NMRA RECOMMENDED PRACTICES	
TRACKAGE GENERAL	
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RP-10 Trackage General

I

Nothing so affects the successful operation of the model railroad as the sound engineering of its right-of-way and the careful construction of its roadbed and trackage. Model railroad engineering is subject to many of the same considerations governing the prototype, among them: curvature, grades, clearances, easements, special trackage, etc.

First comes the decision as to the type of railroad to be modeled. Will it simulate the large trunk lines that spend millions to blast and move earth to reduce curvature and grades so their giant locomotives can haul the 100-plus car trains at maximum speeds, or will it follow the example of the smaller, less costly roads that accept the limitations of following the contours of the land and content themselves with the lighter loads they can haul over the ups and downs and around the curves of the lightly ballasted and railed roads? Smaller and lighter equipment is appropriate to the latter roads, so the type of road and the equipment used should be kept consistent with each other.

No ordinary model can hope to match the vast expanse of miles that make up almost any prototype road: so too, no model can hope to match the broad sweeping curves of the prototype but must settle for a more convenient compromise with practicality. **RP-11** correlates the size of the equipment and the minimum curvature that has been found reasonably practical for its operation.

Once the type of road and equipment is determined and space allotted for its construction the detailed planning of the railroad can commence. The basic layout of the track plan is so variable and subject to individual preference that no recommendations are attempted here, altho many ideas may be gleaned from **DATA SHEETS D3j, D3k.1, D3k.2** and **D8b.1**. Be sure the final track plan coordinates with and allows sufficient space for scenery. But regardless of the plan selected certain principles basic to all railroads must be considered - this is where the engineering starts.

Thruout the entire **D2** and **D3** series of **DATA SHEETS**, ideas for scenery, benchwork and roadbed will be found. Whatever construction is selected make sure that it is solid and sturdy - all else depends on this beginning. By all means see that seasoned lumber is used thruout and that all joints are fastened securely.

II

The ideal condition for passage of flanged wheels along the track is the level straightaway - any departure from this ideal carries a penalty in performance. The minute a curve is introduced flange friction commences and adds to the axle friction the locomotive must overcome to move its train. In addition, curvature can cause misalignment of adjoining car ends because of the overhang of these car ends - couplers may not line up, diaphragms may be distorted, etc. To keep this problem to a minimum, change curvature gradually, easing from one into the other by degrees rather than all at once.

Reverse curves are a particular problem in this respect and require a length of tangent (straight) track at least the length of the longest car to connect the two opposite curves. Each of these two curves should then ease into the connecting tangent track. Various methods of laying out these easements are found in **DATA SHEETS D3b, D3c** and **D3c.1**.

The Clearances of **STANDARD S-7** insure that all equipment will clear trackside structures and scenic features beside tangent track. End and side overhangs of this equipment will require increased clearances and widened Track Centers between multiple tracks as specified in **STANDARD S-8**. Just as the curve itself was eased, so should this additional clearance be eased. Remember that good trackwork 'flows' smoothly without abrupt changes in direction or gradient.

While track laid on the straightaway should be laid as closely as possible to the minimum limit of track **Gage G** shown in **STANDARD S-3**, this gage must be widened in sharp curves to permit passage of long wheelbase equipment. A three-point track gage will help follow the rule in the footnote to **STANDARD S-3**, but it must not be allowed to make **G** exceed the maximum allowed by this **STANDARD** - both limits must be observed.

Most railroads must curve, but experience teaches that curves should be kept as large in radius as the track plan and space available will permit. Adding easements to these large curves will insure the finest performance and appearance obtainable.

III

Another basic element of model railroad engineering is that of grades. Lifting the entire weight of that part of the train that is on the incline connecting two different levels of track creates an additional load on the locomotive - the steeper the grade, the greater the load. Care should be taken to see that adjacent grades are joined by a long, easy, transition vertical curve that is eased in similar fashion to the horizontal curves. Abrupt or jerky changes of grade should be avoided lest couplers bind or disengage, or pilots short across the rails, or wheels lift from the railhead. Smooth flowing trackwork is still the goal in the vertical plane as well as in the horizontal plane.

Since curvature and grade each add load to the locomotive, a curve laid on a grade will combine into an even greater load than from either alone. For best performance and equalizing of the load curves may be 'compensated' by reducing the grade in the curve - again, the sharper the curve the more grade compensation needed. **DATA SHEET D1j** describes the calculations for grades.

IV

When a single track branches into two, with the one turning out from the other, a turnout is called for**. DATA SHEET D3e** describes the terminology of many types of turnouts, while construction details are covered in **RP-12**. Precise dimensions for turnouts in the different scales are given in **RP-12.1, 12.2,** etc.

Where one rail crosses another is the most critical problem in track construction. Clearance for the wheel flange requires an interruption of the railhead, and this requires the Frog and Guard and Wing Rails described and dimensioned in the **RP-13** series of sheets. Their function is also explained in **STANDARD S-2**. Particular care must be exercised to see that all the requirements of **STANDARD S-3** are met at every turnout. **RP-2** and the **NMRA STANDARDS GAGE** will help.

Special trackage, such as turnouts from a curve, follow the same general reasoning as the above, but there is too much variety to permit treatment here. Just remember that ALL trackage must meet all the requirements of **STANDARD S-3** as measured by the **GAGE** of **RP-2**.

V

Since all elements of trackage are made from sections of rail, the selection of which rail to use becomes important. Using the height of the rail section as the criterion for determining the "weight" of rail in **RP-15.1**, a section most nearly simulating the prototype may be selected. And since various types of trackage must join, the cross section of each particular size rail must conform to certain specifications if it is to match and permit the use of common components such as rail joiners and spikes. **RP-15.1** also contains these specification.

Brass, Steel, and Nickel-Silver are the chief materials used for making rail. Brass is noted for its conductivity and good solderability, while Steel has half this conductivity and only fair solderability. Nickel-Silver has only half the conductivity of Steel but solders even better than Brass. Tractive effort on all three materials will be equal when the railheads are polished and clean, but oxide buildup on Brass and even more so on Steel increases the possible tractive effort on these materials. These same oxides, however, are generally non-conductive and require frequent use or cleaning to provide reliable current pickup. Nickel-Silver is nearly oxide-free and requires minimum maintenance while providing constant tractive effort of locomotives.

VI

Thru-bolted joint bars like those of the prototype are seldom practical with the smaller sections, so where rails must be joined rail joiners wrapping around and under the base of the rail are used. Compensation should be made for the extra thickness of the rail at these joints to prevent a high spot in the track. Only where excellent stability of both temperature and humidity are maintained is it practical to solder rail joints to simulate the welded rail coming into vogue on some prototype roads. Expansion and contraction of the wood base structure of the model railroad will cause distortion except under closely controlled conditions. Rail joiners to be effective must fit the rail closely in order to hold adjoining rail ends in close alinement and thus avoid derailments.

Model track can be laid in a number of ways, but almost all of them employ spikes or staples simulating them, whether made of steel or molded integrally with their ties. While some modelers prefer not to drive the spikes home against the rail, preferring to leave the rail slightly free to move vertically as on the prototype, all spikes and other projections must be kept sufficiently below the railhead to prevent interference with the passage of wheel flanges. Dimension **H** of **STANDARD S-3** governs this factor.

Extreme care must be taken in all rail laying operations that the surfaces of the rail head contacting the wheels extend smoothly in fair curves and without projections that will cause derailments. Where two rails join together it is important that the radius of the edge of the railhead be maintained on each rail. Switch points require particular attention in this respect since tests show that obstructions in the railhead of only 1% of **Track Gage G** can cause a strikingly high percentage of derailments.

Dimension **P** of **STANDARD S-3** defines the closest approach of the open switch point rail to its adjacent stock rail under the two conditions of insulated and non-insulated point rails in order to assure that no electrical or mechanical interference can occur, while encouraging the more prototypical appearance of the minimum gap allowable.

VII

It is an unfortunate truth that too many model railroads suffer from carelessly engineered and hastily constructed right-of-way and track. The finest model equipment built can perform only as well as the track on which it runs will permit. Time and care spent in preconstruction engineering together with sound and careful construction will be repaid many times over in satisfaction gained from the trouble-free performance of the models running over it. Remember that track, too, is a model.