

TEN YEARS OF COMPUTER VISUAL SIMULATIONS ON LARGE SCALE PROJECTS IN THE WESTERN UNITED STATES¹

by

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Abstract: Computer visual simulations are used to portray proposed landscape changes with true color, photo-realistic quality, and high levels of accuracy and credibility. This sophisticated technology is a valuable tool for planners, landscape architects, architects, engineers, environmental consultants, government agencies and private operators in the design and planning of surface mining operations. This paper presents examples of the application of computer visual simulations on large scale projects in the western United States, including those which generally require environmental impact statements under the National Environmental Policy Act of 1969 (e.g. open pit coal mines, gold surface mines, highways and bridges, oil and gas development, and alpine ski areas).

This presentation will describe the development criteria, process, and use of the computer visual simulations on these types of projects. The issues of computer visual simulation accuracy, bias, credibility, ethics, and realism will be discussed with emphasis on application in real world situations. The use of computer visual simulations as a tool in the planning and design of these types of projects will be presented, along with discussion of their use in project permitting and public involvement.

Additional Key Words: visual simulation, visual resource management, scenic analysis, landscape architecture.

Introduction

Computer visual simulations are used to portray proposed landscape changes with true color, photo-realistic quality, and high levels of accuracy and credibility. This sophisticated technology is a valuable tool for planners, landscape architects, architects, engineers, environmental consultants, government agencies and private operators in the design and planning of surface mining operations and other large scale projects in the western United States.

They are very useful in project permitting and public involvement as well.

This paper describes the major technical, legal, and ethical issues related to the development and use of computer visual simulations in project planning and design. It presents examples of the application of computer visual simulations on large scale projects in the western United States, including those which generally require environmental impact statements under the National Environmental Policy Act of 1969 (e.g. open pit coal mines, gold surface mines, highways and bridges, oil and gas development, and alpine ski areas).

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Different natural resources professionals utilize a variety of discipline specific analysis methods and technologies. This presents a significant challenge to teams of professionals striving to work together to improve environmental quality. Computer visual simulations can bridge this communication gap by addressing a wide range of environmental issues, including soil conservation, revegetation, hydrology, landform design, erosion control, wildlife habitat, and landscape visual quality.

Landscape architects have expertise in analysis and management of landscape visual quality, or scenic beauty. Using advanced computer visual simulation technology, landscape architects can now accurately portray proposed landscape conditions with true color and high resolution, communicating the impacts on landscape visual quality by the proposed project. These visual simulations also provide a realistic picture of revegetation, erosion control, and other activities which can be shared and understood by a diversity of professionals, land managers, private operators, and the public. The visual simulations become the common ground for effective dialogue about project design and planning.

Visual Simulation Issues

There are several technical, legal, and ethical issues associated with the development and use of computer visual simulations (Chenoweth 1989; Zube, et al 1987). In this paper, the issues of visual simulation accuracy, bias, realism, ethics, and credibility will be discussed.

Accuracy is often cited as the most important aspect of visual simulations. Recent research indicates that accuracy tolerances may be within fairly liberal ranges (up to +/-15%), before the human eye can detect error (Watzek and Ellsworth 1994). There is insufficient research to indicate the accuracy ranges of other visual simulation characteristics, such as color.

Bias can be introduced into a computer visual simulation by commission or omission. Commission involves the purposeful misrepresentation of an important aspect of the proposed development with intent to mislead the viewer. The results of this unethical conduct may or may not be obviously apparent, and thus may express this intentional bias in subtle or overt ways. When meaningful aspects of the proposed project or its environmental impacts are inadvertently omitted from the visual simulation, it is often due to inexperience or poor training on the part of the person developing the visual simulation. Producing an unbiased computer visual simulation can be particularly challenging for people with little training in graphic arts who may not understand the basics of perspective, foreshortening, distance, value, and color, or who are unfamiliar with the design and construction issues of the proposed development.

Realism can now be effectively achieved with today's highly sophisticated hardware and software. A well done computer visual simulation will be

indistinguishable from an original photograph. Unfortunately, our ability to achieve high levels of realism with current technology opens the door for unethical misuse.

Credibility, or as Sheppard (1989) has called it "legitimacy", is related to "the extent to which the correctness of the simulation is demonstrated and defensible" (pp. 64-65). This total effectiveness of the visual simulation is influenced by all of the other issues discussed above.

The true test of these issues lies in the technical skill and professional ethics of the person producing the visual simulation.

The Projects

Several projects will be discussed which illustrate the range of applications for computer visual simulations in the design and planning of large scale projects in the western United States. The issues discussed above and the utility of visual simulations for project design and planning, permitting, and public involvement will also be covered.

Please note: Several full color visual simulation slides will be shown for each project. Unfortunately, these cannot be acceptably reproduced in the conference proceedings by the standard xerographic process. Please contact the author directly regarding full color high quality prints.

FMC Corporation Skull Point Mine Project

This project is located in southwest Wyoming, near the town of Kemmerer. The visual simulations were done in the late 1980's, using the technology available at the time. An expansion of the existing open pit coal surface mine was under consideration. This would involve increasing the pit depth to over 600', its length to almost 1.5 miles and width to almost .5 mile. Several visual simulations were developed, showing not only the proposed excavation, but also the backfilling processes and reclamation results. Along with visual quality, one of the major issues was accommodation for wildlife migrations and habitat. With such a large pit, deer would find the water retained in the bottom attractive, and therefore the backfilling and reclamation was planned to facilitate easy access and egress for these animals. The visual simulations were used in project design and planning by the mining engineers and reclamation specialists.

US Highway 89/91 Northern Utah Project

Connecting Brigham City and Logan, Utah, this northern Utah project was designed in the late 1980's, and constructed in the early 1990's. The existing two lane road was insufficient for the volume of traffic. The project received major funding from the federal government, therefore a full scale environmental impact statement (EIS) was required.

The impacts to the visual resources were assessed by several methods, including the use of computer visual simulations. Two major alternatives were considered, widening of the existing route and a new alignment. The visual simulations illustrated the range of cut and fill and related highway construction activities. Revegetation proposals were also shown. The major visual simulation issue was bias. The public was very concerned that what they saw in the visual simulations represented what was actually being proposed, therefore a great deal of time and careful effort was invested to assure that the visual simulations were credible and without bias. This project illustrates another challenge to avoiding bias. When the EIS was undertaken, the alternative designs were very preliminary, therefore credible visual simulations had to be based on "sketchy" design information. A series of public meetings with careful explanations were required.

US Highway 89 Western Wyoming Project

This section of US Highway 89 in southwest Wyoming links Alpine Junction with Hoback Junction through the Snake River canyon. In the early 1990's the Wyoming Highway Department contracted an EIS to study the impacts of widening the existing route. The major visual resource issues were the river rafters' view from the Snake River, and the need to stabilize one section which tended to slump on a regular basis. Elevated structures, proposed to address the slumping problem, required a design treatment that would be visually acceptable to the river rafters. It was determined early on that a standard exposed steel frame structure would likely be visually undesirable, so the landscape architects were asked to visually simulate structures which would minimize the visual impact. Drawing upon their experience with highway structures on Interstate 70 over Vail Pass and in Glenwood Canyon, Colorado, the landscape architects' visual simulations showed structures that were more compatible with the surrounding landscape in terms of form, color, and texture.

Grand Targhee Alpine Ski Area Expansion Project

In 1991 expansions were proposed to the Grand Targhee Ski Resort near Jackson, Wyoming, involving new ski runs, roads, and housing units. Working with the Targhee National Forest landscape architect, the consulting landscape architects completed visual simulations of these elements. The viewpoint was several miles distant, selected as the first point where travelers to the ski area would be likely to first notice the changes. The simulations were used in public meetings to effectively communicate the proposed expansion.

Natural Gas Drilling Project

As part of a proposal for EIS work on a proposed natural gas drilling field near Price, Utah, several computer visual simulations were developed. These simulations illustrate how this project type can be effectively portrayed for agency and public review.

Black Pine Gold Mine Project

The Black Pine Gold Mine is located in southeastern Idaho, near the town of Burley. The heap leach mining operation was planned to continue for approximately five more years. It is located on US Forest Service land and is subject to the applicable laws and regulations of the State of Idaho and the federal government.

In 1993, the mine operators contracted the consulting landscape architects to produce a series of computer visual simulations of the proposed reclamation, erosion control, and revegetation activities for use in their closure permit application. The landscape architects worked closely with the reclamation engineers and with the Sawtooth National Forest landscape architect in developing the visual simulations.

The visual simulations represented proposed mine expansion activities and reclamation over 5 to 10 years. Computer visual simulations were produced to show the recontouring and revegetation activities proposed for the site. These visual simulations not only illustrated restoration of visual quality, but also gave a clear picture of recontouring, erosion control, and revegetation.

These computer visual simulations were submitted as part of the Black Pine Mine proposed expansion and reclamation/closure plan. The plan was approved.

Barrick Mercur Gold Mine Project

The Barrick Mercur Gold Mine is located in west central Utah, near the town of Tooele. This is also a cyanide heap leach process mine, with a projected life of approximately five years. It is located near US Forest Service and BLM land and is subject to the applicable laws and regulations of the State of Utah and the federal government.

In 1995, the mine operators contracted with the consulting landscape architects to produce a series of computer visual simulations of the proposed reclamation, erosion control, and revegetation activities for use in their closure permit application. The consulting landscape architects worked closely with the reclamation specialists and engineers in developing the visual simulations. As with the Black Pine Mine, visual simulations represented proposed mine expansion activities and reclamation over a 5 to 10 year time frame.

The computer visual simulations were submitted by the mining company as part of their interim closure plan in the summer of 1995. The plan was approved.

The Importance of Computer Visual Simulations in Reclamation, Revegetation, and Erosion Control

These examples illustrate the various advantages of visual simulations in the design and planning of surface mining reclamation. The careful planning and management for visual quality in primarily natural environments is important. Visual simulations provide the mine operator, regulatory agencies, and the public with a common base of understanding about the scenic consequences of reclamation activities. In many cases, the public and even trained professionals have difficulty expressing their ideas and concerns about environmental design and, in this case, reclamation.

As discussed earlier, a variety of professionals are involved in the design and planning of mining reclamation. With visual simulations, the hydrologist can clearly understand the implications of the engineer's and landscape architect's grading designs. The revegetation specialist can see, with photographic clarity, the proposed landform that must support new growth. The soil scientist can make more informed decisions about replacing and reclaiming soils when the "lay of the land" is represented in more than a two dimensional grading plan with contour lines and spot elevations. The wildlife biologist, concerned with issues such as access, cover, vegetative diversity, and refuge can benefit tremendously from "seeing" the proposed landscape clearly and realistically. All aspects of erosion control, perhaps the most interdisciplinary of all reclamation activities, benefit from the communication "common denominator" of visual simulations. For all of these people, a realistic and credible computer visual simulation is "worth a thousand words".

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