A design project on retaining wall design methods adopting comprehensive site investigation and laboratory testing

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ABSTRACT: This paper highlights the urgent need for effective geotechnical engineering education to equip students with practical skills for real-world challenges. It focuses on a comprehensive design project undertaken by students at a South African University of Technology. It involved a thorough geotechnical site investigation, laboratory testing, and the design of a cantilever retaining wall. Students engaged in soil sampling and various tests, including Atterberg limits, to assess soil properties and parameters essential for design. The project employed a multi-method approach, comparing manual calculations, Excel spreadsheets, and Geo5 software to enhance understanding and efficiency. Key findings indicate that integrating practical fieldwork with diverse design methodologies significantly enriches students' comprehension of soil mechanics and its applications in engineering. The study underscores the importance of familiarising students with traditional and modern design tools, preparing them for the evolving demands of the profession. This model can serve as a valuable framework for other institutions aiming to strengthen geotechnical engineering education, particularly in regions with limited access to advanced technologies.

Keywords: Retaining wall design, Practical skills, Real-world challenges, Multi-method approach

1 Introduction

The cornerstone of effective engineering education lies in equipping students with practical skills that bridge the gap between theoretical knowledge and real-world applications (Abdel Rahman, 2023). This is particularly vital in geotechnical engineering, where every structure interfaces directly with the ground, making soil behaviour a fundamental consideration. Engineering challenges are inherently complex, demanding hands-on problem-solving skills that extend beyond textbook principles. Real-world scenarios rarely align perfectly with textbook assumptions, necessitating adaptability and practical experience (Ferguson & Kwan, 2021a). Consequently, the engineering industry seeks graduates capable of effectively applying theoretical knowledge in field and laboratory settings. Unlike structural or mechanical components, soil is a naturally occurring material with high variability, requiring thorough investigation and testing. The engineering properties of soil, such as strength, compressibility, and permeability, dictate the stability of any structure. Subsurface conditions significantly affect design decisions; for instance, unsuitable soil conditions can lead to differential settlement or failure. Many geotechnical failures result from inadequate soil investigations or a misunderstanding of soil properties (Day, 2015). Incorporating practical projects, such as the one outlined in the Design Project, ensures students gain hands-on experience in geotechnical site investigations (assessing soil conditions, mapping groundwater levels), laboratory testing (Atterberg limits, shear strength, settlement characteristics), and structural design integration (ensuring proper foundation and retaining wall designs based on site conditions).

2 Literature review

Geotechnical engineering relies heavily on the investigation of the site and laboratory testing to gather essential data about soil conditions for informed foundation design and decision-making (Douglas Partners, 2024; OzGeos, 2024; Sinclair, 2024). Laboratory tests for determining Atterberg Limits provide crucial insights into soil behaviour. The Plastic Limit, a key component of Atterberg Limits, defines the moisture content at which soil transitions from plastic to brittle states, thereby classifying cohesive soils and predicting their behaviour under load (Das, 2010; Navaz et al., 2022; UTA, 2024). Furthermore, the Oedometer test measures soil settlement characteristics under load, which is particularly essential for clayey soils where long-term settlement is a significant concern (Ferguson & Kwan, 2021). The triaxial test assesses soil shear strength under varying confining pressures, yielding parameters like cohesion and friction angle that are pivotal for the stability analysis of foundations and retaining walls (Ferguson & Kwan, 2021b; Keller & Dexter, 2020).

Retaining wall design is a fundamental component of foundation engineering, making it a practical and multifaceted case study for geotechnical analysis. Retaining walls are structures designed to resist lateral earth pressures exerted by soil, particularly in scenarios involving slopes, excavations, or structural load support (Coduto, 2001; Budhu, 2015). The design of retaining walls integrates key foundation engineering principles, including stability analysis against overturning, sliding, and bearing capacity failure. Furthermore, retaining wall design often requires consideration of unsaturated soil mechanics, as the soil behind the wall is rarely fully saturated, and soil suction can significantly influence lateral earth pressures (potentially increasing or decreasing them depending on soil type and environmental conditions) (Smith & Jones, 2023; Toll, 2001). Stability calculations rely on soil properties obtained from laboratory and in-situ tests, ensuring that design parameters align with real-world geotechnical conditions, whether saturated or unsaturated. As foundation design considers vertical and lateral forces acting on a structure, retaining walls are ideal for students to understand load distribution, soil-structure interaction, and engineering safety factors (Bowles, 1996; Diwalkar, 2020; Shrawankar & Gangwal, 2024). By incorporating soil testing results, such as those from Atterberg Limits, Oedometer, and shear strength tests, retaining wall design exercises bridge theoretical knowledge with practical engineering applications

Utilising geotechnical software applications has become standard practice in engineering design, enabling more precise modelling of soil behaviour and structural interactions. Software applications such as GEO5, PLAXIS, Rocscience, and SLOPE/W offer advanced tools for stability analysis, finite element modelling, and predicting foundation settlement (Geo5, 2024; Rocscience, 2024). These programmes integrate geotechnical theories and empirical models to automate complex calculations, providing engineers with a dependable means of verifying manual design methods while optimising material usage and cost efficiency. Moreover, geotechnical software enhances students' learning by offering visualisation tools, sensitivity analysis, and real-time parametric adjustments, thus improving their ability to interpret and analyse soil-structure interactions (Moore, 2012).

GEO5 is a geotechnical software suite that facilitates designing and analysing various foundation and earth-retaining structures. The software employs principles from limit equilibrium methods and numerical modelling to evaluate stability concerns such as overturning, sliding, and bearing capacity failures (Geo5, 2024). GEO5 enables engineers to input soil parameters, structural loads, and geometric configurations, automatically generating factor of safety values for different failure modes. By streamlining the computational process, the software reduces human error and allows for the rapid evaluation of alternative designs. Additionally, GEO5 integrates industry-standard soil classification systems and laboratory test results, ensuring that geotechnical properties such as shear strength, plasticity, and compressibility are accurately incorporated into the design (Fellenius, 2008). The integration of GEO5 in this study exposed students to professional design methodologies, enabling them to compare hand calculations and spreadsheet models with industry-standard software outputs. This experience reinforced their understanding of geotechnical principles while demonstrating the benefits of computational tools in modern engineering practice.

By combining manual calculations, Excel spreadsheets, and software tools, students developed a well-rounded knowledge of soil behaviour and geotechnical design principles, preparing them for academic and professional applications. The cross-validation of different calculation methods ensured that students understood the governing equations and gained insight into the advantages and limitations of software applications in geotechnical engineering.

3 Methodology

3.1 Course context

This paper investigated the effectiveness of integrating a comprehensive geotechnical site investigation with practical retaining wall design to enhance geotechnical engineering education. This retaining wall design project was conducted as part of the *Geotechnical Engineering* course, which is a six-month module offered in the B.Eng.Tech.Hons programme at the Central University of Technology, Free State. The course builds on foundational knowledge from two preceding six-month courses, *Geotechnical Engineering 1* and *Geotechnical Engineering 2*, which are part of the B.Eng.Tech programme and presented in the second and third years, respectively. These earlier courses provide students with essential geotechnical principles and practical skills that prepare them for the honours-level project. The second and third-year courses typically have between 70 and 90 students enrolled, while the honours course is more specialised, with only 25 students registered in 2024. This smaller cohort size reflects the trend of many students entering the workforce after completing the B.Eng.Tech degree before pursuing honours studies. The project thus serves as an advanced, integrative learning experience designed to deepen students' practical and theoretical understanding of geotechnical design methods in a real-world context.

The methodology centred on a design project where students conducted a detailed site investigation to inform the design of a 3.5-metre-high retaining wall for a road shoulder. The initial phase involved a desktop study for thorough site characterisation, including geographic location, dimensions, current land use, notable features (topography, vegetation, existing structures), and a review of the site's history regarding previous ownership, land use changes, and potential environmental concerns. Students then conducted a field investigation, employing methods such as soil sampling, boring, and in-situ testing to observe soil types and conditions, groundwater levels, and signs of instability, all documented with photographs and diagrams. Soil samples underwent laboratory testing to determine classification properties (grain size distribution, Atterberg limits), shear strength parameters, and compaction characteristics. These results informed the selection of a cantilever retaining wall for its material efficiency, constructed using 30/19 grade concrete and Grade 450 high-tensile steel reinforcement. The design process adhered to South African standards, specifically SANS 10160 for structural loading, including earth pressures and traffic surcharges, and SANS 207 for geotechnical design. Students applied these standards to the design, calculating wall thickness, foundation dimensions, and reinforcement requirements while considering sliding, overturning, and bearing capacity stability factors. The project emphasised the integration of hand calculations and organised Excel spreadsheets to enable precise calculation formulas, generate comprehensive bending schedules, and ensure a professional presentation of results. To validate the accuracy and reliability of these calculations, the results were compared with outputs from the GEO5 software application. This comparative approach allowed for cross-verification of manual and automated computations, enhancing confidence in the design process. By incorporating GEO5, the study ensured consistency with industry-standard geotechnical modelling while using hand calculations and spreadsheets to foster a practical understanding of fundamental geotechnical principles and their application in real-world engineering design.

3.2 Instructor Guidance and Support During the Project

Students are encouraged to proactively manage their progress throughout the semester. When groups fall behind schedule or encounter difficulties in calculating or obtaining soil properties and design parameters, they are permitted to schedule additional practical laboratory sessions with the technical assistant responsible for the module. Furthermore, students may arrange follow-up site visits to clarify field conditions or collect supplementary data. Throughout the semester, instructors monitor students' progress and provide formative guidance during tutorials and consultations. This guidance focuses on keeping students "on track" by identifying conceptual or procedural misunderstandings without directly providing solutions or correct answers. This approach encourages independent problem-solving while ensuring that students do not deviate significantly from the project timeline or objectives.

4 Results and discussion

4.1 Site investigation

The geotechnical site investigation was conducted along the R70 roadway near Welkom, Free State, South Africa, to assess subsurface conditions and soil properties influencing road stability. The site, located at coordinates 27°54'37.6"S, 26°44'52.3"E, is a key transport route connecting Hennenman and Welkom, traversing a relatively flat landscape characterised by sparse vegetation and dry grassland. The local climate is semi-arid, with hot summers and dry, cold winters, contributing to seasonal variations in soil moisture content. The investigation occurred during the winter, when minimal rainfall and dry conditions prevailed, which may have affected soil moisture readings.

The R70 roadway is a well-used regional connector, subject to moderate traffic volumes primarily consisting of passenger vehicles and light commercial transport, with occasional heavy trucks. The absence of extensive industrial activities in the vicinity suggests that traffic loads are not excessive, though cumulative effects from long-term vehicular loads may contribute to road surface deterioration. The surrounding area is undeveloped, with adjacent land used for small-scale agriculture and grazing. Nearby landmarks include Benedicto Farms, Bandu Game Lodge, and the residential suburb of Riebeeckstad, indicating a transition from rural to peri-urban land use.

Historically, the site was largely vacant before road construction, with minimal human impact besides light agricultural activities. No significant preexisting structures or industrial developments existed, and the land remained largely undisturbed before road development. Therefore, the soil and subsurface conditions were expected to be in a relatively natural state, unaffected by prior extensive earthworks or infrastructure. However, undulations on the road surface suggested possible underlying soil movement or compaction issues, prompting the need for investigation. The field investigation involved the excavation of two test pits to evaluate the stratification and composition of subsurface layers (Figure 1).

Figure 1. Excavation of testpit 1 (left) and testpit 2 (right)

A Tractor-Loader-Backhoe (TLB) was used to remove the asphalt layer and expose the underlying materials. Test Pit 1 was successfully excavated, revealing a sequence of soil layers, including an asphalt surface, a compacted G5 and G7 material base, an intermediate silty clay layer, and a deeper high-plasticity clay deposit. Test Pit 2 encountered excavation difficulties due to large aggregate stones ranging from 120 mm to 240 mm, which prevented full penetration. This difference in subsurface conditions suggests that the left and right lanes of the roadway may have been constructed with varying material specifications or at different times. No groundwater was observed in either test pit, consistent with the dry climatic conditions and the absence of surface water bodies near the site. The lack of significant moisture variation in the upper soil layers supports the assumption that the site experiences limited subsurface water movement. The roadway showed no signs of surface erosion, though minor undulations and irregularities on the pavement surface indicated possible settlement or subgrade instability.

4.2 Laboratory results

The laboratory testing for the geotechnical investigation focused on sieve analysis (Figure 2), Atterberg limits, soil classification, oedometer settlement, and shear strength parameters to assess the site's suitability for construction. The Atterberg limits indicated low plasticity, with the liquid limit (LL) and plasticity index (PI) values suggesting minimal volume change due to moisture fluctuations. The soil classification results identified the predominant material as silty sand (SM) with an internal friction angle of approximately 28°, classifying it as a low-plasticity, well-draining soil. The oedometer tests revealed that the reworked residual mudrock exhibited a settlement range between 19 mm and 27 mm under a 50 kPa foundation pressure and 29 mm to 41 mm under a 100 kPa load, indicating moderate compressibility. The collapse settlement analysis showed a slight reduction in void ratio and sample height upon saturation, suggesting a mildly collapsible soil structure. The overall findings confirm that while the soil possesses adequate shear strength for foundation support, its compressibility and potential for collapse necessitate site-specific engineering interventions, including proper compaction, moisture control, and reinforced foundations to mitigate settlement risks.

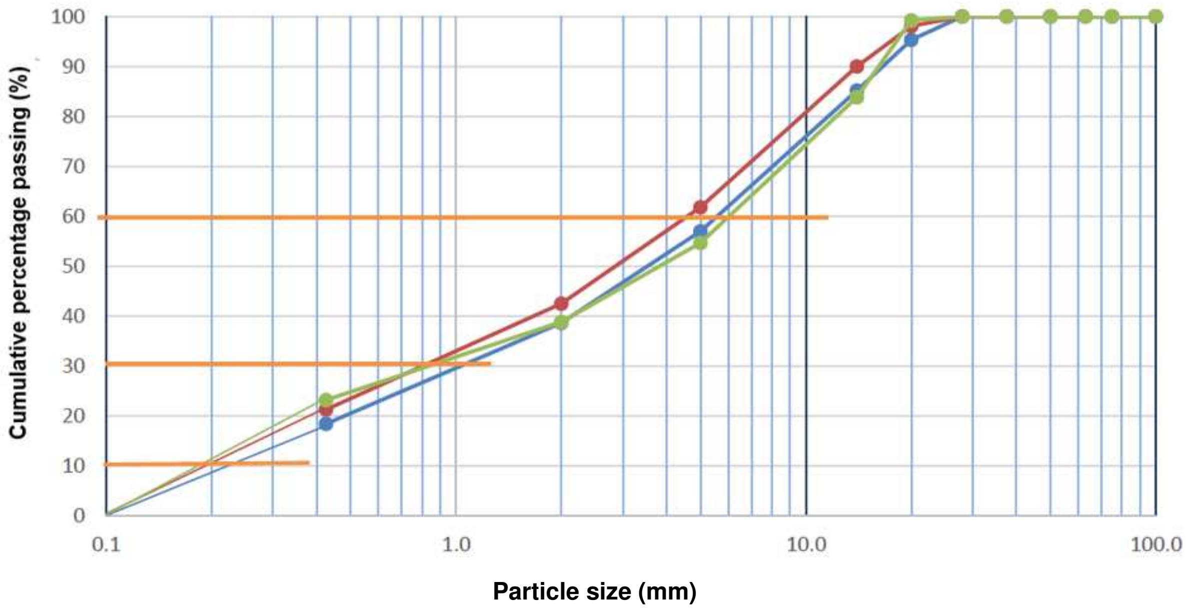

Figure 2. Particle size distribution: testpit 1

Figure 2 presents the particle size distribution (PSD) curves for the three distinct soil horizons encountered in Testpit 1. Each curve shows the cumulative percentage by weight of soil particles finer than a given particle size, plotted on a logarithmic scale from the largest particles on the left to the finest on the right. The three curves correspond to the different soil layers or horizons identified during the site investigation, illustrating the gradation characteristics unique to each horizon. For each curve, key particle size values- D10, D30, and D60- are indicated. These represent the particle diameters at which 10%, 30%, and 60% of the soil sample's particles are finer by weight, respectively.

4.3 Retaining wall design

4.3.1 Excel spreadsheets

Excel spreadsheets were used to design a retaining wall (Figure 3) by systematically organising design parameters, applying fundamental geotechnical equations, and automating iterative calculations for stability checks. The spreadsheet was structured to input soil properties, wall dimensions, surcharge loads, and groundwater conditions, ensuring flexibility for various design scenarios. Formulas were embedded to calculate the overturning moment by summing the moments of active and passive earth pressures about the wall's toe, allowing for direct computation of the safety factor against overturning. Sliding resistance was assessed by comparing the resisting frictional and passive forces at the wall base to the driving lateral forces, ensuring a sufficient safety factor against sliding failure. The bearing capacity was evaluated by applying both Terzaghi and Meyerhof's bearing capacity equations, integrating soil strength parameters and load distribution to determine the safety factor against foundation failure.

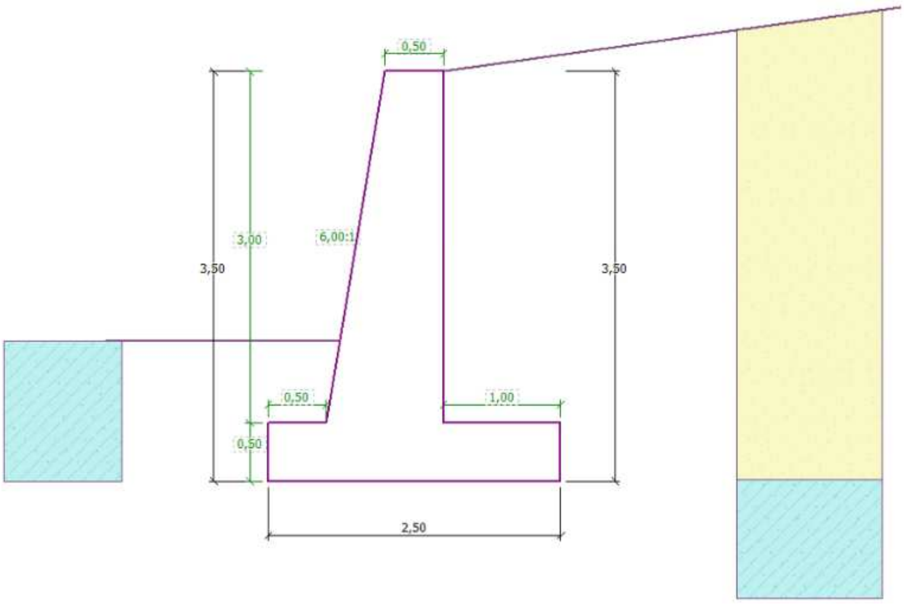

Figure 3. Geometry of retaining wall

4.3.2 GEO5 software

GEO5 software was utilised to design the retaining wall by performing advanced stability analyses, which included overturning, sliding, and bearing capacity assessments based on established geotechnical design methodologies. The software facilitated precise input of soil properties, wall geometry, surcharge loads, and groundwater conditions, automatically generating earth pressure distributions using Rankine theory. GEO5 calculated the moments of driving and resisting forces around the wall's toe for overturning stability and determined the safety factor against toppling failure. The sliding analysis evaluated the horizontal equilibrium between active forces exerted by the retained soil and the resisting forces at the base, considering interface friction and passive resistance. The bearing capacity check employed Terzaghi and Meyerhof's equations to assess foundation stability, ensuring that the applied loads remained within safe limits to prevent excessive settlement or bearing failure. By integrating these calculations into a unified analysis, GEO5 streamlined the design process, provided both graphical and numerical results, and facilitated quick adjustments to optimise wall dimensions and reinforcement. The results were cross-checked with hand calculations and Excel spreadsheets to ensure accuracy and alignment with industry standards.

4.3.3 Comparison

The comparison of the results obtained from the Excel spreadsheet and the GEO5 software package demonstrated a high degree of consistency, with discrepancies limited to decimal variations (Figures 4 & 5). This close alignment validates the accuracy of both approaches, confirming that the manual calculations, structured in Excel, correctly apply fundamental geotechnical principles and stability equations. The minor variations observed are attributed to rounding differences and the inherent numerical precision of GEO5's computational algorithms. The agreement between the two methods reinforces confidence in the reliability of the design calculations, demonstrating that the spreadsheet provides a transparent and adaptable means for preliminary design. At the same time, GEO5 offers an efficient and industry-standard verification tool. This validation process highlights the robustness of the design methodology and ensures that the retaining wall meets safety and performance requirements under different loading conditions.

Factor of safety against overturning

Section no.	Area (m²)	Weight/ unit length (kN/m)	Moment arm from A (m)	Moment (kN.m/m)
1	1.500	36.000	1.250	45.000
2	0.750	18.000	0.834	15.003
3	1.250	30.000	1.250	37.500
4	3.000	54.000	2.000	108.000
5	0.070	1.265	2.167	2.741
Pv		5.893	2.500	14.732
	ΣV =	145.158	ΣMR=	222.975
Mo =	Ph	x	H / 3	
Mo =	41.928	x	1.213514	
Mo =	50.881	kN.m/m		
FS overturning =		ΣMR	/	Mo
FS overturning =		222.975	/	50.881
FS overturning =		**4.382**	**>**	**2**
			OK!	

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 223,85 kNm/m
Overturning moment M_{ovr} = 53,99 kNm/m

Safety factor = 4,15 > 2,00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 89,04 kN/m
Active horizontal force H_{act} = 44,43 kN/m

Safety factor = 2,00 > 1,50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Factor of safety against sliding

FS sliding = Resisting HF / Active HF

FS sliding = (ΣV)tanφp + B'.Cp / Pa cos α

Kp = (1+sinϕ) / (1-sinϕ)
Kp = 2.770

Pp = 1/2.Kp.γp.D² + 2.C'p.SQRT(Kp).D
Pp= 59.857 kN/m

FS sliding = (ΣV)tanφp + B'.Cp / Pa cos α

FS sliding = 77.182 11.856 0.000 / 41.928

FS sliding = 2.12 > 1.5
OK !

Figure 4. Comparative values between Excel spreadsheet (left & right) and GEO5 software (middle)

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	12,03	145,51	44,43	0,033	62,33

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	12,03	145,51	44,43

Verification of foundation soil
Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0,033
Maximum allowable eccentricity e_{alw} = 0,333
Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 62,33 kPa
Bearing capacity of foundation soil R_d = 446,74 kPa
Safety factor = 7,17 > 3,00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Bearing Capacity:
qu = C'p.Nc.Fcd.Fci + q.Nq.Fqd.Fqi + 1/2.γp.B'.Nγ.Fγd.Fγi

C'.Nc.Fcd.Fci =	5	25.8	1.163	0.674
C'.Nc.Fcd.Fci =	**101.079**			
q.Nq.Fqd.Fqi =	24	14.72	1.151	0.674
q.Nq.Fqd.Fqi =	**274.187**			
1/2.γ.B'.Nγ.Fγd.Fγi =	0.5	20	2.371	16.7
1/2.γ.B'.Nγ.Fγd.Fγi =	**71.4747**			
qu =	**446.740388**	**kN/m²**		
FS bearing capacity =	**qu**	**/**	**Pmax**	
FS bearing capacity =	**446.740**	**/**	**61.218**	
FS bearing capacity =	**7.297**	**>**	**3**	
		OK!		

Figure 5. Comparative values between Excel spreadsheet (top) and GEO5 software (bottom)

4.4 Sustaining Practical Learning through Industry Collaboration

Access to active construction sites for in-situ testing and soil sampling is indeed invaluable for geotechnical engineering education. Recognising the challenges in consistently securing such access annually, the Civil Engineering Department at the Central University of Technology maintains ongoing collaborative projects with industry partners. These projects are real-world engineering challenges with a strong research component, often focusing on aspects that industry partners lack the time or funding to address themselves. Postgraduate students are actively involved in these projects, gaining hands-on experience in field investigations and laboratory testing within authentic industrial contexts. This model not only ensures sustained practical exposure despite potential limitations in site availability but also fosters mutually beneficial relationships between academia and industry. For readers aiming to implement similar programmes, establishing formal partnerships with local engineering firms, contractors, or government agencies can provide continuous access to live projects. Additionally, integrating research-focused elements into these collaborations can attract industry interest by addressing their knowledge gaps, thereby securing long-term engagement and enriching student learning

5 Student Feedback and Comparative Reflection

Formal student evaluations conducted at the end of the module provide evidence of the exercise's positive impact on the students. These evaluations are collected via an anonymous university-wide online survey, where students assess various aspects of their courses, including the lecturer’s effectiveness, the module content, and its practical value. Feedback from the 2024 cohort indicated a positive reception to the retaining wall design project, with students highlighting its practical relevance and the integration of fieldwork, laboratory testing, and computational analysis as particularly valuable for their learning experience. Comparatively, in years prior to the inclusion of this comprehensive design project, student feedback reflected a desire for more hands-on and integrative practical exercises within the geotechnical engineering curriculum. The introduction of this project has thus enhanced student engagement and understanding, as evidenced by improved evaluation scores related to the module’s applicability and the development of practical skills. This aligns with educational research emphasising the importance of active, problem-based learning in engineering education to improve comprehension and motivation

6 Conclusions

In conclusion, the exercise offered students a comprehensive, hands-on approach to geotechnical design, integrating field investigations, laboratory testing, and computational analysis. The site investigation provided practical experience in soil profiling, sample collection, and in-situ testing, enhancing their understanding of subsurface conditions and retaining wall design. Laboratory tests determined key parameters like soil classification, Atterberg limits, shear strength, and bearing capacity, emphasising their role in structural stability. Students worked in groups of five but were assessed individually through rubrics and detailed reports. They faced challenges due to the project's intensity alongside other coursework within 15 weeks, highlighting the need for careful scheduling to avoid overwhelm. Using Excel and GEO5 software, they developed skills in geotechnical calculations, assessing overturning, sliding, and bearing capacity factors. The spreadsheet approach clarified fundamental equations, while GEO5 introduced industry-standard automated computations. Comparison of both methods showed high consistency, validating their accuracy and the importance of cross-verification. Overall, the assignment enhanced their technical skills, confidence in software and manual calculations, and ability to integrate methodologies and communicate findings, preparing them well for professional geotechnical engineering roles.

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Authors' bios

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Elizabeth Theron has over 35 years of academic experience, strongly focusing on geotechnical engineering. She has developed innovative teaching materials and methodologies, significantly enhancing student learning experiences. Her research, particularly on foundation problems related to heaving clays, has earned her multiple awards, including the J.E. Jennings Award from the South African Institution of Civil Engineering for three consecutive years (2017-2019). In addition to her academic rols, she actively participates in community projects, such as the Pothole Eradication Programme, demonstrating her commitment to applying engineering solutions to real-world challenges. She maintains high professional standards as a registered Professional Engineering Technologist with the Engineering Council of South Africa.

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Jonathan Steenkamp is a technical lecturer at the Central University of Technology, South Africa. He holds a National Diploma, Advanced Diploma, and a Bachelor of Engineering Technology Honours degree in Civil Engineering from the same institution. Currently, he is pursuing a Master of Engineering degree with a research focus on the rehabilitation of gravel roads using nanotechnology. He has 14 years of industry experience in construction management and five years in academia. He specialises in teaching geotechnical engineering. In addition to his academic role, he serves as the project coordinator for the Pothole Eradication Project, an initiative dedicated to community upliftment and the skills development of unemployed youth in the Free State region. He is also a member of the South African Institute of Civil Engineering and is registered as a Candidate Technologist with the Engineering Council of South Africa.

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Samuel Waters is a lecturer in Geomatics and Engineering Surveying at the Central University of Technology, Bloemfontein, with seven years of academic experience. He also teaches the final-year Project subject, integrating practical applications with theoretical knowledge. His research focuses on database design, problematic soil identification, road inspection, and Geographic Information Systems (GIS). He has contributed to the field through publications and conference presentations, with his work recognised by the National Research Foundation of South Africa, which awarded him a Thuthuka Research Grant for 2025. Samuel is committed to advancing geospatial and geotechnical methodologies, particularly in South Africa's diverse soil and infrastructure environments.

Paul Vosloo, University of Technology, Free State (South Africa)

Paul Vosloo is a lecturer at the Central University of Technology in Bloemfontein, South Africa, specialising in structural design and geotechnical engineering. With a decade of industry experience in civil and structural engineering, he brings practical insights to his academic role. His research focuses on soil variability, suction, shear strength, and soil-water characteristic curves, which are crucial for understanding unsaturated soil behaviour. Paul has contributed to the field through publications and presentations, and his work has been recognised by the National Research Foundation of South Africa, which awarded him a Thuthuka Research Grant for 2025. He is committed to advancing geotechnical engineering through teaching and research to bridge the gap between theoretical concepts and practical applications.