ASSESSMENT OF INCORPORATING SUSTAINABILITY INTO THE DESIGN PHASE OF HIGHWAY PROJECTS IN TÜRKIYE

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ABSTRACT

ASSESSMENT OF INCORPORATNG SUSTAINABILITY INTO THE DESIGN PHASE OF HIGHWAY PROJECTS IN TÜRKIYE

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This study investigates the applicability of infrastructure sustainability rating systems for Turkish highway projects through a case-based evaluation using the Envision rating system. Despite the growing integration of worldwide sustainability frameworks into infrastructure design, their adoption in Türkiye remains limited, particularly within the transportation sector. This study assesses a typical Turkish highway project with Envision v3 to determine the sustainability criteria that align with contemporary design and construction methodologies. In addition to the assessment, semi-structured interviews were performed with key stakeholders, including route engineers, managers, and environmental and social specialists, to evaluate the practical feasibility of integrating Envision criteria into future projects. The findings reveal that some credits pertaining to quality of life, leadership, and climate resilience are partially implemented in existing practices; however, others are underutilized due to legislative deficiencies, insufficient awareness, or contractual constraints. This study contributes to the literature by providing a practical framework for incorporating sustainability concepts into Turkish infrastructure development and identifying context-specific barriers and opportunities for advancement.

Keywords: Sustainability Rating Systems, Sustainability Assessment, Envision, Highway Design, Türkiye

ÖZ

TÜRKİYE'DE OTOYOL PROJELERİNİN TASARIM AŞAMASINA SÜRDÜRÜLEBİLİRLİĞİN DAHİL EDİLMESİNİN DEĞERLENDİRİLMESİ

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Bu çalışma, Envision derecelendirme sistemini kullanarak vaka bazlı bir değerlendirme yoluyla Türk otoyol projeleri için altyapı sürdürülebilirlik derecelendirme sistemlerinin uygulanabilirliğini araştırmaktadır. Dünya çapında sürdürülebilirlik çerçevelerinin altyapı tasarımına giderek daha fazla entegre edilmesine rağmen, Türkiye'de, özellikle ulaştırma sektöründe, bu çerçevelerin benimsenmesi sınırlı kalmaktadır. Bu çalışma, çağdaş tasarım ve inşaat metodolojileriyle uyumlu sürdürülebilirlik kriterlerini belirlemek için tipik bir Türk otoyol projesini Envision v3 ile değerlendirmektedir. Değerlendirmeye ek olarak, Envision kriterlerinin gelecekteki projelere entegre edilmesinin pratik uygulanabilirliğini değerlendirmek için rota mühendisleri, yöneticiler ve çevre ve sosyal uzmanlar dahil olmak üzere kilit paydaşlarla yarı yapılandırılmış görüşmeler yapılmıştır. Bulgular, yaşam kalitesi, liderlik ve iklim direnci ile ilgili bazı kredilerin mevcut uygulamalarda kısmen uygulandığını, ancak diğerlerinin yasal eksiklikler, yetersiz farkındalık veya sözleşme kısıtlamaları nedeniyle yeterince kullanılmadığını ortaya koymaktadır. Bu çalışma, sürdürülebilirlik kavramlarını Türkiye'nin altyapı

gelişimine dahil etmek için pratik bir çerçeve sunarak ve bağlama özgü engelleri ve ilerleme fırsatlarını belirleyerek literatüre katkıda bulunmaktadır.

Anahtar Kelimeler: Sürdürülebilirlik Derecelendirme Sistemleri, Sürdürülebilirlik Değerlendirmesi, Envision, Karayolu Tasarımı, Türkiye

To My Supporting Family

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LIST OF ABBREVIATIONS

ABBREVIATIONS

ACEC	American Council of Engineering Companies
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
EGD	European Green Deal
EIA	Environmental Impact Assessment
ENV SP	Envision Sustainability Professional
EU	European Union
ESIA	Environmental and Social Impact Assessment
HLPF	High-Level Political Forum
GHG	Greenhouse Gases
ISRS	Infrastructure Sustainability Rating Systems
ITS	Intelligent Transportation Systems
LEED	Leadership in Energy and Environmental Design
NDC	Nationally Determined Contribution
SRS	Sustainability Rating Systems
TOPSIS	Technique for Order Preferance by Similarity to the Ideal Solution
TSRS	Transportation Sustainability Rating Systems
VNR	Voluntary National Review Reports

CHAPTER 1

INTRODUCTION

1.1 Motivation and Research Background

As people realize the negative impacts of traditional and unsystematic works on the environment, sustainability becomes a priority around the world. The increasing awareness and emphasis on sustainability are prompting the construction industry to adopt its traditional methods to more sustainable ones, since the industry causes significant harm to the environment through intensive resource consumption and the large amounts of waste production. The construction sector should integrate economic, environmental, and social aspects of sustainability into its practices, while maintaining technical and functional standards (Hellstrom, 2007; International Organization for Standardization, 2019). While the building sector prominently adopted sustainable development principles, recently other sectors, especially the transportation sector, have started to incorporate them as well (Oluwalaiye, 2018). During the 20th century, the establishment of new transportation networks in cities facilitated urban development while also creating numerous sustainability challenges (Millar et al., 2016). The transportation industry is responsible for approximately 15% of global greenhouse gas emissions (GHG) and 23% of global energy-related CO_2 emissions (IEA, 2020). Transportation infrastructure, particularly road construction, is a critical sustainability concern due to its significant land use, environmental costs, resource consumption, and impact on society.

In Türkiye, societal awareness of environmental challenges and institutional initiatives for sustainability has only lately emerged, even though it started earlier in European countries (Ozmehmet, 2008). The nation's adherence to European Union (EU) norms, especially during the EU membership process, has been essential in facilitating these advancements. Türkiye is part of agreements initiated in Europe,

such as the Sustainable Development Goals, the Paris Agreement, and the Green Deal. Through these agreements, Türkiye has made plans for better transportation systems. These plans and policies include, but not limited to, extending the reach of services for smart and sustainable transportation, broadening the range of transportation modes, designing for vulnerable groups, and incorporating electric vehicle and micro mobility intensives (İklim Değişikliği Başkanlığı, n.d.b; T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019; T.C. Ticaret Bakanlığı, 2021). To satisfy these plans, Türkiye, as an EU membership candidate, should gain momentum in incorporating these into highway designs as well.

As Lord Kelvin said (as cited in Ratcliffe, 2012), "What is not defined cannot be measured. What is not measured, cannot be improved. What is not improved, is always degraded". Thus, to initiate and improve the sustainability performance, first, it needs to be measured. Sustainability rating systems (SRS) are developed to meet this need. The construction sector has extensively adopted SRS to assess the degree of sustainability in construction projects (Simpson, 2013). SRS, such as Envision, provides a unified metric for the range of sustainable solutions; aids in quantifying sustainability and rendering it manageable; promotes dialogue regarding sustainability objectives, initiatives, and achievements; and presents a pragmatic framework that allows designers and contractors to develop innovative solutions (Muench, Armstrong, & Allen, 2012). Many studies in the literature show that inclusion of these SRS systems into projects increases their sustainability performance by enhancing cost efficiency, elevating social welfare, diminishing material usage, greater conservation of limited environmental resources, and contributing to the achievement of global sustainability objectives (UN, 2019; Montgomery, Schirmer, & Hirsch, 2014).

1.2 Research Gap and Objectives

Sustainability expectations in infrastructure projects differ for each country due to various factors, including technical standards, legal regulations, and implementation practices. Road construction practices also vary among countries, depending on many aspects, such as used materials, decision making processes, key stakeholder relations, and control mechanisms. Collectively, the aforementioned factors affect the effectiveness of universally developed SRS.

Due to such differences in region-specific effectiveness of SRSs, the exploration of the suitability of different SRSs attracted attention in the literature. For instance, some studies evaluated SRS in highway projects, conducting interview-based analysis (Trop, 2018; Muench et al., 2012). However, most of those studies introduced the general structure of SRS, compared different SRS in terms of context or evaluated which SRS is more appropriate for which country (Oluwalaiye, 2018; Clevenger et al., 2016). On the other hand, current literature lacks information on a systematic approach to assess the level of sustainability of highway projects designed with existing, traditional approaches and suggest context-specific ways to improve their sustainability.

There is a need for solid recommendations, such as how sustainability criteria can be integrated into projects and how barriers encountered in practice can be overcome. Even though existing studies provide a solid foundation for assessing the sustainability of transportation systems, these studies are largely theoretical and lack contextual information that can guide practitioners. This presents a significant shortcoming, particularly in developing countries, as SRS do not function solely as assessment tools but also as decision-support mechanisms.

Based on the need for context-specific exploration of sustainability potential in transportation projects, this study focuses on the case of a developing country, Türkiye. In Türkiye, there is very little application of sustainability-focused evaluation methods in infrastructure projects. Although Türkiye's Environmental

Impact Assessment (EIA) framework provides the principal legal mechanism for evaluating the environmental consequences of infrastructure projects, several limitations persist. The system remains primarily focused on the environmental pillar of sustainability, while social and governance dimensions—such as community engagement, transparency, accountability, and post-construction monitoring—are insufficiently addressed (Tekayak, 2014; Demir, 2022). Moreover, despite strong alignment with EU directives at the regulatory level, implementation and enforcement remain inconsistent across regions due to capacity constraints and institutional fragmentation. The limited public participation and the lack of comprehensive performance monitoring further weaken the effectiveness of the EIA process in ensuring long-term sustainability outcomes (Pehlivanzade & Zaimoğlu, 2023; Savaşan, 2019). To improve success in sustainable practices sustainable rating systems can serve as a helpful tool. However, there are limited tangible examples of the application of comprehensive systems such as Envision within the Turkish context. Previous research has insufficiently examined the degree to which these internationally developed rating systems correspond with Türkiye's institutional framework, legislative regulations, and implementation practices. This results in a deficiency of knowledge and guidance for the advancement of sustainable infrastructure techniques in Türkiye.

Relying on the literature, Envision has been selected as the SRS to be used in this study. The reasons in choosing Envision include: consideration of three pillars of sustainability, covering all project stages, especially the design phase, international applicability, the assessment type, tools for project evaluation, and suitability for highway projects. In a recent study, Censorii et al. (2022) state that the Envision system offers a valuable and comprehensive framework for assessing sustainability in road projects. Similarly, in a study conducted by Szpotowicz and Tóth (2023) using multi-criteria decision-making for Hungary, Envision was identified as the most suitable sustainability system for road projects. Both Hungary and Türkiye being developing countries provide strong evidence and a theoretical basis for using the Envision system in Türkiye. However, while Hungary and Türkiye share similar

economic and administrative characteristics as developing countries, there are significant differences in their institutional and regulatory frameworks for infrastructure projects. As a member of the European Union, Hungary's construction regulations comply with EU directives, and project development often starts with Green Public Procurement (GPP), followed by comprehensive Cost–Benefit Analysis (CBA) and EIA procedures (Szpotowicz & Tóth, 2020). However, in Türkiye, public procurement mechanisms and environmental assessment practices are not yet fully integrated with sustainability-based decision frameworks. Therefore, instead of adopting the framework used in Hungary directly, this study developed an adapted methodological approach that reflects Türkiye's institutional structure, data limitations, and project delivery practices.

Since there is no national-level SRS in Türkiye, the existing level of sustainability of typical projects and the potential to improve their sustainability are unknown. Therefore, this thesis aims to address a fundamental gap in the literature. First, prior studies did not systematically evaluate how an international SRS translates into the institutional and legislative contexts of Türkiye. This gap raises the need to explore the contextual applicability of SRSs in developing countries' highway projects. Second, a structured approach for identifying context-specific sustainability practices that can be integrated into infrastructure projects is missing in the literature. In this context, the primary objective of this study is to analyze a completed highway project in Türkiye within the context of the Envision Sustainability Assessment System (v3) and develop a contextual understanding of the system's applicability at the local level. Two primary research questions are addressed in this context. Two primary research questions are addressed in this context:

- To what extent does the Envision SRS align with the characteristics and practices of traditional highway projects in Türkiye?
- Which currently unimplemented Envision sustainability practices should be incorporated into highway projects in Türkiye, from the perspective of transportation project experts?

A systematic assessment of a typical highway project, which is a widening of an existing two-lane state road project to four lanes and financed with public resources based on project documents, is conducted within the scope of the research. Through semi-structured interviews with project stakeholders, the difficulty level, importance, and potential integration of the Envision criteria are analyzed. Thus, the study examines the applicability of an SRS in Türkiye and offers practical implications for practitioners.

1.3 Overview of Research

This thesis study aims to evaluate the sustainability of a typical highway project in Türkiye by the Envision Sustainability Rating System (V3) and investigate the applicability of Envision in Türkiye conditions to improve sustainability applications. This study follows a mixed-method design that combines quantitative project sustainability evaluation and qualitative thematic analysis of semi-structured interviews with experts.

The first component evaluates the sustainability performance of a typical Turkish highway project. To evaluate the full sustainability performance of a project, a completed highway project is selected so that the project team knows all the ins and outs of that project. During the project selection, the key criteria were that the case study should represent typical engineering design workflows and decision-making structures of highway projects in Türkiye, and that its scope should encompass environmental assessment procedures defined under national regulations, including the preparation of an EIA report. The selected highway project's sustainability is evaluated using 5 main categories and 64 credits from the Envision rating system. This evaluation process was carried out by taking into account only the activities under the responsibility of the design firm. The applicability of each credit is evaluated on a project-specific basis and analyzed by evaluating project documents, reports, and drawings, etc.

The second component of the research is the semi-structured interview with the experts in the fields of environmental engineering, highway alignment engineering, management, and social expertise. The questions asked within the scope of the interview consist of the topics for which the project did not receive any points in the project evaluation in the first component. On a scale of 1 to 5, interviewees were asked to score how difficult it was to implement each Envision requirement and how important they were to the project. Through a quantitative analysis, each asked criteria are classified as directly for inclusion to the projects as; include in projects, scheduled for inclusion, or exclude. For the quantitative data obtained from these interviews, the thematic analysis method is used with MAXQDA 24 software. This analysis reveals how the criteria in the Envision system are perceived by project teams and which criteria are deemed more applicable or challenging, more important or needless in projects in Türkiye.

A technical evaluation of the project documentation is performed according to Envision criteria, alongside semi-structured interviews with the experts, to assess the perceived significance and complexity of the criteria. This sequential integration of numeric and textual evidence characterizes the study as an explanatory mixed-method research and reflects the significance and implications of SRSs. Chapter 3 of this thesis explains the methodology used in more detail.

1.4 Contribution

This thesis aims to contribute at three main levels: theoretical, practical and methodological. These contributions are listed below:

- **Theoretical Contribution:** This study contributes to the theoretical discussions on sustainability assessment in highway projects by demonstrating how internationally developed SRS align with a country-specific regulatory and governance structure through a mixed-method approach. This study conceptualizes the role of SRS not only as an evaluation tool but also as a decision-support mechanism, building on the reflections of highway project stakeholders. This provides a theoretically grounded explanation of how sustainability criteria are interpreted and operationalized in highway projects.
- **Practical Contribution:** This thesis offers project implementers, engineers, managers, and environmental and social specialists, a practical framework for incorporating sustainability criteria into project procedures. Empirical insights obtained from interviews distinctly illustrate which criteria are more readily applicable in highway projects in Türkiye and which provide obstacles due to diverse institutional, economic, or technical factors. This presents definitive facts that will allow both governmental institutions and the private sector to prioritize sustainable practices. Moreover, it emphasizes that the system serves not just for certification but also as a decision-support instrument when included into project management processes.
- **Methodological Contribution:** This study establishes a decision-support technique based on the experiences and viewpoints of field actors, illustrating the applicability of sustainability criteria to project management procedures. This method enables managers to assess Envision criteria in a more pragmatic and relevant manner during the project planning and design stages. Other countries can follow these research tasks, which are exemplified

specifically for Türkiye, and examine the sustainability situation and potential for other countries.

1.5 Outline of Research

This thesis consists of five chapters. Each chapter and its content are expressed below.

Chapter 1 presents the introduction. It contains the study motivation, research background, identified research gap in the literature, overview of research, contribution of this study, and thesis structure. Chapter 2 provides a detailed overview of the literature review on sustainability, the importance of sustainability in the transportation sector, Türkiye's sustainability approach, and a comprehensive examination of SRS, particularly the Envision rating system. Chapter 3 explains the mixed-method research approach, including the selection of the case study, the Envision rating system as a method and application in this study, and semi-structured interview analysis methods for qualitative and quantitative data. Chapter 4 presents the results and discussion of this thesis. The chapter displays the conclusions drawn from the interviews as well as the outcomes of the Envision-based evaluation of the chosen road project. It contains both qualitative and quantitative score results from the semi-structured interview about the relevance of Envision credits in the local context. The results are discussed in the context of research questions, point out difficulties with applying sustainability standards to Turkish highway projects, and evaluate the data in light of recent studies. Chapter 5 concludes this thesis by highlighting the theoretical and practical contributions, summarizing the key findings, and offering suggestions for sustainable highway projects and future sustainability grading system implementations in Türkiye.

CHAPTER 2

LITERATURE REVIEW

In this section, an overview of the concept of sustainability and sustainable development is provided and its importance in the transportation sector is emphasized. Then, the background on sustainability strategies and practices in Türkiye are summarized. Finally, the use of sustainability evaluation systems for measuring sustainability in infrastructure projects are discussed including how SRS is used in the different regions. In particular, the Envision Evaluation System, a comprehensive sustainability evaluation tool used in infrastructure projects, is introduced. In this context, the literature review aims to establish the conceptual framework of sustainability and to reveal the knowledge that forms the basis of the study.

2.1 Sustainability

The term "sustainable development" has suffered from a lack of consensus over the last two decades, leading to a situation where it now implies different things to different individuals. About three hundred definitions of "sustainability" and "sustainable development" are thought to exist (Johnston et al., 2007). The most well-known definition is from the Brundtland report, where it is defined as "Development that meets the needs of the present generations without compromising the ability of the future generations to meet their own needs" (Brundtland, 1987). Another definition of sustainability from the transportation field, provided by the Federal Highway Administration (FHWA), describes sustainability as meeting fundamental economic and social demands—both present and future—while using natural resources responsibly and preserving or enhancing the health of the environment that supports life (FHWA, 2018).

The term “pillars of sustainability” originated from the 2002 World Summit on Sustainable Development. It was gathered under the theme "People, planet, and prosperity," which later came to be referred to as the "pillars of sustainability" (UN, 2002; Elkington, 1997). The reason is that they demonstrate responsible development necessitates considering environmental, social, and economic capital (Kajikawa, 2008; Schoolman et al., 2012). Each of these pillars represents different necessities for sustainable development. According to Black (2004), the social dimension of sustainability is the degree to which social institutions, relationships, identities, and values may be upheld in the future. The environmental pillar of sustainability aims to increase the well-being of people by safeguarding the sources of the raw materials needed for human requirements (Goodland, 1995). When it comes to economic sustainability, the third pillar, the primary goal is to ensure that those in need have access to stable and sustainable livelihoods. In addition, initiatives must be designed and implemented to take into account the needs and capacities of the people who will benefit from them in order for economic development to be really "sustainable" (Uphoff, 1985).

For sustainable development, it is imperative to eliminate poverty, change patterns of consumption and production, and preserve natural resources (UN, 2002). Many actions have been taken worldwide regarding sustainable development. The first international conference on environmental issues was held in 1972 at the United Nations in Stockholm, known as "the Stockholm Conference". The conference marked a significant milestone in the development of international environmental laws (United Nations, n.d.). As the concept developed over time, the Brundtland Report's 1987 introduction of the phrase "sustainable development" significantly increased the concept's level of acceptance (Alhaddi, 2015). In 1997, in response to global concerns about climate change, the Kyoto Protocol was established, and it set legally enforceable emission targets for developed nations to meet during the commitment period of 2008–12 (Böhringer, 2003). Another important event for sustainability was the 2002 World Summit on Sustainable Development, where it aimed to enhance people's lives worldwide by promoting sustainable development

and intended to agree on the achievable measures that humanity needs to take (UN, 2002).

The importance and the actions taken for sustainable development call for the construction industry to take action. The construction sector can work toward sustainable development through sustainable construction by considering environmental, socio-economic, and cultural factors (Majdalani et al., 2006). Sustainable construction, however, calls for considering technical sustainability in addition to environmental, social, and economic sustainability. The final pillar, "technical sustainability," addresses ideas about a building or structure's functionality, lifespan, and quality (Hill & Bowen, 1997).

2.2 The Significance of Sustainability in the Transportation Sector

Transportation networks have a strong relationship with living quality. It facilitates personal mobility, access to healthcare and education, and the distribution of products and services (Montgomery et al., 2015). Throughout the 20th century, as cities developed new transportation networks, they both supported urban development and presented several obstacles to sustainability (Millar et al., 2016). Sustainable development principles should be implemented in the construction industry not just for buildings but also for other sectors like the transportation sector (Oluwalaiye, 2018).

The World Business Council for Sustainable Development (2001) defined sustainable mobility as "the ability to meet society's need to move freely, gain access, communicate, trade, and establish relationships without sacrificing other essential human or ecological values, today or in the future". Another sustainable transportation definition is made by Black (2010), which states, "A sustainable transport system provides transport and mobility with renewable fuels while minimizing emissions detrimental to the local and global environment and preventing needless fatalities, injuries, and congestion”.

The transportation sector significantly impacts the ecosystem and the use of natural resources (Montgomery et al., 2015). After the electricity, industrial, agriculture, forestry, and land use (AFOLU) sectors, global transportation accounted for the fourth-largest source of GHG emissions in 2019 (Jaramillo et al., 2022). The transportation industry is responsible for approximately 15% of global GHG emissions and 23% of global energy-related CO_2 emissions (IEA, 2020). Over the past 20 years, there has been a significant increase in GHG emissions associated with transportation; since 2010, this sector has experienced the fastest rate of growth in emissions of any end-use sector (Jaramillo et al., 2022). If humanity continues to do nothing, the atmosphere's concentration of carbon dioxide will keep rising, causing more severe warming than is currently predicted; urban air quality may worsen; traffic-related deaths and injuries would increase, and may cause serious socioeconomic adjustment issues as fuel supplies run out or their price rises to previously unheard-of levels (Black, 2010). Also, non-sustainable transportation systems cause problems like security concerns, noise pollution, and travel delay (Awasthi & Chauhan, 2011). Thus, sustainable transportation is essential for both present and future benefits (Montgomery et al., 2015).

There's no problem that can't be solved with enough time, resources, and effort, according to Ed Jordan, the first chief executive officer of the Consolidated Rail Corporation (Black, 2010). Experts in the transportation field have proposed several ways to find more sustainable solutions. Some of these solutions include energy-efficient automobiles, fewer trips made in private vehicles, clean fuels, carbon taxation and other pricing mechanisms, the use of technology such as smart transportation networks, and passenger and freight transportation regulations. These strategies seek to replace the current transportation system with a more effective and sustainable one (Black, 1996; Clevenger et al., 2016).

Numerous advantages come with sustainable transportation projects: secure and equal access for people of all ages, genders, races, and ethnicities; effectiveness in addressing community and individual needs; creation of new jobs and businesses; preservation of human and environmental health; various affordable transportation

options; substantial economic benefits; resilience to climate change; reduced ecological footprints; reduced material and energy consumption; and reduced pollution and waste to the amount that can be accepted by the planet (Clevenger et al., 2016; Black, 2010; Montgomery et al., 2015).

2.3 Sustainability in Türkiye

The emergence of an environment-focused awareness in society and efforts towards sustainability in Türkiye is very recent (Ozmehmet, 2008). As part of the EU integration process, following the critical milestone of the partnership relationship marked by the Customs Union Agreement (1995), Türkiye took on the duty of bringing its laws into compliance with E.U. trade, customs, and environmental policies. In this context, Türkiye has started to give international environmental commitments greater significance (Ay, 2017). As a candidate for E.U. membership, Türkiye must accept and incorporate the E.U.'s sustainable development policies (Ada, 2011).

This section will examine Türkiye's sustainability approaches in line with E.U. sustainability actions such as The Sustainable Development Goals, The Paris Agreement, and The Green Deal. Within the scope of this thesis, the development of sustainability awareness and practice regarding highway transportation in Türkiye will be investigated.

2.3.1 Sustainability Development Goals

The Sustainable Development Goals (SDG) are a call for action by all countries independent from income level to promote prosperity while protecting the planet. Ending poverty must go hand-in-hand with strategies that build economic growth and address various social needs, including education, health, social protection, and

job opportunities while tackling climate change and environmental protection (United Nations, n.d.a). For that purpose, 17 SDGs were adopted by the United Nations in 2015 to end poverty, protect the planet, and ensure that by 2030, all people enjoy peace and prosperity (United Nations, n.d.b.). Those 17 SDGs are presented and explained in the Figure 2.1 below.



Figure 2.1 Sustainable development goals (United Nations, n.d.c).

2.3.1.1 Türkiye's Approach

At the U.N. General Assembly in 2015, Türkiye was one of the nations that voluntarily approved the 2030 Agenda. The Ministry of Development's "SDG-Development Plan Comparison Table" reveals that, out of 169 SDG targets over 100 are covered under the 10th Development Plan (2014–2018), which was created before the 2030 Agenda's adoption (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019).

The SDGs are being implemented by embedding them into the national development strategies developed over the past five years instead of creating an additional national plan or strategy for this purpose. Priority is given to SDGs during the plan preparation stage, and goals are projected until 2030 (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019).

The international agenda and the benefits of recent changes to the public administration system are closely followed. Twenty-two nations, including Türkiye, submitted Voluntary National Review Reports (VNR) on implementing the 2030 Agenda and SDGs at the initial U.N. High-Level Political Forum (HLPF) meeting in 2016. These assessments cover nations' attempts to carry out the 2030 Agenda and their successes and lessons learned, which are crucial for tracking the SDGs' advancement and guaranteeing U.N. oversight (T.C. Sayıştay Başkanlığı, 2020).

2.3.1.2 Effects on Türkiye's Transportation Sector

In Türkiye, since the 2000s, there has been a significant advancement in the design of urban transportation networks, focusing on accessible and safe mobility. Many cities, especially metropolitan ones, have seen advancements in areas like reducing traffic congestion and enhancing traffic safety using Intelligent Transportation Systems (ITS). In addition, cities including Istanbul, Izmir, Kocaeli, Kayseri, and Konya have installed bicycle rental programs and bicycle pathways (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019). With the publishment of the National Smart Transportation Strategy Document (2014–2023), the goal is to use information and communication technologies in all forms of transportation to create an intelligent, safe, efficient, sustainable, and environmentally friendly network of transportation that will facilitate the movement of people and goods (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019).

Since Türkiye voluntarily approved the 2030 Agenda more commitments and actions are made for sustainable transportation. Among 17 Sustainable Development Goals,

SDG 11: Sustainable Cities and Communities stands out in transportation. According to Türkiye's Sustainable Development Goals 2nd National Review Report (2019), the following issues are the critical areas of emphasis for the policy framework related to SDG 11 targets.

- Raising public knowledge of environmental issues and enhancing living standards through energy, water, and resource efficiency; waste and emission reduction; recycling; and using sustainable city strategies to avoid noise and visual pollution in urban areas.
- Increasing the amount of urban development that is economical, efficient, and environmentally friendly.
- Consider the requirements of underprivileged populations when designing housing and the areas around it, as well as building and supplying all urban services, including transportation.
- Allocating funds for urban transportation by land use and transportation plans based on public transportation.
- Using smart transportation systems and information technology efficiently for traffic control and public transportation services.
- The creation and modification of urban transportation infrastructure, focusing on public transportation and pedestrians (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019).

To accomplish SDG 11 in the near future, the following policies are intended to be put into practice in Türkiye:

- Choosing and executing smart city initiatives while keeping in mind the areas, capacities, and applicability that are given priority at the national level, extending the reach of services for smart transportation,
- Broadening the range of modes of transportation in areas where intermodal integration is accomplished with respect to accessibility and safety,

- Adopting worldwide standards for road signs, as well as updating signage for those who are hearing, visually impaired, and mentally disabled to help make transportation accessible, particularly for vulnerable groups (T.C. Cumhurbaşkanlığı Strateji ve Bütçe Başkanlığı, 2019).

2.3.2 The Paris Agreement

On December 12, 2015, world leaders gathered at the U.N. Climate Change Conference (COP21) in Paris, France. They achieved a significant breakthrough in addressing climate change and its adverse effects: the significant Paris Agreement. The Agreement outlines long-term objectives for all countries to follow. These objectives include:

- Since limiting global temperature rise to 1.5°C above pre-industrial levels will significantly lessen the risks and effects of climate change, efforts should be made to drastically cut global GHG emissions to keep the rise below 2°C.
- The objective of this contract and its long-term aims shall be evaluated regularly to measure the collective progress made.
- To give developing countries financial support to reduce the effects of climate change, build resilience, and improve their capacity to adapt to its effects (United Nations, n.d.d).

The Agreement is a worldwide agreement with legal force and on November 2016, it became active with signature from 195 parties. All nations have committed to lowering their emissions and cooperating to adapt to the effects of climate change, and the Agreement encourages nations to increase their contributions progressively. The Paris Agreement offers a solid foundation for directing international efforts for many years. It signals the start of the transition to a world with net-zero emissions. Achieving the Sustainable Development Goals, mentioned in Section 0 also depends on the Agreement's implementation (United Nations, n.d.d).

The Agreement establishes a framework for the open monitoring and reporting of countries' climate goals while giving developed countries a method to support developing nations in mitigating climate change's effects. The Paris Agreement is based on a five-year cycle of countries taking more and more dedicated climate action. Each nation is obliged to submit an updated Nationally Determined Contribution (NDC) every five years, which is a national climate action plan. Countries outline the steps to decrease their GHG emissions in their NDCs to meet the Paris Agreement's objectives. In the NDCs, nations also outline the steps they will take to strengthen their resilience and prepare for the effects of rising temperatures (United Nations, n.d.d).

2.3.2.1 Türkiye’s Approach

Türkiye embraced the Paris Agreement in 2015 when Türkiye's demands for access to technological and financial support under the new climate regime were satisfied. On April 2016, Türkiye signed the pact, orally declaring itself a Developing Country and announcing a 2053 net zero emission target (İklim Değişikliği Başkanlığı, n.d.a). Türkiye stated intention to cut its GHG emissions 41% by 2030, or 695 million tons of CO2 equivalent, using the reference scenario outlined in its First Nationally Determined Contribution, with 2012 as the reference year (İklim Değişikliği Başkanlığı, n.d.b).

Türkiye, which pursues a green growth policy, contributes to global efforts to combat climate change with its conditions and national competencies. Türkiye’s increasingly ambitious climate objectives will be enshrined in the Twelfth Development Plan, which covers 2024–2028 and the long-term strategy towards 2053. This plan will ensure that sustainable development approaches work smoothly in all sectors (İklim Değişikliği Başkanlığı, n.d.b).

2.3.2.2 Effects on Türkiye's Transportation Sector

In 2020, Türkiye's transportation sector, road transportation accounting for 93.6% of all transportation (measured in passenger kilometers) produced 80.7 million tons of carbon, which accounted for 94.9% of the emissions in 2020 (İklim Değişikliği Başkanlığı, n.d.b).

To promote sustainability in the transportation industry, Türkiye has recently invested in initiatives like the enlargement of the railway network and the application of the smart city concept in urban areas to boost energy efficiency. Alternative modes of transportation have also been promoted; a 3,165 km route's "Inter-Settlement Transportation and Tourism Bicycle Path Master Plan" has been created. Additionally, to guarantee that CO2 emissions are as low as possible and that pollutant emissions are decreased, emission restrictions for automobiles, vans, lorries, buses, and motorbikes comply with E.U. norms (İklim Değişikliği Başkanlığı, n.d.b). The following are some of other Türkiye's primary transportation-related mitigation policies for 2030:

- To guarantee a balanced utilization of transportation modes for freight and passenger transportation by increasing the proportion of maritime and railway transportation and decreasing that of road transportation.
- To promote the use of electric vehicles by building a nationwide network of fast charging stations.
- Increasing the amount of electricity and alternative energy sources used on highways instead of fossil fuels.
- Implementing sustainable transportation strategies in urban areas (İklim Değişikliği Başkanlığı, n.d.b).

2.3.3 The Green Deal

With the European Green Deal (EGD) announcement on December 11, 2019, efforts to battle climate change and promote sustainable development have gained momentum globally. With the Green Deal, the E.U. announced that it will implement a new growth strategy to reorganize all of its climate change policies, aiming to be the first continent to be climate-neutral by 2050. The EGD aims to achieve comprehensive reforms of E.U. policies in several areas, such as industry, energy, transportation, finance, and agriculture (T.C. Ticaret Bakanlığı, n.d.)

2.3.3.1 Türkiye’s Approach

Türkiye's commercial integration with the E.U., both as an E.U. candidate and as a Customs Union partner, will undoubtedly be significantly impacted by the EGD. It will have revolutionary effects on the E.U. Single Market, since Türkiye has reached an advanced integration under the Customs Union. It is crucial for Türkiye to closely monitor the primary concerns outlined in the context of the EGD, which may impact Türkiye to reduce any potential negative impacts and use compliance to transform the intended policy changes into potential benefits for Türkiye. On the other hand, it is crucial to achieve a transition towards a sustainable, resource-efficient, and green economy considering the transformation of the global economy and trade as well as the extensive changes envisioned in E.U. policies by the EGD. This is essential to preserving Türkiye's post-1980 export-driven economic strategy and its integration into the world economy (T.C. Ticaret Bakanlığı, 2021).

To preserve and further advance the integration achieved within the scope of the Türkiye-EU Customs Union and to support Türkiye's transition to a sustainable and resource-efficient economic structure, a Green Deal Action Plan has been prepared in line with the EGD. The Green Deal Action Plan consists of 9 main headings, which are:

- Border carbon adjustments
- Green finance
- Secure, affordable, and clean energy supply
- Green and circular economy
- Smart and sustainable transportation
- Sustainable agriculture
- Fighting climate change
- Diplomacy
- EGD education and awareness campaigns

Under these headings are the actions that need to be taken to accomplish these goals. Within this framework, 32 goals and 81 actions, organized under nine major headings, comprise the Türkiye's Action Plan (T.C. Ticaret Bakanlığı, 2021).

2.3.3.2 Effect's on Türkiye's Transportation Sector

In context with The Green Deal, on December 9, 2020, the European Commission published the Sustainable and Smart Mobility Strategy (European Commission, 2020). Examining the E.U.'s Sustainable and Smart Mobility Strategy within the context of the EGD reveals that the strategy calls for the development of combined transportation to increase the share of environmentally friendly and sustainable modes of transportation; the introduction of zero-emission vehicles in vehicles, air, and marine transportation; the development of infrastructure for electric vehicles; an increase in the production and use of alternative sustainable fuels in all modes of transportation; pricing transportation while taking the environment into account; and the development of connected and smart transportation systems. It also seeks to cut transportation-related emissions 90% by 2050 through the development of a smart, competitive, safe, cheap, accessible, and environmentally friendly transportation system (T.C. Ticaret Bakanlığı, 2021).

According to Türkiye’s The Green Deal Action Plan, the following is a list of some of the plans that fall within the sustainable smart transportation goal:

- The 'Combined Transport' and 'Logistics Centers' regulations will be implemented to facilitate the balanced advancement of transportation modes and approaches.
- The development of electric vehicles and charging infrastructure will include planning and strategy creation.
- The National Intelligent Transportation Systems Strategy Document and the 2020–2023 Action Plan's action '4.5. The use of Electric Vehicles in Public Transport Fleets and Service Vehicles and Promotion of Public Transport' will be monitored to ensure effective implementation.
- The necessary legislative work will be finished to promote micro-mobility vehicles, such as shared electric scooter systems and bicycles, to lower exhaust emissions and offer low-emission, alternative-fuel personal transportation options. cycling/e-scooter lanes, parks, and charging stations will be constructed, and master plans for cycling transportation will be created.
- Projects related to urban transportation, particularly bike lanes, will be funded by IPA in the framework of sustainable urban mobility. (T.C. Ticaret Bakanlığı, 2021)

Annual activity reports are being published to accomplish the goals given in Türkiye’s The Green Deal Action Plan. According to the 2023 Green Deal Annual Activity Report, the current status of the progress being made is listed below.

- As of 2023, 17 businesses have been approved for the Green Logistics Certificate, and the Combined Transport Regulation, published on May 27, 2022, is a step toward our nation's goal of creating intelligent and sustainable transportation.

- In September 2023, 181 companies were granted charging network operator licenses as part of the planning and preliminary studies for positioning electric vehicle charging stations on urban and intercity roads. At the beginning of 2023, there were 1,719 charging stations nationwide; by the end of the same year, there were 5,924 stations and 3,081 sockets (or charging points) countrywide. It is anticipated that the number of charging stations will keep rising nationwide.
- The Ministry of Transport and Infrastructure's "Sustainable and Smart Mobility Strategy and Action Plan" has been prepared and is scheduled for publication following approval procedures about promoting and facilitating sustainable urban mobility. (T.C. Ticaret Bakanlığı, 2023)

2.4 Sustainability Rating Systems

The growing focus on sustainability is encouraging construction industries toward rapid improvements that embrace sustainable practices, in three main features: economic, environmental, and social (Hellstrom, 2007; ISO 15392, 2019). The construction sector incorporate sustainable practices without compromising technical and functional expectations (ISO 15392, 2019).

To evaluate how well construction projects adopt sustainability, the construction sector has widely embraced and used sustainability rating system (SRS) (Simpson, 2013). The SRS is composed of criteria for sustainable best practices and a common metric. Sustainable best practices, such as energy consumption, tons of recycled materials, pavement design life, pollutant loading in stormwater runoff, pedestrian access, ecosystem connectivity, and many others, are quantified using this common metric, often expressed as points. This allows for the direct comparison of the various measurement units used in sustainability best practices (Muench et al., 2012).

SRSs are intended for use by those who create, design and construct infrastructure, frequently with the help of a sustainability advisor (Scanlon & Davis, 2011). For

many SRSs, a third-party verification option is available, which grants the applicant an official certification according to the total points achieved (Smith, 2017).

In 2000, the green building rating system Leadership in Energy and Environmental Design (LEED) was introduced by The United States Green Building Council, which is globally the most widely used building rating system (Yudelson, 2010). The different infrastructure sustainability rating systems (ISRS) that have been created attempt to address infrastructure similarly to how the LEED certification for buildings is accomplished (Smith, 2017). Therefore, several rating systems have also been introduced to the transportation sector to measure project performance.

2.4.1 Types of Transportation Sustainability Rating Systems (TSRS)

A growing number of SRSs are available to evaluate the degree of sustainability of projects. SRS, which can be used to evaluate the sustainability of a transportation project, is referred to as a transportation sustainability rating system (TSRS). Major TSRS that are currently accessible include BE2ST-in-Highways, Greenroads, Envision; Illinois Livable and Sustainable Transportation (I-LAST); Green Leadership in Transportation and Environmental Sustainability (GreenLITES); the Infrastructure Voluntary Evaluation Sustainability Tool (INVEST); GreenPave; Sustainability Assessment and Awards for Civil Engineering, Infrastructure, Landscaping and the Public Realm (CEEQUAL); and the Sustainable Transportation Analysis Rating System (STARS) (Clevenger et al., 2016). Although there might be other systems, the ones shown in Figure 2.2 below were the TSRS that were most frequently mentioned in the literature (Mattinzioli et al., 2020).

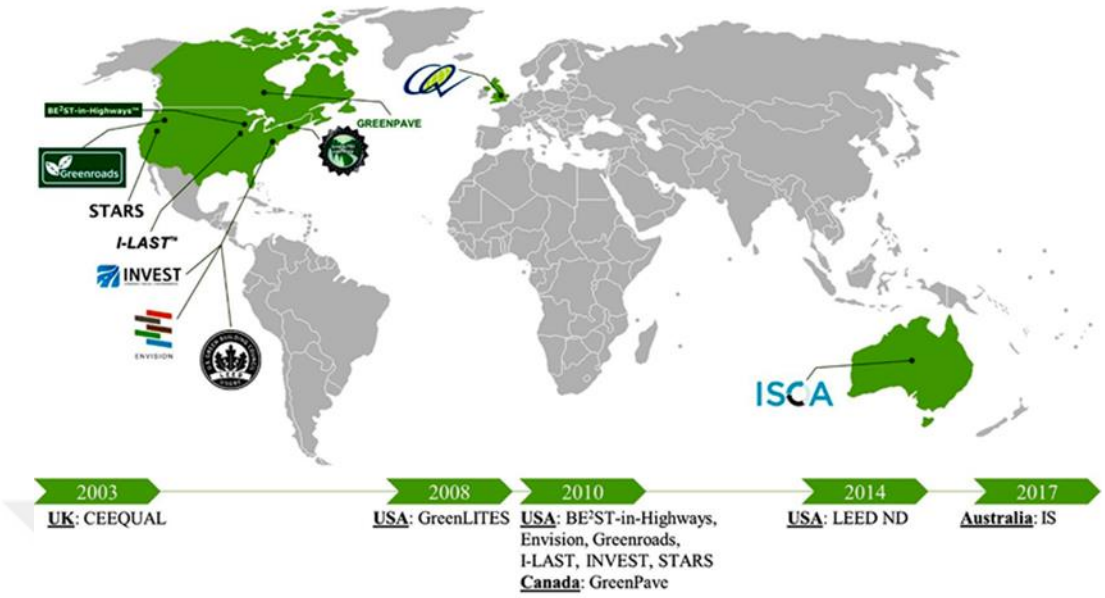


Figure 2.2 Origin and release timeline map for TSRS (Mattinzioli et al., 2020)

The important attributes of the TSRSs are shown in Table 2.1. The table provides each tool's structure, the scope of the evaluation, and the certification program according to the following categories: the origin of the TSRS, version and publication date, international applicability, assessable project topics (infrastructure, pavement, and roadways), assessment type, rating method, and rating classifications (Mattinzioli et al., 2020).

Table 2.1 Key characteristics of the selected SRS (Originated from Mattinzioli et al., 2020)

	Sustainability Rating Systems						
	CEEQUAL	*Invest*	*Envision*	*Greenroads*	*GreenPave*	*BE²ST in Highways*	*GreenLITES*
Origin	UK & Ireland	USA	USA	USA	Canada	USA	USA
Version & Year	v6 & 2019	v1.3 & 2019	v3 & 2018	v2 & 2017	v2.1 & 2017	v1 & 2010	v2.1 & 2010
International Applicability	+	+	+	+	-	-	-
Project Scope	Infrastructure: railways, airports, ports, water-related projects, energy-related projects, gas and electricity supply-related projects, and communication and information-related projects	Roadways: alignment, pavement-related structures, pedestrian and cycle routes	Infrastructure: railways, airports, ports, water-related projects, energy-related projects, gas and electricity supply-related projects, and communication and information-related projects	Roadways: alignment, pavement-related structures, pedestrian and cycle routes	Pavement	Roadways: alignment, pavement-related structures, pedestrian and cycle routes	Roadways: alignment, pavement-related structures, pedestrian and cycle routes
Assessment	Third-party	Self-assessment	Third-party	Third-party	Self-assessment	Self-assessment	Self-assessment
Rating Method	Fulfillment of mandatory requirements and the total amount of credits granted	The sum of gained points from the criteria	The sum of gained points from the criteria	After project requirements are fulfilled, the cumulative sum of credits provided is calculated.	The sum of gained points from the criteria	A screening procedure followed by a quantitative evaluation of the percentage reductions	The sum of gained points from the criteria
Rating Classifications	Pass (≥30%) Good (≥45%) Very Good (≥60%) Excellent (≥75%) Outstanding (≥90%)	N.A.- describes goals as emphasizing outcomes over scores	Verified (≥20%) Silver (≥30%) Gold (≥40%) Platinum (≥50%)	All PR + Bronze (40) Silver (50) Gold (60) Evergreen (80)	Bronze (9-11) Silver (12-14) Gold (≥15) Trillium (yet to be defined)	Bronze (≥50%) Silver (≥75%) Gold (≥90%)	Certified (≥33%) Silver (≥67%) Gold (≥90%) Evergreen (≥98%)

2.4.2 Benefits of SRS

Several scholars studied the benefits of TSRSs in the literature, as briefly outlined in Muench, Armstrong, and Allen (2012). According to their research, TSRSs offer a common metric for the full spectrum of sustainable solutions; help measure sustainability and make it manageable; facilitate open discussion of sustainability goals, efforts, and accomplishments; and offer a reasonable framework in which material suppliers, designers, and contractors can be creative in their solutions. In addition, according to Griffiths, Boyle, and Henning (2020), establishing a mechanism that provides evidence-based certification by a third party could encourage funders, asset managers, and delivery teams to aim for improved levels of sustainable performance. Green practices can be incorporated into minimum requirements, planning procedures, and regulations. Moreover, several sustainable options included in these systems can quantifiably increase project sustainability with little to no cost impact (Anderson & Muench, 2013).

The effect of SRSs on users was investigated by Griffiths, Boyle, and Henning (2020) in a study where interviews were done with 63 participants who used rating tools in projects at work. The majority of users (77%) reported that their usage of the rating tools had a significant or extremely strong effect on their professional practice and a greater understanding of sustainability. A number of participants also reported that this influence extended to their non-work activities (e.g., renovating homes).

In the literature, some studies measured the differences between a regular project and an SRS-used project. In the study of Lew, Anderson, and Muench (2016), 28 Greenroads-certified projects were evaluated, and a demonstrable increase in performance was seen when compared to standard projects. Additionally, 22 projects were measured before and after Invest SRS during a 14-year period in the Illinois Tollway, USA, and it was discovered that project sustainability increased over time (Illinois Tollway, 2015).

2.4.3 Comparison of TSRS

Each SRS has certain differences, even though all are used to measure the sustainability of a project. The differences between each previously mentioned SRS are pointed out in the following discussion.

- INVEST recognizes that not all projects can meet all sustainability standards and makes distinctions between various work levels and types (FHWA 2012c). It enables scorecard customization and helps project teams determine which credits are reachable at the start of the project. INVEST divides projects into small- and large-scale, paving-only, custom, and rural-urban locations, as well as organizes the rating system's requirements into a logical sequence (Simpson,2013).
- Greenroads fosters creativity the greatest compared to other systems. It gives innovation up to 10 points, as opposed to other systems' 1-2 points. It divides innovation into two categories, allowing project teams to apply many inventive characteristics to their work (Greenroads, 2012a).
- CEEQUAL and Envision cover the greatest variety of infrastructure projects. Both are applicable to energy generation, water treatment and storage systems, information systems, and landscaping in addition to roads (ISI, 2018). Being the only rating systems that give points for leadership, these systems also demand that a credentialed employee be a member of the project team for projects aiming for Envision or CEEQUAL certification (CEEQUAL 2012c; ISI, 2018).
- The focus of BE2ST-in-Highways is mostly on materials and resources. Because BE2ST-in-Highways measures a project's sustainable elements against a base design that lacks any sustainable features, it is different from other rating systems (Simpson,2013).
- GreenPave stands out from other sustainability grading systems because it is the only one that evaluates a project's sustainability only on the basis of its

pavement. Similar to BE2ST-in-Highways, GreenPave has a strong emphasis on resources and materials (Simpson,2013).

In the study of Mattinzioli, Sol-Sánchez, Martínez, & Rubio-Gámez (2020), the qualitative assessment of each rating system's indicators was conducted to determine the degree of interdependence among the three sustainability pillars, and the result of the research is presented in Figure 2.3 and discussed below.

- Across the systems investigated, the majority of sustainability measures (average of 77%) were found to be multi-dimensional. The systems that best represented this multi-dimensionalism were BE2ST-in-Highways, Greenroads, Envision, and Invest, where at least 80% of the indicators considered multiple pillars.
- There is a significant emphasis on environmental indicators among the SRS. All systems were found to be driven mostly by their environmental criteria (average of 39%) except for BE2ST-in-Highways, which had the same allocation of scores on environmental and economic issues. However, the social and economic pillars were also well represented.
- It was discovered that 70% of the social indicators—such as the decrease in hazardous waste, the reduction of traffic delays, the use of local materials, and the accessibility of non-motorized vehicles—were closely connected to the environmental pillar. This could suggest that improving environmental projects also has a significant positive social impact (Mattinzioli et al., 2020).

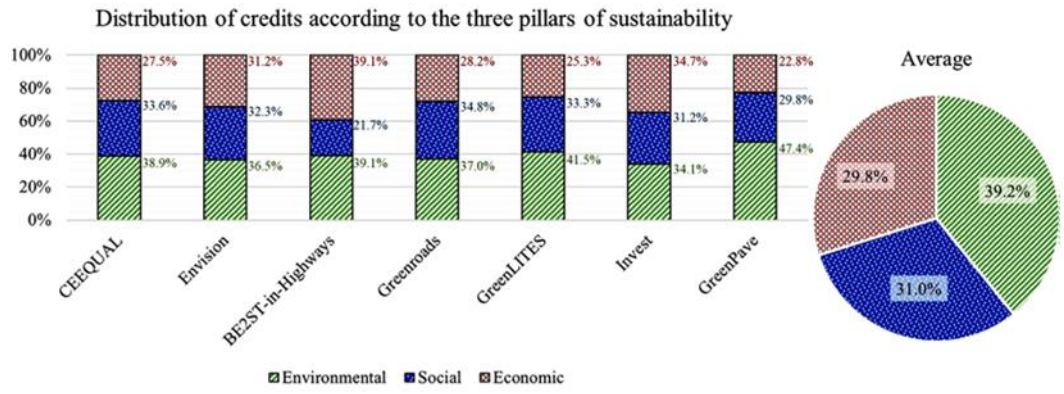


Figure 2.3 Three pillars of sustainability analysis for six selected rating systems (Mattinzioli et al., 2020).

2.4.4 SRS Use in Developing Countries

Reliable and safe transportation systems constitute a fundamental prerequisite for the economic growth and overall development of developing countries (Montgomery, Schirmer, & Hirsch, 2014). As highlighted by Montgomery et al. (2014), many transportation planners, engineers, and environmental scientists have increasingly emphasized the necessity of enhancing the sustainability of roadway systems, particularly considering the depletion of natural resources, the sensitivity of environmental conditions, and the constraints of limited economic capacity. In response to these global sustainability concerns, several formal sustainability rating and evaluation systems have been developed, and all originated in the developed countries, as shown in Table 2.1, by collaborations among governmental agencies, private organizations, and academic institutions (Szpotowicz & Tóth, 2020).

Rating systems such as the CEEQUAL, Envision, IS, and Greenroads have been primarily developed and applied in advanced economies; therefore, their criteria may not fully align with the national priorities and development strategies of other regions. Accordingly, adapting these frameworks to reflect the contextual needs and realities of less affluent nations is essential to ensure their relevance and effectiveness (Diaz-Sarachaga, Jato-Espino, Alsulami, & Castro-Fresno, 2016).

The literature identifies two primary approaches for establishing a national evaluation system. The first involves developing country-specific credit standards and systems defined by a larger committee of experts. This is usually the approach commonly adopted when governments design their own SRS. The second approach is to adopt an existing sustainability assessment system that has already been proven effective in practice. In this case, the next step is to modify its components to suit national characteristics (Szpotowicz & Tóth, 2020). However, as emphasized in the literature, assessing sustainability performance first requires identifying which actions and criteria are truly applicable within a specific national or project context; otherwise, it is impossible to determine their relative priority or expected return (Montgomery, Schirmer, & Hirsch, 2014; Diaz-Sarachaga, Jato-Espino, & Castro-Fresno, 2017).

Several countries, including Malaysia and India, have developed their own sustainability assessment systems to address national circumstances such as climatic and environmental conditions, social priorities, and local construction practices. In both cases, the development of these tools followed a similar approach, being initiated by governmental bodies and supported through collaborations with academic institutions and transportation authorities (Szpotowicz & Tóth, 2020). Similarly, in South Korea, the establishment of the Green Road Grading System involved a structured expert consultation process in which experienced industry professionals were asked to define relevant categories, indicators, and credits, and to rank them according to their relative importance. This participatory approach enabled the identification and weighting of key evaluation parameters tailored to the Korean context (Park & Ahn, 2015).

A comparative evaluation of existing sustainability rating systems, including Greenroads, GreenLITES, I-LAST, Envision, and INVEST, was conducted in Hungary to determine the most appropriate framework for national application. Using the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) decision analysis method, Szpotowicz and Tóth (2020) incorporated weighted input data derived from industry experts and academic professionals

familiar with Hungarian construction practices. The results indicated that the Envision Rating System best met the evaluation criteria, followed closely by Greenroads. Similarly, Contreras and Gloria (2017) applied the Envision framework to 38 infrastructure projects across Latin America and the Caribbean to explore regional sustainability patterns and project-type differences. Their study established a sustainability performance baseline for the region, demonstrating that Envision can serve as an effective tool for evaluating context-specific sustainability outcomes in developing regions.

Integrating sustainability principles and best practices into road projects in developing countries continues to be a major challenge due to limited institutional commitment, financial constraints, and insufficient understanding of how to tailor sustainability concepts to local contexts. In addition, the lack of context-specific sustainable technologies and materials further restricts implementation (Montgomery, Schirmer, & Hirsch, 2014). Evidence from Nigeria reveals that the absence of measurable sustainability techniques and the low level of professional awareness have created a "sustainability literacy gap," resulting in social, economic, and environmental dissatisfaction with completed highway projects (Uchehara, Moore, Jafarifar, & Omotayo, 2022). Similar institutional weaknesses have been observed in East Timor, where the limited exposure to sustainability rating systems, inadequate enforcement of environmental laws, lack of technical capability, and minimal private-sector involvement have collectively hindered the development of sustainable infrastructure frameworks (Amaral & Abraham, 2020). In such contexts, economic benefit remains the primary motivation driving decision-making in sustainable road design (Amaral & Abraham, 2020).

2.4.5 Rational for Using Envision

SRSs play an important role in increasing projects' sustainability. Currently there are many rating systems like Envision, CEEQUAL, Invest, Greenroads, etc. In this thesis, the Envision SRS is used to analyze the sustainability of a typical highway project. This chapter explains the reasons behind the use of Envision in this study. The main aspects include extent in consideration of three pillars of sustainability, covering all project stages, especially the design phase, international applicability, the assessment type, tools for project evaluation, and suitability for highway projects.

Three Pillars of Sustainability: Sustainability assessment of infrastructure projects requires evaluating economic and social aspects besides the environmental impacts. Mattinzioli et al. (2020) criticized different SRS, including CEEQUAL, Envision, BE2ST-in-Highways, Greenroads, GreenLITES, Invest, and GreenPave, to see how well they included the three pillars of sustainability, assessed a project's life cycle, and covered major categories like management, energy use & atmosphere, resource use, social aspects & community, environment & land use, and innovation. Study results, given in the Figure 2.4 below, showed that Envision evaluated these three main aspects more homogeneously compared to other systems. . While variations in the weights of key common categories are observed, the similarity in terms of the distribution of the three pillars of sustainability is evident.

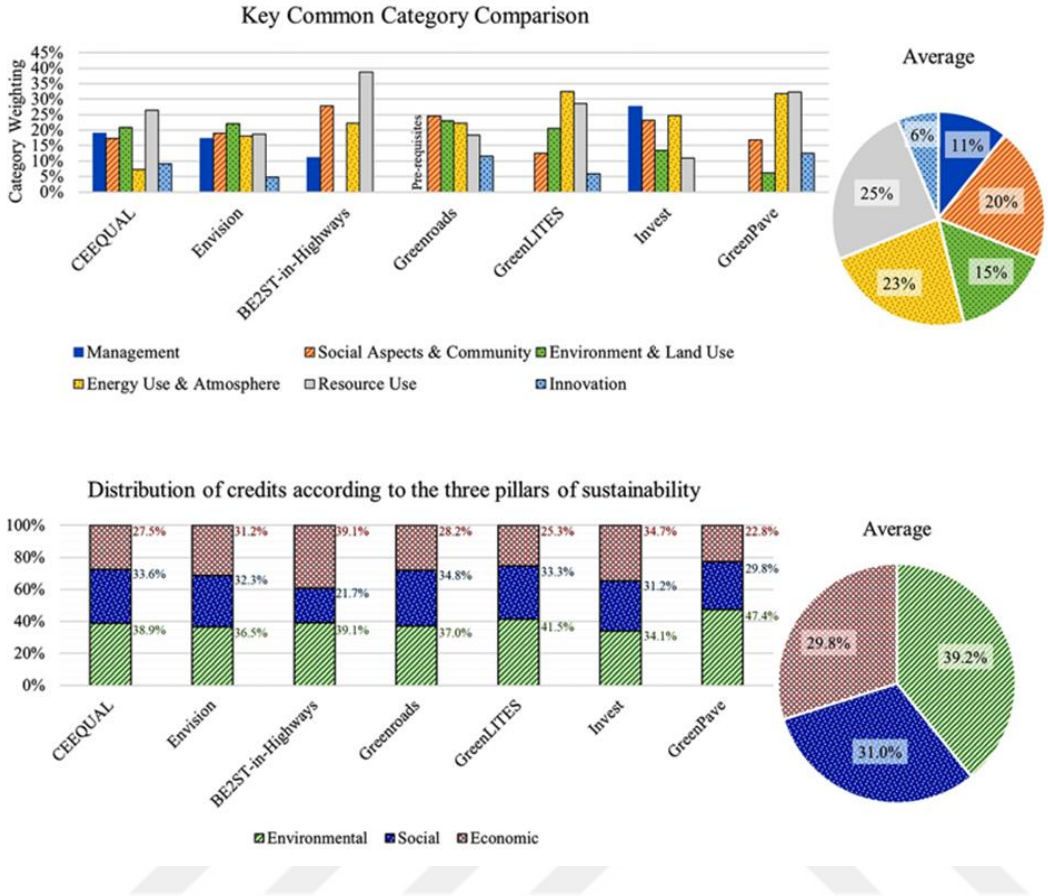


Figure 2.4 Comparison of rating systems against key common categories and three pillars of sustainability (Mattinzioli et al., 2020).

Project Stages: Each rating system assessed the sustainability performance of projects at several stages, including planning, project development and operation, and maintenance stages. As shown in Figure 2.5, Envision and Invest rating systems examine the project at all stages. Thus, both systems are significantly comprehensive. Utilizing it from preliminary studies through to completion of construction, Envision enables the assessment of sustainability and improvement in the subsequent design phases, resulting in the higher certification levels (Censorii et al., 2022).

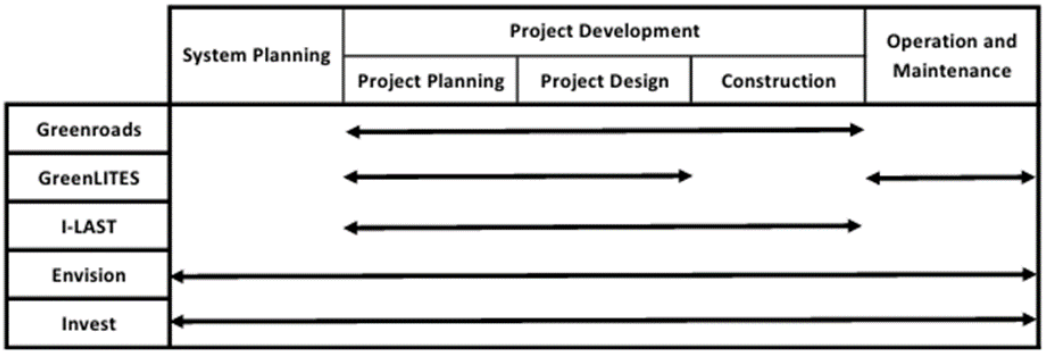


Figure 2.5 Applicability of rating tools per project stages (Szpotowicz & Tóth, 2023).

International Applicability: International applicability is prominent when investigating the use of an SRS beyond the country of origin. Literature review shows that only Envision, Greenroads, CEEQUAL, and Invest are being used internationally (Mattinzioli et al., 2020). Envision is currently being used in more than 10 countries, including Canada, Italy, Kenya, and Saudi Arabia. (ISI, n.d.a).

Assessment Type: Two types of assessments are used in SRS: self-assessments and third-party assessments. Third-party assessments are more internationally applicable and provide better assessments for the projects (Mattinzioli et al., 2020). Lew et al. (2016) reported that that self-evaluation overestimates the final project sustainability score by 15%.

Auxiliary Tools for Evaluation: The Envision rating system can be used in combination with other Envision products, such as the Envision Pre-Assessment checklist, mentioned in more detail in chapter 2.2.3.2 Envision Pre-Assessment Checklist, which aids users in understanding critical elements. The checklist consists of a series of yes/no questions intended to clarify the sustainability criteria utilized in the Envision assessment, supporting improved consideration in the project (Trop, 2022). Envision is supported by the Envision Sustainability Professional (ENV SP) designation, an important certification for professionals engaged in civil infrastructure. The ENV SP credential, administered by ISI, provides the expertise through training necessary to implement innovative Envision principles in your

professional activities, ensuring that infrastructure projects are sustainable, adaptable, and equitable (ISI, n.d.b.).

Flexibility: The Envision rating system comprises a total of 64 credits. Of the 64 credits, five are classified as Innovation credits, with one allocated to each of the five categories. These are designated as “0.0” credits and are purposefully unassessed for baseline criteria. The objective of these “0.0” Innovation credits is to encourage inventive, progressive methodologies that surpass the conventional standards defined in the Envision manual. Although these credits are optional, they provide a means to accumulate additional points that can improve the project's total score. (ISI, 2018). This feature provides an opportunity to gain points for different sustainability approaches besides the one included in Envision. In contrast to other rating systems, including LEED, Envision's capacity to exclude credits from the evaluation and total score contributes to its comprehensiveness, flexibility, and adaptability (Trop, 2022).

Suitability: In a study made by Szpotowicz and Tóth (2023), using a multi-objective decision-making method, the Envision system for sustainability rating was found to be the most appropriate rating system for road projects to use in Hungary. This result provides a solid basis for Envision's use in Türkiye, due to the similar administrative and economic conditions. Censorii et al. (2022) emphasized that the Envision framework is a valuable instrument for assessing the sustainability of a road project.

The research and literature review showed that for many aspects listed above, Envision is found to be an appropriate rating system to use in this research.

2.5 Reserach Gap

Although the literature on the use of SRS in infrastructure projects is growing, existing studies have significant limitations. First, the marked differences between countries in technical standards, legal regulations, implementation practices, decision-making processes, and stakeholder relationships prevent universally developed SRSs from being equally effective in every context. Various studies in the

literature have discussed the suitability of different SRSs for specific countries or project types; some studies have examined the use of SRS in highway projects (Muench et al., 2012; Trop, 2018). Other studies have compared SRSs in terms of their structural characteristics or evaluated which system may be more suitable for which country (Oluwalaiye, 2018; Clevenger et al., 2016). However, most of these studies remain theoretical and do not sufficiently reveal how sustainability criteria can be integrated in practice and how operational or institutional obstacles encountered can be overcome.

Empirical studies on the subject are also limited in important ways. For example, although Rooshdi et al. (2014) and Aljboor et al. (2023) have identified the key elements and implementation barriers in sustainable road projects, these studies have not aimed to analyze the current level of sustainability of projects designed using traditional methods within a comprehensive framework. Similarly, studies such as Trop (2018), Contreras and Gloria (2017), and Huang (2014) have shown performance differences in SRS categories, but they do not offer a systematic approach to evaluating sustainability performance in conjunction with design decisions, organizational capacity, technical feasibility, and stakeholder perceptions.

In Türkiye, the research gap is more pronounced. Although the EIA process in Türkiye provides the basic legal framework for assessing environmental impacts, the insufficient consideration of social and administrative dimensions limits the comprehensive assessment of sustainability (Tekayak, 2014; Demir, 2022). Furthermore, since there is no nationally applicable sustainability rating system, the current sustainability level of typical projects or how this level could be improved is unknown. This situation clearly demonstrates the need for both an application-oriented and context-specific assessment approach in the Turkish context.

Therefore, there is a serious need in the literature for studies that:

- systematically reveal the sustainability level of highway projects designed using traditional methods,
- detail the gaps with expert opinions,
- jointly evaluate technical feasibility and institutional/operational barriers,
- offer context-specific improvement recommendations
- possess an integrated methodology.

This thesis aims to present a comprehensive and application-oriented approach that seeks to fill this gap.

CHAPTER 3

METHODOLOGY

This study aims to analyze the current sustainability gaps in Türkiye's highway design approach and provide guidance for project designers to improve sustainability in current design techniques. The overview of the methodology is given in Figure 3.1 and explained below.

In this study, a mixed-method research approach is followed with the use of a case study. First, the current sustainability practices related to highway projects in Türkiye were investigated by selecting one design-phase-completed highway project as a case study. The selected project was owned by the General Directorate of Highways and represents typical practices for highway design projects. Section 3.1 details the rationale behind the selection of the project. To learn the sustainability level of the current design approaches, the selected project was evaluated according to the Envision sustainability rating system credits. Each credit was investigated according to the credit necessities and scored through Envision to assess the sustainability level. For each Envision credit, the reason behind the scored point and recommendations for better points were given. As a result, current sustainability practice in Türkiye was analyzed, and deficiencies were determined, and suggestions were made to increase sustainability performance.

Then, to improve sustainability in highway projects, Envision credits that were not satisfied in the case study were provided to the relevant professionals through semi-structured interviews to acquire their reflections. Credits were categorized according to relevant professions, and different interview questions were created. Semi-structured interviews were conducted with the alignment engineers, environmental engineers, social experts, and managers with permission obtained from METU

Ethics Committee for Human Research (Protocol Number: 0236-ODTÜİAEK-2025). Experts evaluated the unsatisfied Envision credits that could be included in the Turkish system. These interviews helped to understand which Envision credits can be included in the stage of design and what level of effort is required to improve highway projects' sustainability.

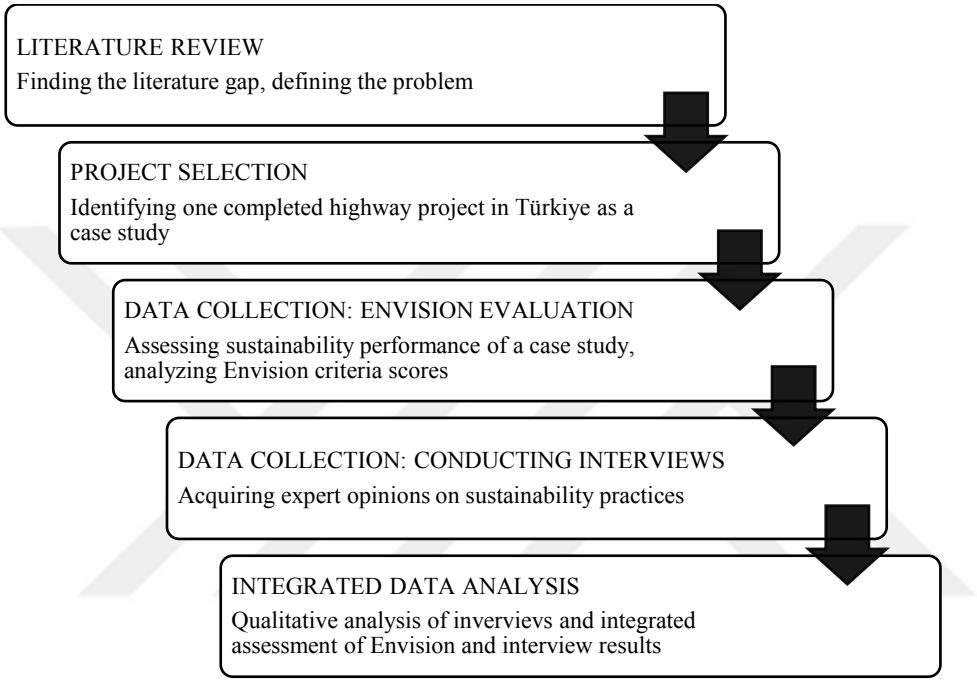


Figure 3.1 Research methodology flow

3.1 Project Selection

In this thesis, a sustainability evaluation of a design phase completed highway project in Türkiye was carried out using the Envision Sustainability Assessment System . This section encompasses details regarding project selection, project information, and evaluated documentation. It should be acknowledged that permission from the General Directorate of Highways is obtained to use the project data in this thesis, due to the intellectual and industrial property rights. However, due to the permission conditions, the project name and any other details that may cause

the identification of the project are not included in the thesis. For that reason, the project will be referred to as Project X in the thesis.

Project X is the widening of an existing two-lane state road project to four lanes for a design speed of 90 km/h, financed with public resources. The total length of the project is approximately 35 kilometers. Project X includes several level-intersections, bridges, underpasses, culverts, and retaining walls. The project is jointly carried out with the designer firm and the relevant regional directorate of the General Directorate of Highways. The project scope includes site investigations, preliminary design, detailed design, and final design for implementation. There are many reasons for selecting Project X, including (i) the project represents typical practices for highway design projects in Türkiye, with an environmental impact report (EIA), (ii) The General Directorate of Highways owns the project, and their permission to use data in the thesis is obtained, and (iii) the researcher is in contact with the engineers who worked on the project, facilitating a reliable and complete flow of project information.

To evaluate the extent to which Envision credits are achieved, project documents were reviewed. The analysis encompassed, but did not restrict itself to, the following documents:

- Project reports (such as Hydrology Report, Basin Plan, Bridge Report, Alignment Report, etc.)
- Final EIA Report,
- Technical drawings,
- Official correspondence,
- Regulations and specifications (such as Highway Traffic Law, Regulation on the Assessment and Management of Environmental Noise, Cultural and Natural Heritage Protection Law, Environmental Law, Soil Conservation and Land Use Law, Land Use and Land Protection Law, Law on the Improvement of Olive Cultivation and Grafting of Wild Species, Regulation on the

Protection, Use, and Land Consolidation of Agricultural Lands, Pasture Law etc.)

As a consequence, factors including representativeness, data accessibility, and document diversity significantly influenced project selection. The widening project of the state highway was deemed appropriate for the study's aims. The listed documents served as the foundation for the data set included in the sustainability assessment.

3.2 Overview and Structure of Envision

Envision is a framework that offers the direction required to start this systemic shift in the planning, design, and delivery of resilient and sustainable infrastructure. Envision is not a list of prescribed actions; instead, it is a framework for making decisions. Envision is designed as a holistic sustainability rating system for all types and sizes of both public and private infrastructure. This includes, but is not limited to, airports, bridges, dams, landfills, levees, parks, power-generating stations, pipelines, railways, streetcars, stormwater management systems, water treatment plants, and other types of infrastructure. For all types and sizes of infrastructure, Envision offers industry-wide sustainability metrics that enable you to evaluate and quantify how much a project adds to sustainability across social, economic, and environmental parameters (ISI, 2018).

Envision was developed with the collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI) (ISI, 2018). The ISI is a nonprofit education and research organization that was established by the American Society of Civil Engineers (ASCE), the American Public Works Association (APWA), and the American Council of Engineering Companies (ACEC) in 2010. ISI then collaborated with the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design to develop Envision to create a comprehensive

sustainability framework and rating system, which was needed for civil infrastructure development. Using the Envision sustainability framework, ISI creates sustainable infrastructure through project verification by a third party, education, and training (ISI, 2025).

The first version of Envision was published in 2012. By applying Envision to infrastructure projects worth billions of dollars, ISI learned key lessons and developed its third version in 2018 (ISI, 2018).

The Envision framework is composed of 64 sustainability indicators referred to as credits. Those credits are listed under five main categories, which are Quality of Life, Leadership, Resource Allocation, Natural World, and Climate & Resilience. There are multiple achievement levels in each of these 64 credits, ranging from slightly improving to protecting and renovating the environment and communities. Through evaluating the success of each of these 64 credits, project teams can assess the level of sustainability the project achieves and work to improve performance (ISI, 2018).

3.2.1 Envision Categories

The entire spectrum of infrastructure sustainability is covered by the 64 sustainability indicators, credits, that make up the Envision framework. Each credit in the Envision system includes an intent statement and metric, levels of achievement, a description, ways to improve performance, evaluation criteria, documentation guidance, and related Envision credits. The maximum points available based on these criteria are 1000 in total, as shown in Table 3.1. Credits are listed under 5 categories and 14 subcategories according to the subject.

- Quality of Life: Wellbeing, Mobility, Community
- Leadership: Collaboration, Planning, Economy
- Resource Allocation: Materials, Energy, Water
- Natural World: Siting, Conservation, Ecology
- Climate and Resilience: Emissions, Resilience (ISI, 2018).

Table 3.1 Envision credits and scores corresponding to the achievement level (ISI, 2018).

				Improved	Enhanced	Superior	Conserving	Restorative	Maximum Points
Quality of Life	Wellbeing	QL1.1	Improve Community Quality of Life	2	5	10	20	26	200
		QL1.2	Enhance Public Health & Safety	2	7	12	16	20	
		QL1.3	Improve Construction Safety	2	5	10	14	-	
		QL1.4	Minimize Noise & Vibration	1	3	6	10	12	
		QL1.5	Minimize Light Pollution	1	3	6	10	12	
		QL1.6	Minimize Construction Impacts	1	2	4	8	-	
	Mobility	QL2.1	Improve Community Mobility	1	3	7	11	14	
		QL2.2	Encourage Sustainable Transportation	-	5	8	12	16	
		QL2.3	Improve Access & Wayfinding	1	5	9	14	-	
	Community	QL3.1	Advance Equity & Social Justice	3	6	10	14	18	
		QL3.2	Preserve Historic & Cultural Resources	-	2	7	12	18	
		QL3.3	Enhance Views & Local Character	1	3	7	11	14	
		QL3.4	Enhance Public Space & Amenities	1	3	7	11	14	
Leadership	Collobration	LD1.1	Provide Effective Leadership & Commitment	2	5	12	18	-	182
		LD1.2	Foster Collaboration & Teamwork	2	5	12	18	-	
		LD1.3	Provide for Stakeholder Involvement	3	6	9	14	18	
		LD1.4	Pursue Byproduct Synergies	3	6	12	14	18	
	Planning	LD1.5	Establish a Sustainability Management Plan	4	7	12	18	-	
		LD2.1	Plan for Sustainable Communities	4	6	9	12	16	
		LD2.2	Plan for Long-Term Monitoring & Maintenance	2	5	8	12	-	
		LD2.3	Plan for End-of-Life	2	5	8	14	-	
	Economy	LD3.1	Stimulate Economic Prosperity & Development	3	6	12	20	-	
		LD3.2	Develop Local Skills & Capabilities	2	4	8	12	16	
		LD3.3	Conduct a Life-Cycle Economic Evaluation	5	7	10	12	14	
Resource Allocation	Materials	RA1.1	Use Recycled Materials	3	6	9	12	-	196
		RA1.2	Reduce Excavated Materials	4	6	9	16	-	
		RA1.3	Reduce Construction Waste	4	7	10	14	-	
		RA1.4	Reduce Construction Water Consumption	4	7	10	16	-	
		RA1.5	Balance Earthwork On Site	2	4	6	8	-	
	Energy	RA2.1	Reduce Operational Energy Consumption	6	12	18	26	-	
		RA2.2	Reduce Construction Energy Consumption	1	4	8	12	-	
		RA2.3	Use Renewable Energy	5	10	15	20	24	
		RA2.4	Commission & Monitor Energy Systems	3	6	12	14	-	
	Water	RA3.1	Preserve Water Resources	3	5	7	9	12	
		RA3.2	Reduce Operational Water Consumption	4	9	13	17	22	
		RA3.3	Reduce Construction Water Consumption	1	3	5	8	-	
		RA3.4	Monitor Water Systems	1	3	6	12	-	
Natural World	Siting	NW1.1	Preserve Sites of High Ecological Value	2	6	12	16	22	232
		NW1.2	Provide Wetland & Surface Water Buffers	2	5	10	16	20	
		NW1.3	Preserve Prime Farmland	-	2	8	12	16	
		NW1.4	Preserve Undeveloped Land	3	8	12	18	24	
	Conservation	NW1.5	Reclaim Disturbed Soils	11	13	16	19	22	
		NW2.1	Manage Stormwater	2	4	9	17	24	
		NW2.2	Reduce Pesticide & Fertilizer Impacts	1	2	5	9	12	
		NW2.3	Protect Surface & Groundwater Quality	2	5	9	14	20	
		NW2.4	Enhance Functional Habitats	2	5	9	15	18	
	Ecology	NW3.1	Enhance Wetland & Surface Water Functions	3	7	12	18	20	
		NW3.2	Maintain Floodplain Functions	1	3	7	11	14	
		NW3.3	Control Invasive Species	1	2	6	9	12	
		NW3.4	Protect Soil Health	-	3	4	6	8	
Climate and Resilience	Emission	CR1.1	Reduce Net Embodied Carbon	5	10	15	20	-	190
		CR1.2	Reduce Greenhouse Gas Emissions	8	13	18	22	26	
		CR1.3	Reduce Air Pollutant Emissions	2	4	9	14	18	
	Resilience	CR1.4	Conduct Vulnerability Assessment	3	6	8	12	16	
		CR2.1	Assess Climate Change Vulnerability	8	14	18	20	-	
		CR2.2	Evaluate Risk and Resilience	11	18	24	26	-	
		CR2.3	Establish Resilience Goals and Strategies	-	8	14	20	-	
		CR2.4	Maximize Resilience	11	15	20	26	-	
		CR2.5	Improve Infrastructure Integration	2	5	9	13	18	
								Maximum TOTAL Points	1000

- Quality of Life: Quality of Life covers the impact of projects on the host and impacted communities being affected, including the well-being of the living individuals. The aim of this category is to help project teams evaluate whether the project aligns with the community's goals, contributes to the long-term well-being of the affected community, and integrates effectively within existing community networks. Quality of Life includes 13 credits, which are evaluated under three subcategories: Wellbeing, Mobility, and Community, with a maximum achievable point of 200, as shown in Table 3.1 (ISI, 2018).
- Leadership: Projects are more successful when they include a diverse range of individuals in the ideation process, interact and communicate from the start, and have a long-term, holistic perspective on the project and its life cycle. The leadership category promotes and rewards these activities when combined with conventional sustainability measures like reduction of energy and water use; effective and cooperative leadership creates a project that is truly sustainable and benefits the community. Leadership contains 11 credits, which are evaluated under three subcategories: Collaboration, Planning, and Economy, with a maximum achievable point of 182 as shown in Table 3.1 (ISI, 2018).
- Resource Allocation: The assets required to construct and maintain infrastructure are known as resources. The quantity, source, and quality of these resources, as well as their effects on the project's overall sustainability, are the main concerns of this area. Since these resources are limited, they ought to be used with care as an asset. Resource Allocation contains 13 credits, which are evaluated under three subcategories: Materials, Energy, and Water, with a maximum achievable point of 196 as shown in Table 3.1 (ISI, 2018).
- Natural World: The natural environment surrounding infrastructure projects is affected, including species, ecosystems, and nonliving natural systems. This section discusses strategies for identifying and mitigating adverse

effects while taking into account the beneficial, synergistic interactions that the infrastructure might have with natural systems. Natural World contains 13 credits, which are evaluated under three subcategories: Siting, Conservation, and Ecology, with a maximum achievable score of 232 as shown in Table 3.1 (ISI, 2018).

- Climate and Resilience: The Climate and Resilience category focuses on ensuring that infrastructure investments are robust and on reducing emissions that contribute to climate change and other short- and long-term challenges. Infrastructure needs to be knowledgeable, resourceful, robust, redundant, adaptable, integrated, and inclusive to be resilient. Climate and Resilience contains 9 credits, which are evaluated under two subcategories: Emissions and Resilience, with a maximum achievable point of 190 as shown in Table 3.1 (ISI, 2018).

3.2.2 Evaluation of Levels of Achievement

The degree and quality of project performance in each credit are defined by the levels of achievement. These are as follows:

- Improved: Performance is above average and exceeds regulatory requirements.
- Enhanced: Correct course of sustainable performance. There are signs that higher performance is achievable.
- Superior: Very high level of sustainable performance.
- Conserving: Achieved performance essentially has zero negative impact.
- Restorative: Sustainable performance that results in the restoration of social or ecological systems. The greatest distinction is called Restorative. Not every performance goal has a restorative level.

It should be noted that not every credit has five achievement levels. The credit's nature and the capacity to distinguish across levels in a significant way determine the level of achievement. (ISI, 2018).

3.2.3 Envision Framework

There are six components that comprise the Envision framework.

3.2.3.1 Envision Guidance Manual

The core component of the Envision structure is the Envision Guidance Manual, which is the written framework. As discussed previously, it has 64 sustainability indicators, credits, that include all aspects of sustainable infrastructure. Every credit in the Envision framework has an intent statement, a metric, a description, techniques to enhance performance, levels of achievement from Improved to Restorative, evaluation criteria, documentation guidelines, and linked Envision credits. By subject type, the credits are arranged into five categories and fourteen subcategories, as given in Table 3.1 (ISI, 2024).

3.2.3.2 Envision Pre-Assessment Checklist

The Excel-based Envision Pre-Assessment Checklist consists of a set of yes/no questions based on the criteria in the Envision Guidance Manual, which provides an early high-level pre-assessment. In the beginning of the project planning stage, when precise performance data required for a thorough assessment is still unclear, it can be useful. Additionally, it serves as a teaching tool to familiarize Envision users with the sustainable components of infrastructure design, planning, and building. Before important project decisions are made, the Pre-Assessment Checklist can be used to swiftly analyze project alternatives (ISI, 2024).

3.2.3.3 Envision Online Scoresheet

Envision account holders can view the Envision Online Scoresheet, a digital rendition of the Envision Guidance Manual, on the ISI website. In other words, it is a comprehensive online calculator and assessment tool. In addition to being used to register and submit a project for verification, the Envision Online Scoresheet is also utilized to perform more thorough sustainability project assessments (ISI, 2024).

3.2.3.4 ENV SP Credential

A person who has finished ISI's Envision training program is known as an ENV SP, which is an expert instructor on the use of Envision. The ISI website offers training programs online, or a trainer who has been approved by ISI can provide it in person. A project team needs to include at least one ENV SP in order for the project to be submitted for Envision verification (ISI, 2024). Researcher of this thesis received the relevant training and obtained ENV SP to enhance the validity of the research.

3.2.3.5 Envision Verification

Envision is a popular self-assessment tool for project teams, but ISI also provides project verification software, that processes independent third-party project review. An impartial third-party peer review procedure called verification is used to ensure the project satisfies Envision evaluation standards. Project teams can calibrate their self-assessments by pursuing verification (ISI, 2024).

Envision's mission is to support the significant and essential enhancement of the resilience and sustainable performance of physical infrastructure by assisting owners, planners, engineers, communities, contractors, and other stakeholders in the infrastructure in putting into practice more affordable, resource-efficient, and flexible long-term infrastructure investments. Increasing awareness and starting this systemic change both depend on recognition. To accomplish this, ISI provides an

Envision verification and awards program to honor sustainable project accomplishments (ISI, 2024). Projects can follow one of two verification processes under Envision v3:

• Pathway A: Design + post-construction (Figure 3.2)

• Pathway B: Post-construction (Figure 3.3)



Figure 3.2 Pathway A: design + post-construction (ISI, 2018)



Figure 3.3 Pathway B: post-construction (ISI, 2018)

In Pathway A: Design + Post-Construction: Following the design phase, the project team completes the primary verification and receives the Envision award (at or after 95% design completion). For projects to keep their Envision award, they must subsequently finish a second post-construction review. Verifying that promises made during the design review were kept during construction is the goal of the post-construction review (ISI, 2024).

In Pathway B: After Construction: The verification is carried out by the project at or after 95% of the building phase (ISI, 2024).

3.2.3.6 Envision Awards

An Envision award is given to projects that successfully finish the verification process and score enough points according to the Envision award system. Based on the proportion of applicable points attained, award levels are determined (ISI, 2024). Awards levels and required point achievements are verified (20%), silver (30%), gold (40%), and platinum (50%).

3.2.4 Application of the Envision System for the Case Study

To accurately interpret and analyze the criteria of the Envision sustainability assessment methodology applied in this thesis, the researcher has obtained the ENV SP certification which is shown in the Figure 3.4. This credential, awarded by the ISI, signifies expertise in the use of sustainability concepts within infrastructure projects. During the certification process, extensive training was conducted on the Envision system's structure, credit assessment methodologies, and the incorporation of sustainability techniques into projects, resulting in the acquisition of expert competence through examination. Consequently, a systematic, consistent, and expert opinion-based methodology was employed in the study of Envision credits in this research, enhancing the reliability and methodological precision of the evaluations.



Figure 3.4 ENV SP certification of the researcher.

In this study, in order to analyze credits of the Envision sustainability rating system in a systematic and consistent manner, a standardized evaluation table is prepared, which is shown in Figure 3.5. Each Envision credit is analyzed in the same formatted spreadsheet according to the project documents, regulations, and laws. This approach helps to evaluate each credit in the same way with transparency.

QUALITY OF LIFE																	
Code	Credit Name	Envision Applicability	Assessment Applicability	Max. Available Point	Reference Documents	Evaluation							Achievement Level		Score		Recommendation
						A	B	C	D	E	F	G	Base	Upper	Base	Upper	

Figure 3.5 Spreadsheet used in the Envision evaluation of Project X

Each column in the spreadsheet serves the following purpose and functions:

- **Code:** It refers to the unique code given for each credit in the Envision system. (For example: QL1.1, NW2.3)
- **Credit Name:** The original name of the credit given in the Envision system. (For example: Enhance Functional Habitats, Improve Construction Safety)

- **Envision Applicability:** The overall application of credit has been assessed in accordance with the criterion outlined in the Envision guide and is deemed valid.
- **Assessment Applicability**: Assesses the evaluability of the criterion in question for this study specifically. Criteria are designated as invalid (not applicable) if they fall under the direct purview of the contractor or infrastructure owner institutions, and adequate data cannot be supplied within the research parameters.
- **Maximum Available Point:** The maximum point given for the credit in the Envision system.
- **Reference Documents:** Refers to the documents evaluated for the scoring of the credit.
- **Evaluation (A–G)**: For each credit to be met, there are different questions given. To check if required performance in these questions is met, each credit is evaluated according to these questions, A to G. The performance in these questions is evaluated as "Yes," "Maybe," or "No."
    - **Yes:** The project satisfies all the requirements listed in the question.
    - **Maybe:** Some requirements are met, but some studies are missing.
    - **No**: Refers to cases where there is no study in the project corresponding to the relevant question.
- **Achievement Level (Base/Upper)**: According to each satisfied question, the achievement level is determined. The evaluation in this section is based on the Pre-Assessment Checklist provided by Envision. Two distinct approaches determine the credit's achievement level.
    - **Base Level:** This approach solely takes into account questions that receive a "Yes" evaluation.
    - **Upper Level**: It refers to the highest level of achievement that can be obtained if the questions evaluated as "Maybe" are raised to the "Yes" level with appropriate improvements. The score also includes questions that have already been answered "Yes".

- **Score (Base/Upper)**: According to each satisfied question, a score is determined. The evaluation in this section is based on the Pre-Assessment Checklist provided by Envision. Two distinct approaches determine the credit's achievement level.
    - **Base Score**: Refers to the points that are only gathered from questions evaluated as “Yes.”
    - **Upper Score**: It refers to the highest score that can be obtained if the questions evaluated as “Maybe” are raised to the “Yes” level with appropriate improvements. The score also includes questions that have already been answered “Yes”.
- **Recommendation**: For questions assessed as "No" or "Maybe" in the evaluation, recommendations are provided to enhance the project's sustainability moving forward. This section offers instructions on addressing existing problems and identifying practices that can be incorporated into the project.

This table structure facilitates both the analytical and practical dimensions of the study while also offering a visual and methodical evaluation for decision-makers. This consistent evaluation of the criteria enabled a systematic presentation of the project's sustainability level.

3.3 Data Collection

This study aims to assess Türkiye's current sustainability level in highway design and explore potential ways to enhance it. The sustainability level of Project X was determined based on the Envision system by the researcher of this thesis who obtained ENV SP for this evaluation. The contents of the criteria for which the project X failed in the envision evaluation were asked to experts in the field through interviews.

The main purpose of selecting the interview method in this research is to provide broad knowledge of experts' experiences and perspectives regarding the incorporation of Envision sustainability standards into Turkish highway projects. The interview method enables interviewees to explain current executions in the sector, observations, decision-making processes, and perspectives toward sustainability comprehensively. The interview method is widely used in literature for similar research as well. Griffiths (2019) conducted semi-structured interviews to learn the perspectives of infrastructure owners and rating tool users. Trop (2022) used face-to-face semi-structured interviews in research to understand how Envision systems are applied in the project stages and the important elements that the system ignores. Aljboor et al. (2023) investigated the barriers in achieving sustainability on Jordan highways by conducting interviews with highway experts. Interviews were considered the best way to conduct the research, providing a wide view of how each part of the Envision system is understood in different fields and how it fits into projects.

This research was carried out with the authorization granted by the Human Research Ethics Committee of Middle East Technical University. All participants engaged in the interviews voluntarily and provided written consent. To protect the participants' information, the names of participants and their conversations were mentioned in the thesis by coding their names. The security of participant information was carefully secured; the audio recordings from the interviews were retained solely until transcription was finalized and subsequently erased permanently. The transcribed texts and analytical outputs were stored in protected digital environments, accessible solely to the researcher.

The following sections will detail the preparation of the interview questions, the selection of participants, the data collection, and the analysis of the data.

3.3.1 Interview Questions

In this study, interviewee opinions are gathered by semi-structured interviews. Semi-structured interviews are characterized by their flexible and fluid structure, in contrast to structured interviews. This structure encompasses subjects, themes, or domains to be addressed during the interview, rather than a sequential script of uniform questions. This allows the interview to be influenced by the interviewee's perspectives and the researcher's interests, facilitating the emergence of unforeseen themes (Galletta, 2004). The interviews utilized a combination of open-ended, yes/no, and scaled questions, with four different sets of questions for highway alignment engineers, environmental engineers, managers, and sociologists.

In creating interview questions, each applicable credit of Envision rating systems to Project X was taken as a basis. Within the scope of Project X evaluation, sub-questions that resulted in a "maybe" or "no" were determined. The interview questions incorporate each of the Envision sub-questions. Each interview question was followed by 1 yes/no and 2 ranking questions. The aim of those interview questions was to achieve three main purposes:

- Whether the participants have previously implemented the credits related to the mentioned Envision sub-questions in international or domestic projects,
- Identification of how difficult the Envision sub-questions were found to be included in the projects by the participants.
- Determine the extent to which the inclusion of the Envision sub-questions in the projects are prioritized by the participants.

3.3.2 Participant Selection and Sampling

In this research, the aim is to learn from the experts in the field how sustainability topics are implemented in highway design in Türkiye. For that reason, purposive sampling is used in selecting participants for interviews. Purposive sampling in

qualitative research involves the intentional selection of participants with specific qualities, aligned with the requirements of evolving analysis and developing theory (Purposive sampling, 2004).

Factors considered during participant selection were: i) work experience on highway projects, and ii) a minimum of five years of professional experience. Participants were chosen from specialists across various disciplines involved in the highway projects. The selection process intended to gather insights from individuals possessing technical, managerial, and social experience capable of directly enhancing sustainability practices. Participants were chosen from four separate professional categories, which are

- Highway alignment engineers: Engineers worked in highway projects' planning and design phase.
- Managers: Senior engineering professionals who supervise decision-making processes and confirm project credibility.
- Environmental engineers: Engineers who are responsible for determining the environmental impacts of highway projects.
- Social experts: Experts who analyze the social impacts of the project.

Through these considerations, semi-structured interviews are conducted with 8 alignment engineers, 6 managers, 7 environmental engineers, and 5 social experts. To ensure the confidentiality of participants, their identities were anonymized through the use of coding rather than personal names. Coding and participant's work experience are given in the Table 3.2.

Table 3.2 Participant name coding and their work experiences

Occupation	Code	Participant Code	Work Experience (Years)
Alignment Engineers	A	A1	20
		A2	13
		A3	8
		A4	8
		A5	10
		A6	8
		A7	5
		A8	8
Environmental Engineers	E	E1	9
		E2	12
		E3	25
		E4	15
		E5	18
		E6	9
		E7	13
Managers	M	M1	21
		M2	16
		M3	20
		M4	21
		M5	25
		M6	24
Social Experts	S	S1	9
		S2	15
		S3	25
		S4	5
		S5	10

3.3.3 Data Collection and Interview Process

In this study, interviews are performed either face-to-face or online (Teams, Zoom), depending on the interviewees' preference. The interview duration differed from 30 to 90 minutes depending on the question sets. Each participant was asked to fill in the form, which included interview follow-up questions with yes/no and ranking.

Before all interviews, the participants were informed about the purpose of the study, duration, principles of volunteering, and data use, and an informed consent form was signed. With their permission, interviews are voice recorded and word-by-word transcription is completed.

3.4 Data Evaluation Methods

3.4.1 Quantitative Analysis

In the scope of the semi-structured interview with experts, participants are asked to evaluate each Envision criteria-related question with two perspectives:

- Difficulty Level: How hard is it to integrate related Envision criteria into current Turkish highway design projects?
- Priority Level: How important is it to integrate related Envision criteria into current Turkish highway design projects?

Each interviewee is asked to rank each criterion from 1 (lowest) to 5 (highest). The average of the difficulty and priority levels is taken from the rankings given by the participants. A decision has been made on the level to which the relevant criterion should be integrated into the project. The decision logic is structured as follows:

- If the priority average ≥ 3 and difficulty level ≤ 3 then → "Include."

  This means that the criteria are both prioritized and found easy; its direct application under current project conditions is suggested.

- If the priority average > 3 and difficulty level > 3 then → "Plan & Include."

  This means that even if it can be hard to implement, those subjects are prioritized; thus, it is suggested that it be implemented by integrating it into planning in future projects.

- If the priority average < 3 then → "Exclude."

  The criterion was evaluated as a low priority, and its applicability was questioned, so it was decided not to integrate it into the project.

The numerical data acquired with this method were examined by computing the average difficulty and priority ratings for each Envision criterion. This investigation made it possible to find out which sustainability issues are most important to decision makers and problems they have when putting them into action. The results help figure out what gaps there are in current implementation and how to set the order of importance for sustainability criteria in the future.

3.4.2 Qualitative Analysis

In this study, semi-structured interviews are conducted in order to evaluate and improve sustainability of highway projects. This resulted in qualitative data which are analyzed using thematic analysis. Thematic analysis offers a structured yet flexible framework for identifying, interpreting, and interpreting recurring patterns (themes) in data (Ahmed et al., 2025; Braun & Clarke, 2006). Compared to alternative methods (e.g., Grounded Theory, IPA, content analysis), thematic analysis is more suitable for the purposes of this study because it does not have the strict goal of developing theory; rather, the aim is to systematically reveal patterns of meaning in the data obtained (Ahmed et al., 2025). Because the aim of the study was to gain an in-depth understanding of participants' experiences, perceptions, and approaches to sustainability-focused processes, thematic analysis was considered the most appropriate method in this context.

Thematic analysis is the process of systematically classifying qualitative data and uncovering patterns (themes). The thematic analysis approach, developed by Braun and Clarke (2006), is a six-step process encompassing data description, coding, and interpretation. This method allows the researcher to identify recurring meanings in the data, create themes, and then draw conclusions based on these themes. The thematic analysis process used in this study employed an inductive and semantic approach; that is, themes were extracted directly from participants' discourse and analyzed at the level of explicit statements.

Analysis process is conducted in accordance to the Braun and Clarke's (2006) six stage thematic analysis which is detailed in the Figure.3.6 below. During this analysis MAXQDA 24 software is used.

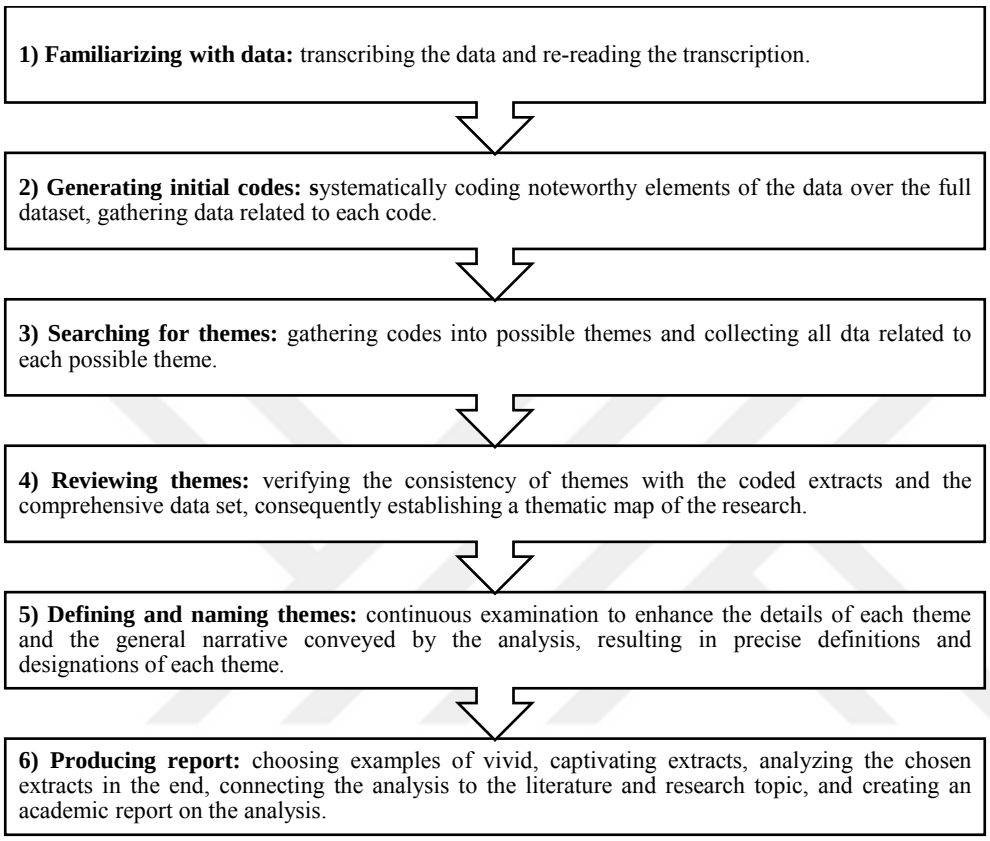


Figure.3.6 Six stage thematic analysis (Braun & Clarke, 2006)

After the themes were identified, a relationship analysis was conducted to examine the conceptual and contextual relationships between them. This process was carried out to understand how the topics obtained from the interviews were connected to each other and to reveal the overall structure of the sustainability dimensions within the scope of the project. The analysis was conducted using an interpretive and comparative approach. Each sub-theme was compared with other sub-themes based on content similarities, overlaps, and logical relationships derived from participant statements. Relationships were classified as complementary, contrasting, or cause-and-effect. This assessment contributed to understanding how different sustainability elements interact and influence each other within the project context.

Following the thematic analysis, the meaning and context of each code were evaluated in terms of its relationship with the UN SDGs. The purpose of this step was to reveal the level of alignment between the sustainability-themed concepts obtained from the interviews and the global sustainability framework. Each code was examined in terms of which SDG target it corresponded to, taking into account its meaning, the topic it focused on, and the sustainability dimension it represented. The analysis process was conducted based on the content structure and focus area of the codes; the results were organized into a list showing which SDG targets the emerging concepts corresponded to.

3.4.3 Integrated Analysis of Findings

The integration of quantitative and qualitative findings was carried out within the scope of a mixed-method approach. This research was conducted to combine quantitative and qualitative data and to analyze project evaluation and interview findings in a complementary manner. The goal was to ensure a comprehensive interpretation of the sustainability assessment by combining measurable data obtained through the Envision system with perceptual and contextual information obtained from interviews.

In the first stage of the integrated analysis, the results of the quantitative project assessment based on the Envision system were compared with the quantitative data obtained from the interviews. In this context, credits identified as “Maybe” and ‘No’ in the project assessment were matched with the “Include,” “Exclude,” and “Plan and Include” results obtained from the quantitative analysis of the interviews. This comparison enabled a systematic examination of which sustainability topics were considered feasible, partially feasible, or infeasible according to the participants' views. Thus, the technical assessment based on project documentation and the quantitative findings based on expert perceptions were made comparable on the same plane.

In the second stage of the integrated analysis, these matched data were supported by qualitative (thematic) analysis findings. At this stage, conceptual frameworks explaining the reasons behind the criteria assessed as “Plan and Include” and “No” were created by examining the interview themes, codes, and subcodes for each credit. The themes obtained from the interviews were used to explain, justify, and interpret the quantitative patterns. This approach ensured that the findings emerging from the quantitative analysis were not limited to the outcome level, but were also addressed in their contextual, managerial, and technical dimensions. The mixed-methods analysis process integrated the data at three levels:

- Project evaluation and quantitative interview analysis results were compared to identify similarities and differences.
- Thematic findings from the interviews were used to explain and deepen the reasons behind the quantitative patterns.
- Quantitative and qualitative data were structured to answer the same research questions from different angles and were brought together at the interpretation stage.

This approach ensured that the quantitative assessment results based on the Envision system were considered alongside expert views and provided an analytical framework that revealed the relationship between the two data types in a holistic manner. Therefore, the mixed-methods approach formed an important component of the overall methodological structure of the study and enabled the comparative interpretation of different data types related to sustainability assessment. Consequently, integrated analysis ensured a comprehensive understanding of both measurable sustainability outcomes and the contextual factors influencing these outcomes.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Envision Evaluation

The Envision Sustainability Rating System (Version 3) evaluation system was implemented to investigate how well the highway project selected as case study did in terms of sustainability. During the evaluation, it was determined how every parameter in the Envision system applied to the project, and a score was awarded based on these criteria. The criteria are analyzed based on project documents, considering the design scope and the distribution of responsibilities among participants. The results show what the project's strengths and weaknesses are when it comes to sustainability, and they also give crucial clues about how well the Envision method may be used on highway projects in Türkiye.

4.1.1 Assessment Approach and Evaluation Scope

In this study, the sustainability of highway project X is evaluated by the ENV SP. However, not every criterion in the Envision system is applicable to all projects and project stages. For this reason, in the project evaluation process, two different applicability approaches are considered.

- Envision Applicability: Criteria eligibility according to project types. The applicability of criteria totally depends on the explanation given in the Envision Manual v3.

- Assessment Applicability: Whether the criterion in question can actually be evaluated within the framework of project-specific conditions. The applicability of the criteria totally depends on the researcher. The evaluation of assessment applicability was performed using two criteria:
    - whether the credit exceeded the contractual responsibilities of the design company,
    - whether it was exclusively a duty of the project owner or contractor.

The assessment excluded credits that satisfied either of these criteria. The applicability of each Envision criterion is provided in the Table 4.1.

Table 4.1 Envision criteria applicability

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability
QUALITY OF LIFE	Wellbeing	QL1.1 Improve Community Quality of Life	Yes	Yes
		QL1.2 Enhance Public Health & Safety	Yes	Yes
		QL1.3 Improve Construction Safety	Yes	No
		QL1.4 Minimize Noise & Vibration	Yes	Yes
		QL1.5 Minimize Light Pollution	Yes	No
		QL1.6 Minimize Construction Impacts	Yes	No
	Mobility	QL2.1 Improve Community Mobility	Yes	Yes
		QL2.2 Encourage Sustainable Transportation	Yes	Yes
		QL2.3 Improve Access & Wayfinding	Yes	Yes
	Community	QL3.1 Advance Equity & Social Justice	Yes	Yes
		QL3.2 Preserve Historic & Cultural Resources	Yes	Yes
		QL3.3 Enhance Views & Local Character	Yes	No
		QL3.4 Enhance Public Space & Amenities	Yes	Yes
LEADERSHIP	Collaboration	LD1.1 Provide Effective Leadership & Commitment	Yes	Yes
		LD1.2 Foster Collaboration & Teamwork	Yes	Yes
		LD1.3 Provide for Stakeholder Involvement	Yes	Yes
		LD1.4 Pursue Byproduct Synergies	Yes	Yes
	Planning	LD2.1 Establish a Sustainability Management Plan	Yes	Yes
		LD2.2 Plan for Sustainable Communities	Yes	Yes
		LD2.3 Plan for Long-Term Monitoring &Maintenance	Yes	No
		LD2.4 Plan for End-of-Life	Yes	Yes
	Economy	LD3.1 Stimulate Economic Prosperity & Development	Yes	Yes
		LD3.2 Develop Local Skills & Capabilities	Yes	Yes
		LD3.3 Conduct a Life-Cycle Economic Evaluation	Yes	Yes
RESOURCE ALLOCATION	Materials	RA1.1 Support Sustainable Procurement Practices	Yes	No
		RA1.2 Use Recycled Materials	Yes	No
		RA1.3 Reduce Operational Waste	Yes	No
		RA1.4 Reduce Construction Waste	Yes	No
		RA1.5 Balance Earthwork On Site	Yes	Yes
	Energy	RA2.1 Reduce Operational Energy Consumption	Yes	No
		RA2.2 Reduce Construction Energy Consumption	Yes	No
		RA2.3 Use Renewable Energy	Yes	No
		RA2.4 Commission & Monitor Energy Systems	Yes	No
	Water	RA3.1 Preserve Water Resources	Yes	Yes
		RA3.2 Reduce Operational Water Consumption	No	No
		RA3.3 Reduce Construction Water Consumption	Yes	No
		RA3.4 Monitor Water Systems	No	No
NATURA WORLD	Siting	NW1.1 Preserve Sites of High Ecological Value	No	No
		NW1.2 Provide Wetland & Surface Water Buffers	Yes	Yes
		NW1.3 Preserve Prime Farmland	Yes	Yes
		NW1.4 Preserve Undeveloped Land	Yes	Yes
	Conservation	NW2.1 Reclaim Brownfields	Yes	Yes
		NW2.2 Manage Stormwater	Yes	Yes
		NW2.3 Reduce Pesticide & Fertilizer Impacts	Yes	No
		NW2.4 Protect Surface & Groundwater Quality	Yes	Yes
	Ecology	NW3.1 Enhance Functional Habitats	Yes	Yes
		NW3.2 Enhance Wetland & Surface Water Functions	Yes	Yes
		NW3.3 Maintain Floodplain Functions	Yes	Yes
		NW3.4 Control Invasive Species	Yes	No
		NW3.5 Protect Soil Health	Yes	No
CLIMATE AND RESILIENCE	Emissions	CR1.1 Reduce Net Embodied Carbon	Yes	No
		CR1.2 Reduce Greenhouse Gas Emissions	Yes	Yes
		CR1.3 Reduce Air Pollutant Emissions	Yes	Yes
	Resilience	CR2.1 Avoid Unsuitable Development	Yes	Yes
		CR2.2 Assess Climate Change Vulnerability	Yes	Yes
		CR2.3 Evaluate Risk & Resilience	Yes	Yes
		CR2.4 Establish Resilience Goals and Strategies	Yes	Yes
		CR2.5 Maximize Resilience	Yes	Yes
		CR2.6 Improve Infrastructure Integration	Yes	Yes

4.1.1.1 Envision Applicability

The flexible and adaptable nature of the Envision system recognizes that not all credits will be applicable to all projects and project types. Therefore, credits may be designated as "not applicable" and removed from evaluation. This applies when the sustainability indicator addressed by a specific credit is not feasible for the project. This means that the total points associated with the credit are subtracted from the total points applicable to the project within the Envision framework.

During the analysis conducted as part of the project evaluation, it was determined that three credits included in the Envision Sustainability Rating System were not applicable to the Project X. In this context, three credits were rated "Not Applicable" according to the Envision guidelines. This status stems not from the system-wide applicability of these credits, but rather from project-specific circumstances. These three credits, along with the reasons for their designation as "Not Applicable," are explained in detail below.

- RA3.2 Reduce Operational Water Consumption (22 points); This credit is not included in the evaluation because there is no operational water consumption in highway projects.
- RA3.4 Monitor Water Systems (12 points); This credit is not included in the evaluation because there is no operational water consumption in highway projects.
- NW1.1 Preserve Sites of High Ecological Value (22 points); This credit is not included in the evaluation because there is no high ecological value in the project site as stated in the EIA report of the project.

4.1.1.2 Assessment Applicability

In the project evaluation conducted within the scope of this thesis, some credits in the Envision Sustainability Rating System have been marked as “Not Applicable” due to the scope and limitations of the study. First, the contract between the designer

and the client for Project X, along with its annexes and job descriptions, was examined; credits falling outside the designer's contractual scope of responsibility were systematically excluded. Furthermore, as the study was limited to the design phase and the designer's perspective, credits related to applications that could only be implemented during the construction/implementation phase under the contractor's control were not included in the assessment . This exclusion decision was made based on the criteria of controllability, direct impact, and verifiable evidence. As a result, a total of 20 Envision credits were excluded from this research, thus focusing only on topics that can be verifiably directed by the designer and for which reasonable data/evidence can be provided within the scope of the project. Below, these credits that were not included in the analysis are listed individually, and the contractual, scope, and process reasons underlying the "Not Applicable" classification for each are summarized.

- QL1.3 Improve Construction Safety (14 points); This credit is not included in the evaluation since the contractor is responsible for this subject.
- QL1.5 Minimize Light Pollution (12 points); This credit is not included in the evaluation because the lighting project is not within the scope of the designer's contract.
- QL1.6 Minimize Construction Impacts (8 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- QL3.3 Enhance Views & Local Character (14 points); This credit is not included in the evaluation because the landscape project is not within the scope of the designer's contract.
- LD2.3 Plan for Long-Term Monitoring &Maintenance (12 points); This credit is not included in the evaluation because monitoring and maintenance are not in the scope of the designer's contract.
- RA1.1 Support Sustainable Procurement Practices (12 points); This credit is not included in the evaluation because the contractor is responsible for this subject.

- RA1.2 Use Recycled Materials (16 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- RA1.3 Reduce Operational Waste (14 points);
- RA1.4 Reduce Construction Waste (16 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- RA2.1 Reduce Operational Energy Consumption (26 points); This credit is not included in the evaluation because the lighting project is not within the scope of the designer's contract.
- RA2.2 Reduce Construction Energy Consumption (12 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- RA2.3 Use Renewable Energy (24 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- RA2.4 Commission & Monitor Energy Systems (14 points); This credit is not included in the evaluation because the lighting project is not in the scope of the designer's contract.
- RA3.3 Reduce Construction Water Consumption (8 points); This credit is not included in the evaluation because the contractor is responsible for this subject.
- NW2.3 Reduce Pesticide & Fertilizer Impacts (12 points); This credit is not included in the evaluation because the landscape project is not within the scope of the designer's contract.
- NW3.4 Control Invasive Species (12 points); This credit is not included in the evaluation because the landscape project is not in the scope of the designer's contract.
- CR1.1 Reduce Net Embodied Carbon (20 points); This credit is not included in the evaluation because the contractor is responsible for this subject.

4.1.1.3 Overall Envision Credit Applicability

The Table 4.2 shows the percentage of Envision credits that are considered relevant in two distinct contexts: Envision Applicability and Assessment Applicability.

Table 4.2 Envision criteria applicability percantages

Categories	Envision Applicability	Assessment Applicability
Quality of Life	100%	69%
Leadership	100%	91%
Resource Allocation	85%	15%
Natural World	92%	69%
Climate and Resilience	100%	89%
OVERALL	**94%**	**62%**

The Table 4.2 indicates that, although the weighted average of 94% of the Envision credits were relevant to the Project X, according to the Envision manual, only 62% were practically applicable to the assessment. The difference was especially apparent in the Resource Allocation category, where the evaluation application rate fell to 15%, mostly due to applications related to the construction phase and contractors' responsibilities, such as procurement procedures and implementation-related subjects, including electricity and water usage during the construction phase. In contrast, categories like Leadership and Climate and Resilience exhibited elevated assessment applicability rates (91% and 89%), signifying that the majority of pertinent planning-level decisions and documentation were established and fell within the purview of the design team.

This dual-layered applicability evaluation ensures that the ultimate sustainability assessment is grounded in both conceptual scope and practical applicability, hence enhancing both the credibility and openness of the findings.

4.1.2 Summary of Credit-Based Evaluation

In this section, the score obtained by Project X according to the Envision Manual v3 is examined. As mentioned in the previous section, first the Envision credits included in the evaluation were determined, and then the sustainability assessment of Project X was made based on the project documents.

The Table 4.3 below indicates the achievement level obtained by the project for each of the 59 items of Envision, the score defined for credit in Envision, the maximum score that can be obtained according to Envision applicability, the maximum score that can be obtained according to applicability in the research, and the score received by the examined project under the relevant credits. As mentioned before, base and upper scores and achievement levels were determined within the research, and the examination was carried out accordingly. As a result of the examination, the sustainability success of the project and the score it received from Envision were determined. As part of the detailed assessment of the total 59 Envision credits, the reference documents reviewed during the evaluation process for each credit, along with the "Yes," "Maybe," and "No" assessments made on a sub-credit basis, and which applications in the project earned points are presented in a systematic manner. Additionally, the base and upper score values for each credit, the achievement levels obtained, and recommendations for improvements to achieve higher sustainability performance are provided in Appendix A. The projects success in each subquestion of the credits are also shown in Table 4.4, Table 4.5, Table 4.6, Table 4.7 and Table 4.8 by color codes, where green meaning "Yes", yellow meaning "Maybe" and red meaning "No".

Table 4.3 Project X's Envision assessment results

ENVISION V3 CREDITS			Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
			Base	Upper				Base	Upper
QUALITY OF LIFE	Wellbeing	QL1.1 Improve Community Quality of Life	No Achievement	Enhanced	26	26	26	0	5
		QL1.2 Enhance Public Health & Safety	Enhanced	Enhanced	20	20	20	7	7
		QL1.3 Improve Construction Safety	X	X	14	14	0	X	X
		QL1.4 Minimize Noise & Vibration	Enhanced	Superior	12	12	12	3	6
		QL1.5 Minimize Light Pollution	X	X	12	12	0	X	X
		QL1.6 Minimize Construction Impacts	X	X	8	8	0	X	X
	Mobility	QL2.1 Improve Community Mobility	Enhanced	Restorative	14	14	14	3	14
		QL2.2 Encourage Sustainable Transportation	No Achievement	No Achievement	16	16	16	0	0
		QL2.3 Improve Access & Wayfinding	No Achievement	No Achievement	14	14	14	0	0
	Community	QL3.1 Advance Equity & Social Justice	No Achievement	No Achievement	18	18	18	0	0
		QL3.2 Preserve Historic & Cultural Resources	Enhanced	Enhanced	18	18	18	2	2
		QL3.3 Enhance Views & Local Character	X	X	14	14	0	X	X
		QL3.4 Enhance Public Space & Amenities	Improved	Improved	14	14	14	1	1
LEADERSHIP	Collaboration	LD1.1 Provide Effective Leadership & Commitment	No Achievement	Improved	18	18	18	0	2
		LD1.2 Foster Collaboration & Teamwork	No Achievement	No Achievement	18	18	18	0	0
		LD1.3 Provide for Stakeholder Involvement	No Achievement	Improved	18	18	18	0	3
		LD1.4 Pursue Byproduct Synergies	Superior	Superior	18	18	18	12	12
	Planning	LD2.1 Establish a Sustainability Management Plan	No Achievement	No Achievement	18	18	18	0	0
		LD2.2 Plan for Sustainable Communities	No Achievement	No Achievement	16	16	16	0	0
		LD2.3 Plan for Long-Term Monitoring &Maintenance	X	X	12	12	0	X	X
		LD2.4 Plan for End-of-Life	No Achievement	No Achievement	14	14	14	0	0
	Economy	LD3.1 Stimulate Economic Prosperity & Development	No Achievement	Superior	20	20	20	0	12
		LD3.2 Develop Local Skills & Capabilities	No Achievement	No Achievement	16	16	16	0	0
		LD3.3 Conduct a Life-Cycle Economic Evaluation	No Achievement	No Achievement	14	14	14	0	0
RESOURCE ALLOCATION	Materials	RA1.1 Support Sustainable Procurement Practices	X	X	12	12	0	X	X
		RA1.2 Use Recycled Materials	X	X	16	16	0	X	X
		RA1.3 Reduce Operational Waste	X	X	14	14	0	X	X
		RA1.4 Reduce Construction Waste	X	X	16	16	0	X	X
		RA1.5 Balance Earthwork On Site	Improved	Improved	8	8	8	2	2
	Energy	RA2.1 Reduce Operational Energy Consumption	X	X	26	26	0	X	X
		RA2.2 Reduce Construction Energy Consumption	X	X	12	12	0	X	X
		RA2.3 Use Renewable Energy	X	X	24	24	0	X	X
		RA2.4 Commission & Monitor Energy Systems	X	X	14	14	0	X	X
	Water	RA3.1 Preserve Water Resources	Improved	Improved	12	12	12	3	3
		RA3.2 Reduce Operational Water Consumption	X	X	22	0	0	X	X
		RA3.3 Reduce Construction Water Consumption	X	X	8	8	0	X	X
		RA3.4 Monitor Water Systems	X	X	12	0	0	X	X
NATURA WORLD	Siting	NW1.1 Preserve Sites of High Ecological Value	X	X	22	0	0	X	X
		NW1.2 Provide Wetland & Surface Water Buffers	No Achievement	No Achievement	20	20	20	0	0
		NW1.3 Preserve Prime Farmland	No Achievement	No Achievement	16	16	16	0	0
		NW1.4 Preserve Undeveloped Land	Improved	Enhanced	24	24	24	3	8
	Conservation	NW2.1 Reclaim Brownfields	No Achievement	No Achievement	22	22	22	0	0
		NW2.2 Manage Stormwater	No Achievement	No Achievement	24	24	24	0	0
		NW2.3 Reduce Pesticide & Fertilizer Impacts	X	X	12	12	0	X	X
		NW2.4 Protect Surface & Groundwater Quality	No Achievement	No Achievement	20	20	20	0	0
	Ecology	NW3.1 Enhance Functional Habitats	No Achievement	No Achievement	18	18	18	0	0
		NW3.2 Enhance Wetland & Surface Water Functions	No Achievement	No Achievement	20	20	20	0	0
		NW3.3 Maintain Floodplain Functions	No Achievement	No Achievement	14	14	14	0	0
		NW3.4 Control Invasive Species	X	X	12	12	0	X	X
		NW3.5 Protect Soil Health	No Achievement	Superior	8	8	0	0	4
CLIMATE AND RESILIENCE	Emissions	CR1.1 Reduce Net Embodied Carbon	X	X	20	20	0	X	X
		CR1.2 Reduce Greenhouse Gas Emissions	No Achievement	No Achievement	26	26	26	0	0
		CR1.3 Reduce Air Pollutant Emissions	No Achievement	Improved	18	18	18	0	2
	Resilience	CR2.1 Avoid Unsuitable Development	No Achievement	No Achievement	16	16	16	0	0
		CR2.2 Assess Climate Change Vulnerability	No Achievement	No Achievement	20	20	20	0	0
		CR2.3 Evaluate Risk & Resilience	No Achievement	No Achievement	26	26	26	0	0
		CR2.4 Establish Resilience Goals and Strategies	No Achievement	No Achievement	20	20	20	0	0
		CR2.5 Maximize Resilience	No Achievement	No Achievement	26	26	26	0	0
		CR2.6 Improve Infrastructure Integration	No Achievement	No Achievement	18	18	18	0	0
		TOTAL				**944**	**690**	36	83

Table 4.4 Project X's success under each subquestion of Quality of Life category

QUALITY OF LIFE							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
QL1.1 Improve Community Quality of Life							
QL1.2 Enhance Public Health & Safety							
QL1.3 Improve Construction Safety							
QL1.4 Minimize Noise & Vibration							
QL1.5 Minimize Light Pollution							
QL1.6 Minimize Construction Impacts							
QL2.1 Improve Community Mobility							
QL2.2 Encourage Sustainable Transportation							
QL2.3 Improve Access & Wayfinding							
QL3.1 Advance Equity & Social Justice							
QL3.2 Preserve Historic & Cultural Resources							
QL3.3 Enhance Views & Local Character							
QL3.4 Enhance Public Space and Amenities							

Table 4.5 Project X's success under each subquestion of Leadership category

LEADERSHIP							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
LD1.1 Provide Effective Leadership & Commitment							
LD1.2 Foster Collaboration & Teamwork							
LD1.3 Provide for Stakeholder Involvement							
LD1.4 Pursue Byproduct Synergies							
LD2.1 Establish a Sustainability Management Plan							
LD2.2 Plan for Sustainable Communities							
LD2.3 Plan for Long-Term Monitoring &Maintenance							
LD2.4 Plan for End-of-Life							
LD3.1 Stimulate Economic Prosperity & Development							
LD3.2 Develop Local Skills & Capabilities							
LD3.3 Conduct a Life-Cycle Economic Evaluation							

Table 4.6 Project X's success under each subquestion of Resource Allocation category

RESOURCE ALLOCATION							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RA1.1 Support Sustainable Procurement Practices							
RA1.2 Use Recycled Materials							
RA1.3 Reduce Operational Waste							
RA1.4 Reduce Construction Waste							
RA1.5 Balance Earthwork On Site							
RA2.1 Reduce Operational Energy Consumption							
RA2.2 Reduce Construction Energy Consumption							
RA2.3 Use Renewable Energy							
RA2.4 Commission & Monitor Energy Systems							
RA3.1 Preserve Water Resources							
RA3.2 Reduce Operational Water Consumption							
RA3.3 Reduce Construction Water Consumption							
RA3.4 Monitor Water Systems							

Table 4.7 Project X's success under each subquestion of Natural World category

NATURAL WORLD							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
NW1.1 Preserve Sites of High Ecological Value							
NW1.2 Provide Wetland & Surface Water Buffers							
NW1.3 Preserve Prime Farmland							
NW1.4 Preserve Undeveloped Land							
NW2.1 Reclaim Brownfields							
NW2.2 Manage Stormwater							
NW2.3 Reduce Pesticide & Fertilizer Impacts							
NW2.4 Protect Surface & Groundwater Quality							
NW3.1 Enhance Functional Habitats							
NW3.2 Enhance Wetland & Surface Water Functions							
NW3.3 Maintain Floodplain Functions							
NW3.4 Control Invasive Species							
NW3.5 Protect Soil Health							

Table 4.8 Project X's success under each subquestion of Climate and Resilience category

CLIMATE AND RESILIENCE							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
CR1.1 Reduce Net Embodied Carbon							
CR1.2 Reduce Greenhouse Gas Emissions							
CR1.3 Reduce Air Pollutant Emissions							
CR2.1 Avoid Unsuitable Development							
CR2.2 Assess Climate Change Vulnerability							
CR2.3 Evaluate Risk & Resilience							
CR2.4 Establish Resilience Goals and Strategies							
CR2.5 Maximize Resilience							
CR2.6 Improve Infrastructure Integration							

The project can obtain a maximum of 944 points when evaluated according to all applicable Envision credits. However, the greatest score that may be assessed is computed as 690 when the applicable credits are calculated according to the applicable points for the research's scope which is the design stage. According to this approach, Project X is evaluated by the ENV SP certified researcher and score out of 690 is as follows:

- Base Score: 36 points
- Upper Score: 83 points

These results show that on the evaluable criterion, the project attained a success percentage of 5.21% (36/690) as a base score, and the success rate is merely 12.03% (83/690) even in the upper score scenario.

The assessment was conducted under the Envision system's five main categories, and the significance of every category for the overall project score was examined. Table 4.9 shows the points the project achieved in each of the Envision categories. For both the base and upper scores, Project X fails in the Climate and Resilience category, with zero points in the base score and two points in the upper score. Such an issue

was expected, although there are significant initiatives towards climate resilience, they have not been integrated into the regulatory frameworks regarding transportation works. However, the project achieved most points from the Quality of Life category in both base and upper scores, followed by the Leadership category. The fact that the road project's inherent nature involves developing mobility, providing transportation, and reducing noise that may arise due to the project is reflected in the Turkish codes, which explains why it received the highest score in the Quality of Life category. From the comparison between base and upper scores, it is seen that the Quality of Life category is the one with the most potential for increase in the overall score. Conversely, there is no change in the base and upper scores for the Resource Allocation category mainly because many of the credits are excluded from the evaluation due to the reasons listed in Section 4.1.1.

Table 4.9 Overall project's base and upper score in accordance with the Envision categories

Envision Categories	**Maximum Applicable Points**	**Score**	
		Base	**Upper**
Quality of Life	152	16	35
Leadership	170	12	29
Resource Allocation	20	5	5
Natural World	178	3	12
Climate and Resilience	170	0	2
TOTAL	**690**	**36**	**83**

Detailed evaluation according to each Envision category and credits will be mentioned in the following sections.

4.1.2.1 Quality of Life

As shown in the Table 4.10 out of the 13 credits in the Quality of Life category, 13 were found to be applicable according to Envision. The four credits listed below were deemed invalid within the scope of the research and reasons are provided in the Section 4.1.1. The remaining 9 credits were evaluated in the following sections.

- QL1.3 Improve Construction Safety
- QL1.5 Minimize Light Pollution
- QL1.6 Minimize Construction Impacts
- QL3.3 Enhance Views & Local Character

Table 4.10 Project X's sustainability evaluation on Quality of Life category

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability	Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
					Base	Upper				Base	Upper
QUALITY OF LIFE	Wellbeing	QL1.1 Improve Community Quality of Life	Yes	Yes	No Achievement	Enhanced	26	26	26	0	5
		QL1.2 Enhance Public Health & Safety	Yes	Yes	Enhanced	Enhanced	20	20	20	7	7
		QL1.3 Improve Construction Safety	Yes	No	X	X	14	14	0	X	X
		QL1.4 Minimize Noise & Vibration	Yes	Yes	Enhanced	Superior	12	12	12	3	6
		QL1.5 Minimize Light Pollution	Yes	No	X	X	12	12	0	X	X
		QL1.6 Minimize Construction Impacts	Yes	No	X	X	8	8	0	X	X
	Mobility	QL2.1 Improve Community Mobility	Yes	Yes	Enhanced	Restorative	14	14	14	3	14
		QL2.2 Encourage Sustainable Transportation	Yes	Yes	No Achievement	No Achievement	16	16	16	0	0
		QL2.3 Improve Access & Wayfinding	Yes	Yes	No Achievement	No Achievement	14	14	14	0	0
	Community	QL3.1 Advance Equity & Social Justice	Yes	Yes	No Achievement	No Achievement	18	18	18	0	0
		QL3.2 Preserve Historic & Cultural Resources	Yes	Yes	Enhanced	Enhanced	18	18	18	2	2
		QL3.3 Enhance Views & Local Character	Yes	No	X	X	14	14	0	X	X
		QL3.4 Enhance Public Space & Amenities	Yes	Yes	Improved	Improved	14	14	14	1	1
TOTAL							200	200	152	16	35

The total potential points for this category are 200. However, with the scores of inapplicable credits being deducted, the maximum points available for the assessment of the Quality of Life category are 152 points. Base and upper scores of each Quality of Life subcategory (Wellbeing, Mobility, and Community) are given in Figure 4.1 below. It is seen from the Figure 4.1 that Project X scores better at the Wellbeing sub-category, and there are huge potential points available for the Mobility sub-category.

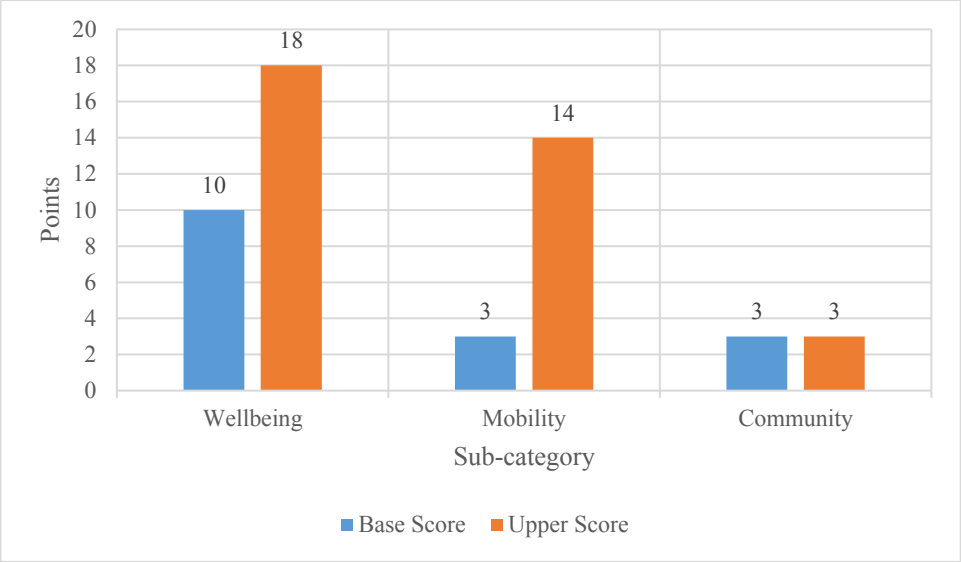


Figure 4.1 Base and upper score distribution according to sub-categories of Quality of Life

Each of the applicable credits of this category is discussed as follows:

Wellbeing

- QL1.1 Improve Community Quality of Life

In this Envision credit, even though the base score is 0, there is a potential for 5 points according to the upper score. The project does include a brief comparison of project goals and community needs and general information about how it affects the community. There are notes regarding the community concerns learned through the community participation meeting. However, to achieve these extra 5 points, more details on these subjects are needed, like a social impact assessment and information about whether there were any changes in the project due to these community concerns.

- QL1.2 Enhance Public Health & Safety

The project achieved the Enhanced level (7 points) in both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, health and sefety risks can be reduced and actions to fairly distribute

health and safety risks between communities can be incorporated into project. Detailed explanation of what could be done is given in the Appendix A.

- QL1.4 Minimize Noise & Vibration

The project achieved 3 points as a base score and 6 points as an upper score. An additional 3 points can be achieved if the project team informs the community and stakeholders about the project's noise impacts, targets, and mitigation measures. Noise maps are conducted in the project, and their results can also be shared to achieve an additional 3 points.

Mobility

- QL2.1 Improve Community Mobility

This credit is important to consider for the project team because there is an important point difference between the base and the upper score. Even though the project currently achieved an Enhanced level with 3 points, there is little effort needed to increase the achievement level to the highest level, which is Restorative with 14 points.

As stated in previous sections, to reach the upper levels in Envision scoring, it is necessary to complete the required sub-criteria starting from A. Although sub-criteria A, B, C, E, and F have been completed in this credit, the project cannot reach the Restorative level because the requirement in criterion D has not been completed. In order to reach the Restorative level and gain 14 points, it is necessary to show that other modes of transportation were also evaluated when deciding on the project, as requested in sub-criterion D.

- QL2.2 encourages sustainable transportation, and QL2.3 improves access and wayfinding.

For both Envision credits, the project achieved 0 points. If the project team wants to achieve points and increase sustainability performance in this credit, shared or mass transportation can be considered. Additionally, incident management strategies and

protection measures for sensitive areas can be incorporated. Detailed explanation of what could be done is given in the Appendix A.

Community

- QL3.1 Advance Equity & Social Justice

For this Envision credit, the project achieved 0 points. If the project team wants to achieve points and increase sustainability performance in this credit, management programs, decisions, strategies to address equity and social justice impacts and mitigation strategies should be considered. Detailed explanation of what could be done is given in the Appendix A.

- QL3.2 Preserve Historic & Cultural Resources

This credit is important to consider for the project team because there are additional points available. Even though the project currently achieved Enhanced level with 2 points, there is little effort needed to increase the achievement level to Superior with 7 points.

There is no score difference between base and upper because although sub-criteria A, B, and D have been completed in this credit, there is no initiative in credit C. Completion of credit C would mean an additional 5 points for this credit. To gain those 5 points, it is necessary to make an effort on identification of cultural or historic resources beyond the registries, as requested in sub-criterion C. The project could fulfill this requirement during its construction stage.

- QL3.4 Enhance Public Space & Amenities

Project achieved Improved level (1 point) in both base and upper score. If the project team wants to achieve points and increase sustainability performance in this credit, the project can add new public space open to cyclists, pedestrians, and drivers. Detailed explanation of what could be done is given in the Appendix A.

4.1.2.2 Leadership

As shown in Table 4.11, of the 11 credits in the Leadership category, 11 were found to be applicable according to Envision. The 1 credit listed below was deemed invalid within the scope of the research and the reasons are provided in Section 4.1.1 The remaining 10 credits were evaluated.

- LD2.3 Plan for Long-Term Monitoring & Maintenance

Table 4.11 Project X's sustainability evaluation of the Leadership category

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability	Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
					Base	Upper				Base	Upper
LEADERSHIP	Collaboration	LD1.1 Provide Effective Leadership & Commitment	Yes	Yes	No Achievement	Improved	18	18	18	0	2
		LD1.2 Foster Collaboration & Teamwork	Yes	Yes	No Achievement	No Achievement	18	18	18	0	0
		LD1.3 Provide for Stakeholder Involvement	Yes	Yes	No Achievement	Improved	18	18	18	0	3
		LD1.4 Pursue Byproduct Synergies	Yes	Yes	Superior	Superior	18	18	18	12	12
	Planning	LD2.1 Establish a Sustainability Management Plan	Yes	Yes	No Achievement	No Achievement	18	18	18	0	0
		LD2.2 Plan for Sustainable Communities	Yes	Yes	No Achievement	No Achievement	16	16	16	0	0
		LD2.3 Plan for Long-Term Monitoring &Maintenance	Yes	No	X	X	12	12	0	X	X
		LD2.4 Plan for End-of-Life	Yes	Yes	No Achievement	No Achievement	14	14	14	0	0
	Economy	LD3.1 Stimulate Economic Prosperity & Development	Yes	Yes	No Achievement	Superior	20	20	20	0	12
		LD3.2 Develop Local Skills & Capabilities	Yes	Yes	No Achievement	No Achievement	16	16	16	0	0
		LD3.3 Conduct a Life-Cycle Economic Evaluation	Yes	Yes	No Achievement	No Achievement	14	14	14	0	0
TOTAL							182	182	170	12	29

The total potential for this category is 182 points. However, with the scores of inapplicable credits being deducted, the maximum points available for the assessment of the Leadership category is 170 points. Base and upper scores of each Leadership subcategory (Collaboration, Planning, and Economy) are given in Figure 4.2 below. It is seen from Figure 4.2 that Project X scores better at the Collaboration sub-category, and there are huge potential points available for the Economy sub-category.

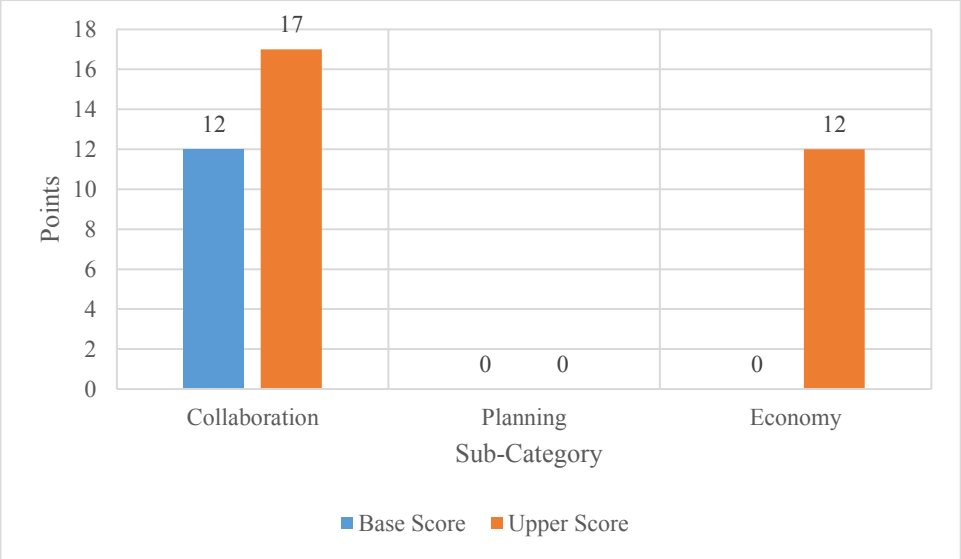


Figure 4.2 Base and upper score distribution according to sub-categories of Leadership Category

Each of the applicable credits of this category is discussed as follows:

Collaboration

- LD1.1 Provide Effective Leadership & Commitment

The project achieved 0 as a base score and 2 points as an upper score. The project contract does include EIA, but the social and economic impact of the project is not considered in detail in the assessment. The project can earn an additional 2 points if it incorporates an ESIA. This would provide a better understanding of project's impacts to society and provide more concious desicion making.

- LD1.2 Foster Collaboration & Teamwork

For this Envision credit, the project achieved 0 points for both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, sustainability goals can be defined at early stages of the project through interdisciplinary meetings. Detailed explanation of what could be done is given in the Appendix A.

- LD1.3 Provide for Stakeholder Involvement

The project achieved 0 as a base score and 3 points as an upper score. Sub-criteria A and B are partially completed. To achieve an Improved level with 3 points, identified stakeholders need to be categorized as primary and secondary stakeholders, where primary stakeholders are individuals or groups directly impacted by the project, and secondary stakeholders are individuals or groups indirectly affected by the project. Engagement plans for each stakeholder need to be developed according to Envision manual. Including an ESIA in the project can lead to an additional 2 points similar to the credit LD 1.1. This would provide a better understanding of project's impacts to society and provide more concious desicion making.

- LD1.4 Pursue Byproduct Synergies

The project achieved a Superior level (12 points) in both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, other than use of excess excavation material, more study on by product synergy could be done in order for the project to support circular economy. Detailed explanation of what could be done is given in the Appendix A.

Planning

- LD2.1 Establish a Sustainability Management Plan, LD2.2 Plan for Sustainable Communities, and LD2.4 Plan for End-of-Life

The project has no achievement in either the base or upper scores for three of these credits. If the project team wants to achieve points and increase sustainability performance in these credits, sustainability management plan could be established and when choosing and identifying projects, sustainability can be taken into account. Also, the project team might create an end-of-life plan. Detailed explanation of what could be done is given in the Appendix A.

Economy

- LD3.1 Stimulate Economic Prosperity & Development

This credit is important for the project team because there is an important point difference between the base and the upper score. Even though the project currently has No Achievement with 0 points, there is little effort needed to increase the achievement level to Superior with 12 points.

Although sub-criteria B and C have been completed in this credit, the project cannot reach the Superior level because the requirements in criteria A and D have not been fully completed. To gain points, it is necessary to include the information regarding any job opportunities created during the design stage and explain the economic impact of these job opportunities, as requested in sub-criterion A. To reach the Superior level and gain 12 points, analyses regarding the economic effects of the increased attractiveness need to be investigated as stated in sub-criterion D.

- LD3.2 Develop Local Skills & Capabilities, and LD3.3 Conduct a Life-Cycle Economic Evaluation

The project has no achievement in both the base and upper scores for both credits. If the project team wants to achieve points and increase sustainability performance in these credits, training initiatives for the development of local skills may be a part of the project. Detailed explanation of what could be done is given in the Appendix A.

4.1.2.3 Resource Allocation

As shown in the Table 4.12, of the 13 credits in the Resource Allocation category, 11 were found to be applicable according to Envision. The 11 credits listed below were deemed invalid within the scope of the research and reasons are provided in Section 4.1.1. The two remaining credits were evaluated.

- RA1.1 Support Sustainable Procurement Practices
- RA1.2 Use Recycled Materials
- RA1.3 Reduce Operational Waste
- RA1.4 Reduce Construction Waste
- RA2.1 Reduce Operational Energy Consumption
- RA2.2 Reduce Construction Energy Consumption
- RA2.3 Use Renewable Energy
- RA2.4 Commission & Monitor Energy Systems
- RA3.2 Reduce Operational Water Consumption
- RA3.3 Reduce Construction Water Consumption
- RA3.4 Monitor Water Systems

Table 4.12 Project X's sustainability evaluation on Resource Allocation category

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability	Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
					Base	Upper				Base	Upper
RESOURCE ALLOCATION	Materials	RA1.1 Support Sustainable Procurement Practices	Yes	No	X	X	12	12	0	X	X
		RA1.2 Use Recycled Materials	Yes	No	X	X	16	16	0	X	X
		RA1.3 Reduce Operational Waste	Yes	No	X	X	14	14	0	X	X
		RA1.4 Reduce Construction Waste	Yes	No	X	X	16	16	0	X	X
		RA1.5 Balance Earthwork On Site	Yes	Yes	Improved	Improved	8	8	8	2	2
	Energy	RA2.1 Reduce Operational Energy Consumption	Yes	No	X	X	26	26	0	X	X
		RA2.2 Reduce Construction Energy Consumption	Yes	No	X	X	12	12	0	X	X
		RA2.3 Use Renewable Energy	Yes	No	X	X	24	24	0	X	X
		RA2.4 Commission & Monitor Energy Systems	Yes	No	X	X	14	14	0	X	X
	Water	RA3.1 Preserve Water Resources	Yes	Yes	Improved	Improved	12	12	12	3	3
		RA3.2 Reduce Operational Water Consumption	No	No	X	X	22	0	0	X	X
		RA3.3 Reduce Construction Water Consumption	Yes	No	X	X	8	8	0	X	X
		RA3.4 Monitor Water Systems	No	No	X	X	12	0	0	X	X
TOTAL							196	162	20	5	5

The total potential points for this category are 162 points. However, after subtracting the scores of inapplicable credits, the maximum point available for the Resource Allocation category assessment is 20 points. This huge gap is result of the inapplicable credits where mainly because those credits are responsibility of the contractor and lighning and landscape projects are not in the contractural scope of the designer. Base and upper scores of each Resource Allocation subcategory (Materials, Energy and, Water) are given in the Figure 4.3 below.

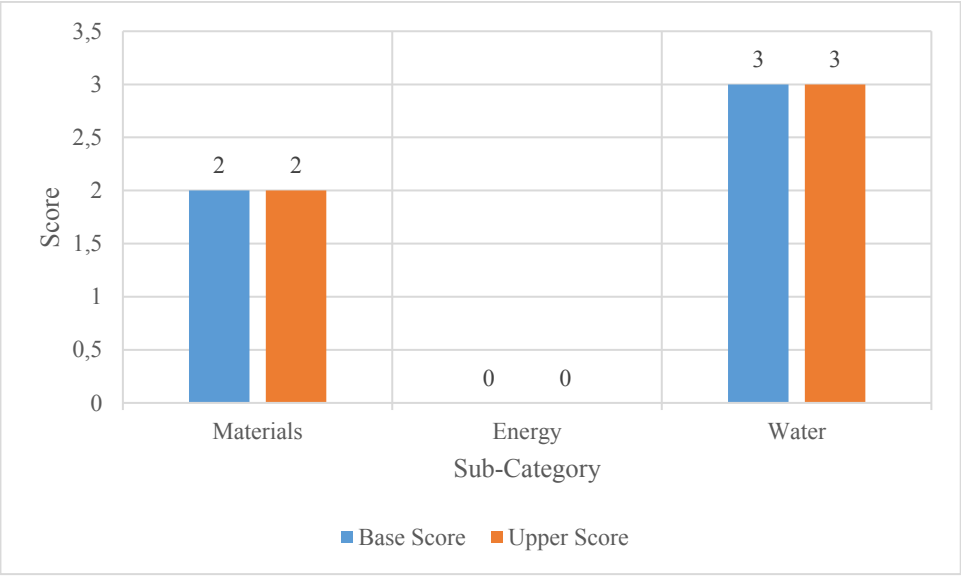


Figure 4.3 Base and upper score distribution according to subcategories of the Resource Allocation Category

Each of the applicable credits of this category is discussed as follows:

Materials

- RA1.5 Balance Earthwork on Site

Project achieved Improved level (2 points) in both base and upper score. If the project team wants to achieve points and increase sustainability performance in this credit, more effort could be given to balance cut-fill quantity.

Energy

In this subcategory, there are no applicablecredits for this research assessment due to the reasons provided in Section 4.1.1.

Water

- RA3.1 Preserve Water Resources

The project has achieved an Improved level (3 points) in both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, rainwater harvesting and stormwater management techniques, such as bio-retention basins and permeable pavements, could be used in the project. Detailed explanation of what could be done is given in Appendix A.

4.1.2.4 Natural World

As shown in Table 4.13, of the 13 credits in the Natural World category, 12 were found to be applicable according to Envision. The 4 credits listed below were deemed invalid within the scope of the research and the reasons are provided in Section 4.1.1. The remaining 9 credits were evaluated.

- NW1.1 Preserve Sites of High Ecological Value
- NW2.3 Reduce Pesticide & Fertilizer Impacts
- NW3.4 Control Invasive Species
- NW3.5 Protect Soil Health

Table 4.13 Project X's sustainability evaluation of the Natural World category

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability	Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
					Base	Upper				Base	Upper
NATURA WORLD	Siting	NW1.1 Preserve Sites of High Ecological Value	No	No	X	X	22	0	0	X	X
		NW1.2 Provide Wetland & Surface Water Buffers	Yes	Yes	No Achievement	No Achievement	20	20	20	0	0
		NW1.3 Preserve Prime Farmland	Yes	Yes	No Achievement	No Achievement	16	16	16	0	0
		NW1.4 Preserve Undeveloped Land	Yes	Yes	Improved	Enhanced	24	24	24	3	8
	Conservation	NW2.1 Reclaim Brownfields	Yes	Yes	No Achievement	No Achievement	22	22	22	0	0
		NW2.2 Manage Stormwater	Yes	Yes	No Achievement	No Achievement	24	24	24	0	0
		NW2.3 Reduce Pesticide & Fertilizer Impacts	Yes	No	X	X	12	12	0	X	X
		NW2.4 Protect Surface & Groundwater Quality	Yes	Yes	No Achievement	No Achievement	20	20	20	0	0
	Ecology	NW3.1 Enhance Functional Habitats	Yes	Yes	No Achievement	No Achievement	18	18	18	0	0
		NW3.2 Enhance Wetland & Surface Water Functions	Yes	Yes	No Achievement	No Achievement	20	20	20	0	0
		NW3.3 Maintain Floodplain Functions	Yes	Yes	No Achievement	No Achievement	14	14	14	0	0
		NW3.4 Control Invasive Species	Yes	No	X	X	12	12	0	X	X
		NW3.5 Protect Soil Health	Yes	No	No Achievement	Superior	8	8	0	0	4
TOTAL							232	210	178	3	12

The total potential points for this category are 210. However, with the scores of inapplicable credits being deducted, the maximum point available for the assessment of the Natural World category is 178 points. Base and upper scores of each Natural World sub-category (Siting, Conservation, and Ecology) are given in the Figure 4.4 below. It is seen from Figure 4.4 that Project X scores better at the Siting sub-category, and there is potential for higher points. However, there is no achievement for the Conservation subcategory mostly because the sustainability practices in these credits are not included in Türkiye's regulations and they are not included in the common design methodology.

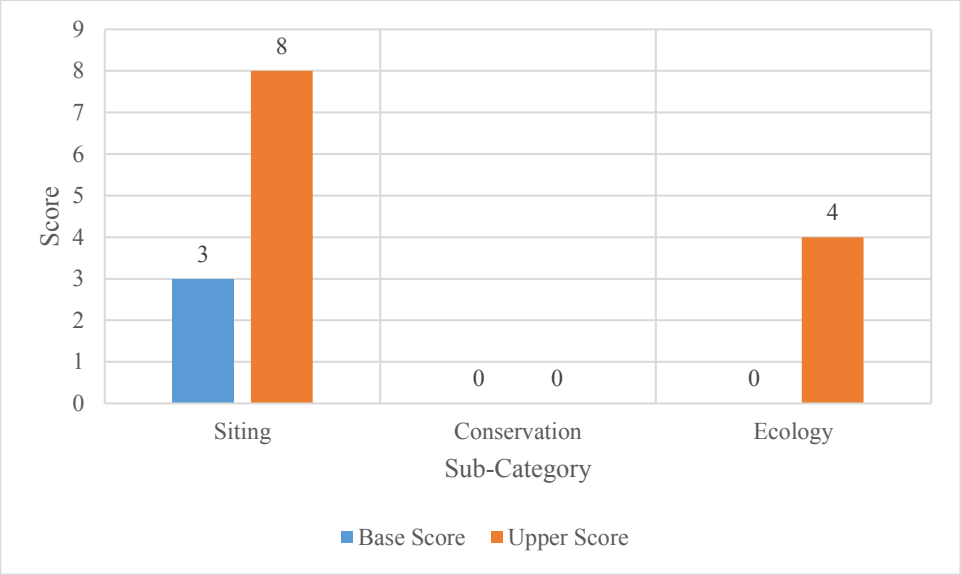


Figure 4.4 Base and upper score distribution according to subcategories of the Natural World category.

Each of the applicable credits of this category is discussed as follows:

Siting

- NW1.2 Provide Wetland & Surface Water Buffers, and NW1.3 Preserve Prime Farmland

The project has no achievement in both the base and upper scores for both credits. If the project team wants to achieve points and increase sustainability performance in these credits, studies should include buffer zones and while choosing the road alignment more effort could be given to avoid prime farmlands and this consideration could be documented. Detailed explanation of what could be done is given in Appendix A.

- NW1.4 Preserve Undeveloped Land

For this Envision credit, the project achieved 3 points for the base and 8 points for the upper score. The score would increase if, during the alignment studies, more effort was given to using previously developed lands.

Conservation

- NW2.1 Reclaim Brownfields, NW2.2 Manage Stormwater and NW2.4 Protect Surface & Groundwater Quality

The project has no achievement in both the base and upper scores for three of these credits. If the project team wants to achieve points and increase sustainability performance in these credits, a detailed explanation of what could be done is given in Appendix A.

Ecology

- NW3.1 Enhance Functional Habitats

For this Envision credit, the project achieved 0 points for both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, existing connections between habitats and ecological bridges or other structures could be provided to preserve or create connections or movements between habitats. Detailed explanation of what could be done is given in Appendix A.

- NW3.2 Enhance Wetland & Surface Water Functions

This credit is important to consider for the project team because there are additional available points. Even though the project currently has No Achievement with 0 points, there is potential to increase the achievement level to Restorative with 20 points.

There is no score difference between base and upper because, although sub-criterion C has been completed in this credit, there is no initiative in sub-criterion D, and there is partial completion of sub-criterion A, B, E, and F. To gain an additional 5 points, along with the project's impact on hydrological connectivity and aquatic habitat, the sediment transportation project team should also consider water quality. The study of comprehensive mitigation measures is necessary to address the impacts on

hydrological connectivity, aquatic habitat, sediment transportation, and water quality.

- NW3.3 Maintain Floodplain Functions

For this Envision credit, the project achieved 0 points for both the base and upper scores. If the project team wants to achieve points and increase sustainability performance in this credit, floodplain map should be studied with climate change effects. Detailed explanation of what could be done is given in Appendix A.

- NW3.5 Protect Soil Health

The project has No Achievement in the base score and 4 points as the upper score. The project team can earn an extra 4 points by documenting the restoration of 95% of post-construction vegetated areas following construction activities. The project team could fulfill this requirement during the construction stage.

4.1.2.5 Climate and Resilience

As shown in Table 4.14, of the 9 credits in the Climate and Resilience category, 9 were found to be applicable according to Envision. The one credit listed below was deemed invalid within the scope of the research and reasons are provided in Section 4.1.1. The remaining 8 credits were evaluated.

- CR1.1 Reduce Net Embodied Carbon

Table 4.14 Project X's sustainability evaluation of the Climate and Resilience category

ENVISION V3 CREDITS			Envision Applicability	Assessment Applicability	Achievement Level		Points	Maximum Available Points	Maximum Applicable Points	Score	
					Base	Upper				Base	Upper
CLIMATE AND RESILIENCE	Emissions	CR1.1 Reduce Net Embodied Carbon	Yes	No	X	X	20	20	0	X	X
		CR1.2 Reduce Greenhouse Gas Emissions	Yes	Yes	No Achievement	No Achievement	26	26	26	0	0
		CR1.3 Reduce Air Pollutant Emissions	Yes	Yes	No Achievement	Improved	18	18	18	0	2
	Resilience	CR2.1 Avoid Unsuitable Development	Yes	Yes	No Achievement	No Achievement	16	16	16	0	0
		CR2.2 Assess Climate Change Vulnerability	Yes	Yes	No Achievement	No Achievement	20	20	20	0	0
		CR2.3 Evaluate Risk & Resilience	Yes	Yes	No Achievement	No Achievement	26	26	26	0	0
		CR2.4 Establish Resilience Goals and Strategies	Yes	Yes	No Achievement	No Achievement	20	20	20	0	0
		CR2.5 Maximize Resilience	Yes	Yes	No Achievement	No Achievement	26	26	26	0	0
		CR2.6 Improve Infrastructure Integration	Yes	Yes	No Achievement	No Achievement	18	18	18	0	0
TOTAL							190	190	170	0	2

The total potential points for this category are 190. However, with the scores of inapplicable credits being deducted, the maximum points available for the assessment of the Climate and Resilience category is 170 points. Base and upper scores of each Climate and Resilience subcategory (Emissions and Resilience) are given in Figure 4.5 below. It is seen from Figure 4.5 that Project X scores 0 for the Resilience category in both base and upper scores.

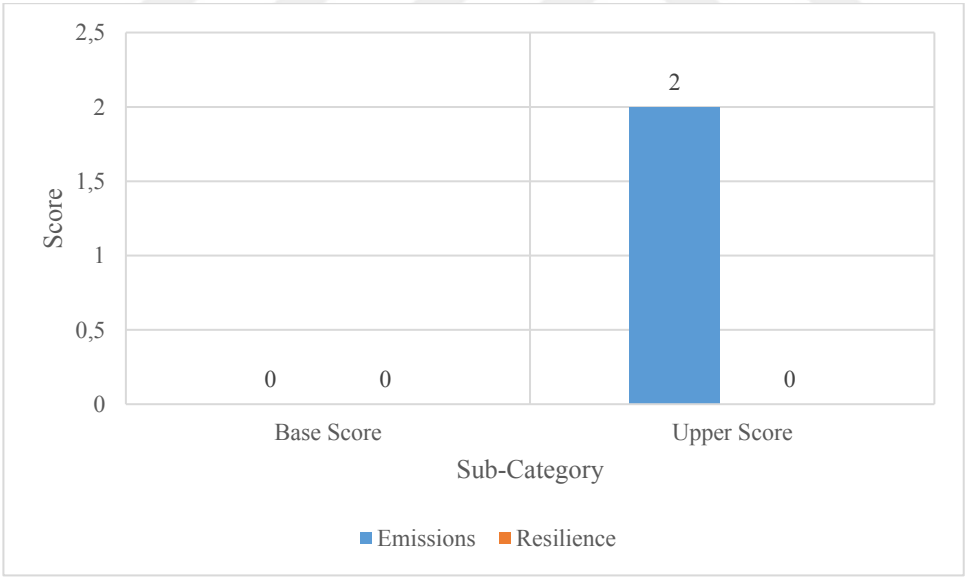


Figure 4.5 Distribution of base and upper scores by sub-categories within the Climate and Resilience Category

Each of the applicable credits of this category is discussed as follows:

Emissions

- CR1.2 Reduce Greenhouse Gas Emissions

The project has no achievement in both the base and upper scores for both credits. If the project team wants to achieve points and increase sustainability performance in this credit, calculating baseline emissions for the course of the project's operation is necessary to evaluate its greenhouse gas impact. Detailed explanation of what could be done is given in Appendix A.

- CR1.3 Reduce Air Pollutant Emissions

The project has No Achievement in the base score and 2 points as the upper score. An additional 2 points can be achieved if the project team has strategies for reducing air pollutant emissions during operation.

Resilience

- CR2.1 Avoid Unsuitable Development

This credit is important to consider for the project team because there are additional points available. Even though the project currently has No Achievement with 0 points, there is little effort needed to increase the achievement level to Enhanced with 6 points.

There is no difference between the base and upper scores because, although subcriteria A and C have been completed with this credit, there isn’t any initiative in credit B. Completion of credit B would mean an additional 6 points for this credit. To gain those 6 points, it is necessary to show an alternative project site study has been done to minimize siting risks.

- CR2.2 Assess Climate Change Vulnerability, CR2.3 Evaluate Risk & Resilience, CR2.4 Establish Resilience Goals and Strategies, CR2.5 Maximize Resilience, and CR2.6 Improve Infrastructure Integration

The project has no achievement in both the base and upper scores for 5 of these credits. If the project team wants to achieve points and increase sustainability performance in these credits, climate change vulnerability should be assessed. Additionally for other credits, risk and resilience should be evaluated and resilience strategies should be established to maximize resilience. Detailed explanation of what could be done is given in Appendix A.

The results obtained show that the projects contain sustainability elements, particularly in areas such as public health and safety, the creation of byproduct synergy, and the use of undeveloped land. Conversely, credits that did not receive points reveal significant shortcomings, particularly in terms of climate resilience, protection of agricultural areas, and ensuring long-term ecosystem integrity. Therefore, the next phase of the research aims to examine the opportunities for increasing sustainability potential and the reasons behind these limitations.

4.2 Interview Evaluation

4.2.1 Interview Questions and Distribution to Expert Groups

Interview questions were developed based on Project X's success in the each applicable credit's subquestions in the Envision sustainability assessment. The classification of "Yes", "Maybe" and "No" is given in Appendix A in detail, which is also shown in Table 4.15, Table 4.16, Table 4.17, Table 4.18, Table 4.19 by color codes, where green means "Yes", yellow means "Maybe", and red means "No". Except for the subquestions that were deemed successful, those rated "Maybe" or "No" were asked as interview questions. After determining the questions to be asked, the Envision subquestions were divided into expert groups based on their content, and four different groups of interview questions were prepared.

The Table 4.15, Table 4.16, Table 4.17, Table 4.18 and Table 4.19 show the questions prepared as a result of the envision evaluation and the distribution of the

expert groups to which the questions were asked. The interview questions implemented on environmental engineers, highway alignment engineers, social experts and managers are given in Appendix B, C, D, and E, respectively. In these tables, successfully completed subquestions in the Project X assessment are colored green, partially completed subquestions are colored yellow, and unsuccessful subquestions are colored red. The letters written in the tables report refer to the professions of interwee's. Explanations of the letters are as follows:

- S: social experts
- AE: alignment engineers
- EE: environmental engineers
- M: managers

Table 4.15 Distribution of questions to experts for Quality of Life category

QUALITY OF LIFE							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
QL1.1 Improve Community Quality of Life		S	S	AE/S	S	S	S
QL1.2 Enhance Public Health & Safety					S	S	
QL1.3 Improve Construction Safety							
QL1.4 Minimize Noise & Vibration				S	EE		
QL1.5 Minimize Light Pollution							
QL1.6 Minimize Construction Impacts							
QL2.1 Improve Community Mobility							
QL2.2 Encourage Sustainable Transportation	AE	AE					
QL2.3 Improve Access & Wayfinding	AE	AE	AE	AE			
QL3.1 Advance Equity & Social Justice	S	S		S	S	S	S
QL3.2 Preserve Historic & Cultural Resources			S		AE	EE	
QL3.3 Enhance Views & Local Character							
QL3.4 Enhance Public Space and Amenities			S	EE			

Table 4.16 Distribution of questions to expertise for Leadership category

LEADERSHIP							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
LD1.1 Provide Effective Leadership & Commitment	M	M	M				
LD1.2 Foster Collaboration & Teamwork	M	M	M	M			
LD1.3 Provide for Stakeholder Involvement	M	S	M	M/S			
LD1.4 Pursue Byproduct Synergies							
LD2.1 Establish a Sustainability Management Plan	M	M	M	M	M		
LD2.2 Plan for Sustainable Communities							
LD2.3 Plan for Long-Term Monitoring &Maintenance							
LD2.4 Plan for End-of-Life							
LD3.1 Stimulate Economic Prosperity & Development	S			S	S		
LD3.2 Develop Local Skills & Capabilities	S	S					
LD3.3 Conduct a Life-Cycle Economic Evaluation	M	M	M	M	M		

Table 4.17 Distribution of questions to expertise for Resource Allocation category

RESOURCE ALLOCATION							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
RA1.1 Support Sustainable Procurement Practices							
RA1.2 Use Recycled Materials							
RA1.3 Reduce Operational Waste							
RA1.4 Reduce Construction Waste							
RA1.5 Balance Earthwork On Site	AE						
RA2.1 Reduce Operational Energy Consumption							
RA2.2 Reduce Construction Energy Consumption							
RA2.3 Use Renewable Energy							
RA2.4 Commission & Monitor Energy Systems							
RA3.1 Preserve Water Resources			AE	EE			
RA3.2 Reduce Operational Water Consumption							
RA3.3 Reduce Construction Water Consumption							
RA3.4 Monitor Water Systems							

Table 4.18 Distribution of questions to expertise for Natural World category

NATURAL WORLD							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
NW1.1 Preserve Sites of High Ecological Value							
NW1.2 Provide Wetland & Surface Water Buffers		EE	EE	AE	EE		
NW1.3 Preserve Prime Farmland		AE		AE	EE		
NW1.4 Preserve Undeveloped Land	AE	EE					
NW2.1 Reclaim Brownfields	AE/EE	AE/EE	EE	EE			
NW2.2 Manage Stormwater	AE	AE					
NW2.3 Reduce Pesticide & Fertilizer Impacts							
NW2.4 Protect Surface & Groundwater Quality							
NW3.1 Enhance Functional Habitats	EE	AE/EE	EE	EE	AE/EE	EE	
NW3.2 Enhance Wetland & Surface Water Functions	EE	AE/EE		EE	EE	AE	
NW3.3 Maintain Floodplain Functions	AE	AE/EE	AE	AE	AE		
NW3.4 Control Invasive Species							
NW3.5 Protect Soil Health		EE	EE	EE			

Table 4.19 Distribution of questions to expertise for Climate and Resilience category

CLIMATE AND RESILIENCE							
ENVISION CREDITS	**A**	**B**	**C**	**D**	**E**	**F**	**G**
CR1.1 Reduce Net Embodied Carbon							
CR1.2 Reduce Greenhouse Gas Emissions	EE	EE					
CR1.3 Reduce Air Pollutant Emissions		EE	EE				
CR2.1 Avoid Unsuitable Development		AE		AE	AE	AE	
CR2.2 Assess Climate Change Vulnerability	AE /M	AE /M	AE /M	AE /M			
CR2.3 Evaluate Risk & Resilience	M	M	M	M	M	M	
CR2.4 Establish Resilience Goals and Strategies	M	M	M				
CR2.5 Maximize Resilience	M	M	M	M	M		
CR2.6 Improve Infrastructure Integration	M	M	M	M	M		

The interview questions are directly derived from the sub-questions within the Envision credits. To address participants' sustainability awareness gap, each question includes a detailed explanation of what is required by the subquestion and examples of best practices.

4.2.2 Quantitative Assessment

In this study, interviews were conducted with experts from different professional groups (highway alignment engineers, environmental engineers, managers and social experts) to evaluate the potential of the Envision Sustainability Assessment System criteria for integration into highway projects in Türkiye. During the interviews, each participant was asked to evaluate the selected Envision criteria in two dimensions: difficulty of implementation and priority level. A quantitative assessment was created for each criterion by averaging the scores given by the participants, and thus the applicability of the criteria was systematically analyzed.

The criteria for the systematic evaluation of findings have been classified into three main groups: criteria recommended for direct inclusion, criteria requiring planning, and excluded criteria.

- Recommended for direct inclusion: This heading covers the Envision criteria that are considered technically feasible and applicable in the context of highway projects in Türkiye. However, this does not mean that these criteria can be directly or immediately incorporated into the existing structure. On the contrary, the applicability of these criteria depends on the project owner or designer prioritizing sustainability, allocating sufficient financial and institutional resources, and demonstrating managerial commitment. Therefore, this group represents sustainability opportunities that are not subject to any legal barriers but require institutional planning and strategic commitment.

- Criteria required planning: The criteria included in this group are technically feasible, but they require early-stage coordination, long-term planning, or additional data collection processes for implementation. The findings show that most of these criteria fall outside the time, budget, and scope framework of traditional design processes and therefore need to be addressed with a proactive management approach. Integrating these criteria into projects is possible not only through technical suitability but also by incorporating sustainability goals into planning mechanisms from the project feasibility or preliminary design stages onwards.
- Excluded criteria: The criteria included in this group consist of items that, if implemented, could lead to significant budget increases, technical difficulties, and additional complexities in the project process. Interview findings show that although participants consider these criteria important in terms of sustainability, they are rated as lower priority compared to other topics because their implementation would require too much effort, resources, and coordination. Furthermore, designers' limited knowledge and experience in these areas also emerge as a factor reducing applicability. Therefore, the formation of this group indicates a situation where sustainability goals are generally embraced but constraints exist in transitioning to implementation due to factors such as cost, technical capacity, and institutional readiness.

The evaluation results for each professional group and combined are presented in detail below.

4.2.2.1 Environmental Engineers

As a result of the interview with environmental engineers, the scores the interviewee gave for difficulty and priority were evaluated as explained in the Section 3.4.2. The decision about the implementation of each sub-question in Türkiye was made. The

results for each sub-question of the Envision criteria asked to environmental engineers are given in Table 4.20.

Table 4.20 Results of interview with environmental engineers

Question Number	Envision Credit	Difficulty Average	Priority Average	Decision
5	QL1.4 Minimize Noise & Vibration (E)	2.86	4.43	Include
6	QL3.2 Preserve Historic & Cultural Resources (F)	3.29	4.14	Plan and Include
7	QL3.4 Enhance Public Space and Amenities (D)	2.86	3.57	Include
8	RA3.1 Preserve Water Resources (D)	3.43	4.43	Plan and Include
9	NW1.2 Provide Wetland & Surface Water Buffers (B)	2.86	4.57	Include
10	NW1.2 Provide Wetland & Surface Water Buffers (C)	2.86	4.57	Include
11	NW1.2 Provide Wetland & Surface Water Buffers (E)	3.00	4.29	Include
12	NW1.3 Preserve Prime Farmland (E)	3.00	4.14	Include
13	NW1.4 Preserve Undeveloped Land (B)	3.71	3.86	Plan and Include
14	NW2.1 Reclaim Brownfields (A)	4.29	3.29	Plan and Include
15	NW2.1 Reclaim Brownfields (B)	4.57	3.14	Plan and Include
16	NW2.1 Reclaim Brownfields (C)	4.14	3.43	Plan and Include
17	NW2.1 Reclaim Brownfields (D)	4.29	3.57	Plan and Include
18	NW3.1 Enhance Functional Habitats (A)	3.14	4.86	Plan and Include
19	NW3.1 Enhance Functional Habitats (B)	3.14	4.57	Plan and Include
20	NW3.1 Enhance Functional Habitats (C)	3.71	3.57	Plan and Include
21	NW3.1 Enhance Functional Habitats (D)	3.43	3.86	Plan and Include
22	NW3.1 Enhance Functional Habitats (E)	3.00	4.71	Include
23	NW3.1 Enhance Functional Habitats (F)	3.43	4.14	Plan and Include
24	NW3.2 Enhance Wetland & Surface Water Functions (A)	2.57	4.57	Include
25	NW3.2 Enhance Wetland & Surface Water Functions (B)	2.71	4.71	Include
26	NW3.2 Enhance Wetland & Surface Water Functions (D)	3.00	4.71	Include
27	NW3.2 Enhance Wetland & Surface Water Functions (E)	2.43	4.43	Include
28	NW3.3 Maintain Floodplain Functions (B)	3.29	4.00	Plan and Include
29	NW3.5 Protect Soil Health (B)	2.57	4.00	Include
30	NW3.5 Protect Soil Health (C)	2.57	3.57	Include
31	NW3.5 Protect Soil Health (D)	3.00	4.29	Include
32	CR1.2 Reduce Greenhouse Gas Emissions (A)	3.00	4.29	Include
33	CR1.2 Reduce Greenhouse Gas Emissions (B)	3.00	4.14	Include
34	CR1.3 Reduce Air Pollutant Emissions (B)	2.71	4.14	Include
35	CR1.3 Reduce Air Pollutant Emissions (C)	2.14	4.00	Include

Recommended Criteria for Direct Inclusion

Out of 31 topics, 18 of them can be directly included in projects as a result of the analysis. Most criteria related to water protection were indicated to be included in the project by environmental engineers. Therefore, we can observe that environmental engineers give importance to issues related to water in particular. In addition, measures related to soil protection and gas emissions were also identified as important to be included in the projects.

Criteria Requiring Planning

Out of 31 topics, 13 of them require planning before being included in projects as a result of the analysis. In particular, the headings related to brownfield were found by experts to be the most difficult to implement and to have a lower priority compared to other criteria. Although the issues related to habitat seem easier and more important than the brownfield, according to experts, planning is still required to include these headings.

Excluded Criteria

The evaluations showed that environmental engineers weren't considering any criteria in the "Exclude" category. This reveals that experts agree that these criteria are significantly important for sustainability and that the correct approaches can help overcome the drawbacks in the highway projects.

4.2.2.2 Highway Alignment Engineers

As a result of the interview with highway alignment engineers, the scores the interviewee gave for difficulty and priority were evaluated, and the decisions about the implementation of each sub-question in Türkiye were made. The results for each sub-question of the Envision criteria for highway alignment engineers are given in Table 4.21.

Table 4.21 Results of interview with highway alignment engineers

Question Number	Envision Credit	Difficulty Average	Priority Average	Decision
5	QL1.1 Improve Community Quality of Life (D)	2.75	3.75	Include
6	QL2.2 Encourage Sustainable Transportation (A)	3.25	4.38	Plan and Include
7	QL2.2 Encourage Sustainable Transportation (B)	3.13	4.00	Plan and Include
8	QL2.3 Improve Access & Wayfinding (A)	2.50	4.63	Include
9	QL2.3 Improve Access & Wayfinding (B)	3.00	4.50	Include
10	QL2.3 Improve Access & Wayfinding (C)	2.38	4.00	Include
11	QL2.3 Improve Access & Wayfinding (D)	2.25	4.00	Include
12	QL 3.2 Preserve Historic & Cultural Resources (E)	3.38	4.50	Plan and Include
13	RA1.5 Balance Earthwork On Site	3.50	3.00	Plan and Include
14	RA 3.1 Preserve Water Resources (C)	3.00	4.25	Include
15	NW 1.2 Provide Wetland & Surface Water Buffers (D)	3.13	2.50	Exclude
16	NW 1.3 Preserve Prime Farmland (B-D)	2.88	2.63	Exclude
17	NW 1.4 Preserve Undeveloped Land (A)	2.75	2.88	Exclude
18	NW 2.1 Reclaim Brownfields (A-B)	2.88	1.88	Exclude
19	NW2.2 Manage Stormwater (A)	2.63	3.38	Include
20	NW2.2 Manage Stormwater (B)	2.50	4.25	Include
21	NW 3.1 Enhance Functional Habitats (B-E)	2.63	4.13	Include
22	NW 3.2 Enhance Wetland & Surface Water Functions (B)	2.75	3.63	Include
23	NW 3.2 Enhance Wetland & Surface Water Functions (B-F)	2.63	3.00	Include
24	NW 3.3 Maintain Floodplain Functions (A)	3.38	3.63	Plan and Include
25	NW 3.3 Maintain Floodplain Functions (C)	3.13	3.38	Plan and Include
26	NW 3.3 Maintain Floodplain Functions (B-D)	3.25	3.75	Plan and Include
27	NW 3.3 Maintain Floodplain Functions (E)	3.38	3.88	Plan and Include
28	CR 2.1 Avoid Unsuitable Development (B-D-E)	3.25	4.50	Plan and Include
29	CR 2.1 Avoid Unsuitable Development (F)	3.50	4.00	Plan and Include
30	CR2.2 Assess Climate Change Vulnerability (A)	3.88	3.75	Plan and Include
31	CR2.2 Assess Climate Change Vulnerability (B)	3.75	3.63	Plan and Include
32	CR2.2 Assess Climate Change Vulnerability (C)	3.38	3.38	Plan and Include
33	CR2.2 Assess Climate Change Vulnerability (D)	3.75	3.13	Plan and Include

Recommended Criteria for Direct Inclusion

Out of 29 topics, 11 of them can be directly included in projects as a result of the analysis. Among the criteria that technical experts found to be of high priority and feasibility, transportation accessibility, water management, and ecological functionality were particularly prominent. All sub-criteria under the Access and wayfinding heading received high feasibility and priority scores from technical experts. This shows that physical access arrangements can be easily integrated from an engineering perspective. It also reveals that structural solutions for water resource management are technically affordable in project processes.

Criteria Requiring Planning

Out of 29 topics, 14 of them require planning before being included in projects as a result of the analysis. Titles that concern social and cultural sustainability, such as Sustainable Transportation and Preserving Historic & Cultural Resources, have high importance despite having some technical limitations. The subject of Climate Change is included in the "Plan and Include" group because it requires technically complex analyses.

The excavation-fill balance criteria are not directly applicable because they require project-specific topographic and logistical planning, but they can be integrated into the planning process. Similarly, Unsuitable Development is evaluated as dependent on planning because it requires detailed analyses specific to project locations.

Excluded Criteria

Prime farmland, brownfield, and undeveloped land criteria were excluded from the project scope. Interview findings indicate that the main reason for this exclusion was participants' unfamiliarity with these concepts, particularly the definition of "brownfield" areas. The redevelopment of such areas has not yet been systematically addressed in planning processes in Türkiye. Furthermore, the fact that land allocation decisions are generally made by higher-level institutions makes it difficult to consider prime farmland and undeveloped land criteria at the project level. Therefore, the exclusion of these topics stems more from a lack of awareness and limited authority.

4.2.2.3 Social Experts

As a result of the interview with social experts, the scores the interviewees gave for difficulty and priority were evaluated, and the decision about the implementation of each sub-question in Türkiye was made. The results for each sub-question of the Envision criteria asked for social experts are given in Table 4.22 below.

Table 4.22 Results of interview with social experts

Question Number	Envision Credit	Difficulty Average	Priority Average	Decision
5	QL1.1 Improve Community Quality of Life (B)	4.20	4.80	Plan and Include
6	QL1.1 Improve Community Quality of Life (C)	2.80	4.40	Include
7	QL1.1 Improve Community Quality of Life (D)	3.40	4.00	Plan and Include
8	QL1.1 Improve Community Quality of Life (E)	2.80	4.40	Include
9	QL1.1 Improve Community Quality of Life (F)	2.60	4.60	Include
10	QL1.1 Improve Community Quality of Life (G)	3.80	4.60	Plan and Include
11	QL1.2 Enhance Public Health & Safety (E)	3.20	4.60	Plan and Include
12	QL1.2 Enhance Public Health & Safety (F)	3.20	3.80	Plan and Include
13	QL1.4 Minimize Noise & Vibration (D)	2.40	4.40	Include
14	QL3.1 Advance Equity & Social Justice (A)	3.00	4.00	Include
15	QL3.1 Advance Equity & Social Justice (B)	2.40	4.40	Include
16	QL3.1 Advance Equity & Social Justice (D)	3.20	4.40	Plan and Include
17	QL3.1 Advance Equity & Social Justice (E)	3.80	3.60	Plan and Include
18	QL3.1 Advance Equity & Social Justice (F)	3.00	4.20	Include
19	QL3.1 Advance Equity & Social Justice (G)	3.80	3.60	Plan and Include
20	QL3.2 Preserve Historic & Cultural Resources (C)	3.00	4.20	Include
21	QL3.4 Enhance Public Space & Amenities (C)	2.20	4.60	Include
22	LD1.3 Provide for Stakeholder Involvement (B)	2.60	4.80	Include
23	LD1.3 Provide for Stakeholder Involvement (D)	2.40	4.20	Include
24	LD3.1 Stimulate Economic Prosperity & Development (A)	2.00	4.20	Include
25	LD3.1 Stimulate Economic Prosperity & Development (D)	3.20	3.40	Plan and Include
26	LD3.1 Stimulate Economic Prosperity & Development (E)	3.20	3.60	Plan and Include
27	LD3.2 Develop Local Skills & Capabilities (A)	2.40	3.80	Include
28	LD3.2 Develop Local Skills & Capabilities (B)	3.00	3.80	Include

Recommended Criteria for Direct Inclusion

Out of 24 topics, 14 of them can be directly included into projects as a result of the analysis. All the titles of stakeholder involvement and developing local skills were marked as "Include" for implementation by social experts. This situation reflects the importance that social experts give to participatory planning. Although all of the topics related to increasing the quality of life of the community, and equality and social justice seem important, some of the criteria were found easier to implement. It is envisaged that the criteria that are both high priority and easy to implement by social experts can be integrated into existing projects without requiring any major structural or administrative changes.

Criteria Requiring Planning

Out of 24 topics, 10 of them require planning before being included in projects as a result of the analysis. Even though all of the titles related to increasing the quality of life of the community and equality and social justice seem important, half of them were found to be harder to implement by the experts. This means planning is required before implementing those criteria in the Turkish industry. Advanced level of applications regarding to public safety were found to be harder to implement, just like the criteria about economic development.

Excluded Criteria

The evaluations showed that social experts weren't considering any criteria in the "Exclude" category. This indicated that most experts agree that those criteria are significantly important for sustainability and that the correct approaches can help overcome the drawbacks in the highway projects.

4.2.2.4 Managers

As a result of the interview with managers, the scores the experts gave for difficulty and priority were evaluated, and the decision about the implementation of each sub-question in Türkiye was made. The results for each sub-question of the Envision criteria asked for managers are given in Table 4.23.

Table 4.23 Results of interview with managers

Question Number	Envision Credit	Difficulty Average	Priority Average	Decision
6	LD1.1 Provide Effective Leadership & Commitment (A)	2.17	3.83	Include
7	LD1.1 Provide Effective Leadership & Commitment (B)	2.67	3.33	Include
8	LD1.1 Provide Effective Leadership & Commitment (C)	2.00	3.33	Include
9	LD1.2 Foster Collaboration & Teamwork (A)	2.17	3.33	Include
10	LD1.2 Foster Collaboration & Teamwork (B)	2.17	3.50	Include
11	LD1.2 Foster Collaboration & Teamwork (C)	2.17	3.17	Include
12	LD1.2 Foster Collaboration & Teamwork (D)	2.67	3.33	Include
13	LD1.3 Provide for Stakeholder Involvement (A)	2.67	2.83	Exclude
14	LD1.3 Provide for Stakeholder Involvement (C)	2.83	3.33	Include
15	LD1.3 Provide for Stakeholder Involvement (D)	2.83	3.33	Include
16	LD2.1 Establish a Sustainability Management Plan (A)	1.83	3.67	Include
17	LD2.1 Establish a Sustainability Management Plan (B)	2.17	3.00	Include
18	LD2.1 Establish a Sustainability Management Plan (C)	2.83	3.50	Include
19	LD2.1 Establish a Sustainability Management Plan (D)	2.83	3.67	Include
20	LD2.1 Establish a Sustainability Management Plan (E)	2.50	4.00	Include
21	LD3.3 Conduct a Life-Cycle Economic Evaluation (A)	2.83	4.50	Include
22	LD3.3 Conduct a Life-Cycle Economic Evaluation (B)	2.50	4.33	Include
23	LD3.3 Conduct a Life-Cycle Economic Evaluation (C)	2.83	4.33	Include
24	LD3.3 Conduct a Life-Cycle Economic Evaluation (D)	2.67	4.00	Include
25	LD3.3 Conduct a Life-Cycle Economic Evaluation (E)	2.50	3.83	Include
26	CR2.2 Assess Climate Change Vulnerability (A)	2.67	3.67	Include
27	CR2.2 Assess Climate Change Vulnerability (B)	2.50	3.67	Include
28	CR2.2 Assess Climate Change Vulnerability (C)	2.67	3.50	Include
29	CR2.2 Assess Climate Change Vulnerability (D)	3.00	3.00	Include
30	CR2.3 Evaluate Risk & Resilience (A)	2.67	3.67	Include
31	CR2.3 Evaluate Risk & Resilience (B)	2.67	3.17	Include
32	CR2.3 Evaluate Risk & Resilience (C)	2.33	4.00	Include
33	CR2.3 Evaluate Risk & Resilience (D)	2.33	4.17	Include
34	CR2.3 Evaluate Risk & Resilience (E)	3.00	3.50	Include
35	CR2.3 Evaluate Risk & Resilience (F)	2.83	3.17	Include
36	CR2.4 Establish Resilience Goals and Strategies (A)	2.67	3.50	Include
37	CR2.4 Establish Resilience Goals and Strategies (B)	2.67	3.17	Include
38	CR2.4 Establish Resilience Goals and Strategies (C)	2.67	3.17	Include
39	CR2.5 Maximize Resilience (A)	2.67	3.33	Include
40	CR2.5 Maximize Resilience (B)	2.83	3.33	Include
41	CR2.5 Maximize Resilience (C)	3.00	3.17	Include
42	CR2.5 Maximize Resilience (D)	2.83	2.83	Exclude
43	CR2.5 Maximize Resilience (E)	2.83	2.83	Exclude
44	CR2.6 Improve Infrastructure Integration (A)	2.83	2.83	Exclude
45	CR2.6 Improve Infrastructure Integration (B)	2.67	3.83	Include
46	CR2.6 Improve Infrastructure Integration (C)	2.50	3.83	Include
47	CR2.6 Improve Infrastructure Integration (D)	2.33	4.17	Include
48	CR2.6 Improve Infrastructure Integration (E)	2.50	3.33	Include

Recommended Criteria for Direct Inclusion

Most of the Envision criteria asked to the managers can be included in the highway projects of the Turkish industry. Each of the below sub-question of Envision criteria fall into "Include" category:

- LD1.1 Provide Effective Leadership & Commitment
- LD1.2 Foster Collaboration & Teamwork
- LD2.1 Establish a Sustainability Management Plan
- LD3.3 Conduct a Life-Cycle Economic Evaluation
- CR2.2 Assess Climate Change Vulnerability
- CR2.3 Evaluate Risk & Resilience
- CR2.4 Establish Resilience Goals and Strategies

Managers have a higher awareness of organizational issues, especially leadership, sustainability management plans, and life cycle cost analysis. These criteria are indicated as applicable in project planning and execution processes. In addition, technically complex issues such as risk assessment and climate change adaptation, but which can be supported at the administrative level, are also seen as directly applicable. This indicates that sustainability is accepted at the project management level.

Criteria Requiring Planning

There are no criteria in this dataset that fall into the "Plan and Include" category. This indicates that managers either found the criteria applicable or did not see them as strong enough in terms of priority.

Excluded Criteria

Managers considered the implementation of advanced resilience practices at the project level to be more challenging compared to other sustainability components. This is related to the fact that these practices involve more technically complex processes and require long-term planning, additional budget, and interdisciplinary

coordination. Stakeholder involvement and infrastructure integration criteria were also placed in the “exclude” category. Although the implementation of these criteria involves relatively fewer technical challenges, interview findings indicate that these areas are practically neglected due to project management priorities, time constraints, and organizational structure. Therefore, the exclusion of these criteria stems more from current organizational prioritization, awareness levels, and resource planning approaches than from technical impossibility.

4.2.3 Qualitative Assessment

This section presents in detail the coding process based on qualitative data obtained from interviews, thematic analysis, and studies related to the Sustainable Development Goals. In the first step, a general distribution and frequency analysis of codes are conducted, highlighting prominent themes and less frequently recurring but analytically significant elements within the findings. Thematic findings are then systematically examined at the topic and subtheme level. The definitions of each code are supported by direct quotes from participants, strengthening the reliability and context of the findings.

In the third stage of the analysis, the connections between subthemes are explored and how these connections create interaction and cohesion across various dimensions are explained. This allows the findings to be evaluated not only as independent categories but also in their interrelationships. Finally, codes and themes are systematically mapped to the United Nations Sustainable Development Goals, examining which areas are being met strongly and which goals remain incomplete. This allows for a comprehensive assessment of the findings not only in terms of local project implementation but also in terms of their alignment with the global sustainability agenda.

4.2.3.1 General Distribution of Codes and Frequency Analysis

The thematic analysis identified a total of 175 codes with a total frequency of 3295 codes. Through the analysis, these 175 codes formed 24 subthemes, and these subthemes were gathered under 10 themes. These codes, subthemes and themes are given in the Appendix F in detail. This demonstrates that the data was collected from diverse sources and that the sustainability dimensions were evaluated from multiple perspectives. The numbers and names of the themes, the number of subthemes corresponding to each theme, number of codes, and the frequency of the total codes for each theme are presented in the Table 4.24. Based on the frequency distribution, the most prominent theme was "Theme 1: Project Context and Applicability Conditions" with 938 occurrences. This theme with high frequency emphasize the sensitivity of sustainability in projects to project type, funding source, and implementation conditions. The theme “Theme 2: Priority and Criticism Assessment” (876) follows Theme 1 with a very close repetition count. “Theme: 10 Implementation Barriers and Enabling Conditions” (353) has both a high number of repetitions and the most codes (33). This indicates that participants frequently mentioned barriers to sustainability and that these barriers have various causes.

Medium-frequency themes include Theme 8: Design and Implementation Sensitive to Environmental and Social Impacts" (265), “Theme 6: Conservation, Restoration, and Harm Minimization” (254), “Theme 9: Data-Driven Decision Making and Analytical Evaluation” (191), and “Theme 5: Management of Social Impacts and Social Support” (150). These themes offer a significant focus, particularly in protecting environmental values, incorporating analytical methods into decision-making, and managing social impacts. Theme 8 “Design and Implementation Sensitive to Environmental and Social Impacts”, with the highest number of codes (33), addresses the wide variety of design measures taken to address environmental and social impacts of projects and demonstrates the diverse ways to enhance sustainability.

Lower-frequency themes include “Theme 4: Stakeholder Engagement and Communication” (121), “Theme 3: Legal and Institutional Framework” (100), and “Theme 7: Negative Effects and Types of Harm” (48). Although these themes are rarely repeated, the codes they contain are strategically important. For example, although stakeholder engagement and communication are mentioned only a limited number of times, they play a critical role in the adoption of sustainable decisions. Similarly, the limited number of codes related to the legal and institutional framework suggests that legal regulations require greater consideration.

Table 4.24 Themes’ distribution

Theme Number	Theme Name	Number of Subthemes	Number of Codes	Total Frequency
1	Project Context and Applicability Conditions	3	18	938
2	Priority and Difficulty Assessment	2	11	876
3	Legal and Institutional Framework	1	8	100
4	Stakeholder Engagement and Communication	2	7	121
5	Management of Social Impacts and Social Support	3	15	150
6	Conservation, Restoration and Harm Minimization	2	23	254
7	Negative Effects and Types of Harm	3	7	48
8	Design and Implementation Sensitive to Environmental and Social Impacts	3	33	265
9	Data-Driven Decision Making and Analytical Evaluation	2	22	191
10	Implementation Barriers and Enabling Conditions	3	33	353

The word cloud shown in Figure 4.6 was created to visually demonstrate the frequency density of the codes used in the thematic analysis. This allows you to discern at a glance which concepts are dominant in the study and which are relatively less frequently mentioned.



Figure 4.6 Word cloud

The Figure 4.7 lists the 10 codes with the highest frequency in the descending order. The high frequencies of the listed 10 codes indicate that project feasibility, priority, and project type are the most frequently mentioned areas of focus for sustainability. These concepts are critical not only in terms of their frequency of occurrence but also in terms of their contribution to strategic direction and decision-making processes.

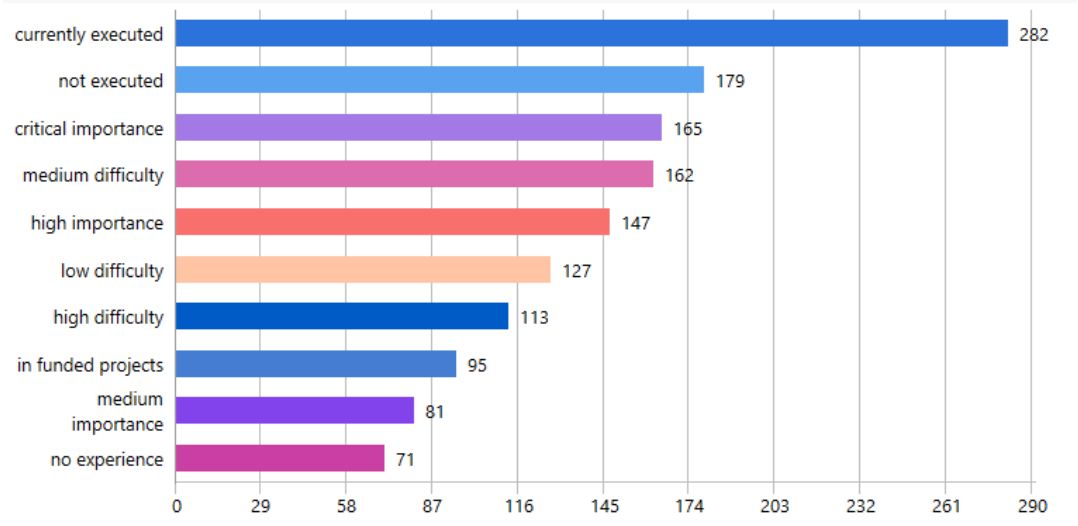


Figure 4.7 Highest frequency codes

According to the frequency analysis, the code with the highest number of repetitions was "currently executed" (282). This finding indicates that the most emphasized issue within the scope of sustainability is the currently implemented processes. The subsequent code, "not executed" (179), points to areas that are not implemented or have not been implemented, revealing the gap between the current status and potential. When these two findings are considered together, while currently implemented activities are highlighted in sustainability practices, the presence of areas that have not been implemented becomes apparent. Therefore, the codes "currently executed" and "not executed" reveal the coexistence of strengths and areas requiring development within projects. Furthermore, the codes related to project type support this: "in-funded projects" (95), "international projects" (58), and "in-national projects" (52). Diversifying sustainability practices across projects with different scales and resources is crucial for understanding which sustainability practices are being successfully implemented and which areas have gaps in implementation. Thus, the difference between implemented and non-implemented practices can be observed more clearly depending on project types.

Codes emphasizing the degree of importance were also repeated with high frequency: "critical importance" (165), "high importance" (147), and "medium importance" (81). This result indicates that participants considered the sustainability practices mentioned in the questions to be crucial for project performance. In particular, it shows that most considered the inclusion of these practices a critical priority.

Finally, the fact that "stakeholder communication" (67) was one of the top ten codes with the highest frequency among codes covering various sustainability practices highlights the importance of managerial processes such as interaction with stakeholders and clarification of priorities in sustainability.

The frequency analysis reveals that some codes are repeated only once in the interview as shown in Table 4.25. The fact that these codes have only been repeated once indicates that the statements in question describe exceptional or project-specific situations rather than reflecting general trends. Participants rarely mentioned topics such as “reactive decision-making,” “budget claims during construction,” or “emergency exit intersections”; this suggests that these issues are considered secondary priorities in terms of sustainability assessment or are raised in a manner specific to certain events.

Similarly, practices such as “using recycled material” and “raising public awareness” were only mentioned in isolated examples. This indicates that such sustainability actions have not yet been institutionalized in project practice and are mostly addressed based on individual awareness or project conditions.

Table 4.25 Lowest frequency codes

Code	Frequency
reactive decision-making	1
budget claims during construction	1
risk assessment	1
employee management difficulty	1
contamination	1
trafic projection	1
raising public awareness	1
using recycled material	1
pubic ignoring historically important pieces	1
emergency exit intersections	1

4.2.3.2 Thematic Findings

This section presents the results of the thematic analysis conducted based on the information obtained from the interviews in detail. The results are structured under separate headings for each main theme, including a systematic explanation of the relevant subthemes and the content of the codes that comprise these subthemes. This method allows for the presentation of themes not only conceptually but also in a way supported by original data obtained from the field. The explanations of the codes were enriched by including direct statements from the participants, thus increasing the reliability of the analysis findings and strengthening the contextual basis of the interpretations. Within this framework, each theme was evaluated in depth in terms of both its theoretical dimensions and practical implications.

Theme 1: Project Context and Applicability Conditions

This theme emphasizes how important project context and application circumstances are when putting sustainability guidelines into practice. According to participant remarks, the type of project, the source of funding, and the stages of the project lifecycle all affect execution. Regarding the applicability of certain criteria, it was also noted that different levels of necessity and likelihood were emphasized. Three subthemes are formed under this theme which are:

- Subtheme 1.1: Dependence on Project Type and Funding Source,
- Subtheme 1.2: Expressions Regarding the Possibility of Implementation,
- Subtheme 1.3: Stages in the Project Lifecycle

The codes used under each subthemes are also represented in the Figure 4.8 below.

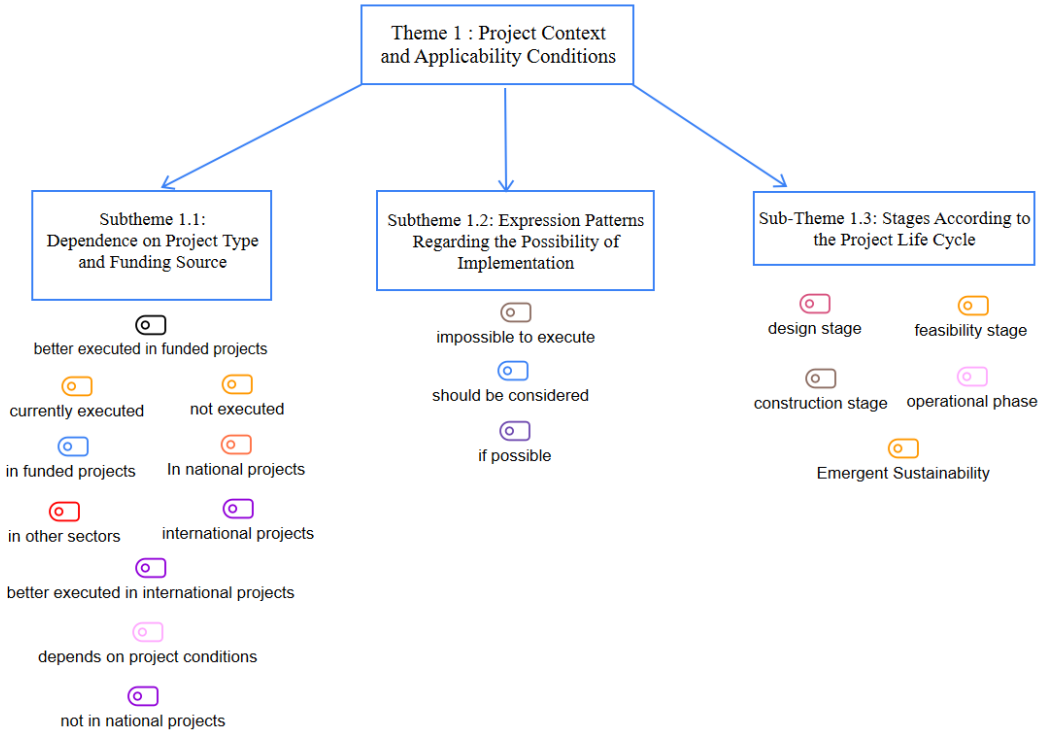


Figure 4.8 Theme 1's subthemes and codes

- Subtheme 1.1: Dependence on Project Type and Funding Source

When it comes to implementing sustainability principles, the majority of participants highlighted that the type of project and the source of funding plays an important role. The highest frequency expressions in the code analysis were "currently executed" (282) and "not executed" (179). This finding indicates that while some criteria are already implemented, a significant portion has never been implemented.

When evaluated according to funding source, the codes "in-funded projects" (95) and "international projects" (58) indicate that the likelihood of applying the criteria

increases in externally or internationally funded projects. S3 indicates this as given in the Figure 4.9.

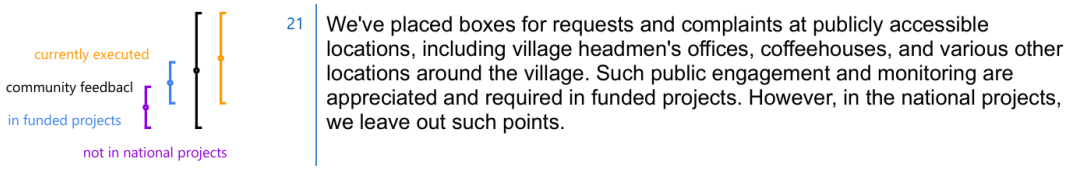


Figure 4.9 S3's statement from the interview

Additionally, as the code "depends on project type and conditions" (52) indicates, implementation often depends on specific factors such as project size, location, technical requirements, or stakeholder expectations. The statement's use of the phrase "in other sectors" (34) indicates that some criteria are more appropriate in industries other than highways.

Although less frequent, the codes "better executed in funded projects" (19) and "better executed in international projects" (9) indicate that not only the probability of implementation but also the quality of implementation are higher in funded and international projects. This finding suggests that project type is a determining factor not only in terms of applicability but also in terms of implementation effectiveness. In deed, while discussing project execution, A2 emphasized the effect of funding to the projects quality by stating:

"International projects are carried out in a more systematic manner, and they consider this [citizen's demands] from the beginning and proceed accordingly."

This sub-theme shows that the project type, funding source, and context all have a direct impact on how applicable sustainability criteria are; in projects that receive international funding, both applicability and implementation quality improve, while in national projects, implementation is limited.

- Subtheme 1.2: Expression Patterns Regarding the Possibility of Implementation

This subtheme encompasses the forms of expression used by participants in their assessments of the applicability of sustainability criteria. Code analysis reveals three distinct approaches: “should be considered” (26), “impossible to execute” (16), and “if possible” (11).

The most frequently occurring code, "should be considered," indicates that participants believe that, regardless of the circumstances, specific criteria ought to be taken into account when planning a project. This form of expression indicates flexibility in the implementation of the criteria and the expectation of long-term benefits. In the interview, M1 expressed this situation with the following words:

“That [risk analysis] part could actually add significant value to the project. It contributes greatly.”

The second-highest-ranked code, “impossible to execute,” reflects that certain criteria are impossible to implement under current technical, financial, or legal conditions. In fact, while discussing balancing the earthwork, A2 highlighted implementation possibility by the statement given in the Figure 4.10.

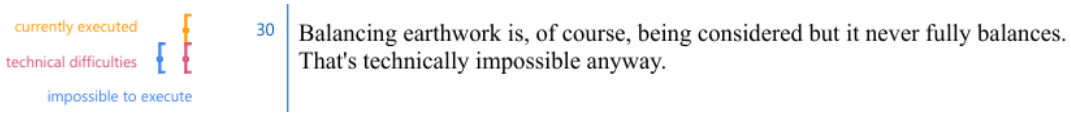


Figure 4.10 A2’s statement from the interview

Overall, this subtheme reveals that participants' approach to sustainability criteria is not one of absolute acceptance or absolute rejection; it is often based on conditional acceptance, emphasis on necessity, or a determination of current impossibility. This demonstrates that implementation decisions are contextually shaped and that a flexible evaluation process is required based on project conditions.

- Subtheme 1.3: Stages According to the Project Life Cycle

This subtheme encompasses participant evaluations regarding the stages at which sustainability criteria can be implemented throughout the project lifecycle. The highest frequency in the code analysis belongs to the "construction stage" code (27). This finding indicates that many criteria are implemented directly on-site during construction activities. E6 expressed this as follows:

"For example, when water must be withdrawn from non-critical areas, such as wetlands, filters are installed at the ends to prevent the intrusion of wetland fauna. Critical habitats are not withdrawn at all anyway. Filters are also used in non-critical areas, or if the water flow must be narrowed, the construction team then restores it to its original state and opens it up."

The second-ranked code, "feasibility stage" (12), emphasizes the importance of integrating criteria during the early planning and feasibility stages. During the discussions, participants emphasized that some sustainability practices require early integration, ideally during the feasibility stage. In support of this view, M5 stated that:

"The lifecycle cost analysis is typically conducted during the feasibility phase… if we are conducting the feasibility study, then we do the lifecycle cost analysis."

The code "Emergent sustainability" (8) indicates that sustainability is not initially targeted during the project process but emerges as a byproduct. In this case, sustainable outcomes develop spontaneously as a result of the decisions made or methods implemented, even though they are not the primary objective of the project. Participants noted that in such cases, sustainability impacts are often not included in the planning documents but emerge as unexpected benefits during the implementation process. For example, M3 explained this situation as follows:

"Yes, we actually do a lot of this [sustainability practices], but the goal is not sustainability. We critique some social and economic impacts, but it's not called sustainability."

Overall, this subtheme demonstrates that sustainability criteria can be implemented with different priorities at different stages of the project lifecycle. The findings suggest that the construction phase, in particular, is the most critical period for implementing the criteria on-site, but that integrations made in the early planning stages are strategically important for long-term success.

Theme 2: Priority and Criticism Assessment

This theme reveals how participants' responses to the Envision criteria differ in terms of importance and implementation difficulty. The purpose of creating this category is to highlight the differences in the importance and difficulty ratings given when discussing the criteria. Thus, which sustainability practices participants prioritized and in which areas they experienced implementation difficulties were evaluated through both quantitative and qualitative analysis.

The findings obtained under the “Implementation Priority” sub-theme show that the vast majority of participants rated sustainability topics as highly or critically important. This indicates that sustainability principles are conceptually valued. However, different prioritization levels emerge for different criteria.

On the other hand, the sub-theme “Perceived Level of Implementation Difficulty” reveals the perceived levels of difficulty in the implementation process of these criteria. The findings show that many topics are associated with a medium level of difficulty; therefore, they are not considered completely unimplementable but rather as applications requiring specific organizational, technical, or financial effort. The codes used under each subthemes are also represented in the Figure 4.11.

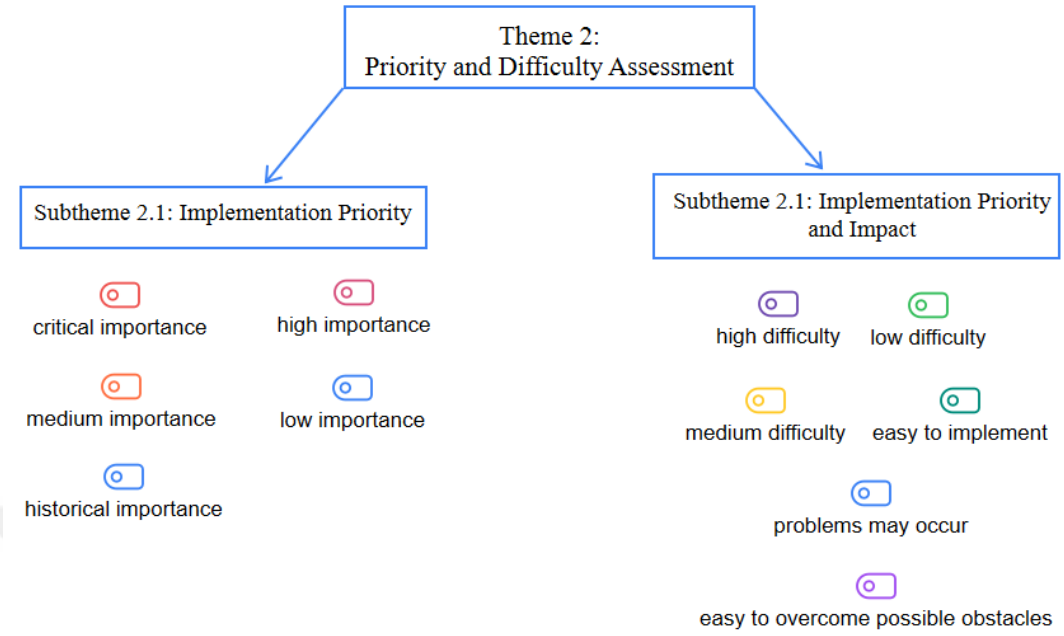


Figure 4.11 Theme 2's subthemes and codes

- Subtheme 2.1: Implementation Priority

This subtheme covers the priority levels at which sustainability criteria are addressed within the project context and the impact of these priorities on the project. "High importance" (147) and "critical importance" (165) were the most frequently used terms in the code analysis. This implies that participants thought specific requirements were essential to the project's success. M4 expressed this approach as given in Figure 4.12.

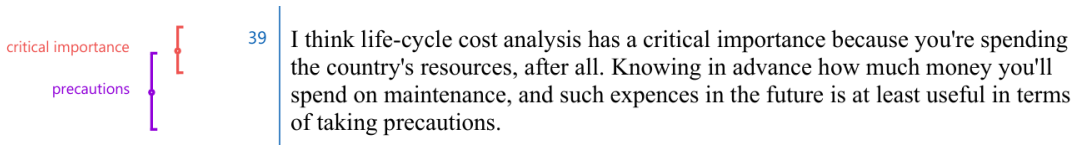


Figure 4.12 M4's statement from the interview

Medium priority criteria were grouped under the code "medium importance" (81). These statements represent situations where the criteria were viewed as useful, but more critical issues were prioritized in the project plan. Participants stated that implementing these criteria could contribute to project success, but they were kept low priority due to time, budget, and technical constraints.

The code "low importance" (29) reflects situations where the criteria were viewed as secondary to the project objectives or where their implementation was not mandatory.

According to the interview findings, the most important issues were water management, habitat protection, preservation of historical and cultural assets, life-cycle economic evaluation and prevention of unsuitable development.

- Subtheme 2.2: Perceived Level of Implementation Difficulty

This sub-theme reflects participants' perceived levels of difficulty in applying sustainability criteria to projects. When examining the code distribution, it is evident that the majority concentrated on the statement “midium difficulty” (162). This indicates that sustainability practices are not considered entirely new or unattainable, but rather as practices that require a certain degree of effort and adaptation under current conditions. The sum of the codes “low difficulty” (127) and “easy to implement” (39) reveals that some participants view certain sustainability topics as achievable under current project conditions. This finding indicates a positive perception, particularly for practices with low technical requirements, institutional support, or alignment with the existing legal framework. In contrast, the “high difficulty” (113) code indicates technical, financial, or administrative barriers to integrating certain criteria into existing project processes. Participants noted that applications requiring complex calculations, innovative materials, or designs create challenges in terms of both cost and time.

Overall, the findings obtained under this sub-theme show that participants do not view sustainability criteria as either completely unfeasible or completely easy, but

rather as applications requiring a moderate level of effort, resources, and institutional support. This situation indicates that technical knowledge, managerial awareness, and process planning need to be developed together for the integration of sustainability goals into projects.

According to the interview findings, the hardest subjects for the implementation were related to brownfields and climate change while issues regarding to teamwork, improving wayfinding and soil health were found to be easier to implement.

Theme 3: Legal and Institutional Framework

This theme encompasses the legal regulations, standards, and institutional permitting processes that shape the applicability of sustainability criteria. Participant statements indicate that, in addition to technical and financial capabilities, compliance with existing legislation and obtaining the necessary permits from relevant institutions are critical to the project process. While legal and institutional frameworks sometimes serve as a guide to encourage implementation, they also act as a barrier, limiting or completely preventing certain activities. The results show that ensuring legal compliance and efficiently managing permitting procedures are just as important to the success of sustainability implementations as the project team's willingness and ability. The codes used under each subthemes are also represented in the Figure 4.13.

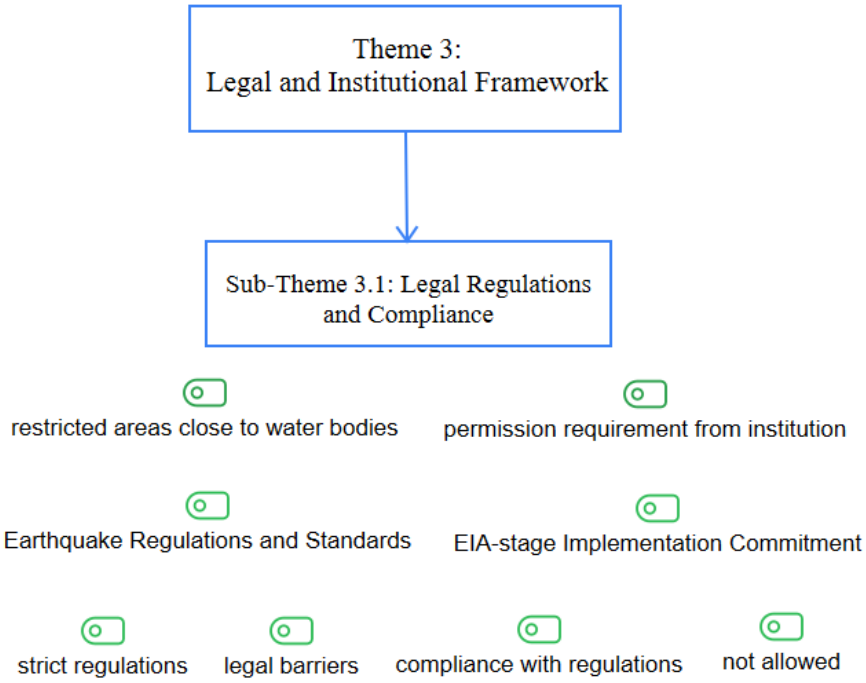


Figure 4.13 Theme 3's subthemes and codes

- Subtheme 3.1: Legal Regulations and Compliance

This subtheme includes the institutional permit procedures, standards, and laws that establish whether sustainability criteria are applicable. "Compliance with regulations" (28) and "permission requirement from institution" (25) were the most frequently occurring terms in the code analysis. This finding reveals that sustainability practices are largely shaped by existing legislation and official approvals required from relevant institutions. In particular while discussing improved safety, A2 poiğnted out the role of regulations by stating:

"For example, let's consider lighting. While lighting is less frequent on an intercity road, areas with high pedestrian density or, especially, high public transportation density are illuminated more frequently, ensuring both safety and better illumination. This is required by standard."

The code "strict regulations" (13) reflects the strict nature of current regulations and the need for compliance. Participants emphasized that standards in construction, environment, and safety, particularly at the national level, are decisive. The code "not allowed" (13) indicates that some practices are completely prohibited under the current legal framework. These prohibitions are generally associated with environmental protection areas, security zones, or private property rights. Some specific regulations also stood out in participant statements. The code "EIA-stage Implementation Commitment" (12) indicates that the commitments made during the EIA process are binding during the implementation phase. About this topic, participant M1's statement is given in the Figure 4.14.

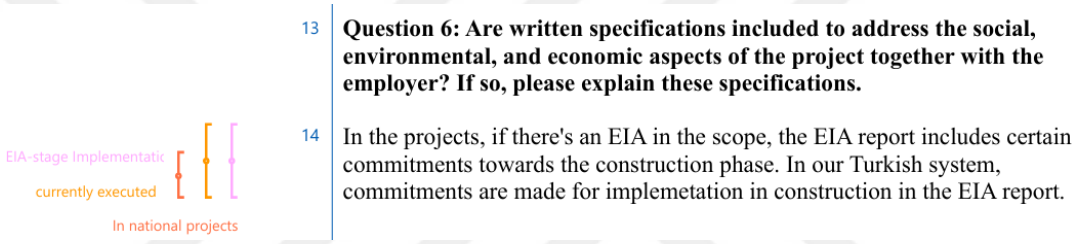


Figure 4.14 M1's statement from the interview

The codes "legal barriers" (3) and "restricted areas close to water bodies" (3) indicate that, despite their rarity, laws impose site limitations and permit obstacles on certain projects. Building standards can have a direct impact on sustainability practices, particularly in areas with a high risk of earthquakes, according to the code "Earthquake Regulations and Standards" (3). Overall, this subtheme reveals that sustainability criteria are not limited to technical or financial dimensions, but rather strongly constrained by legal and institutional frameworks. The findings indicate that legal compliance is a critical step in project planning, while permitting processes and regulatory barriers directly impact the implementation schedule and strategy.

Theme 4: Stakeholder Engagement and Communication

This theme encompasses the communication, negotiation, and feedback processes conducted with stakeholders throughout the project process, as well as their views and priorities regarding the project. Participant statements reveal that the applicability of sustainability criteria is directly related not only to technical and legal aspects, but also to the level of interaction and collaboration established with stakeholders. While effective communication mechanisms increase both project acceptance and implementation success, failure to consider stakeholder expectations and priorities can negatively impact the success of the process. The codes used under each subtheme are also represented in the Figure 4.15.

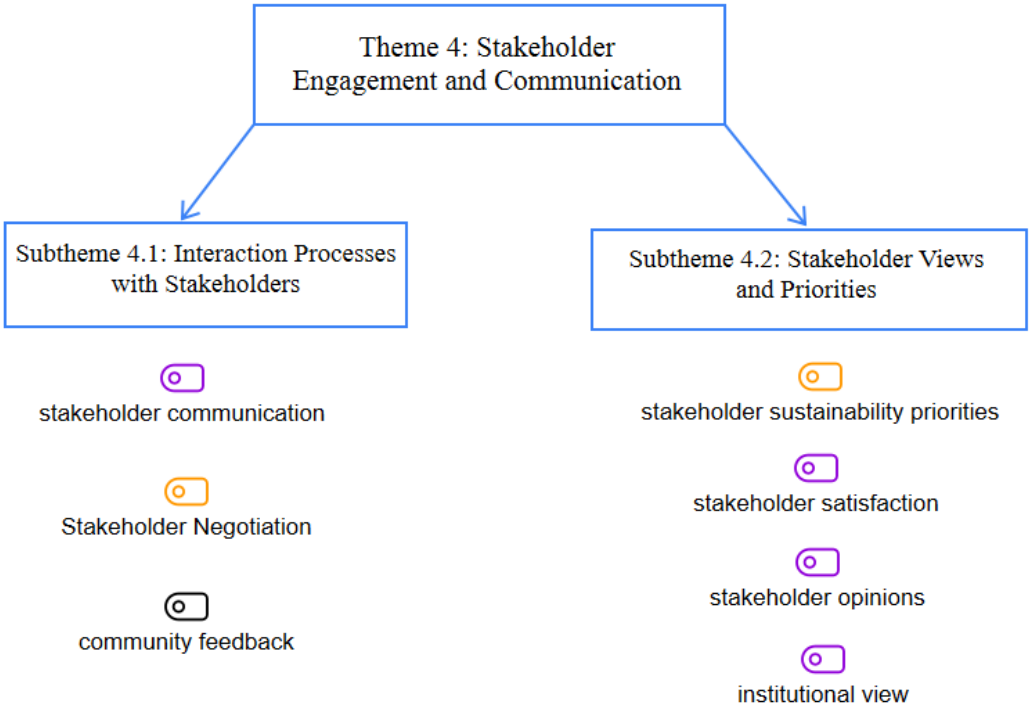


Figure 4.15 Theme 4's subthemes and codes

- Subtheme 4.1: Interaction Processes with Stakeholders

This subtheme encompasses the communication, negotiation, and feedback mechanisms conducted with stakeholders throughout the project process. The highest-frequency expression in the code analysis was "stakeholder communication" (67), which emphasizes the importance of information flow and regular communication between project teams and stakeholders. Participants stated that establishing open and transparent communication channels increases both trust and process efficiency. In deed, while discussing project execution, M5 emphasized the importance of continuous feedback by stating:

"Regular meetings are held. At these regular meetings, you conduct a reassessment. You get their feedback. You get the operator's feedback. You also get the investor's feedback. You progress the project accordingly. They are absolutely involved at every stage."

The code "community feedback" (11) demonstrates the contribution of feedback received from local communities to project decision-making processes. Participants stated that community opinions are critical, particularly regarding social acceptance. The lower-frequency code "stakeholder negotiation" (5) represents the negotiation processes conducted to resolve conflicts of interest and achieve consensus among different stakeholder groups. Overall, this subtheme demonstrates that not only information transfer but also interaction and negotiation play a critical role in sustainability practices.

- Subtheme 4.2: Stakeholder Views and Priorities

The opinions, satisfaction, and sustainability priorities of stakeholders with respect to the project process are all included in this subtheme. The most frequently occurring term in the code analysis was "stakeholder opinions" (17), which represent the direct evaluations of the project by stakeholders. These viewpoints typically center on expectations, areas for improvement, and the effects of the project.

The "institutional view" code (11) represents the perspectives of public institutions and other official actors. These statements are important for the projects' compliance with legislation, regional development goals, and strategic plans. In this context, M6 emphasized this point by stating:

"We gather information about their [institution's] existing infrastructure, superstructure, facilities, and planning. Then, after implementing something accordingly, we ask if it's suitable."

The "stakeholder satisfaction" code (5) indicates the level of satisfaction with project outcomes, while the "stakeholder sustainability priorities" code (4) reveals stakeholders' priorities regarding sustainability. Participants emphasized that considering stakeholder priorities in project planning strengthens both implementation success and social acceptance. Overall, this subtheme reveals that stakeholder opinions and priorities are diverse, but that integrating this diversity into project planning and implementation processes is critical.

Theme 5: Management of Social Impacts and Social Support

This theme encompasses participant evaluations of the management of project social impacts and the development of community-based social support mechanisms. Findings indicate that projects should address not only technical and economic objectives but also issues such as social well-being, social inclusion, and improving quality of life. Participants stated that projects can provide direct and indirect benefits to society, and that these benefits can be assessed across a wide range of areas, from employment and education to social support and awareness-raising activities. The codes used under each subtheme are also represented in the Figure 4.16.

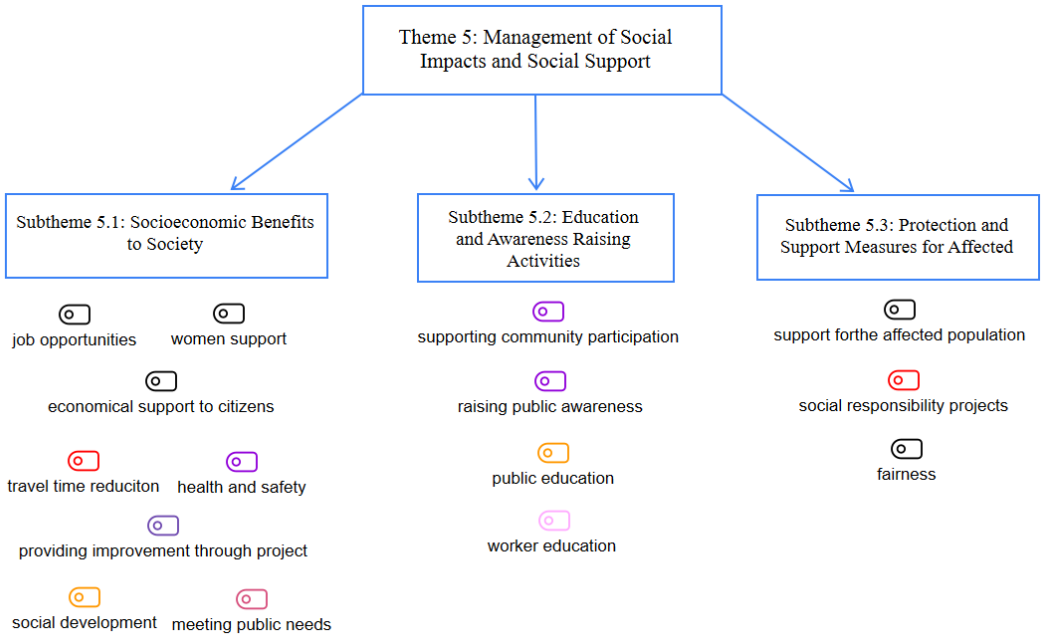


Figure 4.16 Theme 5's subthemes and codes

- Subtheme 5.1: Socioeconomic Benefits to Society

This subtheme encompasses the contributions of projects to the economic and social well-being of society. The highest-frequency expression in the code analysis was "providing improvement through projects" (25). This expression emphasizes the projects' capacity to improve infrastructure, improve quality of life, and foster social development. E6 expressed this situation as follows:

"Let me give you an example. In a project, the elected neigborhood representative requested our assistance in improving the school and another one for a community area. When we are asked to provide concrete for muddy gardens, we do our best to accomate these needs."

The code "health and safety" (15) reflects the projects' impact on occupational and community safety and health. The codes "women support" (13) and "economic support to citizens" (12) indicate social benefits such as social inclusion and direct economic benefits. The code "Meeting public needs" (12) reflects the projects' role in meeting basic community needs. The lower-frequency codes "job opportunities"

(9), “social development” (6), and “travel time reduction” (2) reveal the projects' side benefits such as employment creation, social development, and reduced commute times.

- Subtheme 5.2: Education and Awareness Raising Activities

This subtheme encompasses the education, information, and awareness-raising activities of the projects. Code analysis highlighted "public education" (9) and "worker education" (6). Participants stated that worker training is critical for occupational safety and technical proficiency, and that public training increases new skills, project knowledge and acceptance. In the interview participant S5 stated that:

“For example, a contractor needs to employ formwork workers. They want to make formworks, but we can't find knowledgeable personnel. So they take 10 local people and send them to a training course. When they learn and receive certification, they start working in the projects construction.”

The code "supporting community participation" (5) indicates activities that encourage the active participation of local people in decision-making processes. The low-frequency code "raising public awareness" (1) refers to specific initiatives aimed at raising awareness about sustainability issues.

- Subtheme 5.3: Protection and Support Measures for Affected Population

This subtheme encompasses protection and support mechanisms for the population directly affected by the project. The highest frequency is "support for the affected population" (24), which covers various forms of assistance. In particular, this support often arises from the relocation needs caused by the project, the risk of unemployment that may emerge during or after construction, and the necessity of providing machine or equipment assistance for people to sustain their livelihoods and continue their work. The interviewee S1 highlighted this aspect by stating:

“For example, citizens are interested in animal husbandry. They're requesting seed support for this. Citizens are actually losing their homes. They're requesting replacement support for their homes. This could include moving support or the

ability to purchase land instead of a house, along with the title deed fees associated with the replacement cost."

The code "Fairness" (7) emphasizes the need for these support mechanisms to be implemented in a transparent and equitable manner, ensuring that affected communities are not left vulnerable.

Theme 6: Conservation, Restoration and Harm Minimization

This theme encompasses project strategies for protecting natural, cultural, and social values, as well as preventative practices implemented to minimize environmental and social damage. Participant statements reveal that sustainability performance is directly linked not only to creating new value but also to preserving existing values, rehabilitating degraded areas, and preventing potential negative impacts. The findings highlight the importance of both conservation and restoration activities and proactive mitigation interventions in this context. The codes used under each subtheme are also represented in the Figure 4.17

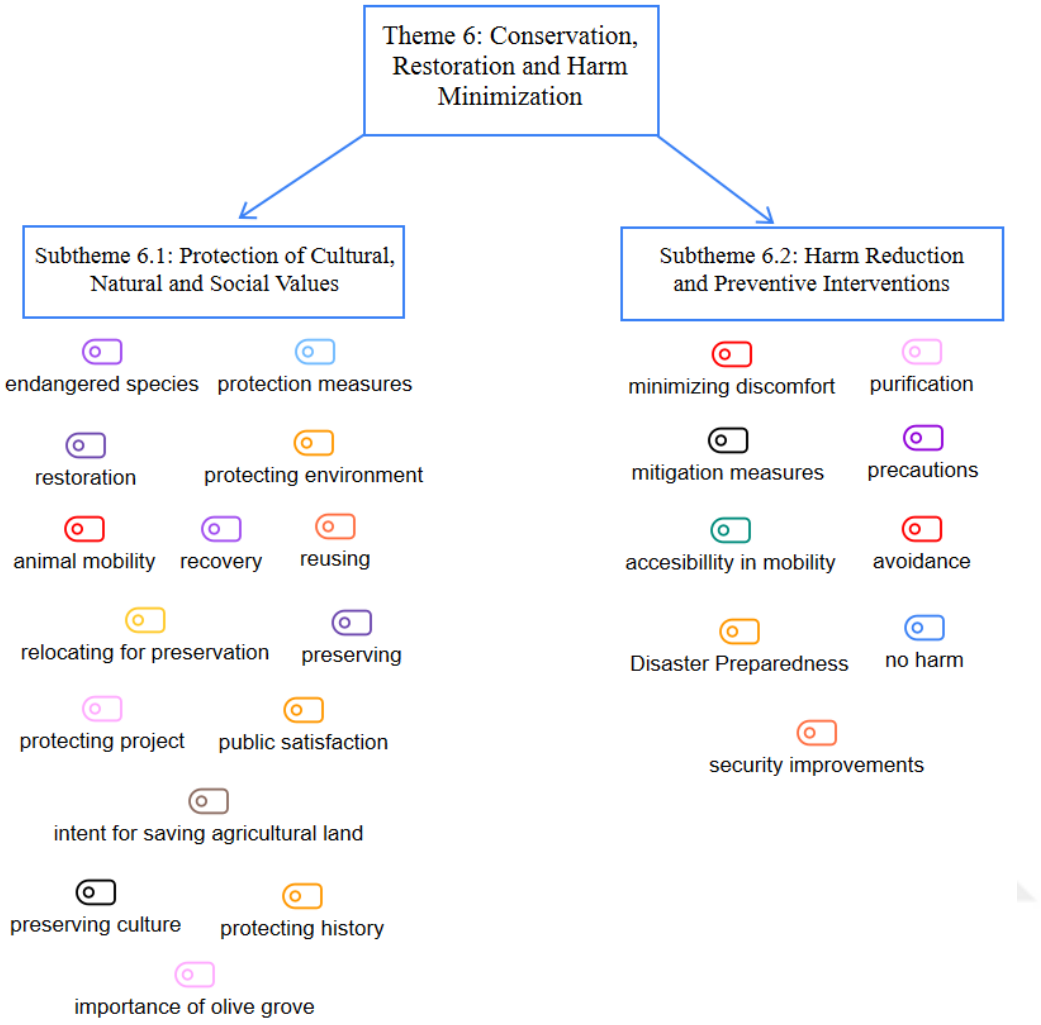


Figure 4.17 Theme 6's subthemes and codes

- Subtheme 6.1: Protection of Cultural, Natural and Social Values

The highest frequency in the code analysis belongs to the code "protecting environment" (24). This finding indicates that participants view environmental protection measures in projects as a fundamental element of sustainability performance. During the interview M4 stated the following on this topic:

"Water drained from drainage projects is taken to other facilities by other disciplines. None of it is released into the environment. All wastewater is first collected from detention tanks, then transferred to other treatment facilities, and then cleaned and transferred to the lake in a way that doesn't harm the environment. In

this project, for example, the water is neither hazardous nor harmful to the surrounding area."

The codes "protection measures" (18) and "relocating for preservation" (17) refer to technical and administrative measures taken for conservation purposes. Among these, relocations to prevent damage to historical artifacts, natural areas, or ecological assets stand out. E3 made the following statement regarding this process:

"We began a search for location to determine where we could transport these olive trees along the route. We found a mental health hospital and decided to plant some in its garden. A couple of sites were found to contribute to the women's community. This would allow the local community to grow these olives, sell their products, and generate economic value. We had the contractor carry out the necessary work."

The codes "preserving" (15) and "recovery" (13) reflect practices aimed at restoring degraded areas and preserving existing values. Similarly, the code "intent for saving agricultural land" (12) highlights the importance of protecting agricultural lands and the sustainability of agricultural production.

The codes "protecting project" (10) and "protecting history" (9) reflect an integrated perspective that emphasizes both the long-term sustainability of the project and the preservation of historical assets. Similarly, the codes "animal mobility" (9), "endangered species" (8), "restoration" (8), and "reusing" (8) indicate the consideration of ecological integrity and resource efficiency through actions aimed at conserving biodiversity, maintaining natural habitats, and encouraging material recovery. In addition, the less frequent codes, such as "public satisfaction" (5), "importance of olive grove" (3), and "preserving culture" (2), demonstrate the projects' sensitivity toward cultural continuity and community well-being, highlighting their potential to contribute to the social dimension of sustainability.

Overall, this subtheme addresses the protection of environmental, cultural, and historical values in projects, as well as the sustainability of agricultural lands and biodiversity. Participants prioritized environmental protection and the safeguarding

of agricultural lands and wildlife, emphasizing the significant contributions of restoration, reuse, and community satisfaction to sustainability.

- Subtheme 6.2: Harm Reduction and Preventive Interventions

In the code analysis, "avoidance" (20) and "precautions" (20) stood out as the codes with the highest frequency. These expressions reflect planning and implementation approaches aimed at preventing negative impacts before they occur. E2 expressed this approach as follows:

"At the beginning of the project, if you have a natural place, a natural habitat, you have to avoid it. So, the first principle is you have to avoid it, you have to leave it alone, or if there's an archaeological site related to cultural heritage there, you have to try not to touch it."

This code "disaster preparedness" refers to the preventative and preparedness measures taken in project design against rare but high-impact natural disasters. Participants emphasized the criticality of early planning and structural strengthening efforts against low-probability but potentially devastating disasters. Accordingly, M4 highlighted this aspect in her statement given in Figure 4.18.

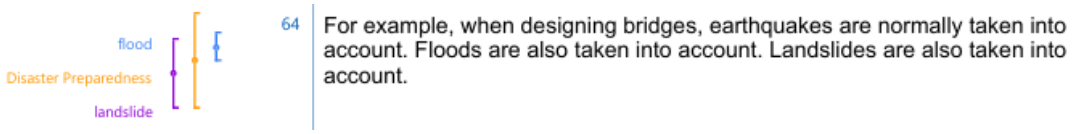


Figure 4.18 M4's statement from the interview

The code "minimizing discomfort" (10) aims to reduce the discomfort caused to the community by project activities. The code "accessibility in mobility" (9) refers to measures aimed at facilitating transportation and increasing mobility, while the code "security improvements" (7) points to strengthening the security infrastructure. "No harm" (5) indicates the goal of conducting activities without causing any harm to the environment or society. The lower-frequency codes "mitigation measures" (4) and "purification" (3) represent environmental cleanup and pollution reduction interventions.

The findings of Theme 6 indicate that projects should focus not only on creating new value but also on preserving existing values, preventing damage, and remediating degraded areas. Participants emphasized that both environmental and social impacts can be minimized through proactive measures and early planning.

Theme 7: Negative Effects and Types of Harm

This theme encompasses physical, environmental, socioeconomic, and societal negative impacts that may arise during or after project implementation. Participant testimonies indicate that these impacts can negatively impact project sustainability performance in both the short term (e.g., physical damage during construction) and the long term (e.g., loss of future benefits or social dissatisfaction). The findings suggest that these impacts must be managed not only through technical measures but also through effective communication, transparency, and social support mechanisms. The codes used under each subtheme are also represented in Figure 4.19.

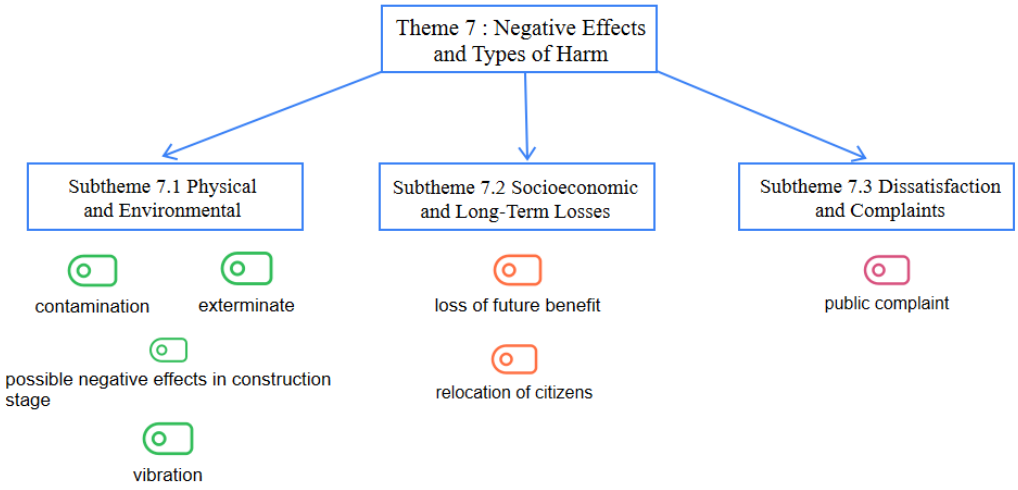


Figure 4.19 Theme 7's subthemes and codes

- Subtheme 7.1: Physical and Environmental Damages

The highest frequency in the code analysis is "possible negative effects in the construction phase" (21), which refers to environmental, physical damage, and social impacts to the community that may occur during the construction phase. Participants

stated that these effects generally manifest as dust, noise, and vibration. Moreover, some negative effects on the community would result in negative social impacts due to the settlement of construction workers. S4 expressed this as follows:

"We conducted a study on the impact of rent increases in the area, the change in the cultural structure of the area, and the impact on health services, school services or infrastructure services in the area, as the personnel who will work on the project will come to the area."

The lower frequency codes "vibration" (4), "exterminate" (2), and "contamination" (1) reflect the potential damage from structural vibrations, species extinction, and environmental pollution, respectively.

- Subtheme 7.2: Socioeconomic and Long-Term Losses

This subtheme encompasses the potential long-term socioeconomic losses from projects. The code "relocation of citizens" (8) refers to the relocation of residential areas due to the project and its impact on social ties and living standards. S5 statement about this topic is given in the Figure 4.20.

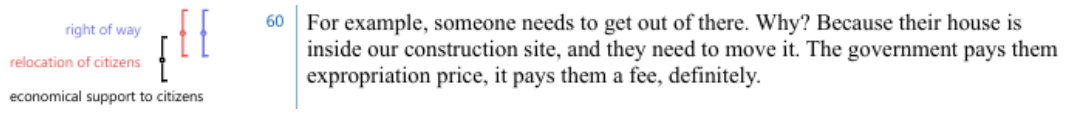


Figure 4.20 S5's statement from the interview

The code "Loss of future benefit" (4) represents the loss of future economic, ecological, or social opportunities that could have been achieved as a result of project implementation.

- Subtheme 7.3: Dissatisfaction and Complaints

This subtheme encompasses public dissatisfaction and complaints about the project. The "Public complaint" code (8) typically arises from reasons such as environmental impacts, noise, access difficulties, or failure to meet expectations. Participants stated that complaints negatively impacted public perception of the project and revealed

the inadequacy of communication processes. S3 made the following statement on this matter:

"When local residents, especially village leaders, are disturbed by noise, dust, or other negative effects caused by various projects, they complain to the contractor."

Theme 8: Design and Implementation Sensitive to Environmental and Social Impacts

This theme encompasses the design and implementation solutions developed to minimize environmental and social impacts of projects, as well as the interaction established with the community during this process. Participant testimonies demonstrate that sustainable projects require not only technical but also socially sensitive planning. The findings demonstrate that protecting natural areas, ensuring the continuity of ecosystems, and establishing effective communication with the local community are critical to project success. The codes used under each subtheme are also represented in the Figure 4.21.

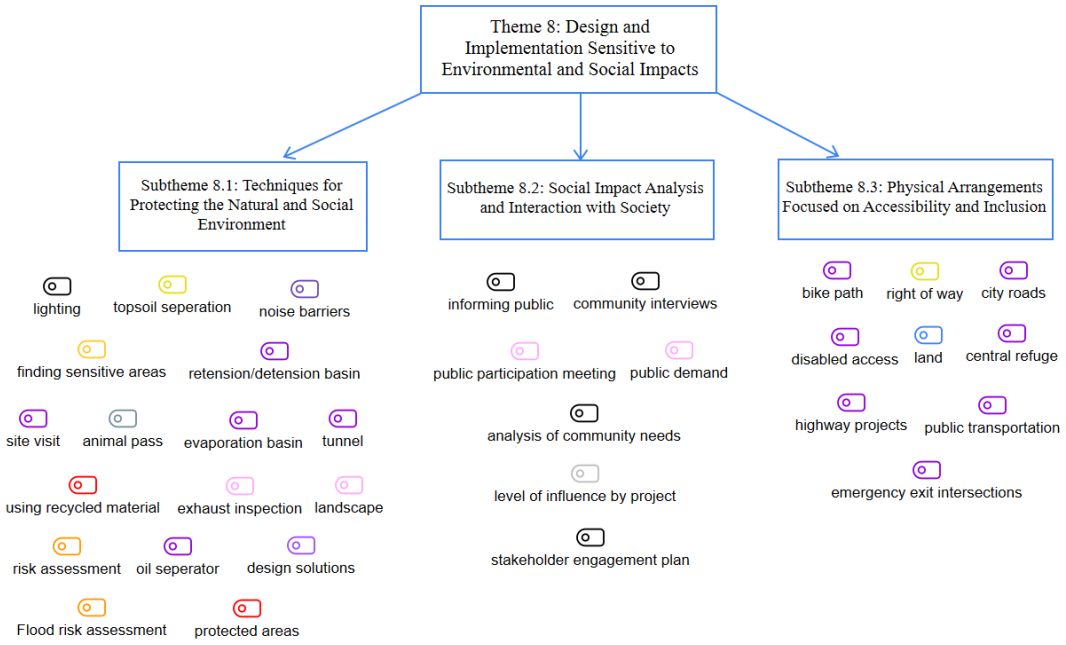


Figure 4.21 Theme 8's subthemes and codes

- Subtheme 8.1: Techniques for Protecting the Natural and Social Environment

The highest-frequency phrase in the code analysis was "design solutions" (32), which encompasses environmentally friendly design strategies developed specifically for the project. Participants emphasized that these solutions were often developed to adapt to the project's local conditions and sensitive areas.

The code "animal pass" (18) represents passages constructed to protect wildlife migration. The codes "tunnel" (10) and "noise barriers" (10) stand out as structural solutions aimed at reducing both environmental and social impacts. The codes "retention/detention basin" (9), "oil separator" (8), and "flood risk assessment" (6) cover technical measures focused on water and pollution management.

Although lower in frequency, the codes “topsoil separation” (4), “finding sensitive areas” (4) and “landscape” (3) reflect the work done to protect natural areas and soil quality.

- Subtheme 8.2: Social Impact Analysis and Interaction with Society

This sub-theme covers the assessment of the social impacts of projects and the processes of interaction established with the community. The highest frequency was observed in the code “public participation meeting” (21), which refers to meetings organized to gather public opinion and introduce the project. Participants stated that these meetings played an important role in increasing social acceptance. Indeed, A1 pointed out this processes by staating:

“In EIA processes, public information meetings are held to gather the wishes and demands of the public.”

The codes “analysis of community needs” (13) and “public demand” (12) reflect the shaping of projects according to social needs and expectations. The code “informing the public” (9) refers to the regular provision of information to the public about the project process.

The less frequent codes “community interviews” (8) and “stakeholder engagement plan” (5) represent more planned and targeted participation mechanisms, while the code “level of influence by project” (3) indicates the analysis of the project’s impact on different segments of society.

Theme 9: Data-Driven Decision Making and Analytical Evaluation

This theme highlights the importance of data-driven approaches in project decision-making and alternative evaluation. Participant testimonials demonstrate that systematic data collection, analysis, and benchmarking processes play a critical role in the success of sustainability implementations. Findings suggest that decisions are made more rationally, transparently, and with long-term benefits when based not only on experience and intuition but also on measurable data. The codes used under each subtheme are also represented in the Figure 4.22.

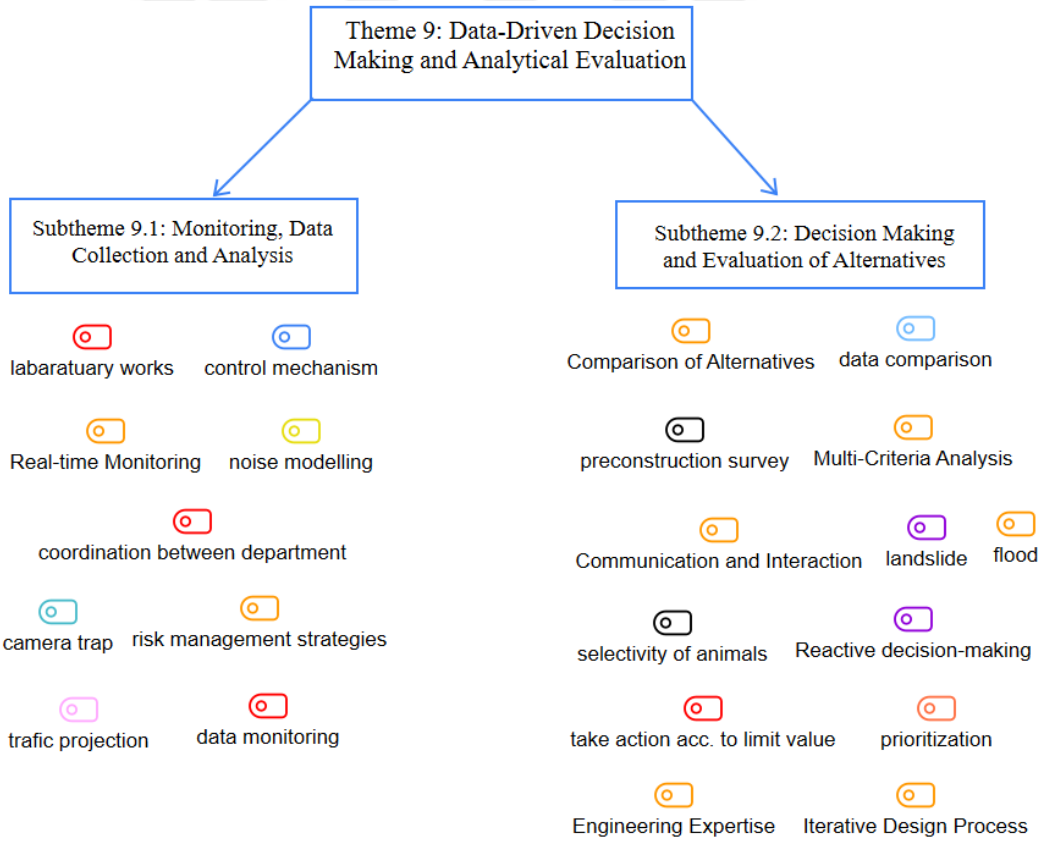


Figure 4.22 Theme 9’s subthemes and codes

- Subtheme 9.1: Monitoring, Data Collection and Analysis

The highest frequency in the code analysis was "control mechanism" (18). This finding demonstrates that data is regularly collected and evaluated in projects, and that control mechanisms are critical for monitoring sustainability performance. Participants noted the importance of continuous monitoring, particularly in areas such as quality control, environmental impact monitoring, and construction site inspections. E4 made the following statement on this topic:

"I was an environmental engineer in a project. The project remained within the Mediterranean seal habitat. It's been operational for about 15 or 16 years. For 16 years, approximately 20 academics and others have been studying the seals with cameras and protective measures. They breed, have pups, and hang out there, getting used to the harbor."

Lower-frequency codes indicate specific applications. For example, "noise modeling" (6) refers to measuring environmental impacts through simulations; "real-time monitoring" (3) refers to integrating real-time data into the project process; "camera trap" (2) refers to wildlife monitoring; "laboratory works" (2) and "risk management strategies" (2) refer to environmental quality measurements and risk mitigation plans. "Traffic projection" (1) represents analyses aimed at estimating transportation impacts. Overall, this subtheme demonstrates that data collection, analysis, and interpretation play a central role in the decision-making processes of sustainable projects.

- Subtheme 9.2: Decision Making and Evaluation of Alternatives

This subtheme focuses on data-driven decision-making and the evaluation of alternatives. The highest frequency in the code analysis belongs to the code "prioritization" (53). Participants stated that prioritizing project options is essential for the efficient use of limited resources. A1 made the following statement given in the Figure 4.23 on this topic:

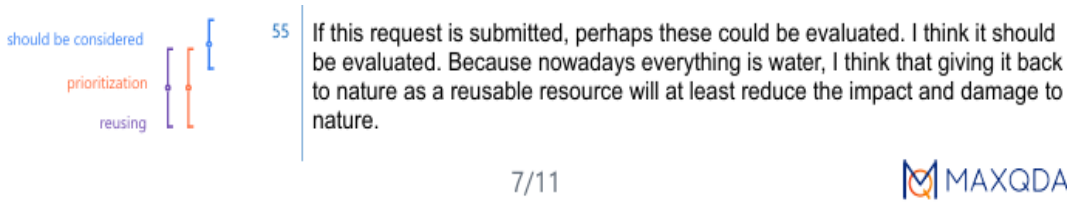


Figure 4.23 A1's statement from the interview

The codes "engineering expertise" (14) and "take action according to limit value" (12) demonstrate the decisive role of technical expertise and established thresholds in decision-making processes. The codes "data comparison" (11), "comparison of alternatives" (8), and "multi-criteria analysis" (2) represent the systematic comparison of different scenarios.

The codes "iterative design process" (10) and "communication and interaction" (8) reflect that decision-making processes are not one-time processes, but rather a cycle evolving through continuous feedback and interaction. Lower-frequency codes such as "landslide" (7), "flood" (3), "selectivity of animals" (2), "preconstruction survey" (2), and "reactive decision-making" (1) indicate the need for immediate decision-making due to environmental risks or site conditions. Overall, this subtheme demonstrates that data-supported decision-making processes both increase technical accuracy and enhance the transparency of decisions in sustainable projects.

Theme 10: Implementation Barriers and Enabling Conditions

This theme comprehensively outlines the obstacles encountered in the process of integrating sustainability principles into infrastructure projects and the conditions necessary for implementing these practices. Participant statements show that incorporating sustainability goals into project processes is not merely a technical choice, but a multidimensional process directly related to institutional capacity, behavioral attitudes, financial resources, and the regulatory framework. The findings reveal that the challenges encountered in the planning and implementation stages of sustainability are not limited to factors such as information gaps, managerial resistance, operational uncertainties, and resource constraints; they also depend on

enabling conditions such as organizational legitimacy, early integration, and awareness levels. The codes used under each subtheme are also represented in the Figure 4.24.

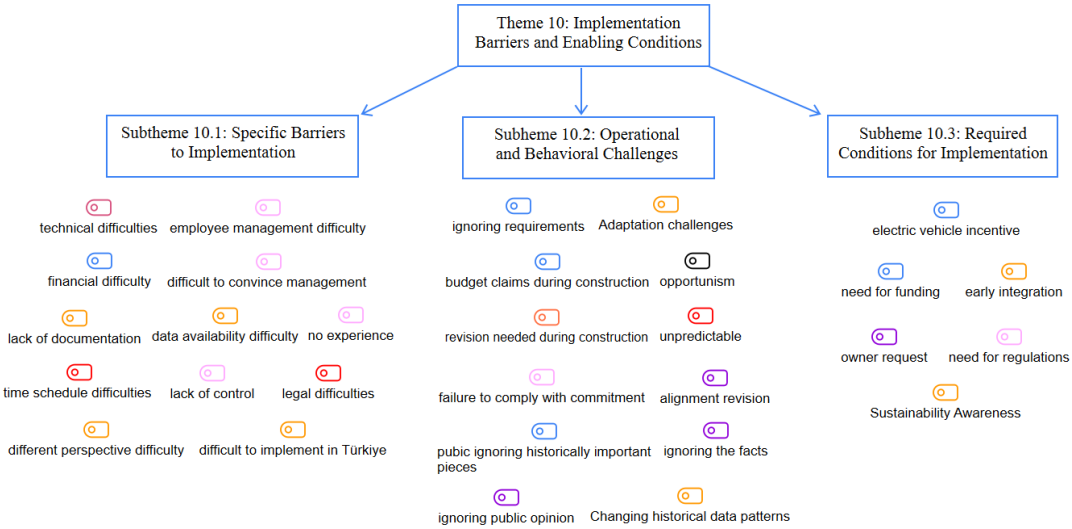


Figure 4.24 Theme 10's subthemes and codes

- Subtheme 10.1 Specific Barriers to Implementation

Participants' statements reveal that the challenges encountered in integrating sustainability practices into projects are multidimensional. Code frequencies indicate that lack of experience (86) is the most common obstacle. This situation shows that the level of knowledge and awareness regarding sustainable infrastructure design is insufficient both within organizations and across the sector, thereby making it difficult to systematically implement practices.

Significant barriers that follow include financial difficulties (55) and technical difficulties (24). Participants stated that sustainable solutions create extra work items and therefore increase the need for labor. Similarly, a lack of technical knowledge or technological inadequacy regarding what sustainable solutions are also limits the applicability of sustainable practices in the design and construction phases.

Time constraints (17) cause sustainability measures to take a backseat, as projects are often carried out with tight delivery schedules. On the other hand, lack of documentation (9), as emphasized by participants, relates to the failure to adequately record or report on activities rather than the failure to implement them. This situation makes it difficult to monitor sustainability indicators and hinders systematic learning and the formation of institutional memory in projects.

On the other hand, legal challenges (7) and implementation difficulties in Türkiye (7) indicate that current legislation does not fully support sustainability criteria and that there are uncertainties in bringing some practices into line with national regulations. Institutional barriers such as difficulty in persuading management (4), lack of control (4), and disagreements between different perspectives (4) reveal that differences in priorities among decision-makers make it difficult to develop a common approach to sustainability goals.

- Subtheme 10.2: Operational and Behavioral Challenges

This sub-theme reveals how operational disruptions and behavioral tendencies arising during the implementation of sustainability practices affect project performance. Code frequencies indicate that revisions, compliance, and behavioral oversights are particularly challenging areas during the implementation process.

The codes with the highest frequencies, alignment revision (23) and revision needed during construction (10), reflect the need for frequent changes to design decisions during the project implementation process. Participants indicated that this situation usually arises as a result of new requests or change requests being raised later on. Such revisions stem from insufficient planning at the start of the project or the failure to integrate sustainability requirements into the design process at an early stage. Consequently, the emergence of additional regulation and approval processes during implementation creates inefficiencies in time and cost management, while also weakening project continuity. This finding highlights the importance of comprehensive pre-planning, stakeholder communication, and decision-making processes for the effective implementation of sustainability goals.

From a behavioral perspective, the codes opportunism (5), ignoring the facts (2), ignoring requirements (3), ignoring public opinion (3), and failure to comply with commitment (3) show that some stakeholders prioritize short-term gains or ease of implementation over sustainability principles. Participants emphasized that failure to fulfill commitments, disregard for requirements, and failure to consider public opinion weaken trust and accountability in projects. These findings show that sustainability goes beyond being a technical issue and is directly related to ethical responsibility, governance culture, and stakeholder communication.

Furthermore, the code "public ignoring historically important pieces (1)" reveals that sensitivity towards preserving cultural heritage is lacking in some projects and that historical values are not sufficiently considered in the context of sustainability.

- Subtheme 10.3 Required Conditions for Implementation

This sub-theme highlights the prerequisites and supporting factors necessary for effectively integrating sustainability practices into projects. Findings indicate that the feasibility of sustainability depends not only on technical competence but also on multifaceted factors such as financial resources, managerial demand, regulatory infrastructure, and awareness levels.

The code with the highest frequency, need for funding (17), indicates that securing sufficient financial resources is one of the fundamental requirements for implementing sustainable practices. Participants emphasized that sustainable solutions often entail additional costs, and that the absence of these costs in project budgets poses a significant obstacle to implementation. Similarly, the "owner request" (14) code shows that the employer's guiding attitude towards sustainability is decisive in projects. Participants stated that when employers explicitly demand sustainability goals, project teams act accordingly; otherwise, sustainability issues are often relegated to the background.

The "need for regulations" code (14), which has the same frequency level, reflects the need for stronger legal and institutional regulations for sustainability practices to

become permanent. Participants stated that sustainability criteria in Türkiye have not yet reached the level of mandatory standards, and therefore practices largely depend on individual or institutional initiatives. This finding highlights the need for national-level legislation and policy support for the institutionalization of sustainability.

The code “sustainability awareness” (4) indicates that increasing the level of knowledge and awareness among individuals, institutions, and decision-makers is necessary for the implementation of sustainability. Participants emphasized that sustainability should be internalized as a value-based approach rather than a technical requirement. The early integration (4) code supports this finding, pointing to the importance of considering sustainability principles in the early stages of the project life cycle—particularly in the feasibility and design processes.

Finally, the electric vehicle incentive (3) code demonstrates the necessity of public policies that encourage the implementation of environmentally beneficial technologies. This highlights that sustainability must be supported not only at the project level but also at the national level through strategic policy tools.

Overall, this sub-theme shows that conditions such as the provision of financial resources, employer guidance, the creation of legal regulations, raising awareness, and ensuring early integration are key determinants for the implementation of sustainability practices. The findings reveal that sustainability requires not only technical implementation but also a political, institutional, and cultural transformation process.

Summary of Themes

The contents of the themes for which detailed thematic analysis has been made above are summarized below.

- Theme 1 Project Context and Applicability Conditions: It has been understood that the sustainability practices currently implemented are 1.5 times more than those not implemented, and the most important factors in the implementation of these practices are funding type and project location.
- Theme 2 Priority and Criticism Assessment: This theme is a result of the framework followed in the interview for the quantitative analysis. Results indicate that most of the sustainability practice are found to be critically important by the expers while for the most questions the answer to the difficulty level is the medium difficulty.
- Theme 3 Legal and Institutional Framework: Legal obligations are meticulously met in projects, but sustainability practices not included in the legal framework are often overlooked. This highlights the need for strengthening legislation and new legal regulations to advance sustainability.
- Theme 4 Stakeholder Engagement and Communication: Continuous communication with institutions is essential in decision-making processes, and stakeholder interaction plays a significant role, particularly at the institutional level. Furthermore, the views of institutions appear to directly influence project direction.
- Theme 5 Management of Social Impacts and Social Support: Projects make significant contributions to society in economic, social, and security terms, with support and recovery activities for the affected population being prioritized. Furthermore, efforts are being made to strengthen social benefits through education, awareness, and community engagement activities.
- Theme 6 Conservation, Restoration and Harm Minimization: This theme demonstrates the significant role of performance indicators (KPIs) for protecting environmental and cultural values in projects. The harm

minimization approach, on the other hand, is based on the goal of protecting the environment, society, and the project from negative impacts; preventive measures and environmental protection practices are key priorities.

- Theme 7 Negative Effects and Types of Harm: Projects experience significant physical and environmental impacts, particularly during the construction phase, leading to social consequences such as displacement of residents, loss of future benefits, and public complaints. Reducing negative impacts is a critical requirement for improving project sustainability performance.
- Theme 8 Design and Implementation Sensitive to Environmental and Social Impacts: This theme demonstrates the focus on minimizing environmental and social impacts. Various engineering solutions, environmental protection measures, and community engagement mechanisms are implemented throughout the design and implementation processes to mitigate negative impacts. Design solutions, public participation meetings, and accessibility measures, in particular, contribute to the implementation of projects with a sustainable, inclusive, and impact-minimizing approach.
- Theme 9 Data-Driven Decision Making and Analytical Evaluation: This theme demonstrates the adoption of a systematic and data-driven decision-making process in projects. Decisions are shaped by measurable data and technical analysis, resulting in more consistent, rational, and sustainable outcomes across the planning and implementation phases of projects.
- Theme 10 Implementation Barriers and Enabling Conditions: The main obstacles encountered in implementing sustainability practices are lack of experience, financial and technical constraints, and organizational resistance; conversely, financial support, employer guidance, legal regulation, and increased awareness are the main factors that facilitate the process.

These themes represent complementary stages of the sustainability process. After determining the context, priorities, and legal and institutional frameworks of projects, stakeholders are contacted, and social impacts and societal benefits are assessed. Potential negative impacts are then identified, and strategies are developed to protect environmental and cultural values. The process is supported by data-based analysis, and the results are translated into environmentally and socially sensitive design solutions. Thus, the themes create a holistic sustainability flow that connects the decision-making, mitigation, and implementation phases. Summary of theme relations and more detailed evaluation are presented in Figure 4.25.



Figure 4.25 Themes' relations

Concrete examples from the interview demonstrate how the sustainability decision-making process in projects operates in a holistic flow across themes. As one example, E7 stated:

"First of all, during project design, we use a noise modeling system as part of our ESIA.. Based on this noise modeling, we conduct modeling at sensitive points and determine whether noise levels are at acceptable levels. Then, if we anticipate high noise levels during construction or operation, we can implement measures such as installing noise barriers or installing sound-absorbing products such as cushions."

This statement primarily demonstrates that the project meets the legal requirements of the EIA. Noise modeling aims to ensure compliance with the environmental performance limits stipulated by legislation. This process is also a typical example of a data-driven decision-making approach. Thanks to the noise modeling system, measurable data is obtained at specific points, which are analyzed to assess whether noise levels exceed the limits specified in the legislation. This allows decisions to be based not solely on prediction or observation, but on quantitative data and technical assessments. Finally, appropriate solutions are determined based on the analysis results. Preventive measures, such as noise barriers or sound-absorbing materials, are planned based on modeling results, demonstrating that engineering solutions are deliberately developed to minimize impacts. Therefore, this sentence represents a concrete example of the sustainability decision flow in environmental management, where legal compliance, analytical assessment, and implementation decisions proceed in an interconnected manner. As another example illustrating the connection between the themes, E7 stated:

"Regulations regarding wetlands in Türkiye are already very strict. Both the buffer zones of water and sewerage administrations, wetland zones, and the buffer wetland zones of the State Hydraulic Works are protected by the institution... But this never occurs in the first protection zone. If I recall correctly, the first protection zone is the area within the first 100 meters of the wetland. No work can be done within that 100

meters... This is subject to certain conditions. Once those conditions are met, work can be carried out with certain precautions."

This statement indicates that wetlands are protected areas under relevant regulations, and certain distance restrictions and permit requirements apply to any activity in these areas. This statement also demonstrates that effective communication with stakeholders is maintained in the projects. The aforementioned State Hydraulic Works (DSI) and the Water and Sewerage Administration are the competent authorities in these areas. The project team communicates with these institutions to share both their needs in the field and their conservation requirements, thus enabling decisions to be made through a mutual exchange of information. Finally, the statement clearly reflects the management of permitting processes. It states that official permissions must be obtained from the relevant authorities for work to be carried out in areas close to wetland boundaries, and that these permissions are granted only if certain conditions are met. This demonstrates that project activities are carried out through institutional approval mechanisms, and that the planning process simultaneously complies with the legal framework, institutional views, and environmental measures.

Another example of this approach is seen in the context of protecting natural habitat and developing ecologically sensitive design. E7's response to a question exemplifies this:

"We're considering animal crossings. First, we determine the exact locations where we divide the habitat... Those camera traps are there. Which animals use them? So we can size them accordingly. There's no need to build massive overpasses for the areas where squirrels and rabbits use them. A study is conducted and then determined accordingly."

This demonstrates how data obtained directly from the field informs design decisions. This example demonstrates that after impact assessment (Theme 7), environmental protection and design decisions (Themes 6–8) proceed in a complementary cycle.

When these statements are evaluated holistically, it becomes clear that sustainability decisions progress along sequential themes.

4.2.3.3 Relationships Between Sub-Themes

This section examines the internal dynamics of the subthemes and their interrelations. This strategy prevents qualitative data from only being categorized, illustrating how various subthemes might converge to reveal broader implications for sustainability. Evaluating the connections among subthemes improves the systematic clarity of the interconnections between various aspects of project sustainability.

Analyzing the interconnections among subthemes reveals similarities in topics, divergent perspectives on situations, and components that, when considered collectively, yield more comprehensive solutions. The study was performed within the context of three essential sorts of relationships: similarity, contradiction, and cause and effect. The investigation of these interactions demonstrates that several subject areas are interdependent, hence illustrating the complex and dynamic essence of sustainability. The relationship between subthemes are presented in Figure 4.26

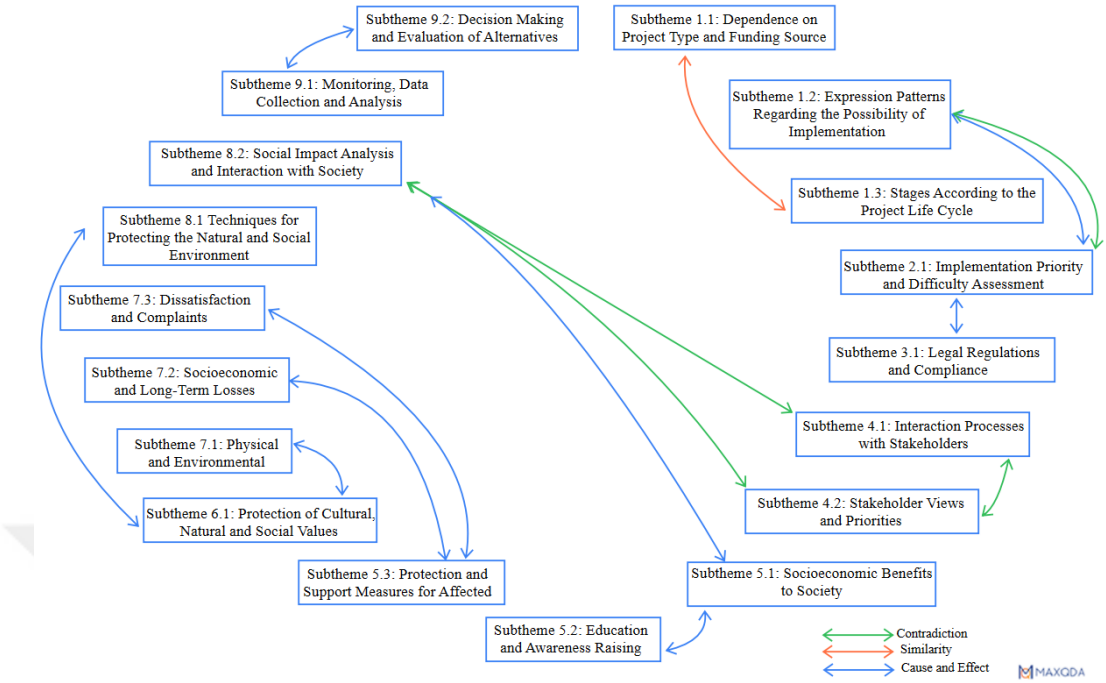


Figure 4.26 Relationships between subthemes

Similarities Between Sub-Themes

Despite being addressed under several categories, the subthemes have notable similarities in content. These parallels indicate that participants expressed the same phenomenon through varied terms and established a shared comprehension of some aspects of project sustainability. Implementation conditions, prioritizing, legal regulations, stakeholder expectations, societal benefits, environmental protection emerged as consistent themes throughout the many subthemes. This indicates that sustainability practices cannot be confined to distinct dimensions but should be assessed within a unified framework influenced by related trends. Subthemes with similarities are explained in this section.

- Influence of project type and funding on life cycle stage

According to the subtheme analysis, the implementation of sustainability in projects depends on various conditions. Project type and funding source (Subtheme 1.1) and the project lifecycle stages (Subtheme 1.3) emerged as critical determinants of sustainability performance. Participants' statements indicate that the availability and

type of funding source are crucial for meeting the required costs in sustainable projects. It was observed that sustainability practices can be more easily incorporated into the project when financing is secured, whereas sustainability is often overlooked in initiatives facing financial constraints.In the context of determining society needs participant S4 mentioned about the importance of funding as follows:

"This is easy to do theoretically, but in practice it is economically difficult because it is a budget issue, but I think it should definitely be included as a critical priority."

Similarly, project lifecycle stages appear to play a significant role in sustainability practices. It appears that decisions made during the feasibility and design phases are easier to implement during the construction phase, while decisions made later in the project require revisions and incur additional costs. Consequently, Subthemes 1.1 and 1.3 are important in determining the sustainability practices that can be implemented in the project.

Contradictions Between Subthemes

Analysis of the subthemes reveals significant contrasts among some sustainability practices. While many subthemes aim to achieve similar sustainability goals, they often create conflicts in their implementation. This section analyzes the contradictions between the subthemes and addresses the discrepancy between theoretical sustainability goals and practical constraints. Subthemes with contradictions are explained in this section.

- Divergence between expression of feasibility and actual implementation priorities

Analysis of subthemes reveals a notable discrepancy between assessments of implementation feasibility (Subtheme 1.2) and the importance and impact of implementation (Subtheme 2.1). Participants' statements indicate that many sustainability techniques are technically feasible, but not all are given equal priority, and some are overlooked.

This situation creates an obstacle to improving sustainability performance. Theoretically applicable techniques are sometimes held back by economic constraints, decision-making processes, and political preferences. Consequently, the discrepancy between priority and applicability poses a constraint on the comprehensive application of sustainability principles in the field.

- Disregard of community opinions in stakeholder process

An analysis of the subthemes indicates a notable contrast between stakeholder engagement methods (Subtheme 4.1), stakeholder viewpoints and priorities (Subtheme 4.2), and social effect evaluation and community involvement (Subtheme 8.2) and its execution. Participants observed that communication strategies are implemented at various levels within the community in these efforts. Social impact evaluations and stakeholder viewpoints seek to systematically reveal community anticipations and possible effects. Nonetheless, the outcomes of these processes frequently remain superficial within decision-making systems. The evaluation of many research and viewpoints about project priorities is frequently limited, with decisions driven by economic, technical, or political influences. Thus, a divergence occurs between "interaction" and "prioritization in decision-making processes". This mismatch illustrates that the concept of inclusive decision-making, a core component of the sustainability framework, is inadequately executed in practice. In summary, although community and stakeholder perspectives are acknowledged, they frequently do not influence decision-making. What S3 said during the interview provides an example of this situation:

"Local people are intensively involved in greenhouse farming. Their insistent request is, "Please don't victimize us here and don't go over our greenhouses." However, the project also has standards that must be met. To comply with these standards, the greenhouses were again overhauled. In other words, local people presented their situation, but due to the project's requirements, it was ignored."

Cause-and-Effect Relationships Between Subthemes

An examination of the subthemes demonstrates that sustainability practices operate not only as independent elements but also within a strong cause-and-effect relationship. Factors such as project type, funding sources, and legal regulations determine the conditions under which practices can be implemented, and these conditions directly influence implementation priorities, decisions, and societal outcomes. Furthermore, interactions with stakeholders shape their priorities; social support mechanisms help compensate for losses; and data collection and analysis processes constitute the fundamental drivers of decision-making. This demonstrates that the multidimensional nature of sustainability projects can only be fully grasped by considering the cause-and-effect relationships among the subthemes. This section systematically examines the cause-and-effect connections among the subthemes and discusses the dynamics affecting sustainability practices. Subthemes with cause and effect relation are explained in this section.

- Fundemental role of feasibility in prioritization

A review of the subthemes reveals a clear cause-and-effect link between assessments of the feasibility of an implementation (Subthemes 1.2) and the implementation's priority and impact (Subthemes 2.1). Participants' statements reveal that when deciding which priorities an implementation should receive, its likelihood of implementation is considered first. In other words, unless an implementation is deemed technically, financially, or institutionally feasible, it cannot be included among the priorities. The relation between implementation priority and feasibility is expressed in the interview by S3 as follows:

“I think the difficulty level is very high, and it would be too utopian. That's why we can say it's not a priority at all.”

This connection demonstrates that priorities in sustainability projects are built on the basis of "what is possible". Prioritized areas often comprise more feasible solutions,

leading to the exclusion of long-term and innovative, but more challenging, alternatives. Thus, assessing an implementation as feasible is not only a technical analysis but also a critical requirement that determines the direction of the prioritization process.

- Role of legal regulations in implementation and prioritization

Legal regulations and regulatory compliance (Subtheme 3.1) and implementation priority and impact (Subtheme 2.1) are directly related. Legal obligations ensure that certain practices are not only feasible but also prioritized in project processes.

Participant statements indicate that sustainability practices are often sidelined due to economic or technical considerations, but that issues explicitly mandated by legislation often transcend these boundaries and become priority areas of implementation. This demonstrates that legislation serves not only as a regulatory tool but also as a priority-setting tool.

Therefore, the impact of legal obligations largely shapes which practices are prioritized in projects and which areas receive more resources. In this context, legislation plays a direct role in prioritizing sustainability practices and guides implementation practices in the field. One example can be given from the interview with E3;

"Regulations regarding wetlands in Türkiye are already very strict. Both the buffer zones of water and sewerage administrations, wetland areas, and the buffer wetland areas of the State Hydraulic Works are protected by the institution. If we need to conduct any work on this issue, we apply to these administrations. These are already taken into consideration during planning. This is a critical priority, especially because it concerns drinking water."

This statement clearly reflects the cause-and-effect relationship between Subtheme 3.1 and Subtheme 2.1. The stringent legal regulations and inter-institutional

permitting processes regarding wetlands in Türkiye mandate the protection of these areas in projects, making this a priority implementation area in the planning process. In other words, legal restrictions on sensitive ecosystems related to drinking water resources require project teams to consider these areas early and prioritize protection measures.

- Raising public awareness for socioeconomic benefits

When examining the subthemes, a clear cause-and-effect link emerges between the socioeconomic benefits provided to society (Subtheme 5.1) and education and awareness-raising activities (Subtheme 5.2). Information campaigns, educational programs, and awareness-raising activities increase public awareness and participation in the project, helping to broaden the reach of the project's benefits.

Participants' views reveal that raising public awareness, particularly regarding environmental and social issues, increases the socioeconomic benefits of projects. Education and awareness-raising activities increase the likelihood of individuals directly benefiting from the project, facilitate local people's access to employment opportunities, and contribute to improving their standard of living in the long term. In this context participant S1 stated that:

"We are researching locations to create new pasture areas. We will create pasture areas by sowing seeds and planting crops, and we will also educate village shepherds and local people involved in animal husbandry through training programs. In this way, we will boost development."

Therefore, awareness and education activities not only serve as a complementary social element but also serve as a vital mechanism for enhancing the socioeconomic benefits of projects to society.

- Protection and support mechanisms facilitate reduction in public dissatisfaction

An examination of the subthemes reveals a reverse causal relationship between the protection and support systems established for project-affected individuals (Subtheme 5.3) and social unrest and complaints (Subtheme 7.3). Participants indicate that measures such as resettlement assistance, livelihood protection, temporary shelter, or basic needs provision mitigate the negative impacts of the projects, resulting in lower levels of complaints in society.

This demonstrates that social support systems not only reduce grievances but also help increase social acceptance. In other words, effectively implemented protection and support measures mitigate potential tensions and prevent negative attitudes toward projects. In this context participant S5 stated that:

"A complaint mechanism is being established so that people can find out who to contact and where these issues will be resolved, and they can voice their complaints through these channels. They see that these negative effects are being reduced, resolved, and completed. This reduces the negative perception of the project."

Therefore, protection and support mechanisms serve as important tools to reduce public dissatisfaction, limit the intensity of complaints, and enhance the social sustainability of projects.

Moreover, relationship between socioeconomic losses resulting from projects (Subtheme 7.2) and social protection and support mechanisms for the directly affected population (Subtheme 5.3). Participants stated that negative impacts such as income loss, employment problems, or a decline in living standards caused by projects trigger social support mechanisms.

In this context, practices such as resettlement support, temporary housing opportunities, job creation, or economic incentives emerge as responses to

compensate for the losses caused by projects. In other words, economic losses form the rationale for social support policies and directly determine their scope.

Therefore, this relationship between socioeconomic losses and social support mechanisms demonstrates that a sustainability approach should focus not only on preventing harm but also on compensating for the resulting negative consequences. This demonstrates that economic losses in projects are a key driver for the development of more socially inclusive policies.

- Conservation measures preventing and mitigating damage

A review of the subthemes reveals an inverse cause-and-effect relationship between measures taken to protect cultural, natural, and social values (Subtheme 6.1) and the physical and environmental damage caused by projects (Subtheme 7.1). Conservation strategies play an effective role in reducing the magnitude of damage by limiting the ecological damage, natural resource loss, and environmental degradation that may occur during the construction and operation of projects.

Participants' views support this position; buffer zones, restoration efforts, and environmental monitoring systems, particularly those established to protect sensitive ecosystems, are effective in reducing both the magnitude and impact of damage. This demonstrates that conservation measures in sustainability practices not only serve a preventative function but also a mitigating factor in the damage they cause.

Therefore, conservation efforts contribute to the more effective implementation of sustainability principles in practice by reducing the environmental damage that projects may directly cause.

- Techniques as drivers of cultural and environmental value protection

A review of the subthemes reveals a direct relationship between technical methods for protecting natural, cultural, and social values and the goal of their sustainable preservation. Technical methods enable the practical realization of conservation goals and make the protection of these values tangible.

In this context, approaches such as environmental monitoring systems, ecological restoration practices, green infrastructure solutions, and conservation-focused engineering regulations not only contribute to the abstract goal of preserving these values but also enhance the feasibility of this goal. Participant comments also indicate that the adoption of technical methods directly impacts the success of conservation efforts and plays a significant role in preventing damage. In other words, the values to be protected provide a normative framework, while technical methods serve as tools that facilitate the implementation of this framework in the field.

The code "topsoil separation," coded four times in the analysis and overlapped with the code "reuse" twice. One of the example is from the interview with A8 is given in Figure 4.27.

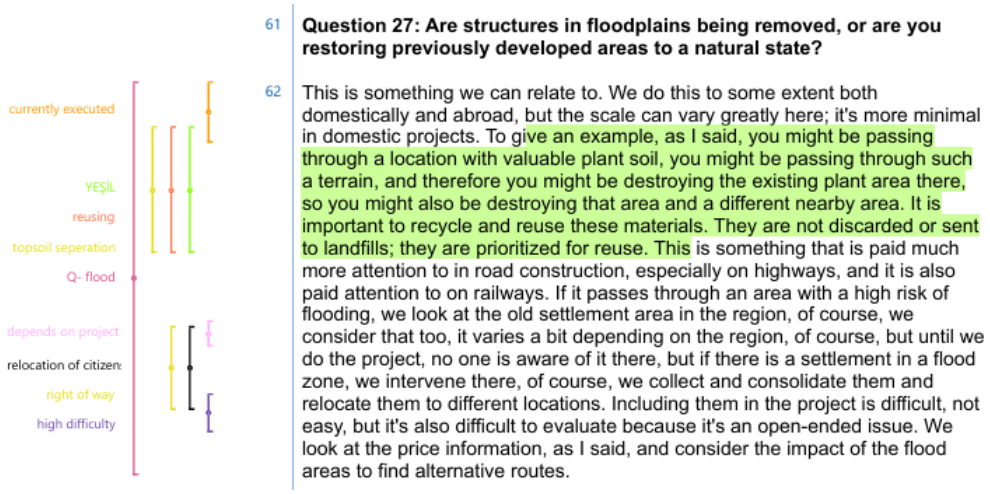


Figure 4.27 Sample sentence and coding from the interview

"Topsoil separation" is a technical conservation method evaluated under Subtheme 8.1 – Techniques for Protection. It reduces the degradation of natural areas by separating and reusing fertile topsoil during excavation. This practice is directly related to Subtheme 6.1 – Protection of Values, as the recovery and repurposing of soil contributes to both the regrowth of vegetation and the preservation of local ecological values. Therefore, technical measures such as soil separation and reuse reflect a cause-and-effect relationship that enables the sustainable protection of environmental values.

- Social impact as a catalyst for socioeconomic improvement

An examination of the subthemes reveals a clear cause-and-effect link between social impact assessments (Subtheme 8.2) and the socioeconomic benefits provided to society (Subtheme 5.1). Social impact assessments systematically identify the potential impacts of projects on society, helping to identify areas where risks can be mitigated and areas where they could benefit.

This ensures that projects are considered not only for their technical or environmental aspects, but also for their social and economic outcomes. As participants noted, social impact assessments allow for a foreseeable understanding of which segments of society will be affected and how, facilitating the development of practices that will benefit education, employment, income growth, or quality of life. One of the example is from the interview with S1:

"Survey studies are being conducted to analyze needs. Within this framework, citizens are provided with the necessary support based on this needs analysis. For example, if citizens are involved in animal husbandry, they are provided with support in the form of seeds or hay. If citizens have actually lost their homes, they are provided with replacement support related to their homes."

In conclusion, social impact assessments serve not only as an analysis tool but also as a strategic guide for maximizing socioeconomic benefits. This enables projects to provide more effective support to society in terms of sustainability.

- From data to decisions

An examination of the subthemes reveals a clear cause-and-effect relationship between monitoring, data collection, and analysis processes (Subtheme 9.1), as well as decision-making and the evaluation of alternatives (Subtheme 9.2). Data collection and analysis activities serve as crucial elements shaping decision-making processes and enable the evaluation of alternatives based on objective criteria.

As participants noted, a data-driven approach in sustainability-focused projects helps reduce uncertainties, predict risks, and enable more rational decision-making. In this regard, continuous monitoring and systematic data collection not only facilitate understanding the current situation but also enable the creation of future scenarios.

Therefore, data collection cannot be considered merely a technical step; it is also a strategic tool that forms the basis of decision-making processes and enables the comparative evaluation of alternatives.

4.2.3.4 SDG Analysis

Transportation projects, particularly in developing countries, are large-scale investments that generate significant economic and social impacts and play a key role in terms of the United Nations Sustainable Development Goals (SDGs). Such projects affect not only transportation efficiency but also sustainability dimensions such as environmental protection, social inclusion, and institutional capacity development. Therefore, examining the sustainability performance of transportation projects from the perspective of the SDGs is important for understanding the connection between these projects and broader development goals. The purpose of this section is to reveal which sustainable development goals the project can be

associated with through themes and codes obtained from interviews and to discuss the areas in which transportation projects contribute to sustainable development through these relationships.

In this section, the codes that were obtained from the interviews are connected to the United Nations Sustainable Development Goals (SDGs), and how these sustainability dimensions affect the project. The SDG mapping of codes was conducted to determine which sustainable development goal each code, emerging from the thematic analysis process, aligned with. This analysis showed which sustainability issues were most emphasized in the interview data, which goals were supported directly or indirectly, and which areas lacked clarity.

The following subsections will present the findings of the SDG analysis, based on the distribution and frequency of codes, and provide a detailed discussion of which goals Türkiye's highway projects have the strongest links to in terms of sustainability and which areas need improvement. In this assessment, all codes of Theme 1 and most of the codes of Theme 2 are excluded from the analysis since those codes don't reflect any of the SDG's. The table showing which code matches which SDG is given in the Appendix G.

SDG Based Findings

This section presents the SDG-based findings derived from the qualitative analysis, illustrating how the identified codes and themes align with the United Nations Sustainable Development Goals (SDGs). As a result of this matching, the number of codes that each SDG matches is given in the Figure 4.28.

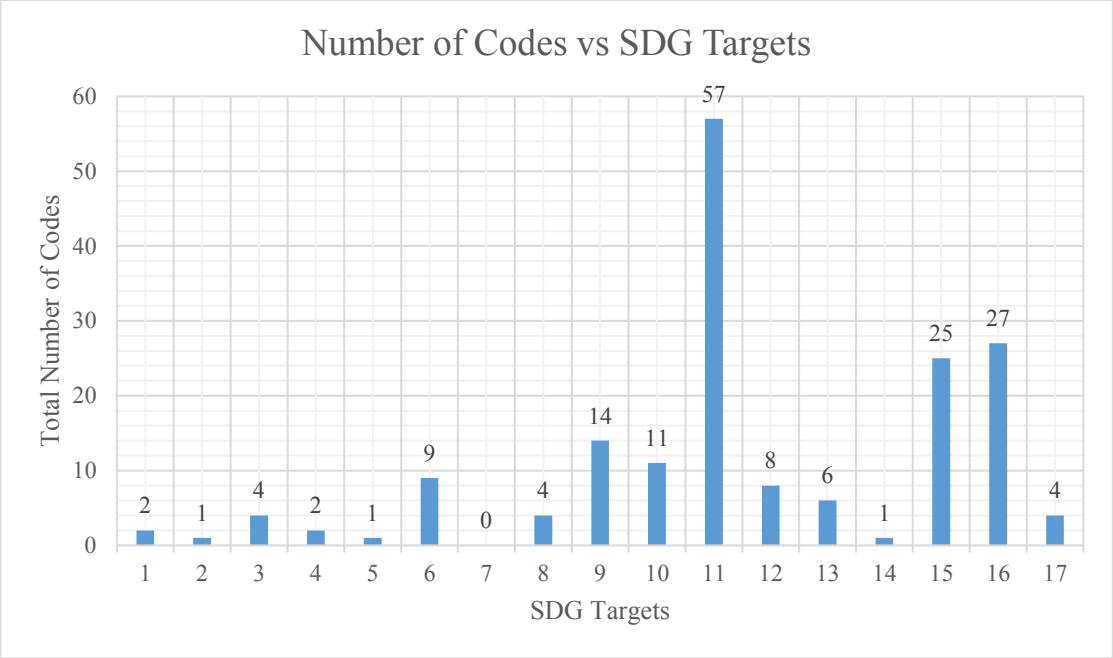


Figure 4.28 Number of codes corresponding to each SDG targets

This analysis investigates which of the SDG goals listed in Figure 2.1 the codes align with. The most emphasized SDG was SDG 11 with 57 codes, SDG 16 with 27 codes, and SDG 15 with 25 codes. This strong focus reveals that projects are directly linked to the dimensions of community quality of life, stakeholder engagement, and environmental protection. Findings indicate that transportation projects not only facilitate transportation but also have the capacity to enhance social well-being (SDG 11), shape governance processes (SDG 16), and create long-term impacts on the natural environment (SDG 15).

Within the scope of SDG 11, codes such as bike paths, public transportation, disabled access, central refuge, community feedback, and meeting public needs demonstrate the projects' contribution to inclusive transportation and participatory urban planning. Elements such as bike paths, disabled access, and community feedback, in particular, highlight the inclusiveness and accessibility aspects of projects. These findings reveal that transportation investments are considered not only as technical infrastructure but also as tools that enhance social well-being, support social integration, and improve the quality of urban life.

Within the scope of SDG 16, codes such as stakeholder communication, fairness, compliance with regulations, public complaint, and institutional view emphasize the importance of transparency, justice, accountability, and participatory decision-making mechanisms in projects. This demonstrates that transparent institutional processes are critical for social acceptance. Elements such as stakeholder communication, fairness, and public complaint, in particular, reveal the fundamental conditions for ensuring accountability and justice in projects.

Within the scope of SDG 15, codes such as animal pass, endangered species, intent for saving agricultural land, protecting environment, and restoration demonstrate that the protection of ecosystems, biodiversity, and natural resources are taken into account in projects. Considering environmental sensitivities plays a critical role in mitigating the long-term ecological impacts of projects. Practices such as animal pass, endangered species, and saving agricultural land, in particular, strengthen the environmental sustainability dimension of transportation projects.

SDG 9 (14 codes) is particularly relevant to engineering and technical expertise. Codes such as comparison of alternatives, engineering expertise, multi-criteria analysis, iterative design process, tunnel, and city roads demonstrate that technical capacity is decisive in decision-making processes and that engineering solutions in projects are considered in line with sustainability goals. This demonstrates the potential for infrastructure projects to develop technological capacity and integrate innovative design processes.

More limited matches show that SDG 1 (2 codes), SDG 2 (1 code), SDG 4 (2 codes), SDG 5 (1 code) and SDG 7 (0 codes) transportation projects fall short in terms of social inclusion and energy transition.

- SDG 1 is represented only by the codes "economic support to citizens" and "support for the affected population." This indicates that the projects make a limited contribution to poverty reduction.

- SDG 2, on the other hand, only aligned with the "importance of olive groves" code. While attention is drawn to the protection of agricultural lands, this contribution remains quite limited in terms of food security and sustainable agriculture, highlighting the need for more comprehensive approaches.
- SDG 4 emphasizes that worker and public education components in the project extend beyond short-term awareness activities. The training programs are designed to support continuous capacity building, professional development, and the transfer of technical and environmental knowledge, contributing to long-term institutional learning and community awareness within the sustainability framework.
- SDG 5 (women support) is represented only through a single code. This demonstrates that gender equality is not sufficiently prioritized in projects and is marginalized in project planning. However, because transportation projects directly impact both women's mobility needs and their employment roles, this deficiency is considered a significant social risk.
- The absence of any match with SDG 7 is striking. While energy efficiency, renewable energy use, and carbon emission reduction are among the fundamental sustainability criteria for infrastructure projects today, ignoring these issues demonstrates a critical shortcoming in transportation projects in the context of combating climate change. Furthermore, this is considered a significant risk factor that could create incompatibility with Türkiye's energy and climate policies (e.g., the Paris Agreement, the 2053 Net Zero target).

General Evaluation

The results show that the strengths of transportation projects (urban planning, stakeholder engagement, institutional structure, environmental protection) are concentrated in the institutional and technical sustainability dimensions, while they contain systematic gaps in the areas of social equity, gender, poverty, and energy.

This distribution indicates that projects' existing strengths should be preserved and expanded. In particular, implementations within the scope of SDGs 11, 15, 16, and 9 can be considered areas of success for sustainable transportation projects. However, the remaining weaknesses indicate that projects need to develop a more holistic sustainability approach.

For example, the lack of an energy dimension (SDG 7) is a risk factor that could conflict with Türkiye's national climate targets. Similarly, shortcomings in gender (SDG 5) and poverty alleviation (SDG 1) limit the social inclusiveness of projects. This suggests that future projects should include renewable energy solutions, more active participation of women in projects, diversification of education programs, and more systematic integration of social benefit mechanisms for the poor.

In conclusion, code-SDG mapping not only reveals the current situation but also allows for the identification of strengths and weaknesses in terms of sustainability, providing a strategic roadmap for future policies, planning, and implementation.

4.3 Overall Results Discussion

This section presents the integrated discussion of findings obtained through the mixed-method approach, combining the quantitative results of the Envision sustainability assessment with the qualitative insights derived from the thematic analysis of interviews. The purpose of this integration is to provide a comprehensive understanding of how sustainability principles are reflected in the selected highway project, both in measurable performance indicators and in the perceptions and practices of the project stakeholders. While the Envision evaluation reveals the project's level of achievement across key sustainability categories, the interview analysis offers a deeper explanation of the underlying factors shaping these outcomes—such as institutional context, stakeholder collaboration, and implementation challenges. Together, these results highlight the extent to which sustainability is operationalized in design and planning stages in Türkiye, illustrating both the strengths and the critical gaps between theoretical sustainability frameworks and practical project realities.

The subheadings under each Envision main category (Quality of Life, Leadership, Resource Allocation, Natural World, Climate and Resilience) were examined based on data obtained from both project documentation and interviews; points of convergence and divergence between the project assessment and stakeholder views were identified. Each credit was classified as "Include," "Plan and Include," or "Exclude," highlighting the gap between the project's current practices and its sustainability potential. This analysis demonstrates how technical practices relate to social, environmental, and economic sustainability components; it also contributes to identifying areas for improvement in future projects.

4.3.1 Quality of Life

The Quality of Life category, despite being the highest-scoring category within the project, still holds significant potential for improvement in terms of sustainability practices. The Envision assessment revealed relatively strong performance in key indicators such as social benefit, accessibility, and user safety. However, interview findings indicate that, despite this success, practices remain limited in areas such as stakeholder participation, community engagement, and monitoring long-term social contributions. Therefore, this category presents important opportunities to strengthen the social benefit-oriented aspect of current design and planning processes, address user needs in a more inclusive manner, and make social sustainability permanent. The Table 4.26 below shows the combined results of this study in the Envision category of Quality of Life.

Table 4.26 Combined results of Quality of Life category

QUALITY OF LIFE								
CODE	**CREDIT NAME**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
WELLBEING								
QL 1.1	Improve Community Quality of Life		⚡ Plan and Include	✓ Include	⚡ Plan and Include	✓ Include	✓ Include	⚡ Plan and Include
QL 1.2	Enhance Public Health & Safety					⚡ Plan and Include	⚡ Plan and Include	
QL 1.3	Improve Construction Safety	X	X	X	X	X	X	X
QL 1.4	Minimize Noise & Vibration				✓ Include	✓ Include		
QL 1.5	Minimize Light Pollution	X	X	X	X	X	X	X
QL 1.6	Minimize Construction Impacts	X	X	X	X	X	X	X
MOBILITY								
QL 2.1	Improve Community Mobility and Access							
QL 2.2	Encourage Sustainable Transportation	⚡ Plan and Include	⚡ Plan and Include					
QL 2.3	Improve Access & Wayfinding	✓ Include	✓ Include	✓ Include	✓ Include			
COMMUNITY								
QL 3.1	Advance Equity & Social Justice	✓ Include	✓ Include		⚡ Plan and Include	⚡ Plan and Include	✓ Include	⚡ Plan and Include
QL 3.2	Preserve Historic & Cultural Resources			✓ Include		⚡ Plan and Include	⚡ Plan and Include	
QL 3.3	Enhance Views & Local Character	X	X	X	X	X	X	X
QL 3.4	Enhance Public Space & Amenities			✓ Include	✓ Include			

LEGEND	
⊘ Exclude	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be excluded.
⚡ Plan and Include	Although it was scored zero in the project evaluation, it was deemed appropriate to plan and include it in the quantitative analysis of the interviews.
✓ Include	Although it was scored zero in the project evaluation, it was deemed appropriate to include it in the quantitative analysis of the interviews.
⊘ Exclude	Although it was scored plan and include in the project evaluation, it was deemed appropriate to exclude this item in the quantitative analysis of the interviews.
⚡ Plan and Include	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be planned and included.
✓ Include	Although it was scored plan and include in the project evaluation, it was deemed appropriate to include this item in the quantitative analysis of the interviews.
	It did not receive any points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did not receive full points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did receive full points in the project evaluation, thus it is not adressed during the interviews.

4.3.1.1 Wellbeing

In the Wellbeing subcategory, the focus is on enhancing the quality of social life by protecting the safety, health, and comfort of individuals in sustainable infrastructure projects.

According to the assessment matrix, QL 1.1 and QL 1.2 credits were rated as “Include” and “Plan and Include” in most groups. This indicates that applications related to community welfare and public health were partially considered in the project, and that work in this area is open to improvement. The QL 1.4 credit was rated as “Include.” This finding shows that measures to reduce noise and vibration are important and feasible in the project. Various codes emerged on this subject in the thematic analysis (noise modeling, noise barriers), and participant E3 mentioned the work on this subject as follows:

"First of all, during the design phase, we use a noise modeling system as part of our ESIA assessment. Based on this noise modeling, we model sensitive points and check whether noise levels are acceptable. Then, if we think these noise levels will be high during the construction or operation phase, we can implement measures such as installing noise barriers or sound-absorbing products like sound-absorbing pads."

When the interview analysis is combined with the results, the table shows that when seeking Envision certification for a highway project in Türkiye, full points can be obtained for the Q.L1.4 credit in the wellbeing subcategory, and full points can also be achieved for QL1.1 through planning.

Overall, the Wellbeing category reveals that the projects in Türkiye has a certain level of awareness in terms of social sustainability, but there are still shortcomings at the implementation level. This situation indicates that in future projects, issues such as public health, safety, and quality of life should be prioritized not only in the planning phase but also during the implementation process.

4.3.1.2 Mobility

This section aims to promote sustainable modes of transportation and increase social mobility and accessibility by addressing the project's impact on the surrounding transportation network.

Although the QL 2.2 credit received zero points in the project evaluation, it was determined as "Plan and Include" in the interview analysis. Regarding sustainable modes of transportation, participant A5 stated:

"In the last urban project I worked on, we also designed bicycle lanes. The integration of bicycle lanes into our road was also included in the project. So, where will the bicycle lane pass? What will be done when crossing the road here?"

Although it is seen that sustainable transportation modes such as bicycle lanes are currently included in projects, participant A7 stated that this integration also depends on the project location and scope:

"For example, some pedestrianization projects, like square pedestrianization projects, are being done in places like Taksim Ulus. But these works are in urban projects."

The QL 2.3 credit was rated as "Include" in all assessment groups. This finding reveals that access arrangements and guidance systems were considered within the scope of the project, ensuring that road users were guided in a safe and understandable manner.

When the interview analysis and results are combined, the table shows that when seeking Envision certification for a highway project in Türkiye, it is possible to achieve certain scores in the QL2.2 category of the mobility subcategory with planning, and to achieve full points in the QL2.3 category.

Overall, the Mobility category reveals that, although transportation and access issues have been addressed to a certain extent in the current projects, sustainable transportation modes need to be integrated in a more planned manner. This situation

shows that increasing the integration of pedestrians, cyclists, and public transportation in future highway projects is an important opportunity area in terms of both environmental and social sustainability.

4.3.1.3 Community

This section emphasizes that infrastructure projects must consider their overall impact on society, not only technically but also by preserving social cohesion, equality, and cultural structure.

According to the assessment matrix, the QL 3.1 credit has been assessed as “Include” and “Plan and Include.” This finding reveals that although the project does not directly apply the principles of social equality and justice, these issues are considered important from a sustainability perspective. All social experts emphasized that such practices are not included in Turkish legislation but are mandatory in international standards. This situation shows that the legal framework in Türkiye is not yet sufficiently developed in terms of its social dimension, but that these principles are taken into account in international projects. Therefore, the integration of social equality and justice principles into sustainable infrastructure assessments in local legislation stands out as a critical requirement for bringing practices in Türkiye into line with international best practices.

In addition, QL 3.2 credit has been assessed as “Include” and “Plan and Include.” Although the project site has a limited historical or cultural impact, it reveals that stakeholders view the preservation of cultural heritage as part of sustainable development. This approach demonstrates an awareness of preserving the local cultural fabric and strengthening cultural awareness in projects. In contrast, the QL 3.4 credit was rated as “Include” in all groups. This indicates a certain awareness of the accessibility of public spaces, user comfort, and the preservation of social interaction areas.

When the interview analysis is combined with the results, the table shows that in Türkiye, when seeking Envision certification for a highway project, a full score can be achieved by planning in accordance with the QL3.1 and QL3.2 criteria in the community subcategory. It appears that a full score can be achieved by directly including the topics in the QL3.4 credit in the project.

Overall, the Community category shows that the social dimensions of the projects in Türkiye are currently addressed to a limited extent, but stakeholder awareness is high. This indicates that social justice, cultural sustainability, and local identity elements need to be more strongly integrated into future projects.

4.3.2 Leadership

The Leadership category, despite being the second highest scoring heading within the project, achieved a generally low overall score. This indicates that leadership themes were partially considered in the projects, but sustainability goals were not systematically integrated into management processes. On the other hand, interview findings reveal that many leadership-focused practices that are not currently implemented are actually suitable for inclusion in the project structure. The Table 4.27 below shows the combined results of this study in the Envision category of Leadership.

Table 4.27 Combined results of Leadership category

LEADERSHIP								
CODE	CREDIT NAME	A	B	C	D	E	F	G
	COLLABORATION							
LD 1.1	Provide Effective Leadership and Commitment	✓ Include	✓ Include	✓ Include				
LD 1.2	Foster Collaboration and Teamwork	✓ Include	✓ Include	✓ Include	✓ Include			
LD 1.3	Provide for Stakeholder Involvement	⊘ Exclude	✓ Include	✓ Include	✓ Include			
LD 1.4	Pursue Byproduct Synergies							
	PLANNING							
LD 2.1	Establish a Sustainability Management Plan	✓ Include	✓ Include	✓ Include	✓ Include	✓ Include		
LD 2.2	Plan for Sustainable Communities							
LD 2.3	Plan for Long-Term Monitoring and Maintenance	X	X	X	X	X	X	X
LD 2.4	Plan for End-of-Life							
	ECONOMY							
LD 3.1	Stimulate Economic Prosperity & Development	✓ Include			⚡ Plan and Include	⚡ Plan and Include		
LD 3.2	Develop Local Skills and Capabilities	✓ Include	✓ Include					
LD 3.3	Conduct a Life-Cycle Economic Evaluation	✓ Include	✓ Include	✓ Include	✓ Include	✓ Include		

LEGEND	
⊘ Exclude	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be excluded.
⚡ Plan and Include	Although it was scored zero in the project evaluation, it was deemed appropriate to plan and include it in the quantitative analysis of the interviews.
✓ Include	Although it was scored zero in the project evaluation, it was deemed appropriate to include it in the quantitative analysis of the interviews.
⊘ Exclude	Although it was scored plan and include in the project evaluation, it was deemed appropriate to exclude this item in the quantitative analysis of the interviews.
⚡ Plan and Include	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be planned and included.
✓ Include	Although it was scored plan and include in the project evaluation, it was deemed appropriate to include this item in the quantitative analysis of the interviews.
	It did not receive any points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did not receive full points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did receive full points in the project evaluation, thus it is not adressed during the interviews.

4.3.2.1 Collaboration

This section emphasizes that different stakeholders must work together to achieve innovation, savings, and synergy in sustainable projects, and that a communication-based management approach with strong leadership must be adopted.

Although LD 1.1 and LD 1.2 credits do not appear to be applied in current projects according to the assessment matrix, both credits have been assessed as “Include” based on the analysis of the interviews conducted. This indicates that there is an

effective leadership structure and a strong culture of collaboration within the project team, particularly in terms of coordination between different disciplines. The LD 1.3 credit, on the other hand, was rated “Include” in most evaluation headings and “Exclude” in only one heading. These findings are consistent with the results of Theme 4: Stakeholder Engagement and Communication and Subtheme 9.2: Decision Making and Evaluation of Alternatives, which emerged from the thematic analysis. Indeed, these themes show that stakeholder participation and interdisciplinary communication in decision-making processes are decisive factors for project success, thus supporting the importance of leadership and collaboration-based practices.

When the interview analysis and results are combined, the table shows that when seeking Envision certification for a highway project in Türkiye, full points can be achieved by directly including criteria LD1.1 and LD1.2 in the collaboration subcategory. However, in the LD1.3 criterion, even if the other items are completed, points cannot be obtained from this criterion due to the Envision scoring system, as the first item results in “exclude.”

Overall, this category highlights that leadership and collaboration processes play a fundamental role in project success, but that stakeholder participation and external communication mechanisms need to be institutionalized from a sustainability perspective.

4.3.2.2 Planning

This section emphasizes that approaching the project with a long-term perspective will increase sustainability and make processes more efficient by anticipating future needs and potential impacts.

According to the evaluation matrix, LD 2.1 credit was rated as “Include” in all groups based on interviews with experts, despite receiving no points in the project analysis. This indicates that the project takes sustainability principles into account to a certain

extent, but that these principles need to be translated into a corporate management plan. Participant M4 explained the process in Türkiye as follows:

"In the projects we prepare, if there is an EIA within the scope, certain definitions are provided in the EIA report. But these definitions are mostly related to the construction process. But in our system in Türkiye*, it is generally directed towards the commitments made during the construction process."*

When the interview analysis and results are combined, the table shows that in Türkiye, when seeking Envision certification for a highway project, full points can be achieved by directly including the LD2.1 criterion in the planning subcategory.

Overall, the Planning category shows that there is awareness of sustainability management, but planning and life cycle approaches are limited at the implementation level. This highlights the importance of institutionalizing long-term sustainability plans and integrating them into project management processes in future projects.

4.3.2.3 Economy

This section emphasizes that infrastructure projects must be comprehensively evaluated in terms of their direct and indirect effects, such as contributions to economic growth, employment, education, and quality of life.

According to the evaluation matrix, the LD 3.1 credit has been successfully achieved in certain items in the project evaluation, and other items have been marked as “Include” or “Plan and Include” in the interview analysis. This finding indicates that the project has the potential to contribute to regional economic development, creating a positive impact, particularly in terms of job creation and increasing local economic activity. The LD 3.2 credit was rated “Include” in the interview questions, indicating that the project does not directly include education or capacity-building activities but that the need for such initiatives is recognized. Although the LD 3.3 credit did not score points in most headings in the project evaluation, it was rated as “Include” in

every heading as a result of the interviews with experts. It was learned from the interviews that this heading is implemented in current projects and that its inclusion in projects may be possible at the feasibility stage, as explained by participant M3.

Combining the interview analysis with the results, the table shows that when seeking Envision certification for a highway project in Türkiye, full points can be achieved by directly including the LD3.1 and LD3.3 criteria in the economy subcategory. For the LD3.2 criterion, it appears that some points can be earned by including the first two items in the project.

Overall, the Economy category shows that the projects in Türkiye has a certain level of impact in economic terms, but that local capacity development and life cycle-based economic analyses need to be systematically integrated in terms of sustainability. This approach will ensure that infrastructure projects are more aligned with regional development goals.

4.3.3 Resource Allocation

The Resource Allocation category stands out as one of the topics with the most limited scope of application from the designer's perspective within the project. Upon examining the credits in this category, it is observed that only three credits are directly related to the design team's authority and responsibility area. Therefore, as this heading is generally linked to the contractor's decision-making and implementation processes, the number of areas where project managers can be actively involved in the design process is quite limited. Consequently, when evaluated from the designer's perspective, the Resource Allocation category can be considered an area where there are almost no subheadings that can be directly influenced. The Table 4.28 below shows the combined results of this study in the Envision category of Resource Allocation.

Table 4.28 Combined results of Resource Allocation category

RESOURCE ALLOCATION								
CODE	**CREDIT NAME**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
MATERIALS								
RA 1.1	Support Sustainable Procurement Practices	X	X	X	X	X	X	X
RA 1.2	Use Recycled Materials	X	X	X	X	X	X	X
RA 1.3	Reduce Operational Waste	X	X	X	X	X	X	X
RA 1.4	Reduce Construction Waste	X	X	X	X	X	X	X
RA 1.5	Balance Earthwork On Site	⚡ Plan and Include						
ENERGY								
RA 2.1	Reduce Operational Energy Consumption	X	X	X	X	X	X	X
RA 2.2	Reduce Construction Energy Consumption	X	X	X	X	X	X	X
RA 2.3	Use Renewable Energy	X	X	X	X	X	X	X
RA 2.4	Commission and Monitor Energy Systems	X	X	X	X	X	X	X
WATER								
RA 3.1	Preserve Water Resources			✓✓ Include	⚡ Plan and Include			
RA 3.2	Reduce Operational Water Consumption	X	X	X	X	X	X	X
RA 3.3	Reduce Construction Water Consumption	X	X	X	X	X	X	X
RA 3.4	Monitor Water Systems	X	X	X	X	X	X	X

LEGEND	
⊘ Exclude	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be excluded.
⚡ Plan and Include	Although it was scored zero in the project evaluation, it was deemed appropriate to plan and include it in the quantitative analysis of the interviews.
✓✓ Include	Although it was scored zero in the project evaluation, it was deemed appropriate to include it in the quantitative analysis of the interviews.
⊘ Exclude	Although it was scored plan and include in the project evaluation, it was deemed appropriate to exclude this item in the quantitative analysis of the interviews.
⚡ Plan and Include	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be planned and included.
✓✓ Include	Although it was scored plan and include in the project evaluation, it was deemed appropriate to include this item in the quantitative analysis of the interviews.
	It did not receive any points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did not receive full points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did receive full points in the project evaluation, thus it is not adressed during the interviews.

4.3.3.1 Materials

This section emphasizes the need to consider sustainable procurement, use of recycled materials, waste reduction, and a life cycle approach to reduce the environmental impacts of material use in infrastructure projects.

In the assessment matrix, the RA1.5 credit is designated as “Plan and Include.” This indicates that plans for the excavation-fill balance have been made within the scope of the project and that this balance has been taken into account in the design process, but that technical difficulties may be encountered. In the interview findings, participant A6 also commented on this issue as follows.

"It[balancing cut and fill]is actually prioritized. But this is not something that can be done in every project due to logistics. This is something that would normally happen under optimal conditions. Because most of the time, projects yield large volumes of excavation that need to be transported to storage. There might also be significant demand for fill, and in that case, you may need to bring in material from the quarry. But of course, the ideal condition here is for the two to be balanced. Unfortunately, it is not possible to achieve this in every project. The usability of the material is also a critical constraint at this point, where it cannot be used, importing other materials becomes unavoidable.”

Overall, the RA 1.5 credit demonstrates that the highway projects has a concrete plan to reduce environmental impact and optimize material management; this indicates that sustainability in the use of on-site resources has been adopted at the operational level.

4.3.3.2 Water

This section emphasizes the need for efficient water use in infrastructure projects, the evaluation of alternative water sources, and the monitoring and reduction of water losses in the face of increasing population and climate change.

In the assessment matrix, the RA3.1 credit is marked as “Include” and “Plan and Include”. This indicates that specific practices aimed at protecting water resources were considered during the project's design phase. The thematic analysis related to this topic, Subtheme 8.1: Techniques for Protecting the Natural and Social Environment, includes various techniques.

When the interview analysis and results are combined, the table shows that when seeking Envision certification for a highway project in Türkiye, a certain number of points can be obtained from this credit if RA3.1 planning is included in the project under the water subcategory.

In general, the RA 3.1 credit indicates that there is awareness of water conservation within the scope of the project, but these practices need to be developed in terms of scope and continuity. In this regard, it is recommended that methods such as water recovery, rainwater storage systems, and flow control be integrated in a more holistic manner in future projects.

4.3.4 Natural World

The Natural World category is one of the most suitable areas for designers to develop sustainability practices, yet it stands out as one of the topics receiving low scores in project evaluations. This situation indicates that there is considerable room for improvement in areas such as protecting the natural environment, reducing ecosystem impacts, and preserving habitat integrity within the scope of project responsibility. However, interview findings indicate that most subheadings in this category require planning at early stages and that these issues are not addressed

systematically enough in the design process. Therefore, although the Natural World category has high potential in terms of sustainability, current practices fail to fully reflect this potential due to a lack of planning and limited coordination. The Table 4.29 below shows the combined results of this study in the Envision category of Natural World.

Table 4.29 Combined results of Natural World category

NATURAL WORLD								
CODE	**CREDIT NAME**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
	SITING							
NW 1.1	Preserve Sites of High Ecological Value	X	X	X	X	X	X	X
NW 1.2	Provide Wetland & Surface Water Buffers		✓ Include	✓ Include	⊘ Exclude	✓ Include		
NW 1.3	Preserve Prime Farmland		⊘ Exclude		⊘ Exclude	✓ Include		
NW 1.4	Preserve Undeveloped Land	⊘ Exclude	⚡ Plan and Include					
	CONSERVATION							
NW 2.1	Reclaim Brownfields	⊘ Exclude	⊘ Exclude	⚡ Plan and Include	⚡ Plan and Include			
NW 2.2	Manage Stormwater	✓ Include	✓ Include					
NW 2.3	Reduce Pesticide & Fertilizer Impacts	X	X	X	X	X	X	X
NW 2.4	Protect Surface & Groundwater Quality							
	ECOLOGY							
NW 3.1	Enhance Functional Habitats	⚡ Plan and Include	✓ Include	⚡ Plan and Include	⚡ Plan and Include	✓ Include	⚡ Plan and Include	
NW 3.2	Enhance Wetland & Surface Water Functions	✓ Include	✓ Include		✓ Include	✓ Include	✓ Include	
NW 3.3	Maintain Floodplain Functions	⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include		
NW 3.4	Control Invasive Species	X	X	X	X	X	X	X
NW 3.5	Protect Soil Health		✓ Include	✓ Include	✓ Include			

LEGEND	
⊘ Exclude	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be excluded.
⚡ Plan and Include	Although it was scored zero in the project evaluation, it was deemed appropriate to plan and include it in the quantitative analysis of the interviews.
✓ Include	Although it was scored zero in the project evaluation, it was deemed appropriate to include it in the quantitative analysis of the interviews.
⊘ Exclude	Although it was scored plan and include in the project evaluation, it was deemed appropriate to exclude this item in the quantitative analysis of the interviews.
⚡ Plan and Include	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be planned and included.
✓ Include	Although it was scored plan and include in the project evaluation, it was deemed appropriate to include this item in the quantitative analysis of the interviews.
	It did not receive any points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did not receive full points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did receive full points in the project evaluation, thus it is not adressed during the interviews.

4.3.4.1 Siting

This section emphasizes that infrastructure projects should minimize environmental impacts by avoiding ecologically sensitive areas such as agricultural lands, wetlands, and natural habitats, and implement protection and improvement measures when unavoidable.

According to the assessment matrix, the NW 1.2 credit has been rated as “Include” in most categories. This indicates that surface waters and wetlands have been taken into account to a certain extent in the project area. In the thematic analysis, specific codes such as “restricted areas close to water bodies” and “data monitoring” have been identified in relation to this issue. This indicates that there is legislation in the country regarding the protection of wetlands and that monitoring is carried out using various methods. Credits NW 1.3 and NW 1.4 were mostly rated as “Exclude,” indicating that although the project route affects agricultural areas, this factor was only considered to a limited extent in the alternative route planning. Furthermore, efforts to utilize existing developed land remain limited.

When the interview analysis is combined with the results, the table shows that in Türkiye, when seeking Envision certification for a highway project, it appears that some points can be earned from this credit by including two items in the NW 1.2 criterion under the siting subcategory in the project. However, it appears that the project does not currently include the NW1.3 and NW1.4 criteria, and the interview results also indicate that they are not suitable for inclusion.

Overall, the Siting category shows that the highway projects in Türkiye has a certain awareness of limiting environmental impacts, but that more comprehensive planning is needed in terms of natural area protection and wetland management. This indicates that site selection decisions in future projects need to be more closely linked to ecological analyses.

4.3.4.2 Conservation

This section emphasizes that every project has a responsibility to protect environmental quality by preventing rainwater runoff and pollution from pesticides or fertilizers in infrastructure projects, and to remediate contaminated areas if necessary.

According to the assessment matrix, NW 2.2 credit is marked as “Include.” This indicates that stormwater management has been taken into account to a certain extent within the scope of the project, specifically aiming to control surface runoff and reduce environmental impacts in the design of drainage systems. The techniques used in such works are listed under Subtheme 8.1: Techniques for Protecting the Natural and Social Environment. One of the findings from the interviews is that methods for reducing environmental impacts in drainage are relatively new in Türkiye but are widely used in international projects. The NW 2.1 credit was mostly rated as “Exclude.” This indicates that the project is not being implemented on a site with a history of pollution, and the responses in the interviews show a lack of knowledge and experience in this area.

When the interview analysis and results are combined, the table shows that when seeking Envision certification for a highway project in Türkiye, the NW 2.1 criterion in the conservation subcategory is not currently included in the project and, based on the interview results, is not considered suitable for inclusion. In the NW 2.2 criterion, it appears that a certain number of points can be obtained from this credit by including two items in the project.

Overall, the Conservation category shows that environmental awareness exists but remains limited in terms of implementation. This situation indicates that nature-based solutions that support the natural water cycle (e.g., green infrastructure, rainwater harvesting, plant-based filtration systems) need to be integrated into the planning process in a more holistic manner in the coming periods.

4.3.4.3 Ecology

This section emphasizes that infrastructure projects must be designed to be compatible with local ecosystems without harming natural systems such as the hydrological cycle, habitat integrity, and soil health, and that the spread of invasive species must be prevented.

According to the assessment matrix, the NW 3.1 credit has been weighted primarily as "Include" and "Plan and Include." This indicates that ecological balance and habitat protection elements have been considered to a certain extent in the project design, but that implementation has mostly remained at the planning stage. This issue was also highlighted in the interviews; an environmental engineer emphasized this limitation, stating, "Wetlands and floodplains are protected under institutional control, but projects often fail to develop measures that would enhance the ecosystem functions of these areas."

The NW 3.2 and NW 3.5 credits were rated as "Include" across all groups. This shows that although wetland and surface water functions were not directly addressed in the project, participants considered this issue critical for sustainability. Therefore, although this criterion was not reflected in the project evaluation, according to the interview findings, it stands out as an important area of environmental sustainability that should be considered in future projects. It shows that soil stability, erosion control, and topsoil management issues were considered in the project and contributed to the protection of ecosystem health.

All items under the NW3.3 heading were rated as "Plan and Include." This indicates that although no work is currently being done on this topic in projects, it can be included in projects as part of planning.

Overall, the Ecology category reveals that the highway projects in Türkiye recognizes ecosystem functions in terms of environmental sustainability but that more comprehensive nature-based solutions (e.g., green infrastructure, habitat restoration, natural drainage systems) are needed in these areas. This points to the

importance of integrating ecological planning into the engineering design process in future infrastructure projects.

4.3.5 Climate and Resilience

The Climate and Resilience category stands out as the topic with the least application within the project scope but the highest potential for development. Compared to other Envision categories, the low performance in this topic indicates that climate risks are not yet systematically addressed in infrastructure projects in Türkiye. However, both the Envision assessment and interview findings reveal that resilience offers significant opportunities for developing a holistic approach, particularly in areas such as risk management, disaster prevention, and increasing adaptation capacity. The Table 4.30 shows the combined results of this study in the Envision category of Climate and Resilience.

Table 4.30 Combined results of Climate and Resilience category

CLIMATE AND RESILIENCE								
CODE	CREDIT NAME	A	B	C	D	E	F	G
	EMISSIONS							
CR 1.1	Reduce Net Embodied Carbon	X	X	X	X	X	X	X
CR 1.2	Reduce Greenhouse Gas Emissions	✓ Include	✓ Include					
CR 1.3	Reduce Air Pollutant Emissions		✓ Include	✓ Include				
	RESILIENCE							
CR 2.1	Avoid Unsuitable Development		⚡ Plan and Include		⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include	
CR 2.2	Assess Climate Change Vulnerability	⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include	⚡ Plan and Include			
CR 2.3	Evaluate Risk & Resilience	✓ Include	✓ Include	✓ Include	✓ Include	✓ Include	✓ Include	
CR 2.4	Establish Resilience Goals and Strategies	✓ Include	✓ Include	✓ Include				
CR 2.5	Maximize Resilience	✓ Include	✓ Include	✓ Include	⊘ Exclude	⊘ Exclude		
CR 2.6	Improve Infrastructure Integration	⊘ Exclude	✓ Include	✓ Include	✓ Include	✓ Include		

LEGEND	
⊘ Exclude	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be excluded.
⚡ Plan and Include	Although it was scored zero in the project evaluation, it was deemed appropriate to plan and include it in the quantitative analysis of the interviews.
✓ Include	Although it was scored zero in the project evaluation, it was deemed appropriate to include it in the quantitative analysis of the interviews.
⊘ Exclude	Although it was scored plan and include in the project evaluation, it was deemed appropriate to exclude this item in the quantitative analysis of the interviews.
⚡ Plan and Include	As a result of both the project evaluation and the quantitative analysis of the interviews, this item should be planned and included.
✓ Include	Although it was scored plan and include in the project evaluation, it was deemed appropriate to include this item in the quantitative analysis of the interviews.
	It did not receive any points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did not receive full points in the project evaluation. Since it was not within the scope of the study, it was not addressed during the interviews.
	It did receive full points in the project evaluation, thus it is not adressed during the interviews.

4.3.5.1 Emissions

The Emissions subcategory aims to reduce global environmental risks by reducing carbon, GHG, and pollutant emissions throughout the entire life cycle of infrastructure projects.

According to the assessment matrix, CR 1.2 and CR 1.3 credits have mostly been assessed as “Include.” This indicates that the project includes indirect measures to reduce GHG and air pollutant emissions. For example, measures such as reducing fuel consumption indirectly contribute to these goals.

When the interview analysis is combined with the results, the table shows that when seeking Envision certification for a road project in Türkiye, it is possible to receive full points for the credit by including the headings related to the CR1.2 criterion in the emissions subcategory in the project. For the CR 1.3 criterion, it appears that a certain number of points can be obtained for this credit by including two items in the project.

Overall, the Emissions category shows that, despite the absence of direct carbon management strategies, there is awareness and indirect implementation of emission reduction measures. This highlights the need to calculate the carbon footprint of future infrastructure projects on a life-cycle basis and to guide design decisions accordingly.

4.3.5.2 Resilience

The Resilience subcategory aims to ensure that infrastructure projects are resilient to short-term risks (e.g., floods, fires) and can adapt to long-term climate change. Identifying risk types and probabilities in advance enables projects to be designed to be more resilient and responsive to the future needs of society.

According to the assessment matrix, CR 2.1 and CR 2.2 credits have been assessed as "Plan and Include". This finding indicates that factors such as climate conditions and land suitability were considered during the project planning process, but that these issues require further planning.

The CR 2.3, CR 2.4, and CR 2.5 credits were predominantly rated as "Include." This indicates that risks and resilience targets were considered within the project scope, but an integrated strategy or performance indicator has not yet been established for these issues. Participant M4 commented on this issue as follows:

"For example, no one asks us for such a risk analysis on the route. But we try to avoid it by doing the best we can just to stay away from it. Because risk mitigation

measures are taken but not reported. It is not written down anywhere. No one is told about it, and no mathematical equivalent is calculated. It is just experiential."

The CR 2.6 credit has been assessed as "Include" in most categories. This indicates the level of integration of the project with different infrastructure systems (e.g., drainage, transportation, power lines, etc.) and the need to increase interdisciplinary coordination in resilience planning.

When the interview analysis and results are combined, the table shows that in Türkiye, when seeking Envision certification for a highway project, points can be earned if the headings related to the CR2.1 and CR 2.2 criteria in the resilience subcategory are included in the project planning. The CR2.3 and CR2.4 headings were found suitable for inclusion in the project, and it was understood that high scores could be obtained from these criteria. In the CR 2.5 criterion, it appears that a certain amount of points can be obtained from this credit by including two items in the project. In the CR2.6 credit, since the first item resulted in "exclude," no points can be obtained from this credit.

Overall, the Resilience category shows that resilience awareness exists, but that applications mostly remain at the level of legal requirements. This indicates that strategic steps towards risk management, pre-disaster planning, and infrastructure integration need to be strengthened in future projects.

4.3.6 Recommendations for Turkish EIA

The EIA process in Türkiye has a strong procedural structure and a clear legal framework that governs the application, review, and decision stages in a systematic way. This structure makes sure that projects follow the law and that environmental effects are taken into account to some extent. The evaluations undertaken for the thesis indicated that sustainability practices in Türkiye are predominantly confined to the obligatory requirements established by legislation, with practices beyond this framework largely overlooked. This finding underscores the necessity for

sustainability criteria to be explicitly integrated into legislation rather than being left solely to corporate initiatives. The Envision-based assessment results within the thesis provide definitive insights into the applicability of numerous sustainability criteria not currently integrated into the EIA process, demonstrating that international sustainability rating systems like Envision could guide the development of the EIA framework in Türkiye. According to the results of this thesis recommendations for Turkish EIA are given below.

Early Integration into the Planning and Design Phase

A large part of the environmental and social impacts are dealt with after the project design is mostly done in the way described through EIA process. The analyses performed in this thesis demonstrate that the relevance of most sustainability practices diminishes when introduced in the post-design phase, resulting in technical and economic challenges. So, it is very important that the EIA be included earlier in the feasibility, route selection, and preliminary design phases, instead of just being a way to get approval before construction starts. Early integration makes it easier to figure out the environmental and social risks that will affect design choices. It also makes sure that sustainability standards are included in the project life cycle in a way that is more cost-effective and efficient. So, decision-making processes get a more complete framework, and the sustainability performance of infrastructure projects gets stronger over time.

Capacity Building and Corporate Training Programs

Interviews conducted for the thesis indicated that insufficient awareness and practical experience among experts significantly hinders the incorporation of sustainability practices into projects. This means that corporations need to improve their ability to consistently include sustainability criteria in project processes. In this situation, it is important to set up regular sustainability training programs for people who work for the government, local governments, and businesses. Also, adding international sustainability tools like Envision to the regular training materials for

public institutions will help technical staff learn how to use these tools well, which will improve their skills.

Enhancing Social Impact Assessment

In Türkiye, social impact is generally addressed within a limited framework in infrastructure projects; however, the codes emerging under Theme 5-6-7-8 demonstrate that social impact can be analyzed in a much more comprehensive and systematic manner. In this regard, social impact assessment should begin with a detailed examination of the socioeconomic benefits that projects will provide to society. Employment opportunities, travel time savings, contributions to the local economy, and potential improvements in health and safety should be evaluated using measurable indicators. Such an analysis will ensure that not only the physical outputs of the project but also its impact on regional development and social welfare are made visible.

The assessment of social impact should also cover the community's level of knowledge about the project, awareness, and participation in the process. In this context, the training activities organized should not only be for informational purposes but should also include programs that support the economic development of the local community and increase labor productivity. Capacity-building training in vocational skills, occupational safety, entrepreneurship, basic technical knowledge, or specific job areas required in the project process can enable the local community to benefit directly from the project and strengthen their economic position. Such an approach increases social participation and helps raise social acceptance by strengthening the project's contribution to local employment and regional development.

Support mechanisms for affected populations should be a complementary element of the social impact assessment. Objective identification of impacts such as displacement, economic loss, or changes in living conditions is necessary; the development of practices such as fair compensation, resettlement plans, and social

support programs is required. Such an approach enables projects to be implemented in accordance with the principles of social equality, justice, and rights ownership.

It is also important to analyze the potential physical and environmental damage of projects and their effects that could lead to long-term socioeconomic losses. Physical damage such as vibration, pollution, and environmental degradation should be assessed alongside social impacts such as displacement, job loss, or loss of future economic opportunities. Regular analysis of citizen complaints will provide important data for understanding the social perception and impact level of projects.

Such an approach will contribute significantly to the effective integration of social sustainability into infrastructure projects in Türkiye and to strengthening the social legitimacy of projects.

Inclusion of Climate Change, Risk, and Resilience Analysis

The findings of the thesis show that climate change is not evaluated in the design process of infrastructure projects in Türkiye and that there is no institutional approach in this regard. On the other hand, while engineering teams consider classic technical risks such as floods, landslides, or ground conditions in practice, these assessments are mostly not reported as systematic risk analyses. Similarly, the resilience component, which defines the performance of projects against long-term environmental and structural uncertainties, does not have a methodological framework in current practices. Therefore, adding a separate section examining the potential impacts of climate change, a risk analysis subheading where technical risks are analytically assessed, and an evaluation section outlining the long-term resilience strategies of projects to the EIA process is necessary to address the existing structural deficiency and strengthen the sustainability-based management of projects. Such a structure will contribute to the transparent documentation of risks that are already implicitly considered in engineering, the integration of climate risks into the design process, and the institutional monitoring of projects' resilience capacity.

The study's findings suggest that the existing framework of the EIA methodology in Türkiye requires enhancement to effectively encompass sustainability dimensions. EIA can be a more complete tool for guiding decision-making processes if it includes things like early integration into the planning phase, looking at the social impacts, a design approach that takes ecosystem services into account, and a systematic evaluation of risks. This change also shows how important it is to have a modern EIA approach that fits with Türkiye's international sustainability goals, especially its duties under the SDGs, the Paris Agreement, and the European Green Deal. So, the recommendations given here are the first steps toward an EIA framework that will help manage the environmental and social effects of future infrastructure projects in Türkiye in a way that is more sustainable, responsible, and long-term.

4.3.7 Discussion of Results with the Literature

Studies on sustainable highway design in the literature reveal that sustainability is particularly shaped during the design phase. Tsai and Chang (2012) emphasized the decisive role of the design phase in integrating sustainability principles into projects and demonstrated that a significant portion of technical and material-based sustainability elements can be addressed during the design process before the project is even constructed. This finding aligns with the approach of the current study conducted in the Turkish context. While evaluating the applicability of sustainability practices, the study found that decisions made during the design process directly determine the environmental and social performance of the project.

Rooshdi et al. (2014) indicated that elements such as context-sensitive design, appropriate alignment, reducing the use of undeveloped land, and minimizing socio-economic impacts are prominent in sustainable highway projects, demonstrating that these elements are fundamental determinants of sustainability. The findings of this study's thematic analysis largely align with these results. However, the data obtained in the Turkish context provide a much more detailed picture of not only design principles but also the conditions under which these criteria should be addressed in

the design process, with which data sets, under which technical constraints, and with which stakeholder interactions. In this respect, the study operationalizes the sustainability components defined at a general level by Rooshdi et al. (2014), and develops a context-specific explanation of how sustainable practices can be embedded throughout the design decision chain. Similarly, Rooshdi et al.'s general emphasis on environmental impact reduction has become much more comprehensive in this study. Themes such as preventing habitat loss, protecting water resources, avoiding historical areas, and controlling unsuitable development risks are addressed with detailed codes not only in site selection but also in all sub-components of the design (geometry, drainage, engineering structures, protection measures, excavation management, etc.). Thus, the research shows that environmental sustainability is not a one-time design decision, but a multi-layered process that extends to all stages of the design. The current study also takes the literature further in terms of socio-economic impacts. While Rooshdi et al. (2014) state that these impacts should be minimized, the study does not present a comprehensive assessment of how these processes should be carried out. In contrast, the social dimension in this thesis; The study is detailed under subheadings such as defining social expectations, the level of impact of vulnerable groups, local development potential, social assistance and communication mechanisms, and the protection of cultural heritage. Thus, it is demonstrated that socio-economic sustainability is not merely about mitigating impacts; the social contribution and communication mechanisms required by the local context are also an integral part of the design process. In these respects, the research confirms the general framework of Rooshdi et al. (2014) and makes an original contribution to the literature by presenting a much more detailed and applicable model of how sustainability can be implemented, under what conditions, under what constraints, and with what stakeholder dynamics.

Despite the expanded scope of sustainability tools, Sarachaga et al. (2016) demonstrated that social and economic dimensions are not sufficiently supported in developing country contexts. The findings of this study also reflect this trend. In the Envision assessment conducted in Türkiye, while the Quality of Life and Leadership

categories received relatively higher scores, social and governance-focused credits were generally quite low. Interview findings also illustrate this situation; it was determined that social topics were not implemented in most projects due to their inadequate coverage in national regulations, while social inclusion, stakeholder participation, and local development were addressed more effectively in internationally funded projects. These results confirm Sarachaga et al. (2016)'s recommendations that sustainability tools should be aligned with context-specific socio-economic priorities.

Chang and Tsai (2015) showed that sustainable design requires 2–12% additional time compared to traditional design processes, creating an additional man-hour burden on the design process. This finding is directly consistent with the time schedule difficulty barrier identified in this study. Participants stated that sustainability practices strain existing project schedules; they stated that the additional time required naturally leads to increased costs. This also explains the "financial difficulty" barrier frequently emphasized in the study. Thus, the time-cost relationship discussed in the literature was confirmed in the Turkish context, and it was seen that sustainable design integration creates additional pressure on both the schedule and the budget. Similarly, a study conducted in Jordan by Aljboor et al. (2023) identified the most significant barriers to sustainability practices as lack of sustainability training, poor communication between project teams, and lack of experience with sustainable techniques. This study also revealed similar barriers in more detail. The thematic analysis revealed "no experience" as the most dominant barrier, and it was determined that lack of experience directly hinders the implementation of sustainability practices. In addition, participant statements revealed that lack of experience triggered interrelated sub-barriers such as financial difficulty, technical difficulty, and time management difficulty. Therefore, the study confirms Aljboor et al.'s findings that the success of sustainability practices is closely related to knowledge, experience, and institutional capacity. It also provides a more detailed explanation of the obstacles to sustainable projects and the necessary work to overcome them.

Despite the expanded scope of sustainability tools, Sarachaga et al. (2016) demonstrated that social and economic dimensions are not sufficiently supported in developing country contexts. The findings of this study also reflect this trend. In the Envision assessment conducted in Türkiye, while the Quality of Life and Leadership categories received relatively higher scores, social and governance-focused credits were generally quite low. Interview findings also illustrate this situation; it was determined that social topics were not implemented in most projects due to their inadequate coverage in national regulations, while social inclusion, stakeholder participation, and local development were addressed more effectively in internationally funded projects. These results confirm Sarachaga et al. (2016)'s recommendations that sustainability tools should be aligned with context-specific socio-economic priorities.

The critical role of leadership and institutional capacity in determining sustainability performance has also been clearly demonstrated by Trop (2018). The Tel-O-Fun bike-sharing system achieved a Gold rating when evaluated with Envision, with the highest scores achieved in the Leadership and Quality of Life categories. Trop (2018) states that this success stems from strong local government leadership, long-term policies, active stakeholder engagement, and comprehensive documentation. In this study conducted in the Turkish context, many of these same elements emerged not as success factors but as barriers. In particular, a lack of regulation and inadequate documentation were identified as obstacles limiting sustainability practices. Trop's study suggests that addressing these shortcomings could lead to higher-level sustainable projects in Türkiye. A similar result was reported by Contreras and Gloria (2017). An Envision assessment of 38 infrastructure projects in Latin America showed that transportation projects performed better in the Quality of Life and Leadership categories, but received lower scores in the Resource Allocation and Climate & Risk categories. The assessment conducted in Türkiye also confirmed this trend; technical categories such as resource efficiency, carbon reduction, material cycling, and climate resilience performed the least. Interview findings revealed that climate change-related practices were considered among the most difficult to

implement by experts. Finally, the Envision study conducted in the US by Huang (2014) demonstrated that significant score improvements in the Climate & Risk category were achieved when climate resilience and environmental management plans were systematically integrated into the design process in a developed country context. This finding suggests that contextual and institutional deficiencies underlie the poor performance in this category in Türkiye.

This study presents a systematic approach that responds to calls in the literature to identify context-specific requirements. Using the Envision assessment, a comprehensive analysis of a typical highway project, followed by presentation of the areas identified as deficient to relevant expert groups and further elaboration through detailed interviews, enabled a holistic assessment of both the technical feasibility of sustainability practices and the existing institutional and operational barriers. This methodology also holds unique value in that it enables integrated analysis within a single study of stages such as project evaluation, expert opinions, feasibility analysis, and barrier identification, which are typically addressed separately in various studies using different methodologies. This allows sustainability performance to be understood not only through project outcomes but also simultaneously through design decisions, technical capacity, institutional functioning, and stakeholder perceptions. This assessment approach, developed through the study, offers a practical roadmap for countries lacking sustainable infrastructure standards or seeking to adapt existing tools to local conditions. The methodology developed through the Envision system is flexible enough to be adapted to different sustainability assessment tools as needed, enabling researchers and practitioners to capture an objective picture of the current situation and systematically identify areas for future improvement. Therefore, the study makes a significant contribution to the literature and practice by proposing both an analytical framework and a practical method for the context-specific assessment of sustainability tools.

CHAPTER 5

CONCLUSION

In this study, the feasibility of incorporating sustainability practices into projects through the international sustainability system was investigated to support the development of sustainable highway projects in Türkiye.

The Envision system was used to evaluate only the topics within the design firm's responsibility during the project phase of a completed highway project in Türkiye. The selected pilot project was examined in detail according to Envision v3 criteria; "Yes, Maybe, No" assessments were conducted for each credit item, reference documents and design decisions were analyzed, and both base and upper scores were calculated accordingly. This assessment quantified the current sustainability status of projects in Türkiye. The semi-structured interview study was designed to understand the conditions under which the topics classified as "No" and "Maybe" in the Envision system following the project evaluation might be applicable. To this end, four different expert groups— highway alignment engineers, managers, environmental engineers, and social experts—were presented with these topics and were asked to rate the importance and difficulty of implementing each practice on a scale of 1 to 5. These scores were analyzed quantitatively, and based on the experts' consensus, the sustainability practices most applicable in the Turkish context were determined. Following the quantitative analysis process, all interview data were coded using MAXQDA 24 and subjected to thematic analysis. This systematically revealed not only numerical trends but also the experts' decision-making logic, perceived structural barriers, assessments of institutional processes, and detailed explanations of sustainability practices. This holistic approach made it possible to understand the real reasons for the missing or weak headings in Envision, specific to Türkiye, and to produce practical and context-specific implications on how sustainability practices can be improved in the future.

The Envision assessment identified the project's eligible credits, and 64% were deemed suitable for research. The project's success as base score was %5 and %12 as upper score. As a result of the sustainability assessment of the project, it was seen that highway projects in Türkiye were lagging behind in terms of sustainability and could not achieve success within the scope of Envision certification. Currently, there are initiatives in the Quality of Life and Leadership categories of Envision, compared to other categories. When comparing base and upper scores, Quality of Life was the category most open to development with small improvements. However, no success has been achieved in the Climate and Resilience category and in the interview with experts, climate change efforts were cited as the most challenging due to lack of documentation and regulations.

Quantitative analysis of interview led to an assessment categorizing the suitability credits for inclusion in highway projects in Türkiye as "include," "plan," and "exclude." The analysis resulted in a total of 75 credits to be included, 36 to be planned and included, and 10 excluded. Studies regarding to minimizing noise and vibration, improving access and wayfinding, enhancing public space are found to implementable in Türkiye in Quality of Life category. Almost every credit in the Leadership category can be implemented in the highway projects but some of them might require early planning. In the Natural World category where the credits are related to environmental pillar of sustainability is the category where there are many credits resulting in requiring planning and exclusion.

This study reveals the conditions under which existing practices are implemented in sustainable highway projects, the areas where they have potential for development, and the institutional, social, environmental, and technical dynamics that shape implementation processes. The findings demonstrate that sustainability practices vary depending on the context, project characteristics, and financing type, with social impact management, environmental protection, data-based decision-making, and stakeholder communication playing decisive roles in projects. However, while lack of experience, cost, technical constraints, and institutional resistance pose significant barriers, in order to achieve sustainable projects in Türkiye financial support, strong

employer guidance, legal regulations, and increased awareness have emerged as key facilitators of this process. In this context, the effective implementation of international systems such as Envision in Türkiye requires not only technical adaptations but also a holistic understanding of governance. In order to increase sustainability efforts in Türkiye, government agencies need to improve the regulations and standards used in highway design as well as the content of EIA reports.

This study offers an original contribution to the literature as it is one of the first comprehensive analyses based on both project-based and expert opinions regarding the sustainability level of highway projects in Türkiye. The assessment approach of this thesis, provides a practical roadmap for countries lacking specific sustainable infrastructure standards or those attempting to adapt existing tools to local conditions. It allows researchers and practitioners to draw an objective picture of the current situation and systematically identify areas for future improvement. The results obtained in this thesis explain the sustainability topics that can be applied to highway projects in Türkiye. This allows both public institutions and the private sector to use it as a decision-making tool to prioritize sustainable practices and to design sustainable projects.

Limitations and Future Work

This study has some limitations. Among the various stages in the implementation of projects, only the design stage was examined. A suitable project was selected to represent the overall highway project work in Türkiye, but the study was limited to evaluating a single project. The results of the study would have been differences for different type of projects such as highway projects or city road projects. In the interview study, experts from various disciplines were interviewed, and although a sufficient number of experts were interviewed to guide the study, this sample size could be increased. It is recommended that future studies include interviews with a wider range of clients and contractors across different project types, reaching a wider audience and achieving a broader perspective.

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APPENDICES

A. Envision Evaluation of Project X

Table A.1 Envision evaluation of Project X

QUALITY OF LIFE														
Code	Credit Name	Referance Documents	Evaluation							Achievement Level		Score		Recommendation
			A	B	C	D	E	F	G	Base	Upper	Base	Upper	
WELLBEING														
QL 1.1	Improve Community Quality of Life	Municipality Scope Opinion EIA Report Annex-3 (Institutional Opinions) EIA Report Annex-7 (Public Participation Meeting) EIA Report - Non-Technical Summary of the Project EIA Report - 1.1 / 1.3 / 3.35 / 3.36	YES - The project team has engaged with the affected municipalities in the project. Project team conducted public participation meeting, informing the community with the project and answering their questions and concerns.	MAYBE- There is comparison of the projects goals to the needs or issues of the community but not in detail.	MAYBE- Social Impact Assessment is not conducted. General information about how the project will affect the community and the broader community is included but it is only limited to positive impacts. Negative social impacts are not discussed.	MAYBE- Public participation meetings are held and feedbacks from the community are noted. There is no specific information regarding there were some changes in the project due to the received community concerns.	NO- Negative social impacts are not identified.	NO- There are significant community concerns. However, there is no specific information regarding there were some changes in the project due to the received community concerns or mitigations for the negative impacts.	NO-The project doesn't proactively address long term social, economic, or environmental changes that impact quality of life.	No Achievement	Enhanced	0	5	There needs to be more detailed comparison of project goals and community needs and concerns. It is unclear to what extent the project respond to public needs and concerns and if there were any changes in the project to fulfill the needs of the community. Social Impact assessment can be conducted. Environmental affects of the project is investigated in details. The same needs to be done for the social effects of the project. Reports mostly mention the possible positive social impacts. For example, there would be negative social impacts due to the use of agricultural and olive fields which is not mentioned.
QL 1.2	Enhance Public Health & Safety	Highway Traffic Law etc.	YES - Project meets all health and safety laws and regulations for the operation.	YES- Project exceeded minimum requirements by making slight changes in the road alignment given in the zoning plan in order to increase the road and intersection safety for users.	YES - There were accidents due to the uncontrolled agricultural traffic in the community. It is solved in the project by diverting agricultural vehicle traffic from the highway by using intersections and underpasses.	NO - There are no health and safety benefits for the broader communities.	NO - There is no study in the project regarding to proportionally disturbing health and safety risks to communities.	NO - Critical infrastructure services are not provided by the project to communities who are now or could soon experience negative impact on personal safety and/or health.	-	Enhanced	Enhanced	7	7	Green areas, air quality improving systems and water pollution prevention infrastructure can be added to the project. With risk analysis conducted on communities, health and safety risks can be fairly distributed among communities. Health and safety risks of the society can be reduced by establishing infrastructures that solve problems such as pollution of water resources and traffic safety.
QL 1.3	Improve Construction Safety	EIA Report - 3.30 / 3.31 / 3.32 / 3.33 Regulation on Occupational Health and Safety in Construction Works Regulation on Fire Protection of Buildings Regulation on Buildings to be Constructed in Disaster Zones Disaster Regulation for Engineering Structures Along Highways	X	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because the project is not in the construction stage, there is no contractor.

Table A.1 Envision evaluation of Project X (cont'd)

QUALITY OF LIFE													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendation
			A	B	C	D	E	F	Base	Upper	Base	Upper	
QL 1.4	Minimize Noise & Vibration	EIA Report - 3.13 EIA Report - Annex 5 (Acoustic Report) Regulation on the Assessment and Management of Environmental Noise	YES- Project created acoustic report assessing constructional and operational noise impact. Report included noise generation assessment for 20 years later.	YES- In order to mitigate the noise resulting from the project, commitment to Regulation on the Assessment and Management of Environmental Noise is given. It is stated that noise map and action plan will be prepared for the affected areas.	YES - Project sets target noise level which is defined by the Regulation on the Assessment and Management of Environmental Noise. However, operational noise level exceeds the limits for the surrounding communities. It is stated that noise map and action plan will be prepared for the affected areas. As a result of those studies which are not completed, project related noise should be below the target noise level according to regulations.	MAYBE - There is no information or documentation related to informing affected community or impacted stakeholders on the subject of noise impacts, targets and mitigation measures. However, noise map can be shared with the public.	NO- Analyses of anticipated operational noise is conducted however, current noise level is not conducted. There is no study regarding the affect of mitigation measures on existing noise level. It should be either preserving or decreasing the existing noise level.	-	Enhanced	Superior	3	6	There is a current 2x1 highway in operation. The noise level of existing condition should be investigated. It would help compare how the project effects the existing noise level. Information to the affected community and stakeholders should be provided regarding to the anticipated noise level and the planned mitigation measures.
QL 1.5	Minimize Light Pollution		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because lighting project is not in the scope of the designer firm.
QL 1.6	Minimize Construction Impacts	EIA Report - Section 3 Annex 5 (Acoustic Report)	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because the project is not in the construction stage, there is no contractor.

Table A.1 Envision evaluation of Project X (cont'd)

QUALITY OF LIFE													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendation
			A	B	C	D	E	F	Base	Upper	Base	Upper	
MOBILITY													
QL 2.1	Improve Community Mobility and Access	EIA Report - 3.27 Alignment Studies	YES - The project alignment is consistent with the regional transportation plans.	YES - Access issues with the affected stakeholders have been discussed and solutions are provided.	YES - The aim of the project is to increase capacity by expanding a 2x1 road to a 2x2 road. Project includes, field roads and underpasses to ensure safe crossings and manage agricultural traffic without direct access to the main road.	MAYBE - There is no specific consideration of other modes of transportation. However, it may be considered that since there is an existing 2x1 road the direct decision on expanding the existing highway is probably made.	YES - Long-term mobility has been considered. Design has been made to meet the demand of 20 years. Project creates connectivity to new planned roads.	YES - The project improves the existing connectivity by including new intersections, connector and access roads.	Enhanced	Restorative	3	14	Project achieves great success in this credit. Consideration of other transportation modes could be included in order to make the best decision.
QL 2.2	Encourage Sustainable Transportation		NO - There is no initiative to encourage shared or mass transportation.	NO - There is no initiative to encourage shared or mass transportation.	NO - There is no initiative to encourage shared or mass transportation.	NO - There is no initiative to encourage shared or mass transportation.	-	-	No Achievement	No Achievement	0	0	In the project there is no consideration of shared or mass transportation. This could be included in the project and initiatives to encourage sustainable transportation can be included.
QL 2.3	Improve Access & Wayfinding		NO - Access, safety, and wayfinding plans for emergency personnel, evacuation, and incident management are not sufficiently covered by the project.	NO - The project's integration with its surroundings through navigation and clear signage, the safe division of pedestrian and non-pedestrian zones, and the protection of sensitive sites are all not sufficiently addressed.	NO - The project does not sufficiently provide public access restrictions, safe public access points, nor does it guarantee that these spaces are made to serve a variety of users.	NO - The project does not have transformative or positive impact on the community issues of access wayfinding or safety.	-	-	No Achievement	No Achievement	0	0	Stakeholder cooperation, appropriate signage, and well-defined emergency access, evacuation routes, and incident management strategies are all necessary. Clear, long-lasting, and multilingual markings are necessary to enhance wayfinding and signage. Buffer zones and sustainable design strategies should be used to safeguard sensitive regions, such as wetlands or cultural sites. Restrictions on public access should be apparent.

Table A.1 Envision evaluation of Project X (cont'd)

QUALITY OF LIFE														
Code	Credit Name	Referance Documents	Evaluation							Achievement Level		Score		Recommendation
			A	B	C	D	E	F	G	Base	Upper	Base	Upper	
COMMUNITY														
QL 3.1	Advance Equity & Social Justice	EIA Report - 2.18	NO- There is no information regarding to the social justice and equity.	NO- The socio-economic characteristics of the provinces and districts along the highway route have been studied but not in the requested specifics and do not include topics of equity and social justice. Especially potential negative impacts of the project are not included.	YES- Project owner and the designer made commitments for social justice and equity within their organizations.	NO- There is no information regarding to the project addressing social impacts related to the social justice and equity.	NO- There is no information regarding to the project equally disturbing positive and negative impacts of the project.	NO- Communities were involved through public participation meetings. However there is no information regarding to specifically targeting underrepresented communities during this process.	NO- There is no information regarding to the project positively addressing an existing or historic injustice or imbalance.	No Achievement	No Achievement	0	0	Project should include equity and social justice history of the affected community and project's positive and negative social impacts on those subjects should be studied. Management programs, decisions, strategies etc., to address equity and social justice impacts and mitigation strategies should be considered. Investigations should be included if the risks and negative impacts of the project is evenly distributed on the affected communities.
QL 3.2	Preserve Historic & Cultural Resources	EIA Report - 2.6 / 3.29 General Directorate of Cultural Heritage and Museums Scope Opinion Cultural and Natural Heritage Protection Law	YES - Engagements with General Directorate of Cultural Heritage and Museums have been made. Information regarding historic and cultural resources impacted by the project are gathered.	YES - Studies have been made in order to avoid Archaeological Sites. Different alternatives to avoid those sites have been studied but project variations couldn't avoid one Third-Degree Archaeological Site. In order to minimize the negative affect, project passes that site in fill section instead of cutting.	NO - There is no effort on identification of cultural or historic resources beyond the registries.	YES - Engagements with General Directorate of Cultural Heritage and Museums have been made. Information regarding historic and cultural resources impacted by the project are gathered. Necessary variation to the alignment have been made to minimize the impact.	NO- The project does not fully avoid all historic/ cultural resources	NO- The project does not enhance or restore the historic/ cultural resources.	-	Enhanced	Enhanced	2	2	More effort should be given in identifying historic or cultural resources, that are important to the affected community beyond the registries. In the design process, more effort can be given to avoid disturbing the historic or cultural values of the community. Beyond that, enhancements or restoring strategies can be done to preserve threatened historic or cultural resources.
QL 3.3	Enhance Views & Local Character	EIA Report - 3.14 / 3.16 / 3.34	X	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because landscape project is not in the scope of the designer firm. NOTE: Some issues to be taken into consideration in landscaping projects are stated in the EIA. Commitments to preserve and protect the natural landscape have been given and protection of view in construction stage have been mentioned.
QL 3.4	Enhance Public Space & Amenities		YES -The project team examines public amenities that may be affected by the project and produces new solutions to reduce the impacts within the scope of the project.	YES - Project protects public amenities and future plans by engaging stakeholders.	NO- The project doesn't add new public space.	NO- The project doesn't restore previously degraded or unusable amenities.	-	-	-	Improved	Improved	1	1	Creation of new public areas that are open to cyclists, pedestrians, and drivers can be done. Regulations for public spaces can be discussed with local governments, and gaining written authorization can guarantee the process's transparency. New park areas, green spaces, or recreation areas may be created as part of the project. Developing these areas in accordance with societal demands and promoting public health can be the goal. For instance, expanding public social spaces through the construction of new parks in areas with a shortage of park space benefits the neighborhood.
TOTAL												16	35	

Table A.1 Envision evaluation of Project X (cont'd)

LEADERSHIP													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
COLLABORATION													
LD 1.1	Provide Effective Leadership and Commitment	EIA Report	MAYBE - Project contract contains EIA which includes measures to improve environmental and partially social and economic effects of the project.	NO- There is no sustainability management policy.	NO- There is no sustainability management policy.	MAYBE - Project owner and the designer firm have organizational sustainability policies, initiatives to improve sustainability performance. Sustainability strategies are embedded into business strategy however there is no third party recognition related to sustainability.	-	-	No Achievement	Improved	0	2	Sustainability management policy can be included in the project with commitments regarding to the improvement of sustainability of the project. These commitments can be reevaluated throughout project delivery. Project owner and design firm can obtain third party recognition in their organizational sustainability studies.
LD 1.2	Foster Collaboration and Teamwork		NO- There are no sustainability goals.	NO- There are no sustainability goals.	NO- There are no sustainability goals.	NO- There are no sustainability goals.	-	-	No Achievement	No Achievement	0	0	Sustainability goals can be defined at early stages of the project through interdisciplinary meetings. With interdisciplinary collaboration, improvements can be made. These meetings can be held regularly, including all project stages in order to define and achieve sustainability goals.
LD 1.3	Provide for Stakeholder Involvement		MAYBE - Stakeholders are identified but not classified as primary or secondary stakeholders. Stakeholders are not prioritized.	MAYBE - The project team has not developed engagement plans for each stakeholder. Stakeholders participated in decision-making processes. Additionally, documentation of the engagement has been maintained.	NO - There isn't specific project team member involving in stakeholder engagements.	MAYBE - Stakeholder feedbacks from municipalities or ministry are incorporated into the design and changes were made. However there is no document showing changes were made due to feedbacks from community. There is no supporting document for stakeholder feedbacks being treated equally.	YES - There are documents from stakeholders that they are satisfied with the changes made in line with their requests.	NO - Stakeholders are not partners in the project.	No Achievement	Improved	0	3	Stakeholder mapping could be done including prioritation and classing as primary and secondary stakeholders. Stakeholder engagement plan could be formed and a specific project team member could be working with stakeholders. Clear explanations could be given about the actions taken according to the given stakeholder concerns. This should include equal treatment to stakeholders. Stakeholder may be included in the project as a partner.
LD 1.4	Pursue Byproduct Synergies	EIA Report - 1.2.3.	YES - Project evaluated the cut material to use in filling instead of wasting the material. Thus, project team used internal resources.	YES - The project team determined that the excess material resulting from the excavation process could be used as fill and identified the opportunity to reuse this material as a by-product.	YES - The project team actively evaluated this opportunity by carrying out engineering and logistics studies for the use of excavation material in the filling.	YES - Cut material would normally be disposed as waste. In the project it is re-evaluated and thus excess material waste was prevented. The use of excavated material as fill is an example of short-term and one-time reuse as it is limited to the construction process.	NO - The use of excavated material as backfill is not enough to create a circular economy model.	-	Superior	Superior	12	12	Other than use of excess excavation material, more study on by product synergy could be done in order for the project to support circular economy.

Table A.1 Envision evaluation of Project X (cont'd)

LEADERSHIP													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
PLANNING													
LD 2.1	Establish a Sustainability Management Plan		NO - There is no sustainability management plan.	NO - There is no sustainability management plan.	NO - There is no sustainability management plan.	NO - There is no sustainability management plan.	NO - There is no sustainability management plan.	-	No Achievement	No Achievement	0	0	Important members of the project team can be given responsibilities related to sustainability. While establishing sustainability goals and targets, creating a sustainability management plan can help in evaluating and prioritizing the project's environmental, economic, and social components. Management controls should be part of this plan to ensure that these goals are reached. These can be put into practice and reviewed on a regular basis.
LD 2.2	Plan for Sustainable Communities		NO - Sustainability was not considered.	NO - Sustainability was not considered.	NO - Sustainability was not considered.	NO - Sustainability was not considered.	NO - Sustainability was not considered.	-	No Achievement	No Achievement	0	0	When choosing and identifying projects, sustainability can be taken into account. Early on in the process, assessments can be used to assess sustainability performance. To find out how the project will affect long term regional sustainability, an evaluation can be conducted. The effectiveness of the project can be increased by aligning it with a thorough sustainable development plan. Furthermore, the project can be planned to address issues in the community or region that are fundamentally unsustainable.
LD 2.3	Plan for Long-Term Monitoring and Maintenance		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because monitoring and maintenance is not in the scope of the designer firm.
LD 2.4	Plan for End-of-Life		NO - There is no end-of-life plan for the project.	NO - There is no end-of-life plan for the project.	NO - There is no end-of-life plan for the project.	NO - There is no end-of-life plan for the project.	NO - There is no end-of-life plan for the project.	-	No Achievement	No Achievement	0	0	The project team might create an end-of-life plan. It is possible to assess opportunities to prolong its usable life or reuse it in a constructive manner. Negative effects can be lessened by evaluating possible social, environmental, and economic impacts near the end of life. Making well-informed decisions can also be supported by assessing the expenses and salvage value of replacement, deconstruction, or decommissioning. Long-term advantages and sustainability can be further increased by actively including stakeholders in end-of-life planning.

Table A.1 Envision evaluation of Project X (cont'd)

LEADERSHIP												
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
ECONOMY													
LD 3.1	Stimulate Economic Prosperity & Development	EIA Report 1.1 / 1.6 /1.7/1.9.5/2.18 /3.36 /3.8.1	MAYBE - Number of jobs created during construction is calculated to be 150 workers. For the operation stage there will be no workers. However, there is no information for the job opportunities during design stage. There is no explanation regarding to local economic impact of these job opportunities.	YES - While it provides faster and safer logistics for businesses and industry, it will increase access to public services by facilitating transportation for the public. These developments will create new business capacities that support economic growth and positively impact commercial activities in the region.	YES - The project improves transportation infrastructure, increasing access, improving road safety and capacity, and diversifying transportation options for businesses and the public. These changes will contribute positively to the local economy by improving logistics processes, saving fuel and time, and supporting tourism.	MAYBE - Improvement in the community attractiveness is expected through the improvement in the road standards and capacity increase. However, there is no analyses about the economic effects of this increased attractiveness.	NO - Further economic development is expected as the result of the project. However there aren't any analyses in this concept.	-	No Achievement	Superior	0	12	Job opportunies at all stages of the project should be considered with it's local economical impact. Economical impact of increased attractiveness and further economic development due to the projects should be analayzed in detail.
LD 3.2	Develop Local Skills and Capabilities	EIA Report 1.6 /2.18.3	NO - There are training programs for emergency situations but not for local skill development.	NO - There are no training programs for local skill development.	NO - There are no training programs for local skill development.	NO - There are no training programs for local skill development.	-	-	No Achievement	No Achievement	0	0	Training initiatives for the development of local skills may be a part of the project. The local workforce has skill gaps that the project team can pinpoint and fill with focused training initiatives. To guarantee long-term advantages, training, education, and skill development initiatives can continue even after the project is completed. In order to promote inclusion and local development, these programs might also target underemployed, economically distressed, or underprivileged groups.
LD 3.3	Conduct a Life-Cycle Economic Evaluation	EIA Report 1.7	NO - There is no life-cycle cost analysis of the project.	NO - There is no life-cycle cost analysis to compare alternatives.	NO - Social, environmental and financial cost and benefits of the project are not conducted.	MAYBE- There is cost benefit analyses but it does not identify social and environmental impacts of the project.	NO- Cost benefit analyses is not used to compare alternatives for project components.	-	No Achievement	No Achievement	0	0	Life cycle cost analysis could be used to identify projects financial impacts and to compare major project components with it's alternatives. Social , environmental and financial aspects of the project could be included in the cost benefit analyses and major project components could be compared with it's alternatives.
TOTAL											12	29	

Table A.1 Envision evaluation of Project X (cont'd)

RESOURCE ALLOCATION													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
	MATERIALS												
RA 1.1	Support Sustainable Procurement Practices		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 1.2	Use Recycled Materials		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 1.3	Reduce Operational Waste	EIA Report 3.8 / 3.9	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 1.4	Reduce Construction Waste	EIA Report - 3.8 /3.9 / 3.9.2 /3.9.3	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 1.5	Balance Earthwork On Site	EIA Report - 3.1 /3.2.3	YES - Fill necessary to brought to the site is 60.9% of total site soil handling, which satisfies the maximum limit of 70% but higher than the other limit of 50%.	-	-	-	-	-	Improved	Improved	2	2	More effort could be given to balance cut-fill quantity.
	ENERGY												
RA 2.1	Reduce Operational Energy Consumption		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because lighting project is not in the scope of the designer firm.
RA 2.2	Reduce Construction Energy Consumption	EIA Report 1.4	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 2.3	Use Renewable Energy		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because lighting project is not in the scope of the designer firm.
RA 2.4	Commission and Monitor Energy Systems		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because lighting project is not in the scope of the designer firm.

Table A.1 Envision evaluation of Project X (cont'd)

RESOURCE ALLOCATION													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
WATER													
RA 3.1	Preserve Water Resources	EIA Report - 2.10/2.11/2.14/ 3.7 3.8.3 /3.20/ 3.21 /3.24	YES - Project team conducted watershed assessment.	YES - Water usage and wastewater generation for the construction stage is calculated. There is no wastewater generation or water usage for the operational stage.	NO - Project does not include actions towards minimizing negative impacts to watershed-scale issues.	NO - The project does not have net-zero impact on surface water and groundwater.	NO - The project is not a part of regional plan to improve watershed.	NO - The project doesn't have net-positive improvements on watershed.	Improved	Improved	3	3	Rainwater harvesting and stormwater management techniques, such as bio-retention basins and permeable pavements, could be used in the project. The project should use recycled water, low-impact development methods, and on-site stormwater collection and treatment to reach net-zero water impact. Effectiveness will be increased by working with local authorities to align with regional watershed plans. A net-positive effect on the watershed can also be achieved by restoring wetlands, managing erosion, lowering pollution runoff, and adding wildlife-friendly water crossings.
RA 3.2	Reduce Operational Water Consumption	EIA Report - 3.6	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because there is no operational water consumption.
RA 3.3	Reduce Construction Water Consumption	EIA Report - 3.6	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
RA 3.4	Monitor Water Systems	EIA Report - 3.6	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because there is no operational water use.
TOTAL											5	5	

Table A.1 Envision evaluation of Project X (cont'd)

NATURAL WORLD													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
	SITING												
NW 1.1	Preserve Sites of High Ecological Value	EIA Report 2.6 Environmental Law Article 9	X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because there is no high ecological value in the project site.
NW 1.2	Provide Wetland & Surface Water Buffers	Hydrology Report Basin Plan p.160	YES - Project conducted map including surface water and wetlands.	NO - Buffer zone is not used in the project.	NO - Buffer zone is not used in the project.	NO - There is no information about project locating the site in order to avoid disturbance to wetland or surface waters.	NO - Buffer zone is not used in the project.	-	No Achievement	No Achievement	0	0	Studies should include buffer zones. Proposed buffer type and buffer width calculations could be provided according to soil type and properties. A site plan showing the final buffer design could be provided. For better achievement in this criteria, project team could provide documents showing the consideration of intentionally avoiding wetlands and surface waters. Previously developed lands could be considered to be used as buffer zone this way those places can return to natural state.
NW 1.3	Preserve Prime Farmland	EIA Report 2.15 / 3.37 Soil Conservation and Land Use Law	YES- Project team assessed the soil type of the selected alignment and classified according to soil fertility.	NO - According to the soil fertility analyses of the project team, it is evaluated that 86.19% of the project alignment passes through farmlands which is way above the limit of 10%.	MAYBE - There are regulations to follow regarding to the disturbed farmlands. For temporarily disturbed farmlands, soil conservation project will be developed. However it doesn't involve preservation of adjacent or similar farmland. Currently there is no construction management plan. Thus, it is unknown if it involves protection of farmlands during construction.	NO - Project site doesn't avoid prime farmland.	NO - The project site doesn't preserve farmland or restore previously disturbed farmland.	-	No Achievement	No Achievement	0	0	While choosing the road alignment more effort could be given to avoid prime farmlands and this consideration could be documented. Project could preserve farmlands against future disturbance or restore disturbed farmlands.
NW 1.4	Preserve Undeveloped Land		MAYBE - The project involves widening the existing 2x1 road to a 2x2 configuration, thus the expanded new alignment mostly follows and extends the current alignment. Although the concept of "previously developed area" has not been emphasized, approximately 60% of the route follows the existing, previously developed alignment.	NO - There are no previously developed areas which have been returned to natural space by the project.	-	-	-	-	Improved	Enhanced	3	8	During the alignment studies more effort could be given to use previously developed lands and thus less disturbance would be given to undeveloped lands. Also, it can be considered to restore previously disturbed lands back into natural habitat.

Table A.1 Envision evaluation of Project X (cont'd)

NATURAL WORLD													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
PLANNING													
NW 2.1	Reclaim Brownfields		NO - The project is not located in the brownfield. There is no study regarding to the subject of brownfield.	NO - The project is not located in the brownfield. There is no study regarding to the subject of brownfield.	NO - The project is not located in the brownfield. There is no study regarding to the subject of brownfield.	NO - The project is not located in the brownfield. There is no study regarding to the subject of brownfield.	-	-	No Achievement	No Achievement	0	0	Study could be done to identify brownfields. If there brownfields those areas could be considered for highway alignment and remediation of the site should be done. If there are no brownfields it should be documented for this credit to be not applicable.
NW 2.2	Manage Stormwater		NO - The project does not include stormwater management plan or strategies.	NO - The project does not include stormwater management plan or strategies.	NO - The project does not include sedimentation, erosion and pollution control plan. It is not known if those will be included for the construction activities.	NO - Project does not treat stormwater.	-	-	No Achievement	No Achievement	0	0	By implementing techniques that improve infiltration, evapotranspiration, reuse, and on-site treatment, the project can improve stormwater management. Additionally, drainage upgrades and natural water retention techniques can reduce the volume and rate of runoff in comparison to current conditions. A detailed erosion, sedimentation, and pollution control strategy should be put into place to lessen the effects of construction. Also, the project's overall sustainability can be improved by incorporating it into a broader stormwater management system by treating runoff from other locations or supporting regional water management initiatives.
NW 2.3	Reduce Pesticide & Fertilizer Impacts		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because landscape project is not in the scope of the designer firm.
NW 2.4	Protect Surface & Groundwater Quality	EIA Report - 2.10/2.11 /3.8.3/ 3.21 /3.24	NO - Potential contamination sources for surface and groundwater are investigated and mitigation actions are taken. However, those studies don't include potential impacts, risks and consequences of surface and groundwater pollution.	MAYBE - Project prevents polluting water sources but does not include spill and leak prevention and response plans.	MAYBE - Within a minimum 20-meter strip on either side of the stream excavation and filling are completely prohibited. It is forbidden to dispose of waste, production leftovers, or other materials from operations in or close to the stream. It is necessary to take precautions against erosion sediment and quarry debris getting to the streambed. There is no action preventing pollution during operational stage.	NO - There is no monitoring system for surface or groundwater quality.	NO - There is no action regarding to eliminating polluting or hazardous sources.	NO - The project does not improve surface or groundwater quality.	No Achievement	No Achievement	0	0	A thorough examination of possible contamination sources should be included of the project, along with an evaluation of risks, effects, and negative consequences of groundwater and surface contamination. To reduce environmental risks, reaction plans and effective spill and leak prevention are crucial. The project could incorporate pollution prevention measures during the operational phase and a surface or groundwater quality monitoring system. Actions can also be made to improve the quality of surface or groundwater, as well as to remove sources of pollution or danger. For the environment to be sustainable over the long term, proactive measures in these areas must be put into practice.

Table A.1 Envision evaluation of Project X (cont'd)

NATURAL WORLD													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
ECOLOGY													
NW 3.1	Enhance Functional Habitats	EIA Report - 2.13/ 2.15.2/ 3.16/ 3.17	MAYBE - Project team evaluated existing habitats, assessed potential impacts of the project and limited actions to minimize these negative impacts are taken. However, during site selection habitats was not considered.	NO - The project does not fully mitigate the disturbances to the terrestrial habitats.	NO - The project doesn't increase the number of terrestrial habitat.	NO - There is no improvement in the quality of new or existing habitats.	NO - The project does not provide new connections or movements between habitats.	NO - The projects doesn't return any of the developed lands into natural habitat.	No Achievement	No Achievement	0	0	In alignment studies habitats could be considered and project could fully mitigate the disturbances to terrestrial habitats. Improvement in the quality of existing habitats could be made, or new habitats could be provided to increase the number of terrestrial habitats. As a highway project it disturbs the existing connections between habitats and ecological bridges or other structures could be provided to preserve or create connections or movements between habitats. It could be considered to return any of the developed lands into natural habitat.
NW 3.2	Enhance Wetland & Surface Water Functions		MAYBE - Project identified impacts on hydrological connectivity and aquatic habitat, considered sediment transportation but not water quality.	MAYBE - Project minimizes affects to hydrological connectivity and partly sediment transport but actions regarding to water quality and aquatic habitat are mostly not considered.	YES - Project protects hydrological connections by culverts and bridges.	NO- Quality of water is not evaluated.	MAYBE - Habitat survey has been conducted by professionals. However there is no action to protect or restore aquatic habitat.	MAYBE- Sediment transport is protected through the use of bridge and culverts in the project. Structure sizing is done considering sediment accumulation and accumulated sediment is planned to be removed during maintenance. However there are no details to how the sediment will be removed and what would be done to removed sediment. Also there is no engineer involved in the project who has specialized in sediment transport.	No Achievement	No Achievement	0	0	Along with the projects impacts on hydrological connectivity and aquatic habitat, sediment transportation project team should also consider water quality. According to the impacts comprehensive mitigation measures should be studied for subjects hydrological connectivity, aquatic habitat, sediment transportation and water quality.

Table A.1 Envision evaluation of Project X (cont'd)

NATURAL WORLD													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
NW 3.3	Maintain Floodplain Functions	Bridge Reports	MAYBE - Structures in the project are design according to 100 years or 500 years of flood flow rate. However, there is no floodplain map and no consideration of climate change effects on floodplain map.	NO - There is no site map indicating floodplain and indication of natural zones.	NO - No steps have been taken by the project to minimize its effects on floodplain functions. No documents show that floodplain storage has been preserved, riparian buffers improved or natural infiltration preserved.	NO - There is no information about locating the project site to avoid floodplains.	NO - There is no action to remove structures from the floodplain.		No Achievement	No Achievement	0	0	Floodplain map should be studied with climate change effects. Vegetated zones in the floodplain should be studied, preserved and shown in the site map. Studies should be done in order to decrease the projects effect on floodplain functions such as floodplain storage, buffers and natural infiltration.Project site should be chosen to avoid floodplains and existing structures in the floodplain should be removed and developed for vegetated state
NW 3.4	Control Invasive Species		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because landscape project is not in the scope of the designer firm.
NW 3.5	Protect Soil Health	Land Use and Land Protection Law Law on the Improvement of Olive Cultivation and Grafting of Wild Species Regulation on the Protection, Use, and Land Consolidation of Agricultural Lands Pasture Law EIA Report- 2.15.4 / 3.14 / 3.37	YES - Percentage of total disturbed area through the project is given clasified according to soil properties. Soil disturbance is limited with 250m left and right of the project for the construction activities.	MAYBE - Topsoil is stripped and restored during construction to reuse in the project for landscape. However, there is no document indicating that 95% of post-construction vegatated areas to be restored after construction activities.	MAYBE - Soil protection plan is supposed to be prepared but not submitted in this stage of the project.	NO - Project does not include any restoration for previously disturbed areas.	-	-	No Achievement	Superior	0	4	Efforts could be made to show that the 95% vegetative restoration criterion is being met. The plan for protecting the soil needs to be created. To preserve soil health, removed topsoil must also be managed properly, which includes storage, erosion prevention, and additives. Finally, looking into possibilities for revegetation or soil restoration of previously disturbed areas could improve sustainability performance even further.
TOTAL											3	12	

Table A.1 Envision evaluation of Project X (cont'd)

CLIMATE AND RESILIENCE													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
EMISSIONS													
CR 1.1	Reduce Net Embodied Carbon		X	X	X	X	X	X	X	X	X	X	This credit is not included in the evaluation because contractor is responsible from this subject.
CR 1.2	Reduce Greenhouse Gas Emissions		No - Greenhouse gas emissions are not considered.	No - Greenhouse gas emissions are not considered.	-	-	-	-	No Achievement	No Achievement	0	0	Calculating baseline emissions for the course of the project's operation is necessary to evaluate its greenhouse gas impact. The project team should determine the operational time, estimate annual emissions, and compute the percentage decrease from the baseline. In order to facilitate ongoing monitoring and development, the project team may also compute and report yearly greenhouse gas emissions.
CR 1.3	Reduce Air Pollutant Emissions	ÇED Raporu - 3.10 /3.11 /3.12 ÇED Raporu EK-11 Hava Kalitesi Modelleme Raporu	YES - Project does meet all minimum air quality regulations and standards.	MAYBE - Total annual air pollutant emission is calculated for the construction and operation stage of the project. However, there is no strategies to reduce emissions during operations.	NO - There is no monitoring system on air pollutants.	NO - There is no consideration on the effects of volatile organic compounds (VOC) on workers.	NO - Project does not remove existing air pollutant sources.	-	No Achievement	Improved	0	2	To guarantee commitment to environmental and health regulations, the project should include reduction strategies for operational air pollution and continuous monitoring and control of direct air pollutant emissions. Maintaining a safe working environment requires evaluating how volatile organic compounds (VOCs) affect construction personnel and project operators. Furthermore, initiatives to eliminate or reduce current sources of air pollutants can enhance air quality and promote sustainability over the long run.

Table A.1 Envision evaluation of Project X (cont'd)

CLIMATE AND RESILIENCE													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
RESILIENCE													
CR 2.1	Avoid Unsuitable Development		YES - The project team investigated potential siting hazards has been done and design includes engineering solutions in order to minimize the risks of hazards.	NO - There are no documentation showing alternative project site study has been done in order to minimize siting risks.	YES - Mitigation measures have been done in the project including engineering structures to reduce and mitigate the risk of site hazards.	NO - There is no documentation showing the chosen project site is the one with the lowest potential site hazard.	NO - Project site does not fully avoid site hazards.	NO - There is no removal of existing structure due to potential future site hazard.	No Achievement	No Achievement	0	0	The project team needs to demonstrate that the site location was chosen according to comprehensive study on different site alternatives and their site hazard risks. Project team should demonstrate that the least risky site are is chosen while still fulfilling project specifications. The location should be purposefully chosen to stay clear of known hazards including earthquakes, landslides, and flooding. To improve resilience and guarantee long-term safety, any existing structures that are prone to frequent damage should also be taken down or altered.
CR 2.2	Assess Climate Change Vulnerability		NO - There is no consideration of climate change threats.	NO - There is no consideration of climate change threats.	NO - There is no consideration of climate change threats.	NO - There is no consideration of climate change threats.	NO - There is no consideration of climate change threats.	-	No Achievement	No Achievement	0	0	The project team could evaluate the risks posed by climate change to the community, the infrastructure system, the project, and its surroundings. Enhancing resilience involves identifying areas that are susceptible to harsh weather, changes in temperature, and sea level rise. Furthermore, informing stakeholders about climate risk results guarantees well-informed decision-making and strengthens adaptive tactics for long-term sustainability.
CR 2.3	Evaluate Risk & Resilience		NO - There is no risk assessment.	NO - There is no risk assessment.	NO - There is no risk assessment.	NO - There is no risk assessment.	NO - There is no risk assessment.	NO - There is no risk assessment.	No Achievement	No Achievement	0	0	A thorough risk assessment that takes into account the community, infrastructure system, and project should be carried out by the project team. For resilience to be strengthened, vital functions, dependencies, and possible risks or hazards must be identified. Furthermore, evaluating risks and vulnerabilities by calculating the likelihood and consequences of threats improves readiness. A comprehensive and successful approach to risk management is ensured by involving the owner and other stakeholders in the risk assessment process.

Table A.1 Envision evaluation of Project X (cont'd)

CLIMATE AND RESILIENCE													
Code	Credit Name	Referance Documents	Evaluation						Achievement Level		Score		Recommendations
			A	B	C	D	E	F	Base	Upper	Base	Upper	
CR 2.4	Establish Resilience Goals and Strategies		NO - There is no study in defining project performance goals and owner's risk appetite.	NO - There is no risk assessment and risk management strategies.	NO - There are no resilience goals.	NO - There are no resilience or climate change adaptation goals of the project.	-	-	No Achievement	No Achievement	0	0	The owner's risk tolerance and performance targets should be determined by the project team to guarantee alignment with resilience and sustainability goals. The team must create risk management plans based on a thorough risk assessment in order to handle any obstacles. It's critical to include essential stakeholders in the development of resilience goals. To increase its influence on regional sustainability, the initiative should also support or contribute to more general community resilience or climate change adaptation objectives.
CR 2.5	Maximize Resilience		NO - There are no risk evaluation or resilience goals.	NO - There are no resilience strategies.	NO - There are no resilience strategies.	NO - There are no resilience strategies.	NO - There are no resilience strategies.	-	No Achievement	No Achievement	0	0	To manage key risks and improve long-term durability, the project team could create resilience goals and plans based on a thorough risk assessment. Throughout the project delivery process, regular assessments and ongoing monitoring are crucial to determining its effectiveness. To guarantee long-lasting effects, resilience goals and methods should also be incorporated into continuing operations and maintenance. Adaptive management and continuous development are further supported by the inclusion of techniques for assessing and quantifying resilience performance.
CR 2.6	Improve Infrastructure Integration		NO - There is no consideration of infrastructure integration.	NO - There is no consideration of infrastructure integration.	NO - There is no consideration of infrastructure integration.	NO - There is no consideration of infrastructure integration.	NO - There is no consideration of infrastructure integration.	-	No Achievement	No Achievement	0	0	To reduce the danger of cascading or systemic failures, the project can improve the amount of integration between internal and external systems. Incorporating data or monitoring systems with infrastructure networks can also help increase performance.
TOTAL											0	2	

B. Environmental Engineers' Interview Questions

1. Mesliğiniz ve uzmanlığınız nedir?
2. Kaç yıl tecrübeniz bulunmaktadır?
3. Daha önce sürdürülebilirlik ilkelerini benimseyen bir projede görev aldınız mı?
4. Sürdürülebilirlik derecelendirme sistemleri hakkında neler biliyorsunuz?
5. QL1.4 Minimize Noise & Vibration (E)

Projelerde mevcut gürültü seviyelerinin korunması veya azaltılması nasıl sağlanmaktadır?

(Mevcut ve öngörülen işletme aşamasındaki gürültü ve titreşim seviyelerinin analizi. Projede uygulanan azaltıcı önlemlerin, çevredeki toplulukta mevcut koşulların ötesinde insan kulağı tarafından fark edilebilecek bir gürültü artışına neden olmaması.)

6. QL3.2 Preserve Historic & Cultural Resources (F)

Projeler, topluluktaki tehdit altındaki veya bozulmuş tarihi/kültürel kaynakları iyileştiriyor, eski haline getiriyor veya koruma altındaki bir kaynağı tescilli bir listeye dahil ediyor mu?

(Örneğin: hükümet standartlarına uygun rehabilitasyon, tarihi peyzaj veya yeşil alan gibi kaybolmuş unsurların restorasyonu, kültürel etkinlikler için kullanılan tesislerin yenilenmesi ve genişletilmesi veya tarihi/kültürel paydaşların taleplerine uygun olarak halka açık eğitim/müze alanlarının oluşturulması veya proje sonucunda bir kaynağın koruma altındaki bir listeye eklenmesi.)

7. QL3.4 Enhance Public Space and Amenities (D)

Projeler, kamusal alanları ve/ya olanakları önemli ölçüde iyileştirme, oluşturma veya yeniden kazandırma konusunda ne derece katkı sağlamaktadır?

(Yeni veya iyileştirilmiş kamusal alanlar/olanaklar için yapılan çalışmaların kapsamını ve boyutunu gösteren planlar ve çizimler, yerel topluluk için önemli bir değer taşıdığını gösteren kanıtlar. Örneğin, proje, yeterli park alanına sahip

olmayan bir mahallede bir halk parkı sağlayarak uzun vadeli topluluk hedeflerine katkıda bulunuyor olabilir.)

8. RA3.1 Preserve Water Resources (D)

Projeler, su kalitesinden ödün vermeden tatlı yüzey suyu ve yeraltı suyu kaynaklarının miktarı ve erişilebilirliği üzerinde net sıfır etki yaratabilir mi?

(Projenin su kullanımının, tatlı yüzey suyu ve yeraltı suyu kaynaklarının miktarı ve kullanılabilirliği üzerinde hiçbir etkisi olmayacağını gösteren hesaplamalar. Projenin, havzadaki su kalitesini tehlikeye atmadığını açıklayan belgeler.)

9. NW1.2 Provide Wetland & Surface Water Buffers (B)

Projelerde, sulak alanları ve yüzey sularını korumak için gerekli tampon bölge türüne ve genişliğine yönelik çalışmalar yapılmakta mıdır?

(Uygun tampon bölge genişliği ve tipini belirlenirken, arazi koşulları (toprak türü, eğim, arazi kullanımı ve bitki örtüsü karışımını) dikkate alınır. Önerilen tampon bölge genişliği ve tipinin, pestisit tutulumu; kıyı stabilizasyonu, sediment kontrolü; besin maddesi tutumu, çöp ve atıklar, su sıcaklığı; kara hayvanları, ve sucul hayvanlar konularını ele almada yeterli olmalı. Su kütlelerinin asidifikasyonu ve/veya eutrofikasyonunun kümülatif etkilerini proje tasarımında dikkate alınır.)

10. NW1.2 Provide Wetland & Surface Water Buffers (C)

Projelerde, sulak alanlar ve yüzey suları etrafında koruyucu tampon bölgeleri uygulanmakta mıdır?

(Nihai alan tasarımını, tampon bölge sınırlarını ve tampon bölge sınırı ile belirlenen sulak alan, su kütlesi veya kıyı çizgisi arasındaki en kısa mesafeyi gösteren bir bölge planı hazırlanır. Tampon tasarımının, başarı seviyeleri gereksinimlerini karşıladığını gösteren belgeler. Koruyucu tamponun büyük kısmının doğal alan (örneğin, biçilmeyen çimenler) olması istenir.)

11. NW1.2 Provide Wetland & Surface Water Buffers (E)

Projeler, tampon bölge içerisinde daha önce geliştirilmiş veya bozulmuş alanları doğal haline döndürmeye yönelik çalışmalar içermekte midir?

(Proje alanındaki koruyucu tampon bölgeler içinde doğal hale döndürülecek geliştirilmiş alanların harita ve plan çalışmaları.)

12. NW1.3 Preserve Prime Farmland (E)

Projelerde, mevcut tarım arazilerini gelecek nesiller için korumaya veya daha önce bozulmuş tarım arazilerini restore etmeye yönelik çalışmalar yapılmakta mıdır?

(Tarım arazisinin, gelecekteki bozulma veya yapılaşmaya karşı gelecek nesiller için korunduğunu gösteren belgeler.)

13. NW1.4 Preserve Undeveloped Land (B)

Projelerde, geliştirilmiş alanları doğal açık alan, habitat veya doğal hidrolojiyi destekleyecek bir duruma geri getirmek için çalışmalar yapılmakta mıdır?

(Daha önce geliştirilmiş (inşa edilmiş veya insan müdahalesine uğramış) alanların doğal haline geri döndürüldüğünü gösteren belgeler.)

14. NW2.1 Reclaim Brownfields (A)

Projelerde, kapalı terkedilmiş endüstri bölgesi olarak tanımlanan bir alanda yer almasına yönelik çalışmalar yapılmakta mıdır?

(Kapalı terkedilmiş endüstri bölgesi, önceden endüstriyel veya ticari faaliyetler için kullanılmış ancak şu anda atıl durumda olan ve potansiyel olarak kirlenmiş bir araziyi ifade eder. "Kapalı" ifadesi, bu alanın artık aktif olarak kullanılmadığını veya kapatıldığını belirtir.)

15. NW2.1 Reclaim Brownfields (B)

Projelerde, aktif terkedilmiş endüstri bölgesi olarak tanımlanan alanda yer almasına yönelik çalışmalar yapılmakta mıdır?

(Aktif terkedilmiş endüstri bölgesi, daha önce endüstriyel veya ticari faaliyetler için kullanılmış, ancak hâlâ bir dereceye kadar faaliyet gösteren veya kısmen kullanılan

bir alanı ifade eder. Bu tür araziler, genellikle kirlenmiş olabilir ancak tamamen terk edilmemiştir. Rehabilitasyon ve yeniden geliştirme için fırsatlar sunarken, mevcut kullanımlar nedeniyle ek zorluklar da içerebilir.)

16. NW2.1 Reclaim Brownfields (C)

Projelerde, aktif terkedilmiş endüstri bölgesi alanını hafifletici veya iyileştirici çalışmalar yapılmakta mıdır?

(İlgili düzenleyici kurumlar tarafından onaylanmış bir azaltım ve iyileştirme planı sunulmalıdır. Planın, pasif ve/veya aktif iyileştirme hedef seviyelerine ulaşmalıdır. Mevzuata veya saha özelinde belirlenen konsantrasyon eşiklerini aşan tüm kirletici maddeler için, sahada veya önerilen geliştirme alanına göç etme potansiyeline sahip olan kirleticiler için kullanılan muhafaza, azaltım ve/veya iyileştirme yöntemlerinin tanımlanması. Eğer ilgili kirletici maddeler arasında potansiyel olarak uçucu bileşikler bulunuyorsa, uygulanabilir olduğunda buhar giriş yolunun değerlendirilmesi ve gerektiğinde bir azaltım yaklaşımının belirlenmesi.)

17. NW2.1 Reclaim Brownfields (D)

Projelerde, aktif terkedilmiş endüstri bölgesi alanı kapatılma sürecine getiriliyor mu?

(Alanın ilgili düzenleyici kurumlar tarafından kapatıldığını veya kapatma/derecelendirme sürecinde olması.)

18. NW3.1 Enhance Functional Habitats (A)

Projelerde, alan seçimi sırasında mevcut kara habitatları belirlenerek, habitatlara olan etkiyi minimize etmek amaçlanmakta mıdır? Bu konuda ne gibi çalışmalar yapılmaktadır?

(Proje bölgesi ve çevresindeki önemli habitat alanlarının, habitat alanları arasındaki potansiyel ve/veya muhtemel hareket koridorlarının ve bu koridorlar üzerindeki olası mevcut engellerin araştırılması.)

19. NW3.1 Enhance Functional Habitats (B)

Projelerde, fonksiyonel kara (toprak) habitatlarına yönelik tüm bozulmaları hafifletici çalışmalar yapılmakta mıdır?

(Gelişimin sonucunda oluşacak yeni etkiler veya engelleri tanımlayan ve bunları en aza indirmek veya hafifletmek için alınacak spesifik eylemler. Çalışmalar, proje alanında, bitişik bir komşu parselde veya etkilenen peyzaj içinde olmalıdır. Hafifletme önlemleri, hayvanların gelişim tamamlandıktan sonra önceki habitatlarına erişebilmelerini sağlamak için net habitat kalitesini, miktarını ve bağlantısını korumalıdır. Habitat kalitesini ve bağlantıyı korumak için hafifletme önlemlerinin etkin olduğunu doğrulamak amacıyla bir izleme planı oluşturulmalıdır.)

20. NW3.1 Enhance Functional Habitats (C)

Projelerde, kara habitatlarının miktarı arttırılmakta mıdır?

(Yeni habitat sağlamak için alınan önlemleri gösteren bir arazi planı ve yeni habitattan faydalanacak türlerin tanımlanması.)

21. NW3.1 Enhance Functional Habitats (D)

Projelerde, mevcut veya önerilen yeni kara habitatlarının kalitesini iyileştirmeye yönelik çalışmalar yapılmakta mıdır?

(Projedeki mevcut habitatın kalitesini iyileştirmek için alınan önlemler ve eğer projeye yeni habitat öneriliyorsa, önerilen habitatın kalitesini iyileştirmek için alınan önlemler. Habitat iyileştirme çabaları ve bu çabaların arazideki türlere beklenen etkisi. Habitat kalitesini iyileştirmek için alınan önlemlerin performans hedeflerine ulaşmasını sağlamak amacıyla bir izleme veya bakım planı.)

22. NW3.1 Enhance Functional Habitats (E)

Projelerde, kara habitatları arasındaki hareketi kolaylaştırmaya, yeni bağlantılar sağlamaya veya engelleri kaldırarak habitat bağlantısını iyileştirmeye yönelik çözümler eklenmekte midir?

(Habitatlar arasındaki yeni bağlantıların sağlandığını ve bu bağlantıların yerel yaban hayatı için uygunluğunu gösterilmesi ve/veya mevcut hareket ve habitat bağlantısı engellerinin kaldırılması. İyileştirilmiş habitat bağlantılığını doğrulamak için bir izleme planı.)

23. NW3.1 Enhance Functional Habitats (F)

Projelerde, geliştirilmiş alanı doğal habitat haline getirmek veya mevcut habitatı korumak amaçlanmakta mıdır?

24. NW3.2 Enhance Wetland & Surface Water Functions (A)

Projelerde, sulak alanlar ve yüzey suyu fonksiyonlarına yönelik potansiyel etkiler belirlenmekte midir?

(Sulak alanlar ve yüzey suyu işlevlerine, hidrolojik bağlantı, su kalitesi, sucul habitat ve sediment taşıma dahil olmak üzere tüm potansiyel etkilerin tanımlanması.)

25. NW3.2 Enhance Wetland & Surface Water Functions (B)

Projelerde, sulak alanlar ve yüzey suyu işlevlerine verilen rahatsızlıkları en aza indirme ve hafifletme çalışmaları dahil edilmekte midir?

(Sulak alanlar ve yüzey suyu işlevlerine; hidrolojik bağlantı, su kalitesi, sucul habitat ve sediment taşıma gibi konularda verilen rahatsızlıkları en aza indirmek için uygulanan stratejiler ve kaçınılmaz kayıpları telafi etmek için hafifletme önlemleri alınması.)

26. NW3.2 Enhance Wetland & Surface Water Functions (D)

Projelerde, su kalitesini korumak veya restore etmek amaçlanmakta mıdır?

(Akarsuyun normal akışının mevcut kaynağını, kaynak suyunun su kalitesini ve su kalitesinin nasıl korunacağı veya yeniden sağlanacağına dair çalışmalar.)

27. NW3.2 Enhance Wetland & Surface Water Functions (E)

Projelerde, sucul habitatı korumak veya restore etmek amaçlanmakta mıdır?

(Su kütlesi ve referans alanlarının, tanınmış bir profesyonel tarafından yapılan habitat anketi ve sucul ve kıyısal türler için habitatı korumak veya yeniden sağlamak amacıyla dikim ve uygun fiziksel değişikliklerle yapılan bir plan. Bu çalışma, mevcut engellerin (örneğin, barajlar, yol yapıları ve sucul veya kıyısal türlerin göçünü engelleyebilecek diğer altyapılar) habitat bağlantısını engellediği yerleri ve önerilen hafifletme önlemlerini içerebilir.)

28. NW3.3 Maintain Floodplain Functions (B)

Projelerde, taşkın alanındaki bitkisel bölgeler korunmakta mıdır?

(Proje geliştirilmeden önce ve geliştirilmesinden sonra, taşkın alanı içindeki doğal/bitkilendirilmiş bölgelerin alanını gösteren bölge haritaları. Gelişim sonrası mevcut bitkilendirilmiş alanların yüzdesinin hesaplanması.)

29. NW3.5 Protect Soil Health (B)

Projelerde, herhangi bir gelişim faaliyetleriyle bozulan bitkisel alanlar, sağlıklı bitki ve ağaç büyümesini destekleyecek uygun toprak tipi, yapısı ve fonksiyonu için restore edilmekte midir?

(Toprak restorasyon faaliyetlerinin, proje sonrası bitkilendirilmiş alanların en az %95'inin sağlıklı bitki ve ağaç büyümesini destekleyecek şekilde restore edilmesi. Topraklar, orijinal fonksiyonlarıyla yeniden kullanılmalıdır (yani, üst toprak üst toprak olarak, alt toprak alt toprak olarak kullanılmalı ya da alt toprak, işlevsel üst toprak haline getirilmelidir). Bitkilendirilmiş alanlardaki bozulmuş doğal toprakların, mümkün olduğunca alanda korunup yeniden kullanılması.)

30. NW3.5 Protect Soil Health (C)

Projelerde, toprak koruma planı veya politikaları uygulanmakta mıdır?

(Toprak koruma planının veya politikalarının, en azından özel peyzaj özelliklerini tanımladığını ve koruyucu bölgelerinde toprak bozulmasını önlemek için en iyi yönetim uygulamalarını içermesi.)

31. NW3.5 Protect Soil Health (D)

Projelerde, eski gelişim faaliyetleriyle bozulan bitkisel alanlar, uygun toprak tipi, yapısı ve fonksiyonu ile restore edilmekte midir?

(Projenin, daha önce bozulmuş alanları sağlıklı bitki ve ağaç büyümesini destekleyecek bir duruma geri getirmeyi içerdiğine dair belgeler. Sertifikalı bir toprak bilimci rehberliğinde, toprakların işlevselliğini (örneğin, restore edilen toprakların, referans topraklar gibi uygun su tutma kapasitesine, besin tutma yeteneğine ve erozyon önleyici kapasiteye sahip olması) göstermesi gerekmektedir.)

32. CR1.2 Reduce Greenhouse Gas Emissions (A)

Projelerde, operasyonel yaşam süresi boyunca oluşacak sera gazı emisyonlarını azaltmaya yönelik çalışmalar yapılmakta mıdır?

(Projenin operasyonel ömrü boyunca (örneğin, 25 yıl) temel sera gazı emisyonlarının hesaplanması. Aynı dönem boyunca kullanılan temel emisyon değerlerine kıyasla yüzde azaltım hesaplamaları. Bazı durumlarda, projenin ömrü boyunca bir talep veya hacim artışı bekleniyorsa, proje ekipleri emisyon azaltımlarını birim başına hesaplamayı tercih edebilir (örneğin, yolcu kilometreleri, işlenen su miktarı gibi).)

33. CR1.2 Reduce Greenhouse Gas Emissions (B)

Projelerde, yıllık sera gazı emisyonları hesaplanıp raporlanmakta mıdır?

(Hesaplamalar, proje sınırları içinde sahip olunan veya kontrol edilen tesisler, süreçler veya araçlardan kaynaklanan tüm emisyonları ve projenin kullandığı enerjinin yerinde üretimi dışındaki dolaylı emisyonları içermelidir.)

34. CR1.3 Reduce Air Pollutant Emissions (B)

Projelerde, operasyonlar sırasında hava kirletici emisyonlarını azaltmaya yönelik çalışmalar yapılmakta mıdır?

(Projenin ömrü boyunca yıllık toplam hava kirletici emisyonlarının tahminleri. Hava kirletici emisyonlarını azaltmak için uygulanan tüm stratejilerin belgelenmesi ve mevcut en iyi kontrol sistemlerini veya en iyi yönetim uygulamalarını kullanılması)

35. CR1.3 Reduce Air Pollutant Emissions (C)

Projelerde, doğrudan hava kirletici emisyonlarının sürekli izlenmesi ve yönetimi dahil edilmekte midir?

(Proje, operasyonlar sırasında doğrudan salınan hava kirleticilerinin izlenmesi için sistemler içermesi, emisyonlardaki değişiklikleri belirlemek ve performansı sürdürmek amacıyla süreçlerin, tasarlanmış prosedürlerin veya sistemlerin olması.)

C. Highway Alignment Engineers' Interview Questions

1. Mesleğiniz ve uzmanlığınız nedir?
2. Kaç yıl tecrübeniz bulunmaktadır?
3. Daha önce sürdürülebilirlik ilkelerini benimseyen bir projede görev aldınız mı?
4. Sürdürülebilirlik derecelendirme sistemleri hakkında neler biliyorsunuz?
5. QL1.1 Improve Community Quality of Life (D)

Proje sürecinde topluluk geri bildirimlerinin toplanması, değerlendirilmesi ile birlikte tasarım sürecine dahil ediliyor, projede bu doğrultuda değişiklikler yapılıyor mu? Yapılıyorsa örnek verebilir misiniz?

(Çiftçilerin ekinlerine ulaşabilmesi için 10 km'lik bir yolun oluşturulmasını talep etmesi ve proje dahil edilmesi, proje sonucu oluşacak gürültü endişelerinden ötürü projeye ses bariyeri eklenmesi.)

6. QL2.2 Encourage Sustainable Transportation (A)

Mevcutta bulunan aktif ulaşım (bisiklet, yürüyüş yolları), paylaşımlı ulaşım veya toplu taşıma seçeneklerine kolay erişim sağlama çalışmaları yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Projenin 0,8 km'lik (10 dakikalık yürüyüş mesafesi) alan içinde yaya erişimini ve ulaşım bağlantılarını gösteren harita çalışması.)

7. QL2.2 Encourage Sustainable Transportation (B)

Aktif, paylaşımlı veya toplu taşıma kullanımını teşvik edecek elementler projeye dahil ediliyor mu? Projeye dahil ediliyorsa bunlar nelerdir?

(Kısıtlı otopark uygulaması, proje alanına ve/veya projeye bağlı kesintisiz kaldırımlar, yollar ve/veya bisiklet ağlarının genişletilmesi, projeye yakın veya proje alanında birleşen yaya ve bisiklet yolları ağına uygun topoğrafya, kapalı duraklar veya yürüyüş yolları gibi hava koşullarına karşı koruma.)

8. QL2.3 Improve Access & Wayfinding (A)

Acil durum yönetimi, tahliye ve acil müdahale ekiplerinin erişimiyle ilgili çalışmalar yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Ambulans, itfaiye, polis için yeterli giriş ve çıkış noktaları, kaçış ve tahliye güzergâhlarının belirlenmesi, alternatif güzergâhlar ve yönlendirme sistemlerinin oluşturulması, yolun genişliği, şerit düzeni ve tasarımının acil müdahaleleye uygunluğu, yol boyunca acil durum cep alanları veya güvenlik şeritleri, acil durum müdahaleleri için uygun sinyalizasyon, yönlendirme tabelaları ve aydınlatma sistemleri.)

9. QL 2.3 Improve Access & Wayfinding (B)

Erişim, güvenlik ve yönlendirme sistemlerini kullanarak çevresel etkileri en aza indirmek veya çevresini korumak için çalışmalar yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Projenin yakındaki hassas alanları (sulak alanlar, kültürel alanlar vb.) korumak, nüfusun yoğun olduğu alanlarda, yaya ve araç trafiği bölgelerini net bir şekilde ayırarak güvenliği arttırmak, erişim yolları, bisiklet yolları veya yaya yolları net bir şekilde işaretlemek.)

10. QL 2.3 Improve Access & Wayfinding (C)

Proje kapsamında, toplumun yararına olacak şekilde erişilebilir, güvenli ve herkes için kullanılabilir kamusal alanlar yapılıyor mu? Yapılıyorsa örnek verebilir misiniz?

(Engelli dostu kaldırımlar, güvenli yaya geçitleri, bisiklet yollarına erişim sağlayan bağlantı noktaları veya kamusal ulaşım duraklarıyla entegre edilmiş girişler.)

11. QL 2.3 Improve Access & Wayfinding (D)

Topluluk veya mahalle erişimini, güvenliğini ve yönlendirmeyi iyileştirecek çalışmalar yapılıyor mu? Tasarlanıyorsa örnek verebilir misiniz?

(Aydınlatılmış ve güvenli yaya yolları, açık ve erişilebilir kamusal alanlar, yönlendirme tabelaları, trafik yatıştırma önlemleri veya toplu taşıma bağlantılarını güçlendiren çözümler.)

12. QL 3.2 Preserve Historic & Cultural Resources (E)

Güzergah çalışması sırasında tarihi ve kültürel bölgelerden kaçınmak ne kadar önceliklendiriliyor?

13. RA1.5 Balance Earthwork On Site

Projelerde kazı dolgu malzemelerinin proje içerisindeki dengesini sağlamak ne kadar önceliklendiriliyor?

14. RA 3.1 Preserve Water Resources (C)

Su kullanımının olumsuz etkilerini ve/veya havza ölçeğindeki sorunları en aza indirmeye yönelik çalışmalar yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Geçirgen asfalt kullanımı, suyun tutulmasını sağlayan yeşil altyapı çözümleri, taşkın alanları ve sel havuzları oluşturmak, sediment çökeltme havuzları, yağ ve ağır metal partiküllerini tutan filtreler)

15. NW 1.2 Provide Wetland & Surface Water Buffers (D)

Güzergahı sulak alanlardan ve yüzey sularından minimum tampon mesafeleri dışında konumlandırmak ne derece önceliklendiriliyor?

16. NW 1.3 Preserve Prime Farmland (B-D)

Güzergah seçilirken verimli, özgün veya önemli tarım arazilerinden geçilmemesi, korunan tarım arazilerinin birbirine bitişik ve tarım yapmaya uygun işlevsel bir şekilde kalması ne derece önceliklendiriliyor?

17. NW 1.4 Preserve Undeveloped Land (A)

Proje arazisinin daha önceden kullanılmış araziler üzerine konumlandırılması ne derece önceliklendiriliyor?

18. NW 2.1 Reclaim Brownfields (A-B)

Güzergahın, önceden sanayi veya başka bir amaçla kullanılmış ve potansiyel olarak kirlenmiş olan arazi üzerinde konumlandırılması ne derece önceliklendiriliyor?

19. NW2.2 Manage Stormwater (A)

Yağmur suyunu sahada sızdırma, terleme yoluyla buharlaştırma, yeniden kullanma ve/veya arıtma metodları projelere dahil ediliyor mu? Örnek verebilir misiniz?

(Sızdırma: biyolojik hendekler, Terleme ve buharlaşma: ağaçlandırma, yeşil refüjler, Yeniden kullanım: yağmur suyu depolama sistemleri, Artıma: yağmur suyu ayrıştırma, filtereleme sistemleri.)

20. NW2.2 Manage Stormwater (B)

Tamamlanan proje, mevcut koşullara kıyasla yüzey akış hızını veya miktarını ne ölçüde sınırlandırdığı araştırılıyor mu? Yapılıyorsa anlatabilir misiniz?

(Proje doğal veya mevcut arazi koşullarında belirli bir yağış miktarıyla oluşan yağmur suyu akışını artırmamalı. Projenin, ilgili 2-, 5-, 10-, 25-, 50- ve/veya 100-yıllık 24 saatlik yağış olayları için akış hızı veya miktarını aşmamalı. Yağış suyunun kontrolsüz bir şekilde çevreye yayılmasını önlemek için yağmur suyu depolama havuzları, drenaj sistemleri ve geçirgen yüzeyler dahil edilebilir.)

21. NW 3.1 Enhance Functional Habitats (B-E)

Kara habitatları üzerindeki olumsuz etkileri minimize etmek için hafifletme önlemleri alınıyor mu? Alınıyorsa bunlar nelerdir?

(Yaban hayatı köprüleri, alt geçitler vb.)

22. NW 3.2 Enhance Wetland & Surface Water Functions (B)

Sulak alan ve yüzey suyu işlevlerindeki bozulmayı en aza indirmek ve telafi etmek amacıyla su kalitesi açısından çalışmalar yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Yağmur suyu arıtma ve toplama sistemleri, çökeltme havuzları, filtrasyon sistemleri, karayolu yüzeyine dökülen yakıt, yağ, antifriz gibi kirleticilerin suya karışmasını önlemek için sızdırmazlık kaplamaları, doğal su yollarının akış yönünün korunması, aşırı su akışını engellemek için geçirimli yüzeyler tercih edilmesi.)

23. NW 3.2 Enhance Wetland & Surface Water Functions (B-F)

Sulak alan ve yüzey suyu işlevlerindeki bozulmayı en aza indirmek ve telafi etmek amacıyla sediment taşınımı açısından çalışmalar yapılıyor mu? Yapılıyorsa bunlar nelerdir?

(Erozyon kontrol önlemleri, eğimli alanlarda sediment perdeleri, çökeltme havuzları kullanılması, geotekstil bariyerler ve çitler ile gevşek toprak ve çamurun suya karışması önlenmesi, suya karışabilecek gevşek malzemelerin stabilize edilmesi (taş döşeme, bitki örtüsü vb.).)

24. NW 3.3 Maintain Floodplain Functions (A)

İklim değişikliği tahminlerinin, taşkın alanı haritasına ve projeye olası etkileri değerlendiriliyor mu?

(Proje mevcut taşkın alanı haritalarına göre güvenli bir bölgede yer alıyor olabilir. Ancak iklim değişikliği nedeniyle artan yağış miktarı ve deniz seviyesi yükselmesi, bu haritaların güncellenmesini gerektirebilir.)

25. NW 3.3 Maintain Floodplain Functions (C)

Taşkın alanı işlevlerine yönelik etkileri hafifletmek için önlemler alınıyor mu? Örnek verebilir misiniz?

(Su baskını alanı depolama kapasitesini korumak veya artırmak, gelişim öncesi suyun sızma kapasitesini korumak için su geçirmez yüzeyler, bitki örtüsü ve toprak koruma bölgeleri, su baskını sızması ve kirleticilerin filtrelenmesine olanak tanıyan diğer yaklaşımlar, su baskını alanındaki su yolları boyunca veya içinde, riparyen tamponlar gibi habitatları korumak veya iyileştirmek.)

26. NW 3.3 Maintain Floodplain Functions (B-D)

Taşkın alanlarından kaçınmak ne derece önceliklendiriliyor?

27. NW 3.3 Maintain Floodplain Functions (E)

Taşkın alanındaki yapıları kaldırıyor veya daha önceden geliştirilmiş alanları bitkisel bir duruma geri getiriyor musunuz?

(Daha önce taşkın riski yüksek bir alandan geçiyorsa, bu bölgede yer alan eski yerleşim alanları veya altyapı yapıları kaldırılabilir, taşkın riskinin yüksek olduğu bir bölgedeki betonlaşmış alanlar doğal bitki örtüsüyle yeniden yeşillendirilebilir.)

28. CR 2.1 Avoid Unsuitable Development (B-D-E)

Proje alanındaki risklerden kaçınacak alternatif çalışmaları ne derece önceliklendiriliyor?

(Dik yamaçlar (> 20 derece) Kalıcı don

Olumsuz jeoloji

Taşkın riski taşıyan alanlar Tehlike altındaki kıyı bölgeleri)

29. CR 2.1 Avoid Unsuitable Development (F)

Gelecekte arazi koşullarıından dolayı hasar görme riski yüksek olan mevcut yapıları kaldırılıyor veya değiştiriliyor mu?

(Yağış nedeniyle heyelan riski taşıyan yollar, taş duvarlar, istinat duvarları veya kazıklı sistemlerle güçlendirilebilir. Deniz kenarında inşa edilmiş bir yol, kıyı erozyonu veya deniz seviyesindeki yükselme nedeniyle tehdit altındaysa, yol iç kesimlere taşınabilir veya kıyı koruma yapılarıyla güçlendirilebilir.)

30. CR2.2 Assess Climate Change Vulnerability (A)

İklim değişikliğinin; projeye, proje ile bağlantılı altyapı sistemlerine ve geniş bir topluma yönelik tehdit analizi yapılıyor mu?

(Proje tehtidi: Otoyolun taşkınlardan etkilenmesi, yol bakım ve onarım maliyetlerini artırabilir.

Altyapı tehtidi: Kuraklık nedeniyle suyun yetersizliği, su temini için altyapı sisteminin yeterli çalışmamasına yol açabilir.

Toplum tehtidi: Su kaynaklarının azalması, hem tarıma bağımlı olan halkın yaşam koşullarını zorlaştırabilir hem de şehirdeki diğer altyapıların (sanayi, evsel su kullanımı) sağlıklı bir şekilde çalışmamasına yol açabilir.)

31. CR2.2 Assess Climate Change Vulnerability (B)

Projenin iklim değişikliği tehditlerine karşı hassasiyeti belirleniyor mu?

(İklim Değişikliği Tehditi: Aşırı Yağışlar ve Taşkın Riski

Proje Hassasiyeti: Drenaj Sistemlerinin Yetersizliği. Proje, aşırı yağışların ve taşkınların etkisiyle yetersiz kalabilecek drenaj sistemlerine sahip olabilir. Bu, otoyolun alt yapısının su baskınlarından dolayı hasar görmesine yol açabilir.)

32. CR2.2 Assess Climate Change Vulnerability (C)

Altyapı sisteminin iklim değişikliği tehditlerine karşı hassasiyeti belirleniyor mu?

(Şiddetli fırtınalar, trafik sinyalizasyon sistemlerini çalıştıran elektrik hatlarını devre dışı bırakabilir, bu da trafik kazası risklerini artırabilir.)

33. CR2.2 Assess Climate Change Vulnerability (D)

Topluluğun iklim değişikliği tehditlerine karşı hassiyeti belirleniyor mu?

(Enerji, su, ulaşım, iletişim sistemleri, atık yönetimi ve/veya gıda temini gibi fiziksel sistemleri içerebilir. Ayrıca, acil durum hizmetleri, finansman, düzenlemeler, iş gücü ve/veya topluluk/politik destek gibi fiziksel olmayan sistemleri de kapsayabilir.)

D. Social Experts' Interview Questions

1. Mesleğiniz ve uzmanlığınız nedir?
2. Kaç yıllık tecrübeniz bulunmaktadır?
3. Daha önce sürdürülebilirlik ilkelerini benimseyen bir projede görev aldınız mı?
4. Sürdürülebilirlik derecelendirme sistemleri hakkında neler biliyorsunuz?
5. QL1.1 Improve Community Quality of Life (B)

Projelerde, ev sahibi ya da etkilenen toplulukların ihtiyaç ve hedeflerinin belirlenmesi ve bu hedeflerin desteklenmesi yönünde çalışmalar yapılıyor mu?

(Projenin vizyonu ve hedeflerinin, topluluğun ihtiyaçları, hedefleri ve/veya sorunlarıyla karşılaştırıldığını gösteren kanıtlar.)

6. QL1.1 Improve Community Quality of Life (C)

Projelerde, ev sahibi ve etkilenen toplulukların yaşam kalitesi üzerindeki olası sosyal etkileri değerlendirme yönünde bir çalışma yapıyor mu?

(Projenin etkilenen toplulukların yaşam kalitesi üzerindeki olumlu ve olumsuz sosyal etkilerinin değerlendirilmesi, tanımlanması ve analiz edilmesi (örneğin, bir sosyal etki değerlendirmesi).)

7. QL1.1 Improve Community Quality of Life (D)

Etkilenen topluluklar, projenin topluluk ihtiyaçlarını ve/veya hedeflerini nasıl karşıladığını belirleme sürecine dahil edilyor mu?

(Topluluk geri bildirimlerini toplama, değerlendirme ve planlama ile tasarım sürecine dahil etme.)

8. QL1.1 Improve Community Quality of Life (E)

Projelerin olumsuz sosyal etkilerini ele almak için herhangi bir çalışma yapıyor mu?

(Olumsuz etkileri azaltma seçeneklerinin hangi ölçüde belirlendiği ve önceliklendirildiğini, ayrıca proje üzerinde makul değişikliklerin yapılması.)

9. QL1.1 Improve Community Quality of Life (F)

Projelerden etkilenen topluluklar, projelerin ihtiyaçlarını ve hedeflerini karşıladığını ve olumsuz etkileri azalttığını düşünüyor mu? Bu konuda bir memnuniyet söz konusu mu?

(Örneğin, topluluk memnuniyet anketleri, etkilenen toplulukların temsilcileriyle yapılan röportajlar, sosyal medya platformlarından gelen yorumlar ve tepkiler.)

10. QL1.1 Improve Community Quality of Life (G)

Projelerde, yaşam kalitesini etkileyebilecek uzun vadeli sosyal, ekonomik veya çevresel değişikliklere proaktif bir yaklaşım sergileniyor mu?

(Topluluk hedeflerini ve ihtiyaçlarını zaman içinde etkileyebilecek uzun vadeli sosyal, ekonomik veya çevresel değişiklikler/eğilimlerin belgelenmesi (örneğin, yaşlanan nüfus, ekonomik geçişler veya çevrenin ve ekosistem hizmetlerinin bozulması). Örneğin, turizm ve balıkçılıkla geçinen bir kıyı topluluğundaki çevresel bozulma, ekonomiyi olumsuz etkileyebilir, bu da nüfusun azalması gibi sosyal etkilerle sonuçlanabilir. Bu durumda, topluluğun yaşam kalitesi risk altına girer. Projenin, bu değişikliklere/eğilimlere nasıl proaktif bir şekilde yaklaşacağına dair belgeler. Projenin, topluluğun geleceği için akıllıca bir uzun vadeli yatırım olduğunu gösteren belgeler.)

11. QL1.2 Enhance Public Health & Safety (E)

Proje ekipleri sağlık ve güvenlik risklerinin ve etkilerinin bir topluluk tarafından orantısız şekilde taşınmadığını gösterebiliyor mu?

(Sağlık ve güvenlik risklerinin ve etkilerinin belirli bir topluluk tarafından orantısız şekilde taşınmadığını gösteren belgeler. Örnekler arasında, risk veya etki alanlarını temel demografik verilerle örtüştüren saha haritaları yer alabilir. Bu değerlendirme, proje bağlamında tarihsel eşitlik ve sosyal adalet faktörlerini dikkate almalıdır. Bu durum, yaygın olarak "çevresel adalet" olarak da adlandırılır. Projeden en çok

etkilenen topluluklara yönelik hafifletici önlemlerin orantılı şekilde dağıtıldığını gösteren belgeler.)

12. QL1.2 Enhance Public Health & Safety (F)

Projelerde, halihazırda olumsuz sağlık, kişisel güvenlik etkileri yaşayan veya bu riskle karşı karşıya olan topluluklara kritik altyapı hizmetleri sağlanıyor mu?

(Topluluğun şu anda sağlık ve/veya güvenlik etkilerini nasıl yaşadığını veya bu riskle nasıl karşı karşıya olduğunu gösteren belgeler (örneğin, kirli içme suyu). Projenin, bu etkileri çözmek veya önemli ölçüde azaltmak için gerekli kritik altyapı hizmetlerini nasıl sağlayacağını gösteren belgeler. Etkinin ölçeği, topluluk düzeyinde olmalı ve projenin kapsamı ve büyüklüğü ile orantılı olmalıdır. Projeler, yalnızca proje sınırları içinde sağlık ve/veya güvenlik etkilerini ortadan kaldırarak veya azaltarak yüksek seviye puan alamaz.)

13. QL1.4 Minimize Noise & Vibration (D)

Gürültü ve titreşim etkileri ile ilgili azaltma stratejileri ve hedef seviyeleri konusunda etkilenen paydaşlarla iletişim sağlanıyor mu?

(Gürültü etkilerinin anlaşılması ve operasyonel gürültü hedeflerinin ve azaltım stratejilerinin geliştirilmesi konusunda topluluk katılımını gösteren kanıtlar.)

14. QL3.1 Advance Equity & Social Justice (A)

Paydaş katılım süreci, etkilenen topluluklardaki geçmişten gelen eşitlik ve sosyal adalet bağlamını dikkate alıyor mu?

(Etkilenen topluluklardaki geçmişten gelen eşitlik ve sosyal adalet bağlamının anlaşıldığını gösteren belgeler. Eşitlik ve sosyal adalet bağlamının paydaş katılım sürecini nasıl şekillendirdiğini gösteren belgeler. Projenin egemen toplulukları, özellikle de yerli halkları etkilediği durumlarda, bu paydaşların katılımının nasıl önceliklendirildiğini ve sürecin bu toplulukların özerkliği, yetkisi ve haklarını

destekleyen karşılıklı saygı ve anlayış ilişkisini geliştirmeye nasıl odaklandığını gösteren belgeler.)

15. QL3.1 Advance Equity & Social Justice (B)

Proje ekipleri projenin ev sahibi ve etkilenen topluluklar üzerindeki sosyal etkilerini değerlendiriyor mu?

(Eşitlik ve sosyal adaleti de içeren olumlu ve olumsuz sosyal etkilerin belgelenmesi. Bu değerlendirme, daha geniş kapsamlı bir çevresel ve sosyal risk ve etki değerlendirmesinin parçası olabilir. Değerlendirme şunları içermelidir:

a.Proje ve ilgili faaliyetlerin doğrudan etkileri.

b.Proje sonucunda ortaya çıkabilecek bağımsız ikincil gelişmeler veya eylemlerden kaynaklanan etkiler.

c.Yerel topluluk için önemli olan kaynaklar veya hizmetler üzerindeki dolaylı etkiler.)

16. QL3.1 Advance Equity & Social Justice (D)

Projelerde, eşitlik ve sosyal adaletle ilgili sosyal etkiler ele alınıyor mu?

(Sosyal etki değerlendirmesinde belirlenen eşitlik ve sosyal adaletle ilgili etkileri ele almak için oluşturulan yönetim program(lar), uygulanan belirli kararlar, stratejiler vb. etkilerin ve bunlara yönelik azaltma stratejilerinin nasıl önceliklendirildiği.)

17. QL3.1 Advance Equity & Social Justice (E)

Projenin etkileri ve faydaları etkilenen topluluklar arasında adil bir şekilde dağıtılıyor mu?

(Projenin, bazı topluluklara orantısız şekilde risk veya olumsuz etkiler yüklemeyip, diğer topluluklara projenin çoğunlukla fayda sağlamadığını gösteren belge.Sosyal etki değerlendirmesinde belirlenen temel demografik verileri içeren ve projenin fayda veya etkilerini alması muhtemel alanlarla örtüşen haritalar.)

18. QL3.1 Advance Equity & Social Justice (F)

Proje ekipleri toplulukları kalkınma sürecine etkin bir şekilde katılmaları için destekliyor mu?

(Proje ekibinin, paydaş katılım sürecine dahil olmanın önündeki engelleri belirlediğini, analiz ettiğini ve ele aldığını gösteren belge. Büyük projeler için, paydaş katılım sürecini yöneten bireylerin niteliklerini içeren belgeler de sunulmalıdır. Projenin özellikle yeterince temsil edilmeyen toplulukları hedeflediğini ve daha yüksek katılım ve/veya kapsayıcılık sağladığını gösteren belge.)

19. QL3.1 Advance Equity & Social Justice (G)

Projelerde, mevcut veya tarihi bir adaletsizlik ya da dengesizlik olumlu bir şekilde ele alınıyor veya düzeltiliyor mu?

(Projenin mevcut veya tarihi bir adaletsizliği veya dengesizliği olumlu bir şekilde ele aldığı veya düzelttiğine dair belge. Bu, ancak bunlarla sınırlı olmamak üzere aşağıdaki örnekleri içerebilir:

a.Tarihsel olarak hizmetlerden yetersiz faydalanmış topluluklara altyapı hizmetlerinin sağlanması veya iyileştirilmesi.

b.Tarihsel olarak bir topluluğu bölen veya engeller yaratan mevcut altyapının kaldırılması.

c.Bir topluluğun, altyapı etkileri nedeniyle orantısız şekilde olumsuz yükler taşıdığı ve faydaları almadığı tarihsel eşitsizliğin ele alınması.

d.Kapsayıcılıkla ilgili altyapı tasarımı, geliştirilmesi ve

İşletilmesindeki tarihsel sosyoekonomik eğilimlerin ele alınması.)

20. QL3.2 Preserve Historic & Cultural Resources (C)

Projelerde, tarihi ve kültürel kaynaklar tanımlanırken yalnızca kayıtlara mı odaklanılıyor, yoksa topluluğun kültürel mirası ve önemli parçaları da göz önünde bulunduruluyor mu?

(Tarihi/kültürel kaynakların tanımlanmasının, sadece tarihi alanlar kayıtlarıyla sınırlı kalmayıp daha geniş bir alanda yapıldığını gösteren belge. Tarihi kayıtlarında yer almayan, ancak topluluğun kültürü için hâlâ önemli olabilecek tarihi veya kültürel kaynakların dizini. Bunlar, yerler, etkinlikler, doğal özellikler, sözlü gelenekler veya yerel beceriler gibi unsurları içerebilir.)

21. QL3.4 Enhance Public Space & Amenities (C)

Kamu paydaşları projede yer alan kamu alanları ve olanaklarına yönelik planlara memnuniyeti değerlendiriliyor mu?

(Projenin kamu alanları/olanakları üzerindeki etkilerini nasıl ele alacağına dair paydaş onayının kanıtı. Bu, gerektiğinde yeni veya iyileştirilmiş kamu alanlarının/olanaklarının tasarımı ve erişimiyle ilgili onayı da içerebilir. İnşaat sürecinde kamu alanları/olanaklarına (özellikle erişime) yönelik etkilerin paydaşlar tarafından anlaşıldığı ve kabul edildiğine dair kanıt. İlgili olduğu durumlarda, kamu alanları/olanaklarıyla ilgili proje planlarına dair yetkililerden alınan yazılı onay.)

22. LD1.3 Provide for Stakeholder Involvement (B)

Her bir paydaş için, proje ekibinin ele alması gereken konuları ve katılım yöntemlerini dikkate alan etkileşim planları oluşturuluyor mu? Yapılıyorsa detay verebilir misiniz?

(Her bir kilit paydaş için katılım planları hazırlamalıdır. Bu planlar, paydaşların hangi konularla ilgilendiğini ve nasıl bir katılım yönteminin (bilgilendirme, danışma, iş birliği vb.) uygulanacağını içermelidir. Katılım süreci proaktif olmalı, sadece duyuru yapmaktan ibaret olmamalıdır. Paydaşlarla çift yönlü iletişim kurulmalı, onların görüşlerine yer verilmeli ve karar alma süreçlerine katılmaları için gerçek fırsatlar sunulmalıdır. Paydaşlarla yapılan görüşmeler, toplantılar ve

yazışmalar gibi katılım sürecine dair belgeler sunulmalıdır. Bu belgeler, paydaşların proje hakkında dile getirdiği konuları ve geri bildirimleri açıkça göstermelidir.)

23. LD1.3 Provide for Stakeholder Involvement (D)

Paydaş geri bildirimlerinin adil ve eşit şekilde ele alınmakta mıdır?

(Paydaş geri bildirimlerinin, ırk, gelir durumu, din, cinsiyet, yaş, etnik köken, engellilik durumu fark etmeksizin sosyal ve çevresel adalet ilkelerine uygun şekilde adil ve eşit biçimde değerlendirildiğini gösteren destekleyici kanıtlar.)

24. LD3.1 Stimulate Economic Prosperity & Development (A)

Tasarım, inşaat ve işletme aşamalarında yeni istihdam olanakları oluşturuluyor mu?

(Projenin tasarım, inşaat ve işletme aşamalarında yerel ekonomiye fayda sağlayan yeni işlerin sayısını ve türünü gösteren hesaplamalar. Hesaplamalar, doğrudan ve dolaylı işler arasındaki farkları belirtmelidir. Bu işlerin, projenin büyüklüğüne göre yerel ekonomi üzerindeki etkilerinin açıklaması.)

25. LD3.1 Stimulate Economic Prosperity & Development (D)

Projelerde, topluluğun sosyoekonomik koşullarını genel olarak iyileştirerek, iş dünyası, sanayi veya kamu sektörü için topluluğun cazibesini artırmak hedefleniyor mu?

(Projenin, topluluğun sosyoekonomik koşullarını genel olarak iyileştirerek, topluluğun cazibesini nasıl artırdığına dair belge. Topluluk cazibesinin yerel ekonomik kalkınmaya nasıl fayda sağlayacağına dair analizler.)

26. LD3.1 Stimulate Economic Prosperity & Development (E)

Projelerde, ekonomik refahı teşvik etmek ve daha fazla ekonomik kalkınmayı desteklemek hedefleniyor mu?

(Projenin kendi kapsamı dışında ekonomik etkiler yaratacağına dair belge. Örneğin, bir liman genişlemesi, bölgedeki sanayilere fayda sağlayacak veya kamu alanları, topluluk mülklerinin değerini yeniden canlandıracak şekilde katkı sağlıyorsa. Projenin, yerel ekonomide sistemik değişim yaratma olasılığını gösteren analizler.

Ekonomik etkinin ölçeği, projenin büyüklüğüne göre değerlendirilebilse de, çok küçük projeler için projenin tasarım, inşaat ve işletme dışındaki daha geniş ekonomik etkiler gösterilemeyebilir. Projenin, gelecekteki ekonomik kalkınma üzerindeki etkisinin, sosyal, ekonomik ve çevresel trendlerdeki değişimleri dikkate alarak projekte edildiğine dair belge. Bu, ancak bunlarla sınırlı olmamak üzere, topluluğun demografik değişimleri, büyüyen veya küçülen vergi tabanları ve çevresel bozulma veya iklim değişikliği gibi faktörleri içerebilir.)

27. LD3.2 Develop Local Skills & Capabilities (A)

Yerel beceri geliştirme amacıyla eğitim programları sunuluyor mu?

(Proje ile ilişkili eğitim programlarının varlığını gösteren kanıtlar. Altyapı sahibinin kapsamlı veya dikkate değer eğitim programlarına sahip olduğunu göstermek. Ancak, belgeler bu eğitim programlarının proje ile olan ilgisini de ortaya koymalıdır.)

28. LD3.2 Develop Local Skills & Capabilities (B)

Projelerde, yerel iş gücündeki beceri ve yetkinlik eksiklikleri belirlenip, bu eksiklikleri gidermek amacıyla eğitim programları oluşturuluyor mu?

(Belirlenen beceri veya yetkinlik eksikliklerini gösteren belgeler (örneğin, sürdürülebilir teknolojilerin uygulanmasında deneyimsizlik, en iyi uygulamalar veya yeni yöntemler). Belirlenen eksiklikleri özel olarak hedefleyen eğitim programlarının varlığını gösteren kanıtlar.)

E. Managers' Interview Questions

1. Mesleğiniz ve uzmanlığınız nedir?
2. Çalıştığınız şirketteki rolünüz nedir?
3. Kaç yıldır bu pozisyonda çalışmaktasınız?
4. Daha önce sürdürülebilirlik ilkelerini benimseyen bir projede görev aldınız mı?
5. Sürdürülebilirlik derecelendirme sistemleri hakkında neler biliyorsunuz?
6. LD1.1 Provide Effective Leadership & Commitment (A)

İşverenle birlikte, projenin sosyal, çevresel ve ekonomik yönlerini ele almak amacıyla yazılı taahhütlerde bulunuluyor mu? Eğer bulunuluyorsa, bu taahhütleri açıklayabilir misiniz?

(Bu tür taahhütler, sürdürülebilirliğe yönelik ifadeler içeren sözleşme dokümanlarında ya da proje ekibinin kilit üyeleri tarafından sürdürülebilirliğe olan bağlılıklarının belirtildiği değer mühendisliği oturumları, yol haritası oluşturma toplantıları gibi çalışmalarda yer alabilir.)

7. LD1.1 Provide Effective Leadership & Commitment (B)

Proje, kapsamına, ölçeğine ve karmaşıklığına uygun bir sürdürülebilirlik yönetim politikasıyla destekleniyor mu? Eğer evet ise, bu politikanın içeriğiyle ilgili örnek verebilir misiniz?

(Sürdürülebilirlik yönetim politikası; sürdürülebilir performansı artırmaya yönelik taahhütleri, net hedef ve amaçları içeren bir belgedir. Aynı zamanda proje paydaşlarıyla ilişkileri, sağlık ve güvenlik, çevresel ve sosyal/topluluk konularındaki taahhütleri de kapsar.)

8. LD1.1 Provide Effective Leadership & Commitment (C)

Proje süresince sürdürülebilirlik taahhütleri periyodik olarak gözden geçiriliyor mu? Yapılıyorsa detaylandırabilir misiniz?

(Projeye özgü sürdürülebilirlik raporları veya toplantı tutanakları, projenin hedeflerine nasıl ulaşacağını ve girişimleri ölçmek ve yönetmek için hangi temel performans göstergelerinin kullanılacağının belirtilmesi.)

9. LD1.2 Foster Collaboration & Teamwork (A)

Projede sürdürülebilirlik hedeflerini belirlemek amacıyla, erken aşamada disiplinler arası iş birliğine dayalı bir başlangıç toplantısı düzenleniyor mu? Eğer düzenleniyorsa, bu toplantının içeriğini ve sürecini anlatabilir misiniz?

(Bu tür toplantılar; farklı disiplinlerden ekip üyelerinin ya da proje rolleriyle ilgili kişilerin belirlenmesini, sürdürülebilir performansı artırma ve tasarım çakışmalarını azaltma fırsatlarının değerlendirilmesini amaçlayan tasarım çalıştayları veya değer mühendisliği oturumları gibi uygulamaları içerebilir.)

10. LD1.2 Foster Collaboration & Teamwork (B)

Disiplinler arası iş birliği süreci, projenin sürdürülebilirlik performansında iyileşmeler sağlıyor mu? Eğer sağlıyorsa, bu iyileştirmelere örnek verebilir misiniz?

(Bu tür iyileştirmeler, farklı disiplinlerin iş birliğiyle elde edilen proje kazanımları olabilir. Örneğin, çevre mühendisleriyle yapılan çalışmalar sonucunda otoyol boyunca yağmur suyunun doğal drenaj sistemleriyle yönetilmesine karar verilmesi gibi.)

11. LD1.2 Foster Collaboration & Teamwork (C)

Sürdürülebilirlik hedeflerini belirlemek ve bu hedeflere ulaşmak amacıyla düzenli olarak hangi disiplinler arası ve iş birliğine dayalı toplantılar yapılıyor? Bu toplantıların içeriği ve sıklığı hakkında bilgi verebilir misiniz?

(Bu tür toplantılar; proje ekibinin iş süreçlerini, yönetim kontrollerini, prosedürleri, akış şemalarını, kontrol listelerini ve diğer kayıtlı önlemleri içerebilir. Ayrıca, sürecin farklı aşamalarında düzenli olarak gerçekleştirilen disiplinler arası iş birliği toplantılarını da kapsar.)

12. LD1.2 Foster Collaboration & Teamwork (D)

Toplantılar projenin ilerleyen aşamalarında daha iyi değerlendirmeler yapılabilmesi için inşaat, işletme veya bakım paydaşlarını içeriyor mu?

13. LD1.3 Provide for Stakeholder Involvement (A)

Proje kapsamındaki paydaşlar birincil veya ikincil olarak sınıflandırılıyor mu? Yapılan çalışmalara örnek verebilir misiniz?

(Birincil Paydaşlar: Projeden doğrudan etkilenen bireyler veya gruplar. Örneğin; yeni bir yolun geçtiği ve hizmet verdiği topluluklar. Bu, projenin yaşam döngüsü boyunca etkilenebilecek veya etkisi altında kalabilecek paydaşları da içermelidir.

İkincil Paydaşlar: Projeden dolaylı olarak etkilenen bireyler veya gruplar. Örneğin; ulusal ve yerel yönetimler, kamu hizmetleri, ruhsatlandırma ve denetim kuruluşları gibi projeye doğrudan dahil olmayan kurumlar.)

14. LD1.3 Provide for Stakeholder Involvement (C)

Proje ekibinin öncü bir üyesi, paydaş gruplarla doğrudan iletişim kurarak onların ihtiyaç ve beklentilerini anlamaya yönelik herhangi bir çalışma yürütüyor mu? Eğer yürüttüyse, bu süreci kısaca anlatabilir misiniz?

15. LD1.3 Provide for Stakeholder Involvement (D)

Paydaş katılımı sürecinde elde edilen geri bildirimler, proje planlarına, tasarımına veya karar alma süreçlerine entegre ediliyor mu? Eğer ediliyorsa, buna örnek verebilir misiniz?

(Örneğin, çiftçilerin talepleri doğrultusunda ekinlerine ulaşabilmeleri için 10 km'lik bir yolun projeye dahil edilmesi ya da halkın gürültü endişeleri nedeniyle ses bariyerlerinin eklenmesi gibi uygulamalar.)

16. LD2.1 Establish a Sustainability Management Plan (A)

Sürdürülebilirlikle ilgili roller ve sorumluluklar, proje ekibinin kilit üyelerine açıkça atanıyor mu? Eğer atanıyorsa, bu yapıyı örneklerle açıklayabilir misiniz?

(Bu kapsamda, sürdürülebilirlik sorumluluklarını gösteren bir organizasyon şeması hazırlanmış olabilir. Bu şema, sürdürülebilirlikten sorumlu kişilerin proje organizasyonundaki yerini ve proje kararlarına etki edebilme ya da değişiklik yapabilme yetkilerini ortaya koyabilir.)

17. LD2.1 Establish a Sustainability Management Plan (B)

Projenin çevresel, ekonomik ve sosyal yönlerini değerlendirmek, önceliklendirmek ve sürdürülebilirlik hedeflerini belirlemek amacıyla bir sürdürülebilirlik yönetim planı hazırlanıyor mu? Eğer hazırlanıyorsa, bu planın içeriği hakkında bilgi verebilir misiniz?

(Sürdürülebilirlik yönetim planı, projede sürdürülebilirlik yönetim politikasının nasıl uygulanacağını gösteren süreçler ve stratejiler içerir. Bu plan; proje hedeflerinin, amaçlarının ve performans hedeflerinin önceliklendirildiği çalışmaları kapsar ve projenin çevresel, ekonomik ve sosyal etkilerini değerlendirir.)

18. LD2.1 Establish a Sustainability Management Plan (C)

Sürdürülebilirlik yönetim planı, sürdürülebilirlik hedeflerini ve amaçlarını ele almak için süreçler ve yönetim kontrol mekanizmaları içeriyor mu? Eğer içeriyorsa, bu mekanizmaların nasıl uygulandığına dair örnek verebilir misiniz?

(Bu mekanizmalar; iş süreçleri, yönetim kontrol önlemleri, prosedürler, akış şemaları, kontrol listeleri, denetimler, düzeltici eylem raporları ve planla-yap-kontrol et-önlem al (plan-do-check-act) metodolojisinin uygulanması gibi unsurları içerebilir.)

19. LD2.1 Establish a Sustainability Management Plan (D)

Sürdürülebilirlik yönetim planı uygulamaya konulup periyodik olarak gözden geçiriliyor mu?

(Planın hedefleri ve amaçları doğrultusunda ilerlemenin düzenli olarak izlenip raporlanması)

20. LD2.1 Establish a Sustainability Management Plan (E)

Proje sürdürülebilirlik yönetim planı, projenin ömrü boyunca çevresel, sosyal veya ekonomik koşullardaki değişikliklere uyum sağlayabilecek şekilde esnek ve dayanıklı bir şekilde hazırlanıyor mu? Eğer hazırlanıyorsa, buna dair bir örnek verebilir misiniz?

(Örneğin, proje bölgesindeki iklim değişiklikleri, yağış seviyelerindeki artışları ve su yönetimi ihtiyaçlarını etkileyebilir. Bu tür bir değişiklik, yol yüzeyindeki erozyonu artırarak su birikintilerine yol açabilir. Bu durumda, proje yönetimi, yağış sularının yönlendirilmesi için dayanıklı drenaj sistemleri ve su geçirgen yüzeyler kullanmayı planlayabilir.)

21. LD3.3 Conduct a Life-Cycle Economic Evaluation (A)

Tüm projenin finansal etkilerini belirlemek amacıyla yaşam döngüsü maliyet analizi yapılıyor mu?

22. LD3.3 Conduct a Life-Cycle Economic Evaluation (B)

En az bir ana proje bileşeni için alternatifleri karşılaştırmak amacıyla yaşam döngüsü maliyet analizi kullanılıyor mu? Eğer kullanılıyorsa, buna bir örnek verebilir misiniz?

(Örneğin, yağmur suyunun tahliyesi için geleneksel beton borular ile geçirgen drenaj sistemleri arasındaki yaşam döngüsü maliyet analizinin yapılması ve bu analiz sonuçlarına göre karar verilmesi gibi.)

23. LD3.3 Conduct a Life-Cycle Economic Evaluation (C)

Proje ekibi, projenin sosyal, çevresel ve finansal maliyetlerini ve faydalarını haritalandırıyor mu? Eğer haritalandırılıyorsa, bu süreç nasıl işliyor?

(Sosyal Etkiler; Maliyet: Otoyolun geçtiği bölgede yerleşim yerlerinin ayrılması, kamulaştırma nedeniyle insanların yer değiştirmesi. Fayda: Yolun tamamlanmasıyla

ulaşım süresinin kısalması, trafik kazalarının azalması ve ekonomik kalkınmanın desteklenmesi.

Çevresel Etkiler; Maliyet: İnşaatı sırasında orman alanlarının kesilmesi, yaban hayatının habitat kaybına uğraması ve karbon emisyonlarının artması. Fayda: Yeni bir karayolunun, araçların daha verimli bir şekilde seyahat etmelerini sağlayarak yakıt tüketimini azaltması ve karbon salınımını minimize etmesi.

Finansal Etkiler; Maliyet: İnşaat, bakım ve işletme maliyetlerinin uzun vadeli harcamalar gerektirmesi. Fayda: Ekonomik büyüme, ticaretin hızlanması, yakıt tasarrufu ve araç bakım maliyetlerinin azalması.)

24. LD3.3 Conduct a Life-Cycle Economic Evaluation (D)

Tüm projenin finansal, sosyal ve çevresel etkilerini belirlemek amacıyla detaylı bir maliyet-fayda analizi yapılıyor mu? Eğer yapılıyorsa, bu analizde dikkate alınan bazı faktörlere örnek verebilir misiniz?

(Ekonomik Etkiler: Yol uzunluğu kısaldığında veya trafik akışı iyileştiğinde, araçların harcadığı yakıt miktarının azalması. Sosyal Etkiler: Yeni yol tasarımı ile kazaların azalması durumunda, sağlık harcamalarının ve sigorta giderlerinin düşmesi. Çevresel Etkiler: Yeni yol daha kısa mesafeler sağladığında, araçların emisyonlarının azalması.)

25. LD3.3 Conduct a Life-Cycle Economic Evaluation (E)

Finansal, çevresel ve sosyal faydaları içeren maliyet-fayda analizleri, en az bir ana proje bileşeni için alternatifleri karşılaştırmak amacıyla kullanılıyor mu? Eğer kullanılıyorsa, bu süreç hakkında örnek verebilir misiniz?

(Örneğin, yeni bir katlı kavşak yapılması ile akıllı trafik ışıkları ve adaptif sinyalizasyon sistemlerinin kullanılması arasındaki maliyet-fayda analizi.)

26. CR2.2 Assess Climate Change Vulnerability (A)

İklim değişikliğinin projeye, proje ile bağlantılı altyapı sistemlerine ve geniş bir topluma yönelik tehditleri analiz ediliyor mu? Eğer ediliyorsa, bu tehdit analizine dair örnekler verebilir misiniz?

(Proje Tehdidi: Otoyolun taşkınlardan etkilenmesi, yol bakım ve onarım maliyetlerini artırabilir.

Altyapı Tehdidi: Kuraklık nedeniyle suyun yetersizliği, su temini için altyapı sisteminin yeterli çalışmamasına yol açabilir.

Toplum Tehdidi: Su kaynaklarının azalması, tarıma bağımlı halkın yaşam koşullarını zorlaştırabilir ve şehirdeki diğer altyapıların (sanayi, evsel su kullanımı) sağlıklı bir şekilde çalışmamasına yol açabilir.)

27. CR2.2 Assess Climate Change Vulnerability (B)

Projenin iklim değişikliği tehditlerine karşı hassasiyeti belirleniyor mu? Eğer belirleniyorsa, buna dair örnek verebilir misiniz?

(Örneğin: İklim Değişikliği Tehditi: Aşırı yağışlar ve taşkın riski. Proje Hassasiyeti: Drenaj sistemlerinin yetersizliği. Proje, aşırı yağışlar ve taşkınların etkisiyle yetersiz kalabilecek drenaj sistemlerine sahip olabilir, bu da otoyolun altyapısının su baskınlarından dolayı hasar görmesine yol açabilir.)

28. CR2.2 Assess Climate Change Vulnerability (C)

Altyapı sisteminin iklim değişikliği tehditlerine karşı hassasiyeti belirleniyor mu? Eğer belirleniyorsa, bu tehditlere dair bir örnek verebilir misiniz?

(Örneğin: Şiddetli fırtınalar, trafik sinyalizasyon sistemlerini çalıştıran elektrik hatlarını devre dışı bırakabilir, bu da trafik kazası risklerini artırabilir.)

29. CR2.2 Assess Climate Change Vulnerability (D)

Topluluğun iklim değişikliği tehditlerine karşı hassasiyeti belirleniyor mu? Eğer belirleniyorsa, bu tehditlere dair örnekler verebilir misiniz?

(Örneğin, enerji, su, ulaşım, iletişim sistemleri, atık yönetimi ve/veya gıda temini gibi fiziksel sistemler; acil durum hizmetleri, finansman, düzenlemeler, iş gücü ve/veya topluluk/politik destek gibi fiziksel olmayan sistemler.)

30. CR2.3 Evaluate Risk & Resilience (A)

Proje, altyapı sistemi ve toplumdan hangileri risk değerlendirmesinin kapsamındadır? Eğer bu değerlendirme yapılıyorsa, buna dair örnek verebilir misiniz?

(Örneğin, risk, sel olayının olasılığı ve şiddetinin, kritik sistemlerin su basması durumunda oluşabilecek kayıplarla değerlendirilmesi olarak ele alınır.

Proje düzeyinde: İnşaat sırasında beklenmedik hava koşulları nedeniyle çalışmaların gecikmesi.

Sistem düzeyinde: Karayolu, büyük bir enerji nakil hattına veya su boru hattına çok yakın inşa ediliyorsa, bu sistemlerde meydana gelebilecek arızalar projenin ilerleyişini etkileyebilir. Toplum düzeyinde: Yeni yapılan yol, bölgedeki taşkın kontrol sistemleriyle uyumlu olmazsa, sel riski artabilir.)

31. CR2.3 Evaluate Risk & Resilience (B)

Projenin ve ilgili sistemlerin hedeflerine ulaşmak için gerekli olan kritik varlıklar ve sistemler belirlenirken, bu varlıklar arasındaki bağımlılıkların analizi yapılıyor mu? Eğer yapılıyorsa, bu analiz nasıl işliyor?

(Örneğin, bir otoyol projesinde köprüler, trafik yönetim sistemleri ve drenaj sistemleri kritik varlıklardır. Ancak köprüler malzeme tedariğine, trafik yönetim sistemleri elektrik altyapısına ve drenaj sistemleri şehir kanalizasyonuna bağımlıdır. Eğer bu sistemlerden biri çalışmazsa, projenin işleyişi sekteye uğrayabilir.)

32. CR2.3 Evaluate Risk & Resilience (C)

Proje ve bağlamını dikkate alarak, doğal tehlikeler ve insan kaynaklı tehditler de dahil olmak üzere ani şoklar ve uzun vadeli stres faktörleri içeren tehditler belirleniyor mu? Eğer belirleniyorsa, bu tehditlere dair örnekler verebilir misiniz?

(Doğal Tehlikeler:

Ani Şoklar: Depremler, seller, toprak kaymaları, fırtınalar, tsunamiler vb.

Uzun Vadeli Stres Faktörleri: Kuraklık, iklim değişikliği, deniz seviyesi yükselmesi, orman yangınları vb.

İnsan Kaynaklı Tehditler:

Ani Şoklar: Sanayi kazaları, yangınlar, terörist saldırılar, radyoaktif sızıntılar, kimyasal sızıntılar vb.

Uzun Vadeli Stres Faktörleri: finansal sıkıntı, nüfus artışı, kaynak kıtlığı vb.)

33. CR2.3 Evaluate Risk & Resilience (D)

Projenin önemli bileşenlerinin ve işlevlerinin, potansiyel tehditler karşısında zayıf noktaları tespit ediliyor mu? Eğer yapılıyorsa, buna dair bir örnek verebilir misiniz?

(Örneğin, bir otoyol projesinde kritik bileşenlerden biri köprü olabilir. Eğer bu köprü, yoğun trafikle karşılaşacak ve deprem riski bulunan bir bölgede inşa ediliyorsa, deprem riski karşısında zayıf noktaları tespit etmeye yönelik bir analiz yapılır. Bu durumda, köprünün zayıf noktası zemin yapısının yeterince sağlam olmaması ve deprem anında köprünün çökme riski taşıması olabilir. Proje ekibi, zayıf noktanın farkına vararak, köprünün deprem dayanıklılığını artırmak için güçlendirilmiş temeller tasarlar ve sismik etkileri azaltacak inşaat malzemeleri kullanır.)

34. CR2.3 Evaluate Risk & Resilience (E)

Proje ekibi, bir tehdit veya riskin meydana gelme olasılığını ve buna bağlı etkileri belirleyerek riskleri değerlendiriyor mu? Eğer değerlendiriliyorsa, buna dair bir örnek verebilir misiniz?

(Örneğin, belirlenen tehditler ve tehlikeler için gerçekleşme olasılığı belirlenir ve riskin meydana gelmesi durumunda ortaya çıkacak sosyal, çevresel ve finansal sonuçlar analiz edilir.)

35. CR2.3 Evaluate Risk & Resilience (F)

Yapılan risk değerlendirmesi, iş veren ve ana paydaşlardan oluşan çeşitli ve entegre bir ekibin katılımını içeriyor mu? Eğer içeriyorsa, bu katılım nasıl sağlanıyor?

(Örneğin, risk değerlendirme sürecine iş veren ile anahtar paydaşların katılımı ve paydaşların projeyle ilgili olarak uygun kapsamda çeşitli bakış açılarını temsil etmeleri sağlanır.)

36. CR2.4 Establish Resilience Goals and Strategies (A)

Proje performans hedefleri ve iş verenin risk toleransı belirleniyor mu? Eğer belirleniyorsa, nasıl bir süreç izleniyor?

(Örneğin, projenin anahtar performans hedeflerinin belirlenmesi ve iş verenin projedeki risk yönetimi yaklaşımını açıklayan kabul edilebilir risklerin öğrenilmesi süreci.)

37. CR2.4 Establish Resilience Goals and Strategies (B)

Kapsamlı bir risk değerlendirmesi temel alarak risk yönetimi stratejileri geliştiriliyor mu? Eğer geliştiriliyorsa, nasıl bir yaklaşım izleniyor?

(Örneğin, potansiyel risk yönetimi stratejilerinin listesi veya matrisi oluşturulur. Stratejiler, risk azaltma potansiyellerine ve herhangi bir zorlayıcı faktöre (maliyet, erişilebilirlik, güvenilirlik, etkinlik vb.) göre önceliklendirilir.)

38. CR2.4 Establish Resilience Goals and Strategies (C)

Ana paydaşlar, dayanıklılık hedeflerinin geliştirilmesinde yer alıyor mu?

(İş veren ve anahtar paydaşların, dayanıklılık hedeflerini geliştirme veya gözden geçirme sürecine katılması ve paydaş katılımının dayanıklılık hedeflerinin belirlenmesi veya önceliklendirilmesi konusunda geri bildirimler alınması.)

39. CR2.5 Maximize Resilience (A)

Kapsamlı bir risk değerlendirmesi temel alarak dayanıklılık hedefleri ve stratejileri geliştiriliyor mu? Eğer geliştiriliyorsa, nasıl bir yaklaşım izleniyor?

(Dayanıklılık Hedefi: Uzun vadede karşılaşabileceği zorluklara karşı dayanıklılığını artırmaya yönelik hedefler. Örneğin, sel riski, iklim değişikliği, aşırı sıcaklıklar.

Risk Yönetimi Stratejisi: Dayanıklılığı artırmak için önerilen çözümler. Örneğin, altyapı güçlendirmeleri, yeşil çatılar, enerji verimliliği sistemleri.

Risk Azaltma Potansiyeli: Bir stratejinin, ilgili riski ne kadar etkili şekilde azaltabileceği derecesi. Örneğin, yüksek, orta, düşük.

Zorlayıcı Faktörler: Stratejinin uygulanmasını etkileyebilecek faktörler. Örneğin, maliyet, erişilebilirlik, güvenilirlik, etkinlik. Öncelik: Risk yönetimi stratejilerinin uygulanmasındaki öncelik düzeyi. Örneğin, yüksek, orta, düşük)

40. CR2.5 Maximize Resilience (B)

Ana proje risklerini ele almak ve projenin dayanıklılığını artırmak için dayanıklılık stratejileri uygulanıyor mu? Eğer uygulanıyorsa, hangi stratejiler izleniyor?

(Uygulanan stratejiler, dayanıklılık sistemlerinin bir veya daha fazla temel ilkesini ele alabilir.

Kaynak Yöneticisi: Stratejiler, sınırlı kaynakları verimli bir şekilde kullanmak ve yaratıcı çözümler geliştirmek.

Kapsayıcı: Tüm paydaşlar projede nasıl aktif bir şekilde yer alıyor ve sorumluluk paylaşıyor?

Entegre: Proje, farklı sistemler, kurumlar ve insanlar arasındaki entegrasyonu nasıl sağlıyor?

Dayanıklı: Proje, güçlü, uzun ömürlü ve dayanıklı altyapılar veya sistemler kullanarak dayanıklılığı nasıl sağlıyor?

Yedekli: Proje, herhangi bir sistem arızası durumunda alternatif yollar veya yedek sistemler oluşturuyor mu?)

41. CR2.5 Maximize Resilience (C)

Proje dayanıklılık stratejilerinin uygulanması, periyodik olarak izlenip proje teslimi süresince bu stratejilerin etkinliği sürekli olarak gözden geçiriliyor mu?

(Örneğin; ilk yıl sonunda dayanıklılık stratejilerinin başarılı bir şekilde uygulandığı ve belirlenen KPI'ların çoğunun karşılandığı raporlanmıştır. Ancak, şehirdeki ani sel olayları nedeniyle su yönetim sisteminin kapasitesinin artırılması gerektiği belirlenmiştir. Bu durum, ek bir analiz yapılmasını ve altyapı iyileştirmelerinin projeye dahil edilmesini gerektirmiştir.)

42. CR2.5 Maximize Resilience (D)

Dayanıklılık hedefleri ve stratejileri, projenin operasyon ve bakımını da dahil ediyor mu?

(Dayanıklılık Hedefi: Su Yönetimi ve İklim Dayanıklılığı Operasyonel Strateji: Yağmur suyu toplama sistemleri, düşük su tüketimi sağlayan sulama teknikleri ve suyu geri kazanma sistemlerinin entegrasyonu sağlanır. Bu stratejiler, iklim değişikliği nedeniyle artan su stresi ile başa çıkmaya yönelik tasarlanmıştır.

Bakım Stratejisi: Su yönetimi sistemlerinin düzenli bakımı, sızıntıların tespit edilmesi ve su depolama alanlarının temizliği gibi rutin işler dahil edilir. Ayrıca, su kalitesini izlemek için sensörler kullanılır ve sistemin verimli çalışıp çalışmadığı periyodik olarak kontrol edilir.)

43. CR2.5 Maximize Resilience (E)

Dayanıklılık performans hedeflerini ölçme veya nicelendirme yöntemleri projeye dahil ediliyor mu?

(Dayanıklılık Hedefi: Su Yönetimi ve İklim Dayanıklılığı Hedef: Yağmur suyu toplama verimliliğini %30 artırmak.

Ölçüm Yöntemi: Toplanan yağmur suyu miktarı, kurulum öncesi ve sonrası düzenli olarak izlenir. Yağmur suyu toplama sisteminin verimliliği, toplanan suyun yüzde oranı ile ölçülür. Yağmur suyu toplama verimliliği, toplanan su miktarı ve sistemin

su kaybı oranı ile nicelendirilerek %30'luk artış hedefi doğrultusunda değerlendirme yapılır.)

44. CR2.6 Improve Infrastructure Integration (A)

Proje kapsamındaki sistemler, verimliliği artırmak, yedeklilik sağlamak veya sistem çeşitliliğini geliştirmek amacıyla iç entegrasyon sağlanıyor mu?

(Örneğin, trafik akışını izleyen sensörlerin yol bakım sistemleriyle entegrasyonu, hızlı yanıt süreleri ve sürdürülebilir bakım için büyük önem taşır. Ayrıca, karayolu üzerindeki trafik akışını izleyen sensörlerle trafik ışığı kontrol sistemlerinin entegrasyonu sayesinde, trafik yoğunluğu arttığında ışık süreleri otomatik olarak ayarlanabilir.)

45. CR2.6 Improve Infrastructure Integration (B)

Altyapı entegrasyonu, sistemik veya zincirleme arızaların riskini azaltıyor mu?

(Zincirleme Arıza Örneği: Yoğun yağmur yağdığında suyun birikmesi, yol yüzeyinin kaymasına ve trafik kazalarına yol açabilir. Ancak, drenaj sistemi yetersizse, bu su birikintileri zamanla yolun altyapısına zarar verebilir ve yolda büyük bir çökme yaratabilir. Ayrıca, suyun tahliye edilmemesi nedeniyle, bu suyun çevreye yayılması da başka sorunlara yol açabilir.

Altyapı Entegrasyonu ile Risk Azaltma; Akıllı Su Drenajı Sistemi Entegrasyonu. Akıllı su drenaj sistemleri, sadece suyun tahliye edilmesini sağlamakla kalmaz, aynı zamanda suyun depolanması veya geri kazanılmasına olanak tanır. Bu sistem, yağmur suyu geri kazanım için su depolama havuzları kullanabilir. Böylece, yoğun yağmur yağdığında, su hızla tahliye edilir ve birikintiler oluşmaz.)

46. CR2.6 Improve Infrastructure Integration (C)

Proje, proje sınırlarının ötesindeki daha geniş altyapı sisteminin verimliliğini, yedekliliğini veya çeşitliliğini artırmak amacıyla dış sistemlerle entegrasyon sağlıyor mu?

(Örneğin, karayolunun çevresindeki toplu taşıma sistemleri (otobüs, metro) ile entegrasyon sağlanabilir. Otobüs durakları, metro istasyonlarına yakın bir konumda inşa edilerek, karayolu kullanıcılarının toplu taşıma ile kolayca bağlantı kurması sağlanabilir.)

47. CR2.6 Improve Infrastructure Integration (D)

Proje, altyapı ağlarını entegre ediyor mu?

(Her bir altyapı bileşeninin (örneğin su, elektrik, ulaşım, iletişim) birbirine bağlı ve koordineli olmasını sağlar. Örneğin, akıllı trafik sinyalizasyonu ve yol durumu izleme sistemi entegre edilebilir. Trafik ışıkları, yol yüzeyi sensörleri, trafik yoğunluğu ve hava durumu sensörleriyle bağlantılı hale getirilerek, trafik akışı yönlendirilebilir ve olası kazalar, tıkanıklıklar veya kötü hava koşullarına karşı sürücülere erken uyarı yapılabilir.)

48. CR2.6 Improve Infrastructure Integration (E)

Performansı iyileştirmek amacıyla veri veya izleme sistemlerini entegre ediyor mu?

(Bu tür sistemler, gerçek zamanlı veriler toplayarak, operasyonel kararları iyileştirir, potansiyel sorunları önceden tespit eder ve bakım gereksinimlerini optimize eder.)

F. Theme, subtheme and code classification

Table F.1 Themes, subthemes and codes details

THEMES	SUBTHEMES	CODES	FREQUENCY
THEME 1: PROJECT CONTEXT AND APPLICABILITY CONDITIONS	Subtheme 1.1: Dependence on Project Type and Funding Source	currently executed	282
		not executed	179
		In national projects	52
		not in national projects	50
		in funded projects	95
		better executed in funded projects	19
		international projects	58
		better executed in international projects	9
		in other sectors	34
		depends on project conditions	52
	Subtheme 1.2: Expression Patterns Regarding the Possibility of Implementation	if possible	11
		impossible to execute	16
		should be considered	26
	Sub-Theme 1.3: Stages According to the Project Life Cycle	construction stage	27
		feasibility stage	12
		design stage	5
		operational phase	3
		Emergent Sustainability	8
THEME 2: PRIORITY AND CRITICISM ASSESSMENT	Subtheme 2.1: Implementation Priority and Impact	critical importance	165
		high importance	147
		low importance	29
		medium importance	81
	Subtheme 2.2: Perceived Level of Implementation Difficulty	medium difficulty	162
		low difficulty	127
		high difficulty	113
		easy to implement	39
		easy to overcome possible obstacles	9
		problems may occur	2
THEME 3: LEGAL AND INSTITUTIONAL FRAMEWORK	Sub-Theme 3.1: Legal Regulations and Compliance	strict regulations	13
		compliance with regulations	28
		not allowed	13
		legal barriers	3
		Earthquake Regulations and Standards	3
		EIA-stage Implementation Commitment	12
		restricted areas close to water bodies	3
		permission requirement from institution	25

Table F.1 Themes, subthemes and codes details (cont'd)

THEMES	SUBTHEMES	CODES	FREQUENCY
THEME 4: STAKEHOLDER ENGAGEMENT AND COMMUNICATION	Subtheme 4.1: Interaction Processes with Stakeholders	stakeholder communication	67
		Stakeholder Negotiation	5
		community feedback	11
	Subtheme 4.2: Stakeholder Views and Priorities	stakeholder opinions	17
		stakeholder satisfaction	5
		stakeholder sustainability priorities	4
		institutional view	12
THEME 5: MANAGEMENT OF SOCIAL IMPACTS AND SOCIAL SUPPORT	Subtheme 5.1: Socioeconomic Benefits to Society	job opportunities	9
		travel time reduction	2
		women support	13
		economical support to citizens	12
		social development	6
		meeting public needs	12
		providing improvement through project	25
		health and safety	15
	Subtheme 5.2: Education and Awareness Raising Activities	worker education	6
		public education	9
		raising public awareness	1
		supporting community participation	5
	Subtheme 5.3: Protection and Support Measures for Affected Population	fairness	7
		social responsibility projects	4
		support for the affected population	24
THEME 6: CONSERVATION, RESTORATION AND HARM MINIMIZATION	Subtheme 6.1: Protection of Cultural, Natural and Social Values	protecting environment	24
		protecting project	10
		protection measures	18
		preserving	15
		preserving culture	2
		restoration	8
		relocating for preservation	17
		reusing	8
		intent for saving agricultural land	12
		animal mobility	9
		endangered species	8
		recovery	13
		public satisfaction	5
		protecting history	9
		importance of olive grove	3
	Subtheme 6.2: Harm Reduction and Preventive Interventions	minimizing discomfort	10
		mitigation measures	4
		avoidance	20
		purification	3
		precautions	20
		disaster preparedness	18
		security improvements	7
		no harm	5
		accesibillity in mobility	9

Table F.1 Themes, subthemes and codes details (cont'd)

THEMES	SUBTHEMES	CODES	FREQUENCY
THEME 7: NEGATIVE EFFECTS AND TYPES OF HARM	Subtheme 7.1: Physical and Environmental Damages	vibration	4
		contamination	1
		exterminate	2
		possible negative effects in construction stage	21
	Subtheme 7.2: Socioeconomic and Long-Term Losses	loss of future benefit	4
		relocation of citizens	8
	Subtheme 7.3 Dissatisfaction and Complaints	public complaint	8
THEME 8: DESIGN AND IMPLEMENTATION SENSITIVE TO ENVIRONMENTAL AND SOCIAL IMPACTS	Subtheme 8.1: Techniques for Protecting the Natural and Social Environment	topsoil seperation	4
		animal pass	18
		protected areas	2
		evaporation basin	3
		retension/detension basin	9
		oil seperator	8
		exhaust inspection	5
		noise barriers	10
		landscape	3
		lighting	4
		tunnel	10
		flood risk assessment	6
		finding sensitive areas	4
		risk assessment	1
		using recycled material	1
		site visit	5
		design solutions	32
	Subtheme 8.2: Social Impact Analysis and Interaction with Society	informing public	9
		public participation meeting	21
		stakeholder engagement plan	5
		community interviews	8
		analysis of community needs	13
		level of influence by project	3
		public demand	12
	Subtheme 8.3: Physical Arrangements Focused on Accessibility and Inclusion	bike path	7
		central refuge	3
		city roads	16
		disabled access	4
		emergency exit intersections	1
		public transportation	2
		highway projects	14
		right of way	18
		land	4
THEME 9: DATA-DRIVEN DECISION MAKING AND ANALYTICAL EVALUATION	Subtheme 9.1: Monitoring, Data Collection and Analysis	data monitoring	13
		real-time monitoring	3
		noise modelling	6
		fotokapan	2
		coordination between department	11
		labaratuary works	2
		risk management strategies	2
		trafic projection	1
		control mechanism	18

Table F.1 Themes, subthemes and codes details (cont'd)

THEMES	SUBTHEMES	CODES	FREQUENCY
THEME 9: DATA-DRIVEN DECISION MAKING AND ANALYTICAL EVALUATION	Subtheme 9.2: Decision Making and Evaluation of Alternatives	comparison of alternatives	8
		data comparison	11
		multi-criteria analysis	2
		prioritization	53
		engineering expertise	14
		take action acc. to limit value	12
		preconstruction survey	2
		communication and interaction	8
		iterative design process	10
		reactive decision-making	1
		selectvity of animals	2
		flood	3
		landslide	7
THEME 10: IMPLEMENTATION BARRIERS AND ENABLING CONDITIONS	Subtheme 10.1: Specific Barriers to Implementation	no experience	86
		difficult to convince management	4
		technical difficulties	24
		financial difficulty	55
		time schedule difficulties	17
		lack of documentation	9
		legal difficulties	7
		data availability difficulty	6
		employee management difficulty	1
		lack of control	4
		different perspective difficulty	4
		difficult to implement in Türkiye	7
	Subheme 10.2: Operational and Behavioral Challenges	alignment revision	23
		adaptation challenges	4
		budget claims during construction	1
		unpredictable	3
		changing historical data patterns	11
		revision needed during construction	10
		opportunism	5
		ignoring the facts	2
		pubic ignoring historically important pieces	1
		ignoring requirements	3
		ignoring public opinion	3
		failure to comply with commitment	3
	Subheme 10.3: Required Conditions for Implementation	electric vehicle incentive	3
		need for funding	17
		owner request	14
		need for regulations	14
		Sustainability Awareness	4
		early integration	4

G. Code and SDG Matching

Table G.1 Codes matched with SGD targets

CODES	SDG																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
THEME 3: LEGAL AND INSTITUTIONAL FRAMEWORK																	
Sub-Theme 3.1: Legal Regulations and Compliance																	
strict regulations																**x**	
compliance with regulations																**x**	
not allowed																**x**	
legal barriers																**x**	
earthquake regulations and standards											**x**					**x**	
EIA-stage implementation commitment																**x**	
restricted areas close to water bodies						**x**								**x**		**x**	
permission requirement from institution																**x**	

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
THEME 4: STAKEHOLDER ENGAGEMENT AND COMMUNICATION																	
Subtheme 4.1: Interaction Processes with Stakeholders																	
stakeholder communication											**x**					**x**	
stakeholder negotiation																**x**	**x**
community feedback										**x**						**x**	
Subtheme 4.2: Stakeholder Views and Priorities																	
stakeholder opinions											**x**					**x**	
stakeholder satisfaction											**x**						
stakeholder sustainability priorities																	**x**
institutional view																**x**	
THEME 5: MANAGEMENT OF SOCIAL IMPACTS AND SOCIAL SUPPORT																	
Subtheme 5.1: Socioeconomic Benefits to Society																	
job opportunities								**x**									
travel time reduction									**x**		**x**						
women support					**x**					**x**							
economical support to citizens	**x**									**x**							
social development											**x**						
meeting public needs											**x**						
providing improvement through project								**x**	**x**								
health and safety			**x**					**x**									

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Subtheme 5.2: Education and Awareness Raising Activities																	
worker education				**x**													
public education				**x**													
raising public awareness												**x**					
supporting community participation										**x**						**x**	
Subtheme 5.3: Protection and Support Measures for Affected Population																	
fairness										**x**						**x**	
social responsibility projects																	**x**
support for the affected population	**x**										**x**						

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
THEME 6: CONSERVATION, RESTORATION AND HARM MINIMIZATION																	
Subtheme 6.1: Protection of Cultural, Natural and Social Values																	
protecting environment						**x**						**x**			**x**		
protecting project									**x**								
protection measures															**x**		
preserving															**x**		
preserving culture											**x**						
restoration															**x**		
relocating for preservation															**x**		
reusing												**x**					
intent for saving agricultural land															**x**		
animal mobility															**x**		
endangered species															**x**		
recovery															**x**		
public satisfaction											**x**					**x**	
protecting history											**x**						
Importance of olive groove		**x**													**x**		
Subtheme 6.2: Harm Reduction and Preventive Interventions																	
minimizing discomfort											**x**						
mitigation measures															**x**		
avoidance															**x**		
purification						**x**						**x**			**x**		
precautions											**x**		**x**		**x**		
disaster preparedness											**x**		**x**				
security improvements																**x**	
no harm						**x**									**x**		
accesibillity in mobility										**x**	**x**						

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
THEME 7: NEGATIVE EFFECTS AND TYPES OF HARM																	
Subtheme 7.1: Physical and Environmental Damages																	
vibration											**x**						
contamination						**x**											
exterminate															**x**		
possible negative effects in construction stage											**x**	**x**					
Subtheme 7.2: Socioeconomic and Long-Term Losses																	
loss of future benefit								**x**							**x**		
relocation of citizens											**x**						
Subtheme 7.3 Dissatisfaction and Complaints																	
public complaint											**x**					**x**	

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
THEME 8: DESIGN AND IMPLEMENTATION SENSITIVE TO ENVIRONMENTAL AND SOCIAL IMPACTS																	
Subtheme 8.1: Techniques for Protecting the Natural and Social Environment																	
topsoil seperation			**x**												**x**		
animal pass															**x**		
protected areas											**x**				**x**		
evaporation basin						**x**											
retension/detension basin						**x**											
oil seperator						**x**						**x**					
exhaust inspection			**x**								**x**						
noise barriers											**x**						
landscape											**x**						
lighting											**x**						
tunnel									**x**		**x**						
flood risk assessment											**x**		**x**				
finding sensitive areas															**x**		
risk assessment											**x**		**x**				
using recycled material												**x**					
site visit											**x**						
design solutions									**x**		**x**						
Subtheme 8.2: Social Impact Analysis and Interaction with Society																	
informing public																**x**	
public participation meeting																**x**	
stakeholder engagement plan																**x**	**x**
community interviews										**x**						**x**	
analysis of community needs										**x**	**x**						
level of influence by project										**x**	**x**						
public demand											**x**					**x**	

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Subtheme 8.3: Physical Arrangements Focused on Accessibility and Inclusion																	
bike path											**x**						
central refuge											**x**						
city roads											**x**						
disabled access										**x**	**x**						
emergency exit intersections			**x**								**x**						
public transportation											**x**						
highway projects											**x**						
right of way											**x**						
land											**x**						
THEME 9: DATA-DRIVEN DECISION MAKING AND ANALYTICAL EVALUATION																	
Subtheme 9.1: Monitoring, Data Collection and Analysis																	
data monitoring									**x**		**x**						
real-time monitoring									**x**		**x**						
noise modelling											**x**						
camera trap															**x**		
coordination between department																**x**	
labaratuary works						**x**						**x**					
risk management strategies											**x**		**x**				
trafic projection									**x**		**x**						
control mechanism																**x**	

Table G.1 Codes matched with SGD targets (cont'd)

CODES	SDG																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Subtheme 9.2: Decision Making and Evaluation of Alternatives																	
comparison of alternatives									x		x						
data comparison									x		x						
multi-criteria analysis									x		x						
prioritization											x				x		
engineering expertise									x								
take action acc. to limit value															x	x	
preconstruction survey										x	x						
communication and interaction											x					x	
iterative design process									x		x						
reactive decision-making									x		x						
selectvity of animals															x		
flood											x		x				
landslide											x						
TOTAL	**2**	**1**	**4**	**2**	**1**	**9**	**0**	**4**	**14**	**11**	**57**	**8**	**6**	**1**	**25**	**27**	**4**