PARALLEL LINES: Examining S Curves

Pursuing more reliable and better-looking trackwork

About our track modeling columnist

Tim Warris is a long time model railroader and co-founder of Fast Tracks, a trackwork fixtures company. Tim first developed his track assembly fixtures out of a desire to find a better way to hand-build reliable turnouts and crossings.

Since March of 2007, Tim has been constructing the 1930's CNJ Bronx Terminal in both HO and N scale.

Are S curves really so bad?

FIGURE 1: The thing to watch with S curves is coupler alignment – which actually doesn't look too bad in the above photo. In this issue, our trackwork columnist takes another look at that trackwork bug-a-boo, the S curve.

I was scanning through Paul Mallery's book on Trackwork the other day and a paragraph about S curves caught my eye. For some reason I seem to be stumbling onto articles about S curves lately and this got me thinking.

We have long been told to avoid S curves in our trackwork. Failure to do so would result in poor operation, derailments and could possibly even tear a hole in the fabric of space and time.

This is one of those design rules that I think the majority of us accept without question. Even when I built my last layout, The Port Kelsey Ry, I avoided S curves wherever possible, certain that they would lead to trouble.

My current layout, the CNJ Bronx Terminal, is a different story. This track plan seems to go out of its way to use S curves. This layout took its track plan from the original drawings of the terminal, scaled faithfully to HO scale with no compression.

So like the prototype, my layout will have S curves – lots of them.

An S curve is a section of track where curved track changes direction without any straight track between the arcs, effectively forming an "S".

As a result, individual cars of a train are offset as they change direction when crossing an S curve (figure 1). Depending on the equipment and the radii, this offset can be extreme enough to cause cars to tip, as the couplers are unable to pivot enough to accommodate the curve.

Looking at most track plans, it isn't hard to find S curves in nearly every design. Even a simple crossover between two parallel tracks will form an S curve. Studying the track plan for my Bronx Terminal I can spot several of them, yet in the tests I have run so far I don't seem to have any operating issues at all.

So if S curves are so evil, why don't I have derailments on my layout? Are

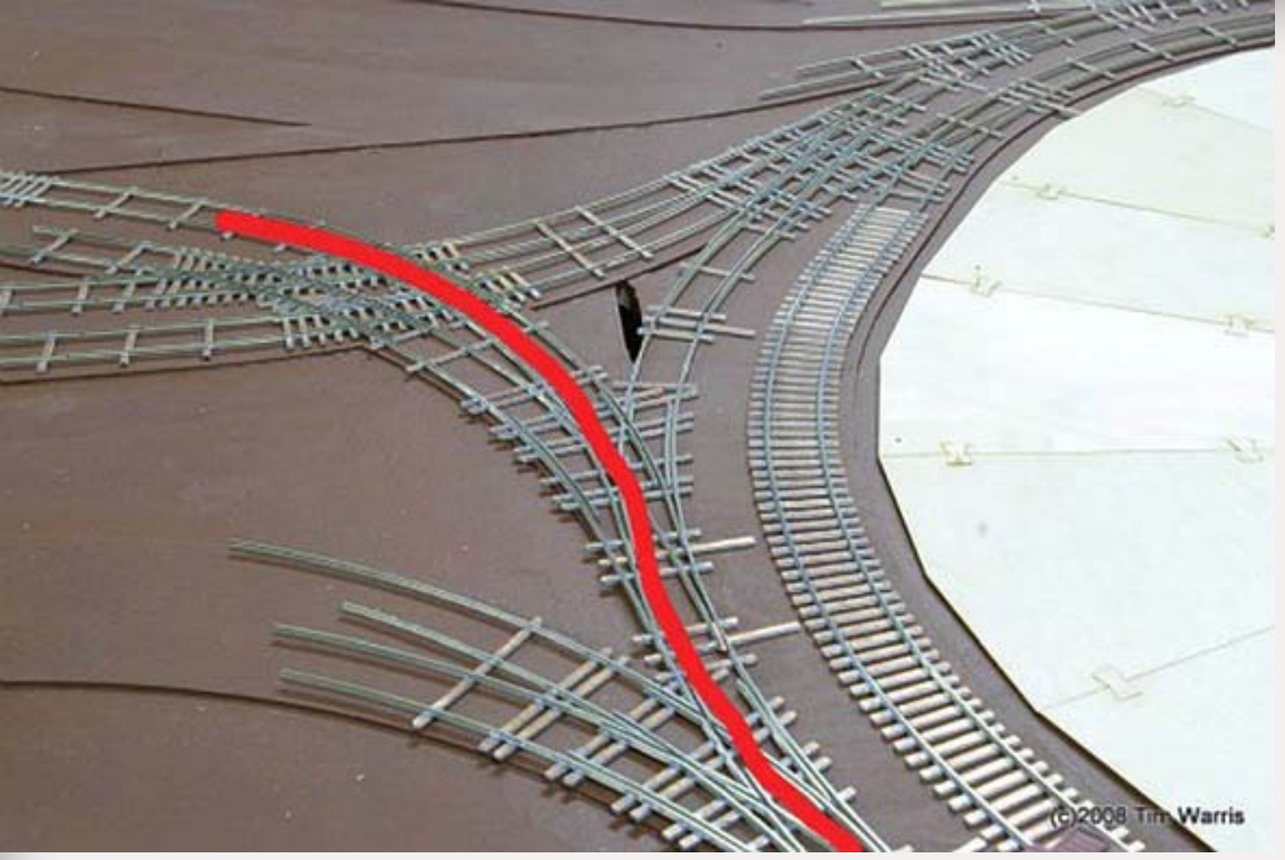

FIGURE 2: In this issue, our trackwork columnist takes another look at that trackwork bug-a-boo, the S curve.

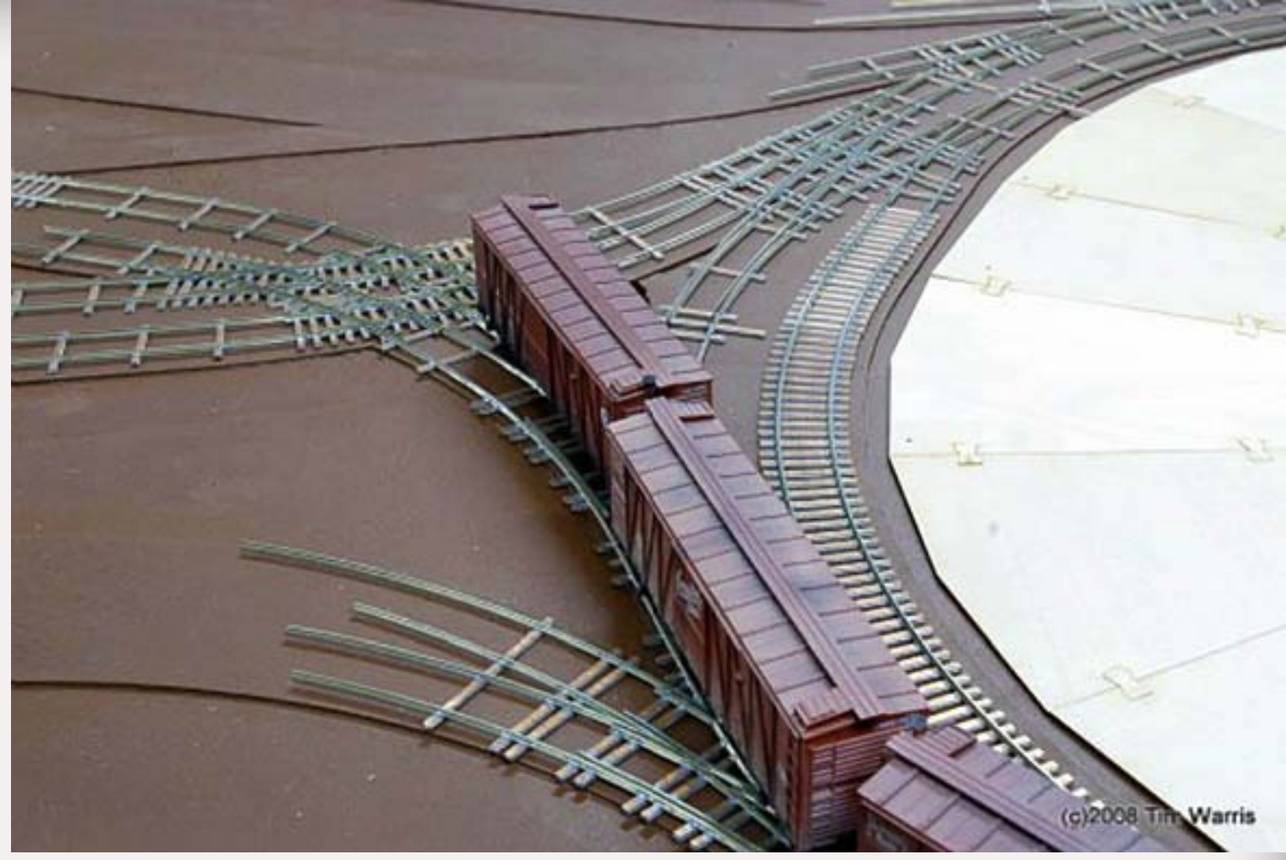

FIGURE 3: In this issue, our trackwork columnist takes another look at that trackwork bug-a-boo, the S curve.

S curves as big a problem as we have been lead to believe?

It seems that over time what originally was "be careful if using S curves" has become "never use S curves". This can create a lot of difficulty for modelers as they develop their track plan.

I found a good example of this while reading an article in the 2007 issue of *Model Railroad Planning* about the Harlem Transfer; a small terminal of similar design to the CNJ Bronx Terminal.

In a sidebar about working with extreme radii it says that you should steer clear of S curves.

Yet, the prototype track plan next to it shows several extremely tight S curves! So should we avoid them or *not?*

Now, in the author's defense he is probably right to be wary of S curves when using small radii, but I take issue with his blanket recommendation to steer clear of them completely, because they can and in many cases *must* be used.

Lets look as some examples of S curves that will operate reliably.

Figure 2 shows some of the trackwork from my CNJ Bronx Terminal (still under construction, but usable enough for this example). This trackwork was scaled from original blueprints and is a faithful reproduction of what was used at the terminal – a full sized version that was built and used successfully for many decades.

The red line shows a great example of an S curve with very small 12.4" radii. The route clearly changes direction without any tangent (straight) track between the curves.

The effect of this S curve can be seen between the extreme offset of the first two boxcars shown in Figure 3 as they change directions. Still, the couplers take up this offset with no problem by pivoting, providing enough movement to allow the cars to travel through the S curve without any issues.

ELSEWHERE IN THIS ISSUE: The effects of curve radius

The other key curve factor is radius – and we cover *that* in this issue's feature article presenting the new curve rule-of-thumb guidelines.

Armed with these two insights of curve radius and S curve effects, your track alignments will be much more reliable. ■

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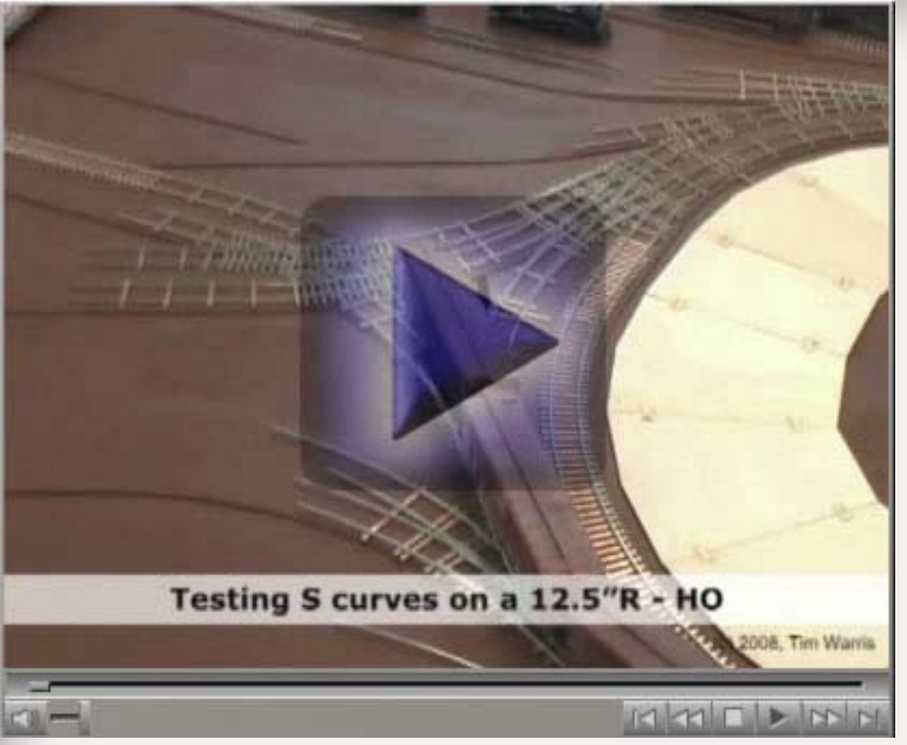

FIGURE 4: This video shows a 12.5" radius S curve in HO with 40 foot boxcars using body-mounted couplers.

Figure 4 video

This effect is very clearly shown in the figure 4 video (left). In this example I am using small equipment; HO scale 40' boxcars with body mounted couplers on a 12.4" radius. Notice the offset between the cars as they snake through the S curve?

If this works with these radii, I don't think any modeler using the same equipment on their layout has to worry about any S curves using larger radii.

Now lets look at some examples that fail.

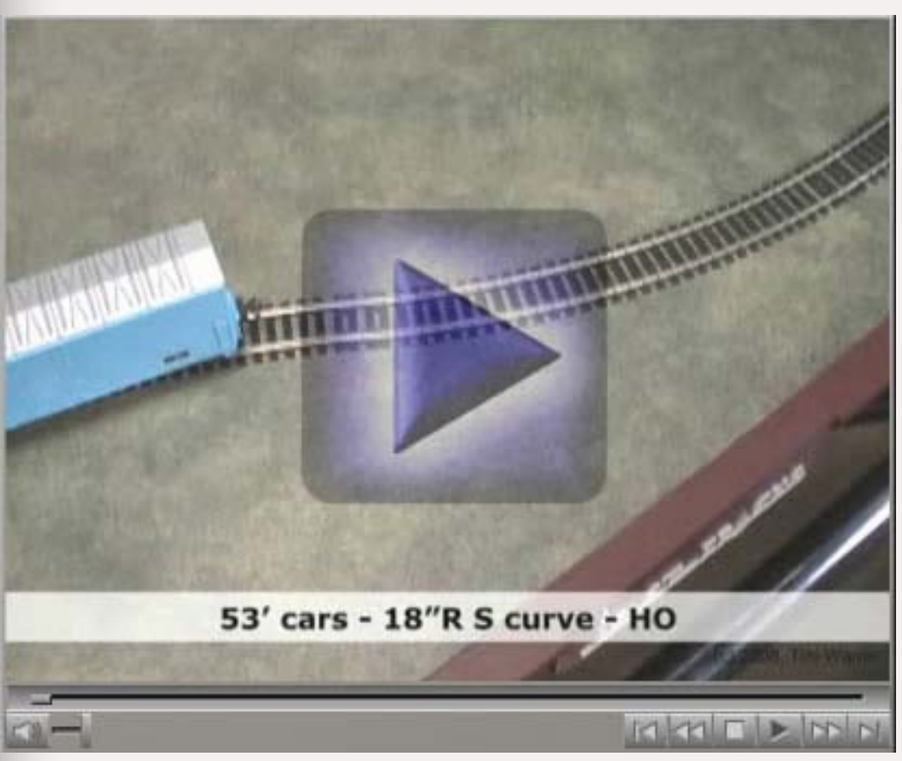

FIGURE 5: This video illustrates what happens when two 53' HO boxcars negotiate an 18" radius S curve.

Figure 5 video

The video in figure 5 shows two 53' HO scale boxcars trying to negotiate an 18" radius S curve. Clearly there is interference. The couplers simply do not have enough swing to handle these tight radii and long cars. So if you are using 53' cars, than HO 18" radii are not for you.

Figure 6 video

In the figure 6 video, you see the same two cars on a 24" radius S curve, with much improved the performance.

Figure 7 video

Now using the same 24" radius S curve, I tested a couple of 89' flat cars, and as you can see in figure 7's video, there is no way these cars can handle this S curve.

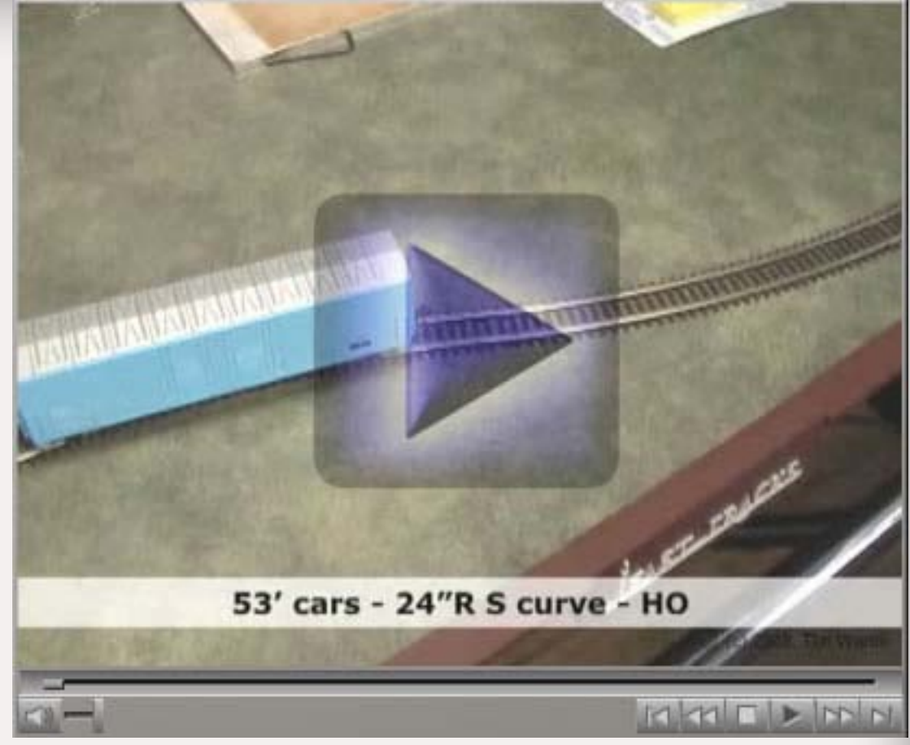

FIGURE 6: This video shows the same 53' HO cars as figure 5, but now with a 24" radius S curve.

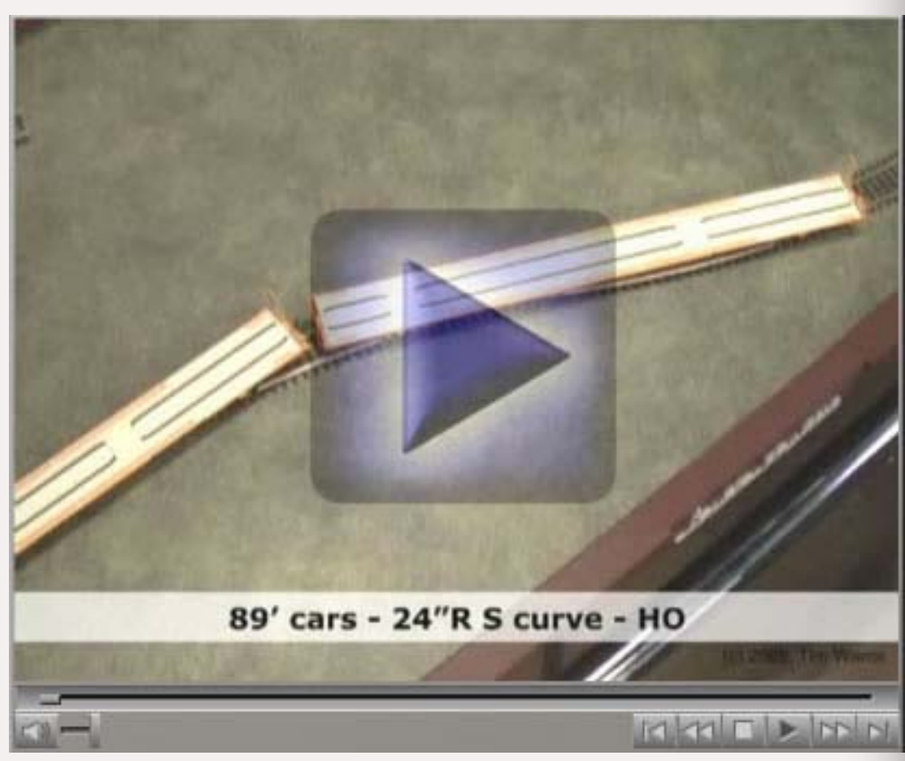

FIGURE 7: What about 89' HO flat cars on a 24" radius S curve? This video shows what happens.

FIGURE 8: What happens if we try the HO 89' flats on a 30" radius S curve?

FIGURE 9: This video shows what adding a 53' HO boxcar between the two 89' flats does on a 30" S curve.

Figure 8 video

So I upped the radii to 30" to test these same 89' flat cars (figure 8), and even with these fairly large radii, the cars still struggle.

Figure 9 video

Adding a 53' boxcar between the two 89' flat cars eliminates the issues with the S curves. (figure 9) This has the same effect as a small straight section of track between the two arcs.

In all of the previous examples I used cars with body mounted couplers. However if you use truck-mounted couplers, operational reliability over S curves increases dramatically.

Using some N scale equipment, which typically employs truck-mounted couplers, I ran some similar tests.

Figure 10 video

The figure 10 video shows two 60' N scale boxcars operating on a 9-¾" S curve. As can be clearly seen, these cars handle this very small radius just fine, as the pivoting couplers will always stay in line regardless of the radius.

Figure 11 video

Figure 11's video shows a closer view of the how the couplers remain aligned as the cars pass over a very tight 9-¾" N scale S curve. Not only can they handle this track, but can also reliably couple on the curve!

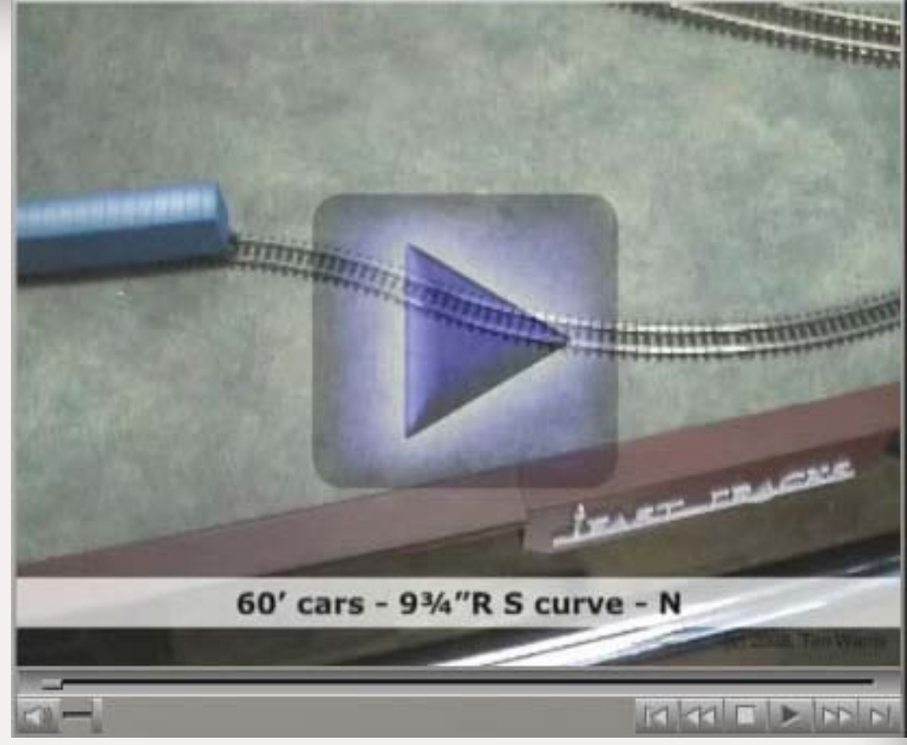

FIGURE 10: Moving to N scale, this video illustrates to 60' boxcars on a 9-3/4" radius S curve.

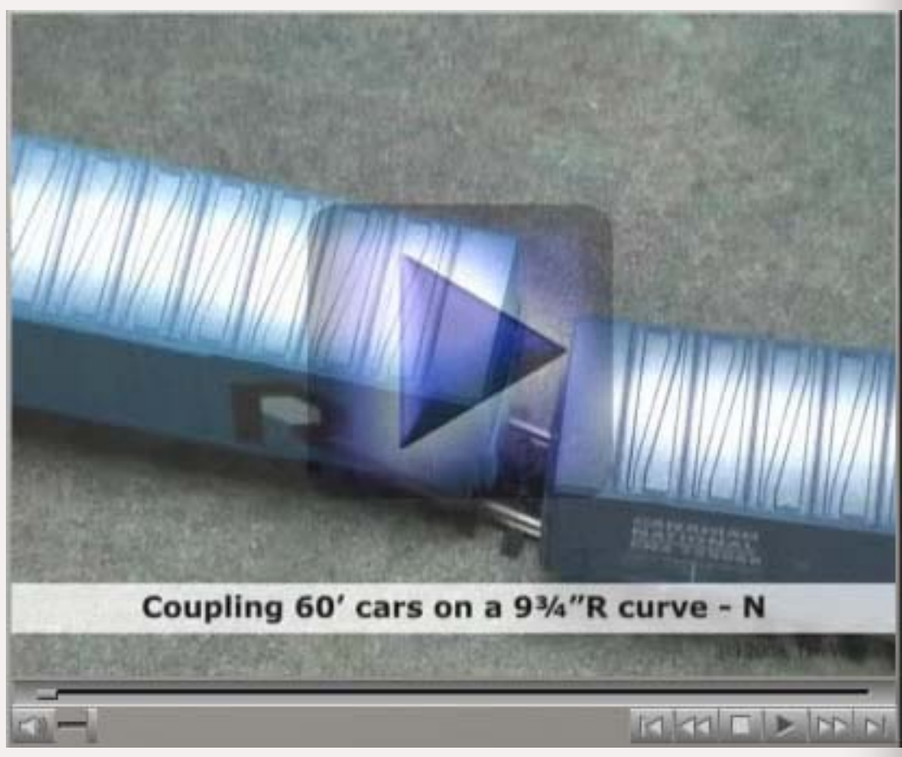

FIGURE 11: This video shows the N scale coupler alignment up close with 60' boxcars on a 9-3/4" radius S curve.

FIGURE 12: This video shows a 9-3/4" radius S curve in N with 85 foot passenger cars using truck-mounted couplers.

Figure 12 video

OK, so lets go really nuts. Figure 12's video shows a couple of 85' passenger cars negotiating the same 9-¾" radii. I doubt anyone would actually need to do this, but it is a great example of how truck mounted couplers can handle very tight curves.

Even though the cars are unbelievably offset from each other, the couplers stay in line over the length of the S curve.

Most N scale equipment is supplied with truck-mounted couplers, and if you elect to stay with the truck-mounted couplers, there's little need to be concerned with S curves in your designs. They will not cause any issues.

Conclusions

For larger scales where body mounted couplers are more common, it is best to do some tests to see what your chosen equipment and radii is capable of handling.

A few quick tests with some flextrack will let you know what will work. As always, use common sense. If you are trying to cram 60' boxcars through small radii, you are probably going to run into some trouble.

As for crossovers and other switch created S curves, unless you are using very large equipment, like the 89' flat cars shown above or turnouts smaller than a #5, I would not be too concerned about the S curve in the switch.

Most commercial turnouts that match prototype design have straight track through the frog, and when used in a crossover will automatically add a straight length of track between the arcs of a turnout.

However (there always seems to be a however), if you are using "snap track" or other train set type turnouts, be careful. These typically have a constant arc through the frog and when joined in a crossover can create a very nasty, small radius S curve. ☑