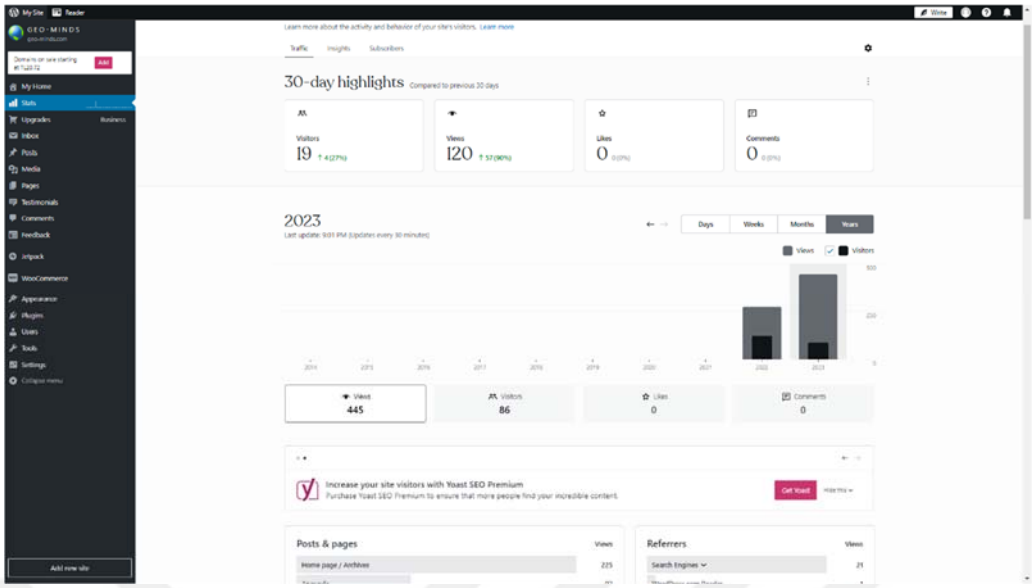


Figure 2.11 Statistics page (Geo-Minds, 2023)

2.3 Creating A Geotechnical Database

The first stage of creating a geotechnical database was to learn the limits of the Content Management System (CMS) with the help of additional resources like tutorials or guide books, and to determine a road map accordingly. The priority of a database is the consistency and clarity of the information within, the well-organised categorisation of the contents, and the accessibility of the information sought, like a virtual library. Although the first Geomind (as shown in Figure 2.12) designed for this purpose was able to fulfil its function properly, it was realised that it is not ideal in terms of practicality and aesthetics. *Geo-Minds* (see Appendix 1) was established to perform all the functions of a geotechnical database, which is designed to be fast, reliable, aspectable, modern, easy to use, and easy to access the desired information (see Appendix 2). The contents planned to be included in the database are as follows;

- Turkiye earthquake hazard map of AFAD (The Disaster and Emergency Management Presidency)
- Turkiye interactive live fault map of MTA (General Directorate of Mineral Research and Exploration),
- The currently used and abolished national technical specifications and regulations within the geotechnical field,

- The chapters related to pile foundations and soil mechanics,
- And real applicated projects.

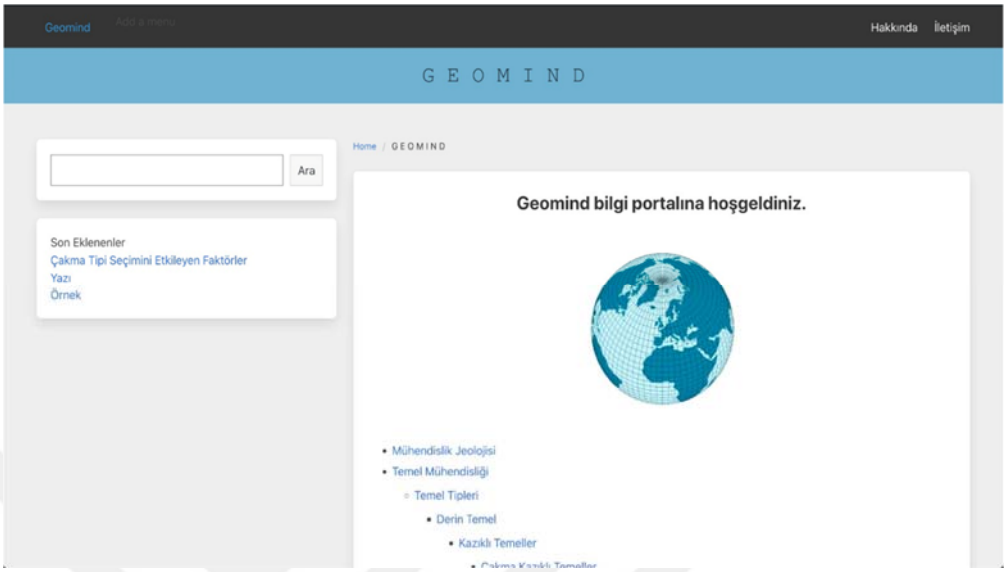


Figure 2.12 Cancelled Geo-Mind project (Geomind, 2022)

2.4 Content of the Database

The site is designed in such a way that new concepts and information can be easily added to it in the future. An area has been prepared for the contents that are decided to be added in the future (as shown in Figure 2.13).

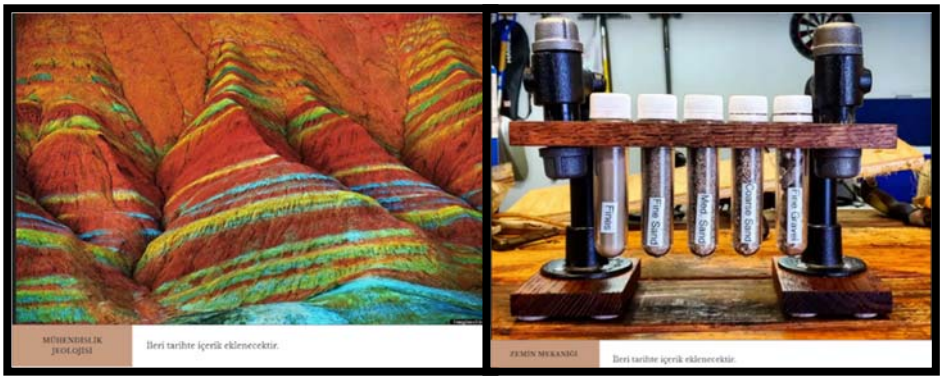


Figure 2.13 Future contents (Geo-Minds, 2023)

2.4.1 Maps

A large part of Turkiye's surface area is under earthquake hazard. AFAD has prepared an up-to-date interactive earthquake hazard map (as shown in Figure 2.14) in recent years, and there is a direct link to this site in the database.

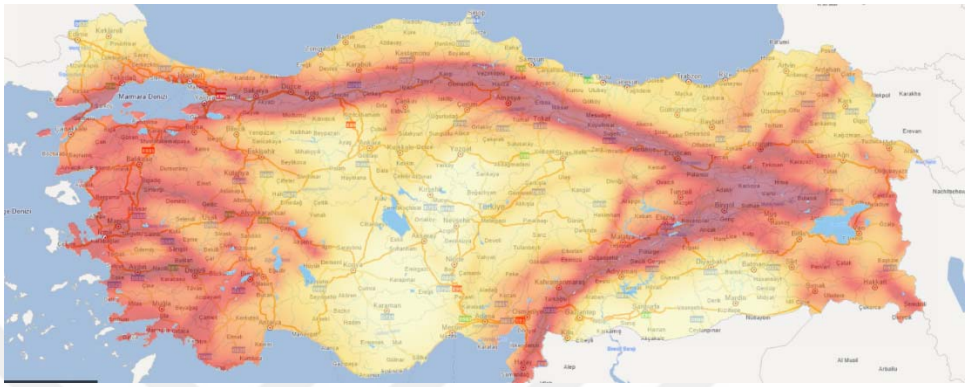


Figure 2.14 Turkiye earthquake hazard map (AFAD, 2018)

MTA's website has an interactive map showing the fault lines (active and inactive) beneath Turkiye (as shown in Figure 2.15). The following filters can be applied from the menu on the side; geological formation, landslide, livefault, faults, igneous rocks, geographical regions. In addition, the map also shows the locations of the earthquakes that have occurred in a day, week, and month. Depth and magnitude of each individual earthquake can be browsed by hovering the curser over them.

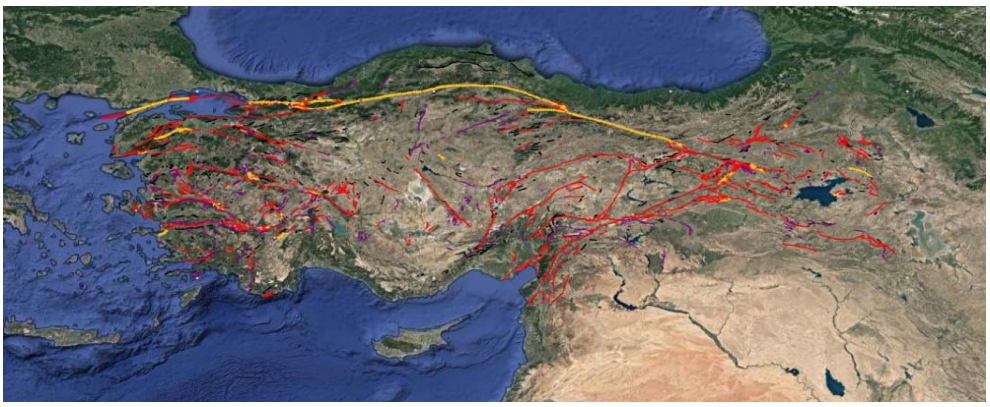


Figure 2.15 MTA live fault lines map (MTA, 2021)

The *Geo-Minds* information portal also includes the TURDEMAP database developed by Dokuz Eylül University Earthquake Research and Application Center, which is still in the prototype stage and runs on Google Earth Pro infrastructure (as shown in Figure 2.16).

The primary focus of the project is to define the criteria necessary for an earthquake master plan that can be examined and implemented at the provinc.ial level in Turkiye, with a specific emphasis on testing it in Izmir province. Within this scope, the existing earthquake master plans in Izmir and Istanbul, Turkiye, will first be compared, highlighting their international advantages and disadvantages. Subsequently, parameters that can be tailored to every province in Turkiye, following international standards, will be developed according to a specific classification and set of standards.

Figure 2.16 Prototype of the TURDEMAP database (Sözbilir, 2023)

2.4.2 National Technical Specifications And Regulations

In civil engineering, there are general regulations and technical specifications that guide the application and design. In the "National Regulations and Specifications" section (see Appendix 3) of *Geo-Minds*, only national regulations and technical specifications that are directly related to the geotechnical engineering department of civil engineering are discussed.

2.4.2.1 National Regulations Guiding Foundation Design

The first section covers national regulations that are still in force today**.** The regulations within the section are as follows;

- Regulation on Principles for the Design of Highway and Railway Earthquake Tunnels and Other Ground Structures Under the Influence
- Circular on Excavation Safety and Measures to be Taken
- Earthquake Regulation on Coastal and Port Structures, Railways, Airports Construction
- Turkiye Building Earthquake Regulation 2018
- TS 500
- TS 498 (2021)
- Soil and Foundation Study Application Principles

2.4.2.2 Outdated Earthquake Regulations

This section includes earthquake regulations that have been repealed. The aforementioned regulations, even though they have now been repealed, play a very important role in determining whether old buildings meet the requirements of their time or not. The related section consists of:

- Earthquake Regulation 1975
- Earthquake Regulation 1997
- Earthquake Regulation 2007

2.4.2.3 Technical Specifications

The last section covers technical specifications that are still in use today**.** The specifications within the section are as follows;

- Aggregate General Technical Specifications
- General Technical Specifications for Reinforced Concrete Works
- Cement General Technical Specifications

- Technical Specifications for Excavation and Backfilling Works
- Pile Technical Specification
- Water General Technical Specifications
- General Technical Specification for Waterproofing
- General Technical Specifications for Tunnelling Works

In the following sections, the bearing capacity and settlement limits of pile foundations under the loads to which they are subjected will be analysed. Finally, the behaviour of piles when used in groups and their design stages will be discussed.

2.4.3 Section 1: Use and Purpose of Piles in Special Foundations

Shallow foundations cannot provide an adequate bearing capacity in areas with extreme soil conditions and in special projects (high-rise buildings, bridges, etc.) and cannot be sufficient alone to ensure that the required settlement limits are not exceeded. In such cases, soil improvement methods should be considered first. In case of inadequacy, the use of pile foundations becomes mandatory.

2.4.3.1 Use and Purpose of Foundation Piles

The first section discusses the main functions of foundation piles and their main behavioural differences with shallow foundations. Various types are shown in Figure 2.17. It also discusses the ability of deep foundations to solve the bearing capacity and settlement problems of particularly heavy structures due to their behavioural differences.

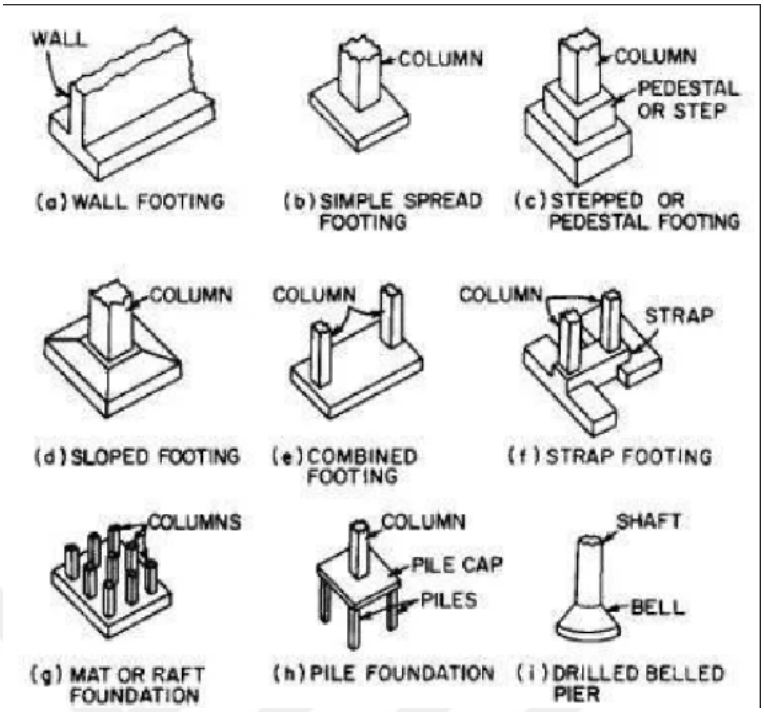


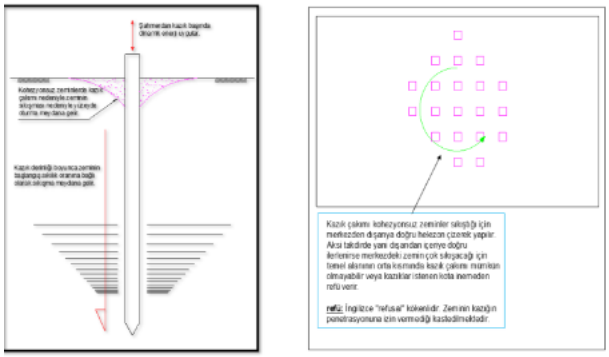
Figure 2.17 Various foundations (Geo-Minds 2023)

2.4.3.2 Types of Pile Foundations and Their Effects on Pile Behaviour

In this section, the location and nature of the deformations caused by the construction of pile foundations and how much displacement can be mobilised safely are discussed. The types of piles are also discussed.

2.4.3.3 Special Considerations for Driven Piles

In the third chapter, the design, application and stacking of driven piles and some of the obstacles (as shown in Figure 2.18) that the civil engineer may encounter are discussed.



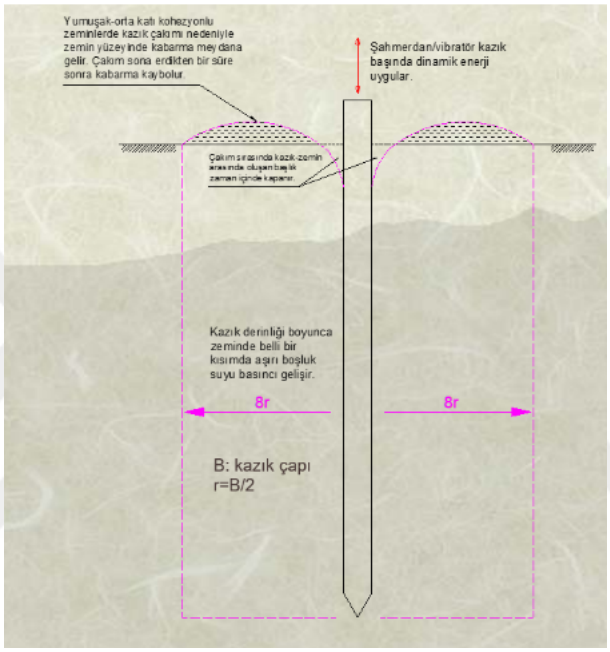


Figure 2.18 Special conditions (Geo-Minds, 2023)

2.4.3.4 Steel Pipe Piles

In the fourth chapter, the usage areas and advantages of steel pipe piles are mentioned, as well as the coatings that can add durability to the pile and the shoe that can be added to the pile end (as shown in Figure 2.19).

Figure 2.19 Steel piles at shore (Geo-Minds, 2023)

2.4.3.5 Driven Cast-in-place Piles

In this chapter, the main types of cast-in-place driven piles and the design phases of each type are described and illustrated (as shown in Figure 2.20).

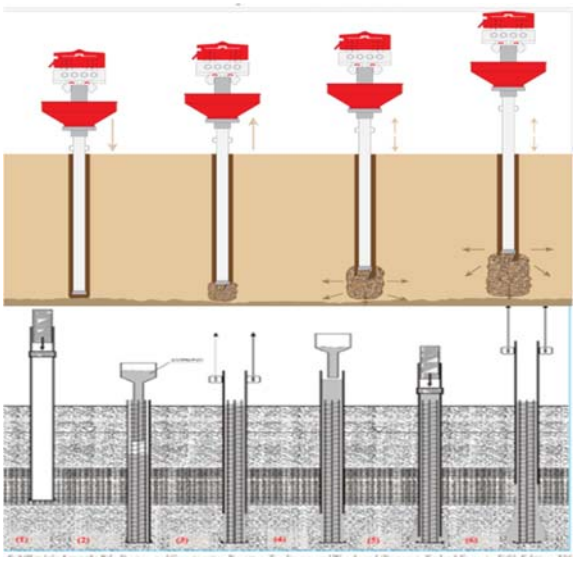


Figure 2.20 Stages of the application of driven cast-in place piles (Geo-Minds, 2023)

2.4.3.6 Bored Piles

In this chapter, the types of manufacturing of small displacement piles, the changes in the ground and the advantages of a special type of bored pile, the barette pile (specific machine is shown in Figure 2.21), due to its rectangular shape are discussed.

Figure 2.21 Barrette pile machine (Ege Zemin, 2023)

2.4.3.7 Considerations in the Selection of Driven Piles

In this section, the details and some unusual situations that should be known if the driven pile design is preferred are mentioned. The reasons why it cannot be used in the city and why it is dangerous are also mentioned.

2.4.3.8 Considerations in the Selection of Cast-in-place Piles

In this section, the details and some unusual situations that should be known if the driven pile design is preferred are mentioned. Although its behavior in the ground is

similar to that of driven piles, additional difficulties arising during application are also mentioned.

2.4.3.9 Considerations in the Selection of Bored Piles

In this section, the details and some unusual situations that should be known if the driven pile design is preferred are mentioned. Since bored piles can, in theory, go much deeper compared to the others, the nuances that need to be taken into account if these unusual designs are being considered are discussed.

2.4.4 Section 2: Load Bearing Capacity Calculations for Single Piles in Special Foundations

The calculation of the axial load carrying capacity of the individual piles under different soil conditions and the control of the safety of the bearing capacity provided according to the 2018 Earthquake Regulation will be explained in the following sections.

2.4.4.1 Axial Load Bearing Capacity of Single Piles in Cohesionless Soils

In this chapter, the precautions to be taken for different types of pile installations (as shown in Figure 2.22) in cohesionless soils and the installation stages are explained. Friction and tip resistance of the pile are obtained from the pile length, diameter, and the parameters of the soil to which it is socketed are described.

Figure 2.22 Piling in cohesionless ground (Geo-Minds, 2023)

2.4.4.2 Axial Load Bearing Capacity of Single Piles in Cohesive Soils

In this chapter, the precautions to be taken for different types of pile installations in cohesive soils and the installation stages are explained. Friction and tip resistance of the pile, pile length, diameter and axial load carrying capacity calculation using the coefficient α (Greek letter Alpha) obtained from the undrained shear strength parameter of the cohesive soil different from the cohesionless soil are also presented.

2.4.4.3 Axial Load Carrying Capacity of Single Piles Socketed in Rock

In the design of piles socketed into rock, unlike all other soils, the bearing capacity is determined by the material of the pile (reinforced concrete, steel, or composite), especially in undifferentiated rock. In addition, methods for determining the parameters of rocks in the laboratory or in the field are specified.

2.4.4.4 Safety of Pile Bearing Capacity against Axial Loads

The pile bearing capacity safety against axial compressive loads can be calculated by two methods; the first method is the conventional safety factor approach, the second method is the characteristic load - characteristic capacity approach specified in the 2018 Turkiye Building Earthquake Regulation. These methods will be illustrated with more detail in the following section.

2.4.4.5 Pile Bearing Capacity Safety According to Turkiye Building Earthquake Regulation 2018

In this section, the previously mentioned characteristic load - characteristic capacity approach was explained with direct references from the regulation. According to this approach, firstly the design load should be calculated and then the pile design strength should be calculated and these values should be compared.

2.4.5 Section 3: Group Piles

Piles as foundation elements are used singularly only in some special cases(such as offshore wind turbines) in practice. In most cases, pile foundation systems are constructed by using multiple piles together and covering the ground like a block.

2.4.5.1 Use of Piles in Groups

This section deals with the most important difference between individual and group behaviour, namely the interference behaviour. And the effects of this behaviour on the stress increase on the soil and how to minimise it are discussed.

2.4.5.2 Bearing Capacity of Pile Groups

In this section, tables and methods that can be used in the calculation of bearing capacity of pile groups in different soil types are given. In addition, some of the considerations that may affect the bearing capacity calculation are summarised as a list.

2.4.5.3 Prediction of Settlement and Displacement of Pile Groups

This section describes the block settlement behaviour of piles used in groups. In addition, methods are proposed to estimate the undrained shear strength, which, as mentioned previously, is one of the most important soil parameters affecting the soil behaviour under loading in cohesive soils. Finally, relative displacement limits of piles under earthquake loads and the behaviour of piles in case of non-compliance with these limits are discussed.

2.4.5.4 Design Steps of Pile Groups

In this section, the design of group piles is explained in detail in steps, starting from the creation of an idealized soil profile and ending with the calculation of the settlement of the piles as a block. The terms Building Utilization Class, Building Height Class, and, Earthquake Design Class used in the design of pile foundations are defined with direct references from the Turkiye Building Earthquake Regulation 2018.

2.4.6 Additional Contents for Special Foundations

2.4.6.1 Negative Skin Friction

This section (see Appendix 4) describes the negative perimeter friction phenomenon which is observed in pile foundations, the conditions under which it occurs and how it should be handled in the calculations (as shown in Figure 2.23).

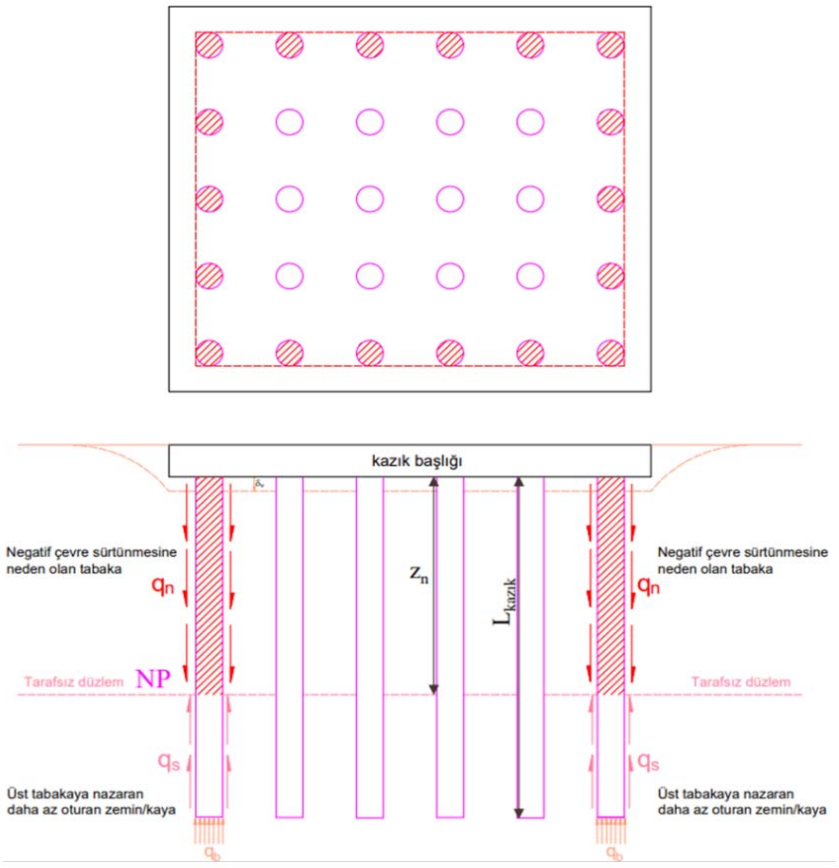


Figure 2.23 Negative skin friction (Geo-Minds, 2023)

2.4.6.2 Video Links

Various videos have been compiled for a better comprehension of the main topics of Special Foundations so far. These videos are listed in Appendix and in the database.

CHAPTER THREE
THE DATABASE

3.1 Introduction

The aim of the applied projects section in *Geo-Minds* is to guide and give an idea to the civil engineers who want to specialise in geotechnical engineering. Applied projects consist of four individual projects which took place in Turkiye and their foundation pressure conditions, architectural and reinforced concrete projects, ground investigations, geotechnical analysis reports, and ground improvement and pile foundation projects. The implemented projects can be accessed both through the toolbar dedicated to them as a whole and separately from the section under the lecture notes.

3.2 First Project

The first project that is demonstrated in *Geo-Minds* was shown in the below Figure 3.1.

Figure 3.1 First Project (Geo-Minds, 2023)

The first project is an up-to-date residential project in Izmir Cigli region, constructed in accordance with the Turkish Building Earthquake Code 2018. The *Geo-Minds* knowledge portal provides information on the project's foundation contact pressure conditions, soil investigation, geotechnical analysis report, and ground improvement and pile foundation project information. In addition, recommended

points to be considered during pile installation and drilling are added as project notes at the end of the relevant section.

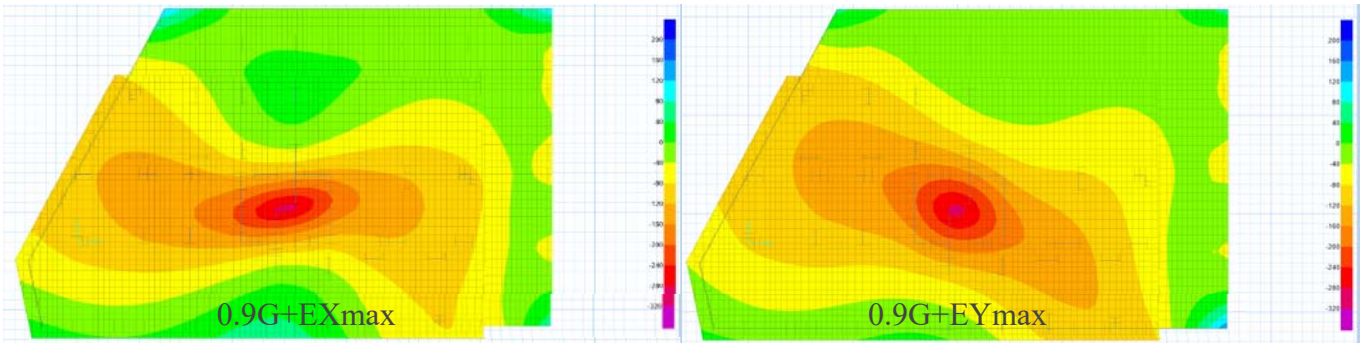


Figure 3.2 Foundation Pressure Diagrams, First Project (Geo-Minds, 2023)

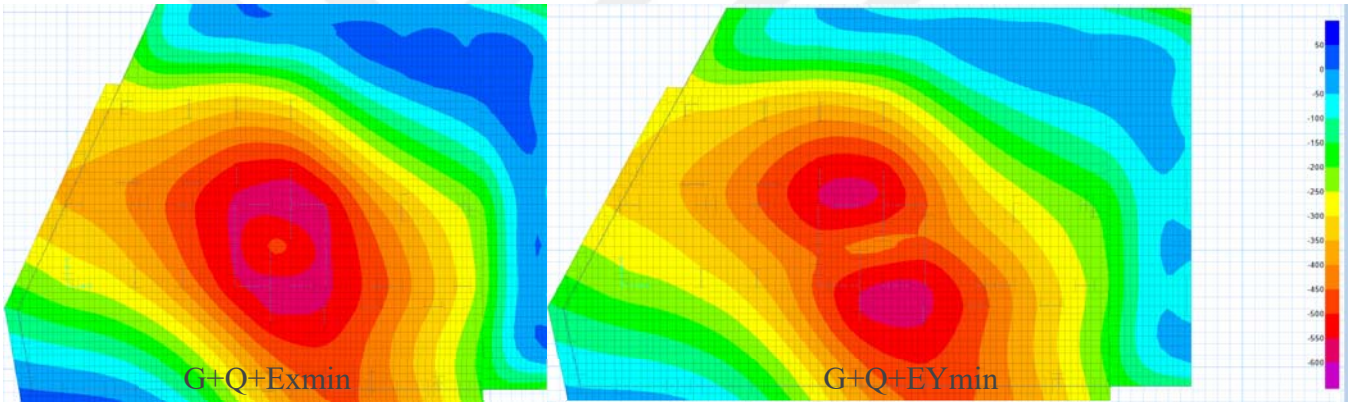


Figure 3.3 Foundation pressure diagrams, first project (Geo-Minds, 2023)

3.3 The Second Project

The second project that is demonstrated in *Geo-Minds* was shown in Figure 3.4.

Figure 3.4 The Second project

The second project is a corporate retail project built in a relatively confined area within the İzmir Karşıyaka District. In this project, in addition to the technical information provided in the first project (foundation contact pressure conditions, soil investigation, geotechnical analysis report, ground improvement, pile foundation), there is also a Diaphragm wall project. At the end of all the information, there are notes guiding about the angular distortion ratio and suspension type specifications to be used in the diaphragm wall panel manufacturing.

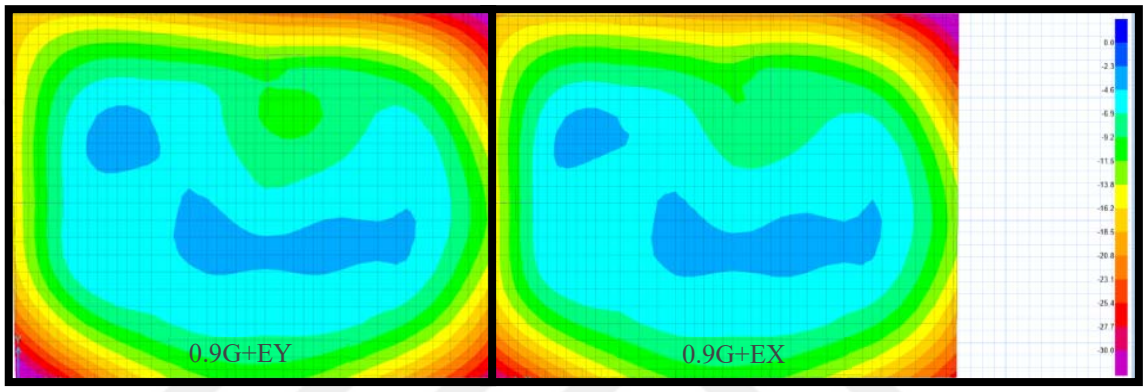


Figure 3.5 Foundation pressure diagrams, second project (Geo-Minds, 2023)

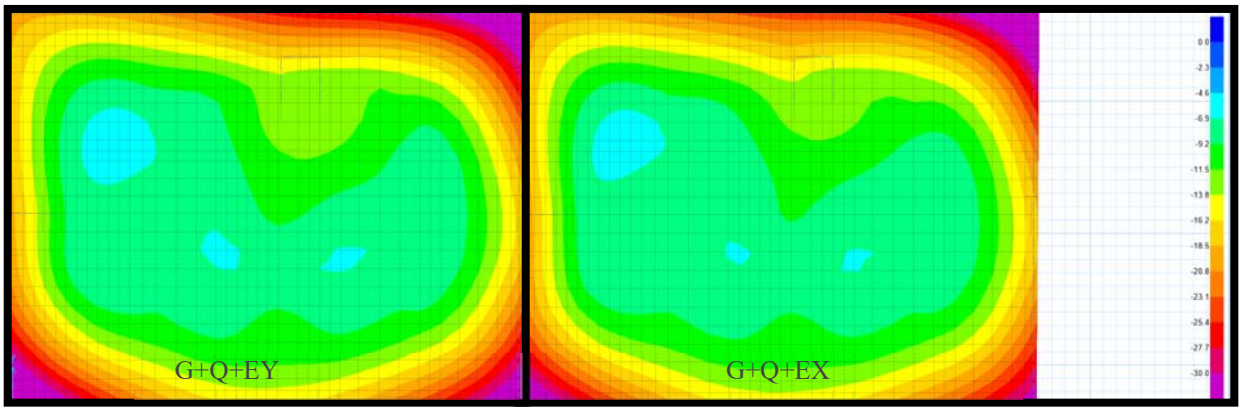


Figure 3.6 Foundation pressure diagrams, second project (Geo-Minds, 2023)

3.4 The Third Project

The third project that is demonstrated in *Geo-Minds* was shown in the below Figure 3.7.

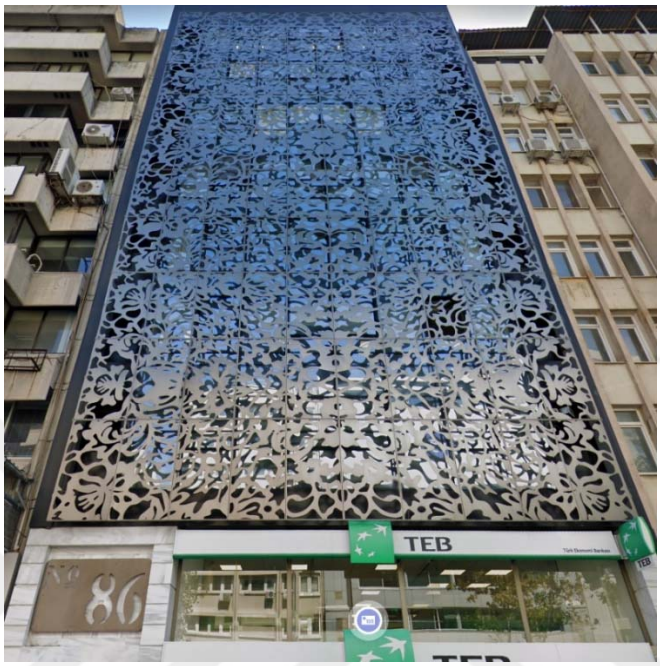


Figure 3.7 Third project (Geo-Minds, 2023)

The third project is a 9-storey residential project located in Alsancak district of Izmir, built between two old existing buildings in an adjoining order, with a workplace on the lowest floor. Due to the special condition of the project, the project requires barrette pile, shoring pile system, and diaphragm wall construction in addition to raft foundation. Concrete of C40 strength class was used in all of the piles. Similar information is given in the project notes at the end of the chapter. After the demolition of the old building on the site, the melting process was carried out with the bored pile machine in the places where the previous piles were found.

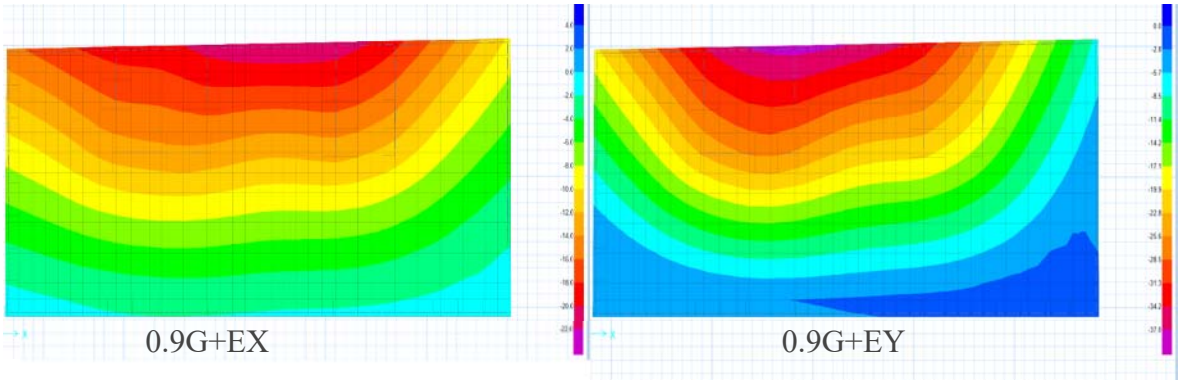


Figure 3.8 Foundation pressure diagrams, third project (Geo-Minds, 2023)

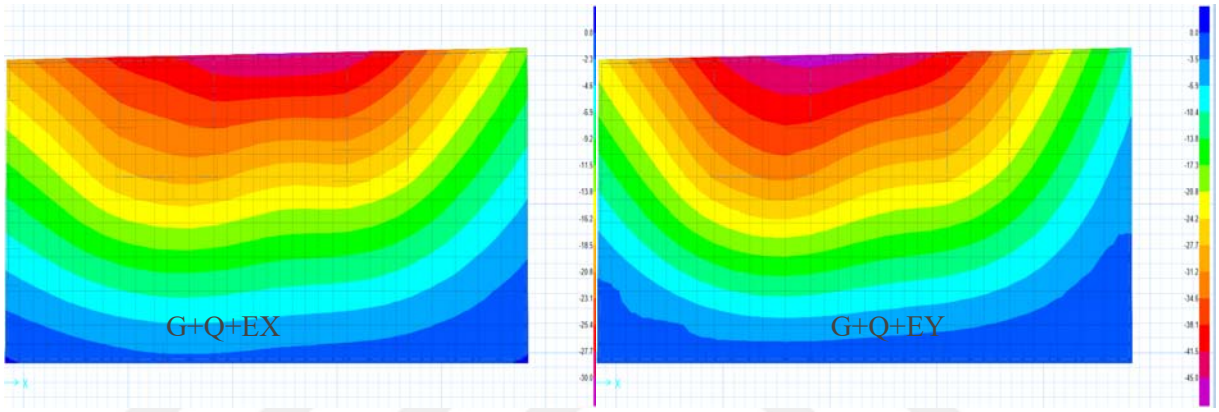


Figure 3.9 Foundation pressure diagrams of the third project (Geo-Minds, 2023)

3.5 The Last Project, Karşıyaka Elementary School

The last project that is demonstrated in *Geo-Minds* was shown in the Figure 3.10.

Figure 3.10 Karşıyaka Elementary School

The ground improvement and pile foundation project of Karşıyaka Elementary School was designed by Professor Gürkan Özden, who is still working actively at Dokuz Eylül University, in the Faculty of Civil Engineering. It is the most detailed project presented on the *Geo-Minds* knowledge platform. It includes; construction and demolition site plans, architectural project views of all floors, and sections of the building from all directions. There are also foundation formwork and reinforcement plans, and jet grout column layout plan. Ground investigation reports, drilling logs, and geotechnical analysis and evaluation report are also included (see Appendix 4).

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Evaluation of the Database

The success of a service offered to a community can be most accurately measured through feedback from that group. A questionnaire created using Google Forms was presented to a group that represents as accurately as possible the audience who will actually use the database. The main purpose of the survey was to evaluate the usefulness of the *Geo-Minds* information portal in its current state and measure the potential of its future functionality.

4.2 The Survey

Geo-Minds Information Portal Survey consists of 16 multiple-choice questions. The questions need to be answered on a 1 to 5 scale (1 = Strongly agree, 5 = Strongly disagree). Participants included 44 people interested in the geotechnical field or geotechnical engineering itself. The online survey was distributed via WhatsApp, and the original language was Turkish. To view the original survey, please see Appendix 1-2.

Among all the other methods, an online survey is used to gather feedback because it is fast and easy to analyze data. However, the crucial benefit of using an online survey is that geotechnical engineers can easily access it to respond, and it is not time-consuming.

A 16-question online survey aims to understand the potential impacts of the database in both practical applications and theory. The survey and the analysis of the results were conducted using Google Forms.

Additionally, the survey aims to measure *Geo-Minds*' contribution to the knowledge levels of students, engineers, lecturers, and individuals interested in this field, its

success in raising earthquake awareness, and its effectiveness in providing an alternative to conventional learning methods.

The answers to all questions and their analysis among the 16 questions are presented in the charts below:

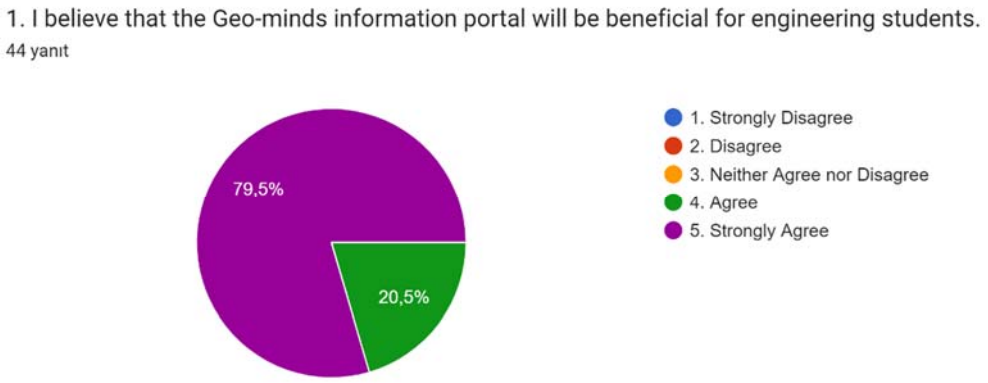


Figure 4.1 Online survey, question 1 (Google, 2023)

In the question 1, everyone believed that the *Geo-Minds* information portal would be beneficial for engineering students. Since it presents a substantial amount of accurate and well-organized information.

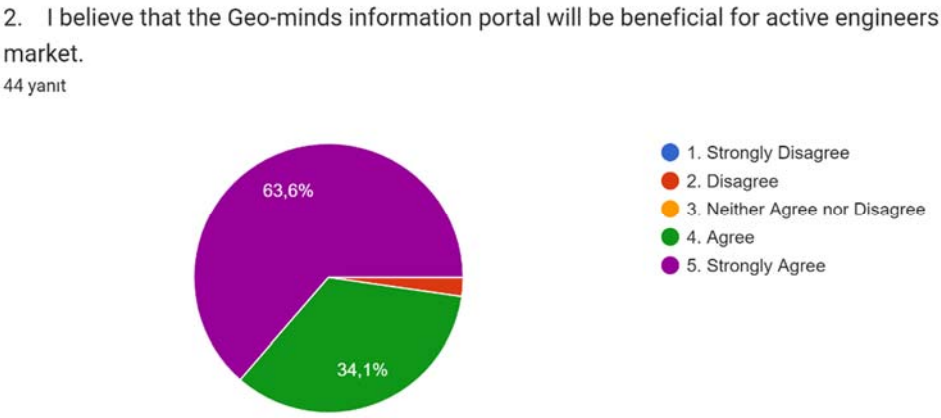


Figure 4.2 Online survey, question 2 (Google, 2023)

In question 2, most people believed that the *Geo-Minds* information portal would be beneficial for engineering students. The only difference in the answers for questions

1 and 2 is whether it is more beneficial for engineering students or active engineers in the market. Both answers still support the idea that the *Geo-Minds* information portal will be beneficial for both groups, but there is a slightly reduced number of strong agreements among active engineers in the market. One reason for this could be that students generally seek online sources to enhance their expertise. Additionally, students represent younger generations compared to working professionals, and they have a natural inclination to seek and access knowledge online. Laptops and computers are relatively new gadgets, and older generations have less experience with them than their younger counterparts. This difference arises from the fact that older generations grew up in a more traditional world where encyclopedias and lectures were primary sources of information.

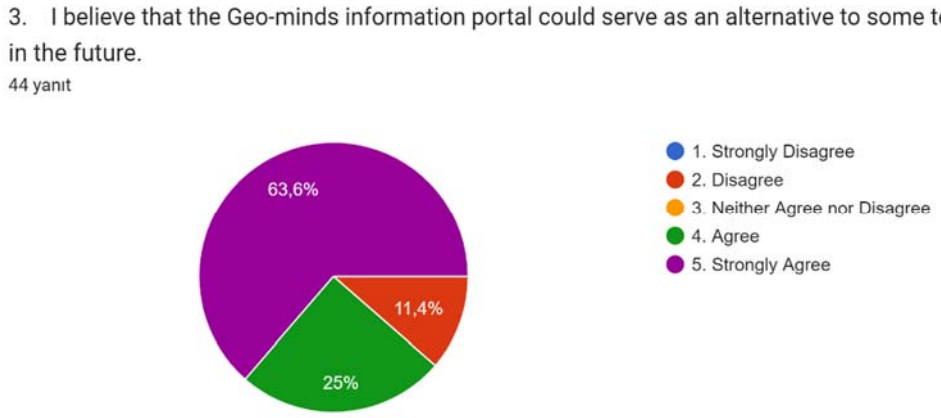


Figure 4.3 Online survey, question 3 (Google, 2023)

Approximately 89 percent of participants believe that the *Geo-Minds* information portal has the potential to become an alternative to textbooks in the future. Fifteen years ago, this question might not have received such a positive response. Technological advancements have made not only the *Geo-Minds* information portal but also other reputable databases or websites potential alternatives to textbooks. These digital alternatives only need internet connection for access, and provide easier facilitating information retrieval and data analysis compared to traditional textbooks.

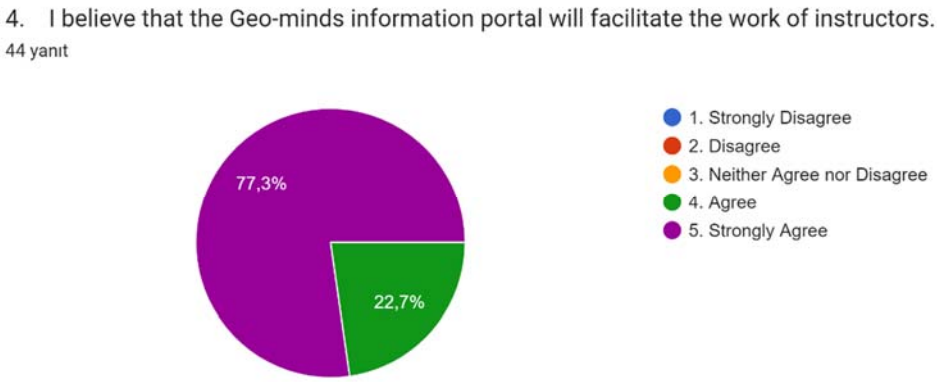


Figure 4.4 Online survey, question 4 (Google, 2023)

All respondents agreed that the *Geo-Minds* information portal would facilitate the work of instructors. This aligns with the findings from the answer to the first question since if students benefit from the *Geo-Minds* information portal, they will gain a better understanding of the geo-technical field, which will positively impact their assigned tasks by instructors.

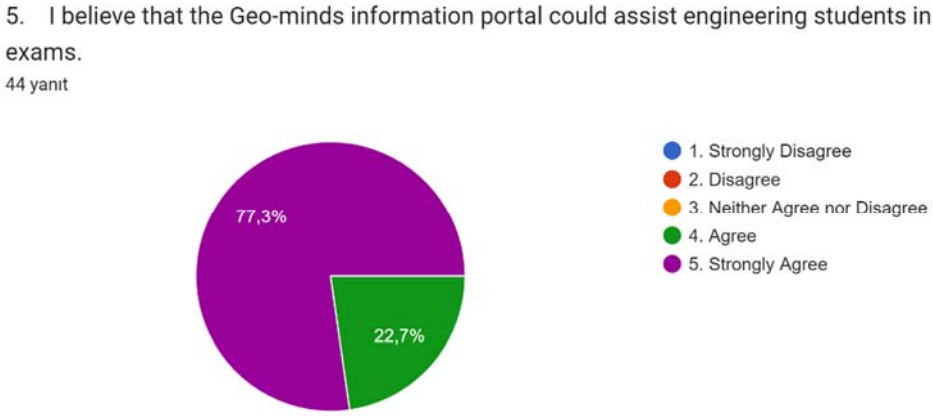


Figure 4.5 Online survey, question 5 (Google, 2023)

Everyone agreed that the *Geo-Minds* information portal would be beneficial for engineering students' exams. This finding is consistent with the responses to the first and fourth questions.

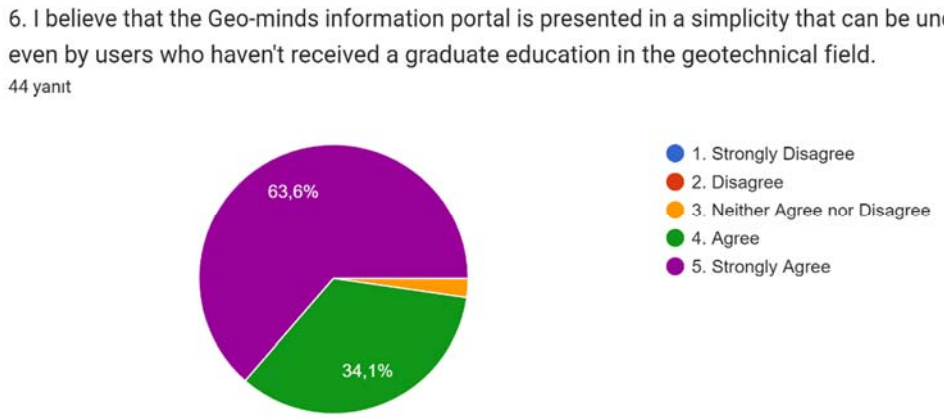


Figure 4.6 Online survey, question 6 (Google, 2023)

Nearly everyone stated that the *Geo-Minds* information portal is easy to understand, even for users without prior education in the Geo-technical field. This aligns with one of the goals of creating this website, which was to keep it simple by avoiding excessive use of technical terms and elaborate backgrounds. The website's simplicity is achieved through the simplification of terms and contexts, making it accessible and readable for anyone interested in the geo-technical field.

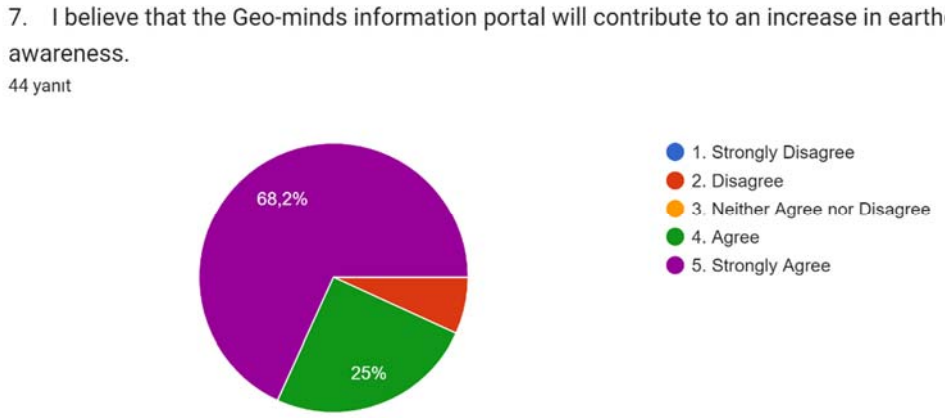


Figure 4.7 Online survey, question 7 (Google, 2023)

About 93 percent of participants believed that the *Geo-Minds* information portal would contribute to an increase in earthquake awareness, while the remaining participants disagreed. The *Geo-Minds* information portal includes numerous real-life

examples and a variety of knowledge from textbooks and articles about earthquakes. Seven percent of the participants disagreed with this statement. All participants were either geotechnical engineers or interested in the geotechnical field, indicating that they are more aware of earthquakes than the general population. While it is unlikely that individuals uninterested in the geotechnical field would visit the *Geo-Minds* information portal, the overall earthquake awareness may not change significantly. However, recent earthquakes in Turkiye and Syria have likely raised awareness among the general population about building safety and earthquake-prone regions. In the age of the internet, where misinformation is prevalent, the *Geo-Minds* information portal can increase earthquake awareness by providing scientifically accurate and easily understandable knowledge.

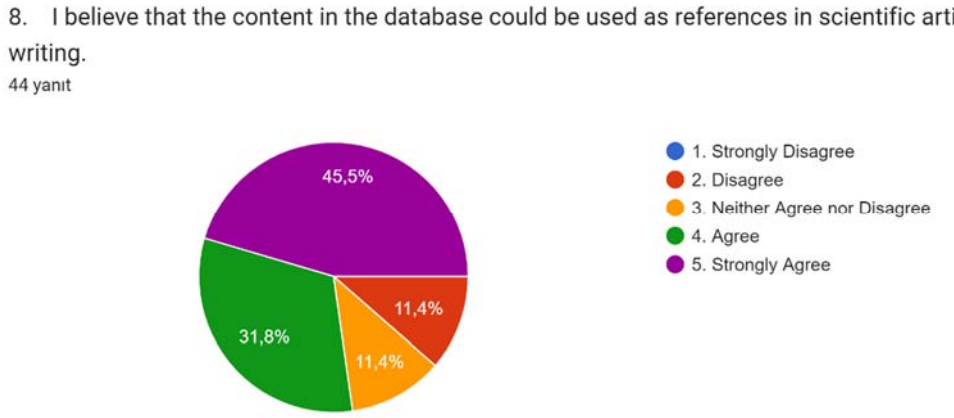


Figure 4.8 Online survey, question 8 (Google, 2023)

Most participants believed that the content in the database could be used as a reference in scientific article writing. The *Geo-Minds* information portal cites the sources of its information, including only verified knowledge.

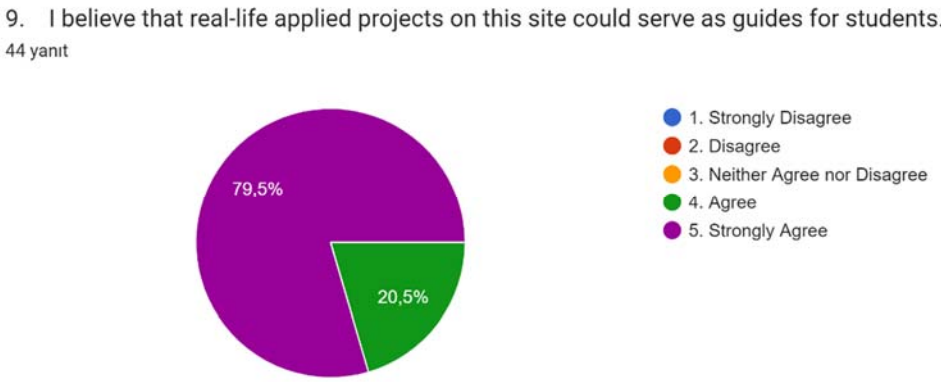


Figure 4.9 Online survey, question 9 (Google, 2023)

All participants agreed that real-life applied projects on the *Geo-Minds* information portal could serve as guides for students. During their school years, students often acquire theoretical knowledge rather than practical experience. The *Geo-Minds* information portal offers students access to real-life applied projects without cost or difficulty. All applied projects are carefully selected for students and professionals.

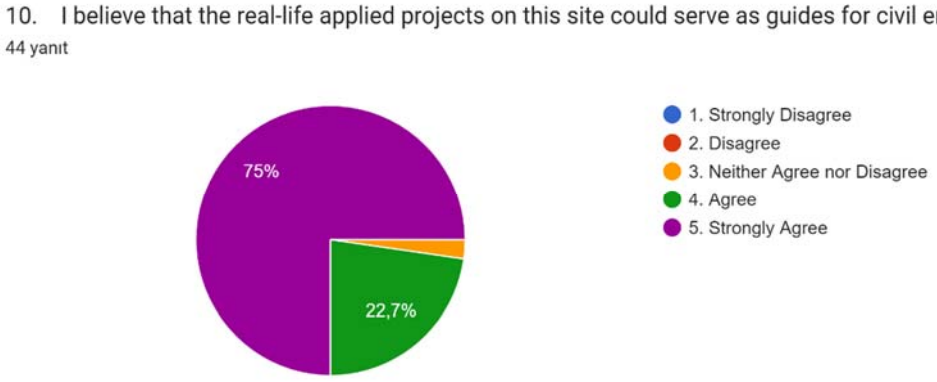


Figure 4.10 Online survey, question 10 (Google, 2023)

Nearly every participant believed that the real-life applied projects on the *Geo-Minds* information portal could serve as guides for civil engineers. The level of agreement in this question is slightly lower than in the previous question, most likely due to students having a greater tendency to seek information portals as guides, given their familiarity with the internet. However, the difference between the two questions

is significantly low. In the end, all participants agreed that the *Geo-Minds* information portal is a successful guide for students and professionals.

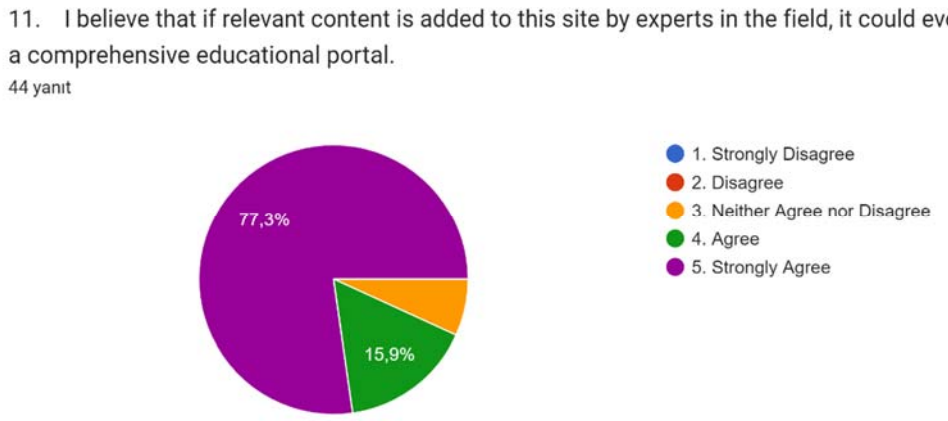


Figure 4.11 Online survey, question 11 (Google, 2023)

About 93 percent of the participants agreed that if relevant content is added to the *Geo-Minds* information portal by experts in the field, it could evolve into a comprehensive education portal. When it comes to education portals, there is never enough data to stop adding more. More accurate knowledge enables users to think more creatively and gain a better understanding of concepts in detail. However, there may be a challenge in categorizing vast amounts of data. Therefore, when experts in the field begin adding relevant content, it becomes crucial to conduct validity and reliability checks on the added content and categorize it in a way that all users can access the content of their choice. The simplicity of the information portal needs to be maintained while adding new content. One solution could be a filtering option for users, differentiating between beginners in geotechnical knowledge and experts in the field. This way, highly detailed newly added content can be displayed only to experts, preventing other users from becoming overwhelmed by complex knowledge.

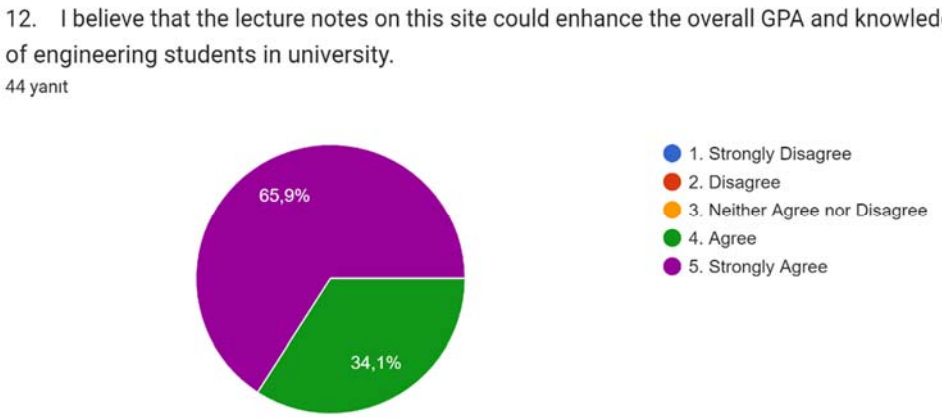


Figure 4.12 Online survey, question 12 (Google, 2023)

Everyone agreed that lecture notes on this site could enhance the overall GPA and knowledge levels of engineering students in university. This result is consistent with the first question since the *Geo-Minds* information portal is highly beneficial for engineering students, offering a wide range of well-categorized topics.

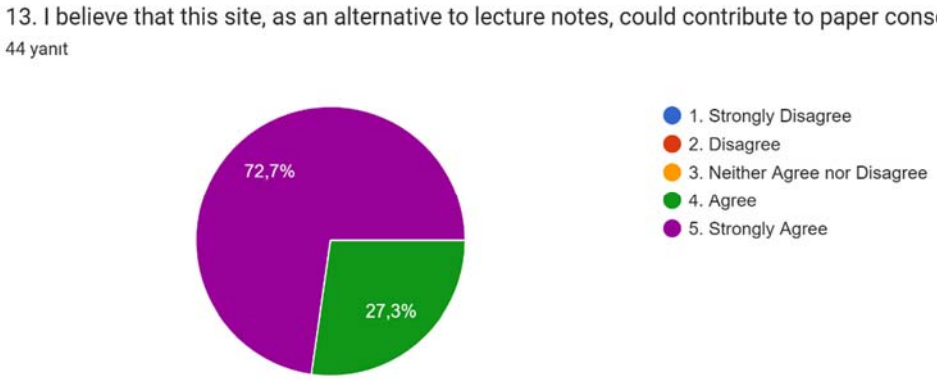


Figure 4.13 Online survey, question 13 (Google, 2023)

All participants agreed that the *Geo-Minds* information portal could contribute to paper conservation. Furthermore, in the future, it is likely to have an even greater impact, as the use of the internet as an educational tool encourages people to move away from traditional pen-and-paper learning methods. Neither method is dominant, but it is a fact that reading an article from the *Geo-Minds* information portal or any

other online source, such as Google Scholar or Web Of Knowledge, reduces paper consumption compared to printing the article or reading it from a physical book.

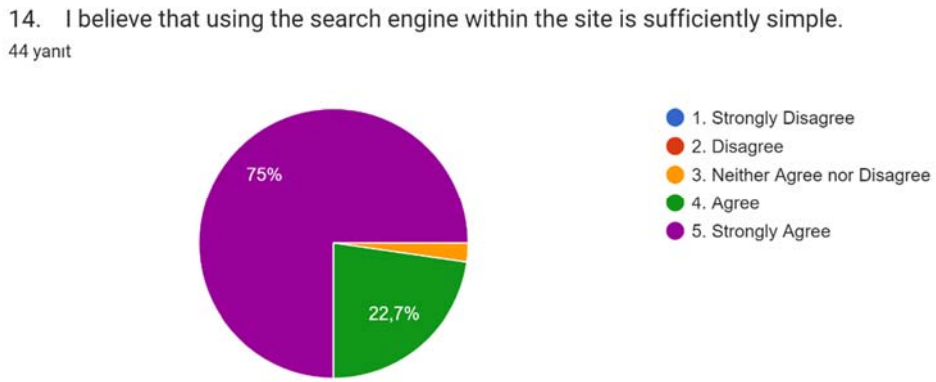


Figure 4.14 Online survey, question 14 (Google, 2023)

Nearly all participants believed that using the search engine within the site is sufficiently simple. Although the participants were all geotechnical engineers or individuals interested in the geotechnical field, they concluded that the search engine is designed to be straightforward, even for ordinary people without expertise in engineering. One of the aims of the *Geo-Minds* information portal is to be accessible and understandable by everyone, and it appears to have achieved this goal.

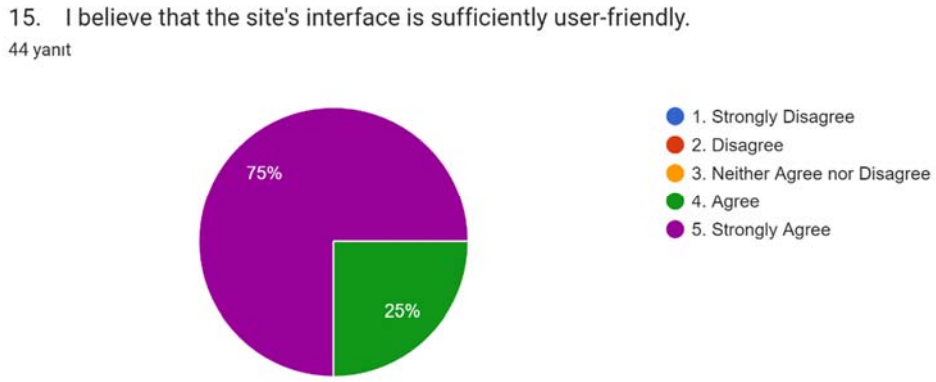


Figure 4.15 Online survey, question 15 (Google, 2023)

All participants agreed that the *Geo-Minds* information portal's interface is sufficiently user-friendly. This result aligns with the previous question, highlighting the importance of a user-friendly design to attract a large user base.

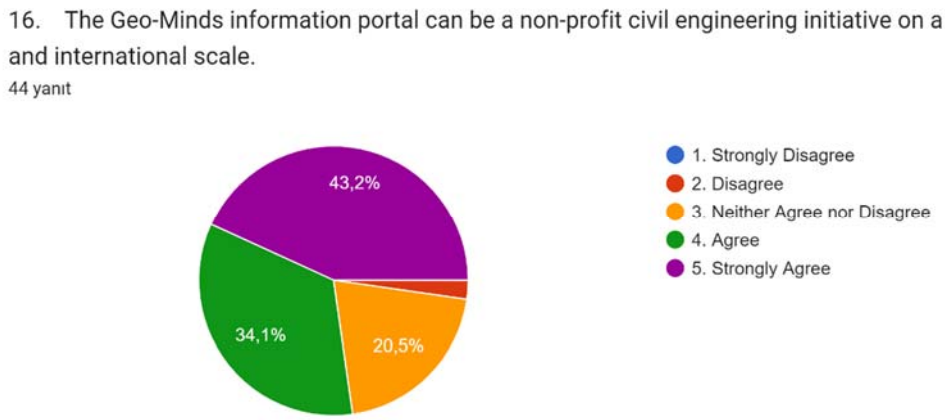


Figure 4.16 Online survey, question 16 (Google, 2023)

Approximately 77 percent of the participants agreed that the *Geo-Minds* information portal could be a non-profit civil engineering initiative on both a national and international scale. This aligns with the mission of the *Geo-Minds* information portal, as increasing its user base would raise awareness about the geotechnical field and disseminate valid and reliable information nationally and globally. Additionally, around 20 percent of participants neither agreed nor disagreed with the statement, while around 3 percent disagreed. Building a new information portal's international reputation is a challenging task, as explained in the response to the eleventh question. The *Geo-Minds* information portal requires a vast amount of data and effective organization and categorization to maintain quality. If this can be achieved, it has the potential to become a non-profit civil engineering initiative on both national and international scales. Unlike many information portals in the engineering field, the *Geo-Minds* information portal is easy to understand and navigate and also provides accurate information, and is user-friendly.

4.3 Discussion

The data obtained from the survey can be summarized as follows:

1- The idea that the *Geo-Minds* knowledge portal can benefit students and active working engineers emerged prominently. However, according to the responses, it can be concluded that the benefit to students is more certain.

2- The information portal might be an alternative to some textbooks in the future due to its advantages such as being accessible everywhere, and enables easier knowledge retrieval and data organization compared to conventional books.

3- *Geo-Minds* information portal can benefit both the instructors and the students with the school work. Instructors can find more time for their searches and students can be more able to comprehend some concepts on their own, thanks to the knowledge available online.

4- People may have increased earthquake awareness by observing the database, yet people who are not interested in the field of geotechnics are unlikely to throughly examine the database, hence it will provide its main benefit to people associated with this field.

5- All participants agreed that the real life applied project section can be used as guides for both students and geotechnical engineers alike, but it can be observed that the assistance it provides can be more clear to students.

6- With future additional contents and up-to-date knowledge, *Geo-Minds* is expected to transform into a more comprehensive educational portal. The simplicity of the data base should be preserved in future additions, to prevent users from being underwhelmed by the complex design.

7- The lecture notes on the site can be alternative to paper notes, contributing to the paper conservation, moreover, enhancing the overall GPA and knowledge levels of

civil engineering students thanks to its advantages, as stated earlier. The user friendly design of the information portal does not only allow to be used by an expert or an engineering student, but anyone who can check their social media, e-mail etc. can also look into *Geo-Minds*, too. The design's main aims are to be fluent and easy to use and browse.

8- Approximately ¾ of the participants voted that *Geo-Minds* can evolve to be a non-profit civil engineering initiative, nationally and internationally. The majority of the remaining participants neither agreed nor disagreed.

CHAPTER FIVE
CONCLUSION

5.1 Conclusions and Recommendations

Geotechnical engineering is an emerging field in civil engineering, particularly in soil mechanics, and it has experienced significant technological advancements. The global impact of the COVID-19 pandemic has brought about substantial changes in education, industry, and research, including within geotechnical engineering. The use of geotechnical databases has become more prevalent due to the growth of online resources.

This study's objective is to enhance geotechnical education for both undergraduate and graduate students by introducing a knowledge-based learning platform called "*Geo-Minds*." This platform covers subjects like pile foundations and soil mechanics and is designed with a user-friendly interface using the WordPress content management system.

The decision was made to develop *Geo-Minds* as a website-style database, offering several benefits, including independence from device and operating system, low maintenance costs, and accessibility from anywhere with an internet connection. *Geo-Minds* is designed to work smoothly on various devices such as phones, tablets, and personal computers, automatically adjusting its user interface for the best browsing experience.

Some of the main contents of the database are as follows:

- The earthquake hazard map for Turkiye by AFAD.
- An interactive real-time fault map of Turkiye by MTA.
- National technical specifications and regulations that have been both currently in use and those that have been discontinued within the geotechnical field.
- Specific chapters pertaining to pile foundations and soil mechanics.
- Applied projects that aim to guide the civil engineers

The "Applied Projects" section in *Geo-Minds* aims to assist civil engineers interested in specializing in geotechnical engineering. It consists of four individual projects conducted in Turkiye. These projects encompass information about foundation pressure conditions, architectural and reinforced concrete aspects, ground investigations, geotechnical analysis reports, ground improvement, and pile foundation projects. Users can access these projects as a whole or separately through the dedicated toolbar or the lecture notes section.

The First Project: The first project showcased in *Geo-Minds* is a modern residential building situated in Izmir Cigli, constructed in compliance with theTurkish Building Earthquake Code 2018. *Geo-Minds* offers information regarding foundation pressure conditions, soil investigations, geotechnical analysis reports, and ground improvement and pile foundation project details.

Second Project: The second project is a corporate retail venture located in the Izmir Karşıyaka District. In addition to the technical information presented in the first project, including foundation conditions, soil investigations, geotechnical analyses, ground improvement, and pile foundations, this project includes details about a Diaphragm wall project.

Third Project: The third project is a 9-story residential building situated in Izmir's Alsancak district, positioned between two existing buildings with a ground-level workplace. This project necessitated barrette piles, shoring pile systems, and diaphragm wall construction, alongside a raft foundation. The piles were constructed using C40 strength class concrete.

The Last Project, Karşıyaka Elementary School: The final project featured in *Geo-Minds* is the ground improvement and pile foundation project for Karşıyaka Elementary School. This project was designed by Professor Gürkan Özden, an active member of Dokuz Eylül University's Faculty of Civil Engineering. It provides comprehensive details, including site plans for construction and demolition, architectural views, building sections, foundation formwork and reinforcement plans,

and layout plans for jet grout columns. Additionally, the project includes ground investigation reports, drilling logs, and geotechnical analysis and evaluation reports.

A survey was conducted using Google Forms, targeting individuals who closely represent the future users of the database since the success of the information portal is best evaluated through feedback from its intended audience. The survey's primary objective was to assess the current usefulness of the *Geo-Minds* portal and gauge its potential for future enhancements.

The *Geo-Minds* Information Portal Survey consists of 16 multiple-choice questions, with participants rating their responses on a scale ranging from 1 (Strongly agree) to 5 (Strongly disagree). A total of 44 individuals, all with an interest in geotechnical engineering, participated in this online survey, which was distributed in the Turkish language. The decision to use an online survey was made because of its speed, ease of data analysis, and accessibility for geotechnical professionals, without consuming excessive time.

Detailed results of the research can be analysed in the discussions section.

It is of great importance that the information to be added in the future does not disrupt the clear structure of the information portal in order to bring even more benefits to all the contents added to the database. Researchers will have a great responsibility for the database to reach its potential at national and international level.

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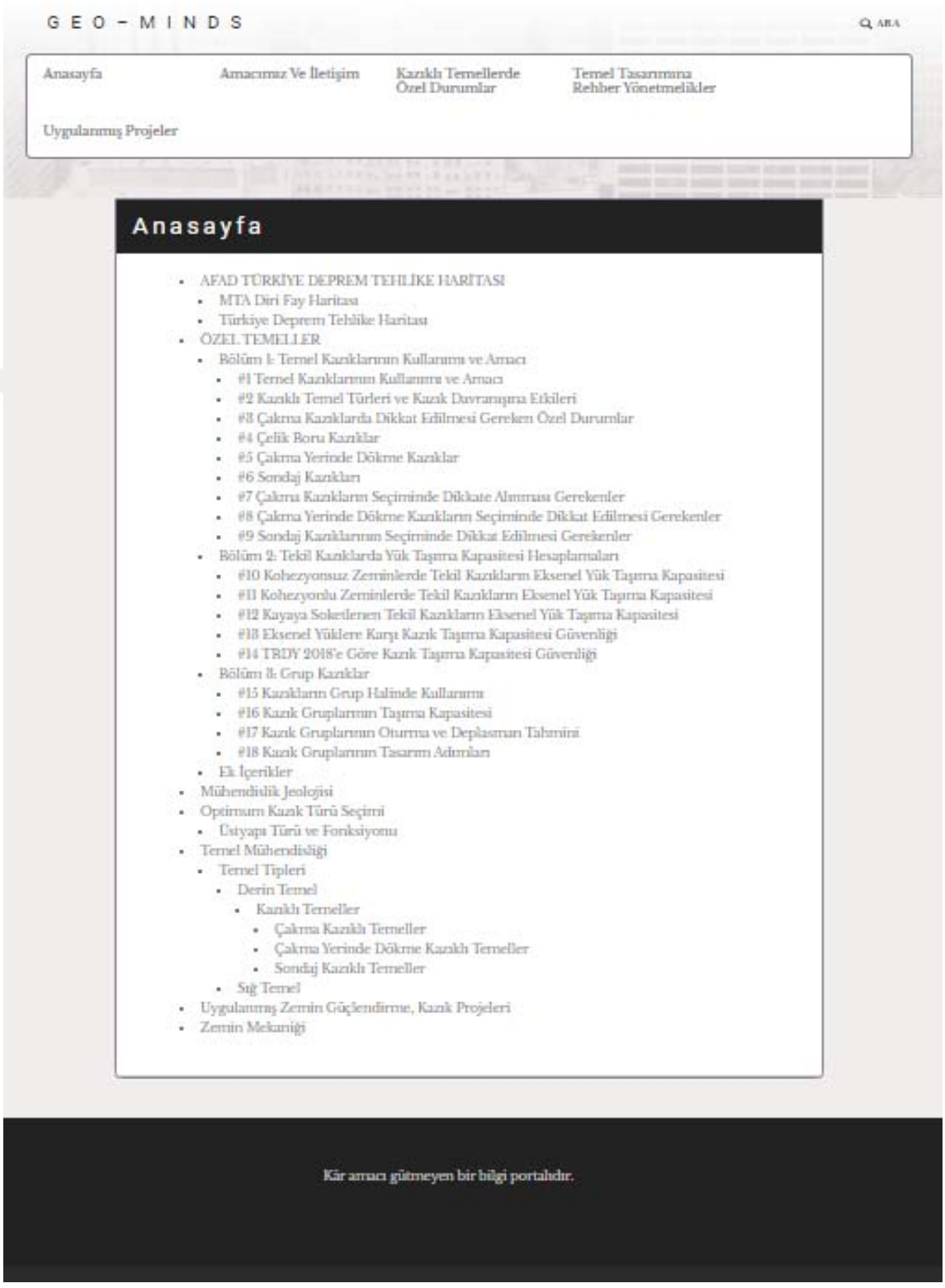
APPENDIX-1: Geo-Minds Information Portal Website Home Page



APPENDIX-2: Geo-minds Information Portal Our Mission and Contact Page

APPENDIX-3: Geo-minds Information Portal National Technical Specifications and Regulations

BAŞLANGIÇ ▸ ULUSAL YÖNETMELİK VE ŞARTNAMELER

Ulusal Yönetmelik ve Şartnameler

Temel Tasarımına Yön Veren Ulusal Yönetmelikler

Deprem Etkisi Altında Karayolu ve Demiryolu Tünelleri İle Diğer Zemin Yapılarının Tasarımı İçin Esaslar Yönetmeliği

Kazı Güvenliği ve Alınacak Önlemler Hakkında Genelge

Kıyı ve Liman Yapıları, Demiryolları, Hava Meydanları İnşaatlarına İlişkin Deprem Yönetmeliği

TBDY 2018

TS 500

TS 498(2021)

Zemin ve Temel Etüdü Uygulama Esasları

Tedavülden Kalkmış Deprem Yönetmelikleri

Deprem Yönetmeliği 1975

Deprem Yönetmeliği 1997

Deprem Yönetmeliği 2007

Teknik Şartnameler

Agrega Genel Teknik Şartnamesi

Betonarme İşleri Genel Teknik Şartnamesi

Çimento Genel Teknik Şartnamesi

Kazı ve Dolgu İşleri Teknik Şartnamesi

Kazık Teknik Şartnamesi

Su Genel Teknik Şartnamesi

Su Yalıtımı Genel Teknik Şartnamesi

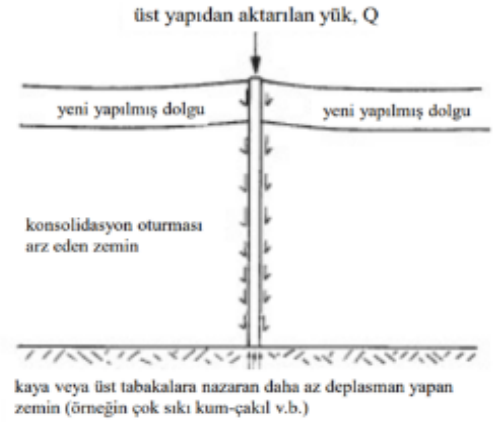
Tünel İşleri Genel Teknik Şartnamesi

APPENDIX-4 - Geo-minds Information Portal Special Conditions in Piled Foundations Page, Negative Skin Friction

BAŞLANGIÇ ▸ **NEGATİF ÇEVRE SÜRTÜNMESİ**

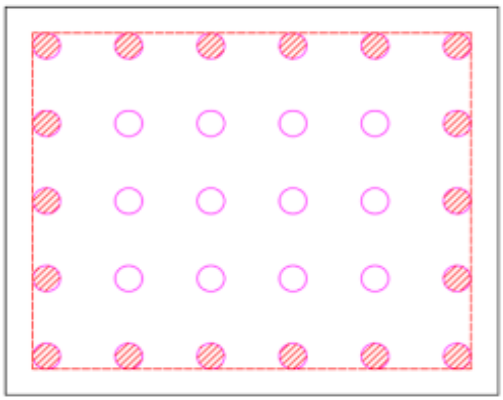
NEGATİF ÇEVRE SÜRTÜNMESİ

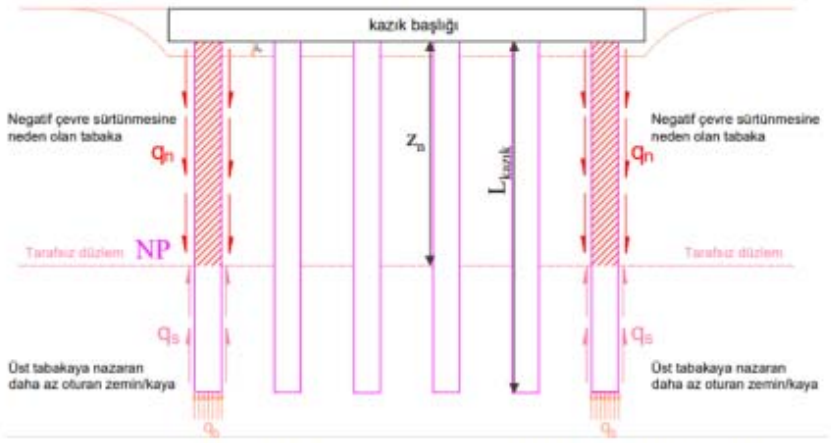
Uç veya uca yakın alt kısmı daha sıkı veya katı zemin ya da kayaya soketli kazıklarda zemin yüzeyinden itibaren bir dolgu ve/veya yumuşak kil-silt tabakası uca nazaran daha fazla oturma yaparsa bu tabakalardan kazığa aşağı doğru kuvvet uygulanır. Bu kuvveti doğuran mekanizmalar sonucu gelişen ters yöndeki sürtünmeye negatif çevre sürtünmesi denilir.



Negatif çevre sürtünmesini ortaya çıkaran mekanizmalar aşağıdadır. Bu mekanizmaların negatif çevre sürtünmesi oluşturabilmesi için öncelikli şart kazık ucunun oturmakta olan tabakaya nazaran daha az oturmasıdır. Kazık zeminle birlikte otururs a negatif çevre sürtünmesi oluşmaz.

1. Yumuşak kil/elastik silt tabakasının üstüne dolgu yapılması ve bu dolgu yükü altında zemin oturma yaparken içinde kazık bulunursa
2. Yumuşak kilde kazık çakıldıktan sonra aşırı boşluk suyu basıncı sönümlenirken kilin oturma yapması
3. Yeraltı su seviyesinin bir şekilde düşürülmesi ve bunun sonucunda efektif gerilme artışına bağlı oturma meydana gelmesi
4. Komşu parsellerde sürşarj uygulaması





Negatif çevre sürtünmesi bir kazık grubu içinde dış sıra kazıklarda etkili olur. İç sıra kazıklarda bu etki genellikle ihmal edilecek mertebede kalır. Tarafsız düzlemde negatif çevre sürtünmesi pozitif çevre sürtünmesine eşit olur (Qn=Qs). Qn'nin hesaplanabilmesi için tarafsız düzlemin derinliğinin (zn) belirlenmesi gerekir. Bu parametre kazığın ucuna yük aktarılma durumuna göre değişen değerler alır. Uç kazıklarında (kazık ucu çok sıkı kum-çakıl veya kayada) derine inerken, yüzer kazıklarda (uca hiç yük aktarmayan veya uç direncinin ancak küçük bir kısmının mobilize olduğu kazıklar) kazığın alt ucundan yaklaşık L/3 kadar yukarıda olur.

Negatif çevre sürtünmesi oturan tabakanın deplasmanı ile ortaya çıktığı ve bilhassa ince daneli zeminlerde zaman içinde tam olarak mobilize olduğu için efektif gerilme tabanlı hesap yöntemleri kullanılır.

Negatif yük geçici bir etki olup kazık servis yüküne doğrudan eklenmez. Kazığa olan etkisi basınç gerilmesinin malzeme emniyet gerilmesini aşma ihtimali açısından incelenir. Ancak üst yapıdan gelen servis yükü (basınç) ve negatif çevre sürtünmesi birlikte dikkate alınarak bunların kazık kapasitesine nazaran makul bir güvenlik faktörü ile taşındığını göstermek gerekir (Qp hesabında negatif çevre sürtünmesi arz eden çok yumuşak-yumuşak kil tabakasının kazık kapasitesine pozitif katkısı ihmal edilir. Qp' nin basınç yüklerine göre hesabında Fs=2.0 veya 2.5 güven faktörünü sağlaması temin edilir.) Aksine bir yaklaşım mühendisi aşırı güvenli tarafta kalan bir tasarıma sürükler:

$$F_s = \frac{Q_P}{Q_{servis} + Q_n} \geq (1.5 \sim 2.0)$$

APPENDIX-5: Geo-minds Information Portal Applied Projects Page- Project Number 4 Karşıyaka Elementary School

BAŞLANGIÇ ▸ **UYGULANMIŞ PROJELER**

Uygulanmış Projeler

4. Proje: Karşıyaka İlköğretim Okulu

Mimari Proje

Yapım Vaziyet Planı

Bodrum ve Zemin Kat Planları

1.Kat Planı

2.Kat Planı

3.Kat Planı

Çatı Katı Planı

Çatı Planı

A-A Kesidi

B-B ve C-C Kesitleri

Yıkım Vaziyet Planı

Betonarme Proje

Temel Kalıp Planı

Temel Donatı Planı

Jet Kolon Yerleşim Planı

Zemin Etüdü

Zemin Etüdü

Ekler

Geoteknik Rapor

MEB Karşıyaka Cumhuriyet İlkokulu Geoteknik Analiz ve Değerlendirme Raporu

Zemin İyileştirme ve Kazıklı Temel Projesi

Geçici Palplanslı iksa ve jet grout Kolon Projesi

APPENDIX-6: Geo-minds Information Portal Survey English Version

Geo-minds Information Portal Survey

Informed Consent Form

The survey you have participated in is being conducted by civil engineer Onur Atlı as part of the Geotechnical Master's thesis at Dokuz Eylül University. This survey includes questions aimed at measuring the contributions of the Geo-minds information portal (https://geo-minds.com/) to its users. As part of the study, you are expected to complete a 16-question survey. Participation is only open to those whose native language is Turkish. The survey will take approximately 5 minutes to complete. You can pause or withdraw from the study at any time.

Furthermore, if you have any questions or topics you would like to discuss, you can contact the researcher Onur Atlı through the email address geominds.forms@gmail.com.

geominds.forms@gmail.com Hesap değiştir

Paylaşılmıyor

* Zorunlu soruyu belirtir

Please mark one of the options below. *

- ◯ I voluntarily consent to participate in the survey.
- ◯ I do not consent to participate in the survey.

Sonraki

Formu temizle

16-Question Geo-minds Information Portal Survey

Please read the following items and mark the answer that best suits you.

1. I believe that the Geo-minds information portal will be beneficial for engineering students. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

2. I believe that the Geo-minds information portal will be beneficial for active engineers in the market. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

3. I believe that the Geo-minds information portal could serve as an alternative to some textbooks in the future. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

4. I believe that the Geo-minds information portal will facilitate the work of instructors. *

- 1. Strongly Disagree
- 2. Disagree
- 3. Neither Agree nor Disagree
- 4. Agree
- 5. Strongly Agree

5. I believe that the Geo-minds information portal could assist engineering students in their exams. *

- 1. Strongly Disagree
- 2. Disagree
- 3. Neither Agree nor Disagree
- 4. Agree
- 5. Strongly Agree

6. I believe that the Geo-minds information portal is presented in a simplicity that can be understood even by users who haven't received a graduate education in the geotechnical field. *

- 1. Strongly Disagree
- 2. Disagree
- 3. Neither Agree nor Disagree
- 4. Agree
- 5. Strongly Agree

7. I believe that the Geo-minds information portal will contribute to an increase in earthquake awareness. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

8. I believe that the content in the database could be used as references in scientific article writing. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

9. I believe that real-life applied projects on this site could serve as guides for students. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

10. I believe that the real-life applied projects on this site could serve as guides for civil engineers. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

11. I believe that if relevant content is added to this site by experts in the field, it could evolve into a comprehensive educational portal. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

12. I believe that the lecture notes on this site could enhance the overall GPA and knowledge levels of engineering students in university. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

13. I believe that this site, as an alternative to lecture notes, could contribute to paper conservation. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

14. I believe that using the search engine within the site is sufficiently simple. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

15. I believe that the site's interface is sufficiently user-friendly. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

16. The Geo-Minds information portal can be a non-profit civil engineering initiative on a national and international scale. *

- ◯ 1. Strongly Disagree
- ◯ 2. Disagree
- ◯ 3. Neither Agree nor Disagree
- ◯ 4. Agree
- ◯ 5. Strongly Agree

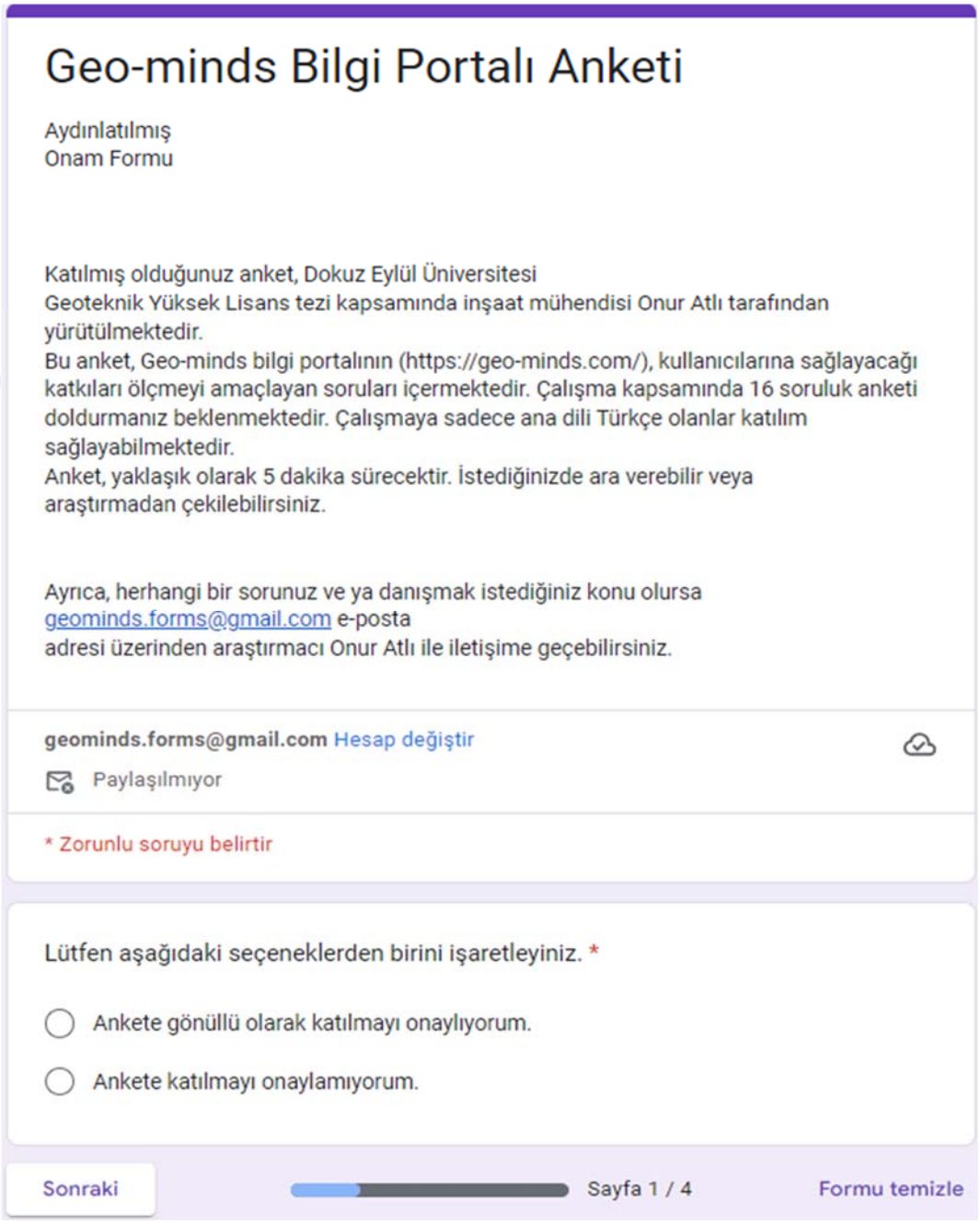
Debriefing

Don't forget to press the SEND option located at the bottom left to submit the form.

Thanks for participating in the survey about the Geo-minds information portal. With the data collected from participants, the aim is to improve the information portal. If you wish for any reason that your data not be used, please inform researcher Onur Atlı at geominds.forms@gmail.com.

If you have any questions about the study or if you'd like to be informed about the results, feel free to contact the researcher provided with the contact information above.

APPENDIX-7: Geo-minds Information Portal Survey Turkish Version



Geo-minds Bilgi Portalı Anketi

Aydınlatılmış
Onam Formu

Katılmış olduğunuz anket, Dokuz Eylül Üniversitesi
Geoteknik Yüksek Lisans tezi kapsamında inşaat mühendisi Onur Atlı tarafından yürütülmektedir.
Bu anket, Geo-minds bilgi portalının (https://geo-minds.com/), kullanıcılarına sağlayacağı katkıları ölçmeyi amaçlayan soruları içermektedir. Çalışma kapsamında 16 soruluk anketi doldurmanız beklenmektedir. Çalışmaya sadece ana dili Türkçe olanlar katılım sağlayabilmektedir.
Anket, yaklaşık olarak 5 dakika sürecektir. İstediğinizde ara verebilir veya araştırmadan çekilebilirsiniz.

Ayrıca, herhangi bir sorunuz ve ya danışmak istediğiniz konu olursa geominds.forms@gmail.com e-posta
adresi üzerinden araştırmacı Onur Atlı ile iletişime geçebilirsiniz.

geominds.forms@gmail.com Hesap değiştir

Paylaşılmıyor

* Zorunlu soruyu belirtir

Lütfen aşağıdaki seçeneklerden birini işaretleyiniz. *

- ◯ Ankete gönüllü olarak katılmayı onaylıyorum.
- ◯ Ankete katılmayı onaylamıyorum.

Sonraki Sayfa 1 / 4 Formu temizle

16 Soruluk Geo-minds Bilgi Portalı Anketi

Lütfen aşağıdaki maddeleri okuyup size en uygun gelen cevabı işaretleyiniz.

1. Geo-minds bilgi portalının, mühendislik öğrencilerine fayda getireceğini düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

2. Geo-minds bilgi portalının, piyasadaki aktif mühendislere fayda getireceğini düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

3. Geo-minds bilgi portalı, gelecekte bazı ders kitaplarına alternatif olabilir. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

4. Geo-minds bilgi portalının, eğitimcilerin işini kolaylaştıracağını düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

5. Geo-minds bilgi portalının, mühendislik öğrencilerine sınavlarında yardımcı olabileceğini düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

6. Geo-minds bilgi portalının, geoteknik alanında yüksek lisans eğitimi almamış kullanıcıların dahi kavrayabileceği sadelikte olduğunu düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

7. Geo-minds bilgi portalı sayesinde deprem farkındalığının artacağına inanıyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

8. Veri tabanındaki içeriklerin bilimsel makale yazımlarında kaynak olarak kullanılabileceğini düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

9. Bu sitedeki uygulanmış projelerin öğrencilere rehber olabileceğine inanıyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

10. Bu sitedeki uygulanmış projelerin inşaat mühendislerine rehber olabileceğine inanıyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

11. Bu siteye alanında uzman kişiler tarafından ilgili içerikler eklenmesi halinde kapsamlı bir eğitim portalına evrileceğine inanıyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

12. Bu sitedeki ders notlarının üniversitedeki mühendislik öğrencilerinin genel not ortalamasını ve bilgi seviyelerini yükseltebileceğine inanıyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

13. Bu sitenin, ders notlarına alternatif olduğu için, kağıt tasarrufu sağlayabileceğini düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

14. Site içinde arama motorunu kullanmanın yeterince basit olduğunu düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

15. Sitenin arayüz kullanımının yeterince basit olduğunu düşünüyorum. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

16. Geo-Minds bilgi portalı, ulusal ve uluslararası ölçekte kâr odaksız bir sivil mühendislik girişimi olabilir. *

- ◯ 1. Hiç katılmıyorum.
- ◯ 2. Çoğunlukla katılmıyorum.
- ◯ 3. Çoğunlukla katılıyorum.
- ◯ 4. Tamamen katılıyorum.
- ◯ Fikrim yok.

Bilgilendirme Metni

Formu göndermek için sol altta bulunan GÖNDER seçeneğine basmayı unutmayınız.
Geo-minds bilgi portalı anketine katıldığınız için teşekkürler. Katılımcılardan elde edilen verilerle bilgi portalının geliştirilmesini amaçlıyoruz.

Lütfen herhangi bir sebepten dolayı verilerinizin kullanılmamasını isterseniz geominds.forms@gmail.com e-posta adresi üzerinden araştırmacı Onur Atlı'yı bilgilendiriniz.
Eğer çalışmayla ilgili sorunuz olursa veya sonuçlar hakkında bilgilendirilmek isterseniz yukarıda iletişim bilgisi verilen araştırmacı ile iletişime geçmekten çekinmeyiniz.

Geri | Gönder | Sayfa 4 / 4 | Formu temizle