

Impact on soil environment due to construction projects

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ABSTRACT.

A major problem faced by the construction industry is the pollution of ecosystems. Since the study of whole ecosystems is difficult and extensive, one of its main aspects, soil pollution, is considered here.

The impact on soil environment affect for long time duration. Because of soil pollution, there are so many side effects can be happen. Water pollution, health issues (such as cancers...) issues in agricultural field can be arise due to the soil pollution. Natural water springs can block too. Nowadays, many problems have contributed to the stagnation of the construction project against soil environment.

The objective of this study is identified issues face by the constructors, villagers, stakeholders and relevant parties those who involving this situation and identifying practical solutions. Then It`s easy to identified issues and answers issues with soil environment when conducting construction project i.)Soil erosion.

ii.)Soil compaction.

iii.)Soil contamination. iv)

Soil subsidence.

This can help preserve soil quality, protect the environment, and maintain the long-term sustainability of the construction site.

The major objective of this study is to identify parties with significant knowledge about the relevant fields and propose practical solutions to the problem.

Key words: construction project, soil environment, issues, practical solutions.

1. Introduction.

1. Background of the study.

The impact of construction projects on the soil environment can be significant and varied. Here are some common impacts associated with construction activities:

Soil compaction: Heavy machinery, equipment, and vehicles used in construction can lead to soil compaction. Compaction reduces soil pore spaces, limiting the infiltration of water and air into the soil. This can affect plant growth and nutrient availability.

Soil erosion: Construction activities often involve land clearing, excavation, and grading, which can disturb the topsoil and vegetation cover. This increases the risk of soil erosion by wind and water. Eroded soil can be carried into nearby water bodies, causing sedimentation and affecting aquatic ecosystems.

Loss of soil fertility: Construction activities may result in the removal of topsoil, which is the most nutrient-rich layer of soil. Topsoil contains organic matter, nutrients, and microorganisms essential for plant growth. Removal of this layer can lead to a loss of soil fertility and hinder the re-establishment of vegetation after construction.

Contamination: Construction projects can introduce contaminants into the soil environment. For example, spills of fuels, oils, or chemicals used in construction activities can result in soil contamination. Improper handling and disposal of construction waste can also contribute to soil pollution.

Changes in soil hydrology: Alterations to the natural landscape during construction, such as grading and excavation, can disrupt the natural flow of water in the soil. This can lead to changes in groundwater levels, drainage patterns, and the overall hydrological balance of the area.

Disturbance of soil ecosystems: Construction activities can disrupt soil ecosystems, including microorganisms, insects, and small animals. These organisms play crucial roles in nutrient cycling, decomposition, and maintaining soil health. Disruption of these ecosystems can have long-term impacts on soil fertility and ecological functions.

Understanding the specific impacts of construction on the soil environment is important for effective mitigation measures and sustainable development. By implementing erosion control measures, using appropriate construction techniques, minimizing soil disturbance, and employing proper waste management practices, the negative impacts on the soil environment can be reduced.

II.) Problem statement

The impact of construction projects on the soil environment can vary depending on the nature and scale of the project. Here are some common issues associated with construction activities and their potential impact on soil.

Soil Erosion: During construction, vegetation is often removed, exposing the soil to erosion by wind and water. Soil erosion can result in the loss of topsoil, which is rich in organic matter and essential nutrients. It can also lead to sedimentation in nearby water bodies, negatively affecting aquatic ecosystems.

Compaction: Heavy machinery and equipment used in construction can compact the soil, reducing its porosity and disrupting its natural structure. Compacted soil has reduced water infiltration and air circulation, which can inhibit root growth and nutrient uptake by plants.

Contamination: Construction sites may contain hazardous materials such as fuels, oils, paints, solvents, and construction debris, which can leak or spill onto the soil, contaminating it. Contaminants can persist in the soil for long periods and pose a risk to both human health and the surrounding ecosystem.

Soil disturbance: Excavation and grading activities can disrupt the soil profile, mixing different soil layers and altering their composition. This disturbance can affect soil fertility, nutrient cycling, and the nutrient balance of microorganisms present in the soil.

Loss of soil productivity: Construction projects often result in the permanent loss of fertile soil due to land conversion. Construction of buildings, roads, and infrastructure replaces agricultural land or natural habitats, leading to the loss of soil's ability to support vegetation growth and perform essential ecosystem functions.

Drainage and Runoff issues: Changes in land use and the addition of impermeable surfaces such as concrete and asphalt can affect the natural drainage patterns of an area. This alteration can cause increased surface runoff and reduce infiltration, potentially leading to localized flooding, soil erosion and sedimentation.

To mitigate these impacts, construction projects should implement best management practices such as erosion control measures, sedimentation ponds, and proper waste management, and soil stabilization techniques. Adhering to environmental regulations and conducting site assessments before construction can help identify potential soil issues and guide appropriate mitigation measures.

III.) Research question

Impact on the soil environment due to construction project.

IV) Objective of the study

- i.) Identify the impacts on soil environment due to construction projects.
- ii.) Identifying, analyzing and give practical solutions for those issues and impacts.

V.)Scope of the company

The scope of a study on the impact of construction projects on the soil environment may include assessing and analyzing various aspects related to the subject matter. Here are some potential components that can be considered within the scope:

Soil quality assessment: Evaluate the changes in soil properties, such as compaction, fertility, organic matter content, pH, and nutrient levels, before and after construction activities. This can involve soil sampling and laboratory analysis to quantify the impacts.

Erosion and sedimentation analysis: Investigate the extent of soil erosion and sedimentation caused by construction activities. Assess the amount of soil lost, the areas affected, and the potential downstream impacts on water bodies.

Contamination assessment: Identify and analyze potential soil contamination resulting from construction projects. This can involve sampling and analysis of soil for pollutants, such as heavy metals, hydrocarbons, or other hazardous substances commonly used in construction.

Vegetation and biodiversity assessment: Examine the effects of construction on vegetation cover, plant species composition, and overall biodiversity in the area. Determine the capacity of the soil to support vegetation and the recovery potential after construction.

Hydrological analysis: Study changes in soil hydrology, including groundwater levels, surface runoff patterns, and drainage characteristics due to construction activities. Assess the impacts on water resources and nearby ecosystems.

Mitigation measures and best practices: Identify and evaluate the effectiveness of different mitigation measures employed to minimize the negative impacts on the soil environment during construction. This can include assessing the use of erosion control techniques, soil stabilization methods, and sustainable construction practices.

Policy and regulatory review: Examine existing policies, regulations, and guidelines related to soil protection during construction projects. Assess their effectiveness in mitigating soil-related impacts and recommend improvements or additional measures.

It is essential to define the specific objectives, boundaries, and methodologies within the scope of the study to ensure a comprehensive and focused analysis of the impact of construction projects on the soil environment.

VI.)Significant of the study

The significance of studying the impact of construction projects on the soil environment lies in understanding and addressing the potential negative consequences associated with such activities. Here are some key points highlighting the significance of this study:

Environmental protection: Construction projects have the potential to cause significant degradation of soil resources, which are vital for sustaining life and ecosystems. By studying the impact on the soil environment, the study contributes to promoting environmental protection and sustainable development practices.

Policy and regulation development: The findings of the study can inform the development or improvement of policies, regulations, and guidelines related to construction practices. It can help policymakers and regulatory bodies establish effective measures to minimize soil-related impacts and ensure the long-term sustainability of construction activities.

Mitigation and management strategies: Understanding the specific impacts on the soil environment allows for the development and implementation of appropriate mitigation and management strategies. This study can provide insights into effective erosion control measures, soil conservation techniques, and best practices that can be applied in construction projects to minimize soil disturbance and protect soil quality.

Sustainable land use planning: The study findings can contribute to sustainable land use planning by highlighting the potential impacts of construction on soil resources. This information can guide decision-making processes related to site selection, project design, and land development, aiming to minimize soil degradation and preserve valuable soil ecosystems.

Economic considerations: Soil degradation resulting from construction activities can have economic implications, such as decreased agricultural productivity or increased costs for soil remediation. By understanding the impacts, the study can assist in quantifying the potential economic costs and benefits associated with different construction practices, helping stakeholders make informed decisions.

Public awareness and education: The study can raise awareness among the general public, construction professionals, and stakeholders about the importance of preserving soil resources during construction projects. By disseminating the study's findings, it can contribute to educational initiatives and promote sustainable construction practices that prioritize soil conservation.

By comprehensively assessing the impact of construction projects on the soil environment and emphasizing its significance, this study can pave the way for sustainable construction practices, informed decision-making, and the protection of soil resources for future generations.

2.) Literature review.

The impact of construction projects on the soil environment has been a subject of study in various scientific literature. Conducting a literature review on this topic can provide a comprehensive understanding of the existing knowledge and research gaps. Here are some key points that can be covered in the literature review:

Soil compaction: Review studies that investigate the effects of construction activities on soil compaction. Examine how compaction alters soil physical properties, affects soil structure, and influences water and air movement within the soil.

Soil erosion and sedimentation: Explore research on the erosion and sedimentation processes resulting from construction projects. Assess studies that quantify the extent of soil erosion, identify contributing factors, and examine the impacts of sedimentation on water bodies and aquatic ecosystems.

Soil fertility and nutrient loss: Review literature focusing on changes in soil fertility due to construction activities. Investigate studies that assess the loss of topsoil, changes in nutrient availability, and the long-term impacts on soil fertility and plant growth.

Soil contamination: Examine research that investigates soil contamination resulting from construction projects. Analyze studies that identify the types and sources of contaminants, assess the extent of soil pollution, and explore the potential risks to human health and the environment.

Soil biodiversity and ecosystem disruption: Explore literature on the effects of construction activities on soil biodiversity and ecosystem functioning. Review studies that examine the impacts on soil microorganisms, invertebrates, and vegetation, and evaluate the potential consequences for nutrient cycling and soil ecosystem services.

Mitigation measures and best practices: Assess studies that focus on mitigating the negative impacts of construction on the soil environment. Review research that investigates the effectiveness of erosion control techniques, soil stabilization methods, and sustainable construction practices in minimizing soil disturbance and promoting soil conservation.

Modeling and assessment tools: Explore literature on modeling approaches and assessment tools used to predict and evaluate the impacts of construction projects on the soil environment. Review studies that employ models or frameworks to simulate soil erosion, quantify soil loss, or assess the effectiveness of mitigation strategies.

By conducting a thorough literature review, you can gather and synthesize the existing knowledge, identify research gaps, and establish a foundation for your study on the impact of construction projects on the soil environment.

3.) Methodology

The purpose of this study is Identify the impacts on soil environment due to construction projects, analyzing and give practical solutions for those issues and impacts in Sri-Lankan construction field.

In this chapter include by the population and sample method, data analysis methods use for the research for the analyzing impacts on soil environment due to construction projects in tangalle area. The research focused on,

- i. The impacts on soil environment.
- ii. The solutions for those problems

Sample and population

When consider about the population of the constructions conducting in tangalle area. Now this is a town area and constructing projects are more than previous years. Considering about the population chosen by the 15 people as the sample for collect data to the research from MAGA constructors, NITA technical academy and few engineers from construction field.

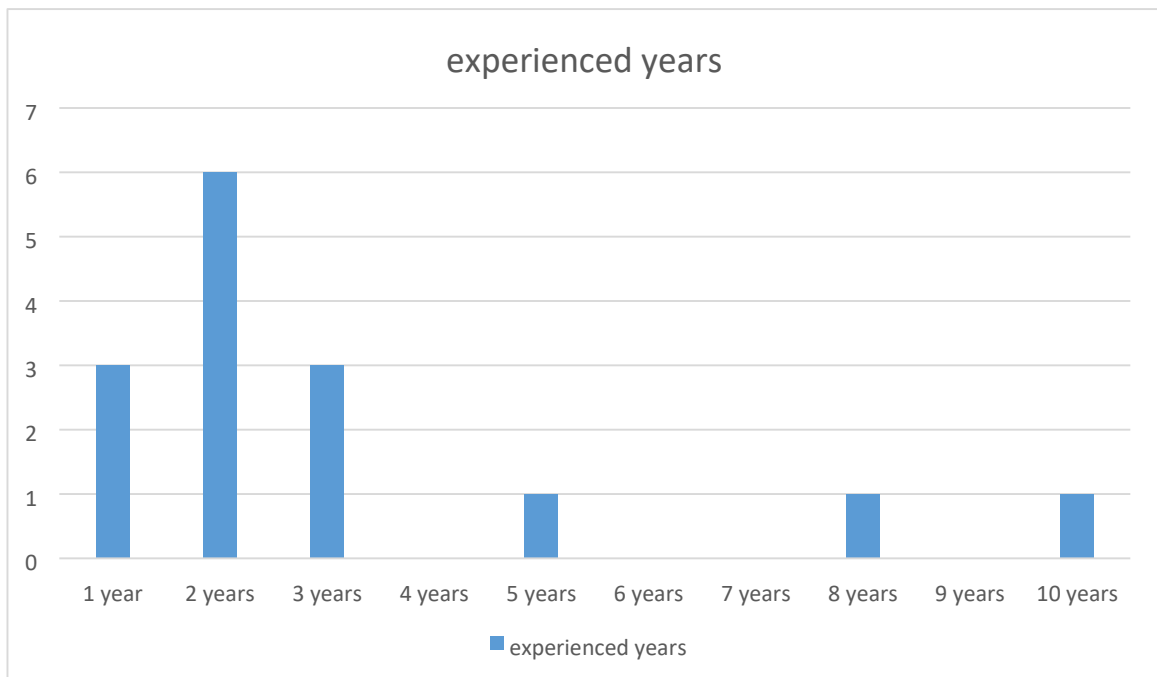
These population is chosen by using the random sampling method.

4.) Data collection and data analysis techniques.

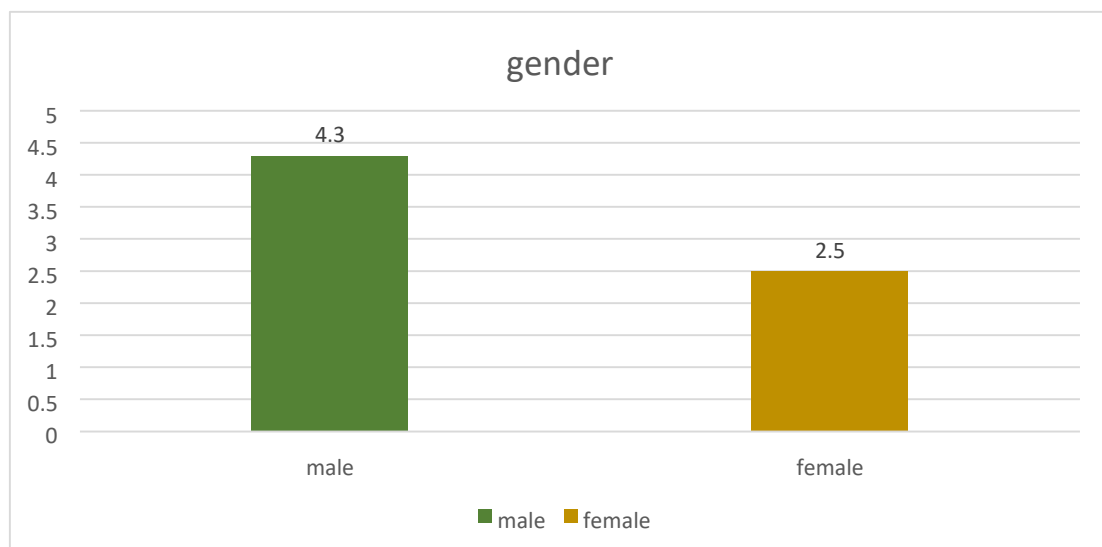
In his research used the primary data as the data collection method. The primary data by used from the researcher were questionnaires, interviews etc. In here the researcher used by the online and verbal questionnaires and the telephone call interviews for collect to the data from the people

Data analysis

Through the sample, few employers were involved to the industry before 5 years.. Few workers have less than 5 years' experience.



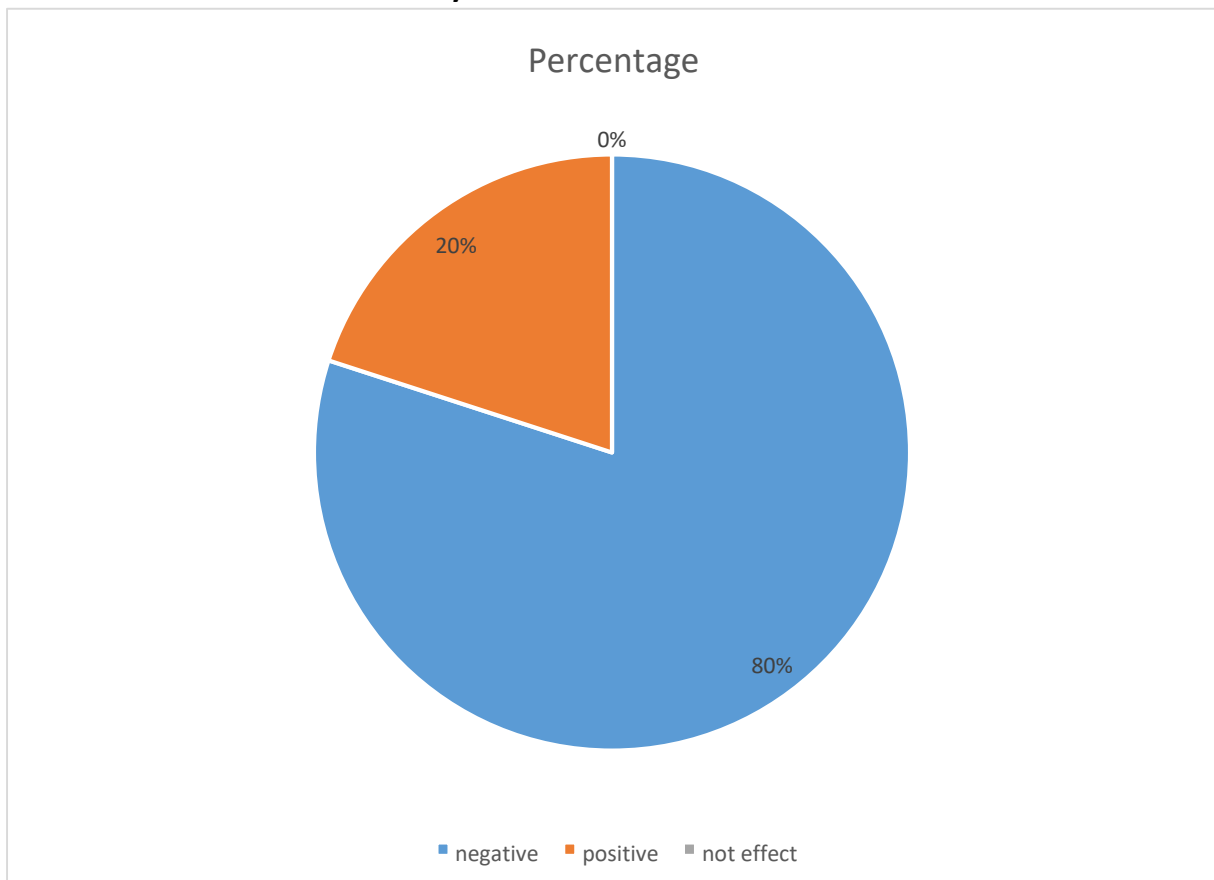
Years of involve to the industry



According to the questionnaires from 12 people who were involving in the construction field in tangalle area, most employers are 33.3% percent are male employers and 66.7% percent are female employees

No of years	Frequency
1	0
2	6
3	1
5	1
7	2
8	1
10	1

How Modern constructions mainly effect on soil environment



Majority of people (80%) says that modern constructions mainly effect negatively on soil environment. Few number of people reacts as “positive”. It`s 20% percentage.

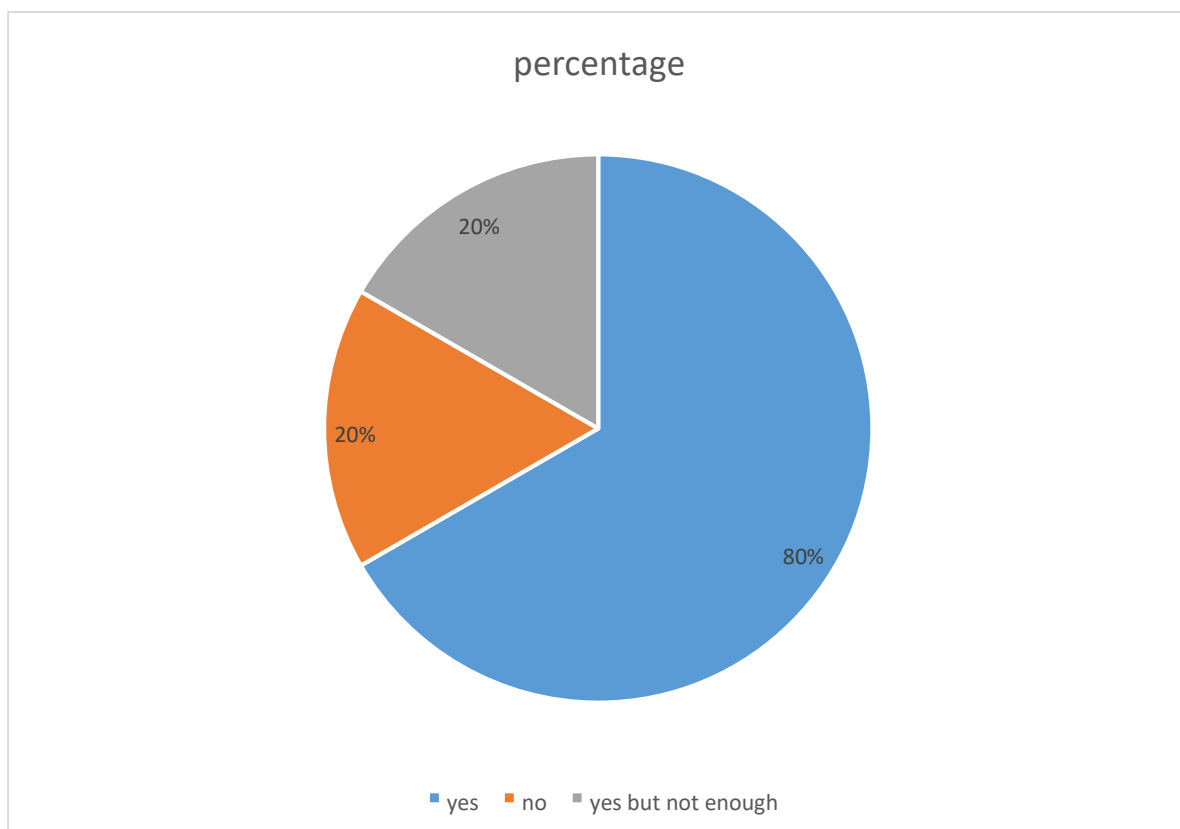
No one answered as “not effect”.

So, their opinion is construction projects mainly effect negatively on soil environment. As it`s the main reason for the soil chemical disorder, PH unbalancing, low soil diversity etc.

Most people says that they trying to conducting constructions with minimum soil damages. But they know practically it`s not easy to do.

Tools and techniques to protect soil environment in construction projects

For that, in questionnaires, I ask the question “is there are tools and techniques to protect soil environment in construction field?”



80% people of the sample says there are enough tools and techniques to protect soil environment when constructing. But 20% percentage reply as “no”. All employees have enough experience about relevant field. So we can say that modern tools and techniques couldn`t cover all negative impacts in construction projects against soil environment. As 20%

sample reply that, tools and techniques are good but not enough for recover the soil environment at defined situations.

Employees' opinion about modern construction against soil environment.

I had 9 responses for that question in Google form which I shared through the sample population.

- i. "Sometimes, soil environment is polluted by unnecessary constructions"
- ii. "There are many negative impacts", "Should be environment friendly"
- iii. "I think modern construction mainly focus on about the project our environment. So they help to protect our soil and to minimize the soil erosion"
- iv. " must be systematic"
- v. "Yes"
- vi. "Not so good"
- vii. "It's more suitable if it is possible to protect the soil environment",
- viii. "It's more desirable if the soil can be constructed in such a way as to protect the environment".

Many people say it's good to have systematic approach more than that. Few are say the system is good against protect soil environment.

Identified issues and answers issues with soil environment when conducting construction project

- i. Soil erosion. ii. Soil compaction. iii. Soil contamination. iv. Soil subsidence.
- v. Soil disturbance and loss of topsoil.
- vi. Soil runoff and sedimentation

It's crucial for construction projects to mitigate these issues by implementing proper soil management practices, erosion control measures, and sediment control strategies. This can help preserve soil quality, protect the environment, and maintain the long-term sustainability of the construction site.

5.) Conclusion and recommendations.

A major problem faced by the construction industry is the pollution of ecosystems. Since the study of whole ecosystems is difficult and extensive, one of its main aspects, soil pollution, is considered here. And construction activities can cause soil erosion due to the removal of vegetation and disturbance of the soil's natural structure. During construction, topsoil is often removed or disturbed, which is the most fertile layer of soil, and also construction activities may disturb and release hazardous materials into the soil. So this study mainly focus the problems like that.

The objective of this study is identified issues face by the constructors, villagers, stakeholders and relevant parties those who involving this situation and identifying practical solutions. As they have specific knowledge and experiences about the relevant industry.

The major objective of this study is to identify parties with significant knowledge about the relevant fields and propose practical solutions to the problem.

Then It's easy to identified issues and answers issues with soil environment when conducting construction project

- i. Soil erosion. ii. Soil compaction.
- iii. Soil contamination.
- iv. Soil subsidence.

This can help preserve soil quality, protect the environment, and maintain the long-term sustainability of the construction site.

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7. Appendices

Soil erosion can start during construction when the protective vegetation cover is removed, the soil is disturbed, and heavy machinery is operated on the site. Nowadays project managers implement various techniques to control soil erosion during construction projects.

Some of these techniques include,

- i.) Sediment and erosion control plans: This can lead to sediment runoff into nearby water bodies, resulting in water pollution.
- ii.) Best management practices (BMPs): Heavy machinery and equipment used during construction can compact the soil, reducing its ability to absorb water and nutrients.
- iii.) Site stabilization: these contaminants can seep into the soil, affecting its fertility and paten
- iv.) Retention and detention ponds.
- v.) Monitoring and maintenance vi.) Compliance with regulations

By incorporating these erosion control measures into the construction process, project managers aim to protect the soil environment, minimize sediment runoff, and maintain the ecological integrity of the surrounding areas.