Bloomington Commercial Reclamation Project
Ball State University, Muncie, Indiana
Landscape Architecture 405 Thesis
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An Introduction into Thesis

Based on our current rate of consumption, some experts predict the world will soon deplete most of its natural energy resources, such as oil, natural gas and uranium. Land is also being consumed by development processes at alarming rates. On the average our farmlands lose from 4 to 7 tons of topsoil per acre per year. That is about 1.25 million acres of topsoil or an estimated 6 billion dollars loss per year. At this staggering rate of depletion, the United States average rate of production is expected to drop from 10 percent to 30 percent in the next thirty years (1). This could devastate the United States agricultural system in the years ahead.

By the year 1970, over six million acres of land across the United States had been devastated by surface mining. Of that six million acres, only one third had been reclaimed adequately and restored to some useful state. The remainder lies in waste, unable to support vegetation, wildlife or any other productive function. In Indiana alone, population growth is expected to reach over six and one half million by the year 2000. This is an expected 27 percent increase in our current population (2). The impact this added pressure will have on our resources must be considered now. Careful planning must strive to considerably lessen stresses on the environment. Without special efforts now the landscapes of the world, and Indiana in particular, will soon prove to be aesthetically deprived and environmentally unstable.
This study is designed to prove that an integrated set of urban land uses, especially three that are in some conflict with each other, can work together into a viable final plan and produce a dynamic product. It is the goal of this study to design a masterplan of a commercial project, with residential and recreational aspects, on an abandoned stone mining site. The quarry chosen was close to the metropolitan center of Bloomington, Indiana, to assist in demonstrating its appropriate conversion to mixed urban use.

Why a quarry? Most Indiana cities would hold the belief that there is still plenty of land to develop and the technical difficulties associated with quarry reclamation would be overwhelming. This study wishes to emphasize that land is running out. We must utilize our present resources to their utmost potential. This means for some lands no development, and for the others wise decisions about their future uses. Serious environmental questions must be answered to determine just how much urbanization can occur before the ecological balance is upset. Obviously there are limits. This is the reason why my creative project focuses on an already disturbed parcel of land, especially one that seemingly has so many negative aspects to it, like poor soils, high walls, and little vegetation. It is for those same reasons that this site proves so interesting. I view it as a dynamic design problem that only the most innovative and creative designers could tackle effectively!

The site I have chosen to test my creative study on is the Rodgers Group, Inc. Ready-Mix concrete site located on the northwest corner of state roads 45/46 and 37. An attempt was made to determine the program of uses and activities within the site boundaries by questioning several city planners of the Bloomington City Planning Commission. Unfortunately no known uses or plans for the site had been determined. Finally I decided on a program of mixed use: commercial, residential and recreational open space that would best exemplify a diversity of land use that the quarry could attain.
The majority of limestone produced in Indiana is Salem limestone, deposited during the Mississippian Age according to geologists some 300 million years ago. Salem limestone is composed primarily of shell fragments and microfossils deposited in a shallow sea that covered most of Indiana. The sea margins migrated over time either seaward or landward and deposited this carbonate sand, interrupted at times in areas by mud. This produced layers of accumulated sand, and as lagoons formed this impeded circulation and caused local concentrations of unoxidized matter. As a result, a geometrically complex network of skeletal debris was cemented into what is now known in South-Central Indiana from Montgomery County to the Ohio River and beyond into Kentucky as Salem Limestone(3).

Indiana has more than a thousand abandoned quarries; a result of the early quarriers who mined limestone and dolomite found near the surface. Stream beds and river valleys were used for their deposits of sand and gravel for road aggregates in areas where overburden covered the bedrock or where the resource of limestone was scarce. In 1827 the first Salem Limestone quarry that went into production on record was opened near Stinesville. Unfortunately this and other quarries had limited exposure, and were only used for bridge foundations, flagging and tombstones until railroads linked them with outside markets. With the advent of the railroad, however, the market boomed and shipments of stone went to Chicago, St. Louis, Louisville, and the eastern seaboard. These shipments were primarily for ballast, bridge abutments, and lime, but in 1855 quarries that were specifically equipped to produce dimension stone were put into production. This marked the beginning of Indiana's largest dimension stone industry(4).
Salem limestone is chemically 97 percent pure calcium carbonate, composed primarily of a common microfossil, Endothyra baileyi, roughly 0.7 millimeters in diameter and spherical in shape. Besides dimension slabs for stone or veneer, limestone is a major raw material for Portland Cement, crushed stone, and lime for metallurgical, chemical and agricultural purposes. It is used as flux for the manufacture of steel, as a neutralizer for soil in agriculture and acid wastes derived from coal mine drainage, and is a component of glass. It is also used for the removal of sulfur dioxide from stack gases at power plants(5).

Indiana produces more than 60 percent of the total dimension limestone quarried in the United States, but this is only 5 percent of the entire mineral output. Nevertheless, roughly 55 million tons with a value of more than 1.6 billion dollars (based on 1968 economy) have been produced since 1877. Of this the major market has been a line drawn from Chicago to New York, and deviating no more than 200 miles from it. Most of the Salem limestone now is used in Indiana and its adjacent states, but in the past a sizable portion was shipped to the eastern seaboard, especially New York and Washington D.C. Unfortunately the sales have dropped because of the popularity of synthetics, such as concrete, steel and glass(6).

Dimension limestone is cut, quarried, or broken to the desired sizes and shapes, and some formations are more than 80 feet thick (the Rodgers Group, Inc. quarry walls average about 35 to 40 feet high). Steam, gasoline, or electrically driven chisels in the past were used to cut blocks of limestone out of the bedrock. Today, most of the cutting has been taken over by the more economical wire saws. After a large hole has been opened in the bedrock, slabs ranging 60 feet long, 4 feet wide, and 8 to 12 feet high are cut and toppled onto their sides ready for shipping to mills where gangsaws slice the blocks into a dozen or more pieces. These may then be cut by circular saws into sills, coping, panels or into rectangular veneer called ashlar seen on prominent residences (7).
Salem limestone is unique in the fact that it is virtually uninterrupted by prominent budding planes, and the stone has almost enough strength with the grain as across the grain. This is the quality that outweighs its overall moderate strength and absorption. Another quality is the fact that it can be carved to great detail. The golden Age in Indiana’s stone industry climaxed during the twenties because Salem limestone could be carved intricately.

Because the stone mined has a low unit cost, quarries are located close to urban centers where shipment costs will be minimized. But unfortunately this proximity has a number of drawbacks:

1) conflicts with adjacent users and neighboring properties,
2) mining is controlled by a high degree of local regulations,
3) there is a great demand for property after mining ceases, because of its proximity to the city (therefore effective reclamation is needed), and
4) environmental problems in waste stone after mining has ceased. It seems that there is more waste stone above ground after mining than was in the ground before mining began. An estimated 50 percent of all limestone removed from the bedrock, including grout, mill spalls, and mill slurry, is wasted in the process of quarrying. The Rodgers Group, Inc. quarry has a large mound located to the east of center of grout and spall wastes.

Some of the hazards created by the limestone mining industry have to be controlled by the government and include:
- released suspended solids into the atmosphere,
- dangerous openings in the ground such as open pits and shafts,
- subsidence or slope failure,
- failure to contain fluid waste materials,
- physical displacement of ground, such as caused by explosives, and
- other problems associated with transport of mined materials.
Other, less quantifiable hazards, but ones that still cause long-term problems include low level alteration of the quality of air and water, noise pollution, and changes to local scenery(11). These problems have to be dealt with effectively in the reclamation stage after the quarry is no longer in operation. Affected are the aesthetics and safety of the property and the neighboring community, and reclamation techniques have to be well thought out in order to provide the city and the surrounding communities with a development that they will find functional and attractive.

Unfortunately, reclamation has not always been an issue worthy of discussion. Until recently the idea has fallen to the individual(s) idealistic and rich enough to undertake such a cause, without the prodding of law or the encouragement by subsidy of our local governments. Those quarries that have been reclaimed have usually been done so for recreational reasons. Swimming pools and beaches have been introduced in two old quarries near Logansport and Markle that have become a part of public camping sites, secluded and beautifully natural again. A sunken garden marks an example of imaginative rehabilitation in a quarry in Huntington City, and another quarry in Pendleton reflects images from a scenic pond that is now a city park(12). There is no reason quarried land that would otherwise be left useless could not be developed into similar areas for recreation or developed into commercial districts. Obviously the only thing that lies between desolation and our own crafted beauty lies in the power of the imagination and the will to see it thrive.
The location of this creative project is the Rodgers Group, Inc. quarry in Bloomington, Indiana. It lies on the northwest corner of the intersection between state roads 45/46 and 37.
inventory
This inventory map details the existing conditions of the site, i.e. topographic conditions, vegetation, and structures, its adjacent land uses, and shows section lines detailed on the following pages.
This section, labeled A-A1 on the inventory map, gives a detailed condition of topography for the site were the line cuts west to east. The vertical dimension has been doubled to give the viewer a better understanding.
Section B-B1, oriented north and south, shows the topographic conditions of the site and the existing boundaries on the north and south. The vertical dimension has been exaggerated to better understand the steepness of the quarry walls.
The shadow patterns, displayed on the next page, defines how sunlight affects the site and helps to define the buildable locations. Solar accessibility will define microclimates within the site and in or around the built landscape and buildings, which will define the users and the user times. For instance, if a patio is oriented incorrectly so that during the winter months the patio receives no direct sunlight, it will be very uncomfortable even during those pleasant winter days. If, on the other hand, the patio has correctly been designed, the space will have the potential to be used close to year round. This idea works for all built environments.
A: At the height of summer, June 21, the sun is peaking at 60°00' and has an azimuth of 121°00'. It also casts the shortest but most intense shadow.

B: On the spring/fall equinox, the sun is at its midpoint of 41°30' with an azimuth of 90°00'.

C: During the shortest day of the winter, December 21, the sun is at its lowest of 20°30' and has the smallest azimuth of 50°00'. It also casts the longest and least intense shadow.

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SHADOW PATTERNS
scale: .
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The wind patterns also help define the comfort levels of the built environment, and thru proper understanding of them the designer can manipulate to control environmental conditions and work with them for a better and more functional product. The arrows present the prevailing wind patterns for the summer season. During the morning, the colder air, always closer to the ground because heat rises, will flow into the quarry and out thru the lower points of elevation which happen to be the eastern entrance from Old Highway Road. During the late afternoon and the evening hours, the cold air will flow back up from the creek and Old Highway Road, back into the quarry and over its banks heading toward the southwest.

Since most of the winds will be projected upward and over the quarry, and only turbulent drafts and the slower, cooler air will flow into the site, the design must take into consideration wind patterns and implement design ideas that will help channel winds into the site to prevent stagnate air from condensing inside the quarry.
analysis
On the analysis page, all the inventory is analyzed to determine how the project can be manipulated on the site. In the case of this project, the prime buildable location was determined to be the southernmost shelf closest to the main entrance and the state roads because of its superior visibility from the highways and its ease of access. Another reason for this spots consideration was that it had excellent visibility overlooking the rest of the site and that it was close to the focal point for the site; a wooded "finger" that juts northward into the quarry floor.

A secondary buildable location was defined as the spall and grout mound which creates a plateau in about the middle of the site on the eastern boundary. It has an objective vantage toward the quarry's basin floor and good accessibility from either the secondary or proposed tertiary entrance.
design
The actual design of my creative project focuses on the prime buildable location as defined under the analysis section of this report. The main entrance into the site has remained, with alterations for parking and widening for safety. The buildings marked "C" are commercial facilities, while the buildings marked "R" are residential in nature. Also, the secondary entrance to the Old Highway Road proceeds of the page toward the right or the east.
Parking facilities are located either as above ground parking or as structure parking within the first two levels of buildings where the parking symbol is located. Approximately 220 parking spaces have been provided by this arrangement.
The buildings have been arranged to provide maximum solar gain with maximum channelization of winds. On a following page I will describe the concept behind solar gain by providing a section thru a typical building layout and detailing the processes behind it. The need for maximizing wind access has already been described, but I will detail it again. Since the quarry is basically a big hole in the ground, but not really a big hole as far as nature goes, the quarry does not have a big impact on prevailing wind currents. Therefore most of the wind has passed over the quarry before it even knows there was a "dip in the road", so to speak. Only little eddies of turbulent winds are affected, so the air can become stagnant at times when enough air is not present to flush it out.
The following sheet has numbers corresponding to either perspectives or details about the project. They will discuss what occurs at each location.
1. This perspective, oriented looking northwest from the number, details the character of the store fronts and the planters shown. The planters are actually wind walls designed to help project air currents upward and over the buildings and to minimize the effects of turbulent winds. This will help "smooth" out the wind currents and help maximize air velocity. The trees are flowering crabapples, but they can be of any small species, and are there as a transition between the wind walls and the buildings to round out the patterns of air.
2. This perspective orients the viewer toward the southwest from the number and details the rear facade of the structures. The building closest to the viewer is the commercial building next to the entrance to the above ground parking. Across the automobile entry is the middle complex of commercial structures. On the first two floors are parking, while on the third is commercial. The roof is a patio for the upper story units.
3. This is a detail of the catwalk system of paths that connect the upper level commercial shops with the lower level commercial and residential apartments. They are projected from the sides of the buildings they skirt, and are designed to be as safety conscience as possible. The decking is 2" by 4" wooden planks, while the railing is made up of 1" by 2" slats. They are in a vertical arrangement to prevent small children from walking up them and are only 1/2" spacing to prevent feet from wedging between them. The top of the railing is four feet high and are capped with 2" by 12" ledges to limit access by reaching children. Although the steps are not detailed here, they would not have lips on the steps to catch feet.
WALKWAYS

1\texttimes{}2\

\frac{1}{2}\text{"} SPACING

2\texttimes{}4\text{"

6\texttimes{}6\text{"

6\texttimes{}6\text{"} 1\text{-BEAM

2\texttimes{}12\text{"

2\texttimes{}6\text{"

TO BUILDING

ADDITINAL SUPPORT

DETAILS
4. This enlargement shows a greater scale of the park located on the focal point detailed in the analysis section. The focal point is a large white obelisk with a fountain originating at its base. The fountain flows down into several steps in the shapes of the shadow patterns created by the sun, mainly the summer sun, the spring and fall sun, and the winter sun's shadow patterns. The park before it also has the same theme, depicting the sun in its three stages of summer solstice, winter solstice and the spring and fall equinoxes. Originally I had the concept of extending this 'Stonehenge' theme into the commercial and residential districts by implementing a series of miniature obelisks that would be illuminated only on the hours at the predescribed times of the year.

The obelisk is 200 feet tall and could be seen from quite a distance.
5. This plan could be considered to be in opposition with the standard idea of designing with solar orientation in mind. Unfortunately the buildings could not be implemented on the south-facing slopes as is the rule because they would be too far away for visual access from the major roads and in a spot that was considered to be less than acceptable for a building location. Therefore something dynamic had to be designed.

This building section is the concept behind the solar orientation aspects of the site. Even at the lowest sun angle, which occurs on December 21, of 20 degrees and 30 seconds, all the apartments or commercial locations will be illuminated at least thru their individual south-oriented windows, located on raised roof platforms. All the roofs shall have a shallow roof angle of 20 degrees and 30 seconds to honor this. During the summer months, when the sun is at a greater angle, the patios will be in full illumination.
This final detail on the project is shown to help control the effects of slope failure. A large wire mesh screen, larger than chicken wire, would be 'stapled' to the rock surface by using hook nails driven into the rock fractures. The wire mesh would stabilize the slope and contain broken particles of rock. Emergent vegetation would start the process of soil formation or the walls could be topped by topsoil and vegetation could be sown. Terracing soil using wooden or concrete retention sections is another possibility.
conclusions
In conclusion, I feel this is a feasible way to deal with over-manipulated lands. This is a study that brings together many aspects of the design profession and focuses on the affordability of continued mismanagement of land and what can become better city planning and reclamation ideals.

I feel this brings together an exciting project with diversity and practicality. The commercial aspects would be speciality shops, open probably during normal business hours while the residents would be away at work. At night time, the shops would be closed except for a couple restaurants or bars. Therefore the atmosphere would be two-fold; business in the morning and afternoon, residential and recreational during the evenings.
endnotes


8. Ibid, pp. 18-19.


11. *Surface Mining of Non-Coal Minerals*, p. 3.

bibliography


