

The design and construction of a scale model railway owes its interest to the many facets of the operation, for it is at one and the same time a science, an art, a craft, a mental exercise, a therapy, a pastime and a form of collecting. For this reason it is not possible to discuss the subject in a few sentences, nor is it possible to offer the newcomer to the subject specific advice, as in no two individuals will the goals and the approach be quite the same.

Yet the disturbing feature of a hobby which offers such potential for enjoyment is that very many model railways have been abandoned at various stages in their construction because of the unforeseen difficulties which were encountered.

The major problems confronting the modeller can be summarised as follows :

- i) unsatisfactory standards, resulting in unreliable and non-prototypical running of rolling stock,
- ii) difficulties in initial planning, especially in respect of trackwork,
- iii) lack of components to scale dimensions,
- iv) non-compatibility of components,
- v) time-wasting work required in the modification of many components,
- vi) difficulties of obtaining data on modelling techniques.

Many of the above problems beset the beginner and experienced modeller alike with the result that both time and money are wasted. The Protofour concept embraces standards, a related set of components, construction techniques and planning aids, and has been designed to eliminate the obstacles which were previously such a frustration to the modeller.

The Protofour components and techniques are described in detail in the Instruction Leaflets, which form Section 4 of the Protofour Manual, and the following notes are intended as a general guide to the factors which must be considered in the planning and construction of a scale model railway, and its associated equipment. The purpose of these notes is to assist the modeller to avoid the waste of time and money which results from the use of faulty planning techniques.

The planning of a model railway can be considered under the following headings :

1. Choice of scale and standards,
2. Choice of prototype and period,
3. Nature of rolling stock,
4. Nature of layout - permanent or portable,
5. Design of baseboards and trackwork,
6. Design of control system and electrics,
7. Design of scenic and architectural features,
8. Choice of construction techniques.

1. Choice of Scale and Standards. The choice of scale is usually a compromise between the space which is available, or which is likely to be available, and the amount of detail that is to be represented on the layout.

Scale is normally indicated by a convenient reference (e.g. millimetres to the foot), or by a code (e.g. Gauge '0'), although in the latter case the standards used in conjunction with the nominal scale may vary widely. However, in these notes only those standards applicable to correct scale modelling are considered, since these are the only ones with which faithful reproduction of the prototype and smooth running of rolling stock, can be simultaneously achieved.

The 'Proto-Standards' listed in Section 2.0 of the Protofour Manual have been chosen as the correct scale equivalents to the nominal commercial scales. They are listed as ratios, which apply to all situations, and they represent the ultimate in scale appearance and operational reliability.

The general characteristics of the Proto-Standards are as follows, and as a guide to space requirements it is worth noting that, starting at Proto-160, each of the subsequent scales requires approximately twice the area of the preceding one for a given layout design, with the exception of Protofour (1:76.2).

Proto-160 (Proto-equivalent to 'N' Gauge). The smallest Preferred Proto-Standard and the scale suitable for modellers whose layout space is severely restricted. The amount of detail which can be incorporated in this scale is limited, and it is normally chosen to provide maximum train lengths in minimum space. 'N' Gauge models are generally produced to a ratio of 1:160, but PECO 1:148 complicates the situation for modellers of British prototypes. U.S. and Continental prototypes are well covered in 1:160 scale, and in Great Britain a 2mm Scale Association is active.

The use of Proto-160 standards calls for extremely fine tolerances. At present it is probably not economically feasible for commercial products to be produced.

Proto-120 (Proto-equivalent to 'TT' Gauge). Proto-120 covers a scale region for which few suitable commercial parts are available, irrespective of country. In Great Britain the 3mm Scale Association caters for modellers in this scale.

Proto-87 (Proto-equivalent to 'H0' Gauge). Commercial models in the U.S. and Europe are generally built to 1:87 ratio and a wide selection of good models is available. Certain parts for Proto-87 have been designed by the MRSNG and others may be adapted for use from the range produced for Protofour 1:76.2 operations.

PROTOFOUR (1:76.2). Equivalent to the British 4mm scale (4mm/1ft), and for which a large selection of British prototype equipment is available, including a full range of Protofour equipment.

Proto-64 (Proto-equivalent to 'S' Gauge). Although a very satisfying scale, with a combination of '0' Gauge bulk and 4mm space economy, there is very little equipment available and modellers must perforce make nearly all parts themselves. 'S' Gauge is the only scale/ratio common to Great Britain, the U.S. and Europe. In Great Britain the 'S' Gauge Society promotes the scale.

Proto-45 (Proto-equivalent to '0' Gauge). Commercial standards for '0' Gauge vary between The U.S., Britain and Europe. An excellent scale for detailed modelling, but requiring considerable space for the best results. Often used for outdoor layouts. A reasonable range of commercial products is available and Proto-45 components are in the design stage. In Great Britain the Gauge '0' Guild is active.

Proto-32 (Proto-equivalent to '1' Gauge). Outdoor operation and steam driven locomotives fired by spirit or coal are features of this scale. Few commercial components are available and the emphasis tends to be on vehicles rather than on the railway as a whole. There is renewed commercial interest in this scale in Europe, and the Gauge '1' Society supports the scale in Great Britain.

2. Choice of Prototype and Period. This is clearly a matter for individual taste to decide, although certain factors tend to influence the final choice.

Many modellers commence with freelance railway building but find that contact with prototype data and experience in modelling tends to channel their interest in the direction of a particular railway company. In the ultimate case, they may select a particular railway location and model the trackwork, buildings, scenery and stock as accurately as possible.

Unfortunately, prototype railways are rather extravagant in their use of space, and for many modellers the building of a correctly scaled model of a particular location is out of the question. They therefore base their layouts on the general practice of a railway company and the scenery is produced as typical of that through which the railway ran. Buildings from diverse locations are modelled and assembled on the layout to give the essential character of the original.

Indeed, freelance railways are rather difficult to design for a convincing effect, as they have to follow practical railway rules. As a wide range of commercial products is available which enables the reproduction of typical prototypes in an authentic manner, entirely freelance models are rare.

The choice of company and period is affected by the availability of reliable information and the supply of suitable components. Where it was once possible to visit the site of the prototype and to take measurements of the remaining buildings and equipment and photographs of trackwork, nowadays the site is all too often found with tracks removed and buildings demolished. The success in reproducing the particular scene in its railway prime is then dependent upon the assistance of others with records or sources of information. British Rail public relations officers are unfailingly helpful to the modeller as are such groups as the L.M.S. Society.

The Protofour Society exists to provide modellers with information concerning possible sources of data, and its membership offers possibilities of contact with other modellers.

3. Nature of the Rolling Stock. It often happens that the rolling stock is constructed before the layout itself. The type of stock can influence the layout design to a considerable extent, especially where long or rigid-wheelbase vehicles are envisaged. The minimum radius of curves, and the capacity of bays, headshunts and station platforms is determined largely by the type of stock. Alternatively, where space is restricted, the length of stock may have to be restricted also. Conversely, if a specific layout design is envisaged then rolling stock construction must take any restrictions of the layout into account.

4. Nature of the Layout. There are basically three types of layout :

a) The Permanent Layout. In this form, the baseboards are tailored to fit the site and are frequently large in order to keep baseboard joints to a minimum. Moving such a layout is a major operation which may result in the destruction of much of the track and associated equipment.

b) The Semi-permanent Layout. In this type of layout the baseboards may still be matched to the site, but are of such a size that they may be easily removed when necessary.

c) The Portable Layout. This type of layout is designed to be easily and quickly dismantled and moved. Exhibition layouts usually fall into this category.

The Permanent Layout is often considered to be the best. It has the advantage of being always ready for operation and display, and lighting and scenery can be installed without difficulty. Wiring can be carried across baseboards and joints in unbroken lengths, and the controls can be permanently built into the layout. A disadvantage is that the layout cannot be exhibited or operated in conjunction with other layouts. Further disadvantages are that work under the fixed baseboards is difficult and uncomfortable and, as previously mentioned, moving the layout is a major operation fraught with the risk of damage.

For most modellers the Semi-permanent layout is the ideal one. The use of Protofour baseboard joiners removes the problems usually associated with the dismantling and reassembly of bases, and the latter can therefore be worked upon in conditions of comfort and in good lighting wherever it is most convenient for the operations. With proper design, the layout can be adapted for exhibition use and may be linked to other systems.

Portable layouts offer scope for much ingenuity of design. When their days of intensive travelling are over, they may always form part of a semi-permanent layout. As space is usually a decisive factor in the choice of portability, correct design will enable one baseboard to be worked on and completed at a time; portable layouts can also be built on the 'extensible' principle, in which a basic minimum-space track plan enables running in restricted space, while the insertion of matched extension bases expands the system into a larger layout with the same effective track plan. The Protofour track and wiring planning templates are of great assistance in formulating such a scheme, as well as for planning operations generally.

With the availability of such planning aids the idea that a layout cannot be started because 'no space is available' is defeated. Trackwork and rolling stock may be built in the knowledge that they can be used as planned when space is obtained. If storage space is available for only a single baseboard section, this section can be built so that it takes its place in the eventual layout.

A very convenient solution, where only one or two bases can be stored, is to model a baseboard section, or sections, comprising the locomotive depot. Work on the locomotive stock can then proceed in preparation for the time when additional bases can be incorporated.

5. Design of Baseboards and Trackwork. Ideally the baseboards should be designed to suit the track plan, in order to avoid the inconvenient siting of joins and battens. Wiring and switch controls are normally sited below the baseboard, so battens must also be placed where they will not interfere with these fittings.

The track plan should be carefully evaluated before it is accepted as a basis for construction, as potential difficulties are easily removed in the planning stage, but are quite another matter when track is firmly in position. Baseboard joins should never be situated where they will cut across complex track formations.

6. Design of the Control System and Associated Electrics. The object in wiring a layout is to ensure reliable operation with whatever type of control system is chosen. If the Protofour Unit Wiring System is adopted, the simplest of controls may be used initially, while the later addition of more complex controls will involve few wiring changes. In conjunction with the Unit Wiring System, Protofour Wiring Templates enable the build-up of a wiring diagram which complements the track plan obtained by means of the Track Planning Templates. The wiring diagram serves not only as a simple aid to wiring but also as a permanent reference for fault finding.

7. Design of Scenic and Architectural Features. The general planning of the architectural and scenic features can be made in conjunction with the 1mm/1ft planning templates, using the appropriate overlays (see Section 4.1.2). They can be modified as building proceeds, but the more care used in the initial planning stages the fewer the modifications that will be required.

8. Choice of Techniques. Protofour constructional methods have been developed for trackwork, wiring, rolling stock, and other aspects of model railway construction, and new techniques are continually being developed. However, much valuable information may be found in the model railway literature and since no index of such data exists a bibliography has been compiled to assist the Protofour modeller.

Space does not allow the bibliography to be fully comprehensive and, in general, prototype data is not included. However, enough references are included to cover most areas with which modellers are likely to be concerned. The abstract covers journals up to mid-1971 and supplements will be issued at intervals.

Abbreviations used in the Bibliography

- MR — Model Railroader (USA)
MRs — Model Railways (GB)
MRC — Model Railway Constructor (GB)
MRN — Model Railway News (GB)
RM — Railway Modeller (GB)
RMC — Railroad Model Craftsman (USA)

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 From Kit to King (Jamieson Kit). T.Thoday. MRC, 35, Aug/Sept 1968.
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 A Trio of Compounds - MR 4-4-0 (Gem Kit). L.W.Goddard. RM, 22, Jan 1971.
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- Use Casein on Rolling Stock too. A.Armitage. MR, 33, Feb 1966.
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