Upper Cumberland Railroad Society

A Chartered Tennessee Non-Profit Corporation, IRC 501(c)(3) designated

MODEL WIRING – PART II

TURNOUTS

May 24, 2025

TURNOUTS

Today’s Clinic is Confined to Two Rail DC & DCC

TURNOUT?

A railroad switch or turnout is a mechanical installation enabling trains to be guided from one track to another.

Why use Turnouts

Route Diversion: The primary purpose is to allow trains to switch between different tracks.

This is essential for creating interesting operational possibilities like:

Sidings: Tracks that run alongside a main line, used for storing cars, parking trains, or allowing other trains to pass.

Yards: Complex areas with multiple tracks for fiddling trains.

Why use Turnouts cont.

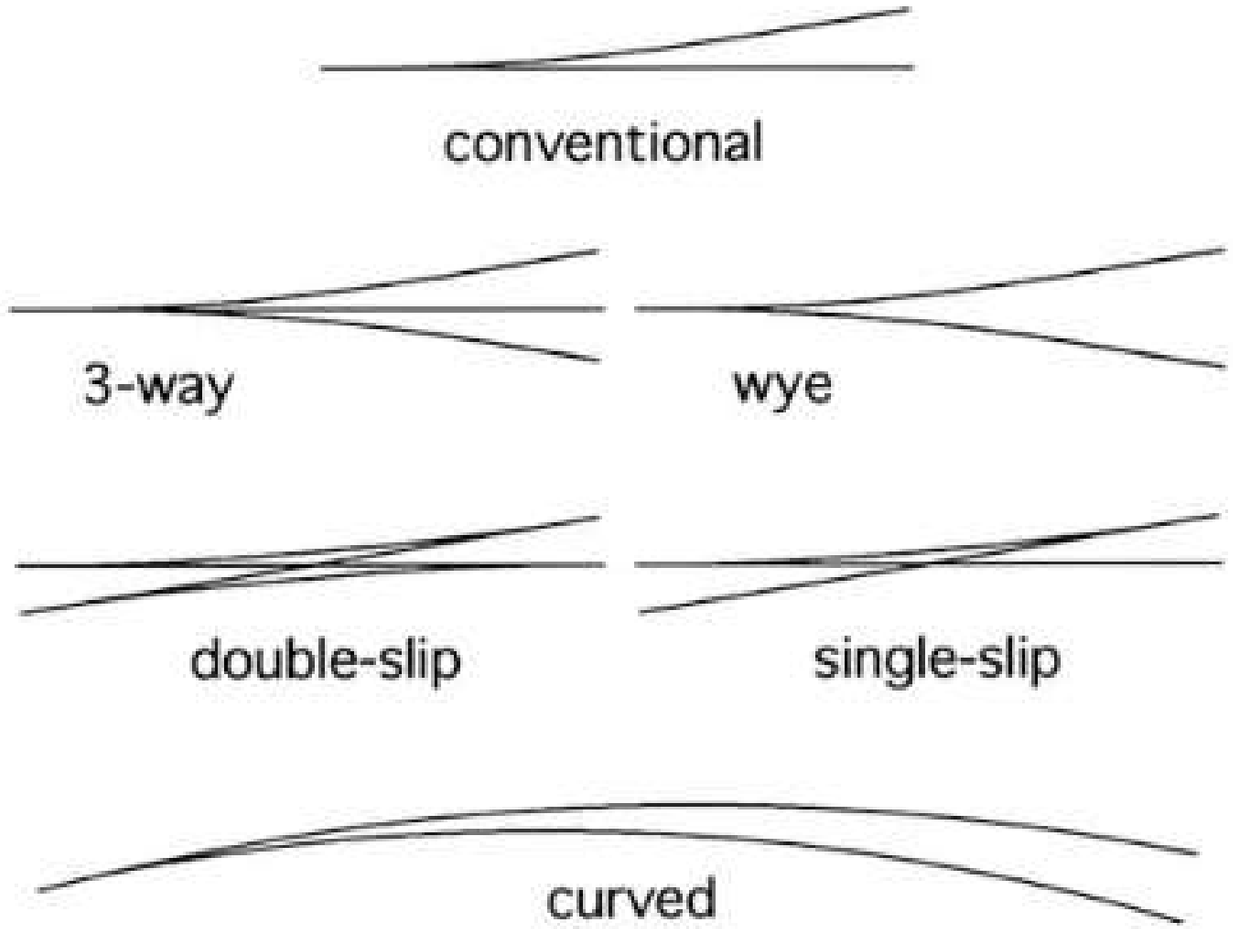
Branch Lines: Secondary lines that diverge from the main line to serve different industries or towns.

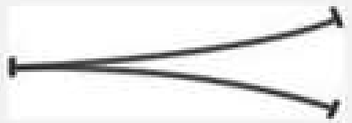
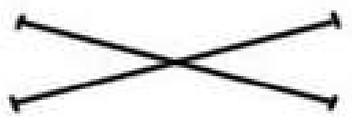
Passing Loops: Sections of double track on a single-track line that allow trains traveling in either direction to pass each other.

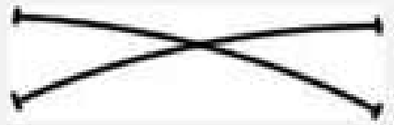
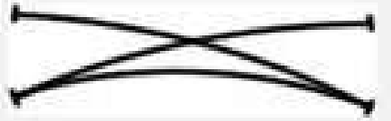
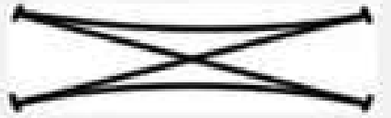
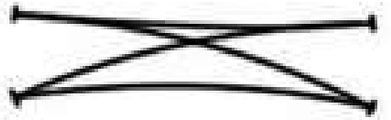
Reversing Loops and Wyes: Allow entire trains to change direction.

Interchanges between different railroads

Types of Turnouts



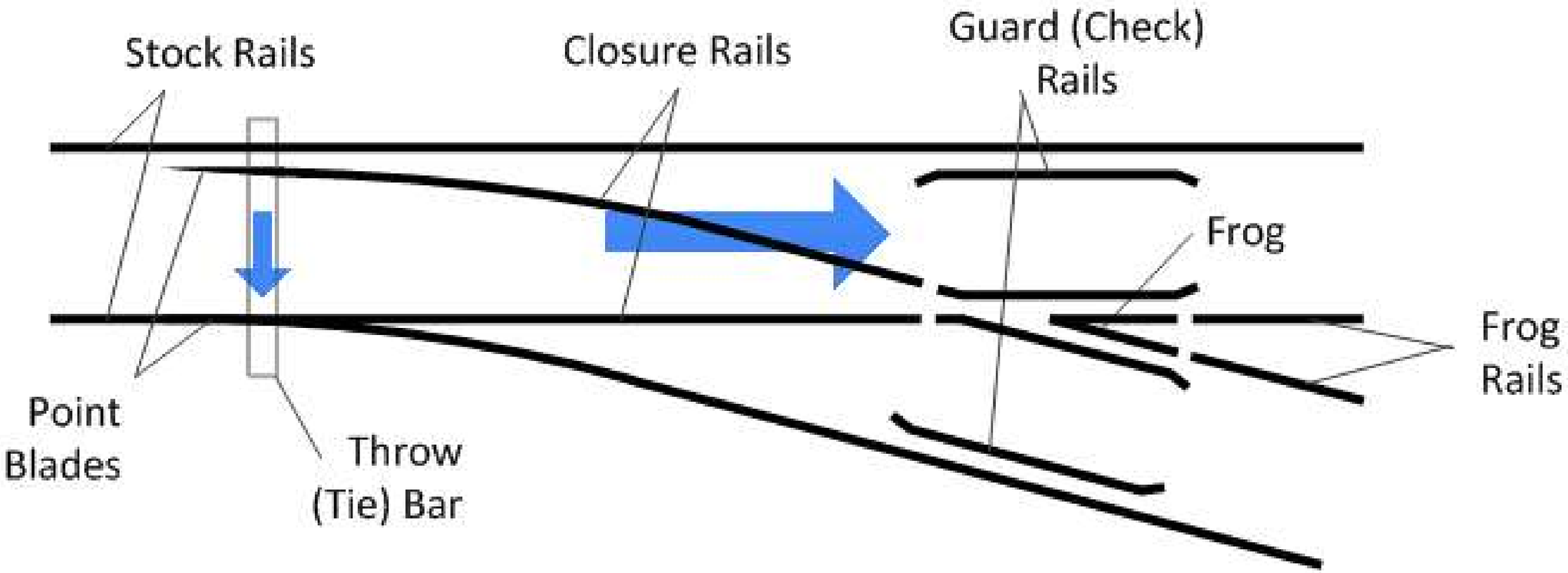
Single Switch (right)	
Single Switch (left)	
Inner curve Switch	
Outer Curve Switch	
One-Sided Double Switch	
Two-Sided Double Switch	
Crossing	

Curve Crossing	
Single Crossing Switch	
Single Inner-Curve Crossing Switch	
Single Outer-Curve Crossing Switch	
Double Crossing Switch	
Double Curve Crossing Switch	

TURNOUT PARTS

Understanding the parts of a turnout will help you install, operate, and troubleshoot them:

By definition ALL turnouts have movable parts to direct change of track path called **points**



Parts of a Model Railroad Turnout

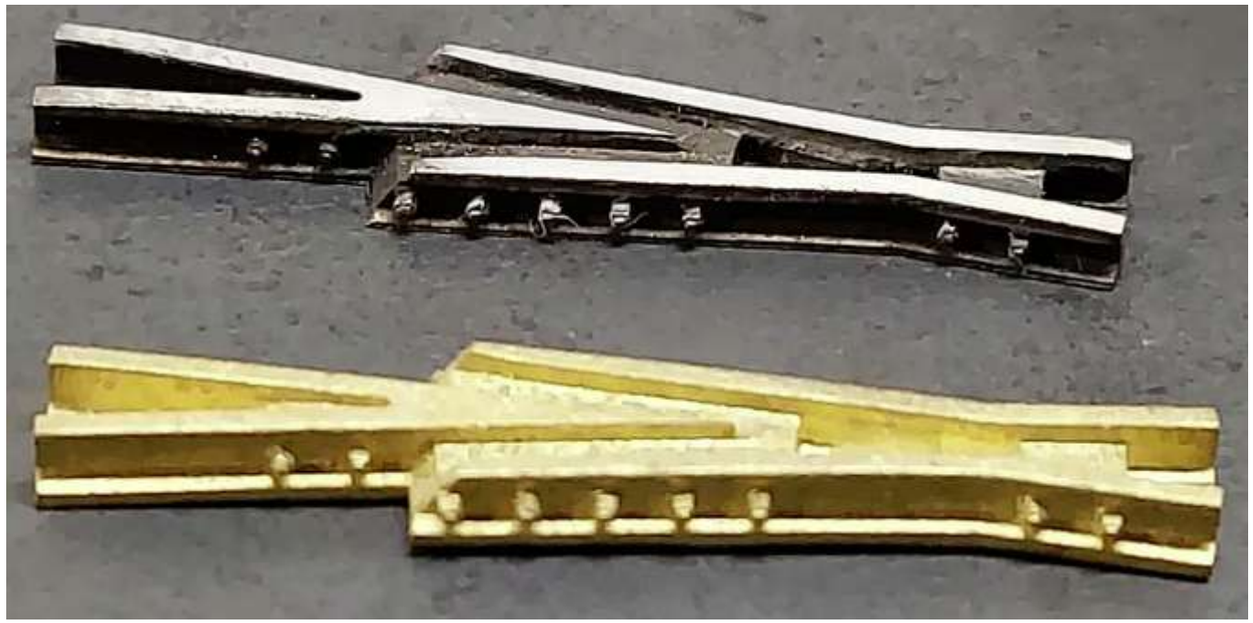
TURNOUT PARTS

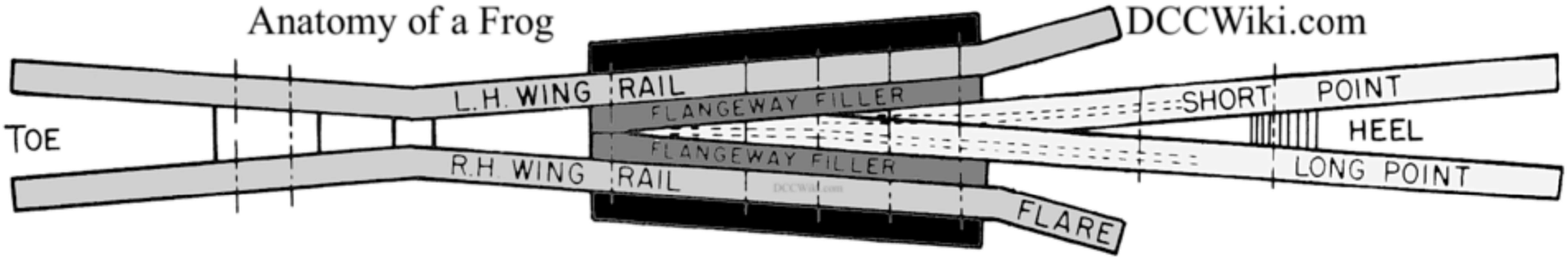
By definition ALL turnouts have movable parts to direct change of track path called POINTS

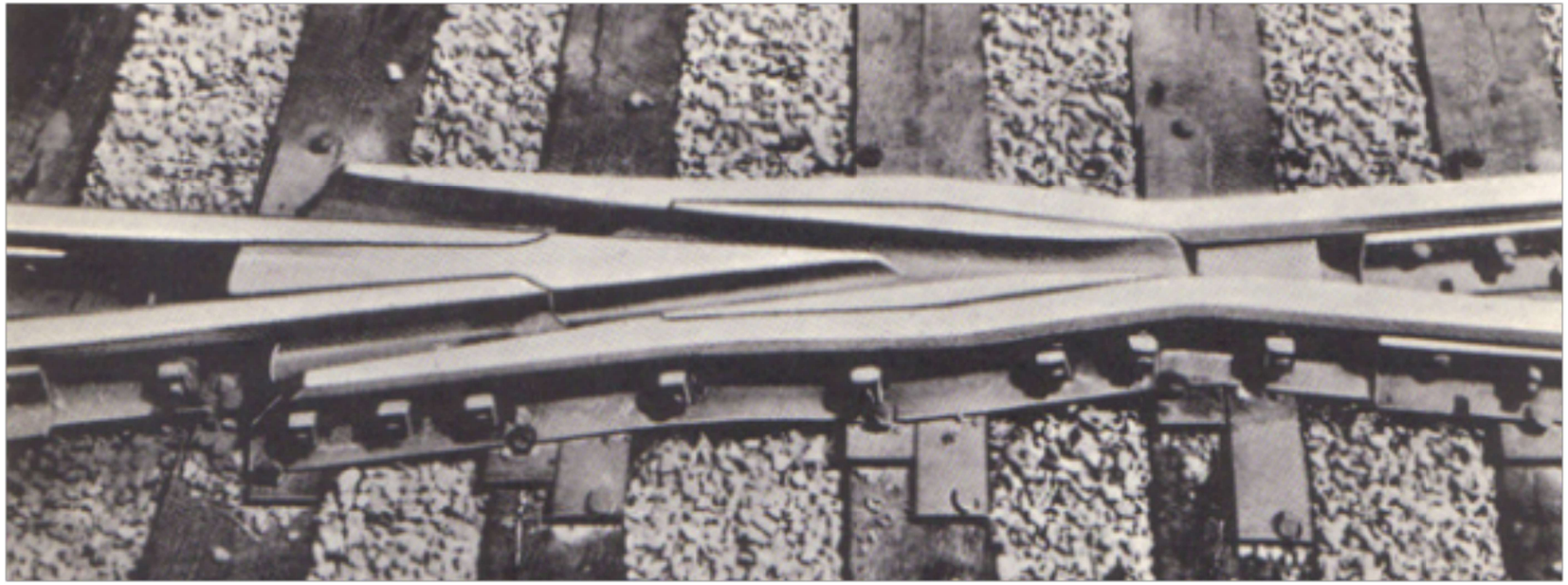
And a structure called a FROG to provide clearance for the wheel flanges to clear the crossing track **and** a bearing surface for the the wheel. (also used in crossings)

FROG

This is the X-shaped (or V-shaped) component where the rails of the diverging tracks cross. Unlike prototypical railroads. It's a critical and often problematic area for electrical conductivity if not handled correctly.



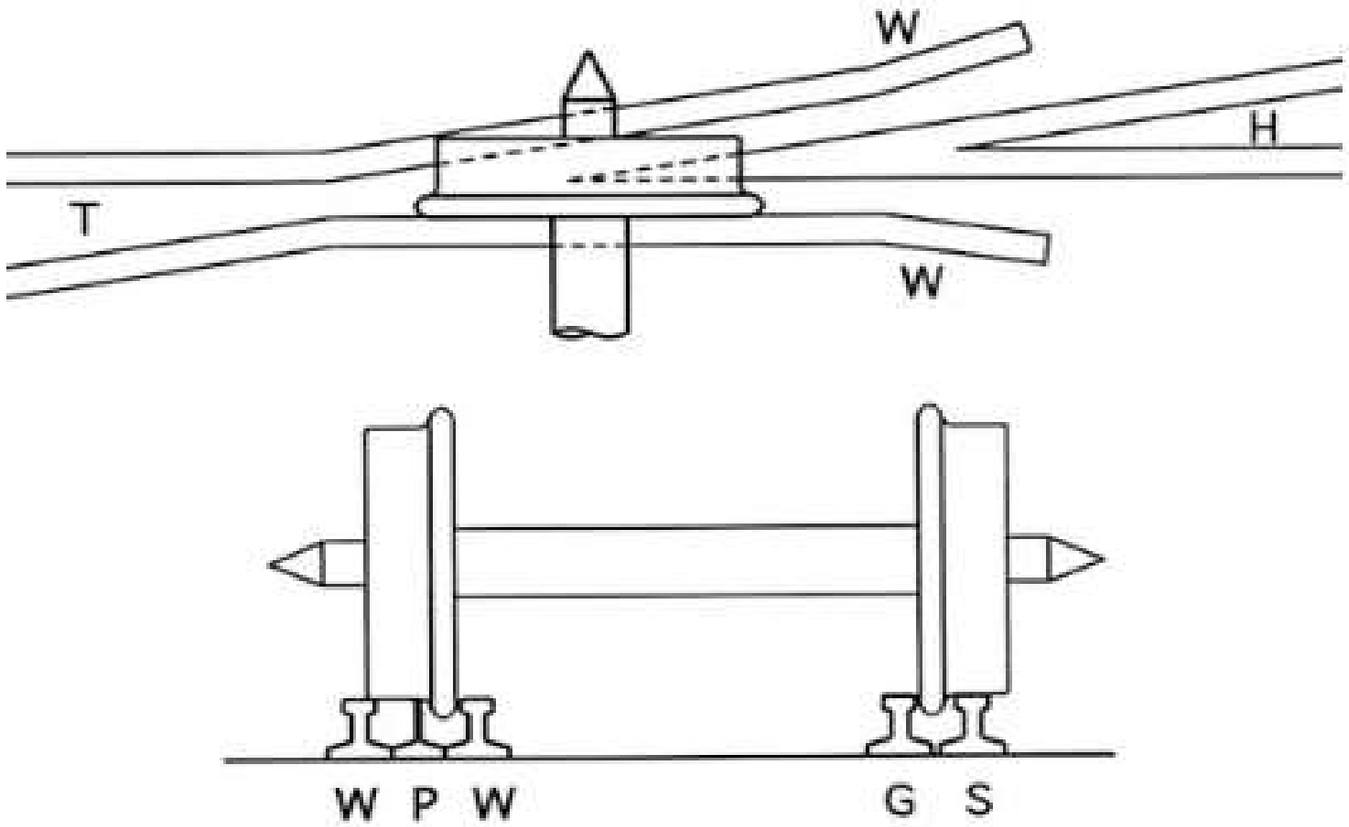

Anatomy of a Frog
DCCWiki.com
L.H. WING RAIL
FLANGEWAY FILLER
SHORT POINT
TOE
HEEL
FLANGEWAY FILLER
R.H WING RAIL
LONG POINT
FLARE



FROGS:

The simple turnout frog is a device to enable the wheels running on one track to cross the rail of a diverging track. It provides continuous channels for the wheel flanges, and supports the wheels over the intersection of the flangeways.

WHEEL TRACKING THROUGH A #6 FROG



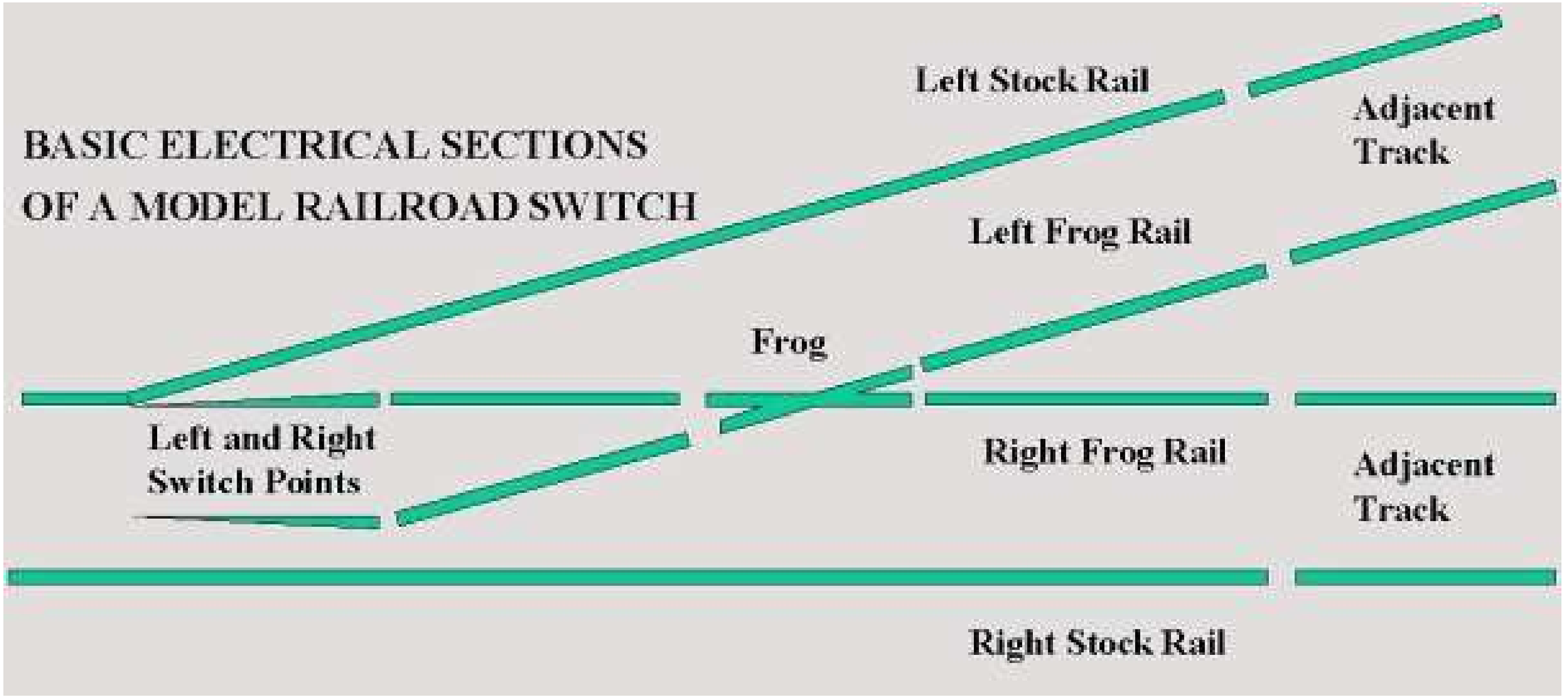
P = point of frog W = wing rail S = stock raill
G = guard rail T = toe H = heel

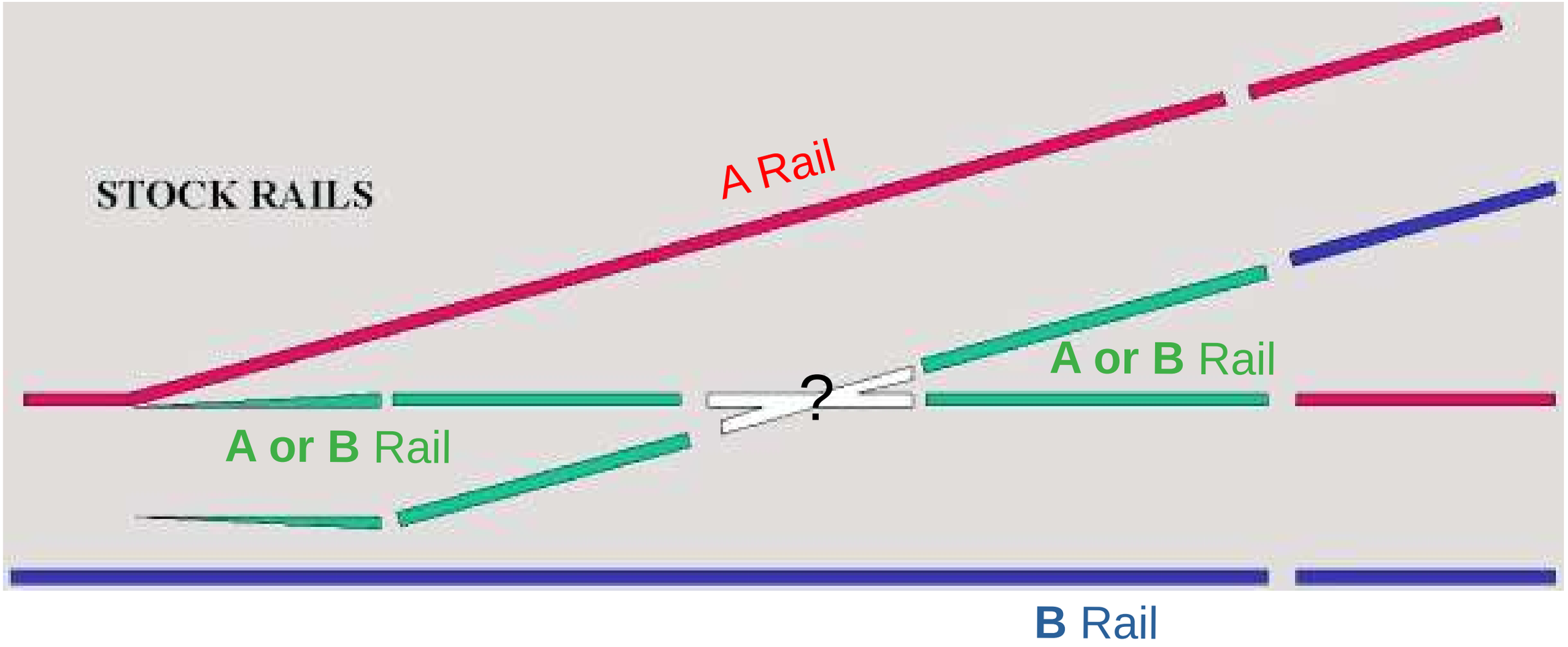
There are different types of model railroad frogs:

Insulated Frog

(aka Dead Frog): The frog is made of plastic or is otherwise electrically isolated. Locomotives can sometimes stall on these if they lose electrical pickup.

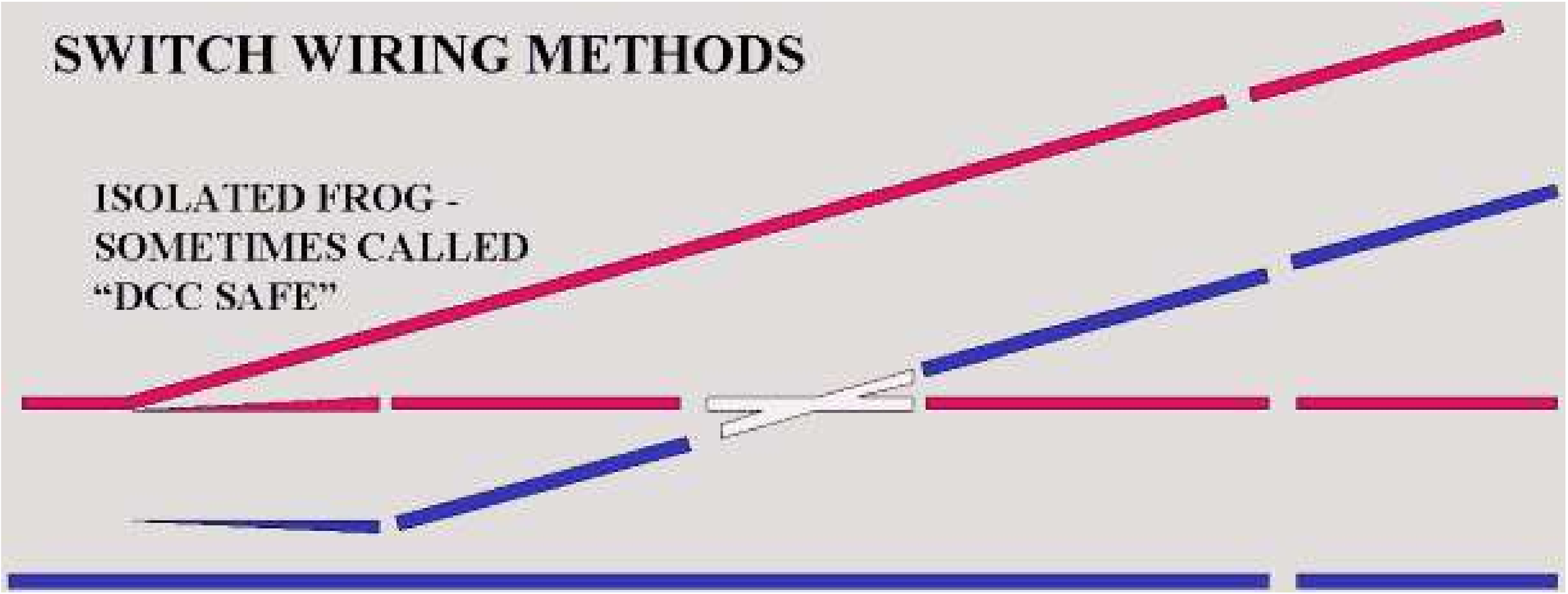
They are much simpler to wire initially.


BASIC ELECTRICAL SECTIONS
OF A MODEL RAILROAD SWITCH
Left Stock Rail
Adjacent
Track
Left Frog Rail
Frog
Left and Right
Switch Points
Right Frog Rail
Adjacent
Track
Right Stock Rail

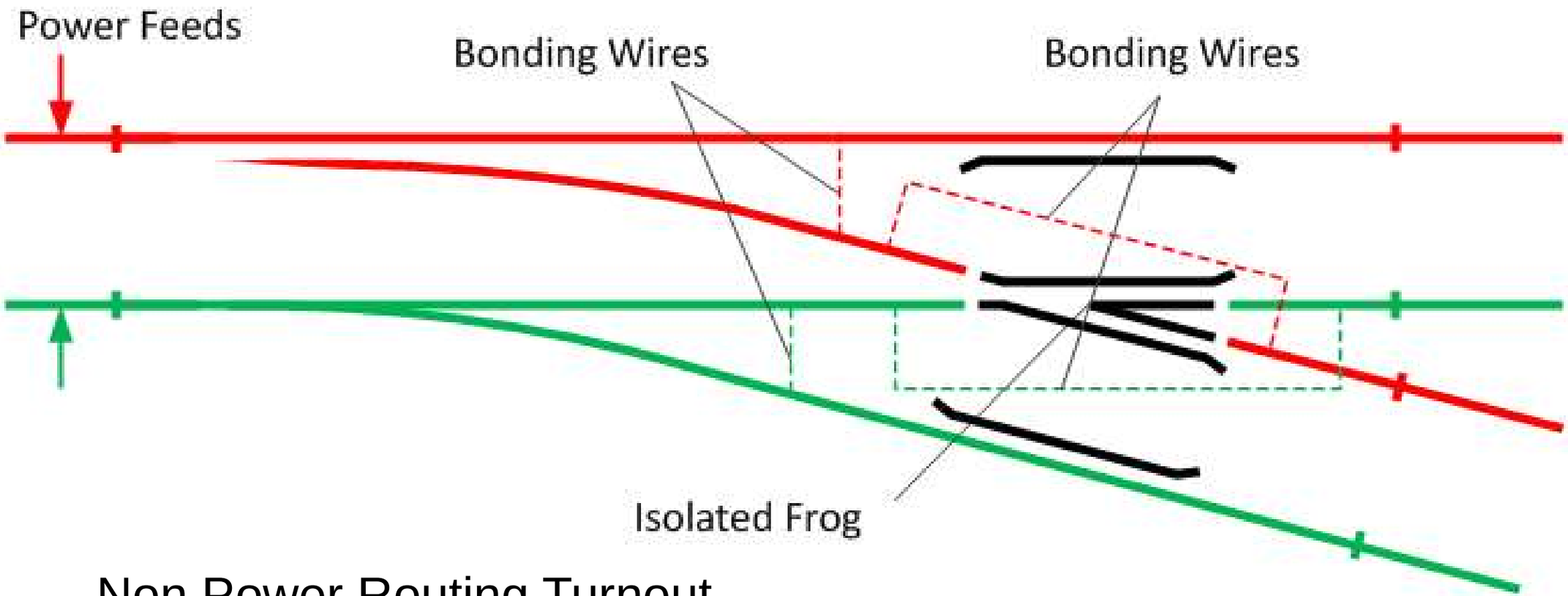


To Power the Frog ? Yes/No

SWITCH WIRING METHODS



Best if the Frog is non-metalic



Non Power Routing Turnout

aka DCC Safe or Friendly

Summary—A "DCC Friendly" Insulated Frog

Designed to minimize the chance of short circuits as metal wheels pass through.

Isolated Frog: The frog is often made of insulating plastic, or if metal, it's isolated from the point rails.

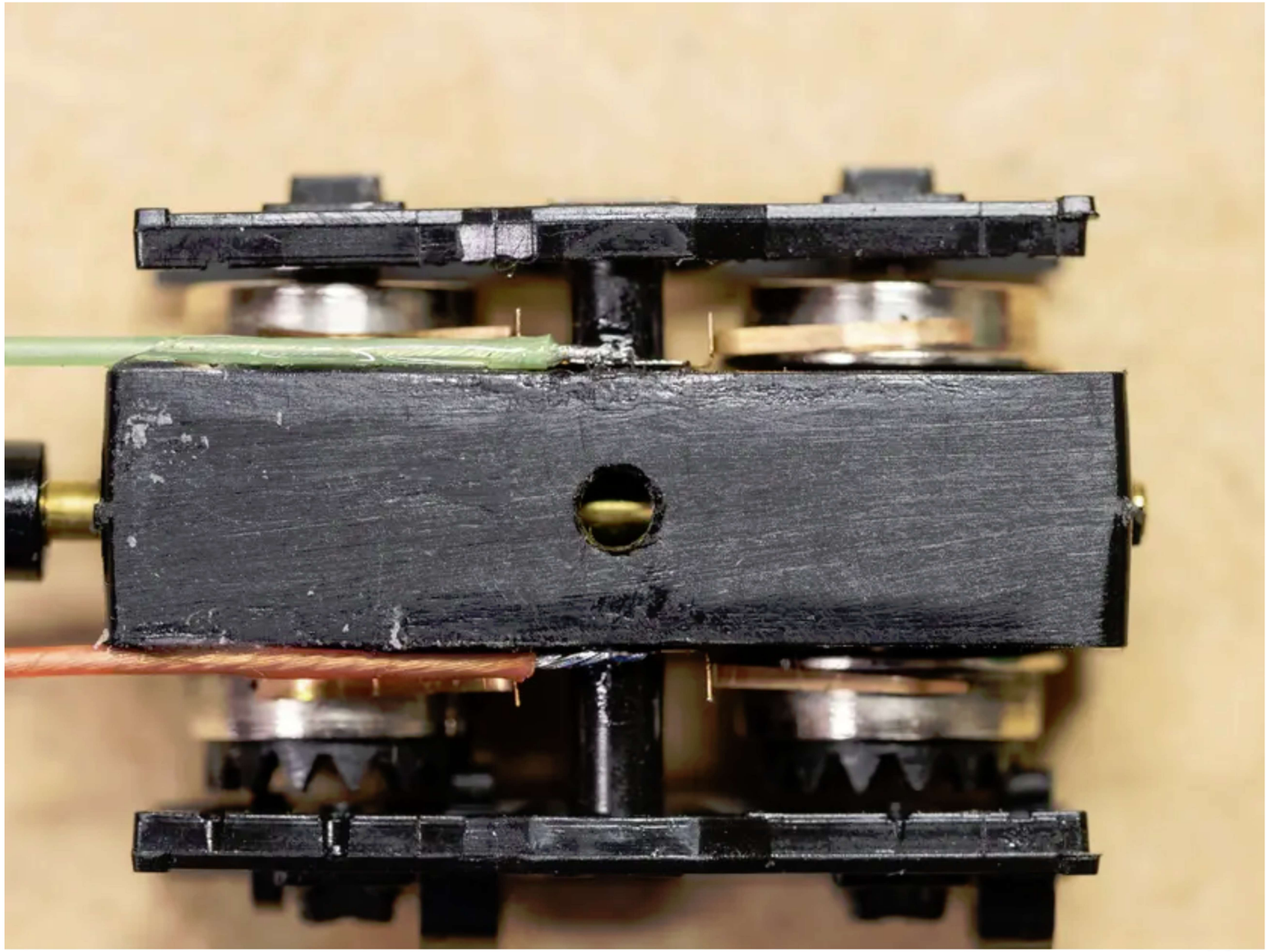
Point Rails Power: Point rails are typically powered by contact with the stock rails or via small jumper wires.

Gaps: Pre-gapped or designed so wheel back-to-back spacing doesn't easily bridge opposite polarity rails near the frog.

Often, no special wiring is needed beyond just connecting the track feeders.

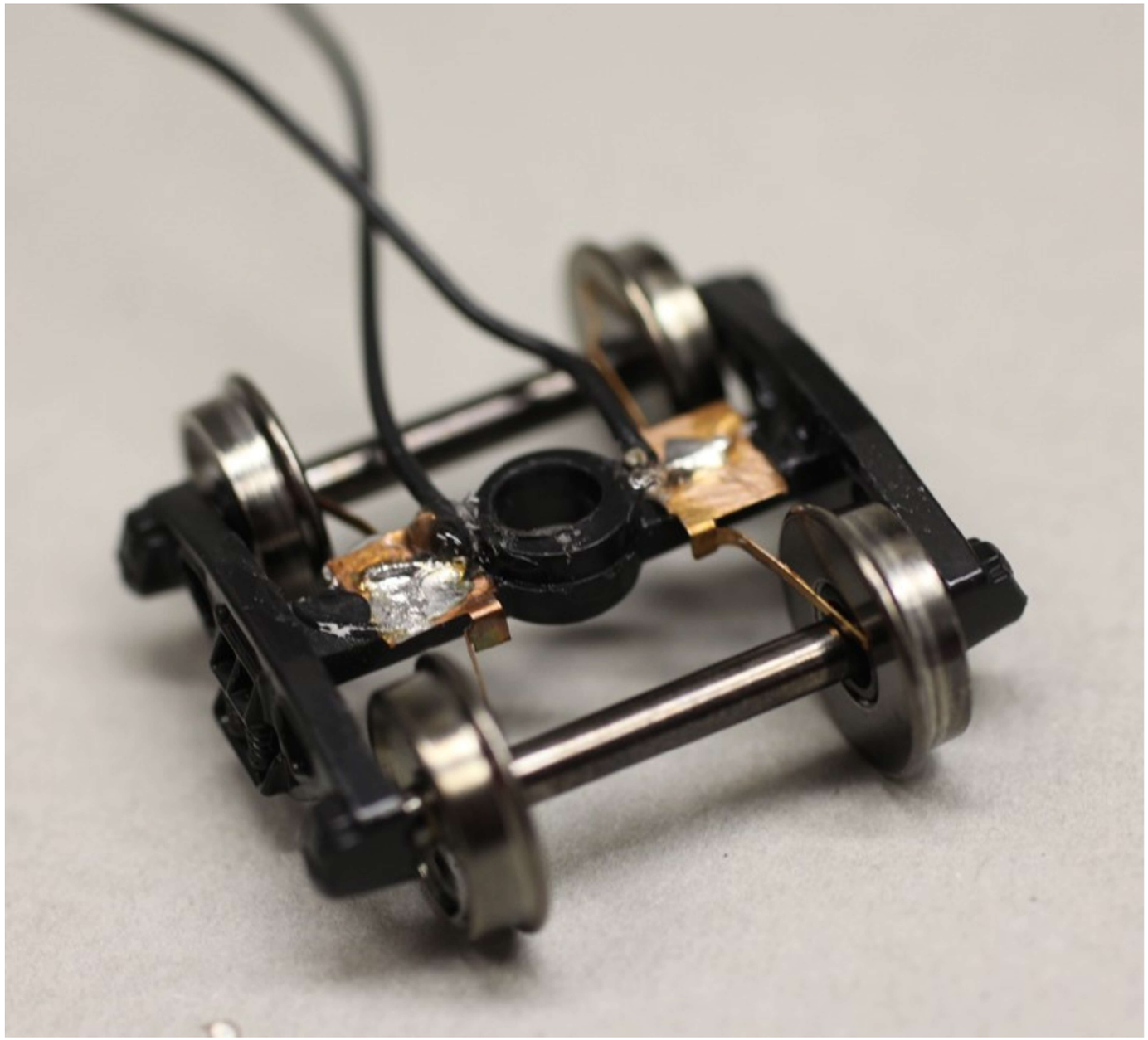
Insulated Frog and loco power pickup as possible issue

Verify all pickups on each side are connected.



Power Pickup from wheels

Dirty or broken can stall when other truck is on frog



Another Frog type is Live Frog

(or Power-Routing Frog): The frog is electrically powered and changes polarity depending on which route is selected. This provides better electrical conductivity, especially for locomotives with short wheelbases or few power pickups. It requires additional wiring and often a switch machine with electrical contacts. These can be more prone to shorting.

Live Frog has two sub categories

The main difference between a "live frog" and a "powered route frog" turnout is in how the frog (the metal piece that connects the rails at the switch) is electrically handled.

A live frog is a metal frog that is electrically connected to the track power internally from the manufacturer.

A powered route frog, on the other hand, has a mechanism that changes the frog's polarity depending on which route is selected, ensuring power continuity. Usually external to the turnout.

.

DC Wiring

Live Frogs: For DC, you can use a live frog, where the frog is electrically connected to the track.

Power Routing: Power is routed to the frog using a switch or contact that changes when the turnout is thrown.

Insulated Frogs: If using an insulated frog, **no** power feed is required to the frog.

DCC Wiring:

Live Frogs: With DCC, live frogs can be used, but they require insulated rail joiners or gaps to prevent shorts.

DCC-Friendly Turnouts: DCC-friendly turnouts are designed to minimize the risk of shorts by isolating certain parts of the turnout and switching the frog's polarity based on the route.

Frog Juicers: Some DCC systems use frog juicers, which are electronic circuits that automatically switch the polarity of the frog to prevent shorts, according to Tam Valley. Caution-not for DC

Insulated Frogs (DCC): Insulated frogs DO NOT require a separate power source and may be used in DCC & DC layouts.

Key Considerations:

In DCC, it's crucial to prevent shorts by isolating the point rails and ensuring the frog's polarity matches the route being taken.

Long Wheelbase Locomotives: For locomotives with long wheelbases, powering the frog is often recommended to ensure consistent electrical contact.

Turnout Type: Different turnout designs (e.g., Insulfrog, Electrofrog) have different wiring requirements.

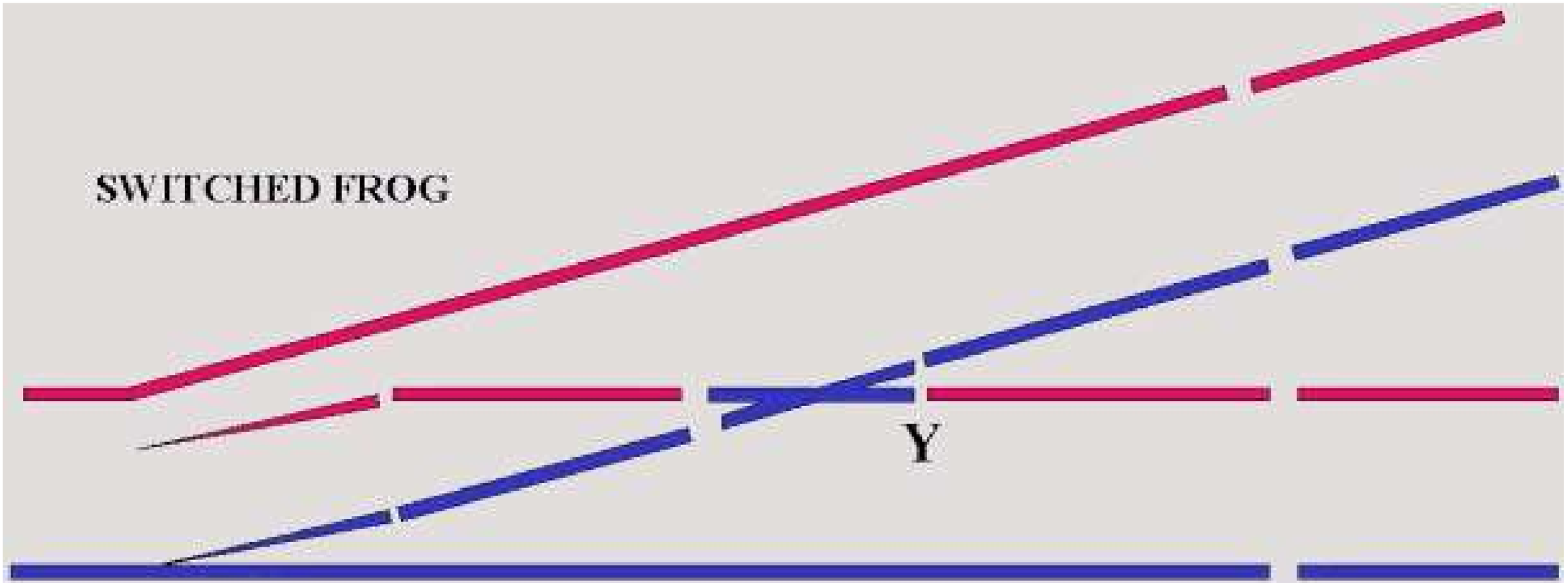
DCC-Friendly Features: Look for DCC-friendly turnouts that are designed to minimize the risk of shorts and are easy to wire for DCC

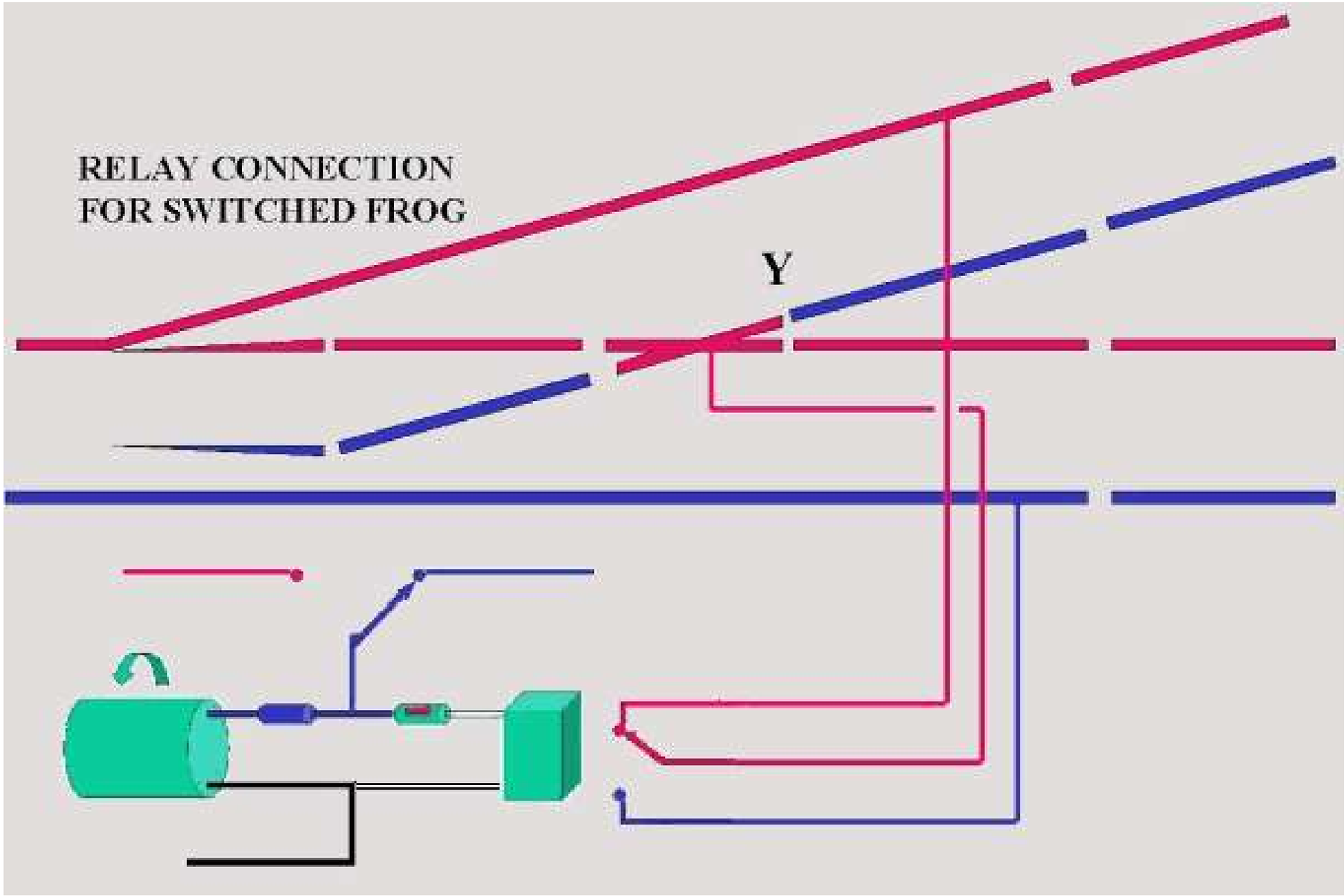
Commercial produced turnouts are available in many different shapes, sizes, sleeper types, rail profiles, and degrees of realism. To complicate the choice there are various different electrical behaviors and some are labeled "DCC-Ready" or "DCC-Friendly" and others are not. Powered and non-powered frogs.

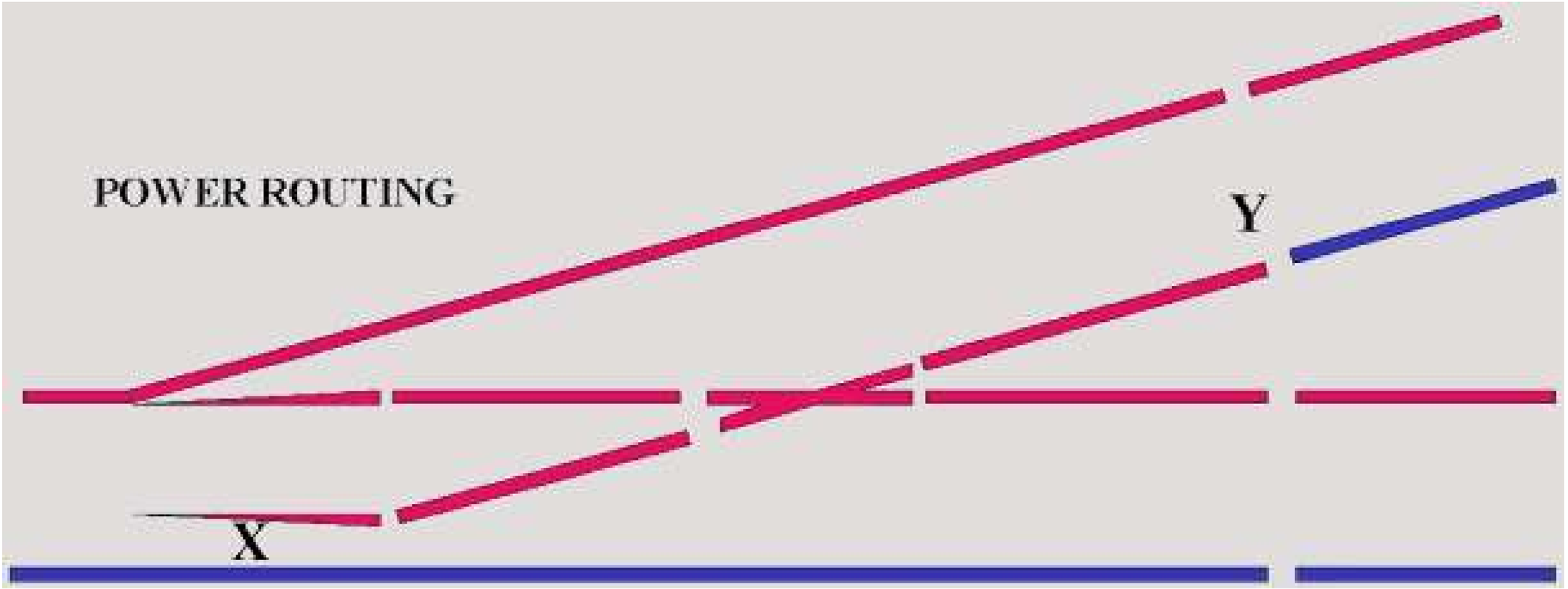
So, which type should you choose?

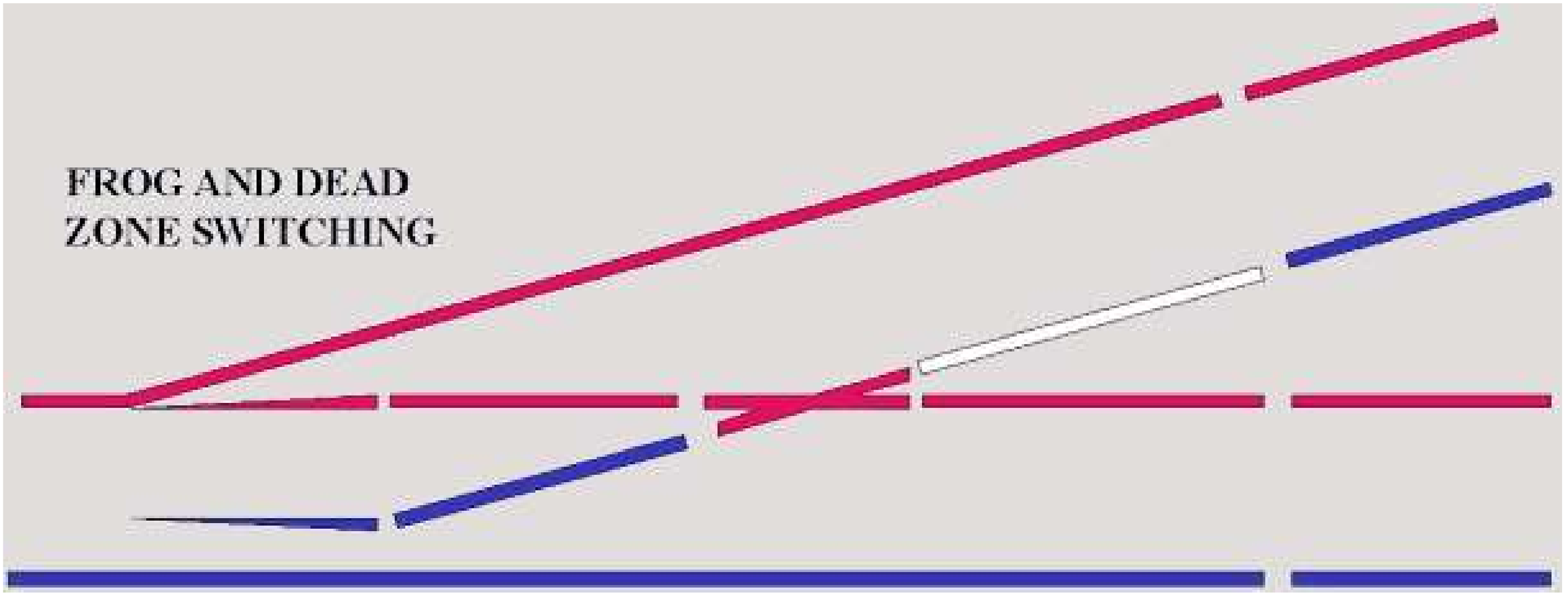
You do not have to buy turnouts labeled "DCC-ready" and you MAY have to modify existing turnouts when converting a layout to Digital Command Control. You should choose the turnouts that best suit your overall requirements and don't go out of your way to find "DCC-ready" or "DCC Friendly Turnouts".

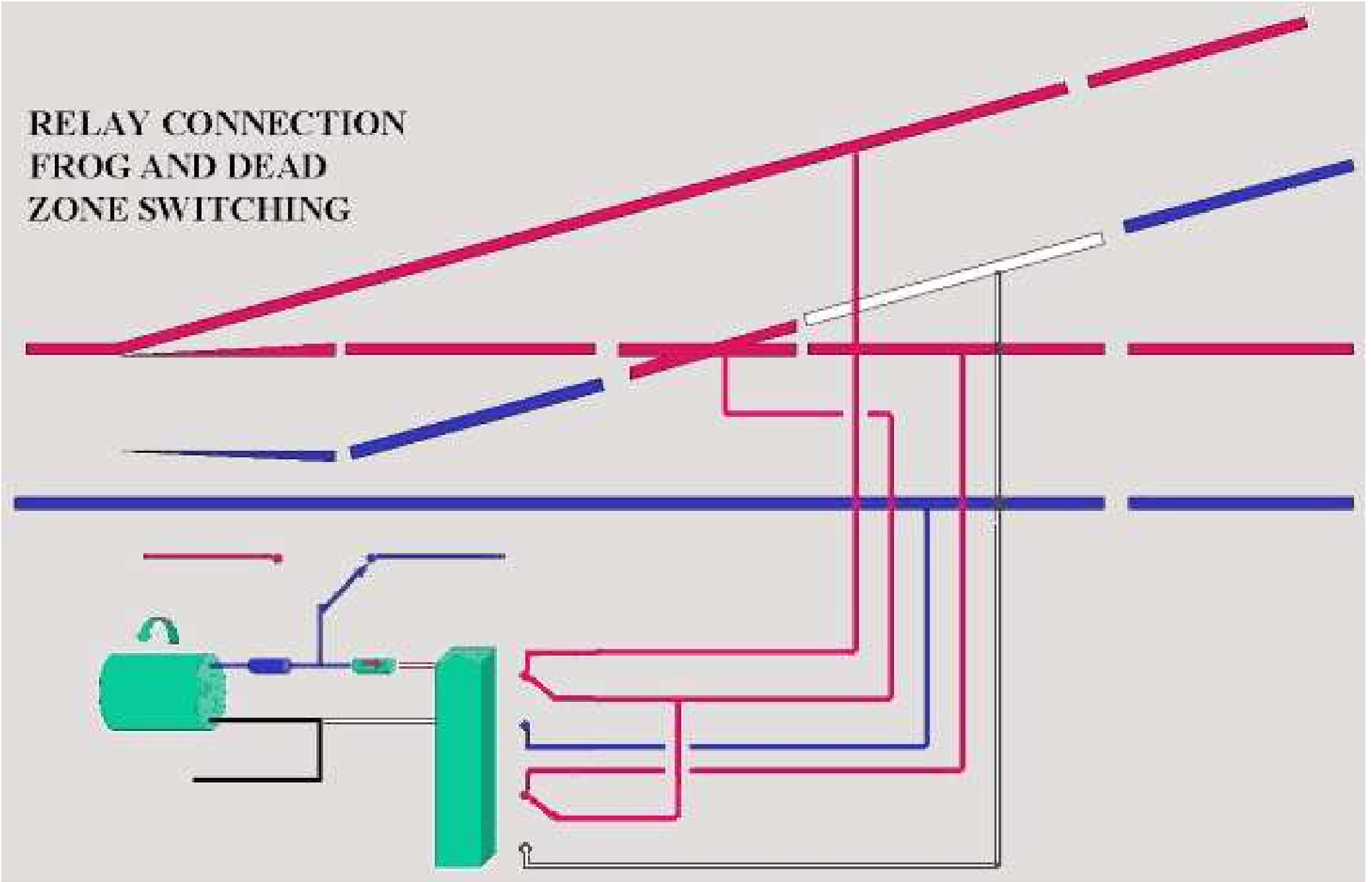
However, there are several special considerations to bear in mind and if you're just starting out on a Digital Command Control project it will be well worth investing the time to understand the different types of turnouts, their various benefits and the best way to wire them to satisfy your needs.

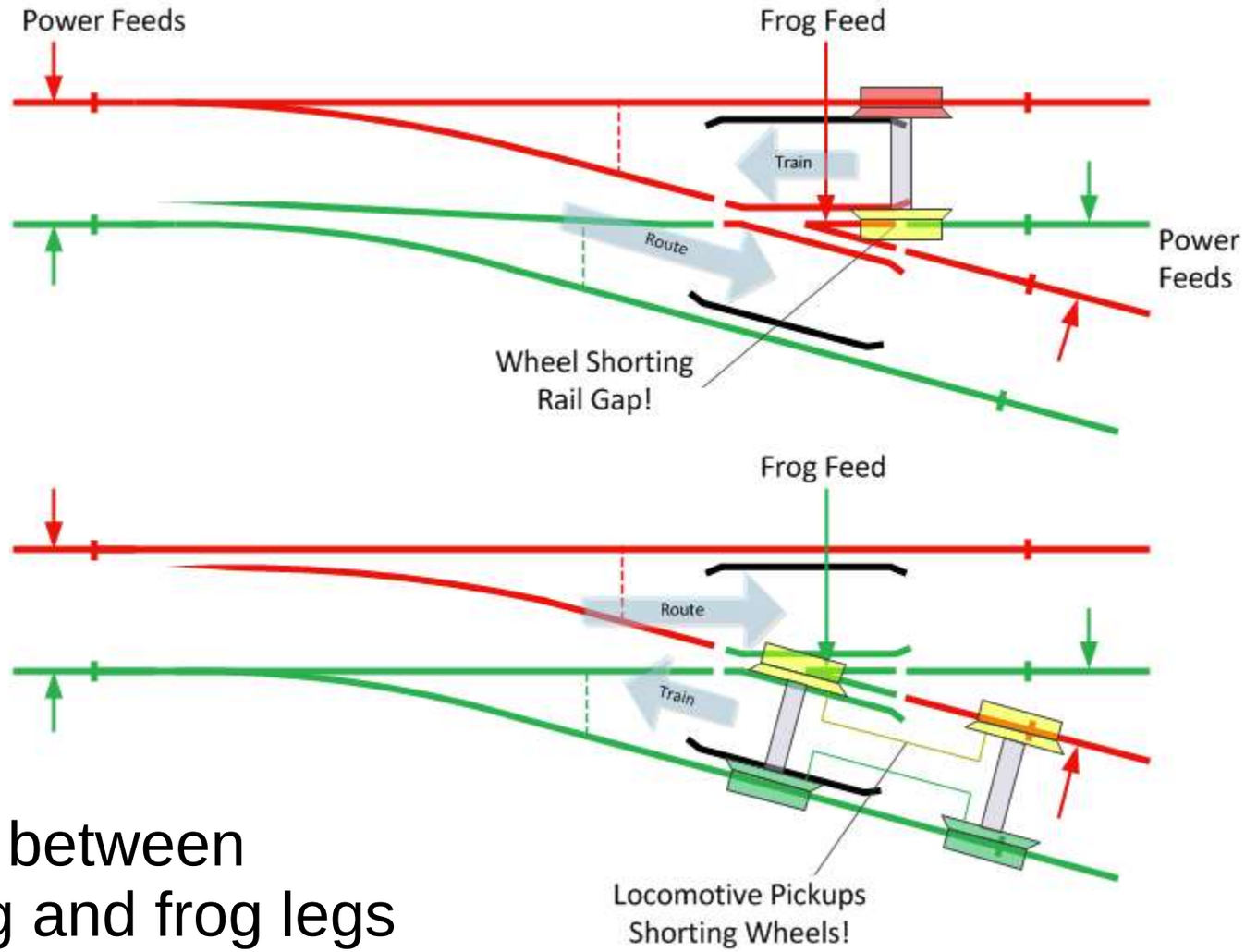

SWITCHED FROG
Y


RELAY CONNECTION
FOR SWITCHED FROG
Y

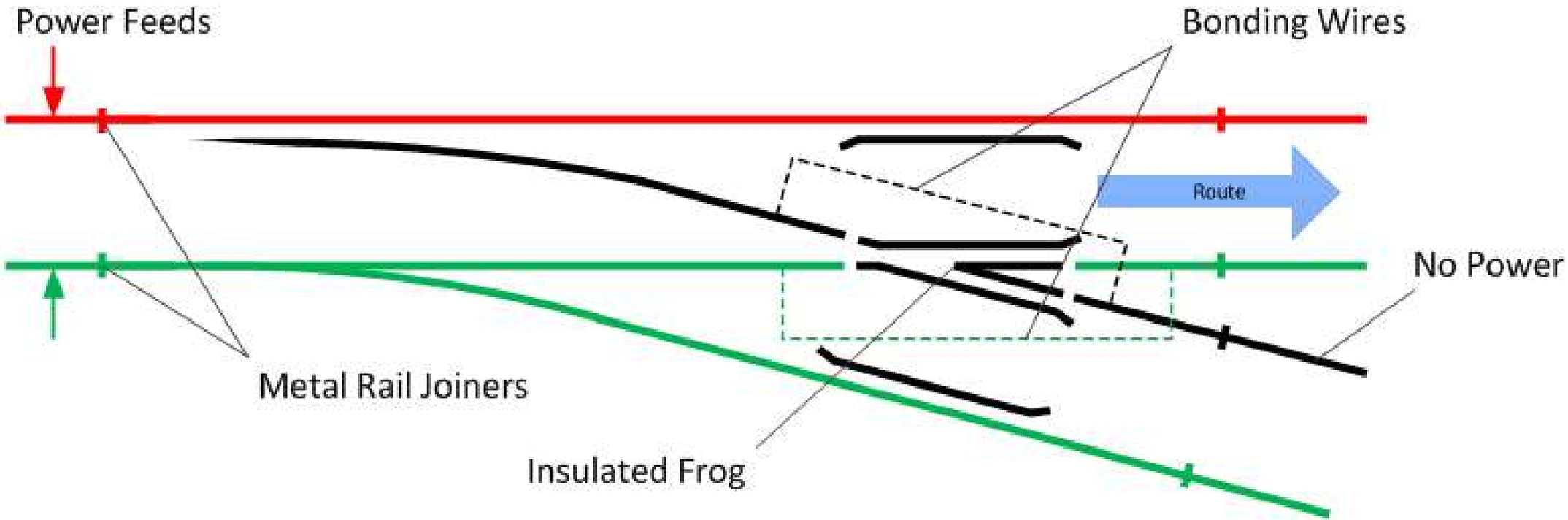

POWER ROUTING
Y
X


FROG AND DEAD
ZONE SWITCHING

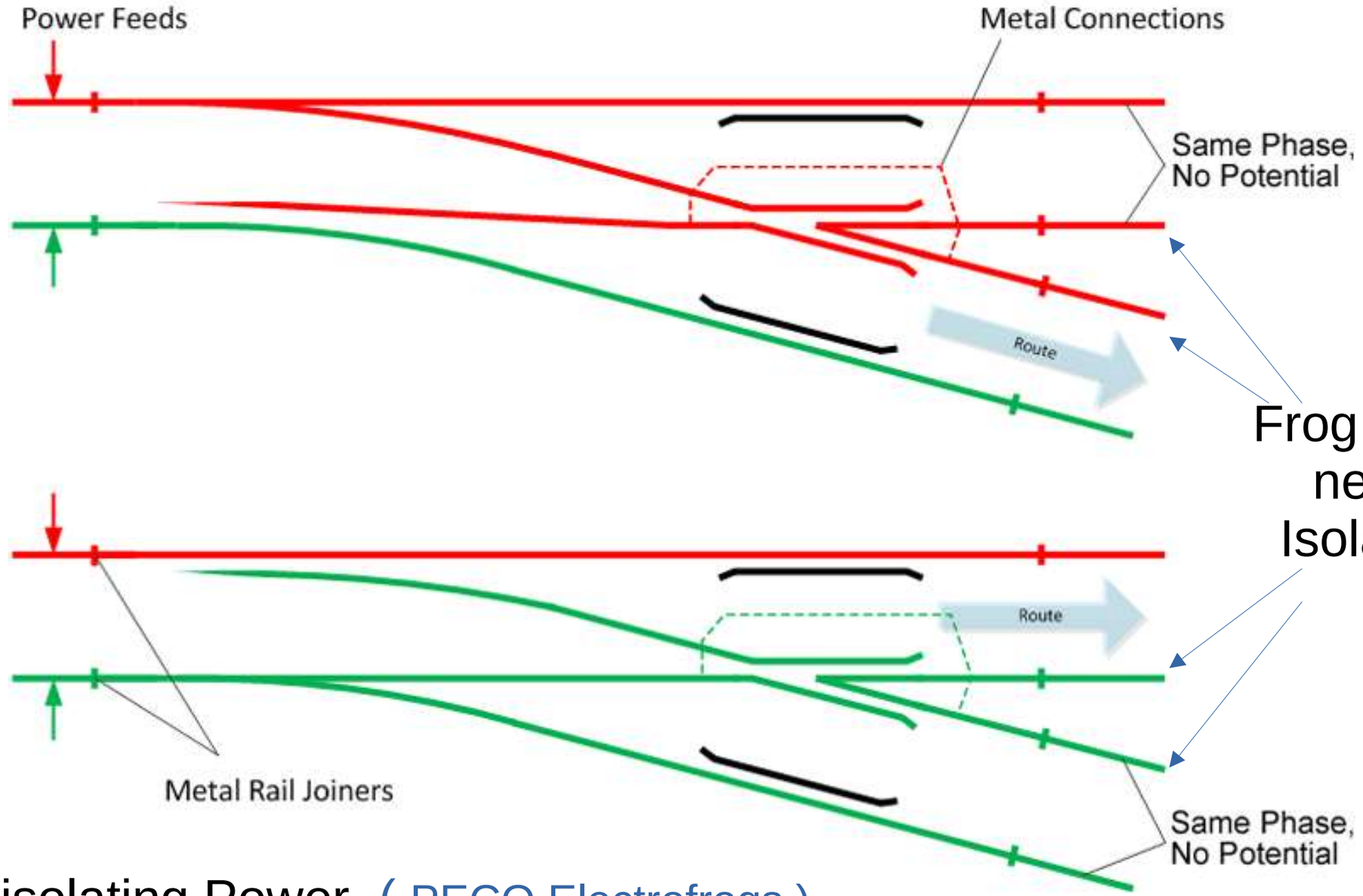

RELAY CONNECTION
FROG AND DEAD
ZONE SWITCHING



Wiring Issue between switched frog and frog legs



Self Isolating or Power Routing

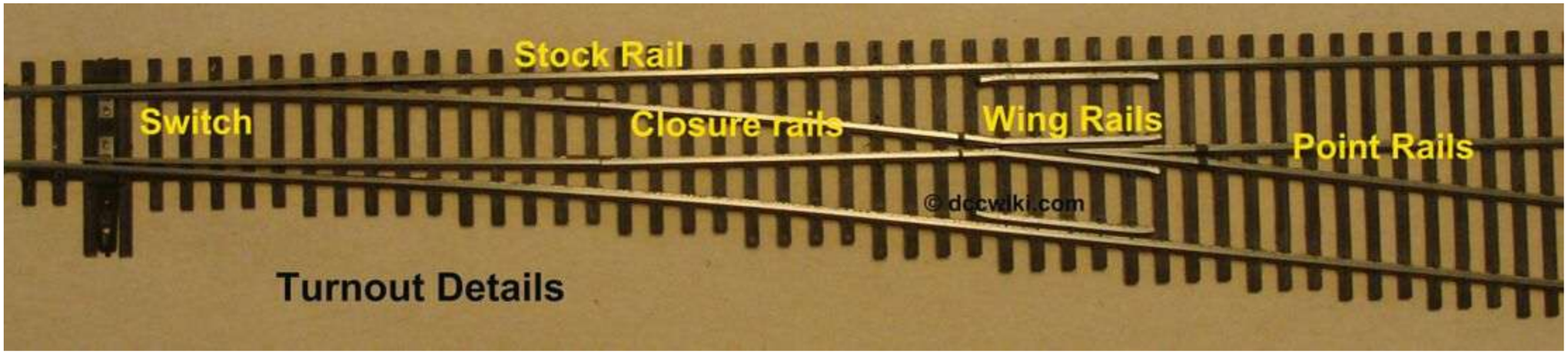


Non-isolating Power (PECO Electrofrogs)

And now another frog

The Unifrog

Peco Unifrog



Next a Wiring Concept from Kato Unitrack

Digitrax and other DCC manufacturers recommend setting Kato #4 turnouts to non-power routing for better DCC performance.

Kato Unitrack N Scale #4 Turnouts Powering Options

on bottom side

Turnout Troubleshooting DCC

Engine stalls and layout shuts down

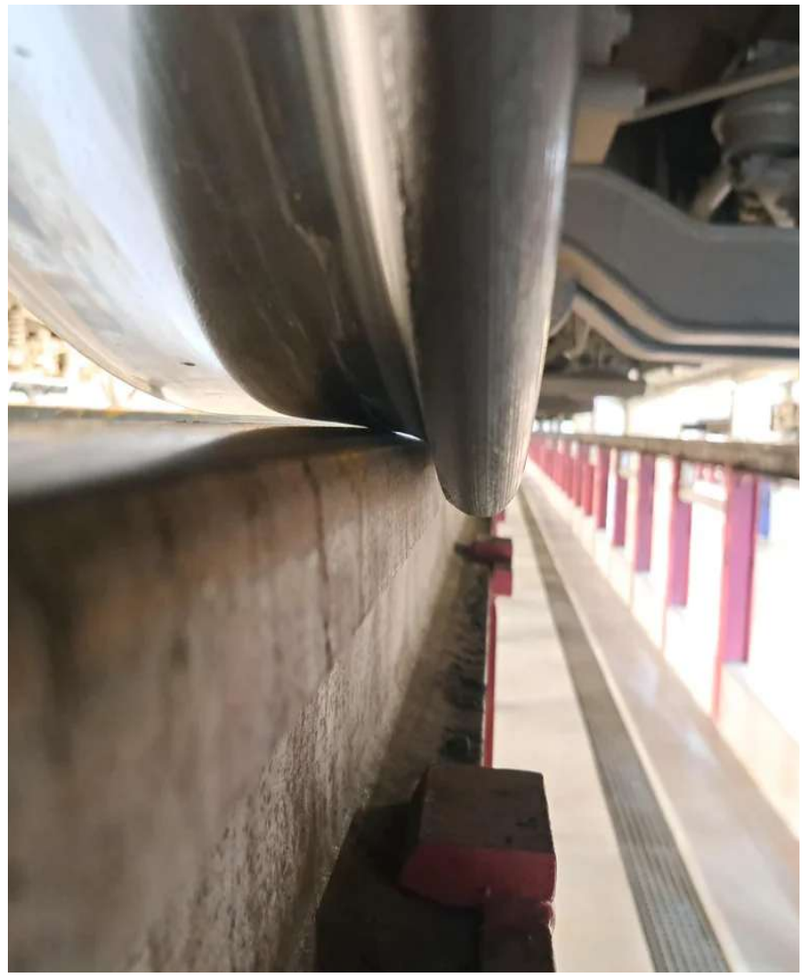
Polarity Shorting at points or heel
Track gaps not filled
Wiring Issue-test rail connections with VOM

Engine stalls and layout stays on

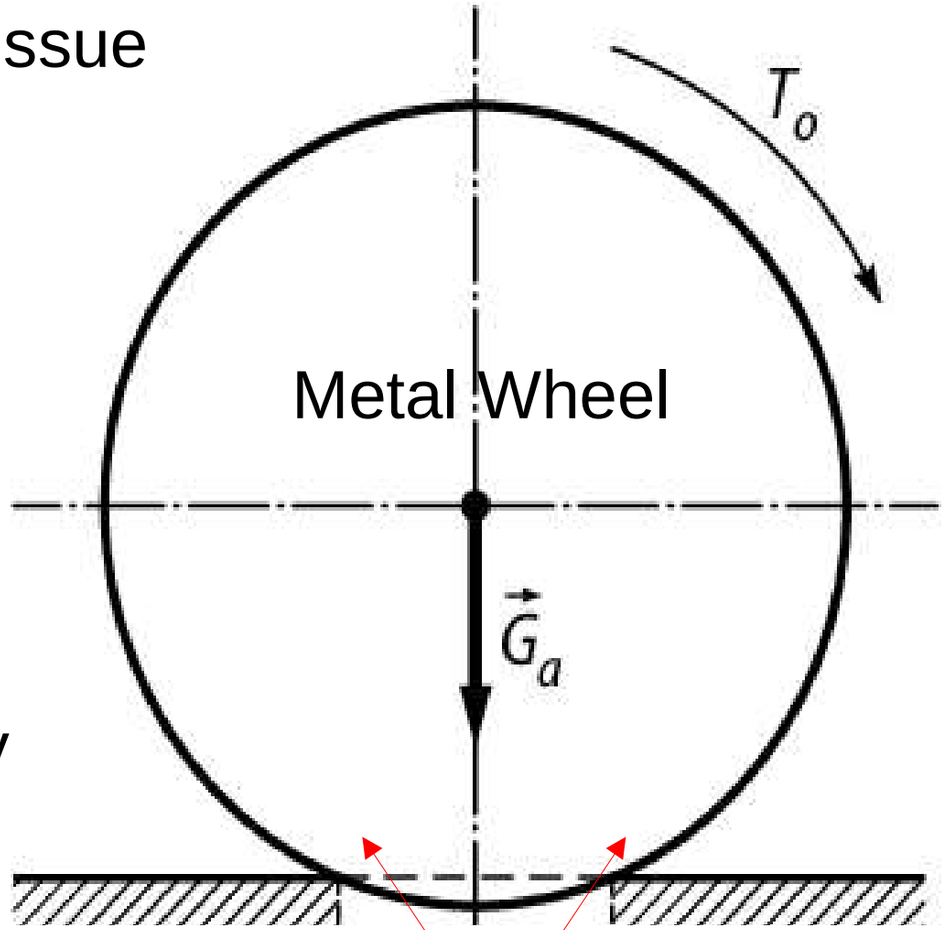
Power interruption from turnout parts or on locomotive

Prototype wheels have a contact patch to the rail the size of a **Dime**.

In N scale that the contact patch is the head of a **Pin.**



Un-Filled Gap Issue



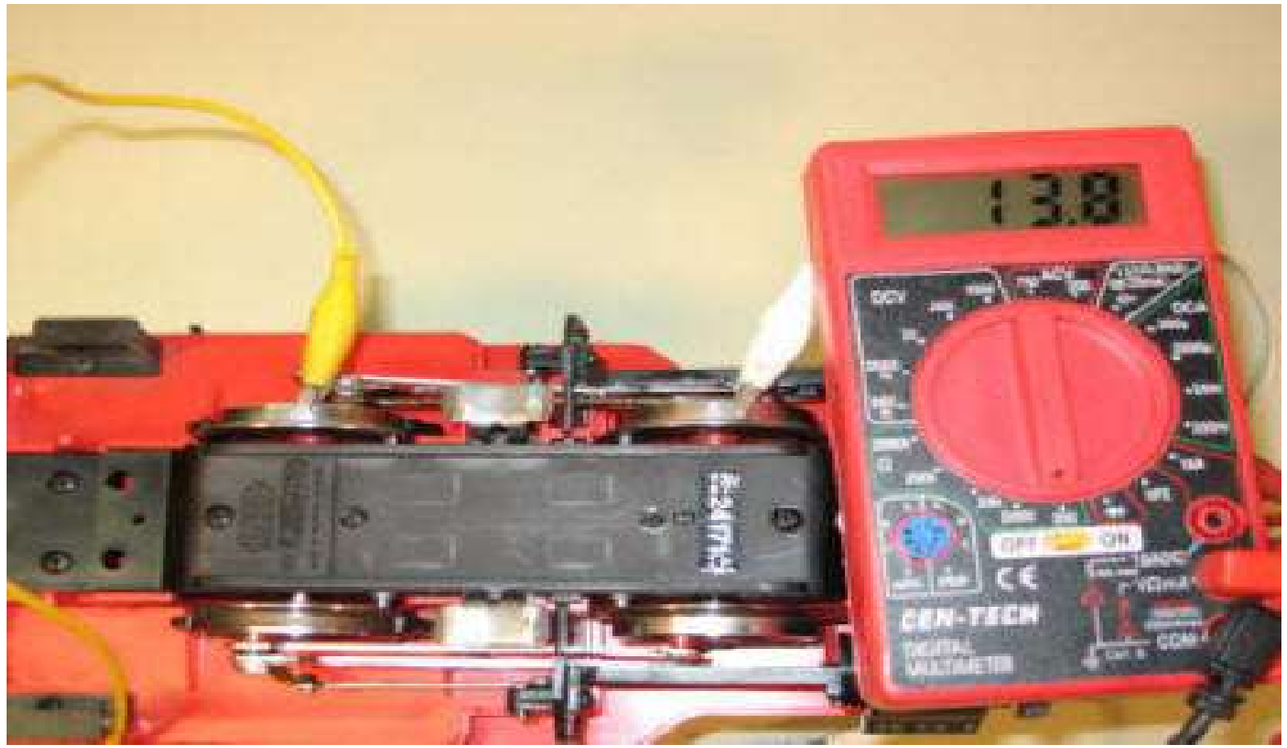
Rail A Polarity

Rail B Polarity

SHORT!

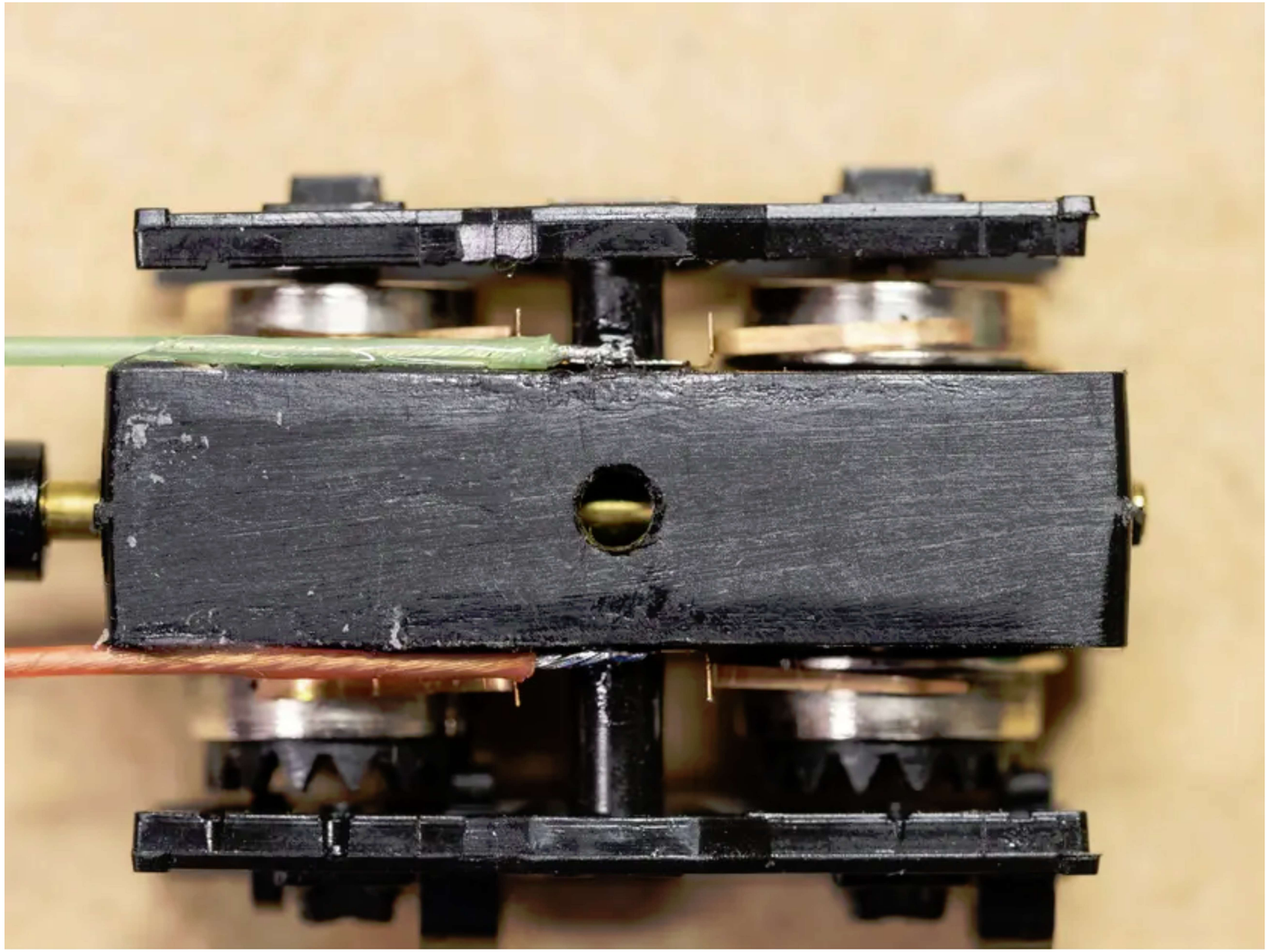
Turnout Troubleshooting DCC

All loco wheels on each side need to be connected. Use a ohm setting on VOM meter to verify.
Needs to be uniform.



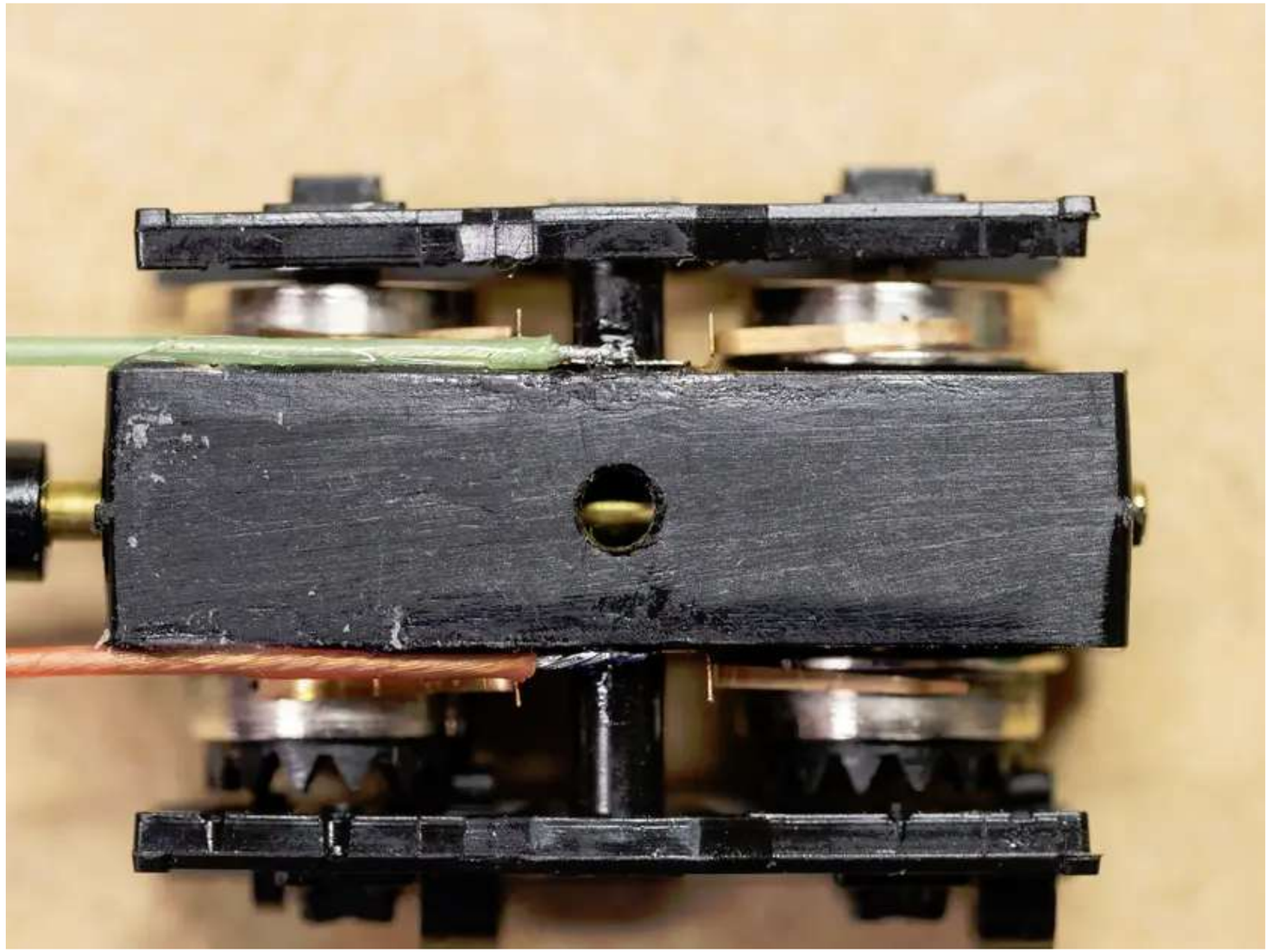
Power interruption from turnout parts or on locomotive

Verify all pickups on each side are connected.



Power Pickup from wheels

Dirty or broken can stall when other truck is on frog



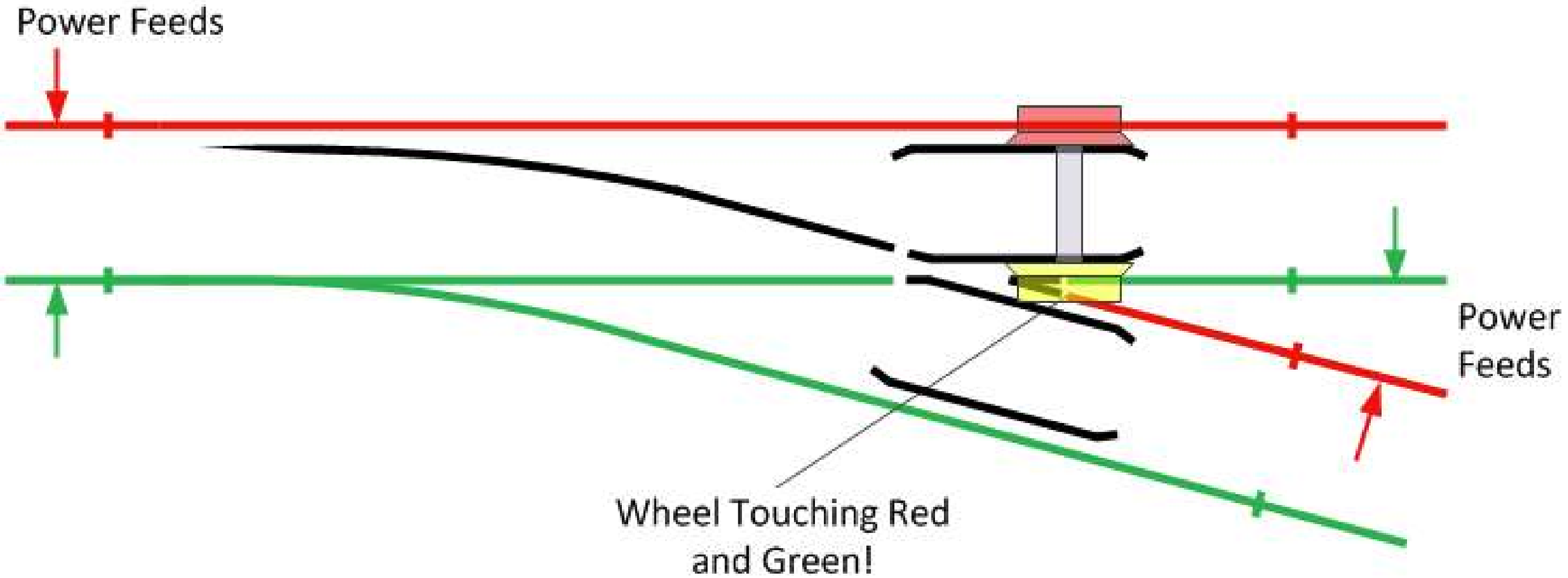
Turnout Troubleshooting DCC

» Trains run against track switch with powered frogs of wrong polarity = SHORT!

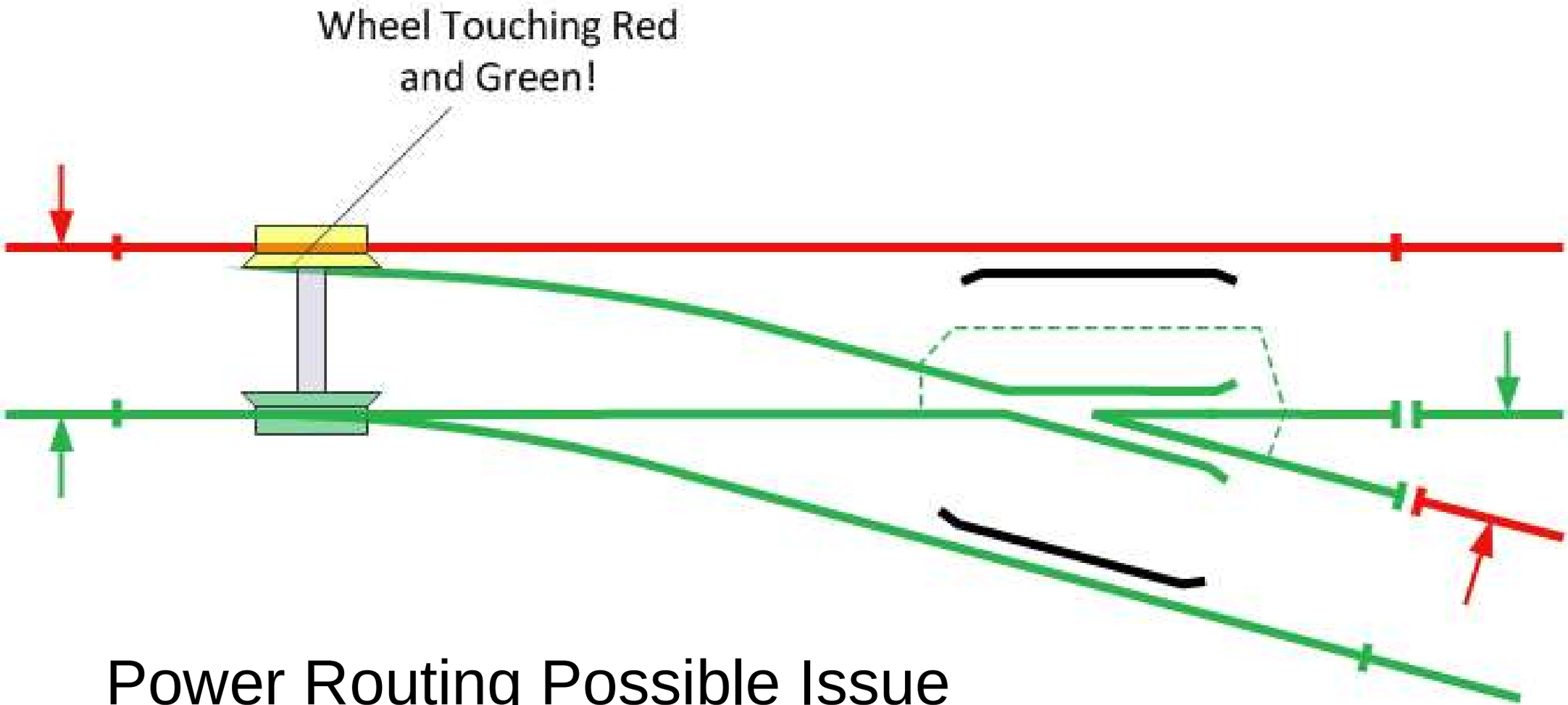
» Wheels of Long wheel base Locomotives touch back side of point rails = SHORT!

» The switch is too small for the Loco. Install larger # turnout or use smaller loco!

George T. Galyon HO Turnout Compendium



Power Routing Possible Issue



Power Routing Possible Issue

Turnout Troubleshooting Derailments

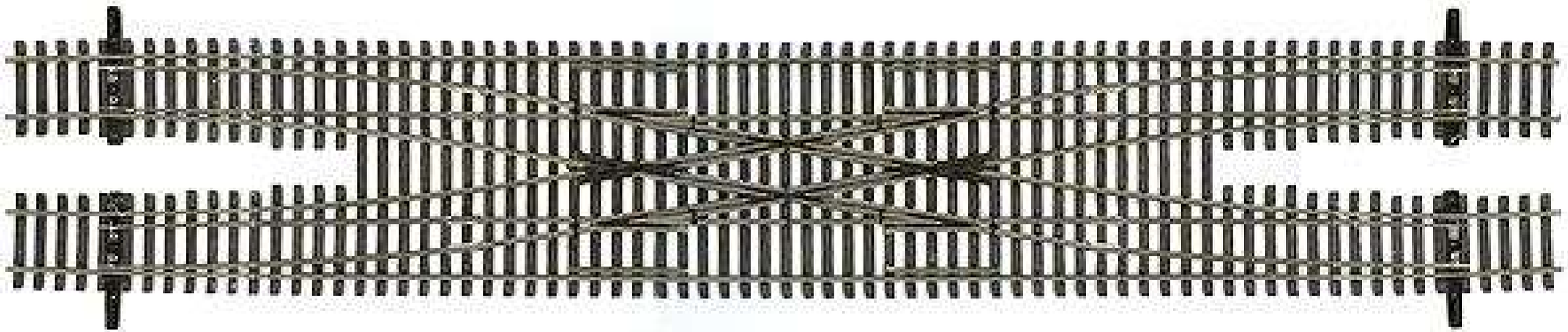
At points, check alignment and gauge

At frog, check for flangeway depth,
wheel flange too high,
gauge at both frog and guard rail

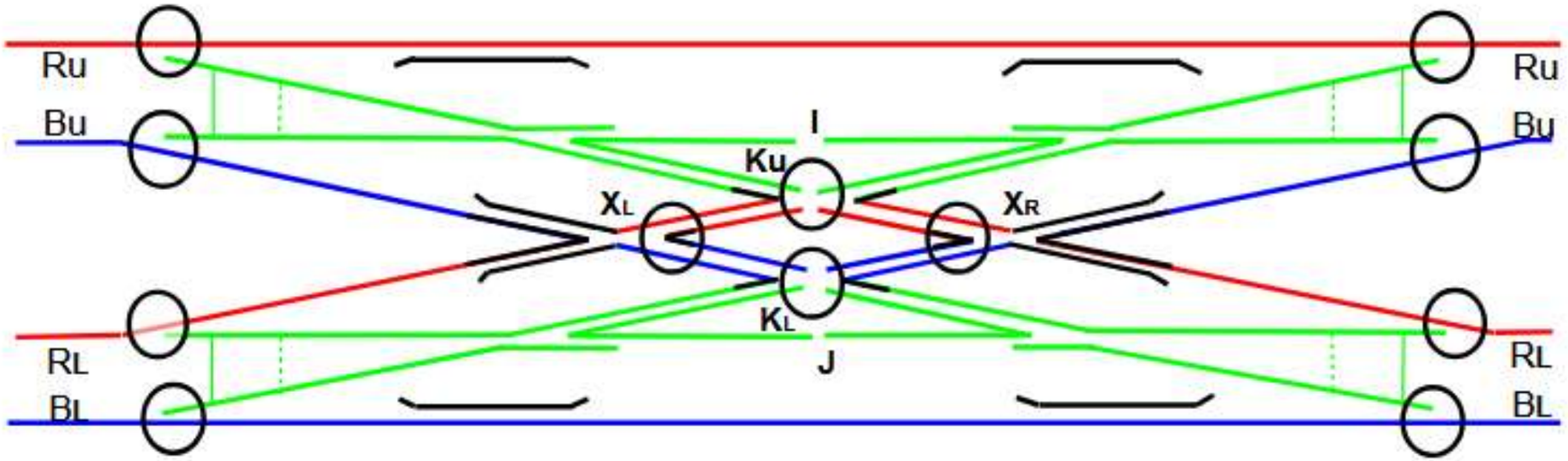
Crossovers are a special breed of turnouts. A single crossover is two turnouts with their diverging routes joined to conserve space.

A Fast Tracks version built to curve!!

A double crossover is four turnouts and a crossing combined to conserve space



A passel of Frogs!!



Wiring considerations for a double crossover – it quickly gets very involved

Wiring Metal Frogs (Electrofrogs) - The Basics

Powering the Frog for Ultimate Reliability

Eliminates stalling for all locomotives, especially those with short wheelbases.

Provides continuous power through the frog.

Power a Metal Frog? Consider Pros/Cons

Wiring Metal Frogs (Electrofrogs) - The Basics cont.

The Challenge is Avoiding Shorts

A metal frog must be switched to the correct polarity based on the direction the turnout is thrown. If not, a short circuit will occur when a locomotive enters the frog.

Essential First Step: Insulating Rail Joiners

ALWAYS use insulated rail joiners on the two rails leading away from the V of the frog (the "point" end of the frog). This isolates the frog section.

Methods for Powering Metal Frogs - Option 1: Switch Machine Contacts

Frog Powered via Switch Machine Auxiliary Contacts

Many slow-motion switch machines (e.g., Tortoise, Cobalt) have built-in electrical contacts (SPDT or DPDT). These contacts switch automatically when the turnout points are thrown.

Methods for Powering Metal Frogs - Option 2:

Frog Juicers

What is a Frog Juicer? An electronic device that automatically detects a train entering the frog and instantly switches the frog's polarity to match the train's path, preventing a short. Examples: Tam Valley Depot Frog Juicers (Hex Frog Juicer, Mono Frog Juicer).

Connect the frog directly to the output of the frog juicer.

Can simplify wiring, especially if not using switch machines with contacts or if hand-throwing turnouts. Automatically handles polarity.

Not compatible with DC

No Shorting Problems: Non Power Routing Type (Plastic/Dead Frog)

» Atlas, Elite Plitz, Peco Insulfrog, Roco, Tyco, New Walthers, Kato Unitrak

Potential for Shorting Problems: Power Routing types (Metal/Live Frog).

» Peco Electrofrog, old Shinohara, old Micro Engineering and hand laid.

Takeaways

Choose the turnouts that work best for you & your needs

Document what you do and what you change

Consider the advantage of Keep-Alives

Below are the sites referenced for this presentation

https://dccwiki.com/Turnout

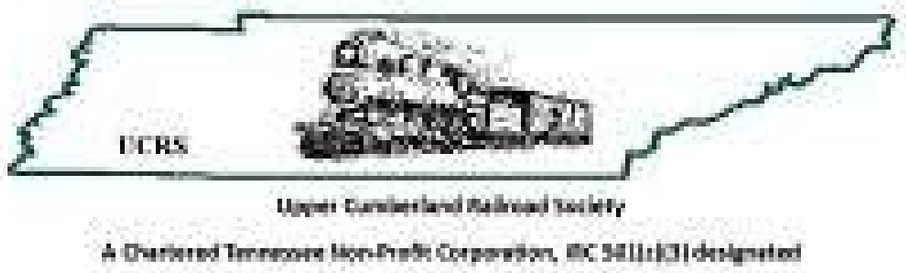
https://dccwiki.com/PECO_Electrofrog

https://ohrtracksupply.com/

https://handlaidtrack.com

https://www.wiringfordcc.com/switches.htm

https://www.youtube.com/@PECOrailwaymodeller



??Next Clinic Ideas??

Thank you for attending!

May 24, 2025