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## **SPATIAL ENVIRONMENTAL IMPACT OF THE LRT3 DEVELOPMENT PROJECT: A PERCEPTION STUDY IN SEKSYEN 7 SHAH ALAM**

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### **Abstract**

This study aimed to examine the perceptions of the local community in Seksyen 7, Shah Alam, regarding the environmental impact of the LRT3 construction project. The objectives were to identify the environmental impact on the community and evaluate the state of environmental pollution in the area. Based on several factors, a questionnaire was selected as the data collection instrument. The LRT3 project's highest percentage of respondents, 66.8%, identified air pollution as a concern, indicating perceived negative impacts on air quality in the vicinity. Approximately 60.6% of respondents attributed increased traffic congestion to the project, suggesting disruptions caused by construction activities and changes in road infrastructure. Furthermore, 51.6% of respondents identified noise pollution as a concern from the LRT3 project, possibly due to construction-related noise and machinery operation. A smaller percentage, 20%, expressed concerns about potential health issues associated with the project, while 19.8% mentioned water pollution. The research highlights the importance of tackling air pollution, traffic congestion, noise pollution, health issues, and water pollution to alleviate the adverse environmental effects. This study's findings have the potential to provide valuable insights for spatial decision-makers involved in the implementation of specific strategies and promoting the overall well-being of the community throughout the construction and operation phases.

**Keywords:** Environment Impact, Construction Project, LRT3, Perception Study

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## **INTRODUCTION**

Spatial environmental impacts can be considered a disturbance to the natural and built environment, which causes adverse effects on the air, land, water, wildlife, and the ecosystem's inhabitants. An environmental impact is pollution, contamination, or damage that occurs due to an action and can have either short-term or long-term consequences (Abdallah, 2017). Biodiversity and healthy ecosystems are essential to human well-being. All of the activities that humans have carried out have impacted ecosystems. Some activities have caused irreversible environmental effects, including environmental pollution, the extinction of animal species, resource depletion, and habitat loss (MAPRE, 2020). The construction industry is a well-known sector that can significantly impact the surrounding environment.

Since the Industrial Revolution, construction activities have drastically altered our environment. Tall skyscrapers tower over our streets; mines delve deep into the earth's crust; valleys are raised to allow dam construction; and slopes are flattened to accommodate housing developments. All these activities have the potential to degrade and pollute the environment. This has also been agreed upon by Ling et al. (2020): a city or town with more industrial and transportation land uses with fewer greens was more polluted than the area with fewer industrial and transportation land uses with more greens. Project managers, environmental health and safety experts, and site managers must understand the environmental implications of construction projects and how these impacts can be mitigated and decreased. Construction is one of the industries that contributes significantly to the growth of the nation's infrastructure and facilities.

This research specifically focuses on the construction area of LRT3, located at Seksyen 7, Shah Alam, as the project's construction process might negatively impact the environment. Rail systems in Malaysia, such as the Light Rail Transit (LRT) system, are used for transporting passengers in urban areas. This system can carry large numbers of people efficiently and forms the backbone of a city's public transportation network. Moreover, public transportation is a government measure to reduce carbon emissions and protect environmental quality, especially in cities. It is agreed by Sultan et al. (2016) that green mobility has emerged as the best approach for promoting sustainable and environmentally friendly transportation in modern cities. However, the construction and operation of the LRT might adversely impact the surrounding physical environment with contaminants such as air pollution, water pollution, vibration, and traffic congestion.

## **LITERATURE REVIEW**

### **Environmental Issues in Railway Construction**

Construction projects are purported to have an increasingly negative influence on the environment. The effects include air pollution and other sorts of pollution,

such as noise, water chemicals, and various others familiar in many construction projects. Furthermore, air pollution problems significantly influence the surrounding ecosystem simply because people are staying in these locations. Air pollution induced by construction activities on building sites or projects can negatively affect living beings regarding their health, and economic and social difficulties.

Furthermore, air pollution issues are severe because increased air pollutant levels from all of these anthropogenic sources are typically found in environments where serious harm to human health and well-being is much more likely to arise in densely populated urban areas such as Klang Valley, Kuala Lumpur, and Shah Alam (Zawawi & Ghani, 2018). The standard practice by contractors is to consider environmental concerns from a business perspective where the concern lies in the protection of construction materials, activities, or resources from environmental harm. This is primarily due to the practice that construction project management work considers just three factors: cost, schedule, and quality. As environmental concerns receive much attention from all groups in society, the historical paradigm is less applicable to the success of future projects (Pandit & Yadav, 2014).

Nevertheless, construction is frequently associated with environmental issues because of the nature of its activities which have both beneficial and harmful effects on the environment. Consequently, this research focuses on the negative environmental implications (Asmawi, 2010) and the issues are as follows:

i. Environment Degradation

Even though construction is essential to the country's physical, economic, and social development, it is also linked to environmental issues such as the increased extraction of raw materials from the environment's resources, the deterioration of water quality, and the degradation of land which is a valuable resource. The building industry impacts a sixth of the world's freshwater, a quarter of its timber harvest, and a quarter of its material and energy flow (Asmawi, 2010). According to the fifth Malaysia Plan (1986-1990), more than 30% of Peninsular Malaysia land has been developed, whereby only 10% of the area is covered with rich, diversified natural forests (Asmawi, 2010).

ii. Environment Stress

The production of dust particles, hazardous substances, and other construction debris exacerbates the environmental impact of building operations. These wastes in the atmosphere are regarded as possible health risks. During construction operations, the vibration on construction sites is a critical environmental stressor that can lead to seismic activity. According to Asmawi (2010), large-scale engineering buildings have impacted the area's ecological environment and

altered its ecological balance. Other factors include increased solar energy received and increased precipitation intensity, which leads to floods (Asmawi, 2010).

### iii. Loss of Habitats

Numerous habitat types have been lost as a result of urbanisation (Liu, Liu, Li, Li, Liu, & Zhao, 2023) which showed that extensive urbanisation significantly affects the environment both directly and indirectly. This is relevant directly through the expansion of newly urbanised land and indirectly through an increase in environmental loads and changes in consumption as more people move into cities. For example, development is reported to cause wetland habitat loss, water quality decline, and sedimentation. Construction in ecologically sensitive locations, such as wetlands, causes a substantial build-up of sediments in the wetland areas and water channels.

### iv. Environmental Pollution

According to data from the World Green Building Council's Bringing Embodied Carbon Upfront, buildings and construction account for 39% of global carbon emissions, of which 28% are attributable to energy use and 11% to construction materials. Buildings use energy mostly when they need to be heated or cooled, particularly if their ventilation and insulation systems are inadequate. The construction process produces embodied carbon at similar levels of construction materials that are manufactured and supplied.

### v. Impacts on Climate Change

Constructing new buildings will add to the carbon (CO<sub>2</sub>) emissions already present (Ahmed, Abdel-Hamid, Abd El-Razik, & El-Dash, 2021). For example, about 50% of the UK's CO<sub>2</sub> emissions come from building use, and another 7% come from construction. The government's estimates of how energy-efficient houses are way too low regarding how much CO<sub>2</sub> could be saved by building more energy-efficient buildings. Most of the CO<sub>2</sub> savings can be made in the thermal performance of the building shell, which is the main base performance criterion for energy-efficient buildings (Asmawi, 2010).

### vi. Waste Problem

Construction waste is a significant issue that when not managed properly, can have negative environmental and health consequences. The problems associated with construction waste include the generation of large volumes of waste, such as soil and concrete, which can be hard to dispose of and can lead to environmental pollution (Napier, 2016). Hazardous waste like chemicals is also produced during construction, posing risks to both human health and the environment if not handled correctly. Proper disposal can be challenging, often

necessitating specialised equipment and facilities; improper disposal can result in environmental pollution and health risks. It is a fact of the matter that the construction industry generates the most waste.

vii. **Impact of Railway Construction**

Among various modes of transportation, rail transport is widely acknowledged as the most energy-efficient and environmentally friendly form of motorised transportation. Compared to other modes of transportation, the growth in the appeal of railways for both passengers and freight can be attributed to the development of trans-European transport networks and the enhancement of interoperability among neighbouring countries, particularly in Europe. Nevertheless, the construction phase's environmental impact is often disregarded, focusing primarily on the operational phase's environmental performance, specifically concerning greenhouse gas (GHG) emissions (Damián, 2022).

**The LRT3 Construction in Malaysia: Current Issue, Challenges and Solutions**

The Shah Alam Line LRT, also called LRT 3, was previously named the Bandar Utama-Klang LRT, Bandar Utama-Johan Setia Line LRT, or Johan Setia Line LRT. It is a light rapid transit (LRT) line designed to accommodate medium capacity and is set to commence operations. The Shah Alam and Klang regions are located in Malaysia's western part of the Klang Valley. The upcoming addition to the Klang Valley region's transport infrastructure will mark the establishment of the third Light Rail Transit (LRT) line and the fourth fully automated and driverless train system in the area. The line operation will be carried out within the framework of the RapidKL system, overseen by Rapid Rail, a subsidiary of Prasarana Malaysia. On April 24, 2013, an announcement was made by Prasarana Malaysia (Contributors, 2023).

The present concern about the LRT3 project in Malaysia pertains to the prospective environmental consequences on the neighbouring communities. Large-scale infrastructure projects, such as the LRT3, can impact the neighbouring communities differently, encompassing both advantageous and detrimental aspects. The community is subject to environmental consequences that arise from various factors, including noise, vibrations, potential land acquisition, and the potential displacement of residents or businesses. The above impacts can have significant social and economic consequences for the affected communities.

The current issues of the projects are noise and vibration impacts, negative social impacts, and changes to the landscape. For noise and vibration impacts, the construction and operation of the LRT3 project in Malaysia are anticipated to result in the impacts. These impacts can arise from various activities associated with the project's construction and operation phases. During

the construction phase, noise and vibration levels can significantly increase due to the utilisation of heavy machinery, construction equipment, and related activities. Moreover, resilient track systems or vibration isolation measures can minimise vibrations transferred to nearby structures (Ismail, 2015). Aside from that, there is no other way to get to this minor route; it can only be reached from the main road, which is frequently congested during peak hours.

## RESEARCH METHODOLOGY

Seksyen 7 in Shah Alam, the study area, is a well-established residential and commercial area (Figure 1). It features a mix of residential properties, commercial establishments, and various amenities. The area will likely have a diverse population, including residents, businesses, and other stakeholders who may be directly or indirectly interested in the LRT3 construction project and its environmental impact. Seksyen 7, as part of the LRT3 construction line, would likely be directly affected by the construction activities. Seksyen 7 Shah Alam was selected as a case study due to its variety of populations. There is a higher number of institutional, commercial, and residential types of respondents. This might provide different and interesting feedback on the environmental impacts caused by the construction phase.

This study employed a quantitative approach to research. Quantitative data can be used to investigate cause-and-effect relationships and create predictions. A more significant, randomly selected sample also increases the likelihood that the quantitative findings may be extrapolated to an entire population or subpopulation (Rahman, 2016). A stratified sampling method was employed to ensure a representative and diverse research sample. The population in Seksyen 7, comprising a mix of landed properties, apartments, and condominiums, encompasses families, working professionals, students, and individuals from different age groups.



Figure 1: Seksyen 7 map and LRT3 line Bandar Utama- Klang (Slainthayer, 2023)

Stratification was done by dividing the population into distinct strata based on relevant characteristics such as residential property types and demographics. From each stratum, a sample size proportional to its representation in the population was randomly selected using methods like simple random sampling or probability proportional to size sampling. This approach ensured that the research sample adequately represented the various segments of the Seksyen 7 community. By incorporating stratified sampling, the study captures the nuanced perspectives and experiences of different strata within Seksyen 7, enhancing the generalizability and depth of the research findings.

## **Data Collection**

### ***Questionnaire***

The questionnaire was chosen as the instrument for data collection due to its ability to be developed in less time, its capacity to collect data from many respondents, its capacity to allow multiple questions about a subject, its extensive flexibility in data analysis, and its cost-effectiveness (USIM, 2023). The questionnaire will include questions such as the age of the respondent, respondent's status, monthly household income, types of premises, satisfaction with the existing neighbourhood, environmental satisfaction, perception of the LRT3 project, awareness of the LRT3 project, issues arising from the LRT3 project, perception of the environmental impact of the LRT3 project, and factors that contribute to the pollution. Data was collected within a month based on the researcher's observations, random interviews, and distributed questionnaire links to the public community using Google Forms. The data collection started in April and ended in May 2023. This study involved communities in Seksyen 7 with residential, commercial, and public institutions. The survey was sent out to the selected sample. The total sample that answered the questionnaire was 804 people.

Besides that, observations at the case study site were carried out to understand the type of pollution that occurred, the factors that cause pollution in the area, and the impact of pollution on the surroundings. The result of the received responses was automatically generated by the Google Forms engine for the questionnaire survey. The result for each question can be easily abstracted from the Google Form website as a list, chart, or graph. The result was also converted into a spreadsheet file, which allowed for more detailed viewing of the results. Hence, the results of the questionnaire were categorised and analysed according to the research questions. A table can be used to explicitly display the result.

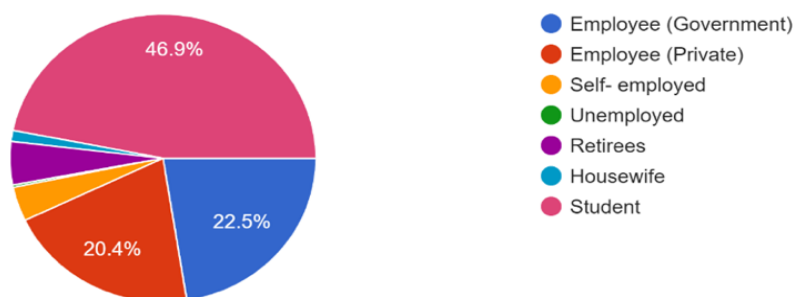
## **ANALYSIS AND DISCUSSION**

The study's discussion is focused on three sections based on the questionnaire analysis: the respondents' demographic information analysis, the perception

analysis of environmental impacts, and the residents' awareness analysis of the construction of the LRT3 projects.

### **The Demographic Information Analysis of the Respondents**

This section examines the demographic information, which includes four (4) categories: age of respondents, employment status of respondents, monthly household income, and types of premises. A descriptive analysis is carried out to demonstrate the frequency and percentage distribution of the demographic information. The percentage and frequency of respondents who participated by age show that the number of respondents aged 18–24 is more significant than others. Figure 2 shows the percentage and frequency of respondents who participated by employment status.



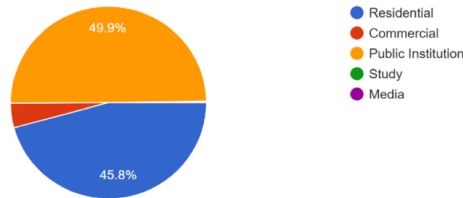
**Figure 2:** Respondent's employment status

The percentage and frequency of respondents who participated by monthly household income show that the number of respondents with a salary lower than RM2,000 is higher than the others. This proves that in terms of the percentage and frequency of respondents who participated by type of premises, the Seksyen 7 area has many residents from the B40 group. Figure 3 shows that the number of respondents from public institutions is higher than others. The Seksyen 7 area is home to two public institutions, UiTM and Unisel. In addition, many students stay in rented houses around that area; they also contribute to the B40 group.

### **The Perception Analysis of Environmental Impacts**

This section is related to the perception study on environmental impacts in Seksyen 7 Shah Alam due to the LRT3 construction project. This section consists of Likert scale questions to obtain data from the respondents.

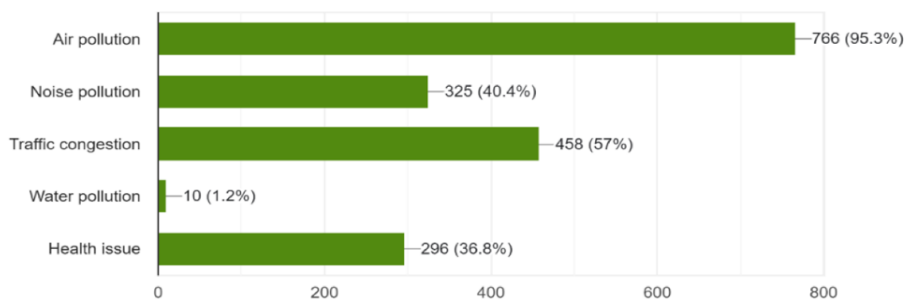




**Figure 3:** Respondent’s type of premises

To investigate neighbourhood satisfaction further, five factors were used to assess respondents' perceptions of the extent of the environment in their neighbourhood. These five factors are typically associated with significant urban road or rail development, particularly during the construction phase. Based on the provided data on current environmental issues in Seksyen 7, Shah Alam, the respondents' voting distribution is shown in Figure 4. According to the data, air pollution is the most prominent concern among the respondents in Seksyen 7, with an overwhelming majority of 95.3% voting for it.

This suggests that air pollution is a significant and widely recognised problem. The second-highest vote goes to traffic congestion, with 57% of respondents expressing it as a concern. This indicates that the volume of traffic and associated congestion is a substantial issue affecting the residents of Seksyen 7. Noise pollution received the third highest vote at 40.4%, suggesting that excessive noise from various sources is a notable problem in the area. Health issues garnered a vote of 36.8%, making it the second-last highest concern among the respondents. This suggests concerns about the potential health impacts arising from the environmental conditions in Seksyen 7. Water pollution received the lowest vote at 1.2%, indicating that it is perceived as the least significant issue among the listed environmental concerns. The data highlights that air pollution, traffic congestion, noise pollution, and health issues are the most pressing environmental concerns in Seksyen 7.



**Figure 4:** Percentage of current environmental issue

Based on the data in Figure 5, the highest number of respondents, 761, agreed that community activities contribute to air pollution. This suggests that community activities, such as burning waste or outdoor events, are considered significant sources of air pollution in the area. The second-highest number of respondents, 661 in total, agreed that construction work is a contributing factor to air pollution. This indicates that emissions from construction sites, such as dust and pollutants from machinery, are seen as a significant source of air pollution in Seksyen 7.

A total of 572 respondents agreed that vehicles contribute to noise pollution. This highlights the impact of vehicle-related noise, including engine noise, honking, and traffic noise, on the acoustic environment in Seksyen 7. A total of 562 respondents agreed that construction work contributes to noise pollution. This indicates that the noise generated by construction activities, such as machinery, drilling, and construction-related activities, is seen as a notable source of noise pollution in the area. A total of 100 respondents agreed that waste management contributes to noise pollution. This suggests that activities related to waste management, such as waste collection or disposal, may generate noise and contribute to the overall noise pollution in Seksyen 7.

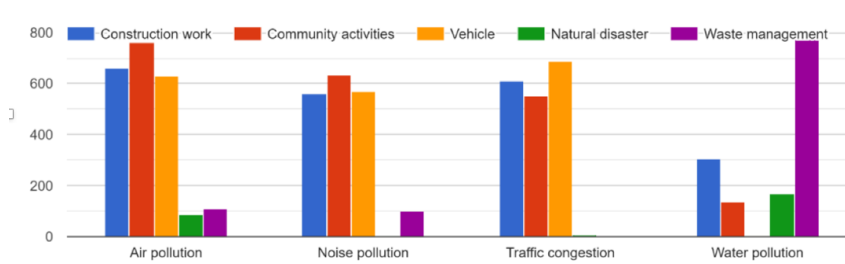


Figure 5: Factors of pollution

Table 2: Number of respondents

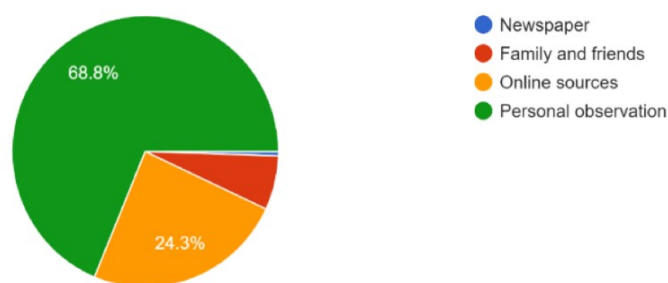
Factor	Number of respondents
Community activities	635
Vehicles	572
Construction work	562
Waste management	100

### The Residents' Awareness Analysis of the LRT3 Construction Projects

This section aims to identify the residents' awareness of the construction of the LRT3 in Seksyen 7, Shah Alam, and the environmental impact caused by the LRT3.

Based on the respondent's knowledge of the project, as indicated in Figure 6, 68.8% of the respondents stated that they became aware of the LRT3 project through personal observation. This means they likely noticed the

construction or other related activities related to the project in their surroundings. 24.3% of the respondents reported obtaining information about the LRT3 project online. This could include websites, social media platforms, news articles, or official project updates available on the internet. 6.5% of the respondents mentioned learning about the LRT3 project through family and friends. This suggests they received information or discussions about the project from their network. A small percentage, 0.5% of the respondents, said they learned about the LRT3 project through newspapers. This indicates that traditional print media played a minor role in their awareness.

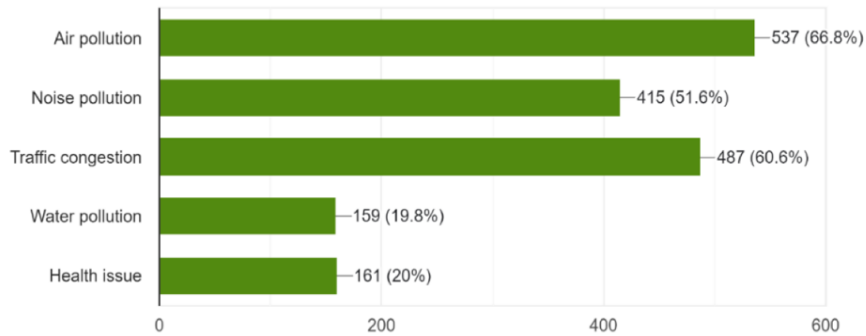


**Figure 6:** Respondent's source of knowledge about the LRT3 project

The respondents have also responded to the project's effects on the environment (Figure 7). The data indicates that a majority of respondents (73.4%) in Seksyen 7, Shah Alam, agreed that the LRT3 project significantly impacts the environment. On the other hand, a smaller percentage (26.6%) of respondents disagreed with this perspective, suggesting they believe it has a lesser or no significant impact on the environment. The study also addresses the main issues raised by the LRT3 project (Figure 8). The highest percentage of respondents, 66.8%, identified air pollution as an issue resulting from the LRT3 project. This suggests that the project's construction or operation negatively impacts air quality in the surrounding area. This can be due to emissions from construction machinery, increased traffic during construction, or the operation of the LRT system itself.

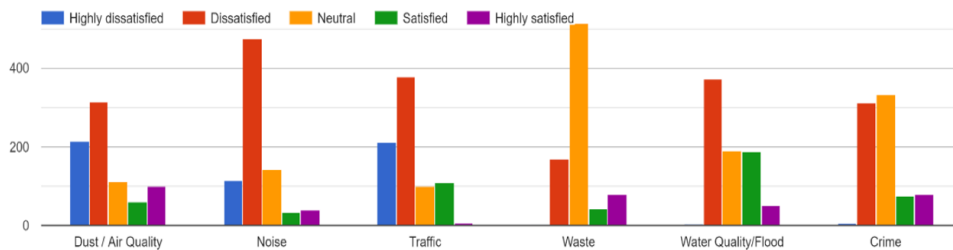
Approximately 60.6% of respondents identified traffic congestion as an issue arising from the LRT3 project. This implies that they believe the construction activities or changes to road infrastructure associated with the project have led to increased traffic congestion in the area. This can occur due to lane closures, traffic rerouting, or construction activity disruptions. About 51.6% of respondents mentioned noise pollution as an issue resulting from the LRT3 project—construction activities, including the operation of heavy machinery and construction increases, contribute to increased noise levels in the vicinity. A smaller percentage includes concerns about health issues (20%) and water

pollution (19.8%). It is important to note that these perceptions and concerns expressed by the respondents may or may not reflect actual impacts or issues related to the LRT3 project. It would be necessary to conduct further studies and assessments to evaluate the validity and extent of these concerns.



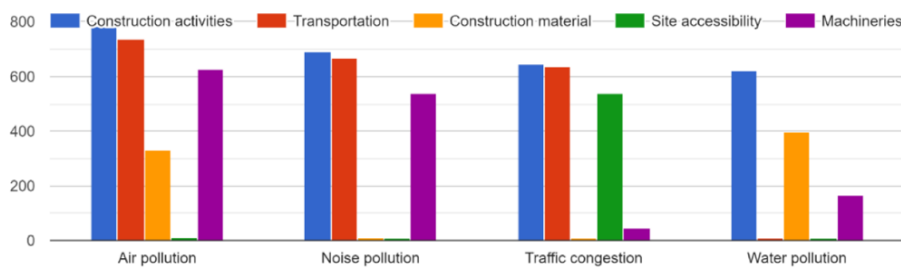
**Figure 7** Issue arises from the LRT3 project.

The study also analyses satisfaction with the LRT3 project issue. Figure 8 shows that the respondents were given options ranging from highly dissatisfied to highly satisfied, and their preferences were recorded accordingly. In terms of satisfaction with air quality, out of the total respondents, 216 individuals expressed being highly dissatisfied with the air quality related to construction activities. Additionally, 315 respondents stated that they were generally dissatisfied. This indicates that a significant number of people are unhappy with the air quality in their vicinity due to construction. The others only reported a neutral stance (112 respondents), being satisfied (61 respondents), and being highly satisfied (100 respondents). These findings highlight the need for measures to address the air quality concerns caused by construction. It may be essential to evaluate and implement strategies to minimise dust, pollutants, and other harmful emissions during construction projects to improve the overall air quality and mitigate the dissatisfaction expressed by many respondents.



**Figure 8:** Respondent's satisfaction with the LRT3 project issue

The data provided useful insight into construction issues and their impact on crime. Out of the total respondents, only a small number of individuals, precisely five respondents, expressed being highly dissatisfied with the crime situation related to construction activities. This indicates that the construction projects have not significantly contributed to increased criminal activity or have successfully managed potential security concerns. A more significant proportion of respondents, 311, reported dissatisfaction with the crime situation. This suggests that there are perceived issues or concerns related to criminal activities near construction sites. These concerns could include theft, vandalism, trespassing, or other crimes that may occur during or as a result of construction activities.



**Figure 9:** Factors that contribute to the pollution.

These findings underscore the importance of maintaining adequate security measures and addressing any potential security risks associated with construction activities. It is critical to implement appropriate safety protocols, such as securing construction sites, installing surveillance systems, and fostering collaboration with local law enforcement, to minimise the occurrence of criminal incidents and create a safe environment for workers and nearby residents.

The data in Figure 9 indicates various factors contributing to the traffic congestion associated with constructing the LRT3. Most respondents (645 individuals) identified construction activities as a significant contributor to traffic congestion. This can include road closures, lane reductions, and detours due to construction work. Transportation related to the construction also emerged as a prominent factor, with 635 respondents highlighting it as a contributor to traffic congestion. This likely refers to the movement of construction vehicles and trucks, which can add to the existing traffic load. While the impact of construction material and machinery on traffic congestion was relatively low with 9 and 46 respondents, respectively, site accessibility was highlighted by 540 respondents as a significant factor. This suggests that difficulties in accessing the construction site, such as limited entry points or disruptions to regular traffic flow, contribute to the overall congestion in the area. These findings underscore the importance of efficient traffic management strategies, coordination with local authorities, and

proper planning of construction activities to minimise traffic congestion during the construction of the LRT3.

The data reveals several factors that contribute to the water pollution associated with constructing the LRT3. Most respondents (624 individuals) identified construction activities as a significant factor contributing to water pollution. This could include runoff from construction sites carrying sediment, debris, and other pollutants into nearby water bodies. Construction material was also identified by 395 respondents as a contributing factor, suggesting that the materials used in the construction process may leach pollutants into the surrounding water sources. While transportation and site accessibility had relatively low impacts (9 and 8 respondents, respectively), machinery used in construction activities was highlighted by 167 respondents as a contributing factor to water pollution.

## CONCLUSION

Air and noise pollution can cause long-term health effects in humans and animals. The construction industry is regarded as one of the world's leading environmental polluters. The widespread development projects in Shah Alam burden the local ecosystem and produce various pollutants. Most of the LRT3 construction project activities are located in areas with a high population density. These activities can be particularly harmful to the health of people who are already susceptible to the effects of construction dust. The findings also highlighted the potential sources of air pollution, including emissions from construction machinery, increased traffic during construction, and the operation of the LRT system itself. Additionally, noise pollution was identified as a significant issue, indicating that the community is apprehensive about the potential disruptions caused by construction activities and the subsequent operation of the LRT system. The community members' limited availability and time constraints to participate in the study must be enhanced for future significant studies. The findings can inform spatial-based policy decisions, improve construction practices, and contribute to sustainable development in the transportation sector.

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