1. Introduction - What is G scale?

G scale was introduced by ‘Ernst Paul Lehmann Patentwerk’, when they introduced their innovative indoor/outdoor "LGB" brand trains in 1968.

A typical G-scale model train is 22.5 times smaller than the real train it represents. By comparison, an HO-scale model train is about 87 times smaller than the real train it represents, and a Z-scale train is about 220 times smaller.

Although 22.5 sounds like an odd figure, it's really quite sensible.

That proportion will make it possible to build attractive and realistic models of European and American prototype narrow gauge trains (1000 mm) that would run on traditional 45 mm gauge model track. ("Gauge" is the distance between the track rails.)

The math is simple:
Distance between the rails of meter gauge track - 1,000 mm Divided by the distance between the model rails - 45 mm G-scale proportion - 22.5

Garden Railroading Scales & Gauges

Any railway laid round a garden can be called a garden railway, but the multitude of scales for Garden railways can be quite confusing.

Today the term 'Garden Railway' or 'G Scale' is normally applied to Gauge I, IIm or SM32 and SM45.
Gauge 'I', though using the same 45mm track gauge as IIm scale, is quite different - Gauge '1' models are of standard gauge railways while IIm Scale models are of narrow gauge railways.

Garden Railroading:

Generally, garden railroads fall into two main types. One style is characterized by realism. Railway designs are based on real railroads, features are kept to scale and trains and structures have a weathered appearance. The other style is more whimsical. The colorful trains and buildings of these railways serve as garden ornaments designed to add a decorative touch to the landscape. Each railway is truly unique, with much diversity within these two categories.

2. Garden Railroading

Garden railroading is the art of combining a model railroad and a beautiful garden to create a railway-like atmosphere. The difference between a traditional indoor layout and a garden railway is the difference between realism and reality.

Indoors, the goal is to create the illusion of reality through the use of artificial materials - mountains are made of plaster, rivers are made of plastic resin, etc.
Outdoor it is possible to build a railway using stones, water and live trees.

The resurgence in popularity of garden railroading was due in large part to the advent of the colorful LGB trains from Germany. These trains were designed specifically with outdoor use in mind. As the company began introducing more US-style trains, garden railways began to spring up all over the US.

Before starting you should determine at the outset how elaborate you want your line to be. As a general rule, less is more. A traditional indoor railway may have many loops of track, dozens of engines, and hundreds of pieces of rolling stock while an outdoor can be a local narrow gauge railway with just one loco and few rolling stocks.

3. Get Started Outdoor

Outdoors, where we are dealing with the elements, a single-track mainline usually suffices, with sidings at stations, industries, and points of interest, and perhaps a branch line to an outlying terminal.

To get started, a single locomotive and three or four pieces of rolling stock -- freight or passenger -- are all you really need.

In choosing a first train, decide what your railroad is to be:
Is it a passenger line that connects small towns?
Is it a line that will haul only freight?
Is it an old-fashioned narrow-gauge steam railway, or a modern, standard gauge, diesel-powered line?
The space you have available may help to answer these questions. A small industrial line, with little engines, short cars, and tight curves, will fit better into a limited space. A modern mainline road will require broader curves and longer straight stretches to look right. Do your homework. Read books and magazines on the subject before jumping in engines, and hundreds of pieces of rolling stock.

Example of a small lay-out from LGB

4. Scale and Gauge

Scale and gauge are two important terms that have caused a lot of confusion over the years, and will no doubt continue to do so. They are sometimes used interchangeably, though incorrectly.

It really is quite simple: Scale is nothing more than the proportion of the model to the full size train. This can be expressed as a fraction or a ratio (as in 1:24 scale) or as the scale's relationship to a foot (like 1/2" to the foot, or just 1/2" scale). Gauge is simply the distance between the rails, measured from the inside edges. Where it becomes confusing is when we begin to see all of the different scales -- many of them very close to one another -- that are used with the different gauges.

There are many, many possibilities. LGB is 1:22.5 scale -- also called G scale -- and it runs on No 1 gauge track (45 mm between the rails).

Today the term 'Garden Railway' or 'G Scale' is normally applied to Gauge I, IIm or SM32 and SM45.

IIm scale, SM32 and SM45 are normally grouped together as size compatible, despite the scales being slightly different. Though they have two different gauges, 32 mm and 45 mm, all three represent narrow gauge models and have similar overall sizes of locomotives and stock. In the USA they have 1/2" and 5/8" scale narrow gauge using 45 mm gauge track which can be run along side the above mentioned

Table 1

G Scale and Garden Railways

Today the term 'G Scale' is normally applied to Gauge I, IIm or SM45 all running on 45 mm tracks.

G Scale				
Scale	Scale	Model Gauge	Type	Normal Size
IIm	1:22,5	45 mm	Narrow Gauge	1000 mm
I	1:30,5	45 mm	Standard Gauge	1435 mm
SM45	1:19	45 mm	Narrow Gauge	1000 mm
5/8"	1:19,2	45 mm	Narrow Gauge	914,4 mm. / 3 ft.
1/2"	1:24	45 mm	Narrow Gauge	914,4 mm. / 3 ft.

5. Track and Track plan

There is a wide range of commercially track available today, and this is probably the best approach for the novice. When you have gained some experience, you might want to consider building your own.

Commercial track is available in short pieces of set lengths and curvature - called sectional track - - or in longer sections that you can bend to suit your own needs. Sectional track is good for some applications, but it can be very limiting. If your railway is not to be permanent, sectional track can be easily picked up and put down at will.

For a permanent railway, though, you should consider using flexible track. This can be bent to any desired curvature, and with it you can make your railway go where it should go, not where it may have to go with sectional track.
In designing your track plan, use the widest-radius curves your space will allow. A 820 mm radius (LGB R2 curves) might be considered a minimum (although sectional track will take you down to 645 mm radius - R1 curves). - 1200 mm (R3) to 2360 mm (R5) will give your railway a much more plausible look.

For my track plan I have got inspiration form the German 1000mm narrow gauge railway – Spreewaldbahn.

My rolling stock is prototype model for various German narrow gauge railways.

Space is always a problem, so do what you must; but tailor your rolling stock to your curves. Very long engines and cars just don't look right negotiating very tight curves. When planning grades, try not to make them steeper than about 3 percent (3" rise over 100" horizontal travel). Steep grades are unrealistic, and they will severely limit your train length.

This is an example of a 2.5 m x 10 m narrow gauge line . The traffic is made up of a passenger train - a local freight train and a mixed train – all with small 2 or 3 coupled engines and short cars because of the tight curves.

The Loco is a Live Steam from Roundhouse (http://www.roundhouse-eng.com/) and rolling stock from Esha Holzbau in Germany: (www.schreinerguide.com/schreinerei_wolfgang_esser)

Example of loco and rolling stock:

6. Roadbed

There are dozens of different methods suited to different people and different situations. You can even just lay your track on the grass and run your train right on the lawn. For permanent installations, however, use the "floating" method. The track floats in a bed of gravel, called "ballast," just like real railroad track. Dig a shallow trench, say 50 to 60 mm deep, and fill it with ballast up to the level of the bottom of the ties.. Then set the track into the ballast, level it and pour a bit more ballast on top. That's it. (If you want to get fancy, you can dig a shallow trench to hold the ballast in place.) Rainwater and snow melt will drain away from the track, and the track can move when it contracts in the winter and expands in the summer. Plus, it's easy to change your layout when you use this method The more established the railway becomes, the less it will change.

What kind of gravel should I use for ballast?

The ballast you use is important. Don't use round stones like pea gravel. They will slide around and won't really grip the ties. A heavy rain will wash them away. Use a 4 to 10 mm crushed stone that has a "tooth" to it. This will lock with the stones around it and make a firm bed for the track to sit on. Crusher fines from a rock yard, or chicken grit from a feed store are two good sources of ballast.

In many areas of the U.S., farm supply stores sell gravel in this size as "turkey grit" or "chicken grit." (In Germany, look for gravel, called "vierer Körnung," about 4 mm in diameter.)

7. Power your trains

If there were a "best" way to power large scale trains? Conventional Track Power Operation- Battery Power Operation - Digital Command Control - each method has both significant advantages and serious disadvantages. The choice is therefore a trade-off and the factors that influence that trade-off vary sharply depending on many conditions such as environment, operating practice and personal preference.
Conventional track power is the choice of the majority of large scale train operators.

Conventional Track Power

Electricity in the garden is not a problem. Trains generally run on 12V-18V DC, which is quite safe, even in the rain. However, you'll need to keep your power pack dry and safe from the weather. And a ground-fault circuit interrupt is always a good thing to use between your power pack and the house current. Talk to the folks at your local hardware store about them.

Perhaps the biggest problem in running electricity through the rails is maintaining continuity across the joints as the rails expand and contract. One way of doing this is to solder jumper wires across the joints. There are clamp-on rail joiners that aid in continuity, too. Electrically conductive grease -- available at electronics-supply stores -- can also be used in the joints. Trains run on the same voltage that garden lighting uses. The two systems can be successfully integrated, creating wonderful nights capes.
You can either use traditional analog systems use variable DC to power the trains or a digital Multi-Train System Alternatives If you finding running electricity through the rails to be a big hassle, there are other ways to go.
Battery-powered , radio-controlled trains are becoming very popular today, and several companies offer systems that can be fitted to existing track-powered trains. Another popular alternative is live steam -- real steam locomotives to pull your trains. These burn Butane Gas, Coal or or spirit (meths or alcohol).

7.1. Battery Power

Battery powered Large Scale trains have become very popular especially in environments were track cleaning gets to be a real problem.

Outdoor garden railroading involves factors of weather etc. that makes electricity in the garden a potential trouble spot. Battery power negates most of those problems and adds many plus factors.

The main reason to go to the trouble and expense of running trains on battery power is to avoid cleaning or even wiring the track. The issues of track cleaning really can be a big deal. In some environments, track power is flatly impractical due to a number of conditions. In other environments, track power works quite well and is certainly less expensive than implementing battery power.

Digital Command Control (DCC)

Adding radio control to a battery power system adds the capability of command control, a highly desirable feature. However, adding Digital Command Control (DCC) to an existing track powered system does the same thing, at something like the same total expense depending on the number of locomotives converted. DCC tends to be more costly up front and less costly incrementally. If a large number of locos are converted, DCC becomes less expensive than battery power. If you go that far, the money probably doesn't mean that much to you anyway. If track power works in your current setup, DCC will work too for all but the smallest locos and it will add all the advantages of command control in a flexible and expandable fashion. Walk around radio control with DCC is also highly effective if not a little costly up front. Due to the limited number of power pickups on small locos, they will require fairly clean track to run and might best be converted to battery power anyway. A battery powered loco will run fine along with DCC locos.

8. Live Steam Operation

A "live steam" engine is one which is actually driven by steam which has been produced by heating water until it boils, just like the real full size steam locomotive. This is quite different to an engine that has the outward appearance of a steam loco but has an electric motor driving the wheels.

Water is heated inside a sealed container (the boiler) until it boils and produces steam. It is kept boiling while ever steam is required. Because this process is contained within the boiler, the pressure of the steam increases to a pre-determined limit and it is this pressurized steam that is drawn off as required to power the engine. In the larger scales and full size locomotives, coal or oil is the most common fuel used. In models, you have the choice of Butane gas, coal or spirit (meths or alcohol).

Many G-scale locomotives are fired by butane gas, which is the simplest method of heating the water. The gas is stored in a special tank mounted on the locomotive and fed, via a gas regulator valve, to a burner mounted inside a tube (flue) which passes right through the boiler from one end to the other. As this flue is surrounded by water, whenever the burner is lit it is heating the water to produce the steam. The rate at which steam is produced is controlled by the gas regulator. Turning it up increases the heat at the burner and thus the amount of steam produced whilst turning it down has the opposite effect. G Scale models are also available for coal or spirit firing.

Example of Roundhouse live steam loco:

8.1 The steam" is driving the loco"

The steam is passed from the boiler through a regulator valve and down to the cylinders. In the cylinder, it pushes a piston from one end to the other, first one way then the other. The piston is mounted on a rod which is attached by a cross head to a second connecting rod which in turn is connected to the wheel or crank. As the piston is pushed backwards and forwards, it causes the wheel to rotate.

The steam has to be sent to each end of the cylinder in turn and the used steam must exhaust up the chimney. This is taken care of by a valve in the valve chest mounted either on top or at the side of the cylinder. It must also do it at the right time on every stroke of the piston and this is accomplished by means of the valve gear.

The amount of steam passing to the cylinders is controlled by the steam regulator.

Radio control is normally used to control the locomotives. This gives full control of stop, start, speed and direction from a distance.

Can I run steam engines along side my electric ones?

If insulated wheels are fitted you can operate the G Scale steam locomotives on the same track as your electric trains without shorting out the system.

Because a working steam engine exhausts a certain amount of water and oil from the chimney, track cleaning may be required a little more frequently but this does not normally cause a problem.

9. The Garden

Many beautiful garden railways have been created by people who claim not to be gardeners. Gardening is a fascinating aspect to the hobby, and railway gardening has become a sub-hobby in its own right.

It is the garden that often draws entire families into garden railroading. Look into your local rock garden society. Rock-garden plants go especially well with garden railways. Go to garden centers, read gardening magazines and books, and visit public and private gardens in your area.

Join your local garden railway society. Meet people. Have fun. After all, that's what it's all about. Outdoors, you are dealing with real life. Mountains are made of dirt, rivers are made of water, rocks are made of stone. This can be both a blessing and a curse. Wash outs can cause problems, snow can stop trains, and trees and branches can fall on the track. But when you compare these nuisances to the joys of having a railroad at your doorstep that is constantly growing changing with the seasons, the weather, and even the time of day, this seems a small price to pay.

Plants for Garden Railroads

Garden railroads combine two popular pastimes, gardening and model railroads, into a hobby that provides fun for the entire family, from youngest to oldest. For example, the family can plant, weed and water the garden, operate the trains, or build train stations, houses, and other structures from scratch or with kits.

Plant Environments?

Plants need a compatible environment to survive. A plant that fits the theme might not fit the growing site. To be successful, railroad gardeners must heed the plant selection guidelines applicable to all gardens.

Does the plant require acidic or alkaline soil, sunlight or shade, and moist or dry soil?

Is the plant fast-growing or slow-growing?

What size will it eventually be?

Is it hardy in your country?

Will it grow in clay soil or does it require good drainage?

Fortunately, plant labels often contain much of this information.

9.1 Themes for Garden Railroads

Popular themes are the mountain railroad, The forest or a desert theme.

The mountain theme

An alpine garden setting is created using delicate-looking, small-sized plants and groundcovers such as Dianthus 'Tiny Rubies', Turkish Veronica (Veronica liwanensis), or Mother-of-Thyme (Thymus serpyllum). These and similar plants provide color while maintaining a small scale. Moss covered rocks and boulders form the mountains.
More elaborate mountain railways complete the alpine setting with ponds, streams and waterfalls.

The forest theme

Miniature forests are created with dwarf conifers like Dwarf Alberta Spruce (Picea glauca ') - Norway Spruce (Picea abies 'Little Gem') or a larch forest (Larix decedua). Columnar junipers such as Juniperus communis 'Compressa', Thuja Orientalis Rosedalis, and American arborvitae also work well

The desert theme.

Sandstone rocks, dry washes, barren sections and sparsely planted areas suggest arid terrain. Gray leafed plants, including Silver Mound Sage (Artemisia schmidtiana) and Woolly Thyme (Thymus pseudoanuginosus), are especially suitable for this theme. Succulents such as 'Dragon's Blood' Sedum (Sedum spurium) and Houseleek (Sempervivum arachnoideum) are also effective.

The solitaire trees

box tree (Buxus sempervirens), lilac Syringa microphylla and Japanese cedar (Cryptomeria japonica) are suitable assolitaire trees or in small groups.

Groundcovers:

Cotula squalida
Blue Pratia
Scleranthus Biflorus
Syn. Sutera .....Bacopa Snowflake
Thymus Serpyllum Cocconeus
Thymus Serpyllum .....Wild Thyme
Drosanthemum Hispidum.....Pink Champagne
Pratia Pedunculata
Cotoneaster Dammeri
Myoporum Parvifolium..... .....Fine Leaf Form
Sagina Subat a

Shrubs:

Alyssum.....Rosie O'Day
Hebe.....Emerald Green
Coleonema Compactum.....Dwar fPink Diosma
Lonicera Nitida Aurea
Melaleuca Thymifolia..... .....Little Beauty
Boronia Megastigma.....Heaven Scent

Trees:

Buxus sempervirens
Juniperus Communis..... .....Compressa
Chamaecyparis Obtusa Nana. .....Dwarf False Cyp ess
Chamaecyparis Lawsoniana.....Green Globe
Chamaecyparis Obtusa Tetregona Aurea Nana
Cotoneaster horizontalis
Cryptomeria japonica.....Japanese cedar
Juniperus sinensis.....Chinese juniper
Larix decedua.....European larch
Syringa microphylla
Taxus cuspidata
Thuja Orientalis Rosedalis

10. G-Scale suppliers

Page from LGB catalogue

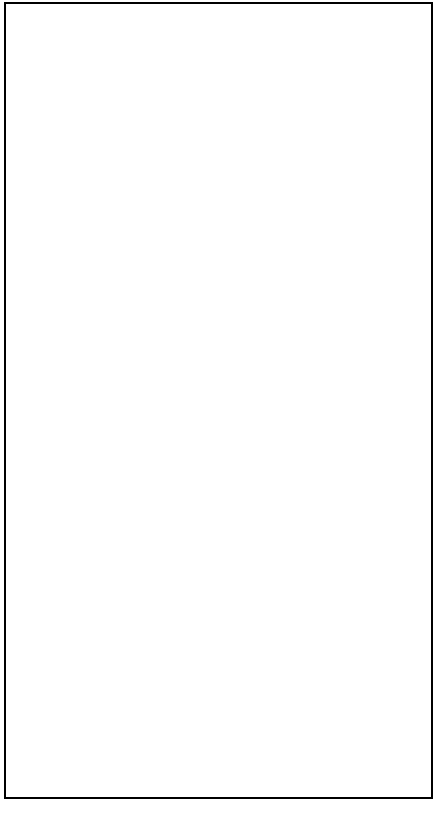
The most popular trains for garden Railroading are

LGB - "Lehmann GrossBahn"

In 1968, Wolfgang and Eberhard Richter created something unique: LGB, the world's first model railroad for indoors and outdoors. Today, LGB still stands alone, far above conventional toy trains:

LGB is big. The letters "LGB" stand for "Lehmann Gross Bahn" or "Lehmann's Big Train." LGB trains are G-scale (1:22.5) — four times larger than conventional HO-scale trains (1:87).LGB trains are easy to put on the track, even for kids. Details on LGB trains are big enough to see and strong enough to with stand frequent handling. But you can fit a full circle of LGB track in space less than 1.3 meters (51 inches) wide.

Get more information on www.lgb.com



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