Appendix A: Identifying Scenic Resources

There is no uniform approach to designating scenic resources among national, state and local jurisdictions, or for identifying them for consideration in a visual impact assessment (VIA). What is typically meant when "scenic resources" are discussed is an area highly sensitive (or people in an area that are sensitive) to visual impacts. While some states have relatively strong VIA laws and scenic resources are well defined, much of the country does not normally require VIAs or define scenic resources. The following framework defines four types of resources that are highly sensitive to visual impacts and lists special databases that should be used to identify scenic resources.

1. Natural Heritage

1. **Protected Areas Database** (PAD-US), which is America's official national inventory of U.S. terrestrial and marine protected areas that are dedicated to the preservation of biological diversity and to other natural, recreation, and cultural uses, is available at: https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/pad-us-data-download?qt-science_center_objects=0#qt-science_center_objects.
2. **National Conservation Easement Database** (NCED) is the first national database of conservation easement information, which compiles records from land trusts and public agencies. Recorded easement purposes include farm, forest, ranch or scenic open space, environmental system, historic preservation, and education/recreation. The database is available at: https://www.conservationeasement.us/downloads/.

2. Cultural and Historical Heritage

1. **National Register of Historic Places** is the official list of the nation's historic places that are worthy of preservation. There is a non-spatial database that is up to date, but the GIS data are only current to 2012. It is available at https://www.nps.gov/subjects/nationalregister/data-downloads.htm.
2. **State Historic Preservation Offices** (SHPO) may also maintain a state database of historic places. SHPO links are available here: https://ncshpo.org/directory/ and https://www.nps.gov/subjects/nationalregister/state-historic-preservation-offices.htm.

3. Recreation

1. **Protected Areas Database** (PAD-US) is America's official national inventory of U.S. terrestrial and marine protected areas that are dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses. It is available at https://www.usgs.gov/core-science-systems/science-analytics-and-

synthesis/gap/science/pad-us-data-download?qt-science_center_objects=0#qt-science_center_objects

2. **Scenic Byways** provide for one of America’s favorite recreation pastimes — driving for pleasure.

    a. The National Park Service compiled state and national **Scenic Byways** in 2017; the shapefile is available at https://koordinates.com/layer/38757-us-scenic-byways/download/.

    b. The Federal Highway Administration maintains current information on **America’s Byways** (but not GIS data) and links to the additional resources are available at: https://www.fhwa.dot.gov/byways.

    c. Scenic America maintains also has detailed descriptions of each state’s scenic byways, (but no GIS data). These are available at https://www.scenic.org/visual-pollution-issues/scenic-byways/scenic-byway-maps-by-state/.

3. **Trails** are often not documented in designated scenic resource data bases; however, they are the primary locations frequented by people in many natural areas.

    a. **Trails Explorer** is a website coordinated by the U.S. Geological Survey to aggregate national and state trails data: https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=d3c32c758316402dbd8292b7ffea720e. The data are part of the Transportation theme in the National Map Download Manager: https://apps.nationalmap.gov/downloader/#/

    b. **All Trails**, an internet subscription service: https://www.alltrails.com/pro

    c. **Delorme Atlas & Gazetteer for the state**: https://buy.garmin.com/en-US/US/p/575993

    d. **Other Trail Apps:** There are several “apps” for trails; the 10 best are reviewed at https://thedyrt.com/magazine/lifestyle/best-navigation-apps-hiking/

4. **National Rivers Inventory** includes free-flowing river segments that are potential candidates for inclusion in the National Wild and Scenic River System. Under the Wild and Scenic Rivers Act section 5(d)(1) and related guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect National Rivers Inventory river segments. https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm

4. High Use

1. **Census Designate Places (CDPs):** Include both incorporated places (legal entities) and census-designated places (statistical entities). CDPs are delineated to provide data for settled concentrations of population that are identifiable by name but are not legally incorporated under the laws of the state in which they are located. In the following webpage, select a year and select "Place" as the layer type: https://www.census.gov/cgi-bin/geo/shapefiles/index.php.

2. **High Traffic Places:** Each state's Department of Transportation, including Caltrans, maintains an official database of roads, which normally includes annual average daily traffic counts for many road segments: https://www.fhwa.dot.gov/about/webstate.cfm and https://www.gis.fhwa.dot.gov/statepracs.asp.

Appendix B: Standard Inventory and Analysis Phase Forms

KEY VIEW INVENTORY

(Key view baseline data. Select at least one key view for each landscape unit and scenic/visual resource. It is preferred to identify a key view for both neighbors and travelers. Select key views so they are well distributed throughout the proposed project area. Select key views for their potential for visual simulations. Use this form to describe why this location was selected as a potential key viewpoint.)

KEY VIEW NUMBER:	**LANDSCAPE UNIT:**	
PRECISE LOCATION DESCRIPTION:		
OBSERVER NAME:		
DATE:	**TIME:**	**WEATHER:**
☐ **PROPOSED LANDSCAPE UNIT CONFIRMED?**		Remarks:
☐ **AREA OF VISUAL EFFECT/VIEWSHED VERIFIED AND MARKED ON MAP?**		Remarks:

PROPOSED PROJECT IN RELATION TO KEY VIEW:	**DISTANCE ZONES:** (Describe how far they extend, what delineates them, and which one the proposed project is in)
☐ Looking up	Foreground:
☐ Eye level	Middle ground:
☐ Looking down	Background:

WHY WAS THIS LOCATION CHOSEN?
(Check one or several answers as applicable.)

	Public, random, average typical view of the majority of the proposed project.
	Public high-use area with best clear view of the majority of the proposed project.
	Public, high-use scenic or visual resource area with clear view of the majority of the proposed project.
	Public area from which the proposed project blocks/obstructs a scenic or visual resource.
	Public area with the worst case (largest visual impact) view of the majority of the proposed project.
	Location recommended during public review of proposed project.
	To document a sensitive, public high-use area with NO/LIMITED view of/impact on the proposed project.
	Other reason. (Describe):

HOW APPROPRIATE WOULD THIS VIEW BE AS A KEY VIEW ON A SCALE 1-5 (LEAST-MOST): __

OTHER REMARKS REGARDING KEY VIEW POINT (INVENTORIED LOCATION):

LANDSCAPE VISUAL CHARACTER (Describe the potential key view's visual character. Consider the basic visual features and their relationships/patterns for existing natural, cultural, and project environments. Circle as many terms as needed and add notes to help describe the view.)							
LANDSCAPE CHARACTER TYPE:	Natural	Agricultural	Rural	Suburban	Urban	Industrial	Other
EPA ECOREGION:	(enter Ecoregion number)	1. Coast Range; 4. Cascades; 5. Sierra Nevada; 6. Central CA Foothills & Coastal Mountains; 7. Central CA Valley; 8. Southern CA Mountains; 9. Eastern Cascades Slopes and Foothills; 13. Central Basin and Range; 14. Mojave Basin and Range; 78. Klamath Mountains/CA High North Coast Range; 80. Northern Basin and Range; 81. Sonoran Basin and Range; 85. Southern CA Northern Baja Coast.					
DESCRIBE LOCAL VEGETATION:							
DESCRIBE LOCAL TOPOGRAPHY:							
DESCRIBE NATURAL ENVIRONMENT: (Describe vegetation, landforms, water bodies, rock outcrops and describe their basic visual elements of physical shape/form (blocky, spheric, rolling, rounded, conic, etc..), prevailing lines (vertical, horizontal, sinuous, etc.), colors, texture and material. Then describe relationships (such as balance, scale, diversity, continuity, dominance, focal points, patterns, etc.) with the cultural, and project environments).							
NATURAL ENVIRONMENT:							
NATURAL ENVIRONMENT DESCRIPTION:							
RELATIONSHIP WITH CULTURAL ENVIRONMENT:							
RELATIONSHIP WITH PROJECT ENVIRONMENT:							
DESCRIBE CULTURAL ENVIRONMENT: (Describe buildings, homes, bridges, infrastructure, etc. and their basic visual element of physical shape/form (blocky, spheric, rolling, rounded, conic, etc..), prevailing lines (vertical, horizontal, sinuous, etc.), colors, texture and material. Then describe relationship (such as balance, scale, diversity, continuity, dominance, focal points, patterns, etc.) with the project environment).							
CULTURAL ENVIRONMENT:							
CULTURAL ENVIRONMENT DESCRIPTION:							
RELATIONSHIP WITH PROJECT ENVIRONMENT:							
DESCRIBE PROJECT ENVIRONMENT: (Describe roadways, overpass structures, infrastructure, etc. and describe their basic visual element of physical shape/form (blocky, spheric, rolling, rounded, conic, etc..), prevailing lines (vertical, horizontal, sinuous, etc), colors, texture and material.							
EXISTING PROJECT ENVIRONMENT							
PROJECT ENVIRONMENT DESCRIPTION:							

EXISTING LIGHTING AND GLARE SOURCES (Describe existing daytime and nighttime baseline lighting levels, lighting color consistency, and glare sources in the AVE so they can be compared later with proposed lighting levels for both the construction and operation of the project. Document also the existing vehicle light levels and any other light sources associated with all environments as viewed by the travelers and neighbors. Record on maps the location of the primary lights visible from potential key viewpoints. For Advanced VIA Reports, record both ambient light and spotlight light meter readings.)				
AMBIENT NIGHTTIME LIGHT ZONE:	☐ LZ1 – Low ambient brightness, dark landscapes. Parks, natural and remote rural areas. No roadway lighting.	☐ LZ2 – Moderate ambient brightness. Lighting is not uniform and continuous. Suburban or rural areas. Roadways may be lighted to residential standards.	☐ LZ3 – Moderately high ambient brightness. Lighting is often uniform and continuous. Urban residential areas. Road lighting to traffic rte stds.	☐ LZ4 – High ambient brightness. Lighting is mostly uniform and continuous. Urban resid/comm. areas.
LIGHTING COLOR:				
DISABILITY GLARE SOURCES:				
DISCOMFORT GLARE SOURCES:				
SPILL LIGHT SOURCES:				
SKYGLOW:	High	Medium	Low	None

LANDSCAPE VISUAL QUALITY (Describe the potential key view's visual quality. Consider the vividness, intactness, and unity of the existing natural, cultural, and project environments. For visual quality to be high, all three attributes have to be high.)					
KEY VIEW OVERALL VISUAL QUALITY: (Circle one based on the weighted average of the visual quality of each environment described below and your professional judgement.)	**VERY HIGH**	**HIGH**	**AVERAGE**	**LOW**	**VERY LOW**

NATURAL ENVIRONMENT VISUAL QUALITY (The natural environment typically consists of vegetation, land, rocks, soil, water, animals and wildlife, atmospheric conditions.)					
VISUAL QUALITY: (Determine based on Intactness, Vividness and Unity ratings below)	**Very High**	**High**	**Average**	**Low**	**Very Low**
INTACTNESS: (desired landscape character type's visual integrity based on below)	Very High	High	Average	Low	Very Low
Natural Environment in the Key View is:	Defining of the Landsc. Character	Cohesive with Landsc. Character	Unremarkable	Inconsistent with Landsc. Character	Intrusive Does not fit
UNITY: (natural harmony based on below)	Very High	High	Average	Low	Very Low
Natural Environment in the Key View is:	Well balanced and in scale with other environments in view	Somewhat balanced and in scale w/other environments	Unremarkable	Somewhat out of balance and scale w/other environmts	Completely out of balance and scale w/other environs
Key View Natural Environ. Elements are: (form, line, color, texture)	Well balanced and in scale w/other elements	Somewhat balanced and in scale w/other elements	Unremarkable	Somewhat out of balance and scale w/other elements	Completely out of balance and scale w/other elements
VIVIDNESS: (Memorability of nat. env. elements)	Very High	High	Average	Low	Very Low
(Some) Elements of Natural Environment are: (form, line, color, texture)	**Very** bold, striking, contrasting, unusual dominant, or moving	Bold, striking, contrasting, unusual dominant, or moving	Somewhat unusual	Very common, typical of adjacent landscape	Completely unremarkable
Remarks:					

CULTURAL ENVIRONMENT VISUAL QUALITY (The cultural environment typically consists of buildings, houses, infrastructure, art.)					
VISUAL QUALITY: (Determine based on Intactness, Vividness and Unity ratings below)	**Very High**	**High**	**Average**	**Low**	**Very Low**
INTACTNESS: (desired landscape character type's visual integrity based on below)	Very High	High	Average	Low	Very Low
Cultural Environment in the Key View is:	Defining of the Landsc. Character	Cohesive with Landsc. Character	Unremark able	Inconsistent with Landsc. Character	Intrusive Does not fit
UNITY: (cultural order based on below)	Very High	High	Average	Low	Very Low
Cultural Environment in the Key View is:	Well balanced and in scale with other environments in view	Somewhat balanced and in scale w/other environments	Unremark able	Somewhat out of balance and scale w/other environs	Completely out of balance and scale w/other environs
Key View Cultural Environment Elements are: (form, line, color, texture)	Well balanced and in scale w/other elements	Somewhat balanced and in scale w/other elements	Unremark able	Somewhat out of balance and scale w/other elements	Completely out of balance and scale w/other elements
VIVIDNESS: (Memorability of cul. env. elements)	Very High	High	Average	Low	Very Low
(Some) Elements of Cultural Environment are: (form, line, color, texture)	**Very** bold, striking, contrasting, unusual dominant, or moving	Bold, striking, contrasting, unusual dominant, or moving	Somewhat unusual	Very common, typical of adjacent landscape	Completely unremarkable
Remarks:					

PROJECT ENVIRONMENT VISUAL QUALITY (The project environment typically consists of the ROW roadways, grading, constructed elements, highway planting, other vegetation cover, and ancillary visual features.)					
VISUAL QUALITY: (Determine based on Intactness, Vividness and Unity ratings below)	**Very High**	**High**	**Average**	**Low**	**Very Low**
INTACTNESS: (desired landscape character type's visual integrity based on below)	Very High	High	Average	Low	Very Low
Project Environment in the Key View is:	Defining of the Landsc. Character	Cohesive with Landsc. Character	Unremark able	Inconsistent with Landsc. Character	Intrusive; Does not fit
UNITY: (project coherence based on below)	Very High	High	Average	Low	Very Low
Project Environment in the Key View is:	Well balanced and in scale with other environments in view	Somewhat balanced and in scale w/other environments	Unremark able	Somewhat out of balance and scale w/other environmts.	Completely out of balance and scale w/other environs
Key View Project Environment. Elements are: (form, line, color, texture)	Well balanced and in scale w/other elements	Somewhat balanced and in scale w/other elements	Unremark able	Somewhat out of balance and scale w/other elements	Completely out of balance and scale w/other elements
VIVIDNESS: (Memorability of pr. env. elements)	Very High	High	Average	Low	Very Low
(Some) Elements of Feature are: (form, line, color, texture)	**Very** bold, striking, contrasting, unusual dominant, or moving	Bold, striking, contrasting, unusual dominant, or moving	Somewhat unusual	Very common, typical of adjacent landscape	Completely unremarkable
Remarks:					

VIEWER IDENTIFICATION - NEIGHBORS	
NEIGHBOR TYPE(S): Residential; Recreational; Institutional; Civic; Retail; Commercial; Agricultural; Other	
PROXIMITY: (Which viewers are closer than others, distance zones)	
NUMBER: (Number and density of viewers, which most affected)	
DURATION: (Length of viewing, dynamic views)	
Remarks:	

VIEWER IDENTIFICATION - TRAVELERS	
TRAVELER TYPE(S): Commuters; Tourists; Truckers; Bicyclists; Pedestrians; Other	
PROXIMITY: (Which viewers are closer than others, distance zones)	
NUMBER: (Number and density of viewers, which most affected)	
DURATION: (Length of viewing, dynamic views)	
Remarks:	

SCENIC AND VISUAL RESOURCE IDENTIFICATION Scenic resources should be identified prior to field work and their presence and visibility in the AVE confirmed in the field. The following information should be filled out for confirmed scenic, and additional VIA preparer identified visual resources in the field.				
RESOURCE IMPORTANCE IN VIEW:	☐ National/State Scenic Resource	☐ Regional/Local Scenic Resource	☐ Visual Resource (VIA Preparer Designated Resource)	☐ Not visible (from public areas of project)
DISTANCE FROM PROJECT:	☐ Immediate Foreground	☐ Foreground	☐ Middle Ground	☐ Back-ground
VISUAL QUALITY OF RESOURCE:	☐ High	☐ Moderate	☐ Low	☐ None
RESOURCE DESCRIPTION:				
RELEVANT VIEWER GROUPS:				
PHOTOS TAKEN:				

SCENIC AND VISUAL RESOURCE IDENTIFICATION Scenic resources should be identified prior to field work and their presence and visibility in the AVE confirmed in the field. The following information should be filled out for confirmed scenic, and additional VIA preparer identified visual resources in the field.				
RESOURCE IMPORTANCE IN VIEW:	☐ National/State Scenic Resource	☐ Regional/Local Scenic Resource	☐ Visual Resource (VIA Preparer Designated Resource)	☐ Not visible (from public areas of project)
DISTANCE FROM PROJECT:	☐ Immediate Foreground	☐ Foreground	☐ Middle Ground	☐ Back-ground
VISUAL QUALITY OF RESOURCE:	☐ High	☐ Moderate	☐ Low	☐ None
RESOURCE DESCRIPTION:				
RELEVANT VIEWER GROUPS:				
PHOTOS TAKEN:				

VISUAL CHANGE ANALYSIS FOR KEY VIEW ________ (Determine visual change as the average of the scores established for visual compatibility and visual contrast below for visual change where compatibility and contrast are of the same importance. Weighted averaging and professional judgement should be used to determine visual change for projects where visual compatibility and visual contrast are of unequal importance.)		
Visual Compatibility (based on table below)	**Visual Contrast** (based on table below)	**VISUAL CHANGE** (use (weighted) average)
+3, +2, +1, 0, -1, -2, -3	**+3, +2, +1, 0, -1, -2, -3**	**+3, +2, +1, 0, -1, -2, -3**

VISUAL COMPATIBILITY ANALYSIS FOR KEY VIEW ________ (Compare the fit of the proposed project environment's attributes of landscape character, intactness, lighting and glare with the same attributes of the natural, cultural and existing project environment using the descriptive and numerical values below.)						
Descriptive and Numerical Values to be Used: (Circle one based on the results below)	**Highly Adverse (-3)**	**Slightly Adverse (-1)**	**No Effect (0)**	**Slightly Beneficial (+1)**	**Moderately Beneficial (+2)**	**Highly Beneficial (+3)**
Visual Compatibility with	**Proposed Project Compatibility Attributes**				**Overall Visual Compatibility:**	
	Character	**Intactness**	**Lighting**	**Glare**		
Natural Environment (Vegetation, land, rocks, soil, water, animals, atmospheric conditions)						
Cultural Environment (Buildings, houses, bridges, infrastructure)						
(E) Project Environment **(**ROW roadways, grading, constructed elements, highway planting, other vegetation cover, and ancillary visual features)						

VISUAL CONTRAST ANALYSIS FOR KEY VIEW _________

(Compare how the proposed project contrasts with the descriptions of the existing natural, cultural, and project environments in terms of vividness and unity and then rate visual contrast using the descriptive and numerical values below.)

Descriptive and Numerical Values to be Used: (Circle one based on the results below)	**Highly Adverse (-3)**	**Slightly Adverse (-1)**	**No Effect (0)**	**Slightly Beneficial (+1)**	**Moderately Beneficial (+2)**	**Highly Beneficial (+3)**

<table>
<tr><th rowspan="3">Visual Contrast of with</th><th colspan="8">Proposed Project Visual Qualities</th><th rowspan="3">Overall Visual Contrast:</th></tr>
<tr><th colspan="4">Vividness</th><th colspan="4">Unity</th></tr>
<tr><th>Form</th><th>Line</th><th>Color</th><th>Texture</th><th>Dominance</th><th>Scale</th><th>Diversity</th><th>Continuity</th></tr>
<tr><td>Natural Environment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Cultural Environment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Exist. Project Environment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

VISUAL SENSITIVITY ANALYSIS FOR KEY VIEW ________

(Determine visual sensitivity as the average of the scores established for viewer sensitivity and viewpoint sensitivity below for visual sensitivity where viewer sensitivity and viewpoint sensitivity are of the same importance. Weighted averaging and professional judgement should be used to determine visual sensitivity for projects where viewer sensitivity and viewpoint sensitivity are of unequal importance.)

Viewer Sensitivity (based on table below)	**Viewpoint Sensitivity** (based on table below)	**VISUAL SENSITIVITY** (use (weighted) average)
0, -1, -2, -3	**0, -1, -2, -3**	**0, -1, -2, -3**

<table>
<tr><th colspan="9">VIEWER SENSITIVITY ANALYSIS FOR KEY VIEW ________
(To determine viewer sensitivity, evaluate three attributes for viewer exposure (proximity, extent or number of viewers, and duration) and three for viewer awareness (attention, focus, and preference) in the context of viewers' assumed preferences for natural harmony, cultural order, and project coherence (FHWA 2015). Consider the importance of distance zones and movement.)</th></tr>
<tr><td colspan="2">Descriptive and Numerical Values to be Used:
(Circle one based on the results below)</td><td>None
(0)</td><td colspan="2">Low
(+1)</td><td colspan="2">Moderate
(+2)</td><td>High
(+3)</td></tr>
<tr><td rowspan="2">Viewer Type</td><td colspan="3">Viewer Exposure
(Viewer exposure is a measure of the viewer's ability to see a particular object. High exposure helps predict high sensitivity.)</td><td colspan="3">Viewer Awareness
(Viewer awareness is the viewers' recognition of a particular object or project.)</td><td rowspan="2">Overall Viewer Sensitivity</td></tr>
<tr><td>Proximity
(object distance)</td><td>Extent
(# of viewers)</td><td>Duration
(viewing period)</td><td>Attention
(on surroundings)</td><td>Focus
(specific?)</td><td>Preference
(for vis. quality)</td></tr>
<tr><td>Neighbors:</td><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="2"></td></tr>
<tr><td>Travelers:</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">Remarks:</td></tr>
</table>

VIEWPOINT SENSITIVITY ANALYSIS FOR KEY VIEW ________ (The degree of viewpoint sensitivity can be determined based on the VIA preparer's professional judgement adjusted average of three factors – the level of scenic resource designation and importance in the view, the distance of the scenic or visual resource from the project, and the visual quality of the scenic or visual resource..)				
Descriptive and Numerical Values to be Used: (Circle one based on the results below)	**None (0)**	**Low (+1)**	**Moderate (+2)**	**High (+3)**
Resource Designation Level (high (+3) for nationally or state recognized scenic resources, moderate (+2) for regionally and locally recognized scenic resources, low (+1) or moderate (+2) for visual resources identified by the preparer of the VIA report, and none (0) for resources that are not visible from any publicly accessible viewpoints.)	**Viewpoint Distance** (high (+3) when the scenic or visual resource is in the immediate foreground; moderate (+2) when the scenic or visual resource is in the foreground; low (+1) when the scenic or visual resource is in the middle ground; and none (0) when the scenic or visual resource is in the background.)	**Resource Visual Quality** (based on visual resource visual quality evaluation of its intactness, unity and vividness on the scale of 0 through +3)		**Overall Viewpoint Sensitivity**
Remarks:				

Appendix C: Photography Guidelines

To standardize photography for documentation and for use in photo simulations, the following best practices are recommended. The size of the camera sensor is important; a small camera sensor may have a sufficient resolution, but the pixels of the sensor are so small that they cannot collect sufficient light for a high-quality image. A “full-frame” format camera is preferred. The term “full frame” refers to a camera sensor of the same size as a single negative (or frame) on a 35-millimeter (mm) roll of film (i.e., 24 × 36 mm). The ratio of width to height of a sensor is known as the aspect ratio, which governs the proportions of each image. With a full frame camera, it is a ratio of 3:2. In 1996, a new, smaller “Advanced Photo System” (APS) camera film format was introduced with a camera sensor that measures 16.7 × 30.2 mm. Currently, there are three different APS digital image formats: APS-H (high definition), APS-C (classic) and APS-P (panorama). All three are smaller than the original APS and full-frame sensors, hence the term “cropped sensor.” The H format is the same ratio as the entire APS negative, while the C format has an aspect ratio of around 3:2, the same as in a full-frame camera. The exact size of an APS-C digital sensor varies slightly, depending on the camera manufacturer. APS-C sensors can be found in most digital single lens reflex (DSLR), mirrorless, and compact system cameras today. The APS-C or APS-H formats are normally adequate for baseline photography as long as the minimum number of horizontal pixels is 4,800.

The quality of the lens is also important. A prime lens, which has a fixed focal length, is generally preferred. Zoom lenses should be avoided. It is traditional to use a so-called “normal” lens, which has a 50-millimeter focal length with a full-frame (FX type on Nikon cameras) sensor, or a 35-millimeter focal length lens with an APS-C (DX type on Nikon cameras) sensor.

At a minimum, the following field conditions must be recorded when the photography is collected:

- Global positioning system (GPS) location of the camera within 1-meter accuracy
- Compass bearing to the center of the view
- Camera and lens make and model
- Lens focal length
- Lens and camera settings used to take the photograph
- Time, date, and weather conditions
- Order and placement of photos if a panoramic image is to be collected

If there are no clear registration points in the photograph, at least two markers must be placed at a reasonable distance from each other in the view and their location recorded with a GPS unit. For best practice, several markers should be used.

Appendix D: Area of Visual Effect Determination

The main tools used to establish AVE boundaries include topographic mapping, satellite imagery, land use and vegetation mapping, and digital terrain models (DTMs). Of these, DTMs offer the most efficient and effective way of determining viewsheds. As geographic information systems (GISs) become increasingly sophisticated and include information on the location and massing of vegetation and structures as well as satellite imagery, topography, climate, and land use, viewsheds derived from GIS data are progressively more accurate. Traditionally, a project's viewshed is initially delineated by using a DTM to map it, as illustrated in Figure 2 2, using only topography. Adjust this preliminary map by conducting a field review that locates obscuring elements, such as vegetation and structures that may further limit the visibility from and to the highway.

The ability of DTMs to create accurate viewsheds is limited by the digital information available to construct the model. If the model accounts for terrain but not vegetation, the built environment, or the presence of typical atmospheric conditions, it will not generate an accurate viewshed without further field verification. Advances in DTM modeling and newly available digital surface models (DSMs) may overcome these limitations in the future. Vegetative cover and atmospheric conditions can vastly affect the visibility of a project. Viewsheds based solely on topography should be considered preliminary, subject to adjustment made during a field review of the project corridor. Although viewsheds can be initially developed using information gleaned from electronic databases, field observations are important for verifying viewsheds and determining the actual landscape units from which visual impacts will be assessed.

For smaller projects, determine the AVE by delineating on a map viewshed areas that can be seen from several different points along the edges of the project area or from several viewpoints looking toward the project. Use software that can display satellite imagery and topography to produce the delineations.

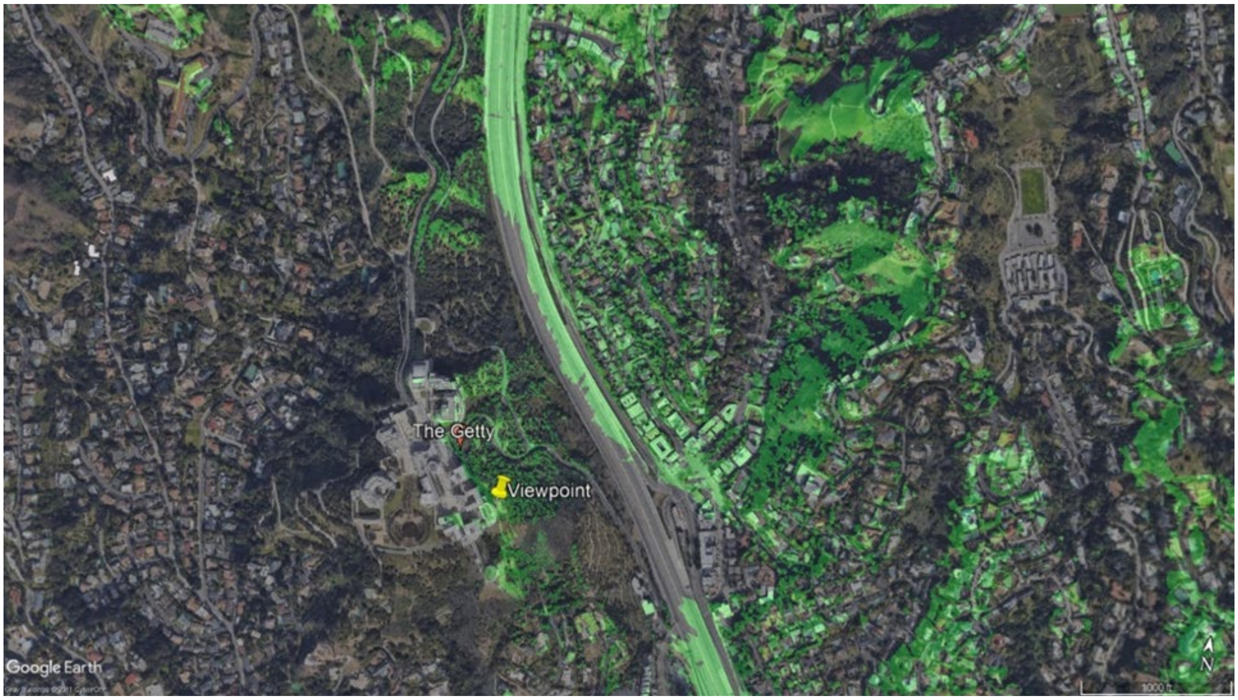

Figure D-1: Google Earth Pro delineation of a project viewshed (shown in green)

Larger projects may use ArcGIS, MicroStation, or similar software to delineate the AVE, combining all viewsheds visible from the entire project area (Figure D-2).

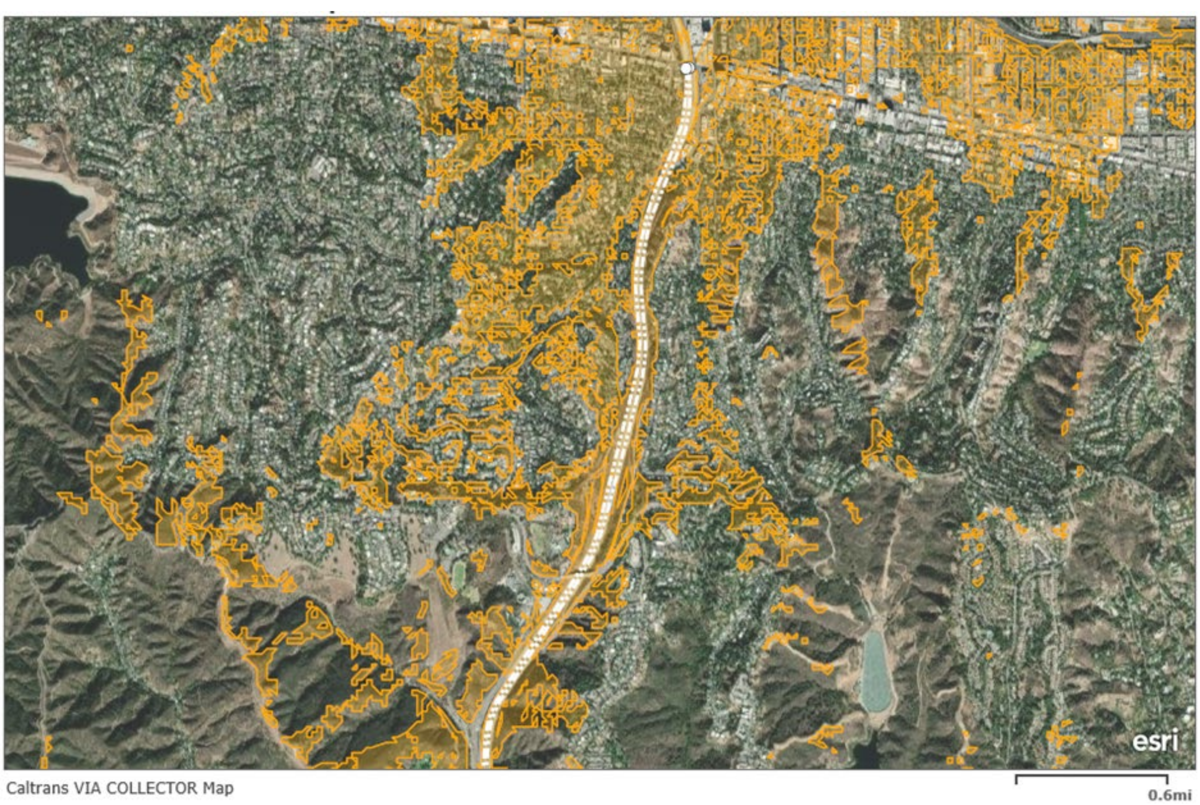

Figure D-2: ArcGIS Collector delineation of a project Area of Visual Effect

Appendix E: Key View Selection

The VIA preparer should aim for a broad selection of view types while avoiding duplication. The sum of key views selected should adequately represent views of the project from multiple angles, distances, vantages, and viewers (travelers and neighbors). Each major landscape unit should be represented, and any scenic or potential other visual resources should be captured. Key views should be evaluated and ultimately selected to include the following:

- Views that are the most sensitive for a majority of affected viewers
- Typical views
- Views of/from scenic resources
- Views of/from highly frequented locations

The selection of the “worst-case” viewpoint is a professional judgment based on the following criteria:

- The view of the project is relatively unobstructed and represents the full extent of the project’s visual effect on the surrounding visually sensitive area.
- The viewpoint must be publicly accessible and preferably used by a relatively high number of more sensitive viewers compared to other possible viewpoints.
- The location of the viewpoint is within an area where scenery is valued (e.g., a recognized scenic or visual resource).
- The view of the scenic or visual resource from the project is blocked by project elements.
- The view of the scenic or visual resource impacted by the project is within the drivers’ and travelers’ cone of vision (in both directions of travel).

The importance of views relates, in part, to the position of the viewer relative to the resource. To identify the importance of views within the AVE, divide each key view viewshed into distance zones. Distance zones are defined by perceptual characteristics, based on the position of the viewer in relationship to the landscape. The closer a visual resource is to the viewer, the more dominant it is and the greater its importance to the viewer. Generally, distance zones can be categorized as:

- Foreground: The viewer can see surface details and hear project sounds.
- Middle Ground: Landscape features and their arrangement dominate the view.
- Background: Colors are muted and there are few to no distinct landscape features; zone extends from middle ground to limit of visibility.

These distance zones may vary depending on the viewpoint of the observer, the surrounding topography, and other landscape elements.

For best practices regarding photography documentation, refer to Appendix C.

Appendix F: Design Visualizations

1.1 Preparing Photo Simulations

The process used to create the simulations must be clearly described so that it can be replicated by a competent professional. Intermediate files should be preserved in an orderly manner in case the simulation is audited.

The current best practice consists of the creation of a rendered and correctly lighted 3D model of the project in CAD and its subsequent registration in the base photograph, using markers at known locations.

- The project data must be current, and the simulation must be updated if the project design changes significantly.
- The simulations should provide the expected appearance of the project area and vicinity from the selected key view points within one year after the completion of the project or at the completion of the highway planting or revegetation establishment period. Visualization that simulate the project area at times after the establishment period should be clearly described as future simulations and their captions should include approximately how many years after the completion of the project they were prepared for. Distant future simulations should be included only in addition to regular 1-year-after simulations, not used alone.
- There should be at least two registration markers plus the viewpoint in each visualization, but the best practice would be to geolocate several more.
- The lighting of the rendered 3D model visualization of the project should match the lighting of the base photograph.

Wireframe 3D models (i.e., just the outline of the project form) registered over the base photograph are an effective way to illustrate how remaining landscape elements will screen views of a project. The accuracy of nighttime simulations should be field checked by comparison to similar projects if possible. Memorandum-level VIAs may use spatially accurate computer graphics or rendered, hand-drawn perspective views developed by using proven descriptive geometry methods rather than photo simulations, as appropriate. It is no longer considered acceptable to use a photograph of a similar project that has been placed over the base photograph, with the resulting image digitally cleaned up. If environmental commitments are necessary, then they must be simulated to evaluate their effectiveness.

1.2 Displaying Photo Simulations

Photo simulations are based on a single-frame photograph and must retain the full resolution and image quality of the original photograph. If simulations are compressed for including in VIA documents, the uncompressed version must also be made available. Photo simulations should be printed as large as possible on tabloid (11 by-17-inch) paper intended for color photographs, with full color depth and at least 600 dpi. To minimize distractions, include only basic information to identify the view on the photo simulation page. To accurately represent the scale of the landscape features and perspective geometry of the view, the photo simulation sheet must be held perpendicular to the viewer's line of sight at the distance determined by this formula: Distance from viewer in inches equals one-half of the photo simulation sheet width in inches divided by the tangent of one-half of the photograph's HAoV. If the photograph was taken with the focal length equivalent of a 50-millimeter (mm) lens on a full-frame camera, then the distance is just a bit farther than a comfortable arm's length for an adult (approximately 22 inches).

Panoramic simulations can be prepared by "stitching" together overlapping photographs. However, care must be taken in properly assembling and displaying the panorama. They may be printed on a high-resolution color plotter so that the single-frame photograph is approximately the size it would be if printed on tabloid paper. A cylindrical projection should be used with a stitched panoramic image to correctly represent the scale of landscape features. For controversial projects and to maximize the accuracy of the view, the panoramic simulation should be mounted in a curved frame with a radius that corresponds to the appropriate viewing distance. Alternately, the panoramic image can be broken into separate overlapping single-frame equivalents.

Nighttime simulations do not accurately represent the visual conditions when printed and must be viewed on a monitor or projector. Glare and reflection cannot be accurately simulated and must be accounted for and evaluated by measurements with light meters.

When motion is a critical element of the view (e.g., an elevated view of traffic at night), it may be appropriate to create an animation. Use the highest resolution available (e.g., 4K resolution or 3,840 × 2,160 pixels) for making the animations.

1.3 Accompanying Documentation

The current best professional practice is to provide the existing base photograph and simulated alternatives accompanied by a cover sheet with information appropriate for the project, the audience, and the potential for litigation. While this information is ideal, it is not required. The cover sheet with accompanying information could include the following:

- Topographic map or aerial photograph locating the project, and key viewpoint that shows its HAoV
- Base photography date, time, meteorological visibility (from the nearest weather station), and image size in pixels
- Camera properties, including the camera and lens make/model, lens focal length and full-frame equivalent, HAoV, Vertical Angle of View (VAoV), and camera height
- Viewpoint information, including the address or a description of the location, latitude/longitude, elevation, and compass bearing to the center of the simulation photograph(s)

- Version or date of the project specification that is simulated
- Appropriate viewing distance when printed on tabloid paper
- A description of the existing photograph and each alternative with a photo simulation that includes the distance to the nearest portion of the project and other pertinent information

Additional information could include:

- The name and location of the person and organization responsible for preparing the photo simulation and of the client who commissioned the photo simulation
- For projects that extend over a large area, a map of the project showing the location of the key viewpoint
- Instructions for printing the simulation and viewing it on a monitor
- Panoramic image of the existing condition to provide context and a red rectangle indicating the portion of the view in the photo simulation

Additional design visualization guidance that should be reviewed for advanced VIAs is:

- FHWA. 2021, Design Visualization Guide. https://highways.dot.gov/federal-lands/design-visualization/guide.
- Sullivan, R., M. Meyer and J. Palmer. 2021. Evaluating photo simulations for visual impact assessment. Lakewood, CO: Natural Resource Stewardship and Science, Air resources Division. National Park Service. https://irma.nps.gov/DataStore/Reference/Profile/2287365.

Appendix G: Lighting and Glare

In the Inventory Phase, it is important to include a daytime and nighttime baseline visual assessment of existing lighting levels, lighting color consistency, and glare sources in the AVE so they can be compared later with proposed lighting levels for both the construction and operation of the project. As part of this task, it is necessary to document not only the existing nighttime lighting and glare sources in the AVE but also the existing vehicle light levels and other light sources associated with the project environment as viewed by the travelers and neighbors. Photography may be used, but nighttime photographs are a poor representation of how people experience night lighting. It may be useful to create line drawings or maps locating the primary lights visible from key viewpoints. For Advanced VIA Reports, record both ambient light and spotlight light meter readings.

Light trespass (obtrusive lighting) is defined by three interrelated elements (see also Figure G-1):

- Spill light: Light that falls outside the area intended to be lighted. It is typically measured in lux in the vertical plane with the light meter pointing to the light source. Spill light assessed in the vertical plane may be most feasible following completion of construction to assess if light trespass is occurring instead of both producing studies and post-construction assessment:
    - Rensselaer Polytechnic Institute's Lighting Research Center notes that: "The Institution of Lighting Engineers (ILE) specifies light trespass limits for light entering windows in terms of environmental zones (ILE 2000). (See “What are lighting environmental zones?”) It is difficult to measure light trespass because the occurrences are so different. Illuminance on a vertical plane (for example vertical illuminance at the window) may be appropriate in some cases. Horizontal illuminance might be appropriate in other cases (for example, horizontal illuminance on a bed)." For the purposes of a VIA, both horizontal and vertical are appropriate since measurable visual changes to the environment surrounding the highway as well as direct impacts in neighboring properties are being assessed, however it is important to flag this for review early to make sure we have the capability to produce measurements in the software we will need to use to assess the impacts in PAED.
    - A light source that is lighting in the vertical plane also produces measurable ground plane illuminance, so the horizontal method may be preferable for the purposes of producing both pre-construction studies and review in the field post-construction.
    - Depending on the angle of lighting and horizontal and vertical receptors, horizontal and vertical elements can be either lit more brightly, or not as

brightly, as the other, and this needs to be assessed on a project-specific and location specific level by the preparer of the VIA.

- Glare: Light that is viewed at the light source (luminaire), which reduces one's visibility.
- Skyglow: Light reflected from the light source, road, or other surfaces up into the atmosphere. Skyglow in effect reduces one's ability to view stars in the night sky by casting unwanted light into the atmosphere. Although this is not a safety or security issue, groups such as the International Dark-Sky Association have mounted strong campaigns to reduce skyglow and protect visibility of the night sky. Skyglow may be reduced by improving the uniformity of luminaires. Reducing the "bright spots" directly below the luminaires (often called nadir dump) can positively affect skyglow as well as provide a reduction in energy usage.

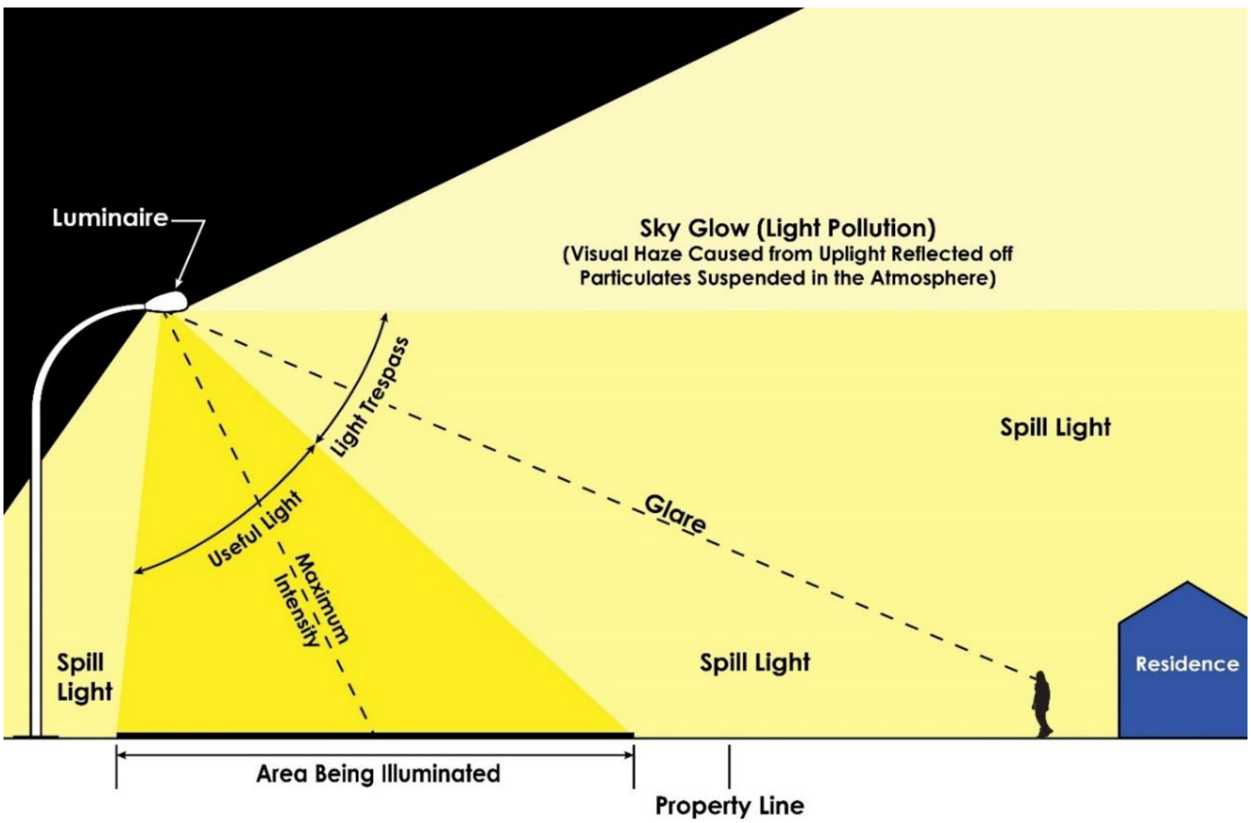

Figure G-1: Spill light, glare, and skyglow (FHWA 2012)

There is an overlap between the light trespass discussed above and a Community Impact Assessment. Lighting may change the character of a rural area to a more urban character. Removing "dark skies" from a community can be extremely controversial, which is why many communities have ordinances to protect their residents from unnecessary lighting. As mentioned above, there are organizations that promote dark skies and push for protections and for the addition of glare shields to current lighting (which should be considered). Removing people's ability to see the night sky and the stars is an impact that needs to be addressed. Equity has become a major concern; the excessive light flooding low-income communities, shining into homes and affecting health should also be addressed. The key components of Caltrans projects that may require detailed lighting analysis include, but are not limited to, the following:

- Park and ride facilities
- CMS (Changeable Message Signs)
- Lighting standards
- SRRA (Safety Roadside Rest Areas)
- Maintenance facilities
- Toll plazas
- Structure/ and bridge elements
- Light exposure from the opening up of views and removal of vegetation resulting from project improvements

Maintaining an effective balance between the reduction of light trespass and the provision of quality beneficial roadway lighting requires thoughtful design and the selection of light fixtures with cutoff or full cutoff optical systems. Lighting design with full cutoff luminaires will typically reduce skyglow, spill light, and especially glare (veiling luminance), thus greatly improving overall visibility.

When selecting the type of lighting to be used, the PDT should determine whether the project would "create a new source of substantial light or glare which would adversely affect day or nighttime views in the area" (mandated in the *Checklist*, question 1d, Aesthetics). Potential impacts will need to be addressed in both the VIA (by the landscape architect) and the environmental determination /document (by the environmental generalist, who is responsible for filling out the *Checklist*). Substantial new glare impacting nearby residences or community facilities may affect quality of life and human health and may be considered significant in the *Checklist* and require mitigation; minimization measures (such as glare shields directing light only upon the roadway) should always be considered. Example measures for reducing impacts due to lighting are included in Chapter 1.10 of the Roadway Lighting Manual (Caltrans 2021). There are many options when designing lighting, and the visual expert and generalist should work closely with Design to find options that minimize lighting impacts while still meeting safety needs. Visual impacts do not only stem from the new light; there is also the "hardscape" to be considered, such as the number of light standards and their height. Disclose both in the VIA and Environmental Document (ED), and if these data cannot be provided by the design engineer, then an estimate is the next best practice. Instead of installing light standards for an entire corridor, it may well be possible to limit them (as well as their height) to only intersections/interchanges where there is the greatest safety need, that is, only where necessary for safety reasons.

Since this subject is new and evolving as well as complex, examples of how the issue has been addressed for visual impacts are provided in Figure G-2 below.

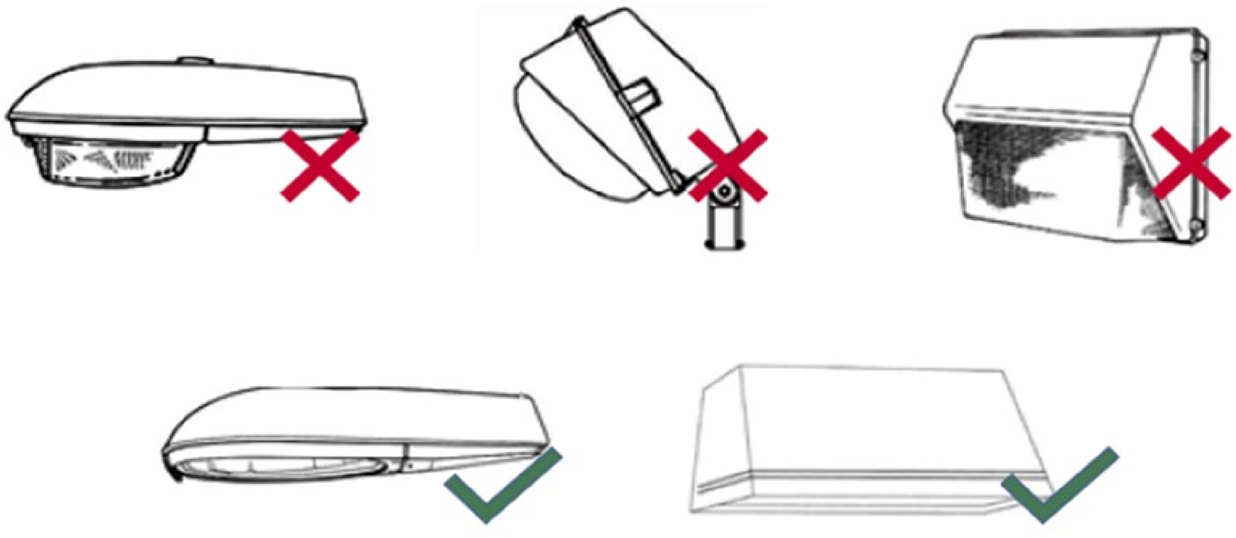

Figure G-2: Full cutoff luminaires (CDOT 2020)

The luminaire's BUG (Backlight-Uplight-Glare) rating system as promulgated in Illuminating Engineering Society document, "Luminaire Classification Systems for Outdoor Luminaires" (2011) (IES TM-15-11) provides a numerical rating of the luminaire light distribution as it applies to backlight (spill light), uplight (skyglow), and glare. BUG ratings are defined by the lumen output within the distribution angles of the luminaire (Figure G-3). In general, a higher BUG rating means that more light is emitted in each angle.

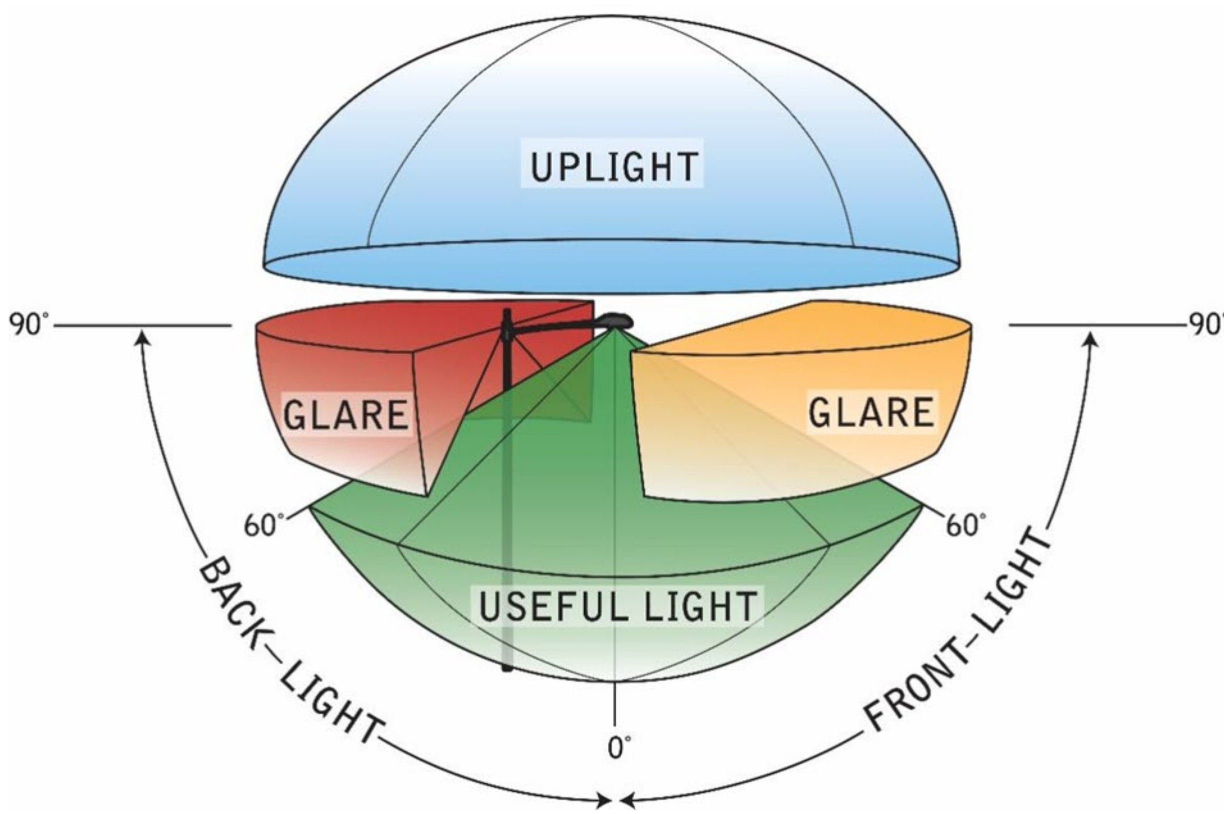

Figure G-3: Roadside pole-mounted light fixture BUG rating diagram (CDOT 2020)

Spill light levels have been developed and are documented in FHWA (2012). They are defined in Table G-1 below. Complying with these levels is recommended where possible. These maximum light levels do not apply to areas within the right-of-way but only to properties adjacent to it. They are typically calculated and measured from the residential boundary line but are sometimes evaluated from the location of the residence being investigated. Designations LZ1 through LZ4 define the light zones within the AVE adjacent to the right-of-way. Light zones do not always correspond with land use zones. They should be identified by the VIA preparer with professional judgment for specific project conditions. Among factors that must be considered are neighborhood ambient light conditions, lighting expectations, special environmental concerns, and how project lighting may affect the adjacent environment. Because identifying the appropriate light zone may be a matter of judgment and consensus, there is no automatic means of determining which zone is appropriate for a given area.

Table G-1: Classification of Light Zones Outside of the Right-of-Way Based on Existing Ambient Lighting and Maximum Pre-Curfew and Curfew Spill Light Levels within These Zones

Light Zone	Light Zone Description	Max. Pre-Curfew Spill Light Level [lux]	Max. Curfew Spill Light Level [lux]
LZ1	Areas of low ambient brightness with intrinsically dark landscapes where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of residents and users is adapted to low light levels. Lighting may be used for safety and convenience but is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or greatly reduced as activity levels decline. Examples are national parks, areas of outstanding natural beauty, or residential areas where inhabitants have expressed a strong desire for strict limitation of light trespass.	1.0	0.0
LZ2	Areas of moderate ambient brightness where the vision of the residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience, but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline. These may be outer urban and rural residential areas. Roadways may be lighted to typical residential standards.	3.0	1.0
LZ3	Areas of moderately high ambient brightness where the vision of residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security, or convenience and is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline. This will generally be urban residential areas. Roadway lighting will normally be to traffic route standards.	8.0	3.0
LZ4	Area of high ambient brightness where the vision of residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security, or convenience, and is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline. Normally this category will include urban areas with mixed residential and commercial use with a high level of nighttime activity.	15.0	6.0

Source: Adapted from FHWA 2012
Max. = maximum

Bright sources of light in the visual field create glare. Light is scattered in the human eye, resulting in a phenomenon known as “veiling luminance” This results in a visual haze within the eye, reducing visibility. Veiling luminance that occurs when bright oncoming headlights significantly reduce one's vision is a common experience. Blocking the bright source or looking away from the visual field reduces the haze associated with veiling luminance, and vision is partially restored. The perception of glare, however, varies greatly between observers. The Illuminating Engineering Society (IES) defines glare as "the sensation produced by luminances within the visual field that are sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility. The magnitude of the sensation of glare depends on such factors as the size, position, and luminance of a source, the number of sources, and the luminance to which the eyes are adapted." Glare typically falls into one of the following categories:

- Disability Glare: The presence of an amount of glare so significant as to prevent an individual from seeing adequately. An example of disability glare is a driver's substantially reduced visibility caused by the headlights of an oncoming car.
- Discomfort Glare: The presence of glare that may over time cause a sense of pain or annoyance and may increase blink rate or even cause tears.

Disability and discomfort glare are very different phenomena. Disability glare depends on the quantity of light falling on the eye and the angle from the line of sight. With discomfort glare the source luminance is a major factor; with disability glare the source intensity is a major factor. Typically, disability glare will apply to drivers on the roadway, and a numerical ratio has been developed, which is referred to as the veiling luminance ratio (IESNA RP-8). Veiling luminance is a key criterion in undertaking lighting design. The effect of veiling luminance on visibility reduction is dependent on the average lighting (luminance) level of the pavement. A higher level of veiling luminance can be tolerated if the pavement lighting level is high. Veiling luminance is calculated in terms of a ratio of the maximum veiling luminance experienced by the observer to the average pavement lighting level.

Light source luminous intensity control (Table G-2) is a reliable method of evaluating the off-site discomfort glare (CIE 2003). This method will be typically applied where high-wattage light sources such as flood lighting or high mast lights are used. From the perspective of limiting the impact of a lighting system to both on- and off-road observers, a lighting system meeting the disability glare requirements of the American Association of State Highway and Transportation Officials (AASHTO) and IES generally provides the needed control. Luminous intensity in Table G-2 is shown in units of candela, a basic unit of measure of luminous intensity in the International System of Units. A 100-watt incandescent light bulb has an intensity of about 120 candela.

Table G-2: Discomfort Glare Pre-Curfew and Curfew Maximum Luminous Intensities of Light Fixtures for Different Light Zones Outside of the Right-of-Way

Light Zone	Max. Pre-Curfew Luminous Intensity [cd]	Max. Curfew Luminous Intensity [cd]
LZ1	2,500	0*
LZ2	7,500	500
LZ3	10,000	1,000
LZ4	25,000	2,500

Source: Adapted from FHWA 2012

Max. = maximum
*Note: If the luminaire is for public lighting then this value may be up to 500 cd.

In general, headlights are a source of glare in all circumstances but pre-curfew LZ4. Viewers should be screened from oncoming headlights whenever possible. "The federal lighting standard is very complex and is difficult to interpret even for some manufacturers and lighting specialists. The actual performance standards are based principally on the standards developed by the Society of Automotive Engineers (SAE). FMVSS No. 108 and the SAE standards apply to all vehicles registered in the United States, regardless of the headlamp filament or light source. Stated simply, the maximum light output of headlamp systems, whether two-or four-light systems, is limited as follows:

1. Type 2 or 2A Lights—Upper beam limited to 20,000 to 75,000 candela per lamp. Lower beam limited to 15,000 to 20,000 candela per lamp.
2. Type 1 or 1A Lights—Upper beam limited to 18,000 to 60,000 candela per lamp.

Example of light and glare text from a VIA for a unique road project:
Note: This is very detailed for explanatory purposes.
"*If not properly designed, new and relocated street lighting proposed along the project corridor at intersections could negatively affect nearby roadway neighbors. In particular, LED lighting can negatively affect humans by increasing nuisance light and glare, in addition to increasing ambient light glow (skyglow), if proper shielding is not provided and BRWL [blue-rich white light lamps] are used (American Medical Association 2016; International Dark-Sky Association 2010a, 2010b, 2015). Studies indicate that a 4000 K white LED light causes approximately 2.5 times more light pollution than high pressure sodium lighting with the same lumen output, which would affect sensitive receptors, and more than double the perceived brightness of the night sky (Aubé et al. 2013; Falchi et al. 2011, 2016). This would result in a substantial source of nighttime light and glare that would negatively affect nighttime views in the area if lighting is not properly designed and shielding is not employed."*

Example of a lighting minimization measure from a VIA for a unique road project:
Note: This is extremely detailed for explanatory purposes.
"VIS-1: Apply Minimum Lighting Standards. All artificial outdoor lighting and overhead street lighting will be limited to only those locations where it is absolutely necessary for safety and security requirements, such as intersections. In most cases, lighting will consist of lighting standards that are up to 35 feet in height and the minimum required for driver safety. It is estimated that approximately 40 standards would be needed. Current estimate lighting will be designed using the Illuminating Engineering Society's design guidelines and in compliance with International Dark-Sky Association–approved fixtures. All lighting will be designed to have minimum impact on the surrounding environment and will use downcast, cutoff type fixtures that are shielded and direct the light only toward objects requiring illumination (when needed). Therefore, lights will be installed at the lowest allowable height and cast low-angle illumination while minimizing incidental light spill onto adjacent properties or open spaces, or backscatter into the

nighttime sky. The lowest allowable wattage will be used for all lighted areas, and the number of nighttime lights needed to light an area will be minimized. Light fixtures will have non-glare finishes that will not cause reflective daytime glare.

Lighting will be designed for energy efficiency, with daylight sensors or timers with an on/off program. Lights will provide good color rendering with natural light qualities, with the minimum intensity needed for security, safety, and personnel access. Lighting, including light color rendering and fixture types, will be designed to be aesthetically pleasing. Light-emitting diode (LED) lighting will avoid the use of blue-rich white light lamps (BRWL) lamps and use a correlated color temperature that is no higher than 3,000 Kelvin, consistent with the International Dark-Sky Association's Fixture Seal of Approval Program (International Dark-Sky Association 2010a, 2010b, 2015). In addition, LED lights will use shielding to ensure that nuisance glare and light spill does not affect sensitive residential viewers. Technologies to reduce light pollution evolve over time; design measures that are currently available may help but may not be the most effective means of controlling light pollution once the project is designed. Therefore, all design measures used to reduce light pollution will use the technologies available at the time of project design to allow for the highest potential reduction in light pollution."