SCHOOL OF DESIGN AND MASS COMMUNICATION

AMM 205

ARCHITECTURAL VISUALISATION

Module: Lighting in 3ds Max

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Introduction to Lighting

Lighting is one of the most crucial aspects of any 3D scene, as it directly influences the mood, realism, and visual storytelling of your work. Lighting is essentially the use of light to enhance the appearance of objects, giving depth, color, and emotion to a scene. In the context of 3D graphics, lighting is a collection of tools and techniques used to simulate light in a computer-generated environment.

To achieve photorealistic renders, different render engines such as V-Ray, Arnold, and Mental Ray are used. This chapter will explore the key concepts, different types of lights in 3ds Max, and how to use them effectively, with a particular focus on V-Ray, which is known for producing high-quality renders.

Importance of Lighting:

•**Mood Setting:** Warm light creates comfort, cool light conveys tension.
•**Realism:** Proper lighting and shadows add depth and make scenes more lifelike.
•**Focus:** Spotlights direct viewer attention to key elements in the scene.

Lighting in 3ds Max enhances the quality and realism of 3D renders, making them visually compelling.

What is Lighting in 3D Rendering?

Light is the natural agent that stimulates sight and makes things visible. In the context of 3D graphics, lighting plays a crucial role in creating a believable scene. It affects the way we perceive colors, shapes, and depth, ultimately impacting the overall mood and tone of an image or animation.

Lighting is essential for defining the mood of a scene. Whether it's a serene sunset, a dramatic spotlight on a character, or a mysterious moonlit forest, lighting is a key element that directs how the viewer feels. It not only makes things visible but also adds atmosphere, realism, and emotion to your work.

In a 3D environment, 3D Lighting is a collection of tools and techniques used to simulate real-world light in a computer-generated space. This includes manipulating light direction, intensity, color, and how it interacts with objects in the scene. Artists can utilize different types of lights like ambient, point, spot, or directional to achieve specific looks.

To achieve photorealistic renders, a variety of render engines are used, each with unique characteristics and advantages. Render engines like V-Ray, Arnold, and Mental Ray help to accurately simulate real-world lighting phenomena such as global illumination, caustics, and reflections. Among these, V-Ray is particularly known for its versatility and ability to produce highly detailed and realistic images, making it a preferred choice in industries such as architecture, product visualization, and animation

Light in the Real World

In everyday life, we rarely think about light in the real world, although it is present everywhere. But we are so used to the conditions of reality that we notice immediately if something is not real. Consequently, we would almost always notice a difference between a computer-generated picture and a photograph. This is mainly due to differences or errors in computer-generated presentations of light. Almost anyone can notice that these diverge from reality, but only a trained eye can actually specify the differences.

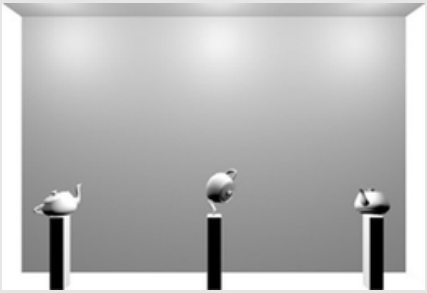
In the real world, there are three lighting scenarios. The first one is natural light, which means sunlight shining directly or indirectly onto Earth, such as moonlight or through a layer of clouds. Natural and weather phenomena provide an exception—for example, lightning and fire. The second scenario is artificial light: any light that is not of natural origin, but manmade. This includes electric light, but also candlelight. The third and most common scenario is a simultaneous occurrence of both natural and artificial light.

Some units of measurement in dealing with light:

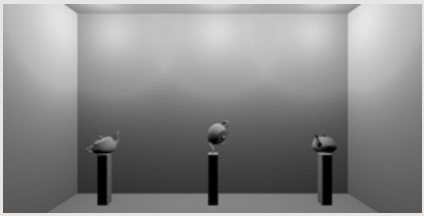
- **Luminous flux (lumen):** Describes the radiated output of a light source per second
- **Luminous intensity (candela):** Describes the luminous flux which is emitted in a certain direction
- **Illuminance (lux):** Describes the luminous flux which arrives at a certain surface
- **Luminance (candelas per square meter):** Describes the luminous flux which is emitted from a certain surface

Illuminance

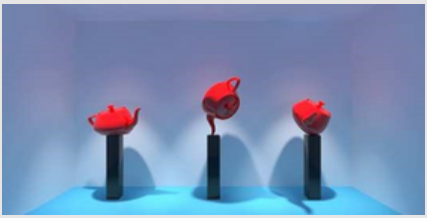
A set of rules governs the behavior of light. Illuminance falls with the square of the distance from the light source, according to the first law. One meter away, a surface receives full intensity; at two meters, it receives only a quarter, and at three meters, it receives a tenth. The light source's luminous intensity doesn't change. The angle of incidence is the second rule. The angle at which light strikes a surface determines its illumination. Maximum intensity is produced by light striking perpendicularly, however brightness is diminished by light spreading across a wider area at oblique angles. Material contact makes up the third rule. Light can be transmitted, reflected, or absorbed when it strikes a substance. Transmitted light travels through, reflected light bounces off, and absorbed light transforms into heat.



Light Source without Decrease in Illuminance.



Light Source with Natural Decrease in Illuminance.



The Blue Floor Makes the Entire Scene Look Blue.

The Multicolored Floor

Image Credit : Kuhlo, M., & Eggert, E. (2010)

Types of Lighting

Standard Lighting in 3ds Max

These are basic lights used for general illumination purposes:

1. **Target Spot:** A spotlight directed at a target point for focused illumination.
2. **Free Spot**: A spotlight that can be moved freely without being tied to a target.
3. **Target Direct:** Similar to directional light, this is focused on a specific target, typically used to simulate sunlight.
4. **Free Direct**: A freely movable directional light, used for consistent illumination across objects.
5. **Omni:** Emits light in all directions from a point, similar to a bulb.
6. **Skylight:** Used to simulate outdoor lighting, providing diffused light from the sky.

V-Ray Lighting in 3ds Max

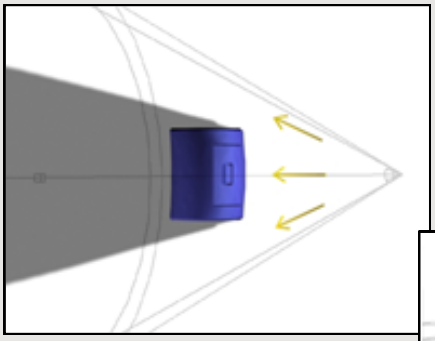
These are more advanced and used for realistic rendering:

1. **V-Ray Light:** A versatile light that can be used in different forms (e.g., plane or sphere) to provide soft and realistic illumination.
2. **V-Ray Ambient Light:** Adds ambient light to a scene, similar to standard ambient light, but more flexible and realistic.
3. **V-Ray IES:** Uses IES data to simulate real-world light fixtures, providing accurate light distribution.
4. **V-Ray Sun:** A powerful light source that simulates sunlight, used for outdoor scenes to achieve realistic sun and sky effects.

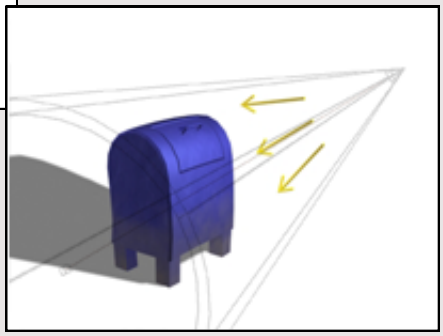
Target Spot Light

A spotlight casts a focused beam of light like a flashlight, a follow spot in a theater, or a headlight. A target spotlight uses a movable target object to aim the light.

- **Create panel > Lights > Standard > Object Type rollout > Target Spot button**
- **Default menu: Create menu > Lights > Standard Lights > Target Spotlight**
- **Alt menu: Objects menu > Lights > Target Spotlight**



Top view of a target spotlight



Perspective view of the same light

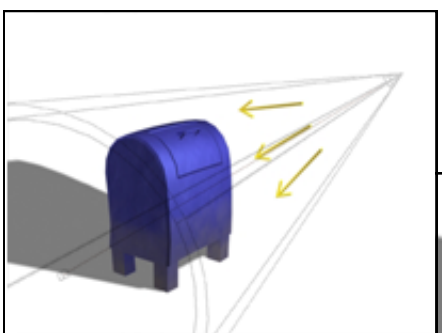
When you add a target spotlight, 3ds Max automatically assigns a Look At controller to it, with the light's target object assigned as the Look At target. You can use the controller settings on the Motion panel to assign any other object in the scene as the Look At target.

Image Credit : Autodesk. (2022)

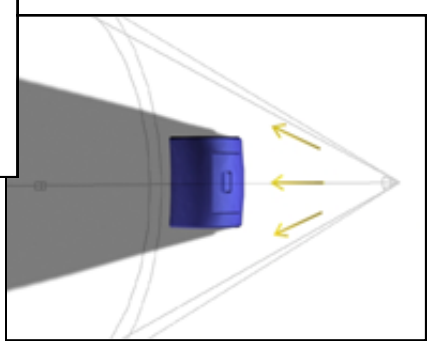
Free Spot Light

A spotlight is a device that emits a concentrated beam of light, similar to a headlight, flashlight, or follow spot in a theater. A Free Spot has no target object, in contrast to a targeted spotlight. The free spot can be aimed in any direction by moving and rotating it.

- **Create panel > Lights > Standard > Object Type rollout > Free Spot button**
- **Default menu: Create menu > Lights > Standard Lights > Free Spotlight**
- **Alt menu: Objects menu > Lights > Free Spotlight**



Perspective view of the same light



Top view of a free spotlight

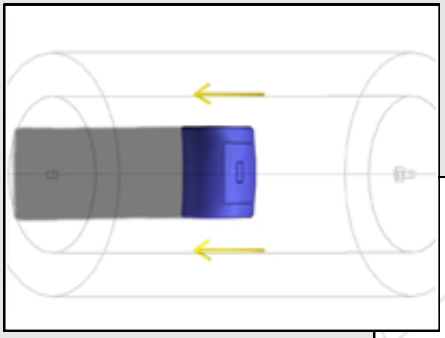
The Targeted parameter on the General Parameters Rollout (Standard Lights) can be changed when creating a Free Spot light. Target lights have a fixed value for this.

Image Credit : Autodesk. (2022)

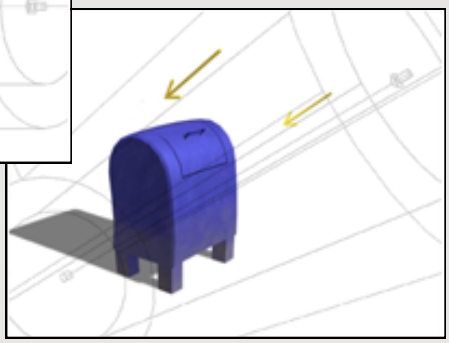
Target Directional Light

Target directional lights emit parallel light beams in a single direction, just like the sun does at the earth's surface (for all intents and purposes). The main purpose of directional lighting is to mimic sunshine. The light's hue, position, and rotation may all be changed in three dimensions.

- **Create panel > Lights > Standard > Object Type rollout > Target Direct button**
- **Default menu: Create menu > Lights > Standard Lights > Target Directional**
- **Alt menu: Objects menu > Lights > Target Directional**



Top view of a target directional light



Perspective view of the same light

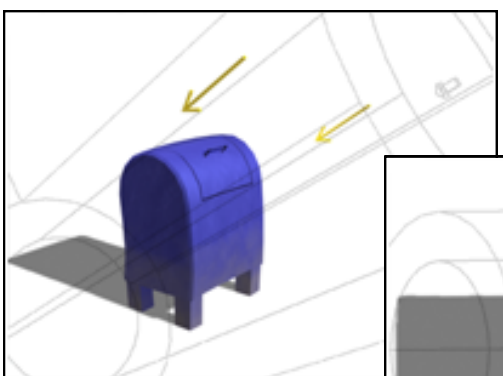
Direct lights are only supported in a radiosity solution if they are pointed downward and outside of the scene geometry's boundary box.

Image Credit : Autodesk. (2022)

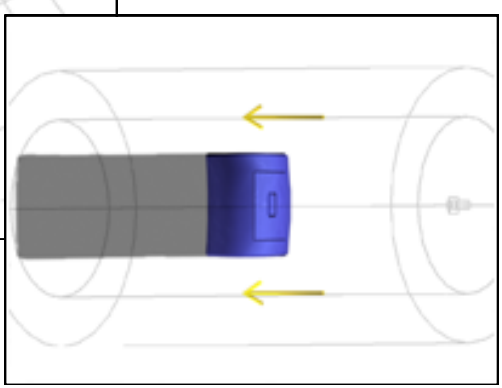
Free Directional Light

Directional lights cast parallel light rays in a single direction, as the sun does (for all practical purposes) at the surface of the earth. The main purpose of directional lighting is to mimic sunshine. The light's hue, position, and rotation may all be changed in three dimensions.

- **Create panel > (Lights) > Standard > Object Type rollout > Free Direct button**
- **Default menu: Create menu > Lights > Standard Lights > Directional**
- **Alt menu: Objects menu > Lights > Directional**



Perspective view of a free directional light



Top view of a free spotlight

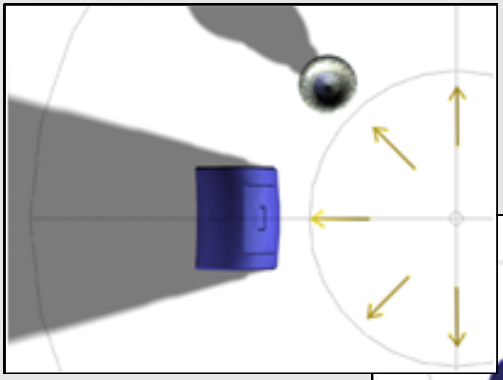
A Free Direct light has no target object, in contrast to a targeted directed light. The light object can be aimed in any direction by moving and rotating it. When you choose a Standard sun in your Daylight system, a Free Direct light is used.

Image Credit : Autodesk. (2022)

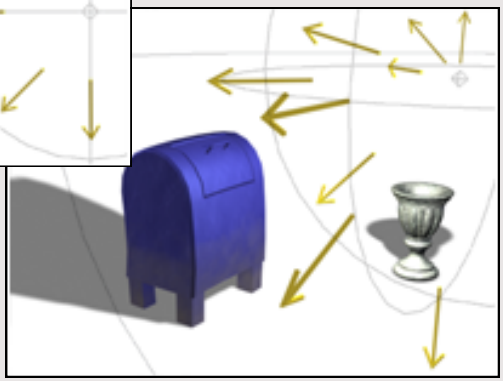
Omni Light

From a single source, an Omni light emits rays in every direction. Omni lights can be used to simulate point source lighting or provide "fill lighting" to your scene.

- **Create panel > Lights > Standard > Object Type rollout > Omni button**
- **Default menu: Create menu > Lights > Standard Lights > Omni**
- **Alt menu: Objects menu > Lights > Omni**



Top view of Omni light



Perspective view of the same light

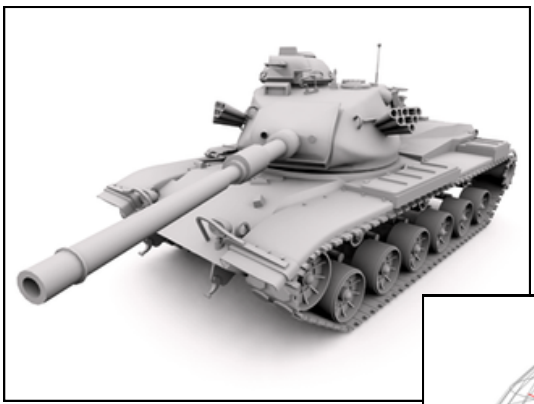
Compared to spotlights, omni lights produce ray-traced shadows more slowly since they can produce up to six quadtrees. Unless your scene calls for it, stay away from utilizing omni lights and ray-traced shadows.

Image Credit : Autodesk. (2022)

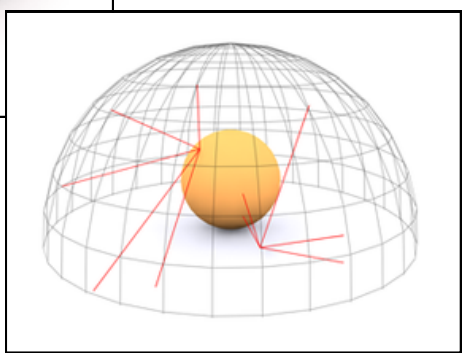
Skylight

The Skylight light models daylight. You can set the color of the sky or assign it a map. The sky is modeled as a dome above the scene.

- **Create panel > Lights > Standard > Object Type rollout > Skylight button**
- **Default menu: Create menu > Lights > Standard Lights > Skylight**
- **Alt menu: Objects menu > Lights > Skylight**



Model rendered with a single skylight, and light tracing



A skylight is modeled as a dome above the scene.

Skylight performs best with advanced lighting, such as the Light Tracer or radiosity, when rendered with the default scanline renderer.

While there are a number of methods for modeling daylight in 3ds Max, a skylight frequently produces the finest results when using the Light Tracer. Reduce the Indirect Light Bump Scale setting after converting the bump-mapped material to an Advanced Lighting Override material if you get visual abnormalities when rendering it with a skylight.

Image Credit : Autodesk 3ds Max. (2025)

What is V-Ray

V-Ray is a 3D rendering software that simulates realistic light and materials in computer graphics by utilizing sophisticated algorithms. Professionals in the design, architecture, and entertainment sectors love it because of its reputation for producing photorealistic images and animations. V-Ray functions as a plugin that smoothly integrates with popular 3D programs like 3ds Max, Maya, SketchUp, and others to give users access to sophisticated and user-friendly rendering tools.

Key Features of V-Ray:

1. **Realistic Lighting:** V-Ray uses physically accurate lighting algorithms, including global illumination, to replicate natural lighting with high fidelity.
2. **Adaptive Lights Algorithm:** This feature speeds up rendering by optimizing how light calculations are handled, especially in scenes with multiple light sources.
3. **Physically-Based Materials:** V-Ray includes a vast library of physical material options that mimic real-world substances like glass, metal, wood, and cloth with incredible realism.
4. **Camera Controls**: Simulating real-world cameras, V-Ray provides features like depth of field, motion blur, and lens effects, allowing artists to capture their scenes as though they were photographed.
5. **Interactive Rendering:** V-Ray's interactive rendering capability lets you view updates to the render in real time as changes are made to the scene. This is especially useful for tweaking lighting, materials, and camera settings on the fly.
6. **Scalability:** V-Ray is built to handle everything from small-scale projects to massive scenes with complex geometry and thousands of lights, making it scalable for different project needs.

Importance of V-Ray Lighting and Rendering in 3ds Max

V-Ray lighting is crucial because it mimics real-world light behavior, which is key to producing believable scenes. The lighting setup can include a range of light types such as area lights, point lights, and image-based lighting with HDR images. Each type has specific settings that can mimic natural lighting conditions or create dramatic effects for stylized visuals.

Importance of Render Settings

Render settings in V-Ray for 3ds Max are critical as they directly impact the quality and efficiency of the final output:

1. **Quality Settings:** Adjustments like the image sampler (antialiasing), noise threshold, and subdivisions directly influence the clarity and smoothness of the final render. Higher settings lead to better quality but require more processing time.
2. **Global Illumination:** Settings for global illumination (GI) contribute to the realism of the scene by simulating how light bounces off surfaces. Fine-tuning GI settings helps achieve more accurate and natural lighting effects.
3. **Environment Settings:** These include controls for background images, HDRIs for lighting, and environmental effects like fog or atmospheric perspective, which can add depth and realism to a scene.
4. **Camera Settings:** V-Ray simulates real camera behaviors, including depth of field and motion blur, which can be crucial for adding realism or focusing attention in a scene.
5. **Output Size and Format:** Deciding on the resolution, aspect ratio, and output formats (like PNG, JPEG, or EXR) based on the needs of the project is essential for the final presentation.

Effective use of V-Ray in 3ds Max involves understanding and manipulating these settings to balance render quality with time constraints, aiming for the best possible output within practical limits. This balance is key in industries where visual quality can directly impact client satisfaction and project success.

V-Ray Light

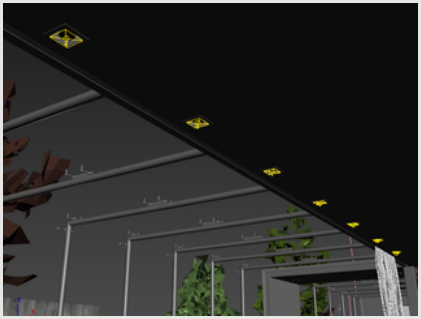
The V-RayLight is a V-Ray specific light source object that can be used to create physically accurate area lights of different shapes. Shapes are selected through options when creating the light via 3ds Max's Create panel (or Create menu), or, after the light is created, through the 3ds Max Modify panel.

A VRayLight can be set to any one of the following types:

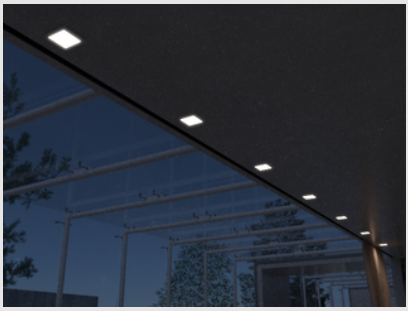
- **Plane light** – A flat rectangular light.
- **Disc light** – A flat circular light.
- **Sphere light** – A spherical light.
- **Mesh light** – A mesh object converted to a light source.
- **Dome light** – A spherical or hemispherical light that shines inward from outside the scene extents.

The light type is set or changed with the Type parameter in the V-RayLight General rollout.

Example:



Plane lights wireframe



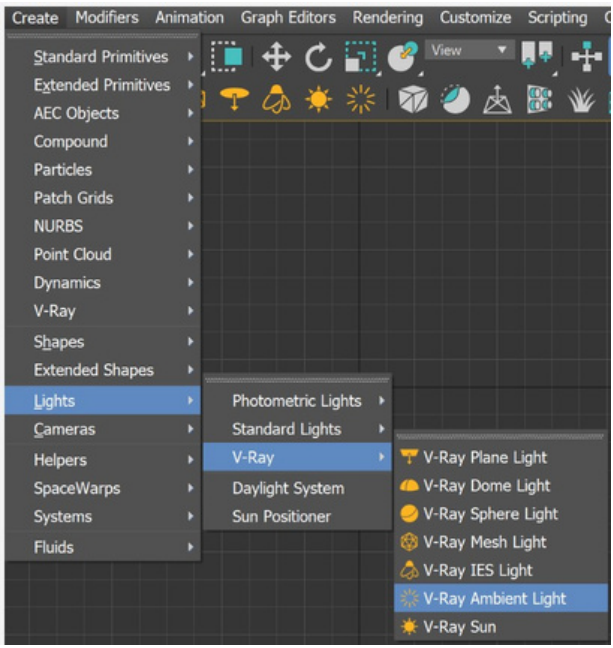
Rendering with Plane lights only (with slight Bloom Effect)

Image Credit : Chaos Group. Plane - Disc - Sphere Light.

V-Ray Ambient Light

To create light that doesn't emanate from a precise direction, use the V-Ray Ambient Light plugin, which is designed specifically for V-Ray. GI, ambient occlusion, and other things can be simulated with it.

At this time, the V-Ray GPU does not support the V-Ray Ambient Light.



Similar to regular ambient light, but more adaptable and realistic, the V-Ray Ambient Light gives ambient light to a scene.

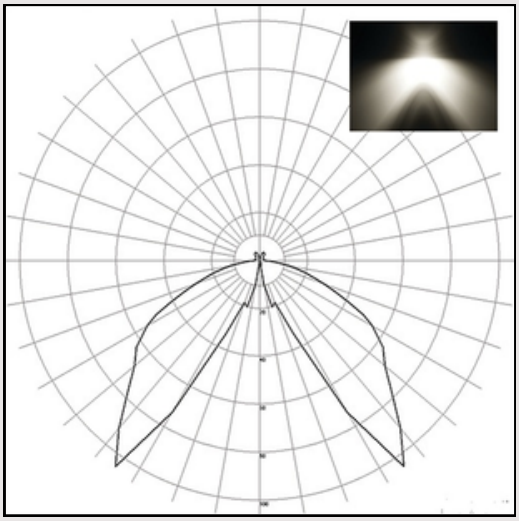
Image Credit : Chaos Group. Plane - Disc - Sphere Light.

V-Ray IES

An.ies file containing the light's distribution profile is used by photometric lamps. A real-world light bulb or tube's full parameters, including the cone's shape and the falloff's steepness, are contained in an.ies file. The manufacturer of the actual lightbulb typically provides these files, and the data they contain—which was obtained through laboratory testing—is incredibly accurate in depicting the light source. for a.ies file is loaded, 3ds Max recreates the light's attributes, which V-Ray uses for rendering.

For architectural interior drawings, where it may be crucial to depict the true effect of employing particular artificial light sources in the scene, IES lights are especially helpful.

While 3ds Max has standard photometric lights, V-Ray photometric lights are optimized to render faster in V-Ray.



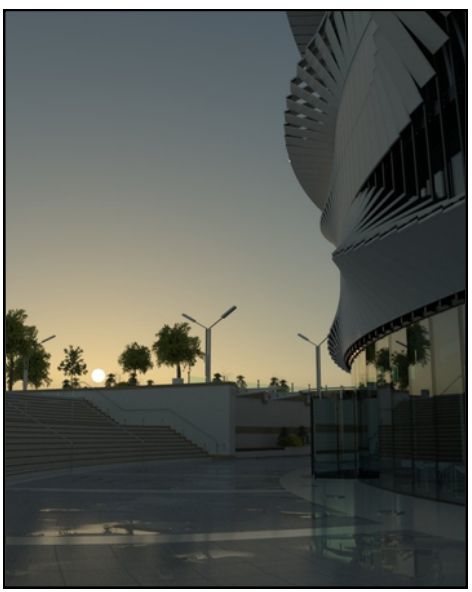
The graph above shows the IES profile of a typical bollard or post light, a type of light commonly used in architectural outdoor scenes. The rendered thumbnail is shown as an inset.

Image Credit : Chaos Group. Plane - Disc - Sphere Light.

V-Ray Sun

Two unique features offered by the V-Ray renderer are VRaySun and VRaySky. Together, VRaySun and VRaySky were created to replicate the Earth's Sun and Sky environment as it exists in reality. Both are programmed to vary their look based on the VRaySun's direction.
The model described in the work A Practical Analytic Model for Daylight serves as the foundation for the V-Ray Sun and Sky.

Example: Direction of the VRaySun Light



This example demonstrates the effect of the sun direction. The Sun is positioned such as its rays hit the ground at certain degrees. Note how in addition to the scene brightness, the sun position also changes the appearance of the sky and the sun light color.

V-Ray Sun is a powerful light source that simulates sunlight, used for outdoor scenes to achieve realistic sun and sky effects

Image Credit : Chaos Group. Plane - Disc - Sphere Light.

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THANK YOU