# VISUAL SIMULATIONS

## bringing concepts to reality

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**Public concerns regarding commercial and industrial development can often make or break a project. This is particularly true when it comes to anticipating its visual character. Stakeholders may form opinions that are influenced by preconceived notions or past experiences without truly understanding how a newly proposed project will look in its landscape or urban setting. Even with the aid of a written description or set of engineering plans, the visual details of a project may be left to the imagination. This leaves an opening for misinformation which, if negative, may jeopardize a project from the outset and can be virtually impossible to reverse.**

To combat the potential for negative misconceptions, projects are well served by addressing visual matters early in the development process. Typically, this can be done with visual simulations - highly accurate project representations that are created by superimposing a three dimensional (3D) model of the proposed activity over a photograph of the existing project setting. Simulations demonstrate the visual character of proposed activities and illustrate visual changes that may be expected from specific locations or viewpoints. To fully understand the value of simulations in communicating a project's appearance, it is helpful to take a broad look at the science of visual impact assessment (VIA). As is often the case with well-executed simulations, these scientifically constructed and aesthetically accurate pictures ***can*** be worth a thousand words.

### Visual Impact Assessment 101

The VIA process is used to describe and evaluate the potential aesthetic change resulting from land development activity. This development activity might include the introduction or removal of built forms or the removal of or changes to natural features. The aesthetic change resulting from these activities, known as visual impact, can be positive or negative.

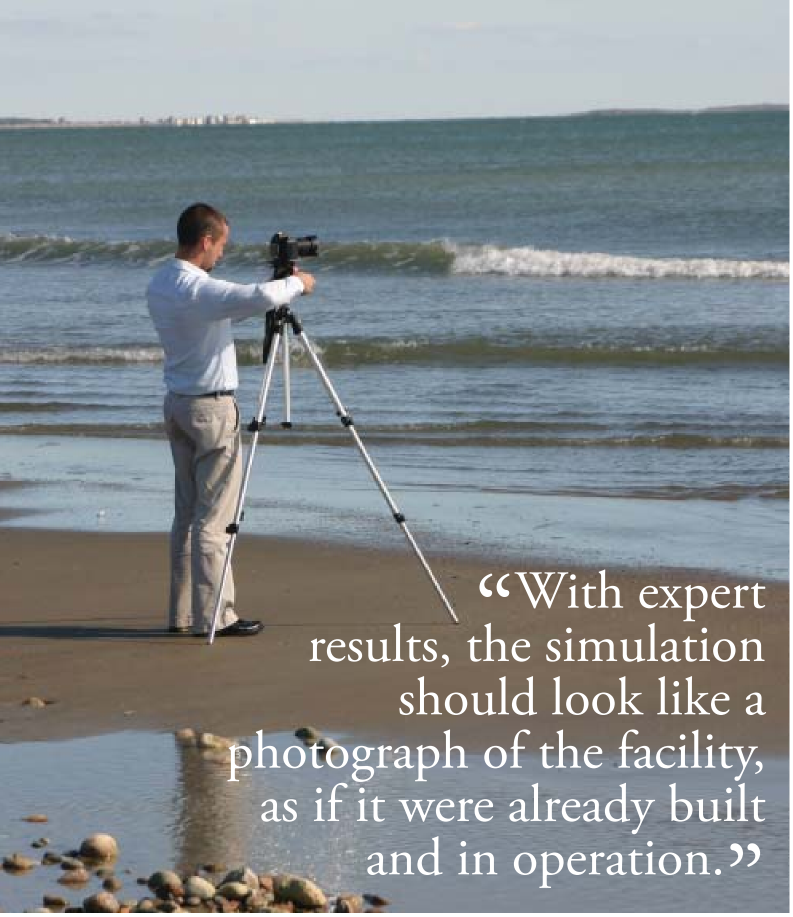
Through the VIA process, one is able to identify character defining elements in a given landscape (also known as visual resources) and to determine if and how an activity will impact those resources. Additionally, VIA can be used to identify opportunities to avoid, minimize, and/or mitigate negative visual impacts. Some federal, state, and local regulations make this assessment of potential mitigation a requirement for new development to ensure that the developer has made good faith efforts to address visual effects.

The visual assessment process answers important questions through the following steps:

1) **What is the visual character of the proposed project?**
   Development of a Project Description. This is detailed description of the project including features such as dimensions, materials, lighting, landscaping, and other elements and associated activities that would contribute to the project's overall appearance and visibility.

2) **What is the visual character of the development setting?**
   Development of a Project Study Area Description and Landscape Character Zone Definition. Most landscapes can be divided up into similar zones based on the type of cover, topography, and the like. These zones help to characterize the study area and divides the site into manageable units.

3) **What existing resources might be visually affected by the project?**
   Inventory and Descriptions of Existing Visual Resources. Visual Resources might include scenic roads, overlooks, historic structures/districts, or places that draw large concentrations of people. This step also includes desktop analysis to determine whether the project is likely to impact each identified resource. The desktop studies often include sophisticated viewshed analysis or zone of visual influence maps that can estimate project visibility based on topography, vegetation and, in some cases, structures. These studies are estimates, but often result




in accurate indicators of the geographic areas that require additional study.

4) **What value do people place on the landscape in the project area?**
Development of an Inventory and Description of the Users/Stakeholders. For example, people who travel through the project area with the express intent of stopping elsewhere (commuters), may have a lower perceived value on the landscape than people living or recreating within the viewshed of the project.

5) **How will the proposed action appear from existing resources of importance?**
Identification of Representative Viewpoint Locations and Simulations. This is an involved process that determines which locations will provide reasonable representative points from which the project would be viewed relative to any resources of importance. **Once the representative views are selected, visual simulations are produced from each of the views.**

6) **What is the compatibility or degree of visual change that will result from the project?**
Assessment of the Visual Impacts. Typically an experienced panel of landscape architects uses a predefined rating system to evaluate the existing views and the simulations in order arrive at an overall assessment score for the potential impact.

## Success through Accurate Simulations

While each piece of the visual impact assessment process is important, visual simulations are a crucial component of every study. Images that accurately portray the physical changes expected from project development are critical for effective review and timely decision making. Conversely, failure to accurately demonstrate a project can result in expensive project delays and even failure of the project.

Producing accurate simulations is a complex process that relies on expertise from a number of disciplines. The first of these is photography.

## The Importance of Baseline Photography

An understanding of photography and photographic equipment is essential for capturing adequate baseline imagery. High-quality, high megapixel, single-lens reflex digital cameras are a requirement. There is no magic number for the megapixel range due to the high variability of project types and distances, but the resolution must be sufficient to demonstrate the view and the proposed change with the greatest clarity permitted by the conditions.

Perhaps as important as resolution is the quality of the lens used. The lens should provide maximum clarity and minimum distortion. A fifty millimeter (50mm) lens setting has been adopted as the most appropriate. It represents a "normal" lens setting, which creates a neutral perspective and contains minimal image distortion. Elements appearing in the background appear at a scale proportional to elements in the foreground, middle ground, and so on. A wide angle lens setting (less than 50mm) can disproportionately reduce the size of elements in the center middle ground, while a telephoto lens will increase the size of those elements, thus misrepresenting the project.

Baseline photos should be taken on a clear day with high visibility for the best representation of daytime views. (Nighttime views may have other standards depending on the type of project.) Sunlight angle can drastically change how a project is perceived; therefore, efforts should be made to capture a variety of lighting conditions.

Typical lighting conditions encountered include:

- **Front Lit** – The sun is behind the viewer and the subject is in full sun. Shadows fall away from the viewer and are typically less noticeable.
- **Side Lit** – The sun is perpendicular to the viewer and the subject. Shadows become more apparent, thus contrast lines of light and dark become more noticeable.
- **Back Lit** – The sunlight is coming toward the viewer from behind the subject. This may cause the subject to appear dark against the horizon. Shadows will be coming toward the viewer and may become more dominant.

*Subject lighting scenarios (left to right: front lit, side lit, back lit)*

The camera should be stable and level and photographs should capture the scene as closely as possible to the actual conditions observed. Cameras used in automatic mode invariably make crucial errors, so manual settings should be used.

## Three Dimensional Transformations

Once the baseline images have been collected, the next step involves recreating the view in a digital 3D environment using professional 3D modeling and animation software. There are typically three controlling elements in this process.

- **Location of the camera** - xyz coordinates are determined by GPS or field survey recorded at the time of the photo.
- **Lens setting** – typically a fixed lens on a full-frame camera will take all of the guess work out of focal length. Zoom lenses may have some variability.
- **View Direction** - determined though survey or other (proprietary) methods.

A 3D camera is created in the software using each of these controls so that it matches the camera properties used in obtaining the baseline photography. Elements that appear in the photo, such as notable topographic features, trees, structures, roads, etc. are incorporated into the model based on field collected survey data and/or desktop interpolated data. Looking through the virtual 3D camera with the baseline image in the background, minor adjustments are made to align the 3D environment with the photographed environment. With the 3D environment aligned to the photograph, any elements placed in the 3D environment will be to the correct scale. This is the point at which the project is added to the model in the appropriate geographic location.

The 3D model of the project must be as accurate as possible to ensure the project intent is correctly conveyed. Site plans, architectural plans, and manufacturer's technical drawings are examples of data used in model building, depending on the type of project. How detailed a model is depends on how visible various project elements will be from the selected vantage point(s).

A good rule is to always go beyond the level of detail assumed to be necessary to ensure accuracy. For example, a shadow line created by an exterior light fixture or roof overhang can change how a project appears in certain views even if the fixture itself is not visible. Therefore, when preparing the 3D model, it is advisable to carefully review details visible in close up views and to include features such as overhangs and fixtures to ensure accuracy.

## Capturing Environmental Influences

With the final 3D camera alignment and model completed, sophisticated software applications can simulate environmental conditions by creating a 3D environment. Details such as sunlight, cloud cover, haze, ground reflectivity, and project materials are programmed into the model. The sunlight is adjustable by location, time of year, time of day, and intensity based on details available in the original photographs of each individual view.

## A Project Comes to Life

The next simulation step is a complex process called rendering. Rendering uses the 3D environment data in combination with the 3D model to create an accurate image of the project, showing visual details based on how it will interact with its overall environment. Finally, the rendering is placed into the original photograph and the 3D model is used to determine which elements belong in the foreground and which are background, so that the project appears in the proper place. With expert results, the simulation should look like a photograph of the facility, as if it were already built and in operation.

## Verification – Is What You See Really What You'll Get?

Increasingly, computer applications are making it easier to manipulate data, such as photographs and video. Just type "photoshopped images" into Google and you will get an idea of how easy it is to make something unreal seem believable. Typically, these images are produced by amateurs with the sole intention of tricking the average viewer; and more often than not, unless the images are totally outlandish, we often accept them as accurate. Even with no trickery intended, computers can make errors and without an operator who has the appropriate expertise these errors can go unnoticed. So how do regulators determine whether a project or activity has been accurately demonstrated? This can be a difficult task. However, there are a number of ways to verify the accuracy of computer generated images. The most reliable is the most obvious: Can the producer of the simulation provide the original data used to create the image and can that data be used to recreate the image with the same results? This simple process of verification by reproducing results has been the foundation of science for centuries and applies equally to the simulation process.

But independent duplication of results is time consuming and costly. Instead, decision makers often rely upon the credentials of the person or firm producing the product, particularly if they know the VIA was conducted by someone with industry experience in creating simulations directly applicable to the project at hand. VIA is a rigorous technical process. To earn the confidence of decision makers, those developing the simulations must be able to demonstrate that they have the right hardware, software, ***and*** experience to accurately simulate the visual characteristics of specific types facilities and how they interact with light and the environment in various landscape settings.

### *ESS Group, Inc. Visual Assessment*

*ESS has a wealth of industry experience when it comes to visual impact assessment and the creation of visual simulations. ESS has experienced photographers, 3D modelers, and GIS experts who have cumulatively spent 25 years visualizing the development industry for developers, stakeholders, and regulators. Our experts have given testimony to our products which stood up to rigorous peer review and public scrutiny.*

*In addition, with experts in civil and industrial engineering, landscape architecture, energy facility development, ecological services, and permitting, ESS brings invaluable input to the visual process. Maybe most important, we understand our client's business and needs.*

*We have created a streamlined process that allows us to efficiently produce visual simulations to meet project budget and schedule. This process even allows us to accurately demonstrate how the project will appear in an animated environment. By capturing video data simultaneously with still images, we can simulate the project in motion and demonstrate it in seconds— wind turbines rotating, steam plume from cooling towers, or even a simulation of a full day of light interaction with the project. Our advanced knowledge in lighting systems allows us to exhibit projects at any time, including night.*

***Why choose ESS?*** *We provide the scientific process that builds each simulation we produce so there is no question about its accuracy. Whether we are providing simulations of land clearing, dredging and wetland creation, an office building, or an energy facility, we can convey the project accurately and convincingly so that stakeholders and regulators have confidence in the product and thus, closing the opportunity for misinformation associated with a project.*