

Installing a Turntable and Operating it Under AI Control

Turntables can be found on many railroads, from the smallest to the largest, and their ability to turn locomotives in a relatively small space makes them a valuable addition to any yard facility, whether it's a single track engine shop or a large, multi-track roundhouse. In this tutorial, we'll explore how to install a turntable and how to set it up so computer-controlled trains can use it.

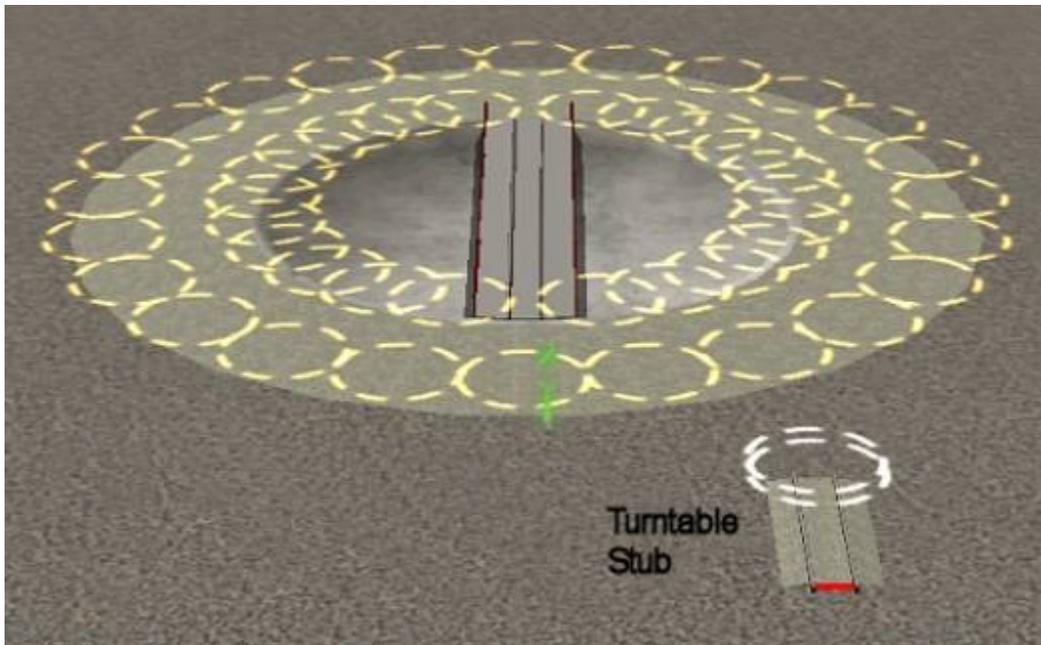
We'll be installing Andi Smith's "AJS Turntable", which consists of the following two parts:

AJS Turntable	<kuid:122285:1500>
AJS Turntable Stub	<kuid2:122285:1502:1>

These items are available on the download station.

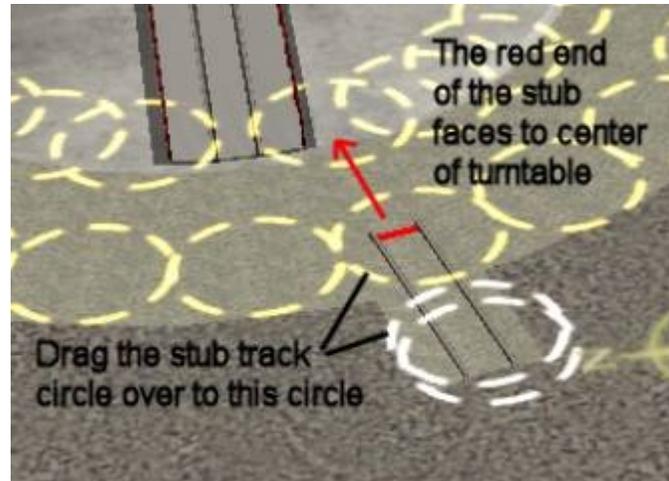
The Turntable

As shown in the drawing below, Andi's turntable consists of two parts, the turntable itself and "stub tracks" which attach to it to provide connectivity to surrounding tracks.



The turntable has 24 positions where tracks can connect, as represented by the sets of circles surrounding the center. In order to connect a track to the turntable, we must first attach a stub for every track we want to use.

In the drawing above, notice the stub track has a red indicator at the end opposite the two circles. This red end of the stub must be face *toward the center* of the turntable. In order to do this, we must rotate the stub track so it lines up where we want to attach it to the turntable. Check out the drawing below.



Notice above the stub has been rotated so it not only faces toward the center of the turntable, but it also lines up approximately where we want it to connect, the "slot" just to the right of where the turntable bridge is facing now. Once you have the stub facing in the right direction, just drag it over the spline point on the outer edge of the turntable, as shown above.

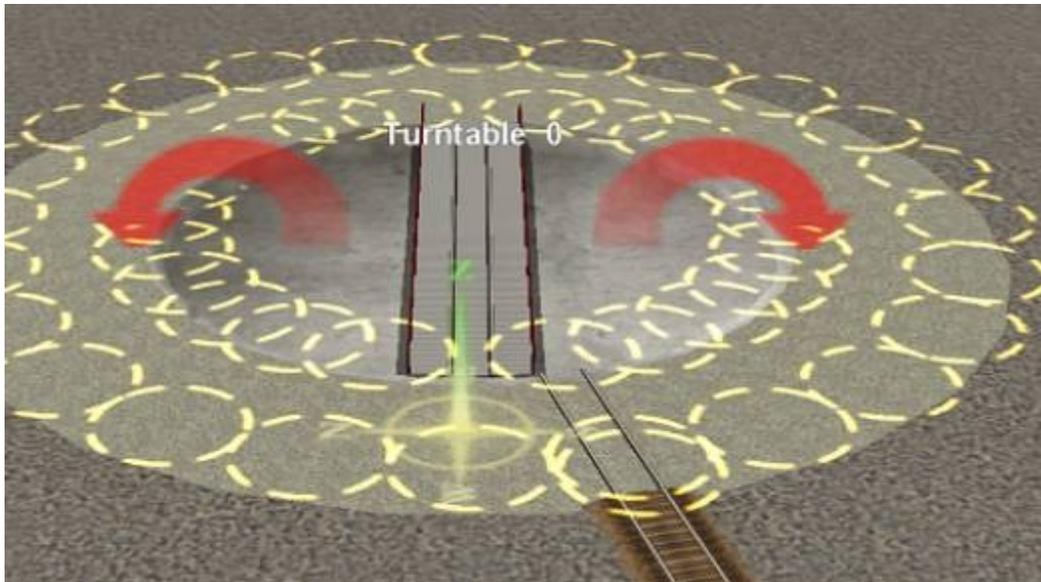
Once you have stub in the right position, it will snap into place, as shown in the drawing below.



Now we have the stub attached to the turntable. This is where it gets a bit tricky and you have to pay close attention. Check the two circles at the lower edge of the picture. The inner circle has turned yellow. This indicates the stub is correctly attached. If the circle is *not* yellow, the stub is not attached correctly. Just grab the stub with your move tool, pull it away from the turntable a bit, and try again.

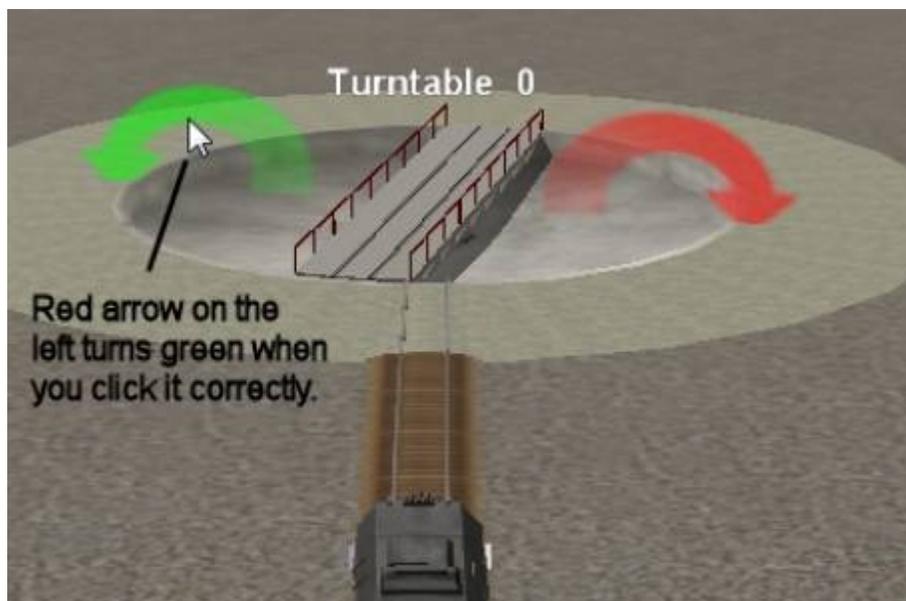
I make a point of this because I've had trouble on several occasions. I might initially attach the stub correctly, but if I later accidentally move or rotate the turntable itself, the stub may detach. So if you're having trouble, always check to be sure all the stubs are *still* attached correctly.

Okay, we've got the stub attached. To attach track, we just drag it onto the second of the two circles, as shown below:



Now we have both circles yellow, indicating the track is correctly attached to the stub. If the outer circle does not go yellow when you attach the track to it, check to be sure the height of the turntable is the same as the incoming track. If the track seems to attach okay, but the circle is white instead of yellow, it's possible you have a very small difference in the height. Use the track tool's "grab height" option to check.

Now that we've established how to connect the stubs, building the rest of the turntable installation is just a matter of attaching as many more stubs and tracks as you wish. If you look at the drawing below, you'll see the arrows to either side of the turntable. In driver, they are initially red, but if you move your mouse over either arrow and click, it will turn green, allowing you to manually move the turntable to whichever position you need.



For some of you, what you've read so far may be enough, especially if you operate only one train at a time and you're satisfied with rotating the turntable manually. If that's the case, you're welcome to jump off the train here. In the rest of this tutorial, we'll discuss using the turntable with AI trains, and we'll finish up by exploring the setup of engine house and roundhouse tracks.

Automatic turntable operation under AI control

When I first learned of Andi's turntable, I found he had a version of it that was scripted. Using that the version of the turntable, you could drive a train onto it and stop. After ten seconds or so, a bell would sound and the turntable would automatically rotate 180 degrees, enabling you to drive off again in the opposite direction.

"Wow," I thought. "How cool is that?"

So I proceeded to set up three such turntables on my Midwest Central route and they all work just fine. There's only one problem: Sometimes you need to move the turntable only one or two stops, to access an additional stub track, instead of just turning the loco around. For that need, the auto rotate function is less desirable and you have to turn it off in surveyor to use manual control effectively.

Fortunately, there is another solution that actually works better, for both the auto rotate and the partial turns. We can use Andi's scripted turntable, with the auto rotate turned off, or use his other version, the one listed above, which is unscripted. Either way, we'll need to add a new driver command, "move turntable" and install a new rule, "InputTable."

Move Turntable Command	<kuid2:131986:180156:1>
Input Table Rule	<kuid:131986:1012>

These items are also available on the download station.

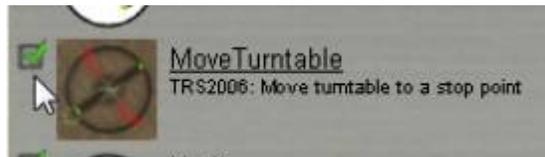
As you might suspect, the move turntable command will up in your driver options, the same as "drive to" or "couple." You just say, "Move turntable 1 to stop 4" or something similar and presto, the turntable rotates. Cool.

Start by downloading and installing both the command and the rule. You can look them up on the DS by name or using the KUID's listed above. Once you've downloaded them, make sure to edit them in Content Manager and select "commit" or they will not show up in Surveyor.

Assuming you have them installed, start Surveyor and click on "Edit session rules" at the top of the screen. When it opens, select "driver commands" and then click "Edit", as shown below:



That will display a list with the various available driver commands. Scroll down to find the "move turntable" command and click the check box to make the command available for this session.



Now let's add our InputTable rule. (When I first read about this rule, I was a bit nervous about working with it, but I discovered you don't know have to know how the rule works to use it successfully! So let's move ahead.)

Return to the Edit Session Rules screen, and this time click on "Add" to add a new rule to the session. When the pull down menu appears, scroll down to "InputTable." Select it, then click the green arrow to add the rule to the session. Check the drawing below:



Now that we've added the rule, we have some decisions to make. Specifically, we need a name for each turntable we plan to control. The Move Turntable command allows you to select from

multiple turntables, and it needs a name for each.

Let's take a real world example. On my route, Midwest Central, I have three turntables, located at East Shelton, the main yard, and Westfield. I could name them anything I wish, but in this case I'll call them "Turntable-ES", "Turntable-MY" and "Turntable-WF", making them easy to remember, since they all begin with Turntable.

Once you've decided on a name for each turntable, we have to edit the "InputTable" rule to add a separate line for each. Each line of the rule must begin with the word "turntable", followed by the specific name of the turntable, followed by the number of stops the turntable has. In this case, Andi's turntable has 24.

Okay, let's edit our rule. Open the Edit Session Rules screen again, where we now have the InputTable rule visible. Highlight "InputTable" and click "Edit" to edit the rule:



Then click "Add" to bring up the input dialog below:



In the box, type the information for the first turntable, in the following form:

turntable, Turntable_name, #stops

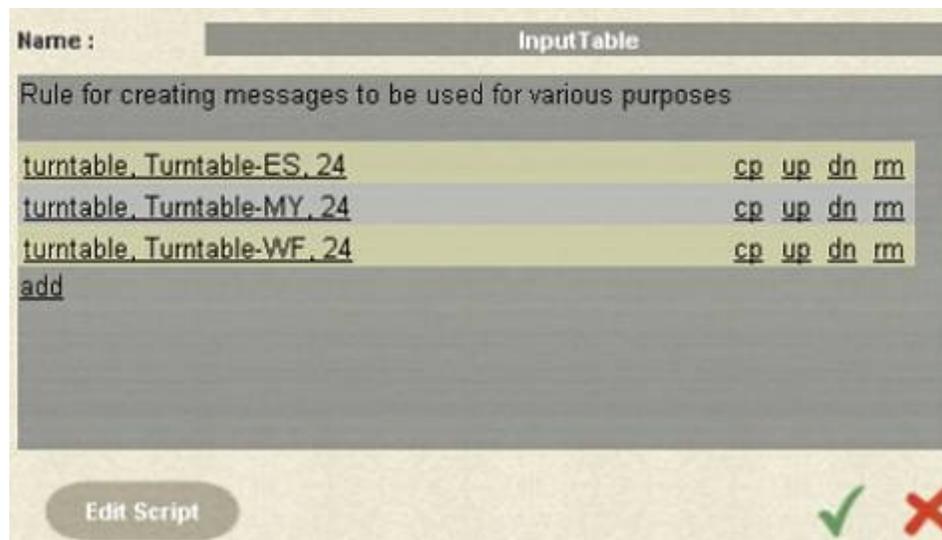
**** IMPORTANT: The key word "turntable" must be lower case, or it will not work. The actual turntable name can be mixed case, as you see above, but the first word must be lower case.

Make sure you have the spelling correct and make sure you include a space after each comma. Here's my real world example:

turntable, Turntable-ES, 24

Pretty simple, huh? Once you've entered the data, click the green arrow to save your changes. I'll go ahead and enter the other two names as well, so we can see how multiple names work with the Move command in Driver.

We end up with this:

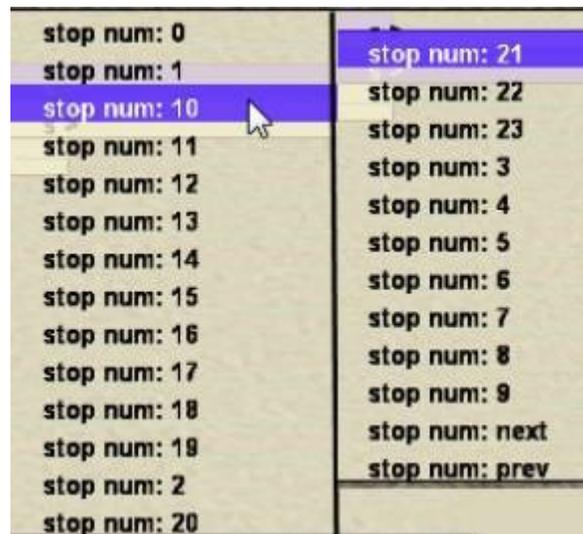


Once you've finished entering your names, click the green arrow to exit. Do not make any other changes to the rule. (The rule does not appear to have a delete function, so if you make a mistake, you'll have to delete the entire rule and add it back in again.)

Okay, let's check out what we've done so far. Let's return to the Edit Session screen. Click on Driver Setup and then "edit." Add a driver if necessary, then let's give the driver a command to move the turntable. Check the picture on the next page:



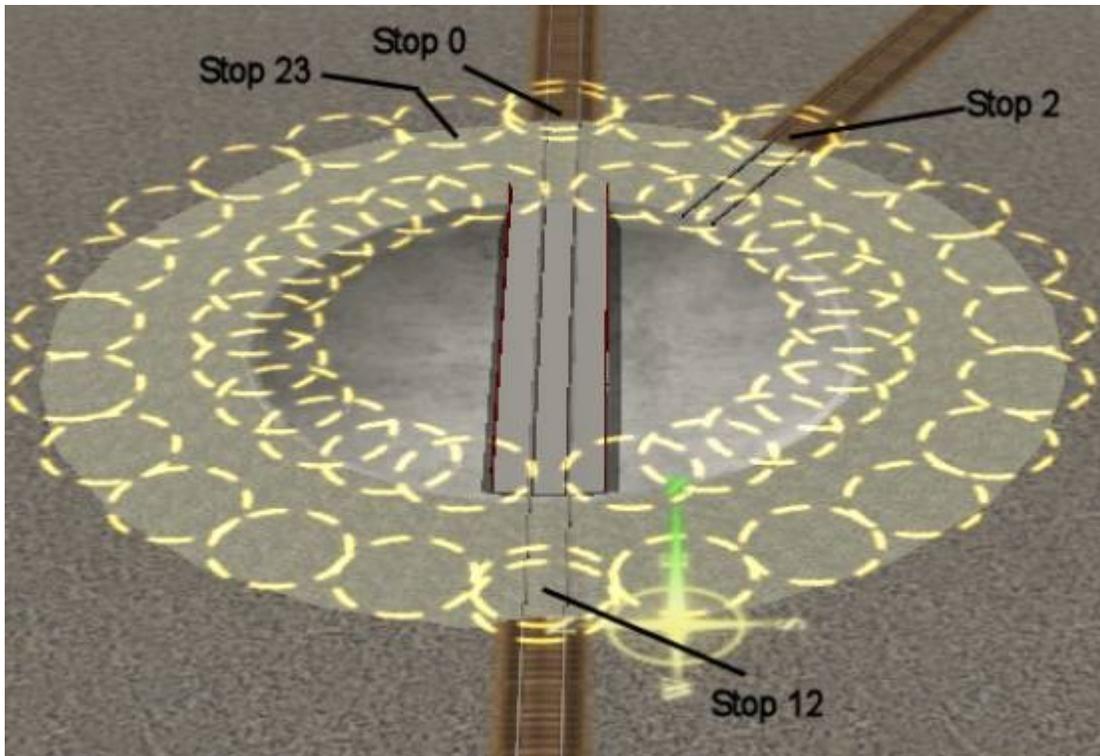
Our "Move Turntable" command now appears at the bottom of the list, and the dialog allows us to select which turntable we want to move. Notice out to right above, there are two "s>" places. Selecting either of them will pull up a list of the turntable stops.



The stops begin with zero, the default position, and go up to 23, with stop 12 being 180 degrees from stop zero. Notice also there is a "previous" and "next" you can use to move the turntable one stop left or right. "Next" moves it clockwise and "previous" moves it counterclockwise.

The Turntable in Operation

We've got our turntable installed and we've set up the necessary rules and commands to make it work. Now it's time put it into operation. Before we start, though, let's have one more look at the turntable itself. Check out the drawing below:



When you place the turntable on the map, the default direction of the turntable bridge is stop 0 in one direction, and stop 12 in the other. The rest of the stops are numbered clockwise. It's important to remember the stop positions are fixed and have no relation to current position of the turntable bridge--unless, of course, it happens to be in the default position. Said another way, "move to 0" always turns the bridge back to the default stop, no matter what direction it's currently pointing.

So, how do we get our locomotive to move to the turntable? We do it by placing a track mark, not on the bridge itself, but near the edge of the turntable skirt, as shown below.



Why? Because if we place the track mark on the bridge, it will rotate with with the bridge, changing ends depending on the direction the bridge is facing. Furthermore, placing the track mark on the bridge will cause the locomotive to stop too soon, before it's fully on the bridge, causing a derailment if the turntable is rotated.

Now check out the drawing below, where I've added some other track marks. Track mark Turntable-ES-Stop0 is on the far side of the bridge and Turntable-ES-Stop12 is on the near side. Track mark Track 2 is on the stub track.



Can you now see where we're headed with this whole thing? It's not quite as simple as it looks here, but this is the basis of all the material that follows. Given the loco sitting on approach track at the bottom of the picture, consider the following driver sequence.

- Drive to Turntable-ES-Stop0
- Wait for 5 seconds
- Move Turntable-ES to stop 2
- Drive to Track 2

Or this sequence:

- Drive to Turntable-ES-Stop 0
- Wait for 5 seconds
- Move Turntable-ES to stop12

The first sequence drives the engine onto the bridge. Then we then wait five seconds for it to come to a stop, rotate the bridge to stop 2, and drive to track mark Track 2.

The second sequence drives the engine onto the bridge, waits 5 seconds for it to stop, and then rotates the bridge 180 degrees, in effect turning the engine around, ready to drive off again.

Get the idea? Pretty cool, and this can work with AI-controlled trains as well as it can with those you control yourself.

Digging In

So far, so good, and I hope some of you are already getting excited about the possibilities for your own sessions. But there's more to it, so let's dig in and explore some other possibilities. Let's look at the picture once more:



Now let's assume for a moment that track mark Track 0 is in an engine house, and the locomotive is now located there. We want to get the loco out of the engine house, onto the turntable, and rotate it so the engine is facing the other way. What sequence would we use to do that? Think about it, then scroll down to see my solution.

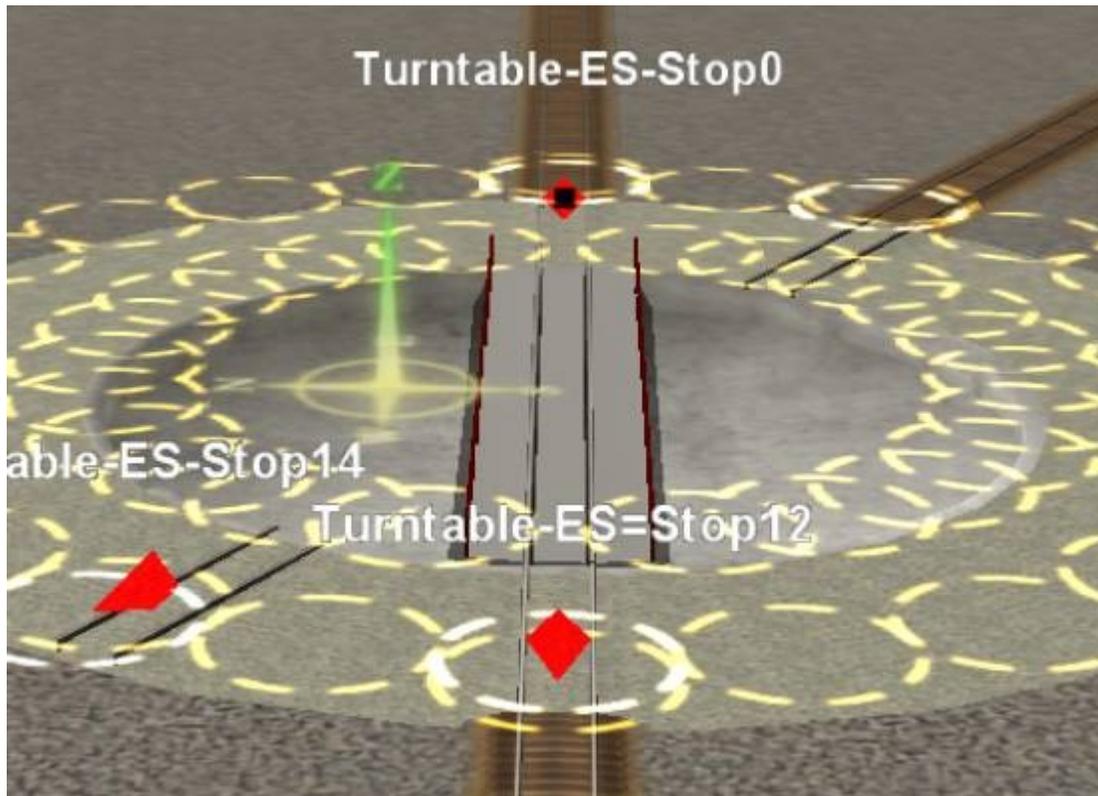
We do it with the following simple sequence

- Drive to track mark Turntable-ES-Stop12
- Wait for 5 seconds
- Move Turntable-ES to stop 12

This sequence moves the loco from Track 0 onto the bridge. We wait five seconds for the loco to stop, then rotate the turntable 180 degrees.

Now take one more look at the drawing above. This time let's say the engine is located at track mark Track 2. How do we get the engine back onto the turntable?

With the current setup, we can't, unless we do it manually. To do it with the AI, we have to add another track mark, opposite track 2, on the turntable skirt at stop 14. See below:



To accommodate the new track mark, I also had to add an additional turntable stub, at stop 14.

Now with the bridge sitting at stop 0 and the loco sitting facing outward at track mark 2 (just outside camera range in the upper right,) we'd need the following sequence to move the loco onto the turntable and get it to face the bottom of the picture:

- Move Turntable-ES to stop 2
- Drive to Turntable-ES-stop14
- Wait for 5 seconds
- Move Turntable-ES to stop 12

This sequence rotates the bridge to stop 2, and the engine drives onto the turntable and stops. Finally, we rotate the turntable 150 degrees to face the loco toward stop 12.

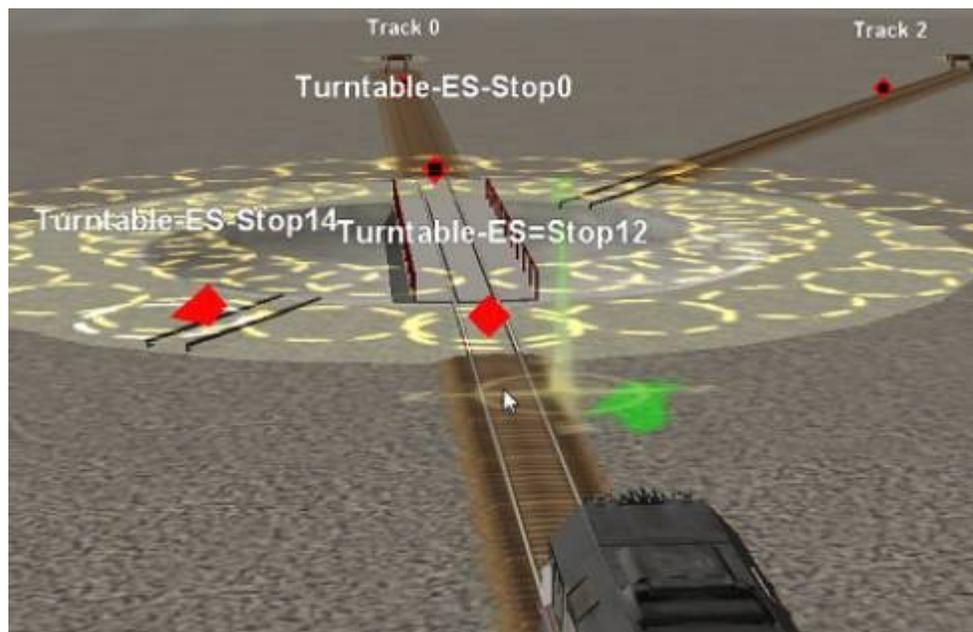
I left the picture above as a closeup for a reason. In inserting the new turntable stub, I created a serious error. Check the picture carefully and see if you can detect it. Then scroll down.

Did you find the error? In placing the new stub, I accidentally moved the turntable itself. When I did, all of the other stubs detached and the circles are white again.

In a way, this error is a good thing, because it illustrates exactly the point I made earlier. You have to be *very* careful around the turntable, especially when attaching new stubs and track to it, or else you're liable to introduce an unexpected error.

We fix the problem by grabbing each of the stubs in turn and gently coaxing them back into position. You can even do it with track attached; no problem as long as there's no train on the track.

All right, now that I've cleaned up the mess, let's check the picture again.



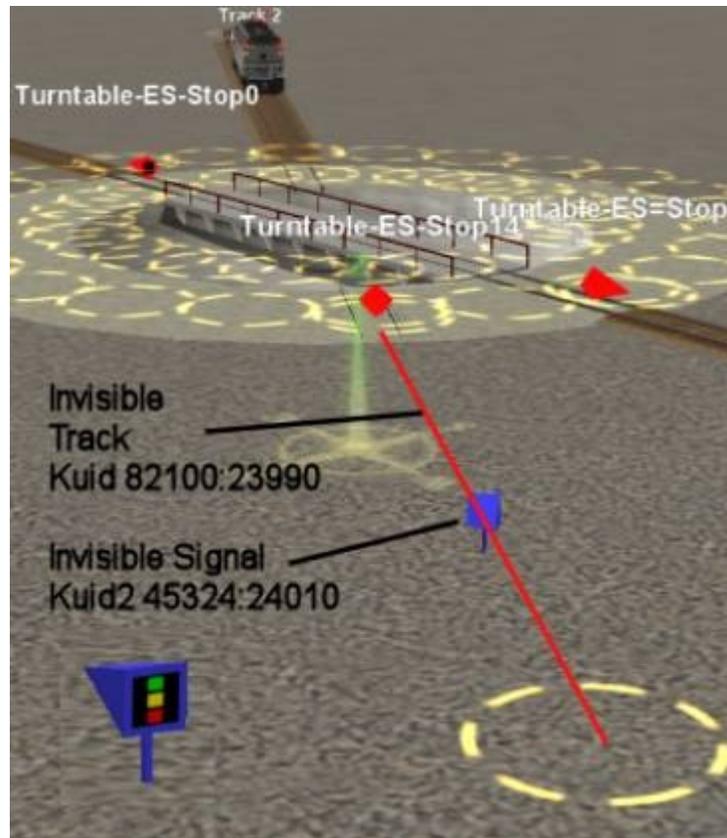
All the stub circles are yellow again, so we're good. There is, however, a second problem, created when we introduced the new turntable stub.

We can place the track mark on stub14 okay, but there's no place to put an end-of-track marker, like there is on Track 2. Without it, the loco will stop before it reaches the track mark. We need to extend the track beyond the stub.

We could, of course, just add a piece of track, similar to track 2, and add the E-of-T marker. That would work fine, and would give you another stub track to park locos.

But suppose you don't have room add to another stub track? There could be a building, or perhaps a parking lot in the way. What do we do then? We still need to extend stub 14.

In response to these questions, I'm going to introduce a new concept: The use of *invisible* track and signals. Check out the drawing below:



Instead of adding a piece of regular track, I've placed a short section of invisible track, connected to the stub. We could place one of the standard end-of-track markers on it, but those would show in Driver, and without track underneath them, they'd look a little strange.

So, I've used an invisible signal instead. As far as Driver is concerned, this invisible track and signal are identical to the real ones, allowing the loco to drive to the track mark like it's supposed to. Just remember, when you place the signal, rotate it so the color portion faces toward the train, as shown in the drawing.

Once placed, the track and the signal are invisible in driver. And, as you'll see later, the invisible track can extend through buildings if necessary to make our situation work.

One final thought before we leave this section, be sure to limit the speed of your locos as they enter the turntable. A speed of 10 or 15 will help trains stop near the center of the bridge and not overshoot. In addition, be sure to restore the speed once your loco has left the turntable area.

Configuring an engine shop track

Some of you may be thinking, "What's the big deal about placing an engine house? All you do is put the building over the top of an existing track."

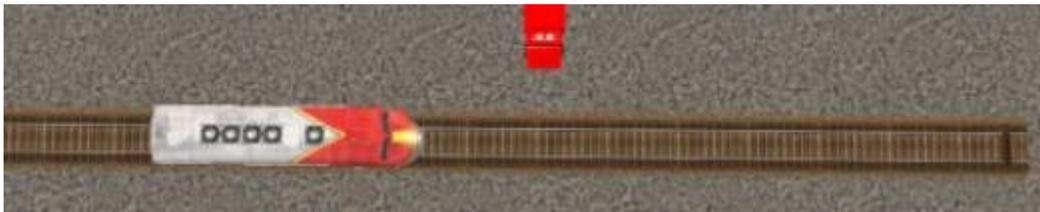
Well, that's true--as long as you plan to move your locos into the building manually. But if you want to have the AI park your loco for you, it requires a bit more work.

Let's start by discussing the nature of track marks. Check out the drawing below;



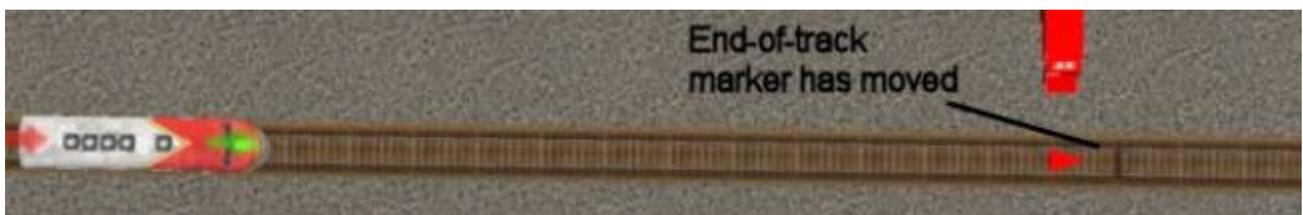
Nothing too unusual here, right? We have a loco on the left, with a track mark and an end-of-track marker out on the right. I've also placed a red truck just above the track mark, so we can see the location of the track mark once we get in driver.

Now I'll give the loco a command to drive to the track mark. Check the drawing below:



The loco has stopped about half a car length from track mark. That means you can't place the track mark exactly where you want the locomotive to stop, it has to be about half a car length beyond the stop point.

The position of the end-of-track marker is also important. See below:



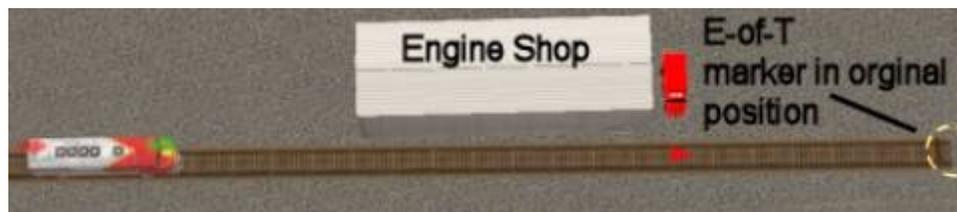
In the drawing above, I've moved the end-of-track marker so that it's just beyond the red track mark. Now see what happens below:



Now the loco stops about two car lengths from the end-of-track marker and never reaches the original track mark.

This behavior is not a problem in most cases, because we usually make our single-ended tracks long enough to compensate for the stopping distance between the loco and the end-of-track marker. It *is* a problem, though, if we need to have our loco stop within a building. If we have a building that isn't much longer than the locomotive, we can't place our stopping track mark and end-of-track marker *inside* the building and expect the loco to stop in the right place under AI control. It can't, because the loco will still stop about two car lengths from the end-of-track marker.

So what do we do? Simple, we put the track mark and the end-of-track marker *behind* the building, like this:

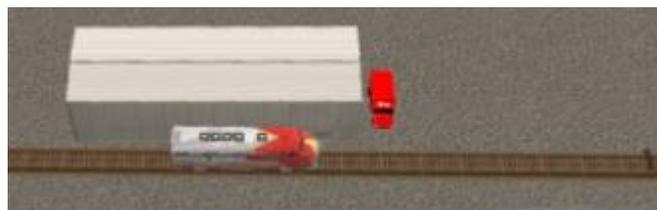


Now I've made several changes. First, I've placed a 1-stall engine house beside the track. Why beside the track? So we can see where the loco stops. Once we have everything working correctly, we just slide the building over the track.

The second change is I've moved the end-of-track marker back to its original position, which is far enough away it won't affect where the loco stops. We want that to be determined only by the track mark.

Finally, notice the red track mark is located *outside* the building, so when the loco stops about half a car length from it, it will be *inside* the building.

Let's see how that works:

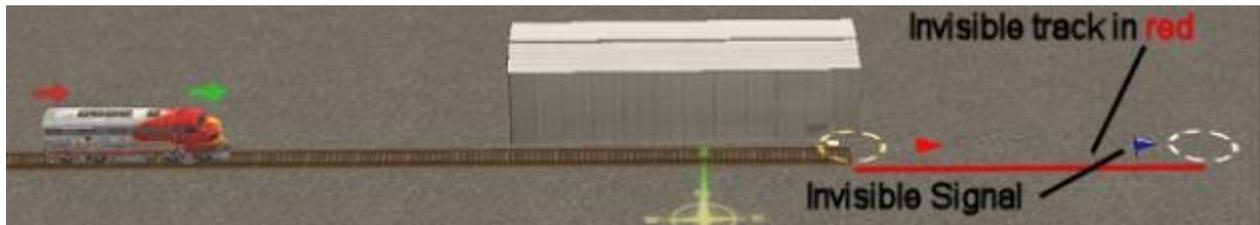


Well, it looks I got lucky, and it worked correctly the first time I tried it. If not, just move either the building or the red track mark until the loco stops in the right place. It's a matter of trial and error, and you may have to move it a few times to get it right.

About now some of you are saying, "Well, that works okay, but I don't want that track sticking out of the back of my engine shop? How can you fix that?"

Simple. We make the track extending beyond the building *invisible*. Yep, just like we did earlier

on that stub track. We lay a piece of invisible track, and we use an invisible signal in place of the E-of-T marker. Like this:



This is actually pretty straightforward, just be sure the face of the invisible signal is *toward* the locomotive!

And the results? Check below:



Looks great, doesn't it? The red track mark and the signal are both invisible, and the loco stops just where it's supposed to stop. All we do now is slide the building over top of the track and we're done.

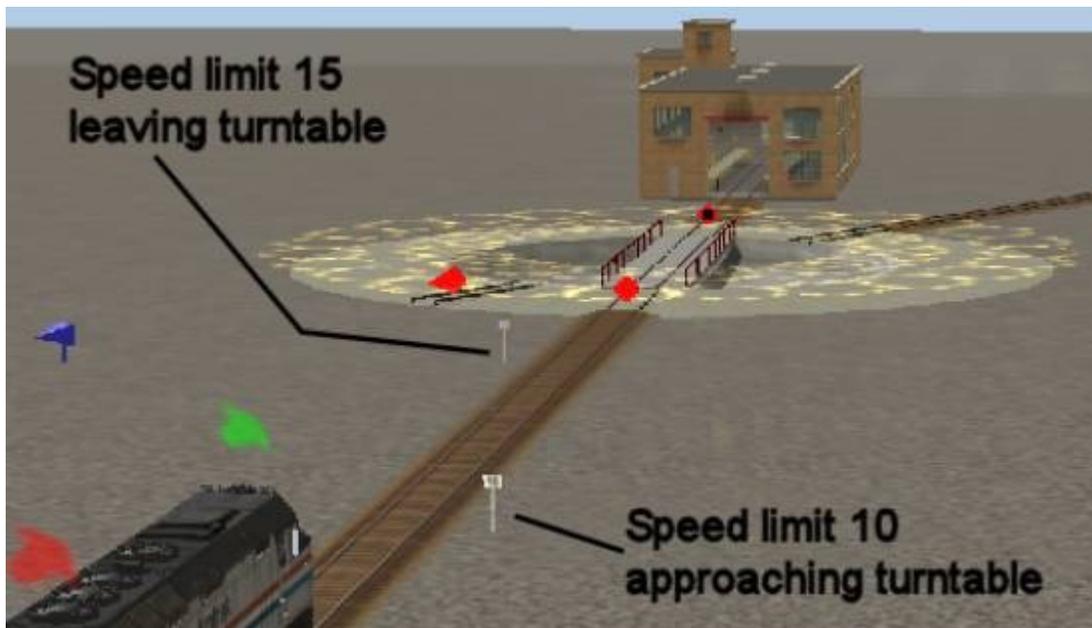
I do need to add one caveat here. The actual stop point may vary a little, depending on the ballistics of the loco you use, and, of course, the speed the engine is moving. You'll have to experiment a bit with the locos you like best to determine the correct place to put the red track mark. If necessary, you may need to use a longer engine shop to allow for the different stopping distances.

You may have your own favorite engine house, but here are two that I use on my route:



The one on the left is "1-Stall Modern Diesel Shed", KUID:63015:28002. On the right is "Engine Shop 1-Stall", KUID:38408:28001. And, of course, there are others on the Download Station.

Now here's a look at our completed engine facility:



Notice I've added a speed limit signs in both directions, 10 for trains headed to the turntable and 15 for trains leaving it. I don't show it in the drawing, but you should also place 10 speed limit signs at the exit of the engine house and track 2, so locos *originating* on those tracks will have the correct speed when they enter the turntable.

Okay, we've reached another stopping place. Some of you may have had about as much as you can handle, and that's okay. If you are planning just one AI loco at a time in the turntable area, what you've learned so far should be enough. Feel free to detrain here, and thanks for plowing through this much.

However, if you're going to have multiple AI locomotives in the turntable area at the same time, there's more to talk about.

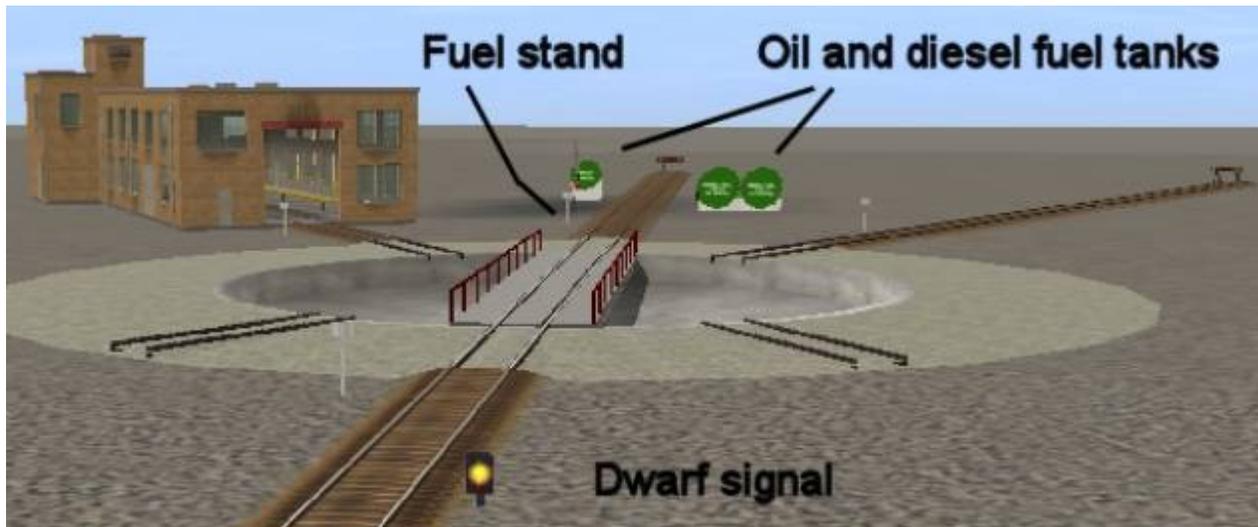
Using Turntables with Multiple AI locomotives

Still with me? Great. Let's get started.

I tested the turntable setup above with two trains, the first train going into the engine house and the second train rotating the turntable and heading into track 2. And that's where I ran into a snag.

If the first train goes to track 2 and the second to the engine house, everything works fine. But if the first loco is in the engine house, I could not get the second loco to enter the turntable. I tried everything, installing signals, moving track marks--I spent many hours playing with it and I couldn't get it to work.

I finally settled on the compromise below.



The problem seems to be when the track on the opposite side of the approach track is occupied, a new train gets stalled, and will dump out of its driver sequence when it gets to the turntable. As I said, I spent a lot of time playing with it and couldn't get it to work.

So, I decided to place the engine shop to one side and call the track opposite the approach track a fueling area. This doesn't fix the problem, but hopefully we won't have engines occupying the fuel tracks for an extended period of time, whereas a loco might be in the engine shop for quite a while.

(By the way, if you're planning on doing a roundhouse instead of an engine shop, the same principle probably applies. If you have a ten-stall roundhouse, just don't use the stall opposite the approach track and you'll stay out of trouble. I'll have more to say about roundhouses later.)

Now check out the picture below, another solution to the problem:



As you can see, the engine facility has grown a bit, with two more stub tracks at turntable stops 1 and 23. In addition, I did away with the fueling track and substituted a tower instead. As you experiment with it on your own route, you'll probably come up with your own arrangement.

This track setup works just fine with four simultaneous AI drivers. You simply direct the first train to the turntable, wait 5 seconds for the loco to stop, and rotate the bridge to whatever track you want. When the bridge stops, then drive off to the track mark you want.

You also need to add one more command to the sequence: Reset the bridge back to stop 0. That way the next train can reach the turntable without delay, because the bridge is already in the right place. Just make that your standard procedure: Any train that rotates the turntable puts it back afterwards.

Now it's time for the test. I lined up four locos back-to-back, as shown below:



Then I programmed each engine exactly the same way, except for the destination turntable stop and destination track. Here's how the sequence worked:





Second train heads to the engine house, track 22



Third loco drives to track 23



We could, of course, assign the locos to the various tracks in any order we wish, and without track 0 to worry about, everything works fine.

Helpful hints

Some of you sharp-eyed folks may have noticed the dwarf signals in the above drawings. I want to talk about that a bit and show you how to use the signals to streamline your operations.

But first, you should know how the turntable affects a loco's AI.

1. Earlier I talked about placing a track mark (Turntable-ES-Stop0) on the side of the turntable *opposite* the approach track. We then give the engine the command Go to Turntable-ES-Stop0 to get the loco to stop on the bridge. Remember that?

Okay, but if the bridge is *open*, that is, if the bridge is not aligned with the approach track, the loco cannot "see" the track mark and will stall, *wherever* it is located, even miles away. The loco will not move until the bridge is properly lined up and the loco can see the track mark.

"How can that happen?" someone might ask. "Why is the bridge open?"

There could be any number of reasons, but here are two in particular: First, another engine may be using the turntable, and second, a loco may have used the turntable and forgot to restore it back to stop 0. When any of your AI trains moves the turntable, always restore it back to stop 0.

2. When you insert "move turntable" in a driver's commands, the driver doesn't do anything while the turntable is moving. What we're saying is that the driver will suspend his command sequence until the bridge has come to a stop. When it does, the driver will automatically resume operations with the next command in line.

3. When you rotate the turntable, a signal leading to the turntable will go red, and stay red until the bridge is again pointing to track 0 (or track 12, just so long as the signal can see a clear path across the bridge.)

All right, now let's see how these these points work with our AI trains that use our turntable. Point 1 says if the bridge is open, a train with a command to go to the turntable will stall. We don't want it to stall, much less a mile or more away, so how to we handle that?

We handle it by adding a second track mark, *before* the train reaches the turntable, like this:



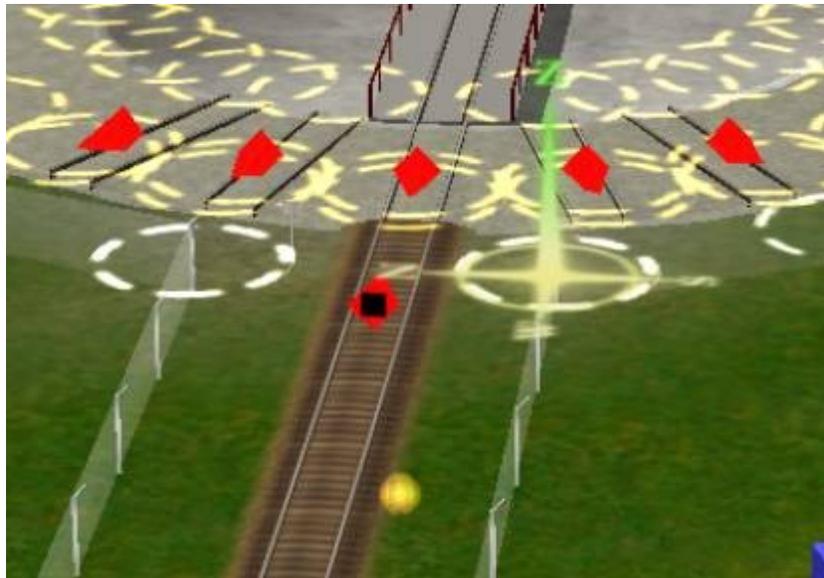
The new track mark is Turntable-ES-Approach. What we tell our driver is:

Drive via Turntable-ES-Approach
Drive to Turntable-ES-Stop0
Wait for 5 seconds
etc....

What happens is the train drives toward the approach track mark from wherever it is, unaware of the open bridge until after it passes the approach mark. If it then sees the open bridge, it will still stop and stall, sometimes refusing to move even if the bridge is restored to the correct position.

We've solved part of the problem, by letting the train advance all the way to the turntable before it detects the open bridge.

We fix the rest of the problem by placing a signal just ahead of the approach track mark, like this:



Remember we said earlier when a loco heads toward an End-of-Track marker, it will stop about two car lengths away? Remember that? The dwarf signal works the same way.

We also said in point 3 above when the turntable bridge is open, any signal leading to it is red.

Now here's the part that's cool. We've placed the approach track mark *behind* the signal, so that any time the bridge is open, the red signal stops an inbound loco two car lengths away. That prevents the engine from reaching the approach track mark.



The train sits at the signal, patiently waiting for the turntable to close. When it does, the signal goes back to yellow, and the train moves toward the approach track mark. When it passes it, it now sees a clear path across the closed bridge and continues.

So, by using the approach track mark *behind* the signal, the inbound train will never see an open bridge and will never stall. It will just drive up to the signal and wait.

Well, that it. We're done. Feel free to exit now, if you wish, but I do want to say a quick word about Andi's cool roundhouse kit and how we use the AI stuff we've been talking about with it.

Using the AI turntable with Andi Smith's Roundhouse

Andi's roundhouse is comprised of several modular parts and is designed work together with his turntable.

The roundhouse parts are, left to right in the drawing below:

AJS Roundhouse Left Closer	KUID:122285:1504:2
AJS Roundhouse Entrance	KUID:122285:1507:3
AJS Roundhouse Right Closer	KUID:122285:1505:2

The entrance module fits between the two end closer modules, and you can use as many as you need. If you want a 10-stall roundhouse, you need a left and right closer, with 8 entrance modules in between.

Notice all the modules have a built-in turntable stub, so they fit right up against the turntable skirt, and there's no need for the turntable stub we used earlier.

As you see in the picture, just drag the white circle on the modular piece over the yellow circle on the turntable and it will snap into place. Building a roundhouse with this method is easy, and it looks great.

Remember the warning I mentioned earlier; if you want to run multiple AI trains into the roundhouse...don't store any locos on the track opposite the approach track.

As far as the roundhouse track marks are concerned, here are a couple of ways to do it.

In Andi's design, the middle "entrance" tracks have open backs, so you can decide whether or not you want a visible stub track to extend beyond the building. On track 3 above, that's what I did, and it's identical to the Track 2 stub we did in the earlier engine house setup.

If you opt for the visible stub, you could actually use two track marks, one where "Track 3" is now, the other closer to the end of the track, so you could also direct a loco to move out onto the stub. Not absolutely necessary, but an option if you need it.

On track 4, I opted not to extend the track beyond the building, so an invisible track section and invisible signal are needed.

Track 5 is one of the two "closer" pieces, and they have solid backs. In this case, Andi has provided a short piece of invisible track extending beyond the building. That may be all you need, but in this case, I just added some additional track to make sure the invisible signal was far enough away.

I tested each of these options and they work fine.

Well, now we're *really* done. Thanks for coming along on this trip into the wonderful world of Trainz.

Thanks especially to Andi Smith, and the other content providers, who give us such great-looking scenery, rules and commands to expand the Trainz product in additional directions.

Chuck Brite (crb001)
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