



# BASIC MODEL RAILROADING

## Part 1: Introduction and THREE INITIAL DECISIONS

### Introduction

It is much easier than you think to enjoy model railroading. It may look complicated or very technical or too artistic, but the beauty of model railroading is that it's easy to learn, you can enjoy the parts that attract you, and you can learn about some aspects that you may not know too much about as you go along. Every model railroad that you see is the product of someone who started out just as you are about to, and learnt as they went along.

And there are lots of learning resources. There's your local hobby store for a start. There are lots of books on "how to", there is lots of information on the Internet, and last but not least, there is the experience of other model railroaders.

You may see them at a show, and they may all look as if they are too busy operating their layouts, but ask them a question, and the chances are they'll talk your ear off for the next half hour about the hobby. All you have to do is ask the questions: – how do you do this? – where do you get that? – what is this made of? – what does this mean? – how much does it cost?

Budding model railroaders are essentially of two kinds:

- Those who look wistfully at trains and would just like to get into the hobby. Their most important decision likely is to decide what scale (and gauge) they'd like to be in – what can they (physically) handle – how much can they afford – how much space do they have – what branch of model railroading interests them.
- Those who already have a "train set" handed down to them, or got one for a present. If they are happy with what they have and would like to build on it, the question of scale and gauge has already been decided – it's now questions of what they can afford – how much space do they have – and what branch of model railroading interests them?

### Scale and Gauge – the first decision

This can be confusing for a beginner, but it's really quite simple.

Scale is the size relationship of the model to the real railway (its "prototype"). Scale is usually expressed as a ratio, e.g., 1:87. That means that 1" of model represents 87" of the real thing.

As it happens, this ratio is the most popular model railway hobby scale, and is easily recognizable as **"HO" scale**.

Around 80 per cent of North American model railroaders enjoy their hobby in this scale.

Gauge is the distance between the inside edges of the rails, and follows the determination of scale. In HO scale, the corresponding width of a standard gauge track (1435 mm) is 16.5 mm.

Most modellers initially opt for HO scale, but may become attracted to other options (acquired tastes!) as they grow in the hobby. The advantages of this scale are

- relative economy of space and costs
- ease of handling if physical restrictions such as eyesight, or participation by youngsters, are to be considered
- the wide variety and scope of ready-to-run manufactured items available
- ease of modeling realistic surroundings (scenery, buildings, structures) within the abilities of most).

The next-popular scale that has grown to maturity in the last 30 years is **“N” scale**.

This is a ratio of 1:160, with a 9 mm gauge. It is an attractive option for anyone with little space to allocate to their hobby, or for those who are attracted to the vision of creating a model railroad in a four-fold larger dimension – thus being able to introduce more railroad (and hence more operation), or a greater vista of scenery (or a combination of both).

It is attractive for “scratchbuilders” (those who build models from basic materials) because of the economy of material and design, but it is a less robust scale in which to work (some would call it “finicky”), and therefore requires more than careful attention to track-laying and maintenance.

Choice of this scale is contra-indicated if some physical handicaps and/or young children are to be considered.

A growing segment of interest is in the **“larger” scales** that have been making a comeback from the toy train era.

For instance Lionel™ is indelibly associated with Scale O (1:45), and now offers quality scale equipment. Ideal for youngsters, great feel for the real thing, but more expensive, and more difficult to create credible scenery.

Another revived large scale is Scale 1 (1:32), more popularly known as “G” (for Garden) Scale. This scale does indeed work well in a garden setting because of its robustness and natural scenery surroundings. The same observations as for Scale O apply. Note that “G” scale also includes narrow gauge trains in what is actually Scale 2 (1:26).

Finally, **narrow gauge** modeling is gathering momentum for modellers who usually have limited space but would like to work in Scale 1 or O with a resulting track equivalent of

Gauges O or HO. They are also intrigued by the idiosyncrasies and “whimsy” of narrow gauge operations.

The predominant practical attraction is the more modest space demands proportionate to the scales involved, especially if one plans to exhibit as a "solo" modeller at a model railway show.

A challenge is the relatively narrow range of ready-manufactured equipment (locomotives and rollingstock), which means that modellers have to build this largely from component parts, with the result that this segment of the hobby does tend to attract the more advanced modellers.

### **Getting it off the floor – the second decision**

Basically, you become a model railroader once you make the decision to get your track off the floor. Whatever its origin, a train set becomes a model railroad when one gets it off the floor into a designated space of its own, so that the track and scenery don't have to be set up and taken down each time.

That space is most popularly in a basement, but also commonly in an attic, garage, spare room, shed, garden, or on a ledge as part of a room used for some other purpose. Model railways have also been found under beds, or in a suitcase, or suspended from a ceiling with hoist-able pulleys and rope, or as a module stored in a closet and brought out to be put on a table.

Leaving aside the garden railway and the ledge-in-a-room options, the other choices require the ability to construct a simple frame, referred to by modellers as "benchwork".

This prospect may seem daunting, but it is really quite doable if one can handle a saw, drill, hammer and a set of screwdrivers. This subject is dealt with more fully at button **BMR – A HOME FOR YOUR RAILWAY.**

### **Methods of train control – the third decision**

Traditionally, since WWII, most model railways in the smaller scales have operated with power packs converting mains voltage to 12 volt direct current (DC).

The hobby is now migrating to Digital Command Control (DCC), which simplifies wiring, provides for the simultaneous operation of multiple locomotives without the hindrance of blocks or cabs, and comes with impressive realism in lighting and sound.

The initial investment, however, is considerable. Again, research is advised, and there are many good "how-to" books on wiring and methods of control.

DCC controls trains electronically by means of signals transmitted through the rails direct to an on-board receiver on each locomotive, making block wiring and cab control obsolete.

DCC control is now gathering momentum in N scale as manufacturers are now offering "decoder-ready" locomotives, that is to say, a connection and space for the necessary microchip receiver on board the locomotive. This subject is dealt with in greater detail at button, **BMR – POWERING and WIRING THE LAYOUT**.

#### **A Word about Coupler designs**

Equipment in all scales is being offered more and more commonly with the **Kadee**<sup>TM</sup>-type coupler, or in N scale, with its **Microtrains**<sup>TM</sup>-type coupler equivalent.

Traditionally, HO equipment came with the **NMRA** standard coupler, and in N scale, with the "**Rapido**" (or "**Elsie**") –type coupler.

Modellers should therefore be aware that they may have to make a decision whether to acquire only equipment of one type of coupler, or to operate with two types of couplers, or whether to convert all their equipment to the more prevalent Kadee/Microtrains –type design coupler.

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# BASIC MODEL RAILROADING

## Part 2: A HOME FOR YOUR RAILWAY

### Getting it off the floor

Basically, you become a model railroader once you make the decision to get your track off the floor.

Whatever its origin, a train set becomes a model railroad when it gets a designated space of its own, so that the track and scenery don't have to be set up and taken down each time.

Most modellers aim for a permanent, or preferably a semi-permanent, set-up, but some prefer a portable module arrangement that they can move around the house or take to a show.

### Location

The space for a “permanent” set-up is most popularly in a basement, but also commonly in an attic, garage, spare room, a shed, garden, or on a ledge as part of a room used for some other purpose.

Leaving aside the garden railway and the “ledge-in-a-room” options, let's call this space “the train room”.

The three enemies of any model railroad are the three D's – dust, damp and damage. (Also there are comfort issues, such as adequate lighting and heating.)

There is always some dust in the air, but be sure that you have a proper ceiling in place and that the floor is as dust-resistant as possible.

A short-weave carpet is ideal both to combat dust and to give anything that falls off the layout a chance of surviving!

Damp will play havoc with your woodwork and your electrical connections, so your space should be well-heated in the winter, and if necessary capable of dehumidification in the summer. Buy a simple humidity meter.

Properly built benchwork at a reasonable height will help to avert accidental damage, but be sure that nothing can fall on the layout.

### Benchwork

Don't build anything that can't be taken apart and moved without destroying what you have created. Any modeler who has endured the anguish of tearing out a permanent layout will resolve to work with freestanding modules in future.

A permanent layout is one that has been built in such a way that it cannot be dismantled without destroying it.

A module is a section of model railway that is self-contained, but can be connected to another section of the same or another layout. It may be attached to the walls for stability, but if it comes time to move, each module can be detached and separated with minimal loss of track and electrical connections. Hence the reference to a semi-permanent set-up.

“Benchwork” is the term for whatever you resolve to build your layout on.

“Benchwork” has three components: the frame, the deck, and the legs (unless it is to be attached entirely to the wall. In that case the maximum width at any point should not be more than 24”, preferably 18”).

Whatever you decide to build, take into consideration what is conveniently available at your local building centre or lumber yard.

### **The Frame**

A rectangular or square wooden frame that supports the deck on which you will create your layout.

Opt for 1 x 4" white pine as the optimum (especially if you plan on using 2" thick rigid styrofoam), but 1 x 3" as a minimum. Most modules are constructed as oblong. When determining the overall size of each module, bear in mind two things:

1. Can you get it out of the room if you need to?
2. Will you be able to reach all parts of the module for maintenance and repairs?

Take into account the usual dimensions of lumber and decking materials at the building centre, in order to cut down on the amount of waste after trimming to the selected size.

Most lumber comes in 4ft, 6ft and 8ft lengths, and decking materials usually come in 8 x 4 ft or 8 x 2 ft sheets. (Most building centres may also stock some 4 x 4 ft or 4 x 2 ft sheets, or if not, will be happy to cut the sheet for you for a small fee.)

An ideal module length is 4 ft or 6 ft, and the width should ideally be no more than 30”.

Before you construct the frame, decide whether your decking is to go on top of the frame, or whether (especially in the case of styrofoam decking), you prefer to install it flush with the top edge of the frame. (See “The Deck” below.) Use #8 screws rather than nails to construct the frame.

### **The Deck**

Once the frame is up and braced, it has to be topped. The three popular deckings (in descending order of popularity) are:

- styrofoam sheeting (2” thick ideal for ground sculpting, but 1½” or 1” also acceptable)

- plywood (½" or ¾" thick)
- homasote (trainboard)

These are all obtainable at building supply stores (although homasote is not stocked as universally as it used to be).

With plywood, a cork bed underlay (obtainable at hobby or hardware stores) is recommended to deaden the noise of the train.

There are two basic styles of decking - solid (i.e., the whole top is covered), or open (i.e., there is only decking where the tracks are). Many modellers use a mix of both.

Solid decking is faster to construct, but results in a uniform flat surface. It has to be cross-braced horizontally across the frame, and a good rule of thumb is that the decking should not move when you press down on it with your fist. This means that for ½" plywood or homasote, or 1" styrofoam, cross-bracing should ideally be 12", but no more than 18" apart (1 x 2" pine is fine). For 2" styrofoam, 24" intervals should suffice.

Open decking has to be supported by "risers" fastened vertically to the horizontal cross-bracing (2 x 1" or 3 x 1" knotty pine will work fine).

The advantage of open decking is that it allows for below deck scenery and easy pop-up access, but it does require careful pre-planning of the track layout, and skill with a jigsaw to fashion the required sections.

### **Support – Brackets or Legs**

A preferred height for the main layout surface is usually between 42" and 48".

Most layouts are supported by legs to the floor, and most modelers use wood, although steel and PVC piping (very light, but strong) supports are also to be found.

If wood, legs should be of 2 x 4" pine, although 2 x 2" may also suffice for intermediate or short sections. Cross-bracing parallel to the width of the module is recommended.

If the module is to be bracketed to the wall, the brackets should be of tri-angular design and sufficiently strong that the module will not move if pushed down upon.

### **PORTABLE MODULES**

A portable module consists of a frame and a deck without the legs. You may wish to add a carrying handle for easier transportation. A portable module should ideally be no more than 4 x 2 ft in dimension. You will have to decide whether it is preferable to have the line-side structures detachable, or glued securely to the deck.

### **SUMMARY**

All that is needed is for this leaflet to be supplemented by a good "how to" book available in any hobby store, a little confidence and a visit to a building supply store.

Ideas can also be obtained from talking to other enthusiasts, and one will very quickly discover that everyone has their own ideas of what works for them. Fact is that no two "benchworks" are built the same way.

The hardest part is always making a start, but it's so surprisingly easy that you will wonder what kept you so long.

It is all really quite doable if one can handle a saw, drill, hammer, measuring tape, spirit level, and a set of screwdrivers.

The only hard-and-fast rule about "benchwork" is that it must not collapse if you lean on it, so build sturdy and brace well!

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# BASIC MODEL RAILROADING

## Part 3: LAYING TRACK

The purpose of this leaflet is to set out the basics of laying ready-made track and its appearance.

Satisfaction with your model railway is very much dependent on how well you have laid your track.

Most modellers start with “setrack” (sectional track) – the geometrically uniform “snap” track that comes with all starter sets.

As the railway moves off the floor, all modellers start to experiment with “flextrack” (flexible track, that is bendable track up to 3 ft in length that can be cut to fit a required length or curvature).

“Flextrack” moves the layout from the toy train world of a geometrically uniform configuration to a replica of prototype railway track formation (subject only to the overall limitation of the model railway itself).

Choice of type of track, the function of track formations such as turnouts, slips and crossings, suggested layout track plans, and how to work with “flextrack” are all covered in the abundant variety of “how to” publications available at all hobby stores and in the model railway press.

The prime criterion for well-laid track is a firm level roadbed that will accept track spikes.

Modellers using a homasote™ roadbed do not need a cork or equivalent underlay, but those with plywood or styrofoam roadbeds will require a homasote, cork or equivalent underlay to deaden sound and accept track pins.

Whatever the combination of materials, ensure that the track itself is continuously level without any undulation.

The vast majority of modellers use track pins of whatever brand to secure the track to the roadbed.

Some use glue, but glue is prone to “pop”, and adjustments are more difficult to make.

For the smaller scales, the Peco™ track pin is to be recommended for easy placement with needle-nose pliers rather than a tack hammer.

In whatever scale, when nailing your track work down, make sure you do not push the nail in too far. If it pushes the tie down it can actually put your track out of gauge by squeezing the two rails in slightly. Keep a track gauge handy.

Do not pin too frequently near turnouts and crossings, but the ultimate test is continuous electrical contact.

Remember to leave minute gaps at rail joints as the rails will expand and contract with temperature variations. Adjust track pinning until this is achieved. Most modellers will ballast track for prototypical appearance.

Ballast with care (if at all) near the connecting rails of turnouts and slips.

Defer ballasting until you are satisfied that you have smooth operation, and that you are unlikely to adjust for track alignment. The pins may be removed once the ballast glue has set.

Two things to watch for when laying the track are lateral sway (track that has not been laid perfectly straight), and “doglegs”, or kinks. Both are unsightly and doglegs will impair smooth running. Pin as necessary until these are corrected. By far the best way to check for them is to look along the track at track level.

Another very common but easily correctable unsightliness is missing ties where one section of track joins another, gaps that occur commonly with flextrack and at turnouts and crossings.

Simply cut some single or double ties from a section of unused flextrack, trim off the plastic chairs and slide the tie(s) under the rails at the gap. The improved appearance transforms your track laying into a professional-looking job.

Switch machines (e.g., Tenshodo™ or Peco™) and switch motors (e.g., Tortoise™) are necessary on large layouts or in remote corners, but many modellers minimize their use for cost, convenience and appearance reasons.

Some brands of turnouts come with ready-assembled above-ground switch machines.

Except where you may be modelling a large urban or heavy main line track configuration, these switch machines are unprototypical for the vast North American single track rail network where turnouts are for the most part thrown manually.

For appearance avoid this turnout option in favour of a switch machine that can be installed under the roadbed. As a neat decorative touch, some modelers buy or scratchbuild non-operative switch stands to simulate the familiar prototype.

Finally, once you have your track laid the way you want it, you will discover that you have to do maintenance just like a real section gang does.

You may have to relieve slight unevennesses in track levels, cure poor electrical conductivity or adjust slightly out-of-gauge spots, or smooth rough joint connections with a fine needle file.

Do not use emery cloth or any other abrasive or liquid to clean your track – invest in good quality track cleaners and have them handy at critical points on your layout.

Since dust is inevitable, occasionally vacuum, brush or blow your trackbed free of particles.

Finally, those turnout designs that rely on an electrical connection between the moving connecting rail (blade) and the stock rail, their two inside surfaces will require occasional burnishing with a very fine emery cloth.

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# BASIC MODEL RAILROADING

## Part 4: POWERING and WIRING THE LAYOUT

### Powering the layout

Since WWII, most model railways in the smaller scales have operated with power packs converting mains voltage to 12 volt direct current (DC).

The hobby is now migrating to Digital Command Control (DCC), which simplifies wiring, provides for the simultaneous operation of multiple locomotives without the hindrance of electrical “blocks” or sections that have to be individually activated or deadened, and comes with fantastic on-board sound and lighting. The initial investment, however, is rather more than for a DC power pack set-up.

Research is advised, and there are good "how-to" books on methods of control and wiring.

Whatever the choice quality equipment with power and features to spare is a good investment.

The fundamental difference between DCC and the traditional DC method of control is that this is achieved not by the provision of electrical power to the wheels or third rail/overhead pick-up of the locomotive, but rather by means of a digital command to an electronic decoder unit placed in the locomotive itself.

For those modellers wanting to move to DCC, it will make a decision necessary whether to rewire your layout and either to install decoders in the older locomotives, or to retire them.

For anyone new to the hobby, it's very definitely the "state-of-the-art" form of control.

The major benefits of DCC (with somewhat simplified wiring as the traditional “block” and “cab control” wiring is no longer required), are the achievable very realistic scale speeds, and the ability to run more than one locomotive independently on the same-powered track.

### Wiring principles

Whatever system is used, model railroading operates with a basic electrical circuit consisting of a positive and a negative lead (polarity). Wherever either lead is broken, the resulting open circuit causes the locomotive to stop, or the motor to quit, or the light to go out.

Where the two leads or polarities touch, a short circuit will result.

A short circuit generates heat and will cause a motor or coil to burn out, or plastic to melt – and in extreme circumstances, a fire.

Most power packs have built-in protection with a thermal cut-out that will shut the power off automatically. Nevertheless, a short circuit should be disabled as soon as it is discovered, if necessary by shutting off all power, and then tracing it circuit by circuit to locate it.

No matter which system of control you have decided on, the layout still has to be wired to avoid potential short circuits arising from turntables and reverse loops (where a track doubles back on itself), and the design properties of turnouts and slips, where the electrical polarity of the “frog” (where the two inside rails come together) may change as the turnout is “thrown”.

Do not wire the whole layout and then turn it on. Chances are that there is a short circuit somewhere, and you will have no idea where it is.

Wire one section at a time and re-test your layout after the installation of every turnout, slip and crossing. If the locomotive no longer moves, chances are it's a short circuit, and you will know that there's a problem with what you just did.

The details of wiring and soldering techniques are beyond the scope of this leaflet and current “how to” books on wiring should be consulted.

### **Wiring for DC (Conventional control)**

The distinctive feature of traditional wiring is the provision of electrical “blocks” or sections that have to be individually activated or deadened. The reason for this is that one DC power pack throttle can only control one locomotive unit independently of any others. So a layout with say 5 locomotives requires a minimum of 6 isolatable sections, so that only one locomotive unit is in motion at any given time under the command of that throttle.

This requirement calls for the detailed planning of the location and extent of the required electrical “blocks”, so that the layout and available locomotives can become interchangeably operable.

### **Wiring for DCC (Digital Command Control)**

As noted, the major advantage of this system is the ability to operate numerous locomotives independently over the same electrically-fed section without “blocks”.

It is however a misleading oversimplification to state that “all that is now required is two wires to the track”.

The only simplification resulting from the DCC method is the elimination of these “blocks” or individual electrical sections.

The layout still has to be wired to avoid potential short circuits as noted under “**Wiring Principles**” above.

While DCC systems usually provide for the operation of one locomotive on the DC system, if you have a need to operate locomotives on both systems, to avoid inadvertent damage to control units or locomotives, it may be advantageous to plan for entirely separate operating circuits to accommodate both systems of control, especially in the smaller scales.

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# BASIC MODEL RAILROADING

## Part 5: SCENERY AND STRUCTURES

“A layout without scenery is a mere exercise in running trains.” (Charles Cooper)

Scenery may be defined as everything around the railway itself that creates an illusion of miniature reality. There is no one way of “doing scenery”. In fact there are likely as many techniques as there are modellers, but there are basic materials and methods that are described in full in the many “how-to” books, and articles available from libraries, book and hobby stores, the internet and the model press.

Scenery encompasses the creation of landscape, mountains, valleys, tunnels, rivers, lakes and ponds, buildings, structures, back drops and the detail – little people, animals and vehicles that populate the layout.

At one time, serious modellers, (as opposed to toy train enthusiasts) were required to build their scenery from “scratch”, using common household materials and taking advantage of whatever limited materials they might be able to find in building centres and art supply stores.

Today, many modellers still prefer to build what they can from scratch, but there is now an abundance of kits and scenic materials available, so that the only hurdle a modeller has to overcome is his own limitations in creating.

The good news is that with a little patience, everyone has the ability to take reasonable shot at “doing scenery”. The further good news is that it’s fun and that there is a lot of built-in forgiveness, because if it doesn’t look right the first time, it is almost always possible to go over one’s effort and do it again.

Two cautions about colour.

First, except perhaps for water, Nature does not do “gloss”.

Most modellers today work with acrylic or tempera powder paints. However, Nature doesn’t do solid colours either.

It is in the treatment of colour and texture that model railroad scenery comes close to an art form, so don’t hesitate to experiment with brushes, paints, dilution with water and the many texture scenic aids ranging from bushes, grasses, earth to substitute water that are now available at modest cost.

The most significant single component of “scenery” is in the creation of the terrain (“the landscape”) itself, and it is here that there is a wide array or approaches.

Traditionally, this has been created with hydrocal™ or plaster of Paris, either of which require shaping with chicken wire, fly screen or a framework of cardboard strips.

In recent years plaster cloth (e.g., by Woodland Scenics™) has become popular, especially for medium and smaller-sized layouts. This is easier to shape using cardboard strips and/or crumpled paper towelling (better than old newspaper), and has the advantage of being lighter for modules that require transportation. A good “how-to” source is recommended here.

As for buildings and structures, there is a choice of ready-made, built from a kit, “kitbashed” (built from more than one kit, often from a combination of different kits to create a unique structure not to be seen anywhere else), or “scratchbuilt” from card, paper, styrene, celluloid, balsa and bass wood, and so forth.

Most modellers start with ready-made structures or kits, and then graduate to scratch-building as their construction skills improve. However, an understanding of perspective is an important dimension. (see **BMR - Prototype and the Model**).

Too many layouts feature buildings everywhere on the layout in the same scale as the railway, with the result that this essential violation of perspective gives the whole layout a toyland appearance.

Final scenic touches are the addition of people, animals, vehicles as the context requires, and this is where many modellers inject a note of whimsy and imagination.

And not to forget trees.

In the past, modellers have scratchbuilt these with varying degrees of success, but today an array of all kinds of realistic-looking trees is available commercially. Again, a good “how-to” source is recommended.

As all model railway layouts have boundaries, and usually face the viewer in one direction, most modellers provide a vertical backdrop that is intended to continue the scene into the distance. Likely the most popular materials for this are masonite board or styroboard. There are ready-made printed scenes available, but many modellers paint their own – sometimes just a plain light blue to represent sky, and/or make up scenes from collages. There are many approaches to creating backdrops, and the best approach is in the eye of the beholder. However, as with all aspects of creating a model railway, visits to other layouts and to shows are good for stimulating ideas.





# BASIC MODEL RAILROADING

## Part 6: THE PROTOTYPE AND THE MODEL

or “How to make your model railway a more realistic miniature of the prototype”.

### **Purpose of a model railway layout**

The purpose of any model railway is to be an enjoyable hobby in creating a scene that evokes a happy recognition of reality in miniature.

### **Visual Perception**

We all know that a model is a model - it's not the real thing, and we accept the fact that any model is a compromise in every way. With that as “a given”, the eye then scans the scene and runs a comparison with what the memory has stored about the real thing. During this process, some allowances will be made by most of us for the knowledge that what the eye sees is only a representation of the real thing.

While our visual perception is prepared to make some allowances, it balks when it is asked to push its acceptance factor beyond a certain point. A good model has to “look right”. So how much of the prototype has to be embedded in the model before it is accepted as looking like the real thing? The answer for most of us is probably “as much as possible”.

### **How to get the model to look like the real thing**

- **By observation.**  
Without trespassing, observe at stations, overpasses and grade crossings and from highways. Take photographs from all angles to fortify your memory.
- **From information.**  
Your main sources of information about yesterday's railways come from photographs, building plans and track diagrams. These are readily available from railway periodicals, especially monthly (model) magazines and “how-to” publications, railway books, hobby shows, clubs and meets that offer quality model railway layouts for observation and instructional (“how-to”) clinics, and of course the Internet.  
Hobby shows also frequently offer railway photographs and old publications for sale at reasonable prices. Of particular value are the publications, because these interpret the railway scene and place it in its correct historical context as to time, place and function.
- **By good design.**  
A good layout design captures the essential details of the prototype while avoiding the pitfalls of texture and dimensions in miniature.

### **Type of layout**

A layout is either prototypical (i.e., it represents an actual railway scene, past or present), or it is freelance (i.e., it represents an imaginary railway scene).

Some freelance layouts introduce prototypical elements of a particular area or structure, but whatever the representation, for a realistic model layout the general railway prototype ought to be observed and followed to the best of the modeller's ability.

All layouts are one of three basic types, and with the exception of dioramas, afford the more usual and ever-popular continuous circuits, or the less common end-to-end (point-to-point) operation, or a combination of both. As such, all have to make compromises with the prototype:

- diorama – analogous to a stage set: a portable, but by definition non-operable, scene in any scale.
- modular – an operable layout built in one or more sections that can be moved/dismantled intact. This includes all of the layouts at a hobby show, and is also highly recommended for any home layout.
- permanent – a larger operable layout that would have to be torn down to be moved.

#### **Rules of space, scale and detail**

- A larger scale obviously demands more space (unless it is a scene in a diorama)
- The larger the scale in a larger space, the more opportunity for roughed-in scenery and detailing.
- The larger the scale in a smaller space, the greater the need for detailing.
- The smaller the layout in any scale, the greater the need for detailing.
- The smaller the scale in a larger amount of space, the more opportunity of building a credible end-to-end operation, and/or to represent a larger and diverse (rural, urban and industrial) landscape.
- Smaller scales are ideal for a layout of reasonable size in a restricted amount of space.

#### **Aspects of “looking right” and mistakes to avoid:**

- **Perspective** - the smaller the scale in relation to the size of the layout, or in the case of any multi-tier layout, the greater is the need for the proper treatment of perspective. The importance of perspective increases in proportion to the amount of geography represented by the model.

A part of a layout that is elevated, or is otherwise intended to be at some distance or in the background, must appear to be at a distance. A good way to achieve this is to reduce the scale of the structures involved, and to ensure that any backdrop acknowledges the necessity for perspective.

- **Boundaries** - Since a model is a model, it has to end at a defined edge. In the background, the edge is often extended into a vertical backdrop. A credible backdrop requires a sense of colour and perspective, as well as some artistic ability.

In the foreground, define the edge of the model. It is in order for roads, (non-operational) tracks, yards, fields and meadows, to end at the edge of the model without any kind of vertical shield. Freely admit the necessary boundaries of the model. Think of it as a stage set.

Study the various types and designs of background. Some are very elaborate and artistic, but even the simplest background is better than none.

Most layouts are constructed at a height of between 42 and 48 inches. At the front a dark (green is popular) cloth will hide the wiring and storage and allow the eye to rise to focus on the show piece.

- **Hide the improbable** - continuous operation layouts of any design (circular, oval, “dog bone”, figure-eight, multiple figure-eight, reversing loop) will seek to hide the curve(s) to avoid the appearance of caboose chasing.
- **Texture and colour** - Matte colours and a little weathering are in order for structures. Above all, colouring the landscape should never be attempted with paint at full strength. A sieve for powdering on landscape materials and a syringe of diluted paint for rock faces work well for proper texture. Techniques vary from modeller to modeller.
- **Time and place** - many layouts are dated to the 1950s, which allows for the operation of both contemporary steam and diesel power. In the past, manufacturers tended to produce motive power models that never existed on a particular railroad, or with numbers chosen at random, or without offering a choice of more than one number, but fortunately, models produced today are more likely to be a more correct representation of the prototype, both in design and livery.

Be sure to choose rollingstock that conforms to the era and location of choice - streamlined passenger cars and heavy modern freight cars are simply not credible on a 1950s branch line.

That said, you can cut yourself some slack by including a railway tourist operation on the layout, or by designing it in such a way that parts of it can be legitimately designated as main and branch line operations.

- **Tracklaying** - the appearance of many a promising layout has been spoilt by indifferent tracklaying and poor or non-existent ballasting.

“Dog-legs”, that is rail joints with a kink, not only look unsightly, but are a hazard to good operation.

Track that is not in good alignment is also very noticeable.

It only takes a few moments to slide spare ties under the track at joints, in order to preserve the continuity of the prototype.

Ballast is also an important component of “acceptance threshold”.

Last but not least, turnouts with attached above-ground electric motors will stretch credibility unless located at busy stations or junctions.

- **Detailing** - Too little detail does not let the model come to life - too much may detract from the overall impression that the model is trying to make. Again, scale plays a part.

For instance, experienced modellers in HO, S and O scales usually “weather” their motive power and rolling stock, but in N and Z scales excessive weathering may detract from the fine detail of the equipment.

As another example, many layouts include roadways, but an excessive attention to road signs, traffic lights, and so forth, is likely to be at the expense of, or will detract from, the detail that should be bestowed on the railway-related infrastructure.

Too much detail can swamp the viewer’s ability to grasp the essence of the model - a good model is a representation, not necessarily a minutely-detailed imitation. However, one tip: tunnel entrances should afford a view of a tunnel rather than an all-too-common cavern.

But detail is necessary to make the model to come to life, and to provide an interest for the viewer.

Do detailing after the essential railway buildings and structures are in place, starting with people, livestock, road vehicles, station names, order boards, switch stands, signalling, fencing, telegraph poles, non-railway buildings, and so on and so forth.

Some layouts add lighting, houses on fire, a street accident, half-built houses, illuminated business signs, a static or operating trolley line. There are loads for the gondola, flat, hopper and bulkhead cars. Got a stash of bits of scrap metal, discarded axle sets? Perfect for a scrap yard. The possibilities are endless.

- **Too much railway.** When planning a layout, resist the temptation to jam in as much track as possible. Unless the plan is for a marshalling yard, that’s simply not prototypical. Allow the layout to breathe. Less is better. Study the many variations of layout plans published in many magazines and periodicals.

For a successful layout there has to be room for other activities that represent the model community around your railway - there is not just the station, but a water tower,

a freight shed, a yardmaster's hut - there are trees, the road leading to the station, some people, road vehicles - even some abandoned track. An abandoned roadbed is very prototypical today, and is proof of the determination to resist laying track on every available inch of space.

A related rule is not to plan too big - better to start modest and do it well than to have a vast expanse of layout (even if you have the space, lucky person) and make a sloppy, obviously rushed model.

### **Conclusion**

Imitating the real thing is more of an art than a science. There are few absolute rules to follow, yet the realism of a model will always depend on an impressionist adherence to the essentials of the prototype, set in the appropriate time and space. At a minimum, the purpose of the model has been achieved as soon as the viewer's forgiveness threshold has been satisfied.



# BASIC MODEL RAILROADING

## Part 7: N SCALE

While HO scale continues to dominate the hobby by a very wide margin (its four major advantages being the great variety of available ready-to-run and kit equipment, ease of handling by youngsters, its economy of space, and a physically comfortable miniature scale to work with), N scale is now second in popularity as a result of great improvement in the selection of equipment and the enormous strides in miniature technology of the past decade or so.

N (for Nine millimetres) Scale came of age in 1960 after a preliminary Gauge 000 designation when the first push-along trains appeared in this size range in 1956.

It has a track width of 9 mm, and a scale of 1:160 (North America).

The principal advantages of N Scale are for those modellers **either** – with rather limited space for their hobby; **or** – for any given amount of space, a larger layout to provide better opportunities for substantial scenery, a layout focus with more distance between points, and such features as more extensive marshalling yards, to provide more operating challenges and opportunities.

### Keys to a successful N scale layout, especially in a limited space

- Careful track-laying is the key to N scale operational enjoyment. N scale, much more so than the larger scales, does not take kindly to indifferently laid track. It has to be perfectly level and straight, and where there are curves on gradients, they must be carefully banked so that 3-axle trucks can negotiate them without derailling.

As with all scales, laid track should be carefully tested with a variety of motive power and rolling stock to ensure that the clearances are adequate, and that the wheels perform well through turnouts and crossings.

- While they can be a little fiddly to instal, N scale Microtrains™ (formerly Kadee™) or other magnetic couplers make a vast difference to the appearance of an N scale train, and the couplers, properly installed, do work remarkably well. In any event, quality N scale equipment is now usually equipped with this superior coupler.
- There is no disgrace in 9" radius curves, but creative scenery design can hide or disguise those unprototypical sharp curves. However, do ensure that no radius anywhere is less than 9". If you can wangle it, try for a 10 or 11" radius at a minimum for main-line operations - some equipment with longer wheelbases may have difficulty with 9".

- Study the track formations and turn-outs offered by different track manufacturers. While No. 6 (medium) or No. 8 to 10 (large) radius turnouts are definitely preferable to No. 4 (minimum radius) anywhere on any layout, compromises do have to be made, but if at all possible, if you have to use No. 4 turnouts, confine them to the yards where your chosen switcher will have no difficulty negotiating them.
- A great advantage of N scale is for those who have limited skills for scenery and structure making to produce a credible railway environment and an attractive model.
- When designing your scenery, remember the importance of perspective. Background buildings should be closer to Z scale (1:220), or even smaller, depending on the implied distance.

As with any layout, ensure that you can reach any part of it to uncouple or re-rail, and that you can get at whatever you enclose for repairs and maintenance, whether this is by means of a "pop-up" or "lift-out".

In summary, N scale has much to offer for a modeller intent on an expanse of scenery, and who has the requisite fine motor skills to work in a more miniature dimension. However, good eyesight, a firm hand and lots of patience are prerequisites. Not recommended though if young children are to be involved.

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# BASIC MODEL RAILROADING

## Part 8: HO SCALE

This is by far the most popular scale today, world-wide. It dominates the hobby by a very wide margin, its four major advantages being the great variety of available ready-to-run and kit equipment, ease of handling by youngsters, its economy of space, and a physically comfortable miniature scale to work with.

HO stands for Half O Gauge. O Gauge today has a track width of 32mm, with a scale of 1:48 (North America).

HO today has a track width of 16.5mm, with a 1:87 scale (North America).

You may have seen references to OO Gauge. OO is the equivalent of HO in the UK, with the same track width of 16.5mm, but with a scale of 1:76, with the result that the track width is slightly under-scale. (Precision UK prototype modellers therefore prefer the EM [Eighteen Millimetre] gauge.)

HO/OO scale and gauge is a direct linear descendant of the larger trains of the original toy train era. That era is generally accepted as having begun at the Leipzig (Germany) trade fair in 1891, where the German firm of Märklin Brothers defined the original toy train gauges 5 (120 mm), 4 (75mm), 3 (67mm), 2 (54 mm) and 1 (45mm).

Gauge O appeared around 1900.

The steady miniaturization of the hobby scales and gauges was driven by the spread of the toy trains' popularity from a simple circle around a Christmas tree, to a new kind of toy for the children of the well-to-do who had large homes; and then to the population at large, whose financial and space resources were generally rather more limited.

Thus it was that the first OO "table top" Gauge trains produced by the German firm of Bing first appeared in 1922, followed by Märklin's trains in that scale in 1935, and by the popular UK maker Hornby in 1938.

World War II interrupted the further development of trains in this scale.

It was in the 1950s that the toy train era finally gave way to model railroading as an adult hobby.

This transition was stimulated by prosperity, improved miniaturization of electric motors, and the appearance of electronic applications.

Arguably, the two most significant transformations in the 1950s era towards prototypical resemblance were the replacement of tin by plastic as a manufacturing raw material, and the move from three-rail to two-rail electrification.



Add to that improved manufacturing and detailing capability, and the model railway industry was born.

The traditional larger scales faded into the background, manufacturers reconfigured themselves as the industry changed direction, acquiring and/or re-working traditional brand names, and the thrust of the hobby was now in the direction of closer adherence to the prototype in its detailing.

The modelling community now aspired to building something that looked like a real railroad in miniature.

Today, the HO modeller's choices are almost limitless in the areas of locomotive and rollingstock ("equipment") selection, layout design, and electric and electronic methods of control.

The basic options are RTR (ready-to-run/operate) locomotives, rollingstock, powerpacks, scenery), kits (assembly of commercially-prepared parts of equipment and scenery), or scratchbuilding (the building of a model railway by hand from a minimum selection of commercially-available parts).

Most modellers start with ready-to-run equipment, and graduate to kitbuilding in areas that interest them. Some modellers develop the necessary patience for handbuilding track, which has advantages of appearance, low cost, and the ability to create track formations ("special work") not commercially available.

As with all endeavours, it pays to start simply, with a modest layout ambition, but with an investment in good locomotives, track and power applications. Few of good quality is much better than plentiful but of poor quality. Most modellers are into the hobby for their lifetime, and it pays to invest in good quality.

Many modellers prefer to work on their own. Others may want the social contact of a club. All modellers are helped by information about their hobby. There are many good "how-to" books available from hobby stores. A subscription to a model railway magazine is a good idea.

There is a lot of information on the internet today, but some of the best immediate advice comes from others in the hobby and from a knowledgeable local hobby dealer.

Hobbyists at a model train show tend to look busy as they concentrate on operating their trains, but stop someone to ask questions, and chances are that you will be well-rewarded.

HO scale is a good starter choice in the hobby, and as their interests progress, many modellers come to “dabble” in another scale, or develop an interest in narrow gauge modelling.

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# BASIC MODEL RAILROADING

## Part 9: SCALES O, G and 1

### O Gauge – O Scale

O Gauge (a track width of 32mm or 1 1/4" to a modern scale of 1:48 in North America) is a direct descendant of the larger trains of the early toy train era. That era is generally accepted as having begun at the Leipzig (Germany) trade fair in 1891, where the German firm of Märklin Brothers defined the original toy train gauges 5 (120 mm), 4 (75mm), 3 (67mm), 2 (54 mm) and 1 (45mm).

Toy trains evolved quickly from a simple circle around a Christmas tree, to a new kind of year-round toy for the children of the well-to-do; and then to the population at large, whose financial and space resources were generally rather more limited.

Gauge O first appeared around 1900, and during the 1920s and 30s established itself as the “electric train” size that was every boy’s dearest wish. There are countless adults in their 70s and up who fondly remember their first Lionel (North America) or Märklin (Germany) or Hornby (UK) or other O Gauge train set.

Gauge O had displaced Gauge 1 in the UK by 1920, in Germany by about 1930, and displaced Standard or Wide Gauge (the equivalent of Gauge 2 in North America) by about 1930.

After WWII, the toy train era finally gave way to model railroading as an adult hobby.

European manufacturers briefly resumed Gauge O production in a half-hearted fashion. (Fleischmann actually introduced gauge O after WWII, but it only lasted during the 1950s.)

The transition to the smaller S and HO gauges was stimulated by prosperity, improved miniaturization of electric motors, and the appearance of electronic applications.

Arguably, the two most significant transformations in the 1950s era towards prototypical resemblance were the replacement of tin by plastic as a manufacturing raw material, and the move from three-rail to two-rail electrification.

The traditional larger scales continued to fade away, but in North America Lionel persevered (not very successfully), and underwent a number of corporate twists and turns until a remarkable thing happened – this traditionally popular pre-WWII scale had a booming revival with the 1990s comeback of the household Lionel name with upgraded designs, and with newly competing manufacturers, such as MTH, Atlas and others.

Gauge O trains are robust, ideal for youngsters, but are rather more expensive than the smaller scales.

They are now being offered both as 3-rail trains, compatible with the track of the Lionel trains of yesteryear, and also with modern 2-rail and 3-rail “Hi-rail” or “Fastrack” track versions. (Those who have inherited a Lionel set from the toy train era and want to indulge their nostalgia can expand what they have with new traditional [tinplate] track (or vintage tinplate track that can be picked up at flea markets or on the internet).

Traditional Lionel tinplate three-rail track is also compatible with Hornby Gauge O track which is also readily available in the second-hand market. (Transition track from the traditional to the newer 3-rail versions are also available).

It should be noted that the couplers between modern and traditional tinplate equipment are not compatible.

Power is now 12V DC, and DCC is available with marvellous sound and lights.

Exponentially, Gauge O requires between two and four times the space of an equivalent HO layout.

Gauge O is better suited to a permanent rather than a modular layout design, and also of course requires a good-sized space for a credible and satisfying rectangular layout – say, something in the order of 16 ft by 8 ft, with an interior operating space. An alternative proposition might be to consider an end-to-end layout (optionally bracketed to a wall) with a width anywhere from a 12” to a 24”.

Gauge O layouts with modern 2-rail or hand-laid track are ideal for highly detailed slow-running switching operations and diorama-type displays.

Traditional tinplate trains are generally referred to as “O Gauge trains”, whereas modellers working to scale are referred to as being in “O Scale”.

In conclusion, anyone considering Gauge O should do their research, especially if they plan to persevere with traditional 3-rail Gauge O, as they will be in good part dependent on the after-market.

### **G Scale and Scale 1**

The introduction of “G scale” LGB trains in 1968, running on Gauge 1 track, definitely contributed to a renewed interest in the larger scales, and after the immediate post-WWII decline of Gauge O, prompted a revival of both Gauge 1 and Gauge O.

True G (for “Garden”) scale is actually narrow gauge Scale 2 (1:22.5 [Europe]), or Scale 2n, with a gauge of 45 mm (1 3/4”); as opposed to standard gauge Scale 1 (1:32), also with the 45 mm gauge (Gauge 1). (The difference in scale is readily noticeable in the dimensions of the track such as between that made by LGB, and that by Märklin, for example.)

There has been a real resurgence in popularity (with corresponding manufacturer support) for trains for the 45 mm gauge, and both the narrow gauge G scale and the standard gauge Scale 1 trains are now popularly, although somewhat confusingly, referred to as "G scale".

G Scale and Scale 1 are robust, ideal for youngsters, marvellously detailed, also highly suited to outdoor operation, but because of their size and relatively small market share, also expensive.

Research is recommended.

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# BASIC MODEL RAILROADING

## Part 10: Other SCALES and GAUGES

### Preface

In summary, the most frequent scales and gauges the new modeller will encounter are HO, N and O, in that order.

Here is information about some other scales and gauges.

All of them are somewhat specialized, all only have modest manufacturing support and/or depend heavily on the vintage market, and the willingness and ability to scratchbuild (build one's own equipment, track and scenery from commercially or commonly available parts or materials).

The majority of modellers start in one of the popular scales and adopt a secondary interest at some stage of their progression in the hobby.

**Narrow Gauge** (A gauge narrower than standard gauge at 1435 mm or 4 ft 8 in) Narrow gauge representation is gathering momentum for modellers who become intrigued by its "whimsy", and are also attracted by the more modest space demands proportionate to the scales involved, especially if one plans to exhibit as a "solo" modeller at a model railway show.

Many modellers add a narrow gauge operation to their standard gauge layout.

Aside from the practical considerations of space, the "whimsy" quality of narrow gauge lets modellers draw on ingenuity, improvisation and imagination, not to mention sense of humour.

As a group, narrow gauge enthusiasts probably do more scratchbuilding than standard gauge modellers, partly because the ready-made market is not as large, and partly because scratchbuilding is part of the fun of this branch of the hobby, combined with a pronounced urge for creative expression.

The most popular narrow gauge interests in North America are **On30"**, **HOn3'**, and **HOn30"** (or **HOe**).

O and HO signify the scale, "n" stands for narrow gauge, and the numbers stand for the track width represented.

In O scale, the 30" gauge is represented by HO Gauge width track with O scale ties, offered by Peco™.

Similarly the 3 ft gauge in HO scale is represented by 10.5 mm wide track obtainable from Shinohara™.

The HO 30" gauge is represented by 9 mm track with HO scale ties obtainable from Peco™, Tillig™ or Roco™.

Another narrow gauge scale with an emerging following is **Gn15"**.

It is G Scale (see **BMR – O, G and 1 scales**) with a usual scale range from 1:22 to 1:24, running on 16.5 mm gauge track, which is either handbuilt, Peco™, or other closest available commercial equivalent.

Other emerging narrow gauge scales are **Nn3'**, running on 6.5 mm track, and **HOm**, with Peco™ or Tillig™ 12 mm track to represent the metre gauge.

All eclectic, but fun, hobby options.

### **S (for Seven-eights) Gauge**

This gauge (22.2 mm or 7/8") appeared in 1946, pioneered by the American Flyer brand.

Originally tinsplate track similar in appearance to traditional Lionel three-rail track (also with bakelite bases for turnouts and crossings), but with the all-important difference that has since become the norm – two-rail electrification.

As for O Gauge, those with the vintage version are said to be in "S Gauge", whereas modellers working with prototypical track and equipment are said to be in "S Scale" (1:64).

S Gauge appeared with the aim of reducing the amount of space required for a comparable Gauge O layout, but was soon overtaken by the rapidly emerging HO Scale.

Those in vintage S Gauge have to rely almost exclusively on the second-hand market, and those in modern S Scale have limited (but improving) manufacturer support, and thus also have to rely on kits and scratchbuilding.

### **TT (for Table Top) Gauge**

The original trains marketed as "table top" were the pre-WWII Bing OO Gauge trains (see **BMR – HO scale**), but again post-WWII, this gauge (12 mm) was designed in North America, and ironically gained sustained popularity in Europe, where this scale (1:120) was promoted by Triang-Rovex in the UK and Rokal in Germany.

Obsolescent in North America, it is now being supported by Peco™ and Tillig™ with 12 mm track with much improved realism, and coincidentally also an option for HO scale one-metre gauge modelling, as noted above.

**Standard** (not to be confused with standard as opposed to narrow gauge) **or Wide Gauge**

This vintage 2 1/8" gauge was the deluxe electric train of the 1920s.

Treasured by collectors and vintage enthusiasts.

Made by Lionel, Ives, American Flyer and Dorfan.

Some very limited modern manufacturing support.

**Z** (for the ultimate smallest, therefore last letter of the alphabet) **Gauge**

The miniaturization of the hobby reached state-of-the-art with Märklin's introduction of Z Scale (1:220) in 1972.

Only one principal manufacturer of equipment.

Conversation piece or curiosity?

Aside from the narrow selection of equipment, with a 6.5 mm gauge, it is generally acknowledged as being too small for most modellers to derive many of the versatile creative and operational satisfactions that the model railway hobby has to offer.