

Application of landscape Architecture to the Rehabilitation of Quarry in Hong Kong and an Overseas Case Study

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Abstract

Background: The objective of this study is to explore the application of landscape architecture in quarries via a case study. The findings of our imitations in this study could have significant positive implications to inspire readers to more comprehensive thoughts and inspirations. **Methodology:** Desktop research is preliminarily adopted. Two case studies (Shek O Quarry in Hong Kong and Serra da Arrabida Natural Park in Portugal) have been selected. **Findings:** There are perceptible benefits from Shek O Quarry and Serra da Arrabida Natural Park on the use of landscaping in quarry. Benefits include the creation of diversity in ecology, vegetation, landscape visual impacts and the nesting areas that have been created. The disbenefits include immeasurable results of negative environmental impacts and high initial costs. **Conclusion:** Based on the research undertaken, it can be ascertained that the benefits of using landscaping in quarry outnumber the disbenefits. This can be perceived through the two case study analyses.

Keywords: Landscape architecture, Quarry rehabilitation, Hong Kong

1 Introduction

Landscaping is delineated as any activity that alters the perceptible features of an expanse of land. The application of landscape in quarry rehabilitation is of great importance as there will be significant impacts on the environment [1]. There are, however, numerous disbenefits of employing landscape in quarry rehabilitation. This is linked to the aspect of adverse ecological impacts since there would continue to be extensive negative implications on the habitats of flora and fauna, deterioration of water quality, spoiled erosion in addition to the loss of land. In the long run, it will also result in greater costs incurred in the rehabilitation and reclamation of such land [2]. On the other hand, however, the use of landscape in quarry rehabilitation does generate numerous benefits. To begin with, it signifies a sustainable fiscal model for quarrying that facilitates, in an assimilated manner, the rehabilitation of the site in a way that is cost-effective. The use of landscape efficaciously amalgamates the landform with the beautiful adjoining and surrounding landscape and improves ecological habitats and generates an engineered side for land uses in the future. As of now, there are limited studies in Hong Kong regarding the application of landscape in quarry rehabilitation. Therefore, there is a need for a relevant study to explore the application of landscape in quarry rehabilitation via local and overseas empirical cases. The objective of this study is to find out whether landscaping is an ideal approach to apply to quarry rehabilitation. This study could have significant positive implications to inspire readers to more comprehensive thought as they will be inspired from the oversea quarry rehabilitation of our imitations.



2 Literature Review

More often than not, quarry rehabilitation projects take into account large-scale remodeling of the topography. Within the process of quarry rehabilitation as a whole, appropriate kinds of plants are selected and massively planted on slopes in order to accomplish the objective of the compatibility of the quarries to the nearby green environment [3]. Disbenefits of using landscape in quarrying involve high initial costs and immeasurable results of negative environmental impacts. The use of landscape to facilitate integration with surrounding areas through the restringing of the natural floristic conformation of the area and the use of native flora species is quite costly [2]. On the other hand, however, the benefits of using landscape in quarrying include diversity of ecology created, a decrease in carbon dioxide and the creation of visual impacts. Through landscaping the scenic quality is deemed to have improved with progressively more diversity of vegetation patterns and also topographic ruggedness. In addition, the landscaped parts are designed to minimize the usage of water and also to facilitate visual impacts [4]. It can be perceived that the benefits of using landscape in quarry for rehabilitation will outnumber the disbenefits.

3 Methodology

Desktop research has been adopted for this study. The research study collects existent relevant documents and related information from various sources [5]. Efforts have been made to ensure that the collections are based on the best available information that is impartial. Data and information have been collected in three steps. The first step is the selection criteria. Relevant documents and related information are selected in relation to the application of landscape to quarry rehabilitation. The second step concerns the language. All documents and information are in English only. The third step analyses the sources and relevant documents that have been collected. A considerable amount of documents and cases have been collected and identified as useful sources. However, sources without systematical analysis in relation to the objective of this study will be considered meaningless. From documents and information review, a local case and an oversea one (Shek O Quarry in Hong Kong and Serra da Arrabida Natural Park in Portugal) have been identified and considered suitable to illustrate the application of landscape in quarry rehabilitation.

4 A Case Study for Rehabilitation of Shek O Quarry in Hong Kong

Shek O Quarry is situated on the south-eastern region of Hong Kong Island on the western part of D'Aguila Peninsula adjacent to Shek O County Park. The operations of the quarry began in 1964 (Figure 1) and 16 years later a major alteration on the landform on the western part was created. Thereafter, after consultation with the government, an agreement resulted in a sanctioned landscape master plan (Figure 2) for the Shek O Quarry rehabilitation. The engineering approach is the creation of restored slopes from quarry benches. A scree slope (Figure 3) was placed over blasted rocks scree for the growth of vegetation on a safe slope angle. Stream courses were excavated in bedrock to avoid landslip (Figure 4). The rationale for this rehabilitation is to generate a landscape that can evolve into a sort of progressive ecological community found on the surrounding native slopes with the same flora and fauna. The rehabilitation of Shek O quarry has exemplified the prospect of taking advantage of natural resources without excessively compromising the natural habitat.



Figure 1: Top-up view of Shek O Quarry where there were no / few trees or plants. Retrieved from https://www.concrete.hk/system/files_force/assets/document/hkila_2012_sq4_low_res.pdf



Figure 2: The project was divided into five phases e.g. Area E (1998), Area B (1999), Area A (1998), Area C (2003) and Area D (2011). Retrieved from https://www.concrete.hk/system/files_force/assets/document/hkila_2012_sq4_low_res.pdf

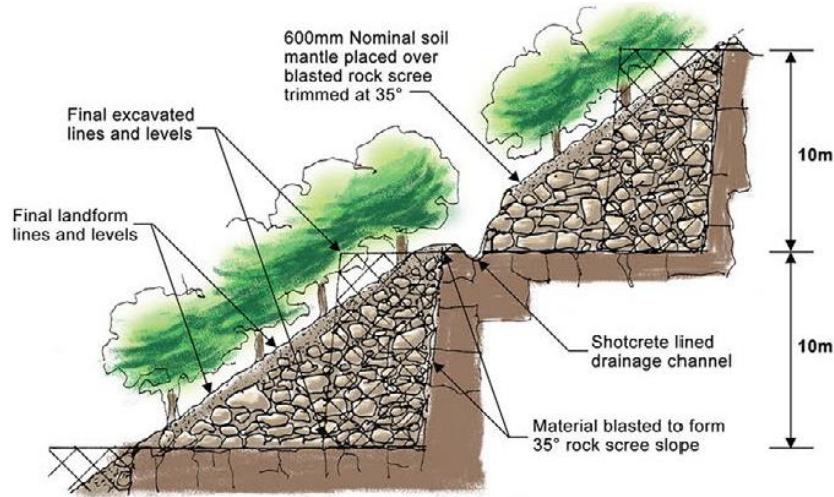


Figure 3: Side view of the formation of scree slope. Retrieved from https://www.concrete.hk/system/files_force/assets/document/hkila_2012_soq4_low_res.pdf

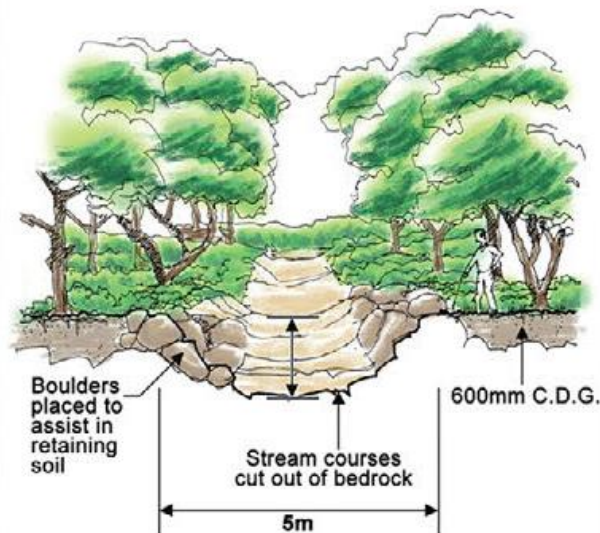


Figure 4: Front view of stream courses. Retrieved from https://www.concrete.hk/system/files_force/assets/document/hkila_2012_soq4_low_res.pdf

5 A Case Study of Rehabilitation at Serra Da Arrabida Natural Park in Portugal

Quarrying activities, for instance the extraction of limestone, encompass major visual effects and degradation issues due to the depletion of the soil and extensive changes to the original topography. The increasing demands for limestone result in an intensification of quarrying which has significant impacts on the landscapes. In earlier times, quarries were basically abandoned subsequent to extraction. Nonetheless, natural colonization of disused limestone quarries is sluggish. The time periods involved in the formation of new communities are not deemed acceptable for the purposes of restoration or reclamation. A rehabilitation quarrying project undertaken in another county is the rehabilitation of a limestone quarry within the Serra da Arrabida Natural Park in Portugal [6]. The area has a longstanding tradition of limestone quarrying. This case study delineates the significant benefits of landscape quarrying. The rehabilitation process took a period of 15 years, during which container grown plants were introduced by Portugal’s mining industry in order to recover the floor of the quarry subsequent to the exploitation of the quarry. At the end of the project, there was a comparison of the

revegetation of five abandoned platforms successively revegetated over the past 15 years at intervals of three years each [7]. This rehabilitation of the quarry resulted in distinctive plant communities, varying in age as well as cover. This permitted the evaluation of establishment and growth of instigated species in addition to the succession of natural species and stabilization of natural vegetation. There was also an evaluation of soil that added to the formation of different species on the platforms [6].

There are perceptible similar benefits between Shek O Quarry of Hong Kong and Serra da Arrabida Natural Park of Portugal for the use of landscaping in quarry. One of the benefits is the creation of diversity in ecology. For instance, in Serra da Arrabida Natural Park, the rehabilitation resulted in distinctive plant communities and different species of flora and fauna and natural vegetation. The same case can be perceived in Shek O Quarry in the sense that ecological regions and vegetation for nesting areas were created to benefit peregrine falcons.

6 Conclusions

The objective of this study explores the application of landscape in quarry rehabilitation in terms of their benefits and disbenefits. The benefits of using landscape in quarry include the diversity of the ecology created, the provision of visual impacts, blending with the surrounding landscape, and the ecological habitats facilitated as well as an engineered location for future uses. Nonetheless, the disbenefits of using landscape in quarry include the issue of immeasurable results and high initial costs. Based on the research undertaken, it can be ascertained that the benefits for using landscape in quarry outnumber the disbenefits. This can be perceived through the case study analysis of the rehabilitation of Shek O Quarry in Hong Kong and that of Serra da Arrabida Natural Park in Portugal.

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