

Research Article

Re-Use of Abandoned Quarries; Case Study of Eco-Tourism and Rangers Academy – Ajloun - Jordan

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Abstract

Natural resources varies from one place to another, among these is natural stone (rock) used mainly in construction and buildings, it is noticed that a high percentage of these quarries are spreading randomly and in an unstructured or studied manner without taking into consideration the environment or the regulations of sustainable development, the quarries especially depleted ones have become an environmental threat to humans, animals and plants, they caused the natural shape of the earth to be distorted and deformed, which requires to find a solution to this issue really fast, conduct studies to exploit and invest these resources properly and sustainably within a well thought out plan, while conserving the environment and the social and the economic development, establish a plan that aim to rehabilitate the abandoned quarries and find a way to benefit from them and educate the local community about these quarries. And that is what will be implemented throughout this paper, where a study case from Jordan will be reviewed of the rehabilitation of an old quarry in Ajloun city, by transforming it into a scientific academy designed on the quarry's site, which aims to help and assist the local community.

Keywords: Ajloun -jordan; Eco-tourism; Natural resources; Sustainable development

Introduction

A quarry can be simply defined as the expanse where different types of rocks including limestone, marble and granite are obtained to be used in various fields of industry and manufacturing. As soon as the needed resources in the quarry are drained and consumed, they usually become deserted and neglected. The excavation resultant holes and openings are either filled with water creating hazardous and unsafe quarry lakes, or they can become an unattractive and repulsive dumping ground. Having quarries within a close distance to urban districts and regions can cause residents to be exposed to various types of pollution, in addition to the inconvenience of being near a deserted quarry, which can be beyond doubt an incontestable and obvious deformity that last for a long time even if the quarrying processes are finished [1]. The most convenient approach to deal with these neglected and deserted quarries is through sustainable redevelopment. Accommodative and flexible plans were initiated across the US and many other countries that aimed to change quarries to a variation of locations; privately owned and public. The prospective utilization of such areas incorporate locations that can be used for training and exploration purposes, entertaining exercises and activities, aquaculture, enterprises, accommodation in addition to warehousing. The objective of the paper is mainly to incite and support the processes of restoration and reconstruction of the areas affected by quarrying and excavation by changing them into expanses appropriate for new supportable and sustainable land utilization [2].

Literature Review

Although quarrying is considered to be an unfavorable industry that can affect the environment and the community, its importance is unquestionable. To be able to preserve the human culture and civilization the way it was during the industrial revolution, it is necessary to recover the resources obtained from quarrying processes so that houses' groundwork can be created [3], the substructure of transportation using cement, asphalt, crushed stone and concrete in addition to various manufacturing utilizations including roofing, binders, additives and abrasives. Globally a huge number of individuals make their living by working in the quarrying industry; hence attempting to eliminate this particular industry can cost innumerable households their livelihoods [2]. Consequently, to rectify the unfavorable outcomes accompanying quarrying, it is essential to make use of the drained expanses in different conducts when the quarries are no longer functional. The possible alterations of quarrying locations to different supportable and sustainable utilizations can contribute in rectifying the unfavorable outcomes of quarrying as well as producing locations with better societal and ecological conditions [1]. The abstract issued in 2002 from the Land Research Center pointed out that quarries have a negative influence on the environment, which includes air, water, soil and noise pollution in addition to their impact on land use, biodiversity and the shape of the land. Mahmoud Abu Shanab's study regarding the environmental impact assessment and its importance to quarries indicated the significance of adopting policies that attempt to better and develop the economic and the environmental situation, in order to spare the environment more deterioration to protect it and ensure the environmental quality, which necessitates an effective and influential public participation in addition to the government's collaboration with the public, venture capitalists, investors, local authorities and environmental defense organizations [4]. The study also referred to a sustainable development policy that accentuate on the favorable connections and relationships between development and the environment. Sustainable development can be defined as the development that matches the present's demands and requirements without impairing the future generations' ability to meet their needs [5]. As for the effectual policies that ensure a sustainable development, certain requirements must be met:

- 1. Settlements and compromises between the economic development and the environmental quality must be cautiously and carefully evaluated.
- 2. The standards and the policies must be practical and compatible with the capability of surveillance and implementation.

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3. Local and public participation in establishing and implementing environmental investment policies.

Abandoned Quarries Impact on the Environment

Environmental pollution, which includes air, water and noise pollution

Air pollution: The dust resulting from working in quarries or from heavy equipment vehicles and trucks' movement on dirt roads is considered the primary polluter of air, the concentration of dust is too high compared to the international standards of acceptable levels, the maximum dust concentration is 15 mg/m³. Dust basically is comprised of Calcium carbonate, in addition to a rather not small amount of Silicon dioxide, a carcinogen when inhaled. The dust causes the pores of the soil to be closed, and reduces the soil's fertility, it can also impact the bio metabolism of tree leaves (e.g. Wadi Seir). There are also the gases resulting from heavy equipment vehicles and transportation means used in quarries and the resultant Carbon Monoxide gas, Sulfur dioxide, Nitrogen dioxide, hydrocarbons and Lead compounds.

- Water pollution: Human waste; solid waste, oils and fuels from vehicles and others are primary causes of water pollution, along with working in quarries which influence water sources.
- Soil pollution: On the long run dust resulting from quarries affects the chemical and physical characteristics of the soil, which is basicity soil in our countries, in addition to altering the soil texture, where the small particles move due to the runoff of stormwater and accumulate in low agricultural lands.

Influencing land use: Setting up quarries randomly has a negative impact on

- 1. Land use is not limited to the expanse of the quarry but it extends to the near fields, meadows and residential areas, and that is noticed through the continuous regression of fields and agricultural lands in aggregations of quarries, which eventually leads to the loss of these lands. It is to be noted that the majority of these aggregations used to be fertile agricultural lands, and among these Alqahoanah and Alzafaran areas in Alshoyokh.
- 2. Offering to buy several houses in Snoot area of Bani Alnaem lands, in order to set up quarries instead within the municipal boundaries.
- 3. The negative impact on livestock in the study area ascribable to establishing quarries on grazing areas that used to have rich vegetation cover [6].
- 4. Main agricultural roads that were invaded by quarries and the greed of their owners, who exploited them, converted them towards the quarries, allowed trucks to use them and the resulting dispersal of damaging dust.
- 5. The remaining narrow roads that stayed without any change has become dangerous to trucks, cars and others [7].

Influencing the biodiversity: Quarries have influenced the wildlife immensely due to the following reasons.

- 1. Establishing quarries on pastoral areas, which destroyed the natural vegetation in addition to animals and plants diversity, for example, Seir area contain 30 species of rare plants.
- 2. The proximity of quarries to the area and the threat they pose since they are located on the edge of a distinct agricultural ecosystem; to the east of this area there exists a system that

makes it difficult on animals and plants that exist in the study area to move to this system, since it is a barren desert area that has no trees and with high temperatures [8].

Influencing the shape of the land (earth): The existence of abandoned quarries without dealing with them leads to

- 1. Deforming the natural condition in the study area, this has a negative impact on the shape of the land and the beauty of nature.
- 2. Dips resulting from excavations and extracting rock layers some of which are almost up to 40 meters, in addition to the insufficiency of the means of protection and public safety [7].
- 3. Destroying the neighboring lands, putting the lives of humans and animals at risk and not providing a protection zone for each quarry and that is mainly due to the lack of regulations that grant the required permits, and the executive authority to follow up on the commitment to these laws and regulations.
- 4. The random spread of quarries leads to the draining of soil in the study area [6].
- 5. Moving the waste resulting from quarries to agricultural lands and forming man-made industrial hills which double the damage.

Influencing the strategic reserves: Using dynamite to blow up weak rock layers lead to the crumbling of the bottom and adjacent rocks in addition to an unfavorable impact on the individuals' health [8] (Figure 1).

Worldwide Endeavors in Quarries Rehabilitations: Quarry Falls

Location and purpose

This quarry is situated in the heart of San Diego, California, was one of the most important suppliers of stone and concrete used in many construction projects in the area for the past 7 decades, among these projects the San Diego Padres baseball stadium located in the city center in addition to airstrips and runways. By the year 2008, the resources in the quarry were completely drained, thus, contractors and builders came up with a plan that aimed to renovate the quarry to a diverse utilization accommodation area, which incorporated building blocks for different families, chain stores as well as an area for business bureaus, this project was named Quarry Falls or Civita, which indicates the attempt to combine 'civic and vitality' (Figure 2).

Considerations and issues preceding rehabilitation process

The location of the quarry being in the center of San Diego is considered a problem, since it is enclosed by many vicinities and neighborhoods that are exposed to different types of pollution; noise, water, air, resulting from the operative quarry. People living in close neighborhoods to the quarry are the most affected, the quarry in itself is an unattractive and repulsive spectacle, it lowered the rates of estates and properties in the location and it caused many objections and protests from the occupants. Reportedly, the level of the land near the quarry has changed from its original level approximately by 200 feet [9] (Figure 3).

Financial support (funding)

In 2008, this extensive and substantial plan was introduced and approved, however, ascribable to the collapse of the housing market,

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Figure 1: One of the abandoned quarries in Jordan.



Figure 2: Regional map of quarry falls [9].



Figure 3: Plan of the quarry falls recreation center [9].

the construction was delayed, and did not start before 2010, and it is planned to proceed in the following 15 years. San Diego City Council's approval of the Quarry Falls plan set up the formal and legitimate advancement strategy for Quarry Falls in the city. The Grant family possessed the quarry from the late 20's of the last century; however, the Corky McMillin Companies of San Diego contracting company in addition to Sudberry Properties development agency appropriated the quarry. The \$1.5 billion worth project is said to be funded by the mortgages offered by local banks, which provided funds to projects of Sudberry.

Characteristics

The outline of the Quarry Falls is approximately 225 acres of designed development situated inside the boundaries of San Diego city. The project is planned near an extensive arrangement of ledged and terraced grounds and public open areas, the multi utilization of the plan is blended in a way that permit the optimum embodiment of the different kinds of accommodation that includes incorporate utilization space, along with vicinities, public merchandise utility, bureau and enterprise parks connected through an operative and effective system of paths and pavements for pedestrians and bikes in addition to the conveyance movement. Quarry Falls are planned to incorporate 37 acres of paths and parks, 4780 residence building blocks, the society within quarry falls will be self-supporting and will contain a primary school, stores, tramcars that link to the public transportation, extensive waterfalls as well as an accentuation on energy proficiency, sustainability and material recovery (recycling).

Benefits

Up until now all the expected benefits of the Quarry Falls are just hypothetical, however, according to the plan, the project will change the expanse into a flourishing and prosperous center for housing, merchandise, enterprise and bureau area. The surviving member of the Grant family was resolved not to allow the quarry to become some other shopping center, since it is on the National Register of Historic Places. The Quarry Falls project contributed in offering job opportunities for lots of laborers in construction field who became unemployed due to the market collapse in 2008, the project also aims to liven the regional economy through tourist attraction and attempting to encourage comparable projects in other areas. The inclination of integrating sustainable conducts in the region must be respected and imitated (Figure 4).

Impediments

The project will cost a huge amount of money, approximately \$1.5 billion, it is also one of the projects that will last for a long period of time and it may be associated with troubles and many disagreeable outcomes especially for people living close to the project location because they are exposed to different obstacles accompanying the construction processes until consummation. Considering the fact that

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the quarry's level has sunken about 200 feet from its initial state, there is the matter concerning the district's drainage. Moreover, along with providing many job openings, residence and enterprise areas, rectifying the unfavorable ecological and artistic effects of the project, together with the high expenses and short-lived troubles and annoyance accompanying the project will eventually be surpassed [9].

Community's reception

The first accommodation block buildings were put up in the market at the beginning of 2012 and were received favorably by the community. Even though the residence units in the district are considered to be expensive to buy or rent, many prizes were awarded for establishing an energy smart district, among these were recognitions including the 2009's Governor's Environmental and Economic Leadership granted by Governor Arnold Schwarzenegger, the Outstanding Planning 2010, Leadership and San Diego Chapter of the American Planning Association's Service Award. As long as the project is developing and the parks are finished, it is anticipated that the community's reception to the entire project will be more favorable.

Eco-Tourism and Rangers Academy - Jordan

The Academy which has an area of 3000 square meters is built on a land that used to be a quarry near Ajloun Forests Reserve and Um Alyanabie, the location was chosen so the environment is not harmed and trees are not cut down, and that is a step toward proving that architecture, when applied properly, will add a creative touch to the place without any negative influence on the surrounding environment. Ajloun's local environment was basically used to obtain raw materials and workers. The Academy's building contain four classrooms set in the open air, conference room, a library, a clinic and a restaurant that accommodate 250 individuals and provides organic foods acquired from local farms, the restaurant is not limited to the use of students of the Academy but it serves tourists and citizens who seek a getaway in vacations and events. The Academy has a nature shop in addition to several tourists' utilities, for it will become a central tourist center in Ailoun. Within the Academy environmental systems are applied and that include natural ventilation, insulation with straw, cooling and heating using a geothermal system and using the internal heat of the earth, collecting rainwater from the Academy's rooftop and Greywater treatment (Figures 5-7).

Owner: The Royal Society for the Conservation of Nature (RSCN)

In the late 1980s-1990s, the Jordanian Government decided to stop many functioning quarries for a variety of environmental reasons. The abandoned quarries remained as untreated wounds and



Figure 5: Eco-tourism and rangers academy [12].



Figure 6: Eco-tourism site before construction [12].



Figure 7: Eco-tourism site while construction [12].

abandoned cuts in the landscape, with no serious land reclamation efforts. The proposed site of the new the Rangers Academy Building held the shadows of a once was a functioning quarry. In this project, our office decided to celebrate the quarry instead of erasing it, by using this man-made artificial exposed cliff to the advantage of the project. This deformed cut turned into the real thrilling challenge of the site. *"As a painter I like painting wounded nature rather than pure nature; pure nature is too much for me, too perfect."-Ammar Khammash* (Figure 8).

The building design was based on the quarry cliff cut-line that a bulldozer driver once drew in the land some twenty years ago, never knowing that this line will be the base of a building elevation. The Citation: Gandah F, Atiyat D (2016) Re-Use of Abandoned Quarries; Case Study of Eco-Tourism and Rangers Academy – Ajloun - Jordan. J Civil Environ Eng 6: 238. doi:10.4172/2165-784X.1000238



Figure 8: Eco-tourism site elevation [12].



Figure 9: Eco-tourism building main entrance [12].

building follows the quarry line very accurately creating a linear addition of constructed stone to the bedrock. The total fill elevation adds up from the ratio of one third added layer of construction on top to two thirds bedrock (Figure 9). The massive southern elevation, which is the most dramatic of all, consists of very small windows with giant vertical blade-like stone cracks shearing into zero width. Those cracks bring light into the vertical circulation areas and the hidden bathroom gardens. The shearing cement in the walls thins down to zero in width, causing the knife edges to crack and act upon their material character (Figure 10). The Academy Building has a double folded functionality: from one side it is an environmental academy that presents natureoriented educational programs, on the other, it is a high-end restaurant and a craft shop that finance the academic program of the project (Figure 11). Arriving to the building after crossing a bridge spanning 30 meters over the quarry gap (the longest masonry arch in Jordan and probably the region and is equivalent in diameter to Hagia Sophia's dome), the building welcomes you at the exact middle contact point between the restaurant's dining room to your right, and the academy to your left. There, the quarry rock acts as the main foundation (Figures 12 and 13). The corridors are defined by a crack in the ceiling that lets natural sunlight in and guides the visitor to the rest of the academy. The building has a very basic treatment of materials. It is made from Ajlouni lime stone from the site's quarry and other quarries that share the same strudel of rock. In the lecture hall, plain concrete block is used for acoustic buffering and insulation in addition to straw in the wall sections. Cuts in the walls were kept exposed without plastering, which shows in the openings of the hall. On the opposite side of the building facing the forest which was not affected by quarrying activities, the academy touches the forest with a beautiful handshake. The building hovers over the forest and barely touches it. It has minimal footprint as the foundation columns cantilever tilts at 45 degrees above the forest floor, and cantilevered terraces with blade-like edges floats -almost like paper- above trees canopies [10-12].







Figure 12: Eco-tourism building section [13].



Conclusion

Ranger's academy is considered one of the best examples that

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clarify how sustainable rehabilitation is the answer to deal with deserted and drained quarries in a way that is advantageous to the public. Through redevelopment support of areas troubled by quarrying, community is able to mend the unfavorable consequences of anthropogenic manufacturing practices. Rehabilitation of quarries can be beneficial to humans as well as the environment by reducing the ecological effects associated with quarrying in a way that prevent the elimination of quarrying as an international and local industry. The process of the rehabilitation of abandoned quarries is a great opportunity to reshape the deformed land due to excavations, and this opportunity needs to be used by creating an edifice, a building or an activity that serves the local community and be of an economic, aesthetic an d beneficial sustainable effect on the environment, and that is evident in the Eco-Tourism and Rangers Academy's design by the architect Ammar Khammash.

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