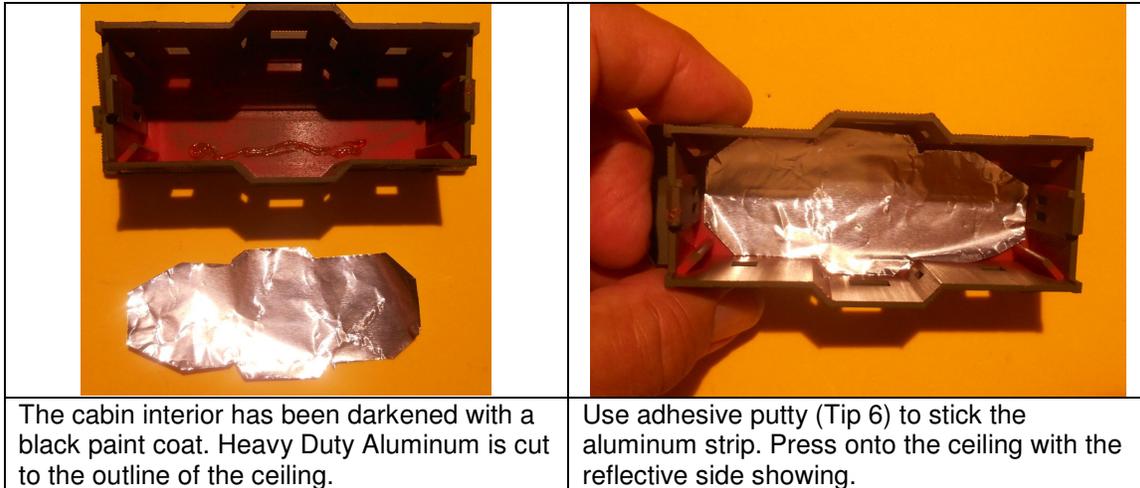


## 8 Tips and Tricks for Improving Rolling Stock Lighting ( Robert J. Wilkins Oct 2017 )

The following are some ideas and suggestions for improving the lighting in your HO rolling stock including passenger cars and cabooses.

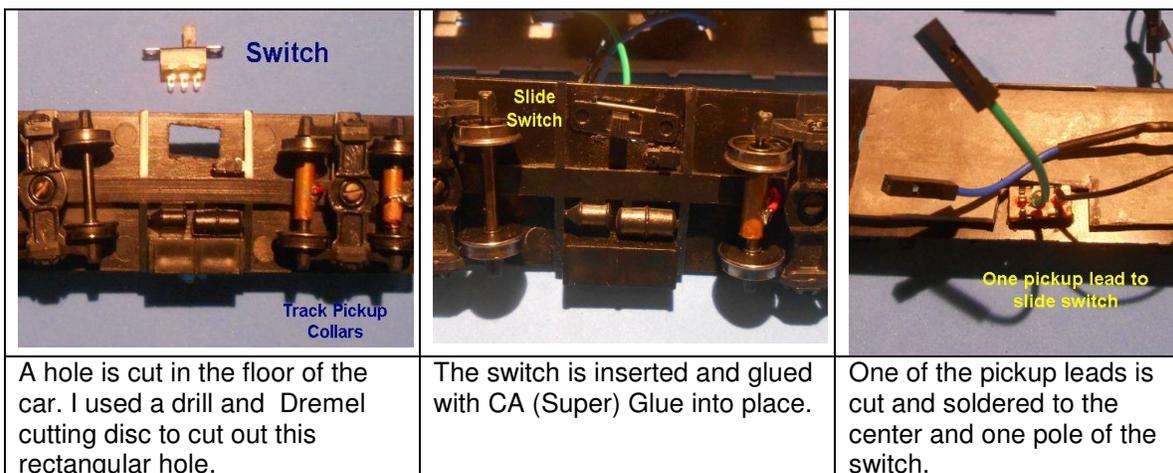
### 1) Enhance Illumination:

Use a strip of heavy duty aluminum wrap and glue to the ceiling of the cab to provide a reflective surface that will shed more light into the cabin. The interior of the cabin should be painted black to prevent the lighter color of the plastic from showing through .



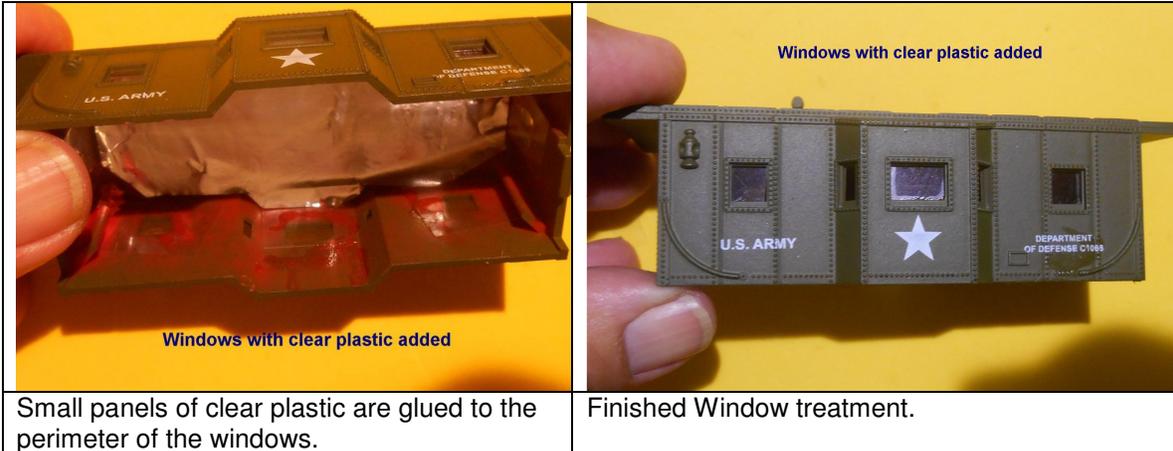
### 2) Install a slide or press-on/off switch to deactivate lights.

With DCC constant track voltage around 12-15 Volts lights in passenger cars and cabooses will stay on even when the car is in a siding. This will also occur in DC mode if the siding is powered. A simple solution is to add a slide switch to the undercarriage of the rolling stock by cutting one of the pickup leads. The photos below describe a process for adding a SPDT slide switch.



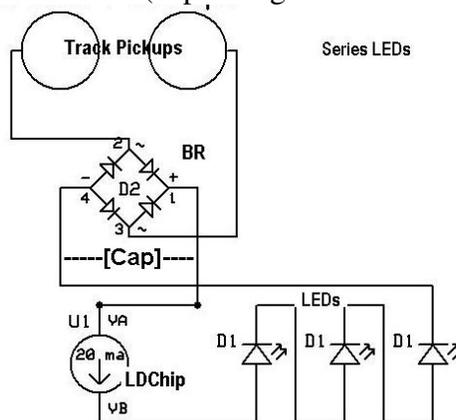
### 3) Add Windows

Some rolling stock comes without window panes included. These empty windows can be readily filled in using clear plastic material such as clear plastic protector sheets or from clear plastic packing material. Cut out a patch to a size larger than the window and glue in on the edges with liquid plastic glue. You can also use 2 pieces of clear adhesive tape stuck onto one another. One piece just larger than the window and the second larger than the first to provide adhesive at the edges for sticking to the wall around the window.



### 4) How Many LEDs to use and what arrangement should be used ?

The LED Driver chip generates a constant 20 milliamps of current starting at 5 volts for the first LED. The chip is rated for a maximum voltage of 90 volts regulating the current output to 20 milliamps so the LEDs will not burn out. No resistors are required. The resistance of an LED has been calculated to be small around 13 ohms hence this is not a factor in changing voltage. What is important is the voltage drop generated by each LED, termed its forward Voltage, when added to a circuit. LEDs vary in their forward voltage drop. Yellow, Orange and Red LEDs have a forward voltage drop of around 2 volts while White, Blue and Green have a forward voltage drop of around 3.3 volts. When LEDs are arranged in series (ie Pos-Neg-Pos-Neg etc) for every LED added the required voltage to illuminate the circuit will rise by the forward voltage of the LED. For DCC operation, operating at between 12-15 volts this would allow 3 to 4 LEDs to be used when arranged in a series circuit. (depending on forward voltage LEDs)



If using DC the threshold voltage for the LEDs to illuminate an in series setup would be too high (over 10 volts). If however the LEDs are arranged in parallel (ie Neg- Pos-Pos- Neg ) the voltage drop proves to be much lower. Three LEDs with the same forward voltage drop, set up in parallel, will require a threshold voltage around 1 volt higher than the initial voltage of 5 Volts required by the LED Driver chip. A total of 6.0 volts.

	<p>Three red LEDs set in Parallel</p>
<p>To illustrate the 3 red LEDs (above) are set up in parallel. Using a regulated voltage the 3 red LEDs light up initially around 5.5 volts with good illumination around 6.0 Volts. The current reading is shown in the lower meter reading at 0.01 amps. (ie between 10 and 20 milliamps. ) Most LEDs begin to light at around 10 milliamps.</p>	<p>Voltage 6.0, Current &lt;20mamps</p>

If a LED of higher voltage drop is added into the parallel circuit it will not illuminate yet the others will. This is shown below. Why this occurs I am not sure. If someone has an explanation please let me know. It may be related to the difference in voltage drop.

<p>White LED added to the parallel circuit does not illuminate at up to 15V..</p>	<p>If added in series to the 2 red LEDs in parallel the White LED illuminates brightly at around 7 volts.</p>	<p>7.4 V, 20 mamp</p>
<p>2 Red LEDs + 1 White LED Set up in parallel. White does not light.</p>	<p>2 Red LEDs set in parallel + 1 White LED set in series. All LEDs Light</p>	<p>This requires a higher threshold voltage (7.4V) and 20 mamps of current</p>

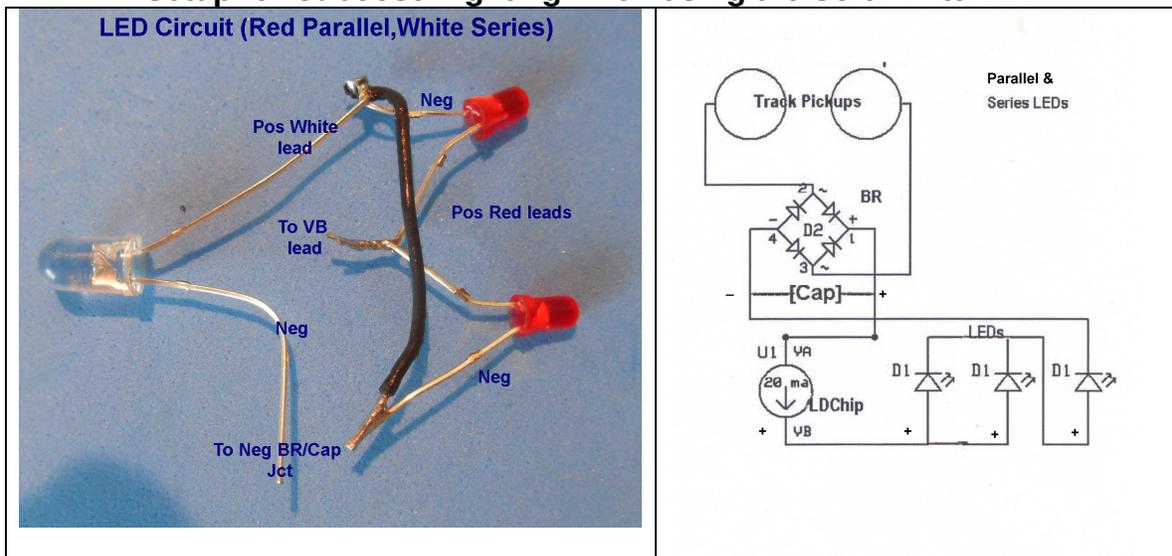
If this LED is added in series to the 2 parallel arranged LEDs it will light quite brightly at around 7 Volts. The voltage drop of the white LED explains a higher threshold voltage is required to light the circuit.

**Bottom line :** The best circuit for DC use no more than 3 LEDs. If all are of the same type or have the same forward voltage they should be setup in parallel. If one of the LEDs has a higher Forward voltage use a parallel arrangement for the 2 LEDs (eg 2 red LEDs) and put the other LED (White or Yellow) in series setup to the red LEDs. Under these circumstances the lights should illuminate adequately at around 7 volts.

Here is the circuit set up for the Caboose lighting system using either the Yellow or Soft white LED. The VB lead of the LED Driver unit connects to the Positive leads of the Red LEDs and the Negative lead from the White or Yellow LED connects to the Bridge Rectifier/Capacitor Negative Junction. This circuit works fine with DCC as well.

**Note :** The Yellow LED will still work when connected in Parallel to the red LEDs as it has the same forward voltage drop.

### Setup for Caboose Lighting when using the Soft White LED



### 5) Use the new 2mm Red LEDs.

2mm LEDs are now available and the smaller size makes them more prototypical for HO scale rear lights. These 2 mm LEDs will now come standard with the Caboose lighting kit replacing the 3mm size. Because of the wider body shape they may require manipulation into place in the cabin. The forward voltage of these LEDs is around 2V.



## 6) Use Blu Tack Putty for temporary adhesion.



This putty like material is available under a number of names including (**Blu Tack Brand**- Adhesive Putty, **Scotch Brand**- Removable Mounting Putty, **Loctite Brand** - Fun Tack, **Duck Brand** Poster Putty). This is used as a versatile, malleable, reusable, temporary sticky adhesive. It is inexpensive and readily available in beige or blue from Stationary Stores, Home Stores, Arts and Craft Stores and Online.

In this project it is used to attach weight plates to the rolling stock floor or install light circuit components and carriage interior seating and passengers.



## 7) The best location for the pickup wire hole.



I have found that the best location for drilling the hole in the floor of the undercarriage is as close to the central pivot point of the truck but clear of the copper pickup collar.

This allows for minimal lateral movement of the copper collar on the axle and tension on the wire and solder joint.

Note here the pickup hole for the pickup wire has been drilled in the middle of the floor between the copper collar/axle and the central pivot point of the truck. This allows the truck to turn freely with minimal pulling on the collar. Make sure there is enough slack to allow gravity on the copper collar to make contact with the electrified axle. Also be sure that the insulated part of the wire is not rubbing against the collar preventing wheel rotation.

## What if the truck cannot hold the second collar ? :



In this case simply use the other truck for the second collar. Here the coupling mechanism prevents the wiring of a collar to the front wheel of the truck. The collar is now placed on the other truck wheel to overcome this problem.

## 8) Add or Modify the Coupler

You may wish to change the couplers of the Rolling stock from hook type to knuckle type couplers. You could also modify the hook type coupler to be compatible with the knuckle type. I have included a description on how this can be accomplished below.

A You Tube video was produced by **TrainTrackTrav** that describes this process. "How to Make Clever Adaptor Coupler" :<https://www.youtube.com/watch?v=l3mW8MPSi3Y>

		
1. Snip off the wing of the hook coupler	2. Optional: Snip off the downward pointing uncoupler or at least the pointed projection.	3. File down the hook to be compatible with the knuckle hook.
 <p><b>Transition Coupler</b></p>	4. Once the trimming of the hook is compatible with the knuckle coupler hook, reattach the couplers to the car.	

