Slope Stability and Erosion Control Challenges on Mega Projects on Construction Phases

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Abstract

All Big Projects have big challenges on the amounts of sediments that need to be controlled on daily basis. It is one of the biggest challenges that needs to be taken in consideration on the owner side and PM for the construction process. Today, technology has many resources that can be used at the time that the project needs to be built, things can be changed quickly. Sediment control needs to be included always on the design, taking all considerations for the specific areas of the development and the special characteristics for each location. Retention ponds, swells, rip rap and other systems to maintain control of the areas are essential and they need to be implemented. But what happens if the site changes daily with the construction process? Changes like heavy traffic equipment's, roads that change for better access, earth work, site logistics for walkways and pedestrian areas, big excavations and site utilities installation. What happens if things change quickly, and decisions need to be implemented? Mega Projects present a big challenge for engineers and contractors, they must comply with all regulations and dedicate time and commitment to get a better-quality product. At the end it always represents a challenge.

Introduction

Impacted Area 3,754 acres, for the construction of 7 retention ponds, 7 Buildings of one level, Data Centers. Each building is approximately 1,000,000 sft and the time of construction is 12 years. Site Work contemplate more than 1,44 million of cubic meters of soil that need to be storage, moved and used for fill again. All those areas are classified as agricultural areas that need to be evaluated on all impacts on the construction process. The emphasis of this project is to make the evaluation and establish controls for soil stabilization and sediment control on projects that change constantly and requires them to comply with codes and environmental regulations because of nearness to sensitive areas, like wets lands and lakes.

Background

Sediment and slope controls in a mega projects, are essential and must focus on several key aspects to ensure environmental protection, project integrity, and compliance with regulations. Conduct detailed surveys to understand slope gradients and soil types. Identify areas prone to erosion and sediment transport.

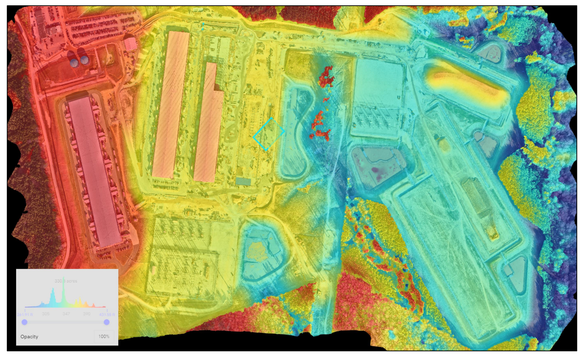
a) Site Assessment and Planning
b) Erosion Control Measures
c) Slope Stability Analysis
d) Stormwater Management
e) Monitoring and Compliance
f) Community Engagement
g) Adaptive Management

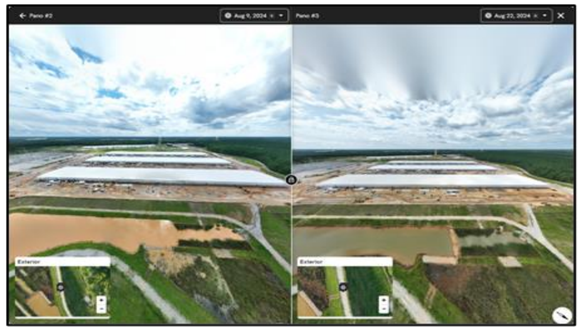
Integrating these elements on mega projects can effectively manage sediment and slope challenges while minimizing environmental impacts.

Methodology

The evaluation process is divided into the following four phases:

- Phase I – Design
- Phase II – Pre-Construction
- Phase III – Construction
- Phase IV – Operational





Problem

The main objective of this article is to determine the countermeasures that need to be used on big developments, taking in consideration all the rules and guidelines to make the project comply with laws and regulations. Including new technology can help confront all the challenges in the construction phases. When managing sediment and slope controls in a mega project, it's essential to focus on key aspects to ensure environmental protection, project integrity, and compliance with regulations.

Results and Discussion

This research bring the opportunity of see an overall view of what are the challenges on mega construction sites, construction methodologies for optimize the project on compliant with laws, codes and designs guidelines. One of the most critical challenges are the constant changes on access for earth work stockpiles and the differences type of soil founded on different areas of the site. Taking in consideration all changes on weather that affect every decision on site work. Every work on the site including work areas, excavations, traffic access for employees, traffic for equipment, construction areas, underground work, foundations, and all work including in the general scope change daily. Using news technologies can help to prevents rules, codes and design guidelines violations special on big areas that are impossible to be analyzed without have all information at real-time.

AI Develop Programs Technologies;

AI can provide advanced tools and techniques to analyze data, predict the impacts of changes, and optimize decisions in real-time. Some of the guidelines that **AI** can be applied in this research are:

Predictive Analytics: **AI** can use machine learning models to analyze historical and current project data, identifying patterns and trends that help predict potential future changes.

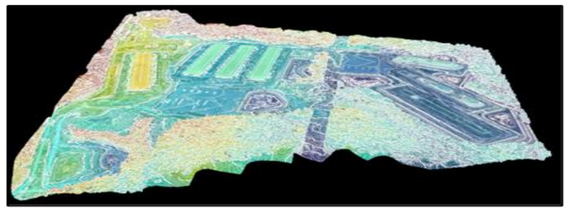
Risk Management: **AI** systems can constantly assess project risks and suggest actions to mitigate them. For example, by identifying areas prior to erosion due to design changes or weather conditions, AI can recommend specific erosion control measures.

Dynamic Planning: Using **AI** algorithms, dynamic project plans can be developed that automatically adjust as circumstances change.

Recommendation Systems: **AI** can offer intelligent, data-driven recommendations to adapt to specific changes in the project.

Automated Monitoring: Using sensors and IOT (Internet of Things) technologies, **AI** can continuously monitor the status of the construction site, including erosion and other environmental impacts.

Simulation and Modeling: **AI** based simulation models can predict the impact of proposed changes to the project, including effects on erosion and soil stability.



Conclusions

Implementing effective slope stabilization and erosion control techniques during construction projects is vital for safety, environmental protection, and long-term sustainability. A combination of proper planning, engineering solutions, and ongoing maintenance can significantly reduce the risk of slope failure, sediment control and additional cost for administrative penalties on environmental violations. AI is one of the most significant tools we have to tackle situations that may require risk assessments and the implementation of new compliance strategies.

Future Work

As a next step for this research, AI need to be implemented as a tool that brings constant information helping on the decisions to prevent possibles changes and non-compliance situations.

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