MANAGING SOIL AND GEOTECHNICAL ASPECTS IN HOUSING DEVELOPMENTS: ANALYSIS OF CASE STUDIES

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The persistent occurrence of soil problems in the Malaysian housing industry remains a pressing concern despite significant industry growth. This study aims to comprehensively understand the issues of soil problems in housing projects, identifying potential causes and legal implications. Employing qualitative case studies and legal research methods, the research explores three housing project failures. Three distinct cases were selected involving different housing types, locations and stages, providing a comprehensive exploration of legal issues in different Malaysian construction scenarios. The findings reveal legal issues during, pre and post construction stages, as such failures in soil condition advisement, ineffective repairs work, lax supervision and inadequate enforcement. While existing research explores legislation gaps in protecting house buyers and the inadequacies of environmental assessments, there is a notable absence of focused inquiry into the legal dimensions surrounding soil-related issues in housing development. Bridging this gap establishes the causes, providing insights for future guidelines and assisting authorities in formulating policies to prevent the recurrence of soil problems, ultimately contributing to successful project completion to address soil and geotechnical challenges.

Keywords: negligence; housing development; slope failure; landslide

INTRODUCTION

Malaysia's rapid economic growth since the early 1990s has driven extensive housing development, including on challenging terrains such as hillslopes. The Malaysian property market's construction plan encompasses a targeted total of 429,985 residential units and 168,028 serviced apartment units (JPPH, 2021). This surge in demand for land has led to a scarcity of suitable locations for housing projects, pushing development towards less ideal areas. Consequently, there are heightened concerns about the safety of houses built on hillslopes due to incidents of landslides, soil erosion, and soil movement (Rashid *et al.,* 2015; Rahman and Mapjabil, 2017). Slope failures and landslide geohazards are frequently associated with hillside development (Anuar, Hamzah, and Asyraf, 2019).

Although hills and mountains cover less than 25% of Malaysia's terrain, slope failures and landslides are common phenomena, often triggered by heavy rainfall impacting

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soil stability (Rahman and Mapjabil, 2017). Beyond natural causes, human factors such as inadequate slope design, construction failures, and insufficient supervision also contribute to these issues (Rahman and Mapjabil, 2017). From 1973 to 2011, Malaysia experienced numerous significant landslides, resulting in over 600 deaths. The lack of a comprehensive database on slopes and landslides complicates effective land use planning, maintenance, and risk assessment (Abdullah, 2013). Ground settlement accounts for approximately 72% of the 252 forensic cases of building failures, with the remaining 28% due to factors like vibration, erosion, and foundation failures (JKR, 2015). These slope failures are influenced by changes in slope angle, weathering, heavy rainfall, and soil overload (Abidin *et al.,* 2020).

The increasing trend of developing housing projects on challenging land types like soft soil, abandoned mining land, and hillslopes due to land scarcity exacerbates these problems (Alias, Ali, and Othman, 2014a). Design and construction flaws, such as inadequate concrete resistance and insufficient shear reinforcement, further contribute to the damage of reinforced concrete structures (Khoiry *et al.,* 2018). Earthquakes can exacerbate soil instability, leading to liquefaction and structural collapse, particularly in buildings lacking adequate reinforcement (Tokimatsu *et al.,* 2012).

Legal cases underscore the complexity of addressing soil-related issues. For instance, in GJH Properties Sdn Bhd v Tribunal Tuntutan Pembeli Rumah, Kementerian Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan and Anor (2021) MLJU 1853, the court ruled that the Housing Development Tribunal exceeded its authority by adjudicating a claim based on negligence not covered in the purchase agreement, highlighting the legal intricacies surrounding soil settlement problems and developer negligence. Moreover, the liability of local authorities, such as MPAJ, is a contentious issue. Section **95(**2) of the Street, Drainage and Building Act 1974 provides local authorities immunity from pre-collapse negligence, but debates persist about whether this extends to post-collapse negligence. In Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006) 2 CLJ 1, the Federal Court upheld complete immunity for local authorities, citing public policy, while a minority view argues against this, particularly for post-collapse negligence.

The challenge of managing soil-related issues in Malaysia's housing sector is exacerbated by inadequate land use planning, maintenance, and regulations. Developers are increasingly utilising marginal lands with significant soil stability problems due to land scarcity, posing risks of structural failures and financial losses for stakeholders. This study focuses on soil-related problems like landslides, soil erosion, and soil settlement in Malaysian housing developments. By examining case studies and legal frameworks. This study seeks to identify the causes of these soil-related problems through detailed case study analyses. In conclusion, the study seeks to contribute valuable insights and propose solutions to mitigate risks, thereby supporting the development of resilient and sustainable housing projects in Malaysia.

LITERATURE REVIEW

Definition of Soil Problems

Soil problems, such as expansive and collapsing soils, create significant challenges for foundation building and structural stability. Detecting these issues is essential for developers and geotechnical engineers to ensure safety (Ali, 2011). Soil degradation affects agriculture, forestry, recreation, and wildlife habitats, requiring comprehensive

management strategies, including land use planning and zoning regulations (Batey, 2009; Boer, 2017).

Legally, the absence of clear landslide definitions in Malaysian cases necessitates using precise scientific definitions. Definitions from geological and engineering sources are crucial for legal proceedings and insurance claims. For example, Justice Veales' definition in Oddy v Phoenix Assurance Co. Ltd. (1966) Is limited, excluding gradual landslides (Griffiths, 1999). The broader definition in New Zealand's 1989 Disaster Insurance Bill includes various ground movements (Griffiths, 1998).

The Malaysian National Land Code Act 828 broadly defines "land," covering the earth's surface and subsurface, vegetation, and structures. Scientifically, "soil" involves particles and organisms crucial for ecosystem services, bridging legal and scientific perspectives for better management of soil-related issues.

Geotechnical Challenges in Construction Projects

Soil-related problems in Malaysia's housing sector refer to a variety of issues stemming from soil instability, erosion, and settlement, which pose significant risks to infrastructure and public safety. These problems include landslides, slope failures, soil erosion, and ground settlement, often exacerbated by factors such as heavy rainfall, inadequate construction practices, and geological conditions (Rahman and Mapjabil, 2017; Abdullah, 2013). One significant aspect of soil-related issues in Malaysia's housing sector is the legal protection afforded to local and state authorities. Teng (2018) Highlights the immunity granted to local governments under Section 95 of Act 133 SDBA 1971, which shields them from liability in cases of building failures or injuries. However, this exemption raises concerns about public safety, as it may lead to oversight during project approval, potentially resulting in building disasters. The case of Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006) 2 CLJ 1 serves as a pertinent example, illustrating debates over local authority liability and the need for proper regulations and procedures to prevent such incidents.

The effectiveness of Environmental Impact Assessments (EIA) In addressing soil-related issues has also been a subject of scrutiny. The shortcomings in the EIA process have been observed, with some projects neglecting safety measures during construction, leading to disasters like landslides and flash floods (Shith *et al.,* 2021). The need to re-evaluate EIA effectiveness and enhance its ability to prevent such disasters during project planning and development is underscored. Concerns regarding legal protections for homeowners facing soil problems after the defect liability period (DLP) Have also been raised. Zolkafli *et al. (*2014) Indicate a lack of dedicated legislation governing the rights of house buyers, relying on common law instead. While common law grants house buyers tortious rights to pursue claims against potential wrongdoers, challenges in recovering economic losses, such as rectification costs, persist. Recent amendments to the Limitation Act 1953, establishing time limits for negligence claims against developers, aim to provide a defined temporal framework for legal actions, contributing to legal predictability and efficient dispute resolution (Zolkafli *et al.,* 2014). Rahman and Mapjabil (2017) And Shith *et al. (*2021) Assert the significance of geological conditions and design failures in contributing to landslide risks and safety concerns, particularly in hilly urban areas. These factors can pose significant challenges to construction projects and necessitate careful planning and engineering solutions to mitigate risks. Borrelli *et al. (*2017) And Lal (2004) Highlight the impact of climate change on soil erosion, which poses

threats to food security and socio-economic stability. Proactive measures are necessary to mitigate these environmental impacts, including sustainable land management practices and adaptation strategies in urban planning and development. Liao *et al. (*2023) And Turgay *et al. (*2016) Discuss negligence cases involving construction professionals and the importance of adhering to legal principles, such as nulla poena sine lege. Ensuring fair treatment and legal clarity in the face of environmental challenges and unplanned urbanisation is essential for maintaining public trust and accountability in the construction industry.

Need for this Study

The need for this study arises from the significant and ongoing challenges associated with soil-related problems in Malaysia's housing sector. Despite existing regulations and practices, persistent issues such as soil instability, erosion, and settlement continue to pose severe risks to infrastructure and public safety. Key reasons for conducting this study include:

- To effectively address soil-related problems, it is essential to understand the underlying causes, including geological, environmental, and construction-related factors. This study aims to uncover these causes through detailed case analyses.
- The study seeks to assess the adequacy of current legal protections and regulatory mechanisms, particularly the immunity provisions for local authorities under Section 95 of the SDBA 1971, and their impact on public safety and infrastructure stability.
- The study addresses the legal challenges faced by homeowners in pursuing claims for soil-related damages, highlighting the need for clearer legal frameworks and better enforcement of existing laws to protect consumers.

Addressing these research needs can help scholars and policymakers develop strategies to mitigate soil-related risks and improve housing safety in Malaysia. A multiple case study approach was conducted to address the identified gaps and research objectives.

Research Questions

a) How do soil problems impact legal aspect within housing projects, including issues such as property rights, regulatory compliance, and potential liabilities?

b) What are the approaches used in resolving the issues of soil problems in the housing projects in Malaysia?

c) How to improve the existing laws or guidelines related to soil and geotechnical aspects in housing developments.

METHOD

This research uses a mixed-method qualitative approach, starting with literature reviews and theoretical frameworks then delves into social phenomena through interviews, observations, and content analysis. Data collection includes interviews, document analysis, and focus groups with experts and affected residents, focusing on failed housing projects in Selangor and Penang.

The study uses qualitative data analysis methods, such as open coding and thematic analysis, to examine legal issues in soil problems within housing development (Creswell, 2014). Independent primary sources ensure reliability, supported by legal provisions, case law, and relevant literature. Case studies provide detailed exploration

of specific instances, allowing for a nuanced understanding of soil-related problems in housing development. They enable triangulation of data from multiple sources, enhancing the validity and reliability of findings (Yin, 2014; Gunasekara *et al.,* 2019).

The analysis involves two stages: generic qualitative data analysis and thematic analysis of interrelated themes from interviews and documents (Creswell, 2014). Meticulous documentation, cross-referencing, and integration ensure data consistency across sources, with field notes providing comprehensive insights into legal issues in the examined cases.

Gunasekara *et al. (*2019) Utilised a qualitative research approach, like methodologies recommended by Yin (2014), focusing on construction projects through semi-structured interviews and document reviews to ensure data quality and reliability. This study adopts similar methods to analyze soil management complexities and legal issues in construction projects, enhancing the understanding of these challenges in the Malaysian context.

FINDINGS AND DISCUSSION

Two Case Studies

The research examined literature to uncover causes and legal issues affecting housing projects, using a multiple case study approach inspired by Yin (2014). Stage Two analyzed primary data from Selangor case studies, utilising documents from local council, crucial for understanding development approvals. Cross-validation with interview findings ensured data accuracy. Field notes were employed for Case Studies 1 and 2, capturing crucial details and contextual insights. Overall, meticulous documentation, regular reviews, and data integration ensured validity and reliability.

Table 1: Respondent background

Panellists	Years of Experience	Company/Discipline	Job Position	Location
P1	31	Architecture	Director	Northern
P2	30	Architecture	Director	Northern
P3	30	Civil Engineering	Director	Northern
P4	20	Civil Engineering and Academician	Director	Northern
P5	15	Local authority; Building Control Division	Director	Southern
P6	20	Local authority; Engineering Control Division	Director	Southern
P7	30	Local authority; Planning Division	Director	Southern
P8	10	Local authority; Geotechnical Engineering Division	Director	Northern
P9	18	Solicitor Advocates	Lawyer Principal	Southern
P10	20	Engineering Company	Geotechnical Engineer and Manager	Southern

Case 1

Case 1 reveals significant legal issues pertaining to soil problems in housing projects in Malaysia, particularly during the pre-construction and construction stages. During

the pre-construction stage, local authorities often overlook crucial soil characteristics, focusing instead on land ownership and technical considerations. This oversight can lead to inadequate risk assessment and planning, as evidenced by cases like Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006), where the absence of a master drainage plan contributed to building instability.

Similarly, during the construction stage, issues arise due to the lack of enforcement on developers to ensure proper soil settlement. Small-scale housing projects frequently skip required soil tests, resulting in improper soil compaction and quick construction without adequate consideration for soil conditions. This negligence can have severe consequences, as seen in cases like GJH Properties Sdn Bhd v. Tribunal Tuntutan Pembeli Rumah (2021), where poor soil compaction led to significant damage to a semi-detached house, resulting in financial claims.

These findings underscore the importance of comprehensive soil testing, regulatory enforcement, and adherence to soil testing protocols in housing projects. Regulatory shortcomings, such as the lack of mandates for soil or geotechnical reports, exacerbate these risks, highlighting the need for stricter regulations and oversight to ensure the safety and stability of housing developments. The data collection method below includes document analysis, interview and observation.

Table 2: Case 1 - The legal issues surrounding soil problems in housing projects in Malaysia

Causes and Legal issues	Literature	Case study One
1. Failure to advise on the physical soil condition	Similar to Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006), where MPAJ neglected its duty to provide a comprehensive master drainage plan, contravening sections 53 and 54 of the SDBA.	The local authority overlooked the cultivation/organic status of the land when granting planning permission. Only land ownership and an underground Petronas gas pipe were considered. Residents reported sinking blocks, with Block 5 sinking about 5 feet. Observations revealed extensive structural damage and flooding in the basement.
2. No enforcement on the developer to allow for the soil to settle and construction completed too quick	In GJH Properties Sdn Bhd v Tribunal Tuntutan Pembeli Rumah (2021), the second respondent filed a complaint about soil settlement issues. The double-storey semi-detached house was built on improperly compacted earth, causing damage attributed to the appellant's negligence.	The size of the development is 10.7 acres. According to P1 some housing projects go straight to soil compaction without local authority oversight. The issue arose when the developer improperly compacted the soil and quickly built houses without allowing the soil to settle.

Case 2

The findings from Case 2 reveal legal issues pertaining to soil problems in housing projects in Malaysia encompassing pre-construction, construction, and post-construction stages. In the pre-construction stage, insufficient consideration of problematic soils and failure to provide adequate advice underscore the critical need for thorough soil assessment and proper guidance. The prevalence of problematic soils in areas like Klang Valley and mining lands necessitates detailed planning and proactive measures to prevent structural failures, as highlighted in the case of Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006) 2 CLJ 1.

During the construction stage, the lack of enforcement on soil compaction supervision emerges as a significant issue. The exemption provided by Section **95(**2) Of the SDBA to local authorities, coupled with inadequate supervision, has led to

construction flaws and subsequent legal disputes, exemplified by GJH Properties Sdn Bhd v Tribunal Tuntutan Pembeli Rumah (2021) MLJU 1853. This case underscores the necessity for stricter enforcement and oversight during construction to ensure the integrity of housing projects.

Post-construction challenges, particularly related to the Limitation Act 1953, highlight the inadequacies in repair work and the limitations imposed on residents' claims. Despite extending the defect liability period, developers often provide insufficient repairs, leaving residents to deal with unresolved structural issues. The amended sections 6A(1) And 6A(2) Of the Limitation Act provide a 15-year window for claims, emphasising the need for developers to address defects promptly and comprehensively.

Inefficient repair methods complicate the situation, highlighting the need for innovative solutions. Effective collaboration and research are essential to develop sustainable repair strategies. The findings emphasize the need for better regulatory frameworks, enforcement, and innovative repair methods for soil-related issues in Malaysia's housing sector. The data collection method below includes document analysis, interview and observation.

Table 3: Case 2 - The legal issues surrounding soil problems in housing projects in Malaysia

Causes and Legal Issues	Literature	Case Study Two
1. Less consideration on problematic soils-sensitive land	In Majlis Perbandaran Ampang Jaya v. Steven Phoa Cheng Loon and Ors (2006), the Federal Court ruled MPAJ failed to advise the developer on a mandated master drainage plan, compromising Blocks 2 and 3.	Local authorities should advise developers on problematic land during planning approval. Failure to do so can result in insufficient soil information, leading to house cracks. According to P5, sensitive lands prone to issues include areas near the sea, paddy lands, and mining sites.
2. Developer offer insufficient repair work of period under Limitation Act	Under the Limitation Act 1953, residents can file claims for property damage until July 2025, starting from when they received their keys in July 2010.	Developers extended defect liability periods and offered repair guarantees, but residents found repair work inadequate. Amendments to the Limitation Act allow claims for damages until July 2025, extending beyond initial expectations.
3. No enforcement on the supervision of soil compaction	In GJH Properties Sdn Bhd v Tribunal Tuntutan Pembeli Rumah (2021), the claim was on improper earth compaction during construction caused damage.	Lack of supervision during construction and legal exemptions for local authorities raise concerns about soil compaction practices. P6 opined local authorities did not supervise as it is not their obligation under the act.
4. Problem of inefficient method of repair	-	Residents reported ineffective repairs during the Defect Liability Period, with issues persisting despite multiple attempts. This highlights challenges in finding effective solutions within legal frameworks.

CONCLUSIONS

This research analysed findings from case studies, cross-validated with literature, interviews, and case laws. Focusing on two Malaysian housing projects, the study revealed legal issues like inadequate soil advisement, ineffective repairs, lax supervision, and enforcement failures. Resolutions included inspections, engineer interventions, and government funding, highlighting the need for better supervision and enforcement.

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