Visual Impact Analysis Tools for Vertical Infrastructure
A Novel Approach to Demonstrating Structure Visibility within an Existing Area

INTRODUCTION
Our clients are often faced with challenges in demonstrating the visual impact of a proposed cell tower structure. Balloon or crane tests are the most common methods of showing how a proposed facility will appear within the existing area. However, conditions are not always conducive to a balloon or crane test:

- Coastal or ridge sites are subject to constant winds,
- Site may be too close to power lines,
- The site is currently vegetated or inaccessible to the necessary equipment, or
- Weather won’t cooperate – long-term predictions for fog, low clouds, rain, or excessive winds

EBI’s creative Geographic Information Systems (GIS) team has come up with a few tools to solve these problems. These novel tools create visual representations to address visibility questions from residents, local review boards, and State Historic Preservation Offices (SHPOs). Additionally, EBI uses site visit photos and other publicly available photos to add value to these visual impact analysis tools.

LINE OF SIGHT ANALYSIS TOOL
One of the GIS team’s most innovative solutions was the Line of Sight Analysis tool. If the problem is to demonstrate how much of the proposed tower will be visible from a few locations surrounding the project site, then the Line of Sight Analysis Tool may be the best solution.

This tool uses Digital Elevation Models (DEM) and forestry data from national sources along with a review of site photos (if available), current aerial photography, and the application of the Pythagorean Theorem to predict how visible the proposed tower or other vertical element will be within the surrounding landscape. Since it predicts visibility between the two points along a straight line, it is best used for a few individual locations. The following is an example of successful application of this new tool for a client:

LINE OF SIGHT ANALYSIS EXAMPLE
In this case, the SHPO expressed concerns with a proposed 150-foot tower adjacent to an existing 120-foot water tank. They requested that the client drop the proposed height of the tower to 120 feet to avoid any adverse visual effects on a historic district nearly 0.5 mile away.

The Line of Sight analysis utilized vegetative cover and canopy data from the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS) and current aerial photos. (Please refer to pages 3-6).

EBI compared the data to the canopy height and coverage shown in the site photos, and used GIS 3-D analysis tools to predict the visibility of the proposed tower from several locations within the Historic District. The locations were selected for having the most favorable lines of sight (longer vistas created by street alignments, surface parking, distance from tree stands, etc.).

Based on EBI’s site visit and the above review of topography and vegetative cover, the team designated viewshed locations within the Historic District (Page 3, denoted as View 1-3 with orange dots). The various colored rectangles represent stands of coniferous trees that have the potential to block views of the proposed tower from various vantage points within the historic district. The colors of the rectangles are keyed to the heights of the trees.

On the Line of Sight Analysis, shown on Pages 4-6, the red line represents line of sight toward the proposed tower site, terminating at the blue dot.
that represents the stand of trees that blocks the view of the proposed tower at the 150-ft height. The graphic in the lower half of each of these pages is an additional representation of the geometry of how the stand of trees blocks the views of the proposed tower. As shown in the Line of Sight analyses, the stands of coniferous vegetation between 600 – 700 feet blocks the views of the proposed 150-ft tower from within the Historic District.

EBI successfully used these figures to convince the SHPO that even at the proposed 150-ft height, that the proposed tower would not be visible from the historic district. EBI’s client was permitted to move forward at the 150-ft height.

**VISUAL IMPACT ANALYSIS TOOLS**

For clients interested in the visual impact on a much larger area, EBI developed the Viewshed Analysis Tool. Like the Line of Sight tool, the Viewshed tool provides useful information on the potential visibility of a proposed tower or other vertical infrastructure, without a balloon or crane test.

Again, data regarding topography and vegetation are used to predict areas within the surrounding landscape that have the potential for views of the proposed tower. This information can be used to demonstrate how larger numbers of historic properties (or any other kind of resource) may or may not be visually impacted by the proposed tower.

Additionally, the tool can be run at various heights to analyze how much of the top of the tower will be visible from ground level throughout the surrounding landscape. This additional data can be used to characterize the “quality” or extent of the visual impact in the surrounding landscape.

**VIEWSHED ANALYSIS EXAMPLES**

Referring to pages 7-10, the Viewshed Mapping simply shows areas (yellow shading) where the proposed tower may be visible. The mapping tool eliminates concerns if no sensitive resources are located within the yellow shaded areas. The tool can also be used to target fieldwork needed during other forms of visibility testing.

The second example of Viewshed Mapping includes the enhancement with the mapping run at various heights to provide information of how much of the tower top will be visible from various locations within the surrounding landscape. Please see pages 7-10.

**REGULATORY PROCESSES THAT MAY REQUIRE THESE TOOLS**

- Maine Land Use Planning Commission’s Review Process
- Section 106 Consultation
- CA Environmental Quality Act Reviews
- And more!

**CONCLUSION**

If you have concerns about how visible your structure will be, consider using EBI Consulting’s novel and innovative visual impact analysis tools. EBI has over 25 years of experience as a trusted advisor to telecom companies with a diversity of environmental and engineering needs.

For more information, please visit our company website at [www.ebiconsulting.com](http://www.ebiconsulting.com) or contact one of our technical experts today:

**Nick Ritz**, National Technical Director, Telecom Environmental – [nritz@ebiconsulting.com](mailto:nritz@ebiconsulting.com)

**Suzanne Derrick**, Director of Cultural Resources, Telecom – [sderrick@ebiconsulting.com](mailto:sderrick@ebiconsulting.com)

**Collin Johnston**, Senior GIS Analyst, Corporate IT – [cjohnston@ebiconsulting.com](mailto:cjohnston@ebiconsulting.com)
Tree Stand Height & Topographic Contours

Legend

- **Project Site**
- **1 Foot Elevation**
- **Historic District**
- **Viewer**

Tree Stand Height (feet)

- 60
- 70
- 40
- 30
- 90
- 50

Sources: USGS, ESRI, EBI
Date: 10/20/2016

View 1

PN: 6116002749
West Profile 1
Elevation with Land Cover

Line of Sight & Profile

Profiles include ground elevation plus tree stand values. Viewer height 6 feet. Tower height 150 feet.

Sources: USGS, ESRI, EBI
West Profile 2
Elevation with Land Cover

Line of Sight & Profile

- Tower Not Visible
- Tower Visible
- Tower Obstruction

Profiles include ground elevation plus tree stand values. Viewer height 6 feet. Tower height 150 feet.

Date: 10/20/2016
Sources: USGS, ESRI, EBI
West Profile 3
Elevation with Land Cover

Line of Sight & Profile

- Tower Not Visible
- Tower Visible
- Tower Obstruction

Profiles include ground elevation plus tree stand values. Viewer height 6 feet. Tower height 150 feet.

Sources: USGS, ESRI, EBI
Legend

- Areas of potential visibility
- Project Site Location
- Project Radius at 1/4 Mile

County Survey Sites
- Cemetery
- Contributing
- Demolished
- NR Site
- Non-Contributing
- Notable
- Outstanding

Viewshed Analysis Map with Landcover

1 inch = 0.06 mile
This map depicts areas of POTENTIAL visibility.
This map accounts for elevation and generalized structure heights.
NED, Land Cover resolution at 10M, Print at 11x17

Source: Selected data from USGS, NPS, & EBI.
Created by: EBI GIS 2/7/2017
PN: 6115004616
Visibility Values
- Top 90 feet of tower potentially visible
- Top 190 feet of tower potentially visible
- More than 190 feet of tower potentially visible

Legend
- Cemetery
- Non-Contributing
- Contributing
- Notable
- Demolished
- Outstanding
- NR Site

Viewshed Analysis: Visibility Quality

1 inch = 0.15 mile
This map depicts areas of POTENTIAL visibility
This map accounts for elevation and generalized structure heights
NED, Land Cover resolution at 10M, Print at 11x17

Created by: EBI GIS 2/7/2017
Source: Selected data from USGS, NPS & BLM
PN: 6115004616