




Article

Strategic Initiatives for Large Transport Infrastructure Planning: Reinforcing Sustainability in Urban Transportation through Better Stakeholder Engagement

Chayaporn Ngampravatdee ¹, Koorosh Gharehbaghi ^{1,*} , Amin Hosseinian-Far ² , Kong Fah Tee ^{3,4}  and Kerry McManus ⁵

¹ School of Property, Construction and Project Management, RMIT University, Melbourne 3000, Australia

² Department of Business Systems and Operations, University of Northampton, Northampton NN1 5PH, UK

³ Department of Civil and Environmental Engineering, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia

⁴ Interdisciplinary Research Center for Construction and Building Materials, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia

⁵ Center of Sustainable Infrastructure, Faculty of SET, Swinburne University of Technology, Melbourne 3122, Australia

* Correspondence: koorosh.gharehbaghi@rmit.edu.au

Abstract: An efficacious stakeholder engagement process is instrumental in achieving success in large transport infrastructure projects. This is due to the integral role of public stakeholders' participation in the decision-making process. The purpose of this study is to explore the key components that are essential for an effective public stakeholder engagement process in large transport infrastructure projects. The paper entails an in-depth analysis of stakeholder management processes, large transport infrastructure complexities, and stakeholder engagement as a holistic framework. A mixed-methods approach is adopted, together with a comparative case study design utilizing various data from large transport infrastructure projects. The findings demonstrate that the engagement framework and objectives are the key components of large transport infrastructure planning. Moreover, such components are dependent upon the characteristics of public stakeholders and the project scope. These findings can assist transport planners in devising effective techniques for stakeholder engagement during the initiation of such projects.

Keywords: transport infrastructure; stakeholder engagement; public stakeholders; transport planning; infrastructure complexity



Citation: Ngampravatdee, C.; Gharehbaghi, K.; Hosseinian-Far, A.; Tee, K.F.; McManus, K. Strategic Initiatives for Large Transport Infrastructure Planning: Reinforcing Sustainability in Urban Transportation through Better Stakeholder Engagement. *Sustainability* **2023**, *15*, 13912. <https://doi.org/10.3390/su151813912>

Academic Editors: Luca Pugi and Fabio Cignini

Received: 30 June 2023

Revised: 14 September 2023

Accepted: 14 September 2023

Published: 19 September 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Generally, in the construction sector, the neglect of stakeholders' concerns often leads to project misconceptions [1–3]. To avoid this, careful stakeholder management should be adopted. Commonly, stakeholder management refers to a series of activities that project managers undertake to acknowledge and address all their concerns. This includes the careful development of plans and frameworks and establishing clear project priorities. While large transport infrastructures aim to improve the livelihood of communities by providing more reliable networks, this will also aid the growing population with social and economic development. As large transport infrastructures are highly complex in terms of their operations and environmental and social impacts, related projects tend to attract significant levels of attention from directly affected local communities. While it is true that members of the community are projected to receive many social benefits from the project, they may also suffer from any resultant environmental pollution and safety accidents [4]. Therefore, it is important to emphasize that considerations for the project's impact on public stakeholders should not be neglected despite the huge benefits accessible to the public once the project is complete.

Particularly to overcome the many challenges of the large transport infrastructure, appropriate stakeholder engagement strategies are needed. Accordingly, this paper identifies the needs of key groups and bodies to have better engagement to overcome the many challenges of such projects. In particular, a successful stakeholder engagement strategy is essential to delivering sustainable infrastructure. identifies the needs of key groups, and the sponsor plays a vital role in ensuring those business needs are met. Moreover, stakeholders are a crucial element in large transport infrastructure, and consumer preferences are key drivers of transportation trends [5]. Further, stakeholder engagement in the construction industry aims to involve all project stakeholders in the planning, decision-making, and implementation of the project to reduce conflicts between the parties [6,7]. The study by [8] views stakeholder engagement as a tool to promote collaboration and embrace fairness and equity. In addition, public engagement serves to safeguard the public interest [9].

Research Aim and Objectives

In this research, public stakeholders are identified as any individual or group of people who are not legally bound to the project yet are likely to be directly affected by the project's activities and have significant influence over its outcome. They often have no formal power to affect the decision-making process of the project but can exercise informal power if their requirements are not met. Large transport infrastructure projects situated within an existing urban area can adversely affect existing services during their construction and operation phases [10]. According to [11], estimating the impacts associated with the project on the public during the planning stage of the project is useful as it will identify any suitable actions that are required during project implementation and the pertinent stakeholder engagements. Instances of such impacts include traffic congestion, noise, and reduced air quality, all of which can have detrimental consequences for the quality of life of the public. Accordingly, this research aims to determine the key components of a stakeholder engagement process for public stakeholders in large transport infrastructure projects. This research has the following aims and objectives:

- To effectively understand the importance of engagement throughout the review of the stakeholder management process,
- To efficiently review the literature on different types of engagement frameworks used within large transport infrastructures existing within urban areas,
- To commendably examine the components of the stakeholder engagement process and their benefits.

The paper is structured as follows: the first section provides a critical literature review to determine the research gap. While Section 3 includes the research methodology, Section 4 entails the case studies. Whereas Section 5 then provides an analysis of the deliberations along with the measures of success through the evaluation processes and exploration of the case studies. Finally, Section 6 contains the research conclusion and recommendations.

2. Critical Literature Review and Research GAP

Cao et al. [12] explored a case study where stakeholder engagement was not properly executed, which led to poor communication processes with the public. The project team did not acknowledge the public as legitimate stakeholders and therefore did not actively involve or communicate with them regarding the construction process. This created public opposition to the project, which resulted in six years of project delay [13]. Therefore, the project success rate is heavily influenced by stakeholders, especially in large infrastructure projects where public stakeholders have significant needs and requirements.

2.1. Stakeholder Management Process

Stakeholder management provides the opportunity for the project team to become acquainted with the stakeholders [14]. It also supports the project team in determining project objectives and devising the project success criteria [15]. Several scholars in the construction field have proposed various stakeholder management process models; however, there is no

consensus on the best model [16]. McCahill et al. [17] classified the process into four steps: stakeholder identification, classification, analysis, and strategy development. It is one of the most acknowledged stakeholder management processes and is still the foundation for many interpretations of stakeholder management to this day. As an instance, [18] adapted [17] the process to form a more detailed framework, which involves gathering information on relevant stakeholders, identifying their mission or interest in the project, determining stakeholder strengths and weaknesses, predicting stakeholder behavior, and implementing the appropriate stakeholder management strategy.

Additional literature has also established a flexible process where the project team can revise the steps again if necessary. The first step is planning the necessary activities and identifying the time and resources required. This is followed by the identification of stakeholders, including the parties that are already involved and any potential stakeholders. The third step is the analysis of the stakeholders to classify their intentions for the project. The fourth step involves communication with the stakeholders to gain their views on the project. This step leads to the development of strategies to engage with stakeholders. The project team needs to assign the appropriate strategy to each stakeholder to gain their trust and cooperation with the project at hand. The last step is following up on the implemented strategies. This is a monitoring stage to see the effectiveness of the strategy and if a different strategy or intervention is required. This process is very comprehensive, yet its flexibility allows the users to adapt it to suit the project scope.

Aaltonen and Kujala [19] summarized that the four procedures of stakeholder identification, stakeholder analysis, strategy development, and performance control are essential phases in the stakeholder management process within the construction industry. This is a very simple outlook on stakeholder management; nevertheless, it highlights the key aspects of stakeholder management mentioned by [17]. The project team needs to know whether the implementation of the stakeholder management process is successful or not. However, the construction industry does not have a high success rate in stakeholder management [20]. As a result, the critical success factors (CSFs) to assess stakeholder management were identified. The CSF concept was then applied to the stakeholder management domain to improve the performance of the process [20]. They are accepted as activities and practices that should be addressed to maintain stakeholder interest and ensure that the project progresses smoothly [21]. Karlsen [22] conducted a comparative study and compiled the top 3 CSFs, which are the following:

- Managing stakeholders with social responsibilities (economic, legal, environmental, and ethical),
- Exploring the stakeholders' needs and constraints for the project, and
- Communicating with and engaging stakeholders properly and frequently.

Moreover, effective communication is one of the most important factors, which demonstrates that the engagement of stakeholders is crucial in the stakeholder management process. Li et al. [23] stated that communication is essential to maintaining the support and cooperation of all stakeholders and needs to be effective, regular, and planned to ensure project success [21]. The project team needs to monitor any changes in stakeholder influence and their relationship, so frequent communication is essential.

2.2. Large Transport Infrastructure

Generally, a large transport infrastructure is an across-the-board system that is multi-faceted and made up of a considerable number of interconnected sub-systems and components [24]. Large transport infrastructures provide fundamental services to the public. They provide fundamental services to the public for social production, economic development, and people's livelihoods. Large transport infrastructures can range from high-speed railways to long-span bridges connecting different parts of the country. They are classified as mega-projects that are characterized by immense organizational complexity, a long-lasting impact on the economy, environment, and society, and a large investment commitment [25]. Also, transport infrastructure such as trams and light metros in areas with geographical

constraints has been shown to widen labor catchment areas and boost surrounding property prices, thereby encouraging inward investment [24]. Rail infrastructures provide an alternative mode of transportation for the public that is cheap and efficient and can enhance the socio-economic vitality of the area [25]. Large transport infrastructure projects also contribute to the strategic development of society by satisfying economic and societal needs, resulting in the improvement of a country's social image [26].

Further, large transport infrastructures still have a critical role in shaping economies, providing high-quality services and infrastructure, and improving the area's economic performance [27]. With these impactful characteristics, they tend to attract a large amount of public attention throughout their lifecycle [28]. In addition, large transport infrastructure projects would ultimately benefit from some of the most advanced technologies, such as intelligent traffic management (ITM), among others, to overcome pertinent challenges [24]. Figure 1 outlines an overview of ITM in dealing with large transport infrastructure.

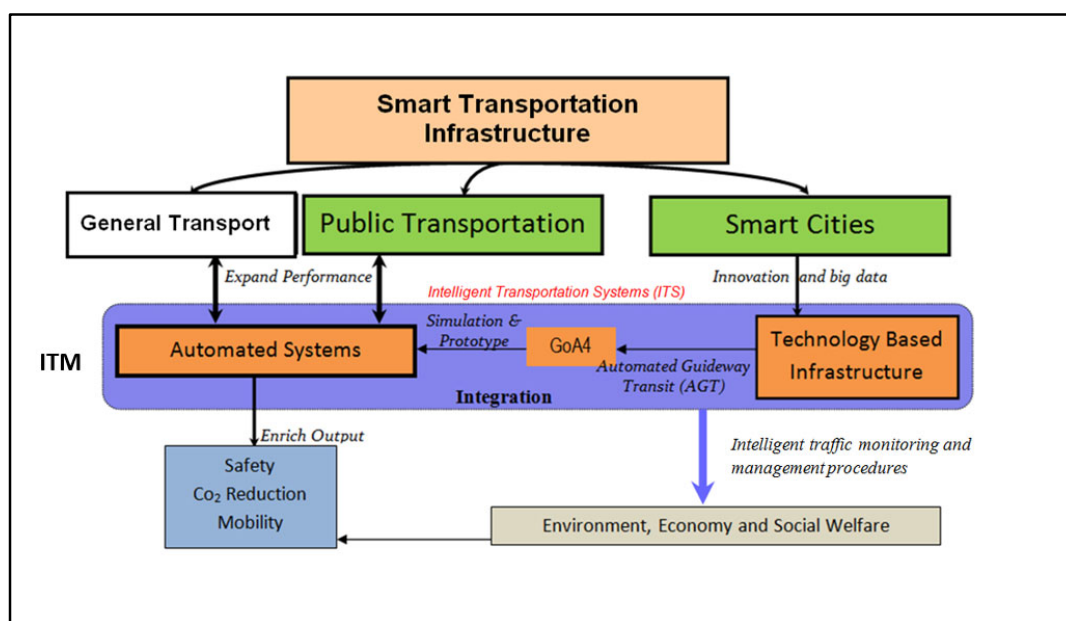


Figure 1. Overview of ITM inclusion within large transport infrastructure components.

As can be seen in Figure 1, the main aspect of ITM is the inclusion of intelligent transportation systems (ITS) in its core. Nonetheless, such intelligent traffic management arrangements need to be carefully integrated, via suitable interfaces, with other elements of transportation infrastructure [25]. Furthermore, according to [29], three major challenges arise from the characteristics of large transport infrastructure. The first challenge is the involvement of numerous stakeholders, leading to complex stakeholder inter-relations and potential conflicts of interest. Second, the complex system of large transport infrastructure involves the human element over the life cycle of the project. Human elements are involved across the life cycle of the project, so their involvement tends to further complicate an already complex system as it introduces non-quantifiable risks and uncertainties that contribute to project failure [11]. The last challenge is the project's governance through a rigid multi-role administrative structure, which can increase the project's complexity. The scale of the project requires collaboration between many organizations, including government ministries, planning and approving authorities, main contractors, an array of sub-contractors, and the public.

Two of the three challenges described above stem from the human factors of the project. Projects do not occur in a vacuum, and they are continuously affected by the external environment, which the project manager cannot control. The project team can only closely monitor and plan according to external dynamics. Before determining any course

of action toward the stakeholders, proper stakeholder identification should be conducted. This will allow the project team to fully understand how each stakeholder is involved with the project.

Olander and Landin [30] categorized stakeholders into two groups for construction projects: internal stakeholders who are formally connected with the project and external stakeholders who are external to the project and are affected by the project in some way. Public stakeholders are classified as external stakeholders since they are not formally involved with the project yet can affect it and are affected by it. Ref. [31] further classifies public stakeholders into two categories: the local community and the public. For instance, the local community is directly affected by the construction of large transport infrastructure projects and is negatively affected by related environmental pollution or safety accidents while gaining direct benefits from the projects in the long run. The public may not be directly affected by the projects; however, it may be indirectly impacted by them. Ref. [15] discussed how the general public's attitude toward such projects may be positive, while the local community around the sites may have a different or opposite perception since they are directly impacted by the project. This raises the NIMBY theory ("Not in my backyard"), which increases the risks associated with social acceptance of the project.

It is crucial for the project team to fully understand the public stakeholders' needs and requirements and consider them within any decision-making process. There are many approaches to analyzing stakeholders' level of intention and their view of the project. [32] proposed a classification approach to gauge the public stakeholders' attitude toward the project in five levels: "active opposition", "passive opposition", "not committed", "passive support", and "active support". A salient model used to assess public stakeholders' influence is to consider the attributes of power, legitimacy, and urgency [33]. The model can be further broken down into seven classes of stakeholders: dormant, discretionary, demanding, dominant, dangerous, dependent, and definitive. These classes can suggest the actions or lack of actions the stakeholder may take toward the project. Public stakeholders can move between these classes at different stages of a project as their interest may increase or decrease.

Public stakeholders do not typically have any formal responsibility or obligation toward the project. They are often neglected by the project management processes, and this negligence can lead to conflict [31]. Public stakeholders are essential since they hold the power to be a threat to the project if their interests are threatened. Accordingly, they may be motivated to take an "active opposition" attitude as a result [33]. They are often ungovernable and cannot be held accountable for the project's scope, budget, and timeline [32]. Any socioeconomic or environmental issue can increase public attention and cause conflict between the government, construction firms, and the public [34]. Many processes in the project life cycle require multiple groups of stakeholders to interact, including decision-making, procedure coordination, and information consulting. These constant interactions are complex, and any conflicts that arise can create social and public issues. Thus, it is crucial for the project team to constantly monitor and engage with public stakeholders to ensure their support for the project has not changed.

2.3. Public Engagement

Stakeholder engagement is a two-way communication process between the project team and the stakeholders to build a strong and mutually beneficial relationship. It can be viewed as a tool to promote collaboration, a social learning platform to establish shared goals, and an ethical need to maintain fairness and equity for all parties [28]. Figure 2 represents the public engagement focus within the stakeholders' paradigm.

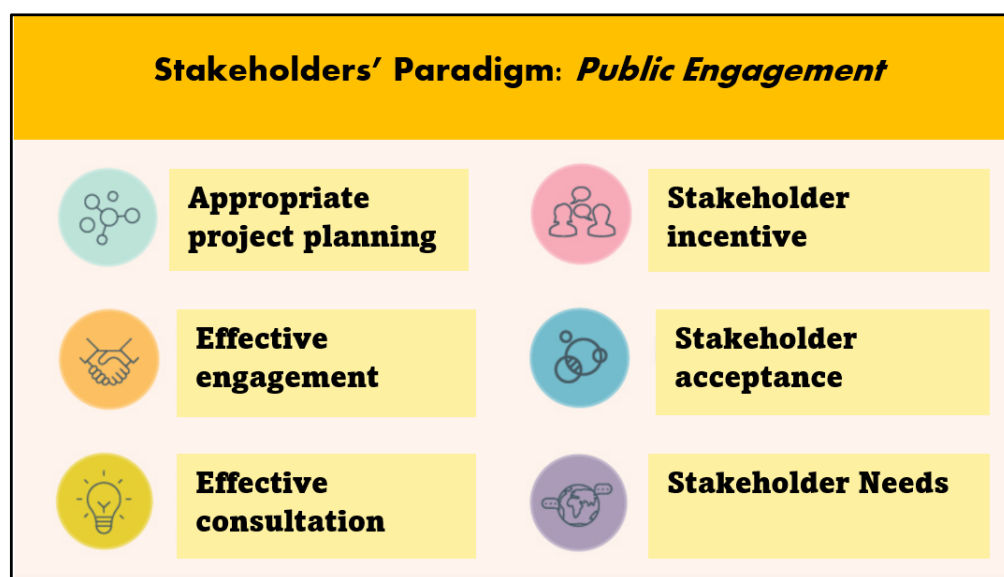


Figure 2. Public engagement and the stakeholders' paradigm.

Locatelli et al. [27] defined the process with two terms: (1) involvement, which is "information giving and consultation" to increase stakeholders' understanding and knowledge of the project; and (2) participation, which is a higher level of engagement to reduce stakeholder resistance toward the project. Effective stakeholder engagement involves communicating both positive and negative consequences regarding the project to build a trusting relationship with stakeholders and attain and maintain their support [29].

According to [6], the public expresses concern about sensitive issues such as democracy, quality of life, and sustainable development. Quality of life and sustainable development are directly related to the objectives of large transport infrastructures, which is why public stakeholders can be a possible determining factor in project success. The requirements of different groups of public stakeholders may contradict each other—road blockage versus footpath blockage caused by the construction site is an example of such a conflict. Some of the common concerns may arise from economics, proximity, usage, and environmental factors [35]. Through public engagement, the interests of different public stakeholders can be systematically captured and integrated into the project's objectives, which will both improve the project's long-term viability and increase benefits to the public stakeholders [35]. Policymakers aim to convey their plans to the public and solicit opinions from various communities before any key policy decisions are reached [34]. Large transport infrastructures are mostly public projects built to serve societal needs and will therefore attract varied types of attention from different groups of stakeholders [29]. In the construction industry, engagement with the public is presented in large transport infrastructures to protect their interests [28].

The aims of public engagement are: (1) to aid the decision-making process; (2) to ensure that public stakeholders are joint decision-makers; and (3) to help shape the decision-making structure [36]. Public engagement is an important part of the decision-making process as it involves the representation of the different interests of stakeholders, which will help solve common issues and promote social cohesion. If these activities are overlooked, public stakeholders may engage in a set of actions to advance their claims [26]. Such actions may increase operational costs, and the project can suffer reputational damage [17]. Public engagement has been used in many large transport infrastructure projects to strike a balance between conflicting public views [35–37].

During stakeholder engagement, information should be provided thoughtfully, with no jargon that may confuse or alienate the receiver, and be concise to avoid the provision of overwhelming or misleading information [15]. Public engagement can be carried out in various forms to best fit the public stakeholders' characteristics. The means used to

engage public stakeholders may vary due to the diverse social, political, and educational backgrounds of public stakeholders [38]. A comparative investigation conducted by [28] stated that a series of meetings with the medium of reference groups is an effective method to gather essential information on the issues most relevant to the public's stakeholders. Each approach has its strengths and limitations, fitting into one of the four levels of engagement: inform, consult, involve, and collaborate [29]. The approach selection should consider the social and cultural background of the public stakeholders as well as the time limit and resources allocated by the project team. The study concluded that no approach is perfect and that combining several approaches is the best solution where necessary.

Although public engagement brings desirable benefits to the project, the implementation of the process is far from satisfactory and remains a challenge [9,17,20]. Not all concerns of every public stakeholder can be addressed due to the limited resources of the project [28]. Nonetheless, public engagement has yet to be fully utilized globally as authorities are cynical about the value of involving the public in the decision-making process as over-active individuals may cause social disorder, thus increasing the risk of project failure [28].

3. Research Methodology

The research methods and design for this study are outlined in Figure 3. The flowchart presented in Figure 3 outlines the steps taken to gather the required data, conduct the analysis, and produce pertinent insights. The arrows denote the steps taken, and the dashed line represents the cross-referral to literature to provide a critical discussion.

The first phase of the research methodology was information gathering. To ensure the data was complete and accurate, explicit collection measures were undertaken. First, a list of specific keywords was determined. These keywords matched the research's aims and objectives. Then, non-biased and peer-reviewed sources were determined. These sources were searched (approximately 60 literature sources) via databases such as Scopus and Google Scholar to identify relevant information. The identified sources were then sorted into academic journal papers and ongoing projects. The academic journal articles were further filtered according to their relevance to the research topic and were divided into theory-focused and case-study-focused categories. The ongoing projects were reviewed to determine their suitability to be used as case studies for the interpretation phase. The second phase of the methodology was data interpretation. Initially, an extensive literature review was conducted to define the premises of stakeholder management and large transport infrastructure. A detailed analysis of such academic publications in the stakeholder management and large transport infrastructure domains provided a synthesis review based on previous research to establish the themes.

A comparative case study approach was then adopted to analyze public engagement in large transport infrastructure projects around Australia. This was judged to be the most appropriate selection, as the design of comparative case studies best fitted the objective of the research. The method used in this research is based on comparative case studies and methodological briefs: Impact Evaluation 9 by [39]. Further, SWOT analysis and comparative matrices were chosen as the key tools to evaluate the effectiveness of each stakeholder engagement process. By using data from case studies in published papers and ongoing case studies, there was a wide range of qualitative and quantitative data to be drawn on.

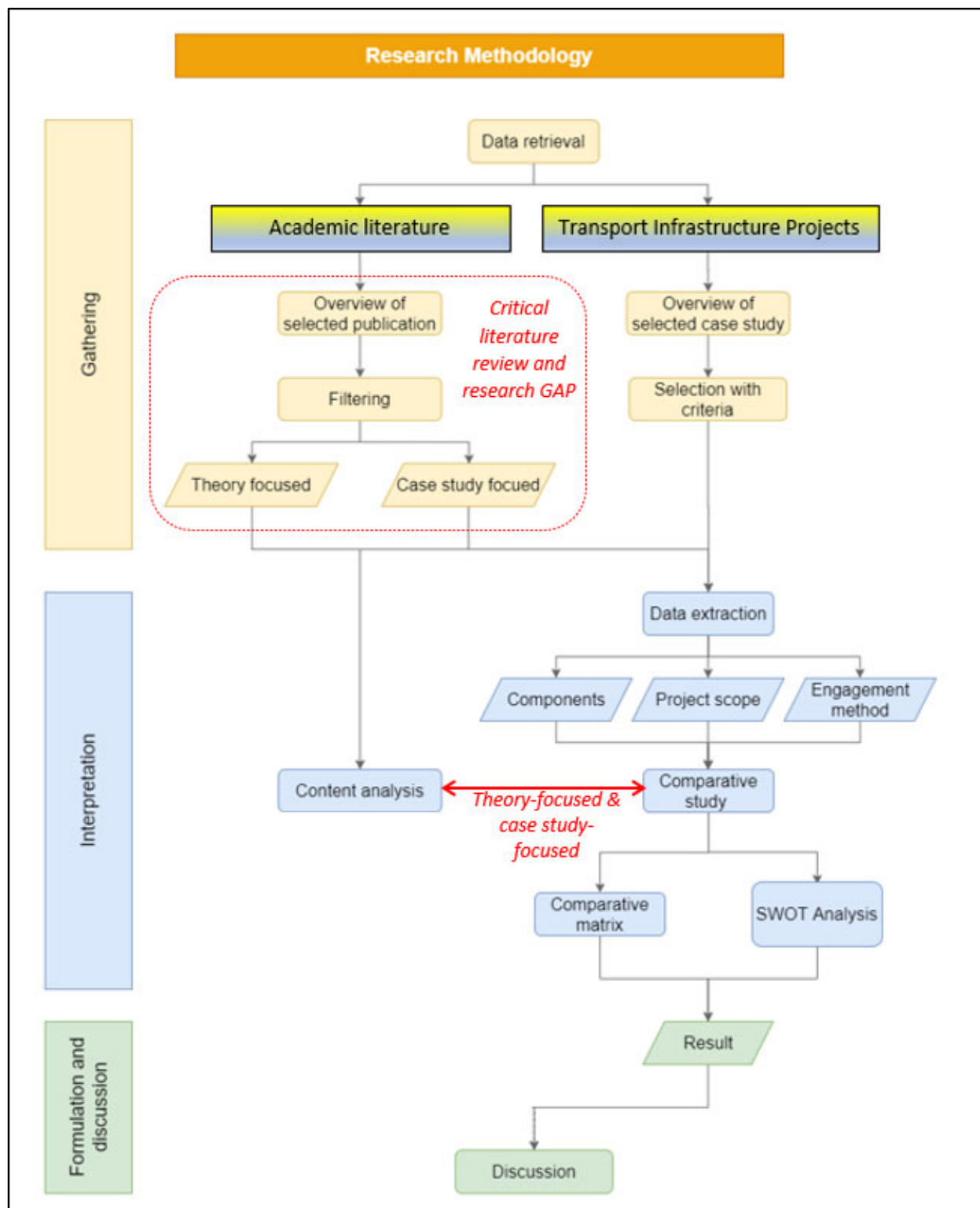


Figure 3. Study methodology, and phases.

4. Case Studies

The following section provides a comparison between the selected case studies. Three large transport infrastructure projects were selected: Case Study 1: Melbourne Metro Tunnel; Case Study 2: Level Crossing Removal Program—Edithvale and Bonbeach; and Case Study 3: Sydney Metro—Chatswood to Sydenham. These case studies were selected because each had similar characteristics such as location, scale, and benefits. The benefits of

these case studies are aligned with the benefits of large transport infrastructure discussed in the literature review, which can be seen in Table 1.

Table 1. Project Benefits of Selected Case Studies.

Project Benefits	Case Study 1	Case Study 2	Case Study 3
Safe, and affordable transport system	✓	✓	✓
Improved reliability	✓	✓	✓
Growth, productivity, and encouraging economic development	✓	✓	✓
Capacity improvements	✓	✓	✓
Improving area liveability	✓	✓	✓
Reducing traffic	X	✓	X

The public stakeholders of the case studies include residents, road users, public transport commuters, business owners, landowners, tenants, and pedestrians. As previously mentioned in the literature review, large transport infrastructure projects have a significant social impact on public stakeholders, and these impacts, extracted from the literature, are categorized in Table 2.

Table 2. Impacts of the project.

Category	Impact
Noise, vibration, and dust	Mostly environmental impacts and pollution to the residents
Reduced accessibility	Roads and footpath blockage, larger vehicles on roads, traffic disruptions
Visual effects	Possible impacts on the landscaping of the area include the removal of trees and other landscaping artifacts
Damages to the existing property	Possible damage to existing properties nearby
Travel effects	Increase in public transport adoption during the construction period due to the impact of various road blockages

It should be noted that only the project documents that were publicly published were examined; hence, the depth of the results of each case study may vary. Additionally, the data gathered was limited to the early stages of the project leading up to the start of construction work.

4.1. Case Study 1—Melbourne Metro Tunnel

4.1.1. Scope

The main objective of the Metro Tunnel Project (MTP) is to improve Melbourne's rail system by increasing its capacity and, therefore, contribute to the social and economic development of Melbourne's growing economy and population. The MTP is scheduled to be completed in 2025 and is budgeted at AUD 11 billion. The scope consists of:

- Twin nine-kilometer rail tunnels from Kensington to South Yarra, connecting the Sunbury and Cranbourne/Pakenham railway lines to form a new Sunshine—Dandenong line,
- Rail tunnel portals at Kensington and South Yarra Station,
- Five underground stations at Arden, Parkville, Central Business District (CBD) North, CBD South, and Domain,

- Train/tram interchange at Domain station,
- High-capacity signaling to maximize the efficiency of the new High-Capacity Metro Trains.

4.1.2. Public Stakeholder

The project covers a large portion of Melbourne, spanning eight suburbs: West Footscray, Kensington, North Melbourne, Parkville, Carlton, Melbourne, South Melbourne, and South Yarra. The total population of the 8 suburbs is approximately 113,104 people, with 38.9 percent having a non-English-speaking background [40]. It was estimated that 386,000 people traveled to the city for work or work-related activities on an average weekday in 2014. Walking is the most preferred mode of travel to get around the city at 65.4 percent, followed by trams and trains at 19.6 percent and 4.6 percent, respectively [40]. Therefore, the construction of the tunnel directly impacts the public's stakeholders' access to roads and footpaths around the city.

4.1.3. Engagement Process

The Melbourne Metro Rail Authority (MMRA) created a detailed management framework titled *The Community and Stakeholder Engagement Management Framework Metro Tunnel*, which outlines the principles and approaches to advising key stakeholders throughout the construction process. The engagement framework is divided into six phases, as shown in Figure 4.

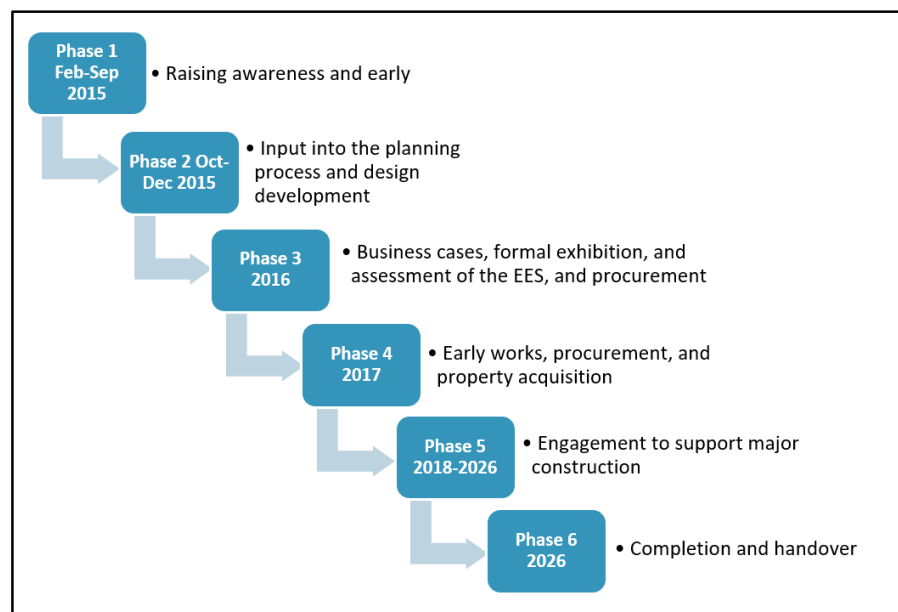


Figure 4. Case Study 1 Engagement Process.

As can be noticed, the engagement process consists of a six-phase program:

Phase 1: The aim of Phase 1 was to reach out to the public and gain as much attention to the project as possible. The purpose of communication channels was to inform public stakeholders about the project benefits and encourage participation in Phases 2 and 3 to solicit feedback [41]. The social survey conducted showed that more than 50 percent of Melbournians were aware of the project, with 58 percent having very little knowledge of it. 13 percent of the people surveyed were opposed to the project, but 65 percent believed that the project would benefit the wider Victorian community [42].

Phase 2: Phase 2 of the engagement framework used a geographic-based approach, with engagement activities undertaken across the project alignment [43]. Multiple locations for involvement were in the Melbourne city center as well as in the vicinity of the tunnel entrances. The engagement activities used were face-to-face-oriented, such as drop-in

sessions and information sessions, to encourage participation; the project team was able to respond to queries and collect relevant feedback with regards to the whole project. This phase of the engagement was a continuous conversation with the public stakeholders from Phase 1, as the feedback obtained was considered in the design process and implemented in the public stakeholder's requirement development.

Phase 3: Phase 3 of the engagement framework consisted of activities to support the statutory planning process, including a public exhibition of *The Environment Effect Statement* (EES) and any subsequent public hearing. The aim was to inform the public stakeholders of the project outcome and how the feedback was used. The public stakeholders were encouraged to continuously provide feedback on the planning assessment and approval process. The EES was the result of Phase 1 and Phase 2.

Phase 4: Phase 4 focused on stakeholder engagement to support procurement, the formal land acquisition process, and the commencement of early works. This phase occurred from 2016 to 2018, overlapping with Phases 3 and 5 [43]. It focused on proactively maintaining a positive relationship with the public's stakeholders by keeping them informed of any major project developments. The project team also utilized this phase to establish the processes for notifying public stakeholders about the potential impacts of the works, including a transparent complaints management process. Communication channels were provided to the public stakeholders to ask questions and raise any issues about the project.

Phase 5: Phase 5 of the engagement framework governed the contract-specific communication and stakeholder relations strategies for the delivery of the major work. Primary contracts played an instrumental role in engaging with public stakeholders for their specific work areas, with MMRA performing an oversight and coordination role across the project [43]. Phase 6: Phase 6 overlaps with Phase 5 as the work packages are completed. This phase focuses on providing advance notice about the operation of the new tunnels and stations. The communication tools used would be like those used in previous phases.

4.1.4. Standards and Guidelines

In the development of the engagement process, MMRA has selected multiple guidelines and references to direct the interaction with the public stakeholders during the project phases. One of the main guidelines used by the MMRA and the work package contractors is the International Association of Public Participation (IAP2). It is an international member association that seeks to promote and improve public participation or community engagement practices. This engagement process refers to the first three levels of the spectrum: inform, consult, and involve. It defines the public's role in the community engagement program and assigns a suitable level of participation for public stakeholders.

4.2. Case Study 2—Level Crossing Removal Program: Edithvale and Bonbeach

4.2.1. Scope

The aim of the level crossing removal program (LXRP) is to remove 75 level crossings across metropolitan Melbourne by 2025. Along with the removal, the rail networks would receive upgrades such as new train stations, track duplication, and train stabling yards. Edithvale Station and Bonbeach Station were selected out of the Frankston Line. Some of the major works consisted of:

- Removal of the level crossings at Edithvale Road and at Station Street/Bondi Road, where they cross the Frankston rail line,
- Railway constriction and associated works to lower the existing Frankston rail line under Edithvale Road and Station Street/Bondi Road,
- Construction of a road bridge over the Frankston rail line, and
- Demolition of existing railway stations and development of a new train station.

4.2.2. Public Stakeholder

Each of the level crossings experiences high traffic volumes every day, with the highest being 17,400 vehicles per weekday on Seaford Road. Through independent market research

requested by the Level Crossing Removal Authority (LXRA), it was revealed that four in five public stakeholders were in favor of the proposed program; hence, the public stakeholders' attitude was classified as "active support" [44]. There would also be considerable impacts from the work on residents, as there are residential areas and recreational facilities situated near most of the crossings. According to the 2016 census conducted by the Australian Bureau of Statistics, Edithvale had an estimated residential population of 5,806 people. The suburb is predominately residential, with a commercial area. In Edithvale, 11.5 percent of people spoke a language other than English at home. In the same year, Bonbeach had an estimated residential population of 6416. In Bonbeach, 11.8 percent of people speak a language other than English at home [45]. The median age of the population in both areas was 40 years old.

4.2.3. Engagement Process

The engagement process stated in the EES only details the activities planned up to the project delivery stage. The document outlines the engagement objectives and principles used by the LXRA. Figure 5 shows the engagement phases proposed by the LXRA—the five-phase engagement process.



Figure 5. Case Study 2 Engagement Process.

Phase 1: The LXRA was used in this phase to allow public stakeholders to learn more about the project and to share what was important to them in their local area. It helped raise awareness for the project and shared information on how people could find out more and participate throughout the project's development [44]. The feedback shows public stakeholders' invested interest and concerns for the project and a high level of support to remove the level crossing [44]. Localized interests varied according to the conditions particular to specific areas, such as concerns regarding the surrounding natural environment and the protection of local cultural heritage [44]. The engagement activities are shown in Figure 6.

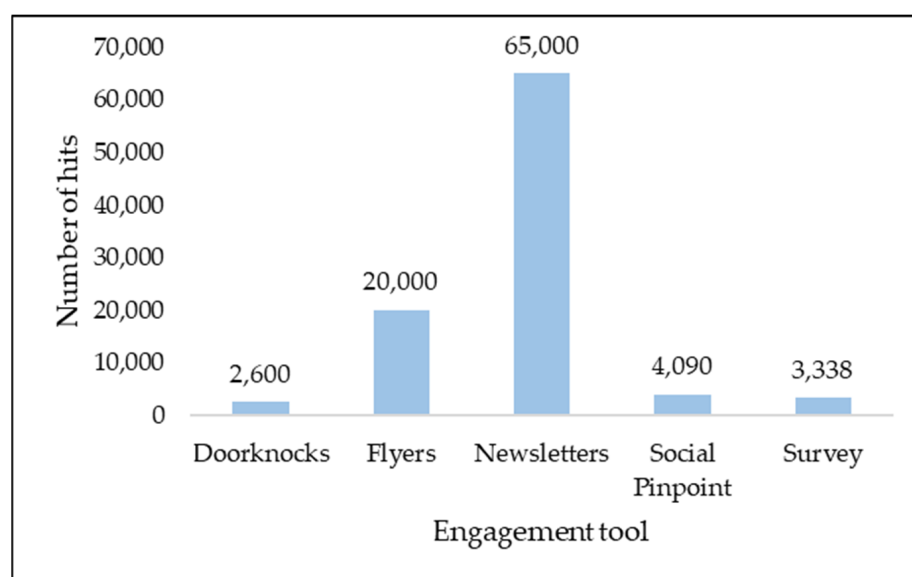


Figure 6. Case Study 2: Engagement Phase 1.

Phase 2: This round of extensive community and stakeholder engagement was a consultation stage through a multi-faceted communications campaign, which is shown in Figure 7. There were two main designs proposed for the project at each site, and the participants were able to pick between the two options after considering the costs and benefits of each option. Feedback and relevant suggestions were collected, which resulted in the trench design being chosen as the preferred option at both locations.

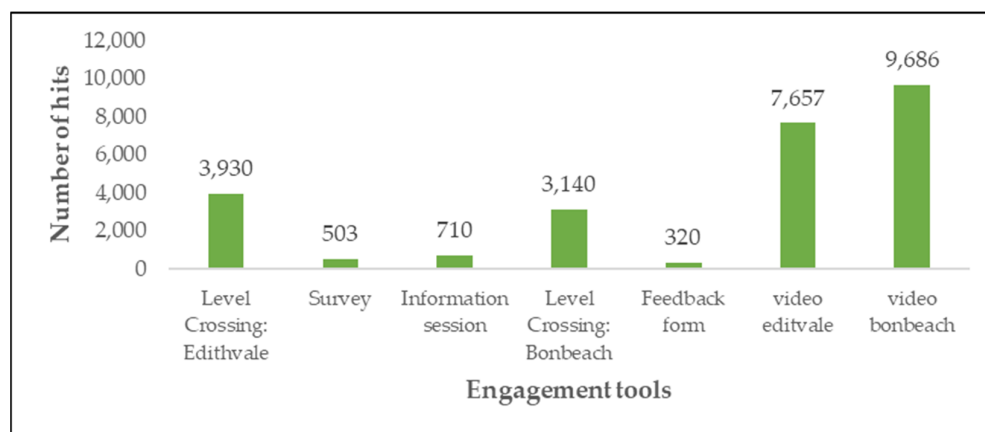


Figure 7. Case Study 2: Engagement Phase 2.

Phase 3: A community reference group (CRG) was formed to strengthen links with the community and share information about the EES process and outcomes. The discussion topics included key areas of interest and more in-depth conversations about the impacts and mitigation measures that would be implemented during the construction phase. The result of Phase 3 engagement included more than 3000 visits to the online engagement hub and 173 survey responses (100% completed) received from the “Have your say” survey. Furthermore, quantitative research was conducted to assess baseline awareness and showed 69 percent of the Edithvale respondents had ‘some’ awareness of the EES and 63 percent of the Bonbeach respondents had ‘some’ awareness of the EES. More issues regarding the impacts on residents during construction, the impact on traffic flow, and consideration for pedestrians and children using the area were raised through the telephone survey.

Phase 4: Phase 4 was designed to allow public stakeholders to view the information presented in the EES and seek feedback through formal channels. The methods of engagement used in this phase are like the methods used in previous phases, as they were deemed to be effective [44]. However, the objective of this phase was to inform the public and other stakeholders about decisions made regarding the project’s development and to maintain continuous engagement [46].

Phase 5: This phase can be seen as a separate engagement process from the rest of the phases. This is because an additional engagement plan, i.e., the comprehensive community and stakeholder management plan, was developed to maintain ongoing communication with public stakeholders through the project delivery stage. The plan was developed to meet the requirements of public stakeholders about construction works and potential impacts. Also, resources were dedicated to handling issues and concerns rather than raising awareness of the project. The objectives of this plan also included:

- Achieve a high level of awareness with residents, businesses, and stakeholders regarding construction works,
- Continuous communication with public stakeholders to provide feedback and concerns, and
- Engage directly to notify the public stakeholders of impact mitigation measures and any disruptions to the routine.

4.2.4. Stakeholder Liaison Group

A stakeholder liaison group (SLG) was formed to help facilitate communication during the construction process. This was one of the key avenues for community involvement, as the members consisted of residents and representatives from local community groups. Members would meet bi-monthly to discuss any concerns or issues from a local perspective. This ongoing engagement with public stakeholders during the project delivery stage maintained continuous and effective communication between the project team and the public stakeholders. These briefings helped strengthen relationships, encourage participation, and increase understanding of project issues and opportunities. Hence, the opportunities for conflicts of interest that may lead to active project opposition are reduced.

4.3. Case Study 3—Sydney Metro: Chatswood to Sydenham

4.3.1. Scope

Sydney Metro—Chatswood to Sydenham is a project within the Sydney Metro City & Southwest program. The scope of Case Study 3 includes:

- New 15.5-km twin railway tunnels between the end of Sydney Metro Northwest at Chatswood and Sydenham,
- New stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, and Waterloo, along with new underground platforms at Central Station,
- The construction started in early 2017 and is expected to be ready for service in 2024. The main objective of the project is to improve the quality of the transport experience for customers so that the system satisfies Sydney's growing demands. The project extends over four local government areas, starting with Willoughby, North Sydney, the City of Sydney, and Marrickville.

4.3.2. Public Stakeholder

According to relatively recent statistics, there are approximately 152,000 residents in the surrounding areas of construction who are therefore affected by the construction work [47]. In 2014, the four local government areas had a combined estimated resident population of 207,421 people, and the 2011 census stated that the areas also had a combined worker population of more than 430,000 [47]. About 37.3 percent of the people working in the area traveled by train for all or part of their journey to work [47]. In addition to residential and commercial infrastructure, a wide range of community services and facilities are on or near the project's construction site. Thus, the public stakeholders can experience social impacts due to their proximity during the construction process.

4.3.3. Engagement Process

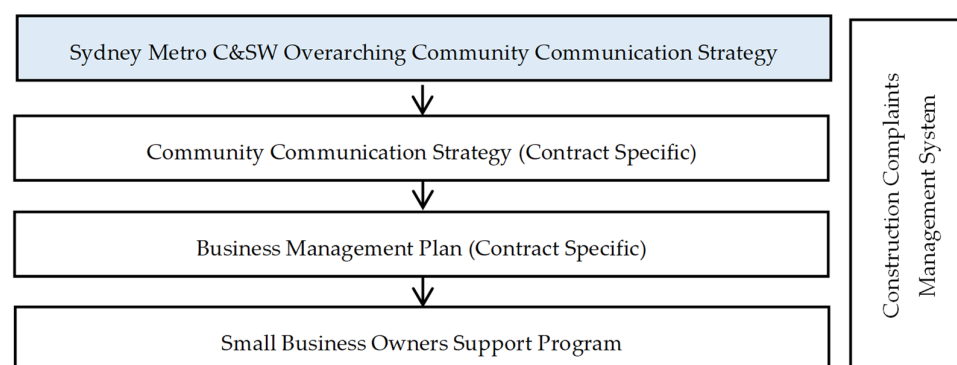
The engagement process for the SM CS was divided into two phases. The first phase was stakeholder and community engagement for the environmental impact statement. The second phase of the engagement process was called the overarching community communication strategy (OCCS).

Phase 1: This phase began following the announcement of the Sydney rapid transit in June 2014 and ended in 2016 [47]. It played an integral role in informing and scoping investigations into the development of the environmental impact statement. The program was divided up into key milestones, as shown in Table 3.

Table 3. Case Study 3 engagement phase 1.

Milestones	Tools	Outcome
Consultation with stakeholders	Information centers, websites, and relevant fact sheets	Enhancing stakeholder awareness
Project scope consultation	Community information lines, community email campaigns, and websites	To collate stakeholders' feedback concerning project scope. This resulted in 10,839 site visits to the online forum
Announcements on project progression	Press and media releases, animation, printed information, translation for announcements in different languages, newspapers, 'project information' flyers, and fridge magnets	Directly affected stakeholders were also notified individually.

Phase 2: Engagement strategy hierarchy. The overarching community communication strategy was prepared to guide the Sydney Metro City and Southwest (C&SW) approach to stakeholder and community liaison during all works and to address the requirements of each project's planning approval. This phase was not divided into different activities but rather into a set of strategies to govern the communication strategies. The document was prepared by Sydney Metro to ensure a coordinated approach to stakeholder, business, and community liaison across the entire program of work [47]. A contract-specific community communication strategy will be prepared by each contract-specific communication team according to their work package. The hierarchy of the engagement strategy is shown in Figure 8.

**Figure 8.** Case Study 3: Engagement Phase 2.

The monitoring program assesses the effectiveness of the strategies to inform and minimize the impacts of the construction on public stakeholders. Each performance parameter has a set of success measures, monitoring strategies, and reporting processes.

4.3.4. JHCPBG Community Communication Strategy for Tunnel and Station Excavation Works

This document outlined the approach used by [47] to manage communication on the TSE Works and meet community relations obligations. It detailed the strategies, resources, methodology, and communication tools used for all TSE worksites. Sydney Metro maintained certain digital communication systems and processes, such as the official project website and social media handles. While [47] was responsible for face-to-face communications, work notifications, and traffic communications, [47] provided monthly reports to Sydney Metro for the duration of the work, which summarized community contacts and communication activities undertaken and planned for the following month [48].

5. Analysis Process

The tools selected to analyze the key components of the engagement process are the comparison matrix (Table 4) and the SWOT analysis (conducted in Section 5.2.2). The comparison matrix visualizes the similarities and differences between each case study, which are then closely examined for further discussion, as shown in Table 4.

Table 4. Matrix outlining a comparison between the 3 case studies.

Component	Case Study 1	Case Study 2	Case Study 3
Principle	Effective Timely Meaningful No surprises	Responsiveness Openness Inclusiveness Transparency and integrity Accountability Awareness	Not stated
Public stakeholder register	✓	Not stated	✓
Measure of success	✓	Not stated	✓
Complaint management	✓	✓	✓
Community reference group	Per precinct	Per precinct	Not stated
Review and evaluation	Annually	Not stated	Annually
Standards, guidelines, and references	Australian Standard AS/NZS 10002: 2014 [49] Guidelines for Complaint Management in Organisations. International Association for Public Participation (IAP2). The Infrastructure Sustainability Council of Australia (ISCA): Infrastructure Sustainability (IS). Better Practice Guide for Public Participation in Government Decision-Making.	Transport Integration Act 2010. Environment Effects Act 1978. Victorian Government Accessible Communications Guidelines 2014. Victorian Governments Communication Guidelines 2013. Victorian Auditor-General's Office Public Participation in Government Decision-Making Guide 2015.	Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation. Australian Standard AS/NZS 10002: 2014 [49] Guidelines for Complaint Management in Organisations.

The comparison matrix in Table 4, was also used to identify the missing components to be discussed in the SWOT analysis.

5.1. Engagement Tools

The first component is the engagement tools used in the engagement process. As discussed before, the four levels of engagement consist of informing, consulting, involving, and collaborating. Case Studies 1 and 3 classified the tools into three formats: printed communication, digital communication, and direct communication. While Table 5 categorizes the tools by their format and level of engagement, Figure 8 outlines the level of engagement with each tool.

Further, as shown in Figure 9, Case Studies 1 and 3 adopted similar engagement approaches due to their similar project scopes. Both case studies used digital communication as the engagement tool, with the highest usage at 51 percent and 52 percent, respectively. Also, official project websites for both case studies were shown to be an effective tool for engagement as they became a central point of up-to-date information that was easily accessible to a high number of public stakeholders, with more than 200,000 hits for Case Study 1.

The number of people reached with direct communication was less than 5 percent for both Case Studies 1 and 3. The public was able to attend community information sessions and pop-up stalls, but only representatives from specific public stakeholder groups were invited to ongoing project and industry briefings. The level of engagement for the public stakeholders was kept at involving and consulting by the project team. Mass public participation would have posed too much risk and unwarranted chaos, hence the lower percentage of direct communication. Methods such as social surveys and online forums

were therefore used instead to gain direct input from public stakeholders, as they could be employed in a controlled manner. Social media was also used as a platform to raise awareness and involve public stakeholders, but the numbers were not as significant as those on the official website. An interesting finding was that, though social media has become the go-to platform for information sharing and is widely used, the number of hits was quite low.

Table 5. Engagement Tools used in the case studies.

Types of Communication	Medium	Level of Engagement
Printed	Fact sheets	Inform
	Newsletters	Inform
	Newspaper ads	Inform
	Site signage	Inform
	Postcard	Inform
Digital	Email updates	Inform
	Media and press release	Inform
	Social media updates	Inform
	Website	Inform and Involve
	Online Forum	Involve
Direct	Meetings	Involve and Collaborate
	Information sessions	Involve and Collaborate
	Door knocks	Involve and Collaborate
	Community event stall	Involve and Collaborate
	Information Centres	Involve and Collaborate
	Hotlines	Involve
	Personalized letters	Involve and Collaborate
	Pop-up stands	Involve
	Presentations	Involve and Collaborate

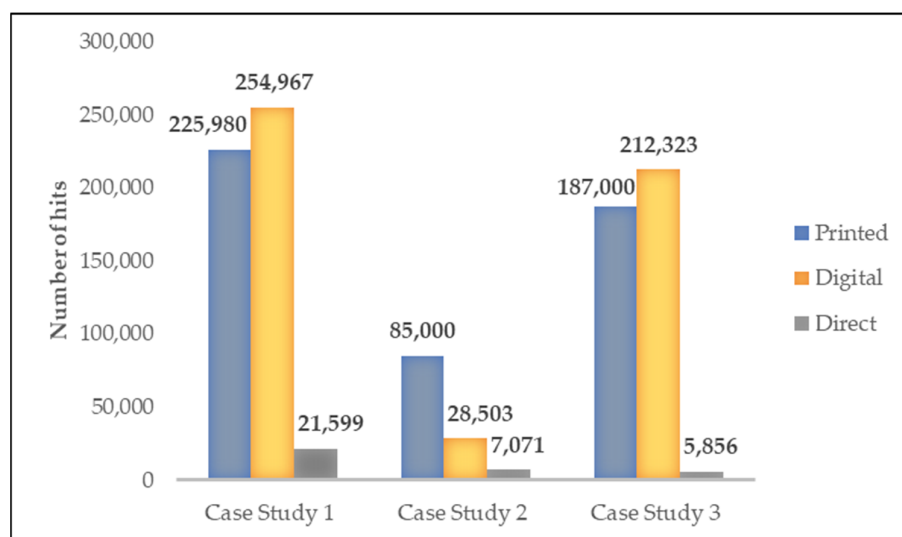


Figure 9. Usage of Engagement Tools in All Case Studies.

On the contrary, Case Study 2 had the highest number of public stakeholders reached using printed communication. The difference between printed and digital communication can be attributed to the lack of data regarding the number of website hits. However, it was expected that the website would receive a significant number of hits from public stakeholders. The direct communication percentage for Case Study 2 was slightly higher than in Case Studies 1 and 3 at 6 percent, although if observed from the actual population, direct communication methods were able to reach more than half of the residents of the

affected areas in Case Study 2. Due to the scale of the project, the engagement level in Case Study 2 among the public stakeholders was very high. Feedback-oriented engagement methods were implemented as a result, including online engagement hubs, feedback forms, and community sessions. It is also important to note that the average age range for the demographic of Case Study 2 was around 40 years old. Even though digital communications are effective, this case study demonstrated that the tools chosen must reflect the characteristics of the receiver.

5.1.1. Linguistically Diverse Community

Additionally, [47] identifies culturally and linguistically diverse (CALD) communities by three variables: country of birth, a language other than English spoken at home, and English language proficiency. Case Studies 1 and 3 were in highly urbanized, densely populated, and diverse areas where there are culturally diverse communities with a high proportion of people born overseas and people who speak a language other than English at home [50–53]. Figure 10 shows the proportion of the population in each case study that speaks a language other than English at home.

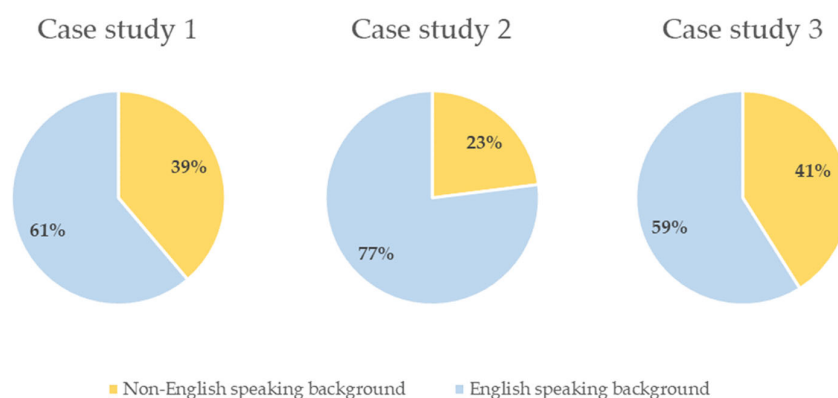


Figure 10. CALD Population of Selected Case Studies.

The CALD population of the affected area in Case Studies 1 and 3 may pose a challenge to the engagement process as there is a possible linguistic barrier between the communications provided and the receiver. The project teams in the case studies, therefore, included tools to minimize the impact of this issue, and all the engagement processes used have a section on how to approach CALD communities. The tools include:

- Publication and distribution of translated printed information to specific communities,
- Advertisement in the community ethnic newspaper, where appropriate,
- Establishing several purpose-specific relationships with existing multicultural community structures to provide a conduit to local CALD communities; these became known as the Melbourne Metro Rail (MMR) CALD hubs,
- Targeted community information sessions,
- Google Translate feature on the official website,
- Promotion of interpreter phone numbers and the availability of translation services in public information, and
- Utilization of the established CALD community centers.

5.1.2. Complaint Management

The channels established to receive feedback and complaints were the project information line, interpreter line, online submission on the official project website, and email. The complaint management suggested by Case Studies 1 and 3 was consistent with the Australian standard AS/NZS 10002: 2014 [49] Guidelines for complaint management in organisations. The approach was integrated with the MMRA's and the work package contractors' environmental management systems. The MMRA maintained all the com-

munication lines and established processes with the contractors to manage inquiries and complaints relating to their work packages. Contractors were not permitted to establish their communication lines; however, email addresses were permitted to be established subject to approval by the MMRA. In comparison, complaints were redirected to contractor delivery communication teams as required in Case Study 3. The Case Study 3 project team developed a construction complaints management system to outline the procedure for managing complaints across Sydney Metro. The complaint management of Case Study 2 was not accessible to the public and, therefore, cannot be compared directly with the other case studies. Nevertheless, their feedback webpage included relevant contact details and various communication channels for the public, which are assumed to be dealt with directly by LXRA. Additionally, Case Studies 1 and 2 utilized a third-party complaint management office called the public transport ombudsman.

5.2. Measures of Success

Case Studies 1 and 3 implemented suitable measures of success in their engagement process. Case Study 2 had no evidence of success measures integrated into its early engagement plan, but it was suggested that appropriate action plans were developed into its comprehensive community and stakeholder management plan for the project's delivery.

5.2.1. Engagement Tools

The demographic of the public stakeholders is diverse in many aspects, such as age, cultural background, and education. As mentioned in the literature review, selecting a suitable method of communication plays a critical role in effective public engagement, so by employing multifaceted communication channels, the project team was able to provide a clear communication stream to public stakeholders. The tools selected were reflective of the expected norms of accessible, visual, and interactive information to accommodate the increased reliance on smartphones and social media.

The first phase of all the engagement processes was to raise awareness for the project, which would be classified as the first level of engagement, "to inform". According to the IAP2 Spectrum, this level of engagement aims to provide the public with balanced and objective information to assist them in understanding the problems, alternatives, opportunities, and solutions.

As a result, large amounts of printed communication were distributed across the affected areas. The content of the printed communication detailed the scope of the project, the project benefits, and relevant infographics to add visual elements [43]. Choosing a suitable method of communication, such as postcards, to raise awareness was a very practical decision, as the small yet significant information would not overwhelm or mislead the receiver. Additionally, social media platforms and website channels were established to reach a wider audience and increase project awareness. These tools can encourage participation by including a range of contact details.

In the second and third phases of the engagement process for all the case studies, more direct communication tools were used. Industry briefings, information sessions, and community meetings were the main actions implemented by all the project teams. Specific issues and key concerns regarding traffic disruption, project design, and noise pollution were raised by public stakeholders attending these face-to-face meetings. These community considerations were then incorporated into the decision-making process for the projects, thereby achieving one of the aims of the engagement process [15]. Public stakeholders have a high interest in social impacts and potential disruption to their livelihoods, so the direct communication actions taken by the project team would therefore allow them to influence the project in a controlled manner, thus decreasing unexpected conflict. Their interest levels would be managed accordingly, and the project team can also monitor the public stakeholders' attitudes toward the project and implement further actions if needed.

5.2.2. SWOT Analysis

The SWOT analyses of Case Study 1, Case Study 2, and Case Study 3 are shown in Figures 11–13, respectively.

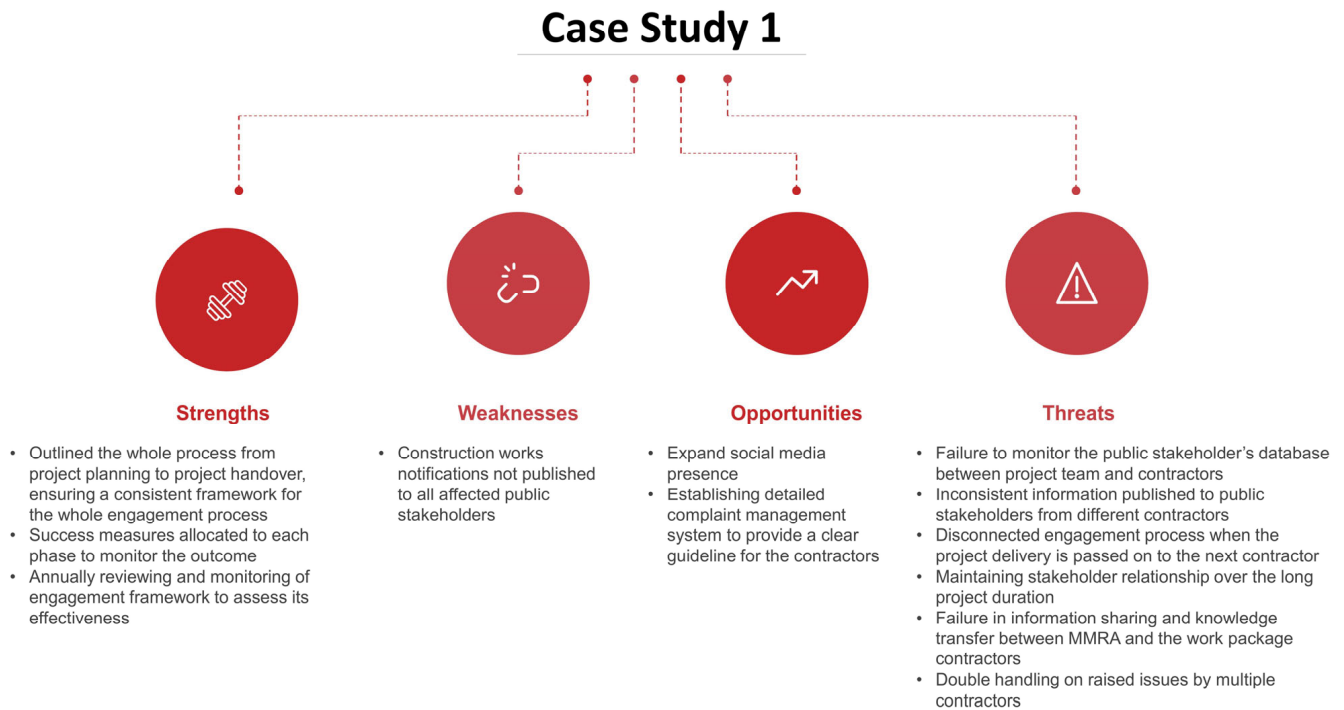


Figure 11. SWOT Analysis for Case Study 1.

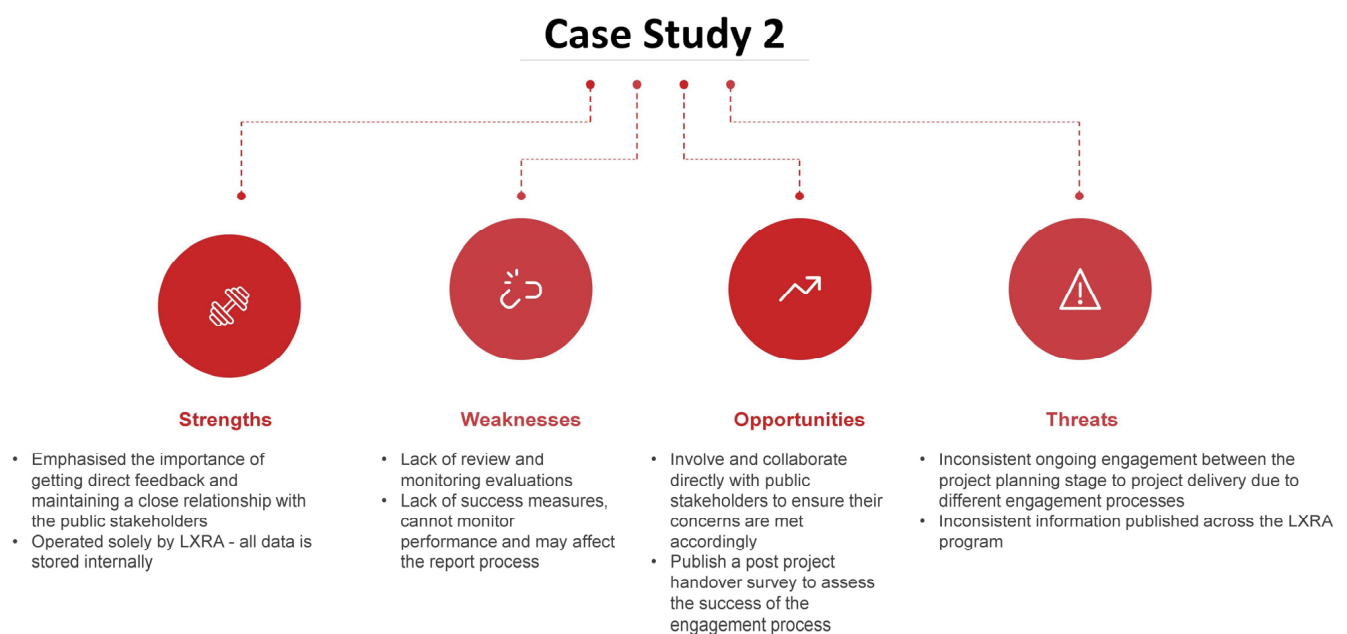


Figure 12. SWOT Analysis for Case Study 2.

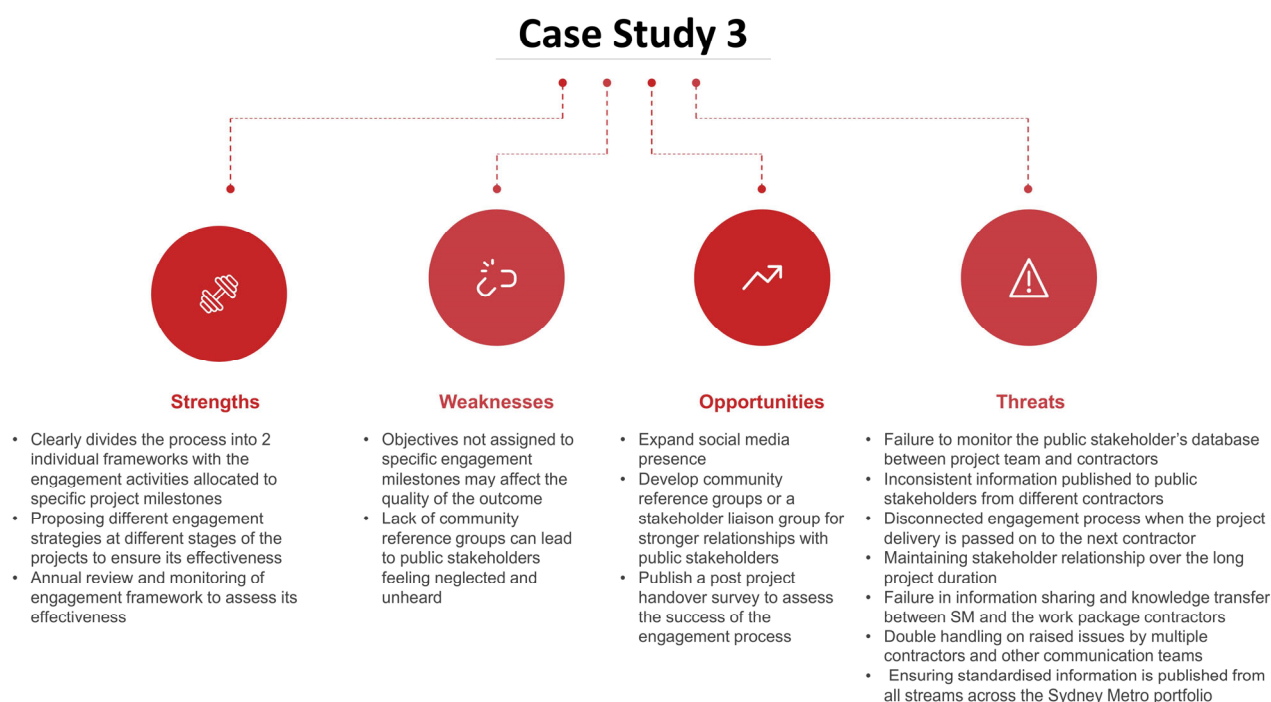


Figure 13. SWOT Analysis for Case Study 3.

Case Studies 1 and 3 will span over the next few years, so the above SWOT analysis can still be helpful for those projects. Additionally, with constant monitoring and review, the processes can be adjusted accordingly to the public's stakeholder concerns. These adjustments will allow the engagement process to be more effective as the project moves through different phases. Case Study 2 was shorter in duration; nonetheless, the LXRA program is still being used, meaning the LXRA can use the lessons learned from this engagement process to improve the engagement process for other similar projects within the LXRA program. All engagement processes must maintain frequent communication with public stakeholders, as this is considered one of the threats due to the long project duration and therefore one of the critical success factors raised by [29].

5.2.3. Findings of the SWOT Analysis

Case Study 1 was divided up into six continuous phases, with Phase 1 to Phase 3 dedicated to the EES preparation and Phase 4 to Phase 6 governing the construction and delivery of the project. Case Studies 2 and 3 took a different approach, where the engagement process for the assessment and the actual delivery of the project were separated. Case Study 1 assigned distinct objectives to each phase, while Case Studies 2 and 3 set overall objectives. With this, the actions implemented for each phase were given a clear goal to achieve, and their success was monitored closely by the project team. It remains unclear to what degree the success of the engagement process is attributed to how the objectives are set, but it is important for each engagement action to have a clear purpose. To support the SWOT analysis, Table 6 presents an overview of the engagement objectives in all three case studies.

Table 6. The engagement objectives in all three case studies.

Engagement Objectives	Case Study 1						Case Study 2	Case Study 3	
	P1	P2	P3	P4	P5	P6	-	P1	P2
Raising awareness of the public concerning construction projects	✓	✓	X	X	X	X	✓	✓	X
Keeping stakeholders informed about the progress and any pertinent developments within the project	✓	✓	X	X	X	X	✓	✓	X
Maintain goodwill and community relationships to ensure that there is a buy-in from the public opinion perspective	X	X	X	X	X	X	X	✓	X
Encourage public stakeholders' involvement where an engagement opportunity arises	✓	✓	X	X	X	X	✓	✓	X
Inform public stakeholders of project outcome, how feedback was used, and relevant impacts	X	X	✓	✓	X	X	✓	✓	X
Minimise the project's negative impacts on stakeholders, where possible	X	X	X	X	✓	✓	X	X	✓
Supporting contractors with the stakeholder engagement process	X	X	X	✓	✓	✓	X	X	✓
Establish a clear notification process if certain impacts arise to notify relevant parties using the set notification protocol	X	X	X	✓	✓	X	X	X	✓
Provide advance notice of construction work including signage, adverts, and notices	X	X	X	X	✓	✓	X	X	✓
Support transition from construction to operation post-implementation	X	X	X	X	✓	✓	X	X	✓

Engagement processes within Case Studies 1 and 2 were both driven by the principles outlined in the SWOT analysis in Figures 11 and 12. The principles focused on providing a clear and transparent process for the development of the case studies based on the concerns of public stakeholders, which would immensely help the project team establish a solid, trusting relationship. Finally, as this section demonstrated, there are many central components of a stakeholder engagement process for public stakeholders in large transport infrastructure projects. These range from keeping stakeholders informed to supporting the transition from construction to operation. Such essential stakeholder engagement needs to be conducted from the initiation stage to the delivery phase. Nonetheless, the key

strategic initiatives for large transport infrastructure planning lie in successful stakeholder engagement.

Moreover, as this analysis shows, there are common factors that affect the outcome of large transportation infrastructure projects. First and foremost is the early involvement of key stakeholders during the planning stage of such projects. Stakeholders' early involvement during the project's initiation ensures that all involved communities and other entities clearly understand the overall objectives of such projects. Finally, this involvement also needs to be ongoing through the conclusion of such projects to ensure overall stakeholder satisfaction.

6. Conclusions and Recommendations

This research undertook an in-depth analysis of stakeholder management processes, large transport infrastructure complexities, and stakeholder engagement as a holistic framework. To support this analysis, three case studies were undertaken: Case Study 1: Melbourne Metro Tunnel; Case Study 2: Level Crossing Removal Program—Edithvale and Bonbeach; and Case Study 3: Sydney Metro—Chatswood to Sydenham. All these studies showed various challenges when dealing with external stakeholders. This was due to public stakeholders' differing interests in the project, which became a great source of uncertainty that may lead to project failure. The public stakeholders' engagement process aimed to minimize and monitor these concerns, and thus a range of components were included to mitigate engagement risks associated with different areas of concern. Further, the analysis of the case studies showed three essential components that made up the core of the engagement process. The first component was the engagement framework, referring to the supporting structure of the engagement process that is used to guide the project team in implementing the best practices of engagement. The second component was a comprehensive list of engagement objectives. The objectives can govern the whole engagement process or be allocated to specific phases or milestones of the engagement process. The impacts of the large transport infrastructures mentioned previously have been shown to directly impact the livelihoods of public stakeholders; thus, the objectives must address these concerns.

The analysis of the case studies also showed that the recurring objectives are to minimize project impact on public stakeholders, address the concerns raised by public stakeholders, and ensure that public stakeholders fully understand the activities undertaken to complete the project. Additional objectives can be added depending on the project's context, but the ones mentioned must be included in the engagement process. The last essential component was the engagement tools and activities used to communicate with the stakeholders. The project team must consider the message they are communicating to public stakeholders and select the right medium to effectively convey that message. The engagement process objectives dictate the goals of the engagement phase, which can be used to determine the level of engagement required. After this, the most suitable engagement tools can be selected according to the engagement level. Factors such as the demographics of the public stakeholders and the geographical location of those affected were shown to influence the tools used for communication. Other components should be included according to the characteristics of the project's public stakeholders. As already discussed, the public stakeholders in the case studies had a relatively high percentage of people from non-English-speaking backgrounds. Appropriate measures were incorporated into the engagement process to lessen the language barrier and establish a common ground for ongoing communications. Measures of success should also be incorporated into the engagement process to evaluate the performance of the engagement activities. The results can indicate the effectiveness of engagement activities and be used to further reassess the communication plan if needed. Complaint management is also a part of the ongoing monitoring process, where it plays a crucial role in observing the public stakeholder attitude towards the project. Any complaints about the project should be immediately dealt with

by the project team along with the principal contractor. This will minimize any potential project opposition, which can negatively impact the probability of project success.

From the research conducted, many recommendations have been made to develop an effective engagement process for public stakeholders in large transport infrastructures. Large transport infrastructures tend to have long durations and high project complexity. There will be many teams involved in the process, as well as principal contractors and government bodies. Hence, the communications and resources utilized must be consistent throughout the whole project duration. Information sharing and knowledge transfer played an integral role in facilitating communication between the project teams due to the complexity of the communication network. Additionally, the database of the public stakeholders' contacts and correspondence must be secured and shared appropriately among the teams involved. This systematic procedure will aid engagement implementation and minimize miscommunication and double handling of work. The project team must establish regular coordination meetings with relevant work package contractors to ensure ongoing communication. Furthermore, the organizational structure must be understood across the different teams, with a clear division of roles and responsibilities. Internal communications must be well established to facilitate communication with external parties. Engagement should be carried out at the earliest opportunity, as shown in the present research, where all case studies implemented engagement activities during the early stages of planning. This is recommended for large transport infrastructures due to the high cost and impact associated with the project, which tend to attract high levels of attention from the public. Public stakeholders do not hold any formal power over the project but can greatly influence its success. By engaging with public stakeholders in the preliminary stage of the project, their concerns can be integrated into the decision-making process, mitigating potential conflict. Their attitude towards the project should be monitored closely to develop an effective engagement plan for the construction and delivery phases.

Author Contributions: Conceptualization, C.N.; Methodology, K.G., A.H.-F., K.F.T. and K.M.; Validation, C.N. and K.F.T.; Formal analysis, C.N. and K.G.; Investigation, C.N.; Resources, K.G., A.H.-F. and K.M.; Data curation, K.G.; Writing—original draft, C.N. and A.H.-F.; Writing—review & editing, K.G.; Supervision, K.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data may be attainable upon request from the correspondence author.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

CBD	Central Business District
CRG	Community Reference Group
CALD	Culturally and Linguistically Diverse
EES	Environment Effect Statement
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
IAP2	International Association of Public Participation
LXRA	Level Crossing Removal Authority
LXRP	Level Crossing Removal Program
MMR	Melbourne Metro Rail
MMRA	Melbourne Metro Rail Authority
MTP	Metro Tunnel Project
OCCS	Overarching Community Communication Strategy
SLG	Stakeholder Liaison Group
C&SW	Sydney Metro City and Southwest

References

1. Zhuhadar, L.; Thrasher, E.; Marklin, S.; Ordonezde Pablos, P. The next wave of innovation—Review of smart cities intelligent operation systems. *Comput. Hum. Behav.* **2017**, *66*, 273–281. [\[CrossRef\]](#)
2. Krasemann, T. Computational decision-support for railway traffic management and associated configuration challenges: An experimental study. *J. Rail Transp. Plan. Manag.* **2015**, *5*, 95–109. [\[CrossRef\]](#)
3. Rangarajan, K.; Long, S.; Tobias, A.; Keister, M. The role of stakeholder engagement in the development of sustainable rail infrastructure systems. *Res. Transp. Bus. Manag.* **2013**, *7*, 106–113. [\[CrossRef\]](#)
4. Coppens, T.; Van Dooren, W.; Thijssen, P. Public opposition and the neighborhood effect: How social interaction explains protest against a large infrastructure project. *Land Use Policy* **2018**, *79*, 633–640. [\[CrossRef\]](#)
5. Deegan, B.; Parkin, J. Planning cycling networks: Human factors and design processes. *Proc. Inst. Civ. Eng.—Eng. Sustain.* **2011**, *164*, 85–93. [\[CrossRef\]](#)
6. Gharehbaghi, K.; McManus, K.; Robson, K. Minimizing the environmental impacts of mega infrastructure projects: Australian public transport perspective. *J. Eng. Des. Technol.* **2019**, *17*, 736–746. [\[CrossRef\]](#)
7. Aaltonen, K.; Jaakko, K.; Tuomas, O. Stakeholder salience in global projects International. *J. Proj. Manag.* **2008**, *26*, 509–516.
8. Saidi, S.; Wirasinghe, S.; Kattan, L.; Esmaeilnejad, S. A generalized framework for complex urban rail transit network analysis. *Transp. A Transp. Sci.* **2017**, *13*, 874–892. [\[CrossRef\]](#)
9. Soteropoulos, A.; Mitteregger, M.; Berger, M.; Zwirchmayr, J. Automated drivability: Toward an assessment of the spatial deployment of level 4 automated vehicles. *Transp. Res. Part A Policy Pract.* **2020**, *136*, 64–84. [\[CrossRef\]](#)
10. Adli, S.; Chowdhury, S.; Shiftan, Y. Justice in public transport systems: A comparative study of Auckland, Brisbane, Perth and Vancouver. *Cities* **2019**, *90*, 88–99. [\[CrossRef\]](#)
11. Bar, L.; Ossewaarde, M.; van Gerven, M. The ideological justifications of the Smart City of Hamburg. *Cities* **2020**, *105*, 102811. [\[CrossRef\]](#)
12. Cao, W.; Feng, X.; Zhang, H. The structural and spatial properties of the high-speed railway network in China: A complex network perspective. *J. Rail Transp. Plan. Manag.* **2019**, *9*, 46–56. [\[CrossRef\]](#)
13. Chen, N.; Wang, C. Does green transportation promote accessibility for equity in medium-size U.S. cities? *Transp. Res. Part D Transp. Environ.* **2020**, *84*, 102365. [\[CrossRef\]](#)
14. Cordera, R.; Ibeas, A.; Okio, L.; Alonso, B. *Land Use–Transport Interaction Models*; CRC Press: Boca Raton, FL, USA, 2018; pp. 89–96.
15. Eldijk, J.; Gil, J.; Kuska, N.; Patro, R. Missing links—Quantifying barrier effects of transport infrastructure on local accessibility. *Transp. Res. Part D Transp. Environ.* **2020**, *85*, 102410. [\[CrossRef\]](#)
16. Kurth, M.; Kozłowski, W.; Ganin, A.; Mersky, A.; Leung, B.; Dykes, J.; Kitsak, M.; Linkov, I. Lack of resilience in transportation networks: Economic implications. *Transp. Res. Part D Transp. Environ.* **2020**, *86*, 102419. [\[CrossRef\]](#)
17. McCahill, C.; Jain, S.; Brenneis, M. Comparative assessment of accessibility metrics across the U.S. *Transp. Res. Part D Transp. Environ.* **2020**, *83*, 102328. [\[CrossRef\]](#)
18. Reggiani, A.; Nijkamp, P. Transport resilience and vulnerability: The role of connectivity. *Transp. Res. Part A Policy Pract.* **2015**, *81*, 4–15. [\[CrossRef\]](#)
19. Aaltonen, K.; Kujala, J. A project lifecycle perspective on stakeholder influence strategies in global projects. *Scand. J. Manag.* **2010**, *26*, 381–397. [\[CrossRef\]](#)
20. Zenkteler, M.; Foth, M.; Hearn, G. Lifestyle cities, remote work and implications for urban planning. *Aust. Plan.* **2022**, *58*, 25–35. [\[CrossRef\]](#)
21. Ng, S.; Li, T.; Wong, J. Rethinking public participation in infrastructure projects. *Proc. Inst. Civ. Eng.—Munic. Eng.* **2012**, *165*, 101–113. [\[CrossRef\]](#)
22. Karlsen, J. Project Stakeholder Management. *Eng. Manag. J.* **2002**, *14*, 19–24. [\[CrossRef\]](#)
23. Li, T.; Ng, S.; Skitmore, M. Evaluating stakeholder satisfaction during public participation in major infrastructure and construction projects: A fuzzy approach. *Autom. Constr.* **2013**, *29*, 123–135. [\[CrossRef\]](#)
24. Gharehbaghi, K.; McManus, K.; Hurst, N.; Robson, K.; Pagliara, F.; Eves, C. Advanced rail transportation infrastructure as the basis of improved urban mobility: Research into Sydney as a smart city. *Aust. Plan.* **2023**, *in press*. [\[CrossRef\]](#)
25. Gharehbaghi, K.; McManus, K.; Myers, M. Utilization of adaptive methodology to underpin rail transportation systems: Sydney metro’s methodical formulation. *J. Eng. Des. Technol.* **2022**, *20*, 1132–1153. [\[CrossRef\]](#)
26. Lobo, S.; Abid, A. The Role of Social Media in Intra-stakeholder Strategies to Influence Decision Making in a UK Infrastructure Megaproject: Crossrail 2. *Proj. Manag. J.* **2019**, *51*, 96–119. [\[CrossRef\]](#)
27. Locatelli, G.; Invernizzi, D.; Brookes, N. Project characteristics and performance in Europe: An empirical analysis for large transport infrastructure projects. *Transp. Res. Part A Policy Pract.* **2017**, *98*, 108–122. [\[CrossRef\]](#)
28. Mathur, V.; Price, A.; Austin, S. Conceptualizing stakeholder engagement in the context of sustainability and its assessment. *Constr. Manag. Econ.* **2008**, *26*, 601–609. [\[CrossRef\]](#)
29. Ninan, J.; Mahalingam, A.; Clegg, S. External Stakeholder Management Strategies and Resources in Megaprojects: An Organizational Power Perspective. *Proj. Manag. J.* **2019**, *50*, 625–640. [\[CrossRef\]](#)
30. Olander, S.; Landin, A. Evaluation of stakeholder influence in the implementation of construction projects. *Int. J. Proj. Manag.* **2005**, *23*, 321–328. [\[CrossRef\]](#)

31. Zeng, S.; Ma, H.; Lin, H.; Zeng, R.; Tam, V. Social responsibility of major infrastructure projects in China International. *J. Proj. Manag.* **2015**, *33*, 537–548.
32. Gharehbaghi, K.; McManus, K. TIS condition monitoring using ANN integration: An overview. *J. Eng. Des. Technol.* **2019**, *17*, 204–217. [[CrossRef](#)]
33. Mok, K.; Shen, G.; Yang, J. Stakeholder management studies in mega construction projects: A review and future directions. *Int. J. Proj. Manag.* **2015**, *33*, 446–457. [[CrossRef](#)]
34. Olander, S.; Landin, A. A comparative study of factors affecting the external stakeholder management process. *Constr. Manag. Econ.* **2008**, *26*, 553–561. [[CrossRef](#)]
35. Ollerenshaw, A.; Murphy, A.; McDonald, K. Leading the way: The integral role of local government within a multisector partnership delivering a large infrastructure project in an Australian growth region. *Local Gov. Stud.* **2017**, *43*, 291–314. [[CrossRef](#)]
36. Yu, J.; Leung, M. Exploring factors of preparing public engagement for large-scale development projects via a focus group study. *Int. J. Proj. Manag.* **2015**, *33*, 1124–1135. [[CrossRef](#)]
37. Yeo, K. Planning and learning in major infrastructure development: Systems perspectives. *Int. J. Proj. Manag.* **1995**, *13*, 287–293. [[CrossRef](#)]
38. Jiang, H.; Qiang, M.; Lin, P. Assessment of online public opinions on large infrastructure projects: A case study of the Three Gorges Project in China. *Environ. Impact Assess. Rev.* **2016**, *61*, 38–51. [[CrossRef](#)]
39. Gharehbaghi, K.; Hosseini-Far, A.; Hilletoft, P. The predicaments of environmental impact assessment (EIA) for transport infrastructure: An examination of policy stagnation and progress. *Transform. Gov. People Process Policy* **2022**, *16*, 449–463. [[CrossRef](#)]
40. Goodrick, D. *Comparative Case Studies, Methodological Briefs: Impact Evaluation 9*; UNICEF Office of Research: Florence, Italy, 2014.
41. Melbourne Metro Rail Authority. *Melbourne Metro Rail Project EES Community and Stakeholder Engagement Plan*; State Government of Victoria: Melbourne, Australia, 2016.
42. Melbourne Metro Rail Authority. *Community and Stakeholder Engagement Management Framework Metro Tunnel*; State Government of Victoria: Melbourne, Australia, 2017.
43. Melbourne Metro Rail Authority. *Melbourne Metro Business Case*; State Government of Victoria: Melbourne, Australia, 2017.
44. Melbourne Metro Rail Authority. *Melbourne Metro Environment Effects Statement*; State Government of Victoria: Melbourne, Australia, 2017.
45. Level Crossing Removal Authority. *Edithvale and Bonbeach Environment Effects Statement (EES)*; State Government of Victoria: Melbourne, Australia, 2016.
46. Level Crossing Removal Authority. *Level Crossing Removal Project Frankston Line Communication and Engagement Report February to June 2016*; State Government of Victoria: Melbourne, Australia, 2016.
47. ABS (Australian Bureau of Statistics). 2023. Available online: <https://www.abs.gov.au/> (accessed on 5 September 2023).
48. Sydney Metro. *Sydney Metro Construction Complaints Management System*; Transport for NSW: Sydney, Australia, 2020.
49. AS/NZS 10002: 2014; Guidelines for complaint management in organizations. Australian Standard: Sydney, Australia, 2014.
50. Sydney Metro. *Sydney Metro Chatswood to Sydenham Environmental Impact Statement*; Transport for NSW: Sydney, Australia, 2016.
51. JHCPBG. *Community Communications Strategy*; JHCPBGH: Australia, Sydney, 2020.
52. Sydney Metro. *Community Communications Strategy—Early Works*; Transport for NSW: Sydney, Australia, 2018.
53. Sydney Metro. *Overarching Community Communications Strategy*; Transport for NSW: Sydney, Australia, 2019.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.