# Model Train Help

## Your Step-By Step Guide To Model Railroading

**By Robert Anderson**

## TABLE OF CONTENTS

**Important Note -**

To reduce the download file size we have also added links to various plans and step-by-step photo tutorials. To access the plans and tutorials you can simply click on the links in this ebook (to do this you need to be connected to the Internet), or copy and paste the links into your browser. The plans and photo tutorials will appear as web pages which can be easily printed.

# All Aboard!

**The hands-on world of a model railroader is indeed a special experience. Bring your sense of wonder with you... as this ebook takes you on a fascinating journey... where you'll learn everything you need to know to make and operate a model railroad.**

***"We don't stop playing because we grow old,***
***we grow old because we stop playing"***
**George Bernard Shaw**

If you ask model railway enthusiasts "what appeals about the hobby?" you'll get a variety of answers. For some, it is a way of re-creating a fond childhood memory. Others; simply enjoy building a world in miniature with all its detail and realism. Then there are those model railroaders who love solving the technical problems of building and operating an electronic control system.

**Interesting Fact:**

The steam locomotive was invented in England in 1797.

U.S. Railroads used steam locomotives from their inception in the early 1800s until the 1960s, when improvements in diesel power made diesel-electric powered rail locomotives a more cost-effective choice.

Steam locomotives worked hard and easily produced enough tractive power to grip metal rail tracks, and pull heavy loads. But, over time, steam powered locomotives presented a difficult problem for the railroads.

The production, maintenance and upkeep of steam locomotives were very specialized and became increasingly expensive for the railroads. By the late 1940s and early 1950s, it was no longer cost-effective for large U.S. railroad companies to maintain and run these powerful iron horses.

It doesn't seem to matter whether you're 5 or 95... or somewhere in between. The personal satisfaction of building and operating a realistic miniature layout is rewarding and fun… no matter what age you are. Model railroading is a truly rewarding leisure activity that will keep you busy and entertained for hours… if not a lifetime.

### Freedom To Create Your Own World

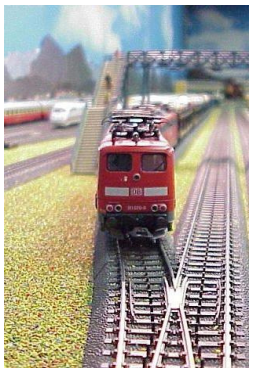
Model railroading is an absorbing leisure-time activity that provides plenty of creative opportunities and interesting projects of a technical nature. It incorporates a variety of interesting activities from building, maintaining, upgrading and operating a train set. What kind of world you create, where you create it, and how much time you spend in it…. is entirely over to you.

You can build a layout in the solitude of your basement, attic, shed or garage workshop…or you can sit in a sun lounger and watch trains weave around your garden… or you can join a local model-railroading club and share your ideas and experiences with others. The opportunities are endless!

Yes! Model railroading is a great way to meet people make friends. There are numerous clubs you can join where you can meet with all types of people who share a similar interest for model railroading. You'll have the opportunity to share ideas, get advice from experienced model railroaders, attend conventions, build a model railroad as a group project, and even take train trips together. This is a truly wonderful hobby because:

- You'll pickup valuable skills in: artistic painting, construction and carpentry, electrical wiring, problem solving and design.
- You'll discover creative opportunities that will bring to the fore your hidden talents when building scenery.
- You'll develop a in-depth knowledge of geography when designing and making landscapes.
- You'll step back in time and learn how things operated in bygone days.
- You'll gain some engineering skills when designing your layout to make it fit, build your bench-work so it won't fall apart, or examine how a level crossing operates, or a bridge is built, or how to create an efficient shunting yard.
- You'll enjoy the challenge of constructing realistic miniature replicas of life and scenes from history.

**Patience And Knowing What You Want**



You don't have to be a millionaire, or a technical genius, or a brilliant artist to be part of this world. The single most important skill you will require is patience. If you have plenty of patience, then you will thrive in this environment.

The scale you choose to model in will depend on what you want from a layout and the space you have available. You may want to see long trains running quickly through a town or countryside scene, or perhaps you would prefer a small compact layout featuring a branch line terminus and small goods yard with lots of small shunting moves.

**Interesting Fact:**

Model Railroading has been called "The Worlds Greatest Hobby", and rightly so. But, could it be a descendant of "The Worlds Oldest Hobby"?

About 500BC the emperor of the Q'in (pronounced 'Chin' which is where the name China came from) dynasty wanted to view all the different regions of his empire.

But of course it was impossible for him to be in all the regions of his empire at once. So he commissioned some artists in his empire to visit each region and make models of each region, so that he could view them all from inside his palace in the forbidden city.

Once each diorama was completed, it was placed on a map of the empire that was carved into the floor in part of his palace. Each day he would travel through his whole empire, admiring the beauty of his kingdom.

The dioramas were called 'penjing'. China in 500BC didn't have the benefit of Woodland Scenic's scatter and trees, or similar materials, and so the dioramas were made from real dirt and rocks, and small trees that were alive.

The art of Bonsai owes it's existence to these penjings, and it would seem that maybe the 'art' of Model Railroading does too!

## What's Included In This Ebook?

It doesn't matter whether you're an experienced model railroader or a newbie, this ebook will provide you with helpful information and useful ideas to help you get the most from this enthralling hobby. We have by no means covered every aspect in detail, but we have answered lots of the problems that you will encounter along the way. We have done extra research for you by sorting through websites and including valuable links to sites that offer an enormous amount of genuine information.

### Easy To Read

We won't try and impress you with loads of confusing technical jargon. We will keep it easy to read and clarify confusing terminology and technical terms. We'll help guide you with equipment choices, layouts and maintenance.

The important thing to note is that this book is independently written. We are NOT owned by any model train manufacturers or hobby companies, so we won't be trying to sell or push any particular brands. If we suggest something, it will be because we genuinely believe that is the best choice.

In addition, we'll answer frequently asked questions and review tips from experts. In short, everything you need to know to get the most from this truly fascinating hobby. Enjoy your read!

**Interesting Fact:**

The Fairy Queen steam locomotive is all gloss and shine. A bronze chimney spewing out thick smoke from its crown into the air, which thins to a misty vapour as the engine warms.

The Fairy Queen broad gauge steam locomotive was built in 1855 by Kitson, Thompson & Hewitson, of England for the British firm East India Railways. The petite engine worked from Howrah to Ranigunj (121 miles). After a complete overhaul in Perambur Workshop of the Southern Railway, it panted back to life in 1997.

The Fairy Queen made several trips between New Delhi and Alwar, India (89km of railway track) between 1997 and 1998. It now runs as a tourist train.

## Understanding The Technical Terms

Model railroading enthusiasts use plenty of fascinating technical terms. But, don't get "hung-up"on them. The important thing is to take things one step at a time and learn new terms and techniques as and when you are ready. Before getting started, we'll quickly outline some of the basic details and concepts to help you on your way. The definitions for some of the more important terms are included in the glossary at the end of the book, while others will be explained as we progress through this book.

### What's The Difference Between Toy And Model Trains?

All trains might be referred to as being toys, but not all trains are considered to be models. That's the important difference. Model trains are designed exactly as the name implies, that they are scale renditions of real full size (prototype) trains. Model trains have dimensions that closely replicate the originals or real thing. Toy trains are made without this same attention to detail and accuracy**.**

### Is Model Railroading Expensive?

Yes it can be, but so too is smoking, drinking, golfing, fishing, driving and most other things in life. Model railroading is an excellent hobby and can be as expensive, or as inexpensive, as you want to make it. If you want the full enjoyment of this enthralling hobby over many years, then be prepared to fork out

a lot of money. If model railroading gives you a lot of pleasure and satisfaction, then it is well worth it.

However, what you invest is entirely over to you. If you're looking for something simple, then you can stick with a cheaper brand. It’s basically up to you. Just make sure that you know what you want and price out any purchase carefully.

**Starter Model Train Sets And What To Expect**

Whether you are a beginner, or experienced railroader, all trains set starts with the basics of a train and some track. Well, there's a little more to it than that. A starter model train set would normally include: at least one locomotive, and some rolling stock (freight and/or passenger cars). Most likely it will also have enough straight tracks and curved tracks to make an oval layout. A starter set would also include a power pack (transformer) and some wiring that runs from the track and the power pack. Those are considered the basics of model train sets. A starter set is a good entry point for a beginner to this exciting model railroading hobby.

**Add To The Basics**

The next step is to add more fun and interest with other features and accessories such as: a turnout (or track switch), tunnels, bridges, buildings, telephone poles, shrubs, trees, fences, hills, vehicles and even people. An idea is to make one of the rails a 'rerailer section', to make it easier to put the locomotive and the trucks on the rails.

**What Are Prototype Trains?**

Generally, model train enthusiasts will refer to the real (full size) trains as prototypes. As the name implies, every track system is a unique, one of a kind system. This explains why the word 'prototype' is a good name for full size trains. If your aim is to create your own "real" system, then it's easiest to refer to full size trains as being the prototypes.

**Why Have Scales?**

It goes without saying that model railroads are not the same size as the real thing. They are scaled down replicas of their real world counterparts. For example, an S scale train set is built to a scaled down ratio of 1:64…. meaning that an S scale train is 1/64 the size of the real thing. When building an S scale train layout the buildings, trees, bridges, roads and other accessories would also be replicated to a scale of 1:64.

**Know Your Scales** As a handy reference here is a list of the main scales from largest to the smallest:

| | |
|---|---|
| **O** | **1:48** |
| **S** | **1:64** |
| **OO** | **1:76** |
| **HO** | **1:87** |
| **N** | **1:160** |
| **Z** | **1:220** |

**What Scale To Choose**

When getting started, don't get put off by all the different scales on offer. It is really very simple. When deciding what to purchase, just keep in mind that O, S, HO and N are the most common scales in use. Of those, HO is the most widely used scale (OO gauge in the UK).
The best way to get started is purchase a 'starter set'. These starter sets are designed to give the beginner everything he or she needs to get up and running. They contain all the basics: a locomotive, cars, track and accessories. As far as cost; starter sets are usually the best value for money, because the manufacturers use them as bait to lure new people and get them hooked on trains.

> **Quick Tip:**
>
> Think carefully about which scale would best suit your needs and then stick with that scale for your first project. It's that easy!

**Why Choose HO Scale?**

Internationally, HO (pronounced "H-Oh") scale is the most popular model railroading scale and that's why there is generally a wider selection of accessories available including locomotives and rolling stock. The manufacturers really produce and cater for the large HO market because most modelers prefer a middle-of-the-road size. But, although HO is convenient for most people, it is difficult to run 50-car trains on even medium-sized HO layouts.

HO scale is 1:87 size with 16.5mm track gauge and a minimum radius of 15 inches. HO scale is an excellent size to appreciate the detail and running performance without being too cramped. Also, many HO enthusiasts say that HO scale is ideal for running their trains using a digital setup. If you're looking for trains that require lots of switching operations then HO enthusiasts will generally agree that HO scale is an excellent choice.

**Q: What is the smallest practical layout size in HO scale?**

Although very confined, the size can be as small as 4 x 1 feet for a switching layout. A layout of this size can include a small staging track (1 track), and perhaps some sidings and maybe even a passenger depot.

**Q: How much space is required for an continuous loop in HO scale?**

A layout size of at least 3 feet 6 inches x 4 feet would allow space for a continuous loop railroad in HO. In this space you could include at least 1 turnout and standard minimum curves of 18 inch radius. But this size layout does not provide much scope for operation.

A layout space of at least 6x4 feet would a better option. This would allow room to have a reasonably interesting model railroad that is based on a continuous loop.

If space is at a premium, consider a different scale (such as N scale) or a shunting layout might be possible option. The advantage of a shunting layout is that it can be accommodated in a narrow space running along a wall.

**Why Choose N Scale?**

N scale is growing in popularity and has the advantage of taking up less space than the HO scale. N scale models are in fact 54.5 percent the size of similar HO models. As a result you can build an N scale layout in an area about 30% of that area needed to build a similar layout in HO scale.

If space is an issue then N scale could be the answer. N Scale allows for more complex and realistic layouts in limited space. Curves can be made much more gradual. The smaller size of N scale greatly reduces the need to utilize unrealistically sharp curves to reverse the direction of the train on a layout.

With N scale a three-foot wide layout could accommodate up to a 213 scale foot radius. The smaller N scale is also more accommodating to larger quantities of cars in a train. So, if you like the idea of long trains going through towering landscape, then N scale models might be what you are looking for.

Due to its smaller size, N scale is more intricate. For this reason it can be less suitable for youngsters and the more seasoned railroaders who may find it difficult manipulating the small rolling stock. There aren't as many options in terms of accessories compared to those available in HO Scale but with growing popularity this is changing.

**What About Other Scales?**

Most model train enthusiasts will focus on one of the scales mentioned earlier. However, without wanting to confuse things, there are two other scales namely OO and TT scales.
TT scale (1:120) is an abbreviation for "table-Top" and TT dimensions are about 73% of HO (1:87). They date back to 1945 and the scale is 1:120 which is scaled using an engineers ruler at 1/10$^{th}$ inch to the scale foot.

OO scale is 1:76 (4mm = 1 foot) compared to HO at 1:87 (3.5mm = 1 foot).

OO and TT scales each have a smaller following of enthusiasts. OO and TT scales are not widely used and are therefore are not as easily obtainable to the average purchaser.

**OO Gauge and O Gauge Confusion Sorted**

Model train set gauges and scales can be confusing particularly when the names sound almost the same. OO gauge and O gauge fall into this category and can trip up beginner and even experience model raliroaders at times. So, here is the difference explained once and for all.

**OO Gauge**

OO Gauge has for many years, been the most popular scale with British Railway Modelers. OO gauge has a ratio of 1:76 equaling a scale of 4mm to the foot. It is considered to be the standard for many model train enthusiasts in the UK and is a popular scale with beginners buying Hornby or Bachmann Train Sets.

**Here is a summary of the OO Gauge Scale:**
4mm : 1ft
1/76th Scale
Track Gauge: 16.5mm

Because OO gauge is so popular in the UK there is a wide range of OO gauge accessories available in the UK. There is also a good secondhand market for OO gauge in the UK which can considerably reduce the costs of the hobby.

**O gauge**

Looking now at O gauge it has a ratio of 1:48, or 7mm to the foot. Many modelers are attracted to O gauge because of the impressive detail on the rolling stock although the costs can prove prohibitive for many.

**What's The Radius?**

In model railroading you'll hear the term 'minimum radius'. It simply refers to the tightest curve that most model equipment in that scale can handle. If you are trying to fit a train set into a small space then HO, N and Z scales can cope with the tightest curves and will therefore take up less space.

**Clearances For Model Railroad Tracks Photo Tutorial**

http://www.model-railroad-resources.com/clearances-members-only1.html

**Why Choose A Bigger Scale?**

It is best to choose a scale that best suits your needs and gives you the effect you are looking for in your train layout. O scale and S scales are large when compared to the more popular HO scale. O scale is 1:48 size with 1¼" track gauge and a minimum radius of 2 foot (24 inches). S scale is 1:64 size with 7/8" track gauge and a minimum radius of 22½ inches. As you can see S scale is smaller in size than the larger O scale.

**What about G Scale?**

G Scale is big and is sometimes referred to as "Garden Scale." Much of the equipment made in G Scale is suitable for use outside in a Garden Railroad. It is also ideal for running around the Christmas Tree.

G Scale is very easy for children to operate because the trains are hard to derail. It is big, so G Scale requires even more space than does O Scale. Quality engines, rolling stock, track, and accessories can get very expensive. There are less accessories available for G Scale. G Scale has not been standardized to the extent of the other scales mentioned.

**Interesting Fact!**

S scale trains were first made in England during the 1930's. At that time model railroaders were looking for a smaller scale that would take up less space but retain the advantages of detailing and the heftiness of modeling that the O scale afforded. At the time, many felt that the HO scale was too small and that a more desirable gauge would be somewhere in between the larger O scale and the smaller HO scale. That's how the S scale came to be.

## Advantages of O Scale and S Scale

O or S scales are suitable for people with plenty of space available, for children and perhaps for anyone who might find it difficult to handle the smaller more intricate scales. However, these scales are not as readily available so the choice of accessories is generally more limited.

When buying a train set for a child, consider the bigger scales like O or S scale, because they are easier for small hands (although more expensive). Most experts would agree that the bigger scales seem to stay on the tracks better. Continually placing trains back on the track can be frustrating for children, as can coupling the trains together all the time, when they come apart. So, it is important that the scale size fits the abilities of the user be they young or not so young.
Also, remember that the very popular HO scale (1:87 proportion, 1/87th of actual size) is reasonably easy to handle. It's not too fiddly!

## Helping You Decide

Naturally, your choice of scale will depend on what you want your railroad to do. It is important to remember that bigger is not necessarily better. You can pack more into the scene with a smaller scale. If you live in an apartment or small house where space is limited, then think about a smaller scale such as Z, N and HO. If you are interested in micro trains, consider Z, which is 1:220

## Planning Micro Model Train Layouts

A micro model train layout is best defined as a self contained, working model railroad with a clear purpose and operating capability. They are ideal for small apartments and confined spaces, because most micro model train layouts will fit in an area of less than three or four foot square. Depending on the design, micro model train layouts can be reasonably quick to construct and can feature a lot of operating functions.

The main thing to remember - a very small micro model train layout requires a different planning approach. Scales are different and the scenery is very compact when compared to a larger scale model railroad layout.

Constructing a micro layout is a bit like a theatrical stage set design.

You choose a scene and then work out the logistics of compressing the illusion of it into a confined space.

You'll need to be flexible in your thinking, because most micro layouts use forced perspective and lots of special tricks and even flexible backdrops (just like on stage!).

Careful thought needs to be given to selecting rolling stock and structures which could include low-relief and flat models of structures.

## 8 Steps To Selecting The Right Scale For You.

**1.** Measure the area or table where the train set is going. Consider that it may not be possible to reach more than three feet across a layout, limiting an "against the wall" layout to about three feet wide.

**2.** Think carefully about who will be using the train set and what you want to achieve from the layout.

**3.** Head to the hobby shop or surf the net for what you want. If you are visiting a store it might be a good idea to take a tape measure.

**4.** Visiting a hobby shop is a good idea because you can measure out a few pieces of track in each scale.

**5.** Do the math if you don't have a tape measure. Sizes are as follows: O track is 1 1/4 inches wide. S track is 7/8 inch wide. HO track is 0.65 inch wide.

**6.** Decide how much detail you'd like to have on your trains if room is not an issue. Remember; detail is easier to see and reproduce on larger trains.

**7.** Consider how extensive you intend your layout to be now.... and in the future. HO scale is the most common and has the widest variety of accessories available.

**8.** See whether the trains and accessories you like are available in every scale or only some scales, and choose accordingly.

## Chart Of Popular Scales

| Scale/gauge designation | Proportion to prototype | Track gauge | Minimum radius | Length of 50' boxcar approx. |
|---|---|---|---|---|
| Z | 1:220 | .256" 6.5mm | 5¾" | 2¾" |
| N | 1:160 | .354" 9.0mm | 7½" | 3¾" |
| HO | 1:87 | .650" 16.5mm | 15" | 7" |
| S | 1:64 | .875" 22.5mm | 22½" | 9¼" |
| O | 1:48 | 1.25" 32mm | 24" | 12½" |
| Gn3 | 1:22.5 | 1.75" 45mm | 24" | 19" |

## More Detailed Scale Chart

Some model railroad names, terms and scales do vary a little between the USA, UK and Europe. This can be confusing, so here is a simple chart to explain some to the major differences. To convert from metric to imperial measurements use the simple conversion calculator at:
http://www.onlineconversion.com/length_common.htm

| NAME | SCALE | TRACK GAUGE |
|---|---|---|
| Z | 1:220 | 6.5 mm |
| OOO | 1:152 | 9.5 mm |
| N (UK) | 1:148 | 9 mm |
| N | 1:160 | 9 mm |
| TM | 1:100 | 14.2 mm |
| TT3 | 1:100 | 12 mm |
| TT | 1:120 | 12 mm |
| HO | 1:87 | 16.5 mm |
| OO (US) | 1:76 | 19 mm |
| P4 | 1:76 | 18.83 mm |
| EM | 1:76 | 18 mm/18.2 mm |
| OO (UK) | 1:76 | 16.5 mm |
| S | 1:64 | 22.2 mm |
| O (US) | 1:48 | 32 mm |

| NAME | SCALE | TRACK GAUGE |
|---|---|---|
| O (EUROPE) | 1:45 | 32 mm |
| O (UK) | 1:43.5 | 32 mm |
| 1 Gauge (UK) | 1:32 or 1:30 | 45 mm |
| G (US) | 1:24 (varies from 1:19 to 1:32) | 45 mm |

**Narrow Gauge Scales:**

G (45 mm. track gauge)
SM32 (32 mm. track gauge)
On (16.5 mm. track gauge)
HOm (12 mm. track gauge)
HOn3 (10.5 mm. track gauge)
On3 (16.5 mm. track gauge)
Nn3 or Nm (6.5 mm. track gauge)

**What's The Difference Between Scale And Gauge?**
The terms scale and gauge are two of the most confused terms in the model railroad hobby. The SCALE proportion is expressed as a fraction of a real life-sized railroad. As an example, HO scale is 1/87 the size of real life-sized railroads. For model trains, track GAUGE is the width between the inside running edge of the rails. For toy trains, gauge is the measurement from the center of the two outside rails.

**Do Tracks Have The Same Gauge?**

No they don't, but there are two main types: standard gauge and narrow gauge. In the US, Canada and most European countries, trains run on "standard gauge."

**What is Narrow Gauge?**

Narrow gauge equipment maintains the scale, but runs on a smaller gauge of track. It is seldom used on main lines. Narrow Gauge track was generally laid in areas where rail traffic was light, curves may have needed to be tight, and cost was a major issue. Most popular in mining spurs, logging spurs, and scenic tourist rails where low speeds were usual.

**Quick Tip:**

Narrow gauge models use the lower case letter "n" to follow the scale and then the track gauge in scale feet. Example: HOn3 means HO scale (1:87 proportion narrow gauge 3 feet between the tracks.). HOn2 would be HO scale narrow gauge 2 feet between the tracks.

**What is Standard Gauge?**

Standard Gauge railroads have a width of four feet eight and a half inches between rails whereas Narrow Gauge railroads have a width of three feet between rails.

**What About S Gauge or On30?**

Increasing in popularity, S gauge narrow track makes it possible to have a very attractive, yet complex layout in about the same space as a more modest HO layout. On30 is another alternative to consider. On30 allows trains to run on track the size of HO while still retaining larger buildings and people.

> **Interesting Fact:**
>
> There are few narrow gauge railroads still in operation. Some have been converted to the standard railroad system. Others have been dismantled and turned into scrap. Even though narrow gauge railroads were inexpensive to build, off loading and on loading became too much of an expense. Each time a narrow gauge railroad met a standard railroad, shipments would have to be unloaded and reloaded.

**Why The Track Is So Important**

Track is made up of two metal rails separated by plastic tie sections. Each rail carries one side of the electrical circuit. To work properly, the two rails should not contact each other and no metal object should contact both rails together. This would cause a short circuit, which could damage your power pack if it happened too often.

With this in mind, assemble your track and connect the power pack… and you'll be ready to start operating your trains. It is as easy as plugging in the power pack, carefully placing the locomotive on the track, turning up the throttle…and enjoying!

> **Quick Tip:**
>
> Set up your train track on a sheet of plywood, a tabletop, or other hard surface. Carpet fuzz and floor dirt can hamper smooth operation.

**What Are Tracks Made Of?**

Track comes in different types made of brass, zinc-coated steel, nickel silver and steel. Regardless of what they are made of, most track sets come with a terminal section so that you can hook it to the transformer. Brass track and zinc-coated steel track are common in starter sets and, when purchased separately, are usually cheaper in price than nickel silver tracks.

**Explain Zinc-Coated Steel Track?**

Zinc-coated steel tracks are another option, but the zinc can wear off. This can expose the steel that can then rust.

**Explain Brass Track?**

It is generally accepted that brass is the best conductor of electricity, but it does need a regular cleaning to keep it in good condition. This is because brass forms an oxide when in contact with the atmosphere, which creates a barrier to the current.

**Explain Nickel Silver Track?**

Nickel silver track also forms an oxide, but still makes for a good conductor on nickel silver tracks. The oxide that forms on nickel silver happens to be electrically conductive whereas that which forms on steel and brass is not. What this means is that after a while on steel and brass rails the trains tend to run erratically. This means you'll need to clean the rails frequently to avoid this problem. Using nickel silver rails means you will have better running trains and less time spent cleaning rails. **That's why many train enthusiasts favor nickel silver tracks.**

**How Can You Differentiate Between The Different Track Materials?**

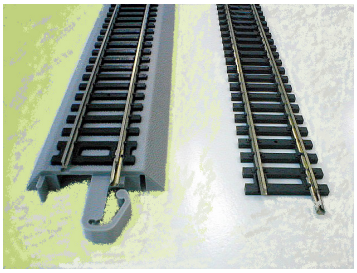
The different rail materials are easy to pick. Steel is a silver color (or rusty if not looked after properly). You can also use a magnet to find out if it is steel. Brass has its own distinctive color/s. Nickel silver is silver colored, but has a slight gold tint to it.

**Explain Sectional Track?**

Model railway track comes in sections for convenience and ease of use. You can purchase track in different lengths and shapes, straight and curved. Some snap together, and some are made on plastic roadbed sections. Sectional track is what most model railroaders start with simply because it's easy to use and it's what usually comes with the train sets.

**Should You Choose Roadbed Or Standard Track?**

Again the choice is over to you and your personal preference. The plastic roadbed sections look like real railroad ballast and feature interlocking tabs that help hold the track sections securely in place.



Roadbead (left) and Standard Track (right) ➔

Roadbed track has the advantage of having a more realistic appearance without the mess involved in adding loose ballast and then having to glue it. The

disadvantage is that it is more expensive than standard track. Another drawback is that the various makes are not always compatible with each other. Also, you are limited by the modular set track nature of the pieces.

**Quick Tip:**

When laying 'loose' ballast, be very careful while distributing it around point blades. Also, when laying 'loose' ballast never run the trains until the glue has fully dried and the track has been vacuum cleaned to ensure no loose ballast remains.

Roadbed tracks are particularly good on temporary layouts because they are generally more stable. If you intend to set up a train set on the floor (not recommended), then roadbed track is the better option because it is slightly raised up. If standard track is put on the floor, especially on carpet, then no matter how clean you think it is, grit, hairs, fluff, cotton and things you never knew were on the floor will get inside and ruin the mechanism.

**Quick Tip:**

Ballasted track adds more scenic realism to a layout. However, you need to make sure that the electrics are all sorted out and that all the rail joiners are tight fitting before you start ballasting. Otherwise you may find that after you have ballasted your track, some sections of track wont work properly.

For yards you may want to use a finer grade of ballast to give the impression of more lightly laid lines, while on the mainline you might want more coarse ballast.

## Ballasting Step-By-Step Photo Tutorial

http://www.model-railroad-resources.com/members-only-ballasting.html

### How Do The Rail Joiners Work?

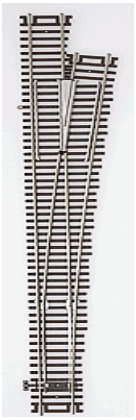
Sectional track comes with a rail joiner that is a slotted clip. Its function is to keep the track lengths together and also conduct the electricity. This is why the tracks need to fit snugly together. These joiners can wiggle loose when the train goes over the track, which can cause a derailment. To stop this happening you can nail the tracks down through the little holes in the middle of the ties.

**Quick Tip:**

When assembling sectional track do not force the pieces together. Make sure both ends of the rails are lined up with the metal rail joiners and fit snugly with little or no gap. If your track has molded roadbed make the tabs lock securely between sections. Make sure there are no gaps at the end of the rails when assembling the track.

**Explain Other Track Options?**

Apart from straight and curved sections, other track options include tracks for crossings and tracks made at different angles (so that tracks can cross each other or make figure eights). There are also turnout (switch) sections for sidings. A quick tip: on turnouts you might need to straighten the points occasionally with needle-nose pliers.



You'll also find that in all the popular scales there are shorter fitter sections available. Shorter fitter sections, such as half curves and 1/4 straights, are needed to complete any plan more complex than a basic circle or oval layout. Many enthusiasts simply cut a section of track to fit.

**Quick Tip:**

When using flexi track, it is important to remember that if you make the bend too tight in your layout you'll need to use shorter trains, otherwise your trains will be prone to derailment.

**What Are The Advantages Of Flexible Track?**

Flexible track (often referred to as flex track or flexi track), as its name implies, can be bent to any shape you want. It usually comes in three-foot lengths. It has the advantage of being bendable which opens up new options when planning your layout. Flexible track can be curved or laid straight or any combination you wish. With flexible track there are usually fewer connections to worry about. It does however need to be nailed down to a board and the rails need to be trimmed to length as you bend the track.

Flexible track also enables you to go into a curve more gently and make the track fit your layout without the constraints of fixed sections.

**Which Type Of Track Should You Use?**

It does not matter what kind of track you use - it is entirely up to you. You can even use both kinds together. Most model railroad enthusiasts have their preference. Flexible track is more work to set up, but the extra time has the benefit of less joins. The curves can be more realistic too. Depending on where you live, flexible track is usually cheaper than the equivalent length of set track.

**Interesting Fact:**

When driving a car, the yellow/amber light appears for a few seconds before the red light appears as a warning to prepare to stop. On a road the yellow/amber signal could be timed depending on a number of factors such as the volume of traffic and/or prevailing speed on the road the signal governs. The timing of the yellow/amber signal phasing is likely to take into account probable stopping distances for cars and trucks on the particular road.

Unlike trains; cars and trucks don't take as much time or distance to stop. Cars and trucks can also change direction to avoid a crash. That is why the yellow/amber warning light on road signals can be located on the same signal apparatus as the red danger light.

Trains, however, are heavy and take considerable time and distance to stop. Trains may require from half a mile, to a mile and a half to come to a complete stop. This is why, trains need a warning signal well before the point where they have to stop.

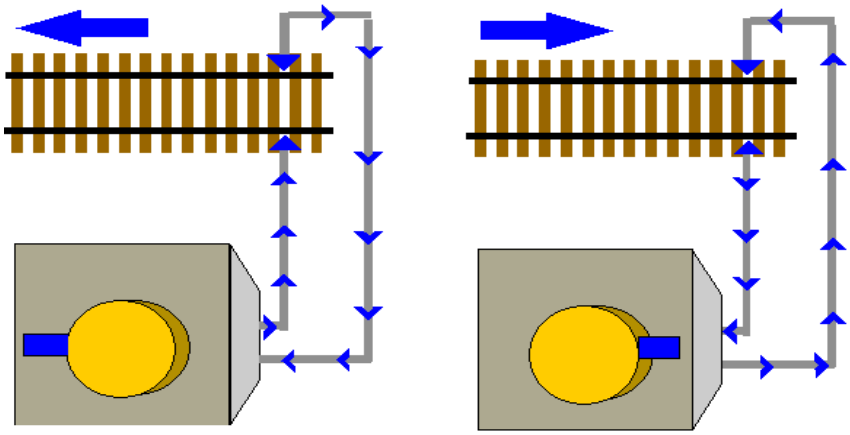
(Note: road traffic laws vary from country to country so the exact meaning of a yellow/amber signal may vary depending on where you live).

## How Does The Power Supply Work?

Most model trains run on low voltage. Unlike the AC electrical circuit in your house, the electricity that moves your locos is DC, ie. Direct Current. The supply to your layout comes by plugging a power pack (also called a transformer) into a wall socket that takes the AC supply, steps it down to  the 12-15 volts needed to run the trains and up to 18 volts for the accessories.

The transformer converts the output to DC, filters the DC to purify it, then outputs the supply from the terminals on the back of your controller, along a couple of wires to the tracks where it is picked up by your locomotives wheels, turning the motor within. The throttle control varies the voltage to the rails, changing the speed of the motor and consequently the rate your locomotive moves down the track.

DC electricity is directional, so the electricity flows along the wires in a certain direction, and the locomotive moves in the direction set by the directional switch on your controller (or left and right if your controller has a center off type control knob).



These lower step-down voltages are not usually dangerous, but it's safest to attach wires to the terminals when the power pack is unplugged from the wall.

Regardless of how simple or complex the layout is, all model train operation follows one basic principle. You control the train speed and direction by varying the voltage and polarity of the electricity reaching the motor. You are in control!

There are, however, exceptions to using DC for trains... if you have Lionel or Marklin, they operate on controlled AC power with 3 rail track.

**How Does A Circuit Breaker Work?**

Not all sets have a circuit breaker designed to provide protection by opening the circuit when too much current is being drawn from the transformer. The output terminals are low voltage A.C. power for the accessories and variable D.C. for the tracks.

> **IMPORTANT SAFETY TIP:**
>
> Electrical currents are not the same in every country. It is important that you know what voltage system operates in the country where you reside. If you are at all unsure, contact your local electricity supplier, or a local electrical contractor. The high voltage circuit in the wall socket can cause injury or death. Also, carefully read any safety instructions that are included with most train sets before getting started.

**What's In A Power Pack?**

There is a big choice when it comes to power packs. They come in a variety of designs to suit individual requirements. All power packs contain a few basic components, including a transformer to provide the 12 volts, a throttle to vary tile output voltage, and a direction switch to control the polarity of the circuit. Power packs also have screw terminals for the track (which is DC) and AC accessory connections.

Larger units may include a larger power supply as well as additional electronic features such as: operating modes, pilot lights and meters, and multiple terminals for accessories such as add-on walkaround throttle units. These units make it easier to operate your train, enabling you to follow it as it moves around the track, rather than standing in one spot and watching it.

**What About A Power Pack For A Small Layout?**

Small layouts can get by with the basic power pack that comes with many starter train sets. Remember, that a starter set power pack probably won't have much extra power. Also, it may not have a circuit breaker to prevent burn-outs. If however, the locomotive you've purchased doesn't have a powerful engine, then this type of power pack may be all you need to get started.

The pack that comes with a typical starter train set (rated as low as 7 volt-amps, or just 0.7 amps delivered at 10 volts) will run one (maybe two) locomotives at the same time.

**What About A Power Pack For A Larger Layout?**

Larger layouts or those with lots of accessories will require power packs with a larger power output. You can upgrade your power pack as your layout grows, using your older units to power accessories and powered turnouts.
A more powerful pack will be able to run more locomotives. If the amperes drawn exceed the pack's capacity, the pack begins to overheat. A 14 VA pack will easily power three or four locomotives.

> **Quick Tip:**
>
> Don't throw away that tiny power pack in starter train sets. It may come in handy for powering accessories separate from your main power source, freeing the bigger pack to run just locomotives.

Have the power you need. If you have a lot of accessories then you'll need to get a larger power pack or use multiple packs that can deliver powerful 18 volt amps of current. There's nothing more frustrating than not having the power that you need.

> **Quick Tip:**
>
> When buying a power pack, it's better not to skimp on quality at the expense of price, especially if you're planning to buy accessories as well. You want to ask yourself just how much current draw will the power pack provide.  Aim at least for a one-amp pack, with two amps being the best choice.

Remember these handy rules when purchasing a pack:

**Amps (Amperes) determine the amount of power.**

**Voltage determines speed.**

Electrical rating (measured in Watts or Voltamps (VA) meaning Volts x Amps) is what matters. Any pack will work on a big layout if enough feeder wires are attached to reduce electrical resistance and the resulting voltage drop that slows trains down as they get farther from the power source.

**Explain Watts And The Rated Capacity Of A Transformer**

In order for a transformer to last a long time it should ALWAYS be operated within its rated capacity.

Let me explain. As already mentioned power can be measured in 'watts' which is calculated by multiplying 'volts' x 'amps' (Volts x Amps = Watts). Example: 10 volts x 10 amps = 100 watts

For reasonable performance of trains and accessories a power rating of 90 watts or higher would be desirable.

Let's now use a real example: A Lionel 1033 transformer has a rating of 90 Watts. Maximum load would be 20 volts output X 4 amps = 80 watts (approx.)

When a DC supply is used the calculation would be as described. For AC applications, it is close enough to help you figure the maximum load.

**How Do I Get A Long Life From A Transformer?**

A quality transformer, when treated properly, should have a lifespan of 30+ years.

The golden rule is to ALWAYS operate the transformer within its rating. It is also important to keep the transformer dry and avoid damp areas (take particular care in basement locations).

When not using your train layout unplug the transformer. Don't walk away and leave it plugged in and unattended as it could start a fire. If a transformer gives off a burning odor, or expels smoke, heed these warning signs and immediately replace it or take it in for servicing.

A loud BUZZING noise coming from a transformer could be due to the transformers core laminations moving. Servicing would be needed as this vibration can cause damage to insulation in contact with the moving metal.

A transformer's circuit breaker can trip occasionally. If this happens simply unplug the transformer and let it cool off. The transformer will usually work again after it

has cooled down. However, if the transformer continues to trip without a load, it will need servicing to fix the problem.

One more thing; NEVER use a transformer with a damaged, split, or cracked power cord. If in doubt have the transformer serviced immediately.

**How Do Electronic Power Packs Compare?**

Electronic packs (or solid state) are another option. These packs give better control at lower speeds, especially as the train gets going. That's not to say that flywheels with heavy locomotives won't perform a similar function.
Acceleration is completely smooth when using an electronic pack. To get the motor started a simple burst of power is given out. The power bursts increase in frequency until straight D.C. is being fed through the motor.

Throttle changes continue to occur until the desired speed is reached.
With electronic packs it's possible to simply set the throttle at the speed you wish the train to reach and it's all done automatically. Electronic packs provide a momentum, similar to the starting and stopping of a real train. An added feature is a brake switch that allows you to stop your train more quickly, rather than allowing it to coast to a standstill.

**Quick Tip From A Veteran Model Train Hobbyist ...**

*"If street lights or other accessories are dim or move slowly, it is most likely a transformer/power pack problem. There may be too many things drawing power. The solution is to invest in more powerful transformer/power pack to run the trains, or buy an inexpensive unit and use it only for accessories."*
**Ralph H. Model train enthusiast for 32 years.**

**IMPORTANT NOTE:**

The next few pages **(from page 29 to page 41)** contain some reasonably technical information on comparing the two operating systems – Analog and DCC. I thought it important to cover the two systems now, before moving on to discuss other aspects of model railroading.

**If you are a beginner, you might prefer at this point to jump to page 42 and return later to this section.**

You could choose this option if the next few pages begin to sound a bit technical for you, depending on what stage you are at in the hobby. I have tried to explain all the key points in easy-to-understand words and avoid technical jargon, however the information is more complex. You decide!

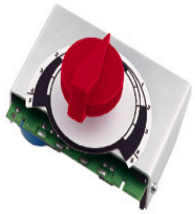
# Explain The Difference Between Analog And DCC Operating Systems

Since the advent of DCC (Digital Command Control), there has been a lot of confusion between DCC and Analog model railway operating systems. The big question is; what's the difference between the two systems and what are the advantages/disadvantages in simple, easy to understand terms?

So, with that in mind, I'll now explain each method for you step-by-step.

## What is Analog?

**An Analog model railway is simply a conventional model railway with conventional analogue controls [DC or AC] to provide a power feed to a piece of track. Any locomotive that is on that piece of track will respond by moving forwards or backwards. The speed and direction of a model train is controlled by varying the voltage and polarity on the rails. The higher the voltage , the faster the locomotive moves, the lower the voltage, the slower the locomotive moves.**



Analog controller panel mount 5 amp

**Quick Tip:**

Using an Analog control requires a basic knowledge of electricity and how electric circuits work. When you have a large Analog layout the wiring can become very complicated and it is worthwhile to have good drawings (schematics) showing how the wiring is done. This is strongly recommended for all model railway wiring on any layout larger than a 4x8 ft board (1x2 meters).

Larger layouts should be broken down into electrical sections or blocks to achieve better running.

## What Are The Advantages & Disadvantages Of An Analog Operating System?

**Advantage #1:** An analog model is cheap and simple to install for simple layouts.

**Disadvantage #1:** If two locomotives are on the powered section of track, then both will move in the same direction. There are ways to take control of each train individually, but for a beginner, it is rather complicated. The basic method used has been block wiring. The model railroad layout is divided up into electrical blocks. Each one of these blocks can control one locomotive. A cab (or throttle) is used to control each train. Arrays of selector switches connect each block. This method of control is also called "cab control."

Probably the most ingenious method of cab control is the one called progressive cab control. As a train moves around the model railroad layout, the connection between the cab and the block is automatically switched by relays to the next block, and the present block is released for another train to use.

**Disadvantage #2:** With the analog system, the majority of your time will be spent throwing toggle switches to keep your train running. But, that is not necessarily a disadvantage, because many model train enthusiasts enjoy doing precisely that.

## Wiring For Analog Explained

Analogue layout wiring involves the traditional methods of cable and switches to operate the layout. The three principal areas of layout wiring are:

1. **Track section wiring - getting the power to the locomotives.**
2. **Turnout motor wiring - electric turnout motors (points).**
3. **Signal wiring.**

When wiring a layout it is important to focus on each of the three areas individually to avoid an electrical mistakes.

To operate more than one train at the same time you will need to divide your analog layout in several sections called 'blocks'. A switch wired to each block enables you to select the controller. To run your train on the same controller over the whole of a selected route needs selector switches in the correct positions. To achieve this requires extra wiring. Making a drawing (schematic) of the wiring will become very useful for fault-finding. A good schematic should help you to locate the fault more quickly.
Before we move onto looking at DCC lets take a closer look at the three principal areas of layout wiring already mentioned.

# 1. Track Section Wiring

Correct wiring allows locomotives to run around a layout at low speed. The sight of a locomotive moving slowly across plain track and turnouts is what model railroaders like to see happen. Unfortunately, for many modelers that is a dream rather than a reality. The running performance (or lack of) is usually due to one or more of these factors:

### a) Track material & careful fixing

Smooth running necessitates the careful fixing of your track, ensuring it is flat, level and correctly joined. Forcing the track together isn't recommended. Generally, if the track looks good after close inspection, and if it is smooth to the touch, then smooth running should result. Irregularities in the track will become evident when you start running your trains. For this reason it is important to spend more time initially by carefully fixing the track, rather than making mistakes that could cause permanent damage to the track.

### b) Wiring methods

Several factors can influence a decision on the best type of track wiring for a particular layout. For example; who is going to use the layout, what size is the layout and what will the locomotive movements require? On small layouts the wiring can be kept simple and easy to understand. On larger layouts it is best to break the layout down into electrical sections or blocks determined by the running requirements of the layout.

You can isolate the blocks using insulated/plastic rail joiners (or a simple break in the track) and feed each block from a switch allowing each block to be switched off. Use a common return system where two controllers are in use (check to see that your controller is suitable) allowing locomotives to cross between controllers without having to increase the speed.

Consider using two-way switches with a 'center off' position as it gives more operational freedom on the layout. This allows each block to be controlled by either controller or to be switched off.

**Quick Tip:**

PTM (push to make) switches located to control the ends of sidings can be another useful addition to track wiring. Use a single cut in one rail approximately 12 inches (300mm) from the end with a PTM switch across the break. This should automatically stop a locomotive as it crosses the break preventing damage to the buffers. Another advantage is that the break allows a locomotive to be stored at the end whilst moving another locomotive on the same track. To move the stored locomotive simply press the PTM switch.

**c) Controller type**

When compared to the more modern electronic controllers, the older 'rheostat' controllers were not as reliable in performing at low speeds.
It is a bit like comparing any 1970's electrical appliance with its modern day counterpart. A controller that is twenty or thirty years old is likely to have its limitations.

The suitability for the required task is another point to consider. The controller should be appropriate to the size of the layout and to the type and number of trains running on the layout. If the layout is underpowered, then poor performance and even damage to the transformer may result.

**d) Locomotive mechanism - motor, gears, collectors (pick-ups) & wheels.**

Better quality motors, gears and wheels are readily available. As with controllers, the technology used in modern day locomotives has improved greatly. So again, a locomotive purchased twenty or thirty years ago can't be expected to perform as well as its modern day counterpart. Although, in saying that, a lot does depend on the quality of the locomotive you purchase and how much money you are prepared to invest in buying a locomotive or its components.

**e) Dirt & Grime**

This point is mentioned elsewhere, but it is worth stressing again. Cleanliness is essential for smooth running. Dirt can accumulate on the track, locomotive wheels and axles, and within the locomotive mechanism, particularly on the commutator of the motor. The fact is; **dirt and grime are major causes of non-running and poor running.** Even the best quality track, controllers and mechanisms will be adversely affected by dirt and grime.  Regular cleaning of the track and servicing of your locomotives is therefore essential.

**Quick Tip:**

**How To Clean A Commutator**

A commutator in good condition will usually appear copper colored with some dark areas of contact between brush and commutator. For a motor to run efficiently it needs a clean commutator. A train with a clean commutator will run better and have more power.

Cleaning a commutator doesn't need to be difficult. One simple cleaning method is to rub an eraser over the surface of the commutator until it's polished clean. Another method is to rub some fine sandpaper over the commutator surface.

**Quick Tip:**

**When To Replace Motor Brushes**

If the brushes are worn, replace them!

Brushes are one of the most critical components in your motor. The brushes need to properly contact with the commutator otherwise there is a risk of excessive heat, arching and damage to the commutator.

The greater the surface area contacting the commutator, the more current (more power) delivered to the armature.

Keeping the brush face FLAT (it contacts the commutator), is the key to good brush performance.

## 2. Turnout Motor Wiring

Walking up and down the layout to change turnouts can wear out your shoe leather very quickly. However, this can be avoided by installing turnout motors.

Most turnout motors function using two solenoids which move a bolt connected to the turnout motor. This changes the direction of the turnout.

To prevent damage to the solenoid coils, the power supply to the solenoid has to be 'non-latched' or momentary. One method is to use a schematic track drawing with studs touched by a probe to complete the circuit. The studs can be replaced by 'push to make switches' or biased (momentary) toggle switches.

**Quick Tip:**

A device called a Capacitor Discharge Unit (CDU) can be fitted. This usually results in greater efficiency and most layouts only need one CDU regardless of the number of turnout motors on the layout. The CDU works by increasing the power available to the switching method. This virtually eliminating 'sticking' solenoids, prevents damage to coils. Also, in most instances, it allows for more than one turnout motor to be operated from one switch ie. facing and trailing crossovers.

In more advanced use the solenoid motor and CDU can be combined to produce diode matrix, allowing complex routes to be set from one switch.

## 3. Signal Wiring

Some model railway layouts still use the older semaphore signals, whilst other layouts use color light signals.

Electrically operated semaphore signals can add to the historical effect, but they can be expensive and do require an accurate mechanical mechanism (often electric motor controlled) to activate the fragile signal arm.

Color light signals are more common and much easier to wire because they don't require any mechanical control. A simple two way switch (SPDT) will do the job for a simple green or red light option. Signals, however, rarely operate alone because one signal showing the all clear, will mean that another somewhere on the layout will show a 'caution' or 'stop' signal. This is where interlocking becomes useful. Accessory switches attached to turnout motors, can assist with the control of signals (particularly color light), usually via a relay(s). The turnout positions on the layout can then control all the related signal options.

With that said, let's now move on and take a look at DCC, starting with a simple definition of DCC.

## What is DCC?

**DCC stands for Digital Command Control. It is a system that allows model railways to independently operate multiple locomotives, functions (speed, sound, lighting, direction, movement) and accessories rather than control of sections of track. This is achieved by locating a decoder in the locomotive that listens to information in the track.**

Decoders are the electronics that go within each locomotive. Decoders operate the locomotives motor and can control the locomotives functions. Some decoders have only a single light function whilst others have 8 functions. The more functions the more items you can control. You will need to decide how many functions you want. It is worth pointing out that if your command station can only send one function and you have decoders with 8, that command station can still only control a single function.

Decoders also have various motor control features. The more basic ones have only speed and direction control features. The more advanced ones might have, for example, acceleration, deceleration, consist control, and motor back emf (electromotive force) control.

**Quick Tip:**

**Back Emf** is somewhat like the speed cruise control in your car. The decoder constantly determines the needs of the motor and adjusts it accordingly. The speed can be set to a predetermined level so that the train will operate at that speed independent of load or grade (until wheel slip). Therefore, when the train comes to a hill it would maintain the same speed going up the hill as on the flat. If you like slow operation or have a lot of grades, then 'back emf' could be worth considering. If you have few grades and like to operate at high speeds then 'back emf' may not be worth the extra expense.

With a DCC system you can even have whistles and sounds. You can control the whistle, bell, air pump, brake, dynamo, blow down, coupler clanking, horns, and the diesel engine rumble. You can even get the sound of a fireman shoveling coal, an air compressor, oiling and more.

You can buy sound systems to add to your locomotive or you can buy locomotives that already have sound built in.

## What Are The Advantages & Disadvantages Of A Digital Command Control (DCC) Operating System?

**Advantage #1:** DCC is able to communicate with each locomotive individually, allowing each to be given its own commands independent of the operation of other locomotives. It does not need the track to be divided into sections.

**Advantage #2:** A DCC system may give you more fun operating your trains because you'll have more time to watch the trains. With DCC, you don't have toggle switches, so you can watch the trains run instead of messing with a control panel full of toggle switches. Everyone is different and it is important to select the system that you personally enjoy operating. If you enjoy toggle switches then stick with analog.

**Advantage #3:** Wiring is much easier with DCC. The larger, more complex layouts will still require a fair amount of wiring and will be complex, however, it should be far less complex, and much easier than wiring the equivalent layout with an analog system.

**Advantage #4:** DCC provides a more accurate signal, and is more open for expansion to future technologies.

**Advantage #5:** DCC is easier to upgrade.

**Disadvantage #1:** DCC controls are more expensive.

**Disadvantage #2:** Each locomotive to be used with DCC must be equipped with a decoder. At approximately $30+ each (not including installation, which can range for $10 to $20+ per locomotive), it could be a big expense if you have several locomotives.

**Disadvantage #3:** Not all locomotives can be converted from analog to DCC.

## What Does A DCC System Include?

There are five components in a basic DCC system:

### 1. Command Station

The command station is the brains of any DCC system (besides the engineer!). The command station is basically a dedicated computer that communicates with all other parts of the DCC system. The command station processes the signals from one or more throttles, and transmits them to the track via a 'booster'. The

throttles connect to the command station either directly via the socket on the unit or via a 'network' for more than one throttle.

Take care when selecting the brand and model of command station, because it is the key to selecting the type of throttle controls as well as system features that can be expanded on.

**2. Throttle, Cab or "Handheld"**

The throttle is the man-machine interface between you, the engineer, and the command station controlling the train. A number of different throttle equipment styles are available. Some systems use a plug-in, walk-around throttles. Some allow more than one throttle to be used at the same time. Some systems even have throttles built into the command station.

In general, use any hand throttle can control up to a reasonable number of locomotives at any one time. There are various differences between the way that each locomotive is selected and some have rotary speed knobs whilst others use a push-button type speed selection.

Locomotive functions such as lights, smoke units, sound etc are selected from the hand throttles. The number of functions in use depends completely on the decoder fitted to the locomotive. In the majority of cases only 3 or 4 functions are available and used, sometimes only 1 or 2, but with the increasing number of specialized sound units becoming available, more functions are necessary to control all of the possibilities.

So, as you can see there are choices to be made depending on your own personal requirements (and available budget). Each brand of DCC system requires their own brand of throttle or engineer's cab, and their specific type of throttle to command station wiring interface. So, choose carefully, because the brands don't easily intermix.

**3. Boosters**

A booster (or power station) amplifies the power of the communication signals from the command station into power applied to the track. It is important to note that almost all boosters require an external power supply. Also note that the ampere rating of the booster and power supply will limit how many locos you can run at the same time.

Track wiring for DCC needs to be robust, because power from the booster must be able to reach and operate all the moving locomotives simultaneously.

Having separate boosters is usually a good idea, because the total locomotive current draw could exceed the rating of a single booster. With separate boosters you can create separate 'power districts' which have independent supply so that a fault on one doesn't shut down the whole layout. Each power district must be fed from a power booster. Separate boosters do not process signals, but need to be linked to a command station via 2 wires known as the 'command bus' in order to pass signals to the track in its power district.

There is no limit to the number of districts, and boosters, that can be used on a layout. Each booster is usually supplied form a separate transformer. One transformer can supply more than one booster, but the maximum current is then limited to the transformers capacity.

Starter systems often combine a command station and booster into one box. For example: the Bachmann EZ DCC has everything in one box; the Digitrax Zephyr' has throttle and command station in one box; and the Lenz LV100 has the booster and command station in one box.

Some boosters are available separately and, depending on the setup, may be controllable from a command station of a different brand.

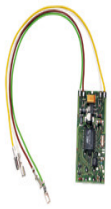
**4. Power Supply**

> *To clarify one point;* DCC puts 'fixed' electrical power on the track whereas with standard DC controls, the 'throttle' puts variable voltage power on the track. With DCC, the decoder inside each locomotive receives track power AND listens to commands sent out over the rails from the command station.

Before you purchase your DCC system check to see if the power supply is included. With many DCC equipment systems the power source must be purchased separately. An additional power supply is usually required with each additional booster.

**5. Loco Decoder**

A loco decoder is an electronic receiver located inside the locomotive. The decoder receives instructions from the command station through the tracks. The decoder simply "decodes" the instructions and responds accordingly which may be to turn a light on, add sounds, move forward, or stop, etc.



Each decoder has to have a unique address so that the controller can individually identify it. This explains why every DCC controlled locomotive must have its own decoder. Almost any brand of loco decoder should work with any brand of DCC command station/throttle equipment.

As a rule, DCC systems can control any decoder. Therefore, you are not restricted to purchasing all the locomotive decoders from the same manufacturer as the command station.

On the other hand, there is an incompatibility between the US and European systems in the way that multiple hand throttles can be used with a command station. The systems, known as LocoNet by Digitrax and XpressNet by Lenz, are networks that use different protocols and connections to communicate, hence you can't mix the two manufacturers. This means that a hand throttle from Digitrax will not be able to work with a Lenz system or vice-versa.

**Remember; the whole reason for DCC is to allow multiple locos to operate independently on the same track, without having to divide up the layout into complicated electrical control blocks.**

A computer is generally NOT required for DCC operation although some "techies" with do-it-yourself DCC systems use of a computer for signaling etc.

**Programming A Locomotive**

NONE of the commercial systems require a computer and therefore, no major programming is required. The only thing you need to do is configure the addresses of each locomotive.

This refers to entering data into a locomotive to determine how it behaves when selected from the hand throttle. In general the locomotive will need an address entered, a loco number, and owners may typically want to set the amount of acceleration and braking delays.

There are also many other items that can be set within the locomotive decoder. Each of the settings that can be programmed within a decoder is known as a Configuration Variable (CV).

There are two ways that programming can be carried out within DCC:

**1. Service Mode**

Service mode programming is carried out on a dedicated programming track and has the ability to change any of the CVs for the decoder. In this method a separate connection is taken from the system control unit to the dedicated track. Only a locomotive on the programming track can be configured in this mode.

**2. Operations Mode**

In this mode the locomotive to be programmed can be anywhere on the layout and must be addressed individually to ensure that any other locomotive on the layout is not affected. It is important to note that some older decoders do not allow operations mode programming. Also, some systems, and some decoders, will not allow locomotive addresses to be changed during operations mode programming.

Be aware that most systems restrict the amount of current draw available to the programming track. The reason is to prevent an excessive overloading or burn-out of a decoder when programming.

**How To Know If A Locomotive Has A Decoder Fitted**

When purchasing a locomotive with a decoder installed, look for the wording "DCC equipped", or "Factory installed decoder", or "W/DCC", or wording like that.

Be careful though, because the words "DCC Ready" usually means that the locomotive is capable of having a decoder installed and that one is NOT already installed. I repeat, "DCC ready" usually means there is NO decoder fitted, but the wiring inside the locomotive is terminated with a socket, ready for addition of a "Plug and Play" decoder. This is an easy installation, no soldering.

If you are still unsure whether or not a locomotive has DCC status, you can try this test. Place the locomotive on the program track of a DCC system. See if the command station can read CVs... and if it can't... then no decoder is fitted. Also, without a decoder fitted, the loco would “hum” with the throttle set at "0".

If the locomotive responds to the throttle on a DC system, then either there is NO decoder, or the locomotive may have a decoder that has analog operation enabled.

If in doubt, it is always best to get clarification from the hobby store staff, or from the manufacturer or person supplying the locomotive.

**Turnouts Using DCC**

A common question is whether or not you can control turnouts with DCC.

The simple answer is yes. You can even have the turnouts report the turnout status to a central computer. You can use this to operate signals or control train movements. Turnouts can be controlled with push buttons or from your throttle. One thing to remember, however, is that with a DCC system, multiple trains may come to a stop at the same time. This can be particularly frustrating when several people are involved.

Trains shorting out on a turnout could be caused by a number of things. Something could be wrong with a locomotive (or rolling stock), or perhaps the points on the turnout may be too close. Fixing the turnout, the rolling stock, or the locomotive can be a real challenge if your layout is not in a climate controlled room. Temperature and humidity can make perfection an unattainable goal. To avoid potential problems; try to have all your turnouts, locomotives, and rolling stock in good condition.

It is usually best to start your DCC system using the five basic components already mentioned. As your model railroad grows, and you become familiar with DCC operation, you may want to add more DCC equipment to your layout such as:

- more power supplies & boosters
- additional throttles for multiple users (same brand)
- remote plug-in panels for walk-around throttles
- auto-reversing track controllers
- accessory decoders for DCC operation of track switches (turnouts)
- electronic circuit breakers for separation of track circuits into multiple power districts
- or even radio equipped throttle adapters

If you would like even more detailed information about DCC then here is an excellent DCC resource is http://www.tttrains.com/dcc/


# Layout Options Explained

## Get It Right From Day One

Think Carefully when planning a model train layout. Stop... and think before you rush in an do something you might later regret. Many modelers begin with the urge to see model trains running as soon as possible, and rush into the first type of layout that occurs to them. Trouble is; they find out too late that they have committed themselves to a design which is not going to be of longterm interest. Worse still, they discover halfway through construction that they would have been better off to have adopted a different plan, even to have modeled a different railway altogether.

The best and most satisfying layouts are almost always the result of a considerable amount of planning. This can appear frustrating at first, however most modelers soon discover that planning and research can be a lot of fun. It is usually well worth the time and effort involved in getting things right from day one.

## How Big Should The Layout Be?

It is almost impossible for even the largest model railway to model an entire line. Most, if not all, interesting lines would 'go off' somewhere to connect with the rest of the system.

Even a very large model train layout must compromise, with the need to 'disappear' off the edge of the modeled world. That's why many layouts simply model a stretch of line with the 'rest of the world' at both ends. This type of layout can be made to look very realistic.

## Generalist Layout or Specialist Layout?

A specialist layout is where there's one major source of traffic, for example a steel mill, brewery or saw mill. In this case, you most definitely need to study the subject in order to model it correctly. If you love the subject, this is the sort of train layout you should consider building.

A generalist layout is where almost anything goes. A sea port for example could realistically be expected to send and receive almost all kinds of freight cars. A generalist model train layout allows for flexibility which for many railroaders is a good reason to choose this kind of layout.

**Why Build A Main Line Layout?**

What you build is really over to you and you may want to build a combination of main line and branch lines. There are however, a few important things that need to be considered. Main line layouts tend to be larger than average and more expensive to build. By definition they are busy layouts and so you'll need more rolling stock. If modeled well, they are without doubt, ***spectacular and well worth the effort.***

**Why Build A Branch Line Layout?**

Branch lines are a popular theme for small layouts. A branch line is a quieter alternative to a main line layout and can be fascinating to build and operate. Although not always the case, a branch line layout generally requires less rolling stock. It can also mean greater flexibility in the complexity of your track plan depending on what you want to achieve.

Building a branch line is a favorite for many railroaders, because it can allow more opportunities to include small dioramas within the layout.

A branch line will commonly have a small station where trains can pass. The station has some shunting possibilities, e.g. serving a freight shed. To make the operations more interesting a "shadow station" or passing loop can be added.

Many branch line layout designs consist of an oval shaped line, though on a shelf-based layout an out-and-back format is also reasonably common. The branch line theme often includes mixed freight and passenger trains running to a timetable-based operation.

Most branch lines run through countryside giving the possibility for creating some truly amazing scenery. But, when creating a small layout branch line, you'll need to accept that it can be hard to depict the wide-open space of the countryside on a small layout. One option is to use forests to "box-in" the scene. Another option, which works well, is to depict a branch line in a cityscape. This makes sense considering that most branch lines start off in a larger town. That way you can build a small station located in this larger town. The buildings will have the same effect of "boxing-in" the theme. Plus you can add connections to several industries, although this does conflict with a countryside theme.

**Why Build An Industrial Layout?**

If space is at a premium building an industrial line may be the answer. Industrial lines are the ones that feed industries. This kind of layout is ideal if you want to run unusual stock and enjoy scenic modeling.

There's no passenger traffic on an industrial line, but if you model the present day, you could run a nostalgic steam museum train on the layout. However, you'll need to be aware that the more modern freight trains are longer with more cars. Older cars are shorter and you can store more of them on a length of track…so that is an important consideration if space is an issue.

The operation of an industrial line focuses on shunting, shunting and more shunting. Some layouts have a continuous loop to allow the trains to run uninterrupted. However, true shunting layouts do not offer this possibility, which is more realistic.

When building an industrial line also think about the types of industries your line will service. To add variety and interest to your layout it usually pays to include several different industries. In real life some industrial areas are tightly packed, busy working areas, so you'll want to squeeze in a lot of track. That's one reason why industrial layouts can be fascinating to build and operate. A quick tip to get more shunting without overloading the scenery, is to give a single plant more independent connections.

**Why Build A Tramway Layout?**

If you are a tramway fan then consider building a tramway layout. The cramped space of an old town with a tramway is perfect to recreate on a small layout. Also, older tramways did offer some kind of freight service feeding local industries; so there is potential to develop the tramway theme. However, most modern tramways only offer passenger services with uniform rolling stock. This is why many railroaders find tramway operations a bit boring and opt for branch lines instead. It is really over to you – do what you enjoy doing - it's your train set!

**Interesting Fact:**

Lionel is a well-known name associated with O gauge trains. Joshua Lionel Cowen started the firm in 1900, later developing Standard gauge (2 1/4-inch gauge) and helped to popularize O gauge. Lionel became a major model train manufacturer during the late 1940s and '50s. In 1969, General Mills secured the rights to manufacture Lionel trains under the names Model Products Corp. and Fundimensions. Richard Kughn acquired those rights in 1986 and formed Lionel Trains Inc. In 1995 he sold the company.

# How Do Locomotives Work?

A Locomotive runs by picking up an electrical current from the metal rails through metal wheels that ride on the rails. The electricity is transferred from the wheels to the motor, which causes the motor to run. The motor connects to the wheels through a mechanical drive system. When the electricity turns the motor, the motor turns the gears that turn the wheels and push the locomotive along the tracks. Simple!

**Quick Tip:**

The contact point where your locomotive wheel meets the rail is extremely small. That's why; it doesn't take much in the way of dirt, dust, or debris to obstruct the wheel-to-rail contact. Dirt can build up, so it is important that you keep the wheels clean and free of accumulated dirt. If the wheels of your locomotive become dirty, they may not make good contact with the metal rails, and your train will stall. Remember, plastic wheels don't conduct electricity.

## Why Are Wheels And Gears So Important?

As you've probably gathered by now, a good locomotive needs lots of wheels and lots of gears. The electricity flows through the wheels transferring the electricity to the motor that turns the gears that turn the wheels. This all needs to work efficiently for best results. A poor performing locomotive is often because of the gears and/or the wheels. Although in saying that, some locomotives with only a few wheels work surprisingly well... although it is considered to be unusual, rather than the norm.


## Buying A Locomotive – Where Do You Start?

You can buy train accessories over the net, but there are advantages in buying from your local hobby shop. Many shops have a model track set up for you to test out locomotives etc. If they do, then without exception, try the locomotive out in the store before buying.

A good-quality model diesel locomotive will pick up electrical power from all eight or 12 wheels and will be geared on all wheel-sets, or "trucks," for the best pulling power.
If you're buying a steam locomotive, make sure it picks up power from as many wheels and drivers as possible. The best option is for the tender to assist in power pickup (if it has a tender).

**Quick Tip:**

No one wants a locomotive that you have to push to get it going. You don't want one that suddenly speeds up and falls off he tracks. If you want your train to run well, be prepared to pay good money for a good quality locomotive. Buy the best locomotive you can afford. Buy a high-performing workhorse and it will pay for itself in no time with the pleasure it gives you over many years.

**Buying A Locomotive – What About The Wheels?**

Check out the wheels. If the wheels are not connected to a gear, then they'll move easily when you push them with your finger. If the wheels move just a little and then go stiff, they're connected to a gear. That's a good sign. If the locomotive is slow to start, then consider buying something a bit better. A good locomotive is worth the investment!

**Buying A Locomotive – What About The Motor?**

The motor is also important and needs to be of good quality, to turn smoothly, using the least amount of electricity.

**Buying A Locomotive – What About The Weight?**

The weight of a locomotive is crucial to ensure that the wheels connect with the tracks. This is achieved through solid metal frames.

**Buying A Locomotive – What About The Flywheels?**

Flywheels are solid-metal cylinders mounted in line with the motor. Flywheels at one or both ends of the motor ensure a smooth take-off by slowing down the initial rotation of the motor. Flywheels help achieve a smoother stop when the electricity is turned off. They also help the locomotive operate more smoothly and negotiate dirty track better.

**Quick Tip:**

Diesel locomotives should have all-wheel electrical pickup and at least eight-wheel drive. Steam locomotives should pick up electricity from the drivers and the tender wheels.

### What Are The Advantages Of A Shorter Locomotive?

Diesel locomotives are generally shorter than steam locomotives. As a rule, shorter locomotives are less prone to derailments, especially when going around a curve. If you are just starting out, or if the train set is going to be used by a child, buying a short locomotive could be the best option. The same point applies when choosing rolling stock.

**Quick Tip:**

Avoid traction tires as these contribute little to performance. They're little rings of rubber around some locomotive drivers and wheels and are intended to overcome poor adhesion. However, traction tires can contribute to an irritating wobbling and also can't pick up electricity. The cure can be worse than the problem.

## 6 Points To Consider When Buying A Locomotive:

**1.** Choose a locomotive that has a good quality motor
**2.** Choose one with plenty of metal wheels
**3.** Choose one with plenty of gears connected to the wheels
**4.** Choose a locomotive with a heavy metal frame
**5.** Choose one with flywheels
**6.** Buy a locomotive that will meet your requirements now and in the future. A low price may result in poor performance and quality.


# Quick Guide To Freight Cars And Rolling Stock

**Autorack**
An autorack is used to haul road vehicles by rail. There are three main types all of which are tall and long: double level, triple level, and Automax. The most common type would be the double level Autorack Cars. The articulated version of a double level autorack is called an Automax car.

**Box Car**
Can be used to ship in a variety of cargo...from boxes, dry goods, food to auto parts... in fact, almost anything that doesn't require refrigeration.
They come in many different sizes, from 40 to 86 feet and were once the most common freight car around. More and more the general cargo is being put into special sized containers made for specific cargo's and placed on flat cars.

**Caboose**
Cabooses were used to house the engineers and other workers on the trains. The Caboose was especially useful on long trips, giving crew a place to sleep and relax when they were not working. From the Caboose, crew members could inspect the train by looking out the coupola windows. They could also watch the air pressure gauge inside. Cabooses are not seen as often these days as the End-of-Train device is more commonly used. Cabooses are still used on sidings and short-lines where reverse moves are made.

**Centerbeam**
These are used to transport sheets of wood or drywall on either side of a center beam.

**Coiled Steel Car**
These cars are specially designed to haul coiled steel. They often have covers on to keep water off the steel.

**Flat Car**
If the cargo didn't fit in a box car, the goods usually went on a flat car. Flat cars can be used for many different things from hauling boats, helicopters, to army tanks. They are commonly used for carrying the trailers that Semi-trucks pull on the road. A flat car with a trailer on it is called piggyback. This method of transporting trailers was introduced in the U.S. around 1950.

There are many different types of flat cars with the bigger ones having as many as 16 axles. Some flat cars are specially designed to carry weighty loads and some have depressed centers.

**Gondola**
Gondolas transport a variety of things. Some have low sides and transport discarded tie plates, cross ties, sections of pre-built track, thick sheets of steal, scrap metal and debris. High sided gondolas were also used to transport cargo's of wood chips and sawdust secured by heavy netting.

**Gunderson Wells**
Gunderson well cars haul one container on top of another and are also known as double stack cars. Gunderson well cars are articulated and come in one, three, or five sections.

**Hoppers**
Uncovered open hoppers are used for non perishable cargo's like ballast and coal. Covered hoppers are used for grains, bone meal, sand, and other things that need protection from the weather.

Hoppers are loaded from the top and can differ in the number of bays they have. A small hopper could have only two bays, whereas a large hopper could have 3 to 6 bays.

Some have chutes that use use gravity to empty themselves. Modern hopper cars are simply rotated upside-down to dump.

**Refrigerator Car**
In 1868, William Davis of Detroit, received a patent for an "icebox on wheels", a refrigerator car he uses to ship fruit and fish by rail.
Before 'reefers' were equipped with gas-powered coolers, trains had to make "ice stops" to load cars with ice. Refrigerated cars are not a common sight these days.

**Roadrailer**
Roadrailers first appeared on American railroads in the 1950s. They are specialized truck trailers suspended by wheel bogies and coupler mates. The advantage of using roadrailers is that due to their construction, the trailers can be pulled directly behind other freight (or passenger) trains without the use of trailer flatcars.

The trailers were built with integrated railroad wheel-sets that were lowered into position when the trailer was pulled behind a train. More recently manufactured roadrailers don't use integrated railroad wheels, instead they ride on specially-manufactured bogies. These bogies perform a double purpose serving as articulation points between multiple trailers in a train.

**Spine Car**
Spine cars are used to carry truck trailers and can be seen in articulated sets of more than one.

**Stock Car**
Stck Cars are not seen much these days. They were similar to box cars but have slatted sides and used to carry live stock by rail.

**Tank Car**
These cars are used to transport bulk liquids such as oil, acids, tallow... even liquefied petroleum gas and granular solids. Tank cars for lighter than air gasses (eg. heilium) have a loaded weight less than their light weight.
Tank cars come in a variety of sizes. A small tank cars might hold the capacity of a few thousand gallons. Large tank cars with eight or emore axles are known to carry extremely heavy loads.

## Buying Cars or Rolling Stock – Where To Start

The cars that come with many starter train sets are not highly detailed. You get what you pay for and the starter sets are lower in price to get you started.

When purchasing the cars separately, look for the most realistic and reliable cars that fit with your budget. You can buy cars and rolling stock over the internet if you know exactly what you are looking for and what you are getting. There is however an advantage in buying through a local hobby store. You can pick up the cars and have a good hands-on inspection before buying.

**Interesting Fact:**

The American Flyer Manufacturing Co. was founded in 1907, and made windup and electric wide gauge (the competitor to Lionel's Standard gauge) trains. The A. C. Gilbert Co. bought the firm in 1937 and offered O and HO trains. After World War II, Gilbert switched from O to S gauge. Lionel purchased the rights to produce American Flyer trains after Gilbert went out of business in 1966.

### Buying Cars or Rolling Stock – Which Wheels To Select

Examine the wheels first.  See how well they spin.  Avoid wheels that only turn once and then stop. Avoid wheels that wobble, because that’s not a good sign.

Wheels can be made of either plastic or metal; the important thing is that they have a metal axle. For the wheels to sit on the rails correctly they must be the same distance apart on the axle. Plastic wheels can sometimes be adjusted to the correct distance apart on the axle.

**Buying Cars or Rolling Stock – Which Couplers To Select**

Most starter train set cars come with truck-mounted "horn-hook" couplers. At some stage you might want to replace the "horn-hook" couplers with more realistic looking and better-operating knuckle couplers. Knuckle couplers are less likely to unhook. Your local hobby shop can show you some inexpensive replacements and how to easy it is to install them.

## All About Couplers Photo Tutorial

http://www.model-railroad-resources.com/couplers-members-only-page.html

**Interesting Fact:**

Marx offered affordable trains for the masses since the time its founder, Louis Marx, began making inexpensive windup and electric trains in the early 1930s. The Marx brand remained strong well into the 1960s and was popular with consumers looking to purchase inexpensive yet attractive metal or plastic toy trains. Although the original company went out of being in 1975, a new Marx Trains Inc. was established to make Marx trains under license.

## How Much Should You Spend?

Model railroading can provide an enormous amount of pleasure, so for that reason it is hard to put a value on how much someone should invest. It is really up to the individual and what you want from a train set. Some people are happy to just stick with a basic layout, whilst many enthusiasts spend thousands of dollars a year and derive thousands of hours of pleasure and satisfaction in return.

**Quick Tip:**

Many model train passenger cars that are being retailed don't have interiors. As a result when you look inside them they look like a toy train. One simple solution is to buy some commercial window tinting film from a hobby, hardware, or car accessory store. A small strip of the tinting film can be attached to the inside of the clear plastic that makes up the windows of most passenger cars. The tinting film can look like polarized glass which is very difficult to look through.

### What Should You Spend Money On?

How much you invest and what you purchase will also depend on your personality. If you are someone who prefers more realism, then it is likely you'll have different goals and different needs to someone who focuses mainly on maintaining and operating the trains. Both people could invest just as much money (and time), but on different things. So, there are no hard and fast rules… we're all different!

**Interesting Fact:**

Before Lionel entered the scene, Ives Corp. dominated the toy train manufacturing in America. Founded in 1868, this toy firm developed a mechanical clockwork locomotive giving its trains the edge of self-propelled motion. Around 1900, Ives faced competition from European toy makers. Ives then produced colorful electric locomotives with the first automatic reversing units. Heightened competition from Lionel and American Flyer led to Ives declaring bankruptcy in 1928.

## What Should You Start With?

We've already agreed that you'll need a locomotive, running stock, track and a power pack (transformer) to get started. You'll need to set aside an area in a spare room, basement or attic and provide a surface on which to place all this gear. And then there are all those exciting accessories to consider!

**STOP!** Before you go crazy with the credit card, think carefully about how much time and money you want to spend on this hobby. You may want to start off slowly before getting too committed in what can become an absorbing hobby… even an obsession. Maybe you had a train set when you were a kid and you can remember those times with great fondness. But that doesn't necessarily mean you want to mortgage the house right at the start.

### Why You Shouldn't Skimp On The Essentials

If the objective is to maximize your pleasure from this enthralling hobby, then don't skimp on the essentials, like a decent locomotive and a good power pack. You don't have to spend megabucks but you do need to get something that will meet your needs and be functional. You can always add to your set or upgrade as you become more involved in the hobby. So, it's not a problem if you can't afford the state of the art stuff from day one.

### Should You Make A List?

Absolutely! Surf the net and read up on the different options available. Then write down your wish list. Set yourself a budget and work out what each item will cost. Then prioritize your list and decide on some alternative choices that might be

worth considering depending on your budget constraints. Talk to the staff at your local hobby shop as they may have some alternative suggestions. They are the ones who should be able to advise what's new, what's good…and even what to avoid.

**Should You Set Objectives?**

It is always a good idea to set some objectives and goals. Begin with the end in mind. Apart from providing pleasure, what else do you want from your layout? When you think about it, you'll probably decide that is has to be functional and as realistic as possible. Write down what you want to achieve and then you can get started on the exciting part where you can combine your vision and attention to detail with your creativity, technical, and problem solving skills.

Ask yourself: How will your layout operate? Do you want several trains to be on the move at the same time? What type of rolling stock do you want to run? Do you enjoy shunting wagons around a goods yard? Maybe you just want to switch on and watch your train go round and round a circle of track. Do you want to run to a timetable?

Get the idea? You won't know the answer to every question you come up with, but it will help clarify your thinking as to what you really want to achieve.


## 13 Steps To Getting Started

It is a fact that many modelers begin their interest in model railroads without having a specific interest in any one particular railway line or company. The trains that they start out running have either been given to them as a gift or chosen because they look nice or are priced within the budget.

Mistakes can be costly so take your time and work through the process carefully, logically and thoroughly. After all, buying a train set or building a layout is not a race. It is better to think things through carefully and then do things the best way to achieve your goals.

Here is a valuable list of steps that will help you on this exciting journey. You don't necessarily need to work through them in this order, but you will want to cover each step:

**Step 1: Make Small Mistakes First**

We all make mistakes especially when we are learning. So, with this in mind it's usually best to start small. Then hopefully, mistakes can be small too. You will

probably want to purchase only a small amount of track to start off and maybe some plugs, switches, an engine or two, and a few cars. A small track layout of 4x8 or less might be a good place to start. There is no point in being intimidated (and maybe discouraged) by a large or complex set when you are learning the basics. With a smaller set it will be easier to fix mistakes or make changes.

A 4x8 layout is large enough to fit the 18-inch radius curves that come with many train sets. With a 4x8 layout there is also room for an oval with 18-inch radius ends and a few sidings.

You can always add accessories and upgrade your set as you go along.

**Model railroading is the type of hobby that will progress as you progress.**

By not going overboard at the beginning, you give yourself a chance to see what you need to make it even better.

**Step 2: Buy A Kit (Starter Set)**

Kits have everything you need to get started in one complete package… and they're usually very reasonably priced. Starter kits are a wonderful entry level for beginners. They include: enough tracks for a basic layout, a locomotive, some rolling stock and a power pack. Those are the basics to get up and running.

Talk with the staff at your local hobby shop because they can advise you on the best selection to meet your needs. Buying a starter kit doesn't necessarily mean you have to compromise on quality. There are a number of really good kits out there to choose from.

**Step 3: Know Your Budget**

Model train sets can run from a few dollars to several thousands of dollars, so it is important to decide how much you want to spend. Set a realistic budget and stick to it.

Thanks to the internet and sites like "e-bay" you can pick up some real bargains in the secondhand market. Make sure you know exactly what you are buying.

When you're in the hobby shop it can be very easy to blow your budget so it's best to decide your limits before you shop. This will ensure that you don't blow your budget when you spot that perfect (but very pricey) train set or accessory. Again it is matter of balancing ambition with realistic objectives. The same considerations apply to how much time you can allocate to building your layout. Many a layout has gone unfinished due to lack of time and money.

It is all about getting value for money without going overboard. When starting off you won't need the most expensive... but nor should you buy a poor quality cheap set from a discount store. You want pleasure from running your trains… not frustration.

Talk with model railroading veterans about this hobby and many will tell you they still have their very first train set. They'll also tell you how much fun they've had with it. So choose carefully.

**Step 4: Research What's Available**

Before purchasing a train set do your own research to familiarize yourself as to what's available. Surf the net (there are lots of useful sites listed in this ebook) and read hobby magazines or train books. Search for information on the models that most interest you.

Surfing the internet you'll see that a lot of sites specialize in certain aspects of model railroading or different scales such as HO, N or Z. Many of these sites offer in-depth information and excellent tips and ideas that will help increase your knowledge and stimulate your creative juices.

**Step 5: Where Is Your Set Going To Live?**

Before you purchase your set think carefully about where you're going to display and built it. Select a space where it won't get damaged… and where you have room to enjoy the set… and work on… and operate the trains with ease. And, if possible, room enough to expand onto your set. Yes, that's something to consider – is it going to be permanent, or is the layout going to put away after each use?

Locate your layout with care. The amount of available space you have will influence what you end up modeling. There is no point in trying to build a layout with several stations, goods yard, bridges and villages etc., if it needs to be cramped into the corner of the spare bedroom. Not that you can't be ambitious as long as you are realistic.

A table or a simple raised platform usually works well. You can make a platform by placing some plywood on a pair of saw-horses or some other raised support. The train will run a lot better if it's secured to a hard surface like plywood. It is also better to be raised to a comfortable height above the floor.

It's usually best not to display your set on the floor. Carpet and rails don't mix because being low to the floor your set will attract pet hair, dirt, dust and debris that can stick to the tracks and get into the engine. The floor is not a good location, because pets, or children might damage the set, it may even cause someone to trip and/or injure himself or herself.
Keep in mind that it's likely the railroading bug will bite you. It is contagious! So, you'll need to have you room for expansion.

**Quick Tip:**

When locating your train set make certain that the site has a good electrical supply for running the trains and lighting your layout. It must be dry and comfortable to work in all year round.

### Step 6: Select Your Scale Carefully

Choose the scale you want to work with carefully. Make sure that you have enough room to accommodate a layout in that scale size. Also, decide how big you want your layout to be now and in the future. If you think you might want to expand your layout in the future, then you may want to start off with a scale that takes up less space.

Many people get started with HO scale, but what you choose is over to you. If space is an issue, then N scale might be a better option than HO scale. N scale takes up less room than HO. As a comparison, you can fit as much detail into an N scale layout using a door as your platform, as you can on a 4 by 8 sheet of plywood with HO.

### Step 7: Select A Theme

Model railroading offers so many different options, that it sometimes pays to stick with a theme. Perhaps select an historical era that you are interested in and then select your trains, building and scenery from that era. For example: a layout depicting California logging railroads in the 1920s might interest you.

Researching a theme can be particularly enjoyable by adding to the fun and also making the layout seem more realistic.

Okay, assuming you have a favorite period in railway history, then you might want to base your layout around that. The alternative is to cover a wider time frame. Think carefully about what time scale you want to model.

The most popular time frame is the steam era. A wide range of rolling stock and scenic accessories are available in both the new and secondhand markets. One thought is to build your layout to cover the transition period from late steam to early diesel. This would give you the best of both worlds. You could run the very latest rolling stock, along side steam if you include a branch preservation line in your layout.

**Step 8: Do Even More Research**

Search the internet for model train retailers and find out as much information as you can online. Re-visit the hobby shops in person (spend an hour or so in each) and ask more questions. Shop around and then shop around some more.

The more you know about model trains, the less chance that you'll be taken for a ride (excuse the pun!). Some shop assistants and internet retailers just want to sell… and others may misunderstand your needs and sell you the wrong thing. However, in saying that, in general hobby shop staff have a wealth knowledge and are happy to share their ideas. Also the more research you do, the better you'll get to know your train scales, styles and which manufacturers you prefer.

Toy stores sometimes carry train sets, but often they specialize in the lower end or battery operated market. Hobby stores are generally more specialized and cater more for the experienced enthusiasts. They sell more challenging electrical model trains sets and offer choices from more manufacturers than do most toy stores. Specialist hobby stores usually carry a full range of accessories, as well as railroading books, magazines, DVDs and videos to help you get started. The other advantage is that hobby shops typically service what they sell. Although there are exceptions, hobby stores generally have shop staff who are knowledgeable about model trains.

**Step 9: Join A Club And Network**

Another advantage of buying from a specialist hobby store is the advantage of networking. They probably have contacts at the local model railway club and may be able to put you in touch with the members. Most model railroad enthusiasts are more than helpful and gladly give you the benefit of their experience and introduce you to others with a similar interest in the hobby. This way, you can learn insider secrets and tricks.

Don't think that everyone in a club is experienced. Most clubs enjoy a mix of long-time experienced railroaders and new members. It is a good place to learn, because most clubs encourage the exchange of ideas between members. They swap photos, show films, discuss techniques, network with other railroad clubs and even have guest speakers from time to time. Joining a model railroad club can be

truly rewarding experience in terms of what you can learn, the people you meet and the fun you have.

Also, if possible, take a look at some of the magazines that are available on model railroading. They make for good reading! (see list at end of book)

**Interesting Fact:**

Diesel power has been around since 1901. It was named after Rudolph Diesel, a German engineer born in Paris in 1858. In the 1920s, improvements in reliable controls to match the load of electrical generating and propulsion systems led to the first generation of diesel locomotives in the late 1930s.

**Step 10: Visit Model Train Shows And Exhibitions**

Model Train Shows have become very popular in the last 10 years. Train shows start with a promoter who rents a large space in a hall, convention center, or perhaps a local fairground. The promoter usually invites the local train clubs to put on displays.

Space is rented to "out of town" dealers so that they can show off and sell their ranges of model train sets and model train accessories... in fact, anything that might be of interest to model railroaders.

The selection of items on offer at model train shows is usually far more extensive than a model railroader could expect to see at a local hobby shop. Also, these model train shows can provide a good opportunity to pick up a bargain as they usually feature a range discontinued items at discounted prices. But, that's where you may need to be particularly careful.

Used or secondhand model trains and accessories are a popular attraction at Model Train Shows. This is where buyers need to be careful and know exactly what they they are looking for and what they are buying. Used items don't usually come with any type of money-back guarantee. A dealer selling items at a model train show could be 500 miles away in a few days.  This could provide little (if any) opportunity to return or exchange items, or to get refunds. This is where a local Hobby Shop can offer an advantage because the shop can't hide from you... and, if the hobby shop management is efficient, they will get to know the wants and needs of each individual customer.

So, Model Train Shows can be confusing and they can, potentially, be a minefield of danger for an inexperienced beginner to this hobby.

However, in saying that, there are many excellent "out of town" dealers at model train shows who will do their best to help and who will stand behind their sales. The key is to ask each dealer about guarantees, replacements, servicing... and to

get accurate contact details. Many reputable dealers will gladly supply a phone number to call if you have a problem with something you bought and will work out an exchange via mail.

Model Train Shows are a wonderful experience and a great venue if you want to expand your knowledge of the hobby and talk model trains with like-minded people. The displays of model trains and running layouts put on by the various clubs that participate are usually well worth the entry fee, even if you buy nothing at the Model Train Show.

**Step 11: Start With The Right Tools**

For collecting trains, no tools are really needed, although a few screwdrivers and needle nose pliers are useful for securing parts. Anyone planning to build a layout should obtain clamps, drill, electric saber saw, hacksaw, hammer, hot glue gun, measuring tape, motor tool, pin vise, safety goggles, soldering iron, utility knife, and wire strippers.

## Soldering Track Photo Tutorial

http://www.model-railroad-resources.com/soldering-members-only-tutorial.html

**Quick Tip:**

**A Mirror Can Be A Helpful Tool**

A small mirror or mirror tile can be helpful when looking for kinks, dips and misalignments in track.

To check alignments simply set the mirror on the edge on the track. The mirror will enable you to inspect the alignment of the rails, not by looking directly along the rails, but instead by looking into the mirror at the image of the rails. This will save you from stretching or bending over (no so easy as we get older) or getting track imprints in your cheek. When you bend down and sight along a rail the track can appear to be very smooth. However, by looking at the image of the rail in a mirror, kinks and dips are often easier to spot.

The mirror can also prove useful when placed alongside the track to view the action of trucks and wheels while the train moves over a trouble spot.

Also, consider using a mirror when laying track in difficult locations and even track that is out in the open.

**Step 12: Plan To Expand**

As already mentioned, you don't need to start off big. You can expand your train set as needed. Take your time and add your own personal touches along the way. Building a small layout to start with, will give you a chance to assess your strengths and weaknesses. You'll learn what you can do with ease and what is more of a challenge.

Some people get put off by attempting difficult projects too early and become overwhelmed by a vast array of details, choices and problems. It is much better to start with something you know you CAN do to get immediate results and instant gratification. You can develop your skills and your layout from there by adding new features, extra rolling stock, new accessories, maybe some additional track and another locomotive.

**Step 13: Enjoy Yourself**

Don't lose sight of the objective of the whole exercise i.e. to enjoy yourself and have fun! Model railroading can be more than just a hobby – it can become an addiction and you don't want to get so involved in the process of problem solving that you forget to have a good time.

**Interesting Facts:**

Flemington in New Jersey is home to "Northlanz", which has 8 actual miles of HO track and 100+ trains running at one time. 25 years went into sculpting 35 foot mountains and building 40 foot bridges. It features thousands of handmade buildings and over 10,000 freight cars. Incredible!

Another place worth a visit is the Pasadena Sierra Pacific Club, located in Pasadena, CA, which operates the Sierra Pacific Lines. This is one of the largest HO Scale operating model railroads in the world covering almost 5000 square feet. The railroad has over 30,000 feet of hand laid steel rail. The 1700 foot single to quad track mainline with ten cabs allows for operating of up to ten 30 foot trains (up to 60 cars long). Yard panels throughout the railroad allow for operation of another 15 to 20 trains. Worth a visit!

**Quick Tip:**

If you need to store your electric trains long or short term then here's what to do. Wrap unboxed items in newsprint (blank), butcher paper, or a thick

layer of white paper towels. Avoid printed newspaper or any colored paper as the inks and dyes can run if moisture forms. This can ruin the paint and decals of your models.

Place wrapped items and/or outer carton in a plastic storage box. This will prevent garage floods and attic leaks from soaking a cardboard box and rusting any metal parts. This is especially important for owners of tinplate trains as water/moisture damage can happen.

**Quick Tip:**

Plan your layout to be easily accessible, so that you can quickly and easily fix problems. What can go wrong? Regardless of how good your trackwork is - derailments still happen. Sometimes it's caused by a super-light flatcar being shoved behind a heavy boxcar, or a hopper with out-of-gauge wheelsets somewhere waiting to pick a switchpoint or be forced off the track. S-curves are a hazard for passenger cars. As well as derailments, locomotives stall on spots of dirty track, or on turnouts that have insulated frogs.

None of these things are much of a problem as long as you can reach the spot of the accident. The trouble starts when you locate tracks and turnouts outside your reach. On paper the placing of a critical turnout 36" or more from the layout edge doesn't seem like a problem, but once the yard starts to operate, it can become your biggest headache.

**Interesting Fact:**

The New York subway system serves an estimated 4.3 million passengers per day (around 1.3 billion per year) and runs throughout Manhattan, Queens, Brooklyn, and the Bronx. The trains on the system cover around 1.6 million km (1 million miles) on an average weekday.

## 5 Steps To Building Your Set

By this time you will have an idea of what you want to create? The question now is; do you just launch in and make a start on building it, or do you take your time, or should you think some more about it, or perhaps you're just wondering where to make a start? Well yes, it is important to get started, but it is really important that you go about things in a logical manner to avoid many of the mistakes that "newbies" to this hobby are known to make.

There are definitely things that you should and shouldn't do, so it's better to do it right the first time. With this in mind, here's our checklist of 5 important things to consider when building your set:

**Important Point #1. Don't Rush Things**

Work carefully through the process of building your train set. Do things logically and thoroughly. It takes time to build a great set – it is NOT a race!
If you rush doing things then you'll get stressed especially when things don't go as planned. Mistakes can be costly and frustrating. It is better to think things through carefully step-by-step in a logical order.

Start by drawing some sketches and writing some notes on what you want to achieve. That's a good idea because you'll then have something to refer to and keep you on track (oops another pun!). Take your time and read any instructions carefully before you get started.

**See Our Online Tutorial**
**Building A Frame And Baseboard**

http://www.model-railroad-resources.com/baseboard-membersonly.html

**Important Point #2. Take One Step At A Time**

This might sound a bit strange, but don't try and do too much at first. It is a common mistake. For example, there is no point in purchasing an expensive train set, setting it all up…only to have the base that supports it collapse under the weight of the set. That would be disastrous!

**Quick Tip:**

Determine the required dimensions for a variety of track layouts before deciding on what size to build your train board(s). Depending on the space available, you can modify the dimensions or create a larger modular unit by joining two or more boards together. The tracks for today's smaller-scale trains need to be precisely and firmly attached to a train board that won't warp or bend easily.

**Quick Tip:**

Install Surface Protectors or Legs: You can lay the train board on a table or the floor, rest it on saw-horses or, for a more permanent setup, use metal folding legs. If you intend to lay the board on a table or wood floor, install six to eight floor protectors on the underside. To guide the positioning of saw-horses and to prevent unwanted collapses, tack strips of wood to the underside of the train board to create channels. Or, attach folding legs to boards firmly screwed to the underside of the train board.

The previous two tips are a good example of the basic, but important, steps that need to be carefully thought though from the start. It is best to start small and then work your way up as and when your skills improve. Model railroading is all about doing what you are capable of doing and what you enjoy doing…WITHOUT getting stressed out from attempting too much, or doing things that are overly complicated when starting out.

**Important Point #3. Complete Each Step**

Finish the entire sequence of construction, including any detailing and scenery before proceeding to the next step. In other words, "always finish what you start." Some people try to do too many things at once, but they fail to complete jobs and sometimes do them poorly.

**DO IT ONCE – DO IT RIGHT THE FIRST TIME!**

It is the secret to creating a reliable and outstanding layout… and besides, it will provide you with an enormous sense of accomplishment. It is tempting to jump ahead and skip out on the different stages of construction. Don't do it, because it's all part of the jigsaw and the all-important learning process. The skills you acquire at this level will help you master more complex projects as you progress with this enthralling hobby.

**Quick Tip:**

Having a separate shelf for your transformer and switch controls can be a good idea. There are different ways you can do this…here's one:

With a piece of plywood approx.12x24" and 1x4 and 1x2 pine, you can make a detachable shelf for your transformer and switch controls. Cut the plywood to length so that the support arms will be spaced exactly as far apart as the train board crosspieces.

Decide where you want the shelf and clamp it in place while you bore four 1/4-in.-dia. clearance holes through the shelf supports and train-board crosspieces. Then, attach the support arms to the underside of the train board with bolts. Determine where you want the shelf and clamp it in place so that you bore four 1/4-in.-dia. clearance holes through the shelf supports and train-board crosspieces. Attach the support arms to the underside of the train board with bolts.

**Important Point #4. Fix Mistakes**

Most layouts are a combination of ideas and compromises built over a period of time. Above all, don't be afraid of making mistakes, because they can always be rectified. Even the most experienced railroaders make mistakes at times. And, in reality, it's likely that only you will notice that the mistakes even exist.

It's better to fix your mistakes as you go along, because it's no fun to have to start over from the beginning. Care in design and testing is essential at each stage of the process because, at times it can be extremely difficult to make alterations or correct mistakes. But, in saying that, you shouldn't be afraid to making mistakes, because that's how we learn.

For instance, if your train makes it around a curve only 80% of the time, then why not rectify the problem? That's not to say you don't enjoy watching a locomotive and cars derail (some people do!). To fix the problem it may mean taking the track apart and realigning the curve so that it isn't so sharp.

Why settle for annoying little omissions and mistakes when often they can easily be fixed? If your hillsides are the wrong color why not repaint or touch them up? If the telegraph poles look lopsided, then straighten them. If a light does work fix it. After all, you're aiming for realism here…and besides, repairs and maintenance are part of what makes railroading such an absorbing and fun hobby.

There's nothing wrong with making and fixing mistakes. In fact, when you're just starting off, you will make mistakes. This is a given but you have to learn from your mistakes and then move on, as failure is only feedback. Creating the perfect layout takes time and there's no pleasure in rushing the process. You'll be glad you took that time to get the detail just right especially when you stand back and look at the excellent results.

**Important Point #5. Keep An Open Mind To New Ideas**

Think outside the square, expand your horizons, keep an open mind and be prepared to try new things. This is important, because model railroading is a creative hobby and there are always new ideas and techniques to explore especially when it comes to constructing layouts.

Talk with other model railroad enthusiasts, read magazines, books and surf the net for ideas and contacts. Subscribe to model railroading newsletters and e-zines on the internet to keep up-to-date with the latest techniques. Use the net to join model railroad newsgroups and forums. They can be a wealth of information and ideas and a great way to have your technical questions answered. You can also help others and share any clever ideas you have.

**The important thing is to keep an open mind and keep learning!**

**Quick Tip:**

To accommodate a growing train set, join two train boards together by installing two or more 1-1/2 x 1-1/2 hinges across the joint between the two pieces. Simply remove the hinge pins when you want to take the sections apart. Once you begin to attach tracks and run wiring, don't fasten down the length of track that joins the two sections. It's best to install electrical connections so they can be taken apart between the two sections.

The following is an excellent article I came across written by successful small business entrepreneur Noel Peebles. It's not specifically on the subject of model trains, but it does relate very well to what we've just been talking about. It's short and to the point, so enjoy it!

## Keep An Open Mind Because Life Is A Self-Fulfilling Prophecy

By Noel Peebles

If you haven't got an open mind that's prepared to accept a different way of doing things, then stop reading right now. Buy a novel instead.

The game of life is real and is played between the ears. The way you think determines the decisions you make. The decisions you make determine what you do. And what you do determines how successful you will become. Your present life is the result of the decisions you have made over the years and the same will be true of your future.

You have a great power under your control - the power to take possession of your mind and to direct it to whatever ends you desire. What you choose to focus your mind on is critical because you will become what you think about most of the time. I remember making that comment to a friend of mine and he raised his eyebrows and asked "Does that mean I'm going to become a woman?" Maybe that's taking things too far but…

Life is a series of thoughts and you can become what you think about most of the time. You have the power of choice and you can create the life you want by choosing what to do and what to think about.

What do you really want? That question is at the foundation of all success. Wanting it badly enough... that you will work through problem after problem, and failure after failure, to get what you really want.

If you think you can, or you think you can't, you're right!

What's holding you back from achieving what you really want?

What's stopping you from developing those brilliant ideas?

What's stopping you from turning your dreams into reality?

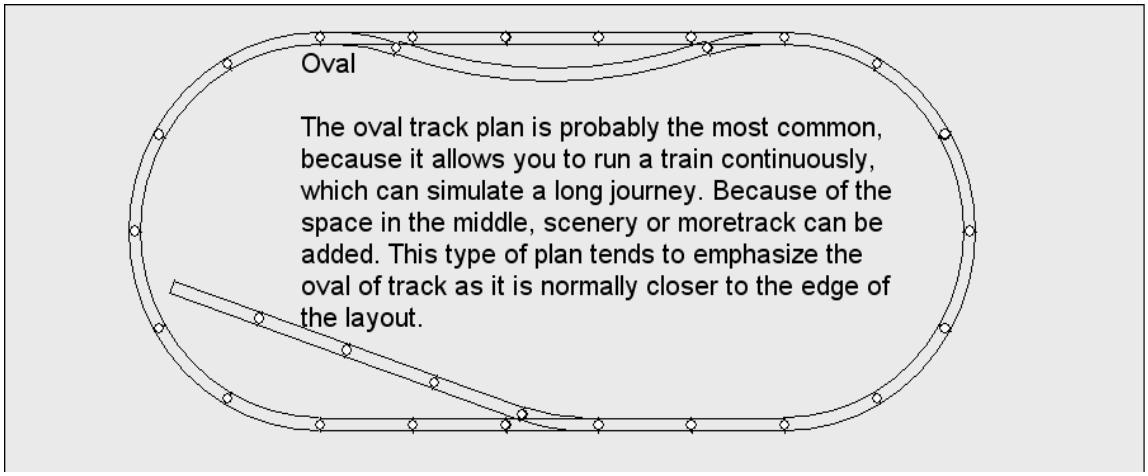
Is it your current circumstances or is it what you are choosing to believe about those circumstances and your power (or lack of) to change them?

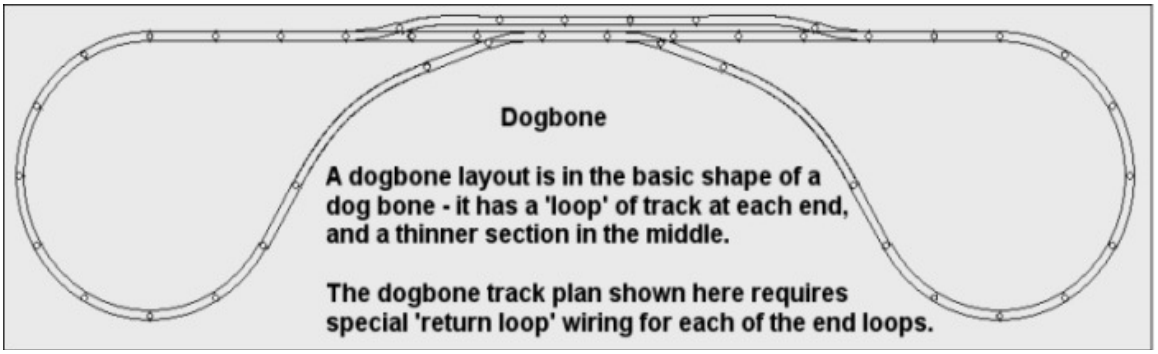
Life is a self-fulfilling prophecy. You create the life you live through your choices and your thoughts. You don't always get exactly what you want, but in the long run you will get what you expect.

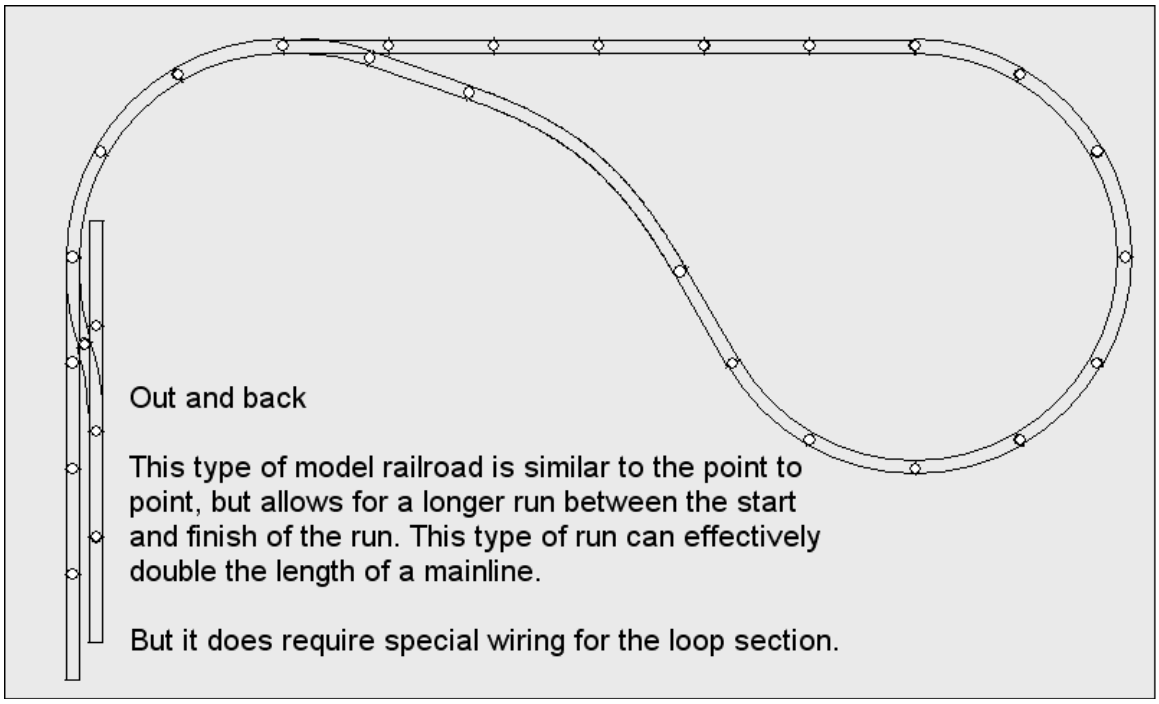
## How Do You Create A Good Layout?

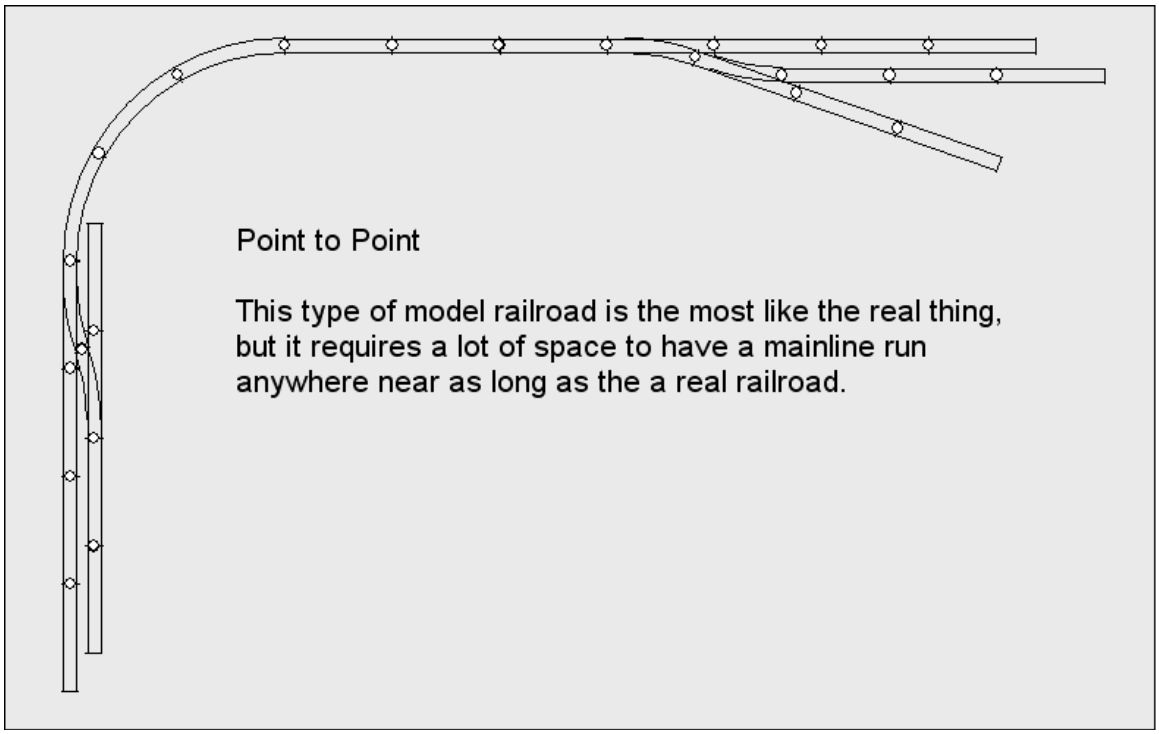
What you create (or recreate) is really over to you. You ideas can and probably will change and evolve as your knowledge expands. That's why you need to be prepared to make changes and add new elements as you go along.

Here are some basic layout options to consider:






Regardless of whether you are replicating a modern day section of railroad or a scene from yesteryear, it's best to research the section of full-size railroad that you will be modeling. Document it physically and operationally, and then scale it down to fit in a reasonable space. The section could be almost anything: shunting yards, a horseshoe curve, engine terminal, industrial theme, town scene, or even an important location from history.

The objective is to then closely replicate the originals or real thing in terms of dimensions and authenticity. In other words, creating a scale rendition of real full size (prototype) trains and surroundings. The huge advantage in this approach is that it can help you to do a better job. By replicating a section, or all of a model railroad, you'll know it will look and operate just like the real thing.

Research the era and location of the scene you are modeling. Take a look at magazines that feature sets from that time period to get your creative ideas flowing. Select the time setting in which you're most interested. The steam era, the transition era from steam to diesel, or maybe a modern day theme…what is your passion?

Whatever you choose, the interesting aspects that caught your eye in the first place can be scaled down - selectively compressed - simply by following the full-sized (prototype) example.

**Quick Tip:**

Sometimes real full-sized railroads have unusual features and things are not always arranged in a way that you would expect them to be. Despite your research, you may not be able to find out why the track and buildings were arranged as they were. Nevertheless, if that's the way the thing are (or were), then proceed to model it in the way it is (or was) in real life. As you learn more, you'll simply confirm that what you already decided to model can be operated realistically.

**Should You Alter Your Layout?**

Layouts, like full-size railroads, aren't cast in concrete. You can construct them using relatively easy-to-change materials like wood, plaster and foam. You need to allow for future growth. It is usually best to start off small. That way you can test as you build, and make changes when needed to improve operation or appearance of your layout.

Layout design and construction are both continuous learning processes. In reality, most model railroads are the result of an ongoing series of changes and additions to the original design efforts. Some even undergo an extreme makeover and are completely rebuilt from the ground up to embrace a new theme.

So, it's best to learn as much as you can so that you can make well-informed decisions during the planning and building process. In this way you'll be able to build a layout in the knowledge that you can still adapt and improve on it as time goes on.

**Quick Tip:**

**Safety First For Model Train Layouts In Lofts**

When space is limited in the family home, model railroaders of try and think outside the square when locating layouts. A lot of people decide that a loft is a great 'out of the way' place to set up a model train set. Yes, a loft can be a good solution, but be careful and do your homework first.

Unless the loft has been properly converted there is a danger that you may overload the ceiling joists (resulting in cracked ceilings in the room below). There could also be the possibility of overloading the entire roof trusses resulting in a collapse... far worse scenario.

Always seek professional advice, because some roofs cannot be modified safely to accommodate a load bearing down from "inside" the roof. If in doubt consult an engineer, or at least an architect before locating your train set in a loft.

**Is The Scenery Important?**

Trains don't just run through an empty landscape, so the scenery (geographical setting) is a vital part of any train layout. Constructing the countryside and cityscape through which your train will travel can be tremendous fun. You need to consider the era, geographic location, and relative prosperity of the area being modeled.


## 9 Tips For Creating More Realistic Scenery

**1.** Choose geographical area for your train to travel through and select a time period.

- Don't mix eras - putting 1970s building in a turn-of-the-century Western theme. Or putting a 1980's Honda model automobile in a fifties-era scene.

**2.** Hunt around for a locomotive and cars from that period and location.
**3.** Study the architecture of the buildings from that time period.

- A book from the library or surfing the internet will give you some ideas.
- Ask at your local model shop about buying suitable buildings.
- You may prefer to construct them yourself with balsa wood and paint.

**4.** Find out what kind of shrubs and trees are likely to be found in that area. Little details can add to the realism. Get model trees that look like native species from your hobby shop or make them yourself.

5. Select a season of the year. Depending on the geographical location, you might need deciduous trees and snow in winter, colorful foliage in fall and beautiful flowers in spring and summer.

**6.** Add excitement to the scene.

- Tunnels and a bridge will add interest to a layout. You'll need a rail station too.
- Put operating signals at crossings. Use either a set of crossing flashers or a flasher and drop-arm combo. Kids (and adults too) are mesmerized by these 'lights and action' items.
- Other ideas like a working grain elevator, water tower, coal loaders, or a control towers help complete a scene. Be creative, but specific, with your scenery.

**Quick Tip:**

A scrap yard can make an interesting addition to a layout. No scrap yard would be complete without a pile of old tires stacked up. Automotive vacuum hose (from an auto parts store) can be cut up with a modeling knife to represent tires. The hose can usually be purchased in short lengths and comes in different diameters... and it's cheap to buy. Cut the tires, glue them together and pile them up. They'll need to be weathered a bit and perhaps plant some weeds in some of the outer tires for added realism.

**7.** Add realism.

- Make sure any vehicles and rail crossings are from the right era. One idea is black washing the grilles and hubcaps to add depth and realism. Using a small brush you can also paint taillights, parking lights and door handles if needed. Then consider taking the cars apart and install drivers and passengers. Nothing looks more fake on a layout than vehicles seemingly driven by invisible ghosts! You can purchase miniature figures in male, female and child variations all molded in 'flesh' color. The arms must be attached by gluing. Then the figures can be painted. Sometimes, the figures won't fit between the steering wheel and the seat. It sounds a bit cruel but you simply cut the legs off with pliers and they fit just fine. Use flat (rather than glossy) model paint to make painted clothing and hair look real.
- Keep things to the right scale relative to the trains.
- Also remember to include figures in period dress. You can never have too many people on your layout. Put them everywhere - on streets, station platforms, walking out of shops, etc. Buy a few from different manufacturers to add variety.
- Use darker colored ballast in middle of your track. Most real railroads have ballast that is naturally darkened in the center of the track - from oil drippings. Use dark ballast around tunnel entrances, too.
- Buy tunnel portals. They look much more realistic at a tunnel entrance than a rough-cut hole. You can 'weather' them with gray-wash, chalk, etc.

**Quick Tip:**

To add realism to a scene make it look like a car has driven through the dirt or grass. After you have put down the grass, take an eraser and rub off some grass to look like tire tracks.

**Quick Tip:**

Splattered mud is easily simulated with an old toothbrush. Dip the brush in dilute (preferably water based) paint and flick splattered "mud" (paint) on to the model. If you are weathering a freight car, work from the underside as mud splashes up from below. It can be messy so be sure to wear old clothes.

**8.** Cover most of the scene with greenery.

- Slopes and inclines always seem to add interest to a scene. Vary the shades of green for your grass, bushes and trees.
- Add roads and buildings or colored gravel.

**Quick Tip:**

Sawdust can be an inexpensive material for making ground cover. Buy some fabric dye from the supermarket or hobby store. Mix up the dye according to the directions and start adding your sawdust. Keep adding the sawdust until all the liquid is gone. Then put the colored sawdust in a baking dish and put in a warm oven for an hour or so to dry it out. Once it's dried and cooled, bag it up to store it until you're ready to use it. You can apply it to the ground with white glue and to trees with spray glue or hairspray.

**Quick Tip:**

To model weeds, hay, straw, and grass get some "binder twine" from a farmer/horse owner. The twine is a natural (unlike the new plastic stuff) material that takes paint/stain well. It also weathers naturally. Hang some outside for a year and it will look like fall weeds, let it lay on the ground and it will get a grayish color. The twine can be cut in very short lengths and used as some ground cover.

**9.** Add detail.

- Blacken the insides of tunnels. Use flat black on all interior surfaces - walls, ceiling and floor. There's nothing worse than a beautiful layout with a plywood-colored tunnel interior. Tunnels should be dark and mysterious.
- Make grade crossings look real. Use black painted balsa wood, plastic strips (or even tongue depressors) as inserts to cover the railroad ties at road crossings - giving the crossing a more authentic look.
- Add some period advertising signage. Scan old magazine ads and resize them with a graphics program to create one-of-a-kind, realistic billboards and signage. You may also want to consider adding eye-catching animated neon signs.

The more detail the better but avoid making it too busy. Too much activity is distracting and ruins the image of your train traveling great distances. Don't leave open spaces where, in real life, there would likely be activity. Always keep in mind that you are trying to re-create a scene from history or real life. You're not just creating a mix of elements for your train to move through.

**Quick Tip:**

The late John Allen was famous for his Gore & Daphetid (Pronounced Gory & Defeated) layout and was equally famous for his clever use of mirrors. John Allen had more than 30 mirrors on his layout, most of which were undetectable. Using a mirror can add depth beyond the backdrop. For example; a mirror can reflect a road, or track, and make it appear to continue. A mirror can also be placed at the

end of a shunting yard to make it look double in size. Using a mirror is a simple technique, but can be very effective especially when used on a small layout.

## How Do You Build Scenery?

Landscape features like hills, valleys, small canyons, rivers, meadows, mountains and even tunnels can be constructed using a variety of materials, such as foam, plaster, Hydrocal and paper maché. White styrofoam board (also known as beadboard and polyfoam) is a popular material with many railroaders because it is easy to handle and inexpensive. A 4' x 8' sheet of 1 ½" thick sheet is a good size to work with. It is easily cut and shaped and releases no chemicals or odors when cut.

### How Do You Use Styrofoam?

It's time to get artistic! Get the hacksaw and electric knife and cut the styrofoam creating a rolling shape. You can make small canyons, valleys and even shape rivers and ponds. Save the scraps and carve them into smaller bumps or rock shapes. Glue the styrofoam together with white styrofoam glue. You can also use a hot wire foam cutter. This can be a big help if you are building a large layout.

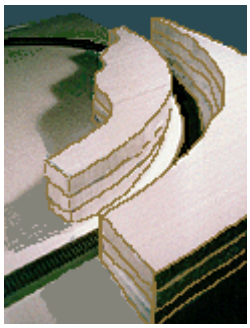
The styrofoam can then be colored with acrylic paints or sprinkled with simulated grass to add to the realism of the scene. When applying simulated grass, use a clean dry paintbrush to move the grass around. It is best to use a stippling action with the brush. Push it into all the cracks. For best results - don't skimp with the grass.

### How Do You Make Rocks?

Rock outcroppings will add a lot of detail to your landscape. Take a small piece of foam and carve it into shape with a hacksaw blade or shape knife. Use acrylic paint to get the desired brown/gray color and paint the foam. While the paint is still wet add some contrast color like a light tan or light gray to the high points of the rocks. Then add a darker color such as black to the cracks. Clean your brush by dipping it in water and gently brush over the surface to blend and settle the colors into the crevices. This will add to the realism. When dry, brush on some glue and sprinkle on some grass.
Remember, rocks are not always perfect in shape, so irregular shapes may look best.

You can also buy **rock molds**. They are durable, flexible and well-detailed and easy to use. Lightweight Hydrocal is used to cast small boulders, rock outcroppings, top rocks for fields and creeks, or entire rock faces. Plaster castings release easily and completely.

**How To Build A Tunnel**



Make a template of the size tunnel you want. To do this slide a piece of paper under the track and mark it out. Cut out your template and recheck its size. Transfer the pattern to a piece of the styrofoam and cut it out. Unless you have really thick foam, you will need to make at least 3 identical foam cutouts and stack them one on top of another to get the proper height of the tunnel. Once cut, glue and stack the three identical pieces of foam as mentioned above.

Depending on what materials you use there are different ways to build a tunnel. Here's an easy but effective method.
White glue or any type of Styrofoam glue will work. If you want to secure the pieces together while the glue dries, push some long nails into the foam or use some temporary tape.
Take another piece of Styrofoam and cut out a lid or top for your tunnel. You don't need to be too fussy about exact fit because you can shape these pieces to fit later. Let the glue dry, then shape and paint the foam.

**Building Mountains Step-By-Step Photo Tutorial**
http://www.model-railroad-resources.com/members-building-mountains-4th.html

**Quick Tip:**

To build **fences**, there are lots of materials that can be used as a complement to the plastic fences you can buy in the model railroad shops. For example: wire-mesh, mosquito net, fiberglass, matches, sewing cotton and small branches from real trees.

**How Do You Create A Pond?**

Ponds are very easy to make when you have styrofoam as your base. The first step is to get your vacuum cleaner handy as this results in a bit of mess. Just mark out the shape you want and wire brush the foam until you get a depth of about 1/4".
Brush the pond base and surrounding area with glue. Sprinkle simulated grass carefully to the area surrounding the pond. If you spill the grass into the pond, remove as much as you can. If you leave it there it will look like a swamp.

To add the effect of water to the pond, begin by brushing brown acrylic paint from the center of the pond outward to about an inch of the shoreline. Then dilute the color a bit nearest the shore by thinning the paint. Let the brown paint dry, then put a small amount of black paint in the area where you want the water to look the deepest. Dip your brush in water and blend the edges of the black into the brown. Let dry completely.

If you want to create the effect of a still, clear pool, begin by modeling and painting the underwater landscape. Then, using a sheet of clear acetate you can simulate the water effect. You sandwich the acetate between the landscape material layers.

**How to you model a waterfall or rolling brook?**

Crumpled cling film or clear plastic wrap is an option to mimic moving water. Stringy glue can be used to simulate a waterfall. The trick is to pull the strings from the top of the falls to the bottom to simulate water falling. Using a hot glue gun is one option worth experimenting with, as the glue can be stretched out using the gun (be careful not to touch the glue to your skin as it is hot and will stick). Dark water presents fewer problems, as it can be sculpted to shape and then painted the most appropriate color.

Another idea is to use Envirotex®, a two part epoxy-like coating used for craft projects. This is excellent for a making realistic water effect. It is available from most craft and hobby stores. Mix equal parts in a clean container and pour it into the pond. It will level itself but you can help it out with a small brush if you like. Leave it overnight to dry.

There are also several craft products available from your hobby shop to create very realistic looking water. One such product is called 'gallery glass' which used for making stained glass hobby items. It comes in several colors. The crystal clear color can be worked to create a surface that looks like moving water. Cut out a river shape from cardboard or plastic. Later on, this can be recessed into the white styrofoam base (if that is what you are using). The cardboard (or plastic) will be a good surface on which to apply the glass stain. It will also prevent the glass stain from reacting directly with the styrofoam base. A white colored base material will help bring out the colors in the stained glass paint. Start by painting over the base

section with a basic blue color. Apply it thickly so that it will dry with a rippled effect.

Use toothpicks to tease in other colors like pearl white for rapids. The toothpicks can agitate the stained glass paint so that it will dry with ripple effects. The greens, silvers and blues look great too. You can also glue in rocks and tease in white around them to simulate rapids and foaming water. Remember, always test new products on a sample piece of the material, as products (like styrofoam) react differently when they come into contact with certain substances.

**How Do You Model A Drainage Canal?**

Streams or drainage canals often run alongside railway lines. The water effect can be achieved using a 4 inch wide strip of Acrylic Perspex. A mixture of dirty gray, black and green paint is applied to the underside of the perspex and is then set into the scenery. Perspex generally comes with a protective film of clear plastic, which could be left in place whilst you construct banks to the canal or stream. It is important to be accurate when calculating the relative heights of the water surface and the railway line. The banks of the canal can be built up using 'sculpted' styrofoam covered in a combination of newspaper, white PVA wood glue and wall filler.

**Quick Tip:**

To avoid damage to your model train set consider attaching foreground scenery in such a manner that if anything is hit during an operating session, it will break away. It's much easier to glue an object (telegraph pole, figure, vehicle) back in place than to glue it back together. White glue is good for attaching these details, because it will bond to non porous materials enough to hold them in place, but not enough to attach them securely.

**How Do You Create Roads?**

Roads are usually an integral part of the scenery on any model railway. Often the roads are not modeled as well as the other scenery, and when this occurs the entire effect suffers. Yet when you know how, modeling roads is easy, fun and reasonably inexpensive. In fact, you probably already have many of the materials to model a realistic road or freeway.

The main ingredient to use is joint compound or it's sometimes called drywall mud. Get the 'lightweight' version because it works better. It has less shrinkage which results in fewer "mud" cracks when it dries. Lightweight joint compound can sometimes be hard to find at the hardware store, so you can use regular joint compound as an alternative. Because it takes longer to dry, joint compound is a better material to work with than plaster. The slower drying joint compound gives you more opportunity to form and smooth out the road before it sets hard.

You'll need some white bead-board Styrofoam (also called polyfoam) for the base surface of the road. Styrofoam is inexpensive and easy to carve out features like culverts and ditches. Using this material it is easy to make natural dips and rises just like on a real road.

Think carefully about what is the best width for your roads before marking them out or laying the road surface. When you've made your decision start masking the area. Remember that not all roads are the same. Rural roads are not usually as wide as the roads in the city. It is a good idea to position some scale vehicles alongside the roads you are building. This will help you determine the width. A two-lane road in HO scale would normally be 3 to 3.5 inches wide as a bit of a guide.

The next step is to apply the joint compound directly to the base using a trowel that is approximately as wide as the road. Spread the joint compound to a depth of ¼ to ½ inch. A light mist of water sprayed on the joint compound helps to spread and smooth the road surface. If you spread the joint compound too thick it is more likely to crack, so don't lay it on too thick. However, you will need to make the road thick enough so that a small crown can be sanded in the road later.

It's a good idea to let the roadways/pavements dry before applying grass as the grass may stick to the road.

It is best to leave the joint compound for two to three days (depending on the thickness) while it drys out. When completely dry it should no longer feel cool to the touch, and will be ready to sand. Start with a coarse grade sandpaper (No. 60), and shape the crown. Then use a finer grade sandpaper, No.150, to sand out any rough marks left by the coarse paper.

The finishing off is usually done with No. 220 fine grade sandpaper. It is a messy so you'll need to vacuum up the dust and expose any air bubble holes, cracks and any other irregularities in the surface. The next step is to repair these with a small application of joint compound. Let it dry and then sand to a smooth finish No. 220 sandpaper.

Road colors do vary depending on what they are made of, how much they are used and the weather conditions they get exposed to. Asphalt roads tend to lighten in color as they age. Concrete roads tend to turn a bit darker with age. So, to keep it simple, duplicating an asphalt surface is the usually the easiest option. Flat latex in gray is probably your best choice, and use a darker or lighter shade to match the look you want. Floquil's "concrete" or "aged concrete" gives a good effect. Colors tend to dry a different shade so it pays to test a small area first.

You'll then be ready to add the centerline to your road and any painted parking bays. Scale Scenics make several different styles of self-adhesive road stripes in HO scale, or check with your local hobby store if you are using a different scale. The stripes do come with a self-adhesive backing, however a light coating of spray

adhesive helps them stick to the road. Take care not to peel the paint if you have to reposition the stripes. Laying the stripes in 2 foot lengths will be easiest.

Another method is to use brass stencils, available at your hobby shop, for the road markings. Hold them down with wax paper. You could use masking tape, but it is more likely to lift the paint. Spray light mists of paint, rather than one heavy coat, to prevent leakage under the stencil. If paint does lift, sand the spot gently with wet-dry No. 600 sandpaper. Then touch up the area with a fine paintbrush. Tar lines can be added using a fine black ballpoint pen, but try it out on a scrap piece of road first.

That's your road finished, or you can take it a step further. To add more realism you can weather the road to make it look like there's been some traffic on it. Use an airbrush filled with Floquil grimy black diluted with paint thinner (1 part paint to 4 parts paint thinner.) You can also utilize the same paint to create a darker stripe down the middle of the road.

Use an airbrush to achieve subtle tonal effects. Remember, it's easier to add more paint than to take it away if you've overdone it. So, go lightly on the weathering process and have fun creating a amazingly realistic road that will enhance your layout wonderfully well.

**Is There A Simpler Way To Make Roads?**

Yes, there is, although it's not as effective. Simply glue sandpaper to the painted baseboard. Use an extra, extra fine grit sand paper for paved or concrete roads and coarse grit sandpaper for dirt or gravel roads. Once painted, the sandpaper looks really good and does the job, although the earlier option does look best because the sandpaper doesn't contour as well as Styrofoam and paint.

Here's another quick idea to make inexpensive roads. Buy some non-skid tape (2 or 6 inch wide) which can be used for a black top road. You then use some white car detail tape for the white line down the center of the road. Result quick, inexpensive roads!

**How Do You Add Grass Ground Cover?**

There are all kinds of products on the market for adding landscape colors and textures to add realism to terrain contours. They include grass matting (pictured).

The grass matting comes in rolls or sheets and is cut to fit and glued down. The grass matting has the feel of coarse fir and allows you to cover a large area quickly with no mess. It is generally more resilient than using scatterings sprinkled on to simulate grass .

Other methods to simulate grass include very fine, short hairlike substances, as well as foam and flock scatterings that can be sprinkled on.

The colors and effect of foam and flock scatterings vary depending on whether you are wanting to simulate ground cover textures on a forest floor, or very realistic looking grassy fields, or perhaps model tall grass on areas like shores and mountain slopes. Shop around and you'll be surprised with what is available.

When applying foams and flocks you first paint the board (or landscape)under the scattering the desired greeny color. After the paint has dried spread glue over the area you want to cover. Use a lot of glue as this stuff can easily fall off. Then spread the scatterings over the glue. It is a good idea to use a sieve to control the amount you use. A small brush can also be used to move the scatterings into all the gaps. Neither are essential but are useful. After the glued has dried use a clean dustpan and brush gently to collect all the lose scatterings so they can be re used. Don't use a vacuum cleaner because this can cause damage by pulling of a lot of the glued down material.

Another option to give an impressive 3 dimensional effect is grass blades charged with static electricity that are dropped on a flexible mat of fiber/lint or glued onto painted landscape. The grass made by German company Noch is in the form of tiny synthetic fibers, in various lengths and colors.

**Quick Tip:**

Static grass is great if you want to create a detailed scene. On the other hand if you are creating a sweeping landscape for a high speed train to pass through, then the scatter grass (mentioned earlier) is probably best as it wont be as distracting to the eye.

If you do decide to use static grass then Noch also make a simple puffer bottle to apply the static grass to white PVA woodwork glue. The grass blades become charged with static electricity and stands on end, giving that 3D effect. The little flock applicator puffer bottle helps tremendously with persuading static grass to actually stand up.

If you are using the Noch Static Grass then here are a couple more tips. Sieve some of the grass fibers to remove any clumps and remember to give the bottle a gentle shake every so often to loosen any clumps. Only fill the puffer bottle about half full with static grass and then puff away. A surprising amount of control can be soon attained using this and once you get the hang of it you will wonder how you ever did without it. It is best to build the grass up slowly working around the area, puffing from different angles.

The static grass is available in a range of colors and lengths like long wild grass, short summer grass and short spring grass. It's best to experiment before starting on your layout. A good technique is to lay down some long grass, and then over lay with short grass. Any bald patches can be touched in after, and laying one layer on top of another can produce some interesting visual effects. The key is to test different techniques.

**Using Surgical Lint To Create Grassed Areas**

Here is a clever idea. Surgical lint can be used to achieve a realistic grass effect. Dye the lint an olive green color before laying it. The intensity of the color will vary depending on how long you leave the lint in the dye. The longer it is left in the dye the darker the lint becomes. Using dye can be messy so it pays to prepare in advance. The dye powder can make a horrible mess if it blows around, as it is highly concentrated and will permanently stain clothes and carpets. It pays to spread newspaper over counter tops and use an apron to protect clothing.

An old clean bucket will be ideal for mixing the dye powder with water. The depth and darkness of the hue can be varied depending to how long you leave the lint in the bucket of dye. Read the instructions on the packet on dye as it will guide you as to how long to leave the lint soaking. Remember, the longer the lint is left in the dye, the darker the final color tends to be after drying.

Leave the lint soaking for the required time, then remove the wet lint from the bucket. It can then be wrung out to remove excess water and dye. The lint can be spread out and hung to dry in a warm place (watch for drips that could stain). All going well, the lint should dry a grassy green color.

**Applying The Grass To The Landscape**

Paint the landscape shell a green grassy color before applying the lint grass. This helps to camouflage any bald patches. After the paint is dry use an old paintbrush

to evenly apply a thin coating of white PVA woodwork glue. It pays to do only small sections at one time as the glue can dry reasonably quickly in warm conditions.

After spreading the glue apply the dyed lint to the glued area with the lint fibers facing downwards into the glue. The trick is to apply enough pressure to make sure that the glue spreads into every little corner without soaking up into the backing part of the lint.

Too much pressure can ruin the final effect and too little pressure can result in unsightly bald patches. So apply gentle pressure evenly.

The lint should be left to thoroughly dry overnight before carefully pulling the backing off the lint. If you do this correctly you should be left with the green fibers sticking up to closely resemble long grass. A sharp scalpel knife can be used to carefully separate the fibers from the backing if the surface of the scenery starts to lift away when removing the backing from the lint.

This method of making grass cover can look extremely effective, but even with care, a few bald patches or shiny patches can result. These can be touched up with the help if a small paintbrush or air brush. If necessary you might want to glue on some extra lint to disguise any bald patches.

Depending on the result you may want to look at touching up other areas of the grass with shades of green, brown or yellow paint. Again use a paintbrush or an airbrush, but be aware that the fibers can matte down when more paint is applied. If this happens wait until the paint is dry and then try fluffing up the grass using an old toothbrush. The lint fibers can also be trimmed with scissors if they are too long.

# Making Natural-Looking Trees And Shrubs

Most hobby shops will stock an interesting range of accessories including trees and lichen. Some enthusiasts even use real twigs. Trees are very easily 'planted' by poking a small hole with a nail and inserting a tree with a dab of glue. It's best to use a variety of tree sizes, types and shapes to add realism.

**How can I make natural-looking trees?**

Natural looking trees will add realism to any layout. You can either buy them ready-made…. or save yourself some money, apply your creative genius and make them yourself. Making trees and shrubbery is not too difficult and can be a lot of fun. Here are some different ideas:

**Method 1. Trees & Scrubs**

To make your own trees you'll need some 3/8 inch balsa wood dowel. It usually comes in three-foot lengths. You'll probably get two or three trees out of one length of dowel depending on the height of your trees. Simply saw the dowel to the lengths you want, then use a rasp to shape each dowel to resemble a tree trunk. Spray the trunks a matt brown color and leave to dry.

To make the greenery, use artificial fern. It normally comes in packs of 10 from a craft/hobby shop or artificial flower specialist. The branches can look really good. You can paint them any color you wish, using a brush or spray can. Remember to let them dry overnight. The next thing is to cut off several of the fronds, leaving a little bit of stem on each. To add realism vary the lengths. Then arrange them according to size for easy assembly.

The next things you'll need are: some scissors, tube of glue and a drill with small drill bit. Begin at the top of the trunk and drill a hole through the dowel. Then insert the stem of one of the small fern branches into the hole with a dab of glue.

You then turn the trunk (a quarter turn should be enough). Then drill another hole about a quarter of an inch lower and glue in another fern branch.

Continue this process down the trunk, gradually making the branches longer as you make your way down the truck of the tree. For 3 or 4 turns do the same size, and then increase it to the next size for another 3 or 4 turns… and so on.

You can then spray the tree with hairspray (use a cheap brand) followed by a sprinkle of woodland scenics ground cover at the base. When using hairspray use only a light coating. Any more will cause an ugly 'frosting' effect that spoils your work, so be careful.

Using the same dowel and glue method you can use other dried floral materials such as baby's breath. To mimic a deciduous tree in autumn spray the tree a golden brown color, and then add some Heki Flor to give it an individual character.

**Quick Tip:**

There is a temptation to make trees too small. This probably because many people live in housing developments that were built less than 40 years ago. In real life mature trees can be huge with some trees being 80-100 feet or more in height.
If you are modeling conifers or other large trees here's what to do. Take your longest passenger car, turn it up on end, and make the trees taller, up to half again as tall.

**Quick Tip:**

When positioning your trees keep in mind the loading gauge of your widest and longest rolling cars. Check to see if the trees will be too close to the tracks BEFORE you glue them into place.

**Method 2. Trees & Scrubs**

Conifers always look good. So here is another method you could try, this time making conifers:

Start by splitting cedar shake shingles into 1/4 to 1/2 in wide pieces lengthwise (with the grain). Use a belt sander with a coarse grit belt to rough them out round and taper them to a point. Be careful because this can be a bit fiddly. Leave some grooves in them to mimic the bark texture.

Get a 'cut to fit' reusable (washable) furnace filter (sometimes called a "horsehair" filter) – it is very coarse with no cardboard frame. Then cut it into several different size squares, ranging from about 5 inches square to 1 inch square. Trim them to rough circles. Pull them apart (make them thicker and less dense) and spear them on the cedar shake trunks in from large to small sizes.

Spray the branches heavily with the hairspray and sprinkle liberally with extra-fine ground foam ground cover (dark green). Woodland Scenics fine turf is ideal and comes in a suitable color called 'weeds'. Hang the trees upside down and plant them when dry.

**Quick Tip:**

Other scenic effects like bushes and hedgerows can be made using similar methods to making trees. Wild flowers can be reproduced by planting short strands of sisal string and painting the tips or applying a small amount of colored fine foam and vacuuming the rest away when the glue is dry.

**Method 3. Trees & Scrubs**

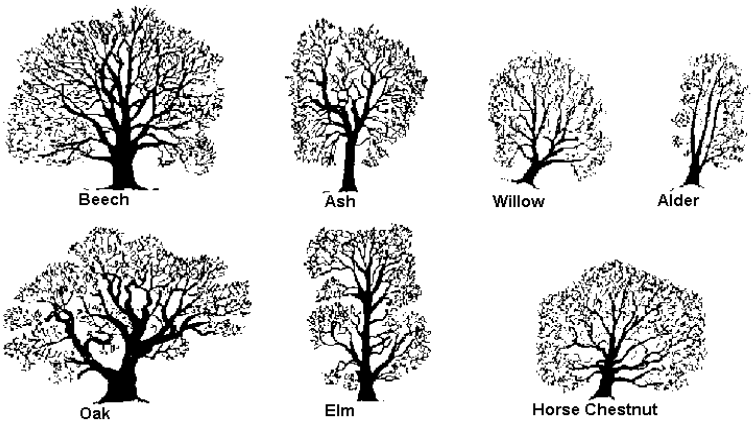
Here's another method you might want to try. Get some wire, preferably steel, but copper strands from electrical leads will do. Start by cutting 12 to 18 lengths of wire 4 to 6 inches long. You then twist the wires into a basic tree shape (trunk and branches). The next thing is to apply some glue on the trunk and the base of the branches.

Get some thick cotton thread (not a bright color). Wind the cotton thread around the trunks when the glue is still wet. Wait overnight for the glue to dry. Then paint the branches (including the ends of the branches) and trunk.

Leave this to dry. Put some glue on the trunk and stick brown 'turf' or ground bark to the trunk. Leave to dry again (approx 24 hours). Use Woodland Scenics foliage for the leaves. Finish with a light misting of hairspray.

Make your trees in batches of 5 to 10 trees at a time. This batch size is large enough to make several trees at once without getting bored with repetition.

**Make Realistic Trees Using These Tree Profiles**




**Method 4. Trees & Scrubs**

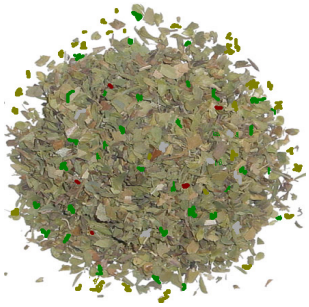
A plant know as "Sea Foam" has great potential to make delicate, realistic looking trees. Depending on where you live it could be sold under a variety of different names. I've even heard it called 'forest in a box'. Ask at model railroad shops and hobby suppliers.

Sea Foam on its own looks like small scale trees, but looks a little artificial and boring without some work. It tends to come slightly curved, so some manipulation will be required to get a proper tree shape. Try assembling a tree from various sprigs of Sea Foam rather than using just one piece. Use a larger piece as the main trunk and to which you will add sprigs for branches.

When joining pieces of Sea Foam together, you may need to strengthen the joints with fine brass wire. To add a greater girth to the bottom of the trunk wind a few pieces of irregularly torn masking tape around the trunk and seal it in with a mixture of wall filler and white glue.

When you've finished creating the basic tree skeleton, give it a quick spray with a dark greeny-grey/brown color aerosol paint. When the paint has completely dried, the foliage can be added by spraying the skeleton with spray adhesive or hairspray. The skeleton can then be dipped into fine ground scenic foam of the color of your choice. Alternatively you can apply foliage matting (like from Woodland Scenics) to the tree skeleton.

Another low cost idea is to use dried kitchen herbs for creating scale leaves. Different herbs and combinations of herbs create different effects. Dried herbs like Oregano, Thyme, and Parsley can be easily glued to the Sea Foam branches with spray adhesive. Put some old newspapers under the branches when you sprinkle the herbs over the tree foam. This way you can catch any herbs that don't stick and reuse them on other branches.



After giving the tree skeletons a thorough coating of the herbs give them a coat of matt Varnish. The matt varnish will help seal the herbs and remove the stickiness of the spray adhesive. The trees can then be left overnight to dry.

After the trees are fully dry, some modelers then like to apply a coating of a white PVA wood glue/water mix by using a spray bottle. This can be done by hanging the trees upside down on some string and again left to dry over night.

If possible, plant the trees on the layout permanently. A couple of suggestions:

1. Use a small length of brass rod (1mm would do) which is glued into the base of the trunk and a small hole pre-drilled in the ground.
2. Or you could simply drill a small hole in the baseboard and then fill it with glue. The trees can then be inserted and the glue left to dry.

Note: Although Sea Foam is reasonably delicate, it is strengthened by the various coatings that are applied. The trees should be sufficiently flexible to withstand the odd brush with a careless hand or wrist. Also note, that some dried herbs can go brown over time, so you may want to add some green paint to the trees.

**Method 5. Trees & Scrubs**
The most inexpensive idea of all is to search your garden for twigs and other things to use to make trees and shrubs. Little twigs are great for this (Ones that are not green on the inside). Cut them up into little pieces and make cordwood, or logs or fire wood for your not so obvious scenes. These twigs should be coated with a clear wood preservative, found in any hardware store. Simply drill a hole in the board and glue in the tree.

You can make a thousand or so trees for next to no cost when you consider common weeds and plants as the source. Things like: sedum, yarrow, oregano, snakeweed, ragweed and other plants.

**Quick Tip:**
The increase realism of scenery consider adding clumps of long grass and weeds sprouting through the ballast and at the bases of buildings etc. Old fashioned carpet underlay (which you can now buy in model shops or at exhibitions specifically for scenic use) is ideal for this purpose. You could also use Heki puff grass.

**Sagebrush Tree Construction Step-By-Step Photo Tutorial**
http://www.model-railroad-resources.com/members-trees4th.html

**Positioning Your Trees**

Everyone has different ideas when it comes to positioning trees on a layout. Some modelers prefer to model the scene to authentically represent the prototype railroad. For example; fire was a potential danger in the steam era.

Trees and other vegetation were often cleared from alongside tracks to prevent fires being caused by the burning embers from the chimneys of steam locomotives. Sparks from the tracks were also a problem explaining why leaves were sometimes cleared away. This was especially the case near stations as leaves could make it impossible for a locomotive to pull away after taking on passengers.

Nowadays the proximity of large trees to overhead power lines has replaced the problem of burning embers.

Storms can also create havoc and necessitate the clearing of trees and vegetation alongside track. Trees get blown over in stormy conditions blocking the track bring down power cables. Tree branches can also trip out the power lines resulting in them having to be reset.
So, it is over to you whether you want to take these kind factors into consideration when positioning trees on your layout. You may prefer to do what a lot of modelers do, and simple position trees and vegetation where they will look best.

## Buildings Add To The Realism

It's usually easiest to buy kitset buildings from a hobby shop, unless you want to build your own. There are numerous kits you can assemble; the easiest ones are the snap-together plastic models. Apply thin washes of acrylic paint to these buildings to give them an interesting patina of age and weathering. This will add to the realism of the scene. Use an up-down motion to simulate the way nature would do it.

**Quick Tip:**

Buildings can make even the smallest layout seem much larger. Even in a town scene buildings should have some space between them. Giving buildings breathing room makes the layout appear to be more realistic and it requires less effort!

**How Do You Select Buildings?**

Buildings can say as much about the scene you're modeling as the trains. So, it is important to select buildings that match the era and geography of the theme. For instance; the architecture of buildings in New Mexico would look very different from those in the coastal Carolinas or in the Dakotas. Wood is the preferred choice for construction in the Eastern and Northern areas of the USA, whereas in the desert Southwest, stone, clay and concrete are common construction materials.

Non-modelers often pick up the clues given by buildings and structures, even though they know nothing about the railroad elements. So don't get caught out!

**Quick Tip:**

Shiny surfaces can spoil the realism of any model train layout. Shiny surfaces can make model buildings and model trains look fake as though they have just come off a shop shelf. A simple way to remove that shine is to over-spray the structure or rolling stock with Dullcote (Testors #1260 clear flat lacquer overcoat). Dullcote is available at most hobby stores and comes in a small spray can like many other model car colors.

**Are The Roofs Important?**

YES! Roofs are a visible part of model railroad structures, so it's important to pay attention to them. Roof pitch and overhang seems to differ significantly from one region of the country to another. For instance, buildings in the 'snowbelt' have steeper roof pitches as a rule to help shed the snow, while buildings in warmer regions tend to have a shallower pitch to the roof. Also, the type of roofing material used tends to vary, depending on the region and the value of the building.

**Quick Tip:**

An easy way to make windows on buildings. Look for some clear plastic packaging strips and cut them to fit a window. Place two drops of glue above the window and place the window on top. Let Dry. Then you can put masking tape or colored paper partly on the plastic to make blinds! It is an easy and inexpensive way to make windows.

**What About Other Accessories?**

You can add all sorts of accessories to your layout, but don't get too carried away. The whole purpose of accessories is to add realism. Automobiles and figures can enhance a layout, but they need to be from the same era and of the same scale if you are after realism.

**Quick Tip:**

You don't need to pay retail for everything. Think about what you could use from around your house. Many household items that normally go in the bin can be used on your layout so next time you throw something out; think again.

For example, tea leaves, saw dust and even cardboard tubes. Try crushing an old brick or tiles into small pieces and scatter the pieces around to look like small rocks. Those styrofoam meat trays you throw away can be carved to make realistic cliffs and walls. And, even though you will need to buy things, you don't need to buy everything at once. You'll get more enjoyment when your railroad is a developing work-in-progress.

**Quick Tip:**

Kitty Litter is worth experimenting with. It is cheap to buy, so some people use it as an economical form of ballast roadbed. You can use it for gravel roads, or put it by your cement plant to be used in concrete.

Another idea is to use kitty litter as carloads for gondolas and hoppers. You can mix it with watered-down white glue. Try to shape it into little piles for more realism. You can also paint it black to represent coal. Kitty litter can be a bit rough to use, however it is economical and worth a try depending on what you want to create.

**What Else Should You Do?**

Attention to detail is important when creating an accurate reconstruction. Keep good records and create an effective plan in the building of your model railroad. Include information on why the original full-sized railroad was built. Keep records on the type of customer it served, or materials that were hauled, or the passenger fares charged etc. This all adds to the enjoyment of your hobby when you aim to recreate a particular railroad in a particular era. In a way, you almost become a time traveler… and it is a great talking point with visitors.

## Explain Weathering Techniques

Throughout this ebook I give you several tips on weathering, which is basically the art of taking something new and making it look like something old. It could be locomotive, caboose, a building, a bridge, a tunnel, a road, a fence, or any element of scenery for that matter. Almost anything ages and changes over time.


For example; when you buy a some rolling stock it comes packaged all shiny, plastic and new. It probably looks too perfect, unreal and out of place alongside the other cars on the track. It may need "roughing up" to make it look used, or at least show some signs of wear and tear.

It really comes down to deciding if want to "rough-up" the factory paint job on the very expensive rolling stock you've just purchased. But, like it or not, shiny new cars usually look out of place on an otherwise "used looking" layout.

In reality; most cars on a railroad show varying degrees of rust, grime (lube and oil), mud, soot, denting, scratches and some are even covered in graffiti. However, cars do vary in age and usage, so they shouldn't necessarily all look the same. And, not everything is dirty, because the contact on bare metal can keep some areas clean.

So, it is a case of thinking carefully about the age and likely wear and tear that you want to mimic... and whether you are prepared to "rough-up" your rolling stock for the sake of adding realism.

Also, think about the region or era you are recreating. Is it likely to be muddy at times or would it be more dusty and arid like in a desert? For example, the rolling stock might need a sun-bleached look, which can be achieved with dullcoat brushed over with some rubbing alcohol. This will give the model a kind of a white milky haze. If you don't like it, respray with dullcoat. However, always test techniques on something else before you try them out on your prized models, because you may not like the effect.

Here are some weathering techniques to get you started.

**Pastel Chalks And Pencils:**

Most art or hobby shops sell pastel chalks individually or in sets of assorted colors. When ground-up, pastel chalks can be ideal for simulating roof dust, rust, dirt, grime and soot. The chalks can be scraped with a knife blade or a file onto a piece of paper and then applied with a stiff brush.

When you are happy with the result, you can fix the chalk permanently in place with a spray coat of Testors Dullcote. The good thing about using chalk, is that it's not permanent until it is sealed in place. If you are not happy with the result, or you make a mistake, you can simply wash the chalk off (as long as you haven't sprayed it).

Colored pencils can be used to add streaks and marks around rivets. A common graphite pencil can be used to leave graphite marks that look like steel, or exposed bare metal, or to simulate worn metal on steps and rungs.

**Dry Brushing:**

Dry brushing is when you use a nearly dry brush to simulate rust and grime. The trick to getting a nearly dry brush, is to dip the brush in paint, and then wipe it off on a paper towel or sponge. Dry-brushing causes the leftover paint to cling to all

the high spots on the model, highlighting the detail. Dry-brushing can make the weathering look less one-dimensional.

Dry-brushing is also a good technique for highlighting truck detail, walkways and ladders. Floquil Polly Scale Reefer Gray is a good color choice for highlighting details like lines of rivets etc.

**Bounce-Weathering:**
This is when paint is sprayed from an airbrush, or aerosol can, onto a piece of cardboard at an angle. With a bit of trial and error, the paint bounces off the cardboard onto the model in nearly dry specks.

Bounce-weathering can simulate the various types of grime and dust that flicks up onto cars and locomotives.

**Acrylic Wash With Airbrushing:**
When it comes to weathering, using acrylic paint is generally better than using oil-based paints. Acrylic paints don't leave an oily sheen and can be easily removed if the effect is not what you want.

Acrylic paints mix well together and can be thinned with water or straight from the tube. They can be thinned right down and applied with a soft brush as an acrylic wash (just like a water color artist uses them). It is usually easier to add move color rather than apply too much and then try and remove it.

Acrylic washes can be very effective for creating subtle color variations, rust marks, fading, and all kinds of streaks and grim spots. Natural colors like raw sienna, burnt sienna, raw umber and burnt umber are choices to start with.

After applying an acrylic wash and letting it dry, it is usually worth over-spraying with an airbrush to add to the effect. Floquil Polly Scale Dirt is ideal for this purpose, because it can easily be brushed or airbrushed without obscuring surface details. Airbrushing alone can sometimes be too uniform in color and coverage, so a mix of acrylic wash and airbrushing solves that problem.

Other colors worth using include: Polly Scale Concrete, Rust, Grimy Black, Mud, New Gravel Gray and Railroad Tie Brown.

Some cars need an oxidized look (with the rust and grime) which can be achieved using Rustall liquid. Start with a base wash of diluted acrylic burnt sienna paint to get rid of the sheen.

Then apply some pastel chalk, followed by Rustall liquid to give an oxidized look, and finally a couple of coats of Rustall black wash. If it looks too oxidized, you can lightly spray on some more Dullcoat to have the oxidization effect fade away.

**Ink & Alcohol Wash:**
Drawing inks can be a useful tool in weathering process. Ink washes work well on buildings and wooden rolling stock where the wash acts like a wood stain (to age the wood) and also penetrates the groves between each board.

For weathering decks try using a mix of 70% isopropyl alcohol with a few drops of india ink added. This mixture can be wiped on with a rag to simulate a weathered worn deck.

Inks can bring out details in plastic or metal, they can be used to add mortar lines to plastic brick buildings, used to stain plaster. Also, use inks to simulate fuels spills on tank cars and locomotives, as well as shading the insides of coal cars.

When using an ink/alcohol wash on rolling stock the ink tends to seep into any cracks, crevices, or seams and around the molded details, adding to the realism. Use a black ink on darker colored rolling stock and brown ink on a lighter colored cars.

Let the ink wash dry before spraying with Dullcote. You can then touch it up with pastels/colored pencils and spray again with Dullcote. To get a whitish glazing effect you can add more alcohol washes over the Dullcote.

**Weathering Wood Cars:**
Weathering in-service wood cars isn't all that different from weathering steel cars. You need to tone down the shine, add a layer of general grime, add weathering to he roof, and add detail highlighting. Keep in mind the era you are mimicking, remembering that the cars might have been almost new at time your railroad was operating.

Some cars should be new and shiny, some should be due for a repaint and the bulk would be in various stages of wear and tear.

To weather a wood model, you want to make it look like the paint is coming off. That's what weathered wood does. Start with a thinned acrylic wash then dry-brush a silverish gray where you want to simulate lost paint.

**Weathering Wheels & Couplers:**
Something you probably should consider is weathering the wheels, couplers and truck side frames. Even brand new wheels have a coating of rust.

Buy some unscented hairspray in a pump-action bottle. Then you just screw off the top and pour a small amount into a bottle cap. Apply it using a throw-away brush and add some weathering powders to get you a textured rust effect on the wheel fronts (and backs). A slightly lighter application can be used on the couplers. Then check for free-play after it dries.

**Adding Dents:**
At some time or another we've all stopped at a rail crossing and watched a train go past and probably noticed varying degrees of denting on the cars.

Replicating dents on a model train can add to the realism, but be warned, this is not easy to do and there the risk of causing unintended damage to the cars.
If you are going give it a go, start by removing the trucks and couplers from an of an ore car, old gondola, or steel boxcar. Remember, the idea is to give the impression that the car has been dented by cargo falling against the inside wall of the car.

This effect can be achieved by using heat to deform the plastic outwards to simulate denting from the inside. Again, I warn that this can be tricky and the result is not always as planned. So, be warned, you might want to try out on an old piece of plastic before working on an expensive car.

Use a soldering iron (not set too hot) to gently press against the inside of the walls. You could also use a heated screwdriver, but again you need to take care and don't break right through the plastic.

**Adding Scratches:**
Use a hobby knife to scratch horizontally along the sides where car doors slide back and forth. You can also scrape off bits of paint to represent flaking.

**Changing Numbers:**
One of the problems with buying duplicate cars from the same manufacturer is that the numbers on the cars can be all the same. Although it might seem like a minor point to an untrained eye, it is a detail that can detract from the realism you are trying to create.

There are ways around the problem. One option is to alter or remove a car number by gently scraping or sanding away a digit. Another method would be to alter one of the numbers with matching black or white paint (maybe a 3 could become an 8 or visa versa). You might also choose  to completely remove the existing numbers and start again using dry transfers or decals.

Remember though, that the numbers should show varying levels of normal wear and tear and shouldn't look too clean and tidy. Some numbers could be partly obscured by grime, soot and even show signs of flaking.

Weathering is an art and usually involves some experimentation to get the desired effect. The big thing is DON"T OVERDO IT! Once you get it down, the hardest part of weathering is knowing when to stop. Less is better until you get the hang of it. And remember, get photographs of real weathered railroad cars from magazines and books to use as references.

**Quick Tip:**

Level crossings always seem to look far too clean out of the box. Consider applying a small amount of dark wash (a thinned down black paint). Apply it only to the hinge and connecting rod areas of the gates. These were the parts that were greased regularly and would usually look greasy. Avoid over weathering as it can make the gates look "grimy" and "uncared for". Also try this wash effect on older freight yards etc.

**Quick Tip:**

Also use subtle visual effects to add realism like dripping and pitted rust.

For instance, forklift operators will sometimes use their forks to open or close the box car door, thus creating big scrapes along the sides of the doors. Simply determine where your gash, scrape or dent is likely to be located. Then, with a fine tip brush, apply rust color paint in a downward motion from your gash, scrape or dent. For best results you may need several shades of rust color and you may need to apply several strokes.

Pitted rust or smaller marks can be the result of kids throwing rocks at a passing box car. With care you can simulate those effects by stippling tiny marks on the car using your fine tip brush and rust color paints. Be careful not to overdo the effects. The more random, the more real.

## How Do You Create A Small Layout?

If you only have a small space in which to set up your layout, then you are not alone. There are a lot of people around in apartments and small houses with only limited space at their disposal. In this situation H0 scale (1:87) is a possibility, but the smaller N (1:160) or Z (1:220) scales may be more feasible. When you use a smaller scale or narrow gauge, you'll need less space, or can use the available space to achieve smoother curves and switches. Many enthusiasts that have small layouts use sectional tracks, because they find it easier than bending flexible track to a smooth but narrow curve.

### What Are The Limitations Of A Small Layout?

When you plan a small layout, it's important that you know the limitations the small space imposes on you. Although the space you have available might limit your choice of scales, the major limitation is usually in the choice of themes you can model. In most cases main line themes wouldn't fit.

Whereas, given that you only have a limited space available, industrial, branch line and tramway themes are possibly the best options to consider. If you must have a mainline theme, but don't have space for it, then you'll probably have to scale it down.

If don't want to compromise, then don't start a small layout. There are a number of differences that you will need to accept or adapt yourself to: the curves may be too sharp, the angles of the switches may be too steep, and the sidings too short. With a small layout everything is compressed to the max. But when you think about it, although a small layout may not be your first choice, it is better than no train set at all!

My follow-on ebooks include excellent sections on creating a small layout, micro layouts and modular layouts. Highly recommended
http://www.model-train-layouts.net

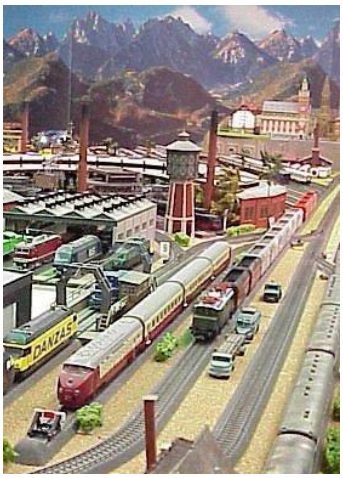
**Can You Adapt A Small Or Large Scale Layout?**

It's not just people with a limited space who build small layouts. Most railroaders who want to build a large-scale layout, soon discover that their large space is smaller than they thought. Some people say that for a small layout you can use elements from larger size layouts. In theory there is some truth in that, but when you think about it, some large size layout themes cannot realistically be used for their small size variants.

On the other hand, using small layout designs for large size layouts usually works. This is because; you can simply blow-up the designs to achieve a more realistic layout with smoother curves and switches, longer tracks for more cars and create possibilities for more realistic scenery.

**Interesting Fact:**
10,000 Square Foot Of Model Railroad Track
When visiting California the Golden State Model Railroad Museum is well worth seeing. The museum has 10,000 square feet of O scale, HO scale and N scale model railroading. Inside the Golden State Model Railroad Museum, you will find three large model railroads, constructed and operated by the East Bay Model Engineers Society (EBMES). The museum is located in Point Richmond, California (just north of San Francisco, at the north end of the East Bay).

## What Is LDE?



LDE is short for Layout Design Element and is a term you will hear a lot when model railroading. It basically refers to elements in a layout design. It is when you base your model train layout on a real full-sized railroad (prototype), document it physically and operationally and then scale it down accurately to fit into a reasonable space. In doing this you focus on just one aspect of the full-sized railroad at a time. It could be a town, engine terminal, shunting yards, horseshoe curve, or an industry with which the railroad is connected.

### Why Is LDE Important?

The "Layout Design Element" can help you do a better job of designing part or all of a model railroad, because you are focusing on just one element of the full-sized railroad at a time. By doing this, you will get to know how the real thing looks and operates, before you begin construction of your scaled-down model.

There is no one "best way" to design a model railroad, but there are certainly proven methods that should be considered. LDE is one such method and will help you achieve realism and functionality (if that is your aim). It is a form of discipline, because it stops you from making assumptions about what should look right and operate well. It takes away the guesswork of how a full-size road operates and in arranged the track.

## 7 Steps To Make LDE Work Best For You

Running just anything on a model railway with scenery that was just thrown together because it looked nice is nothing like duplicating the real thing with LDE.

### 1. Choose Your Prototype

Choosing a prototype, whether a specific station on a specific day or just a general region over a period of years, gives you a purpose for everything on your model railway.

You could model your prototype from a section of full-sized railroad that is currently operating, or you may have a favorite period in railway history that you could select from. The first thing that you need to do in choosing a prototype is to choose the location. First select the state, country, or continent to base your model railway on. The locality can then be further refined as far as is necessary. You may want to focus on a particular company or group of companies to define the location

of the layout more closely. The availability of ready to run models and kits for the various localities in your chosen scale will probably influence your choice.

For instance; if you are modeling North American and choose the DRGW then you perhaps decide that the layout is based somewhere near Denver. Choosing GWR places your location somewhere in the south west of England perhaps in Devon.

For these examples you make a different decision as to precisely how the layout is being located. Each has defined a locality, so with attention to detail you could recreate a far more realistic model than could otherwise have been produced.

The next thing to choose about your prototype is the time period. This will already have been decided to some extent by your choice of Railway Company, because the company may have only existed between or after a particular date.

Research is needed to get accurate details. A bit of detective work on your part is required to gather this information from magazines, books, watching DVD's, surfing the net, visiting museums, talking with fellow railroaders, and even attending historical society gatherings. It can all help to piece the jigsaw together. And, researching your prototype can almost become a hobby itself as you strive to learn all about it.

**Quick Tip:**

When researching your prototype look for the distinguishing features of the railway company. Did they try to avoid using facing crossovers? Did they like using single slips wherever possible? Were the platforms normally directly opposite one another, or did they like to stagger them? What style of station buildings did they use? Were their signals upper or lower quadrant and what style of post and signal arm did they use? What colors were various parts of railway property painted? What construction materials were used?

While reading about your chosen prototype you will also find information regarding train formations. Which locomotives pull what trains? Which wagons run directly behind the locomotive? This information is also useful because it will help you to better decide on how you will assemble your trains for greater realism. By doing this research early, you'll get an indication of what rolling stock is needed and you'll then be able to research if it is readily available or not.

**2. Accurately Define The Layout Space**

Make accurate measurements in all three dimensions. Define the layout space and be really detailed about what you would like to include. Be sure to allow for all projections into the space, especially overhead objects such as beams, ductwork, and piping that people (you included) could knock their heads on. This is especially important when designing multilevel or mushroom layouts, as these place greater emphasis on using vertical space.

**3. Accurately Align Your Straight Tracks With Easements For Curves**

Easements help align the straight track (or tangents) with the curves and make it easier for trains to go around curves. They may also help where space is tight, as it's often better to include easements even if this forces you to reduce the curve radius slightly to accommodate them. Easements are also required in vertical curves at the top or bottom of grades.

You can plan out an easement by creating a template or using the CAD software. The easements can be as short as 1.25 to 1.5 times the length of the longest car or locomotive to be operated.

**4. Make Your Layout People-Friendly**

Model railroads are always constructed, operated, and maintained by people. It is therefore important that you plan your railroad in a way that it makes it easy for you to maintain and operate. You'll get more enjoyment out running, or working on a layout, if everything is within easy reach. 24-30” is about the realistic limit for most people to reach and manipulate objects with ease.

When people need to lean over a layout cars on tracks near the front of the layout can get knocked over and scenery can get damaged. If you must have tracks that extend past 30” deep, make sure the turnouts leading to them are in reach, since that’s where most problems happen.

For maintenance purposes you'll need easy access to the layout. You will want to make sure that you can get around easily and handle any needed repairs. You can be absolutely certain that the most difficult section of track-work to reach will be the toughest to build and always cause you the most grief.

If you are tall, remember that your friends or visitors may not have the same arm span as you do. Layout height makes a difference too, as does distance between decks on multi-level designs. And, not forgetting when there’s more than one engineer on duty… you won’t want a collision of people, or trains.

**Interesting Fact:**

**Model Train Set Layout Stretches 7 Miles.** The Greater Midcontinent Railroad Company was founded in 1991. The HO scale model train set layout occupies approximately 20 by 30 feet of the basement of the Garrett Historical Society Museum, Indiana, USA. The model train layout has about 7 scale miles of track, which typically takes 20 minutes for trains to complete a circuit.

### 5. Use Templates For Drawing Turnouts

Using software templates will help the progress run more smoothly. Making mistakes is easy when estimating the length of track required, or the angles of turnouts, especially when trying to do it in your head. Using templates can eliminate the guesswork and subsequent disappointment. You can make your own templates, or you can use computer software.

CAD software enables you to produce quality prints and makes everything easier, for layering, ease of making changes, to 3-D rendering.

There are a variety of commercial design programs available. Most of them can perform amazing functions, especially if you are prepared to invest the time to master them. They can be a bit of a steep learning curve, but unless you have a really small layout, they're well worth mastering.

**Quick Tip:**

If manual uncoupling is used, yard ladder tracks should ideally be aligned so that the uncoupling locations on each track are easily visible. Track spacing should also be sufficient to provide access for manual uncoupling - 2 1/2" in HO and not much less in N (fingers don't get smaller) is usually about right.

If you're using automatic uncoupling then tracks can be closer together. Uncoupling sites can be out of direct view, but uncoupling devices will still require some sort of visual markers. A pole, or a dab of paint on the side of the rail will do the trick. Also, keep in mind that automatic uncoupling requires higher standards for coupler installation and maintenance.

### 6. Avoid Sharp S-Curves

Create straight track (tangents) of suitable lengths between curves in opposite directions. This will help you avoid hidden “s curves”. They are the ones that are created by crossovers between adjacent tracks and turnout arrangements. By adding an appropriate tangent you’ll prevent reoccurring derailing accidents that can happen when using longer cars and less flexible "stiff-legged" steam locomotives. Hidden "s curves" can easily catch you unawares and become a major problem when you encounter them. Adding easements, and/or increasing the curve radius do help to avoid these problems.

**Quick Tip from model train hobbyist for 28 years...**

*"Here's a quick and cheap way to make evergreen trees and shrubbery that is perfect for an N scale layout. Get a green fiber scouring pad. Tear it apart in varying sizes and thicknesses. Paint round toothpicks either dark brown or gray and set aside to dry while you tear up the scouring pad. With a hot glue gun place a dab of glue where you want the lower limbs to start. Then quickly slide a wide piece of torn scouring pad down the trunk and into the hot glue. Add more pieces of scouring pad (getting smaller as you go), by sliding them down the trunk. They will be held in place by the friction of the trunk. The top piece is again set in place with hot glue and shaped into a peak. Trim to shape with scissors and you're finished."*

**Jamie M, model train enthusiast for 28 years.**

**Quick Tip:**

The easy, inexpensive way to create telephone lines on a layout, is to get some 6lb fishing line from your local tackle shop. Measure out enough fishing line to run a length of the line from one end of the telephone pole route to the other. Add 10% to this length and cut the line. Get a black felt tip marker pen. Hold the fishing line in one hand and pull it between the felt tip and your thumb to mark the fishing line until it is black. Put the line in the sun for about 30 minutes to dry and soften it a little. Tie a knot in the line to attach it to the first telephone pole insulator. Once the line is tied put a drop of glue over the line and insulator.

Then, at the next pole simply put a drop of glue on the insulator and position the line in the adhesive at the base of the insulator. This should hold it in place so that you can do about 3 - 5 feet in one go. If you want to create high tension type lines then use a 10lb line. You may want to experiment with different sizes. Also, don't forget to run lines to buildings... after all they need electricity too!

## 7. Build With Flexibility In Mind

Circumstances chance, so at some stage in the future you might find yourself moving house. For this reason it is a good idea to design a layout to facilitate moving it. Aim for flexibility, so that the layout can be moved easily, with a minimum of disruption or damage. Consider modular construction. It works well as you can disassemble the sections and put them together again when you relocate to a new location.

Most modelers make track-work changes once their railroad is built. After completing your initial layout, you too may want to alter or expand your track and include other features. For this reason, it is a good idea to allow for flexibility and

change in the building process. This way it will be easier to accommodate any design modifications that may be necessary or desirable.

**Interesting Fact:**

The longest train journey in the world without changing trains is 6,346 miles (10,214 km.), from Moscow, Russia, to Pyongyang, North Korea. The train trip takes almost eight days with only one train a week taking this route.

And in Asia... Every day East Rail carries about 800,000 passengers. 48 domestic passenger trains travel into and out of Hung Hom station every hour during the morning peak period.

Hong Kong's heavy rail network is primarily arranged on two axes. Since electrification in 1983 patronage of the East Rail route has soared almost six-fold. A fleet of 451 GEC-Alstom-built EMU vehicles share the same tracks as trains continuing to Shanghai and Beijing, as well as commercially vital freight, mainly container traffic.

## Another 9 Important Considerations When Planning Your Layout

### 1. Think About Your Wiring Requirements

From a planning, safety and reliability point of view it is best to think through your wiring requirements as early as possible in the building process. Most layouts have three main wiring requirements:

- Track power, which includes wiring for switch motors and structure lighting
- Command control bus lines
- Signaling

With most train sets there is always the potential for interference between wires carrying relatively high voltage and current needed to run the trains and those carrying low-voltage control signals. This explains the need to separate them.

Identifying these routes in advance helps prevent interference if electronics such as command control and logic circuitry for signal systems are added at a later stage.

**Quick Tip:**

When wiring your layout to operate points, lights, power feeds, etc. always use different color multi-stranded flexible wires. Plan first with a diagram and record the colors used for each function for future reference. You will find this invaluable when checking for faults later. It is true that, the advent of Digital Command Control systems has helped alleviate interference problems. In saying that, it is best not to ignore such concerns by haphazardly group wiring.

## 2. Stay In 'Walk-Around' Control

Gone are the days of sitting in a central control pit and watching the trains go around. Now it is all about operation. The engineer needs to be able to follow alongside the train, so 'walk-around' control is an important consideration when building a layout. But even 'walk-around' designs can be compromised when a track cuts through the base of a peninsula, keeping the engineer from following the train.

Command control has made 'walk-around' operation much easier to achieve. Radio and infra-red wireless throttles, which avoid "plug-and-chug" crew movement, are becoming increasingly popular.

## 3. Be Comfortable

Don't skimp on comfort because you'll probably spend a lot of time at your layout. Any operating session can easily run for 2-4 hours or even longer, so comfort is important. Standing for long periods on concrete floors is not desirable so consider carpeting where possible. If your feet get really tired try some pliable rubber matting. And not forgetting the off-duty crews that will need a comfortable crew lounge so they can rest in comfort and prepare for the next shift.

**Quick Tip:**

To get the best from your layout:

- Aim to have a heavy locomotive with adequate power available.
- If you want to run really long trains then it's best to have clean track that is level or with only gentle curves.
- Keep your trains well maintained. The wheels on the locomotive should be keep clean, traction tires clean, bearings lubricated (including side rod linkage on steam). Have the locomotive motor checked regularly. Rolling stock should have clean wheels and lubricated bearings. Couplers should move freely to maintain alignment.

**4. Railroads Don't Operate In Isolation**

Very few model railroads depict an isolated part of a countrywide or statewide rail network. Most railroads connect end-to-end or cross. So, depending on your layout, you may need to allow for moving traffic between your railroad and one or more railroads.

**5. Railroads Need Interchanges**

Where railroads cross, interchange tracks are usually constructed. This is so that cars can be delivered and received from each other. Interchange tracks offer more traffic variety, because almost any type and number of cars can be found there. An interchange track is often a quarter circle (more or less) in one quadrant of the level crossing.

To simulate the work of railroading you'll want to operate a car-forwarding system. Having a car-card-and-waybill system is for efficiency in forwarding cars to their proper destinations.

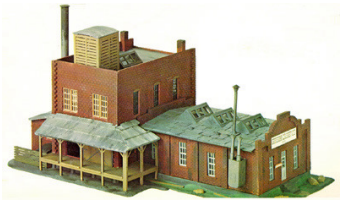
**6. Think About Your Traffic Control**

Small layouts can get by without a dispatcher and/or train-order operators, but these are typically the most challenging and realistic jobs on any railroad. This is especially so, now that timetable and train order operation is becoming more popular.

**7. Include Lots Of Switching**

Industrial switching and yard work can present a lot of interesting challenges for modelers. That's why most modelers enjoy a lot of switching. So, unless you prefer hauling heavy freight trains up steep grades, you might want to consider building in lots of yard and local work…and incorporating lots of switching.

**8. Add Large Industries**



Large industries can add enormously to a layout because of the workload they generate. Smaller industries aren't usually as busy, and more than likely won't even fill one semi-trailer a week, let alone several boxcars or covered hoppers per day. For this reason it can be more interesting to model one large industry that can generate a lot of rail traffic using a variety of rolling stock. For instance: a brewery, steel mill, lumber yard, or a paper mill.

**9. Add Sound**

Sound was at one time considered a novelty for modelers, but now thanks to technology, the possibilities are endless. Digital Command Control (DCC) sound

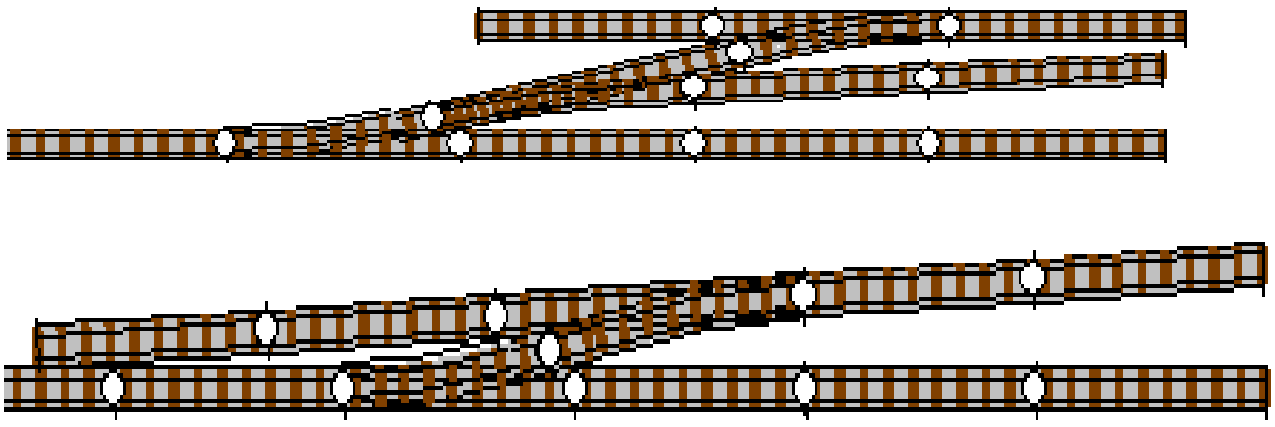
allows for phenomenal realism. Operators can now use whistle or horn signals to support operations such as sending out a flag or alerting a train being met or passed that another section is following.

## Electrically Joining Two Baseboards Photo Tutorial

http://www.model-railroad-resources.com/electrically-joining-tutorial.html

## How Track Geometry Affects Laying of Parallel Track

On most model railroad layouts, as on the prototype, there is often a need to have two or more tracks running parallel to each other. Parallel tracks can either be the mainline, or the different tracks inside a yard, or a passing siding where two trains going in different directions cross. Turnout geometry can affect whether two tracks will be parallel or not. You may have seen turnouts described as #4, #5, through to #8. Using two or more turnouts with different # values can cause problems when trying to lay parallel track. Below is an example of a #4 turnout and a #6 turnout used in the same yard area.
Notice that the center track in the yard is not parallel to the others. This is because the turnout used for the middle track is a #6 turnout while all the others in the example are #4 turnouts. A similar problem is shown in the diagram below, where two mainline tracks are connected by a set of turnouts.



Notice that the tracks are not parallel again, because a #4 and a #6 turnout has been used for the crossover. The example below is how the above example should look:

This is achieved by using the same type of turnouts, in this case two left hand #4 turnouts.

Another thing that can help you to lay flexible track is measuring the distance between tracks at regular intervals, say every foot or so, to check that the tracks are the same distance apart.

Below are some hints to help you lay parallel track either in yards or on the mainline.

- Measure the distance between tracks at regular intervals to make sure they are the same distance apart. If using non-flexible track, you need only measure the distance between tracks at the end of the piece you are laying to check that they are parallel. If you are using flexible track, you should measure the distance between tracks about every foot for straight tracks, and more often on curved track, to ensure the tracks are parallel.
- You could  make a small piece of scrap wood into a device for keeping tracks parallel that should be parallel by simply placing the scrap piece of wood between each piece of track to make sure they are the distance apart that you want them before you fasten the track to the baseboard.
- Use turnouts from the same manufacturer, and with the same track geometry (eg. all #4's, or all #6's, etc), when laying track in a yard, or when using two turnouts in a crossover to join two parallel tracks. The types of rolling stock you plan to use will affect your choice of which type of turnouts to use – longer rolling stock and locomotives generally require higher numbered turnouts.
- If you are new to the hobby of model railroading you might want to consider using one of the brands of non-flexible track for any parallel track on your first layout. There are a number of brands available, either with or without molded plastic trackbed which you can choose from. If you use track with molded trackbed, you won't have to ballast your track either!

**Interesting Fact:**

The Indian Pacific Train travels from the Indian Ocean all the way to the Pacific Ocean. This famous ocean to ocean train trip across Australia is one of the world's longest and greatest train journeys.

This train journey from Sydney (on the East Coast) to Perth (on the West Coast) covers 4352kms. The Indian Pacific Train travels from the spectacular Blue Mountains to the treeless plains of The Nullarbor, where the train travels the world's longest straight stretch of railway track (478 kilometers).

Passengers experience three nights aboard the train as well as scheduled stops at Broken Hill, Adelaide and gold rich Kalgoorlie. A remote outpost on the Nullarbor Plain called Cook, population 2, presents a further opportunity to stretch your legs.

The Indian Pacific passenger train first ran in February 1970 from Sydney Central to East Perth linked New South Wales, Victoria, South Australia and Western Australia but by-passed Adelaide, the capital of South Australia. The Adelaide rail terminal (with standard gauge connection) was opened in May 1984.

## 5 Track Cleaning Methods Explained

Keeping the track clean takes just a few minutes on the average model railway. Keeping tracks clean makes for trouble free running and helps keep debris from your locos wheels and motors, ensuring good electrical pick up and hassle free operating sessions. If any of these parts are dirty then electricity can't do its job and the set will fail to run efficiently. If your set is running poorly (or not at all), it could be a sign that the track needs cleaning. Cleaning the track is not usually difficult but it is important. It is over to you which method you use as modelers seem to have their own preferences. Here are some methods that can make a big difference to the smooth running of your set:

**1. Use A Pink Eraser.**

A pink eraser (typewriter eraser) is probably the most commonly used method for cleaning track. They are cheap to buy, easy to use and generally work well. You simply lightly rub the tops of the rails with the eraser. However, there are a couple of drawbacks. Erasers tend to leave behind a dirty rubbery mess, which can eventually get into the locomotives mechanisms.

Erasers can be particularly troublesome around point-work, because the rubber gets into every nook and cranny. This can cause the point blades not to make contact on the rails and result in unreliable running.

**Quick Tip:**

There is little point in cleaning track if you don't clean all loco and rolling stock wheels at the same time.

### 2. Methylated Spirits Or Industrial Alcohol

Some model railroaders prefer methylated spirits  for cleaning. It can work well, but the colored dye in it can sometimes remain on the rails after cleaning. An industrial alcohol is probably as good as anything if you wish to use a liquid.

Just lightly soak some some meths or industrial alcohol into a rag and lightly rub away the dirt that has accumulated. Make sure the room is well ventilated and DO NOT SMOKE while using this method. Likewise, do not use this method if there is a naked source of heating in the room. And, store it safely away from children, pets or heat…and carefully dispose of any cleaning clothes etc.

### 3. Use Brand Name Cleaners

Use an organic-based cleaner such as Goo Gone (US/Canada)…it uses citrus oils of some sort, and works very well. Goo Gone is great for removing dirt and oxidation from the rails without harming any of the plastic parts. Use a track-cleaning car of the roller type, or else a lint-free rag. Use a dry rag to wipe up the remaining dirt after wiping with the cleaner-wetted rag.

Commercial products available for cleaning include: Formula 49, Bright Boy, Goo Gone and Wahl Clipper Oil. Wahl Clipper Oil has been around for a long time and not only cleans the rails but also improves conductivity.

### 4. Attach A Pad To A Car

Because the pads aren't permanently attached to the car, you can remove them at any time. These pads won't clean the track if it's especially dirty, but they help maintain track already cleaned. The pads have to be sanded clean before each cleaning (or operating) session, otherwise they end up just spreading dirt.

Another way to maintain clean track is make your own inexpensive track cleaning car using a small piece of Masonite hardboard (or similar). You then attach (glue with epoxy) it to the bottom of a car (wagon) with a couple of nails or pins so that the pad can slide up and down, and slides along the track. The pad should have rounded edges. The weight of the pad is enough to hold it to the rails, so it polishes the rails as the car moves along.

**5. Avoid Abrasive Cleaning Blocks**

Abrasive cleaning blocks can scratch the rails. Never clean the track with wire wool as it will leave strands, which will cause a short across the track and trip the controller. Also, never try to clean the wheels or electrical contacts with 'wire wool'. Being made of steel the wire wool is attracted by the magnet and will cause damage. It also causes electrical shorts within the locomotive.

**Quick Tip:**

Running your trains at least once a day helps keep the rails from getting dirty in the first place, so that's a fun way to keep rails clean, and feels less like work.

**Quick Tip:**
Running your trains at least once a day helps keep the rails from getting dirty in the first place, so that's a fun way to keep rails clean, and feels less like work.

**Quick Tip:**
If your loco stops or slows down in the same spot on the track frequently here's what to do:
1. Thoroughly clean section of track
2. Check for "dead spots" a bad track connector or glue from scenery can disrupt power flow.
3. If problem persists track may be too large for the size of transformer/power pack.

**Interesting Fact:**

The Rocket was designed and built by George Stephenson of the Liverpool and Manchester railway in 1829. A common misconception is that the Rocket was the first steam locomotive. Truth is; the first steam locomotive to run on tracks was built by Richard Trevithick 25 years earlier, however it was not a financial success.

In 1829 Stephenson's Rocket won a competition for locomotive power at the Rainhill Trials on the Manchester & Liverpool Railway. All the other competitors broke down so a true result is a bit hard to tell; however in winning Rocket did fulfill the key requirement of the contest that a full simulated 56 mile (90-km) round trip under load be completed with satisfactory fuel consumption.

However, the Rocket's major claim to fame is that it was the first 'modern' locomotive, because it introduced several innovations that were used on almost every steam locomotive built since. George Stephenson had built steam locomotives before 1829. The Rocket was in some ways an evolution, not a revolution.

Rocket used a multi-tubular boiler. This resulted in more efficient and effective heat transfer between the exhaust gases and the water. Previous boilers consisted of a single pipe surrounded by water. The Rocket also used a blast-pipe for the first time. This used the blast of exhaust steam to induce a partial vacuum to pull air through the fire.

Stephenson's Rocket was capable of hauling a coach filled with passengers at 24 mph (39 km/hr). It pulled a load of three times its own weight at the rate of 12.5 mph (20 km/hr). The Rocket could haul 12.75 tons at 14 mph. It set a world speed record of 35 mph.

The Rocket still exists and can be seen in the Science Museum, London. There is also a replica in the National Rail Collection at York.

# How To Repair Problems

What do you do when your locomotive or cars derail or breakdown? Well, the first bit of advice is not to panic. Usually the fault is in the track, the wheels, or the couplers, and it is likely that you can fix it yourself.

**Here are solutions to 4 common problems:**

**1. What if derailments are common?**

Inspect carefully to see if something is tilting the track in the area where derailments occur? Any abrupt changes in the angle of the track can cause derailments. Also check to see if there is something on the track level that is striking the train and causing the derailment? A flashlight will come in handy when examining the track. Look vertically down on the track and horizontally across the track. If you find even a small amount of debris, carpet fuzz, pet hair, floor dirt, or dust… then, clean the track. Surprisingly, small bits of debris are big enough to be the culprits, particularly with N and Z scale trains.

**Quick Tip:**

Ensure all loose track pins have been removed from the track before running trains, as the magnets will attract the pins into the motors and potentially cause damage.

**2. Is one section of track out of alignment?**

Make sure all sections are firmly pushed together, and that the joints between sections align smoothly without any kinks.

**3. Is a wheel defective or broken?**

Dropping a locomotive is not recommended, but can happen to even the most of experienced modelers. Accidents like that are common causes for a broken flange. A wheel on a locomotive or car with a broken flange won't work and must be replaced. The same goes for a wheel that is twisted, or one that looks like it has been forced too close together or too far apart. The solution is always the same – replace the affected wheel.

**Quick Tip:**

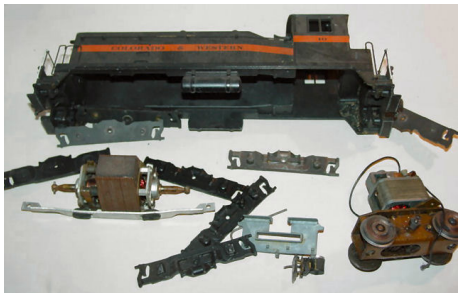
Never pick a locomotive up with your finger tips touching the running gear on the sides of the locomotive because it can damage the alignment of the running gear.

### 4. Is there a defective coupler in the train?

Is your coupler broken or stuck? Couplers must be free to swing from side to side (some are sprung to one side, or made so they return to center). Broken or stuck couplers can force cars off the track. If a coupler won't budge when you try to move it from side to side, then don't force it. More than likely it will need professional repair.

### When To Seek Expert Help

Depending on the skills you acquire, you will be able to fix most day-to-day problems if and when they happen. However, there are times when it is best to seek outside help, particularly when the cause of the problem is not obvious, or if you risk doing damage to your set. In those circumstances it is usually best to call on a professional.



There may be someone in your local railroad club that you could trust with the repair job, but be careful not to ruin a friendship if the repairs don't go as planned. Sometimes it is better get an independent person to do repairs for you. It's more businesslike and that way you insist on a guarantee or dispute anything that you are not happy with. It is not easy arguing with friends, especially when they are just trying to be helpful.

If you are looking for someone to do repairs, then your local phone book is usually a good place to start. Look under the category "Hobby and Model Supplies." The other option is to ask at the hobby store where you purchased the set. The set (or locomotive) might still be under guarantee, or the store might offer repairs, or they might be able to suggest someone who could help.

Fixing model trains requires considerable knowledge and experience, so it is important that the person carrying out the repairs knows what he or she is doing. You wouldn't want your best locomotive (your pride and joy) damaged beyond repair. So, it is important to check the credentials of your repairer carefully. If a fellow modeler recommends the repairer to you, then ask your friend why he or she recommends the person.

**Here are some important questions to ask the repairer:**

- Do you offer free, no obligation consultations?
- Do you do in-house repairs or contract them out?
- How long have you been doing model railroad repairs?
- Will you provide a written quote?
- How long will the repairs take?
- Do you stock the replacement parts or will you have to order them in?
- Do you offer a written guarantee?

**Interesting Fact:**

In August 1845, the town of Scarborough (the UK's oldest and one of its most popular seaside resorts), welcomed its first ever tourists to arrive by train. That historic first steam journey was on the world's most famous steam icon, 'Flying Scotsman.' More than a century and a half later, 'Flying Scotsman' lead the celebrations to mark the 160th anniversary of the event.

It was 160 years ago that more than 15,000 people turned out for the opening of the York to Scarborough railway line. Residents lined the streets of Scarborough, to be serenaded by singers and entertained by brass bands, welcoming the very first steam train to Scarborough's newly constructed wooden platform.

The steam trip to Scarborough, by 'Flying Scotsman' runs along the 42-mile route to the coast. It has been the backbone of the local tourist economy for 160 years.

**Wiring for Two Train Operation**
**Step-By-Step Tutorial**
**http://www.model-railroad-resources.com/two-train-wiring-members.html**

**Double Track With Crossovers And Industry Spurs Wiring**
**Step-By-Step Tutorial**
**http://www.model-railroad-resources.com/double-track-wiring-member.html**

**Wiring A Wye And Reversing Loop**
**Step-By-Step Tutorial**

**http://www.model-railroad-resources.com/members-wiring-wye-tutorial.html**

## Manufacturer/Supplier List

**There are plenty of manufacturers of train sets, parts and supplies. Here are some popular sites to check out** (If for any reason clicking the links doesn't work, you can simply copy and paste the links into your browser to access the correct web page)**:**

**Accurail, makers of HO trains: http://www.accurail.com**

**Acme, model railroad supplies: http://www.acmemodel.com/railroad.htm**

**Aristo-Craft, G models: http://www.aristocraft.com**

**American Models, S trains: http://www.americanmodels.com**

**Athearn, HO scale : http://www.athearn.com**

**Atlas Model Railroad Co., HO scale: http://www.atlasrr.com**

**Bachman, N, HO, On2-½, large scale: http://www.bachmanntrains.com**

**Bowser Manufacturing, N, HO, and O scale models: http://www.bowser-trains.com**

**Buildings - Custom builders site http://www.trainsho.com**

**Cherry Creek Hobbies, model trains HO scale and model railroad supplies: http://www.cchobbies.com/**

**Discount Trains, model trains and railroads at discount prices: http://www.discounttrainsonline.com/**

**Global Outlet, Brass Railroad Models in HO and O scale: http://www.globaloutlet.com**

**International Hobby Corp.HO scale: http://www.ihc-hobby.com**

**Internet Trains, Over 100,000 different model trains, train sets, model railroading supplies & accessories available: http://www.internettrains.com/**

**Kato USA, HO, N scale: http://www.katousa.com**

**K-Lile Trains, O scale: http://www.k-linetrains.com**

**LGB of America, large scale: http://www.lgb.com**

**Lionel, O scale & accessories: http://www.lionel.com**

**Life-Like, N, HO scale: http://www.lifelikeproducts.com**

**Märklin, Z, HO, No. 1 scale: http://www.marklin.com**
**Micro-Trains Line, N, Z scale: http://www.micro-trains.com**

**Model Power, N, HO scale: http://www.modelpower.com**

**Model Railroad Dealers on the Net, listing of dealers both USA and rest of the world: http://www.tttrains.com/links/dealers.htm**

**Model Tech Studios, Unique Structures, Details, 3D Backgrounds and Rollingstock in N, HO and O Scales:**
**http://www.modeltechstudios.com**

**Modratec (Australia), An innovative blend of technologies allows the average modeler to design and build fully interlocking mechanical lever frames: http://modratec.com**

**MTH-Railking, O Gauge Electric Trains:**
**http://www.mth-railking.com/**

**Pacific Mountain Scale Shops, Highly detailed and very prototypically accurate polyurethane models: http://www.pacificmountain.ca**

**Rail Yard Models, Manufacturer of cast resin rolling stock kits for post 1960 era railroads: http://www.railyardmodels.com**

**Railway Recollections, Specialize in narrow gauge resin model railroad kits: http://www.railway-recollections.com**

**ROCO, European model trains: http://roco.com**

**S-Helper Service, S scale: http://www.showcaseline.com**

**Train Track, model railroad supplies: http://www.traintrack.net/**

**Trees - Sage brush tree armatures http://www.fsmtrees.com**

**Walthers, Supplies for the model railroad enthusiast. Walthers also have a newsletter: http://www.walthers.com/**

**Williams Electric Trains, O Gauge Electric Trains:**
**http://www.williamstrains.com**

**Wm. K. Walthers, HO scale: http://www.walthers.com**

These websites are well worth visiting, as they'll keep you up with what's available, as well as pricing.

# Frequently Asked Questions

In writing this bonus section we did a lot of research and asked modelers from around the globe to submit questions that they wanted answered. Here are the answers (in no particular order) to some of the most frequently asked questions:

**Which rails should I use - brass, steel or nickel-silver?**

Nickel-silver rails are a good choice. With nickel-silver rails you will have better running trains. With steel and brass rails the trains can tend to run erratically after a while. Nickel-silver rails also require less cleaning; they provide better electrical conductivity and tend to look more realistic. To work efficiently, brass rails must be kept very clean as the oxide that forms on them creates a barrier to the current. Zinc-coated steel tracks are another option, but the zinc can wear off. This can expose the steel that can then rust. Steel is also more difficult to cut.

**How do I keep my layout free from dust and cobwebs?**

Dust and dirt, are any model railroad's biggest enemies. The first step to keeping track clean is to eliminate the sources of dust and dirt. Among the best ways to do this is to put your layout in its own room (if possible). To cut down on dust and dirt, finish the walls and ceiling. If your layout is in a basement or attic, consider installing a suspended ceiling in the entire room or just over the layout to reduce the amount of dust and dirt that gets on the rails and scenery.

A vacuum with a slit end works well for cleaning away dust. To avoid sucking up any parts of your layout try putting a piece of nylon over the end of the vacuum hose. A brush attachment can be used for removing dust from fixed structures. Also, sweep the surrounding area regularly to keep dust down.

Keeping windows closed also helps, as open windows let in a lot of dust and dirt. If possible, it is best to keep your layout and workshop areas separated to reduce contamination. Also, a no smoking rule is a good policy, because cigarette smoke can leave a buildup of grime on the track.

Running trains is the goal – not nudging stalled engines. By cleaning track regularly, you can keep your trains running smoothly. Dirty track is the result of dirt and dust that accumulates on railheads. Also, an oxide forms on both brass and nickel-silver rail over time. The oxide on brass rail inhibits electrical contact, whereas the oxide on nickel-silver rail is conductive. For this reason nickel-silver rail are preferable.

Dirt and dust are less of a problem with pre-molded roadbeds. The roadbeds hold the sections securely together to help prevent dirt from reaching moving parts.

**What were different methods used to turn an engine?**

Real railroads used three methods of turning engines or trains, wyes, loops and turntables. The turntable was by far the most widely used method for turning an engine. Wyes were also widely used for turning engines, or even whole trains, as they were more space efficient than loops. Loops are still are used in some instances but there are relatively few examples of loops in prototype practice.

In model railroading the opposite seems to be true. Reversing loops are the most common as they allow "continuous" running. Wyes are also a common feature with model railroads and turntables are less common. Each of these methods requires some special power routing to prevent short circuits, which are a consideration with any reversing scheme.

**How do I figure grades, and how steep can they be?**

Expressed as a percentage, grades indicate how steeply tracks climb. A 2 percent grade means a rise of two units for every 100 units of travel (or simply a rise of 2 inches for 100 inches). Even at that this small rise, a locomotive loses roughly half its pulling power. Each additional percent increase reduces the pulling power of a locomotive consist pulling power by half again. The key to determining how steep to make a grade is to decide how many cars you plan to pull and what's practical in the available space. Realistically, anything greater than 5 percent is asking too much from your models.

Prototype Grades Explained:

On a prototype railroad the base is 100 foot, so a 1% grade represents a 1ft elevation change in 100ft of travel.

**Light Grade** = 1% or less
**Heavy Grade** = 1% to 1.8%
**Mountain Grade** = 1.8% or more
**Cresting Grade** = A long ascending Grade that changes with enough magnitude to require a change in train handling procedures.

**What radius is the curve on a prototype track?**

The prototype doesn't actually measure their curved trackage in terms of radius. They measure it in "degrees", meaning how far the track has to bend off the tangent.

Nonetheless, prototype curves generally end up being about a radius of 575 feet. For example; with an HO, this would equal to about 75 inches.

**What do the letters stand for when referring to "scales"**

The letters can be confusing so a brief summary of what some of them stand for:

- HO stands for "Half O" although it isn't exactly half the size of O.
- TT stands for Table Top and is smaller than HO
- G is said to stand for "garden" because that is where most of these trains operate. Others claim it was picked because most of the good letters were already taken.
- Z doesn't stand for anything; it is the smallest commercially available size.

**Should I oil my trains?**

Yes, oil locomotives, but not usually freight and passenger cars.

In modeling, the primary purpose of oil is to reduce wear and tear on moving parts, particularly those subjected to intense friction. Locomotives are under constant stress to transmit power and will eventually break without proper lubrication applied to the motor bearings and gears. (It is important to use the correct lubricants on those parts for maximum performance).

Too much or too little lubrication can cause damage. Too much lubricant will saturate the wiring, insulating material and attract a modelers worst enemy - DIRT and DUST!
The resulting effect could shorten the life of your trains electrical components and adversely affect performance. Most at risk are the motor bearings, commutator and the brushes.

Damaged to the commutator and brushes can happen when oil reaches the commutator. This is because the electrical current passing between the brush and commutator will vaporize the lubricant and glaze the brush surface. This causes an increase in resistance between commutator and brush, greatly increasing the arching between the brush and commutator. The consequence of a dirty commutator is that higher voltages will be needed to operate the trains.

It is true that freight and passenger cars have friction points too, but they're generally under far less stress than locos. Modern day models reduce friction by using acetal plastic side-frames and needlepoint axles. Oiling is unnecessary, because when the oil becomes dirty and breaks down, it actually increases the friction.

**Can I keep any scale model railroads outside?**

Yes, within reason. Any railroad that can stay on a floating roadbed does reasonably well. HO trains are too light to stay on floating roadbed (the way LGB trains do), so you must use some type of solid or concrete roadbed, like concrete, that the track can be rigidly fastened to.

If you are planning an outdoor railway, you should paint the track to protect it from weather damage. Also ensure that you clean it regularly to slow down the oxidization process.

**When I buy a track switch, what is meant by 'No. 4 turnout' or 'No. 8 turnout'?**

The term 'Turnout' can be a bit confusing. It is the British term for a 'switch'.

Yes, there is an important difference between a No. 4 and No. 8 turnout. The smaller the number, then the smaller the radius that comes off the switch.

The smaller numbers are ideal for yards or industrial spurs, but not for high speed. So, if you want to run at high speeds or want to cut over from one mainline to another, the higher numbers will suit you best.

In railroading terms the turnout usually refers to all the components that move a train from one track to another including: the 'switch', point rails, closing rails, frog and guard rails.


**Explain the difference between "hot frogs" and "insulated frogs"**

Firstly, a couple of quick definitions to clear up any confusion.

A "Frog" is best described as the part of a turnout or a crossing where the rails have an intersection which allows the wheel flanges to cross the running rail (the spot where the deverging rail crosses the straight rail).

A **"Hot frog"** or **"Live Frog"** is when electricity is supplied to the frog.

With **"Insulated Frogs"** the two rails in the frog are insulated by a thin piece of plastic.

Hot frogs are are usually best if you plan on running small locomotives with limited electrical pickup and/or you are using or planning to use DCC.

Using a hot frog it becomes necessary to change the polarity of the frog when the points are thrown. Doing this is no problem when using an automatic switch machine (with two sets of contacts).

Another option is to use a small switch to change the polarity of the frog. This would require the operator to throw the points and then use an electrical switch to change the polarity of the frog.

**Why do my trains short circuit at insulated frogs?**

Insulated frogs can mean less electrical problems, but it is possible for cars with metal wheels and the wheel treads of locomotives to briefly bridge the insulation gap and contact both rails at the same time as the train passes through the frog. This can cause a short circuit.

This is not usually as noticeable with Analog layouts because most DC power packs take longer to detect a short circuit and shut down. The train will continue to run because it will usually have passed over - no longer bridging the gap.

Detection and shutdown is usually much faster when a short circuit occurs using DCC power. Factors can depend on the speed of the train and whether or not the locomotive is fitted with flywheels. A fast traveling train (or one with flywheels) could jerk in speed, but continue on past the frog. This pattern will repeat as each wheel set passes the frog. It could also cause erratic speeds for other trains in the same power district.

To avoid constant short circuit problems it is necessary to fix the frog. Here are 3 possible solutions:

**1.** The most permanent solution is to make the rail V shaped using a Dremel Tool. The appex of the V is on the inside of the rails where the flange contacts the rail.

**2.** A quick solution (but not permanent) is to apply a thin coating of clear nail polish to the end of the frog where the short occurs. This is only a temporary fix, as the nail polish will gradually wear away as trains pass over.

**3.** Another answer is to cover the area where the short occurs by gluing a small piece of plastic (or paper) to the frog. When using a small strip of plastic you will need to file the plastic to match the frog perfectly... and you might need to file the frog down a little to allow for the extra thickness of the plastic. It is important that the surface is flat and even.

**Should I replace my horn-hook couplers with knuckle couplers?**

The two reasons why you might consider replacing your horn-hook (HO) or Rapido-style (N) couplers are for realistic appearance and operation. Manufacturers of magnetic knuckle couplers include: Bachmann, Accurail, InterMountain, McHenry, Kadee, and Micro-Trains.

**What is a talgo truck?**

A talgo truck is a freight or passenger car truck with the coupler mounted on the truck frame instead of on the car-body itself. Truck-mounted couplers are common on train set rolling stock. Advanced railroaders often modify or replace talgo trucks and instead use body-mounted couplers for realism and reliability.

**Do some locomotives make less noise?**

Yes they are. An all-metal gear train will generally make more noise than one with plastic gears.

**Why is a locomotive noisy?**

A lot of noise is more than likely a sign of poorly meshing gears. The reason is that most model gear trains have a worm that is attached to the motor shaft. As the worm spins, it rotates the worm gear. In normal circumstances there should be a small space between the teeth of the worm and the worm gear. Too much space results in the drive train being noisy. For best performance the worm gear should be made of plastic and the worm should be made from metal.

**I have connected my new train set and the locomotive sits and hums but will not move?**

Power supplies usually have four connection screws on the back. These are labeled "AC Accessories" and "Track or Variable DC". Use the "Variable DC" connections to enable your train to move. There are, however, exceptions to using DC for trains... if you have Lionel or Marklin, they operate on controlled AC power with 3 rail track.

If you still can't get the locomotive to go, check that the power is plugged in, the connection to the track is correct and that the two rails do not touch each other, as in a reverse loop, (the outside rail meets the inside rail in a diagonal track connection across an oval circuit)

**Should I have a larger motor for my locomotive?**

A larger motor tends to be smoother running. In most cases they can withstand more heat and so are less likely to burn out.

**If I install a larger motor in my locomotive will I be able to pull more cars?**

The weight of a locomotive is the key factor in pulling power. If your locomotive isn't pulling well, and assuming there is space spare inside the shell, you could try filling it with lead. The most effective place to add weight is often above the driving wheels.

**How can I prevent motor burnout?**

When your locomotive is climbing a grade, or pulling too many cars, the motor has to draw extra current to do the work. If the motor is drawing more current than it can dissipate - it will heat up. If the motor gets too hot, either the motor brushes, or the windings melt.

It pays to monitor how warm your locomotive gets under various loads. You can do this by holding the bottom of the frame to your cheek. If it feels hot enough to cause discomfort, then give your train a rest or lighten the load. Please be careful because you don't want to burn yourself if the loco is really hot.

A more accurate way, of monitoring what current your locomotive is drawing, is to install an ameter and voltmeter to your control panel. They are easy to use and will help determine the limitations of your engine.

**How many cars will a locomotive pull?**

Firstly you need to consider the factors that determine the length of the train you can run on your model railroad layout:

**THE DRAWBAR PULL**, or traction, of your locomotive is affected by its weight, contact with the rail, traction tires, motor and the power available. This pulling power is measured in pounds and ounces at the rear coupler or drawbar of your locomotive.

**DRAG OF YOUR CARS** depends on the number of axles, lubrication of the bearings and if there are track pickups on any of the wheels. The weight of each car is also a factor.

**RADIUS OF THE TRACK CURVES** is another factor to consider. The smaller the radius the more the drag. A reverse curve, without a straight line between, causes even more drag. Also remember that a clean track will reduce the drag on curves.

**GRADE OF THE TRACK** can be a major factor affecting the pulling power of a locomotive. Grade is the ratio of distance forward compared to the change in height.
On a model railroad a forward travel of 100 inches with a rise of one inch is a 1% grade. A rise of two inches is 2%, three inches is 3% and four inches is 4%. You

wouldn't want anything steeper than a 4% otherwise you could experience all kinds of problems.
(no more than a 2% grade for garden railroads).

So, the number of cars a locomotive can pull will depend on a number of factors.

**What is "head-end" traffic?**

Mail, express, baggage, newspapers and milk in cans, usually transported in cars nearest the locomotive, are known to railroad staff as "head-end" traffic.

**What's wrong when parts of the track do not work?**
**How do I go about fixing it?**

You will need to think what you might have done or what might be causing the problem, because there could be any one of a number of things wrong with the wiring. Start by asking yourself questions like: "Was the layout working before the last wire was connected?"
The problem is that single conductor wires may break and are difficult to find. Stranded wire may be shorting at screw terminals if not properly managed. Perhaps one wire is connected to the incorrect rail.

Also, check for obvious loose wires and connections under the layout. Have you ignored a reverse loop? Are you using a new type of turnout?

One option is to disconnect all the feed wires at the control panel and methodically work through every connection, testing its operation as you go. Check the location and polarity of all insulating rail joiners and the associated supply wires.

Locating an electrical short is not always an easy process. However, it can be done. The best method, however, is to use a multimeter across each connection to check the contacts. You'll also need to visually inspect everything.

**How can I clean the tracks without causing damage?**

Cleaning the track is not usually difficult but it is important. Keeping them clean makes for trouble free running and helps keep debris from your locos wheels and motors, ensuring good electrical pick up and hassle free operating sessions. The thing about cleaning the rails is that you have to make sure that you don't damage the electrical contact.

Avoid abrasive cleaning blocks. Instead rub the rails with either a pink eraser or using a chemical (or organic) treatment. Rubber erasers can be a bit messy, but they are inexpensive and do a reasonably good job. Chemical methods cost a bit more but can really do a good job of cleaning away the hard debris. Another option is to utilize Goo-Gone, which you'll find in the supermarket, or Wahl Clipper oil, which is often available from beauty supply stores.

**How often should the tracks be cleaned?**

Running your trains once a day helps keep the rails from getting dirty in the first place. At least run them once a week. Running your trains is fun way to keep the rails clean, and it feels less like work.

**My engine freezes or sticks when being fed current?**

In this case, try cleaning the engine and the tracks as previously mentioned.

**On full-sized railroads what is rust-busting?**

Sections of track that have not been used for some time (mainly in railway yards) form a thin layer of rust. This can disrupt electrical contact between the train and rails. Rail Traffic Control therefore diverts trains over these stretches of track at certain times. Heavy freight trains are usually perfect for this job, as they clean the rails better than passenger trains.

**What is meant by "code," as in code 40 track?**

The "code" is simply the rail's height in thousandths of an inch, so code 40 rail is . 040 inches high, regardless of the modeling scale it's used in. The term is not used in prototype railroading, where rail size is typically expressed by to by pounds per yard instead of height.

**Is a locomotive change-over the same as shunting?**

No. Shunting involves splitting up the train into separate wagons or sets. These are then led via an incline to various sidings. They are then combined to form new trains.  During shunting, the separate wagons or sets are often led over kilometers of siding lines, a process that can easily take up 1 to 2 hours.

In the change-over of a locomotive (as carried out at frontier stations), only the locomotive is uncoupled from the train and its place is taken by a new locomotive. Once the brake hoses have been reconnected, only a brake test need be carried out before the train is ready for departure. The entire procedure does not take up more than 10 minutes.

**Is there an easy way to dislodge decals without removing the paint?**

You're probably not expecting this answer, but Formula 409 works well. Simply put a drop on the decal that you want to remove and then wait a few minutes. You can watch as the decal wrinkles up and comes off. If that doesn't work, then try a decal remover such as Walther's decal remover or Joe's Gel Paint & Decal remover.

Be careful because decal removers can sometimes remove paintwork as well as the decal. So, if you use a decal remover, work quickly and wipe off the decal before it attacks the paint.

**What is a green wave for freight trains?**

A green wave for rail traffic is similar to that for road traffic. The routes are set up in such a manner that a freight train traveling at a certain speed can continue running, without encountering any red signal lights. This is done because, a heavy freight train can lose a huge amount of energy, and also a great deal of time to stop and start again. This is time in which tracks are unnecessarily occupied, while obstructing other rail traffic. Green waves save time and energy, whilst also enabling improved use of the track capacity.

**What wetting agent works best for N scale ballast?**

Don't use water and detergent for an N scale, because it won't penetrate the finer sand used in those layouts. Instead, use alcohol and water for best results.

**How do I move my layout without damaging it?**

Moving a layout is always going to be a problem unless you build it with flexibility in mind. Open-grid bench-work sections that can usually be moved easily, with a minimum of disruption or damage. With this system you can disassemble the sections and put them together again when you relocate to a new location.

**What is a module and is it worth considering?**

A module is a sectional layout in with each section only fitting in a specified place. They are great for those who live in apartments, condos or small houses, or for those who move house frequently. Modules are usually 4 to 8 feet long, 24" wide, 40" high with a 8" to 14" sky-board attached to the back. Modules are reasonably inexpensive and don't take long to make.

**What's smallest model railroad I can make?**

Micro layouts are the smallest and yes, there are enthusiasts who specialize in small layouts. The internet is the best place to get information and make contact. One website with a lot of ideas on micro layouts is http://www.carendt.com .

**Is there anything different in wiring for a reverse loop?**

Wiring reverse loops often confuses people because the track folds back on itself, and in the process can create a short circuit.

If you are building a reverse loop, you'll need feeders to the rail every 3 to 6 feet from a common buss. If you have a DCC (Digital Command Control), you could separate your layout into segments for the distribution of power. This could also help with troubleshooting. If you don't do this, and if the whole system shuts down when you have several trains running, you won't know which train is responsible for the short.

**What is Hydrocal and what is it used for?**

Hydrocal is a trademark product of U. S. Gypsum (USG Corp). Hydrocal is often used for making scenery shells and is incredibly durable. To make a remarkably strong scenery shell dip paper towels in a soupy mix of Hydrocal and apply to a structure of balled paper or interwoven cardboard strips.

Another advantage of Hydrocal is that it picks up detail very well when cast in rubber rock molds. The main disadvantage of Hydrcal is that, unlike softer molding plaster, it is more difficult to carve and detail. Modelers often prefer the softer molding plaster as a topcoat on plaster scenery.

**Should I always use track underlay (foam or cork?)**

Track underlay definitely reduces the noise levels. Scenery can also act as a noise absorber or noise buffer. If noise is an issue then a combination of foam and cork together will definitely lower the noise levels. Some modelers find the foam quieter than cork. The big advantage of foam over cork is that it can be profiled using a foam-cutting tool.

**Why do tracks need ballast?**

On a prototype railroad track the ballast is for drainage. The track consists of two rails spiked to wooden ties resting on a bed of ballast. This ballast may be gravel, or any of several kinds of crushed rock, usually limestone or granite. In model railroading, we add the ballast to the track-work for increased realism. Many modelers think this type of track-work is too difficult to build, but it doesn't need to be difficult.

**How do I lay and fix ballast on track-work to get a realistic look?**

Step one is to decided where the track is to be laid. Using a pencil, draw two parallel lines on the roadbed where the ties should be positioned. Using diluted glue, paint the roadbed in two-foot sections then, lay the ties in place. Set the ties in position the full length of the painted section. Ties are spaced about 3000 to the mile. This converts to about 36 ties per foot in S scale standard gauge. Space the

ties a little further apart if using narrow gauge.  Ties should be a tie width or less apart on mainlines, and 1-1/2 to 2-1/2 tie widths apart on branch lines.

**Quick Tip:**

Modern train tracks are very even and perfectly straight, whereas for older lines had imperfections. On older lines, sidings, branches and yards, you'll achieve a more realistic effect by varying the ties somewhat. A typical stretch of track will have ties in all stages of weathering because old ties are replaced only a few at a time.

With the ties in position, sprinkle on the ballast. A saltshaker or teaspoon can be used. After the glue is dry excess ballast can be brushed or vacuumed away. If you are careful, excess ballast can be used again.

While this section is drying, you can move on to the next section. There will always be spots where the ballast does not adhere, so you can go over any bare spots again. Also, make sure the ballast isn't above the tops of the ties.
Wait for everything to dry before laying the rails. Lay the turnout first followed by the rail laid to the turnouts. Use needle nose pliers to insert the spike in under the rail, at a slight angle under the rail.

Place the turnout on the ties using the frog as a center guide, positioning it first with the spike down.  The stock rails can then be spiked in place. You can use two three-point track gauges to get the rails approximately in place, followed by a NMRA Stands gauge for final spiking.  Always check and recheck the gauge with the Standards gauge.

**What is ground foam?**

Ground foam just as the name implies: ground up pieces of foam dyed to represent grass, weeds, soil, shrubbery, and tree foliage. The material can be applied with diluted matte medium or white glue. Ground foam can also be applied directly to wet paint. Manufacturers that supply ground foam (or similar products) include: Woodland Scenics and AMSI.

**What is Homasote, and why do so many modelers use it?**

Homasote is a pressed paper product made by the Homasote Corp. It's recycled newsprint and comes in 4 x 8-foot sheets that are a half-inch thick. It's usually used as wall-insulating material. The main advantage of Homasote is that its density allows it to hold spikes well. Yet Homasote is soft enough that they can be driven in with a pair of needlenose pliers. This is an advantage for those who hand lay their track.

The disadvantage of using Homasote is its poor dimensional stability, as it tends to expand when exposed in humid conditions. One solution seal the product with paint or shellac. Homasote is also difficult to cut without producing a lot of dust and dulling saw blades. One solution is to use a knife-type blade (no teeth) in a saber saw. If you don't want to use Homasote, other roadbed options include Vinylbed and cork.

**What do the three numbers in front of the train stand for?**

This is the Whyte Classification System. It is a classification system to describe the different types of steam engines based on the arrangement of their wheels. The first number relates to the number of wheels on the pilot. The second number relates to the number of drive wheels, and the third number relates to the number of wheels on the trailing truck. So 4-4-0 means four pilot wheels, four drive wheels and no trailing truck wheels.

**How do I simulate smoke and fire?**

There are a couple of ways you can do this.

One idea is to light a flickering 12 volt, 110 amp lamp to simulate flames. You can also add a small fan and some silky material. The material is cut into a tapered shape, similar to the look of a flame. You mount several of them over the fan so it flaps them around, then the light shines up from below. The light flickering on the moving material looks like flames flickering.

If you don't want to use a mini fan, then try just setting up some rapid firing yellow and red LED's to get a flicker. Some careful placement of crumpled aluminum foil with regard to visibility through windows, doorways etc. will give a very realistic flame appearance.
Insulated steel wool makes good smoke. Thin the steel wool out and shape it to look like smoke. Position it coming out of the top windows and the roof in a building. Make sure you have some fire trucks at the scene too to add even more realism to the scene.

**How do I depict the aftermath of a fire?**

Sometimes it is easier to model the aftermath of the fire. One idea is to show a damaged building with blackened framework. You then add some fire trucks and pumps positioned to dampening down the embers. They can be releasing streams of water made from fiber optics aimed at points where you've embedded the electronic LED lights to simulate hotspots. You can also buy smoke generator kits and smoke generator fluid to use when you have visitors.

Another idea is to include a vehicle for the arson investigators, a police car or two and police patrolling the yellow tapes to keep the onlookers at a safe distance. The flashing lights on all the emergency vehicles would add to the drama. Don't forget

to simulate plenty of water in the street gutters as runoff from the fire. Another nice idea is to include a Dalmatian dog investigating the fire hydrants.

**How do I make plastic buildings look real?**

Here's the trick to make plastic buildings look real. First, paint exterior surfaces with a mixture of hobby paint (flat white, flat gray or flat black) and hobby thinner. Let sit for ten minutes then wipe off. This removes some of the glossly look from the plastic and will "color in" any depressions or marks, bringing out tiles, siding, shingles and bricks. To "mortar" the red brick walls of buildings apply white paint and then wipe it off. Another way to apply mortar is by rubbing the surface vigorously with white chalk, brushing lightly and sealing the chalk dust with matte fixative or clear hairspray. (do this in a well-ventilated space).

**Why do some buildings look translucent?**

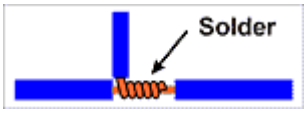
Plastic buildings can become translucent when internally lit. The trick is to get light to shine through the windows, not the walls. The answer is to cut aluminum foil into properly sized panels and glue them to the interior walls. You can use an ordinary glue stick (or Goop). You can do the same for plastic roofs, too. You can even create frosted windows using onionskin paper glued in place. Simply draw curtains, or blinds, on the onionskin for added detail.

**Do I have to solder the track?**

Soldering track has two advantages: it allows for better electrical conductivity and reinforces rail joints to stand up to stresses such as wood expansion, layout moving, and rail shifting. The trick to good soldering is to start with a clean surface. Use a non-acid core solder and a liquid resin flux, and use a hot iron to avoid melting the plastic ties. Don't add too much solder; a little soldering at the joint is all you need.

**Should electric feed wires be included every couple of feet or should I solder rail joiners?**

To ensure proper electrical continuity, all DCC connections should be soldered. At rail level, feeders are directly soldered to the rail. This diagram shows how wrapping one wire around the other makes a junction between wires before soldering them. All non-insulating rail joiners can be soldered and separate feeder wires be installed every 3 ft of track.



**Quick Tip:**

To avoid problems later, thoroughly check every section after it is completed. Follow these 3 steps:

1. Check continuity and insulation of the new wiring, using a Volt/Ohm meter.
2. Turn on the Command Station and put an engine on the newly wired track section to check for correct operation.
3. Short the section (with a metal part) and check that the Command Station detects the short.

If you detect any problems during these tests, then it is an indication that something is wrong in the wiring. The problem should be fixed before going any further (remember that, with DCC, all track sections are wired in parallel and insulating a problem later will be much more difficult). When all sections are correctly wired, your layout will be ready for DCC control of trains.

Here is a method used by many modelers. Purchase some doorbell wire and cut it into 6" to 9" lengths. Strip the last half-inch on both sides of the wire. Flattened the end of the wire using some needle nose pliers and pull the wire downward to form a 90 degree bend just before the flattened end and then clip the end short. If you do this correctly you'll end up with a piece of wire that looks like a track spike.

The next thing is to drill a small hole next to the outside of the rail through the roadbed and base. Use a soldering iron to put some solder next to the feeder hole, then a dab on the flattened end of the wire (the part that looks like a spike). You then feed the straight side of the wire through the feeder hole. The trick is to align the spike side so that it is hanging off the bottom of the rail. You then simply solder the joint.

Using this method, you'll have a feeder and reliable power transfer that resembles a rail spike. It should be almost impossible to detect at a glance.

**Quick Tip:**

**How To Solder Joints And Take Care Of Those Wire Connections**

Good soldering is important, because poor electrical connections result in higher electrical resistance with heat generated when power is applied to a poor electrical connection. Over time, this heat has the potential to damage wire insulation and wire enamel.

To avoid electrical connection problems it pays to regularly inspect wire connections. A solder joint that is a dull silver color, or one that is just a "big blob" of solder, will sooner or later cause problems when running your model trains.

All solder connections should be clean and shiny and use only a small amount of solder. If a solder joint is suspect, take a soldering iron and apply fresh solder to the joint. This will help improve the connection and keep your electrical system in good working order.

**What is a bridge rectifier and what does it do?**

A bridge rectifier will permit the trains to go around it in one direction either clockwise or counterclockwise. Converting AC to DC is done with a bridge rectifier, or with four diodes configured to make a bridge rectifier (a diode is a device that lets electricity flow in only one direction). So, when four diodes are configured as shown here, the rail's AC power is converted to DC.


**How do you run a loco on a reversing loop?**
**Do you have to stop the train on the loop and throw the switch?**

A common method of wiring reversing loops uses a bridge rectifier to set the polarity of the loop so that trains can run around the loop in one direction only. A bridge rectifier should be rated for several amps and have four inputs, two marked 'AC', with one marked '+' and one marked '-'. The first thing to do is connect the ACs to the mainline power feeds, then connect the '+' and '–' to each wire that feeds the reverse loop. The bridge rectifier will keep the train running in the same direction … either clockwise or counterclockwise, depending upon the + connection being hooked to the right or left rail. When the train exits the loop, the track polarity outside the loop has changed to match the rails at the exit of the loop.

**Quick Tip:**

When your train enters a reverse loop from the mainline, you'll need to reverse the throttle direction switch. That way, when the train goes back onto the mainline, the polarity will be lined up. If you have two reverse loops, each loop will need to be wired with its own bridge rectifier.

**What are the advantages of using an iron core can motor?**

Their major advantage is that they are rugged and cheap. The can motor gets its name from the formed steel can it is built in. These are permanent magnet DC motors and usually come with the armature wound on an iron core. Iron core motors can generate an amazing amount of power in a small physical size. Can type motors are not usually designed to be disassembled for repair. If a motor wears out or burns out, buying a new one is usually the cheapest option. Most of the motors found in Large Scale locos are iron core can motors.

**What is coreless motor and how does it work?**

Coreless motors are so named because there is no iron core in the armature. A coreless motor consists of a rotor with coils of wire resembling an open basket. A magnet is located in the center of the coils. A brush gear transfers the electrical current to the rotating coils. The outside of the motor has a can that encloses all the parts, so it may still look like a can motor.

The advantage of the coreless motor is that it can be made smaller and lighter than a cored design. Since they run slowly, a lower gear ratio can be used than with the more conventional iron-cored motor.

The downside; is that the coreless motor doesn't have the thermal stability of a cored motor. An overworked motor will heat very rapidly. If it gets hot enough, it can breakdown the adhesives holding it together, and the armature will simply come apart.

If treated properly, coreless motors will last a long time.

**Quick Tip:**

Too much current can damage coreless motors, so it is probably best to use a controller specifically designed for them. If you're running DCC, you will need to get a decoder to smooth out the current. You should not use older (over a year old) decoders with coreless (basket wound) motors (usually found only in LGB G scale).

**What is a decoder and can I run an analog locomotive on a DCC system without a decoder?**

The first thing to understand is this; an analog train refers to a locomotive without a decoder chip installed in the locomotive.

Decoders are sometimes called receivers, but in reality, they are more that just receivers. Decoders decode the DCC signal and control the engine's speed and direction. Decoders let you program locomotive characteristics like acceleration, deceleration and, starting and mid-point voltages. Some may have built in light and function controls as well.

There are other decoders that include sound and motion control in a single unit. You can even build decoders yourself from a kit.

The two main components of a DCC system are the controller and the decoder. The controller (some systems also require a booster) has the throttles and other controls to operate your trains as well as accessories. The decoder is installed into the locomotive and as instructions are sent from the controller through the tracks to the decoder it "decodes" the instructions and responds accordingly which may be to turn a light on, move forward, or stop, etc. Each decoder has to have a unique address so that the controller can individually identify it.

With most DCC systems you can run one analog locomotive (without a decoder) along with the digital ones. This allows you time to gradually convert your fleet.

**Can I just put a decoder in my old analog engines?**

Yes you can, but you probably don't want to. If the motor pulls over an amp at stall then it will burn up the decoder. The other issue is that most of the older analog engines require a fair amount of work to isolate the motor from the frame.

**Can I put a decoder in my brass engines?**

Again, the answer is basically yes, as there are very few engines that cannot have a decoder in them. But you may not want to because of the motor, load, etc. Again, the stall current could burn out the decoder. Be careful not to do any damage.

**What if the locomotives are too small or too valuable to be converted, but you still want to run them on your DCC layout?**

If you have an unconverted locomotive to run on your layout, then your DCC system will probably be able to handle it. No more than one analog engine at a time on Digital for the whole layout.

And, if you want to run your DCC equipped locomotive on a regular DC layout, many DCC decoders automatically convert to DC operation if there is no DCC signal

present. The important thing is to check with your manufacturer about the availability of this feature.

**Why does my locomotive make a noise when not moving?**

Analog locomotives tend to "sing" when sitting still on DCC layouts. This noise decreases when the analog locomotive runs and accelerates. The noise is caused by the DCC track signal. Using conductive brush lubricants (such as "Conducta") can significantly reduce this noise. It is also a good idea to ensure that there is no vibration inside the locomotive that will add to the noise generated.

> **Quick Tip:**
> It is best to park your analog locomotive on an un-powered section of track when it is not running to cut down on heat build up inside the engine.

**What do I have to do to my layout to make it DCC?**

Well, if you have one loco that has a decoder in it then you are already doing DCC. If you already have a working layout, then usually, it is just a case of removing the two wires from the transformer to the track and putting in the computer (Command Station/Booster) between them. DCC doesn't need to be complicated or difficult. It can be as challenging as you want it to be.  It is entirely over to you.

**Are 'O-gauge' and 'O-scale' the same thing?**

The difference between the two confuses a lot of people... so I'll explain it carefully. The fact is; O-gauge is far more popular than O scale, although the term 'O scale' is more widely referred to. Why? Because, most beginners (and many experienced enthusiasts) use the term 'O scale' when they really mean 'O gauge'.

'O' denotes 1/48th scale. O-gauge uses 3-rail track which is not quite to scale (it sits a little higher than scale). This is because O-gauge rail cars and trains have wheels with large flanges to prevent derailments. Some O-gauge train sets also have shorter-than-scale engines and rolling stock so that they can easily go around tight curves.

Some modelers use three-rail O gauge track to try and create a realistic-looking layout, whereas others use two-rail track of a properly-scaled height, the cars are scale length, their layouts have wide, realistic curves, etc.

**Are "three-rail" trains on the way out?**

Lionel three-rail O gauge track dates to 1915, and the technology that necessitated the creation of a center rail has long ago been surpassed. Technology-wise, there's no need today for O gauge trains to have a center rail.

Today, some high-end locomotives have a convertible two-rail/three-rail configuration. To change a locomotive from one type of track to the other requires the removal or addition of center-rail pickup rollers followed by a simply flick of a switch discreetly located on the locomotive.

However, many enthusiast are not in favor of this idea and prefer to recreate things exactly as they once were without modifications. Also, it is fair to say that many modelers have invested a lot of time, effort and money into three-rail trains and are not that keen on switching to a two-rail system.

For those who have 20 to 50 engines, changing to a two-rail layout would be a big decision. Some might consider adding a loop of two-rail track as a bit of a compromise. But, the older trains are not easily converted so they may not want to change over completely. That is why there will continue to be a market for three-rail trains.

**How much are my trains worth?**

The simple answer is that they're worth what someone is prepared to pay. They may have sentimental value, but be worth far less to someone else than they're worth to you. On the other hand if they are in mint condition, or particularly rare, or in high demand, or short supply … then you might be pleasantly surprised at how much you can get for them. Here are some ways to find out what your trains are worth:

- One of the best ways to assess value is to attend swap meets or a model railroad show and ask some of the knowledgeable and experienced enthusiasts who attend events like that.
- Check with hobby shops that deal in model railways. If you decide to sell to a retailer, remember that you're selling at wholesale. You probably get about 50 percent of the value listed in price guides. The retailer has rents, wages etc to pay and will expect to make some profit on the transaction when reselling your trains. For you it is a hobby – for them it is a business.
- Consult price guides, which can be purchased at hobby shops and from publishers.
- Do some research on eBay and other auction sites to see how much similar sets are selling for, or more importantly, have sold for.

There are a number of factors that can affect the value of your trains and determine what someone might be prepared to pay for them. Before approaching a dealer, going to a swap meet, or searching eBay, you will firstly need to accurately identify your trains. You'll need to know what their gauge is (measure the distance between its wheels), which company made them, and what number was assigned to them (look for names and numbers on the sides and bottom of models).

Secondly, you have to realistically assess the condition of your trains. Here is a guide for you:

**Mint Condition:** Brand new, often in its original, unopened packaging with all original paperwork included.

**Like New Condition:** As the name implies the original condition throughout. Free of any blemishes, scratches or nicks. All boxes should be in pristine condition as they are often are sold with them.

**Excellent Condition:** Means exceptionally clean, maybe with minute scratches or nicks but definitely no dents or rust.

**Very Good Condition:** They'll be clean, possibly with a few noticeable scratches. They will otherwise be free of dents, rust, and warping.

**Good Condition:** Signs of use, possibly with some scratches and small dents and dirty spots.

**Fair Condition:** Definite signs of use including lots of scratched, being chipped, dented, rusted, or warped.

**Poor Condition:** Sometimes bought for parts or restoration. They will be particularly beat-up or worn out.

Having determined what your trains are worth, you'll then be in a better position to decide whether to keep, give them away, or sell them.

**Quick Tip:**

Cutting track the right way is important for a good fit and to prevent derailments. If you cut track on your layout and fail to remove all the shavings, then they will eventually find there way into your engine gears and moving parts. This will create additional headaches for you later on.

Using a hacksaw will create metal dust which is hard to clean up. Wire cutter pliers will save you the shavings, but will create angles on your ends which you'll need to file square to prevent rolling stock from jumping the track. You can buy special track cutting tools with a flat edge on one side so that the resulting cut is straight instead of tapered to a point.

To buy sell or swap trains and train accessories http://www.tradetrains.com

# Glossary of Model Railroading Terms

**Accessory:** An item intended to complement a model train set but generally not included with it, such as a switch, a building, or a trackside light. Some accessories, such as tunnels, billboards, and many buildings, are static…while other accessories such as coal loaders, gatemen, or control towers, have an operating feature.

**Airbrush:** A small paint sprayer that gives a controlled application of thinned paint. They are fun to use but require some skill to get the best effects. Airbrushes are fun to use but there is a bit of a learning process. You need to ensure that you fill the airbrush paint bottle about ¼ full to prevent any spraying through the air vent hole.

**Articulated:** Refers to a locomotive with a jointed frame that is flexible in at least one direction.

**Backlash:** The small amount of space between the teeth of the worm and the worm gear.

**Benchwork:** A frame or bench that is the foundation of a model railroad layout.

**Block:** An electrically insulated zone of track.

**Body shell:** Is the housing of a locomotive or car that covers the interior workings. This is sometimes called the "cab."

**Cab control:** A method of controlling model trains in which one power pack is used for each train so the power pack can be connected to one set of blocks and remain disconnected from all others. Only one engine or set of engines can be controlled in each block.

**Can motor:** Refers to a permanent magnet motor enclosed in a metal "can" (housing). A can motor is generally direct current (DC) - only.

**Chassis:** Is what the body shell sits on. It is the frame of a locomotive or car.

**Chemically blackened:** Manufacturers use these processes on wheels, trucks, and frames. This term relates to a metal part treated with chemicals to achieve a painted or blackened look.

**Command control:** Also known as Digital Command Control (DCC). A way of controlling trains by sending electronic messages through the rails. Each locomotive has a decoder (or receiver) that only responds to the messages specifically directed to it. Engines can be controlled independently anywhere on a layout.

**Couplers:** The knuckle-shaped device found at the ends of locomotives and cars to hook them together.

**Crossover:** Two turnouts (a.k.a. switches) and a connecting track that allow a train to be diverted to a parallel track.

**Drivers:** The large wheels on a steam locomotive connected by side rods.

**Die-cast:** A manufacturing process in which molten material is poured into a metal mold.

**EOT device:** An end-of-train device (sometimes called a FRED, or flashing rear-end device) that has replaced cabooses. Along with a flashing light, many EOTs can transmit information on brake-line pressure and speed to the locomotive.

**Flywheels:** A solid-metal cylinder mounted in line with a model locomotive's motor that smoothes out the motor's rotating motion to the drive train.

**Flextrack:** Sometimes called flexi-track. Is flexible track sections usually available in 3-foot-long sections which can be bent as needed.

**Frame:** The base structure of a locomotive or car, without trucks, motors, etc.

**Gauge:** The distance between the inside of the heads of track rails.

**Gondola:** A long, flat, open car with short sides and ends for hauling items like iron, steel, and scrap.

**Grade:** Refers to the level of the ground upon which track is laid.

**Ground throw:** A machine that is used to move the point rails of a switch. It is built low to the ground as the name implies. An upright machine that does the same job is called a switch stand.

**Hardshell:** A scenery base made by dipping paper towels in plaster or using plaster-impregnated gauze and laying it over a light support structure like cardboard.

**Helix:** A rising curve which turns around an axis like a corkscrew. Used on multilevel model railroad layouts to allow trains to move from one level to another.

**Hopper car:** An open-top car for hauling items that don't need protection, such as coal and gravel. They unload through doors in funnel-like bins in bottom of car. Covered hoppers have roofs and carry grain and other items that need protection from weather.

**Loading Gauge:** Loading gauge designates the space required either side and above the track that needs to be clear, so that either the locomotive and its carriages can pass without hitting anything.

**Locomotive:** The heart of the train set.

**Main line:** This refers to the primary track that defines the railway and which connects the railway's most important destinations. It does not include spurs, branch lines, yards, sidings, or passing tracks.
**Module:** A section of a layout that is built to follow a standard pattern or dimension. It typically can be taken apart and transported easily.

**MOW:** Maintenance-of-way equipment. Used by a railroad to keep track and roadbed in good condition.

**Operation:** Running trains on a model railroad layout in a way that simulates real railroad activity.

**Passing siding:** A track that runs parallel to the main line and joins it at both ends. It is so that another train can pass in the opposite direction. It is usually long enough that an entire train can pull into it.

**Point-to-point:** The track does not form a continuous loop. It is a type of track plan whereby the train begins its journey at a dead end and ends it at another. There are no turning or reverse loops at the ends.

**Points:** This term can refer to an entire switch, or turnout, or to the actual rails that move within a switch to change the direction of the train, also called point rails.

**Prototype railroad:** An actual railroad (not a model).

**Rail joiner:** A small metal clip that joins two sections of rail.

**Rerailer:** The section of track that guides the wheels onto the rails.

**Reefer:** A refrigerator car.

**Roadbed:** It is a foundation of built-up earth that is placed under tracks.

**Rolling stock:** Passenger and freight cars.

**Running board:** Walkway along roof or along sides of tank cars.

**Scale:** The proportion of a model in relation to its real life counterpart.

**Scratch building:** Making a model from raw materials and parts, not using kits.

Here is an inexpensive technique to use when scratch building structures out of balsa wood. Take a flat piece of thin balsa and then use a metal dog comb with a

straight edge to create a board effect on the wood. This effect can look as good as any manufactured siding. The key is to use a comb that is the scale width.

**Standard gauge: Trains that run on tracks with rails spaced 4'8 ½" apart.**

**Styrene:** Short for polystyrene, or polyfoam, or Styrofoam. It is a versatile material commonly used for modeling. Comes in sheets, blocks, and rods of many different thicknesses and sizes.
**Tender:** The car immediately following a steam locomotive that carries fuel for the firebox and water for the boiler.

**Throttle:** The speed control of the locomotive or a potentiometer that controls a voltage regulator.

**Transformer:** Is an electrical device for raising or lowering AC voltage, but in model train terms, and AC power pack for controlling train speed and direction.

**Truck:** The frame assembly under each end of a car or diesel locomotive that holds the wheel sets.

**Turnout:** Called a switch on a real railroad. A piece of track that allows a train to go from one track to another; that is, a switch on a real railroad.

**Universal motor:** An open-frame motor that has a wire-wound armature and a wire-wound field coil in series, allowing it to operate on AC or DC.

**Weathering:** Making shiny new models look more realistic by dirtying them up with chalk or paint.

**Wheel set:** The wheel-axle assembly that fits into the truck.

## Prototype Railroading Terms

In addition to the glossary of model railroading terms, I've had requests to include a section on prototype railroading terminology (that's a mouth full!).

I've compiled a list of some common terms (with simple definitions). You might hear some of these terms mentioned from time to time, so if you're not already familiar with them, this will be a handy reference. The terms I've listed here are reasonably universal, but some may vary depending on where you live. Also note, that the list is by no means complete, as there are literally hundreds of different terms used on railroads around the world including several slang expressions.

**Absolute Block**
A block which must not be occupied by more than one train.

**Accelerometer**
This device measures a trains rate of speed change.

**Active Dynamic Braking**
Uses the traction motors as generators where the output is dissipated in a massive resistor bank. The effect is to consume the trains momentum in generating electricity.

**Adhesion**
The amount of pulling or retarding force a wheel is capable of exerting on the rail without slipping or spinning. Adhesion can be affected by the load on the wheel, rail condition, wheel condition and other factors like oil, rust & weather.

**Air Flow Indicator**
This instrument measures the air flow through the automatic brake valve to the brake pipe.

**Alertness Device**
This is a "deadman" type of safety device that activates a brake application if the engineer fails to maintain the required frequency of movement.

**Angle Cocks**
These are valves on the air hoses controlling air flow between cars.

**Alignment Control Couplers**
These specially equipped couplers minimize rail turnover, wheel climb, and jack-knifing by limiting lateral movement and reduce lateral forces on the track.

**Articulated Car**
This is car that has two (or more) platforms that share a common truck. The platforms are permanently connected to each other by an articulated joint.

**Automatic Block Signal**
An automatic block signal is one that is activated by track circuit or in conjunction with interlocking or controlled point circuits. It automatically indicates track condition and block occupancy.

**Automatic Block Signal System (ABS)**
With this system the use of each block is governed by an automatic block signal, cab signal, or both.

**Automatic Cab Signal System (ACS)**
Cab signals and cab warning whistles operate automatically with this system.

**Automatic Train Stop (ATS)**
As the name implies it is a device on an engine that activates a brake application if the engineer fails to acknowledge a cab signal change.

**"B" End of A Car**
It's usually the end where the hand brake is located.

**Back-Haul**
To transport a shipment back over part of a route from where it has already been.

**Bad Order Tag**
When a car inspector locates a defective car, he or she attaches a "bad order" tag (usually on the door of the car). A "bad order"tag means that the car must be repaired before it is allowed to move from the terminal.

**Ballast Tamper**
A machine for compacting ballast under the ties.

**Belt Line**
Refers to railroad track that operates as a pickup, delivery and transfer facility for industrial plants and truck lines. These are usually located within or around a city.

**Bleeder**
This valve bleeds (releases) air from the auxiliary air tank reservoir on a car.

**Blended Braking**
Uses a mix of service braking and dynamic braking.

**Block**
A length of track with defined limits on which train movements are governed by block signals, cab signals, or Form D's.

**Blocking Device**
A lever, ring, plug, or other control method to restrict the operation of a switch or signal. The abbreviation "BDA" means Blocking Device Applied and "BDR" means Blocking Device Removed.

**Blocking of Cars**
The assembling of cars in proper groups.

**Block Signal**
This is a fixed signal which is displayed at the entrance of a block to govern use of that block.

**Block System**
A block (or series of consecutive blocks) within ABS, ACS, CTC, or interlocking limits.

**Blue Signal**
A blue signal warning that workers are on, under, or between equipment. It can be a blue flag, blue light, or blue tag depending on whether it is day or night.

**Bolster Stop**
This device limits the lateral movement of a drawbar (when properly fitted).

**Bolt-Lock Switch**
A hand-operated switch equipped with a pipe-connected locking device that is designated to shunt the signal system before the switch points are operated.

**Brake Cylinder**
A cylinder containing a piston and piston rod. When compressed air is admitted into the cylinder, it forces the piston outward, which applies the brake. When the compressed air is exhausted, a release spring coiled around the piston rod inside the cylinder returns the piston to its normal position, which releases the brake.

**Brake Cylinder Release Valve**
The valve that bleeds brake cylinder pressure then, if held open, will also bleed auxiliary and emergency reservoir pressures.

**Brake Force**
Refers to the ability of a train to stop. Brake force is usually based on tons per brake ratio, with the effect of increasing braking power when the tons per brake ration is reduced.

**Brake Pipe Gradient**
This is the difference in brake pipe pressure between the locomotive and the rear car of the train.

**Normal Gradient**
The gradient level when the system is fully charged.

**Inverse Gradient**
A temporary condition that exists when brake pipe pressure is higher at the rear of the train than at the front end of the train. This can happen at the beginning of a service brake application.

**False Gradient**
Again, a temporary gradient when the system is less than fully charged.

**Brake Shaft**
A shaft on which a chain is wound and by which the power of a hand brake is applied to the wheels.

**Brake Shoe**
Friction material shaped to fit the tread of the wheel when the brakes are applied.

**Bulletin Order**
A BO is used to notify railroad staff of changes in instructions, procedures, or rules affecting the movement of trains.

**Cab Signal**
This signal indicates track occupancy or condition and is located in the engine control compartment. The cab signal is used in conjunction with interlocking signals, and with or in lieu of block signals.

**Cab Signal System**
A CSS system permits cab signals and the cab warning whistle to operate.

**Camp Car**
This is an on-track boarding/bunk car or vehicle used to house railroad staff.

**Computer Controlled Brake**
A computer based electro-pneumatic system (CCB) that controls air brakes on locomotives and cars.

**Control Operator**
Employee assigned to operate a CTC or interlocking control machine or authorized to grant track permits.

**Control Station**
The location or Dispatch Office where the Operator is on duty. The remote control signal appliances or switchesare operated from here.

**Controlled Point**
A station specified in the timetable where signals are remotely controlled from the control station. Abbreviated as CP.

**Controlled Siding**
A circuited siding where both ends are governed by signals under the control of an Operator or Dispatcher. Abbreviated as CS.

**Controlled Signal**
Controlled by a Dispatcher or Operator, this is a fixed signal, capable of displaying a Stop indication.

**Crossover**
This is a combination of two switches connecting adjacent tracks. When lined, the switch combination allows movements to cross from one track to the other.

**Crow's Nest**
A box-like cupola structure raised above the roof of a caboose for visibility along the train while it is in motion.

**Current of Traffic**
The assigned timetabled direction for movement on a main track.

**Cycle Braking**
The process of applying, releasing, and reapplying train brakes to control speed without completely recharging the train brake system.

**Dead Engine Device**
Located near the locomotive control valve this device is used when a locomotive unit is handled dead-in-train (see below). Abbreviated as DED.

**Dead-in-Train**
Hauling locomotive or locomotives in a train without the MU cable and air hoses coupled (hauled like a car).

**Demurrage**
Tariff charges assessed for detaining freight cars beyond their specified time limit.

**Derail**
This track safety device is designed to guide a car off the rails at a selected spot. Its purpose is to protect against collisions or other accidents.

**Dispatcher**
The person in charge of all movements (and issuing Form D's) within a designated region. Abbreviated as Dspr.

**Disturbed Track**
A section of track with a temporary speed restriction due to track maintenance or a defect.

**Draft Force**
Pulling force (tension) on couplers and draft gear during a slack-stretched condition.

**Draft Gear**
This is a cushioning device that transmits draft or buff forces between the coupler and the locomotive or car.

**Draw Bar Forces**
The longitudinal forces at the couplers between locomotives or cars. These forces can be draft or buff, depending on train operation.

**Dual Control Switch**
A switch equipped for power or hand operation.

**Dummy Hose Coupling**
A device designed to couple unused air hose for protection against damage and to prevent foreign matter from entering the train line.

**Effective Securing Device**
A device applied to secure a manually operated switch. It is vandal/tamper-proof and designed to protect railroad workers.

**Electrically Locked Switch**
A hand-operated switch with an electrically controlled device to restrict the movement of the switch.

**Emergency Application**
A reduction in brake pipe pressure at a rate sufficient to cause control valves to move to the emergency position.

**Engine Servicing Track Area**
Track(s) for servicing, repairing, inspecting, testing or even rebuilding of engines.

**Engineer**
The crew member designated to operate a train. Abbreviated as Engr.

**Extra Board**
A list of crew assigned to trains when an extra train is needed, or when the regular crew has worked the maximum legal hours and needs rest time.

**Fixed Signal**
A signal at a fixed location that affects the movement of a train.

**Flagman**
Usually, the brakeman assigned to duties at the rear end of the train.

**Flares Or Fuses**
A warning signal to other trains. These glow (burn) for up to 15 minutes.

**Foreman**
The person in charge of a Roadway Crew. He or she is authorized to control train traffic (designated by a Form D) through a section of trackage obstructed or undergoing repair. Abbreviated as Frm.

**Form D or Movement Permit Form D**
A form issued by the Dispatcher containing written authorizations, restrictions, or instructions.

**Form D Control System**
A block system (signaled or non-signaled) for the movement of trains outside of yard limits as authorized by a Form D. Abbreviated as DCS.

**Frog**
The "X" shaped portion of a switch.

A Frog can also be a tool used for rerailing car wheels.

**Rerail Frog**

A rerail-frog is a kind of a metal ramp object used to help re-rail a car or engine that has gone off the track but has not overturned or moved too far from the track. The rerail frog is temporarily spiked, wedged or clamped next to the track at the wheel that needs to be lifted back over the rail. The car is pushed (or pulled) by the engine to get the wheel to ride up over the ramp and back onto the track.

Rerail frogs can often be seen dangling from the sides a tender along with some chains or cables (usually on a branch line service).

Other tools like: wrenches, splice bolts, jacks and levers are usually kept in the caboose or stashed on the engine.

**General Order**
A document used to detail Timetable or other changes. Abbreviated as GO.

**Head Man**
Is a freight train brakeman who rides in the locomotive cab.

**Home Signal**
A fixed signal controlling the entrance to an interlocking or controlled point.

**Hot Box**
Overheated wheel bearing or wheel journal which can cause the journal packing to smoke and burn.

**Hump Yard**
A switching yard on an incline where gravity is used to aid the shunting of cars (after movements by the engine).

**Independent Application and Release Control**
Controls independent brakes on multiple locomotives from a single control.

**Interchange**
A track on which cars are delivered or received from one railroad to another.

**Interlocking (Int)**
A predetermined sequence of signals and signal appliances to ensure that movements must succeed each other in the correct order. This is to prevent signals being displayed simultaneously on conflicting routes.

**Interlocking Appliances**
Are parts of any interlocking capable of movement like: switches, movable point frogs, derails, locks, movable bridges etc.

**Interlocking Limits**
The trackage between the opposing home signals of an interlocking.

**Interlocking Signals**
The fixed signals of an interlocking.

**Interlocking Station**
The location from where an interlocking is operated.

**Junction**
Where two or more railroad lines converge as designated by the Timetable.

**Main Track**
A track where train movements are authorized by ABS, DCS, or interlocking as designated by the Timetable.

**Maintenance of Way**
A location where work is being carried out by Railroad Crews as designated by Form D. Abbreviated as MOW or MW.

**Marker**
A highly visible red/amber light, reflector flag, or marking device on the rear of a train.

**Mile Post**
A white sign with black numbers to designate the distance from a location. Abbreviated as MP.

**Movable Point Frog**
A frog with a moving alignment allowing open flange-way for train movement.

**Operator**
The person controlling a designated section of track. He or she is accountable to the Dispatcher for movement of trains. Abbreviated as Opr.

**Overhead Bridge**
Any bridge which crosses above the trackage eg. a railroad bridge, road bridge, or pedestrian bridge. Abbreviated as OH.

**Pilot**
An employee assigned to a train to guide the Engineer, Conductor, or Track Car Driver in unfamiliar situations or territory.

**Push-Pull Train**
A passenger train with a MU or control car at either end.

**Retarder Yard**
A switching yard where an employee in a control tower controls the movement of cars (after they are released from a locomotive).

**Return Movement**
When an uncoupled engine, or leading portion of a train returns toward the remaining stationary portion of the same train.

**Reverse Movement**
A movement opposite to the direction previously authorized.

**Rules-in-effect**
The specific operating rule (or group of operating rules), as designated in the Timetable, that govern the use of tracks.

**Running Track**
A designated track for movements by signal indication or at a Restricted Speed.

**Schedule**
Indicates the direction, number, frequency, and times for trains on a designated timetable.

**Semi-Automatic Switch**
A hand-operated switch that is designed to be trailed through in either position.

**Siding**
A track used for meeting or passing other trains adjacent to a main track.

**Slide Fence**
A fence placed along trackage to warn of rock slides. When the fence is activated, it changes the aspect of the signals governing that block to Stop.

**Speed Control**
An engine safety braking device in case the engineer fails to reduce the trains speed to the speed required by the cab signal indication.

**Spotting Cars**
Switching freight cars to a specified location for loading and unloading.

**Switch Engine**
A locomotive used for switching cars in yards and terminals.

**Switch List**
A listing of cars to be sorted or moved.

**Tamper**
A power-driven machine for compacting ballast under ties.

**Tangent Track**
Straight track.

**Tank Car**
A car with a tank for carrying liquids such as oil, acids, compressed gases and granular solids.

**Tank Dome**
This is the vertical cylinder attached to the top of a tank car. It allows for the tank to be filled to full cubical capacity.

**Tare Weight**
The weight of an empty railroad car. Also referred to as Light Weight or Tare.

**Temporary Block Station**
A station (manned) that is established by Bulletin Order or Form D to control the movement of trains. Abbreviated as TBS.

**Three-Step Protection**
A safety procedure used for the protection of workers going on, under, or between cars.
(1) Apply the brake.
(2) Center the reverser.
(3) Put the generator field switch in the OFF or OPEN position.

**Tons of Operative Brake**
Is calculated by dividing the gross trailing tonnage of a train (not including the locomotives) by the total number of cars with operative brakes. Abbreviated as TOB.

**Track Barricade**
When access to the track is blocked by a sign or obstruction fastened to a track.

**Track Car**
Equipment, other than trains, operated on a track for inspection or maintenance. Abbreviated as TC.

**Train Master**
An executive officer who supervises train service operations at terminals, in yard service, and on one or more divisions (or on part of a division).

**Turn-Around**
A train operated from a terminal to an intermediate station and returned to that terminal in one work shift.

**Under-grade Bridge**
Any point where the trackage crosses above any stream, railroad, road, or pedestrian right of way. Abbreviated as UG.

**Undesired Emergency (Also known as "Dynamiter" or "Kicker".)**
An undesired emergency application of the air brake system on a train.

**Waybill**
A document for handling and accounting for a shipment of freight.

**Way Car**
A box car from which LCL (Less than carload lot) shipments are loaded and unloaded at various towns.

**Yard**
A system of tracks used for the making up of trains and the storing of cars.

**Yard Limits**
The trackage between Yard Limit signs as designated in the Timetable. Restricted Speeds apply within Yard Limits.

## Conclusion

Model railroading is a truly rewarding leisure activity that will keep you busy and entertained for hours… if not a lifetime. Best of all, it is an excellent way to have fun, continue to learn and to make new friends. So, I am sure you will have enjoyed this book.

There are numerous organizations you can join where you can meet with like-minded people from all walks of life who share your passion for model railroading.

If you would like to e-mail me your suggestions, or comments about how you have applied what you learned, or a testimonial, or you if you have a question you'd like me to answer in the next edition, please email me at modeltrainbook@model-train-help.com

If you have a photo of your train set I'd love to see it too!

Please do not expect a reply as I already get far more emails than I can manage… and rest assured I promise to never send you spam!

If you would like to share some tips with others:
http://www.model-railroad-resources.com/train-tips.html

If you want to tell others about your layout:
http://www.model-railroad-resources.com/my-layout.html

If you want to promote your model train club:
http://www.model-railroad-resources.com/train-club.html
http://www.tradetrains.com

If you want to buy, sell, or swap model trains or gear (or if you are finding it hard to find something you can run a WANTED listing):
http://www.tradetrains.com

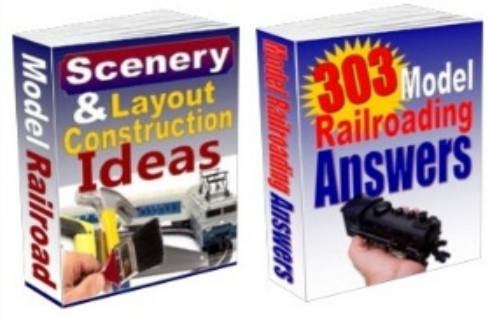

If you want to post a question on the blog:
http://www.model-railroad-resources.com/submit-questions.html

Highly recommended follow-on ebooks:
http://www.model-train-layouts.net

This train is about to pull into the station – I'm sure you enjoyed your journey. So, thanks for reading, take care!

***Robert***

Recommended ***follow-on*** ebooks:




- **Model Train Scenery & Layout Construction Ideas**
- **303 Model Railroad Answers**

Available separately or as a package (save 41%) at
http://www.model-train-layouts.net