

National Capital Trackers

O-Gauge Module Club



Module Standards

and

Building Guide

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National Capital Trackers

Module Standards and Building Guide

Introduction

The National Capital Trackers (NCT) is a three track O gauge modular club with the primary focus of presenting operating trains for the general public's enjoyment at venues throughout the Washington, DC metro area. Since *operating trains* is the cornerstone of the club, the following Module Standards and Building Guide are intended to insure error free operation of member's trains by providing a solid modular platform.

The Module Standards define the mandatory elements which must be met for a successful NCT layout. Unless otherwise noted the Module Standards pertain to straight modules, and are generally applicable to corner modules, "tee" modules, bridge modules, and other specialty modules. New modules built or existing modules modified after this document becomes effective must conform to the Module Standards. Modules which fail to comply with the mandatory Module Standards may, at the Trackmaster's discretion, be excluded from NCT layouts and shows.

The Building Guide presents a proven method of constructing a module which meets the Standards but there are other building options and creative approaches which may be used and still result in a compliant module. The 24" x 48" rectangular module is the basic building block of NCT layouts and is the focus of the Building Guide, although much of the information is relevant to any module type.

Module Standards

Size:

1. The basic rectangular module has a 24" x 48" deck. This dimension excludes "add-on" molding used to hold the Plexiglas shield.
2. Module lengths of greater than 48" are permitted provided your total module length or module set length is divisible by 48" If you want to use a 72" length, you must supply two modules 6 feet long. Two of these equate to 12 feet which equals three four-foot modules.
3. Module widths (front to back) must not be less than 15½" or greater than 60".
4. For safety modules must not protrude beyond the front plane of the layout.

Framing & Decking:

1. The module frame and cross support(s) must be 1"x4" or 1"x3".
2. Frame wood should be clear, straight poplar or pine.
3. The deck surface must be solid, smooth and level.
4. Use of plywood less than 3/8" is strongly discouraged. Thinner decks will require additional framing to eliminate flexing or sagging.
5. Plywood is to be Grade B or better.
6. All wood construction is to be assembled with glue and screws.
7. At least one joist (cross support) is required.

Legs:

1. Legs must provide the primary support; each module must be self-supporting. NOTE: Certain types of modules, such as bridges, may not require legs.
2. Legs must be adjustable to within +/- 1" to achieve 40" module height at the top of the track.
3. The typical leg material is 1½" x1½" and must be straight.

Polycarbon or Plexiglas:

1. Modules require a plexiglas shield on the public (front) side.
2. Plexiglas sections are 48" x 6" x 1/8".
 - a. Plexiglas should be mounted so the top is 5" above the top of the track.
 - b. Plexiglas must be clear and free of cracks or breaks.
 - c. Plexiglas edges should be smooth to reduce the danger of cutting hands.
 - d. Plexiglas holder of base trim board or clamshell molding is to be attached flush with the top of the module surface.

Velcro:

1. Velcro strips (Hook) must be attached on both the front and rear of the module.
2. The strips must be located 1½" below the module surface.

Track Standards

Track Type

1. O-Gauge tinplate tubular track such as Lionel and K-Line (RMT), and wood tie track such as Ross and GarGraves are the standard track systems for the NCT.
2. If any other than Lionel-type tinplate tubular track is used the module owner must provide the proper adapter pins or transition tracks to join to the tubular track, as well as the required 10" or 5" bridge tracks.

Track Placement

1. Each module must have three main lines. These tracks must be spaced exactly as follows:
 - a. The outside track center rail is 3 ½" from the front edge of the module deck.
 - b. The middle track center rail is 7 ¾" from the front edge of the module deck.
 - c. The inside track center rail is 12" from the front edge of the module deck.
2. Track placement is critical for the proper track alignment between modules. The distance from the outer edge of the module deck to the center rail of the first track must be observed.
3. Tracks must terminate 5" from the edge of the module except where the module design, typically found on corners, requires track to be placed to the edge of the module.
4. Additional sidings and other tracks are permitted and may be located at the discretion of the module builder. Any additional tracks must not interfere with normal main line operations.
5. For all main line straight tracks the distance between the center rails must be maintained at a minimum of 4 ¼" at all times.
6. Curve minimum is 072. "S" curves, where a curve section is followed immediately by a reverse curve section, are not permitted on the mainline.
7. Spacing of tracks between curves varies inversely with the curve's radius; wider radius curves may be closer together. Scale or articulated locomotives must have adequate clearance when meeting on adjacent tracks. For test purposes two scale Big Boys or two scale 89' auto racks must be able to run on adjacent tracks without touching. It is incumbent on the module owner to assure engine and rolling stock clearance is adequate.

Electrical Standards

NCT Wiring Harness Overview

The NCT wiring harness was designed and developed with the primary goal of improving the overall operation of the NCT modular layouts. With an eye on a consistent product the club contracted for the manufacture of harnesses utilized on all modules. The construction features 12 gauge wiring with separate returns (grounds) for each track feed. The wiring supports a total of three separate tracks. All modules must have the NCT Standard wiring harness to be included in any NCT modular layout.

The Corporation shall be the source for the harness. All members must purchase the harness from the club. The club shall maintain a supply of harnesses available for purchase. The cost of the harness may vary over time based on the cost of components or other factors, and is to be set by the board of directors on an annual basis, at the beginning of each calendar year, beginning in 2015. The Corporation shall ensure that the harnesses available for sale meet the specifications of the *National Capital Trackers Wiring Harness* drawing package.

The Tracker Wiring Harness is part number NCT-WH01-6FT revision 8 as currently manufactured by Syncom.

1. This harness provides separate feeds and returns for three tracks. No alterations to this harness are permitted. Any accessory power must be provided by the module owner.
2. All additional tracks (other than the three main lines) must be powered from a separate power source. The power source must be provided by the module owner.
3. Passing sidings that are part of mainline operations may use the main line power.
4. All powered turnouts (switches), whether main line or other, must use a separate power source for their switch motors. Using mainline power for any switch motor or accessory is strictly prohibited.
5. Each main line track on the module should be connected to the bus around the middle of the module using track drops (pigtails).
6. Track drops for connections from the bus wiring to each track shall be 14 gauge.
 - a. Drop wire colors must match the wire color for each track.
 - b. Each track drop shall have a wire for its center rail power and its outer rail commons; both outer rails are connected.
 - c. The drops shall be fluxed and soldered to the underside or bottom edge of track. At the solder connection to the center rail, rail blackening shall be removed. Use a Dremel with a burring tool or a grinding stone, a wire wheel is often insufficient to ensure good solder joint.
 - d. Flux must be completely removed with an appropriate solvent, such as isopropyl alcohol, to prevent subsequent corrosion and deterioration of the connection.

- e. Special processing is required on nickel silver or stainless steel track to assure good connections.
- 7. Each track must be electrically isolated from the others.
- 8. Bus wire termination must be at a terminal strip.
- 9. GarGraves and other track systems where the outside rails are not electrically connected should have ground feeds to both outside rails.
- 10. Turnouts (and crossovers) that interrupt the rails must have power and ground feeds on all legs of the turnout. Do not depend on power being fed to a turnout leg from an adjacent module.
- 11. If there is a crossover between main lines all three rails must be insulated.

NCT Wiring Harness Details

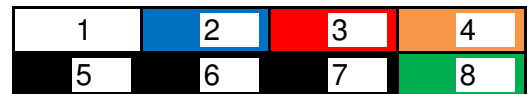
The harness as described below is from the *National Capital Trackers Wiring Harness* drawing package. This drawing package shall be maintained by the corporation. The appended drawing package is hereby incorporated by reference.

- 1. Bus wiring on the module shall be 12 gauge and wire colors as follows:
 - Pin 1. White, Outside Track.
 - Pin 2. Blue, Middle Track.
 - Pin 3. Red, Inside Track.
 - Pin 4. Orange, Continuity, connects to nothing.
 - Pin 5. Black, return dedicated to Pin 1 Outside Track.
 - Pin 6. Gray, return dedicated to Pin 2 Middle Track.
 - Pin 7. Brown, return dedicated to Pin 3 Inside Track.
 - Pin 8. Green, Legacy/TMCC Reference, connects to nothing.

- 2. Electrical plugs for module to module electrical connections shall be:

Female Plug:

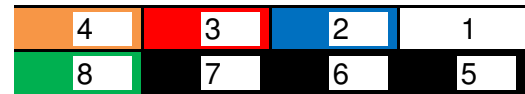
The individual PowerPoles 1327 series arranged as follows into a 1470G3 Snap- in Receptacle installed tongue up.



The female plug shall be on the right as viewed from inside layout looking toward public. Remember "the female is always right".

Male Plug:

The individual PowerPoles 1327 series arranged as follows into a 1460G3 Pak Shell Housing with latch. The individual PowerPoles are installed tongue down.



Scenery Standards

All modules must have scenery for shows

1. Scenery may be defined as a background or decorations used to represent a real or imagined environment.
2. The type and placement of scenery is determined by the module builder. Scenery must not restrict or impact layout operations horizontally or vertically.
3. Scenery which is taller than the top of the rails must not be closer than 1" from the edge of the ties. Scenery, such as ballast or vegetation, which is lower than the top of the rails is not restricted.
4. Scenery which goes over the mainline tracks, such as a structure or tunnel, must have a minimum vertical clearance 7" above the rails.
5. Modules must be painted so that no bare wood shows on the public side once the skirts are in place.

Building Guide

Overview

The Building Guide presents proven methods of constructing a module which meets these Standards but there are other building options and creative approaches which may be used and still result in a compliant module. The 24" x 48" rectangular module is the basic building block of NCT layouts and is the focus of the Building Guide, although much of the information is relevant to any module type.

If you are considering building a specialty module, which may include curves or turnouts, it is strongly recommended that you review your design with the NCT Standards Committee before purchasing supplies or equipment.

Module Construction

Plywood Deck

The basic module is 24" wide by 48" long. The top deck must be made from a piece of plywood cut to that size. Use A or B grade plywood, sanded on one side. Plywood thinner than 3/8" is discouraged as it may be more likely to sag or warp. One joist, centered at 24", is required. Plywood thinner than 3/8" requires two joists, centered at 16". Thicker plywood is a little easier to work with and holds screws better, but weight can be a factor.

Framing

The frame shall be made from 1"x4" clear pine or poplar. 1"x3" framing may be used but it may prove more likely to twist or warp. The joist(s) can be 1"x4" or 1"x3" which leaves space between the bottoms of the joist(s) and frame to run wiring without having to drill holes through the joist(s). The joist(s) shall be of the same type of lumber as the frame.

Sample Materials List: (Single Module)

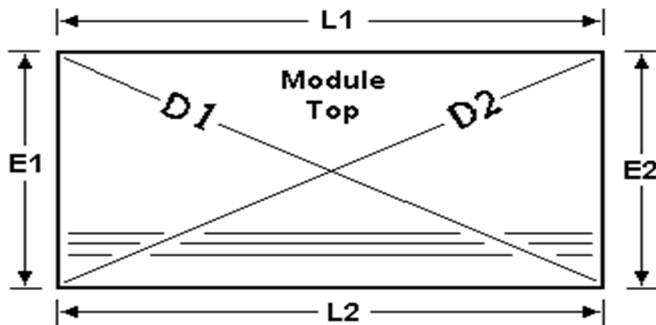
Qty 2	of 1"x4"x24" for the ends of the frame
Qty 2	of 1"x4"x46½" for the sides of the frame
Qty 1 or 2	of 1"x4"x22½" or 1"x3"x22½" for the joists
Qty 4	of 1"x4"x6" retaining plates
Qty 1	2'x4'x 3/8" plywood top
Qty 32	#8 x 1 5/8" screws for the frame
Qty 16	#6 x 1 5/8" flat head screws to secure the plywood
Qty 1	47.75" baseboard for fascia (Plexiglas retainer)
Qty 4	Nominal 2"x2"x37" Balusters for legs
Qty 4	5/16"-18 Tee nuts
Qty 8	#4x½" Sheet metal screws to secure tee nuts
Qty 4	5/16"-18x3" Eyebolts
Qty 4	Foot (McMaster-Carr p/n 23015T63)
Qty 2	¼" x 1½" Carriage bolts for fascia
Qty 2	¼" Flat washers for fascia
Qty 2	¼" Wing nuts for fascia

Note: Alternative construction designs, such as leg pockets or diagonal leg retainers, may require slightly different quantities.

Assembly

The four frame members must be carefully fitted, starting with an end and one side. They must be glued with carpenter's glue applied to the edge of the side and then be screwed together. The ends of the each piece must be square and even to obtain a good bond. Repeat with the other side member, and then attach the other end piece using glue and screws.

The Corners of your module must be square



Lengths L1 & L2 should be equal, as should ends E1 & E2. Diagonal dimensions D1 & D2 should be the same.

The deck must be straight and square. You want to be sure the ends are square because they'll fit better against adjoining modules when you C-clamp them together. Put screws in each joist, countersink holes before you run the screws in.

Joists

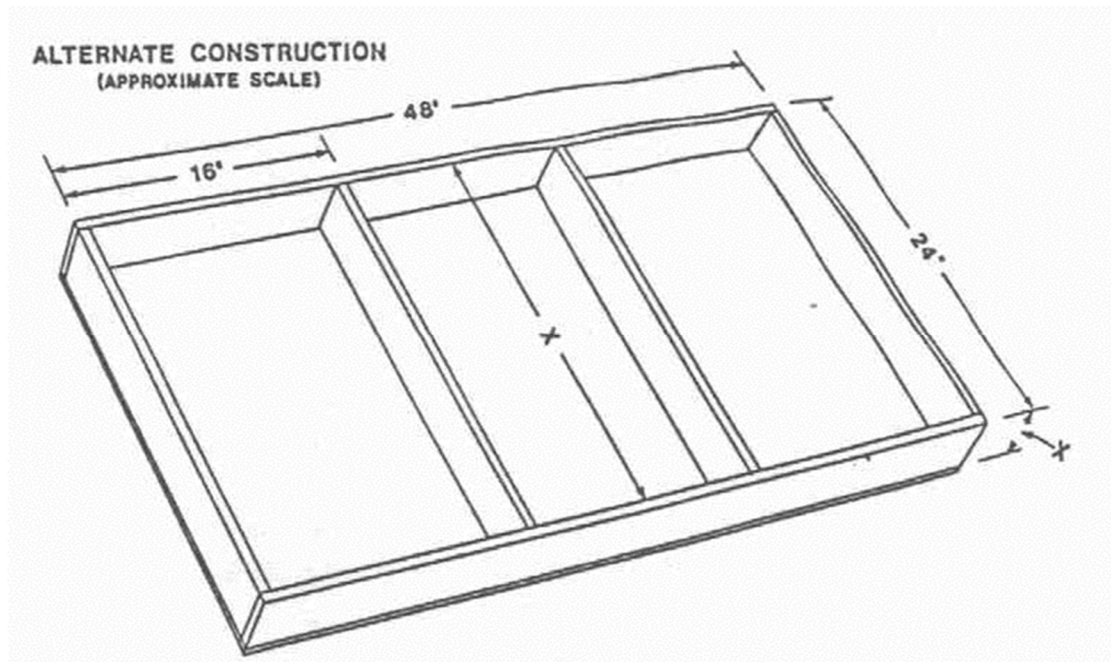
Joists are cross pieces which run under your module from front to back. For modules using 3/8" or thicker deck material a single joist at the module center is sufficient. For additional strength two joists may be used, centered at 16" intervals.

Preferred Method of Assembly:

Put a row of #6 flat head screws through the plywood deck into the frame. It will be helpful if you draw a pencil line from one end to the other along this center line. It will be neater if you countersink the screws and putty or spackle over them before you paint the module. Install in each corner with glue and screws. Let the glue dry for a minimum of 24 hours.

You will now have a very strong, lightweight module that will provide a good base for your track and whatever else you want to put on it. This method will produce a 24"x48" module top, that will weigh about 12 pounds and be easy to carry and store.

Alternative Method of Construction



The fascia is added next. It is suggested that the baseboard have 1/8" step cut into it to a depth of 1". The 1" dimension is measured from the "normal" bottom of the baseboard and the cut is made on the back. Clamp the baseboard molding to the module with the bottom of the baseboard flush to the top of the plywood deck. The fascia should be slightly shorter than the length of the module, center it from each end, and drill a 1/4" hole approximately 12" in from each end and 1 1/2" down from the top. Install carriage bolts, washers and nuts.

Polycarbon or Plexiglas

The top of the Polycarbon or Plexiglas shield must have a height of 5" from the top of the rails. Due to the variations of mounting height, the proper height dimension will need to be determined by the module builder. The typical height of a shield is 6".

"Must Have" Elements

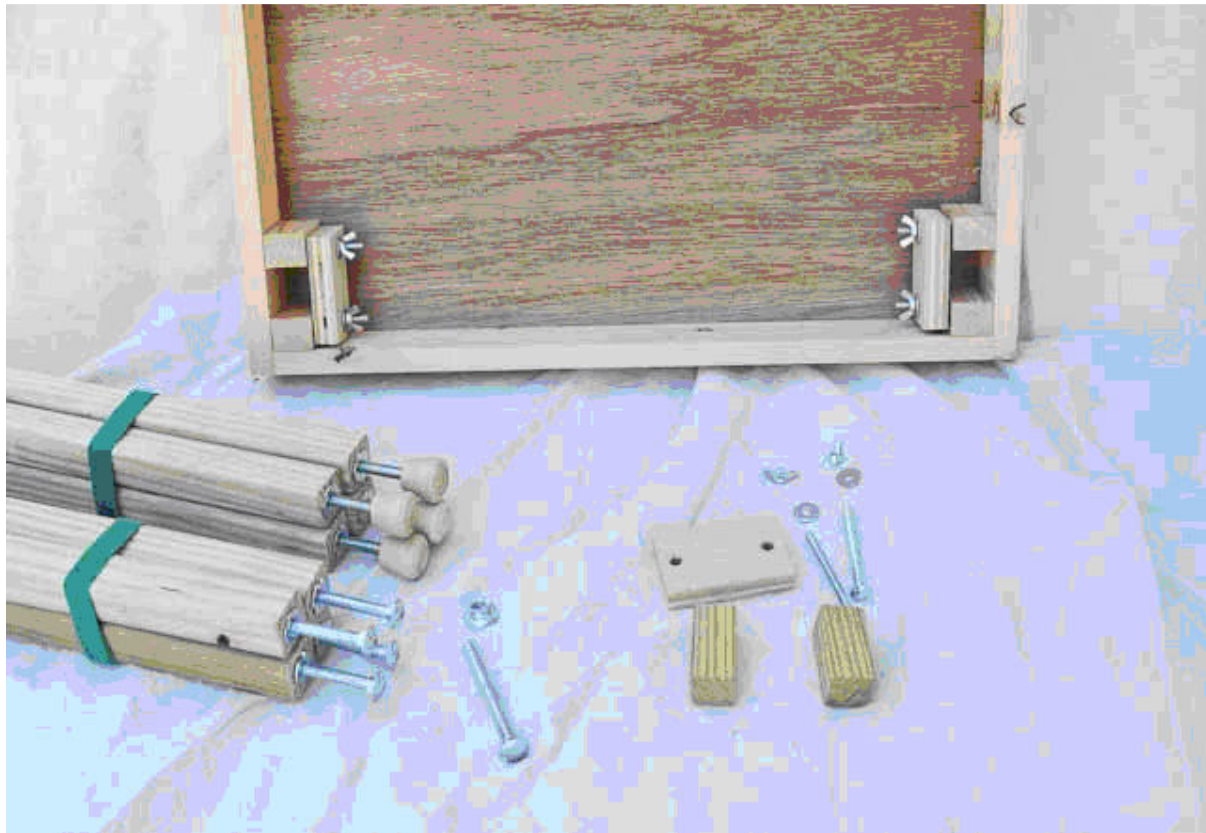
The railhead (top of the track) must be 40" above the floor, legs adjustable +1" or -1", O-gauge track centers 4 1/4" apart, and tracks that end 5" from the module ends. Module width can be determined by the member but must not be less than 15.5" or more than 60". Module lengths of greater than 48" are permitted provided your total module length or module set length is divisible by 48" (if you want to use a 72" length, supply two modules 6 feet long. Two of these equate to 12 feet which equals three four-foot modules.

Legs for Your Module

The typical leg material is 1 1/2" x 1 1/2" and must be straight. Legs must be adjustable plus or minus 1" and they must be long enough so that the railhead is 40" above the floor. This means you must take into account the thickness of your module deck, of the roadbed, the means of adjusting the height, and the height of the rails and ties. Exact dimensions aren't given here because of the variables involved.

Proven Method for Attaching Legs

A retaining plate is attached to a set of blocks using two carriage bolts with a washer and a wing nut to each corner. The set of blocks must be of slightly smaller width than the overall outside width of the leg in order to maintain securing pressure on each leg. The leg should not fall out when assembled.



Tip: Always tighten the wing nuts after take down to prevent them being lost.

Adjusting Module Height

Adjustment of module height to compensate for uneven floors and to mate with adjoining modules can be accomplished with feet (McMaster-Carr p/n 23015T63) or 5/16" eye bolts, to make adjustments when you're setting up.

There are two kinds T-nuts that are recommended:

1. A T-nut with sharp points is driven into the wood with a hammer. Drill a 3/8" diameter hole 1" deep in the end of the leg prior to attaching the T-nut. This will provide adjustment clearance for the screw. Drive the T-nut in straight or your adjustment bolt will go in crooked and hit the side of the hole you drilled in the leg. Proper assembly will assure the T-nut goes in all the way when you need the full 1" adjustment. The T-nuts can be kept from falling out of the leg by driving two small (#4) screws into the notches on the edges of the T-nuts.
- 2 A T-nut with a flange with hole for screw mounting and can be screwed in. It will be easier to get this type in straight and it will not loosen over a period of many uses.

Drill a 3/8" diameter hole 1" deep in the end of the leg prior to attaching the T-nut. This will provide adjustment clearance for the screw.

The legs are typically 1½" x 1½" to 1¼" x 1¼" square and 37" long. This size enables the leg to slide into the PVC leg extenders used for elevated layouts. A hole is drilled in the center of one end. A 5/16-18 tee-nut is inserted into the hole and an eye-bolt screwed into the tee-nut. This is the bottom of the leg. The bottom of all legs must be padded with a rubber or otherwise non marring surface that will not leave scratches on a floor surface. The eye-bolt can be screwed in and out to adjust the module height.

Track

Track Type

O-Gauge tinplate tubular track such as Lionel and K-Line (RMT), and wood tie track such as Ross and GarGraves are the standard track systems for the NCT. These are the preferred track systems based on ease of handling and flexibility (cutting and availability of various lengths) and connectivity. Additional track systems can be utilized such as Lionel FasTrack and MTH's RealTrax but durability and connectivity issues may be more prevalent.

Whatever track system is selected it is incumbent on the module owner to provide the proper bridge tracks or connecting pins to mate with Lionel O-Gauge track. This includes both 5" and 10" bridge tracks.

Track Pros and Cons

Lionel and similar tubular track (such as K-Line or Williams): Price, availability, flexibility, easily connected. Easy to repair in the field.

Ross: Flexibility, darkened middle rail, wooden ties/realistic look, spiked rails, easily connected. Requires special mating pins.

GarGraves: Flexibility, darkened middle rail, wooden ties/realistic look, easily connected. Requires special mating pins. More easily damaged than Ross.

K-Line (RMT): Plastic ties, darkened middle rail, easily connected. More easily damaged and harder to repair than Lionel tubular.

Lionel FasTrack: Built in ties and roadbed, difficult make custom lengths. Must have Lionel transition track to connect to tubular.

MTH RealTrax: Built in ties and roadbed, more difficult to make custom lengths. Must have MTH transition track to connect to tubular.

Atlas: Difficult to make custom lengths. Requires special mating pins (joiners) to mate with Lionel tubular or GarGraves. Nickel/silver track does not work with MagneTraction. Soldering is difficult and special processing is required on all nickel/silver or stainless steel track. The high heat required may melt the plastic roadbed and diligent care must be exercised.

Track Placement

1. Each module must have three main lines. These tracks must be spaced exactly as follows:
 - a. The outside track center rail is 3 ½" from the front edge of the module deck.
 - b. The middle track center rail is 7 ¾" from the front edge of the module deck.
 - c. The inside track center rail is 12" from the front edge of the module deck.
2. For all mainline straight tracks the distance between the center rails must be maintained at a minimum of 4¼" at all times.

Lengths of Track

On a 48" module the track length must be 38". The track must terminate at 5" from either end of the module. The actual 38" length of track can be comprised of several pieces or a single piece of track. Terminating 5" from the module's end helps prevent damage to your track and allows some adjustment capability during setup.

Bridge Tracks

Bridge tracks are the 5" and 10" inch tracks used to connect to the adjacent module. Due to minor variations in module construction these bridge tracks enable making these minor adjustments. This is accomplished by cutting the bridge track 1/8" shorter than the 5" or 10". The club supplies 5" tracks but for a more uniform appearance you may want your own. You must supply your own 10" bridge tracks.

Curves

Modules with curves introduce clearance issues. Follow the Curve standards on page 6. Review your design with the Standards Committee prior to building or buying.

Fastening the Track

Track screws either ½" or ¾" long are preferred. Fasten the track at least every 6". Do not use drywall screws to hold down the tracks.

Roadbed

Gray painted cork, granular rubber, or similar roadbed is preferred.

Turnouts / Switches

The preferred turnout for the three mainlines is the Ross switch, but K-Line (RMT) or FasTrack is acceptable. Based on experience the Ross switch is a smoother working, has fewer dead spots and less picking and a low profile that doesn't interfere with rolling stock or engines. This switch mates with all track systems.

Scenery Suggestions

Overview

Our modules require some form of decoration. Scenery enhances the toy train experience for everyone. Trains passing buildings, traversing bridges, and passing through tunnels brings out the best in everyone's imagination. Use your imagination and make your module exciting. If it looks good to you, the general public will no doubt share the sentiment.

Basic Considerations

1. Modules should be durable, easy to transport and store.
2. Any scenery design must not interfere with operations on the 3 main tracks.
3. Observe the vertical and horizontal clearance requirements.
4. Paint is the most basic decoration and color adds to the interest. The public should not see bare wood in a completed layout. Painting the underside of modules may reduce moisture absorption and warping.
5. Operating accessories must be powered from a separate source provided by the module owner.
6. Publications explaining the various techniques for creating the scenery are available both on-line and in print.

Some Themes for Module Decoration

Prewar: This highlights prewar original and reproduction tinplate buildings and accessories manufactured by Lionel, American Flyer and other toy train manufacturers.

Postwar: This was a boom time when there were a great number of operating accessories manufactured. A collection of these makes an interesting module to watch in action and will always draw a crowd when in operation. This is particularly popular with young children.

Plasticville: A busy community can be made using these plastic kits.

Hi-Rail: This is a relatively new term applied to three-rail operators who set up and decorate with a view toward a realistic appearance. This includes custom buildings and scenery decorated to present realism in miniature.

Whimsical: NCT welcomes whimsical decorations such as cartoon characters, action figures, dinosaurs, etc., as long they do not attack the trains.

Mountains, Bridges, Buildings, Trees

These add to the module's attraction. Take time to really look at the real thing and see if you can recreate a scene in miniature. Mountains and tunnels add a different perspective as trains traverse your module. Always keep in mind the need to follow the basics mentioned above.

Change History

Change Number	Nature of Change	Date of Change
1	Module Standards incorporated into the By-Laws.	6/20/2013
2	New wiring harness voted in as standard.	11/21/2013
3	Complete new edition of Standards (dated 4/20/15) voted in.	TBD