

We're always asking our fellow modelers how they did something so that we can improve our models.

If I could tell you how to improve all your models by doing one thing, would you be interested?

Why this Clinic?

- **How many times have you talked or read about getting the perfect paint mix to replicate that exact shade of blue, red, yellow, etc. to replicate the paint color on your favorite prototype locomotive, train station, passenger train, freight car or other model?**
- **We spend countless hours, days, months, and years building models so that we can have our perfect layouts.**
- **But then.....**



Sooo.... If your basement looks anything like this:





Lighting Your Layout Room

Mark Mincek

What this clinic is:

- **Talk about the types of lighting out there along with the advantages and disadvantages of each.**
- **Provide methods to design your layout lighting based off lighting engineering principles.**
- **Talk about both the light color that you choose and the importance of paying attention to Color Rendering Index (CRI)**

This is **A WAY of lighting your layout that will yield good results. There may be other ways that can be done successfully.**

Special Thanks

Early in my days as a member of Division 8, Bill Moore gave a clinic on lighting that inspired my focus on good layout lighting.

- Bill is a scientist. His conclusions were based off his own experiments.**
- I am an engineer, so my clinic is based off engineering principles of lighting design.**
- When I designed my own layout lighting and compared it to Bill's layout lighting our designs were identical.**

Types of Lamps

- **Incandescent**

Pros

- **Inexpensive**
- **Warm Looking Light**
- **Small size makes it versatile**
- **Dimmable**

Cons

- **Relatively short bulb life (1000 hours)**
- **Uses a lot of energy**
- **Radiates a lot of heat (only 10% of energy used is for light)**

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Types of Lamps

• Fluorescent Tubes

Pros

- Available in different light colors
- Lower Energy Use (65 to 75% savings over incandescent)
- Longer Lasting (15 – 20,000 hours)

Cons

- Higher initial cost
- Replacement bulbs can be expensive if standard four foot bulbs not used
- Large size can make it hard to install between overhead obstacles
- Bulbs will dim and flicker with age
- Omnidirectional

Types of Lamps

- **Fluorescent Tubes (cont.)**

Pros

Cons

- **Produce UV light**
- **Only dimmable with a special type of ballast (appx. \$60 to \$175 each) and requires certain bulbs**
- **Bulbs must be “burned in” for 100 hours before dimmed**
- **On/off cycling reduces life**
- **Being phased out beginning in 2023**

Types of Lamps

• Compact Fluorescent (CFL's)

Pros

- Available in different light colors
- Lower Energy Use (65 to 75% savings over incandescent)
- Longer Lasting (10,000 hours)
- Can be used in older incandescent fixtures

Cons

- Slightly higher initial cost
- Bulbs lose 20 – 25% of their light output at 40% life
- Most bulbs not dimmable
- Produce UV light
- Omnidirectional
- On/off cycling reduces life
- Some do not like the quality of the light
- Being phased out in 2023

Types of Lamps

- **Halogen**

Pros

- Warm Looking Light
- Small size makes it versatile
- Dimmable
- Very little light degradation over time

Cons

- Relatively short bulb life (2500 hours)
- Uses a lot of energy
- Bulbs that use incandescent sockets being phased out
- Extremely **HOT!!!**

Types of Lamps

- **LED**

Pros

- **Available in different light colors**
- **Lower Energy Use (80 to 90%+ savings over incandescent)**
- **Longest lasting (25,000 hours)**
- **100% Directional**
- **Very cool operating temperature**

Cons

- **Higher initial investment in bulbs**

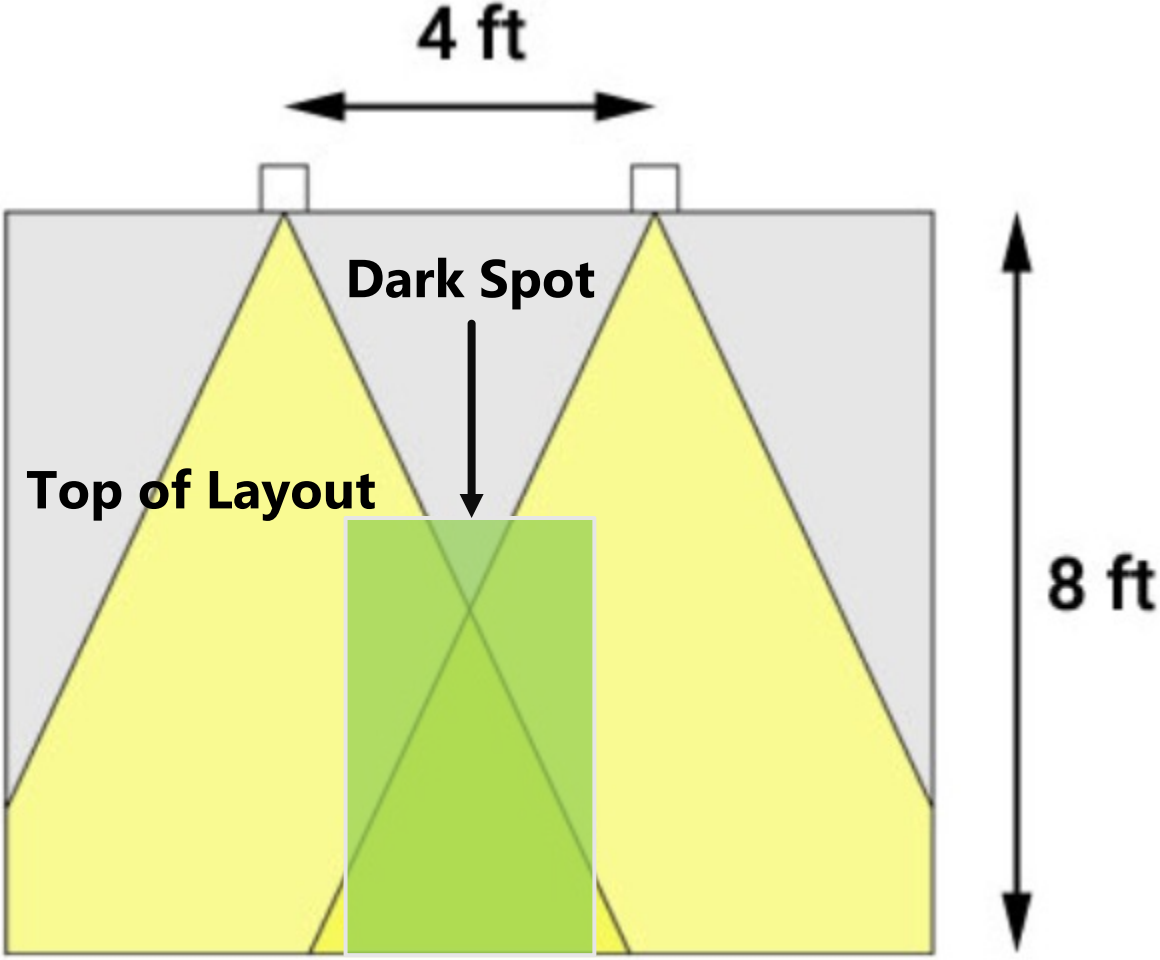
Lamp Spacing Importance

Correct spacing of your general layout lamps will allow a well-lit layout that does not result in shadows.

Don't assume that the spacing for typical room lighting is also applicable to your layout room lighting

Layout photography typically requires supplemental lighting (not covered in this clinic).

Why Typical Fixture Spacing is not Adequate for Layouts



Lamp Spacing How-to Guide

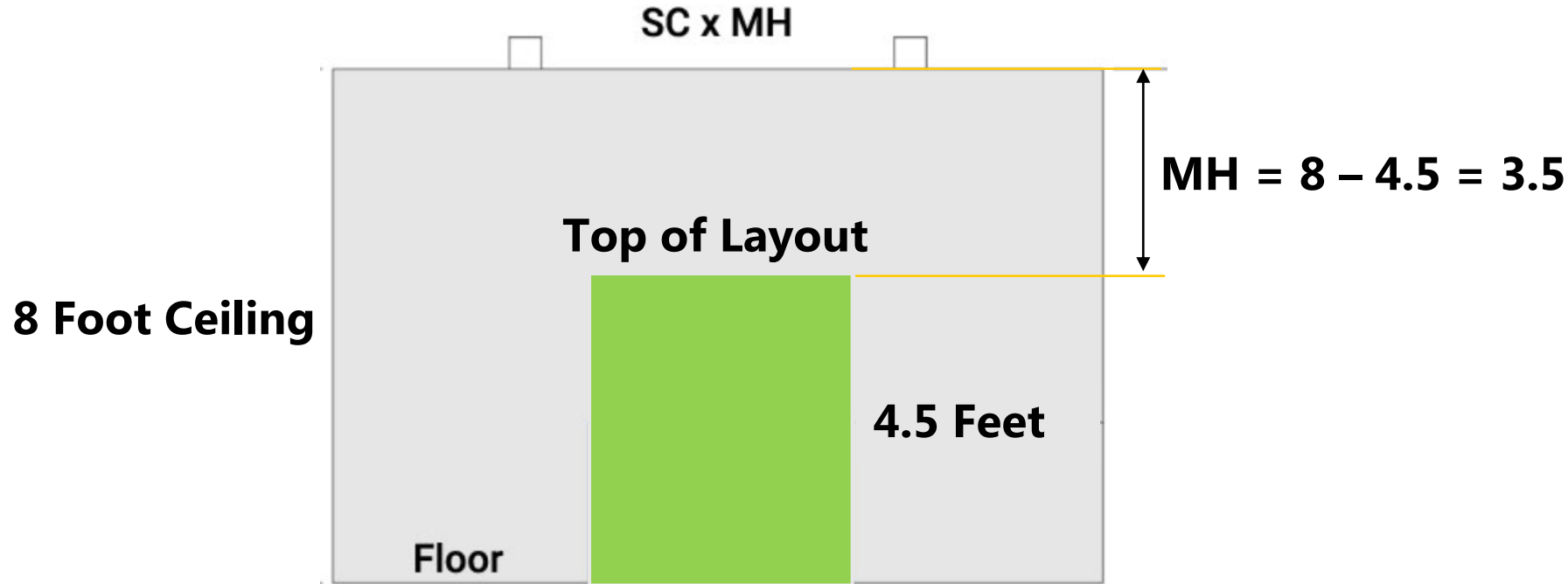
Light fixture manufacturers include a “Spacing Criterion” number (SC) in the spec sheet. This can also be called a “Space to Mounting Height Ratio” or “S/M Ratio” or “SM”

- This number is typically in the range of 0.5 and 1.5. The greater the number, the less fixtures you’ll need.
- Follow this simple formula for the spacing of your lamps:

$$\text{Lamp Spacing} = \text{Spacing Criterion} \times \text{Mounting Height}$$

- Be careful and make sure that your Mounting Height is the distance between your light fixture and your layout!

Fixture Spacing Example



- Assume a ceiling height of 8 feet
- Assume a layout height of 4.5 feet
- Assume a Spacing Criterion of .95
- Fixture Spacing = Spacing Criterion x Mounting Height
- Fixture Spacing = $.95 \times 3.5 = 3.325$ feet or 3 feet 4 inches
- Distance from wall to first fixture should be no more than half this distance

Fixture Spacing Tip



- **If your fixtures are arranged like the picture on the left, maximum distance between fixtures is measured diagonally**
- **Often, it is better to stagger the rows of fixtures like the picture on the right**

Light Color Comparisons

 2700K to 3000K is considered Warm White. This most closely mimics the color from an incandescent bulb.

3000K to 3500K is considered Soft White

Often used in restaurants, residential settings, and places with earthy tones

Often used in offices, retail, and hospitals

4000K to 5000K is Cool White

 **5500K to 6500K is typically referred to as Daylight**

Tips for Choosing a Light Color

Lower K rated bulbs (2700K to 3500K) are a good choice if you have a layout set in the fall or if you like the look of incandescent lighting

Higher K rated bulbs (4000K to 6500K) can be a good choice for a more stark looking winter layout

Don't assume that a Daylight bulb (5500K to 6500K) will make your layout look realistic and most like natural lighting outside (It will NOT!!)

Try a couple of bulbs in a small section of your layout BEFORE you buy enough for your entire layout room

Color Rendering Index

Color Rendering Index (CRI) is one of the most misunderstood concepts in lighting.

CRI is measured on a scale from 0 to 100.

CRI is independent of the color temperature (K) of a light source. CRI describes the similarity between a light source and a reference source at the same color temperature.

The Science of Making Lamps

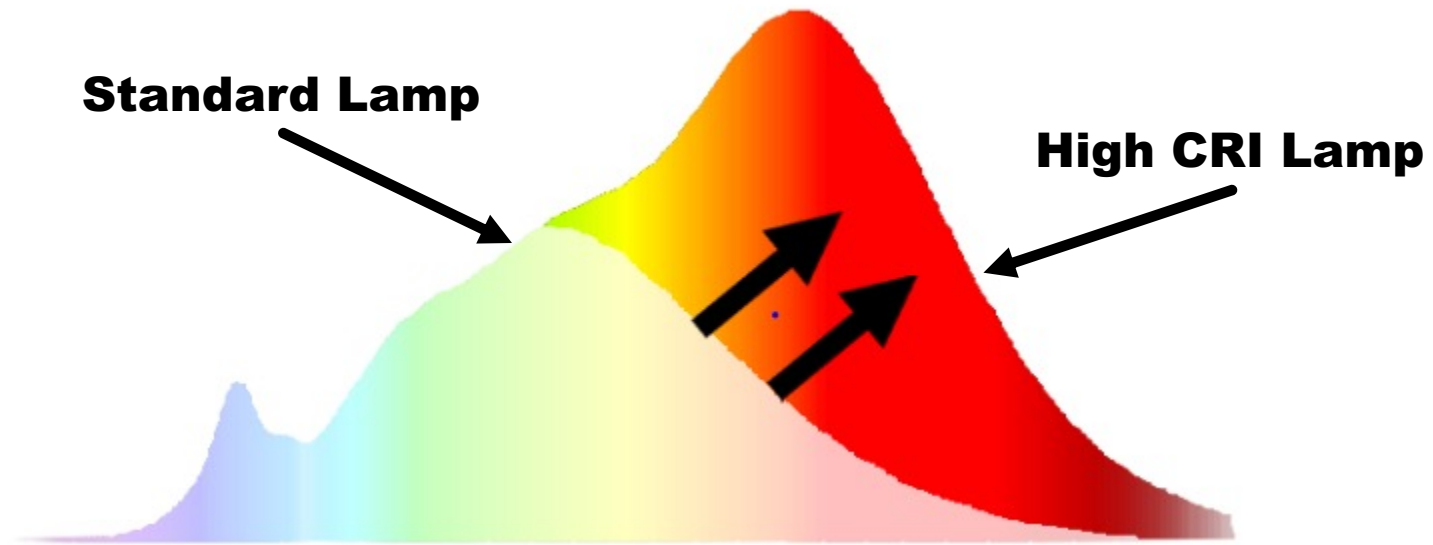
Red wavelength light is plentiful in natural light.

Red wavelength light is not the most efficient for illumination. In other words, it takes a lot of red light to make up for a smaller amount of other colors of light.

A standard non-incandescent lamp typically favors a green tinted spectrum.

High CRI lamps have a higher amount of red phosphorus in the bulb that allows for a higher CRI.

The Science of Making Lamps





High K, Low CRI



High K, High CRI



Low K, Low CRI



Low K, High CRI

Comparison of CRI's

Typical LED lamps have a CRI of 80.

Fluorescent bulbs can have a CRI as low as 50.

For the most accurate rendition of the color you are trying to replicate, use bulbs that have a CRI of 90 or more. CRI's in the mid 90's are not overly expensive. Bulbs with a CRI of 99 get quite expensive.

High CRI BR30 lamps (typical can light bulbs) can be purchased for about \$3 online.

Where to Buy

Big Box retailers are NOT the best place to purchase lamps for your layout room.

- **Very limited selection**
- **Not the best prices**

Specialty lighting stores can have more selection but prices can be quite high

Online is your best choice for selection at the best price

- **Amazon**
- **1000Bulbs.com – My favorite**
 - **Specs included for all their bulbs**
 - **Great prices**
 - **Special discounts around all the major holidays**

Parting Thoughts

There are too many good layouts out there with lighting that doesn't bring out the great modeling.

Good lighting can make a huge difference in the perception of your layout.

Design your layout lighting before you start your work

- **CadRail is a good tool for both layout planning and designing your layout room lighting**

Layouts with good lighting don't happen by accident!