Approved by NMRA BOD July 2012

NMRA RECOMMENDED PRACTICES	
TRACKAGE GENERAL	
RP - 10	July 2012

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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. **NMRA RECOMMENDED PRACTICE RP-11 Curvature and Rolling Stock** correlates the size of the equipment and the minimum curvature that has been found reasonably practical for operations on a model railroad.

Once the type of railroad 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, although many informative ideas may be gleaned from the **NMRA DATA SHEET D3** series on **Trackwork** including roadbed**,** and the **D8** series on **Operations**. Be sure the final track plan coordinates with and allows sufficient space for scenery as discussed in the **NMRA DATA SHEET D2 - Scenery** series. But regardless of the plan selected certain principles basic to model all railroads must be considered - this is where the engineering starts.

Whatever construction method 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 throughout and that all joints are fastened securely.

An additional option that the modeler must decide upon is the degree of fidelity in which the model railroad will be developed. **NMRA STANDARDS S-1.1, S-1.2,** and **S-1.3** identify the four classes for which NMRA Standards have been developed. The four degrees of fidelity are identified as "Proto", "Fine", "Standard", and "Deep Flange" (formerly "Hi-Rail"). Paragraphs in the above mentioned NMRA Standards contain a description of each of the fidelity classes.

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 the misalignment problem to a minimum, change curvature gradually, easing from tangent (straight) track into curved track by degrees rather than all at once.

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

D3b.2 –Spiral Easement Graphs, and **D3b.3 – Spiral Easements and Superelevation: Construction**.

NMRA STANDARD S-7 – Clearances specifies necessary dimensions to insure that all equipment will clear trackside structures and scenic features beside tangent track. End and side overhangs of all equipment will require increased clearances and widened Track Centers between multiple tracks as specified in **STANDARD S-8 – Track Centers**. Just as curves are eased, additional clearance should be eased the same way. Remember, good track work 'flows' smoothly without abrupt changes in direction or gradient.

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 large curves will insure the finest performance and appearance obtainable.

III

Another basic element of model railroad engineering is grades. Lifting the entire weight of the 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, eased, vertical curve. 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 track work 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** – **Grades and Angles** 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 D3c – Turnout Types and Terminology** describes the terminology of many types of turnouts. Construction details and precise dimensions for turnouts in the different scales are covered in the **RP-12 – Turnouts** series.

Crossing one rail over another is the most critical problem in track construction. Clearance for the wheel flange requires an interruption of the railhead, and this interruption requires the use of Frogs, Guard Rails, and Wing Rails, as described and dimensioned in the **RP-13- Guard Rail and Frog Relationship** series of Recommended Practices**.**

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 specified in the **STANDARD S-3** – **Trackwork** series of Standards as measured by the **GAGE** of **RP-2 – NMRA Standards Gage**.

V

Since all elements of trackage are made from sections of rail, the selection of which rail to use becomes important. **RP-15.1 – Rail** relates the weight of a one-yard length of prototype rail to the height of modeled rail for various modeling scales. This RP allows the modeler to select rail that most closely simulates the prototype rail being modeled. 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 the rail cross-section 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 the conductivity of brass 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. A layout operated once or twice a week will generally not require cleaning, even with brass track, because wheels are in general good track cleaners. Nickel-Silver is nearly oxide-free and requires minimum maintenance while providing constant tractive effort of locomotives.

VI

Through-bolted joint bars like those of the prototype are seldom practical with the smaller rail sizes, so where rails must be joined, rail joiners wrapping around and under the base of the rail are often used. Compensation should be made for the extra height 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 all rail joints to simulate welded rail. 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 alignment and thus avoid derailments.

Model track can be laid in a number of ways, and many employ spikes, 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 the **STANDARD S-3 - Trackwork** series governs this factor.

Extreme care must be taken in all rail laying operations that the surfaces of the railhead 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 (See RP-2 – NMRA Standards Gage)** can cause a strikingly high percentage of derailments.

Dimension **P** of **Trackwork STANDARDS S-3.1, S-3.2, and S-3.3** defines the closest approach of the open switch point rail to its adjacent stock rail 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.

